



Validation rules for physical energy flow accounts (PEFA)

Rules for UNSD/OECD PEFA questionnaire for data collection

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1. Introduction

Physical energy flow accounts (PEFA) record 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).

Physical energy flow accounts record energy data in relation to the economic activities of resident units of national economies in a breakdown by economic activity. They present the supply and use of natural energy inputs, energy products and energy residuals. Economic activities comprise production, consumption, and accumulation.

This document presents the validation rules for PEFA questionnaire used by the UN Statistics Division (UNSD) and OECD for global data collection for PEFA. These rules are in line with the PEFA [validation rules used by Eurostat](#).

Many of the validation rules in this document can and should be checked when filling the questionnaire –in particular those checks resulting in ERROR (see next chapter). This will help ensure that national statistical offices run some key validation rules and adjust their data, if needed, before sending the data to OECD and UNSD. This will facilitate the validation process done by the international organizations and ensure a faster dissemination of the data.

Additional questions may be asked beyond the presented rules if any specific observations are made during data validation process.

Feedback on this document is welcomed and can be sent to SDD.SEEA@oecd.org and seea@un.org.

The Annex to this document presents the different codes used in the PEFA questionnaire, which corresponds to the [SEEA Global SDMX Data Structure Definitions \(DSDs\)](#).

2. Types of validation results

A validation rule is a logical statement applied to data. Below is a typology of possible validation results which shows how validation rules will be applied.

OK	This means that the transmitted data passed the validation rule and no specific follow up is required. However, it might be possible that questions will be asked during a later stage of the validation process. In general, validation rules that have 'OK-result' are not listed in the validation report.
ERROR	This means that an issue related to structure and completeness was detected in the data. An 'ERROR-result' will usually trigger questions to the sender seeking an explanation, clarification and correction.

WARNING This means that some reported element is 'suspicious'. It might refer to an individual data point, combination of data points or calculations based on reported data points. It highlights an issue of attention and for which a valid explanation might exist. A 'WARNING-result' will usually trigger questions to the sender seeking an explanation and clarification of the reported values. Countries can accelerate the validation procedures by providing footnotes explaining these warnings.

INFO This means that some reported element is simply an issue of attention to be highlighted. Further clarification or explanation is not required.

When a validation rule triggers an ERROR or WARNING, UNSD/OECD will follow up with the compiler. This document addresses ERROR and WARNING rules.

3. Validation rules for PEFA

This chapter presents a list of validation rules for PEFA.

The validation rules are presented by categories. For each validation rule the type of validation result is indicated in rectangular brackets [ERROR, WARNING].

This document expresses the rules in a language close to the terms of the Excel questionnaire (such as questionnaire cells, symbols, footnotes, etc.), as this is the terminology familiar to most compilers.

3.1 Completeness and structural integrity

The validation checks on completeness and structural integrity will be completed when converting the excel questionnaire into an SDMX conformant CSV file. The questionnaire will be checked to ensure that all values are in the correct format, valid value types (e.g. alphanumeric) are provided for all dimensions, and no rows/columns have been added or deleted from the questionnaire.

At this time, the questionnaire will be checked to ensure that at minimum, Tables A and B have been filled out. If Table B.1, Table B.2 and Table E are not completed, UNSD/OECD will check with the compiler that this information is indeed not available.

3.2 Symbols

Symbols are the alphanumeric characters of a reported value for a data point (cell). A check is performed to ensure that all data points have a valid symbol, and alert if invalid symbols are entered in the questionnaire. Non-valid symbols in filled tables will trigger an [ERROR].

Valid symbols are:

- Positive value and zero value;
- Negative value, for the following characteristics:
 - “Changes in inventories and produced assets” and “Statistical differences
 - for the bridging item 'other adjustments and statistical discrepancy';
- ‘Not available’ and ‘missing’ value for data points which are not available (which should be distinguished from a value of zero).

3.3 Footnotes

The Excel questionnaire contains two types of footnote symbols: symbols for pre-defined footnotes (letters) and symbols for free-text footnotes (numbers).

Rule 1. This rule checks the correctness of symbols of pre-defined footnotes. The four valid pre-defined footnotes include:

Footnote symbol in Excel questionnaire	Label of pre-defined footnote	Explanation/Meaning
b)	Break in series	Break occurs when there is a change in the methodology and/or standards for compiling and/or defining a variable over time. The symbol b) is to be attached to the first time period after the break.
c)	Confidential	Confidential data are data which are subject to confidentiality clauses
d)	Secondary confidentiality	Secondary confidential data are data made confidential in order to prevent third parties from indirectly calculating the data points genuinely flagged as confidential.
e)	Estimated data	Used if one of several data points has been calculated using a significantly different methodology and/or sources than the rest of the data points in the questionnaire.
p)	Provisional	The data provider considers that the data is expected to be revised. In the case of early estimates, the symbol ‘e’ is deemed sufficient, and the ‘p’ flag can be

		omitted. Note that all 'p' (provisional) flags sent during a given data collection will be removed during the subsequent data collection, unless the 'p' flags are again resubmitted.
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The use of non-valid footnote symbols triggers an [ERROR] result.

Rule 2. A free text footnote symbol with no text defined for it in the footnote area of the questionnaire triggers an [ERROR] result.

Rule 3. The following combinations of cell content (value of data point) and pre-defined footnote symbol trigger a [WARNING]: a cell containing a colon (:) meaning 'not available' along with the pre-defined footnotes p) or e).

Rule 4. Only the following combinations of pre-defined footnotes are possible and allowed. Combinations beyond those trigger an [ERROR] result.

Break in time series (b) whilst estimated data (e)
Break in time series (b) whilst provisional (p)
Break in time series (b) whilst estimated data (e) whilst provisional (p)
Confidential (c) whilst break in time series (b)
Secondary confidentiality (d) whilst break in time series (b)
Estimated data (e) whilst provisional (p)

3.4 Confidentiality

The following rules are related to confidentiality.

Rule 5. Confidentiality at the first hierarchical level of ISIC industries (Level 1 of the ISIC classification or households) or at energy flows (Natural energy inputs, energy products, and energy residuals) will trigger an [ERROR]. For ISIC Rev. 4, this is Level 1 (i.e. A, B, C, etc). For the energy flows this is the level of the three generic types of energy flows (i.e. natural energy inputs N00, energy products P00, and energy residuals R00).

3.5 Internal consistency of hierarchically classified dimensions/characteristics

This set of rules relates to the hierarchically classified characteristics (dimensions), namely economic activities (ISIC Rev.4), energy flows (i.e. natural energy inputs, energy

products, and energy residuals), type of supply/use table, PEFA indicators, and bridging items. The internal consistency requires that – for each dimension – the sum of components equals the respective superior aggregate.

Rule 6. For the dimension economic activities (ISIC Rev.4), each of the equations presented in the following table must hold when all components are available. Please note that the equations number 2-14 and 16 apply only to the “Detailed” template, while equation number 15 applies only to the aggregate template. Equation 1 applies to all templates. Equation number 17 applies to all templates.

This check refers to Tables A, B, B.1, B.2, C and D in which dimension ISIC Rev 4 is employed.

No.	Equations	Applicable template
1	$ATU = A + B + C + D + E + F + G + H + I + J + K + L + M + N + O + P + Q + R + S + T + U + _X$	Detailed, medium and aggregate
2	$A = A01 + A02 + A03$	Detailed only
3	$C = C10_C12 + C13_C15 + C16 + C17 + C18 + C19 + C20 + C21 + C22 + C23 + C24 + C25 + C26 + C27 + C28 + C29 + C30 + C31_32 + C33$	Detailed only
4	$E = E36 + E37 - E39$	Detailed only
5	$G = G45 + G46 + G47$	Detailed only
6	$H = H49 + H50 + H51 + H52 + H53$	Detailed only
7	$J = J58 + J59_J60 + J61 + J62_J63$	Detailed only
8	$K = K64 + K65 + K66$	Detailed only
10	$M = M69_M70 + M71 + M72 + M73 + M74_M75$	Detailed only

11	$N = N77 + N78 + N79 + N80_N82$	Detailed only
12	$Q = Q86 + Q87_Q88$	Detailed only
13	$R = R90_R92 + R93$	Detailed only
14	$S = S94 + S95 + S96$	Detailed only
15	$_X = ATU - (A+B+C+D+H)$	Aggregate only
16	$HH = HH_TRA + HH_HEAT + HH_OTH$	Detailed only
17	ATU_HH—Total supply/use of energy flows (natural inputs, products and residuals)= ATU + HH + ATU_HH (Changes in inventories and produced assets +Statistical differences + Rest of world—economic activities + Environment)	Detailed, medium and aggregate

An [ERROR] result is triggered if this rule is not met. Differences smaller than 0.01 are accepted, i.e. they do not trigger an error.

Rule 7. For the dimension energy flow, each of the equations presented in the following table must hold when all components are available.

This check refers to Tables A, B, B.1, B.2, C in which the dimension of energy flow is employed.

1	$N00 = N01 + N02 + N03 + N04 + N05 + N06 + N07$
2	$P00 = P08 + P09 + P10 + P11 + P12 + P13 + P14 + P15 + P16 + P17 + P18 + P19 + P20 + P21 + P22 + P23 + P24 + P25 + P26 + P27$
3	$R00 = R28 + R29 + R30 + R31$
4	$N00_P00_R00 = N00 + P00 + R00 + SD_IO$
5	$EPRD_OUSE < N00_P00_R00$

An [ERROR] result is triggered if this rule is not met. Differences smaller than 0.01 are accepted, i.e. they do not trigger an error.

Rule 8. For the dimension PEFA indicator, each of the equations presented in the following table must hold when all components are available.

These checks refer to Table D.

1	$PEFA_IND06 = PEFA_IND06a + PEFA_IND06b$
2	$PEFA_IND14 = PEFA_IND14a + PEFA_IND14b$

An [ERROR] result is triggered if this rule is not met. Differences smaller than 0.01 are accepted, i.e. they do not trigger an error.

Rule 9. For the dimension bridging item each of the equations presented in the following table must hold when all addends are available.

These checks refer to Table E.

1	$TER = RES - RES_ABR + TER_NRES + ADJ_SD$ Total energy supply (territory principle) = Total energy use by resident unit (domestic energy use- residence principle) - Energy use by resident units, fuel purchased abroad-total + Energy use by non-residents on the territory (only if included in total energy supply), fuel purchased on the territory – total + Other adjustments and statistical discrepancies
2	$RES_ABR = RES_ABR_FWTR + RES_ABR_LTR + RES_ABR_WTR + RES_ABR_ATR$ (Energy use by resident units, fuel purchased abroad-total = Energy use by residents units, fuel purchased abroad - fishing vessels + Energy use by resident units, fuel purchased abroad - land transport + Energy use by resident units, fuel purchased abroad – water transport + Energy use by resident units, fuel purchased abroad - air transport)
3	$TER_NRES = TER_NRES_LTR + TER_NRES_WTR + TER_NRES_ATR$ Energy use by non-residents on the territory (only if included in total energy supply), fuel purchased on the territory - total = Energy use by non-resident units (only if included in total energy supply), fuel purchases on the territory – land transport + Energy use by non-resident units (only if included in total energy supply), fuel purchased on the territory – water transport + Energy use by non-resident units (only if included in total energy supply), fuel purchased on the territory – air transport

An [ERROR] result is triggered if this rule is not met. Differences smaller than 0.01 are accepted, i.e. they do not trigger an error.

Rule 10. For the dimension type of supply/use table, all equations presented in the following table must hold when all components are available.

These checks refer to Tables B, B.1 and B.2.

1	For all data points: $\text{Table B} = \text{Table B.1} + \text{Table B.2}$
2	For all data points: $\text{Table B} \geq \text{Table C}$

An [ERROR] result is triggered if this rule is not met. Differences smaller than 0.01 are accepted, i.e. they do not trigger an error.

3.6 Internal consistency between tables (identities)

This set of rules relates to identities involving data points in Tables A and B, as well as Tables D and E. An E.

An [ERROR] result is triggered if these rules are not met. Differences smaller than 0.01 are accepted, i.e. they do not trigger an error.

Rule 11. The rule on the identity of supply and use of energy flows checks that total supply (row totals of Table A) equals total use (row totals of Table B) for each natural energy input, energy product, energy residual and their sum.

Rule 12. The rule on the identity of inputs and outputs of economic activities checks that total supply (column totals in Table A) is equal to total use (column totals in Table B) for each production activity and household activity. It does not need to be equal for accumulation, rest of world or flows to/from the environment.

Rule 13. The rules on key indicators check that the different vectors of key indicators (Table D) are equal to the sum of respective supplies (Table A) and uses (Table B) of energy flows.

PEFA_IND01 = N00 (Table B); for ISIC = 'A' to 'U', including 'ATU', as applicable
Extraction of natural energy inputs by production activities = Use of natural energy inputs

PEFA_IND02 = P00 (Table A); for ISIC = 'A' to 'U' and ATU'

Domestic production of energy products = Supply of energy products by production activities from Table A

PEFA_IND03 = P00 (Table B); for ISIC = 'A' to 'U' and 'ATU' 13 Intermediate consumption of energy products = Use of energy products by production activities from Table B
PEFA_IND04 = P00 (Table B); for ISIC = 'HH', 'HH_HEAT', 'HH_TRA', 'HH_OTH' Household consumption of energy products = Use of energy products by households from Table B
PEFA_IND05 = R28 (Table B) + R29 (Table B); for 'A' to 'U' and 'ATU' and 'HH', 'HH_HEAT', 'HH_TRA', 'HH_OTH', as applicable Use of waste for energetic purposes = Use of renewable waste + Use of non-renewable waste by production and household activities
PEFA_IND06 = R30 (Table A) + R31 (Table A); for 'A' to 'U' and 'ATU' and 'HH', 'HH_HEAT', 'HH_TRA', and 'HH_OTH', as applicable Net domestic energy use = Supply of energy losses of all kinds + Supply of energy incorporated in products for non-energy use, by production and household activities
PEFA_IND06a = R30 (Table A); for 'A' to 'U' and 'ATU' and 'HH', 'HH_HEAT', 'HH_TRA' and 'HH_OTH', as applicable Net domestic energy use for energy purposes = Supply of energy losses of all kinds of, by production and household activities
PEFA_IND06b = R31 (Table A); for 'A' to 'U' and 'ATU' and 'HH', 'HH_HEAT', 'HH_TRA' and 'HH_OTH', as applicable Net domestic energy use for non-energy purposes = Supply of energy incorporated in products for non-energy use, by production and household activities
PEFA_IND07 = N00_P00_R00 (Table A); for 'A' to 'U' and 'ATU' and 'HH', 'HH_HEAT', 'HH_TRA', 'HH_OTH', 'ATU_HH-Changes in inventories and produced assets' Total energy input/output = Total supply of energy by production and household activities, and accumulation from Table A which is identical with Total use of energy by production and household activities, and Changes in inventories and produced assets from Table B
PEFA_IND08 = N00_P00_R00 (Table C) ; for 'A' to 'U' and 'ATU' and 'HH', 'HH_HEAT', 'HH_TRA', 'HH_OTH' and SD_IO Emission-relevant use of energy = Total emission-relevant use by production and household activities, and statistical differences from Table C

PEFA_IND09 = P00: ATU_HH—Total Use of Energy Products (Table B) + N00_P00_R00:ATU_HH-Rest of the World, economic activities (Table A) Direct energy input (DEI) = Total use of energy products from Table B + Total supply of energy by the rest of the world, i.e. imports from Table A
PEFA_IND10 = N00_P00_R00: ATU_HH—Environment (Table B) + N00_P00_R00: ATU_HH—Rest of the World, economic activities (Table B) Direct energy outputs = Total use of energy by the environment + Total use of energy by the rest of the world, i.e. exports from Table B
PEFA_IND12 = N00_P00_R00: ATU_HH—Changes in inventories and produced assets (Table B) – N00_P00_R00: ATU_HH— Changes in inventories and produced assets (Table A) + N00_P00_R00:SD_IO (Table B) Net additions to stock (reported) = Use of energy by changes in inventories and produced assets (additions to stock) and statistical differences from Table B minus Supply of energy by changes in inventories and produced assets (withdrawal from stock) from Table A
PEFA_IND13 = PEFA_IND09 – N00_P00_R00: ATU_HH—Rest of the world, economic activities (Table B) Domestic energy consumption = Direct energy input (DEI) - Total use of energy by the rest of the world, i.e. exports from Table B
PEFA_IND14 (Table A) Imports of energy products (P00) and energy residuals (waste for energetic use) = Total imports
PEFA_IND14a (Table A) Imports of total energy products (P00) = Total imports of energy products
PEFA_IND14b (Table A) Imports of energy residuals (waste for energetic use) = Total imports of energy residuals
PEFA_IND15 = N00_P00_R00: ATU_HH—Environment (Table B) Domestic processed output = Total use of energy by the environment from Table B

PEFA_IND16 = N00_P00_R00: ATU_HH—Rest of the world, economic activities (Table B) Exports of energy products and residuals = Total use of energy products and residuals by the rest of the world, i.e. exports from Table B
PEFA_IND17a = N00_P00_R00: ATU_HH—Changes in inventories and produced assets (Table A) Supply of energy residuals from stock = Supply of energy residuals by changes in inventories and produced assets (withdrawal from stock) from Table A
PEFA_IND17b = N00_P00_R00: ATU_HH—Changes in inventories and produced assets (Table B) Additions (use) of energy products and residuals to stocks = Use of energy products and residuals by changes in inventories and produced assets (additions to stocks) from Table B
PEFA_IND18 = N00_P00_R00:ST_IO (Table B) Statistical discrepancy between supply and use of energy products and residuals = Total use of energy by statistical discrepancy from Table B

Rule 14. This rule checks that the total energy use by resident units (Table E) is equal to the row sum of net domestic energy use (Table D).

RES (Table E) = row sum of PEFA_IND06 Total energy use by resident units (domestic energy use) - residence principle (Table E) = Net domestic energy use (Table D)
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3.7 Plausibility of revisions

This check detects implausible revisions between the current and previous year's questionnaire. Implausible revisions are defined in the form of thresholds, i.e. a maximum change rate that is still considered plausible.

Rule 15. 'Implausible revisions' are those bigger than 40% if the cell contributes at least 10 % to the respective column total or at least 10% to the respective row total.

This rule refers to Tables A, B, B.1, B.2, C and D.

Implausible revisions trigger a [WARNING].

3.8 Internal plausibility

These checks verify the internal plausibility of the reported data, which is the plausibility within a reported dataset.

Rule 16. Plausibility of the production activity extracting, i.e. using, natural energy inputs: the following table specifies for each natural energy input the most plausible production activities typically extracting the respective natural input.

This rule concerns Tables B and B.1.

Natural energy input	Plausible economic activities (ISIC Rev.4)
N01: Fossil non-renewable natural energy inputs	ISIC B
N02: Nuclear non-renewable natural energy inputs	ISIC B
N03: Hydro based renewable natural energy inputs	ISIC D
N04: Wind based renewable natural energy inputs	ISIC D
N05: Solar based renewable natural energy inputs	ISIC D
N06: Biomass based renewable natural energy inputs	ISIC A01, A02, B, D, C20

Rule 17. Plausibility of the supply and use of nuclear fuel (P22): specifies those economic activities for which supply and use of nuclear fuel is considered plausible.

This rule concerns Tables A, B, B.1, B.2 and C.

Subject	Plausible economic activities (ISIC Rev. 4)
Supply of nuclear fuel (P22)	ISIC B, Imports
Use of nuclear fuel (P22)	ISIC D, Changes in inventories, Exports

A [WARNING] result is triggered if this rule is not met.

Rule 18. Plausibility of the use of crude oil (P12) and supply of derived products (P14-P21) by ISIC C19: specifies that the use of crude oil by ISIC C19 (or ISIC C in the case of medium and aggregated templates) must be greater than or equal to the sum of the supply derived products (P14-P21) by ISIC C19 or ISIC C, as applicable.

This rule concerns Tables A and B1 (Table B should be used if Table B1 is not filled).

A [WARNING] result is triggered if this rule is not met. Differences smaller than 0.01 are accepted, i.e. they do not trigger a warning.

Rule 19. Plausibility of the sum of electricity (P26) and heat (P27) supply by ISIC D: specifies that the sum of electricity and heat supply in Table A should not exceed the sum of transformation use (Table B1) of all energy products (P00) and natural energy inputs (N00).

This rule concerns Tables A and B1 (Table B should be used if Table B1 is not filled).

A [WARNING] result is triggered if the rule is not met. Differences smaller than 0.01 are accepted, i.e. they do not trigger a warning. This concerns Tables A and B1. This rule does not apply if Table B1 is not filled.

Rule 20. The rule on ISIC Rev. 4 L68A (Imputed rents of owner-occupied dwellings) checks that the supply and use of energy flows reported by ISIC Rev. 4 L68A should be 0.

L68A = 0

A [WARNING] result is triggered if the rule is not met. Differences smaller than 0.01 are accepted, i.e. they do not trigger a warning. This rule concerns Tables A, B, B.1, B.2 and C.

Rule 21. Plausibility of the statistical differences reported for a certain energy flow (i.e. natural energy inputs, energy products, and energy residuals): For each energy flow, the statistical differences should be below 5% of the total use of the respective energy flow.

This rule concerns Tables B, B.2 and C.

SD_IO (Tables B, B.2, C) <= 5% of Total supply and use (Tables B, B.2, C); for N00, N01-N07, P00, P08-P27, R00, R28-R31

A [WARNING] result is triggered if this rule is not met.

Rule 22. Plausibility of the statistical differences reported for a certain production and household activity: For each economic activity, the statistical difference should be below 5% of total use energy flow (i.e. natural inputs, products, residuals) of the given economic activity.

SD_IO (Tables B, B.2) $\leq 5\%$ of $N00_P00_R00$ (Tables B, B.2); for 'A' to 'U' and 'ATU' and 'HH', 'HH_HEAT', 'HH_TRA', 'HH_OTH'
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A [WARNING] result.is triggered if the rule is not met. This rule concerns Tables B and B.2

Rule 23. Plausibility of ‘total energy use by resident units (domestic energy use) – residence principle’: It is implausible that the ‘total energy use by resident units (domestic energy use) – residence principle’ equals the ‘total energy supply - territory principle’.

TER (Table E) $\neq RES$ (Table E)

A [WARNING] result.is triggered if the rule is not met. Differences smaller than 0.01 are accepted, i.e. they do not trigger an error. This rule concerns Table E.

Rule 24. Plausibility of bridging item RES_ABR_WTR (Table E): Use of energy products by water transport (ISIC H50) reported in Table B must be bigger than or equal to bridging item RES_ABR_WTR ‘Energy use by resident units abroad, fuel purchased abroad - water transport’.

This rule applies to Tables B and E.

$P00:H50$ (Table B) $\geq RES_ABR_WTR$ (Table E)
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A [WARNING] result.is triggered if the rule is not met.

Rule 25. Plausibility of bridging item RES_ABR_ATR (Table E): Use of energy products [P00] by air transport (ISIC H51) reported in Table B must be bigger than or equal to bridging item RES_ABR_ATR ‘Energy use by resident units, fuel purchased abroad–air transport o’.

$P00:H51$ (Table B) $\geq RES_ABR_ATR$ (Table E)
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A [WARNING] result.is triggered if the rule is not met.

Rule 26. Plausibility of net domestic energy use: For each production and household activity (except for ISIC D Electricity, gas, steam and air conditioning supply), the net domestic energy use (Table D) should be higher than or equal to the sum of use of electrical energy (P26) and heat (P27).

$PEFA_IND06$ (Table D) $\geq P26$ (Table B) + $P27$ (Table B);

for 'A' to 'U' and 'A_U 01-99' except ISIC D, and 'HH', 'HH_HEAT', 'HH_TRA' and 'HH_OTH' (as applicable)

A [WARNING] result is triggered if the rule is not met.

Rule 27. Plausibility of transformation losses: The economy-wide transformation losses recorded in Table B.1, data point R30: ATU_HH—Environment, should be bigger than 0.

R30: ATU_HH—Environment (Table B.1) > 0

A [WARNING] result is triggered if the rule is not met.

3.9 Plausibility of reported time series (year-on-year changes)

This section presents rules for checking implausible changes between consecutive years in a time series for a wide range of characteristics.

Implausible annual change rates are defined in the form of thresholds, i.e. maximum annual change rates that are still considered plausible.

Rule 28. An implausible annual change rate triggers a [WARNING] result. 'Implausible annual change rates' are defined below for Tables A, B, B.1, C, D and E of the PEFA questionnaire.

An exception for certain cases (marked below) is when the value for the first year is zero and is non-zero in the subsequent year.

Table A: Supply of energy

Energy flow	Economic activity	Threshold, i.e. implausible annual change rate*
N00	Environment, total supply	±30%
P00	ATU (Total ISIC/NACE industries)	±30%
P00	ISIC C	±30%
P00	ISIC D	±30%

P00	Rest of world-economic activities	±30%
R30	ATU (Total ISIC/NACE industries)	±30%
R30	Total supply	±30%

Table B: Use of energy

Energy flow	Economic activity	Threshold, i.e. implausible annual change rate
N00	ATU (Total ISIC/NACE industries)	±30%
N00	ISIC D	±30%
P00	Total use	±30%
P12	ATU (Total ISIC/NACE industries)	±30%
P12	ISIC C	±30%
P12	Total use	±30%
P13	Total use	±30%
P00	Rest of world-economic activities	±30%
R30	Environment	±30%
R30	Total use	±30%
N00_P00_R00	ISIC C	±30%
N00_P00_R00	ISIC D	±30%
N00_P00_R00	Rest of world	±30%
N00	Total use	±30%
P00	Total use	±30%
R00	Total use	±30%

Table B.2: End use of energy

Energy flow	Economic activity	Threshold, i.e. implausible annual change rate
P14	ISIC H51	±30%
P15	ISIC H51	±30%
P17	ISIC H50	±30%
P18	ISIC H50	±30%
P19	ISIC H50	±30%
P14	ISIC H49	±30%
P17	ISIC H49	±30%
P14	HH_TRA	±30%

Table E: bridging items

Bridging item	Threshold, i.e. implausible annual change rate
RES_ABR_ATR	±30%
TER_NRES_ATR	±30%
RES_ABR_FWTR	±30%
RES_ABR_WTR	±30%
TER_NRES_WTR	±30%
RES_ABR_LTR	±30%
TER_NRES_LTR	±30%

Rule 29. Implausible annual change rates should be explained with a free-text footnote; or flagged with the pre-defined footnote symbol b), meaning ‘break in time series’. Implausible annual change rates without a footnote trigger a [WARNING] result.

3.10 External consistency (cross-domain plausibility)

This section is about the consistency of PEFA data vis-a-vis data from other statistical domains.

Rule 30. Implausible differences between PEFA data and data from other statistical domains trigger a [WARNING] result.

PEFA vs. OECD's air transport CO2-emissions

In order to be able to check coherence between data on CO₂-emissions of air transport available from OECD¹ and PEFA, one needs to relate tonnages of emissions to energy flows expressed in terajoules. For the resulting emission factors – i.e. tonnes of emissions per terajoule of energy use – one may define plausible ranges around IPCC standard emission factors.

PEFA vs. OECD's air transport
Rule 30.1: CO ₂ : ((A)+(B) +(D)+(E)+(F)) (OECD) / P15:H51 (Table C) = 72 tCO ₂ /TJ +/- 40%
Rule 30.2: CO ₂ : ((B)+(E)+(F)) (OECD) / RES_ABR_ATR (Table E) = 72 tCO ₂ /TJ +/-40%
Rule 30.3: CO ₂ : ((C)+(G)) (OECD) / TER_NRES_ATR (Table E) = 72 tCO ₂ /TJ +/-40%

PEFA vs. Energy statistics

The following table describes PEFA data points that are compared to corresponding data points in energy statistics; and specifies for each data point pair plausible ranges for differences.

PEFA vs. Energy statistics	
Rule 30.4 N00:ATU (Table B) + R28:Total supply (Table A) + R29:Total supply (Table A) + P22:Rest of World (Table A) + P22: ATU_HH—Changes in inventories and produced assets (Table B) = +/-20% Primary Production	The sum of the use of all natural energy inputs by economic activities, the supply of waste, the imports of nuclear fuel and the nuclear fuel obtained from stocks should be close (+/- 20%) to the 'Primary production' as reported by energy statistics
Rule 30.5 P26: ATU (Table A) = +/-20% Gross Electricity Production	The supply of Electrical energy (P26) by economic activities should be close (+/- 20%) to the 'Gross electricity production' as reported by energy statistics

¹[https://data-explorer.oecd.org/vis?lc=en&df\[ds\]=DisseminateFinalDMZ&df\[id\]=DSD_AIR_TRANSPORT%40DF_AIR_TRANSPORT&df\[ag\]=OECD.SDD.NAD.SEEA](https://data-explorer.oecd.org/vis?lc=en&df[ds]=DisseminateFinalDMZ&df[id]=DSD_AIR_TRANSPORT%40DF_AIR_TRANSPORT&df[ag]=OECD.SDD.NAD.SEEA)

Rule 30.6 R31: ATU_HH—Changes in inventories and produced assets (Table B) = +/- 20% Final consumption - non-energy use	The changes in stocks (use) of Energy incorporated in products for non-energy use (R31) should be close (+/- 20%) to the 'Final consumption - non-energy use' as reported by energy statistics. If this threshold is exceeded, it is suggested to follow up to see if any statistical differences are assigned to changes in inventories.
Rule 30.7 P00: ATU_HH—Rest of the world – economic activities (Table A) = +/-20% Total Imports	The total imports of energy products should be close (+/- 20%) to the 'Imports' as reported by energy statistics
Rule 30.8 P00: ATU_HH—Rest of the world – economic activities (Table B) = +/-20% Total Exports	The total exports of energy products should be close (+/- 20%) to the 'Exports' as reported by energy statistics. If this threshold is exceeded, it is suggested to also compare total exports of energy products to the sum of 'Exports' and 'International bunkering' as reported by energy statistics.
Rule 30.9 TER (Table E) = total energy supply (energy statistics)	Total energy supply - territory principle should be equal to the 'total energy supply' as reported by energy statistics
Rule 30.10 P00:HH_HEAT (Table C) = +/-40% SFF_P1000_S2000:FC_OTH_HH_E_SH + G3000:FC_OTH_HH_E_SH + O4000:FC_OTH_HH_E_SH + R5110-5150_W6000RI:FC_OTH_HH_E_SH + SFF_P1000_S2000:FC_OTH_HH_E_SC + G3000:FC_OTH_HH_E_SC + O4000:FC_OTH_HH_E_SC + R5110-5150_W6000RI: FC_OTH_HH_E_SC + SFF_P1000_S2000:FC_OTH_HH_E_WH + G3000:FC_OTH_HH_E_WH + O4000:FC_OTH_HH_E_WH + R5110-	The emission-relevant use of energy products, total (P00) by Heating/cooling activities by households (HH_HEAT) should be close (+/- 40%) to the final energy consumption of households of solid fuels + natural gas + oil and petroleum products + primary solid biofuels for space heating + space cooling + water heating + cooking as reported by the detailed energy statistics on the final energy consumption of households

5150_W6000RI : FC_OTH_HH_E_WH + SFF_P1000_S2000:FC_OTH_HH_E_CK + G3000:FC_OTH_HH_E_CK + O4000:FC_OTH_HH_E_CK + R5110- 5150_W6000RI: FC_OTH_HH_E_CK (nrg_d_hhq)	
Rule 30.11 P00:HH_OTH (Table C) = +/-40% * SFF_P1000_S2000:FC_OTH_HH_E_LE + G3000:FC_OTH_HH_E_LE + O4000:FC_OTH_HH_E_LE + SFF_P1000_S2000:FC_OTH_HH_E_OE + G3000:FC_OTH_HH_E_OE + O4000:FC_OTH_HH_E_OE (nrg_d_hhq)	The emission-relevant use of energy products, total (P00) by Other activities by households (HH_OTH) should be close (+/- 40%) to the final energy consumption of households of solid fuels + natural gas + oil and petroleum products + primary solid biofuels for lighting and electrical appliances + other end use as reported by the detailed energy statistics on the final energy consumption of households (Eurobase table nrg_d_hhq).
Rule 30.12 P00:HH_HEAT (Table B) = +/-40% TOTAL:FC_OTH_HH_E_SH + TOTAL:FC_OTH_HH_E_SC + TOTAL:FC_OTH_HH_E_WH + + TOTAL:FC_OTH_HH_E_CK (nrg_d_hhq)	The use of energy products, total (P00) by Heating/cooling activities by households (HH_HEAT) should be close (+/- 40%) to the final energy consumption of households of all products for space heating + space cooling + water heating + cooking as reported by the detailed energy statistics on the final energy consumption of households (Eurobase table nrg_d_hhq).
Rule 30.13 P00:HH_OTH (Table B) = +/-40% TOTAL: FC_OTH_HH_E_LE + TOTAL: FC_OTH_HH_E_OE (nrg_d_hhq)	The use of energy products, total (P00) by Other activities by households (HH_OTH) should be close (+/- 40%) to the final energy consumption of households of all products for lighting and electrical appliances + other end use as reported by the detailed energy statistics on the final energy consumption of households (Eurobase table nrg_d_hhq).

PEFA vs. Air Emission Accounts (AEA)

Implausible differences between PEFA data and data from Air Emission Accounts (AEA) trigger a [WARNING] result.

In order to be able to check coherence between AEA and PEFA, one needs to relate tonnages of emissions to energy flows expressed in terajoules. For the resulting emission factors – i.e. tonnes of emissions per terajoule of energy use – one may define plausible ranges around IPCC standard emission factors.

PEFA vs. Air Emission Accounts (AEA)
If CO₂ (AEA) > 0 then P00 (PEFA Table C) > 0 If CO₂ (AEA) = 0 then P00 (PEFA Table C) = 0 for 'A' to 'U', 'HH', 'HH_HEAT', 'HH_TRA', 'HH_OTH'
CO ₂ :H51 (AEA) / P15:H51 (PEFA Table C) = 72 tCO ₂ /TJ +/-40%
CO ₂ :H50 (AEA) / (P17:H50 + P18:H50 + P19:H50) (PEFA Table C) = 75 tCO ₂ /TJ +/-40%
CO₂ + CO₂_BIO (AEA) / P00 (PEFA Table C) = annual change rate not beyond +/- 30%; for 'A' to 'U', 'HH', 'HH_HEAT', 'HH_TRA', 'HH_OTH' This rule is only applied for PEFA data points (combinations of country, year, economic activity) where – for a given year – the emission-relevant use of all energy products (P00) is above a certain threshold – currently this threshold is defined as 5% of the PEFA maximum value for the respective country and year.

ANNEXES – code lists employed by PEFA

ISIC Rev. 4: economic activities

This code list is employed for the classification of columns in PEFA questionnaire tables A, B, B.1, B.2, D and E for industries and households.

PEFA questionnaire	
code	label
ATU	Total ISIC/NACE industries
A	Agriculture, forestry and fishing
A01	Crop and animal production, hunting and related service activities
A02	Forestry and logging
A03	Fishing and aquaculture
B	Mining and quarrying
C	Manufacturing
C10-C12	Manufacture of food products, beverages and tobacco products
C13-C15	Manufacture of textiles, wearing apparel and leather products
C16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
C17	Manufacture of paper and paper products
C18	Printing and reproduction of recorded media
C19	Manufacture of coke and refined petroleum products
C20	Manufacture of chemicals and chemical products
C21	Manufacture of basic pharmaceutical products and pharmaceutical preparations
C22	Manufacture of rubber and plastic products
C23	Manufacture of other non-metallic mineral products
C24	Manufacture of basic metals
C25	Manufacture of fabricated metal products, except machinery and equipment
C26	Manufacture of computer, electronic and optical products
C27	Manufacture of electrical equipment
C28	Manufacture of machinery and equipment n.e.c.
C29	Manufacture of motor vehicles, trailers and semi-trailers
C30	Manufacture of other transport equipment
C31_C32	Manufacture of furniture; other manufacturing

PEFA questionnaire	
code	label
C33	Repair and installation of machinery and equipment
D	Electricity, gas, steam and air conditioning supply
E	Water supply; sewerage, waste management and remediation activities
E36	Water collection, treatment and supply
E37-E39	Sewerage, waste management, remediation activities
F	Construction
G	Wholesale and retail trade; repair of motor vehicles and motorcycles
G45	Wholesale and retail trade and repair of motor vehicles and motorcycles
G46	Wholesale trade, except of motor vehicles and motorcycles
G47	Retail trade, except of motor vehicles and motorcycles
H	Transportation and storage
H49	Land transport and transport via pipelines
H50	Water transport
H51	Air transport
H52	Warehousing and support activities for transportation
H53	Postal and courier activities
I	Accommodation and food service activities
J	Information and communication
J58	Publishing activities
J59_J60	Motion picture, video, television programme production; programming and broadcasting activities
J61	Telecommunications
J62_J63	Computer programming, consultancy, and information service activities
K	Financial and insurance activities
K64	Financial service activities, except insurance and pension funding
K65	Insurance, reinsurance and pension funding, except compulsory social security
K66	Activities auxiliary to financial services and insurance activities
L	Real estate activities
L68A	Of which: Imputed rents of owner-occupied dwellings
M	Professional, scientific and technical activities
M69_M70	Legal and accounting activities; activities of head offices; management consultancy activities

PEFA questionnaire	
code	label
M71	Architectural and engineering activities; technical testing and analysis
M72	Scientific research and development
M73	Advertising and market research
M74_M75	Other professional, scientific and technical activities; veterinary activities
N	Administrative and support service activities
N77	Rental and leasing activities
N78	Employment activities
N79	Travel agency, tour operator reservation service and related activities
N80-N82	Security and investigation, service and landscape, office administrative and support activities
O	Public administration and defence; compulsory social security
P	Education
Q	Human health and social work activities
Q86	Human health activities
Q87_Q88	Residential care activities and social work activities without accommodation
R	Arts, entertainment and recreation
R90-R92	Creative, arts and entertainment activities; libraries, archives, museums and other cultural activities; gambling and betting activities
R93	Sports activities and amusement and recreation activities
S	Other service activities
S94	Activities of membership organisations
S95	Repair of computers and personal and household goods
S96	Other personal service activities
T	Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use
U	Activities of extraterritorial organisations and bodies
_X	All other industries (for use in aggregate template only, indicates all industries except for ISIC A to D and ISIC H)
HH	Total activities by households
HH_HEAT	Heating/cooling activities by households
HH_TRA	Transport activities by households
HH_OTH	Other activities by households

PEFA questionnaire	
code	label
ATU_HH	*Please note that the identifier “ATU_HH” is not used uniquely and is used for the following: 1) changes in inventories and produced assets; 2) statistical differences (column-wise); 3) rest of the world – economic activities; 4) environment; and 5) Total supply/use natural inputs, products, and residuals.

Energy flows (natural energy inputs, energy products, energy residuals)

This code list is employed for the classification of rows in PEFA questionnaire tables A, B, B.1, B.2, and C.

PEFA questionnaire	
code	label
N00	Natural energy inputs
N01	Fossil non-renewable natural energy inputs
N02	Nuclear non-renewable natural energy inputs
N03	Hydro based renewable natural energy inputs
N04	Wind based renewable natural energy inputs
N05	Solar based renewable natural energy inputs
N06	Biomass based renewable natural energy inputs
N07	Other renewable natural energy inputs
P00	Energy products
P08	Hard coal
P09	Brown coal and peat
P10	Derived gases (= manufactured gases excl. biogas)
P11	Secondary coal products (coke, coal tar, patent fuel, BKB and peat products)
P12	Crude oil, NGL, and other hydrocarbons (excl. bio)
P13	Natural gas (without bio)
P14	Motor spirit (without bio)
P15	Kerosenes and jet fuels (without bio)
P16	Naphtha
P17	Transport diesel (without bio)

PEFA questionnaire	
code	label
P18	Heating and other gasoil (without bio)
P19	Residual fuel oil
P20	Refinery gas, ethane and LPG
P21	Other petroleum products incl. additives/oxygenates and refinery feedstocks
P22	Nuclear fuel
P23	Wood, wood waste and other solid biomass, charcoal
P24	Liquid biofuels
P25	Biogas
P26	Electrical energy
P27	Heat
R00	Energy residuals
R28	Renewable waste
R29	Non-renewable waste
R30	Energy losses all kinds of (during extraction, distribution, storage and transformation, and dissipative heat from end use)
R31	Energy incorporated in products for non-energy use
SD_IO	Statistical differences between input and output of all energy products
N00_P00_R00	Natural energy inputs, energy products and energy residuals
EPRD_OUSE	Energy products for own use

PEFA key indicators

This code list is employed for the classification of rows in PEFA questionnaire table D.

PEFA questionnaire	
code	label
PEFA_IND01	Extraction of natural energy inputs by economic activities
PEFA_IND02	Domestic production of energy products
PEFA_IND03	Intermediate consumption of energy products
PEFA_IND04	Household consumption of energy products
PEFA_IND05	Use of waste for energetic purposes
PEFA_IND06	Net domestic energy use

PEFA questionnaire	
code	label
PEFA_IND06a	Net domestic energy use for energy purposes
PEFA_IND06b	Net domestic energy use for non-energy purposes
PEFA_IND07	Total energy input/output
PEFA_IND08	Emission-relevant use of energy
PEFA_IND09	Direct energy input (DEI)
PEFA_IND10	Direct energy outputs
PEFA_IND11	Net additions to stock (calculated)
PEFA_IND12	Net additions to stock (reported)
PEFA_IND13	Domestic energy consumption
PEFA_IND14	Imports of energy products and energy residuals (waste for energetic use)
PEFA_IND14a	Imports of energy products
PEFA_IND14b	Imports of energy residuals (waste for energetic use)
PEFA_IND15	Domestic processed output
PEFA_IND16	Exports of energy products and residuals
PEFA_IND17	Net changes (use minus supply) of energy products and residuals in inventories and produced assets
PEFA_IND17a	Supply of energy residuals from stock
PEFA_IND17b	Additions (use) of energy products and residuals to stocks
PEFA_IND18	Statistical discrepancy between supply and use of energy products and residuals

PEFA bridging items

This code list is employed for the classification of rows in PEFA questionnaire E.

PEFA questionnaire	
code	label
RES	Total energy use by resident units (domestic energy use) - residence principle
RES_ABR	Energy use by resident units, fuel purchased abroad—total
RES_ABR_FWTR	Energy use by resident units, fuel purchased abroad—fishing vessels
RES_ABR_LTR	Energy use by resident units, fuel purchased abroad—Land transport operated by resident units abroad
RES_ABR_WTR	Energy use by resident units, fuel purchased abroad—water transport

PEFA questionnaire	
code	label
RES_ABR_ATR	Energy use by resident units, fuel purchased abroad —air transport
TER_NRES	Energy use by non-residents on the territory (only if included in total energy supply), fuel purchased on the territory—total
TER_NRES_LTR	Energy use by non-residents on the territory (only if included in total energy supply), fuel purchased on the territory— Land transport
TER_NRES_WTR	Energy use by non-residents on the territory (only if included in total energy supply), fuel purchased on the territory—Water transport
TER_NRES_ATR	Energy use by non-residents on the territory (only if included in total energy supply), fuel purchased on the territory—Air transport
ADJ_SD	Other adjustments and statistical discrepancies
ADJ_SD_DUXGIC	Energy flows not reported in energy statistics but included in PEFA (bridging item RES)
TER	Total energy supply - territory principle