Recent Developments and Challenges in Energy Statistics in the Czech Republic

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Abstract

Energy statistics in the Czech Republic are responding to national and EU policy-makers' growing needs and requests for more detailed and more recent data, going beyond energy balances, as a way to support decision-making processes. While energy balances remain the most important and most used output of energy statistics, increasing emphasis in the field of energy statistics is now also being placed on energy efficiency indicators, physical energy flows and on the development of new common IT tools. This trend is being implemented within the existing European, international and national organizational set-up of institutions involved in energy statistics, in which various stakeholders at various levels have interconnected roles. This includes several institutions at the national level, and this, in turn, has necessitated increased communication and coordination between stakeholders. After presenting a synopsis of the current functioning of energy statistics, this article aims to provide an overview of the main recent developments and challenges in this field, including information about ongoing discussions regarding further developments and expected challenges in the near future, from both an international as well as domestic point of view.

Keywords

Energy statistics, energy balance, energy efficiency, Sankey diagrams, energy statistical surveys

JEL code

Q40, Q49

INTRODUCTION

Energy statistics in the Czech Republic, just as in the European Union, are changing to better respond to the growing needs of domestic and international users (including the EU and international organizations) for more detailed and more recent data. This has meant that energy statistics outputs have needed to expand beyond their traditional core (which has always been, and continues to be, the energy balance) to now include, for example, data on energy efficiency. At the same time, the format for presenting these outputs has also needed to evolve to go beyond the traditional table matrix and to now also reflect more modern data visualization approaches.

Notwithstanding these developments, the importance of maintaining a high quality of the traditional core output of energy statistics, i.e. the energy balance, remains unchanged. This is because the quality of energy statistics is also reflected in foreign trade statistics and national accounts, as this data is used for the construction of supply and use tables (see Sixta, 2013).

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In order to maintain this high quality, but also in order to jointly coordinate and implement new developments, maintaining and further developing cooperation between the main domestic and international institutions and organizations involved in energy statistics is of key importance.

The present article first provides a synopsis of the current situation and approaches to energy statistics at the international level, keeping in mind that the international approach is the main frame of reference for domestic approaches, including the approach taken in the Czech Republic. The information that is used, as well as relevant tools that employed in the process of collection and evaluation of energy statistics data, along with a description of the role of individual institutions is then described. Then, an overview of the most important recent challenges and developments in energy statistics is provided, as well as an overview of recent discussions regarding future developments in this field. Finally, this article concludes with a description of Czech domestic specificities, including organizational aspects, which are relevant to the field of energy statistics in the Czech Republic.

1 THE TRADITIONAL ENERGY BALANCE AND THE INSTITUTIONS INVOLVED IN ENERGY STATISTICS

Before turning to more recent developments, it is worth noting that the making of an energy balance continues to be the basis of energy statistics and energy balances continue to be the most used output in this field. An energy balance is based on information about where fuels and energies come from, on the one hand, and about how fuels and energies are being consumed, on the other hand. In this way, an energy balance gives an overall picture of the energy situation in a given country. Moreover, it allows users to understand the energy security situation and the effective functioning of energy markets and serves as a tool to ensure comparability of statistical information between different reference periods and between different countries. It also provides data for the calculation of greenhouse gas emissions from fuel combustion, provides the essential basis for calculating various indicators of each energy product's role in the country's economy (energy efficiency, share of renewable energy, energy savings, consumption of energy by sector and others), see Eurostat (2018a).

The traditional form for presenting an energy balance is the table matrix. For this purpose, the table matrix is vertically divided into 3 main parts (rows pertaining to items of supply, transformation and final consumption). The columns in the table matrix then show the commodity balances for individual products (coal, oil, natural gas, renewables, electricity and heat, nuclear energy etc.). All data in an energy balance is comparable, thanks to the use of a common energy unit (and this is why an energy balance can define "Total energy", despite this total being based upon various different products). A common energy unit can be the Terra joule (TJ), Peta joule (PJ), tonnes of oil equivalent (toe) etc. To convert physical units (i.e. how much of a certain product) to such common energy units, calorific values of the products (fuels) need to be calculated and assigned, keeping in mind that the calorific value of a certain fuel has some variability, as it depends upon the quality of the fuel. These calorific values tell us how much energy is produced when burning the given fuel (see Gigoux, 2018). Further information on the structure of the energy balance is available, for example, on the Eurostat website, where the diagram of this matrix is also displayed according to the relevant methodology (Eurostat, 2018a).

Currently, energy balances for individual EU member states are calculated and published by Eurostat based on its methodology. Additionally, energy balances for individual states, such as the Czech Republic, are also calculated and published by several other international organizations (such as the International Energy Agency, as part of the OECD, and also by the United Nations) based upon the same data, but each with its own specific methodology. In addition, some states, such as Germany, also compile and publish their national version of the energy balance, which is based on their domestic methodology.

In order to build these energy balances at the EU and international level, structured data (information) is needed. The necessary data is gathered from national (country) responses to six annual questionnaires jointly developed and issued by the international organizations collecting energy statistics and publishing energy balances. These six joint annual questionnaires are the Coal questionnaire, Natural gas questionnaire, Electricity and heat questionnaire, Oil questionnaire, Renewables questionnaire and Nuclear questionnaire. The goal of these international organizations is to agree on a joint version of each questionnaire and to harmonize and connect the various concepts in the questionnaires. The challenge for the international organizations is to develop joint questionnaires which are suitable for the various needs of the organizations in question while ensuring that the national statistical offices can fill in only a particular joint questionnaire on Coal, for example, instead of having to transmit various different versions of a Coal questionnaire to each international organization.

However, these six annual questionnaires do not only serve to build the energy balance, but are also used for environmental statistics. Eurostat has developed a method for converting energy statistics collected via the annual questionnaires into the Physical energy flow accounts (PEFA) framework, which records the flows of energy (in terajoules) from the environment to the economy (natural inputs), within the economy (products), and from the economy back to the environment (residuals).

However, this joint international approach requires some level of simplification and thus, a certain national level of detail can be missing. From the Czech domestic perspective, we could say that some national specificities are not captured in the international questionnaires, as we might otherwise like them to be. These common international questionnaires are continually being developed and refined and their development follows developments in the energy sector. In practice, the scope of the questionnaires is constantly increasing and the questionnaires are becoming more detailed. Thus, the continual task of ensuring a joint approach to the questionnaires means that cooperation between international organizations collecting energy statistics is also continually being strengthened.

2 RECENT DEVELOPMENTS AND CHALLENGES FOR ENERGY STATISTICS

For end-users with little experience reading energy balances, it can be a challenge to read the traditional table matrix to get relevant information pertaining to energy statistics. The goal of contemporary energy statistics experts is to make energy statistics more easily understandable to the public and to non-statistics professionals. At the international level, in addition to the traditional energy balance in the form of a table matrix, energy statistics data is now also being visualized using infographics and delivered to end-users through explanatory publications, such as articles and videos. The first digital publication on energy statistics in the EU has recently been published ("Shedding light on energy in the EU: A guided tour of energy statistics") and energy flow diagrams, called Sankey diagrams, have begun to be used. These diagrams are one of the important recent developments for visualizing energy statistics data.

Sankey diagrams visualize the flows of fuels and energies in a given country and in a given year. These flows would otherwise have been described by numbers in the energy balance table matrix, but the same information is better visualized in the diagrams representing the flows of production, imports, stocks, transformation, final consumption, etc. A significant advantage of the Sankey diagram is that the reader can quickly see the proportion of individual fuels and energies in the energy flows and their contribution to the economy.

Sankey diagrams are designed to be viewed in electronic format and thus, they are interactive. The user can click to make the transformation flows and processes more detailed and can then see what happens in such processes (in power stations or in refineries, for example) and what other energy transformation processes occur at the same time. The user can choose just one family of fuels, for example solid fuels and can click deeper to see which solid fuels are included in the flow of solid fuels (brown coal, bituminous coal, coking coal etc.). If a user wants to see the ratios of the flows, they can access the graphs for different parts of the flow. In these Sankey diagrams, data can also be compared between different EU countries and also over time (by selecting the appropriate years). Sankey diagrams have been recently complemented with another interactive tool for energy prices. Sankey diagrams in energy statistics are being further developed and more information on this topic is available on the Eurostat and IEA webpages.[2]

Another challenge for energy statistics is that the traditional energy balance itself is now seen as providing insufficient data for policy-makers, analysts and other expert users. Thus, policy-makers in the field of energy statistics have begun to focus on providing an even more detailed breakdown of final energy consumption. For energy consumption in households, more detailed data is already available and the main interest of expert users of such data has been to see how much energy and what kind of energy households consume for space heating, space cooling, water heating, lighting, cooking and for appliances. For the industrial sector, there will be further legislative changes in 2019 to the *Regulation (EC) No. 1099/2008 of the European Parliament and of the Council of 22 October 2008 on energy statistics* (hereinafter "Regulation on energy statistics") and EU member states will begin reporting more detailed data about the final consumption of individual types of fuels and energies in the industrial sector, based on the – more or less detailed – codes of the *Statistical classification of economic activities* (NACE classification). A similar approach is being prepared for the transport and services sectors and the EU is currently evaluating what kind of additional data could be collected and provided in these sectors. The goals of EU policy makers appear to be rather ambitious in this area. Initial proposals include reporting data for the final consumption of fuels and energies in the services sector by type of building and by the NACE classification, classified according to whether the consumption occurs inside or outside of the building, whether the building is public or private, etc. The final consumption reporting according to the purpose of use (heating, cooling, lighting, etc.) is also being taken into account. In the field of transport, it is currently being proposed to divide the final consumption of fuels and energies by freight and passenger transport, by fuel type, by type of transport (road, rail, air, etc.) and to break down the data for urban and extra-urban transport.

An important focus of policy makers is now also being placed on energy efficiency indicators. Energy efficiency indicators tell us how much energy is needed to provide a certain service. The principle of energy efficiency is generally the energy consumption related to an activity. The most typical energy efficiency indicator is the Final consumption related to GDP. However, much more detailed information can be generated from energy efficiency data. For example, information on the energy costs of producing bricks, cellulose, cement etc. Energy efficiency indicators can also provide important information on reductions in emissions, which can then be used to better set targets and to better monitor the impacts of changes in energy policies. Moreover, energy efficiency indicators can help to identify how much of existing energy consumption is covered by existing energy efficiency regulations (only 30% of global energy consumption is a subject to mandatory efficiency targets, for example), see Silva (2018).

Fundamental energy efficiency indicators can be calculated from the energy balance. These indicators, among others, are collected and monitored by the European Commission, which sets and pursues energy efficiency targets. However, even more detailed data for energy efficiency indicators is collected by the International Energy Agency. In order to calculate these more detailed indicators, member states send data to the IEA for four main sectors (residential, services, industry and transport), including data about end uses and about the consumption of individual fuels and energies in these end uses. Examples of end uses by sector include: space heating, space cooling and lighting (residential sector, services sector); production of textiles, chemicals, paper, basic metals (industry sector); operation of passenger cars, buses, trucks (transport sector). Examples of energy efficiency indicators which are then calculated are: per capita energy intensity, per floor area energy intensity, fuel intensity and vehicle-kilometer energy intensity. In calculating these indicators, the IEA also uses macroeconomic data and data from social statistics.

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2 *<https://ec.europa.eu/eurostat/cache/sankey/sankey.html?geos=EU28&year=2017&unit=KTOE&fuels=TOTAL&highlight=_&nodeDisagg=0101000000000&flowDisagg=false&translateX=0&translateY=0&scale=1&language=EN>. <https://www.iea.org/Sankey>.*

The industry sector can be used to illustrate just how much data requests have increased in scope: the original data requirements pertaining to this sector which were then used to calculate the energy balance were for 5 items, but the data requirements pertaining to this sector which are used as a basis for calculating the energy efficiency indicators are for 23 more detailed items.

Just as with energy balances, data visualization is also used for energy efficiency indicators as a tool to make the numerical data better accessible to non-expert users. The IEA has established a new website[3] devoted to energy efficiency indicators this year which includes Sankey diagrams for energy efficiency indicators and for the various datasets for these indicators in the member countries.

The latest challenge for energy statistics that is currently being discussed is the fundamental transformation of European energy system, in the context of the establishment of the Energy Union and ambitious plans in climate policy. The European Union and its member states are currently discussing options for better aligning data collections with such EU policy developments. In particular, the EU's comprehensive update of its energy policy framework (which aims to facilitate the transition away from fossil fuels towards cleaner energy and which was introduced through new legal texts published as part of the "Clean Energy for All Europeans") brings regulatory certainty, in particular through the introduction of the first integrated national energy and climate plans. Ambitious regulatory targets for renewables, energy efficiency as well as electricity interconnection, aim to stimulate Europe's industrial competitiveness, boost growth and jobs, reduce energy bills, help tackle energy poverty and improve air quality. Using reliable high quality statistical data is necessary to monitor these new energy and climate policy goals. Official energy statistics thus need to contribute to this process in order to remain in tune with the needs of EU policy-makers. Recent energy statistics improvements agreed at the European level include the Crude oil import register, improved timeliness of monthly coal and electricity data, early estimates of energy balances and early estimates of indicators for Europe 2020/2030 targets. Moreover, to capture the development of new phenomena in energy statistics, such as the emergence of electric mobility, the expansion of the use of space cooling in southern Europe, the use of hydrogen as fuel, and so on.

3 SPECIFIC CHALLENGES FOR ENERGY STATISTICS IN THE CZECH REPUBLIC

In addition to the developments and challenges described above, which the Czech Republic faces as well, there are also some other challenges for the energy statistics in the Czech Republic.

Several domestic authorities are involved in the production of energy statistics data at the national level in the Czech Republic, with various roles assigned and with a defined scope for their inter-institutional relations. The primary responsibility for energy statistics is shared between the Czech Statistical Office (CZSO) and the Ministry of Industry and Trade (MIT). In addition to the CZSO and MIT, the other authorities involved are the Energy Regulatory Office (ERO), The Czech electricity and gas market operator (OTE), Czech Hydro-meteorological Institute (CHMI), the Administration of State Material Reserves (ASMR) and the General Directorate of Customs Administration of the Czech Republic. These authorities then also cooperate with private-sector associations, such as the Czech Association of the Petroleum Industry and Trade.

The CZSO acts as the main coordinator in energy statistics, which includes a primary methodological role. It is also the primary national contact for international organizations in this field. The CZSO is the main authority responsible for data reporting further to the Regulation on energy statistics and it is co-responsible for data reporting further to *the Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency* (hereinafter EED directive). Conversely, the MIT is the main authority responsible for data reporting further to the EED directive and is co-responsible for data reporting further to the Regulation on energy statistics. Furthermore, the CZSO is responsible

[3] *<https://www.iea.org/statistics/efficiency>*.

for monthly and annual oil statistics, monthly and annual natural gas statistics, annual solid fuels statistics, annual electricity and heat statistics, energy prices statistics and energy efficiency indicators. The MIT is responsible for monthly solid fuels statistics, monthly and annual electricity and heat statistics (for licensed entities), energy efficiency indicators, renewable energy sources, liquid biofuels, filling/gas stations statistics and nuclear energy statistics. Inter-institutional cooperation and coordination among the domestic authorities involved in the production of energy statistics data in the Czech Republic is thus both important and necessary and is becoming increasingly challenging.

The other main challenge for the Czech Republic in producing energy statistics is the same as in other EU member states. On the one hand, there is a growing demand for more energy data and also for more flexible, more detailed and earlier outputs. This means increased workload and necessitates seeking out new administrative sources of data and data from social statistics, macroeconomic statistics or statistics in other sectors (these sources are often new for energy experts). On the other hand, there is also pressure to reduce the administrative burden for respondents and the material resources available in the public sector to perform these tasks are not increasing (in terms of number of employees available to perform such tasks and in terms of the allocated budget).

Regarding the data sources that are currently used to produce energy statistics data in the Czech Republic, the most important source are statistical surveys. Statistical surveys for energy statistics are conducted by the CZSO, MIT and ERO and they are collected in the framework of the *Act No. 89/1995 Coll., on the state statistical service, as subsequently amended* and the *Act No. 458/2000 Coll., Energy Act, as subsequently amended*. The respondents for whom statistical surveys in the area of energy statistics are intended are then defined by the Decree on the Statistical Survey Program, which is issued for each given year and also by Decree No. 404/2016 Coll., on statistics.

The CZSO has two monthly statistical surveys on crude oil processing and petroleum products and five annual statistical surveys (one on fuels and energy sources, two on fuels transformation, two on fuels and energy consumption). Moreover, every five years, the ENERGO survey on energy consumption in households is held. The ENERGO survey is a unique type of survey in Europe and it has become an important source of data for all Czech institutions. For the future, while it is hoped that this survey should continue be held every five years, due the fact that it is rather demanding in terms of the capacity that is required for its development and processing, as well as due to the financial costs incurred, such a frequency is not yet guaranteed. The MIT has two monthly statistical surveys (one on solid fuels and one on biofuels) and three annual surveys (two on energy production, one on operation of service/filling stations, and one biannual survey on network of service/filling stations). The ERO has three monthly and one annual survey on electricity production, distribution, transmission and related licenses and also one quarterly survey for heat production and a further assortment of nine additional surveys for natural gas production, distribution transmission and related licenses.

In addition to statistical surveys, a variety of other sources are used in the production of energy statistics. These are, for example: the Natural Gas Balance and the Electricity Balance (produced by the ERO), Intrastat and Extrastat; business licenses in the various energy sectors; information pertaining to emissions (from the Register of Emissions and Air Pollution Sources administered by the CHMI), renewable energy sources (provided by the ERO and the State Environmental Fund), liquid biofuels (from State Agricultural Intervention Fund) and Oil and Petroleum Products (provided by the Czech Association of Petroleum Industry and Trade).

As regards any new requirements, in practice, it can be difficult to quickly include them in the scope of data collected in the surveys and the participation of all stakeholders, including respondents, is needed. Thus, one new trend in the field of energy statistics is a move away from expanding traditional statistical surveys, and instead using statistical modelling and seeking more existing administrative sources of data.

Lastly, one further challenge that needs to be addressed in the Czech Republic is the need to concentrate energy statistics outputs in one place, or at least to provide information in one centralized location, about where the various outputs can be obtained from the institutions involved, in order to make research easier for non-expert users (essentially, the creation of an energy statistics portal to seamlessly bridge the divide between the various institutions involved).

CONCLUSION

Demand for new energy statistics data is closely linked to developments in the energy sector, as new fuels and energy technologies are now ever more quickly being developed. The demand for new data is linked not only to developments within the energy sector itself (the ongoing fundamental transformation of the European energy system), but in the context of the Energy Union, it is linked to an ever-increasing demand for factually related statistics in related policy areas such as environmental statistics and climate policy (for example, the need to calculate CO_2 emissions). As new fuels, such as hydrogen, begin to be used and as the accumulation of electricity and electric mobility become the new reality, energy statistics will continue to face new challenges and a growing and changing demand. It will be the task of the domestic and international institutions involved and a task for energy statistics experts to address these new challenges and to find solutions which will allow more data to be produced and presented in a user-friendly manner, while at the same time reducing the administrative burden on respondents and making do with limited public resources. It is important to keep in mind, however, that the production of data is not the end-game – once data is produced, it falls especially upon law-makers and policy-makers in the public sector, as well as on private sector businesses, to make effective use of this data in their decision-making processes and in their policy and business planning.

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