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Energy account and energy balance

Documentation of statistics production since statistics year 1990

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Preface

The document describes the statistics production for the energy account and energy balance (EA/EB). It is an extended version of Documents 2017/26 that described the statistics production for the reference year 2010 and onwards.

A new production system has been developed, and was introduced in the statistics production for EA/EB in 2017. The production system harmonises and conflates data from over 30 sources using calculations and data processing in an Oracle application developed at Statistics Norway for editing and estimation (ISEE).

The revision of the production system was accompanied by an extensive review of methods. This document presents the methods and data sources used for the complete time series.

Norway is one of the first countries to have established a universal and consistent production system for energy accounts and energy balances in accordance with the latest international guidelines for energy statistics and international reporting.

Statistics Norway, 21.11.2018.

Lise Dalen Mc Mahon

Abstract

The purpose of this document is to provide a description of the production of the energy account and energy balance statistics (EA/EB). The statistics production has been revised considerably, and changes have been made during the past years to the data sources, methods and use of tools. This document describes the different components of the statistics production that is the base for the publication of revised time series for 1990–2016 and preliminary figures for 2017.

The energy balance (EB) and the energy account (EA) are two statistics on the supply and use of energy products. The statistics have been published every year since 1976, and the time series have been relatively consistent since 1990. The energy account and energy balance are generally based on the same figures, but different principles and definitions are applied. EA follows the definitions of Norwegian economic activity in the national accounts (NA). All energy products that have been produced and are used commercially in the Norwegian economy are included, also consumption by Norwegian enterprises abroad. EB follows a territorial limitation, and encompasses all flows of energy products on Norwegian soil, regardless of nationality.

A new production system was implemented in 2016–2017. The production system harmonises and conflates data from over 30 sources using calculations and data processing in an Oracle application developed at Statistics Norway for editing and estimation (ISEE). The revision of the production system was accompanied by an extensive review of methods. The data sources, methods and the technical solution that provide the base for the publication in November 2018 are presented in this document.

This document begins by describing key concepts and variables that are used in the publication of EA/EB (Chapter 2). The data sources used in EA/EB are described next, as well as the calculations made outside the production system (Chapter 3). This is followed by a description of the technical solution (Chapter 4) and the calculations in the production system (Chapter 5). Finally, an account is given of the principles behind the balancing (Chapter 6) and of how the figures are disseminated (Chapter 7). The appendices include lists of key classifications in the publication and conversion factors.

Contents

1. Introduction

1.1. Purpose, history and areas of use

Compiling data on of production, consumption, imports, exports, distribution losses and stock

The energy account and energy balance (EA/EB) (SN, 2018a; SN, 2018b) show the supply and use of energy products in Norway according to different standards and principles. EA/EB compiles activity data on production, consumption, imports, exports, distribution losses and stock, and the results are published as two statistics at SN.no. See Chapter 7 for more information about the publications and the cohesion between the two statistics.

Purpose of the statistics:

- to increase the relevance of the energy statistics by presenting comprehensive and reconciled information about energy production and consumption in Norway, as well as storage, imports and exports of energy products
- to enable comparability between different years and countries through consistent use of methods and standardisation
- to allow contributions from different energy products or sectors to be calculated relative to country totals
- to provide a foundation for calculating emissions to air (different greenhouse gases and other emission components)
- to provide a foundation for calculating indicators (for example energy intensities)

The statistics have been published annually since 1976. Prior to 1990, different sources were used to some extent in the energy account and the energy balance. Statistics Norway has coordinated the EA/EB work since 1990, so that the figures used in these statistics are consistent. The only distinctions between them now are different delimitations, principles and definitions.

EA vs EB

EA covers all energy products that have been produced and used commercially in the Norwegian economy, including Norwegian consumption abroad. EB follows a territorial delimitation, and encompasses all flows of energy products on Norwegian soil, regardless of nationality. EA shows, for example, consumption of energy products according to the Standard Industrial Classification (SN, 2008) and the definitions in NA (SN, 2014a), while EB shows energy consumption for different purposes according to the definitions and delineations provided by the European Energy Statistics Regulation (2008). The United Nations Statistics Division (UNSD) has drawn up international guidelines for energy accounts in its *System of Environmental-Economic Accounting* (SEEA) (FN, 2012) and for energy balances in the *International Recommendations for Energy Statistics* (IRES) (FN, 2016a), with a complementary manual for implementation (FN, 2016b).

SEEA

IRES

Users

The statistics are used by public and private entities that work with different types of energy issues and analyses. Important internal users at Statistics Norway are the Division for energy and environmental statistics, the Division for national accounts, and the Research department. Government agencies, schools, the media, organisations and other interested parties are also users of the statistics. The statistics provide a foundation for international reporting to the International Energy Agency (IEA), the Organisation for Economic Co-operation and Development (OECD) and the European Union's statistical office Eurostat. Several national and international institutions also retrieve energy data from Statistics Norway's Statbank for use in different types of sets of indicators. See Chapter 7 for more information.

Major users of the energy and emission statistics are regularly invited to advisory committees. The purpose of this is to help chart user needs, and receive advice about prioritisation and dissemination of the statistics. Examples of such major users of EA/EB are the Norwegian Environment Agency and the Norwegian Water Resources and Energy Directorate (NVE).

Time series

The time series that provide input to EA/EB are maintained from the year 1990 an onwards. Long, cohesive time series are in demand by users. The emission statistics are the main user of EA/EB data at Statistics Norway. The emission statistics are reported annually to the United Nations Framework Convention on Climate Change (UNFCCC), which requires the recalculation of the entire time series dating back to 1990 when new information emerges (e.g. changes to basic data, new emission factors, new methods etc.) (SN, 2016a). Statistics Norway must comply with strict international requirements regarding consistency. The energy and emission statistics reported to the IEA, Eurostat and the UN must be cohesive. It is a strict requirement that the energy balance covers all consumption of energy products in Norway in order to ensure that the emission calculations cover all emissions associated with energy use.

The requirement for consistency in the delineation of EA/EB and the emission statistics has been met in Statistics Norway through the introduction of a new production system in 2017 that is designed to maintain time series and the retrieval of data from EA/EB to calculate emissions from consumption of energy products.

Reporting

Many types of energy data reports must be submitted, both within Statistics Norway and to different national and international parties. The different reports vary by scope, definitions and level of detail. The change to a new production system that provides data consistency throughout the system ensures that the different deliverables are comparable, and are based on data from a cohesive, balanced accounting system.

1.2. Change of methods and new production system

Excel was the main tool for compiling input data, preparation and analysis in the production system used from 1995 to 2015 (SN, 1993).

Purpose of developing a new production system

A project to develop a new production system for EA/EB started in the autumn of 2013, and the actual work to build the system began in the autumn of 2015. The purpose of the project was to make the production and use of EA/EB more robust, less vulnerable to errors, easier to understand, more flexible, more efficient, and more in line with Statistics Norway's standards and international standards. The production system provides better cohesion between the energy and emissions accounts, simpler and more flexible deliveries of data to many different user groups and links to other statistics, and simpler, coordinated annual reporting of different energy statistics, which improves consistency. The intended impact of the changes on the actual statistics is improved quality in terms of accuracy, reliability, relevance and punctuality. The new production system was implemented in 2016–2017, and used in the publication of EA/EB starting in 2017.

Guidelines for review of methods

Given that incorporating outdated methods into a new system would be counter-productive, a comprehensive review was undertaken of the methods and data sources parallel to the development of the production system. A set of principles was drawn up for delimitation purposes and to provide guidelines for the development of methods. These principles are based on experiences from the EA/EB work, Statistics Norway's strategy, and international principles for official statistics:

- Greatest possible reuse of statistics
- Greatest possible consistency between own statistics

- Fewest possible assumptions that can be changed over time or which require input
- Fewest possible data sources
- The method chosen must comply with reporting obligations and meet users' needs

Reuse

Greatest possible reuse of statistics is a requirement in the European Statistics Code of Practice regarding non-excessive burden on respondents (SN, 2018c, principle 9). If customer lists from sales statistics for different energy products can be used to calculate the energy use of different industries, the reporting burden will be considerably less than if each business is asked which energy products they use for a period of time.

Consistency

Greatest possible consistency between own statistics refers to the principle of cohesion and comparability (SN 2018c, principle 14). As far as possible, there should be internal consistency between the primary energy statistics and EA/EB. Consistency between EA/EB and the emission calculations is also an objective. The various statistics must be based on the same types of primary data. Differences that are due to diverse delineations must be documented and disseminated. It is important that Statistics Norway does not operate with different numbers and quantities for variables that in principle share the same delineation and definitions.

Fewest possible data sources

EA/EB covers many areas, so broad-ranging and extensive data sources are required. It is nevertheless important to limit the number of data sources. As well as data collection being resource-intensive, using many different data sources also creates challenges in terms of quality. Different delimitations in data sources create a risk of double counting or under reporting.

Reporting obligations

Reporting obligations and user needs also guide the work on methods. The minimum requirements for the breakdown of consumption data by industry and energy product are stipulated in the guidelines for reporting energy accounts to Eurostat in 2017 (Eurostat 2018a). Statistics Norway also has national user needs that can be met through dissemination of the statistics. Detailed tables in Statbank may, for example, reduce the demand for special deliveries.

Consistent method for breakdown by energy product and industry

The review based on these guidelines has led to changes regarding the use of data sources, the breakdown by product and industry, the methods for balancing EA/EB, data sources and publication. The breakdown by product and industry in EA/EB is more consistent now than in the past, particularly in relation to methods for distribution by industry of purchases from distributors in the statistics on sales of petroleum products and estimations of energy use in the aviation industry, the agricultural industry and households. Even though several changes have been made to the data sources, the main data sources are generally unchanged. For instance there have been few or no changes to production and consumption of electricity and district heating or energy use in the manufacturing sector (see Energy use in the manufacturing sector). In addition, the statistics on sales of petroleum products still provide the totals for consumption of petroleum products (with a few exceptions). The EPIM Environmental Hub (EEH) has been adopted as a data source for energy use in oil and gas extraction. A new method for collecting data on production and consumption of biogas has resulted in more detailed product information regarding renewable energy products, while a new data source for biofuel has reduced the need for data collection. Structural statistics have been used to distribute consumption of motor gasoline and road diesel by industry, and have replaced several different small data collections and calculations.

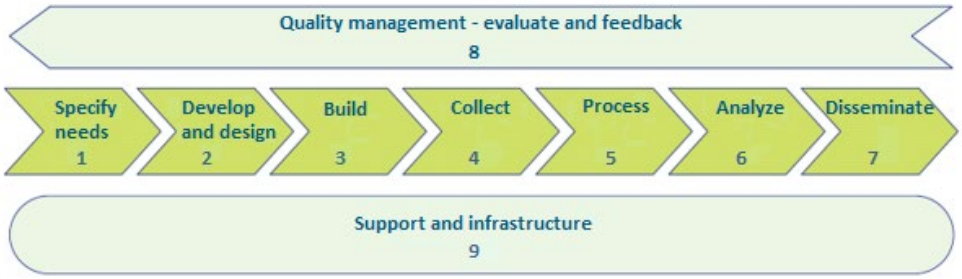
User needs

Changes have also been made to the publication of EA/EB in order to improve user friendliness. The Statbank tables for EA and EB are coordinated and consistent, and new data sources and methods for breaking down aggregated volumes have allowed the publishing of data on a more detailed product and industry level than before. The various reporting requirements at Statistics Norway for EA/EB are also handled in a more cohesive manner.

1.3. Organisation of statistics production

The introduction of a new production system made it necessary to reorganise the EA/EB work with EA/EB. Statistics Norway's business process model provides a shared reference base for the process of producing statistics (Køber, T. et al., 2008). This allows a good distribution of responsibilities and ensures that all parts of the production process are covered.

Figure 1.1 Statistics Norway's business process model



Source: Statistics Norway.

Those who work directly with the data sources have the best knowledge in the area, and this knowledge is developed further in EA/EB. They are given the following responsibilities, according to the business process model (Figure 1.1:

- Monitor developments in the area (1 and 2)
- Create statistical data for their data source (4 and 5)
- Check and quality assure the figures in the balancing of EA/EB (6)
- Quality and methods in the statistical data of the data soruce and in EA/EB (8)

By organising the EA/EB work in this way, much of the checking and balancing has been shifted to the source figures. Errors in the figures may, for example, be due to collection errors or registry errors, and this must be discussed directly with the reporting parties and registry owners. The reason for this is to ensure constant improvement and to improve the quality of the statistics.

1.4. Comparability over time

Comparable methods

All data sources and methods were examined during the 2017 review, and emphasis was placed on avoiding breaks in the time series by using the same or comparable calculation methods and data sources for the entire time series from 1990 onwards. Even though the time series have been more consistent since the review, there are still several breaks of varying sizes in the time series.

Standard classifications

In order to achieve comparability over time, the statistics must be based on common definitions and classifications. The International Standard Industrial Classification was introduced in Statistics Norway in 1994 and was revised in 2002 and 2007 (SN, 2008). The new production system reverts to the Standard Industrial Classification of 2007 which came into effect on 1 January 2009. In some cases, recoding old industry codes to new ones has led to some businesses being placed in different industries from previously. For example, businesses have been moved from the manufacturing sector to service industries (e.g. waste disposal). This has bee taken into consideration when recoding, in order to be able to create time series

that are as uninterrupted as possible, but there may still be minor breaks in the detailed industry classification in the time series.

1.5. Coherence with other statistics

Sale of petroleum products

Totals for consumption

The statistics on sales of petroleum products (SN, 2018d) is the data source that provides the totals for consumption of petroleum products in EA/EB. The statistics are based on annual reports from oil companies and import data from the external trade statistics at Statistics Norway. This is also the data source for consumption in industries that do not collect their own data.

In the statistics on sales of petroleum there is a breakdown of sales by industry. Direct sales to end users are linked to industries or households using the organisation number or other identifiers in the data from the oil companies, while sales to distributors of solid, liquid and gaseous fuels remain attributed to the distributors. However, in EA/EB all consumption must be broken down, also that which is sold via distributors. Thus, the breakdown by industry is therefore different in EA/EB and in the statistics on sales of petroleum products. The method for this breakdown is described in section *Industry* in Chapter 5.

For the time series from 1990 to 2009, monthly sales data are used in i EA/EB. These data are also reported to Statistics Norway by the oil companies, but they do not contain as much information as the annual reports. In the monthly sales data, industrial distribution is specified by the oil companies, and there is no informasjon on individual buyers, such as organisation number, name or address.

The statistics include sales of LPG, but in the first part of the time series the salges figures are incomplete. Prior to 2005 the consumption reported by the manufacturing industry is larger than the total of reported sales. Furthermore, there is a break down by industry only in the period 2009-2012.

Energy use in the manufacturing sector

The statistics on energy use in the manufacturing sector (SN, 2018e) constitute the main data source for consumption in the manufacturing and mining industries.

Data mainly unchanged in EA/EB

The statistical data from the statistics on energy use in the manufacturing sector are unchanged in EA/EB, with a few exceptions. EA/EB requires a more detailed breakdown by energy product than that published in the statistics on energy use in the manufacturing sector. For example, they require a division between renewable and non-renewable consumption. EA/EB thus contains a more detailed distribution by product for waste and biofuels.

The statistics on energy use in the manufacturing sector only include energy products used for energy purposes, while EA/EB also includes consumption for purposes other than energy (e.g. energy products used as raw materials in the chemical industry).

Revision of EA/EB time series

There are also certain cases where data for past years is edited in EA/EB, but not in the statistics on energy use in the manufacturing sector. This is because EA/EB requires the time series to be maintained, while this is not a requirement in the primary statistics. The statistics on energy use in the manufacturing sector publish final figures for *T-2*.

District heating statistics

The district heating statistics (SN, 2018f) are the data source for production, consumption and losses of district heating in EA/EB.

Level of detail on consumption

Total production and consumption of district heating and cooling should be the same in the district heating statistics and EA/EB. The distribution of consumption by industry and household is different and more detailed in EA/EB. This is because EA/EB combines several data sources for consumption and because international reporting requirements call for a more detailed distribution of consumption.

Monthly and annual electricity statistics

The annual and monthly electricity statistics (SN, 2018g) constitute the data sources for production, consumption, imports and exports of electricity in EA/EB.

Different definitions of net consumption of electrical power

In principle, the figures in the electricity statistics and EA/EB should be identical, but there are certain exceptions. Net consumption of electrical power is defined differently in the basic statistics and in EB. The electricity statistics calculate this as total production + import - export - consumption at power plants - pumping storage power plants - loss and statistical difference. In EB, the power consumption of other energy producing industries is subtracted in order to arrive at the net power consumption. This applies to the power consumption of district heating plants, oil and gas extraction, oil refineries and coal extraction. Net electricity consumption in EB is thus lower than in the electricity statistics.

EA does not use the term net consumption. EA adds all consumption, regardless of whether it is used in energy producing industries, for pumping storage power or in other industries and households.

The breakdown by industry in the electricity statistics and EA/EB also differs. This is because EA/EB combines several data sources for consumption and because international reporting requirements call for a more detailed distribution of consumption in EA/EB.

Statistics on emissions

Consistency between energy figures and emissions

The statistics on emissions (SN, 2018h; SN 2018i; SN 2018j) are the main user of data from EA/EB at Statistics Norway, and the emission calculations are reviewed internationally every year to check for consistency between consumption figures in EB and emissions. The statistics on emissions receive an annual, automated extraction from EA/EB as input to their calculations of emissions to air from energy consumption.

In order to achieve the objective of consistency between consumption figures in EB and emissions, the basic figures used in the statistics must be identical. As a result of the reporting requirements for businesses that are covered by an emission allowance obligation, the Norwegian Environment Agency has energy consumption and emission data for a number of businesses that is publicly available. The reason for the double reporting is that the Environment Agency and Statistics Norway need different information, even though parts of the reports are identical. The variations in figures that are reported to Statistics Norway and the Environment Agency for the same businesses are due to different delimitations and reporting errors. In order to ensure consistency between EB and statistics on emissions, data from the Environment Agency should only used for emissions that are not caused by consumption of energy products for energy purposes and for energy products with an unknown emission factor.

Different treatment of reducing agents

Coal and coke oven coke used as a reducing agent in the production of metals and chemical raw materials are regarded as fuel in EB and as raw materials in the emission calculations.

Other statistics at Statistics Norway

The national accounts

The national accounts (NA) (SN, 2018k) are another important user of EA/EB at Statistics Norway. NA uses selected data to, among other things, break down total energy costs in the industries into different energy products, and to check the production value of different energy products.

NA has not received scheduled deliveries of data from EA/EB to date, and has instead retrieved figures from the primary energy statistics. The main reason for this is that up to now EA has been published too late to serve as NA input. In some cases, it has also been necessary for NA to receive details from the input files in order to use them to balance NA. One objective of the new EA/EB system is a radical improvement of the timing of EA (publication in May/June instead of in October). This will improve the quality of EA/EB data that is delivered to NA.

Theoretical differences between EA and NA

In practice, the figures from EA are normally used directly, but there are a few theoretical differences between EA and NA. EA is a satellite account to NA. Satellite accounts are those that are generally based on the concepts and figures in NA, but which are customised in order to illuminate a specific economic phenomenon or area in greater detail, or from a different perspective than in the ordinary NA (SN, 2014a).

EA follows the same principles and delimitations as NA, with a few exceptions:

- NA only covers transactions within the economy, while EA includes energy flows to and from nature.
- EA includes all energy flows between businesses in the same company or group. This type of transaction is partly excluded from NA.
- EA includes waste as an energy product, while NA only contains products with a positive market value. Mixed waste is not covered by the definition of products in NA (except for certain types of renewable waste).

1.6. Reader guidance

This document begins by describing key concepts and variables that are used in the publication of EA/EB (Chapter 2). The data sources used in EA/EB are described next, as well as the calculations made outside the production system (Chapter 3). This is followed by a description of the technical solution (Chapter 4) and the calculations in the production system (Chapter 5). Finally, an account is given of the principles behind the balancing (Chapter 6) and of how the figures are disseminated (Chapter 7). The appendices include lists of key classifications in the publication and conversion factors.

2. Concepts and variables

This chapter describes the key concepts and variables used in the production and dissemination of EA/EB. The technical concepts associated with the production system are described in Chapter 4 *Technical solution*, while the methodology is described in Chapter 5 *Methods*.

2.1. Energy products

Energy products

Energy products are all products used for production, transformation and use of energy in the economy (incl. households). Energy products are used for energy purposes and non-energy purposes (e.g. natural gas as a raw material for the manufacture of chemical raw materials and lubricants). Renewable products like biomass (.e.g. lumber) and waste that is not used for energy purposes are not included. Primary energy products are products that have been extracted directly from natural resources, like crude oil, natural gas and coal. Secondary energy products are products that are produced by transforming primary and secondary energy products, such as gasoline produced from crude oil.

Statistics Norway's standard classification of energy products (SN, 2018l) complies with the Standard International Energy Product Classification (SIEC) in the *International Recommendations for Energy Statistics* (IRES) (FN, 2016a).

Common units of measurement

EA/EB figures are published in common units of energy and in standard units of measurement. Data that forms part of EA/EB is reported or calculated in different units of measurement. For example, motor gasoline is reported in both litres and tonnes. In order to be able to harmonise the data in EA/EB, everything must be converted into a common unit of measurement using factors for energy content and density. Each energy product thus has a standard unit of measurement. The standard unit for motor gasoline, for example, is kilotonnes. Another part of the harmonisation of data in EA/EB is to convert all activity data into common units of energy. Statistics Norway publishes EA/EB in petajoule (PJ) and gigawatt hours (GWh). There are fixed conversion factors for conversion between different units of energy.

Origin

Origin is a classification variable used in EA/EB to indicate the origin of the energy product. The energy product may be of renewable origin, non-renewable origin, mixed origin and unknown origin.

2.2. Energy balance and account items

Production of primary energy products

Production of primary energy products covers extraction of fuel or raw material from natural renewable or non-renewable energy sources. Energy products that are produced without using raw materials from other energy products are called primary energy products. Examples of this are coal, fuelwood, crude oil and natural gas.

Production of secondary energy products

Production of secondary energy products covers production of energy products using intermediate goods from other primary and secondary energy products. Examples of this are petroleum products manufactured using crude oil in oil refineries or district heating produced by the incineration of waste.

Imports/exports

Imports/exports are defined differently in EB and EA. In EB, imports/exports comprise energy products entering and leaving Norwegian territory. In EA, imports/exports comprise energy products that are bought or sold by Norwegian enterprises to/from international parties, regardless of where the transaction takes place.

Changes in stock Changes in stock are defined as an increase or decrease in volumes of stock over the reporting period. This is calculated as the difference between stock levels at the end of the year for two periods (+ = decrease, - = increase). The sign shows whether the change of stock leads to an increase or decrease in the supply of the energy product.

Bunkers Bunker is a concept in EB that covers volumes of fuel delivered to international ocean transport and aviation regardless of industry and nationality of users.

Transformation Transformation is the complete or partial conversion of the energy content of an energy product entering a production process into one or more different energy products. Energy products that enter transformation processes (e.g. fuel for heating or electricity production, crude oil to oil refineries for production of petroleum products, or coal to coke ovens for production of coke) are shown as a negative figure. Energy products that are produced during transformation processes are shown as a positive figure. If the input is greater than the output, the transformation is shown as a negative figure.

Transformation input Transformation input it the energy product used in the transformation process to produce other energy products (e.g. fuel for heating or electricity production, crude oil to oil refineries for production of petroleum products, or coal to coke ovens for coke production).

Energy producing sector The energy producing sector is a concept used in EB that covers plants that produce energy products for sale. These are generally businesses whose main activity is production of energy products, but they can also be businesses in the manufacturing industry whose main activity is, for example, production of chemical raw materials, and which have a plant that produces energy products as a secondary activity. The main groups in the energy producing sector are extraction of crude oil and natural gas, coal extraction, oil refineries, hydropower plants, thermal power plants, combined heat and power plants (CHP) and district heating plants.

Own consumption in energy producing sector Own consumption is a term in EB that covers consumption of energy products in the energy producing sector, excluding consumption in transformation processes and transport. It includes own consumption in extraction of crude oil and natural gas, coal extraction, and consumption in oil refineries, hydropower plants, thermal power plants, CHP and district heating plants.

Net domestic consumption Net domestic consumption covers all domestic energy consumption excluding consumption in the energy producing sector.

Consumption for energy purposes Consumption for energy purposes covers energy products used for production, lighting, heating, transport and as a reducing agent in manufacturing. Energy products used as raw materials or oil that are used as lubricants are not regarded as energy products for energy purposes.

Reducing agent Some coal, coke oven coke and charcoal is used as a reducing agent in the production of metals and chemical raw materials. This consumption is regarded as part of the energy products used for energy purposes in EA/EB.

Raw materials Raw materials refers to energy products that are used as intermediate products in the production of goods. This mainly involves the input of petroleum products in the production of chemical raw materials, natural gas used in methanol production and petroleum coke used in the production of, for example, coal electrodes.

Transport In EB, the item transport includes energy products used for the transport of goods or persons within Norwegian territory regardless of nationality of the transporter and the industry in which the transport occurs. This item includes the subcategories road transport, rail transport, air transport, coastal transport and other transport. In EA, consumption is placed in the industry in which it takes place or in households. Transport in EA covers energy products used for the transport of goods or persons by Norwegian businesses or Norwegian households, regardless of where in the world this takes place.

Statistical errors Statistical errors are the difference between the total supply and total consumption of an energy product.

3. Data sources

3.1. Production

Primary petroleum products and coal

Diskos

Primary petroleum products are produced in the extraction of crude oil and natural gas industry. Annual production figures are retrieved from the Diskos database of the Norwegian Petroleum Directorate (NPD) (Oljedirektoratet, 2017). Diskos is a joint venture between NPD and oil companies on the Norwegian continental shelf, where the oil companies report seismic, well and production data themselves. The production data includes production of LPG, ethane, NGL, crude oil and natural gas.

Re-injected natural gas

Re-injected natural gas is subtracted from EA/EB. The re-injected gas is included in NPD's net production volumes, but is excluded from EA/EB because in principle it can be produced again. The volumes for re-injected natural gas are collected from the gas transporter Gassco.

EEH

NPD's net production figures for natural gas are exclusive of production volumes used on the Norwegian continental shelf and in gas terminals. In order to ascertain total production, these volumes are added to EA/EB. The consumption figures are retrieved from EEH (EPIM, 2017). More information can be found about this data source in *Extraction of crude oil and natural gas, and associated services*.

Coal mines on Svalbard

Coal is produced in the mining of hard coal industry. Figures for produced volumes from Norwegian coal mines on Svalbard are collected annually. Russian coal mines on Svalbard are included in both the economic and geographical definition of Norwegian territory, but practical challenges associated with data capture, the balancing of electricity and confidentiality issues in connection with the release mean that EA/EB does not use or publish production figures for Russian coal mines on Svalbard.

Secondary petroleum products

Oil refineries

Secondary petroleum products are mainly produced in oil refineries[1]. Oil refineries are defined as a manufacturing industry in EA, according to the Standard for Industrial Classification, while they are defined in EB as part of the energy producing sector, as the main activity of oil refineries is production of energy products. Production volumes are collected directly from oil companies annually and the production data includes energy products like motor gasoline, gas oil/diesel oil, kerosene, heavy gas oil, fuel oil, LPG, naphtha and petroleum coke.

Splitting of gas oil/diesel oil

Production of gas oil/diesel oil is more aggregated than the level of detail required in reporting and other dissemination of the statistics. The sales figures (excl. import) from the annual petroleum statistics are used to split production between light heating oil, off-road diesel, road diesel and marine gas oil. The same sales figures are also used to split figures for stocks and imports/exports. The breakdown between products can differ in production, stocks and imports/exports, but as this is not known, the same distribution formula is used for all activities. The reason why the production figures are aggregated and not broken down into light heating oil, off-road diesel, road diesel and marine gas oil is that the products have the same physical properties. Gas oil/diesel oil is not distributed between the different products until it reaches the sales level. See the *Energy product* section in Chapter 5 for more information about the method for splitting energy products.

[1] There is also some production in the chemical industry. See the section *Production of energy products in the manufacturing industry as a secondary activity*.

Petroleum coke and refinery gas

In addition to the solid and liquid energy products mentioned above, the refineries also produce carbon monoxide gas from petroleum coke and refinery gas. Refinery gas is gaseous hydrocarbons generated during the distillation of crude oil or the treatment of oil products (cracking) in the refineries. These production figures are collected from businesses annually.

Electricity

Monthly and annual electricity statistics

The production figures are retrieved from monthly and annual electricity statistics (SN, 2018g). The data is based on reporting. The annual electricity statistics are published about 10 months after the end of the year. The preliminary publication of EA/EB in May/June of the next year therefore uses figures from the monthly electricity statistics. The difference between the annual and monthly electricity statistics is that the annual statistics are more detailed and reliable than the monthly ones. There are few differences in the production figures, however.

Statistics Norway receives monthly production figures from Statnett. It also collects its own figures for power production on Svalbard. The annual production figures come from a joint data collection with the Norwegian Water Resources and Energy Directorate (NVE), where Statistics Norway receives a copy of the data in order to draw up official statistics that are stored in one of its databases.

District heating and cooling

Form-based survey regarding district heating plants

The production figures are retrieved from annual district heating statistics (SN, 2018f), which are collected through an annual form-based survey. The population is all district heating and cooling plants in Norway that deliver heating and/or cooling via a pipe system to external customers from a central plant with a power output of at least 1 MW. These figures exclude manufacturing companies that produce heat for their own use.

Biogas

Form-based survey regarding biogas from sewage sludge, landfill and food waste

Production data on biogas is collected directly from the producers through an annual form-based survey. The sources of the biogas may be extraction from sewerage, landfill and food waste. The producers are mainly located in the water, sewerage and waste disposal industries. Data has been collected from the entire population since 2015, whereas in previous years, production and consumption data was only collected from a small sample of businesses. This means that there is therefore a break in the statistics between 2014 and 2015.

Supplementary figures from the Norwegian Environment Agency

Statistics Norway also receives files from the Norwegian Environment Agency containing data on extraction of methane gas from landfills. This information supplements the production data collected in Statistics Norway's own data collection.

Production of energy products in the manufacturing industry as a secondary activity

Fuel gas, LPG, pyrolytic gasoline and waste oil

Statistics Norway collects data on production of energy products in manufacturing industries. These are businesses where production of energy products is a secondary activity. The chemical industry produces fuel gas, which is a by-product of ethylene production. The figures are collected annually. Some of this gas is resold and used by other businesses in the chemical industry. Production figures are also collected for LPG, pyrolytic gasoline and waste oil as by-products from the chemical industry.

Blast furnace gas

The metals industry produces carbon monoxide gas from coal and coke oven coke as a by-product of metal production, called blast furnace gas. Statistics Norway collects production data from these businesses through an annual form-based survey. Consumption data is also collected from businesses in the chemical,

mineral, metals, electricity production and district heating industries who buy the gas.

Other energy products

For certain energy products in the Norwegian economy, the volumes produced are calculated using imputation. The method for this is described in section 5.2. Below are details on the energy products for which production figures are calculated.

Waste

Waste is produced by the entire economy – industries and households alike. Production figures are set to be as equal to consumption. Most energy recovery of waste takes place in the sewerage and waste management industry and the energy producing industries, but some also occurs in the manufacturing industries.

Fuelwood

The production figure for fuelwood is set to be equal to consumption, corrected for imports and exports. Production is distributed by industry by applying economic production data from NA as distribution formulas. About 60 per cent of the production volumes is placed under agriculture, 30 per cent under forestry and 10 per cent under the nursing and care services industry group. Statistics Norway is aware that some of the consumption of fuelwood by households is produced by the households themselves (own woodland), but there is no exact data on volumes, and the international guidelines regarding energy accounts state that household production must be classified according to the industry where the volumes are normally produced (Eurostat, 2014a, p. 20).

Biogas

Missing production figures for biogas are calculated using consumption, corrected for known production. This mainly applies to missing production figures before the form-based survey was introduced in 2015. See the section *Biogas*.

Biomass pellets and briquettes

Production figures for biomass pellets and briquettes are calculated using consumption data, corrected for imports and exports. This production is presumed to occur in the production of wood and products of wood industry, so the volumes are placed here. Production of energy products in the manufacturing industry that are solely produced and used for own use are placed in the manufacturing industry where consumption takes place. This comprises animal waste, steam/waste-heat, wood waste, and other solid and liquid biofuels.

3.2. Imports and exports

Imports and exports of energy products are retrieved from Statistics Norway's external trade statistics, with a few exceptions. These statistics are based on customs declarations that cover physical flows of goods across the customs border (SN, 2018m).

Splitting of gas oils/diesel oil

The sales figures from the annual petroleum statistics are used to split production between light heating oil, off-road diesel, road diesel and marine gas oil.

Below is a presentation of the energy products for which data sources other than Statistics Norway's external trade statistics are used.

Electricity

Figures for imports and exports of electricity are retrieved from the monthly electricity statistics, which collect figures from Nord Pool Spot AS (SN, 2018g). This data source is used instead of Statistics Norway's external trade statistics in order to balance it against the production and the consumption figures for electricity.

Crude oil, condensate, NGL, LPG, ethane and natural gas

The figures for exports of crude oil, condensate, NGL, LPG, ethane and natural gas are retrieved from NPD, one terminal and one pre- and post-treatment facility at a refinery. This is done in order to balance them against the production figures,

which are also collected from NPD (see the sections *Primary petroleum products and coal* and *Stock* in Chapter 3). The export figures for natural gas have been supplemented with figures retrieved from Gassco since 2015. The micro data on exports of these products is delivered to the Division for external trade statistics, and is thus quality assured together with Statistics Norway's external trade statistics.

Pyrolytic gasoline

Pyrolytic gasoline is produced as a by-product in the chemical industry and the volumes are exported in full (see the section *Production of energy products in the manufacturing industry as a secondary activity*). The classification of products in Statistics Norway's external trade statistics is not detailed enough to filter out these volumes, and they have been included in exports of other products from the chemical industry that are not energy products. The volumes are therefore imputed in EA/EB by entering exports as equal to production. See an explanation of the method in section 5.2.

Bioethanol, other liquid biofuels and additives at refineries

Due to a low level of detail in Statistics Norway's external trade statistics, missing consumption of bioethanol, biodiesel, other liquid biofuels and additives at refineries that are not covered by domestic production is imputed as imports. See an explanation of the method in section 5.2.

Transport fuel bought abroad

In EA fuel bought abroad is added to import figures. This is done for fuel used in international ocean transport and aviation.

3.3. Consumption and loss

Agriculture, forestry, fishing and aquaculture

Electricity

Consumption of electricity in agriculture and aquaculture is retrieved from the electricity statistics (SN, 2018g). Statistics Norway receives sales data by industry from electricity power plants in the annual electricity statistics. Sales are aggregated to the group ‘Agriculture, forestry and fishing’. There is not enough information to be able to split consumption in these sectors, but using calculations based on values in the 2008 NA, 90 per cent is placed under agriculture and 10 per cent under aquaculture. By using measuring point data from Elhub (Statnett, 2017) in the future, the intention is to improve the breakdown of electricity consumption by industry.

District heating

Consumption of district heating in agriculture is retrieved from the district heating statistics. This is sales data by industry reported by the district heating plants (SN, 2018f).

Natural gas

Consumption of natural gas in agriculture is retrieved through an annual form-based survey of businesses that sell natural gas for use in Norway. These distributors break down sales into industries and households (consumption in extraction, energy production, manufacturing and mining are excluded and collected in dedicated data collections). The survey was first carried out in 2004, but data on inland consumption of natural gas had been collected since 1994. Prior to 1994 the consumption was insignificant.

Off-road diesel

The figures for consumption of off-road diesel in agriculture come from Statistics Norway's Sample Survey of Agriculture and Forestry (LU) (SN, 2018n). This is a form-based sample survey where agricultural holdings report how much diesel they have used in their business activity. The primary activity of most agricultural holdings is agriculture, but a number of them have agriculture as their secondary activity, and are thus located in industries other than agriculture. Before the figures are used in EA/EB, the shares of the consumption that do not form part of the agricultural industry are subtracted by linking to the industry code from Statistics

Norway's Norwegian Central Register of Establishments and Enterprises (VoF) for each agricultural holding. Questions regarding energy are only included in LU every 3–4 years. Activity data for intervening years is calculated by using the percentage change in quantities in the aggregate accounts for diesel of the Budget Committee for Agriculture as calculated by the Budget Committee for Agriculture (Nibio) (Budsjettnemnda for jordbruket, 2017).

LPG

Figures on LPG consumption prior to 2005 are taken from agriculture statistics (SN 2005). From 2005 and onwards, total consumption is given by the annual sales statistics for petroleum products and distributed to agriculture industry using the share of direct sales in 2009-2012. Until further work is done, the same distribution formula is applied to all these years.

Other petroleum products

Consumption of petroleum products that is not mentioned above (motor gasoline, road diesel, off-road diesel, aviation gasoline, heating kerosene, light heating oil, marine gas oil, heavy gas oil, LPG and lubricants) is covered by the annual statistics on sales of petroleum products (SN, 2018d). Distributor sales are broken down by industry according to distribution formulas. The method is described in the section *Industry* in Chapter 5.

Extraction of crude oil and natural gas, and associated services

Offshore

Consumption figures for offshore activity in the extraction of crude oil and natural gas, and associated services industry are retrieved from EEH (EPIM, 2017) for 1997 and onwards. This is a national database for statutory reporting from businesses in the petroleum sector on the Norwegian continental shelf. Energy use and emissions are reported here, and quality assurance of the data is performed by NPD and the Norwegian Environment Agency. The data source includes consumption of diesel oil, crude oil and natural gas. Figures on consumption I 1990-1996 have been retrieved from NPD. In EA/EB, it is assumed that consumption of diesel oil refers to marine gas oil offshore and off-road diesel at land facilities. The figures for offshore activity are supplemented by sales figures for marine gas oil. As the sales figures for marine gas oil are considerably higher than the consumption figures that have been reported, it is assumed that the difference is use by ships that are not covered by the statutory reporting obligation. Data from EEH includes figures for flaring, well testing and offshore venting.

Diesel oil, crude oil and natural gas

Pipeline operation

According to the Standard for Industrial Classification, consumption for operation of pipelines for oil and gas extraction is classified under the industry land transport and transport via pipelines. However, it is not possible to separate consumption in transport via pipelines from other consumption in oil and gas extraction, so they are treated as a whole in the dissemination of EA/EB.

Land facilities

Data on consumption and losses at land facilities is retrieved from NPD, Gassco, emission allowance data from the Norwegian Environment Agency, and the Statistics Norway survey on use of natural gas in Norway. Several land facilities also produce electric power (gas power). Power plants that produce both power and heat are called combined heat and power plants (CHP). For these plants, calculations are made for natural gas used in power and heat production based on figures for power production, total use of natural gas and assumed efficiency. For CHP that primarily produce power for own use (manufacturing plants), natural gas used in heat production as fuel is placed under direct use, not transformation, while natural gas calculated for use in power production is placed under transformation. This complies with the reporting obligation to the IEA and Eurostat.

Manufacturing and mining

Sample survey of energy use

Consumption figures for manufacturing and mining industries are retrieved from the statistics on energy use in the manufacturing sector (SN, 2018e). The statistics

are collected via an annual form-based sample survey, where enterprises report energy products used for production, lighting, heating and transport for one or more of their businesses. Energy products used as raw materials are excluded from this survey. The largest manufacturing businesses are included in the sample every year, and a stratified sample of small and medium-sized businesses is added. The sample covers about 95 per cent of total consumption of energy in manufacturing and mining. The remaining consumption in the population is estimated using turnover when calculating preliminary figures (*T-1*) and the energy cost from the income statement for final figures (*T-2*).

Special form

In order to cover all energy use in manufacturing and mining, information is also collected about energy products used as raw materials, and a special form is sent to a small sample of businesses that produce or use special energy products. Examples here are businesses in the chemical industry that use natural gas as a raw material or businesses in the mineral industry that recover energy from different types of waste. A special form is also sent to the oil refineries in order to record the energy flow at the plants.

Time series

The statistics on energy use in the manufacturing sector is consistent from 1998 onwards, when the survey was expanded to include all active businesses and data was collected using forms. In 2005 figures for 1990-1997 were recomplied, partly by collecting new data and partly by calculating consumption using other input data. These revised time series have now been implemented in EA/EB for petroleum products. Other products had already undergone extensive revision in the old EA/EB system, and were thus not replaced.

Electricity, gas, steam and air conditioning supply

Own consumption in electricity production

Consumption of energy products in the electricity production and supply industry is retrieved from the monthly and annual electricity statistics, and covers own consumption of energy products at electricity power plants, as well as distribution losses (SN, 2018g).

Transformation consumption in electricity production

Transformation consumption (i.e. energy products as input to the production of electricity) is calculated in EA/EB using information from the electricity statistics about the energy products used to produce the electricity at the different plants and factors for energy content and efficiency. See the description of the method in the section *Transformation consumption* in Chapter 5.

District heating statistics

Consumption of energy products in the steam and air conditioning supply industry is retrieved from the annual district heating statistics, and covers all energy products used for transformation, own use in the district heating plants and losses (SN, 2018f). The district heating statistics cover all district heating plants, and some of them are located in industries other than steam and air conditioning. For example, district heating plants are found in waste management companies and public administration. EA/EB uses consumption figures from all district heating plants in the district heating statistics.

Transportation and storage

Rail transport

Rail transport means transport by train, tram, and urban and suburban railway. Electricity consumption is retrieved from the electricity statistics (SN, 2018g). Some off-road diesel is used in rail transport. These figures are retrieved from the statistics on sales of petroleum products (SN, 2018d). Small volumes of lubricants from these statistics are also placed under rail transport.

Road transport

Road transport covers the industries freight transport and other passenger land transport (e.g. buses and taxis). Consumption of natural gas and biogas for road transport is collected through annual form-based surveys of businesses that sell

natural gas and biogas for use in Norway. Consumption of petroleum products that is not mentioned above is covered by the annual statistics on sales of petroleum products. In EA/EB, it is assumed that road diesel, motor gasoline and LPG sold to these industries are used for road transport and that off-road diesel, light heating oil and heating kerosene are used for stationary purposes in the industries[2]. Consumption of lubricants and bitumen is regarded as consumption for non-energy purposes (SN, 2018d). Distributor sales are broken down by industry according to distribution formulas. The method is described in the section *Industry* in Chapter 5. For the period 2002-2005 the LPG consumption is estimated by distributors. From 2005 and onwards, total consumption is given by the annual sales statistics for petroleum products and distributed using the shares of direct sales in 2009-2012, as for agriculture.

Transport abroad and foreign transport in Norway

Some Norwegian freight transport by road leaves the country, and foreign freight transport operates on Norwegian roads. EA includes Norwegian transport abroad, and EB includes foreign transport in Norway. At present, information that would enable good calculations is missing. Pending a better calculation basis, 95 per cent of consumption in Norway is distributed to Norwegian operators and 5 per cent to foreign operators. For now, it is assumed that the amount of fuel bought in Norway but used abroad is offset by the amount of fuel bought abroad and used in Norway.

Water transport

The water transport industry is broken down into domestic coastal transport and international ocean transport. International ocean transport covers Norwegian ships transporting goods and passengers between international ports. Consumption of natural gas in water transport is retrieved through an annual form-based survey of distributors of natural gas. Consumption of marine gas oil, heavy gas oil and fuel oil in international ocean transport is calculated using the fuel costs from Statistics Norway's structural statistics. The amount purchased in Norway comes from the statistics on sales of petroleum products, and the share that was purchased abroad is calculated. Consumption of the remainder of petroleum products purchased in Norway (e.g. off-road diesel, motor gasoline and lubricants) in ocean transport is also retrieved from the statistics on sales of petroleum products. For domestic coastal transport, all of the consumption figures for petroleum products are retrieved from the sales statistics.

Air transport

Consumption of kerosene-type jet fuel and aviation gasoline is calculated using three data sources which are updated annually: 1) statistics on sales of petroleum products, 2) data sets on aircraft movements, which are part of the statistics on air transport and 3) reported data on purchase and use of kerosene-type jet fuel from a sample of airlines. Total fuel consumption is modelled on the basis of aircraft movements between Norwegian airports and between Norwegian and international airports. The results from the model are used to distribute sales figures by user group, cycle (LTO/cruise) and technology (jet/helicopter/light aircraft). Figures reported by airlines are used to estimate consumption in Norwegian international aviation and consumption in helicopter transport to offshore oil platforms, among other things. Data needed for these bottom-up calculations are not available for the years prior to 2010. Sales figures for 2010 and onwards show sales of kerosene-type jet fuel and aviation gasoline to various industries. Many sales are small with great annual variation and no affiliation with the aviation industry. It is very difficult to make good estimates on the time series of consumption of aircraft fuel for these industries prior to 2010. However, some industries stand out, with relatively stable and significant purchases between 2010 and 2015 and some affiliation with the aviation industry. These are human extraction of crude

[2] The fact that aviation gasoline is sold to industries whose primary activity is road transport means that they conduct air transport as a secondary activity. In EB, all consumption of aviation fuel is placed under aviation, while in EA consumption is distributed by the primary activity of the industry.

petroleum and natural gas, repair and installation of machinery and equipment, education, health care services, sports activities and amusement and recreation activities and activities of membership organisations. For these industries various methods have been used to estimate consumption in 1990-2009, e.g. statistics on flight hours and production index.

International transport in other industries

There is transport across international boarders in other industries than water transport and aviation. Fuel consumption in these industries are included in bunkers in EB, but distributed among industries in EA.

Consumption of petroleum products that is not mentioned above is covered by the annual statistics on sales of petroleum products.

Warehousing and support activities for transportation

The warehousing and support activities for transportation industry group covers warehousing services for all types of goods and support activities associated with land transport, water transport and air transport. Energy use in operation of train stations, harbours of plants, goods terminals and airports are some examples. Consumption of district heating and electricity is retrieved from the district heating and electricity statistics (SN, 2018f, 2018g). Consumption of petroleum products is retrieved from the statistics on sales of petroleum products.

Water, sewerage and waste management

Electricity and petroleum products

Consumption of electricity in the water collection, treatment and supply industry is retrieved from the electricity statistics and consumption of petroleum products is retrieved from the statistics on sales of petroleum products (SN, 2018d). The method used to break down sales figures by industry is described in section *Industry* in Chapter 5.

Other energy products

The sewerage, clearing and waste management industry includes several district heating plants. Consumption for production of district heating, own consumption at the plants and losses is retrieved from the district heating statistics (SN, 2018f). Consumption of biogas is covered by an annual form-based survey that is supplemented with data on collection, consumption and flaring of landfill gas from landfills from the Norwegian Environment Agency. Figures in consumption are provides with a split between production of heat and electricity. Consumption figures for incineration of hazardous waste are also retrieved from Statistics Norway's hazardous waste statistics (SN, 2016b). Other consumption of electricity and petroleum products is retrieved from the electricity statistics and the petroleum statistics, and consumption of natural gas is retrieved from an annual form-based collection from distributors of natural gas. For the years prior to 2008 the source of LPG consumption is statistics on energy use in the manufacturing sector (SN, 2018e). From 2008 and onwards, total consumption is given by the annual sales statistics for petroleum products and distributed using the shares of direct sales in 2009-2012, as for agriculture. The reason for the change of data source was that the industry for materials recovery was moved from the manufacturing industries when the Standard Industrial Classification was revised in 2007 (SN, 2008).

Education, human health, public administration and defence

Electricity and district heating

Consumption of district heating and electricity is retrieved from the district heating and electricity statistics (SN, 2018f, 2018g). There are also dedicated district heating plants in the public administration, so consumption for production of district heating and own consumption at the plants is retrieved from the district heating statistics.

Petroleum products

Use of kerosene-type jet fuel in the Armed Forces and other consumption of petroleum products in public administration are retrieved from the statistics on sales of petroleum products (SN, 2018d). Other consumption of natural gas and biogas is retrieved through annual form-based surveys of distributors.

Pellets

Sales statistics for pellets are also retrieved from the Norwegian Bioenergy Association (Nobio) (Norsk Bioenergiforening, 2017). Sales of small sacks are placed under household consumption, while sales of large sacks and bulk are distributed as consumption in public administration, education and human health, using distribution formulas from 2004. The distribution is based on estimates and surveys by Nobio. Consumption in the manufacturing sector is subtracted before the figures are distributed.

Other industries

For the remaining main industry classifications (SN, 2008), the same data sources and methods are used for consumption of energy products (with one small exception for LPG described below):
F Construction (41 – 43)
G Wholesale and retail trade; repair of motor vehicles and motorcycles (45 – 47)
I Accommodation and food service activities (55 – 56)
J Information and communication (58 – 63)
K Financial and insurance activities (64 – 66)
L Real estate activities (68)
M Professional, scientific and technical activities (69 – 75)
N Administrative and support service activities (77 – 82)
R Arts, entertainment and recreation (90 – 93)
S Other service activities (94 – 96)
T Activities of households as employers (97)
U Activities of extraterritorial organisations and bodies (99)

Statistics Norway has international reporting obligations that require it to break down energy use in accordance with the A64 industrial classification in NA (SN, 2014b). When necessary, additional information is collected or assumptions are made in order to distribute consumption according to this level of detail.

Electricity, district heating and natural gas

Electricity consumption is collected from the sales figures in the electricity statistics and consumption of district heating from the sales figures in the district heating statistics. In the district heating statistics, for example, sales to service industries are grouped in the annual form. Every 3–4 years, some of the largest producers are asked for a more detailed breakdown by industry. Consumption of natural gas is collected in a separate survey. Here as well it is a challenge to break down consumption in accordance with the detailed industrial classification in the NA. Assumptions are made about consumption when necessary. For example, sales of natural gas in the aggregate group 'Wholesale and retail trade; repair of motor vehicles and motorcycles (45 – 47)' are placed in their entirety under the underlying industry 'Retail trade, except of motor vehicles and motorcycles (47)' because there is not enough information for a more detailed breakdown.

Petroleum products

Consumption of petroleum products in these sectors is retrieved from the statistics on sales of petroleum products. For some of the energy products, the majority of sales are via distributors and not directly to the consumer. Motor gasoline and road diesel are such examples, and distribution formulas are calculated for the sales of these energy products using the fuel costs for transport from Statistics Norway's structural statistics for the industries and from the central government's fiscal account and the municipal account. The method is described and a sample calculation is given in the section *Structural figures, adjusted with direct sales, as a distribution formula* in Chapter 5. There are no structural figures for main industries K, R, S, T and U yet, so consumption in these industries only include direct sales. For stationary petroleum products like light heating oil and heating kerosene, more sales are made directly to users than via distributors. The distribution of the direct sales will then be used as distribution formulas, with the assumption that the direct sales have the same industrial classification as the

distributor sales. The method is described and a sample calculation is given in the section *Direct sales as a distribution formula* in Chapter 5.

LPG

From 2005 and onwards, total consumption is given by the annual sales statistics for petroleum products and distributed using the shares of direct sales in 2009-2012, as for agriculture. It is assumed that LPG consumption in the transport industries, as well as sale and maintenance of vehicles, support activities for transportation and rental and leasing activities is used for transport. For the years prior to 2005 the source of LPG consumption is statistics on the construction industry (SN, 2001).

Households

Electricity, district heating, natural gas, biogas

Consumption of electricity and district heating is retrieved from Statistics Norway's annual data collections from distributors of these energy products (SN, 2018f; SN 2018g). Consumption of natural gas and biogas is also collected through separate annual form-based surveys of distributors.

Solid biofuels

Data on fuelwood, pellets and charcoal is available for solid biofuels. Fuelwood consumption is collected as part of Statistics Norway's travel survey. Figures for annual consumption are calculated on the basis of three to five quarterly surveys. Over 1 000 people are interviewed by telephone every quarter, and the response rate is about 60 per cent. If an interviewee has answered that fuelwood is used to heat the home, but not stated the consumption, the consumption is calculated. The fuelwood consumption is calculated based on average values among all respondents. The theoretical energy content is calculated by multiplying fuelwood consumption with a factor for energy content. For the years prior to 2004, consumption figures are retrieved from the survey of consumer expenditure or the survey on living conditions. Pellet consumption is retrieved from the sales statistics of the Norwegian Bioenergy Association (Nobio). Sales of pellets in «small sacks» are placed under households. In Norway, charcoal is mainly used in households for barbecuing, and the consumption figures are retrieved from Statistics Norway's external trade statistics. The external trade statistics allow the identification of businesses that import. At present, charcoal is not produced in Norway. Import tolls therefore provide a good estimate of consumption. The volumes of imported charcoal for grocery trade, garden centres, retail sale of furniture and other shops that sell items for the home are placed under household consumption.

Light heating oil and heating kerosene

Consumption of light heating oil and heating kerosene in households is calculated using consumption figures collected as part of Statistics Norway's survey of consumer expenditure (FBU) (SN, 2013). This survey was conducted for the years 1993, 1994, 1995, 2001, 2004, 2006, 2009 and 2012, and households were asked to report the volumes of oil and kerosene they had procured during the past 12 months. The intervening years are calculated using changes in sales of light heating oil and heating oil from the statistics on sales of petroleum products, adjusted for consumption in manufacturing and mining (SN, 2018d; SN 2018e). This is because consumption in manufacturing and mining is less dependent on temperatures than household consumption.

Stock effect

How much has been acquired during the course of a year, however, is not necessarily the same as how much has been used in a year. The same challenge is also found in the statistics on the sale of petroleum products, which give the totals of consumption in EA/EB. Since these two data sources are combined in EA/EB, it is beneficial if their delineation of what is included in the figures is the same. It is therefore assumed that this stock effect levels out over time.

Oil is a composite item in EA/EB, made up of various types of heating oils. A small proportion will be heavy gas oil and fuel oil, but most are lighter heating oils.

It is therefore assumed that all are light heating oils. This simplified assumption is supported by the fact that, with the exception of one year, there has been no direct sale of heavy gas oil and fuel oil to private individuals, housing cooperatives or co-ownerships. There may also be some bio-heating oil included in this item (e.g. oil heaters can easily be converted for bio-oil use), but it is not possible to filter out this information, and for now it is assumed that the volumes are very small.

Road diesel and motor gasoline

There is a lack of data sources covering consumption of road diesel and motor gasoline for road transport by households; consumption therefore has to be estimated. The lack of information is due to the fact that fuel is mainly purchased from petrol stations, where the identity of the buyer is unknown. In order to estimate the consumption, information about the number of gasoline and diesel vehicles is retrieved from Statistics Norway's Vehicle Registry[3] (SN, 2018o). Households' share of these vehicles is calculated using identifiers from the register and assumptions about the user. Vehicles registered with an organisation number and which – according to the type of driving – are used for work purposes are classified under commercial use. Vans class 2 and heavy vehicles, such as buses and lorries, are also included in commercial use. The remainder of the vehicles are placed under households. The Vehicle Registry includes the identifier 'work/commercial'. The vehicles registered as private according to this classification are placed under households, and those that are not encoded as private are classified as commercial use. The households' share of the number of vehicles grouped by type of vehicle is then linked to calculations from the roads emission model. Here fuel consumption on roads is calculated for various vehicles (Holmengen & Fedoryshyn, 2015), thus linking information from the Vehicle Registry and the roads emission model enables us to calculate household consumption of motor gasoline and road diesel. The calculations include adjustments to the sales figures for motor gasoline that is not used for road transport (e.g. used by pleasure crafts).

LPG

For the period 2002-2005 the LPG consumption in households is estimated by distributors. From 2005 and onwards, total consumption is given by the annual sales statistics for petroleum products and distributed using the shares of direct sales in 2009-2012, as for agriculture. The consumption is split in use for transport (in passenger cars) and stationary use by estimates from distributors. The estimated use in transport is currently constant for a larger part of the time series, as new estimates have not been attained for for a number of years.

Pleasure crafts

Statistics Norway has a separate model for calculating fuel used in pleasure crafts by households. Here, the consumption of motor gasoline and off-road diesel for boats is calculated for 2-stroke and 4-stroke engines. The number of boats and fuel consumption figures are calculated using a model developed by Civitas. The model is based on a boating survey (*Båtlivsundersøkelsen*) (Kongelig Norsk Båtforbund, 2012). The survey estimates the stock of boats for 2010. For 2011 and onwards, the stock is projected using annual sales figures from Norboat (Norboat, 2017) and an estimate of the number of boats scrapped per year from 2016 (Miljødirektoratet, 2016). The model was revised by the Norwegian Environment Agency in the beginning of 2018. A new boating survey was published in 2018. Plans are being made to implement the results in the model for pleasure crafts.

Consumption of other petroleum products not covered in this section is available in the statistics on the sale of petroleum products.

[3] Statistics Norway's Vehicle Registry is based on the Norwegian Public Roads Administration's Register of Motor Vehicles and vehicle refund data from the Directorate of Norwegian Customs.

Other consumption data

Biofuel

In order to be able to split fuel consumption into renewable and non-renewable for all industries, biofuel sales figures are collected from the main distributors.

3.4. Stock

Oil and gas extraction

Stock figures for primary oil and gas products in the extraction industries are retrieved from NPD as part of an annual agreement for the supply of data.

Oil refineries and terminals

Stocks at oil refineries and terminals are retrieved directly from the businesses as part of an annual data collection. These mainly relate to secondary petroleum products.

Splitting of gas oil/diesel oil and kerosene

Stock figures for gas oil/diesel oil are split between light heating oil, off-road diesel, road diesel and marine gas oil, using sales figures from the annual petroleum statistics (excluding import). There are separate stock figures for kerosene-type jet and heating kerosene, but because of high uncertainty in the figures, they are aggregated and split. It is assumed that the product distribution of sales figures reflect the product distribution of the quantities going in and out of stock, that is the stock *change*, not the stock itself. Thus, the stock change must be calculated before the figures are split. Then the stock figures are calculated for each of the energy products. These calculations are done in Excel.

Coal, coke oven coke and petroleum coke

EA/EB also includes stock figures for coal, coke oven coke and petroleum coke. These are retrieved as part of an annual form-based survey conducted with businesses using such energy products. These businesses are mainly located in the manufacturing and mining industries.

Calculation

Stock figures are used to calculate the changes in stock between two years. The method is described in the section entitled *Changes in stock* in Chapter 5.

4. Technical solution

Oracle database

The data included in the energy balance and energy account are stored and managed in an Oracle database. The data are transferred to the Oracle database in two different ways; they can either be entered manually via an application developed by Statistics Norway for editing and estimating (ISEE), or downloaded from flat files using Oracle Data Integrator (ODI). The flat files are created from SAS files or Excel files using SAS Enterprise Guide.

Oracle Data Integrator

SAS Enterprise Guide

ODI Console

ODI is used to select data that are subsequently processed, partly in ODI and partly in the ISEE application. The ODI procedures are run in ODI Console. Data are moved (and changed where necessary) between tables during a process known as ETL (extract transform load).

Metadata control

The process of selecting and processing data is controlled using metadata. This means there are separate metadata tables in the database where the classification variables that the volume data is marked with are used to define what data is to be processed and how it is to be processed (e.g. breakdown by industry).

Data storage

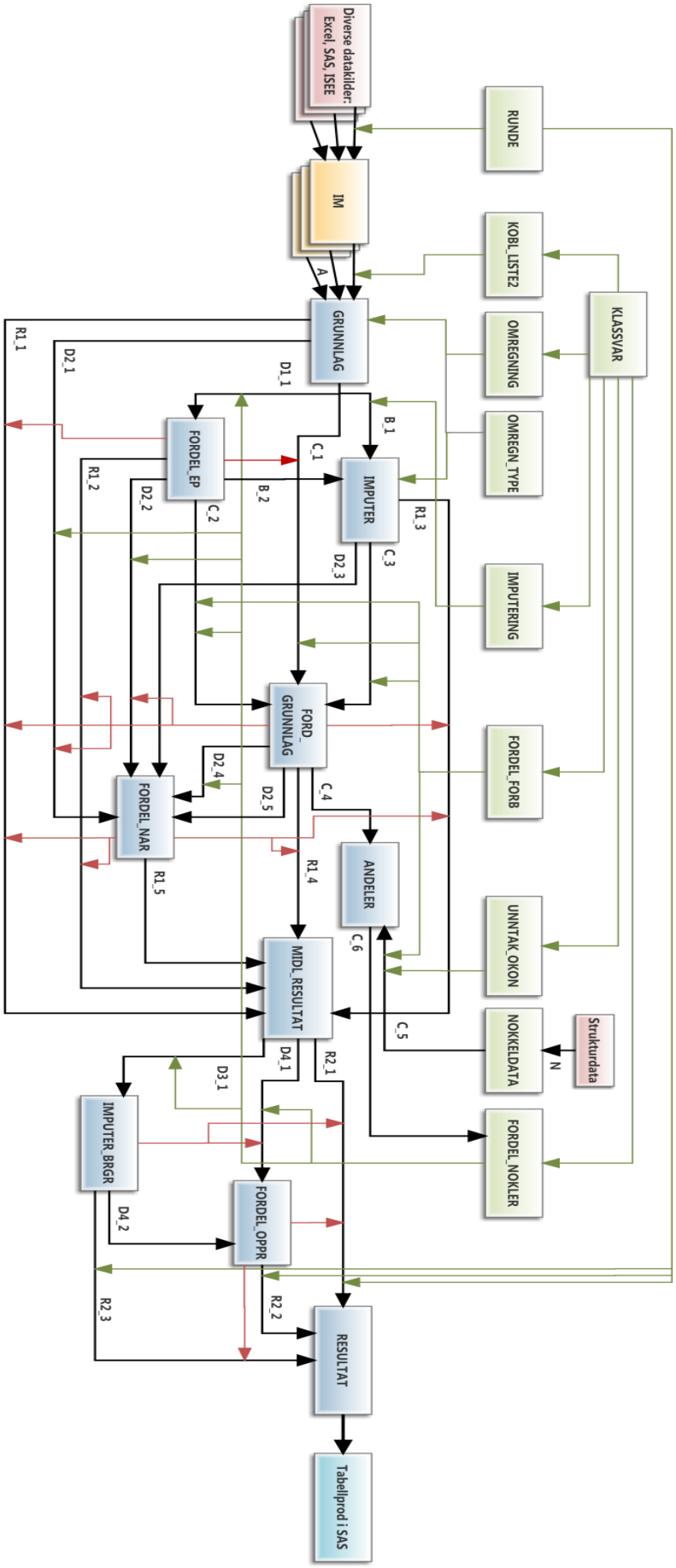
Once the data are harmonised, but before they are processed, all editing is saved. All editing of metadata is also saved. In addition, the versions of harmonised input data, metadata and results that form the basis for each publication of the energy account and energy balance are archived. SAS Enterprise Guide is used for archiving, and the figures are stored in flat files.

Deliverable tables

When data has been processed in Oracle, a master data set is retrieved from SAS. The tables for delivery are itemised using lists in Excel, where the classification variables are used to link the statistical data to cells in the tables. SAS Enterprise Guide is used to produce the tables in several different formats: SAS, Excel and text (flat file). In cases where the delivery constitutes a completed Excel matrix that is defined with coordinates, the data is entered directly from SAS to Excel.

In figure 4.1, green boxes represent tables with metadata, while red boxes show input data in its original format. Yellow boxes are input data in its original format loaded into ISEE. Blue boxes indicate tables with harmonised data. The different blue boxes represent data processing: imputation, calculation of distribution formulas and distribution. Black arrows show how data flows between tables. Green arrows indicate what metadata are used to select data to be moved between tables. Red arrows show how data movements are checked against each other to avoid duplication of data.

Figure 4.1 Technical solution for the EA/EB system



Source: Statistics Norway

5. Methods

5.1. Harmonisation

In EA/EB, the process in which data from different data sources and with different characteristics are made comparable is called harmonisation. Each data source must undergo individual processing in order for it to be combined with other data.

Harmonisation includes the following:

- Changing variable names
- Calculation of derived variables
- Special processing of certain data (e.g. changes to variable values)
- Linking to classification variables used in EA/EB
- Conversion to common units for volume and energy content (GJ)

Classification

The data entered in the EA/EB system are linked to a variety of classification variables. Classification makes it possible to identify groups of data that are to be treated in the same way (regardless of the data source).

The main classifications are as follows (in alphabetical order):

- Activity (production, consumption, loss, imports, exports, storage)
- Country (for imports/exports)
- County
- Data source
- Energy product
- Facility (type of facility where an energy product is produced or consumed, e.g. oil refineries and district heating plants)
- Industrial classification (based on the Standard Industrial Classification 2007 (SIC07))
- Measuring point (indicates at what point in the energy flow the data are measured, e.g. gross production, own production, distribution loss, sale, purchase, use)
- Method (reported or estimated data)
- Origin (indicates whether the energy product is renewable or non-renewable)
- Municipality of business
- Producer (producers of energy products where this production is the main activity and energy producers where other production is the main activity)
- Sector (standard for sector classifications; private, municipal and state sector)
- Technology (type of technology that is used in the production or consumption of an energy product, e.g. turbine, jet engine, wood-burning stove)
- Type of consumption (indicates whether a data source for consumption data takes precedence or is to be included in an aggregate for distribution)
- Unit of measurement
- User group (Norwegian and foreign businesses, purchase and use in Norway or abroad)

Conversion to common units

Original values for volume data are converted to volume figures in the standard unit for each energy product and to a common energy unit.

Types of conversions

The following types of conversions are used in the system:

- Unit of measurement

  - weight ↔ weight
  - volume ↔ volume
  - energy ↔ energy
- Density
  - weight ↔ volume
- Energy content
  - weight ↔ energy
  - volume ↔ energy

The conversion factors for density and energy content can vary from year to year, and can be business-specific. See Appendix A for an overview of conversion factors.

5.2. Imputation

Imputation is a statistical method of replacing missing data using existing data. The following areas lack data sources and must be imputed into the system in this order (after the calculation of *Changes in stock*):

1. Transformation consumption
2. Imports/exports/production

Transformation consumption

Transformation refers to energy products that are used as intermediate goods to produce secondary energy products. Production figures are available for some areas, but there is limited information about the type of energy products used in production. Transformation consumption therefore needs to be calculated for these areas. This applies to the following:

- Consumption for electricity production (excluding CHP facilities)
- Consumption for blast furnace gas production
- Consumption for fuel gas production

Efficiency, energy content, units of measurement

When imputing transformation consumption, factors for efficiency, energy content and conversion between units of measurement of the same unit type are used.

Production figures = transformation consumption x energy content x efficiency →
Transformation consumption = production figures / (efficiency x energy content)

In theory, the efficiency should be given for the combination of technology and energy product, but as this information is not available, the efficiency factors are specified for each energy product and can be specific to (in order of priority) a business or industry group, or they can be general.

Raw materials

For some of the imputations of transformation consumption, the imputed value must be deducted from a volume that is encoded as used as raw material. A parallel imputation is therefore used for the raw material consumption, where the result is negative (i.e. a subtraction).

Production, imports, exports, consumption

The following formula is used for imputing imports, exports and production (also distribution losses, where relevant):

$P1+P2+I1+I2=U1+U2+E1+E2+L1+L2+S1+S2$, where

P stands for production
I for import
U for use
E for export

L for distribution loss
S for changes in stock
1 represents a known factor (if some figures exist, e.g. for production)
2 represents an unknown factor.

Production is calculated as follows:
P2=U1+U2+E1+E2-I1-I2+L1+L2+S1+S2-P1

The import value is calculated as follows:
I2= U1+U2-P1-P2+E1+E2+L1+L2+S1+S2

The export value is calculated as follows:
E2=P1+P2+I1+I2-U1-U2-L1-L2-E1-S1-S2

The distribution loss is calculated as follows:
S2= U1+U2+E1+E2-I1-I2+L1+L2+S2 -P1-P2

An exception to the rule is made for the imputation of production of natural gas that are used or flared offshore or in gas terminals. This consumption and loss take place before the production and storage are measures. Thus only figures on use and flaring are included in the imputation.

5.3. Distribution of aggregated volumes

Distribution formulas

A set of distribution formulas is used to break down consumption data for which sufficiently detailed information is not available. These formulas give the relative distribution between different end values of the variable to be broken down. Some of the breakdowns will be simple divisions of aggregated figures (e.g. a total figure for agriculture and forestry industries is divided into separate figures for agriculture and forestry), while others will be the breakdown of a less specific aggregate such as sales from a distributor. When using a distribution formula for an aggregate, the aggregate is first calculated within the system. The calculation can include figures from several industry groups and subtractions of certain data.

Some distribution formulas are produced more or less manually (in SAS or Excel), but others are created by the system, based on consumption figures and data from structural statistics, KOSTRA, StatRes and the Norwegian tax administration.

The following classification variables can be used for distribution across the EA/EB system, i.e. before table production:

1. Energy product (simple split)
2. Industry (simple split or distribution of calculated aggregate)
3. Origin (simple split)

For some energy products, it may be appropriate to distribute consumption in more classification variables than those mentioned, e.g. the distribution of fuel consumption by technology or sector. This is done as part of the table production as necessary.

Formula distribution is always done per energy product, in the following stages:

1. Linking to the distribution formula from the relevant table (one-to-many link)
2. Calculating shares (which total 1 in most cases)
3. Multiplying the share by the volume

Distribution formulas are also used to impute figures for specific user groups (see the section *User group* in Chapter 5).

Energy product

The input data for some energy products are too aggregated, and must therefore be split. No matter how easy it may be to do this manually, it is done in the system using distribution formulas as far as possible, because this ensures documentation and consistency between input data and harmonised data.

Splitting energy products is relevant to the following areas, among others:

- Consumption of waste and biofuel
- Production figures for NGL and crude oil
- Production and stock figures for gas oil/diesel and kerosene

However, the splitting of stock figures must be done outside the system, see section *3.4 Stock*.

Value conversion

After the formula distribution of energy products, value variables are converted. These conversions correspond to the conversion carried out on the entire data set during harmonisation. This is necessary because the standard unit of measurement for the energy products to be broken down is not always the same as for those that emerge from the breakdown.

Industry

Formula distribution by industry is carried out in the following cases (and combinations thereof):

1. When consumption figures are reported with an industry classification that is not detailed enough
2. When sales to distributors are reported (i.e. with no information on the end user)
3. When data that sets the totals for consumption is to be combined with precedent data.

Calculating an aggregate for distribution

It is appropriate to calculate an aggregate to be distributed in the following cases:

1. The aggregate is a sum of consumption figures for several industries that cannot be used directly
2. One data source provides the totals for the consumption of an energy product (typically sales statistics that cover all sales) and this is to be combined with one or more data sources for consumption that take precedence.

Precedent data is data that remains unchanged as it goes through the system right up to the end result. If there is also a data source that sets a total for the consumption, a calculation must first be made of the differential between any direct sales (S) in this data source and precedent data (P). i.e. what sum the precedent data is to replace:

$D = S\text{-}P$

There are two possible outcomes:

a. If the direct sales are greater than the precedent data ($S > P$), the differential is greater than zero.
b. If the direct sales are smaller than the precedent data ($S < P$), the differential is less than zero.

The aggregate for distribution (A) is thus calculated as:

$$A = A_0 + D$$

A_0 is an aggregate in the data source that sets the totals for the consumption.

For some energy products, this aggregate (A_0) already exists in the form of distributor sales, while for others it does not. If there is no aggregate in the data source, this is set to 0 (expressed as A_0=0). Differentials greater than zero are added to the aggregate, differentials of less than zero are deducted. If the differential (D) is positive and greater than the original aggregate (A_0), the component for distribution (A) will be negative. This means that the precedent data must be covered by subtracting consumption from other industries. This deduction is distributed using distribution formulas.

Example: motor gasoline

- The data source that sets the total for consumption and includes direct sales (S) is the statistics on the sale of petroleum products
- There are several data sources for consumption that will take precedence (P): statistics on energy use in manufacturing, consumption figures in electricity power plants from the electricity statistics and estimated household motor gasoline consumption (see the section *Households* in Chapter 3).
- A_0 is sales from petrol stations and wholesale trade with fuel in the sales statistics
- Direct sales to households are added to A_0 because household consumption is calculated using other methods
- The calculated component (A) is distributed by industry (outside manufacturing industries) using distribution formulas based on reported fuel costs, adjusted for direct sales in the sales statistics.

Direct sales as a distribution formula

Linking to the VoF

Since 2010, sales of petroleum products have been distributed by industry based on the organisation number of the buyer. The sales data from the oil companies is linked to the industry code in VoF using the organisation number. The industry categorisation is then made according to the business's main activity. Sales to private individuals and housing cooperatives are classed as sales to households.

Formula for share of direct sales

Assuming that direct sales to consumers follow the same pattern as sales from distributors, the industry distribution in direct sales can be used as a formula for breaking down distributor sales. The distribution formula is calculated as the ratio between the sum of the sales in a given industry group divided by total sales for the relevant energy product.

Uncertainty

As with all calculations, there is a degree of uncertainty associated with the result of the formula distribution. The assumption that the industry distribution of direct sales to end users is representative of sales through distributors may be inaccurate. It may be that direct sales from the large oil companies and sales through distributors are supplementary to each other and thus allocated to different industries. However, Statistics Norway has no information on this, and this assumption is therefore chosen for petroleum products where distributor sales constitute a relatively smaller part of the total. Examples here are light heating oil and heavy gas oil, where 40 and 25 per cent respectively is sold by distributors.

Structural figures, adjusted with direct sales, as a distribution formula

Cost of purchasing fuel

The structural statistics include industry-specific information about the cost of purchasing fuel. These figures can be used to break down distributor sales by industry, whereby the volumes reflect the costs. Distribution formulas based on structural figures are made for two fuels: motor gasoline and road diesel. For motor gasoline and road diesel, about 95 and 90 per cent respectively is sold by petrol stations and other distributors. We cannot, therefore, solely use direct sales as a distribution formula.

The distribution formula is calculated in several steps, and the calculation contains the following elements:

1. The share of the energy product that is sold directly to consumers, calculated as the ratio of the total sale to a specific industry group divided by the total sale for the relevant energy product, including sales from distributors.
2. The share of fuel costs in a specific industry, calculated as the ratio of the total cost of fuel in a specific industry group divided by the total cost of fuel in the industries included in the formula.

Cost vs direct sales

If the share of fuel costs is greater than the share of direct sales, the share used as a distribution formula is calculated as the difference between the share of the cost and the share of direct sales. Otherwise, i.e. if the share of the cost is smaller, the volume is entered as equal to direct sales (share of distributor sales = 0).

Assumptions

The calculation is based on several assumptions:

- The cost per litre of fuel is roughly the same for all buyers.
- Costs of motor gasoline and road diesel are distributed according to the same pattern, with a few exceptions: in some industries, the fuel costs are not representative of the costs of motor gasoline/road diesel in these industries. This is explained by the fact that there is a high consumption of other fuels in these particular industries, such as *50 Water transport* and *51 Air transport* for motor gasoline/road diesel. These industries are not therefore included in the calculation of the distribution formulas.
- No extra consumption can be added for industries where the consumption is already greater than the cost, as this will only increase the differential between the distributions. The unspecified share of consumption must therefore be distributed among the industries where the consumption is less than the cost.
- Only SIC07 46.120, 46.710 and 47.300 are assumed to be distributors of solid, liquid and gaseous fuels. The remainder of the whole sale and retail trade industries are included in the distribution.

Uncertainty

All of these assumptions entail some degree of uncertainty. There is particular uncertainty concerning the overall cost of fuel being used to break down two different fuels. Furthermore, there are no structural figures for main industries K, R, S, T and U yet, so consumption in these industries only include direct sales. Nevertheless, Statistics Norway chooses to use this method as no other information is available and the quality of the result is considered to be adequate for the purpose of the figures.

Marine gas oil

The same method is used to break down distributor sales of marine gas oil by industry, but instead of fuel costs, monetary figures on refunds of and exemptions from the basic fee on mineral oil is used. Only industries where substantial amounts of marine gas oil are consumed are included: Fishing, extraction of crude petroleum and natural gas, domestic coastal transport and international sea transport. It is assumed that the distribution of refunds and exemptions from the fee is representative for the distribution of consumption of marine gas oil, even though all mineral oils are covered by the fee. The figures are not consistent and do not cover all the relevant industries until 2014. Thus, the figures for 2014 are used for the years 2010-2014.

Mathematical description

Sales from distributors should thus be distributed according to how the consumption that is not given by direct sales is distributed among the different industries. Mathematically, this can be formulated as follows: assume that the cost distribution to the K industries is $u_1, u_2, \ldots, u_K$. The corresponding consumption distribution is

$v_1, v_2, \dots, v_K, v_{K+1}$, where $K+1$ is the group for unspecified industry. The share with unspecified industry, v_{K+1}, will then be distributed to those industries where the costs are higher than the consumption. $R = \{i: u_i - v_i > 0\}$ for the volume of such industries. The total consumption that is missing is thus $\sum_{i \in R}(u_i - v_i)$.

The industry breakdown $(u_i - v_i)/\sum_{i \in R}(u_i - v_i)$ for the missing consumption becomes the distribution formula for the unspecified share v_{K+1}. The updated consumption distribution will thus be as follows:

$$v_i^{'} = \begin{cases} v_i + v_{K+1}\dfrac{u_i - v_i}{\sum_{i \in R}(u_i - v_i)} & i \in R \\ v_i & i \notin R \end{cases}$$

It will always be the case that $\sum_{i \in R}(u_i - v_i) \geq v_{K+1}$, which leads to $v_i^{'} \leq u_i$. If $u_i - v_i > 0$ for all groups, i.e. $R = \{1,2, \dots, K\}$, then $\sum_{i \in R}(u_i - v_i) = v_{K+1}$ and $v_i^{'} = u_i$. Thus, the method distributes the unspecified share in such a way that the cost and consumption distributions are identical.

Example:
Assume that the cost distribution is $u_1 = 20$, $u_2 = 50$ and $u_3 = 30$ per cent. The corresponding consumption distribution is $v_1 = 15$, $v_2 = 25$, $v_3 = 40$ and $v_4 = 20$ per cent, where group 4 is unspecified industry. Then $R = \{1,2\}$ and the volume missing is $(20 - 15) + (50 - 25) = 30$. The distribution formula is thus $(20 - 15)/30 = 1/6$ for the first industry and $(50 - 25)/30 = 5/6$ for the second industry. In other words, $20 \times 1/6 = 3.3$ is given for the first industry and $20 \times 5/6 = 16.7$ for the second. The distribution is thus $v_1^{'} = 18{,}3$, $v_2^{'} = 41{,}7$ and $v_3^{'} = 40$ per cent.

Time series for petroleum products
For the years prior to 2010, there are not economic figures that can be used to make distribution formulas in a consistent way. To achieve the level of detail in the industry distribution required in EA and EB, the industrial distribution in 2010-2012 is used in the same way as the economic figures. In other words, the industrial distribution in 2010-2012, adjusted by direct sales in the sales statistics, is used as a distribution formula for 1995 to 2009. For the period 1990-1994 information on direct sales is inadequate. Thus, the industrial distribution calculated in 1995-1997 is used as a distribution formula instead.

Other classifications

User group
Distribution formulas can be used to:

- Change a user group
- Split user groups
- Calculate consumption for a specific user group

Impute imports of imputed consumption (in order to prevent in imbalance in supply and consumption)

Changing a user group

A user group can be changed if an element of the user group is unknown and a general assumption is called for, e.g. by assuming that an energy product that is known to be purchased in Norway is also used in Norway (from NXN to NNN).

Splitting user groups

Consumption for a specific user group can be split if an element of the user group is unknown and there is a need to divide consumption into two user groups, e.g. consumption of motor gasoline and road diesel purchased in Norway, but with an unknown user nationality, is divided between used in Norway and abroad: NXN → NNN + UNN.

Origin

Renewable and non-renewable origin

Some data not divided by origin, into renewable/non-renewable. These data will either be encoded as mixed or unspecified. However, there is a requirement for such a breakdown in many of the deliveries, including the Eurostat reporting, which means that they must be split into renewable and non-renewable.

Waste is normally a mixed product that consists of a renewable and a non-renewable part. Statistics Norway is required to report this division of waste in the *Physical energy flow accounts* (PEFA) (Eurostat, 2014a). This breakdown is also important for the calculation of Norway's share of renewables. This division is therefore made in the system so that the data is the same for all users. The shares used to split waste is taken from a report on renewable waste at Norwegian waste incineration plants (AvfallNorge, 2010).

For motor gasoline and road diesel, the renewable share is calculated using total sales of motor gasoline and road diesel and total sales of bioethanol and biodiesel.

Adjusting for different density and energy content

When splitting data by origin, there may be differences in density and energy content in the resulting fractions. The calculation is adjusted these differences.

5.4. Other calculations

Changes in stock

Changes in stock is the calculated difference between two measuring points. Changes in stock (*lagere*) are calculated per energy product with volumes of stock (*lagerf*). The following formula is used for the imputation of changes in stock:

lagere (T-1) = lagerf (T-2) - lagerf (T-1)

Changes in stock:

positive number = reduction in stock = increased supply
negative number = increase in stock = reduced supply

Purchased abroad and imported

International ocean transport and aviation

Information is available for some energy products in relation to total purchases (in Norway + abroad) and purchases in Norway. In these cases, purchases abroad are calculated as the difference between the two figures. This calculation is made for the ocean transport industry. As with the imputation of purchases abroad, an import figure that corresponds to the volume purchased abroad is also imputed.

6. Balancing

When all of the data sources have been conflated and harmonised, the work begins on examining the balances of the different energy products. Control files based on the energy balance (EB), energy commodity balance (ECB) and energy account (EA) sheets are used to check the balances. The goal here is for the supply to be equal to the use.

Energy balance

Balance sheet for EB:
Production of primary energy products
+ Imports
− Exports
− International bunkers
+ Changes in stock
+ Transformation (production of secondary energy products minus transformation consumption)
− Energy industries' own use
− Losses
− Net domestic consumption incl. raw materials
= Statistical difference

Energy commodity balance

Balance sheet for ECB:
Production of primary energy products
+ Production of secondary energy products
+ Imports
− Exports
− International bunkers
+ Changes in stock
− Transformation input (energy converted)
− Energy industries' own use
− Losses
− Net domestic consumption incl. raw materials
= Statistical difference

Energy account

Balance sheet for EA:
Production + Imports = Consumption + Exports + Changes in stock

In EA, the production is the sum of the production of secondary and primary energy products for sale or own consumption (i.e. production excluding losses). Consumption is the sum of all types of consumption of energy products. No distinction is made between use for transformation, energy industries' own consumption, energy products used as fuel or raw materials.

Statistical difference

Differences between supply and use lead to statistical differences. A statistical difference means that there are errors or omissions in the source data, or in the production system.

A statistical difference may be caused by:

- errors in the source data (e.g. errors in reported data or errors in data suppliers' registries)
- omissions in the source data
- double counting in or between data sources (e.g. overlapping consumption data)
- errors in the editing process
- incorrect assumptions being used in the calculations
- incorrect conversion factors being used

- data being incorrectly classified (e.g. data encoded as an energy product incorrectly)
- errors in the metadata for calculations in the production system (e.g. can lead to missing data or double counting)
- programming errors in SAS when downloading data or in the production of table files from EA/EB
- errors in table specifications for the table files

Balancing before conflation in EA/EB

For some of the energy products, balancing takes place in the input data and not in EA/EB. Statistical differences are usually caused by incorrect or missing input data, in which case is it advantageous to carry out the balancing before the EA/EB stage. The data source managers are best qualified in this field and are therefore best at identifying errors. Some of the input data is also derived from primary statistics that include final balanced figures.

Balancing in EA/EB

For other energy products, it is not until all the different data sources are conflated, harmonised and distributed in EA/EB that it is possible to check for statistical differences. If errors are identified in the data sources in the balancing of EA/EB, the data source manager is notified so that he/she can follow up the error on the input side.If the input data source is derived from primary statistics for which final figures have already been published (e.g. previous years' energy use in manufacturing), the correction is not made in the input data source. This is instead a correction that needs to be performed in EA/EB.

Statistical differences are an indicator of uncertainty in the statistics, and the EA/EB statistics constantly seek to reduce this. Our international reporting is gauged by the statistical differences. Here, statistical differences are often given as a percentage of the production or the domestic supply. This makes it easier to assess the extent of the deviations.

Goals for statistical difference

There are a number of goals in EA/EB in connection with statistical differences for the different energy products. Some have a lower level of acceptable statistical difference than others:

Electricity and district heating

In theory, there should be no statistical differences in electricity and district heating. Supply and use are retrieved from primary statistics in separate publications. Here the figures are controlled and balanced before they are loaded into EA/EB. When deviations still occur, it means that the overlap between the data sources that are combined has not been handled sufficiently.

Crude oil, NGL and natural gas

Production and export of crude oil, NGL and natural gas are checked against each other before the figures are loaded into EA/EB, and should, as far as possible, be balanced on the input side.

Products with imputed supply or use

Energy products with imputed supply or use in the production system due to data omissions should not have any statistical differences. This applies to:

- Waste: production is set as equal to the sum of consumption.
- Liquid biofuels: omissions in supply figures are set as equal to imports.
- Solid biofuels: omissions in supply figures are set as equal to production. Exceptions are charcoal where all supply stems from imports. A degree of statistical difference is acceptable for this product.
- Biogas: omissions in production figures are calculated from the consumption corrected for known production.
- Recycled steam and heat: production is set as equal to the sum of consumption.

Light heating oil, road diesel, off-road diesel and marine gas oil

For light heating oil, road diesel, off-road diesel and marine gas oil, and for heating and jet kerosene, the statistical difference must be assessed as a whole. This is due to the fact that input data for production, imports, exports and stock is collected together and split between the energy products in the production system using distribution formulas. See the sections *Secondary petroleum products* in Chapter 3 *Energy product* in Chapter 5 for more information.

For the remaining energy products, a degree of statistical difference is accepted.

7. Dissemination

7.1. Publishing of statistics

The energy balance (EB) and energy account (EA) are based on almost the same source data, but different principles and definitions are applied. Some deviations therefore arise in the figures. Consideration should thus be given to which arrangement is most relevant for the particular purpose, and care should be taken not to confuse the figures with each other. This chapter explains the differences between EB and EA, as well as the general publishing situation of both statistics.

Publishing in general

Timeliness and editing of time series

Publishing current figures is part of Statistics Norway's strategy to better meet the needs of users (SN, 2018p). Preliminary figures for *T-1* are published in May/June. Previously, a new version of *T-1* was published in the autumn, along with figures for *T-2*. However, the aim is to ensure that enough input data are available in spring, so that better figures for *T-1* and figures for *T-2* can be published then. Table 7.1 shows when the various data sources are ready and updated. If the data source is ready for use at the time of publication, it is included in the publication. As the data sources that are updated in autumn usually are relatively few and less important part of the total balance and account, the inclusion in the EA/EB can wait to the following spring.

Table 7.1 Data input for EA/EB publications

Data source	*T-1* spring	*T-1* autumn	*T-2* autumn
Biofuel, sale	x		
Biogas, supply and use	x		
Breakdown of sales figures for pellets and briquettes		x	
Production and consumption of fuel gas	x		
Production and use of landfill gas at waste plants		x	
Annual electricity statistics: consumption figures, production figures, transmission figures			x
Monthly electricity statistics: consumption figures, imports, exports	x		
Monthly electricity statistics: production figures, fuel consumption	x		
Energy utilisation of hazardous waste in waste and waste disposal activities		x	
Annual district heating statistics: district cooling	x		
Annual district heating statistics: district hearing	x		
Consumption in gas plants	x		
Consumption of certain energy products for households	x		
Consumption of various types of waste in manufacturing	x		
Energy use in manufacturing[4]	x		x
Consumption of certain energy products in agriculture	x		
Supplementary data for manufacturing (coal, coal products, blast furnace gas etc.)	x		
Production of coal	x		
Stock in oil and extraction	x		
Stock in refineries and terminals	x		
LPG consumption	x		
Consumption of kerosene-type jet fuel and aviation gasoline in aviation	x		
Domestic sales of natural gas	x		
Consumption of fuel by pleasure crafts	x		
Sale of petroleum products, annual	x		
Production, flaring and fuel from refinery gas and petroleum coke gas in oil refineries	x		
Production and consumption in refineries	x		
Consumption in ocean transport		x	
External trade statistics	x		
Consumption in oil and gas extraction	x		
Production in oil and gas extraction	x		
Fuelwood consumption in households	x		

Source: Statistics Norway

Audit of time series

[4] The statistics on energy use in manufacturing include an annual publication with figures for *T-1* and *T-2*. The figures for *T-1* are preliminary and the *T-2* publication is final.

EA and EB are statistics that require comparability over time. This is partly due to the requirement for annual audits of the emission statistics, and the international requirement for cohesion between EA/EB and the emission statistics. Where new information is received for previous years (e.g. new data sources, methods, conversion factors), this is entered in the production system and revised time series are published. This means that the figures are not final in the publication even if they are referred to as final on the statistics' web pages. The most recent version of the figures for a period will always be available in Statbank.

Statbank

Time series and more detailed figures are found in Statbank. Statbank always contains the most recent version of data for a period.

Level of detail in Statbank

The level of detail in Statbank is determined according to what gives the most information to the users, whilst also taking confidentiality into account. This is in line with Statistics Norway's strategy to meet the needs of users. This allows users to more easily extract the information they need from Statbank themselves instead of having to order figures from Statistics Norway.

Discontinued time series

Statbank tables that are no longer updated are available in the 'Discontinued time series'. Statbank tables are normally discontinued due to a break in the time series. For example, there may be changes in classifications, code lists, data sources or methods.

Confidentiality

Publishing rules

Confidentiality means that SN must not publish statistics in such a way that information can be traced back to individuals or other types of statistical units, causing harm to them. If it is considered that publication is not to the detriment of the statistical units and that the needs of society or historical precedent is considered more important, exceptions can be made. Exceptions are considered by Statistics Norway's Confidentiality Committee. The confidentiality requirement is statutory through the Statistics Act (§ 2-6). Compliance with this requirement is crucial for SNs trustworthiness and for us to be able to perform our task as a provider of official statistics.

Exceptions for data with a low sensitivity level

In order for EA/EB to provide the most complete information, this type of permission is obtained from some businesses. For example, permission has been obtained to publish figures for the two oil refineries in Norway. Several source statistics included in EA/EB and international reporting have also been discussed by Statistics Norway's Confidentiality Committee. This applies to annual statistics for electricity, district heating, domestic use of natural gas and biofuels. These data are considered to have a low sensitivity level and exceptions to the rule as mentioned above are granted in order to provide complete statistics.

Detailed reporting

Furthermore, in 2013, the Confidentiality Committee agreed to retain the level of detail in annual joint reporting to the IEA and Eurostat, which is also considered to be publishable by Statistics Norway. This reporting is detailed, and therefore carries a risk of identifying individual businesses. This is also considered to be publishable in other contexts, for example in combination with energy balance tables in connection with reporting greenhouse gas emissions.

About the statistics

The statistics pages include a separate page containing basic information about the statistics and the overarching statistics production. 'About the statistics' is updated following changes to concepts or to how the statistics are produced. More detailed information on the statistics production and methods is given in this document.

Classifications and code lists

KLASS is the common system for managing classifications and code lists in Statistics Norway (SN, 2008;). KLASS contains standard classifications and variations of classifications known as code lists. The following standard KLASS classifications are used for EA/EB:

- Standard classification of energy products (SN, 20181)
- Standard classification of energy balance posts (SSB, 2018r)
- Standard classification of energy commodity balance posts (SSB, 2018s)
- Standard classification of energy account (SSB, 2018t)

In EA, a variant of the standard industrial classification is also used:

- Variant of SIC – Environment accounts (SSB, 2018u)

Cohesion with codes in Statbank tables

The standards for EA/EB in KLASS contain descriptions and definitions. In Statbank, variants of the classifications are used. In order to enable users to see what is included at an aggregated level (e.g. energy products) the codes used are based on the KLASS classifications.

Energy balance and energy commodity balance

General

Norwegian geographic territory

The energy balance (EB) shows total supply, transformation and consumption for all energy products in Norwegian geographic territory during a reference year. EB is considered to be the best way of presenting the flow of energy from production, transformation, energy industries' own use to final consumption. In EB, all energy products are presented in a common unit of measurement (GWh and PJ) in order to show the link between the volume of energy used as input and the volume of energy produced during transformation in the energy producing sector.

Common unit of energy

Balance in physical units

The energy commodity balance (ECB) shows some energy products from production to end-use in a slightly different layout from the energy balance. Unlike in EB, the various energy products are presented in their physical units (e.g. natural gas in millions of Sm^3 or crude oil in kilotonnes).

International standards

EB and ECB follow the same internationally recommended standards and can therefore normally be compared with international statistics in the area.

Production

Placement of primary and secondary energy products

In ECB, all production of primary and secondary energy products is placed under item 1. In EB, production of primary energy products is placed under item 1, while production of secondary energy products is placed under transformation (item 7). This is to show the energy flow between different energy products during transformation in different types of facilities.

International bunkers

International ships and aircraft

Deliveries of energy products from Norwegian ports to external trade ships, regardless of the nationality of the ship, are known as bunkers in EB (item 4 in the energy balance). They are excluded from total domestic consumption of energy and are treated in roughly the same way as exports of energy. This also applies to energy used for external trade aircraft. In EA, ocean transport is a separate transport industry. EA also includes energy consumed by Norwegian ships when in international waters. Most of the fuel for ocean transport is bought and used outside Norway. The consumption in ocean transport is therefore significantly higher in EA than in EB. Energy products that foreign ships purchase directly in Norway are subtracted from EA, but are included in bunkers in EB. In the same way, EA includes Norwegian airlines' purchases abroad, but not foreign airlines' purchases in Norway, while the opposite is the case in EB.

Transformation

Transformation

ECB presents energy products used as transformation input converted to secondary energy products, including the consumption of crude oil in refineries. Volumes of secondary energy products resulting from this transformation are placed under production. This is presented in a slightly different way in EB. Here, production of secondary energy products is presented minus product input as «transformation». Product input is presented as negative figures, while secondary production is presented as positive figures.

Own use

EB makes a distinction between energy products used during the transformation process and the energy industries' own use (e.g. lighting and heating). No such distinction is made in EA; only the total consumption is presented.

Consumption

Distribution by purpose

Consumption in EB is distributed according to purpose. Consumption is distributed in line with what the energy product is used for and not according to the industry in which consumption takes place. Examples of this are the separate energy balance items for the energy producing sector and transport sector. In EA, consumption is distributed according to the Standard Industrial Classification (SN, 2008).

Own use in energy producing sector

Consumption in the energy producing sector that is not used to produce other energy products, such as lighting and heating, is placed under own consumption in the energy producing sector (item 8).

Transport purpose

In EB, item 12.2 *Transport* includes all use of energy products for transport purposes. Both fuel for private cars in households and mobile consumption in supply ships in oil and gas extraction are included. However, energy consumption for military vehicles and fishing and agriculture, which are considered to be for defence and primary industry purposes as opposed to transport purposes, are not included. This consumption is categorised in the relevant industry. EA includes consumption of all energy in the industry that has used it, regardless of whether the consumption is for transport, heating or process purposes (raw materials/reducing agents). This means that the transport oils – gasoline, kerosene-type jet fuel, road diesel, marine gas oil, heavy gas oil and fuel oil – are categorised in different ways. The same applies to natural gas used for transport purposes. One example is the use of fuel in private cars, which is placed under households in EA, but in the transport sector in EB.

Air transport

Item 12.2.3 *Domestic aviation* includes the purchase of kerosene-type jet fuel in Norway, regardless of the nationality of the aircraft. In EB, aviation is split into domestic and international aviation. International aviation is not counted as domestic consumption, but in the same way as ocean transport, is placed on the supply side. The consumption of kerosene-type jet fuel in the Armed Forces is not included in aviation, but is included under services/public administration.

Coastal transport

Item 12.2.4 *Domestic navigation* does not include energy consumption in international ocean transport. Deliveries of energy products from Norwegian ports to external trade ships, regardless of the nationality of the ship, are classed as bunkers in EB and placed under item 4.1.

Imports and exports

EB and EA use different delimitations for imports and exports. EB encompasses imports and exports of energy products entering or leaving Norwegian geographic territory. EA includes imports and exports of energy products purchased or sold by Norwegian entities to and from foreign entities, regardless of where in the world the transaction takes place.

Energy account

General

Norwegian economic territory

The energy account (EA) encompasses energy products produced and used in industries in the Norwegian business sector and in Norwegian households, regardless of where in the world this takes place. Norwegian consumption abroad is included, while foreign consumption in Norway is not. This is known as Norwegian economic territory and has the same delimitation as that used in NA. In practice, obtaining enough data to provide an accurate account can be a challenge, especially regarding transport. For production and stationary consumption, this delimitation is simpler. Businesses are considered to be part of Norwegian economic territory if they have continual economic activity in Norwegian geographical territory (for more than one year).

Standard industrial distribution

In EA, production and consumption are presented according to the Standard Industrial Classification (SN, 2008), while the energy balance shows energy consumption for different purposes according to the definitions and delimitations stipulated in the European Energy Statistics Regulation (European Energy Statistics Regulation, 2008). The manufacturing industries in EA and the manufacturing sector in EB are therefore not fully comparable. For example, energy production (e.g. coal extraction and oil refining) in manufacturing industries is moved from the manufacturing sector in EB into the energy producing sector. In EB, construction is also included in the manufacturing sector, while the consumption for this sector is placed in construction activity (SN07 41-43) in EA.

SEEA

PEFA

International guidelines for energy accounts are provided by the *System of Environmental-Economic Accounting* (SEEA) (FN, 2012). We adhered to these guidelines in the reorganisation of EA in 2017. From 2017, *Physical energy flow accounts* (PEFA) (Eurostat, 2018a) are also reported annually to Eurostat (Eurostat, 2014a). A separate manual describes what the reporting covers and the guidelines for conflating data (Eurostat, 2014a).

Production

Production minus distribution losses

Waste

This post includes the production of energy products minus all types of losses. This is production sold to other businesses and households, or used by the business itself. Production is generally limited to covering energy products that are associated with a positive monetary transaction between two economic units (FN, 2012, section 2.91). In the Norwegian energy account, there is one exception; waste is also included as an energy product. Examples of loss are flaring in the extraction of natural gas and losses during the distribution of district heating.

Unlike in EB, no distinction is made in EA between the production of primary and secondary energy products. The only breakdowns are for type of energy product and the industry where the production takes place.

Production in households

Production of energy products also takes place in households. Examples are production of fuelwood or production of electricity from solar panels. This is regarded as production activity and is therefore included under the relevant industry (Eurostat, 2014a, section 26).

Consumption

Breakdown by purpose

This post encompasses the sum of all types of consumption. Unlike in EB, no distinction is made in EA between different purposes (transformation, transport, raw materials and other end use). The only breakdowns are for type of energy product and the industry where the consumption takes place, or whether it relates to households. However, national adaptations are made to EA with a view to meeting user needs. Statbank table 11558: *Energy accounts. Production and consumption of*

energy products, by industry and household presents statistics on the total consumption of energy products and consumption solely for energy purposes (e.g. the use of natural gas as a raw material in the chemical industry and consumption of lubricants are excluded).

Household consumption includes energy products produced for households' own use. According to the EA delimitation, consumption abroad by Norwegian households and activities must be included, and consumption in Norway by foreign businesses and households must be excluded. As explained in the section *General* in *Energy account*, additional calculations are made for energy products used for transport.

Energy intensities

In addition to showing energy production and consumption according to economic activity in Norway, one of the objectives of EA is to enable these energy data to be combined with other relevant statistics in order to throw light on different developments. As part of the dissemination of EA, energy intensities are calculated for Norway as a whole and broken down by industry (SN, 2018b).

Decomposition analysis

As EA is prepared according to the same definitions and classifications as the emissions accounts, a range of decomposition analyses can also be compiled. These are analyses that identify the reasons for changes in energy consumption and emissions to air.

Imports and exports

Financial transaction between a Norwegian and a foreign entity

Imports and exports are registered when a financial transaction has taken place between a Norwegian and a foreign entity, regardless of where in the world it occurs. This differs from EB; in EB, imports and exports are recorded when the energy product enters or leaves a country.

Consumption of fuel in ocean transport purchased abroad

Although there are theoretical differences between EA and EB, the differences are small in practice. The same data source is used (see section 3.2). One difference that is important to note is that the consumption of fuel in international ocean transport purchased abroad is calculated. These volumes are placed under imports in EA, but are not included in EB (either as an import or as consumption).

7.2. Reporting

EA/EB provides the basis for reporting to several international statistical organisations. These fixed deliveries from EA/EB are automated in the production system in order to ensure the consistent and efficient delivery of figures.

PEFA

As from 2017, PEFA will be reported annually to Eurostat (Eurostat, 2018a). The reporting deadline is in September two years after the end of the year and includes detailed supply and use tables distributed by industry and energy product. The reporting follows the delimitations of the energy account and the figures are published on Eurostat's website.

IEA and Eurostat joint questionnaires

Reporting takes the form of annual joint reporting to the IEA and Eurostat (joint questionnaires). The reporting to Eurostat is pursuant to Regulation (EC) No 1099/2008 (Eurostat, 2014a). There are a total of five forms (reports) that collectively cover the entire energy balance, and include the supply and use of all energy products:

- Oil
- Gas
- Electricity and district heating
- Renewable energy and waste
- Coal and coal products

The reporting follows the delimitations in the energy balance, with preliminary reporting of aggregates in May for the year before (*T-1*) and further reporting with more details in October/November (deadline for submission to Eurostat is 30 November). Within the five forms, there is a detailed division of different energy products. The figures are published on Eurostat's and the IEA's websites. Eurostat publishes final tables for the European countries (Eurostat, 2018c), while time series and international assemblies can be retrieved from Eurostat's statistical bank (Eurostat, 2018b). The IEA website also presents energy statistics for the entire world (International Energy Agency, 2017), but this is a chargeable service.

Petroleum products

Renewable share/SHARES

Statistics Norway is commissioned by the Ministry of Petroleum and Energy to report the energy balance for various petroleum products for the preceding year to the IEA in December/January every year. Based on the five common forms from the IEA and Eurostat plus additional information, information on renewables (SHARES) is also reported to Eurostat based on Directive 2009/28/EF (Eurostat, 2018d). This is reported annually, and the development is followed in order to see if the individual targets for the renewable shares in 2020 that are set for the European countries by the EU and the common European targets for 2030 are likely to be met. Statistics Norway is also commissioned by the Ministry of Petroleum and Energy to report the energy balance for the preceding year to the IEA in October/November every year.

Set of indicators

There is a big demand internationally for data from EA/EB. In addition to serving national needs, it is therefore also important that the statistics are comparable with other countries' statistics. In order to achieve this, different indicators are used. Several international institutions, such as Eurostat, UNSD, OECD and the IEA, devise different sets of indicators in which energy data is included. The different sets of indicators are designed for different purposes, some of which only include energy data, while others include indicators where energy production and energy use are viewed in conjunction with other important variables, such as economic development and emissions to air. Some of the IEA's indicators are based on figures reported by Statistics Norway, while for several of the sets of indicators, data is normally retrieved directly from Statistics Norway's Statbank. The design of the Statbank tables is therefore crucial. Examples of some sets of indicators that include energy are the IEA's *Energy Efficiency Indicators* (IEA, 2014), Eurostat's *Energy Indicators* (Eurostat, 2014b) and the OECD's *Green Growth Indicator set* (OECD, 2017). Energy data is also included in various sets of indicators for sustainable development, including the national set of indicators for sustainable development (SN, 2016c), the European *Sustainable Development Indicators* (Eurostat, 2018e), and the UN's set of indicators for *Sustainable Development Goals* (FN, 2017). Eurostat also devises indicators for renewable energy production (Eurostat, 2018d).

7.3. Other deliveries

Statistics on emissions

EA/EB has fixed deliveries to internal users in Statistics Norway. The emission statistics are the most important user of consumption data from EA/EB. The emission statistics receive an automated table extraction from the EA/EB system, which serves as input for their calculations of emissions from the consumption of energy products. The production processes in EA/EB and the emission statistics are harmonised, and table extractions are provided for the emission statistics after the figures are locked before publication.

National accounts

The national accounts (NA) are also an important user in Statistics Norway. Final balanced and distributed physical volumes of energy products reduce the risk of statistical differences in the values of the energy products in NA. This is particularly important for the economic production figures in the oil and gas

extraction industries (SN07 06) and electricity, gas, steam and air conditioning supply. On the consumption side, energy statistics are used to break down the costs of the different energy products.

EA/EB also has other important external users. The statistics are used by public and private sector entities that deal with different types of energy issues, environmental issues, policy formulation and analyses. The establishment of a new EA/EB production system and the extensive review of data sources and methods have resulted in a universal system of energy statistics, which ensures consistency in data delivered to different users and for different purposes. In some areas, such as the national accounts and the emission accounts, special needs associated with energy data are incorporated into the EA/EB production system. This means that official statistics for EA/EB will be directly comparable with other official statistics where energy data is included, thereby increasing the overall quality of statistics and indicators where energy data is presented either directly or indirectly.

The production system also makes it possible to undertake ad hoc data compilations. Guidelines for assignment-financed activities are available on Statistics Norway's website (SN, 2018q).

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Appendix A: Conversion factors

The conversion factors have two functions in the production system:

1. Conversion to common units of measurement
2. Imputation of missing values for transformation consumption

Table A1 Units of measurement

From unit	To unit	Divisor	Factor
GJ	GWh	3600	0.000278
GJ	Toe	42	0.02388
GWh	Toe	0.01163	86
Nm^3 [1]	Sm^3 [2]	1.055	0.948

[1] Nm^3 (normal cubic metres) = 1 m^3 gas at 0 °C and 1 atmospheric pressure.
[2] Sm^3 (standard cubic metres) = 1 m^3 at 15 °C and 1 atmospheric pressure.
Source: Statistics Norway

Table A2 Density

Energy product	Density	Unit
Gasoline	0.74	kg/litres
Biodiesel	0.88	kg/litres
Bioethanol	0.791	kg/litres
Biogas, excl. landfill gas	0.678	kg/Nm3
Bio jet kerosene	0.88	kg/litres
Bitumen	1.10	kg/litres
Landfill gas	0.7168	kg/Nm3
Diesel, excl. bio	0.84	kg/litres
Ethane	1.24	kg/m3
Light heating oil	0.84	kg/litres
LPG, excl. ethane	0.53	kg/litres
Marine gas oil	0.84	kg/litres
Blast furnace gas	1.20	kg/Sm3
Natural gas[5]	0.85	kg/Sm3
NGL	0.53	kg/litres
Kerosene, excl. bio	0.81	kg/litres
Crude oil (incl. condensate)	0.85	kg/litres
Lubricants	0.90	kg/litres
Waste oil	0.98	kg/litres
Additives and oxygenates	0.74	kg/litres
Wood waste	0.40	tonnes/fm3
Heavy gas oil	0.88	kg/litres
Fuel oil	0.98	kg/litres
Fuelwood	0.50	tonnes/fm3

Source: Statistics Norway

[5] For the conversion of LNG (Liquified Natural Gas) in kilograms to Sm^3 this factor is used: 1 kg. LNG = 1,36 Sm^3.

Table A3 Energy content

Energy product	Energy content	Unit
Black liquor	[1]7.2-9.2	GJ/tonnes
Gasoline	43.9	GJ/tonnes
Biodiesel	36.8	GJ/tonnes
Bioethanol	26.8	GJ/tonnes
Biogas	50.4	GJ/tonnes
Bio jet kerosene	36.8	GJ/tonnes
Bitumen	40.2	GJ/tonnes
Fuel gas	50.0	GJ/tonnes
Briquettes	15.5	GJ/tonnes
Diesel, excl. bio	43.1	GJ/tonnes
Hazardous waste	[3]11.5-40.6	GJ/tonnes
Condensate	43.9	GJ/tonnes
Refuse-derived fuel (RDF)	[3]10.8-18.9	GJ/tonnes
Hydrogen	120.2	GJ/tonnes
Coke oven coke	28,5	GJ/tonnes
Coal, brown coal and coal coke	28.1	GJ/tonnes
Light heating oil	43.1	GJ/tonnes
LNG	[2]48.0-48.6	GJ/tonnes
LPG	46.1	GJ/tonnes
Marine gas oil	43.1	GJ/tonnes
Blast furnace gas	[3]6.1-10.0	GJ/kSm^3
Naphtha	43.9	GJ/tonnes
Natural gas, onshore exclusive gas terminals	[2]35.3-35.7	GJ/kSm^3
Natural gas, offshore and gas terminals	[3]29.4-68.6	GJ/kSm^3
NGL	46.1	GJ/tonnes
Kerosene	43.1	GJ/tonnes
Pellets	17.3	GJ/tonnes
Petroleum coke and petroleum products, excl. petroleum coke gas	35.0	GJ/tonnes
Petroleum coke gas	37.1	GJ/tonnes
Plastic waste	[3]23.9-37.7	GJ/tonnes
Refinery gas	48.6	GJ/tonnes
Refinery feedstocks	40.6	GJ/tonnes
Crude oil	42.3	GJ/tonnes
Lubricants	40.2	GJ/tonnes
Terminal condensate	46.1	GJ/tonnes
Additives and oxygenates	43.9	GJ/tonnes
Charcoal	29.5	GJ/tonnes
Heavy gas oil	43.1	GJ/tonnes
Fuel oil	40.6	GJ/tonnes
Fuelwood	16.8	GJ/tonnes
White spirit	40.2	GJ/tonnes
Other solid biofuels	[3]8.8-21.4	GJ/tonnes
Other liquid biofuels	37.0	GJ/tonnes
Waste, excl. hazardous waste	11.5	GJ/tonnes

[1] Business-specific factor
[2] Year-specific factor
[3] Year and business-specific factor
Source: Statistics Norway

The theoretical energy content can vary for the individual energy product. The values are therefore average values. The energy content is calculated as net theoretical energy content (net calorific value), which is the energy that is available for energy purposes, and excludes latent heat from water in the energy product that will evaporate upon combustion. For natural gas used offshore and in gas power plants that receive unfractionated gas directly from the field, the NCV value is calculated based on reported consumption and associated CO_2 emissions. The equation used is taken from the Norwegian Oil and Gas Association's guidelines for reporting to the Norwegian Environment Agency (Oljeindustriens Landsforening, 2012):

$$f_{CO2} \approx 0.0724 * NCV - 0.5771$$

Table A4 Efficiency

Energy product	Industry	Efficiency
Waste	All industries	0.9
Black liquor	Mining and manufacturing, production of electricity	0.69
Gasoline	All industries	0.2
Biogas	All industries	0.5
Fuel gas	Mining and manufacturing	0.95
Diesel	All industries	0.8
Electricity	All industries	1
Chemicals	Mining and manufacturing, production of electricity	1
Coal, brown coal, coal coke and coke oven coke	Other industries	0.6
Coal, brown coal, coal coke and coke oven coke	Mining and manufacturing, production of electricity	0.8
Light heating oil	All industries	0.8
LPG	All industries	0.95
Marine gas oil	All industries	0.8
Blast furnace gas	All industries	0.95
Natural gas		[1]0.36-0.95
NGL, condensate, terminal condensate	Mining and manufacturing	0.95
Kerosene	Other industries	0.75
Kerosene	Mining and manufacturing, production of electricity	0.8
Petroleum coke and petroleum coke products	Other industries	0.6
Petroleum coke and petroleum coke products	Mining and manufacturing, production of electricity	0.8
Refinery gas	All industries	0.95
Wood waste	Mining and manufacturing, production of electricity	0.9
Charcoal	Mining and manufacturing	0.8
Heavy gas oil	Other industries	0.7
Heavy gas oil	Mining and manufacturing, production of electricity	0.8
Fuel oil	Other industries	0.75
Fuel oil	Mining and manufacturing, production of electricity	0.9
Water, wind	Mining and manufacturing, production of electricity	1
Heat	Mining and manufacturing	1
Fuelwood	All industries	0.65

[1] Year and business-specific factor
Source: Statistics Norway

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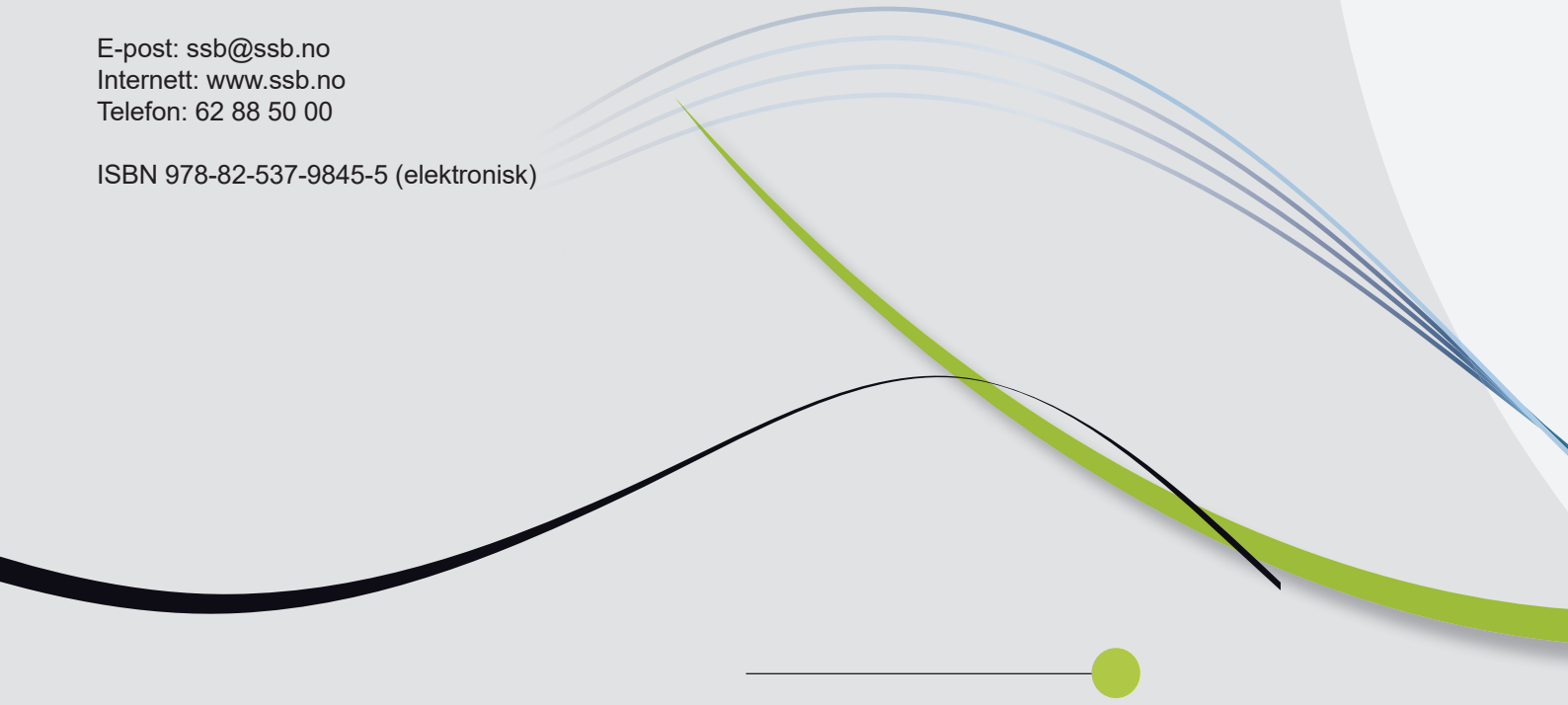

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