PEFA guidelines
for data collection 2018

11 April 2018

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**Important abbreviations**

SNA  International System of National Accounts  
ESA  European System of National and Regional Accounts  
SEEA  System of Environmental Economic Accounting  
IEA  International Energy Agency  
IRES  International Recommendations for Energy Statistics  
AQ  IEA/Eurostat annual questionnaires on energy statistics (coal, natural gas, oil, electricity & heat, renewables & waste)  
NACE  Statistical classification of economic activities in the European Community  
CPA  Statistical classification of products by activity  
SUT  Supply and use tables  
NCV  Net calorific value
1 Introduction

Unfortunately, a comprehensive revision of the 2014 draft version of the PEFA Manual was not possible in due time for the launch of the PEFA data collection cycle 2018.

These PEFA guidelines for data collection 2018 are based on the guidelines prepared for the 2017 data collection. Important changes compared to the 2017-version concern the following:

- Section 2.2.4 'Intra-establishment energy flows beyond those recorded in ESA supply and use tables' has been revised.
- In chapter 3, the compilation guidelines for PEFA Table A (Physical supply table for energy flows) have been adjusted to the instruction in the revised section 2.2.4 on intra-establishment flows.
- In chapter 3, the section 'grey shaded cells ...' has been up-dated.

The general aim of this document remains unchanged. It is to provide PEFA guidelines going beyond those given in the 2014 draft version of the PEFA Manual. Those became necessary because:

- the PEFA questionnaire has been changed and extended throughout the pilot collection cycles 2015 and 2016;
- the Working Group on Environmental Accounts clarified a number of methodological issues at its meetings in 2015, 2016 and 2017.

The PEFA guidelines for data collection 2018 at hand have the same structure (main chapters) as the 2014 draft version of the PEFA Manual. This shall facilitate a complementary use of both documents.

2 Conceptual foundations of PEFA

The broad conceptual foundations for PEFA have not changed since the 2014 draft version of the PEFA Manual. The following provides more precise explanations for some of the sub-sections of chapter 2.

2.1 The SEEA physical flow accounting framework

2.1.1 Definition of natural inputs, products, and residuals

Core to the measurement of physical energy flows is SEEA’s distinction into three principal types of physical flows. The SEEA makes an important distinction between natural inputs, products and residuals (which is also reflected in the classification of rows of the PEFA supply and use tables).

See also:
- 2014 draft version of PEFA Manual, section 2.2.1, Annex 1
- SEEA-Energy, paras. 3.30-3.34, 3.41-3.43, 3.57-3.63
It is important that PEFA compilers have a sound understanding of the differences between the three SEEA-types of physical flows. It is recommended to study carefully the respective sections in SEEA 2012-CF and the 2014 draft version of the PEFA Manual.

It is not always straightforward to draw a clear borderline between products and residuals though. In PEFA, 4 classes of energy residuals are distinguished (see Table 1)

**Table 1: Classification of energy residuals in PEFA**

<table>
<thead>
<tr>
<th>PEFA code</th>
<th>Energy residual name</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>R28</td>
<td>Renewable waste</td>
<td>These two energy residuals correspond to the energy statistics’ category ‘Waste’ (SIEC-code 6). For the purpose of energy statistics and PEFA, ‘waste’ refers to the part of waste-materials that is incinerated with heat recovery at installations designed for mixed wastes or co-fired with other fuels (IRES², para. 3.19). PEFA distinguishes between renewable and non-renewable waste following the delineation applied in the IEA/Eurostat Annual Questionnaires (AQ)³. The renewable versus non-renewable distinction is made with a view to the assessment of related emissions to air.</td>
</tr>
<tr>
<td>R29</td>
<td>Non-renewable waste</td>
<td></td>
</tr>
<tr>
<td>R30</td>
<td>Energy losses all kinds of (during extraction, distribution, storage and transformation, and dissipative heat from end use)</td>
<td>Based on physical law, energy can be neither created nor be destroyed; however, it can change from one form to another. Each transformation process from one form to the other produces so-called losses. These losses are rather low forms of energy which are usually not useable anymore for human purposes. The residual category R30 includes all kinds of losses (during extraction, distribution, storage and transformation, and dissipative heat from end use) – quantitatively most important is dissipative heat from end use (see Box 1), which is released to the surrounding environment (atmosphere) during end use of energy products. E.g. the energy content of electricity used to run a light-bulb or computer is eventually transformed into dissipative heat which is ‘lost’ (unavailable) for further use by humans.</td>
</tr>
<tr>
<td>R31</td>
<td>Energy incorporated in products for non-energy use</td>
<td>Energy products may be used for non-energy purposes, such as e.g. production of lubricants, plastics, asphalt etc. (see IRES paras. 5.21, 5.83, 5.97, 3.8 – 3.10, 5.5). In the case of non-energy use the energy content is (temporarily) stored in the respective output product. It may be used for energy purposes later (e.g. waste oil and plastics incinerated with heat recovery). The whereabouts of energy produces used for non-energy purposes have to be recorded somewhere in the balanced PEFA physical-supply-use framework (see also section 2.1 of the 2014 draft version of the PEFA Manual). Residual code R31 is used for this recording. When an energy product is used for non-energy purposes it is transformed into residual R31 and stocked in the economy (accumulation).</td>
</tr>
</tbody>
</table>

**Box 1: Dissipative heat**

Dissipation is the result of an irreversible process that takes place in inhomogeneous thermodynamic systems. A dissipative process is a process in which energy is transformed from some initial form (useful to humans) to some final form; the final form has lower capacity to do mechanical work than the initial form. Dissipative heat is a kind of final form of energy which hardly can be used anymore. It occurs during any energy transformation process, in particular when an energy product is end used the initial energy content of the energy product is completely transformed into dissipative heat and released to the surrounding environment.

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¹ Standard International Energy Product Classification (SIEC) developed as part of the preparations of the International Recommendations for Energy Statistics (IRES)
² International Recommendations for Energy Statistics (IRES)
³ See [http://ec.europa.eu/eurostat/web/energy/methodology/annual](http://ec.europa.eu/eurostat/web/energy/methodology/annual), in particular the reporting instruction for the Renewables & Waste annual questionnaire
2.2 Accounting principles relevant for PEFA

2.2.2 Economic units – and groupings thereof

It is important that PEFA employs the same groupings of elementary economic units as the ESA supply and use tables. This coherence is important with regards to integrated analyses of monetary and physical accounts — one of the main goals of environmental-economic accounting.

As an overarching general rule PEFA must apply exactly the same demarcation of productive activities (columns in PEFA supply and use tables) as employed for the compilation of the monetary supply and use tables delivered to Eurostat under the ESA transmission programme. Compilers of PEFA are advised to contact and align with compilers of ESA supply and use tables with the aim to ensure highest coherence between PEFA and ESA supply and use tables.

2.2.3 Principal, secondary, and ancillary production activities

The 2014 version of the PEFA Manual explains the national accounts concepts of principal, secondary, and ancillary production activities. Energy products are frequently produced as a result of secondary production activity by industries (NACE divisions) that are not typically producing the respective energy product as a result of their principal production activity. Examples are e.g. the iron & steel industry that may produce coke for own use; wastewater treatment services or agriculture may produce biogas (fermentation of biomass). In particular the production of electricity and heat may occur as a result of secondary production activity. Secondary production activity output is recorded off the diagonal in ESA supply tables and the same is to be applied in PEFA Table A; evidently the associated factor inputs have to be recorded accordingly.

In energy statistics the concept of autoproducers of electricity and heat has been established (see Box 2). Conceptually it is close to the national accounts' concept of secondary and ancillary activity production — however, the two concepts may not entirely overlap in practice. Autoproducers electricity and heat production as reported in energy statistics might not be entirely consistent with the way it is recorded in ESA supply and use tables! Compilers of PEFA are advised to carefully check this issue and cooperate/consult with compilers of ESA supply and use tables as well as compilers of energy statistics.

Box 2: The energy statistics' concept of 'autoproducer of electricity and heat'

Energy statistics record the production of electricity and heat by type of producer and type of generating plant. Two types of producers are distinguished (see IRES; paras. 5.45 ff.):

- **Main Activity Producers**: These are enterprises which produce electricity and heat as their principal activity. Formerly known as public utilities, these enterprises may be privately or publicly owned.

- **Autoproducers (electricity)**: These are enterprises which produce electricity (for sale and own use) but for whom the production is not their principal activity.

  **Autoproducers (heat)**: These are enterprises which produce heat for sale but for whom the production is not their principal activity. Deliveries of fuels for heat generated by an establishment for its own use are classified within the part of final energy consumption where they are consumed.
While above IRES definitions of autoproducers make a clear reference to national accounts' concepts, the reporting instruction for the IEA/Eurostat Annual Electricity & Heat Questionnaire do less so; therein the definition is as follows:

- **Main activity producer** undertakings generate electricity and/or heat for sale to third parties, as their primary activity. They may be privately or publicly owned. Note that the sale need not take place through the public grid. ... All heat production from Main activity producer should be reported.

- **Autoproducer** undertakings generate electricity and/or heat, wholly or partly for their own use as an activity which supports their primary activity. They may be privately or publicly owned. ... Electricity production reported for Autoproducer should be the total quantity of electricity generated. Heat production reported for Autoproducers should comprise only the heat sold to third parties. Heat consumed by autoproducers should not be included.

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### 2.2.4 Intra-establishment energy flows beyond those recorded in ESA supply and use tables

The SEEA recommends recording all intra-establishment flows (see SEEA-CF para. 1.41-1.44), including those not recorded in monetary national accounts, i.e. in the ESA supply and use tables (SEEA-CF para. 2.91 and 3.162; SEEA Energy paras. 2.65 and 3.163).

Moreover, SEEA Energy para. 3.92 recommends recording them separately in PEFA as flows of energy for own use. At its 2017 meeting, the Working Group on Environmental Accounts agreed to follow SEEA and make those 'intra-establishment energy flows beyond those recorded ESA supply and use tables' explicit in PEFA. A row was added to the PEFA supply table (Table A).

However the conceptual recording of intra-establishment flows in monetary national accounts is not straightforward (see Box 1). Besides the conceptual recording rules, there are also practical difficulties to produce national accounts estimates, meaning that the ESA supply and use tables in a given country may not follow the rules in full. Therefore the PEFA compilers must consider what is included in their national ESA supply and use tables and apply the corresponding adjustments. The following cases can be distinguished:

1. **Ancillary production and corresponding intermediate consumption:** Energy products may be produced by any elementary unit undertaking productive activity and used by the very same elementary unit as intermediate use; intermediate use means here energy products used as inputs to a process of production, thereby transformed or used up by the production process.
   
   This case also includes natural energy inputs extracted by an elementary unit and used by the same elementary unit as intermediate use.

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4. see [http://ec.europa.eu/eurostat/web/energy/methodology/annual](http://ec.europa.eu/eurostat/web/energy/methodology/annual)

5. The following recording issue still needs to be clarified by convention: A unit extracts natural gas (=natural input) which it uses for its extractive operations. Here two recording options exist:

   A: The natural input is immediately own used without becoming a product. This implies two recordings (1) supply of natural input by environment, and (2) use of natural input by extracting unit.

   B: The natural input is transformed into a product before it is own used? This implies four recordings: (1) supply of natural input by environment; (2) use of natural input by extracting unit; (3) supply of product by extracting unit; (4) own use of product by extracting unit.
Normally, ancillary activities would not be recorded in the ESA supply and use tables but in practice may do so in specific cases, in particular if the energy is produced and consumed in different establishments (belonging to the same enterprise) and if it is statistically observable (or it can be inferred from observed energy savings). Depending on whether ESA supply and use tables are built on establishment data or enterprise data, and the frequency and importance of ancillary production of energy, it may be already accounted for in ESA supply and use tables or not. If not included, the PEFA compilers would be expected to produce additional estimates.

2. Own account production of energy by households for their own final use (i.e. do not provide to other units): in principle it should be recorded in ESA but in practice it is most likely not done. ESA 2010 only records household’s production and subsequent own final use for a selection of a few products, namely agricultural products and dwelling services. In fact, however, households increasingly produce a wide range of energy products for own final use, mainly electricity and heat from renewable sources. If energy production for own final use was included in ESA supply and use tables, the supply (production) would have to be recorded under the heading of the productive activity typically producing electricity and heat (i.e. NACE D 'electricity, gas, steam and air conditioning supply') and the use would be recorded as final consumption expenditure by households.

PEFA compilers are expected to check that it is included in ESA supply and use tables, and if not, to produce additional estimates.

3. Own account production of energy by government & NPISHs for their own final use: Economic units belonging to the government & NPISHs sectors may produce energy products for their own final use. Similar to the previous case with households, in principle it should be recorded in ESA but in practice it is most likely not done. It is rather unlikely that ESA supply and use tables record these as output and own final use.

PEFA compilers are expected to check that it is included in ESA supply and use tables, and if not, to produce additional estimates.

**Recording of intra-establishment energy flows in PEFA supply and use tables:**

*Intra-establishment energy flows* are recorded twice in PEFA: first in the PEFA supply table and secondly in the PEFA use table(s). The following PEFA recording conventions are made:

- **Ancillary production and subsequent intermediate use:** The supply of the energy product is recorded in the PEFA supply table and the use is recorded in the PEFA use table. In both cases, it is recorded under the heading of the productive activity concerned (which is the same in both tables).

- **Own-account production by households for their own final use (as final consumption expenditure):** The output (i.e. supply of energy products) is recorded in the PEFA supply table under the column-heading of the NACE division typically (as principal activity) producing the respective energy product. E.g. electricity produced by households has to be recorded under the column-heading of NACE division D 'electricity, gas, steam and air conditioning supply'. The use is recorded as final use by households.
Own-account production by government & NPISH for their own final use (as final consumption expenditure): The output (i.e. supply of energy products) is recorded under the column-heading of the NACE division which produces the principal activity output of the respective government & NPISH unit (e.g. principal government services are falling under NACE divisions O 'public administration and defence; compulsory social security' and P 'education'). The use is recorded under the very same heading.
Box 1: treatment of intra-establishment production in SNA

National accounts distinguishes the following two cases:

- Ancillary activities: these are incidental activities to the main activity of an enterprise, which are needed to facilitate the efficient running of the enterprise but not normally resulting in goods and services that can be marketed (SNA para. 5.10). Ancillary activities can only occur in enterprises. The sorts of activities meant here include keeping records, purchasing materials and equipment, training, etc. These can be produced in-house or can be purchased on the market. When they are produced in-house, they are called ancillary activities. Correspondingly, SNA defines ancillary activities as a supporting activity understanding within an enterprise in order to create the conditions within which the principal and secondary activities can be carried out (SNA 5.36). Energy can also be produced in an enterprise as an ancillary activity.

- Own-account production for own final consumption: more exactly, the SNA concept is own-account production of goods that are retained by their producers for their own final consumption or gross capital formation. This only occurs in households, government or non-profit institutions, as only they can incur in final consumption. This is only about goods, not services because the production of services for own final consumption is out of the SNA production boundary (SNA para. 6.27). This handbook considers the production of energy as a good rather than a service, and therefore own-account production of energy for own final consumption is within the scope of SNA and of PEFA.

The distinction between these two cases is very important for conceptual and practical reasons. Only enterprises (i.e. market producers) can incur in ancillary activities. Only households, government and non-profit institutions can incur in own-account production for own final consumption.

The SNA and PEFA rules for recording own-account production of energy for own final consumption are clear: output must be recorded and the corresponding final consumption too. The difficulty is rather practical to assess what national accounts actually includes.

On their side, the SNA and PEFA rules for recording energy production as ancillary activity are less clear. First, the recording of (any kind of) ancillary activities follows a number of conventions depending on exactly how they are provided, which affects the borderline between ancillary and non-ancillary activities. SNA paras. 5.40 and 5.41 consider whether these activities are produced in a different establishing than where they are consumed, and whether they are statistically observable. In that case, the ancillary activity should be recognised as a primary output of a separate establishment, and correspondingly output should be recorded for the producer establishment and intermediate consumption should be recorded for the consumer establishment. However whenever the distinction is not possible, ancillary activities are not recorded neither as production nor as intermediate consumption.

Moreover, in the case of production of energy as an ancillary activity, there is further uncertainty. It seems that SNA does not consider clearly the recording of energy production as a possible ancillary activity: SNA para. 5.37 uses the example of milk to make cheese to conclude that ‘in general, goods that become embodied in the output of principal or secondary activities are not outputs of ancillary activities’ but in the case of energy production the conclusion should be just the opposite (as stated above, this handbook considers the production of energy as a good rather than a service). All in all, SNA does not consider clearly the recording of energy as ancillary activity.

See also:
- document ENV/ACC/WG/3.3(2017)
- minutes of the Working Group on Environmental Accounts meeting 2017, day 1, agenda item 3.3
- 2014 draft version of PEFA Manual, section 2.2.4
- SEEA 2012-CF, paras. 1.41-1.44, 2.91 and 3.162
- SEEA-Energy, paras. 2.65, 3.92, 3.163
3 PEFA-questionnaire

Please use exclusively the most recent 2018 version of the PEFA Questionnaire which is made available on Eurostat’s environment website:


The PEFA Questionnaire is an Excel Macro-Enabled Workbook (*.xlsm) designed to accommodate just one single year. Please save separate files for each year you are reporting (file format: *.xlsm).

The 2018 PEFA questionnaire has 7 tables for reporting data (see sheet 'scheme' for an overview).

Figure 1: Overview of PEFA tables (see sheet 'scheme' in PEFA questionnaire)

The classifications of rows and columns have not changed since 2014 (see sections 3.3 and 3.4 of the 2014 draft version of the PEFA Manual).

In the following additional guidelines are provided for each of the 7 reporting tables.

Table A: Physical supply table for energy flows

At its 2017 meeting, the Working Group on Environmental Accounts expressed the wish to show so-called 'intra-establishment energy flows' separately in PEFA-questionnaire. Hereupon Eurostat added an additional row at the bottom of PEFA Table A. This 'of-which-item' is termed 'supply of energy products for own use' and records those supplies of energy products that are not recorded in monetary ESA supply and use tables (these 'intra-establishment energy flows' are discussed in more detail in section 2.2.4).

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6 beyond the explanations provided in the PEFA questionnaire and the 2014 draft version of the PEFA Manual

7 See previous section 2.2.4
Intra-establishment energy flows are implicitly included and recorded in both, the PEFA supply table and the PEFA use table. For reasons of simplification, it was decided to make it explicit only once, and to show it as a separate ‘of-which’ memo item only in PEFA Table A (supply table).

Please see section 2.2.4 to find out exactly which kind of ‘intra-establishment energy flows’ are to be recorded in this of-which-item.

See also:
- minutes of the Working Group on Environmental Accounts meeting 2017, day 1, agenda item 3.3
- document ENV/ACC/WG/3.3(2017)

Table B: Physical use table for energy flows

Two sub-layers were added to Table B (B.1 and B.2) in the 2016-version of the PEFA Questionnaire.

See also:
- document ENV/ACC/WG/1.3(2016)
- minutes of the Working Group on Environmental Accounts meeting 2016, day 3, agenda item 1.3
- document ENV/ACC/WG/3.3(2017)
- minutes of the Working Group on Environmental Accounts meeting 2017, day 1, agenda item 3.3

Table B.1: Transformation use of energy flows

Table B.1 is a sub-table of Table B and records the ‘transformation use’ of energy flows\(^8\) (row-wise) by user (column-wise). The definition of ‘transformation use’ is based on and derived from principles in energy statistics\(^9\). ‘Transformation use’ denotes the input into those transformation processes where part or all of the energy content of the entering natural input/product/residual is moved to at least one energy product leaving the process. The difference between the energy amount entering the process and the energy content of the leaving energy products is energy loss. In PEFA the latter is referred to as energy residual. Energy statistics usually refer to it as transformation losses.

Figure 2: Transformation use (scheme)

Figure 2: Transformation use (scheme)

‘Transformation use’ recorded in Table B.1 includes all uses of natural energy inputs to create energy products. ‘Transformation use’ recorded in Table B.1 further includes the uses of energy products to create other energy products (so-called secondary energy products). Finally, ‘transformation use’ recorded in Table B.1 includes the uses of certain energy residuals, e.g. waste, to produce other energy products such as e.g. electricity, heat, or biomass based energy products. Table B.1 also records the up-take (use) of transformation losses (energy residual) by the environment.

\(^{8}\) Energy flows = natural energy inputs, energy products, energy residuals
\(^{9}\) See e.g. IRES, paras. 5.63 ff.
Table B.2: End use of energy flows (including non-energy use)

Table B.2 is a sub-layer of Table B and records the 'end use' of energy flows (row-wise) by user (column-wise). 'End use' is the complementary type of use to 'transformation use'. 'End use' denotes the input (use) of energy flows into those transformation processes where all of the energy content of the entering natural input/product/residual is moved solely to residuals leaving the process.

'End use' includes both types of purposes: for energy use, and for non-energy use. For the latter type of purpose PEFA provides a specific residual class 'energy incorporated in products'. In the case of the former type of purpose it dissipative heat leaving the process.

Figure 3: End use (scheme)

Notably, 'end use' includes the 'non-transformative' input of energy flows into the so-called energy sector or energy industry. This is also termed 'energy industry own use' and refers to the consumption of energy flows for the direct support of the production processes of the so-called energy sector or energy industry.

Table C: Physical use table of emission-relevant use of energy flows (related to fuel combustion)

Table C is an 'of-which-sub-layer' of Table B. It is a physical use table too. Table C records the emission-relevant use of natural energy inputs, energy products, and energy residuals (row-wise) by the using and hence emitting unit (column-wise). Table C in general has the same layout/format as Tables A and B.

The Working Group on Environmental Accounts agreed in 2016 to precise the definition of 'emission-relevant use' by confining it to the process of combustion. As a consequence, the respective explanations and guidelines given in the 2014 draft version of the PEFA Manual (paras. 79 – 83) became obsolete.

More up-to-date explanations and guidelines for Table C are given in the following:

'Emission-relevant' may be the combustive use of all three types of energy flows. The majority concerns uses of energy products which are combusted in the context of production and consumption activities of industries and households. There are a few cases where the use of natural energy inputs may be emission-relevant, namely the flaring of natural gas by the extracting industry.

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8 See e.g. International Recommendations for Energy Statistics – IRES, para 5.20
The use of *energy residuals* may be emission-relevant too, namely in the case of using waste for energy recovery.

The definition of *'emission-relevant use'* is confined to combustion processes and based and derived from guidelines established for the compilation of emission inventories. *'Emission-relevant use'* refers to fossil fuel combustion processes as delineated and recorded in emission inventories under the CRF/NFR\(^{12}\) source code 1.A. Notably, fugitive emissions arising from fuel handling (CRF/NFR source code 1.B) are excluded.

In addition to above combustive use of fossil energy products, *'emission-relevant use'* also refers to and includes the combustion of renewable biofuels (not covered by source code CRF/NFR 1.A).

See also:
- document [ENV/ACC/WG/1.3(2016)]
- minutes of the [Working Group on Environmental Accounts meeting 2016, day 3, agenda item 1.3](#)

### Table D: Vectors of key energy indicators

PEFA Table D includes seven key energy accounts indicators in a breakdown by production, consumption and accumulation. The PEFA questionnaire calculates these indicator-vectors automatically from other questionnaire tables.

See also:
- 2014 PEFA Manual, section 3.5

### Table E: Bridge table

PEFA Table E is the so-called bridge table which explicitly presents the differences\(^{13}\) between two energy key indicators:

- The first one (bridging item 1) is derived from PEFA Table D and termed 'domestic energy use'. Conceptually, it follows the *residence* principle\(^{14}\) and includes the eventual net use of energy by all resident units for energy and non-energy purposes.

- The second one (bridging item 5) is supposed to derive from energy statistics which follow a *fuel-sales-on-the-territory* principle.

**Bridging item 5 'Gross inland energy consumption - territory principle':** received a new label. At its meeting in 2017 the Working Group on Environmental Accounts agreed on clearer guidelines/specifications for this second key indicator. Bridging item 5 must be represented by the internationally harmonised indicator *'gross inland energy consumption (GIEC)'* which is produced and...

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\(^{12}\) CRF/NFR are internationally harmonised classifications for emission sources employed by air emission inventories. Common Reporting Format (CRF) is applied in green house gas inventories under the UN Framework Convention on Climate Change. Nomenclature for Reporting (NFR) is applied in inventories for air pollutants under the UNECE Convention on Long-Range Transboundary Air Pollution.

\(^{13}\) The quantitative difference between both key indicators is mainly due to different principles underpinning the accounting of transport fuel use.

\(^{14}\) It includes the energy use by resident units, independent of where it takes place; e.g. it includes fuel use by resident units undertaking international navigation and excludes fuel sales to non-resident units.
disseminated by Eurostat based on data submitted by countries. National key energy indicators derived from national energy balances (which often deviate from the harmonised GIEC) must not be used here.

Bridging item 2.3 'International water transport undertaken by resident units': received a new label indicating an extended scope. Sub-item 2.3 refers to energy use by resident units undertaking international water transport. Here, the scope is extended insofar that all resident units' energy use for the purpose of international water transport is included (i.e. those bunkered abroad and those bunkered in domestic ports).

Bridging item 4.m 'of which (memo): energy flows not reported in energy statistics but included in PEFA (bridging item 1) ': This item has been added following a recommendation by the Working Group on Environmental Accounts. It is an 'of-which-item' of bridging item 4 'Other adjustments and statistical discrepancies'. It is intended to separately present amounts of energy use not recorded in energy statistics (and hence not be included in GIEC) but recorded in PEFA (and hence included in 'domestic energy use' = bridging item 1).

See also:
- explanations/instruction provided at the bottom of Table E in PEFA questionnaire 2018
- document ENV/ACC/WG/3.3(2017), section 3.3
- minutes of the Working Group on Environmental Accounts meeting 2017, day 1, agenda item 3.3

Grey shaded cells in PEFA reporting tables indicate 'not applicable'

The reporting tables A to E in the PEFA questionnaire have a number of grey-shaded cells which must not be filled. Grey shaded cells denote 'not applicable' combinations of dimensions (i.e. are logically not possible).

Grey-shading of cells has been changed several times since 2014. The following table provides the current state of grey shaded cells 'not applicable' and their explanations.

**Table 2: Overview and explanation of grey cells 'not applicable' in PEFA Questionnaire 2018**

<table>
<thead>
<tr>
<th>PEFA Table</th>
<th>Row(s)</th>
<th>Column(s)</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table A (Supply)</td>
<td>All</td>
<td>Statistical Differences</td>
<td>By convention, statistical differences are recorded in the use table (i.e. PEFA table B)</td>
</tr>
<tr>
<td>Table A (Supply)</td>
<td>All Natural Energy Inputs (N00, N01-N07)</td>
<td>Industries, Households, Accumulation; Rest of the World</td>
<td>By definition, natural inputs can only be provided (supplied) by the Environment; i.e. cannot be supplied by Industries, Households, Accumulation, Rest of the World.</td>
</tr>
<tr>
<td>Table A (Supply)</td>
<td>All Energy Products (P00, P08-P27)</td>
<td>Households</td>
<td>Households do also engage in productive activities. By convention, the input into and the output from households' productive activities is not recorded under the household-column. Moreover, it is recorded under the column heading of the respective industry (NACE division) which typically produces the respective product group as a result of its principal activity.</td>
</tr>
<tr>
<td>Table A (Supply)</td>
<td>All Energy Products (P00, P08-P27)</td>
<td>Accumulation</td>
<td>By convention, changes in product inventories are recorded net in the use table (i.e. PEFA Table B)</td>
</tr>
<tr>
<td>Table A (Supply)</td>
<td>All Energy Products (P00, P08-P27)</td>
<td>Environment</td>
<td>By definition, Environment cannot produce products (in national accounts the production process as well as any output from production is confined to economic production activities.</td>
</tr>
<tr>
<td>PEFA Table</td>
<td>Row(s)</td>
<td>Column(s)</td>
<td>Explanation</td>
</tr>
<tr>
<td>------------</td>
<td>--------</td>
<td>-----------</td>
<td>-------------</td>
</tr>
<tr>
<td>Table A (Supply)</td>
<td>All Energy Residuals (R00, R28-R31)</td>
<td>Environment</td>
<td>By definition, energy residuals cannot be supplied by the Environment</td>
</tr>
<tr>
<td>Table A (Supply)</td>
<td>R28 and R29</td>
<td>Industries, Households</td>
<td>By convention, waste supplied for energy purposes (and hence recorded in PEFA) can only be provided (supplied) by Accumulation ('end-of-life goods' arising from the stock of human produced assets) and the Rest of the World (imports).</td>
</tr>
<tr>
<td>Table A (Supply)</td>
<td>R30 and R31</td>
<td>Rest of the World</td>
<td>By definition, 'energy losses all kinds of' (R30) and 'energy incorporated in products for non-energy use (R31) cannot be supplied by the rest of the world (imports)</td>
</tr>
<tr>
<td>Table A (Supply)</td>
<td>Row STADIF (Statistical Difference)</td>
<td>All</td>
<td>By convention the 'statistical difference' between input and output of industries, households, accumulation, rest of the world, environment is recorded in the use tables B and B.2</td>
</tr>
<tr>
<td>Table A (Supply)</td>
<td>P00w</td>
<td>Households, Accumulation, Rest of the World</td>
<td>By definition supply of energy products for own use can only occur by industries and not by households, accumulation or rest of the world (see bullets at the end of section 2.2.4)</td>
</tr>
<tr>
<td>Table B</td>
<td>Table B.1 (Supply)</td>
<td>All Natural Energy Inputs (N00, N01-N07)</td>
<td>Households, Accumulation, Rest of the World, Environment</td>
</tr>
<tr>
<td>Table B</td>
<td>Table B.1 (Use)</td>
<td>All Energy Products (P00, P08-P27)</td>
<td>Environment</td>
</tr>
<tr>
<td>Table B</td>
<td>Table B.1 (Use)</td>
<td>R28, R29; R31</td>
<td>Environment</td>
</tr>
<tr>
<td>Table B</td>
<td>Table B.1 (Use)</td>
<td>R30</td>
<td>Industries, Households, Accumulation, Rest of the World</td>
</tr>
<tr>
<td>Table B</td>
<td>Table B.1 (Use)</td>
<td>R31</td>
<td>Most industries (except two), Households, Rest of the World, Environment</td>
</tr>
<tr>
<td>Table B</td>
<td>All</td>
<td>Households, Accumulation, Statistical Differences, Rest of the World</td>
<td>By convention, transformation use can only be undertaken by industries. By convention, statistical differences are recorded in Table B.2.</td>
</tr>
<tr>
<td>Table B</td>
<td>Row STADIF (Statistical Difference)</td>
<td>All</td>
<td>By convention the 'statistical difference' between input and output of industries, households, accumulation, rest of the world, environment is recorded in the use tables B and B.2</td>
</tr>
<tr>
<td>Table B</td>
<td>All Natural Energy Inputs (N00, N01-N07)</td>
<td>Industries</td>
<td>By convention, natural energy inputs are not used by industries for end use (only for transformation use, see Table B.1 and Table B, respectively)</td>
</tr>
</tbody>
</table>
Table B.2

<table>
<thead>
<tr>
<th>Table B.2</th>
<th>Row(s)</th>
<th>Column(s)</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R31</td>
<td>All industries</td>
<td>‘Energy incorporated in products’ (R31) accommodates the amount of energy resulting from the use of energy products for non-energy purposes (e.g. naphtha use to produce plastics). The end use table records the destination of these energy amounts which is obviously the stock of goods accumulated in the economy. Exceptional up-take of ‘heat from chemical sources’ by industries is recorded in Table B.1 and B, respectively.</td>
</tr>
</tbody>
</table>

Table C

<table>
<thead>
<tr>
<th>Table C</th>
<th>Row(s)</th>
<th>Column(s)</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Natural Energy Inputs (N00, N01-N07)</td>
<td>Households, Accumulation, Rest of the World, Environment</td>
<td>By convention, natural inputs are only used by industries.</td>
<td></td>
</tr>
<tr>
<td>N02-N07</td>
<td>Industries, Statistical Differences</td>
<td>Only the use of N01 may be emission-relevant as it may happen that the extracted natural input is not transformed entirely into a product but combusted on the extraction spot (e.g. flaring of natural gas). The use of other natural energy inputs N02-N07 is not emission-relevant as it is entirely transformed into energy products.</td>
<td></td>
</tr>
<tr>
<td>All Energy Products (P00, P08-P27)</td>
<td>Accumulation, Rest of the World, Environment</td>
<td>The accumulation of energy products is not emission relevant, per se. Note that emission-relevant use is defined as including only the use for combustion. Exports of energy products and residuals to the rest of the world is not emission relevant in the reporting country. The uptake of energy products by the environment is not applicable and hence cannot be emission relevant.</td>
<td></td>
</tr>
<tr>
<td>P26 and P28</td>
<td>All</td>
<td>Per se, the use of these particular energy products (electricity and heat) cannot be emission-relevant.</td>
<td></td>
</tr>
<tr>
<td>R30 and R31</td>
<td>All</td>
<td>Per se, the use of these particular energy residuals (energy losses and energy incorporated in products) cannot be emission-relevant.</td>
<td></td>
</tr>
<tr>
<td>Row STADIF (Statistical Difference)</td>
<td>All</td>
<td>Per se, the ‘statistical difference’ between input and output of industries, households, accumulation, rest of the world, environment cannot be emission-relevant.</td>
<td></td>
</tr>
<tr>
<td>PEFA_IND01 PEFA_IND02 PEFA_IND03</td>
<td>Households, Accumulation, Statistical Differences Rest of the World, Environment</td>
<td>These PEFA indicators are only applied for industries.</td>
<td></td>
</tr>
<tr>
<td>PEFA_IND01 PEFA_IND02 PEFA_IND03</td>
<td>Rest of the World, Environment</td>
<td>The accumulation of energy products and residual is not emission relevant, per se. Note that emission-relevant is defined to include only the use for combustion. Exports of energy products and residuals is not emission relevant in the reporting country. The uptake of energy residuals by the environment is not emission relevant.</td>
<td></td>
</tr>
<tr>
<td>PEFA_IND04</td>
<td>Industries, Accumulation, Statistical Differences Rest of the World, Environment</td>
<td>This indicator is only applicable for households.</td>
<td></td>
</tr>
</tbody>
</table>

Table D

<table>
<thead>
<tr>
<th>Table D</th>
<th>Row(s)</th>
<th>Column(s)</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEFA_IND01 PEFA_IND02 PEFA_IND03</td>
<td>Households, Accumulation, Statistical Differences Rest of the World, Environment</td>
<td>These key indicators apply only to industries.</td>
<td></td>
</tr>
<tr>
<td>PEFA_IND04</td>
<td>Industries, Accumulation, Statistical Differences Rest of the World, Environment</td>
<td>This indicator is only applicable for households.</td>
<td></td>
</tr>
</tbody>
</table>
4 General compilation guidelines

4.2 Important conventions in compiling PEFA

Calorific values

PEFA are recorded in the energy unit terajoule (TJ). Compilers of PEFA may need to convert from other physical units (volume, mass) to terajoule using conversion factors. The latter are called 'calorific values' and provide for each energy product the specific energy content (in Joule) per physical unit (e.g. tonne, cubic metre).

European energy statistics have introduced various conventions with regards to these conversions. In general PEFA employs the same conventions as European energy statistics which are briefly summarised in the following:

Annual Coal Questionnaire:

- Data on solid coal products are reported in thousand metric tonnes ($10^3\text{t}$) and are converted to TJ on the basis of net calorific values (NCV). The latter are provided in Table 4 of the Annual Coal Questionnaire.
- Note, default NCVs (TJ/1000 tonnes) are used for the following six secondary coal products:
  - BKB/peat briquettes 20 000
  - Coal tar 37 700
  - Gas coke 28 000
  - Coke oven coke 28 500
  - Patent fuel 29 300
  - Peat products 20 000
- Manufactured gases are already reported in terajoule on the basis of gross calorific values (GCV).

Annual Natural Gas Questionnaire:

- Data are reported in terajoules (TJ) on the basis of gross calorific values (GCV). For PEFA, all quantities need to be re-converted to a net calorific value (NCV) basis using a factor of 0.9.
Annual Oil Questionnaire:

- Data are reported in thousand metric tonnes ($10^3$ t) and are to be converted to TJ on the basis of net calorific values (NCV). The latter are provided in Table 1 and 2a of the Annual Oil Questionnaire.

Annual Electricity & Heat Questionnaire:

- Data reported are in gigawatt-hours (GWh) for electricity and terajoules (TJ) for heat. 
  $1 \text{ GWh} = 3.6 \text{ TJ}$

Annual Renewables & Waste Questionnaire:

- Electricity is reported in MWh: $1 \text{ MWh} = 0.0036 \text{ TJ}$
- Heat is reported in TJ
- Most data on renewable energy products (except liquid biofuels and charcoal) are reported in terajoule (TJ) on the basis of net calorific values (NCV).
- Liquid biofuels and charcoal are reported in metric tonnes (t) and are to be converted to TJ on the basis of net calorific values (NCV). The latter are provided in Table 3 of the Annual Renewables & Waste Questionnaire.

Non-energy use of peat, wood, etc.

As a general rule PEFA applies the same coverage of energy products as recommended in energy statistics (see IRES, paras. 3.8 – 3.10):

- All fossil fuels are within the scope of energy statistics and PEFA whether or not they are used for energy purposes, but an exception is made for peat used for non-energy purposes, which should be excluded.
- Products derived from fossil fuels are always within the scope of energy statistics and PEFA when used (or intended to be used) for energy purposes, i.e. as fuels.
- Products derived from fossil fuels used (or intended to be used) for non-energy purposes are within the scope only if they are the output of energy industries (e.g. refineries, gas plants or coal mining, coal manufacturing industries). They are included because they explain how much an apparent supply of energy is used for other purposes and allow for a complete assessment of the industries involved. One example are lubricants produced during the refining of crude oil. Even though they are ordinarily used for non-energy purposes, their production and consumption are recorded in energy statistics as this allows for the monitoring of the different products obtained from the refinery intake of crude oil and the assessment of the part of crude oil used for non-energy purposes.
- Some fuels such as peat, waste, agricultural crops or other biomass are not of fossil origin. Such products are within the scope of energy statistics and PEFA only when used for energy purposes. Thus, the inclusion of these products depends on their use, i.e. it is derived from demand-side information.

Although, strictly speaking, part of waste can have a fossil origin, this part has already been accounted for as used (often for non-energy purposes), thus it is treated together with other fuels of non-fossil origin to avoid imbalances in the energy flows.
4.3 PEFA recording conventions for 'primary' energy products...

Nuclear energy

At its 2016 meeting the Working Group on Environmental Accounts discussed and agreed on a PEFA recording convention for nuclear energy. Reporting of nuclear energy flows in the PEFA questionnaire shall be kept as flexible as allowed by the current list of energy products (see up-dated Figure 4 below): The nuclear fuel (P22) used in power plants may originate from imports or product inventories; nuclear fuel may as well originate from the domestic mining industry which extract the corresponding natural input from the domestic environment.

See also:
- document ENV/ACC/WG/1.3(2016)
- minutes of the Working Group on Environmental Accounts meeting 2016, day 3, agenda item 1.3
Biomass based 'primary' products

At its 2017 meeting the Working Group on Environmental Accounts discussed and agreed on conventions for the recording of biomass based energy flows in PEFA.

Introduction into the issue

PEFA record the supply and use of solid, liquid and gaseous biofuels. Guidelines in the 2014 draft version of the PEFA Manual suggest that biofuels – i.e. any biomass used as a fuel – are recorded in form of supply and use of energy products. I.e. it is assumed that the respective biomass is the output of a production process and has become a product in the sense of national accounts before it is used as a fuel.

One may raise the question whether this is always the case. The labels of some of the biofuels recorded in IEA/Eurostat Annual Questionnaires (AQ) – which is the main data source for compiling PEFA – suggest that the respective biomass is at least partly rather a residual than a product in the sense of the SEEA 2012-CF. This yields in particular for the following labels of solid biofuels recorded in Table 4 of the Annual Renewables & Waste Questionnaire:

- **Fuelwood, wood residues and by-products**: Fuelwood or firewood (in log, brushwood, pellet or chip form) obtained from natural or managed forests or isolated trees. Also included are wood residues used as fuel and in which the original composition of wood is retained.
- **Black liquor**: Energy from the alkaline-spent liquor obtained from the digesters during the production of sulphate or soda pulp required for paper manufacture.
- **Bargasse**: Fuel obtained from the fibre which remains after juice extraction in sugar cane processing.
- **Animal waste**: Energy from excreta of animals, meat and fish residues which, when dry, are used directly as a fuel. This excludes waste used in anaerobic fermentation plants. Fuel gases from these plants are included under biogases.
- **Other vegetal materials and residues**: Biofuels not specified elsewhere and including straw, vegetable husks, ground nut shells, pruning brushwood, olive pomace and other wastes arising from the maintenance, cropping and processing of plants.

For above cases, drawing the theoretical borderline between products and residuals seems not always straightforward. In practice it might be very difficult for compilers of PEFA to obtain sufficient information to split above biofuels into products and residuals.

Given this, The Working Group followed Eurostat’s recommendation to maintain the current general guideline to record all biomass used as fuel in form of supply and use of energy products. Notably, the input into the production of these products needs also to be recorded in PEFA (see below).

Three groupings of energy products are distinguished in PEFA in order to show the supply and use of biofuels:

- P23 'Wood, wood waste and other solid biomass, charcoal' (=solid biofuels),
- P24 'Liquid biofuels',
- P25 'Biogas'.
In the IEA/Eurostat Annual Renewables & Waste Questionnaire – an important data source for PEFA – biofuels are broken down in more detail (see Annex 3 of document ENV/ACC/WG/3.3(2017)).

The following questions related to the recording of biofuels in PEFA are at stake:

1. Which economic activities (NACE/HH) produce as output the three biofuel product groupings distinguished in PEFA? This information on the producer is not provided in Annual Renewables & Waste Questionnaire.

2. What are the biomass inputs (energy content) to these domestic production processes, and where do these biomass inputs come/originate from? This biomass input is not recorded explicitly in Annual Renewables & Waste Questionnaire. It may originate from 'old' biomass such as e.g. sewage sludge or waste landfilled, or from 'fresh' biomass such as maize. In both cases, it can be imported or stem from domestic sources.

**Recording convention recommended**

The Working Group agreed in general to establish a flexible recording of biomass based energy flows.

As a principle, biomass used as fuel is in any case recorded in form of supply and use of energy products.

The respective production process is assigned to potentially any economic activity (NACE division or private household).

There are three 'pathways' options to record the biomass input into these production processes (see up-dated Figure 6 below):

1. In case the biomass input originates from domestic nature = natural energy input, code N06
2. In case the biomass input originates from domestic stock = energy residual, code R28
3. In case the biomass input originates from rest of the world (imports) = energy residual, code R28
Figure 6 (up-date): 'Primary' produced based on biomass as recorded in PEFA

See also:
- document ENV/ACC/WG/3.3(2017)
- minutes of the Working Group on Environmental Accounts meeting 2017, day 1, agenda item 3.3

'Primary' energy from waste

Figure 7 of the 2014 draft version of the PEFA Manual has been slightly up-dated (see below). The scope of economic activities using waste as a fuel has been extended. Waste may be used potentially by any NACE division and also by private households to produce electricity/heat.

Figure 7 (up-date): PEFA – recommended recording of waste related energy flows
5 References


See also http://unstats.un.org/unsd/envaccounting/energy.asp.

see also http://unstats.un.org/unsd/nationalaccount/sna.asp

European System of Accounts (ESA2010): final version
see also http://ec.europa.eu/eurostat/web/esa-2010/overview

see also http://ec.europa.eu/eurostat/web/esa-supply-use-input-tables/overview

Eurostat PEFA Manual (2014 draft version)

Including the Standard International Energy Product Classification (SIEC)


IEA/Eurostat/UNECE: Annual Energy Questionnaires & reporting instructions