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Technical Note

Defining PEFA bridging items vis-a-vis to energy statistics

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eurostat

Table of Contents

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1 Introduction

1. Physical energy flow accounts (PEFA) include so-called bridging items presenting the differences between PEFA totals (energy use by all resident units) and totals (key indicators) derived from energy statistics (energy use on the territory).

2. Internationally harmonised principles and concepts as well as recording conventions for energy statistics are laid down in the *International Recommendations for Energy Statistics* (IRES) and in Eurostat guidelines for annual energy statistics questionnaires.

3. Principles and concepts for PEFA are laid down in Eurostat's draft PEFA Manual 2014 and in guidelines accompanying the annual PEFA data collections (most recent version is from 2018). The European PEFA guidelines are conforming with the *System of Environmental Economic Accounting - Central Framework* (SEEA-CF) which is the respective international statistical standard.

4. The differences between PEFA totals and energy statistics' key indicators are due to two main determinants:

- Residence principle versus territory principle: PEFA follow the residence principle (energy used by resident units) whereas energy statistics and derived key indicators follow more or less a territory principle (energy products sold/supplied on the territory of the reporting country).
- Energy statistics provide definitions for three different aggregates of energy use (key indicators). Their scopes differ due to consideration or non-consideration of international water and air transport.

Box 1: Energy statistics' definitions related to territory principle (Source: International Recommendations for Energy Statistics – IRES)

para. 2.14 Reference territory. In general, the term “reference territory” defines the geographical scope of the statistics compiled and the criteria for allocating selected statistics to a particular territory. Energy statistics have historically responded, among others, to the policy concerns of the physical availability of energy and its uses within the territory of a country. Thus, the criteria for allocating certain statistics to the country follow the physical location of the units involved. The reference territory used in energy statistics and energy balances is the national territory and is defined as the geographic territory under the effective economic control of the national government. It comprises:

(a) The land area;

(b) Airspace;

(c) Territorial waters, including areas over which jurisdiction is exercised through fishing rights and rights to fuels or minerals.

para. 2.15 In a maritime territory, the economic territory includes islands that belong to the territory. The national territory also includes any free trade zones, bonded warehouses or factories operated by enterprises under customs control within the areas described above. By convention, the territorial enclaves of other countries (e.g., embassies, consulates, military bases, scientific stations, etc.) are treated as part of the national territory where they are physically located.

para. 2.16 The definition of reference territory recommended for energy statistics largely approximates the economic territory of a country as used in economic statistics (see BPM6, para. 4.5 and SNA2008, para. 4.11). However, it should be noted that the concept of economic territory in economic statistics (including in energy accounts) is used in conjunction with the concept of the residence of the economic unit, which is the determining factor in the allocation of the statistics to the economic territory.

Box 2: Energy statistics' definitions related to transport (Source: International Recommendations for Energy Statistics – IRES)

IRES related to transport

para. 5.89: *Use of energy products for transportation purposes*, (see IRES Figure 5.2), is defined as the **consumption of fuels and electricity used to transport goods or persons between points of departure and destination within the national territory** irrespective of the economic sector within which the activity occurs. The classification of the **consumption of fuels by merchant ships and civil aircraft undertaking the transport of goods or persons to another national territory** is covered under the definitions for **International Marine and Aviation Bunkers** and is therefore **excluded** from this definition. However, deliveries of fuels to road vehicles going beyond national borders cannot be readily identified and by default are included here.

5. This technical note explains in detail the differences – i.e. bridging items – between the PEFA totals and energy statistics' key indicators. These differences are presented for the three main transport modes, namely land, water and air (see Table 1):

Table 1: Content overview of this technical note on PEFA bridging items

	Land transport	Water transport (including fishing and military vessels)	Air transport (including military aircrafts)
	paragraphs 11 ff.	paragraphs 24 ff.	paragraphs 39 ff.

6. This technical note focusses on transport related differences between PEFA totals and energy statistics' key indicators because those usually represent the major part of differences and have been further formalised by the bridging items 2 and 3 of PEFA Table E. There may be other than transport related activities by resident units outside the territory that involve energy flows and are included in PEFA totals but not in energy statistics' key indicators. Those are recorded under bridging item 4 'Other adjustments and statistical discrepancies' and are not subject to this technical note.

2 Definition of key indicators

2.1 Three key indicators derivable from energy statistics

7. Since the data collection performed in autumn 2018 three key indicators are derived from European energy statistics and presented in European energy balances: *'gross available energy', 'gross inland energy consumption',* and *'total energy supply'*. They are arithmetically defined in Table 2. Table 9 at the end of this note includes detailed descriptions of all relevant items of energy balances (Eurostat methodology).

8. The PEFA bridging table (Table E) currently bridges only towards one of the three key indicators, namely *'gross inland energy consumption'*. In future, one may consider to add all three indicators to the PEFA 'bridging table' if this is feasible.

Table 2: Arithmetic definition of three key indicators derived from energy statistics and balances.

Key indicator (derived from energy statistics)	Energy balance elements/items (Eurostat methodology)
Gross available energy =	+ Primary production
	+ Recovered and recycled products
	+ Imports
	– Exports
	+ Stock changes
Gross inland energy consumption =	+ *Gross available energy*
	– International maritime bunkers
Total energy supply =	+ *Gross inland energy consumption*
	– International aviation

2.2 PEFA key indicator

9. The most relevant key indicator derivable from PEFA is termed *'net domestic energy use'*. Conceptually, it follows the residence principle[1] and includes the end use[2] of energy by all resident units for energy and non-energy purposes.

10. The indicator *'net domestic energy use'* is derived from the physical supply table (Table A in PEFA questionnaire). It adds up two energy residual rows from PEFA Table A:

[1] 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

[2] End use refers to the last stage of energy transformation by humans, i.e. afterwards, the energy is not available any more (at least in the reported accounting calendar year). See also PEFA Guidelines 2017: 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.

- 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'

These two residuals are the 'energetic transformation-result' of end use. Both forms of energy are no longer available for human utility (temporarily in the case of R31).

3 Land transport

11. Land transport refers to use of energy products (fuels, lubricants, electricity etc.) associated with the transportation of passengers and freight with road-vehicles, railway-vehicles and via pipelines.

12. In general, the PEFA total (key indicator 'net domestic energy use') includes energy use related to land transportation operated by resident units irrespective of where these activities take place or where[3] the respective energy products are purchased.

13. Notably, land transportation is undertaken by resident units in association with a wide range of economic activities, e.g. private households undertake land transport in form of final consumption e.g. for leisure purposes. Land transport services (NACE division H49) undertake land transport as their principal production activity. All other NACE divisions undertake land transport in form of secondary or ancillary production activities.

3.1 Energy statistics' recording items (flows) relevant for land transport

14. As mentioned (see paras. 7ff.), energy statistics provide three key indicators: *'gross available energy'* (GAE), *'gross inland (energy) consumption'* (GIC), and *'total energy supply'* (NRGSUP). With regards to land transport, the three key indicators have the same definitional scope.

15. Energy statistics provide quantities on the supply, transformation and consumption[4] of more than 50 energy products. Most important energy products relevant for land transport are various classes of fuels and electricity.

16. Table 3 presents the energy statistics' items ('flows') relevant for land transport. Energy statistics are based on fuel sold on the domestic territory to resident units as well as to non-residents. Hence all items ('flows') presented in Table 3 have a resident component as well as a non-resident component.

[3] on the territory of the geographical entity where the operator is resident or in the rest of world
[4] The various items on supply, transformation and consumption are termed 'flows', see IRES.

Table 3: Energy statistics items ('flows') relevant for land transport

Eurostat code	Eurostat label	IRES term	Reporting instructions Eurostat	Explanation IRES
FC_TRA_RAIL_E	Final consumption - transport sector - **rail** - energy use	Use of energy products for transportation purposes – **Rail**	Report fuel consumed in rail traffic, including industrial railways. It includes fuel used in rail transport as part of urban or suburban transport systems.	Rail refers to fuels and electricity delivered for use in rail vehicles, including industrial railways. This includes urban rail transport (including trams).
FC_TRA_ROAD_E	Final consumption - transport sector - **road** - energy use	Use of energy products for transportation purposes – **Road**	Report fuel for use in road vehicles. Include fuel used by agricultural vehicles on highways and lubricants for use in road vehicles. Exclude motor gasoline and diesel used in stationary engines (see Not elsewhere specified – Other sectors), diesel oil for non–highway use in tractors (see Agriculture/forestry – Other sectors), military use (see Not elsewhere specified – Other sectors) and gasoil used in engines at construction sites (see Construction – Industry sector).	Road refers to fuels and electricity delivered to vehicles using public roads. Fuels delivered for "off-road" use and stationary engines should be excluded. Off-road use comprises vehicles and mobile equipment used primarily on commercial industrial sites or private land, or in agriculture or forestry. The deliveries of fuels related to these uses are included under the appropriate final consumption heading. Deliveries for military uses are also excluded here but included under "not elsewhere specified". The fuel use for freight transport by road and by trolley buses is included here.
FC_TRA_NSP_E	Final consumption - transport sector - **not elsewhere specified** - energy use	Use of energy products for transportation purposes – **Transport not elsewhere specified**	Report fuels used for transport activities not included elsewhere. Include fuels used by airlines for their road vehicles.	Transport not elsewhere specified refers to deliveries of fuels or electricity used for transport activities not covered within the modes of transport defined elsewhere. Most of the forms of transport listed in ISIC Class 4922 (other land transport) are included here.
FC_TRA_PIPE_E	Final consumption - transport sector - pipeline transport - energy use	Use of energy products for transportation purposes – **Pipeline transport**	Report energy products used as energy in the support and operation of pipelines transporting gases, liquids, slurries and other commodities, including the energy products used for pump stations and maintenance of the pipeline. Energy products used for the pipeline distribution of natural or manufactured gas, hot water or steam (ISIC 35) from the distributor to final users is excluded and should be reported in the Energy sector, while the energy products used for the final distribution of water (ISIC 36) to household, industrial, commercial and other users should be included in the Commercial/public sector. Losses occurring during this transport between distributor and final users should be reported as Distribution losses.	Pipeline transport refers to fuels and electricity used in the support and operation of pipelines transporting gases, liquids, slurries and other commodities between points within the national territory. It comprises the consumption at pumping stations and for the maintenance of the pipeline. Consumption for maintaining the flow in pipelines carrying natural gas, manufactured gas, hot water and steam in distribution networks is excluded here, but included under the appropriate heading within "Energy Industries Own Use". Consumption for the transport of natural gas in transmission networks is included.

				Consumption of fuels or electricity for maintaining the flow in pipelines carrying water is included in 'commerce and public services'.
FC_OTH_AF_E	Final consumption - other sectors - **agriculture and forestry** - energy use	Final consumption – Other – Agriculture, Forestry	ISIC Divisions 01 and 02 (NACE Divisions 01 and 02). Report consumption of energy products by users classified as agriculture, hunting and forestry.	Fuels used in tractors for the purpose of farming, in vessels for fishing and for the transport by military vehicles are included here. Fuels and other energy products' consumption in fishing should cover all fishing vessels, including those engaged in deep-sea fishing. It is important to ensure that fuels and other energy products delivered to deep-sea fishing vessels are excluded from quantities reported as international marine bunkers.
FC_OTH_NSP_E	Final consumption - other sectors - **not elsewhere specified** - energy use	Final consumption – Other – Not elsewhere specified (including defence activities)	Report activities not included elsewhere. This category includes military fuel use for all mobile and stationary consumption (e.g. ships, aircraft, road and energy used in living quarters), regardless of whether the fuel delivered is for the military of that country or for the military of another country.	

Source: Eurostat online database, International Recommendations for Energy Statistics (IRES), and Eurostat's reporting instructions for annual questionnaires for oil

3.2 Land transport recording elements – energy statistics vis-a-vis PEFA

17. Figure 1 provides an overview of recording elements related to land transport. The various recording elements are labelled by capital letters (A to M). The first six rows present the land transport relevant items ('flows') from energy statistics. The 2nd column denotes a resident component and the 3rd column a non-resident component.

18. Recording elements taken into account when deriving energy statistics totals/key indicators are marked by the horizontal rectangular frame in purple colour. Recording elements taken into account in PEFA totals ('net domestic energy use') are marked by the vertical rectangular frame in yellow colour.

19. Energy statistics' key indicators take into account all six items ('flows') introduced already above in Table 3. Notably, each of those six items has 2 components: a resident component and a non-resident component. Both components of the six items are taken into account for energy statistics' key indicators, namely the element (A) (H), (B) (I), (C) (J), (D) (K), (E) (L) and (F) (M).

20. In contrast, PEFA's total (net domestic energy use) indicator related to land transport takes into account only the resident elements of the six items reported in energy statistics, i.e. elements (A) to (F). In addition the PEFA total (net domestic energy use) includes land transport related energy use by resident units based on fuel purchased outside the domestic territory, i.e. element (G). Notably, element (G) is not included in energy statistics of the reporting country, i.e. alternative data sources need to be found to estimate this element.

Figure 1: Recording elements related to land transport - energy statistics versus PEFA

	Resident units	Non-residents	
Final consumption - **transport** sector – **rail**	(A)	(H)	**Energy statistics' totals**
Final consumption - **transport** sector – **road**	(B)	(I)	
Final consumption - **transport** sector - **not elsewhere specified** – *only parts relevant for land transport*	(C)	(J)	
Final consumption – **transport** sector – **pipeline** transport	(D)	(K)	
Final consumption - **other** sectors - **agriculture and forestry** - *only parts relevant for land transport*	(E)	(L)	
Final consumption - **other** sectors - **not elsewhere specified (military)** – *only parts relevant for land transport*	(F)	(M)	
Land transport based on fuel purchased in the rest of the world	(G)		
	PEFA's total		

3.3 PEFA bridging items in the case of land transport

21. Table 4 describes for the case of land transport the bridging items necessary to get from the PEFA total (net domestic energy use = top row) towards energy statistics' totals (bottom row). The last column refers to the element letters in Figure 1.

22. Energy use by resident units operating land transport based on fuel purchases in the rest of the world (G) are deducted from the PEFA total (A to G). This is the only element to be considered under the PEFA-bridging item *'Less national residents abroad – land transport'* (see Table 4).

23. Energy use by non-resident units operating land transport based on fuel purchases on domestic territory are added, elements (H) to (M) (see Table 4) under the PEFA-bridging item *'Plus non-residents on the territory – land transport'*.

Table 4: PEFA bridging items in the case of land transport

Arithmetic	Bridging item		Description	Elements in Figure 1
	label	no.		
	Net domestic energy use - residence principle	1	Includes all energy uses associated with land transport undertaken by resident units based on fuel purchases on domestic territory as well as based on fuel purchases in the rest of the world.	(A) to (G)
less	Land transport operated abroad by residents	2.2	Deduct: All energy uses associated with land transport undertaken by resident units based on fuel purchases in the rest of the world.	(G)
plus	Land transport operated on the territory by non-residents	3.1	Add: All energy uses associated with land transport undertaken by non-resident units based on fuel purchases on domestic territory.	(H) to (M)
plus/minus	Adjustments and statistical discrepancy	4	Any other differences related to land transport (un-likely)	
equals	Gross inland energy consumption - territory principle	5	Includes all energy uses associated with land transport undertaken by resident units and non-residents based on fuel purchases on domestic territory.	(A) to (F) plus (H) to (M)

4 Water transport

24. Water transport refers to use of energy products (fuels, gas, coal, lubricants etc.) associated with the transportation of passengers and freight over water with watercrafts (ships, boats, fishing vessels etc.). Also included are energy uses in association with the operations of towing or pushing boats, excursion, cruise or sightseeing boats, ferries, water taxis etc. Energy products used to operate fishing vessels is included.

25. In general, the PEFA total (net domestic energy use) includes any energy use related to water transportation operated by resident units irrespective of where these activities take place or where[5] the respective energy products are purchased.

26. There are three NACE groupings the activities of which may involve water transportation as principal, secondary or ancillary production activity:

- NACE 03 'Fishing and aquaculture',
- NACE 50 'Water transport', and
- NACE 84 'Public administration and defence' (e.g. police, coastguards, fire fighting, military). In addition private households operate watercrafts for non-commercial purposes (consumption activity).

27. Energy statistics employ a specific terminology regarding water transportation. A basic distinction is made between ***international navigation*** (international voyages) and ***domestic navigation*** (domestic voyages). Furthermore, fishing vessels and military boats are treated separately.

- *International* versus *domestic* transport: International transport relates to journeys between two ports located in two different countries. Domestic transport relates to journeys between two ports located in the same country.
- Further distinction is made between (a) *sea*, (b) *coastal waters*, and (c) *inland lakes and water ways*. The water body type is obviously the criterion used for this distinction.

4.1 Energy statistics' recording items (flows) relevant for water transport

28. As mentioned (see paras. 7ff.), energy statistics provide three key indicators: *'gross available energy'* (GAE), *'gross inland (energy) consumption'* (GIC), and *'total energy supply'* (NRGSUP). With regards to water transport, the three key indicators have varying definitional scopes.

29. Energy statistics provide quantities on the supply, transformation and consumption[6] of more than 50 energy products. Most important energy products relevant for water transport are diesel oil,

[5] on the territory of the geographical entity where the operator is resident or in the rest of world
[6] The various items on supply, transformation and consumption are termed 'flows', see IRES.

fuel oil, and motor gasoline.

30. Table 5 presents the energy statistics items ('flows') relevant for water transport.

Table 5: Energy statistics items ('flows') relevant for water transport

Eurostat code	Eurostat label	Reporting instructions Eurostat
INTMARB	International maritime bunkers	Report the quantities of energy products delivered to ships of all flags that are engaged in international navigation. The international navigation may take place at sea, on inland lakes and waterways, and in coastal waters. Exclude consumption by ships engaged in domestic navigation (see domestic navigation). The domestic/international split should be determined on the basis of port of departure and port of arrival, and not by the flag or nationality of the ship. Exclude consumption by fishing vessels (see Fishing – Other sectors) and consumption by military forces (see Not elsewhere specified – Other sectors).
FC_TRA_DNAVI_E	Final consumption - **transport sector** - **domestic navigation** - energy use	Report fuels delivered to vessels of all flags not engaged in international navigation (see international marine bunkers). The domestic/international split should be determined on the basis of port of departure and port of arrival and not by the flag or nationality of the ship. Note that this may include journeys of considerable length between two ports in a country (e.g. San Francisco to Honolulu).
FC_TRA_NSP_E	Final consumption - **transport sector** - **not elsewhere** specified - energy use	Report fuels used for [water] transport activities not included elsewhere.
FC_OTH_FISH_E	Final consumption - other sectors - **fishing** - energy use	Report fuels used for inland, coastal and deep–sea fishing. Fishing should cover fuels delivered to ships of all flags that have re-fuelled in the country (include international fishing). Note that this item also includes energy used by the fishing industry for non-transport purposes.
FC_OTH_NSP_E	Final consumption - **other sectors** - **not elsewhere specified** - energy use	Report [water transport] activities not included elsewhere. This category includes military fuel use for all mobile and stationary consumption (e.g. ships, aircraft, road and energy used in living quarters), regardless of whether the fuel delivered is for the military of that country or for the military of another country.

Source: Eurostat online database, International Recommendations for Energy Statistics (IRES), and Eurostat's reporting instructions for annual questionnaires for oil

4.2 Water transport recording elements – energy statistics vis-à-vis PEFA

31. Figure 2 provides and overview of recording elements related to water transport. The various recording elements are labelled by capital letters (A to L). The first five rows present water transport relevant items ('flows') from energy statistics. For each of the five energy statistics items the 2nd column denotes a resident component (A to E) and the 3rd column a non-resident component (H to L).

32. Recording elements taken into account in PEFA totals (net domestic energy use) are marked by the vertical rectangular frame in yellow colour. Recording elements taken into account when

deriving energy statistics key indicators are marked by the horizontal rectangular frame in purple colour. Here, two rectangular are marked.

33. The energy statistics key indicator *'gross available energy'* includes five rows, i.e. international maritime bunkers are included in this indicator. Namely, it includes the elements (A), (B), (C), (D), (E), (H), (I), (J), (K), and (L).

34. The remaining two energy statistics indicators (namely *'gross inland consumption'* and *'total energy supply'*) exclude international maritime bunkers, i.e. items (E) and (L) are excluded.

35. PEFA's total (net domestic energy use) indicator related to water transport takes into account only the resident elements of the five items reported in energy statistics, i.e. elements (A) to (E)). In addition the PEFA total (net domestic energy use) includes water transport undertaken by resident units and based on fuel purchased outside the domestic territory, i.e. element (F). Further, the PEFA total includes fuel purchased in the rest of the world by resident operators of fishing vessels, i.e. element (G). Notably, elements (F) and (G) are not included in energy statistics of the reporting country, i.e. alternative data sources need to be found to estimate this element.

Figure 2: Recording elements related to water transport - energy statistics versus PEFA

	Resident units	Non-residents		
Final consumption - **transport** sector - **domestic navigation**	(A)	(H)	**Gross inland consumption (GIC)** & **Total energy supply (NRG SUP)**	**Gross available energy (GAE)**
Final consumption - **transport** sector - **not elsewhere specified**	(B)	(I)		
Final consumption - **other** sectors – **fishing** – *only parts relevant for water transport*	(C)	(J)		
Final consumption - **other** sectors - **not elsewhere specified** – *only parts relevant for water transport*	(D)	(K)		
International maritime bunkers (as reported in national energy statistics)	(E)	(L)		
Water transport based on fuel purchased in the rest of the world (excluding fishing vessels)	(F)			
Fishing vessels based on fuel purchased in the rest of the world	(G)			
	PEFA's total			

4.3 PEFA bridging items in the case of water transport

36. Table 6 describes for the case of water transport the bridging items necessary to get from the PEFA total (net domestic energy use = top row) towards energy statistics key indicator *'gross inland energy consumption'* (bottom row), as currently implemented in PEFA questionnaire Table E.

37. Energy use by resident units operating water transport and fishing vessels based on fuel purchases in the rest of the world – i.e. elements (F) and (G) – are deducted from the PEFA total (A to G). The respective 'bridging items' in PEFA-bridging are termed:

- *'Less: National fishing vessels operating abroad'*
- *'Less: International water transport undertaken by resident units (including domestic navigation undertaken in other countries)'*

38. Energy use by non-resident units operating water transport based on fuel purchases on domestic territory are added, elements (H) to (K) (see Table 6) under the PEFA-bridging item *'Plus: Water transport operated by non-residents on the territory'*. Notably, element (L) is excluded here, i.e. not added, because 'international maritime bunkers (as reported in national energy statistics)' is excluded from the territory principle indicator GIC.

Table 6: PEFA bridging items in the case of water transport

Arithmetic	Bridging item label	no	Description	Elements in Figure 2
	Net domestic energy use - residence principle	1	Includes all energy uses associated with water transport undertaken by resident units based on fuel purchases on domestic territory as well as based on fuel purchases in the rest of the world.	(A), (B), (C), (D), (E), (F), (G)
less	National fishing vessels operating abroad	2.1	Deduct: Fuels purchased in the rest of the world by fishing vessels operated by resident units.	(G)
less	International water transport undertaken by resident units (including domestic navigation undertaken in other countries)	2.3	Deduct: Fuels purchased in the rest of the word by resident units operating water transport (excl. fishing vessels) Deduct: Fuels purchased from international marine bunkers (as reported by national energy statistics) by resident units operating water transport (excl. fishing vessels)	(F) (E)
plus	Water transport operated by non-residents on the territory	3.2	Add: Fuels purchased on domestic territory associated with water transport undertaken by non-resident units.	(H), (I), (J), (K)
plus/minus	Adjustments and statistical discrepancy	4	Any other differences related to water transport (un-likely)	
equals	Gross inland energy consumption - territory principle	5	Includes all energy uses associated with water transport undertaken by resident units and non-residents based on fuel purchases on domestic territory.	(A), (B), (C), (D), (H), (I), (J), (K)

5 Air transport

39. Air transport refers to the use of energy products (fuels, lubricants, electricity) associated with transportation of passengers and freight with aircrafts (aviation).

40. In general, the PEFA total (net domestic energy use) includes energy use related to air transportation operated by resident units irrespective of where these activities take place or where[7] the respective energy products are purchased.

41. There are two NACE groupings which may be involved in operating aircrafts as primary, secondary, and ancillary production activity:

- NACE H51 'air transport', and
- NACE O84 'public administration and defence'.

5.1 Energy statistics' recording items (flows) relevant for air transport

42. As mentioned (see paras. 7ff.), energy statistics provide three key indicators: *'gross available energy'* (GAE), *'gross inland (energy) consumption'* (GIC), and *'total energy supply'* (NRGSUP). With regards to air transport, the three key indicators have varying definitional scopes.

43. Energy statistics provide quantities on the supply, transformation and consumption[8] of more than 50 energy products. Most important energy products relevant for air transport are kerosene-type jet fuels, other kerosene, and aviation gasoline.

44. Table 7 presents the energy statistics items ('flows') relevant for air transport.

[7] on the territory of the geographical entity where the operator is resident or in the rest of the world
[8] The various items on supply, transformation and consumption are termed 'flows', see IRES.

Table 7: Energy statistics items ('flows') relevant for air transport

Eurostat code	Eurostat label	Reporting instructions Eurostat
INTAVI	International aviation	Report quantities of aviation fuels delivered to aircrafts for international aviation (also known as 'International Aviation Bunkers'). The domestic/international split should be determined on the basis of departure and landing locations and not by the nationality of the airline. Exclude fuels used by airlines for their road vehicles (see Not elsewhere specified – Transport sector) and military use of aviation fuels (see Not elsewhere specified – Other sectors).
FC_TRA_DAVI_E	Final consumption - **transport sector** - **domestic aviation** - energy use	Report quantities of aviation fuels delivered to aircraft for domestic aviation – commercial, private, agricultural, etc. Include fuel used for purposes other than flying, e.g. bench testing of engines. The domestic/international split should be determined on the basis of departure and landing locations and not by the nationality of the airline. Note that this may include journeys of considerable length between two airports in a country (e.g. San Francisco to Honolulu). Exclude fuels used by airlines for their road vehicles (see Not elsewhere specified – Transport sector) and military use of aviation fuels (see Not elsewhere specified – Other sectors).
FC_TRA_NSP_E	Final consumption - **transport sector** - **not elsewhere** specified - energy use	Report fuels used for [air] transport activities not included elsewhere.
FC_OTH_NSP_E	Final consumption - **other sectors** - **not elsewhere specified** - energy use	Report [air transport] activities not included elsewhere. This category includes military fuel use for all mobile and stationary consumption (e.g. ships, aircraft, road and energy used in living quarters), regardless of whether the fuel delivered is for the military of that country or for the military of another country.

Source: Eurostat online database, International Recommendations for Energy Statistics (IRES), and Eurostat's reporting instructions for annual questionnaires for oil

5.2 Air transport recording elements – energy statistics vis-à-vis PEFA

45. Figure 3 provides and overview of recording elements related to air transport. The various recording elements are labelled by capital letters (A to I). The first four rows present air transport relevant items from energy statistics. For each of the four energy statistics items the 2nd column denotes a resident component (A to D) and the 3rd column a non-resident component (F to I).

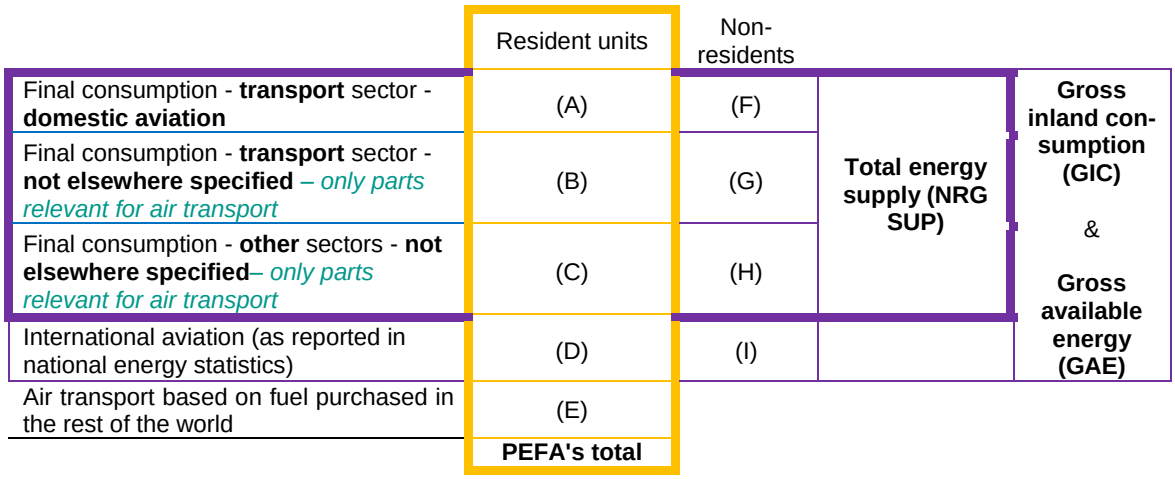
46. Recording elements taken into account in PEFA totals (net domestic energy use) are marked by the vertical rectangular frame in yellow colour. Recording elements taken into account when deriving energy statistics key indicators are marked by the horizontal rectangular frame in purple colour. Here, two rectangular are marked.

47. The energy statistics key indicators *'gross inland consumption'* and *'gross available energy'* include four rows, i.e. international aviation is included in these indicators. Namely, the two indicators include the elements (A), (B), (C), (D), (F), (G) (H), and (I).

48. The remaining energy statistics indicator *'total energy supply'* excludes international aviation, i.e. items (D) and (I) are excluded.

49. PEFA's total (net domestic energy use) indicator related to air transport takes into account only the resident elements of the four items reported in energy statistics, i.e. elements (A) to (D). In addition the PEFA total (net domestic energy use) includes air transport undertaken by resident units and based on fuel purchased outside the domestic territory, i.e. element (E). Notably, element (E) is not included in energy statistics of the reporting country, i.e. alternative data sources need to be found to estimate this element.

Figure 3: Recording elements related to air transport - energy statistics versus PEFA



5.3 PEFA bridging items in the case of air transport

50. Table 8 describes for the case of air transport the bridging items necessary to get from the PEFA total (net domestic energy use = top row) towards energy statistics key indicator *'gross inland energy consumption'* (bottom row), as currently implemented in PEFA questionnaire Table E.

51. Energy use by resident units operating air transport based on fuel purchases in the rest of the world (E) is deducted from the PEFA total (A to E). The respective 'bridging item' in PEFA-bridging table is termed: *'Less: International air transport operated by resident units*[9].

52. Energy use by non-resident units operating air transport based on fuel purchases on domestic territory are added, elements (F) to (I) (see Table 8) under the PEFA-bridging item *'Plus: Air transport operated by non-residents on the territory'*.

[9] This label is not fully correct and should be changed in order to avoid misunderstanding. This bridging item includes only residents' international aviation for which fuel is bunkered at international aviation bunkers outside the reporting country, i.e. airports outside the country.

Table 8: PEFA bridging items in the case of air transport

Arithmetic	Bridging item label	no.	Description	Elements in Figure 2
	Net domestic energy use - residence principle	1	Includes all energy uses associated with air transport undertaken by resident units based on fuel purchases on domestic territory as well as based on fuel purchases in the rest of the world.	(A), (B), (C), (D), (E)
less	International air transport operated by resident units (including domestic aviation undertaken in other countries)	2.4	Deduct: Fuels purchased in the rest of the world by resident units operating air transport	(E)
plus	Air transport operated by non-residents on the territory	3.3	Add: Fuels purchased on domestic territory associated with air transport undertaken by non-resident units.	(F), (G), (H), (I)
plus/minus	Adjustments and statistical discrepancy	4	Any other differences related to air transport (un-likely)	
equals	Gross inland energy consumption - territory principle	5	Includes all energy uses associated with air transport undertaken by resident units and non-residents based on fuel purchases on domestic territory.	(A), (B), (C), (D), (F),(G), (H), (I)

Table 9: Definition of main elements of Eurostat energy balances including derived key indicators

Arithmetic definition	label	Eurostat code	Explanation*
+	Primary production	PPRD	Any kind of extraction of energy products from natural sources. It takes place when the natural sources are exploited, for example extraction of lignite in coal mines or extraction of crude oil. It also includes electricity and heat in its primary energy form (electricity generation using hydro, wind and solar PV). Primary production for all secondary fuels is zero.
+	Recovered and recycled products	RCV_RCY	For coal this includes recovered slurries, middlings and other low-grade coal products, which cannot be classified according to type of coal. This includes coal recovered from waste piles and other waste receptacles. For petroleum products, these are finished (petroleum) products which pass a second time through the marketing network, after having been once delivered to final consumers (for example used lubricants which are reprocessed).
+	Imports	IMP	Imports of energy products into the reporting country.
−	Exports	EXP	Exports of energy products out of the reporting country.
+	Change in stock	STK_CHG	Changes in domestic inventories of energy products. It is determined by the difference between the opening stock level and closing stock level for stocks held on national territory. Positive value for stock changes means stock draw (fuel put in stocks in previous years was used during the reference year). Negative value for stock changes means stock build (fuel was put in stocks during the reference year and can be used in future).
=	**Gross available energy**	**GAE**	For total of all products, the gross available energy is one of the most important aggregate of energy balance and represents the quantity of energy necessary to satisfy all energy demand of entities operating under the authorities of the geographical entity under consideration. Its interpretation for individual products is different. For secondary products, which are produced as

			transformation output and not as primary productions, the Gross available energy can be negative.
−	International maritime bunkers	INTMARB	Quantities of fuels delivered to ships of all flags that are engaged in international navigation. The international navigation may take place at sea, on inland lakes and waterways, and in coastal waters. Excluded are: - consumption by ships engaged in domestic navigation. The domestic/international split should be determined on the basis of port of departure and port of arrival, and not by the flag or nationality of the ship, - consumption by fishing vessels, - consumption by military forces, - aviation bunkers.
=	**Gross inland consumption**	**GIC**	Eurostat energy statistics key indicator until 2018
−	International aviation	INTAVI	Quantities of fuels delivered to aircrafts for international aviation. The domestic/international split is determined on the basis of departure and landing locations and not by the nationality of the airline. Excludes fuels used by airlines for their road vehicles (see Not elsewhere specified (Transport)) and military use of aviation fuels (see Not elsewhere specified (Other)).
=	**Total energy supply**	**NRGSUP**	This aggregate reflects on the recommendations in IRES for calculation of key aggregates of energy balances. For total of all products, the Total energy supply is one of the most important aggregate of energy balance and represents the quantity of energy necessary to satisfy inland consumption (inland fuel deliveries) of the geographical entity under consideration. Its interpretation for individual products is different. For secondary products, which are produced as transformation output and not as primary productions, the Total energy supply can be negative.
−	Transformation input - energy use	TI_E	Transformation input covers all inputs into the transformation plants destined to be converted into derived products. Transformation is only recorded when the energy products are physically or chemically modified to produce other energy products, electricity and/or heat. Quantities of fuels used for heating, operation of equipment and in general in support of

			the transformation are not included.
+	Transformation output	TO	Transformation output is the result of the transformation process of energy products. This output covers production of derived products (secondary products, by-products and co-products).
−	Energy sector - energy use	NRG_E	Energy sector's consumption of own-produced energy and of energy purchased by energy producers and transformers in operating their installations.
−	Distribution losses	DL	This category includes quantities of fuel losses which occur due to transport and distribution, including pipeline losses. Specifically for electricity, transmission losses are included here.
=	**Available for final consumption**	**AFC**	
−	Final non-energy consumption	FC_NE	Elements in this section are included in energy balances with exactly the same conceptual definition as in the reported data based on the definitions in Regulation (EC) No 1099/2008 on energy statistics and in the reporting instructions and, naturally, converted with calorific values from reported units to the energy units of the energy balance. The level of details is fuel specific and therefore the level of details in the energy balance is a compromise between the level of detailed available and the relative importance of the non-energy consumption. By definition, the consumption of energy from renewable sources for non-energy purposes is excluded from the scope of energy statistics (for example use of solid biofuels for the building construction or furniture manufacturing or passive use of solar energy heating buildings).
−	Final energy consumption	FC_E	Elements in this section are included in energy balances with exactly the same conceptual definition as in the reported data based on the definitions in Regulation (EC) No 1099/2008 on energy statistics and in the reporting instructions and, naturally, converted with calorific values from reported units to the energy units of the energy balance. In the energy balance, the final energy consumption is further disaggregated into Industry sector, Transport sector and Other sectors. Each of these sectors have several subsectors.
=	**Statistical differences**	**STATDIFF**	In Eurostat's energy balance, the item statistical differences represents the difference between the top and medium blocks on one side and the bottom block

			on the other side. Negative statistical differences indicate higher observed final consumption than available from the supply and transformation. Positive statistical differences indicate that the observed final consumption is lower than available from the supply and transformation.

* Document made available in Eurostat online database (navigation tree)