



SusValueWaste WP1

Inventory of organic waste resources

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1. Introduction

Reliable and timely statistical data provide a solid basis to make informed decisions, whether at the level of policy-making, of municipal organizations or of business. This report compiles an inventory of statistical information on organic waste¹ resources, with an emphasis on data-quality, consistency and timeliness. The geographic focus is on one country - Norway, although it is recognized that cross-border trade and multi-national companies complicate such a national focus.

This inventory is a result of WP1 in the SusValueWaste project. It explores a number of national and international sources. We distinguish between **core** data-sources, linked to Eurostat's data collection, and non-core data available from other sources. This scoping effort looks into the extent, the quality, and the granularity of relevant data currently available.

The overall aim is integrating this inventory with other data that can provide an accurate, up-to-date and useful overview of organic waste resources and how they are being exploited in the country.

We aim also an integration with data on relevant patenting activity, data on research and development activities and on available human resources.

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¹ We recognize that the use of the term 'waste' carries negative connotations, which many in the related areas tend to avoid. To emphasize the idea of 'resource', other terms have been introduced such as 'side streams', 'residues', etc. These terms however tend to find currency in the context of particular industries (e.g. food or forestry). In the absence of a universally acceptable term, this document maintains the idea of waste-resources to promote consistency.

2. Definitions

Definitions are essential to the accuracy, consistency and comparability of statistics. Efforts are currently afoot at the international level to construct reliable and comparable statistics to take stock of the area of organic waste resources. In this document, we follow the definitions set out in the European reference literature, primarily:

- EU The Waste Statistics Regulation (WStatR) Regulation (EC) No 2150/2002
- EU (2014) The Manual for The Implementation Of Regulation (EC) No 2150/2002 On Waste Statistics. COM(2014) 79 final
- EUROSTAT (2013) Manual on waste statistics - A handbook for data collection on waste generation and treatment - 2013 edition.
- See also List of Wastes Com Decision 532/2000/EC (LoW)

These core documents provide the basis for the data-collection coordinated by Eurostat at the national level, including the national waste accounts for Norway. In addition we look to UNSTAT for guidance in laying out the definitions for this exercise. These sources are quoted extensively below.

2.1. 'Waste': Inclusion and Exclusion Criteria

What constitutes 'waste' in international statistics is subject to a number of important distinctions and inclusion criteria.

The UNSTAT distinguishes between Waste and Residues (or internal recycling)

- Waste includes "Materials that are not prime products for which the generator has no further use for his own purpose and which he discards, or intends or is required to discard."
- Waste excludes "residuals directly recycled or reused at the place of generation (i.e. establishment) and waste materials that are directly discharged into ambient water or air".

The Waste Statistics Regulation (WStatR) also excludes certain material:

- "Fecal matter, straw and other natural non-hazardous agricultural or forestry material used in farming, forestry or for the production of energy from such **biomass** through processes or methods which do not harm the environment or endanger human health."
- "animal carcasses and animal by-products covered by Regulation (EC) No 1069/2009" found elsewhere
- "waste resulting from the prospecting, extraction, treatment and storage of mineral resources and the working of quarries covered by Directive 2006/21/EC."

The exclusion of biomass for purposes of energy production is especially noteworthy.

2.2. Residues and Internal Recycling: Inclusion and Exclusion Criteria

Three different types of residues are currently distinguished.

- 'Production residues' are materials that are not deliberately produced in a production process but may or may not be waste. Boundaries between waste and by-product have been clarified by European laws in the revision of the Waste Framework Directive 2008/98/EC.

- 'Consumption residues' are primary wastes that arise from consumption in private households and businesses and are for instance food residues, packaging material, paper, glass and plastic.
- 'Waste treatment residues' are secondary output generated by treatment facilities during the processing of waste. This includes waste for disposal and for recovery. The Waste Framework Directive provides conditions that should help countries developing criteria determining the point at which a given waste ceases to be waste when it has undergone a recovery, including recycling, operation.

Internal recycling includes the following operations where they take place at the site of waste generation (Eurostat):

- 'the reprocessing of production waste (e.g. of cuttings, shavings, rejects, etc.) in the same or a similar process by which it was generated, as typically carried out in the paper and glass industry, in steel works, or other sectors of the manufacturing industries ('**traditional**' recycling);
- the regeneration of **spent process materials** in order to be reused for the same or a similar purpose (e.g. regeneration of spent solvents, waste oils, acids and bases, catalysts, adsorbents);
- the (re)use of bitumen, gravel or other wastes at road works.
- disposal of by-catches and fish guttings from fishery at sea.'

Note1. Waste arising from consumption residues and production residues are classified as primary waste and waste from waste treatment residues as secondary waste.

Note2. Note the temporal discontinuity in Waste Stats at 2008. (cf. Table 4: Data sets according to the Waste Statistics Regulation before and after revision in 2010 (p 18 Manual))

2.3. Definition of different organic waste types

The Norwegian statistical bureau, Statistic Norway gives a definition of different organic waste types and their sources:² These waste types are listed below:

- Waste is defined by the Pollution Control Act §27 as: "Discarded objects or substances. Waste also includes superfluous objects from service activities, production and treatment plants etc. Waste water and exhaust gases are not regarded as waste".
- Source refers to the unit generating the waste, and follows the Standard Industrial Classification (SN 2007). Various grouping levels are used, for instance manufacturing (section) and service industries (several sections). Households constitute a separate category.
 - o Production waste is defined as waste generated by manufacturing, significantly differing in type or quantity from consumer waste.
 - o Construction waste is generated in connection with construction, rehabilitation or demolition of buildings or other constructions.
 - o Consumer waste is waste generated by households. Also similar waste originating from certain industries is included here.
- Material denotes substances that largely share the same chemical and physical characteristics. The material categories follow the Norwegian Standard for classification of waste (NS 9431).

² <https://www.ssb.no/en/natur-og-miljo/statistikker/avfregno/aar/?fane=om#content>

- Wet organic waste is organic waste that easily decomposes, like discarded food and processing waste from the manufacturing of food products, etc. The waste codes (Norwegian standard for classification of waste - NS 9431) that are included here are 1111, 1127 and 1128.
- Wood waste includes lumber (untreated and treated under 1141 and 1142), sawdust (1143),
- Paper and cardboard comprises different quality-grades including newspaper (1211), cardboard (1221), carton (1231, 1241), and assorted.
- Sludge is a fluid mixture of particles and water. The particles may be both organic and inorganic. The effects of inorganic and organic sludge on the environment differ considerably. Sludge is generated from important processes like: manufacturing of paper and cardboard, oil drilling, metal processes and waste water treatment. Sludge from waste water treatment is given in dry weight, while sludge from other sources are in wet weight.
- Textiles are spun, woven, knitted, etc. products made from natural or synthetic fibres. Animal or artificial skin is also covered under textiles.
- Mixed waste is waste that is not subjected to any pre-sorting or from where some categories have been sorted out (plastics, paper etc.).
- Hazardous waste requires special treatment according to the Waste regulation, and is defined in the EU List of Waste (LoW) and Norwegian legislation defining limits for hazardous properties. Hazardous waste contains a large number of different materials and products, but constitutes one material category in the waste accounts.

Similarly, SSB has defined different waste treatment types:

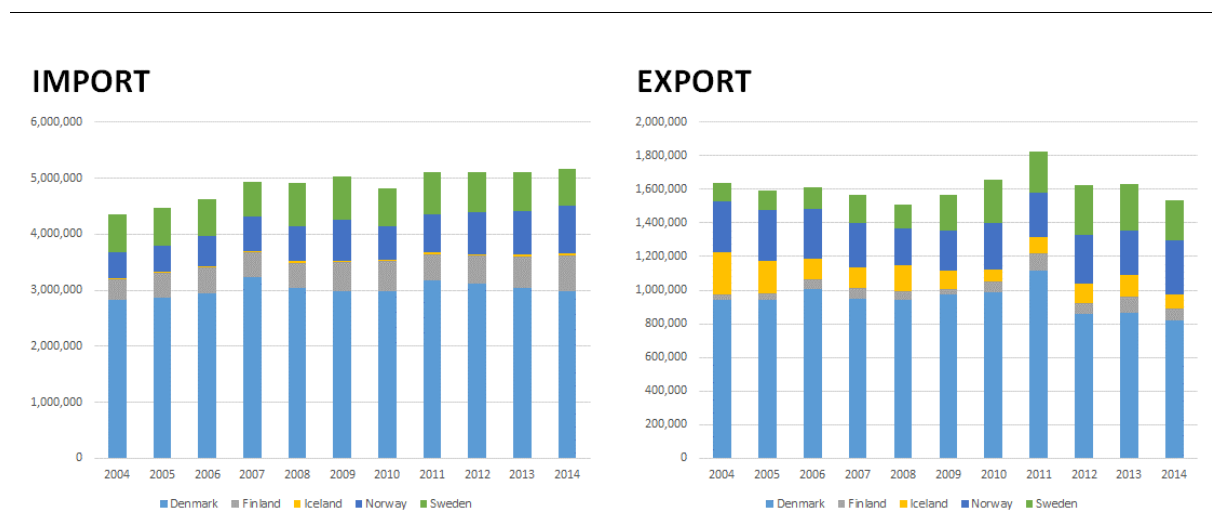
- Treatment of waste means physically, chemically or biological processing and preparation of the waste for recovery or disposal (recycle, compost, incinerate, landfill, dumping, export or reuse) at approved plants.
- Pre-treatment comprise the different processes that prepare waste for subsequent treatment/disposal, for example by sorting of waste or neutralising of acids and bases.
- Reuse covers the use of waste in its original form, for example discarded clothes sold in a second hand shop or sent as refugee aid, or bottles in a return scheme with deposit. When a product is reused, it does not become a waste. On the other hand, preparing for re-use (like repairing a bicycle) is a recovery operation. Used products inside a return scheme are not included in the statistics.
- Waste treatment plant is assigned to all plants having treatment/disposal or pre-treatment of waste as their principal activity. Industrial landfills and incinerators having waste as a secondary fuel, for instance in the manufacturing industries, are not defined as treatment plants.
- Recovery is a collective term for recycling, energy recovery and composting.
- Composting is biologically aerobic treatment by micro-organisms etc. with access to oxygen. Composting is regarded as recovery.
- Biogas production is the production of any gas fuel derived from the decay of organic matter, as the mixture of methane and carbon dioxide produced by the bacterial decomposition of sewage, manure, garbage, or plant crops. Biogas production is regarded as recovery.
- Energy recovery means utilising the energy released by incineration, for instance for heating up buildings, and is calculated as the share of utilised energy to the share of produced energy.

- Landfill means disposal of waste to approved landfill.
- Disposal means all treatment not defined as recovery, principally incineration and landfilling.

2.4. Trade data

Trade-data provides an important lens on the overall generation and use of waste-products. The commodity codes used in trade-data provides fine-grained data on the cross-border trade of different materials. The inventory will arrive at a set of commodities that sort under the definition of waste-resources. To start, we use commodity code 23(HS) “Residues, wastes of food industry, animal fodder” to establish relative volumes of such material.³

Figure 1: Import and export of “Residues, wastes of food industry, animal fodder” in the Nordic countries (metrics tons).

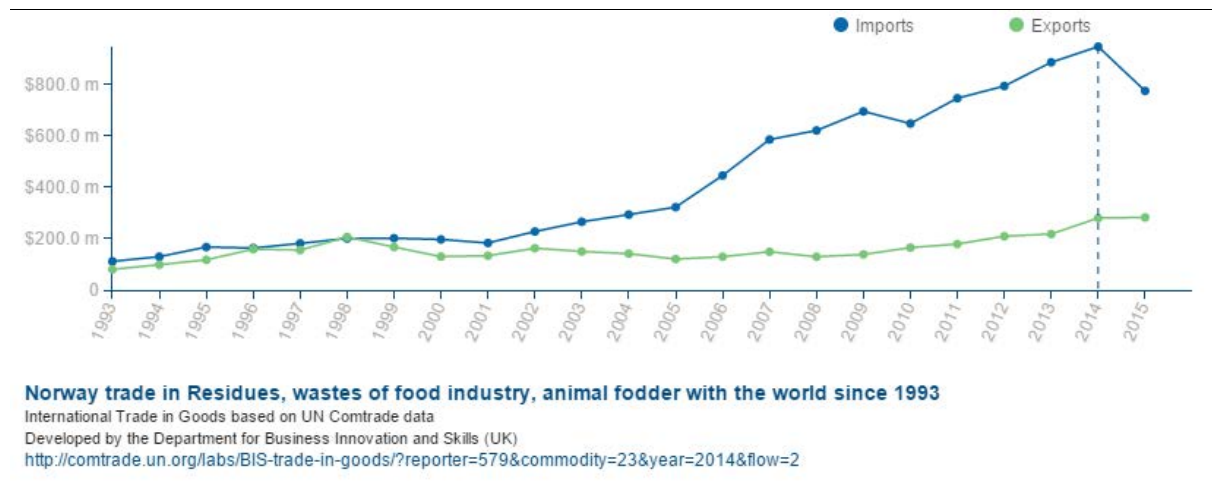


Source: UN Commodity Trade Statistics Database (UN Comtrade)

The initial look indicates a close correspondence between the material that is imported and that which is exported. This figure excludes any re-exportation of the material. These flows, which are limited to the food-industry, can be seen in terms of the activities of domestic industries. In the Norwegian case this particularly involves the aquaculture industry and the import of fish meal (230120) and the export of animal (bone-)meal (230110).

³ <http://comtrade.un.org/db/mr/rfCommoditiesList.aspx>

Figure 2: Import and export of waste commodities from 1993-2014 in dollars, BIS.



The figure illustrates the changing balance between these during the past 20 years. Other relationships between the generation and use of waste open up a number of other analytic vistas. For example, Norwegian energy recovery facilities have been analysed by addressing investments in such facilities, export and import of waste, pricing of waste, and earnings and profitability of energy and material recovery (Magnus, Fiksen, Haukaas, & Karin, 2014).

2.5. Sectoral-level data

There are other overlapping more specialized definitions that come to play. See the definitions on Food Loss and Waste given by FAO (FAO, 2014). Important is here the cultural delineation of the food chain: only parts of food that are defined as edible at the start can become food waste or loss. The definition of ‘edibility’ can change over time, and therefore, the resource stream of food waste and losses is changeable.

A food system gathers all the elements (environment, people, inputs, processes, infrastructures, institutions, etc.) and activities that relate to the production, processing, distribution, preparation and consumption of food, and the outputs of these activities, including socio-economic and environmental outcomes.

The food-focused approach considers as a starting point food and parts of food that are edible and intended for human consumption, but lost or discarded at some point in the food chain. This leads to introduce, at the beginning of the chain, the cultural dimension of “edibility” (as parts of food that are originally considered “not edible” will not be accounted as lost or wasted) and, at the end of the chain, the food safety dimension of “edibility” (as food that was originally edible but becomes non-edible for food-safety reasons needs to be discarded, leading to food loss and waste). It invites considering improvement of the functioning of the food system, with a food chain perspective.

- Food loss and waste (FLW) refers to a decrease, at all stages of the food chain from harvest to consumption in mass, of food that was originally intended for human consumption, regardless of the cause.
- Food losses (FL) refers to a decrease, at all stages of the food chain prior to the consumer level, in mass, of food that was originally intended for human consumption, regardless of the cause.

- Food waste (FW) refers to food appropriate for human consumption being discarded or left to spoil at consumer level – regardless of the cause.
- Food quality loss or waste (FQLW) refers to the decrease of a quality attribute of food (nutrition, aspect, etc.), linked to the degradation of the product, at all stages of the food chain from harvest to consumption

3. Data sources

A number of bodies currently compile waste statistics and indicators. The core data-producers are a set of recognized international bodies with definitional powers: EUROSTAT, OECD, THE UN (UNSTAT, FAO). In addition, a growing number of interest organisations and national bodies are collecting and compiling data. These include AEBIOM and WASTE ATLAS.

Contextual information on Norwegian Waste Policies can be found on the EIONET and compared with other countries.⁴

3.1. Activity-oriented versus Material-oriented data

There are two main approaches, which can be used to size-up organic waste resources.

1. Level: Activity-oriented breakdown: The Economic Activities (NACE) that yield organic waste, in which 'Treatment Infrastructure and Collection' is specified.
2. Level: Material-oriented breakdown:
 - a. Sources for waste generation Section 8 of Annex on waste generation (EWC-Stat) by treatment category (set2 p 136ff)
 - b. Import and export of waste (Article 5).

3.2. Core international data sources

The principles for collecting and compiling data are generally fixed at the international level and implemented at the national level. It therefore makes sense to start from the international data before focusing down on what is available in Norway.

- a. EUROSTAT (2013) Manual on waste statistics: A handbook for data collection on waste generation and treatment;
- b. UN Comtrade database (import, export, re-export)⁵;
- c. PRODCOM database, which gives statistics on the production of manufactured goods, to analyse changes in the volume of specific groups of products;
- d. Sectoral data: Data is also collected (e.g. by FAO) at the level of specific systems such as Globefish for fish production.

European Topic Centre on Sustainable Consumption and Production (EIONET) collates waste accounts for many European countries in a joint database: National Waste Databases.⁶ It currently does not

⁴ See: http://scp.eionet.europa.eu/facts/factsheets_waste/2011_edition/factsheet?country=NO

⁵ Eurostat: Sustainable Development Indicators (SDI), Eurostat 'Generation of total waste, by economic activity' Region: National, Periodicity: biennial on even years from 2006.

<http://comtrade.un.org/data/> ; <http://comtrade.un.org/db/mr/rfCommoditiesList.aspx>

⁶ http://scp.eionet.europa.eu/facts/national_databases

include Norway. In addition, Eurostat's Material Flows and Resource Productivity database⁷ provide measures of total materials consumed in an economy (see also below).

3.3. National waste accounts

Statistics Norway (SSB) collects National Waste Accounts for Norway, based on Norwegian waste standard NS 9431. These statistics are reported every other year and generally at the single or two-digit level of the NACE industrial categorization which is used for reporting to Eurostat for purposes of the EWC-Stat (above). The data for 2014 are due to be published in Spring 2016.⁸

A new study of waste stemming from industry is currently being planned to update the basic figures. The principles for the national data collection for the national waste accounts by Statistics Norway changed after 2011. Therefore, there is a break in the accounts.

Another example for a national account for wood waste in Finland compiled by LUKE, the Natural Resources Institute Finland.⁹

We give first an overview of the Norwegian waste accounts as they had been presented in 2003 by SSB, distinguishing between material types, product types, sources of origin and treatment types. The main data sources for this national waste account (SSB, 2003, p. 14) were five special statistics:

- Household waste statistics
- Industry waste statistics
- Hazardous waste statistics
- Statistics on waste from construction
- Statistics on waste treatment

The account included among others:

- National accounts for waste and recovery in *industries* (Vinju, 1999)
- National accounts for *wet-organic waste* (Skullerud, 1998)
- National accounts for *wood waste* (Frøyen & Skullerud, 2000)

The SSB waste accounts distinguish between four characteristics of the waste: material type, product type (just until 2011), source of origin, and treatment types. The classification by material and treatment/disposal are based on the Norwegian standard for classification of waste (NS 9431). The Standard Industrial Classification (SN2002) was applied for classification by source. Since 2008, the Standard Industrial Classification (SN 2007) has been applied.

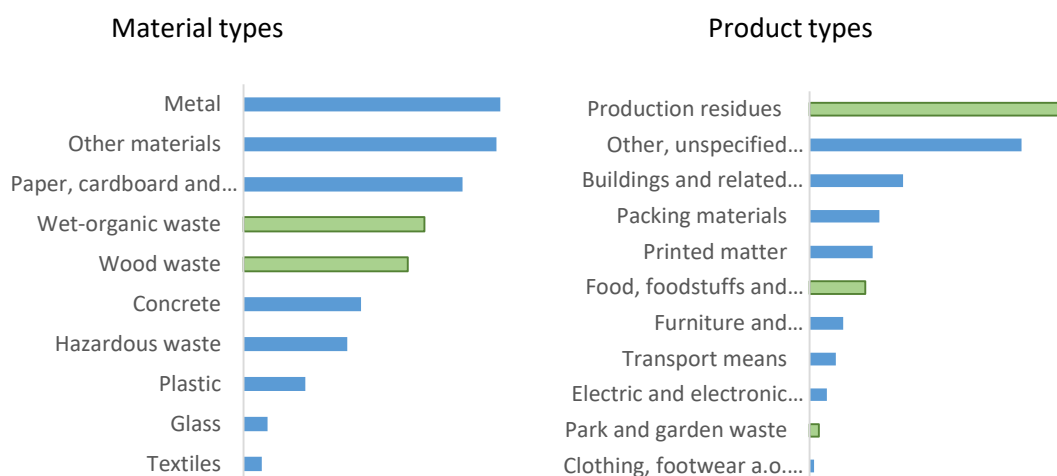
Material types are grouped as following: metal, paper, cardboard and beverage cartons, wet-organic waste, wood waste, concrete, hazardous waste, plastic, glass, textiles, and other materials. In this report, we concentrate on two groups of material types: wet-organic waste and wood waste. We acknowledge, that there can be organic materials also in the category other materials or in the category textiles.

⁷ <http://ec.europa.eu/eurostat/web/environment/material-flows-and-resource-productivity/database>. See also below.

⁸ See <http://ec.europa.eu/eurostat/web/environment/waste/main-tables>

⁹ <http://statdb.luke.fi/PXWeb/pxweb/en/LUKE/?rxid=001bc7da-70f4-47c4-a6c2-c9100d8b50db>

Figure 3: Waste accounts based on material types and product types, schematic overview for 2000, in 1000 tons (SSB, 2003)



Product types include all products produced in or imported into Norway. The statistics on product types distinguishes between different groups of products, but the list of product types is still under development. There are the following main product groups: production waste, buildings and related constructions, packing materials, printed matter, food, foodstuffs and feed products, furniture and household products, transport means with the exception of ships, electric and electronic products, park and garden waste, clothing, footwear and other textile products, other, unspecified or unknown products. Production residues is the biggest group, followed by the unspecified category. Production residues includes all waste generated in the production process without ending in a specific product. In this report, we concentrate on following two product groups: production residues, food, foodstuffs and feed products, and park and garden waste. A challenge will be to identify the relevant organic waste in the production waste. An important method for estimating waste amounts of product types is the calculation of the supply of goods. The supply of goods is calculated by summing up national production and estimates of net stock changes. To this sum, imports to the country are added while exports from the country are subtracted. In this calculation of the supply of goods only end products are included, with the exception of building and construction waste and of production residues (Frøyen & Skullerud, 2000, p. 4).

The aggregation of the classification used in the waste accounts is given in Table 1.

Table 1: Aggregation of Norwegian standard for classification of waste (NS 9431) used in the waste accounts for Norway (SSB, 2003)

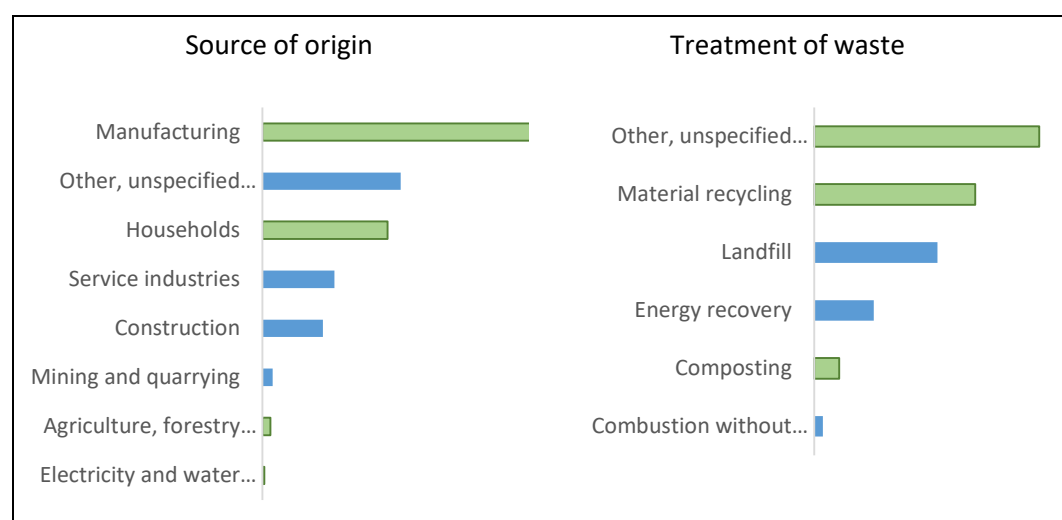
Waste code	Waste type
1111, 1127, 1128	Wet organic waste
1131	Park and garden waste
1141, 1142, 1143, 1149	Wood waste
1126, 1681	Sludge
1211, 1221, 1231, 1241, 1251, 1299	Paper and cardboard
1311, 1312, 1321, 1322, 1331, 1341, 1351, 1399	Glass
1411, 1447, 1451, 1452, 1499	Metals
1501, 1502, 1503, 1504, 1505, 1506, 1507, 1508, 1509, 1510, 1512, 1518, 1519, 1520, 1599	WEEE
1611, 1612, 1613, 1614	Concrete and tiles
1671	Cinders, dust bottom ash and fly ash

1711, 1712, 1713, 1721, 1722, 1723, 1729, 1731, 1732, 1741, 1751, 1752, 1799	Plastics
1811, 1812, 1813, 1814, 1899	Rubber
1900, 1911	Textiles
2411, 2421, 2441	Discarded vehicles
All codes starting with 7	Hazardous waste
1600, 1615, 1617, 1618, 1619, 1621, 1672, 1699, 1912, 2200, 2211, 2221, 2299, 2300, 2311, 2431, 6000, 6003, 6004, 6101	Other
9900, 9911, 9912, 9913, 9914, 9915, 9916, 9917, 9918	Mixed waste
1603, 1604, 1605, 1606	Slightly polluted soil

The statistics on the *source of origin* distinguishes between different industries as listed in the Standard Industrial Classification and households. Main industry groups are here: manufacturing, households, service industries, construction, mining and quarrying, agriculture, forestry and fishing, electricity and water supply, and other, unspecified sources. Here we concentrate on manufacturing of food products and of beverage, agriculture, forestry and fishing, households, and waste management (an industry listed under water supply).

Statistics on *waste treatment or disposal* distinguish between different methods for waste treatment: material recycling, landfill, energy recovery, composting, combustion without energy recovery, and other, unspecified treatment.

Figure 4: Waste accounts based on sources of origin and treatment of waste, schematic overview for 2000, in 1000 tons (SSB, 2003)



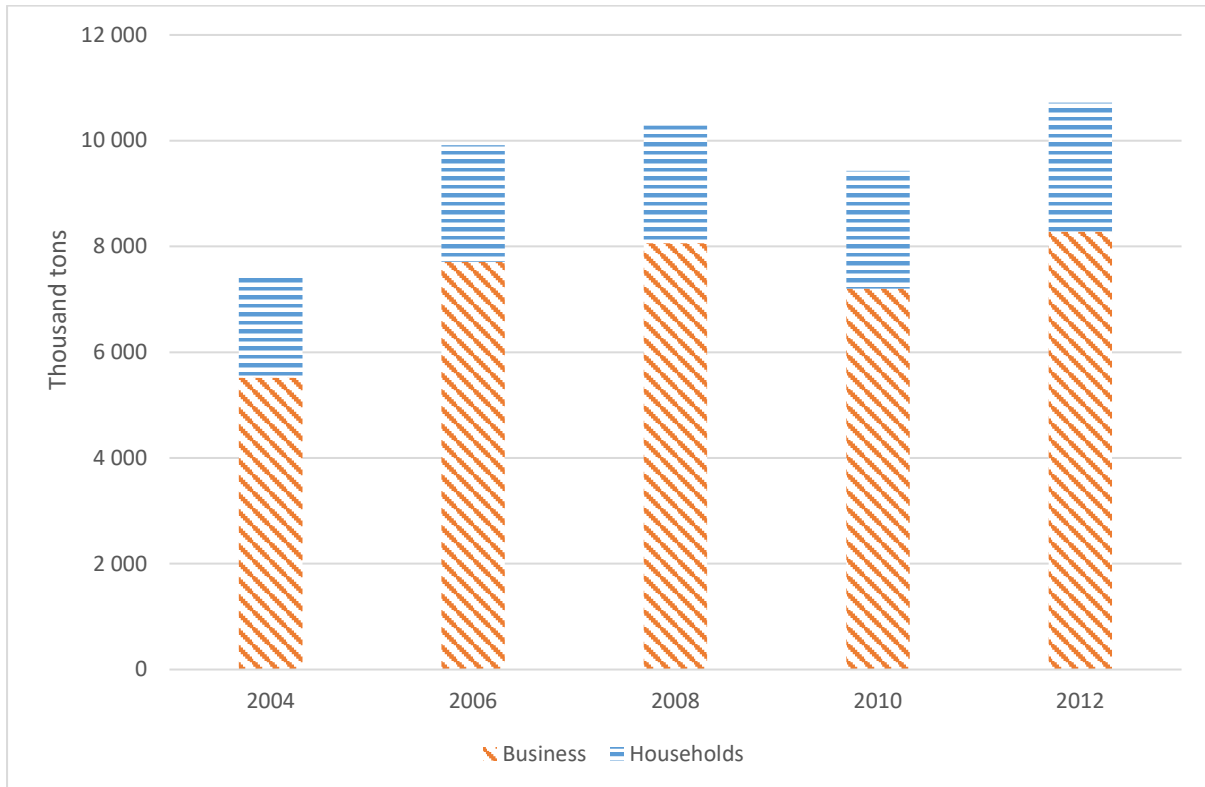
3.4. Secondary national sources

Other, secondary sources have been relevant for the report as well, such as a report on energy recovery of waste resources in Norway (Magnus et al., 2014), and reports assessing future developments of waste volumes and treatment capacities in Norway (Skogesal & Lystad, 2015; Syversen, Bratland, & Skogesal, 2015).

4. Current overview

The following sections give an overview over existing organic waste accounts for Norway. Here we present the most recent data – 2012 and 2013 – and data based on national accounts published for 2002-2011. Organic waste by product type are not included in the most recent data anymore.

Figure 5: Generation of all waste resources by source. 2004-2012. 1 000 tons. Source: Eurostat



Source: Eurostat (ten00106). Total amount of waste generated by households and businesses by economic activity according to NACE Rev. 2 and year.

4.1. Organic waste resources by material type

Table 2: Organic waste resources by material type. 2012-2013. 1 000 tons. Source: SSB

	2012	2013
Wet-organic waste	755	701
Park- and gardening waste	206	226
Wood waste	1 374	1 325

Note: New routines for calculating waste result in huge differences between 2011 and 2012.

Table 3: Organic waste resources by material type. 2002-2011. 1 000 tons. Source: SSB

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Wood waste	1 360	1 412	1 484	1 584	1 653	1 810	1 858	1 629	1 660	1 815
Wet-organic waste	1 293	1 253	1 345	1 421	1 433	1 528	1 534	1 408	1 493	1 452

Note: Park- and gardening waste was not specified.

4.2. Organic waste resources by product type

Table 4: Organic waste resources by product type. 1995-2000. 1 000 tons. Source: SSB

	1995	1996	1997	1998	1999	2000
Wood waste	1 360	1 412	1 484	1 584	1 653	1 810
Wet-organic waste	1 293	1 253	1 345	1 421	1 433	1 528

4.3. Organic waste resources by source of origin

Table 5: Organic waste resources by source of origin and material type. 2012-2013. 1 000 tons. Source: SSB

Source of origin	Material type	2012	2013
Agriculture, forestry and fishing	Wet-organic waste	50	48
	Park- and gardening waste	9	9
	Wood waste	1	1
Manufacturing industries	Wet-organic waste	404	354
	Park- and gardening waste	0	0
	Wood waste	737	676
Water supply, sewerage, waste management and remediation activities	Wet-organic waste	0	0
	Park- and gardening waste	0	0
	Wood waste	0	4
Households	Wet-organic waste	174	174
	Park- and gardening waste	173	194
	Wood waste	235	255

Table 6: Organic waste resources by source of origin and material type. 2002-2011. 1 000 tons. Source: SSB

Source of origin	Material type	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Agriculture, forestry and fishing	Wood waste	1	1	1	1	1	1	1	1	1	1
	Wet-organic waste	81	77	74	91	85	87	97	94	110	98
Manufacturing industries	Wood waste	689	688	719	743	779	830	836	683	696	748
	Wet-organic waste	429	407	412	410	401	423	398	393	401	365
Waste management	Wood waste	0	0	0	0	0	0	0	0	0	0
	Wet-organic waste	0	0	0	0	0	0	0	0	0	0
Households	Wood waste	291	327	315	327	360	364	373	365	373	407
	Wet-organic waste	437	408	470	503	503	550	556	543	556	553

Note: The industries are classified according to SN2007 from 2008 onwards, and SN2002 for the previous years.

4.4. Organic waste resources by type of treatment

Table 7: Organic waste resources by treatment method and material type. 2012-2013. 1 000 tons. Source: SSB

Treatment method	Material type	2012	2013
Sent to material recovery	Wet-organic waste	171	148
	Park- and gardening waste	27	8
	Wood waste	116	215
Biogas production	Wet-organic waste	54	75
	Park- and gardening waste	0	1
	Wood waste	5	0
Composting	Wet-organic waste	361	315
	Park- and gardening waste	152	199
	Wood waste	13	11
Other disposal	Wet-organic waste	4	0
	Park- and gardening waste	9	3
	Wood waste	14	10

Table 8: Organic waste resources by treatment method and material type. 2002-2011. 1 000 tons. Source: SSB

Treatment method	Material type	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Sent to material recovery	Wood waste	304	322	339	362	383	412	424	376	378	374
	Wet-organic waste	372	327	327	340	312	325	323	320	343	313
Composting	Wood waste	93	92	117	108	116	147	152	146	149	133
	Wet-organic waste	187	185	234	216	231	293	303	292	297	267

References

European documentation

EUROSTAT (2013) Manual on waste statistics - A handbook for data collection on waste generation and treatment - 2013 edition

EU The Waste Statistics Regulation (WStatR) Regulation (EC) No 2150/2002

EU The Manual for the Implementation of Regulation (EC) No 2150/2002 On Waste Statistics

EEA Eionet European Topic Centre on Sustainable Consumption and Production.

<http://scp.eionet.europa.eu/themes>

- a. 15 International Waste Databases
(http://scp.eionet.europa.eu/facts/international_databases)
- b. National Waste Databases (http://scp.eionet.europa.eu/facts/national_databases)

UNSTATS, International Merchandise Trade Statistics Methodology

<http://unstats.un.org/unsd/trade/methodology%20IMTS.htm>

UNDATA Commodity Trade Statistics Database, United Nations Statistics Division,

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