Appendix 4 - The Energy Balance for the Federal Republic of Germany

The basis for determination of energy-related emissions is the Energy Balance of the Federal Republic of Germany, which is prepared by the Working Group on Energy Balances (AG Energiebilanzen – AGEB) under commission to the Federal Ministry for Economic Affairs and Climate Action (BMWK). The most important data source for the Energy Balance is the Federal Statistical Office (Statistisches Bundesamt). The surveys of the Federal Statistical Office that were used are listed in Table 477: Zur Erstellung der Energiebilanzen für die Bundesrepublik Deutschland verwendeten Erhebungen des . Data on renewable energy sources are obtained by the Working Group on Renewable Energy Statistics (Arbeitsgruppe Erneuerbare Energien-Statistik (AGEE-Stat), working under the leadership of the German Environment Agency (UBA), and transferred directly to the Working Group on Energy Balances (AGEB), for purposes of the Energy Balances. The data involved include provisional data on renewable energy sources, which enter into the estimated Energy Balance and the evaluation tables. Additional data, supplementing those provided by the aformentioned data sources, are provided by associations of the German energy industry, and by German research institutes. The final Energy Balance includes data from the following associations: Nuclear Technology Germany (KernD); the Federal German association of lignite-producing companies and their affiliated organisations (DEBRIV); the Federal German association of the energy and water-resources industries (bdew); the Gesamtverband Steinkohle association of the German hard-coal-mining industry (GVSt); and the Fuels and Energy industry association (en2x). In the Federal Republic of Germany, energy statistics are published by numerous other agencies, and their statistics can differ in terms of their presentation, scope, methods and aggregation.

The complete Energy Balances for the years since 1990 are available on the Internet at:
http://www.ag-energiebilanzen.de/index.php?article_id=7&clang=0

The AGEB's website presents a foreword for the Energy Balances (AGEB, 2015) that describes the structure of the Energy Balance. The overall responsibility for preparation of Energy Balances lies with the AGEB.

In recent years, German experts on energy statistics have expended considerable efforts on the task of minimizing the differences between the provisional and final Energy Balances. In 2020, the Federal Statistical Office obtained the EU grant “improvement of timeliness of energy statistics” from EUROSTAT. In the framework of a dedicated project, this funding is expected to enable the Federal Statistical Office to provide data for year x-1, to the AGEB, as early as August of the relevant year. The pertinent project was launched in 2020, and it includes the statistical offices of the Länder, which are responsible for the concrete surveys involved. Key surveys for the preparation of the Energy Balance and the emissions inventories have been given temporal priority. As a result, the Federal Statistical Office, working on the basis of the data collected by the reference date, and using imputation procedures, was able – in July 2020 – to extrapolate a complete data set for the year 2019. In July 2021, the so-developed methods were used in routine operations for the first time. In October 2021, quality assurance for the methods was carried out by comparing the extrapolated results with the final 2020 survey data. In the 2022 survey year, the resulting methodological improvements made it possible to prepare a considerably improved provisional Energy Balance, now based, for the first time, on extrapolations – the 2021 provisional Energy Balance. The participating institutions coordinated their scheduling for the relevent data flow so carefully that a number of process steps were carried out in the shortest possible time, and the relevant data were made available for inventory preparation in reporting year 2023.

Structure of the Energy Balances

Via a matrix structure, each Energy Balance presents an overview of production, transformation and use of energy sources / fuels throughout a defined period. In the Energy Balance of the Federal Republic of Germany, energy flows are shown for a total of 30 energy sources / fuels (groups). The production balance shows • domestic production, • imports, • removals from stocks, • exports, • international marine bunkers, and • additions to stocks, of energy resources, and it summarises them under primary energy consumption. The primary Energy Balance provides the basis for calculations under the IPCC reference procedure (Plinke & Schonert, 2000). The usage balance provides a key basis for preparation of emissions inventories. The usage balance can also be used for determination of primary energy consumption. It comprises: • the transformation balance • flaring and line losses • non-energy-related consumption, and • final energy consumption.

Data on non-energy-related consumption, broken down by industrial sectors, are regularly provided to the Federal Environment Agency (UBA) in the framework of an additional table included with the Energy Balance for Germany.

Differences between the production and usage balances are compensated for in the position “Statistical differences”. The transformation balance, part of the usage balance, shows what energy resources are transformed into other, “secondary” resources. The transformation production shows the results of such transformation. Energy transformation can involve

conversions of substances – such as conversion of crude oil (conversion input) into petroleum products (conversion output) – or conversions of energy – such as combustion of hard coal (conversion input) – in power stations, for production of electrical energy (conversion output). The energy consumption in the transformation sector shows how much energy was needed for operation of transformation systems (the transformation sector's own consumption). The transformation balance is divided into a total of 12 different sectors.

Non-energy-related consumption, as a component of the consumption balance, is shown as a total, without allocation to industrial sectors. Data on non-energy-related consumption, broken down by industrial sectors, are regularly provided to the Federal Environment Agency (UBA) in the framework of an additional table included with the Energy Balance for Germany. It describes which energy resources are used as raw materials (e.g. in the chemicals industry, transformation of energy resources into plastics).

The description of final energy consumption (by energy sources / fuels) shows the potential scope of energy consumption in the final consumption sectors. (The energy that is ultimately required (for applications such as work, lighting, space heat and process heat) has to be differentiated from final energy consumption. It is not listed in the EB (AGEB, 2019).) The breakdown covers the areas of industry – sub-divided into 14 sectors – transport, households, commercial use, trade, services and other consumers (including agriculture). The energy flow in the Energy Balances is depicted for 30 energy sources / fuels. These energy resources can be allocated to the following main groups: • hard coal, • lignite, • petroleum (including LPG and refinery gas), • gases (coke-oven and blast furnace gas, natural gas and firedamp, and excluding landfill gas and the gases in the previous category), • renewable energies (including renewable waste and, as of 2013, sewage sludge),

electrical power and other energy sources / fuels (non-renewable waste, waste heat). Detailed information about the transformation balance, non-energy-related consumption, final energy consumption and the energy sources / fuels groups is provided in the NIR (2023). In this regard, we call attention to the brochure “Energie in Zahlen – Arbeit und Leistungen der AG Energiebilanzen” (“Energy in numbers – the work and services of the AG Energiebilanzen”) (AGEB, 2019), which presents further details and background information about the German Energy Balance.

Energy Balances for Germany as a whole are available for the years as of 1990 (AGEB, 2003) As of the year 2000, the energy-resource structure in the area of renewable energies / waste was changed: hydroelectric and windpower systems, and photovoltaic systems, were combined, and waste/biomass was divided into renewable and non-renewable fractions. Since 2003, non-renewable waste and waste heat are also listed under final-energy consumption within the Energy Balance.

In the Energy Balance, fuels / energy sources are listed in natural units, including tonnes (t) for solid and liquid fuels, cubic metres (m^3) for gases (except for natural gas), kilowatt hours (kWh) for electrical power and natural gas, and joules (J) for waste, renewable energy sources, nuclear power and district heating. In order to render the data comparable, and to allow them to be added up, all values are converted into joules (J), via suitable conversion factors. With respect to gases, the Energy Balance differs from gas statistics in that it views all gases in terms of their net calorific value Hi – and not of their gross calorific value, Hs.

To meet the need for emissions reporting to be as up to date as possible, the following procedure will be carried out on an annual basis as of 2022 for purposes of inventory preparation: at the end of August, the Working Group on Energy Balances (AGEB) will provide the German Environment Agency (UBA) with a complete provisional Energy Balance, based on extrapolated statistics of the Federal Statistical Office, for the year x-1. The AGEB will then deliver the final Energy Balance to UBA in the following February (at that point, the EB will be for the year x-2). Publication will then take place in about the following April.

Methodological issues: Energy-related activity rates

Essentially, the inventories for air pollutants and greenhouse gases prepared by the German Environment Agency are based on the Energy Balances for Germany prepared by the Working Group on Energy Balances (AGEB). The data required for emissions calculation can be read directly from Energy Balance lines 11, 12, 15, 16, 40, 60, 65 and 68. For natural gas and light heating oil, EB line 14 is also used in calculation.

In a few cases, the special requirements pertaining to emissions calculation, and the need to assure the completeness of data, necessitate a departure from the above-described system, and additional data have to be added: • The emissions-relevant fuel inputs for lignite drying have to be calculated out of EB line 10. A precise description of category 1.A.1.c is provided in Chapter 3.2.6.2. • Natural gas inputs in compressors, for the years 1995-2002, were taken directly from the Energy Balance (EB line 33). For the years 1990-1994, and for the period as of 2003, the values have to be calculated outside of the Energy Balance. The method is described in the NIR 2022’s Chapter for category 1.A.3.e. • For systematic reasons, and for reasons having to do with a focus on energy production, the Energy Balance does not list incinerated waste quantities completely for all relevant years. In this area as well, therefore, the lacking data have to be added from waste statistics. Relevant explanations are provided in Chapter for category 1.A.1.a and in the Chapter for category 1.A.2.g Other

(stationary). • Firewood use in the categories commercial and institutional is not listed in the Energy Balances through 2012; it has to be added. The method is described in Chapter for category 1.A.4.

In the Energy Balance, inputs of reducing agents, in pig-iron production, are listed in part as energy-related consumption, in EB line 54, and in part as transformation inputs, in EB line 17 (top-gas equivalent). Use, for energy production, of the blast-furnace gas produced in pig-iron production is listed in the relevant Energy Balance lines, 11, 12, 15, 33 and 54. To prevent double counting, the reducing-agent inputs from blast furnaces, as listed in EB line 54, and the relevant top-gas equivalent, are not reported.

Uncertainties, time-series consistency and quality assurance in the Energy Balance

While the Act on Energy Statistics (which entered into force in 2003) improved the relevant basic data foundations for the Energy Balance somewhat, the dynamic development of the energy sector soon necessitated an amendment of that Act. The currently valid amendment of the Act on Energy Statistics of 6 March 2017 (Federal Law Gazette (BGBl) I p. 392) introduces improvements in statistical coverage, updates the survey groups involved and adds a number of new aspects to be surveyed. In addition, the survey periodicity has changed – in part, in favour of monthly surveys. The first survey covered survey year 2018. The data structures of the Energy Balance are adjusted on an ongoing basis, in order to ensure that the best-possible data are provided. These changes are made at relatively large intervals and are documented by the Working Group on Energy Balances (AGEB) in each case: • Explanations relative to revision of the Energy Balances 2003 – 2006 • Remarks regarding changes in the Energy Balances 2003 through 2007 • Revision of the Energy Balances 2003 through 2009 • Methodological changes in the 2012 Energy Balance • Explanations relative to the Energy Balances (updated as of November 2015) In October 2021, the AGEB prepared a report, in compliance with its contract, on “Germany's Energy Balance – required revisions” (“Revisionsbedarf in der Energiebilanz Deutschland”). In all likelihood, the time series will be revised in 2023, as part of the implementation of the proposals made in that report. The AGEB has provided UBA with an overview of the required revisions.

Quality report of the Working Group on Energy Balances (AGEB) regarding preparation of Energy Balances for the Federal Republic of Germany

Since 2012, the Working Group on Energy Balances (AGEB) has regularly submitted joint quality reports, to the German Environment Agency (UBA), that document its quality-assurance measures in preparation of Energy Balances. As of 2020, in the framework of the contract for the Energy Balances, and in the interest of quality assurance, the Energy Balances are being prepared and provided in a time-series format. This facilitates detection of time-series jumps during compilation of the data. The following section presents the content of the current report, in its original wording (marked with a different typeface).

Background

In the framework of greenhouse-gas reporting, the National Co-ordinating Committee for the National System of Emissions Inventories has established minimum requirements pertaining to quality control and quality assurance (QC/QA). Those requirements are to be fulfilled on all levels of inventory preparation. One of the most important data sets for determination of greenhouse-gas emissions consists of the Energy Balances for the Federal Republic of Germany, which the Working Group on Energy Balances (AGEB) has been commissioned to prepare. The German Institute for Economic Research (DIW Berlin), the EEFA research institute (Münster) and the Centre for Solar Energy and Hydrogen Research Baden-Württemberg (ZSW; Stuttgart) support the AGEB in its work, as sub-contractors. In the current Energy Balance cycle, the German Institute for Economic Research is participating for the last time in preparation of an Energy Balance for Germany. All persons working on Energy Balances are required to comply with minimum requirements pertaining to QC/QA, in areas such as transparency, consistency, comparability, completeness and accuracy.

To document its data sources and quality-assurance measures in preparation of Energy Balances, the Working Group on Energy Balances (AGEB) herewith submits its current quality report to the Federal Environment Agency (UBA). It focuses especially on the 2021 Energy Balance.

Work-sharing in preparation of Energy Balances

The basic working method for preparation of Energy Balances has changed, partly for the reason that revisions of Balance data are pending. Now, the Energy Balances for Germany are now being centrally generated, via a database (which is stored

at the Centre for Solar Energy and Hydrogen Research Baden-Württemberg (ZSW). The basic responsibilities for the various energy sources / fuels (Energy Environment Forecast and Analysis (EEFA) institute: hard coal, lignite, coking gas, blast furnace gas, basic oxygen furnace gas and mine gas; ZSW: petroleum and petroleum products, natural gas, petroleum gas, and other fuels; office of the Working Group on Renewable Energy Statistics (Arbeitsgruppe Erneuerbare Energien-Statistik (AGEE-Stat): renewable energies) have not been affected by the change. Also, in connection with its Energy Balance work, the DIW Berlin has coordinated the quarterly estimates of primary energy consumption for the Federal Republic of Germany, and prepared estimates for the energy area “Other.” In this framework, the EEFA research institute is responsible for the fuel “hard coal.” Figures on renewable energies are calculated and published on the basis of the relevant data, in consultation with the office of the Working Group on Renewable Energy Statistics (GS AGEE-Stat).

In February of 2022, EEFA/ZSW prepared an “early-estimate” version of the 2021 Energy Balance (with data available as of 15 February 2022). The 2021 provisional Energy Balance was then submitted in May 2022. In September of the same year, a further 2021 provisional, “early-estimate” Energy Balance was prepared, along with the pertinent evaluation tables. That Balance included data and estimates of the Federal Statistical Office, including data and estimates on development of final energy consumption by industry. In the normal process, data from official Mineral Oil Statistics (AMS) of the Federal Office of Economics and Export Control (BAFA) are integrated within the petroleum section of the Energy Balance. Those data, covering the previous year, are usually in April. In February or spring of any given year, important official data sources, such as surveys relative to energy consumption of industrial sectors, are normally not yet available. Consequently, the pertinent data gaps have to be closed with the help of estimates. Understandably, an estimated Energy Balance (or an early-estimate version of the Balance) cannot fulfill the strict data-quality requirements met by the final Energy Balance, which is a work published with a time lag of about one year.

Quality of the data sources used

The following data of the Federal Statistical Office (StaBuA) are used in the preparation of the Energy Balances for the Federal Republic of Germany: • Annual survey (No. 060) of energy use by manufacturing, mining and quarrying companies, • Monthly survey (No. 061E) of coal imports, • Annual survey (No. 062) of heat and electricity generation from geothermal energy, • Annual survey (No. 063) of production of biofuels, • Annual survey (No. 064) of generation and use of heat and of heating-network operations, • Monthly survey (No. 066K) of electricity and heat generation for the public supply, • Annual survey (No 067) of electricity and heat generation by manufacturing, mining and quarrying companies, • Monthly survey (No. 068) of the gas supply, • Annual survey (No. 070) of electricity feed-in, and electricity demand, as recorded by electricity grid operators, • Annual survey (No. 073) of production, use and supply of sewage gas, • Annual survey (No. 075) of supply of LP gas, • Annual survey (No. 082) of gas sales and income in the gas-supply sector, • Energiesteuerstatistik (energy taxation statistics), Fachserie 14, Reihe 9.3).

The data of the Federal Statistical Office (StaBuA) are subject to official quality requirements. The quality reports of the Federal Statistical Office are available on the Internet: https://www.destatis.de/DE/Methoden/Qualitaet/Qualitaetsberichte/Energie/einfuehrung.html , last checked on 6 February 2023. In addition, data from the Official Mineral Oil Statistics (AMS) of the Federal Office of Economics and Export Control (BAFA) are used: https://www.bafa.de/SharedDocs/Downloads/DE/Energie/Mineraloel/moel_amtliche_daten_2021_12.html, last checked on 6 February 2023.

The AMS, which are published monthly and annually, are a closed, consistent system covering all petroleum production and consumption in Germany. The statistical basis for the AMS consists of the Integrated Mineral Oil Report (Integrierte Mineralölbericht – IM), which is prepared monthly, on the basis of the Act on mineral oil data (Mineralöldatengesetz), with input from companies operating in Germany's petroleum market. The Federal Office of Economics and Export Control (BAFA) reports the pertinent production and consumption data, together with the relevant data of the Federal Statistical Office, to IEA and Eurostat, which publish internationally comparable energy balances. The calorific values for crude oil inputs, and the petroleum products, that are covered by these reports are cross-checked against the national Energy Balance. For the Energy Balance's section on petroleum, both AMS data and data of the Federal Statistical Office are used.

In addition to the available official data, association data are also used. Among the statistics provided by associations, the Statistik der Kohlenwirtschaft (coal-industry statistics; since 2020, available only for lignite) play a special role. The data used for the Energy Balance include the following: • Data on extraction, production of lignite products, producers' own consumption and sales (form 5), and information from production reports, • Data on domestic sales / use, broken down by Länder and consumer groups,

The coal-statistics data available in Germany have a semi-official status, and they are very precise and reliable. For more than 60 years, the Statistik der Kohlenwirtschaft coal-sector-statistics association has served as a liaison between coal-sector companies and official producers of statistics. Official coal statistics in this area are based on surveys carried out by the Statistik der Kohlenwirtschaft association. A large portion of the coal data is made publicly accessible on the website http://www.kohlenstatistik.de. The transparency this provides also attests to the reliability and accuracy of these data

sources. The Act on Energy Statistics (Energiestatistikgesetz) has no separate paragraph relative to surveys on the domestic coal sector; its refers instead explicitly to the functioning system of coal statistics.

A considerable portion of the data used for preparation of the overall natural-gas balance (Erdgasbilanz) comes from official statistics. In some areas, the data and information provided by official statistics have gaps that have to be closed. This is accomplished with the help of additional association data, as well as of model calculations. For natural gas, associated gas: • Data on flaring losses are obtained using the implied net calorific value given by the Federal association of the natural gas, oil and geothermal energy industry (BVEG, the former WEG oil and gas industry association). The 2019 Statistical Report (Statistischer Bericht 2019) (page 22) introduced a change in the breakdown of flaring losses into the categores of “routine,” “safety-relevant” and “non-routine.” • In early Balance years, data on natural gas consumption in the transport sector were derived by Zukunft Erdgas (formerly Erdgas mobil), from data provided by the German Association of Energy and Water Industries (BDEW). Energy tax statistics also yield data for this sector. • As a result of the change in the statistical report of the Federal association of the natural gas, oil and geothermal energy industry (BVEG), own consumption is now listed as process-related own consumption, i.e. including processing losses, measuring differences and flaring losses. For purposes of preparation of Energy Balances, the BVEG has provided actual-own-consumption figures for the years 2018 through 2020. The following additional sources are also used: • In the framework of monitoring under the CHP act (Kraft-Wärme-Kopplungsgesetz), the Öko-Institut e.V. Institute for Applied Ecology estimates inputs of natural gas, and light fuel oil, for electricity and heat generation in compact gas-/oil- fired CHP systems that are not covered by official statistics. Detailed information on how the various data sources are used in preparation of the Energy Balance is provided by the “cookbook” (“Kochbuch”; it contains source information for specific entries in the Balance).

In addition to quality, the important aspects of the available data, relative to preparation of Energy Balances, include their multi-year availability and their standardised, consistent presentations of time series. Such aspects play a critically important role in ensuring that the procedures and methods used for preparation of Energy Balances generate data that can be consistently integrated, without structural discontinuities, in the basic scheme for the Balances. Both the relevant official sources and the coal statistics data have a long tradition. Where breaks in time series cannot be avoided, as a result of reviews or changes in statistical foundations (for example in the Act on Energy Statistics), such breaks are documented in the sources used for preparation of Energy Balances. This ensures that methods are always properly adjusted.

Transparency of methods and procedures

The Act on Energy Statistics (Energiestatistikgesetz – (EnStatG) entered into force on 1 January 2003. That act consolidates official energy statistics, from different legal frameworks, and adapts them to users' changed information requirements. Since the act's entry into force, the Federal Statistical Office has also collected and provided data for the areas heat market, combined heat / power generation (CHP) and renewable energy sources. As a result of the restructuring, the Federal Statistical Office, in addition to providing data on electricity and heat generation from combined heat / power generation (CHP), also provides data on all fuel inputs for CHP, for both the general public supply and industry (broken down by energy sources).

Such changes in the available statistics have made it necessary to adjust the methods used for the Energy Balances – especially for their descriptions of industrial final energy consumption. As a consequence of the described expansion in the data supply, separate data on fuel inputs as of 2003 for industrial electricity generation – i.e. for electricity-only generation – are now available.

The Federal Statistical Office does not collect data on breakdowns of fuel inputs by “electricity” and “heat” in industrial and public-supply combined heat / power generation (CHP) systems; such statistics are collected by the Working Group on Energy Balances (AGEB) and estimated by institutes it commissions. The “Finnish” method used for such purposes is based on Directive 2004/8/EC of the European Parliament and of the Council of 11 February 2004. That method is precisely defined, mathematically, and it is explained in the forewords to the Energy Balances. Currently, it is also explained in the brochure “Energie in Zahlen – Arbeit und Leistungen der AG Energiebilanzen” (“Energy in figures – the work and services of the Working Group on Energy Balances”), p. 10, 11 f.

With regard to quality assurance, the Finnish method makes calculations relative to power/heat production for the public supply and for industry logical and transparent. The necessary pertinent assumptions, such as the reference efficiencies of non-CHP generation as provided in the documentation for the Energy Balances, are stated in the process. In sum, although Energy Balance preparation is a process that makes use of frequently complex transformational methods, its results can still be highly transparent and unambiguous. As a result, all Energy Balance entry fields can always be traced back to their primary statistical foundations. Primary data provided by official or association sources – regardless of its quality – can seldom simply be “plugged into” the Energy Balance without undergoing the statistical processing normally used to prepare the Energy Balances. Description of relevant complex energy flows, using matrices that conform to the formal parameters and methodological specifications for the Energy Balances, and on the basis of statistical raw data, requires numerous transformation steps, recalculations and reallocations. What is more, in some (few) areas of the Energy Balance primary

statistics are no longer available, and thus data gaps have to be closed through use of formal estimation methods, applied in accordance with the requirements of each relevant individual case.

Checking and verification of results

Measures for quality assurance and control cover the following areas: • Assurance of data quality / transparency of methods and procedures, • Mechanisms for checking and critically reviewing the Energy Balances, measures that assure the Balances' correctness, completeness and consistency, • Measures for documentation and archiving, designed to ensure the Balances' clarity and reproducibility, • Expert responsibility for preparation of Energy Balances.

Critical discussion, verification and checking of results take place on various levels: • The involved experts mutually check their work and review it, on the basis of control figures (such as changes emerging year-to-year comparisons, implied calorific values, utilisation levels), for plausibility.

• The time-series consistency is regularly verified. Where a time series shows implausible jumps that cannot be attributed to transfer or calculation errors, and that must be tied to developments in the underlying primary statistics, the problem is discussed constructively with the relevant data-supplying institution (such as the Federal Statistical Office). In preparation of the 2018 Energy Balance, for example, it was seen in the Statistik 064 statistics, with respect to the fuels natural gas, petroleum gas, and light fuel oil, that plants' case numbers had increased, while their fuel inputs had remained at about the same level. This was due to a change of perspective from companies to plants (cf. Table 1 in this regard). • The Energy Balances are cross-checked against the data provided to IEA/Eurostat. • In addition, the AGEB member associations carry out supporting checks. • Furthermore, at early stages data and results are exchanged and discussed with responsible experts of the Federal Environment Agency (UBA), also in consultation with AGEE-Stat. • Statistical questions pertaining to the Energy Balance are also discussed by the “Working Group on methods” (“Arbeitskreis Methodi”“ – AKM) sited within the Federal Ministry for Economic Affairs and Climate Action (BMWK).

Only when the completed Energy Balance has successfully passed through all controlling bodies is it published on the AGEB's website and are provisional Energy Balance data provided to the Federal Environment Agency for further processing within the system for the national greenhouse-gas inventory. With a view to effective prevention of errors in data calculation and estimation for the Energy Balances, the annual balances are prepared via standardised procedures. To that end, a broad range of instruments has been developed that automate proven estimation procedures, and formal calculation methods, within the context of Energy Balance preparation. This approach, which often permits simple entry of statistical raw data into the suitable calculation tools, largely eliminates calculation and transformation errors. What is more, its use of consistent, standardised methods plays an important role in assuring time-series consistency.

Documentation and archiving

The EEFA research institute, the Centre for Solar Energy and Hydrogen Research Baden-Württemberg (ZSW) and the German Institute for Economic Research (DIW Berlin) keep detailed, written documentation relative to the annual Energy Balances. The documentation covers every Energy Balance entry, lists the statistical sources and surveys used and precisely describes the calculation methods and procedures used. The purpose of the documentation is to ensure that all steps can be retraced, both by the organisations themselves and by the Federal Ministry for Economic Affairs and Climate Action (BMWK) and the German Environment Agency (UBA). Furthermore, regular updating of the documentation contributes to data quality and helps to assure consistency in time series and methods.

All statistical data, calculation methods and estimation procedures used in preparation of Energy Balances for the Federal Republic of Germany are archived. The electronic data are stored on servers of the ZSW (AGEB database). For archiving of electronic content, the EEFA institute uses a range of computers and removable disk drives, as well as network-base server and cloud-computing solutions. Data back-ups are carried out both automatically and manually (at regular intervals).

Qualified staff

For execution of the service project “Preparation of Energy Balances for the Federal Republic of Germany” (“Erstellen von Energiebilanzen für die Bundesrepublik Deutschland”), the EEFA research institute, ZSW and DIW Berlin rely on experienced staff with solid backgrounds in the areas of statistics, economics and the energy sector.

Explanations regarding the currentness and availability of data for preparation of Energy Balances

Official statistics Since 2022, and in the framework of national inventory preparation, every August the Federal Statistical Office has collected/calculated additional data that enter into the Energy Balance of the previous year (in 2022, therefore, into the 2021 Energy Balance) and the Joint Annual Questionnaire. As a result, official data now become available much earlier than was previously the case. The “cookbook” for the Energy Balance shows, on a specific-cell level, what statistics provided by the Federal Statistical Office, and by BAFA, etc., are used.

Association statistics In the final Energy Balance, gaps in the available official data are closed, at various points, with data provided by associations (see above). Also, thanks to the quarterly estimates that the Working Group on Energy Balances carries out in cooperation with energy industry associations, current data and forecasts are available, on an ongoing basis, relative to the development of primary energy consumption in Germany.

The BDEW provides important provisional data, dated as of May and August, that are also of relevance to final energy consumption as recorded in the estimate Balance. Every summer, that organisation publishes data under the heading “The German energy market – facts and figures on the gas, electricity and district-heating sectors” (“Energiemarkt Deutschland – Zahlen und Fakten zur Gas-, Strom- und Fernwärmeversorgung”). In addition, the estimated Energy Balance incorporates BDEW data on gross electricity generation, data of Statistik der Kohlenwirtschaft coal-industry statistics, and data of the Fuels&Energy industry association (Wirtschaftsverband Fuels&Energie – en2x, formerly Mineralölwirtschaftsverband e.V. Association of the German Petroleum Industry).

Ongoing early estimate of the German Energy Balance, beginning in February of the following year

The fact that the early estimate of the complete German Energy Balance for the previous year now becomes available as of 15 February of each year must be seen as a significant improvement, schedule-wise, in the availability of complete energy data. The early estimate of the Energy Balance is not based solely on the energy data that are available at the time it is produced; extensive portions of the early Balance (such as those covering final energy consumption) are also based on formal forecasting procedures (models). Details on the approach used in preparing the early estimate of the German Energy Balance are provided in the UBA study “Pilotprojekt zur Frühschätzung der Energiebilanz 2020 und Vergleich zu späteren definierten Datenständen” (“Pilot project on the early estimate of the 2020 Energy Balance, and comparison with later defined data inventories”) (UBA-Texte 18/23) (available on the internet at: https://www.umweltbundesamt.de/publikationen/pilotprojekt-zur-fruehschaetzung-der-energiebilanz).

The most-current early estimate of the Energy Balance for the 2022 reporting year will be provided to the Federal Ministry for Economic Affairs and Climate Action (BMWK) on 15 February 2023.

Other data

All renewable-energies-trends data that are used in Energy Balance preparation are obtained from calculations of the Working Group on Renewable Energy Statistics (Arbeitsgruppe Erneuerbare Energien-Statistik (AGEE-Stat). Figures for electricity generation and fuel inputs in small CHP systems fired with natural gas and HEL (< 1 MW) were calculated with data the BHKW (compact combined heat-and-power (CHP) generating systems) database of the Öko-Institut e.V. Institute for Applied Ecology. The same data are used for reporting in the IEA/Eurostat context. Data on use of petroleum coke in metallurgical coking plants are provided for the Federal balance by the relevant German Länder, on the basis of an agreement between the Working Group on Energy Balances (AGEB) and the Länder working group on Energy Balances (Länderarbeitskreis Energiebilanzen).