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Physical energy flow accounts (PEFA): clarification of technical and methodological issues

Eurostat – Unit E2

Working Group Environmental Accounts

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BECH Building – Room Quetelet

1 Introduction

This document presents technical and methodological questions related to physical energy flow accounts (PEFA) that came up during the pilot data collections. Clarification of these technical and methodological issues will facilitate and improve incoming PEFA data collections.

The document has detailed questions at the end of each section. The Working Group members are invited to present their views in the meeting.

In addition the Working Group members are invited to suggest further proposals to improve the PEFA production cycle.

2 Technical and methodological issues to be improved/changed (lessons learnt from pilot data collection)

The following sections provide some technical and methodological issues that have been arising throughout the PEFA pilot data collections.

2.1 Reporting of time series in one single questionnaire

The current PEFA questionnaire is designed to accommodate only one reference year. Each questionnaire is validated independently. A few countries sent PEFA-questionnaires for several reference years and the validation ('Ping-Pong') has been done separately for each single questionnaire and reference year respectively.

In order to make the validation more efficient it may be advisable to make the EXCEL-questionnaire multi-annual – similar to the questionnaires and validation procedures for air emissions accounts (AEA) and economy-wide material flow accounts (EW-MFA).

Technically this can be done by introducing masks/forms for tables A to E into which the countries can paste data for a given selected year. The year wise data are written (exported) to 31 additional time series sheets, one for each energy product (natural inputs N01 to N07, products P08 to P27, and residuals R28 to R31). A similar solution is employed in the IEA/Eurostat annual energy statistics questionnaires.

Making the PEFA questionnaire multi-annual raises the question of which period[1] should be foreseen in the 31 product-sheets. Eurostat suggests starting the time series with the same reference year 2008 as in air emissions accounts (AEA). 2008 is also the year in which NACE revision 2 entered into force.

The above described technical extension would allow countries to report

[1] Regulation 691/2011 Annex VI section 4 requires that countries have to report the 3 most recent reference years each reporting year (starting with reference years 2014 and 2015 in reporting year 2017).

- PEFA data for the most recent reference year(s) i.e. data are transmitted for the first time; and
- revised data for earlier reference years, i.e. reference years for which data were already reported in previous transmissions; the revised data would 'overwrite' vintage data in Eurostat's database.

Participants are invited to answer the following questions:

- **Should Eurostat re-design the PEFA questionnaire to accommodate reporting of several years instead of single reference year?**
- **Which time period should the PEFA-questionnaire cover? Eurostat suggests starting with 2008 (same as in AEA time series collected and published).**

2.2 Recording of nuclear energy

Based on discussions in the task force, the draft PEFA manual (version 2014) recommends a specific way of recording the flow of nuclear energy through the environment-economy-environment system.

There are however at least three options to record the flow of nuclear energy through the system. All three options have in common that the amount of nuclear fuel (P22) input to nuclear power plants is three times higher than the output of electricity and heat. The three options differ as regards the attributed origin of the nuclear fuel (P22):

- Option 1 attributes the supply of nuclear fuel (P22) to the domestic mining industry. The latter is assumed to extract uranium ores from the domestic environment in form of natural input (N02). Option 1 is currently recommended in the draft PEFA manual (see Figure 4, p. 39). This option is conceptually close to energy statistics where nuclear energy is considered being 'domestic'.
- Option 2 attributes the supply of nuclear fuel (P22) to imports from the rest of the world. This implies that the energy amount originates from the environment in the rest of the world.
- Option 3 attributes the supply of nuclear fuel (P22) to withdrawals from product inventories (column: 'changes in inventories and produced assets') – the origin of the original natural input flow remains unknown. This option is conceptually also close to energy statistics where nuclear energy is considered being 'domestic'.

None of the three options fully reflects the reality (see e.g. EURATOM Supply Agency annual report). The flow of nuclear energy is difficult to portray and stretches over several accounting periods: Within the EU there is little uranium mining. Most of the natural uranium ore is imported into the EU where it is further refined to nuclear fuel. Once produced, the nuclear fuel may stockpile many years in product inventories. The fuel which is loaded into reactors may stay up to three years in the reactor.

Eurostat prefers the currently applied option 1 because it is in line with energy statistics which consider nuclear electricity as a domestic source of energy.

Participants are invited to express their preferred option (1, 2 or 3) for the recording of the nuclear energy flow in PEFA.

2.3 Splitting Table B in the PEFA questionnaire into two sub-tables B.1 and B.2

Table B of the current PEFA questionnaire (see scheme in Annex to this document) is a physical use table and records the use of natural energy inputs, energy products, and energy residuals (row-wise) by destination, i.e. 'user' (column-wise). The current PEFA Table B does not allow distinguishing between *end use* and *transformation use* [2] of energy products as recommended in the SEEA-Central Framework (section 3.4.3).

The distinction between *transformation use* and *end use* is a common element in standard energy statistics (see e.g. IEA/Eurostat Energy Statistics Manual) and supports the understanding of energy flows through the various stages of the economic system. As this distinction is available in the primary energy statistics it makes sense to also keep it in PEFA. Moreover, experiences from the pilot data collection suggest that the PEFA compilation may be facilitated by keeping the distinction.

Eurostat proposes to add two sub-tables to the PEFA questionnaire – representing two layers of the current Table B (one for the *transformation use* and another for the *end use*):

- Table B.1 would record the *transformation use* of energy products;
- Table B.2 would record the *end use* of energy products.

In the PEFA-questionnaire Table B would be automatically calculated as the sum of sub-tables B.1 and B.2.

Participants are asked to endorse adding sub-tables B.1 and B.2 to the PEFA-questionnaire.

2.4 Improving compilation guidance for Table C 'emission-relevant use of energy flows' – clarify certain conceptual issues (e.g. only combustion emission-relevant)

Table C of the PEFA questionnaire is a physical use table that records the *'emission-relevant'* use of energy flows[3] (row-wise) by the using/emitting unit (column-wise).

The draft PEFA manual defines emission-relevant use of natural energy inputs, energy products, and energy residuals as the use of energy carriers in/during economic production and consumption activities – mainly combustion processes – resulting in physical flows of gaseous or particulate materials to the atmosphere.

The pilot data collection showed that the identification of emission-relevant use of energy products, energy residuals and natural energy inputs is complex in particular for non-

[2] = use of energy products for the transformation into other so-called secondary energy products (e.g. from coal to electricity)
[3] = natural energy inputs, energy products, and energy residuals

combustion processes. Better compilation guidance is required but it needs further investigations too (e.g. studying the methods for compiling UNFCCC[4] greenhouse gas inventories and CLRTAP[5] emissions inventories for air pollutants).

Most of emission-relevant energy use relates to the combustion (i.e. oxidation) of energy carriers (i.e. hydrocarbons) resulting in emissions of CO_2, N_2O, NO_x, SO_x, NMVOC, and CO.

The identification of emission-relevant use of energy carriers for combustion is relatively easy: CRF[6]/NFR[7] heading 1.A 'energy - combustion' includes all emissions originating from the combustion of energy carriers. Under this heading emissions are estimated by multiplying the energy use (= activity parameter) with certain emission factors.

The question arises whether non-combustion-emissions can also unambiguously be attributed to the use of energy carriers and should be taken into account and recorded in PEFA Table C?

The compilation methods for CRF/NFR section 1.B 'energy – fugitive emissions' propose as activity parameter the amounts of energy carriers stocked, transported and/or moved instead of the actual use of a certain energy product (i.e. energy flow). E.g. the storage of a certain amount of coal may lead to certain amounts of emissions of particulate matter.

Eurostat suggests to record only combustion related energy use in PEFA Table C.

Participants are invited to express their view on Eurostat's proposal to record only combustion-related energy use in Table C.

3 Possible improvements of the PEFA-builder

Eurostat has invested significant resources in developing the so-called *'PEFA-builder'*. This is an IT-tool that facilitates the compilation of PEFA tables A, B, and D starting from energy statistics (i.e. IEA/Eurostat annual energy questionnaires).

The PEFA-builder serves various aims:

- Facilitating the work of national PEFA compilers and minimising the effort by using already existing data, namely IEA/Eurostat annual energy questionnaires. However, it has to be noted that additional information has to be fed into the PEFA-builder (industry detailing, residence adjustments for transport).
- Enhancing cross-country-comparability of PEFA through harmonisation of results by applying unambiguous assignment methodologies and calorific values.
- Supporting Eurostat in gap-filling if necessary.

[4] = United Nations Framework Convention on Climate Change
[5] = Convention on Long-range Transboundary Air Pollution
[6] Common reporting format = classification of emission sources employed in UNFCCC greenhouse gas inventories
[7] Nomenclature for reporting = classification of emission sources in CLRTAP emission inventories for air pollutants

Eurostat highly recommends using the PEFA-builder, in particular because of the enhanced cross-country-comparability (harmonisation) of results.

Potential areas to improve/extend the PEFA-builder include among others:

- Add routines to populate PEFA Table C 'emission-relevant use'.
- Add routines to populate PEFA Tables B.1 and B.2 (see section 2.3 above).
- Making the PEFA-builder multi-annual (see section 2.1 above).
- Adjusting the recording of nuclear energy (see section 2.2 above).
- Add a module on 'autoproducer' of electricity and heat.
- Add monetary use table

However, further investing into the PEFA-builder would be justified only if enough countries use this IT-tool. Eurostat noticed that not all countries are making use of the PEFA-builder.

Participants are invited to indicate if they use (or will use) the PEFA-builder.

If not, participants are invited to explain why they do not use the PEFA-builder.

How can the PEFA-builder be made more useful to countries? What extensions/improvements would you give priority?

Annex: Scheme of the PEFA-questionnaire (2015 version)

Table A - Physical Supply Table for Energy Flows

	industries	households	accumulation	rest of world	environment	Total
natural energy inputs					A.	TSNI
energy products	C.			D.		TSP
energy residuals	I.	J.	K.	L.	M.	TSR

Table B - Physical Use Table for Energy Flows

	industries	households	accumulation	rest of world	environment	Total
natural energy inputs	B.					TUNI
energy products	E.	F.	G.	H.		TUP
energy residuals	N.		O.	P.	Q.	TUR

Table D - Vectors of Key Energy Indicators

	industries	households	accumulation
energy key indicator 1			
…			
energy key indicator 7			

Table C - Physical Use Table of Emission-relevant Use of Energy Flows

	industries	households	accumulation	rest of world	environment	Total
natural energy inputs	B.er					
energy products	E.er	F.er	G.er			
energy residuals	N.er					

Table E - Bridge Table

energy key indicator (residence principle)
- energy use by resident units abroad
+ energy use by non-residents on territory
= energy key indicator (territory principle)

Legend:

	grey cells denote logical impossible cases for PEFA
	white cells: contain numbers or symbol ':' (not available)
R.	capital letters denote sub-matrices (cells) in accordance with SEEA-CF