Gemeente Amsterdam

Amsterdam Circular Monitor

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Contents

Introduction

To find out whether we on the right track towards a circular city, we are going to measure our progress. Our Monitor charts the extent to which Amsterdam's economy has become circular and identifies areas in which more needs to be done. The Monitor will enable us to measure whether our goals of halving the use of primary raw materials by 2030 and becoming 100% circular by 2050 are feasible.

The transition to a circular economy is far-reaching and complex. This process requires a measuring tool that provides insight into our progress. Therefore, we are developing the Monitor for the Circular Economy in Amsterdam.

In the first instance, the Monitor shows the total weight of the raw materials and other materials that the city consumes and produces as waste. Based on that weight, we can measure the impact on the CO_2 emissions and environmental costs.[1] To do so, the City of Amsterdam has estimated the annual consumption of raw and other materials in the three selected value chains (food & organic waste streams, consumer goods, and built environment) waste processing in the region.[2]

The Monitor for the Circular Economy in Amsterdam is based on Kate Raworth's doughnut model (see Chapter 2 of the Amsterdam Circular 2020-2025 Strategy). In this illustrative representation of the circular economy, we live in social prosperity and respect the ecological boundaries of the Earth. Therefore, using the Monitor we not only looks at our use of materials, but also at the social foundation of the city and region. This document contains the framework of the Monitor and a summary of the most important insights. The Monitor will be refined further in the coming years.

For the Circular Economy Innovation and Implementation Programme 2020-2021 and the Waste & Raw Materials Implementation Programme, the City of Amsterdam works with the seven city districts, local initiatives, market parties, knowledge institutions and residents. This has already led to a wide range of 'projects' in terms of both content and form: from very concrete developments in the city, policy interventions and innovations to less visible research programmes, consortiums and assessment instruments. The output of these projects will be evaluated qualitatively and, where possible, quantitatively. The results will be integrated into the Monitor in the coming years.

Climate change and the economy of Amsterdam

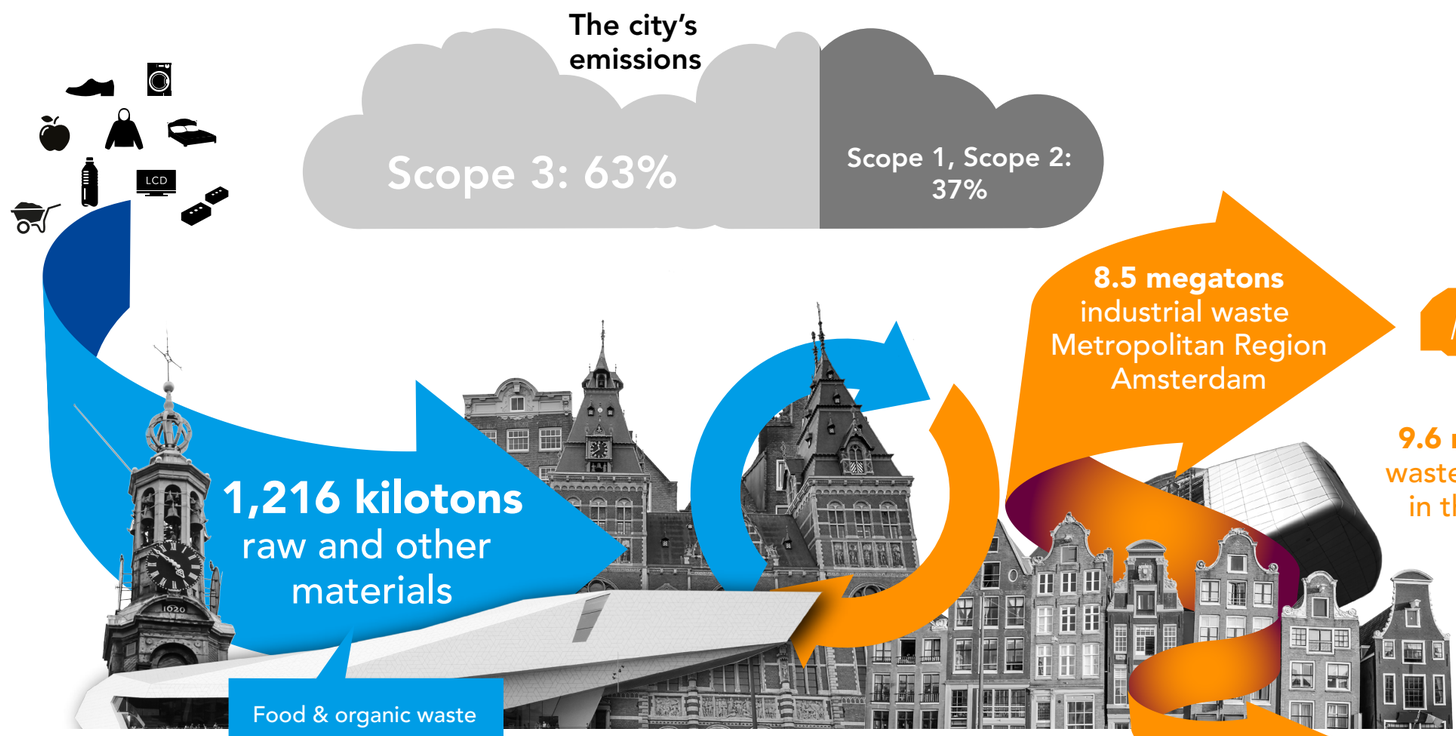
Large amounts of CO_2 are emitted during the production of goods and services. It is estimated that 45% of global CO_2 emissions are due to the production of cars, clothing, food and other products that we use on a daily basis.[3] This percentage is even higher in Amsterdam. The City estimates that 63% of Amsterdam's CO_2 emissions are caused by products and materials that are consumed in the city (see page 6).[4]
We are going to change this with the transition to a circular economy. A circular economy contributes significantly to CO_2 reduction and therefore plays an essential role in combating climate change. By having a better understanding of how many of our materials are primary raw materials from other parts of the world, our partners and we can make better choices that are good for the climate, the environment and life in the city.
The Monitor is an important first step towards significantly reducing our CO_2 impact by specifying materials in the production and waste chain.

All notes can be found on page 50.

This measurement includes a small margin for products that are counted twice because they are both consumed and produced in the region, such as the products produced in the chocolate factory in the Metropolitan Region Amsterdam industrial district. Insight into this will become clearer as the city and the region become more circular.

Description	Kton CO_2	Proportion %
Estimate of total CO_2 emissions (all scopes)	13,540	100%
Calculation of scope 1 and scope 2 CO_2 emissions	5,000	37%
Estimate of scope 3 CO_2 emissions	8,540	63%
% of scope 3 analysed (prioritised value chains)	1,346	16%

General estimate of CO_2 emissions. Scope 1: concerns direct CO_2 emissions caused by burning fossil fuels in Amsterdam; scope 2: indirect CO_2 emissions caused by Amsterdam's energy consumption; scope 3: CO_2 emissions outside Amsterdam caused by consumption in Amsterdam.



Summary of the estimated environmental burden of materials and products consumed and waste produced by the city in 2018 for the three prioritised value chains.

Reader's guide

This document consists of the following three sections:

1. **Translating the doughnut into the Monitor**
2. **Framework and initial insights**
3. **Findings**
4. **Recommendations**

In developing the framework, advice was sought from the Netherlands Environmental Assessment Agency (PBL), Statistics Netherlands (CBS), the National Climate Monitor, the provinces of Noord-Holland and Flevoland, the municipality of Haarlemmermeer, the Metropolitan Region Amsterdam, the Amsterdam Economic Board, the Port of Amsterdam, various departments of the City of Amsterdam, Metabolic, Doughnut Economics Action Lab, Delft University of Technology (TU Delft) and the Netherlands Organisation for Applied Scientific Research (TNO).

Where no data or indicators are available yet, the Monitor provides guidelines for their development.

From Doughnut to Monitor

From Doughnut to Monitor

At the request of the City of Amsterdam, economist Kate Raworth and her staff wrote The Amsterdam City Doughnut. This document is intended as 'an instrument for transformative action'. The City Doughnut – the first city doughnut in the world – provides a snapshot of the impact of Amsterdam's economy on a variety of environmental and social indicators, both local and global. The City Doughnut therefore shows how we as a society can continue to develop while being conscious of the planetary boundaries

The Amsterdam City Doughnut forms the basis for the Monitor for the Circular Economy in Amsterdam. Whereas the City Doughnut provides a snapshot, the Monitor aims to provide continuous insight into both the social foundations and the ecological ceiling of Amsterdam's economy.
The City Doughnut shows that the greatest ecological impact of our economy involves greenhouse gas emissions (expressed in terms of CO_2 equivalents)5, land use, excessive use of chemical fertilisers and marine pollution. The greatest social impact can be found in housing, the further development of the Monitor for the Circular Economy in Amsterdam.

The Monitor uses the four 'perspectives' of the City Doughnut (see right). The answers to these questions result in a large amount of data. By linking and analysing all these data and making connections, we can we lay the foundations for evidence-based measures that further stimulate the transition to a circular economy.

In this first version of the Monitor for the Circular Economy in Amsterdam, we have translated the insights from these four perspectives into an input-output method in which material consumption forms the input and waste the output. This helps us understand the degree of circularity in the use of raw materials in the Amsterdam economy. This first version of the Monitor analyses how the city relates to the ecological ceiling (sections 1, 2, 3 and 4 of the Monitor). At the same time, a transition to a circular economy also has social consequences at the local and global levels. Therefore we also analyse how the social foundation of the city is built up (section 5 of the Monitor).

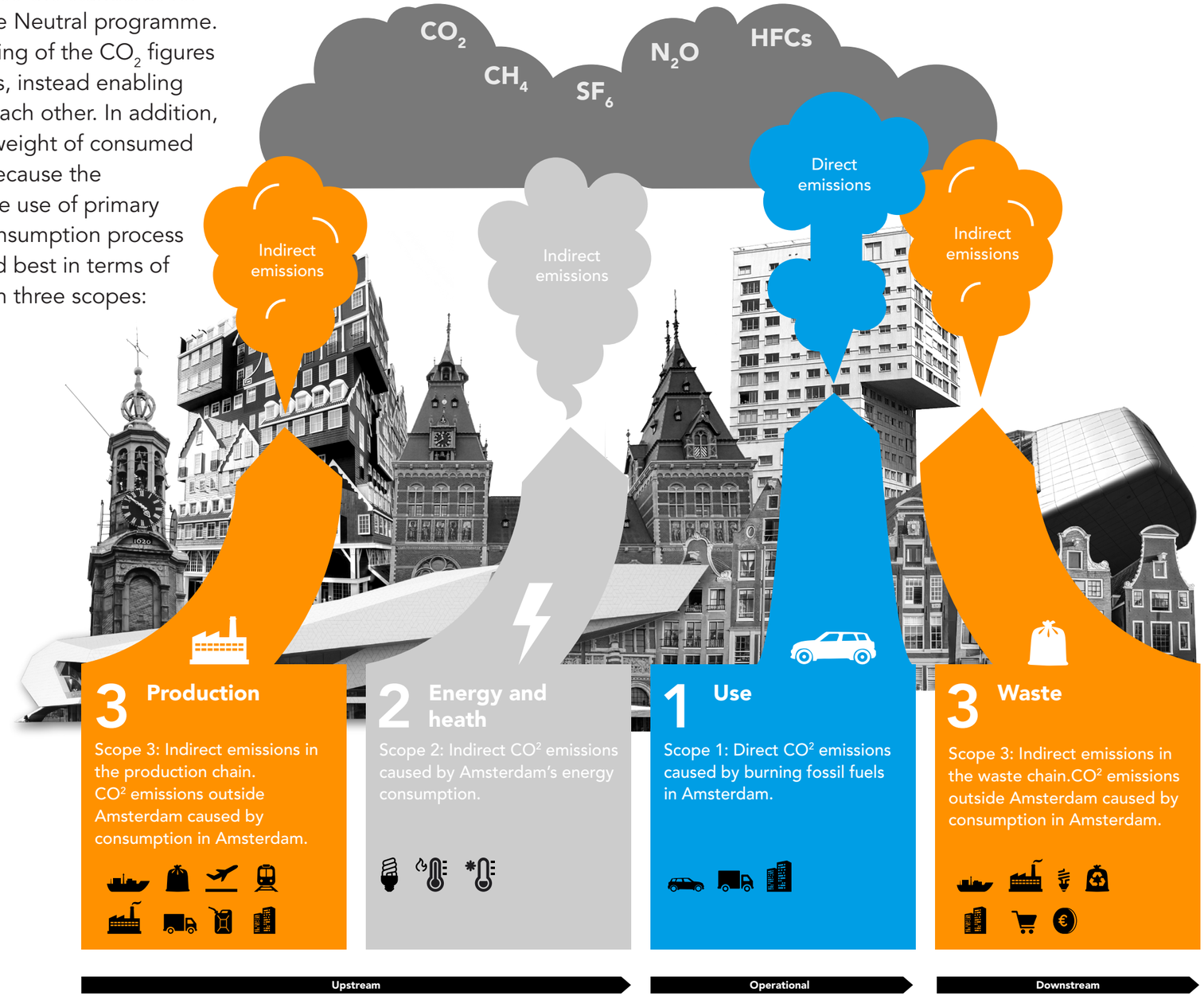
How can our city be a home to thriving people in a thriving place, while respecting the wellbeing of all people and the health of the whole planet?

	social	ecological
local	What would it mean for the people of Amsterdam to thrive? 1	What would it mean for Amsterdam to thrive within its natural habitat? 2
global	What would it mean for Amsterdam to respect the wellbeing of people worldwide? 4	What would it mean for Amsterdam to respect the health of the whole planet? 3

The City Doughnut is a new instrument that the Thriving Cities Initiative (TCI) is testing in Amsterdam, Philadelphia and Portland. The TCI welcomes comments and suggestions to improve this instrument at both the conceptual and the practical level so that it can contribute to transformative campaigns in many more cities.
These perspectives were developed in cooperation with a large number of municipal officials whose expertise yielded valuable insights and who also created access to the most recent and relevant data about the city. The result does not comprise a comprehensive study, but rather a holistic snapshot of the city. Nor should it be read as a report, but instead it can be used to define the contours of the transition and encourage co-creative innovation and systematic transformation. In the years to come, this City Doughnut model will be used as a compass for the development of the Monitor.
The five sections of the Monitor are explained starting on page 13.

The ecological ceiling

The City Doughnut stresses that our impact on the environment is not limited to the CO_2 emissions produced by incoming and outgoing materials. Other environmental indicators, such as land use, biodiversity and air pollution, are also important.[7/8]
For all sections of the Monitor for the Circular Economy in Amsterdam, the choice has been made to calculate the total weight of raw and other materials. In the coming years, the weights will be related to environmental costs and CO_2 emissions. Environmental cost indicators correspond to the indicators of the doughnut. This will allow us to take into account planetary boundaries other than climate change in the future (see Appendix 1 for the main indicators for sections 1 to 4). To calculate the emission of greenhouse gases, we used the IPCC Guidelines for National Greenhouse Gas Inventories from 2006.
In order to refine emissions at the municipal level, we then opted for the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC). Both are both global standards in the environmental economy.[9] These are also the standards for the Amsterdam Climate Neutral programme. This prevents overlapping of the CO_2 figures of the two programmes, instead enabling them to complement each other. In addition, we have included the weight of consumed materials and waste, because the ambitions of halving the use of primary raw materials in our consumption process by 2030 can be defined best in terms of weight. GPC works with three scopes:



The social foundation

The City Doughnut provides a complete picture of Amsterdam's ecological and social impact at the city, national and global levels. This integrated approach forms the basis for the further development of the social foundation of the Monitor for the Circular Economy in Amsterdam.

We have chosen to use the Dutch approach of 'broad prosperity' to illustrate the social foundation. By using this concept, we emphasise that a good life requires more than material wealth.[10] Other important elements are well-being, health, leisure time and the opportunity to learn. The social foundation of the City Doughnut includes all the conditions, both local and global, that are necessary for a society to flourish. To this we add the Sustainable Development Goals of the United Nations (as also done by the City Doughnut). This will strengthen our relationship with the rest of the world and enrich the concept of broad prosperity.

Efficiency, equitable distribution and continuity are important components of broad prosperity: efficiency in how we meet as many of our needs as possible, equitable distribution, and continuity (i.e. being future-proof) in our use of the available resources[11].

This way we further broaden the idea of broad prosperity in Amsterdam. Housing alone is no longer enough: it must also be affordable and, where possible, sustainable, for example through good insulation or solar panels on the roof.
Broad prosperity also includes care for the environment and the climate. In order to enrich the indicators, the Monitor will also do more research into how Amsterdam's residents perceive the interventions involved in the transition to a circular economy, which we refer to in the document as climate perception.[12]

The doughnut teaches us that our prosperity is directly related to the prosperity of others elsewhere in the world. The Monitor cannot yet calculate this relationship.
We will develop a model for this in the coming years. This will involve a deepening of insights into corporate responsibility and circular jobs in Amsterdam that say something about our relationship with each other and our connection to the rest of the world. The dimensions of the social foundation are translated into measurable indicators on page 46 (see also Appendix 2 for a summary of the indicators for section 5).

Framework and initial insights

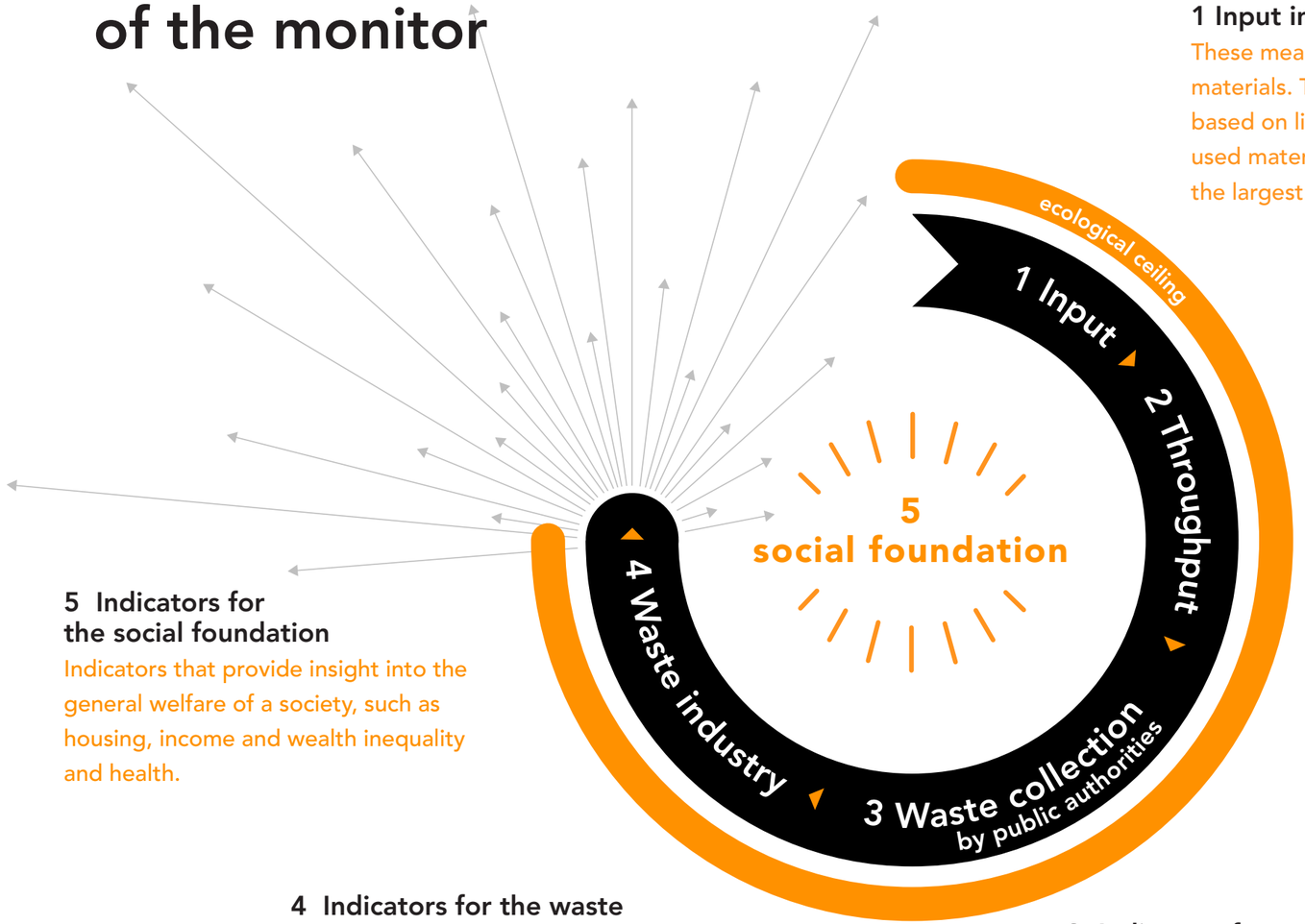
The framework

The five sections of the Monitor

It is important to realise that this framework is under development and will contain much more data in the coming years. The data used concern 2018 or are the most recent data we could find. The following aspects were also important.

- Due to a lack of data, the different sections of the Monitor have not yet been linked together.
- For the ecological sections of the Monitor (sections 1, 2, 3 and 4) kilotonnes of weight per product or material have been calculated. This is the first step towards the standard of scope 3 emissions drawn up by the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC).
- Total emissions produced and environmental costs are included only for section[13].
- Data from the Metropolitan Region Amsterdam have been used where possible. In other cases, the data used relate only to the city. Links to the other municipalities in the region will be established in the coming years.

The five sections of the monitor



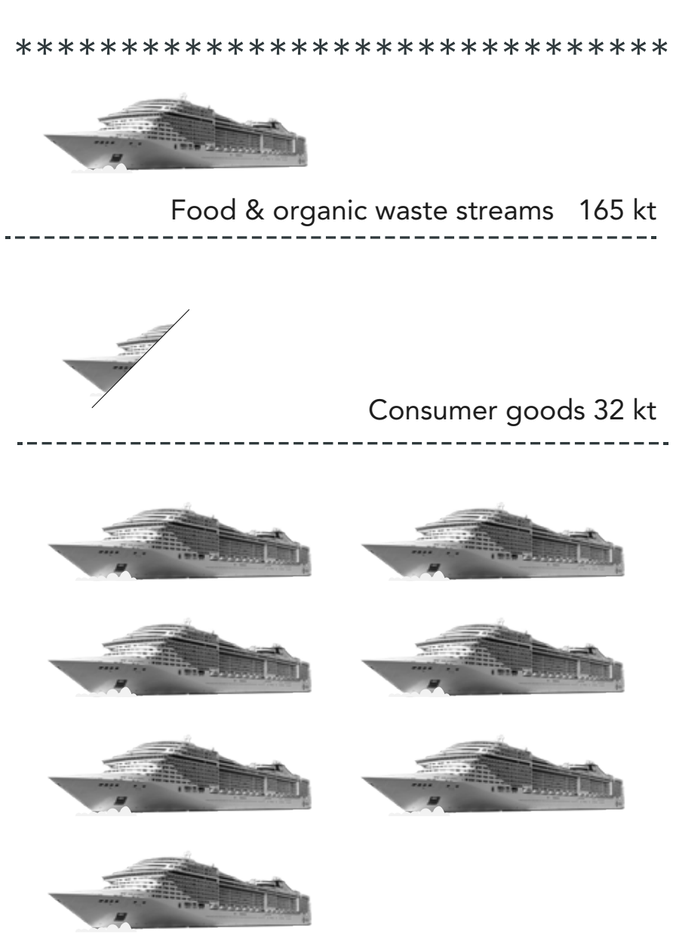
1 Input indicators[14]
These measure the incoming materials. The input indicators are based on life cycle analyses (LCAs) of used materials in product groups with the largest carbon footprint.

2 Throughput indicators
Throughput refers to the way materials are used and here comprises the predicted reduction of CO_2 emissions based on circular projects in the three selected value chains[15].

3 Indicators for waste collection by public authorities
These indicators measure the public authorities' performance in regard to waste collection (e.g. separating waste and collecting bulk waste).

4 Indicators for the waste treatment processes of regional industries[16]
General indicators for industrial waste streams, broken down by value chain and processing form.

5 Indicators for the social foundation
Indicators that provide insight into the general welfare of a society, such as housing, income and wealth inequality and health.



Input indicators

The survey of how the city consumes materials has only just begun. The input indicators are based on models. Where available, the City has used these data for a more accurate estimate of the impact on the environment.

Local information is available about construction. For food, the information used is based on research concerning the west of the Netherlands (the Randstad area). In the case of consumer goods, there is an under-representation, as we have only included calculations for textiles and electronic devices in this version of the Monitor. The consumer goods value chain contains many more types of products (e.g. furniture, cars, personal care and pharmaceutical products) and will be further specified in the coming years.

This initial estimate concerns a total weight of 1,216 kt of raw and other materials consumed by the city annually. This is comparable to the weight of 8.5 cruise ships like the MSC Splendida. For the prioritised value chains, the estimated indirect CO_2 impact is 1,346 kt CO_2.[17] This is one-and-a-half times the annual emissions of Amsterdam's port and industry. Translated into an environmental cost indicator (ECI), this amounts to 418 million euros.[18] The figures form the starting point of the search for the amount of materials consumed in Amsterdam; this indication will be further specified in the coming years.

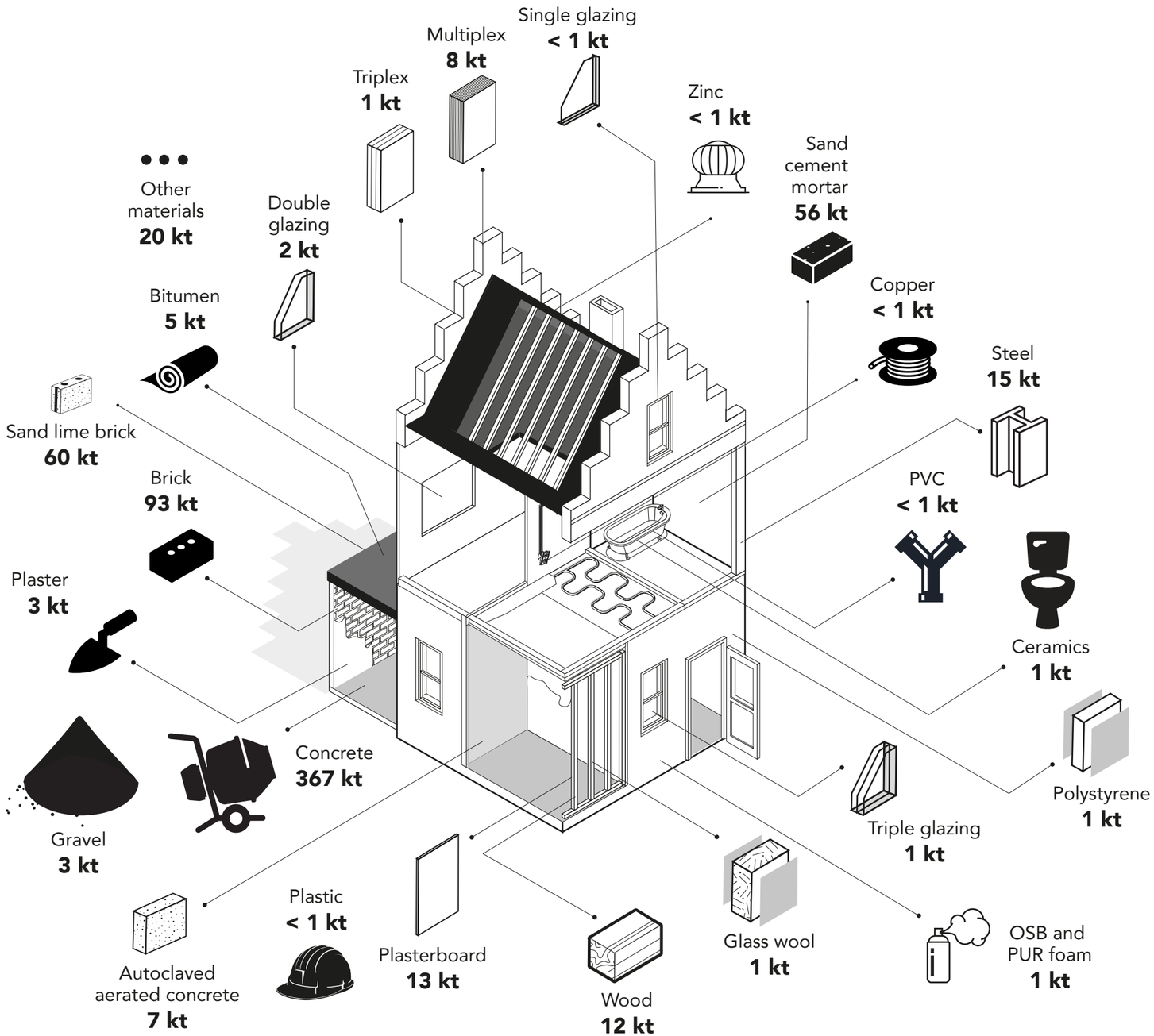
Built environment

8,536
new homes
in 2018

produce:

670 kt
of materials per year
in Amsterdam.[19]

Steel makes the biggest contribution to the indirect CO_2 impact (22%), followed by concrete (20%) and brick (19%).



25,000
euros average for renovation[19]
1,941 homes
renovated in 2018

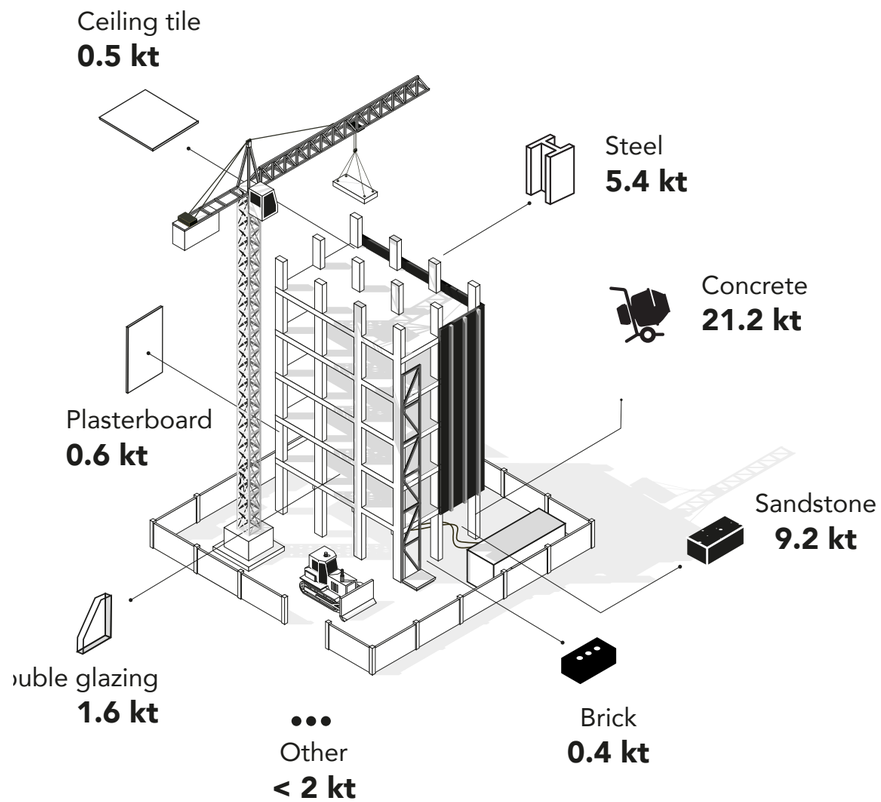
Renovations of homes built between 1945 and 1970 are properly insulated with energy measures.[20]

Offices The biggest contribution is provided by the application of steel (55%), double glazing (15%), sand cement (9%) and concrete (8%).

Infrastructure This concerns the extraction and production of the individual materials that lead to an environmental impact in the asphalt mixture, with the main contributors being bitumen and mineral aggregate. Asphalt mixtures with a high percentage of recycled material or produced at low temperatures can reduce the impact.

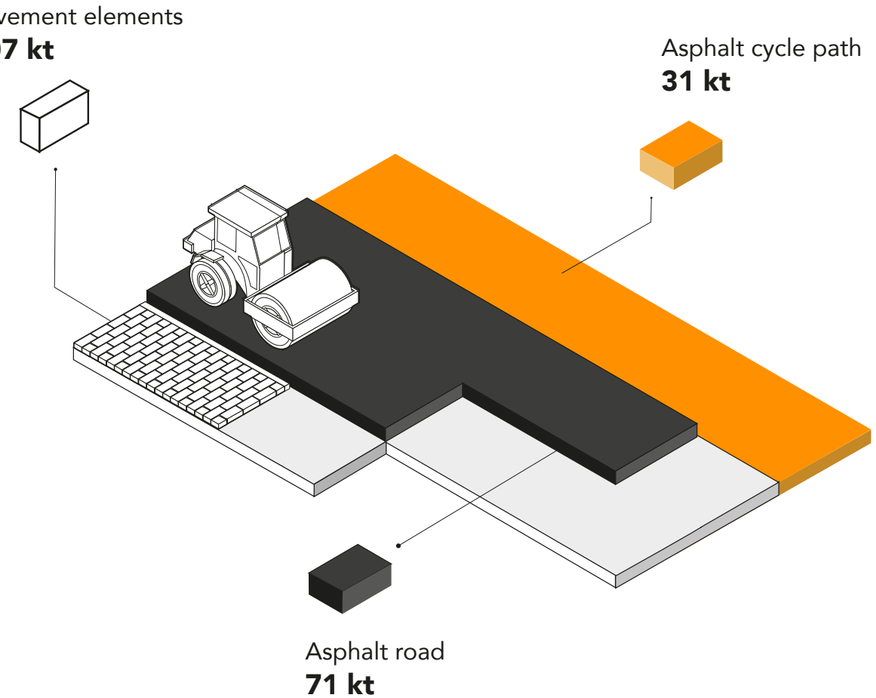
40 kt

Total weight of materials office construction



309 kt

Total weight of materials infrastructure



Source: models for road infrastructure and cycle paths.[21]

Food & organic waste

Tourists contribute around 5% to the total food consumption in Amsterdam.

165 kt
annual **consumption of meat and dairy products** in Amsterdam

Milk, yoghurt, ice cream **117 kt**

Cheese **12 kt**

Cream **2 kt**

Beef **4,9 kt**

Pork **4 kt**

Chicken and turkey **6 kt**

Processed meat **19,1 kt**

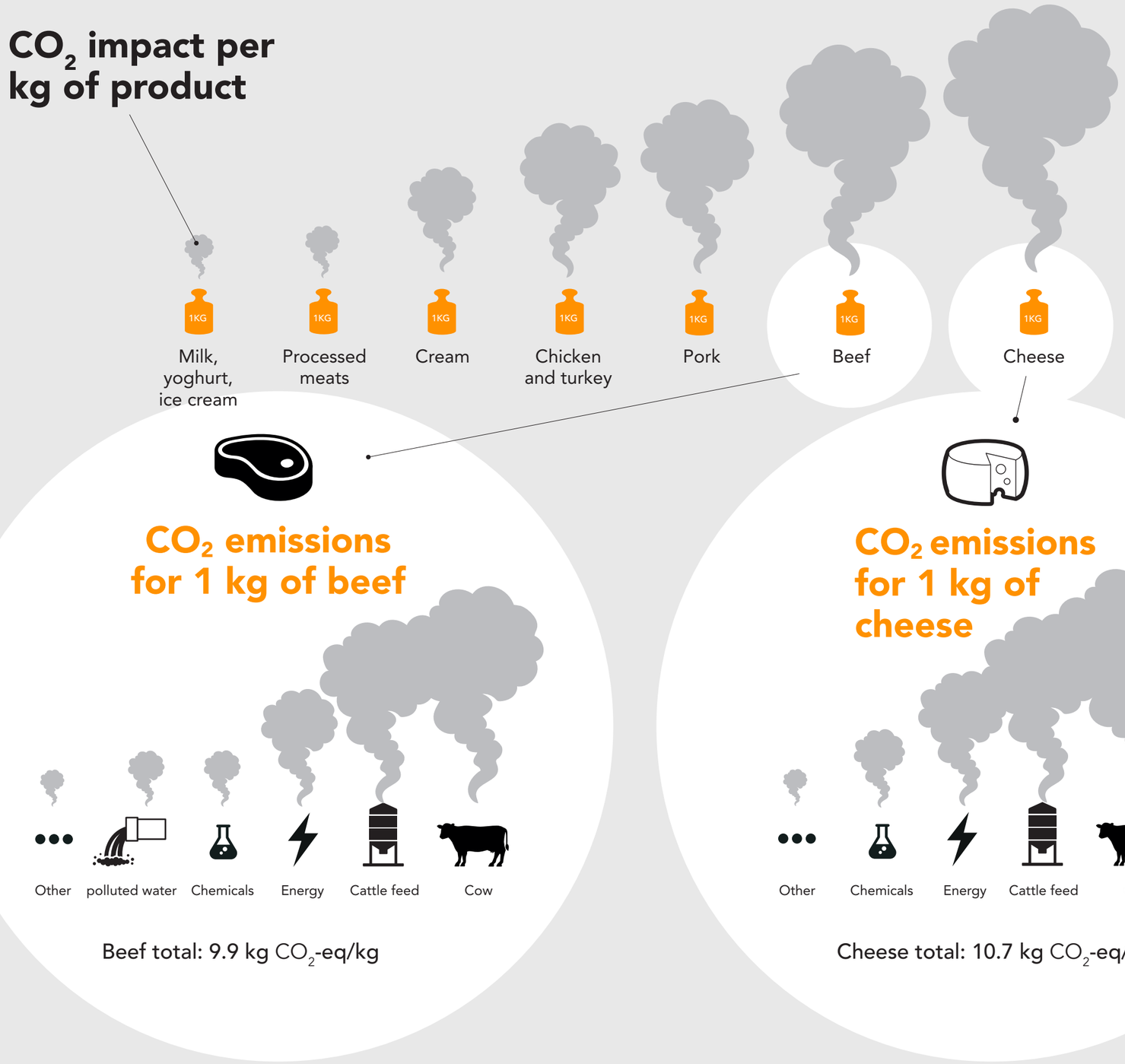
Dairy

Meat

Milk, yoghurt and ice cream make the biggest contribution to the CO_2 emissions from food production, followed by cheese.

The chicken and turkey category scores relatively high compared to the beef and pork categories, because Dutch poultry feed is relatively high in soybeans from South America.

Food waste is estimated to be 30% worldwide, and 20% in the Netherlands. Specifically for meat and dairy, the waste percentages are 10% and 8%, respectively. This waste is added to the amount of consumed products.[22/23]



The biggest contribution to global warming from cheese and beef comes from the cows themselves (methane) and from the production of cattle feed. This analysis is based on Dutch dairy cows, which eat relatively large amounts of grass.

Consumer goods

12.4 kt
annual electronics consumption in Amsterdam

Household appliances
8.8 kt

Computer
1 kt

Radio, TV, audio
2.6 kt

Based on number of residents, Amsterdam represents approximately 5% of the total flow of goods in the Netherlands. Textiles and electronics were chosen for this first measurement. Although textiles and electronics are not the largest categories (12.5% and 6.5%, respectively) of the total, the decision was made to include the environmental impact of these two categories because of the high environmental impact per kg of product and the fast turnaround time of these types of products.[24]

19.5 kt
annual textile consumption in Amsterdam

Clothing
9.3 kt

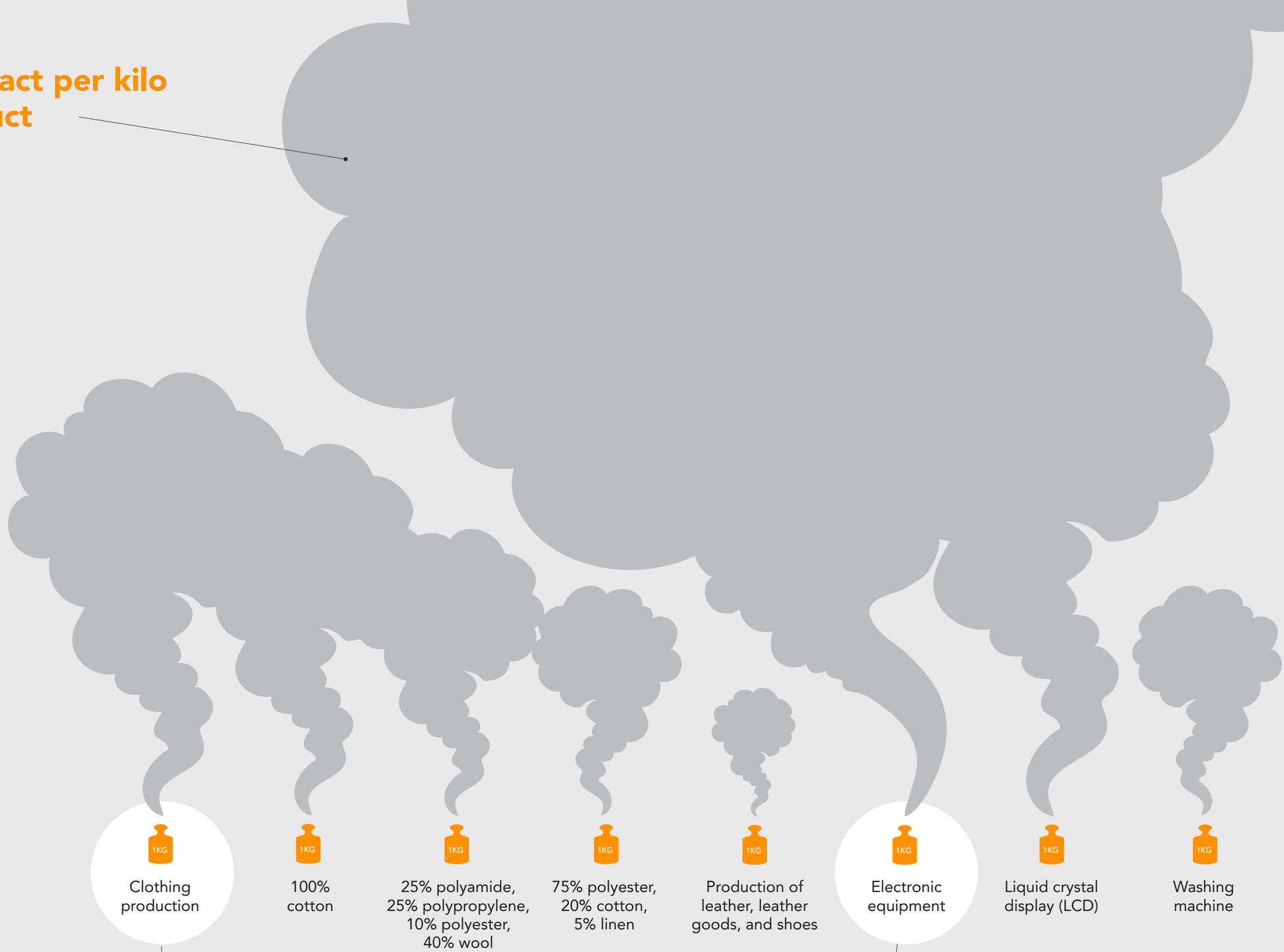
Leather, leather goods
3.9 kt

Bedding
2.5 kt

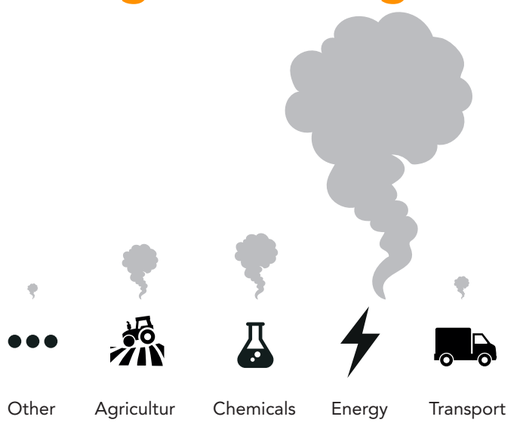
Household textiles
1.4 kt

Carpets
2.4 kt

CO_2-impact per kilo of product

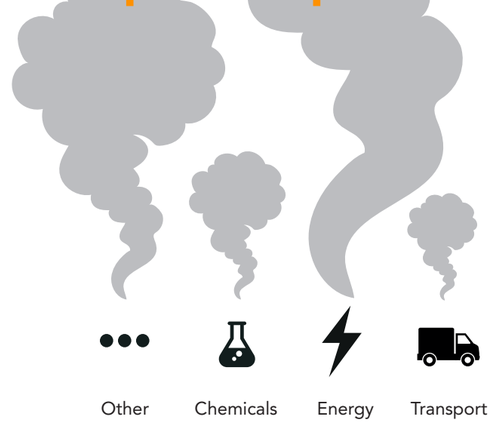


CO_2 emissions per kg of clothing



Clothing total: 27.6 kg CO_2-eq/kg

CO_2 emissions per computer



Computer total: 96 kg CO_2-eq/kg

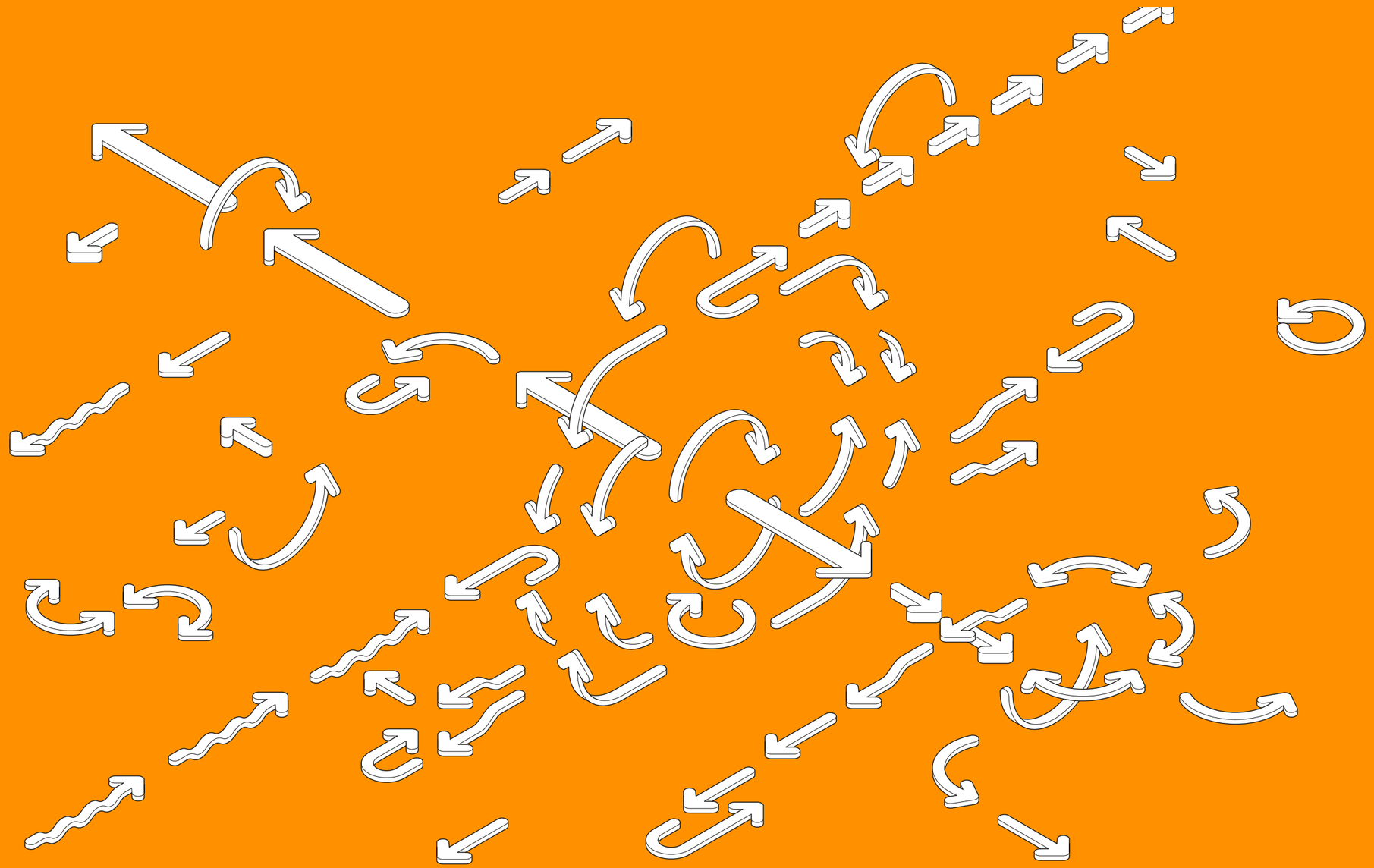
The environmental impact of electronics has several dimensions. The CO_2 impact of one laptop is equivalent to that of seven washing machines. The biggest contribution is from energy used in the extraction, production and processing of raw materials.
For textiles, the impact is caused by extraction and production as well as the processing of raw materials.

Throughput indicatoren

indicators are not included in this Monitor and are expected in 2021. The reason for this is the complexity of the material and the lack of data.

Throughput indicators show the materials that continue to circulate in our economy. Ultimately, indicators must be developed that reflect the turnover rates of these materials in Amsterdam.

It is not known at this time how Amsterdam's residents use materials (e.g. how long a woollen sweater is worn and the chance of it being reused.) In addition, the turnover rates per consumed product also vary per value chain and product group (e.g. how often a building is renovated compared to how often someone purchases a new laptop or how often people eat each day). The methodology required to assess this complexity is still under development. The City is considering using anonymised data (on location, time and amount of materials) to better assess the daily rhythms of the use of materials.[25]

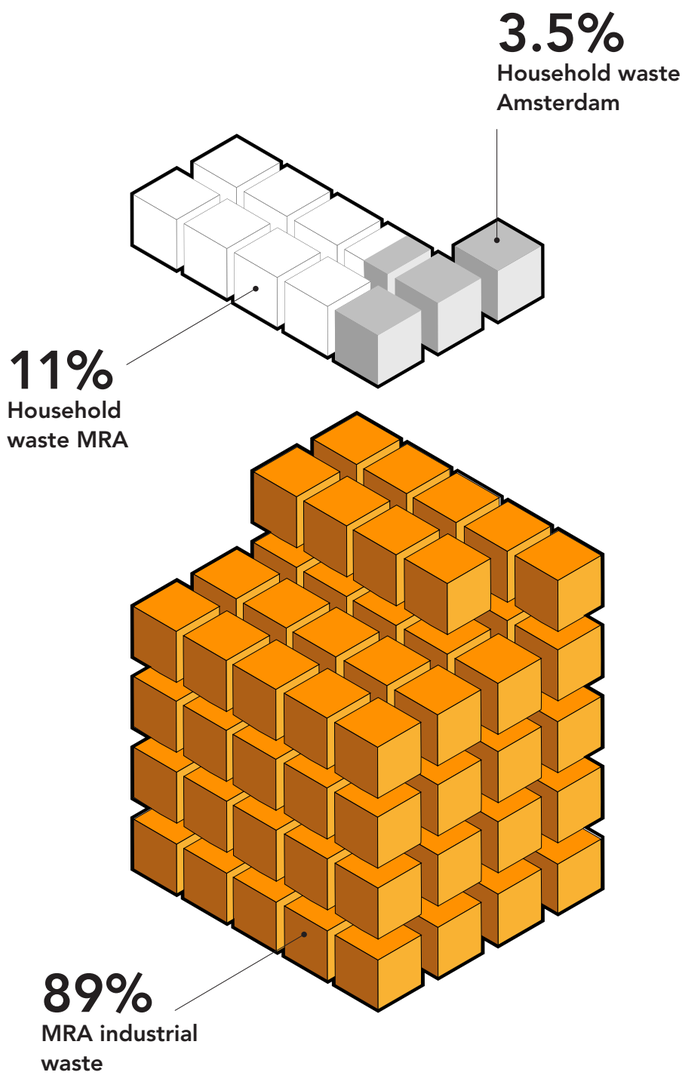


Indicators for waste collection by public authorities

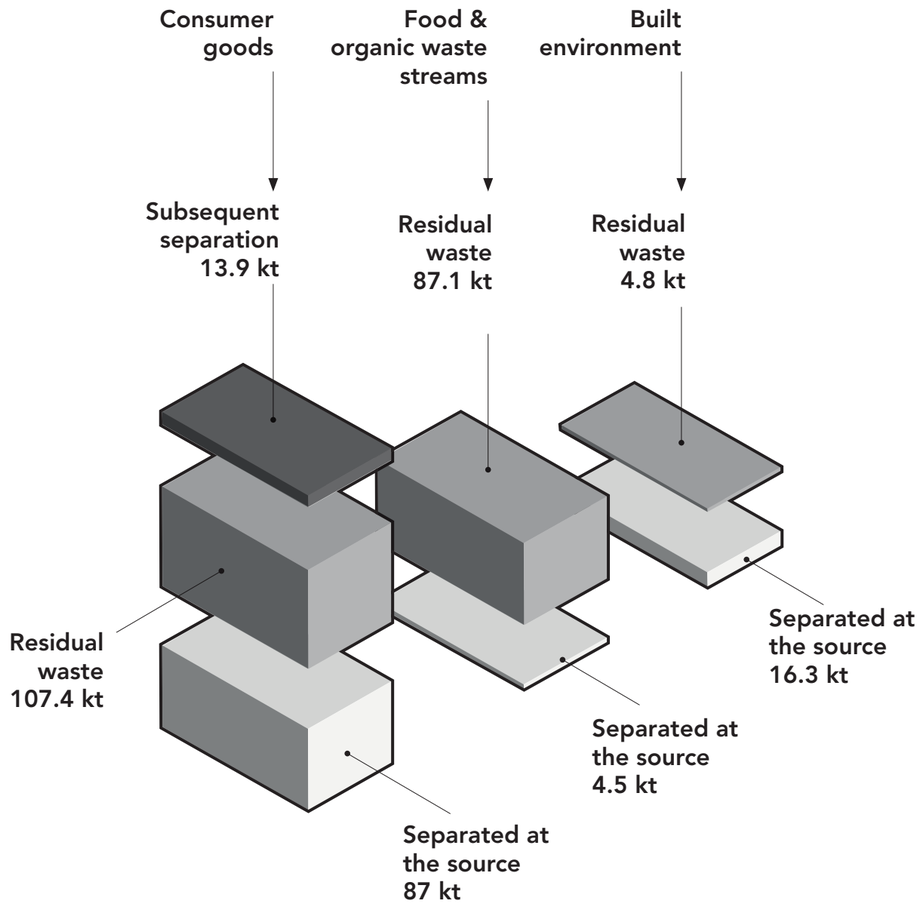
There are roughly two sources of waste: household waste collected by the municipal authority, and industrial waste collected mainly by private parties. This section of the Monitor concerns the collection of household waste.

In 2018, the City of Amsterdam collected a total of over 321 kt of waste. This is comparable to 1.7 times the rail network of the Netherlands Approximately two-thirds of the waste (65%) can be attributed to the consumer goods value chain, 29% to food & organic waste and 7% to the built environment. Of all waste, 62% comes in as residual waste, 34% is separated at source and 4% is subsequently separated from residual waste. This means that approximately two-thirds of all waste has the potential to be collected separately or as a single waste stream. To what extent this would be valuable is explained on the following two pages.

The whole rail network is 3,434 km long, at a weight of approximately 55 kg/m, thus amounting to a total of 188,870,000 kg (+/- 189 kt).



Breakdown of all waste streams produced in the Metropolitan Region Amsterdam in 2018.



Waste collected by the municipal authority by value chain and source.[26]

Waste collection by public authorities

Less than 1,000 tonnes · 1,000 - 5,000 tonnes · 5,000 - 10,000 tonnes · 10,000 - 25,000 tonnes · More than 25,000 tonnes

Separated fine waste

Consumer goods

- Small chemical waste **247 tonnes**
- Textiles **3,041 tonnes**
- Plastic/ beverage cartons **3,044 tonnes**
- Glass **15,361 tonnes**
- Paper **16,768 tonnes**

Food & organic waste streams

- Fruit, vegetable and garden waste **453 tonnes**

Built environment

Fine residual waste

Consumer goods

- Small chemical waste **1,132 tonnes**
- Metals **7,922 tonnes**
- Textiles **9,732 tonnes**
- Glass **12,448 tonnes**
- Plastic/beverage cartons **27,387 tonnes** (Including subsequent separation)
- Other **29,650 tonnes**
- Paper **33,045 tonnes**

Food & organic waste streams

- Wood **3,169 tonnes**
- Fruit, vegetable and garden waste **83,970 tonnes**

Built environment

- Construction waste **4,753 tonnes**

Separated bulky waste

Consumer goods

- Hard plastics **322 tonnes**
- Electronics **1,389 tonnes**
- General bulky waste **46,868 tonnes**

Food & organic waste streams

- Deep-frying oil **9 ton**
- Greenwaste **4,086 tonnes**

Built environment

- Roofing waste **138 ton**
- Clean rubble **3,435 tonnes**
- Construction and demolition **6,221 tonnes**
- B-wood **6,313 tonnes**
- C-wood **255 ton**

Explanatory notes on consumer goods

- Approximately 51% of consumer goods waste has the potential to be separated or to end up in a single waste stream. The value of the separated collection of waste varies by waste type.

- Recycling plastic and textile fractions is more difficult for several reasons, including: poor quality of the fractions, very many mixed types of plastic and textile, and a poor market for secondary materials.[27]

- Paper and glass fractions are known to be easily recyclable (recycling rates of 87% and 86%, respectively).

- As far as plastics are concerned, the separation process is most valuable if the different types of plastic are properly separated.

The main difference is between thermoplastics[28] and thermosets[29], where the latter are incinerated more often.

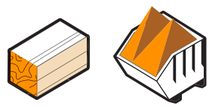
- Separation of textiles is valuable because the quality of textiles decreases when they end up in residual waste. More than half of separated clothing is 'rewearable'. The rest is processed into cleaning cloths or insulation material, or is incinerated.[30]

- Furniture and electronics come in via the disposal facilities and are thus collected separately. Many of the electronics that are brought in provide reusable materials, but an exact percentage is lacking.
- About half of bulk waste consists of furniture. It is estimated that slightly less than one-third of this is still usable and therefore suitable for sale in second-hand shops.[31]

Explanatory notes on food & organic waste streams

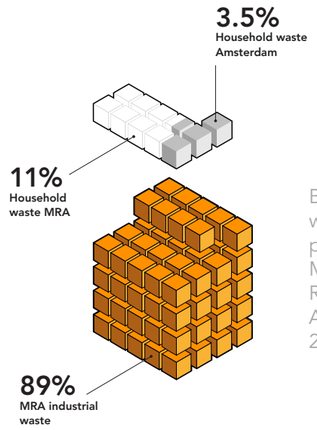
- The vast majority (92%) concerns fruit, vegetable and food waste and garden waste ('GFE/T' in Dutch). Of all the waste in this value chain, only 5% is separated at the source (the other 95% is residual waste). Waste separated at the source is mainly green waste delivered to the disposal point, as well as some deep-frying oil. Low-grade prunings and waste wood are incinerated and deep-frying oil is mainly converted into biofuel.

Explanatory notes on built environment



- In most cases, construction waste consists of B wood (30%), construction and demolition waste (29%) and residual waste (23%).
- Approximately two-thirds of the waste brought to the disposal points is suitable for recycling or reuse.[32]

Indicators for waste processing in regional industry



Breakdown of all waste streams produced in the Metropolitan Region Amsterdam in 2018.

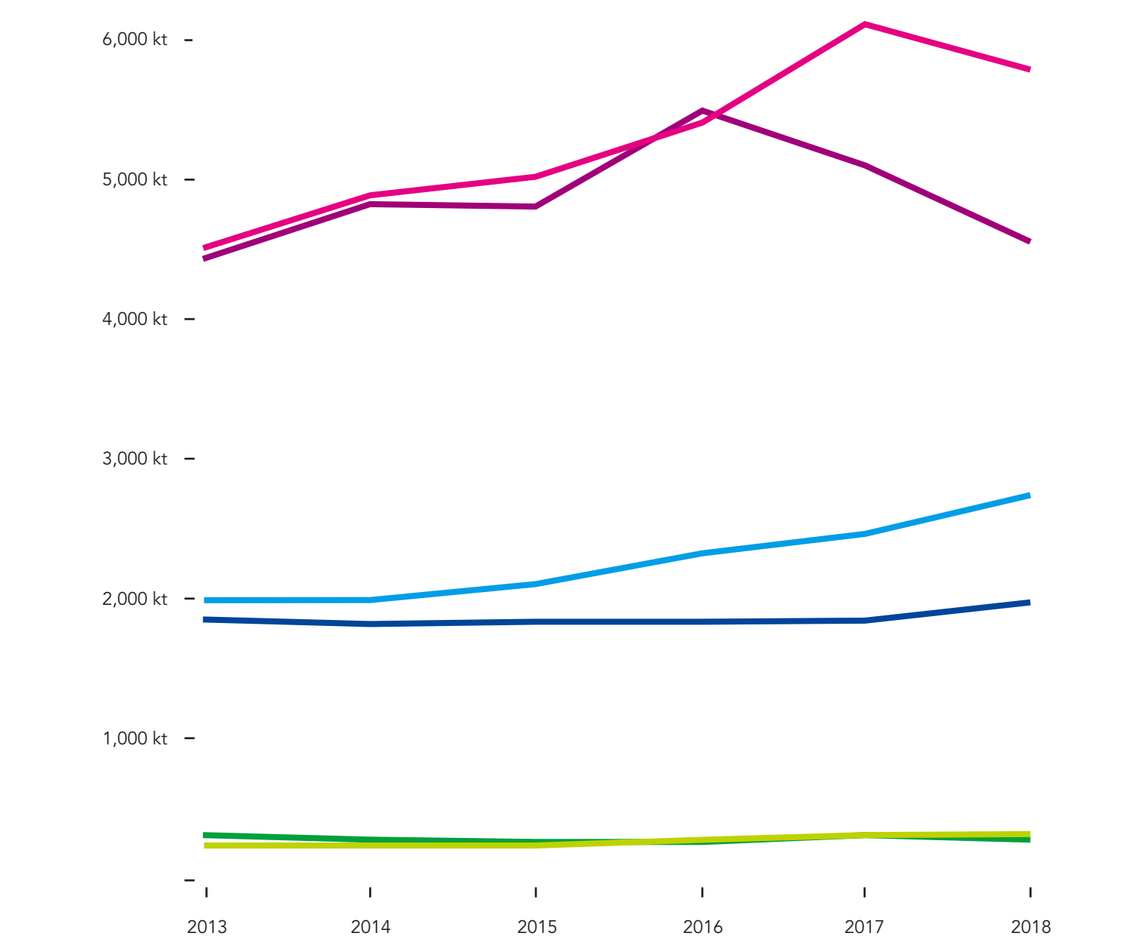
For this section of the Monitor, the remaining 89% of all waste collected annually in the Metropolitan Region Amsterdam was analysed.33 This waste – from business and industry – consists of 47% waste from the built environment, 20% waste from consumer goods and only 3% from food & organic waste streams. Waste from other sectors, such as the healthcare sector or chemical industry, are not included in this Monitor, but together are of a similar order of magnitude as waste from consumer goods.

The graph on the right shows trends in the production and processing of waste from the three value chains in the Metropolitan

from 2013 to 2018. The production of waste in the built environment has grown steadily since 2013, with a strong peak in 2016. This is attributable largely to major urban transformation projects, such as the development of the North/South Line and Port-City.

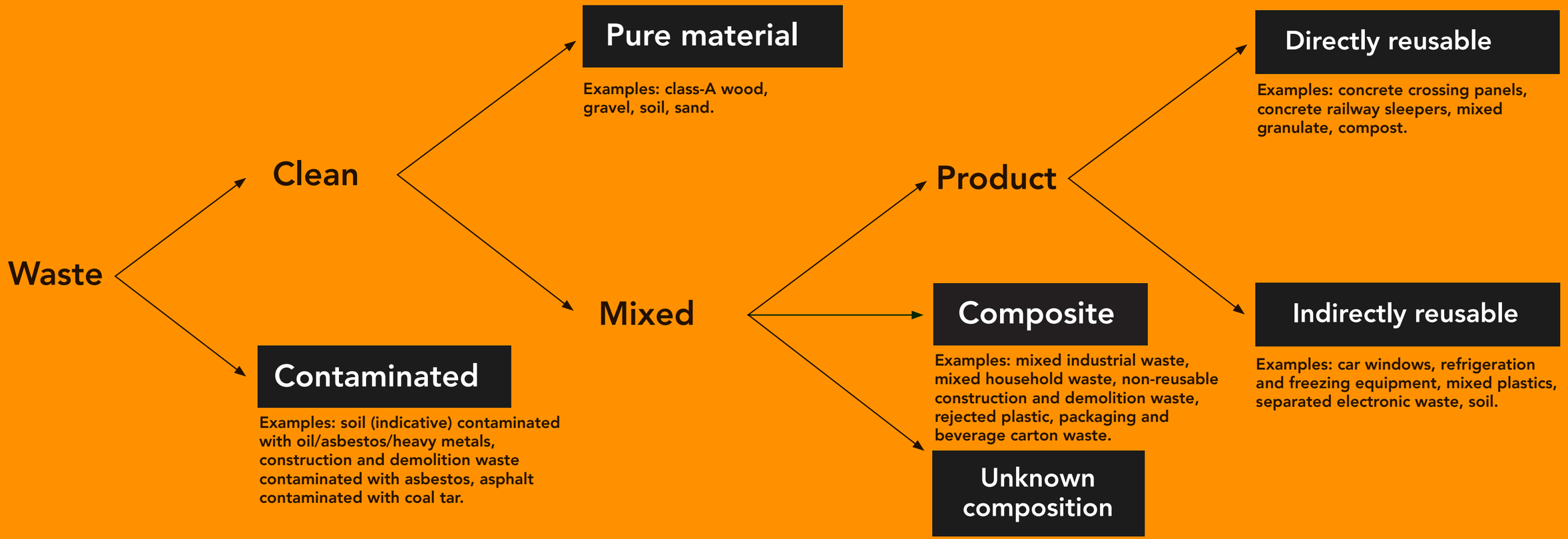
Waste production from consumer goods and food & organic waste streams stagnated between 2013-2018, while the processing of waste in the built environment and consumer growth grew significantly during this period. This is due to the import of waste materials from the rest of the Netherlands (and other countries). This is not the case for food and organic waste materials, because these streams are mainly produced and processed locally (within the Metropolitan Region Amsterdam).

Finally, a new visualisation and classification method (developed by TU Delft) provides a geographical representation of the three aforementioned value chains. The method shows which available streams have the greatest potential for reuse, subdivided into six classes: contaminated, pure, unknown, composite, directly reusable and indirectly reusable products. Materials that are not specified in the data, but are probably part of one of these classes, are also included in the overviews in order to illustrate the complex reality of the waste process.



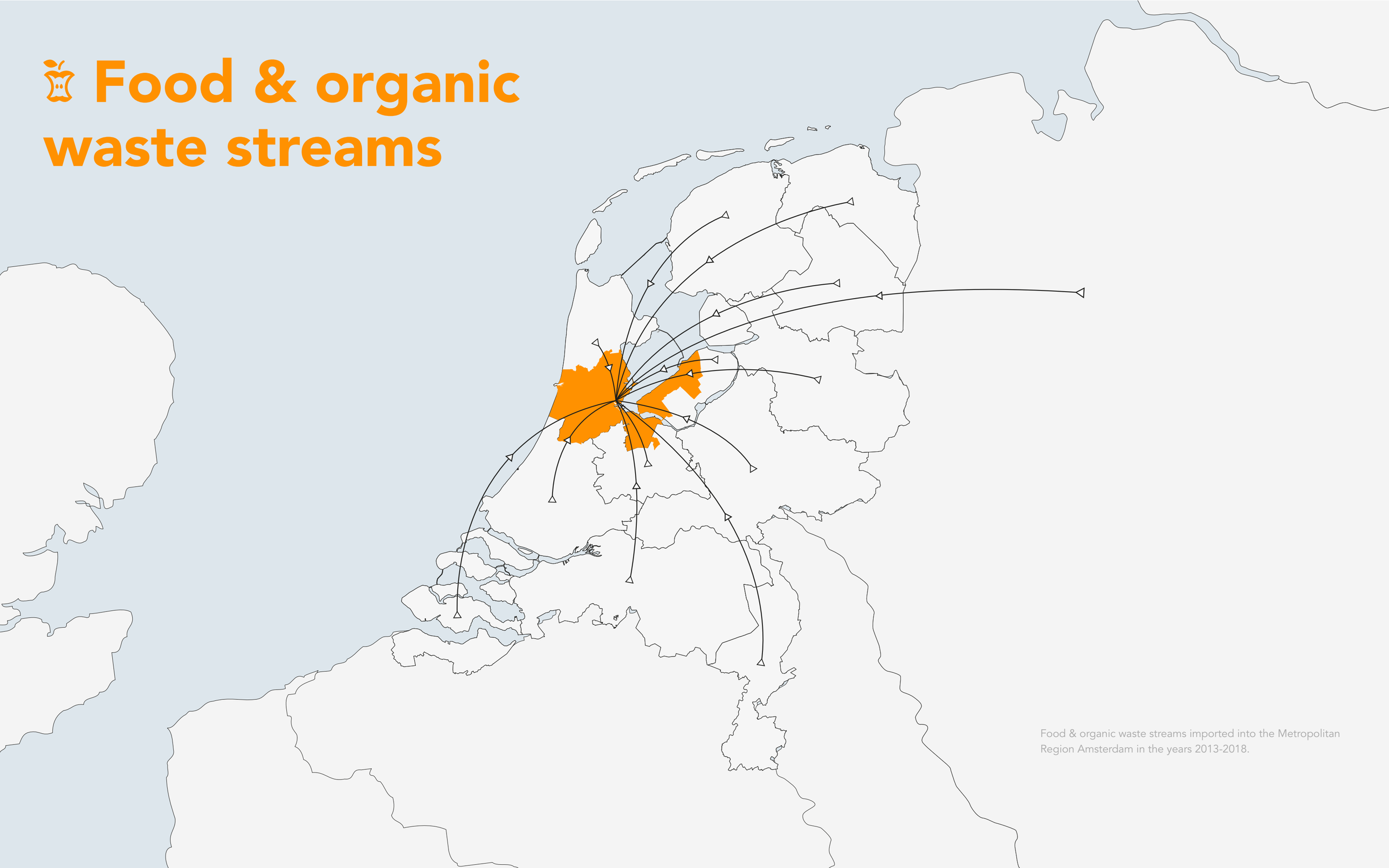
Historical overview of quantities of waste produced and processed by value chain in the Metropolitan Region Amsterdam from 2013-2018.

Classification method for waste



The visualisation and classification method developed by TU Delft visualises the three value chains geographically. Waste is therefore classified, not as 'waste' on the basis of the European list of wastes[34], but on the basis of its potential for reuse within a circular economy. As a result, all industrial residues were divided into six new classes: contaminated, pure, unknown, composite, directly reusable and indirectly reusable products.

Food & organic waste streams



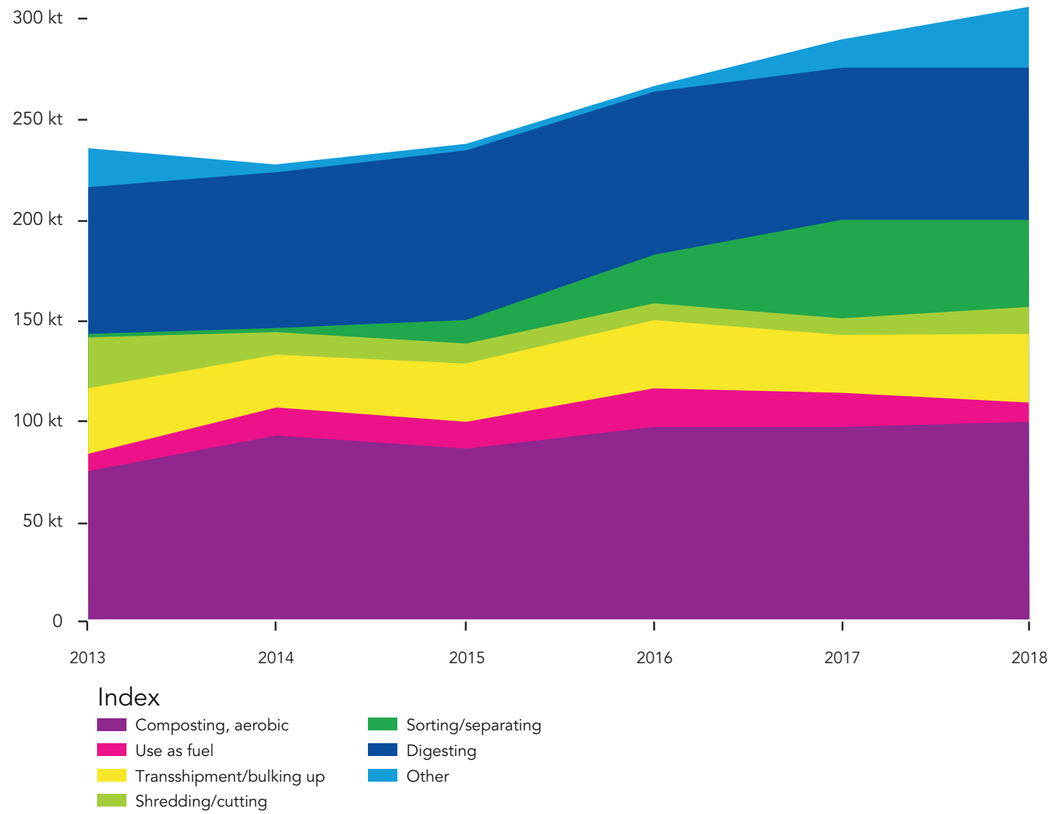
Food & organic waste streams imported into the Metropolitan Region Amsterdam in the years 2013-2018.

Food & organic waste streams

Historical overview

There has been steady growth in the sorting and separation of food & organic waste streams. However, there is a decrease in transshipment/bulking up, which means that more waste streams are processed locally instead of being exported.

As far as food & organic waste streams are concerned, very little is imported from abroad. This gives national and regional policymakers a great action perspective to use this residual stream more efficiently for a circular economy.



Graph: processing methods for food and organic waste in the Metropolitan Region Amsterdam in the years 2013-2018.

Food & organic waste streams

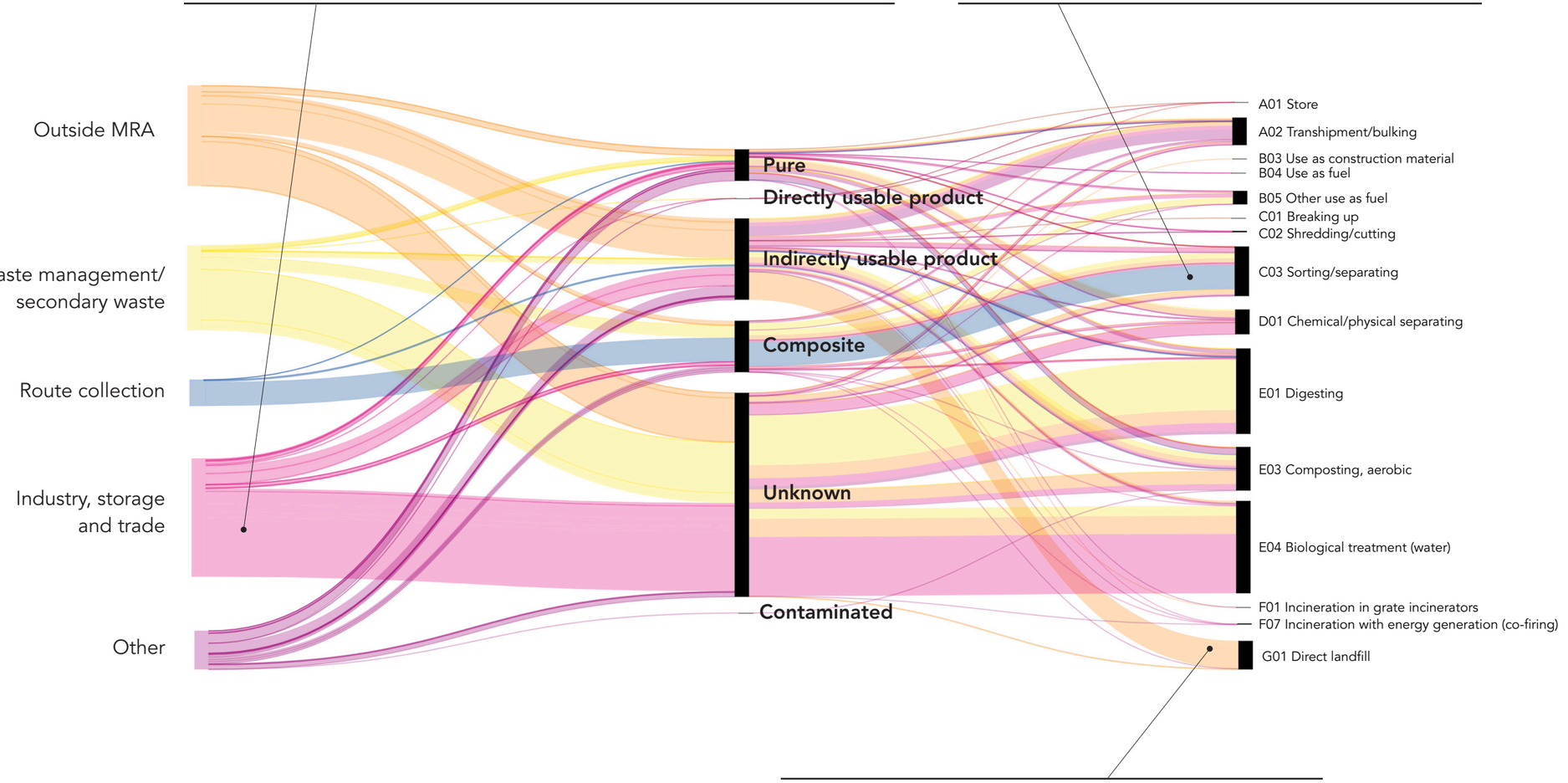
Streams

401 kt of food & organic waste streams were produced and/or processed in the Metropolitan Region Amsterdam (MRA) in 2018.

A specific characteristic of food & organic waste streams is that they often occur in combination with other waste materials (e.g. plastic/ cardboard packaging containing food waste). This level of detail has not been included in this initial survey, but data are available. The stream diagram shows that these separately collected organic waste streams do not end up in the incinerator. However, it is not known what quantities of food waste streams are mixed with other waste materials and are incinerated.

The largest quantities come from large-scale sectors (industry, storage and trade) rather than from the hotel & restaurant sector or small-scale SMEs. The data show that this is where the most can be gained in upgrading these large streams (locally). Food & organic waste streams are both produced and processed locally within the city of Amsterdam.

Oils and fats are mainly collected via route collection (a collector who collects and merges the same type of waste from different addresses). These oils and fats are later sorted and separated for further processing.



It is noteworthy that a considerable amount of organic waste with the potential for reuse after additional processing ('indirect products') is imported and then landfilled.

Food & organic waste streams

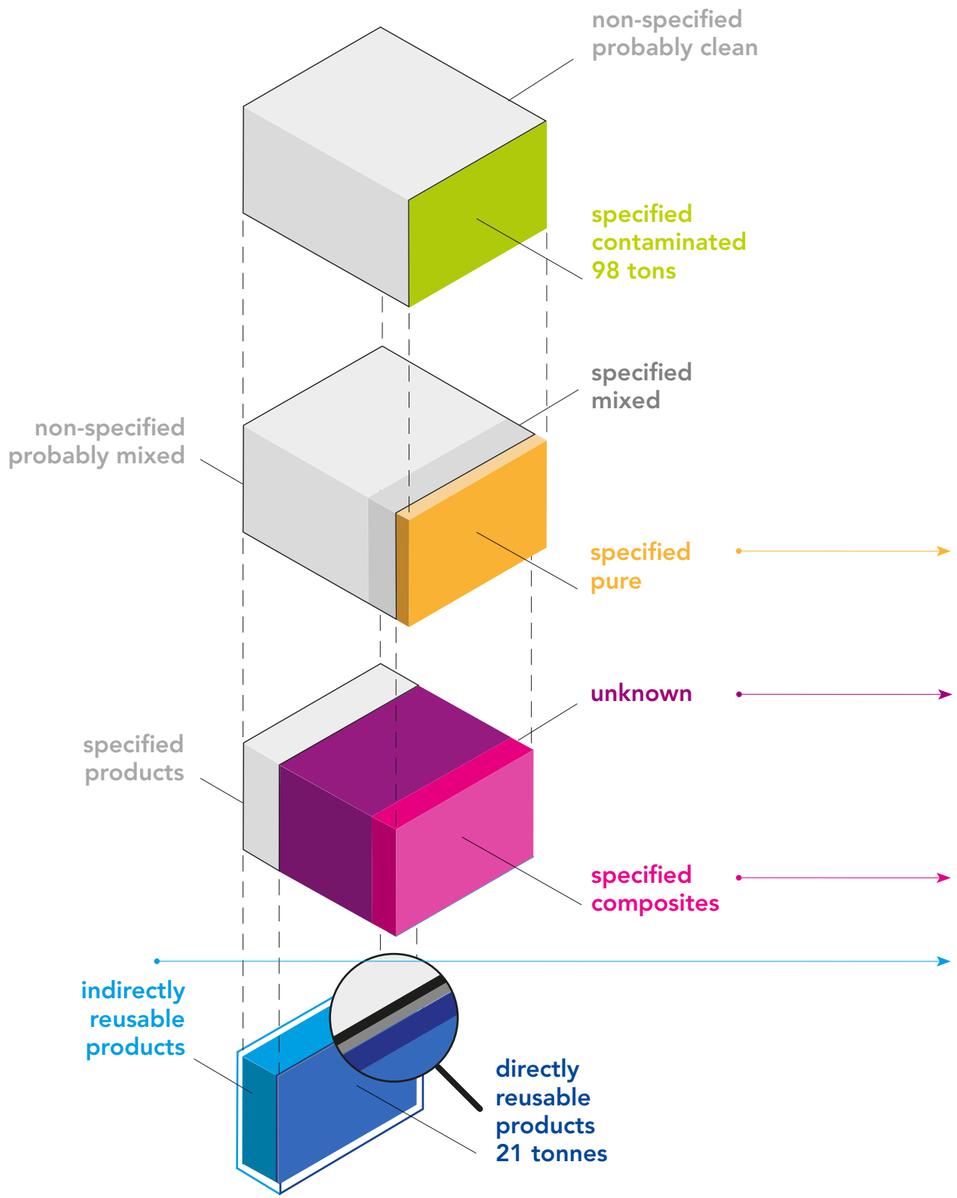
Materials

401 kt of food & organic waste streams were produced and/or processed in the Metropolitan Region Amsterdam in 2018.

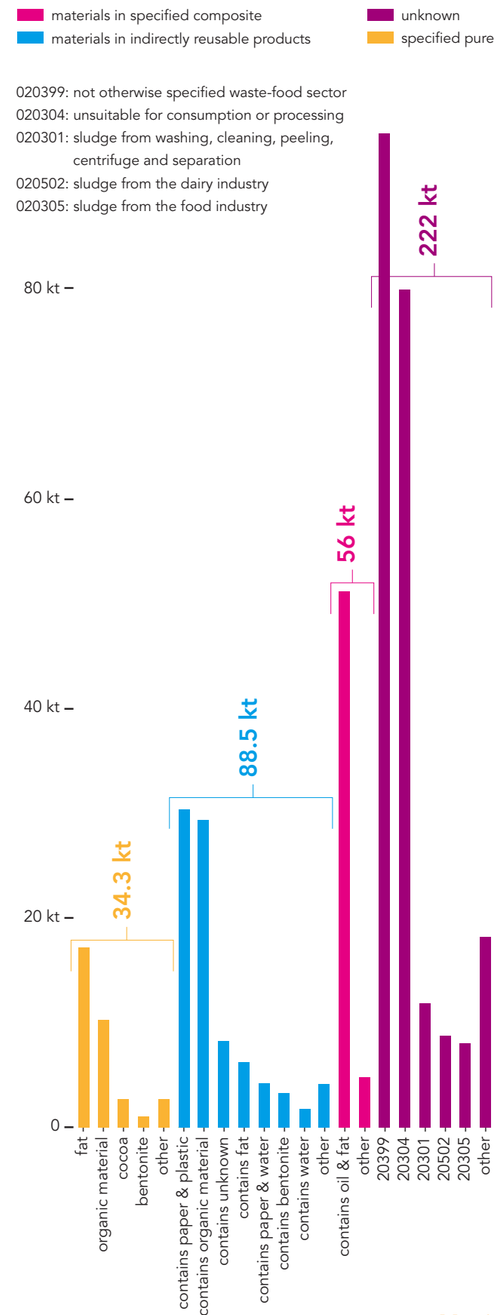
401 kt
food & organic waste streams

3,228 kt
consumer goods

6,817 kt
built environment



Materials and products that exist in identified classes of waste.



Food & organic waste streams

Scales

Large quantities of organic waste streams are imported into the Metropolitan Region Amsterdam (MRA) from the provinces of Overijssel, Zuid-Holland, Flevoland and Groningen, while a significant proportion is exported to Noord-Holland.

In general, more waste is imported into Amsterdam than is exported to other areas. Notably, more than 30 kilotonnes of organic waste streams from Overijssel, Drenthe and Groningen were imported and landfilled in the MRA, while all organic waste streams produced in the MRA are processed in a higher-grade manner with a lower environmental impact.
The City of Amsterdam produces more organic waste streams than the rest of the MRA, but there is little exchange between the City of Amsterdam and the rest of the MRA. Organic waste streams produced in the MRA (but outside the city) are not processed in Amsterdam, but exported to other provinces and processed there.

Food & organic waste streams from the MRA, processed outside the MRA (in 2018).

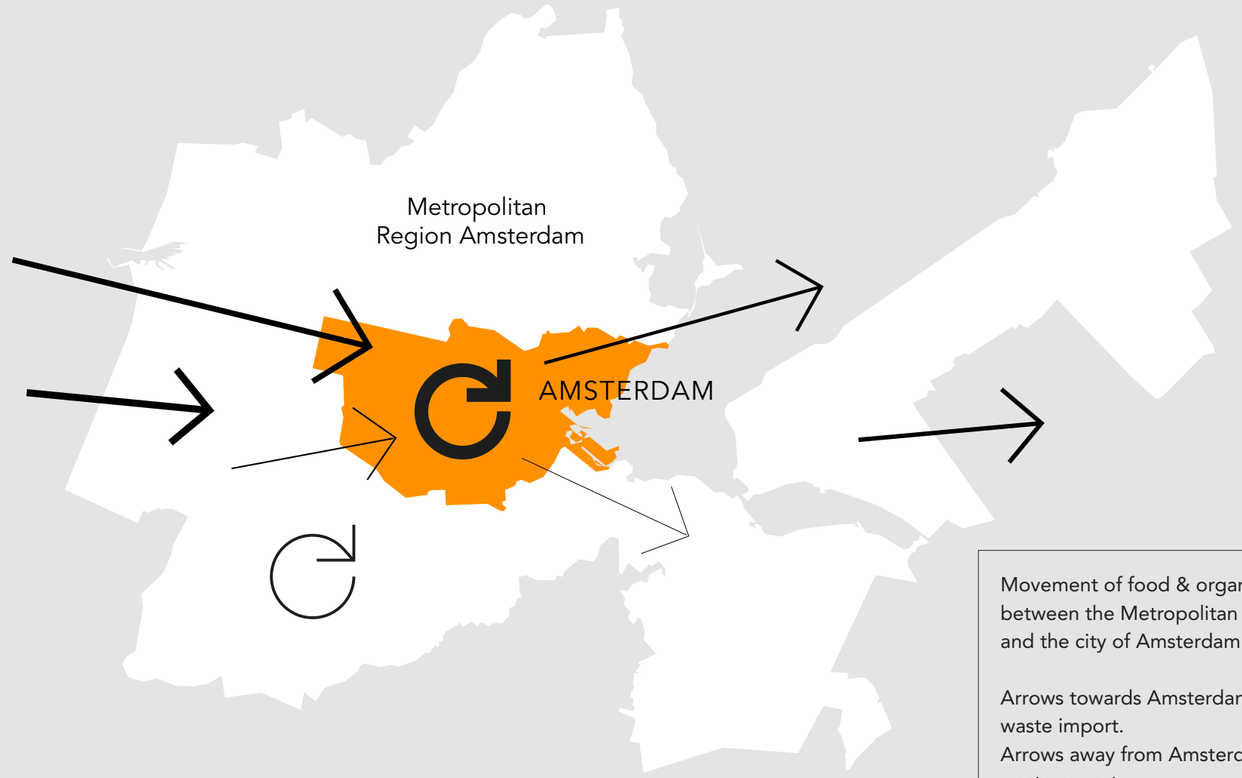
Food & organic waste streams from outside the MRA, processed in the MRA (in 2018).

Food & organic waste streams

Scales

In general, more waste is imported into Amsterdam than is exported to other areas.

The majority of the organic waste streams produced in Amsterdam (> 80%) are also biologically processed in Amsterdam, for example through composting. The city of Amsterdam produces more organic waste streams than the rest of the Metropolitan Region Amsterdam (MRA), but there is little exchange between the city of Amsterdam and the rest of the MRA. Organic waste streams produced in the MRA (but outside the city) are not processed in Amsterdam, but exported to other provinces and processed there.



Movement of food & organic waste streams between the Metropolitan Region Amsterdam and the city of Amsterdam.

Arrows towards Amsterdam/MRA:
waste import.
Arrows away from Amsterdam:
waste export.
Circular arrow:
waste processing in Amsterdam/MRA.

< 0 kt 80 kt 160 kt

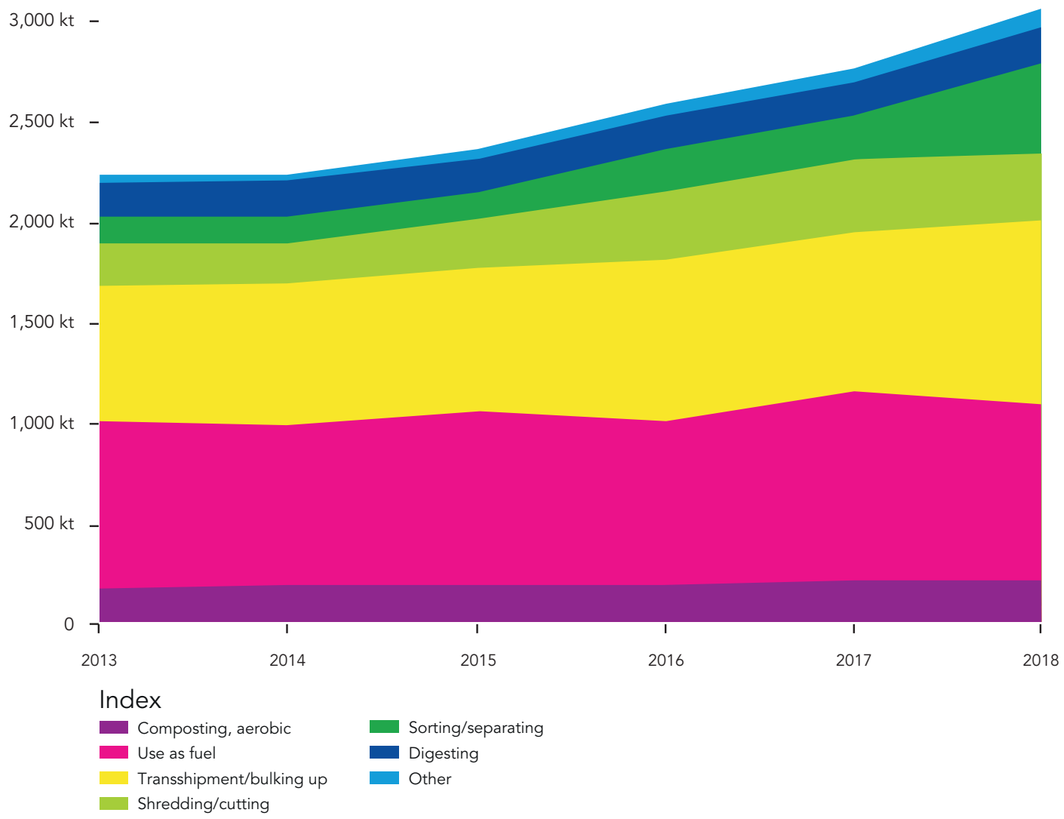
Consumer goods

Consumer goods waste imported into the Metropolitan Region Amsterdam in the years 2013-2018.

Consumer goods

Historical overview

The quantity of consumer goods imported from the rest of the Netherlands and from abroad is far greater than the quantity exported from the Metropolitan Region. An important trend is the increase in the sorting and separation of consumer goods, especially in 2018. Since other processing methods were not used less during that period, we can assume that the improved sorting capacity of waste processors in the Metropolitan Region Amsterdam attracts more waste from outside the Metropolitan Region Amsterdam.
Transshipment and bulking up have also increased considerably and have been the main processing methods for consumer goods since 2018. Since 2013, the majority of consumer goods waste has been used as fuel (incinerated), despite the improved sorting capacity in the Metropolitan Region Amsterdam.



Graph: processing methods for waste from consumer goods in the Metropolitan Region Amsterdam in the years 2013-2018.

Consumer goods

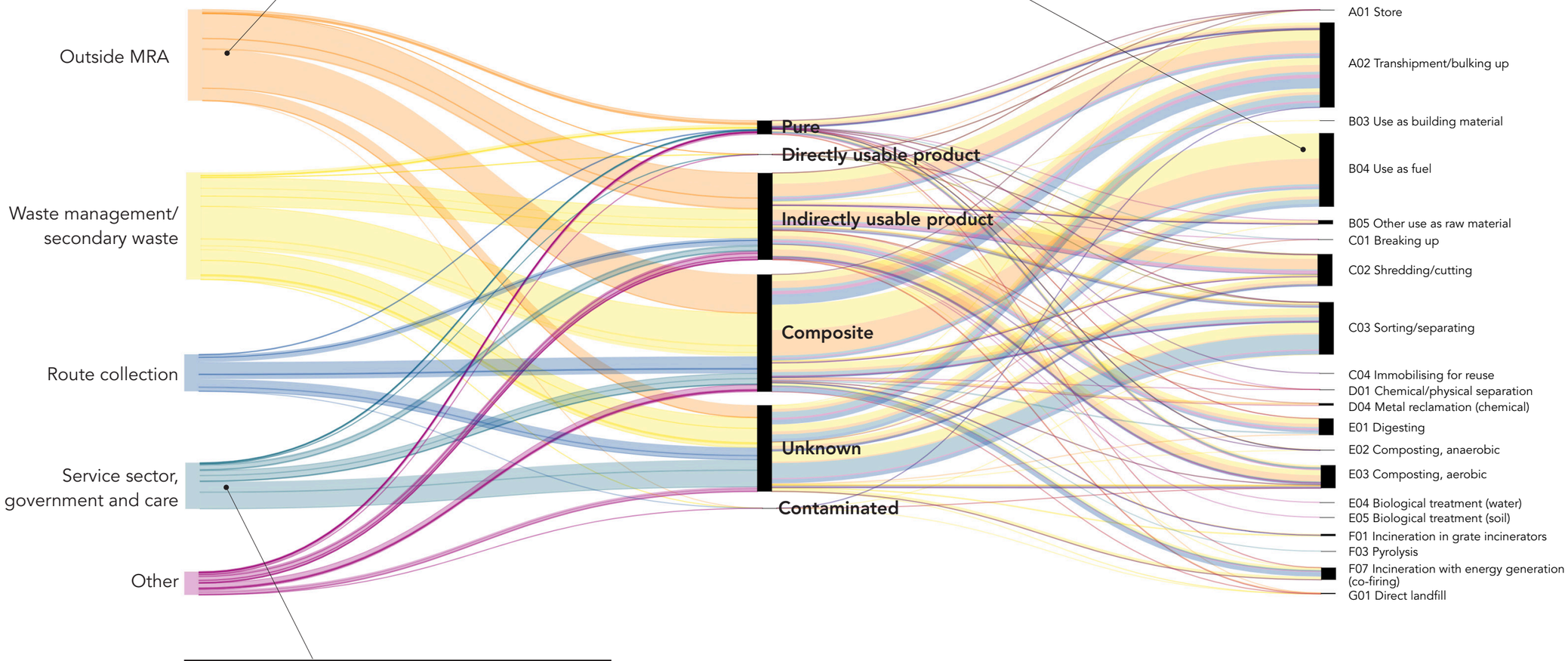
Streams

3,228 kt of waste streams from consumer goods were produced and/or processed in the Metropolitan Region Amsterdam in 2018.

The Metropolitan Region Amsterdam plays an important role in the processing of consumer waste streams for the entire country. We see that these waste streams have great potential for reuse. However, agreements must be made with other provinces to ensure the quality of the waste streams.

Large quantities of mixed waste (composites) are imported from throughout the Netherlands to be used as fuel (incineration) in the Metropolitan Region Amsterdam.

Secondary waste (waste streams that have gone through previous processing) is a second large waste stream that is primarily used as fuel (incineration). This makes it difficult to assess how effectively previous sorting and separation have taken place.



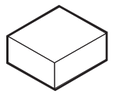
Of the regional business sectors, the service sector (education, public authorities, healthcare, etc.) is responsible for the largest quantities of consumer goods.

Consumer goods

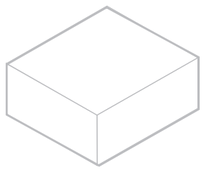
Materials

3,228 kt of waste streams from consumer goods were produced and/or processed in the Metropolitan Region Amsterdam in 2018.

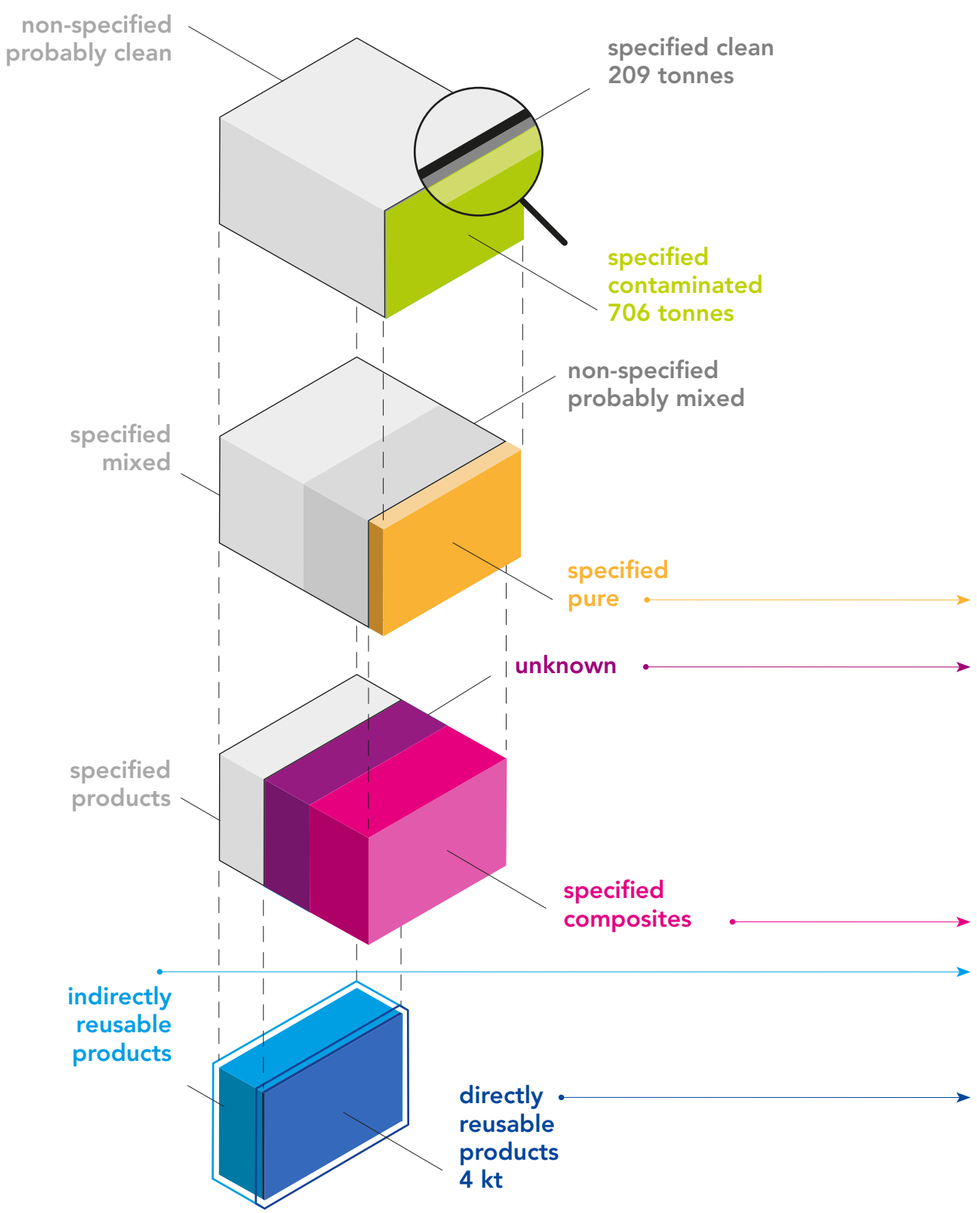
401 kt
food & organic
waste streams



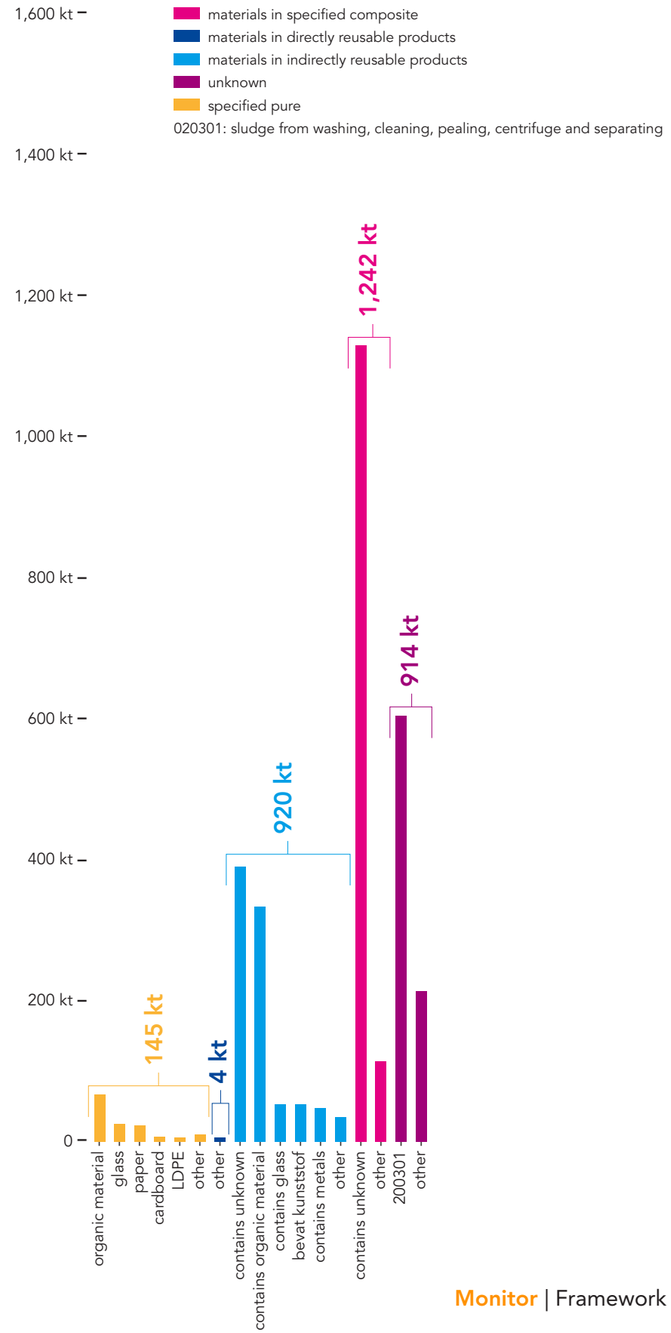
3,228 kt
consumer
goods



6,817 kt
built
environment



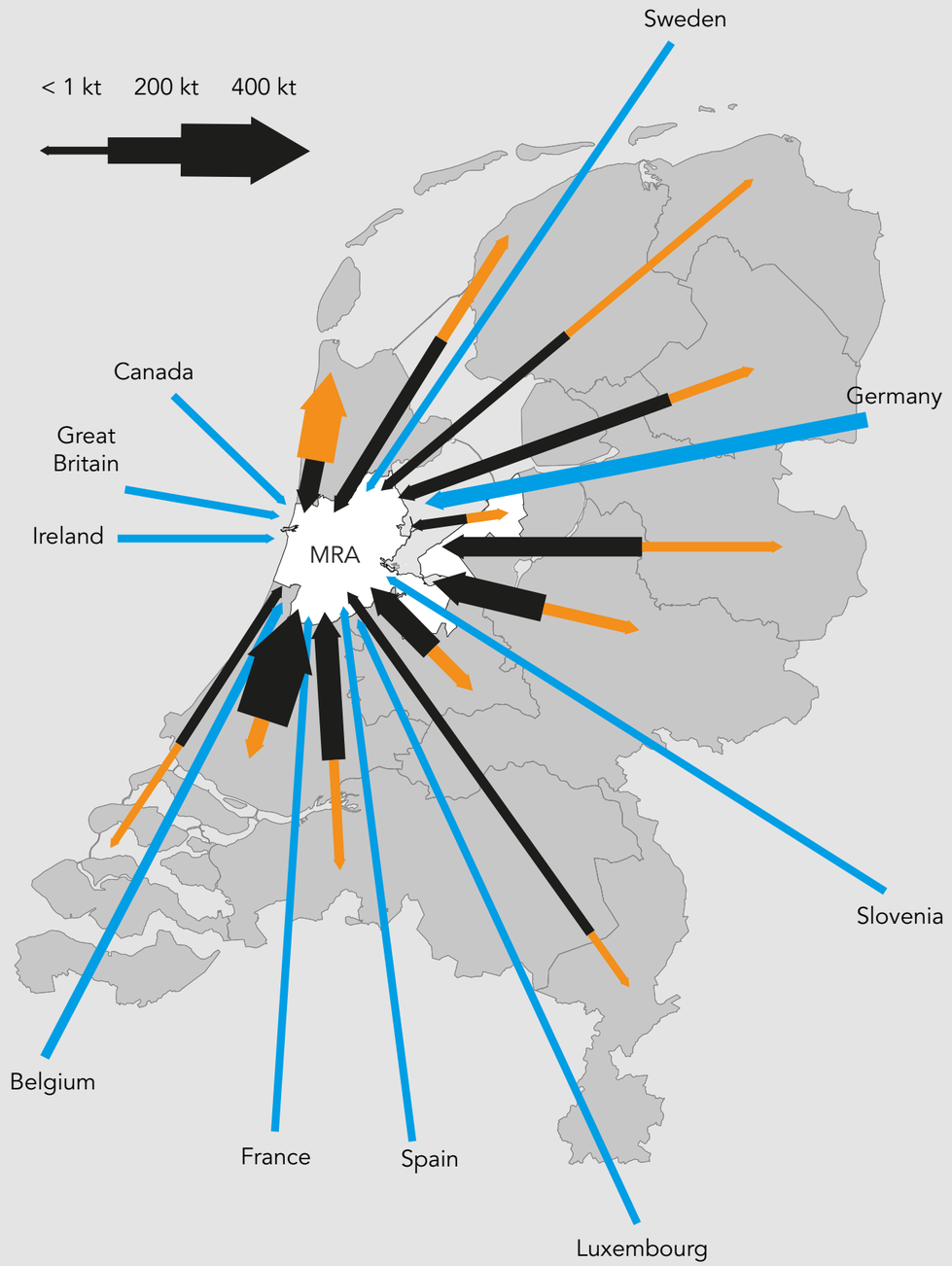
Materials and products that exist in identified classes of waste.



Consumer goods

Scales

More than 50% of the consumer goods waste processed in Amsterdam is produced outside the Metropolitan Region Amsterdam. In other words, the city plays an important role as a processor, despite the fact that the value of this waste is largely lost (since these waste streams are mainly incinerated, i.e. used as fuel). In order to increase the quality of these waste materials – and consequently their potential for reuse – agreements have been made and rules agreed with the importing parties and provinces (mainly Zuid-Holland, Gelderland, Overijssel and Groningen).



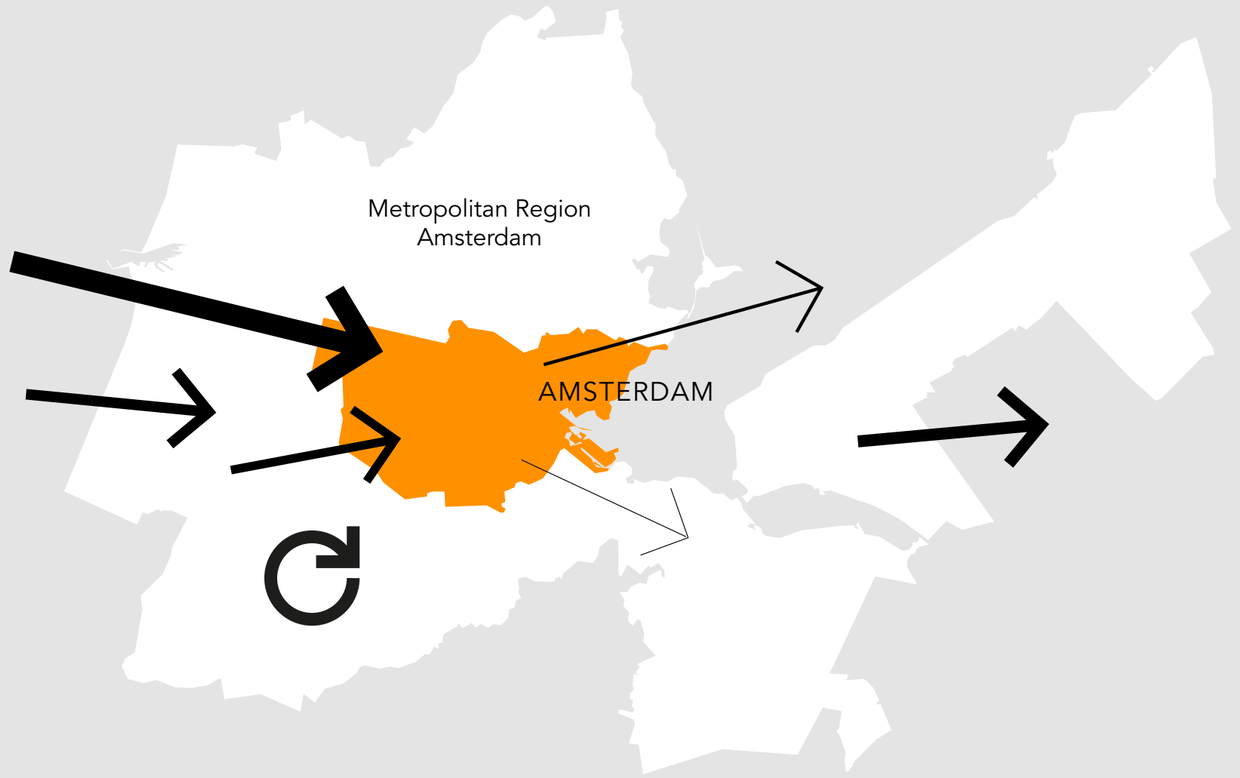
Consumer goods from the MRA, processed outside the MRA (in 2018).

Consumer goods from outside the MRA, processed in the MRA (in 2018).

Consumer goods

Scales

Whereas the vast majority of imported waste streams in the City of Amsterdam are incinerated (used as fuel), the majority of imported waste streams in the Metropolitan Region are biologically processed. This is remarkable, as approximately 20% of all exported waste streams of consumer goods from the MRA are incinerated elsewhere in the rest of the Netherlands, while the city of Amsterdam incinerates waste imported from abroad.

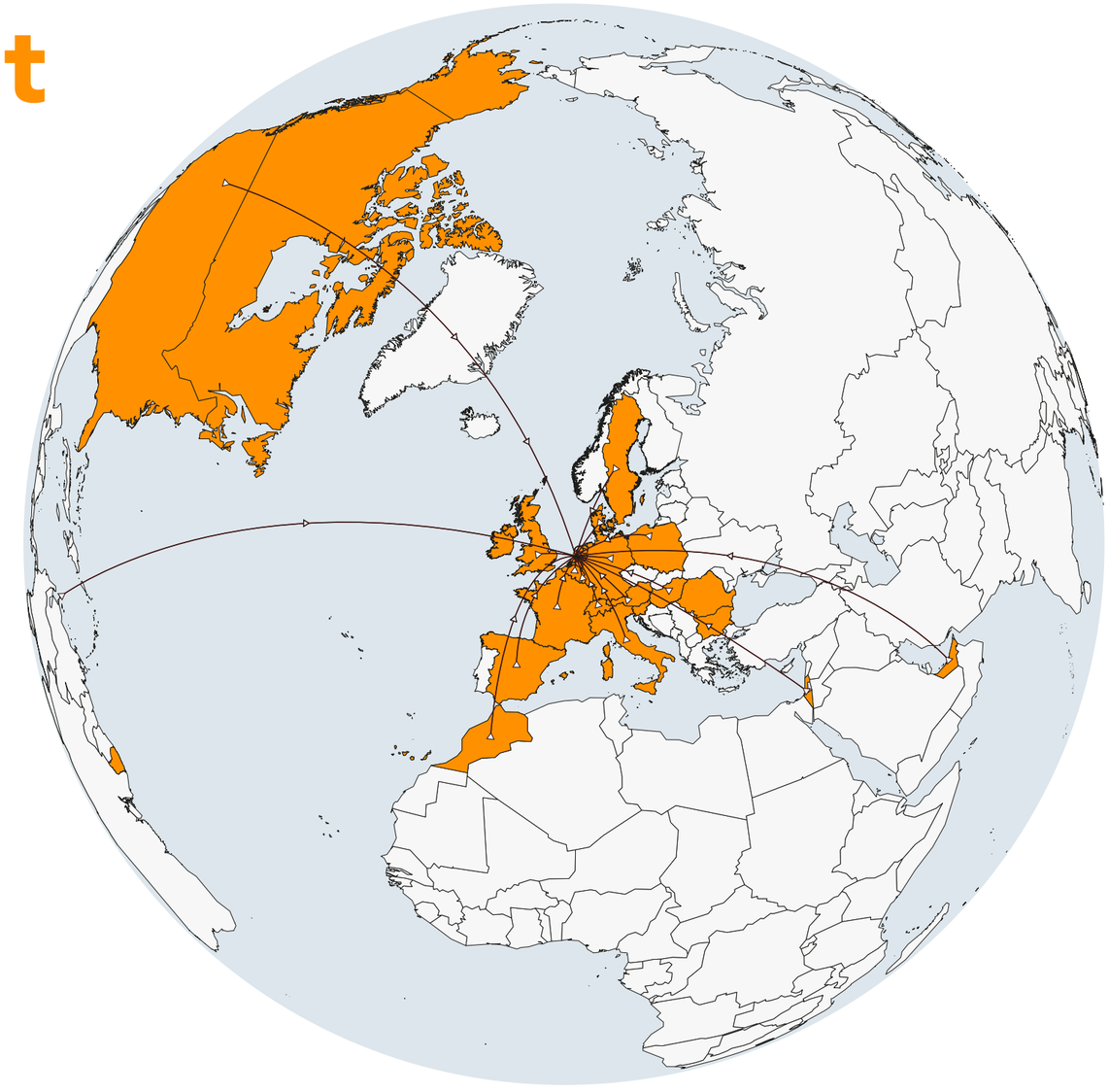


Movement of waste from consumer goods between the Metropolitan Region Amsterdam and the City of Amsterdam.

Arrows towards Amsterdam/MRA:
waste import
Arrows away from Amsterdam:
waste export
Circular arrow:
waste processing in Amsterdam/MRA

< 0 kt 450 kt 900 kt

Built environment

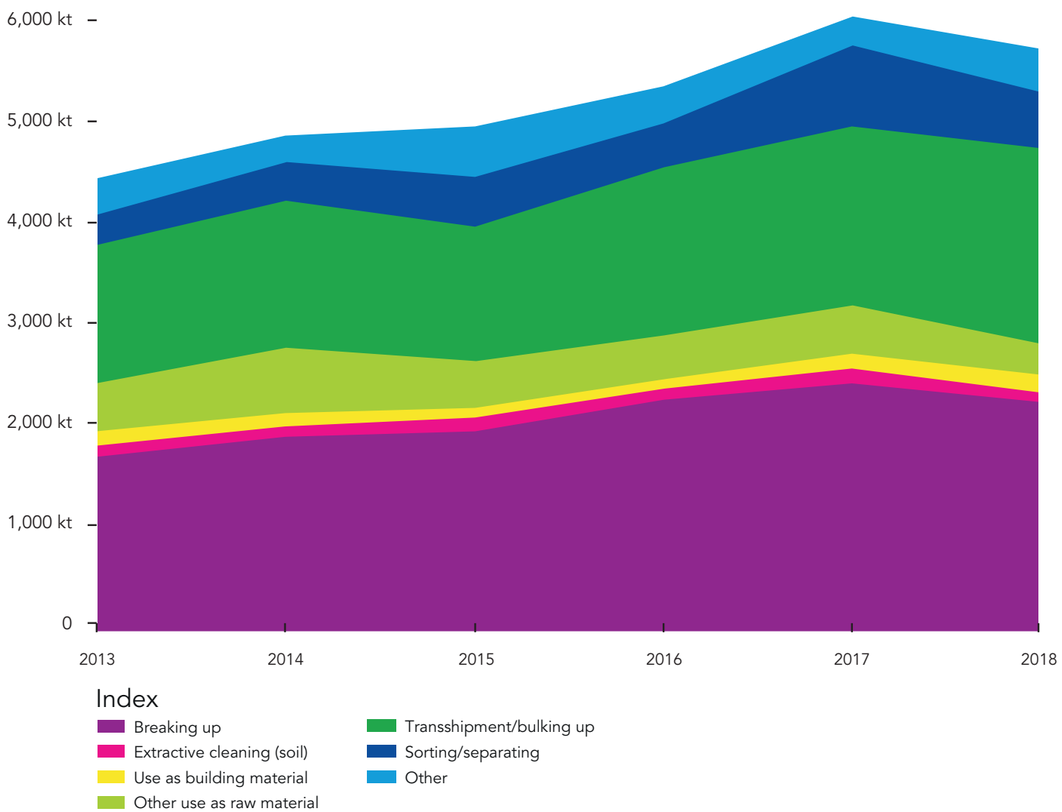


Construction and demolition waste imported into the Metropolitan Region Amsterdam in the years 2013-2018..

Built environment

Historical overview

The majority of construction and demolition waste is crushed and then reused as secondary waste. Transshipment and bulking up are showing significant growth. More research is needed to determine the cause of this. Despite the decline in construction and demolition waste streams since 2016, their processing is increasing due to imports of waste into the Metropolitan Region Amsterdam.
40% of all the construction and demolition waste in the Metropolitan Region Amsterdam between 2013-2018 was broken into smaller pieces and then further processed as secondary waste. Notably, there has been a significant increase in transshipment and bulking up. Further research in the course of 2020 will show how much of this will be reused in a high or low-grade manner as building material in Amsterdam. By gaining more insight into the extent to which high or low-grade materials are reused, companies can make informed decisions to reduce the use of primary raw materials and replace them with secondary raw material alternatives.



Graph: processing methods for waste in the built environment from the Metropolitan Region Amsterdam in the years 2013-2018.

Built environment

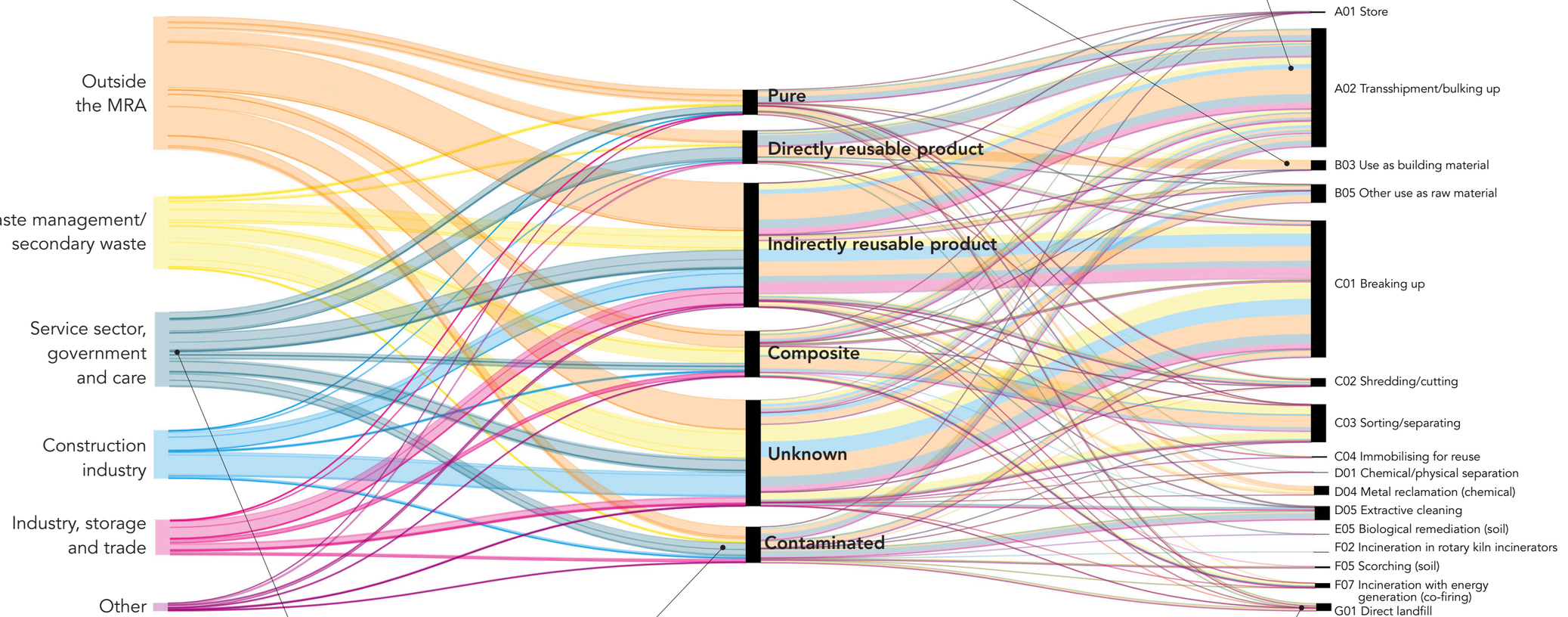
Streams

6,817 kt of waste from the built environment was produced and/or processed in the Metropolitan Region Amsterdam in 2018.

Patterns of construction and demolition waste are much more variable than those of the other two value chains. The decisive role of a number of urban transformation projects such as the North/South Line and Port-City is clearly reflected in the data. Different types and quantities of waste become available, depending on the development phases of these projects.

A positive development is that most directly renewable products are used for transshipment or as new building material.

ure materials are mainly used for transshipment and bulking up, as a result of which it is not clear whether they are reused at a later date.



In 2018, there were many construction projects commissioned by the service sector, public authorities and the healthcare sector.

A considerable amount of construction and demolition waste is contaminated (primarily with tar and/or asbestos).

As is the case for food & organic waste streams, a proportion of the imported waste from the built environment from other parts of the Netherlands is landfilled in the Metropolitan Region Amsterdam.

Built environment

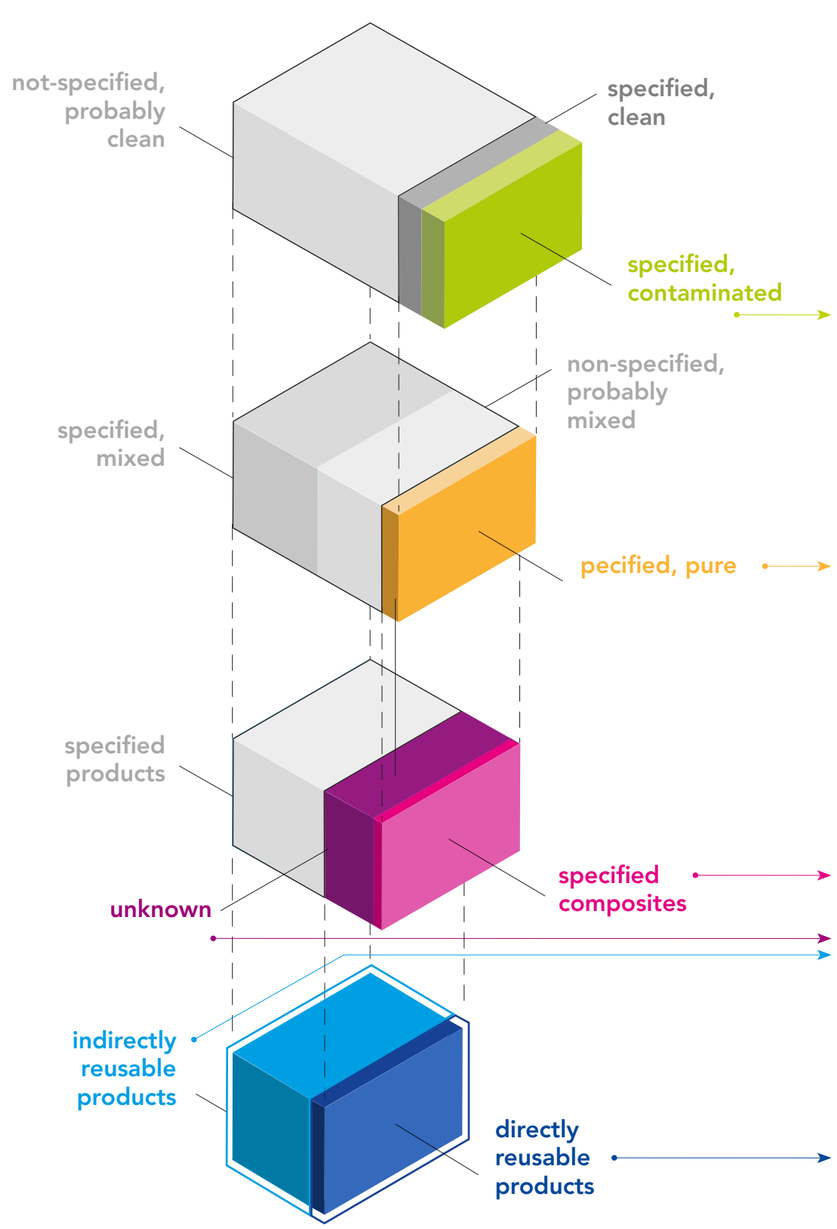
Materials

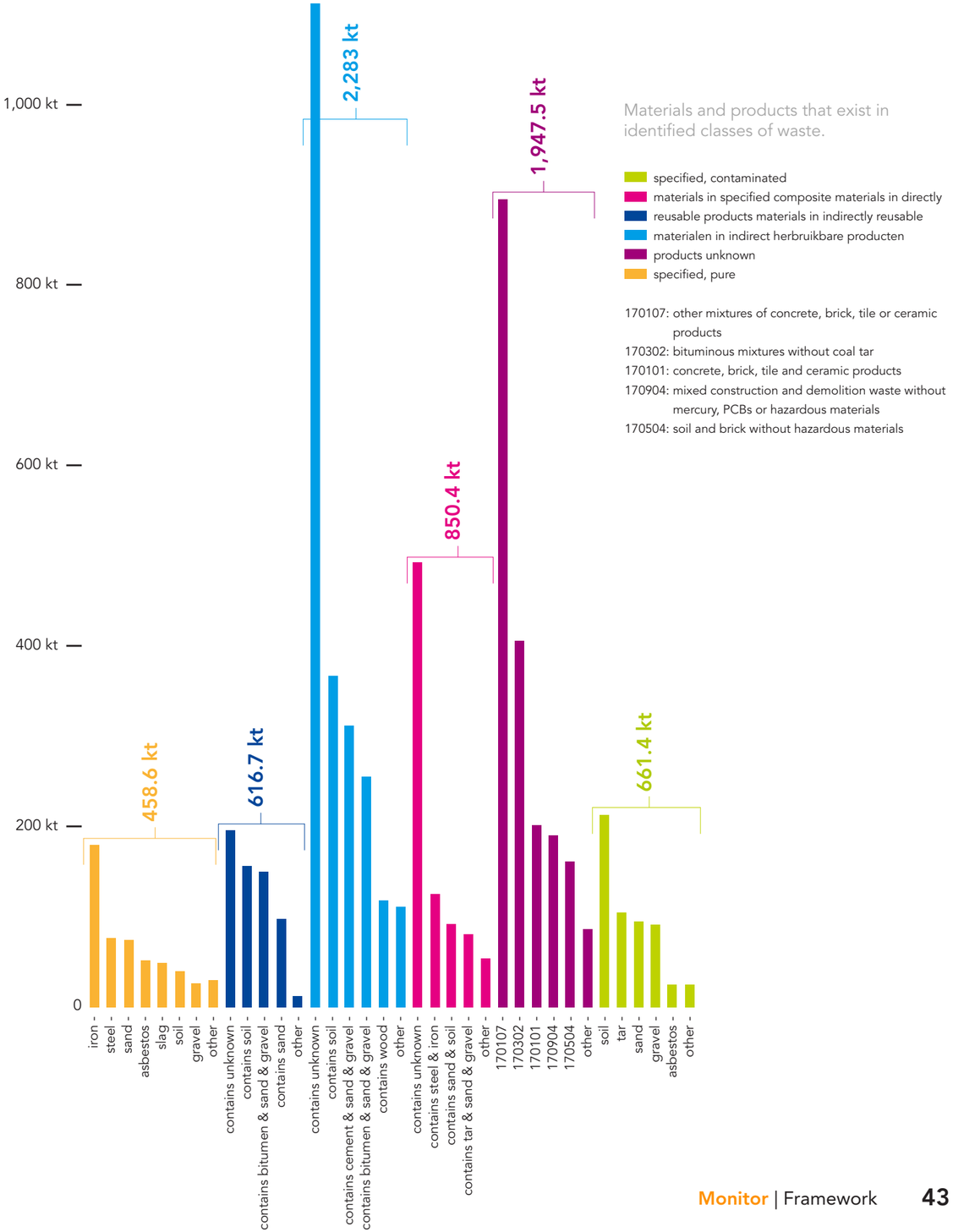
6,817 kt of waste from the built environment was produced and/or processed in the Metropolitan Region Amsterdam in 2018.

401 kt
food & organic waste streams

3,228 kt
consumer goods

6,817 kt
built environment





Built environment

Scales

The largest quantities of construction and demolition waste are imported into the MRA from Zuid-Holland, Gelderland, Noord-Holland and Noord-Brabant, while a significant proportion is exported to Utrecht.

More construction and demolition waste is imported into the MRA than is exported to other areas, which gives Amsterdam an important waste processing role for construction and demolition waste streams.

As these materials come from the Netherlands and abroad, it is important to establish standards and rules for this beyond the boundaries of the MRA with the various importing provinces and companies. At the same time, this gives the waste processing companies in the MRA many opportunities to increasingly take on the role of distributor and/or dealer of waste streams and materials. Only very small quantities of construction and demolition waste are exported from the city, also in comparison with the rest of the Metropolitan Region Amsterdam.

Waste from the built environment from the MRA, processed outside the MRA (in 2018).

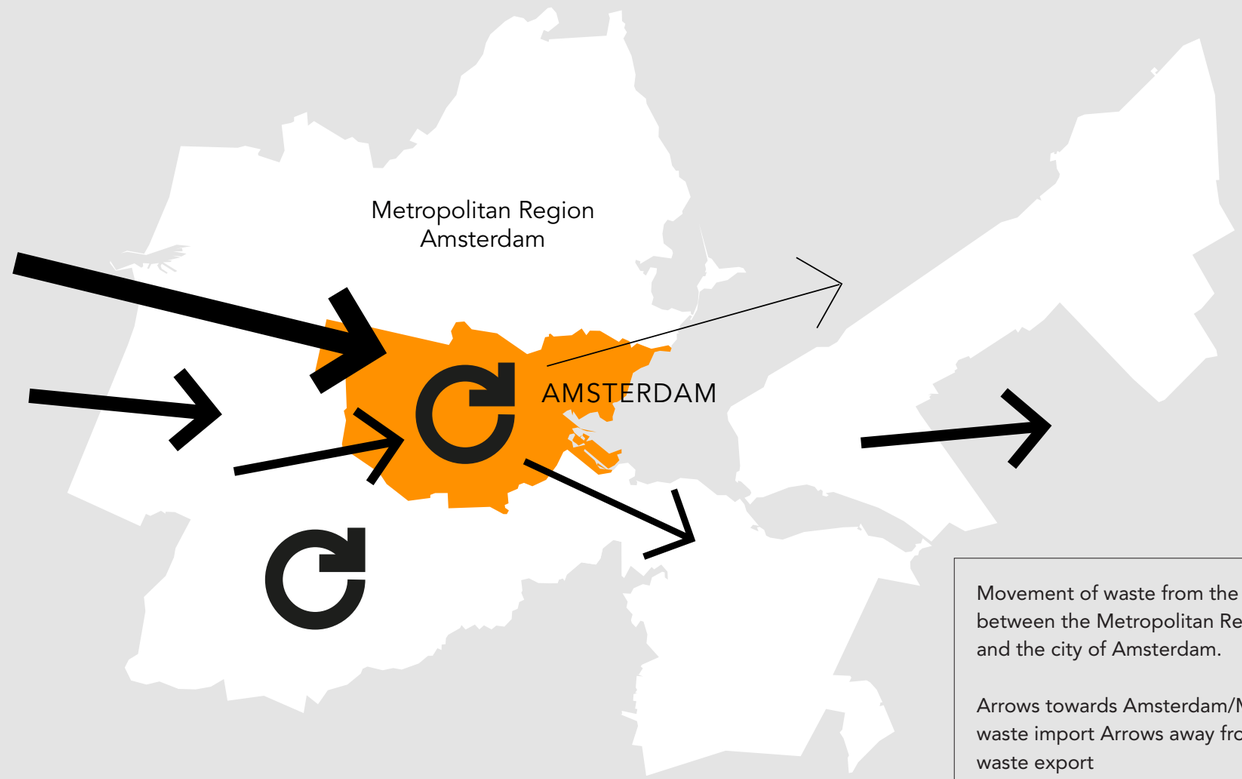
Waste from the built environment from outside the MRA, processed in the MRA (in 2018).

Built environment

Scales

As is the case for consumer goods, the city of Amsterdam imports construction and demolition waste from abroad for incineration. However, most (> 50%) of the waste produced in the city is physically processed: shredded, cut, broken up, separated or used for reuse.

This means that, for most local waste streams, materials are reused at least once before they are definitively discarded. Approximately 30% of all construction and demolition waste produced or imported into the city of Amsterdam is stored. Further research is needed to find out what happens to these materials and what environmental impact they generate in their further processing or disposal.



Movement of waste from the built environment between the Metropolitan Region Amsterdam and the city of Amsterdam.

Arrows towards Amsterdam/MRA:
waste import Arrows away from Amsterdam:
waste export
Circular arrow:
waste processing in Amsterdam/MRA

The social foundation of Amsterdam

For the social foundation of the Monitor for the Circular Economy in Amsterdam, we use the social indicators that fall under our concept of 'broad prosperity'. This means that non-financial indicators, such as quality of education, healthcare and democracy, are also elements of a good life.

The Dutch government developed the term 'broad prosperity' on the basis of certain national values. In Amsterdam, the term has a primarily social character and needs to be supplemented. The doughnut shows us that our prosperity and our well-being are related to the prosperity and well-being of others, elsewhere in the world. We will further detail this relationship in the coming years. For the time being, the Monitor of social indicators is not yet able to calculate and quantify the relationship between local and global. We will develop a model for this in the coming years. In this version of the Monitor, we establish a basis for this. The selected indicators provide an opportunity to chart the social and ecological consequences of the transition to a circular economy.

The figure on the following page shows how Amsterdam has developed in certain relevant areas in recent years. The figure on the subsequent page provides insight into the various aspects of broad prosperity in Amsterdam compared to the Metropolitan Region Amsterdam.[35]

In order to monitor the social foundation, it is very important to build up a time series so that important developments can be identified. Where necessary, further research can be carried out into the relationship to developments in circularity.

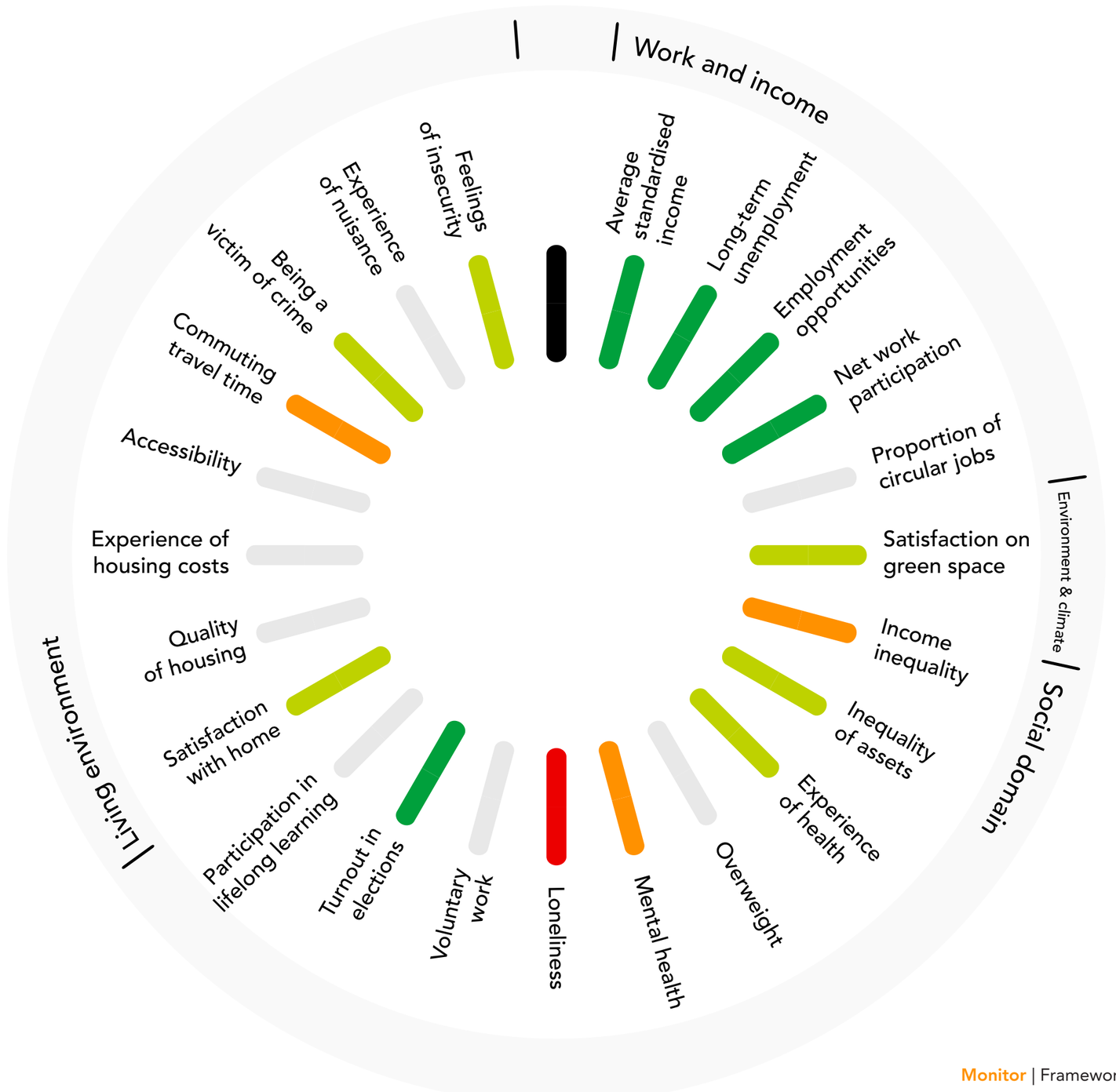
Work and income

In terms of material prosperity, the people of Amsterdam are doing well. Average income, employment and labour participation increased and long-term unemployment decreased between 2012 and 2018. On average, Amsterdam is doing slightly better in terms of material prosperity than the Metropolitan Region Amsterdam.[36]

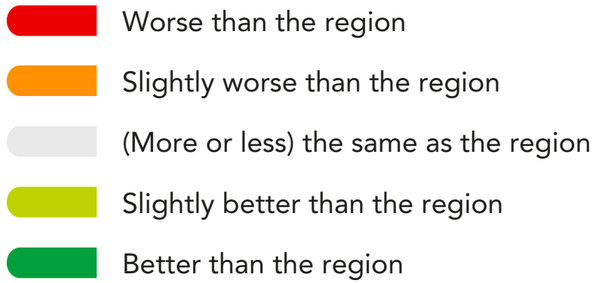
Developments in the labour market in relation to developments within the circular economy are important indicators for the broad prosperity of the population. Circular area development (where reuse of materials plays a key role), as well as combating overconsumption, can create new activity and jobs. At the same time, these developments can also lead to the disappearance of certain jobs in conventional industry and other skills becoming important. It is therefore a good idea to continue to monitor the development of the group of long-term unemployed persons. By recognising patterns in the inflow and outflow in the labour market and the motives associated with it, the City can develop a suitable

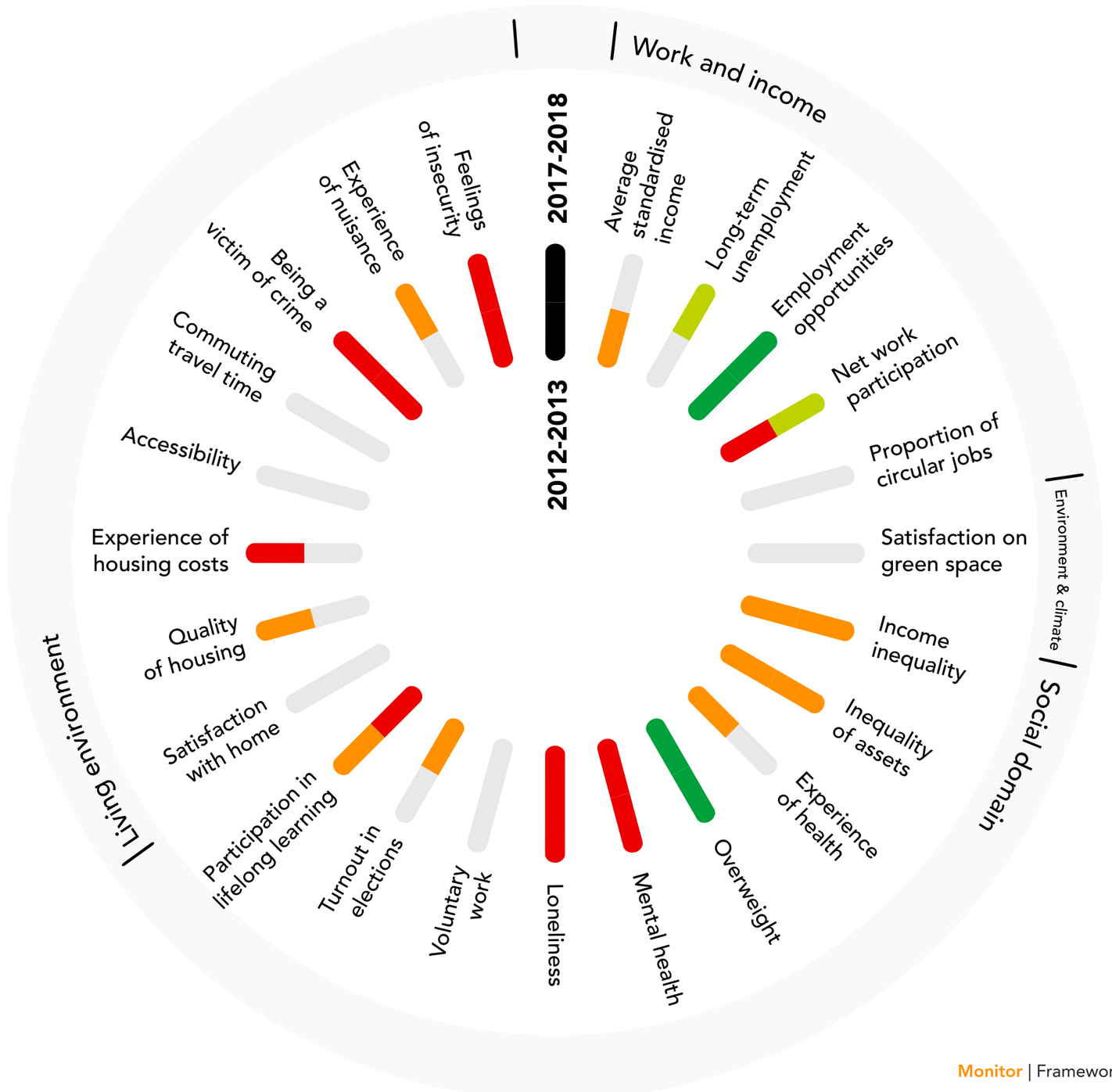
policy that goes hand in hand with the circular economy. Therefore, we follow an additional indicator, namely the proportion of circular jobs, to see if employment increases in the circular economy. Circular jobs contribute to the transition to a circular economy, for example: jobs in the manufacturing industry, reuse, repair, manufacturing cycles, and also complex design work in the development of sustainable business models. Within these types of jobs, it is also important to look at job security and socio-economic security (i.e. the relationship between circular jobs and temporary and permanent contracts). A study by Circle Economy and Erasmus University Rotterdam showed that the proportion of circular jobs is currently 11%.[37] In the coming years, the calculation method will be further refined in order to keep a close eye on developments in circular jobs.

Amsterdam in 2012-2013 compared with Amsterdam in 2017-2018



Amsterdam compared with the MRA in 2012-2013 and in 2017-2018





Environment and climate

In terms of the environment and climate, we are seeing a slight increase among Amsterdam's residents in satisfaction with the green space.
For the time being there is hardly any difference between Amsterdam and the Metropolitan Region Amsterdam in this respect. With a score of 7, Amsterdam's residents rate the green space in which they live almost as highly as their regional neighbours.
During the coming period, we want to further expand the Monitor for the Circular Economy in Amsterdam in terms of this dimension of broad prosperity. We will add more indicators that inform us about the value of nature, the environment and climate for Amsterdam's residents.

This could include various aspects and questions that have to do with ambitions for the three selected value chains, such as:

- To what extent do Amsterdam's residents feel connected to the nature of the city and how much value do they place on biodiversity?
- To what extent are they aware of how air quality is affected by chemical pollution due to waste incineration?
- To what extent do they participate in urban agriculture and purchase local products?
- How much meat do they consume and how much edible food do they throw away?
- How sustainable are the textiles, electronics and furniture they purchase?
- How do online platforms contribute to facilitating the reuse of goods?

Social domain

Within the social domain, we have seen a number of positive developments between 2012 and 2018. For example, wealth inequality has decreased slightly, Amsterdam's residents are slightly more positive about their own health, and political participation has increased. On the other hand, we also see a number of negative developments, such as an increase in income inequality, declining mental health and more loneliness.

Income and wealth inequality are slightly higher in Amsterdam than in the rest of the region. Specific attention should be paid to this when changes take place with regard to payroll taxes, social security benefits or income-related subsidies.38 A shift from taxation on labour to taxation on consumption of raw materials could lead to a reduction in labour costs and, with changes in the labour market, this shift could affect income and wealth inequality. In addition, if craftsmanship is given an increasingly important role in the economy (e.g. the manufacturing industry), there will be opportunities for people at a distance from the labour market. This can help reduce income inequality, as long as access to these jobs remains equal.
The growing 'refurbished housing market' and household effects that are still in good condition can also help minimum-income households with their expenses. The same applies to the provisions around 'Witgoed bij Nood' ('Appliances for the Needy'), a programme that helps replace broken washing machines, refrigerators or gas cookers. Minimum-income households often have nothing to fall back on in order to replace broken appliances. Here too, the question is whether the reuse market can provide opportunities.

Circular construction, as well as high-grade recycling and repair, will probably require different skills.
Retraining and further training may become increasingly important in order to continue to participate in the circular economy. The Monitor follows participation in 'lifelong learning', which is an important indicator for a period of transition to a circular economy. Amsterdam is currently slightly less active than the region in this respect.

More attention must be paid to this. This means more education in professions that will be relevant to the circular economy in the future. We may be able to supplement this indicator in the near future with information about the type of education and courses followed and the extent to which these relate to 'circular skills'.[39]

Mental health and loneliness are worse in Amsterdam than in the region. Initiatives aimed at reducing food waste such as 'no-waste dinners', as well as infrastructure set up for sharing and repairing consumer goods, have a strong social component and offer contact opportunities for residents. With such activities, the circular economy can help counteract individualisation and the pressure on achievement and growth in society. Activities like these can have a positive effect on loneliness and ultimately improve people's mental health. More research is needed to understand in what other ways the circular economy can contribute to this.

One way of determining the social value of circular activities is to expand existing research into social networks and health with questions about participation in these and other activities within the circular economy. Another option is to ask people who take part in these activities about the value of the activities to their social network and their state of mind and/or satisfaction.

Living environment

The extent to which developments in the area of circular economy directly contribute to a pleasant living environment is still difficult to estimate. The Monitor will determine which research question is relevant on the basis of the ambitions set out in the Circular Economy strategy. The more circular building takes place, the better we will be able to express our views on the relationship between living and circular building on the basis of sufficient observations. This requires an investigative approach that follows developments in the long term.

Findings

General findings

Data are invaluable to the transition to a circular economy. They provide the supporting figures needed to take concrete steps and to test whether these yield the desired results. With the Monitor for the Circular Economy in Amsterdam we can provide essential information for our interpretation of the doughnut, in terms of how we establish the social foundation as well as the extent to which we respect the ecological ceiling.

The lack of data prevents some important insights into the transition to a circular economy. For example, the lack of more detailed and structured information about waste materials means that much of its potential value within different chains is lost. Information to be able to establish a link between the input (materials) and output (waste) is also lacking, as a result of which it is impossible to assess whether the consumption of primary raw materials in Amsterdam is decreasing.

In view of the large volume of regional industrial waste compared to household waste, a small improvement in this area could have a major impact. The government can further increase the impact by, for example, encouraging high-grade processing of industrial waste. In addition, there are opportunities to improve the market for secondary materials by placing more emphasis on smarter design and prevention of the use of new and primary raw materials. We therefore draw the same conclusion as the Netherlands Environmental Assessment Agency: focusing on input does not take sufficient account of the effects of the use and discarding of raw materials.[41]

Findings for each section of the Monitor

Input

- This section of the Monitor is expressed mainly in terms of weight. The further breakdown into CO_2 emissions and ECI (environmental cost indicator) will follow in 2021.
- The three prioritised value chains (food & organic waste, consumer goods, and built environment) show different environmental impacts.
- This section still needs to be scaled up to the level of the Metropolitan Region Amsterdam. This requires coordination at the administrative level within the region.
- Closer collaboration on data with strategic partners such as the Customs Administration, Amsterdam Airport Schiphol and the Port of Amsterdam will give the City more insight into the quantities of materials flowing into the city. Collaboration with Rotterdam or other important import hubs can also provide many insights into materials destined for Amsterdam in the short term.
  This will enable us to make the analysis of our material consumption more precise.

Throughput

- It is not yet known how the various products in the city's value chains are used and reused. With relevant information, the City can work with businesses and knowledge institutions to find optimal products that will continue to circulate in Amsterdam's economy for a long time.
- By working together with specific public-private programmes, such as programmes involving circular textiles, circular area development or door-to-door collection of kitchen and garden waste, we can obtain specific insights into the effectiveness of the choices the City makes in its policy.
- In-depth research and experiments are needed with regard to product turnover rates and the underlying materials within an urban region. Both the ecological and the social impact must also be considered.

(Continuation: Findings for each section of the Monitor)

Waste collection by public authorities

- For the time being, this section of the Monitor is expressed in terms of weight and will later be translated into CO_2 emissions and ECI.
- The biggest gains are to be found in the food & organic waste streams and consumer goods value chains.
- Separation does not automatically amount to recycling. Better separation is good, but the processing process afterwards is important. The City lacks data in this area. A closer link between sections 3 and 4 of the Monitor would help in this respect.
- This section still needs to be scaled up to the level of the Metropolitan Region Amsterdam. This requires coordination at the administrative level within the region.
- Further exploration of processing options and opportunities is needed40.

Waste processing in regional industry

- For the time being, this section of the Monitor is expressed in terms of weight and will later be translated into CO_2 emissions and ECI.
- Further exploration of processing options and opportunities is needed.
- The amount of industrial waste is eight times greater than the amount of household waste.
- There are opportunities for higher-grade processing in the different value chains. The Metropolitan Region Amsterdam is attracting more and more waste.
- With the classification method developed by TU Delft, the City is contributing to the development of new jargon to talk about the circular economy.

The social foundation of Amsterdam

- Material prosperity in Amsterdam is positive. At the same time, there are signs of increasing inequality, housing costs are perceived as high and there are greater risks of loneliness and declining mental health.
- A broadening of the indicators of prosperity provides scope to include the quality of the environment and climate.
- The social foundation benefits tremendously from long-term observations (longitudinal research), because both the perception of the environment and climate and the concept of broad prosperity are gradually changing in society, while the impact of careless environmental and climate policy on the lives of Amsterdam's residents can be detrimental over the years.
- The Dutch government developed the concept of 'broad prosperity' on the basis of national values. However, the doughnut teaches us that our prosperity is directly related to the prosperity of others elsewhere in the world. The Monitor cannot yet calculate this relationship. A model for this will be designed in the coming years.

Recommendations

Recommendations

In the coming years, the City intends to increase the visibility of the measures towards a circular economy. The Monitor for the Circular Economy in Amsterdam is an important instrument for this. The provisional framework of the Monitor will be further developed in the coming years.

In addition to the acquisition of more data, this will require the development of universal indicators. This can be done in close cooperation with other public authorities, knowledge institutions and the business community. This is relevant, because a more refined Monitor can support the transition to a circular city in two ways: firstly it provides the market with commercial opportunities to develop circular measures, and secondly it gives the people of Amsterdam more confidence that the transition to circularity will improve their well-being (or in any case maintain it).

We are further developing the Monitor for the Circular Economy in Amsterdam by means of Doughnut workshops, data partnerships and the creation of a data platform.

Doughnut workshops

Last year, the City organised workshops in which decision-makers were familiarised with the doughnut model of the circular economy and the holistic approach behind it. In the coming year we will again use workshops, this time to promote the exchange of data and insights. We will also hold talks with businesses to further embed holistic thinking in Amsterdam's economy. The City Doughnut for Amsterdam, with its clear depiction of indicators, will enrich these talks, in particular through the visually clear links between social prosperity in the city and a healthy planet.

Data partnerships

In the next few years, the City will enter into partnerships with businesses in order to gain more insight into how to prevent waste as much as possible. This will involve developing other ways of designing products as well as converting waste into secondary materials. The City will work together with strategic partners, such as the Customs Administration, the Port of Amsterdam, Amsterdam Airport Schiphol and important online platforms for the circular economy. Together we can refine the calculations for the Monitor for the Circular Economy in Amsterdam in order to gain additional insights. In addition, the partnerships offer opportunities for businesses to develop new concepts that accelerate the transition to a circular economy.

Data platform

In the coming years, we will work on a data platform for the exchange of information. This platform will be the place where all relevant data for the circular economy are brought together in a secure and efficient manner. This includes detailed data on the environmental impact of the materials consumed in Amsterdam, market insights for secondary materials, and open data sources on trends in the circular economy. The Monitor for the Circular Economy in Amsterdam can also be published and updated on this platform. In this way, the data platform can serve as a source of inspiration for new insights. The Monitor and the cooperation with strategic partners are preconditions for the success of the circular economy. The City therefore invites businesses and research institutes to work together towards an open and circular economic system. After all, the circular economy is something we will create together.

Appendices

Appendix I Main indicator list for Monitor sections 1 to 4

Monitor section	Indicator	Available
Input	Total weight of materials in each value chain	✓
	Total CO_2 impact of each value chain	✓
	Total ECI impact of each value chain	✓
Throughput	To be determined	
Waste collection by public authorities	Total weight of materials in each value chain	✓
	Total CO_2 impact of each value chain	
	Total ECI impact of each value chain	
Waste processing in regional industry	Total weight of materials in each value chain	✓
	Total CO_2 impact of each value chain	
	Total ECI impact of each value chain	

Appendix II Overview of indicators in section 5

Dimension	Indicator	Year	Definition
Work and income	Average standardised income	2017	Average disposable income corrected for differences in household size and composition
	Long-term unemployment	2018	The percentage of the working-age population unemployed for a year or more
	Employment opportunities	2017	Number of jobs divided by working-age population
	Labour participation	2018	The proportion of the employed working-age population in the population (working-age and non-working-age population)
	Number of circular jobs	2018	The proportion of circular jobs compared to the total number of jobs
Environment and climate Social domain	Satisfaction about the green space	2017	Score given for green areas
	Income inequality	2017	Gini coefficient
	Wealth inequality	2017	Gini coefficient
	Perceived health	2016	Percentage of the population that indicates it is in (very) good health (population aged 19 years and over)
	Overweight	2016	Percentage of the population with a BMI of 25 and higher
	Mental health	2016	Percentage of the population with a moderate to high risk of anxiety disorder or depression (population aged 19 years and older)
	Loneliness	2016	Percentage of the population that indicates it is moderately to severely lonely (population aged 19 years and over)
	Volunteer work	2016	Percentage of the population that has been active as a volunteer in the last four weeks

Dimension	Indicator	Year	Definition
	Election turnout	2017	Percentage of persons entitled to vote who voted in the parliamentary elections
	Participation in lifelong learning	2018	Percentage of the employed working-age population that enrolled in a study programme or course in the last twelve months
Living (environment)	Satisfaction with home	2017	Degree of satisfaction with the home (total score), as a score of 1 to 10 (1 = very unsatisfied, 10 = very satisfied)
	Quality of homes	2017	Assessment of the state of repair of the home, as a score of 1 to 10 (1 = very poor, 10 = very good)
	Perception of housing costs	2017	Percentage of the population that assesses rent/mortgage as a heavy
	Distance to main road	2017	burden Distance to main road
	Commuting time	2017	Average commuting time of all residents in an area per year
	Victimhood of crime	2017	Percentage of the population that has been the victim of a crime in the last twelve months
	Perceived nuisance	2017	Combined score for various forms of nuisance (1 = little nuisance, 10 = a lot of nuisance)
	Feelings of unsafety	2017	Percentage of the population that indicates that it ever feels unsafe

Footnotes

1. Environmental costs are the costs in the event of a negative environmental impact of a material or product and/or during the processing of the waste it generates.

2. Food & organic waste streams, consumer goods, and built environment. See Amsterdam Circular 2020-2025 Strategy for an explanation.

3. (2019) Completing the Picture: How the Circular Economy Tackles Climate Change. Ellen MacArthur Foundation.

4. This 63% is also referred to as indirect CO_2 emissions (or, according to global protocols, scope 3 emissions upstream and downstream) because the emissions do not take place in the city. For this assessment, the City was advised by TNO and Kate Raworth's team, and a combination of renowned studies was used: Global Carbon Project (2018) for the assessment of emissions; IPCC 2010, IMF - Data Mapper 2018 to determine the gross national product; Eurostat (Statistics Netherlands) for the assessment of emissions in Amsterdam. The calculation of scope 1 and 2 emissions is based on the Amsterdam Climate Neutral Roadmap.

5. CO_2 equivalents: besides CO_2 there are also other gases, such as methane and nitrogen, that contribute to the greenhouse effect. These gases are therefore considered equivalents. The contribution of these gases is calculated in terms of CO_2 emissions.

6. (2020) The Amsterdam City Doughnut: A Tool for Transformative Action.

7. CO_2 equivalents: other gases, such as methane and nitrogen, also contribute to the greenhouse effect. The contribution of these gases is calculated in terms of CO_2 emissions. The method used always gives CO_2 emissions in the entire chain (from mine to product) ('indirect emissions'). This does not include emissions during use and at the end of the useful life (i.e. not 'direct emissions' in Amsterdam).

8. Environmental cost indicators (ECIs) weigh eleven environmental impacts against each other and translate them into a single figure that reflects the social costs of these impacts (in euros). These are the costs that would have to be incurred if the negative environmental impacts of the product were to be avoided with appropriate solutions. Foundation for Building Quality (Stichting Bouwkwaliteit, SBK) (2019) 'Determination Method for Environmental Performance of Buildings and Groundwork, Road and Hydraulic Engineering Works' (Bepalingsmethode Milieuprestatie Gebouwen en GWW-werken). Environmental cost indicators are comparable to the ecological indicators of the doughnut.

9. (2006) IPCC Guidelines for National Greenhouse Gas Inventories: https://www.ipcc-nggip.iges.or.jp/public/2006gl/ and GHG Protocol for Cities: https://ghgprotocol.org/greenhouse-gas-protocol-accounting-reporting-standard-cities

10. The Research, Information and Statistics department of the City of Amsterdam has developed a dashboard with key figures on broad prosperity in the Metropolitan Region Amsterdam: https://www.ois.amsterdam.nl/visualisatie/Brede_welvaart_MRA.html.

11. (2015) 'Broad prosperity' in the research of the Netherlands Environmental Assessment Agency (PBL): https://www.pbl.nl/sites/default/files/downloads/pbl-2015-brede-welvaart-in-onderzoek-van- het-pbl_1917.pdf; (2018) Sustainable development and circular economy: https://primonederland.eu/ wp-content/uploads/2019/01/Duurzame-ontwikkeling-en-circulaire-economie-.pdf.

12. Economic Statistical Reports (Economisch Statistische Berichten, ESB): https:// esb.nu/esb/20051496/ten-geleide-grip-op-brede-wel- vaart.

13. In order to calculate the total emissions, the emissions from collection, logistics and waste processing are needed. Emissions from waste processing within the municipal boundaries are currently included in the Climate Neutral programme. A next step is to further combine the calculations and also to research whether trading in waste results in more or less emissions.

14. This part of the framework was developed by TNO.

15. Built environment, food & organic waste streams, and consumer goods. See the overarching Amsterdam Circular 2020-2025 Strategy for a

16. This part of the framework was developed by TU Delft.

17. Environmental cost indicators (ECIs) weigh eleven environmental impacts against each other and translate them into a single figure that reflects the social costs of these impacts (in euros). These are the costs that would have to be incurred if the negative environmental impacts of the product were to be avoided with appropriate solutions (abiotic resource depletion, fossil fuel depletion, climate change, ozone layer depletion, etc.). ECI is also the Dutch standard that is most comparable to the ecological ceiling of the doughnut.

18. Lifecycle assessments (LCA) are used to calculate the environmental impacts of activities, products and businesses throughout the chain. There are several standards for calculating LCAs. The calculations of the input indicators were made using the Ecoinvent database and formulas of SimaPro 8.5.2.0 and a calculation of 'cradle to grave', i.e. the production process, have been used.

19. Quantities and thicknesses: BOB model for road profiles. Reference: Elisabeth Keijzer, Jacco Verstraeten-Jochemsen, Antoon Visschedijk, Ruben Fransen, Bart Jansen (2017). Waste and Resource Platform 2.0: updated description of BOB model. TNO. LCA data on asphalt: NMD3.0; Based on: Report of the sector average LCAs of asphalt. Reference: Vos-Effting, S. de., Keijzer, E., et al. (2018). LCA background report for Dutch Asphalt Mixtures. Report for inclusion of sector representative asphalt mixtures in the National Environmental Database

(NMD) (version 2.1). Utrecht: TNO & EcoChain. LCA data on Pavement: NMD 3.0

20. Amsterdam Federation of Housing Associations (AFWC) Annual Report 2019: http://www.afwc.nl/fileadmin/user_upload/Bestanden_2019/Jaarboek_2019/ AFWC_jrbrcht2019_Online.pdf.

21. A thinner layer of asphalt is laid for cycle paths than for roads, hence the distinction.

22. Food guide (Eetwijzer) (RIVM, 2012-2016), www.wateetnederland.nl.

23. (2019) Measuring food waste in Dutch households: A synthesis of three studies. Van Dooren et al.

24. The following were used for the impact calculations of consumer goods: Method: SBK Determination Method, 25 May 2018 (NMD 2.2 & IPCC2013) V3.04 / ECI-SBK single-score Calculation: SimaPro 8.5.2.0, SBK 3.0.4 (NMD2.2),IPCC 2013, economic allocation Database: Ecoinvent 3.4 cut-off by classification & economic allocation.

25. (2018) City Rhythm: Logbook of an Exploration. Caroline Nevejan, Pinar Sefkatli, Scott Cunningham.

26. Source-separated means that waste is collected in a separated rubbish bin. Subsequent separation means that the process of separating types of waste took place after waste collection.

27. One of the problems in the transition to a circular economy is that products are not designed in such a way that the various materials can later be taken apart. This makes high-grade processing of materials difficult. In addition, recycled raw materials are often more expensive than new raw materials. A common solution to this problem is a tax shift from labour to raw materials.

28. Thermoplastics like PET (soft drink bottles), HDPE (e.g. laundry detergent packaging), PVC (transparent packaging), PP (e.g. margarine tubs), PS (insulation material) and LDPE (films) can be processed into soft drink bottles or plastic bags. Sorted thermoplastics can be properly processed together into new plastics, but other plastics, such as PVC, can only be properly processed if properly separated from other plastics.

29. Thermosets are plastics that must be able to withstand high temperatures and are used for electrical sockets and pan handles.

30. Sympany.nl; 'Waste Chain Visualised' (Afvalketen in Beeld), 2015, City of Amsterdam, Dutch Circular Textile Valley.

31. Inventory of bulky waste in Amsterdam Watergraafsmeer, CREM Waste Management, 2017.

32. https://www.aebamsterdam.nl/media/1777/aeb180709_jvs2017.pdf.

33. The provinces of Noord-Holland and Flevoland and the municipality of Haarlemmermeer provided the business register details for determining the economic activity of the companies that have reported waste to the National Waste Notification Bureau (Landelijk Meldpunt Afvalstoffen, LMA).

34. https://www.rijksoverheid.nl/documenten/brochures/2010/11/23/europese-afvalstoffenlijst-eural

35. The Research, Information and Statistics department of the City of Amsterdam has developed a dashboard with key figures on broad prosperity in the Metropolitan Region Amsterdam: https://www.ois.amsterdam.nl/visualisatie/Brede_welvaart_MRA.html. Various data sources were used to chart broad prosperity for Amsterdam and the rest of the Metropolitan region. Data on income and employment were obtained from Statistics Netherlands (CBS). Data on the environment and climate were obtained from the Climate Monitor and the National Institute for Public Health and the Environment (RIVM). Living environment data were obtained mainly from the Research, Information and Statistics (OIS) survey 'Living in the Metropolitan Region Amsterdam', and also from the Statistics Netherlands and the Safety Monitor (Veiligheidsmonitor). Data concerning the social domain were obtained from Statistics Netherlands, Health Monitor of Adults (Municipal Health Service, Statistics Netherlands and RIVM) and Kiesraad.nl.

36. Average standardised income and net labour participation are the exceptions. The values of these two aspects were compared to the average for the Netherlands instead of the average for the Metropolitan Region Amsterdam due to the lack of an average for the Metropolitan Region

Amsterdam. When all variables are compared to the Dutch national average, we do not see any major deviations with respect to the comparison with the average of the Metropolitan Region Amsterdam.

37. The estimate of the Netherlands Environmental Assessment Agency (PBL) is significantly lower than the calculation made in the report of Circle Economy & EHERO (2018) Circular Jobs and Skills: The Amsterdam Metropolitan Area. Circle Economy & EHERO used a broader definition of circular jobs than the PBL, which also includes data analysts, architects and, in some cases, lecturers.

38. https://www.cbs.nl/-/media/_pdf/2019/19/ongelijkheid-inkomen-en-vermogen.pdf.

39. Although there have been several studies on circular economy as well as a categorisation of circular jobs, the specific skills for the circular economy have not yet crystallised in commercial registers. Circle Economy & EHERO conducted an initial survey of skills in the metropolitan area in the report (2018) Circular Jobs and Skills: The Amsterdam Metropolitan Area.

40. https://nos.nl/artikel/2315745-wel-een-baanmaar-geen-woning-alarm-om-groei-nieuwe-groepdaklozen.html.

41. https://www.pbl.nl/publicaties/doelstelling-circulaire-economie-2030

Publisher's note

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