

## **Chapter 5 Flows, stocks and related concepts**

*Below is an annotated draft of Chapter 5. The text contains a number of issues which need to be discussed to guide further drafting. The further description of the stocks and flows will be included at a later stage and will be based in the work by InterEnerStat. The Oslo Group is invited to comment and provide guidance on the structure of the chapter, the intended content, as well as on any topics that in your view should be included or dropped.*

### **A. Introduction**

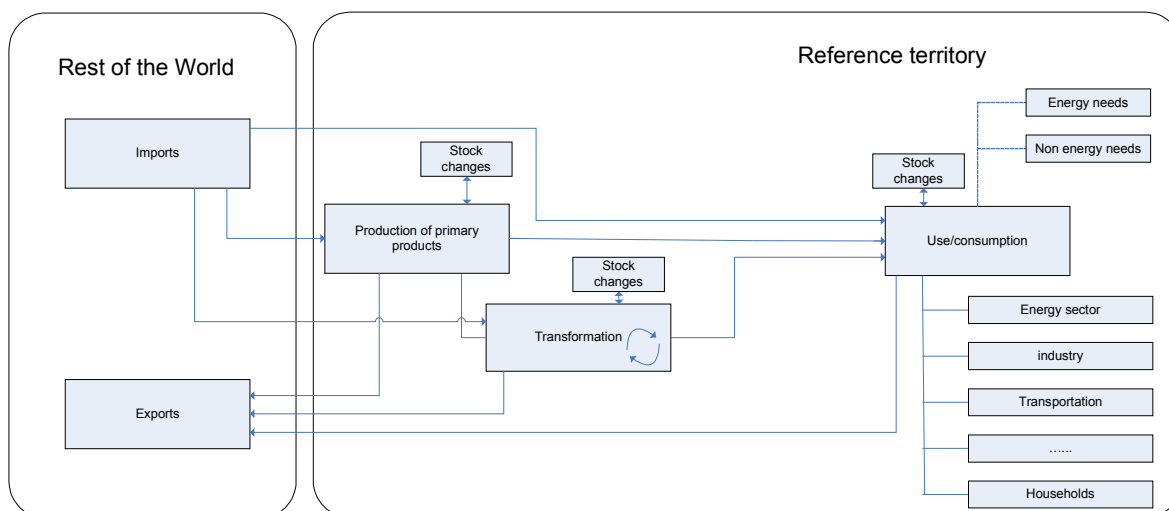
6.1. The main objective of this chapter is to describe the process that an energy product undergoes from its origin to its final use/consumption and provide definitions of the flows and stocks in energy statistics (e.g. production, imports, exports, etc.). It will describe and provide a classification of the main sectors in energy statistics - the energy sector, transformation sector and the consumption sectors – and provide a correspondence of energy and consumption sectors with International Standard Industrial Classification of All Economic Activities (ISIC), Rev 4 and NACE Rev 2.

### **B. Energy/Commodity flow diagram**

6.2. The energy/commodity flow diagram in Figure 1 describes the main stages that an energy product undergoes from the time of its production to its final use/consumption. Figure 1 is intended to show in a very simplified manner the different stages.

6.3. This section will provide a general description of the Figure and definitions of transactions such as production, imports, exports, transformation, international bunkers, stocks and stock changes and use of energy products. In the latter case a distinction will be made between energy and non-energy uses.

**Figure 5.1: Simplified flow chart for an energy product**



Note: this is a first attempt to represent an energy commodity flow diagram which will be revised based on the comments received.

[Further detail may be provided to explain any exceptions or special cases for specific commodities]

### *Production*

### *Transformation*

### *Imports/Exports*

**Stocks and stock changes.** This will define the concept of stocks in energy statistics clearly identifying what is included and/or excluded. There will also be a reference to the concept of stocks in economic statistics which include inventories of underground mineral and energy resources with the objective of clearly defining the boundary of stocks in energy statistics.

### *International bunkers*

### *Transfers*

**Use.** This will provide a definition of uses of energy products for energy and non-energy needs and it will make a reference to the different uses in the different sectors of the economies.

## **C. Main sectors in energy statistics**

6.4. In energy statistics a distinction is made between three sectors of the economy: the energy, the transformation, and the consumption sector. This distinction helps to monitor the processes that an energy product undergoes from its production, transformation and final consumption. This section describes these sectors and provides a correspondence, whenever possible, with the International Standard Industrial Classification of All Economic Activities (ISIC), Rev 4 and NACE Rev 2.

**[NOTE that the text below is based on the available definitions and correspondence of the “energy sector”. For analytical purposes it may be useful to define the energy sector in broader terms to include also the activities related to energy such as construction (e.g. Class: 4220, ISIC Rev. 4 - Construction of utility projects which includes long-distance pipelines, communication and power lines), and transportation by (long-distance) pipelines (Class 4930, ISIC Rev. 4 (long-distance) transportation of gases by pipelines, operation of pipelines).**

**Can countries collect this type of information? If so, should these activities be explicitly identified, for example, by defining a subsector?]**

### ***Energy Sector***

6.5. In (the preliminary text for) chapter 2, the energy sector is defined as comprising economic units whose principal activity is energy extraction, production, manufacturing, transformation or distribution of energy products. In the energy balances the use of energy products in the energy sector refers to the use of fuels, electricity and heat used by the energy sector for heating, lighting, and operation of all equipment used in the extraction process, for traction and distribution. It does not include the use of fuel for non energy purposes and the conversion of fuel, electricity and heat to secondary forms of energy (e.g. coking coal to coke, crude oil to petroleum products, and heavy fuel oil to electricity).

6.6. In terms of the *International Standard Industrial Classification of All Economic Activities*, Revision 4, (ISIC Rev. 4), the energy sector corresponds to the following economic activities:

Division: 05 - Mining of coal and lignite

Group: 051 - Mining of hard coal

Group: 052 - Mining of lignite

Class: 0892 - Extraction of peat

Division: 06 - Extraction of crude petroleum and natural gas

Group: 061 - Extraction of crude petroleum

Group: 062 - Extraction of natural gas

Division: 09 - Mining support service activities

Group 091 - Support activities for petroleum and natural gas extraction

Group 099 - Support activities for other mining and quarrying [energy commodities only]

Class: 0721 - Mining of uranium and thorium ores

Division: 19 - Manufacture of coke and refined petroleum products

Group: 191 - Manufacture of coke oven products

Group: 192 - Manufacture of refined petroleum products

\* Class:2011 Manufacture of basic chemicals

Division : 35 - Electricity, gas, steam and air conditioning supply

Group: 351 - Electric power generation, transmission and distribution

Group: 352 - Manufacture of gas; distribution of gaseous fuels through mains

Group: 353 - Steam and air conditioning supply

Division: 20 - Manufacture of chemicals and chemical products [??.]

6.7. Box 2 shows the correspondence to ISIC Rev.4 based on the ISIC Divisions identified in the 2007 IEA/Eurostat/ECE Questionnaire based on ISIC Rev. 3 (“The Energy sector covers ISIC and NACE Divisions 10, 11, 12, 23 and 40. The Energy sector includes the manufacture of chemical materials for atomic fission and fusion and the products of these processes. Fuels used in the manufacture of fuel briquettes and packaged fuel from coal or lignite and consumption in coke ovens and other transformation industries should also be reported here”).

### Box 5.1: Correspondence from ISIC Rev3 to ISIC Rev. 4

ISIC Rev. 3 from IEA/Eurostat/ECE Questionnaire	ISIC Rev. 4
Division: 10 - Mining of coal and lignite; extraction of peat	Division: 05 - Mining of coal and lignite
Group: 101 Mining and agglomeration of hard coal	Group: 051 - Mining of hard coal
Group: 102 Mining and agglomeration of lignite	Group: 052 - Mining of lignite
Group: 103 Extraction and agglomeration of peat	Class: 0892 - Extraction of peat
	*Class: 0990 - Support activities for other mining and quarrying (support services for peat mining)
Division: 11 - Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction excluding surveying	Division: 06 - Extraction of crude petroleum and natural gas
Group: 111 - Extraction of crude petroleum and natural gas	Group: 061 - Extraction of crude petroleum
	Group: 062 - Extraction of natural gas
	Class: 0910 - Support activities for petroleum and natural gas extraction
Group: 112 - Service activities incidental to oil and gas extraction excluding surveying	*Group 091 - Support activities for petroleum and natural gas extraction
Division: 12 - Mining of uranium and thorium ores	
Group: 120 - Mining of uranium and thorium ores	Class: 0721 - Mining of uranium and thorium ores
	*Class: 0990 - Support activities for other mining and quarrying (Support services for uranium and thorium mining)
*Class: 1429 - Other mining and quarrying n.e.c. (mining and quarrying of bitumen) [ <b>Should this be included?</b> ]	*Class: 0899 - Other mining and quarrying n.e.c. (extraction of natural solid bitumen) [ <b>Should this be included?</b> ]
Division: 23 - Manufacture of coke, refined petroleum products and nuclear fuel	Division: 19 - Manufacture of coke and refined petroleum products
Group: 231 - Manufacture of coke oven products	*Group: 191 - Manufacture of coke oven products
Group: 232 - Manufacture of refined petroleum products	*Group: 192 - Manufacture of refined petroleum products
Group: 233 - Processing of nuclear fuel	* Class:2011 Manufacture of basic chemicals “enrichment of uranium and thorium ores and production of fuel elements for nuclear reactors”
	*Class: 2100 - Manufacture of pharmaceuticals, medicinal chemical and botanical products (Manufacture of radioactive in-vivo diagnostic substances)

	<p>*Class: 2420 - Manufacture of basic precious and other non-ferrous metals (Production of uranium metal from pitchblende or other ores; smelting and refining of uranium)</p> <p>*Class: 3812 - Collection of hazardous waste (Transfer stations for spent nuclear fuels (e.g. temporary storage))</p> <p>*Class: 3822 - Treatment and disposal of hazardous waste (Treatment and disposal of radioactive nuclear waste)</p> <p><b>[NOTE that the 5 classes above correspond to the Group 233 ISIC Rev. 3.1. However, only the first one seems to be within the scope of the energy sector. ]</b></p>
Division: 40 - Electricity, gas, steam and hot water supply	Division : 35 - Electricity, gas, steam and air conditioning supply
Group: 401 - Production, collection and distribution of electricity	Group: 351 - Electric power generation, transmission and distribution
Group: 402 - Manufacture of gas; distribution of gaseous fuels through mains	Group: 352 - Manufacture of gas; distribution of gaseous fuels through mains
Group: 403 - Steam and hot water supply	Group: 353 - Steam and air conditioning supply
	<p>*Division: 20 - Manufacture of chemicals and chemical products <b>[This is not included in the division headings of the energy Sector of the IEA Questionnaire. However, in the electricity questionnaire the energy sector includes “charcoal production plants” which are classified within Class 2011 - Manufacture of basic chemicals. It also appears in the transformation sector in the petrochemical industry. This Division also includes manufacture of ethanol from crops. Should this be included]</b></p>

## 1. Transformation Sector [or processes?]

6.8. The transformation sector [/processes] consists of those processes which transforms (primary and/or secondary) energy products into other energy products. Thus transformation sector is defined in terms of transformation processes. In some cases it is possible to have a one to one correspondence to an ISIC Division/group, but, in general, one type of economic activity may be carried out though several transformation processes or a transformation process may be found in more than one type of economic activity. [TO INSERT EXAMPLE].

**[Note that, depending on the definition of the energy sector (whether or not secondary activities are included in the definition), the transformation sector can be said to be part of the energy sector, that is it includes those activities that transforms energy products and are classified according to the transformation process. One example of the industry that may or may not be classified in the energy sector is the “iron and steel industry” which transform coals, cokes or oils into blast furnace gas in blast furnaces. The principal activity is not the extraction, production, transformation or distribution of energy, but as part of the production process, it transforms energy and this is recorded under transformation]**

6.9. The main transformation processes that are identified in energy statistics are: electricity plants, combined heat and power plants, heat plants (disaggregated into main producers and autoproducers), last furnace/Gas works, Patent fuel plants, petroleum refineries, petrochemical plants, etc.

**[Detail description of these plants will be included]**

## 2. Consumption sector

6.10. All the sectors of the economy consume energy. However, for analytical purposes, it is useful to distinguish those who only ‘consume energy’ from those who consume energy during production, transformation and distribution of energy. The *consumption sector* identifies those economic activities (and household) which are (final) consumers of energy. This information is important for energy planning to identify for example the energy requirements from the different sectors of the economy.

6.11. The consumption sector distinguishes three main groups of consumers: industry, transport, and other sectors. Box 5.2 shows the correspondence of these main groups of industries to ISIC Rev. 4 divisions. These groups of industries in energy statistics are identified for analytical purposes as they group together activities that are similar in the consumption of energy and generation of air emissions [to further expand].

**Box 5.2: Correspondence of the consumption sector to ISIC Rev. 4**

Groups of activities in energy statistics (with correspondence to ISIC Rev. 3.1. from the IEA/Eurostat/ECE Questionnaire)	ISIC Rev.4
<b>Industry Sector</b>	<b>B - Mining and quarrying</b> <b>C - Manufacturing</b> <b>F - Construction</b>
Iron and Steel [Group 271, Class 2731]	241 - Manufacture of basic iron and steel 2431 - Casting of iron and steel
Chemical (including Petrochemical) [Division 24]	20- Manufacture of chemicals and chemical products [should part of this be in the energy sector given the Class 2011?]
Non-Ferrous Metals [Group 272, Class 2732]	242 - Manufacture of basic precious and other non-ferrous metals 2432 - Casting of non-ferrous metals
Non-Metallic Minerals [Division 26]	23 - Manufacture of other non-metallic mineral products
Transport Equipment [Divisions 34,35]	29 - Manufacture of motor vehicles, trailers and semi-trailers 30 - Manufacture of other transport equipment
Machinery [Divisions 28, 29,30,31, and 32]]	25 - Manufacture of fabricated metal products, except machinery and equipment 26 - Manufacture of computer, electronic and optical products 27 - Manufacture of electrical equipment 28 - Manufacture of machinery and equipment n.e.c.
Mining and Quarrying (excluding energy producing industries) [Divisions 13, 14]	07 - Mining of metal ores <i>except</i> Class 0721 – Mining of uranium and Thorium ore 08 - Other mining and quarrying <i>except</i> Class 0892 - Extraction of peat
Food and Tobacco [Divisions 15, 16]	10 - Manufacture of food products 11 - Manufacture of beverages 12 - Manufacture of tobacco products
Paper, Pulp and Printing [Divisions 21, 22]]	17 - Manufacture of paper and paper products 18 - Printing and reproduction of recorded media]
Wood and Wood Products [Division 20]	16 - Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
Construction [Division 45]	41 - Construction of buildings 42 - Civil engineering

	43 - Specialized construction activities
Textiles and Leather [Division 17,18, 19]]	13 - Manufacture of textiles 14 - Manufacture of wearing apparel 15 - Manufacture of leather and related products
Non-specified (Industry) [Divisions 25, 33, 36, 37]	24 - Manufacture of basic metals <i>except</i> 242 - Manufacture of basic precious and other non-ferrous metals <i>and</i> 2432 - Casting of non-ferrous metals 21 - Manufacture of basic pharmaceutical products and pharmaceutical preparations 22 - Manufacture of rubber and plastics products 31 - Manufacture of furniture 32 - Other manufacturing 33 - Repair and installation of machinery and equipment
<b>Transport activities [Division 60, 61, 62]</b>	49 - Land transport and transport via pipelines 50 - Water transport 51 - Air transport
International aviation	51 - Air transport [to note the difference in definition of this class with energy statistics]
Domestic aviation	51 - Air transport [to note the difference in definition of this class with energy statistics]
Road	*492 - Other land transport *4921 - Urban and suburban passenger land transport* *4922 - Other passenger land transport* 4923 - Freight transport by road
Rail	491 - Transport via railways
Pipeline transport	493 - Transport via pipeline
Domestic Navigation	Note that this does not correspond as ISIC does not distinguishes between international and national water(sea) transport. 50 - Water transport 501 - Sea and coastal water transport 502 - Inland water transport
Non-specified (Transport)	*53 - Postal and courier activities [??] *4921 - Urban and suburban passenger land transport *4922 - Other passenger land transport
<b>Other sectors</b>	
Residential [Division 95]	T - Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use [??] [Note that this ISIC Section is only a part of the "Residential" sector.]
Commercial and Public Services	E - Water supply; sewerage, waste management and remediation activities G - Wholesale and retail trade; repair of motor vehicles and motorcycles 52 - Warehousing and support activities for transportation 53 - Postal and courier activities [??] I - Accommodation and food service activities J - Information and communication K - Financial and insurance activities L - Real estate activities M - Professional, scientific and technical activities N - Administrative and support service activities O - Public administration and defence; compulsory social security P - Education Q - Human health and social work activities

	R - Arts, entertainment and recreation S - Other service activities U - Activities of extraterritorial organizations and bodies
Agriculture/Forestry [divisions 01, 02]	01 - Crop and animal production, hunting and related service activities 02 - Forestry and logging
Fishing [Division 05]	03 - Fishing and aquaculture
Non-specified (Other) (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)	
Public lighting (from UNSD questionnaire)	

<sup>a</sup> the grouping and terminology are based on the IEA/Eurostat Questionnaire.

**The terminology may need to be revisited and aligned more with that in ISIC.**

#### EXPLAINING NOTE ON THE USE OF TERRITORY AND RESIDENCE PRICIPLES ON STOCKS AND FLOWS OF ENERGY PRODUCTS.

The stocks and flows of energy products of a given country can be defined in two different ways – by application of either territory or residence principles.

The territory principle is in use when any energy products physically located on the country's territory are included in its total stock of energy products and any changes in them are considered as flows (internal) unless energy products are removed from the country territory (exports) or added by obtaining them from other countries (imports). **[It is very important to include in IRES recommendation on what territory is implied here – economic territory as in other economic statistics? economic territory with certain exclusions (as in international trade statistics)? The OG is invited to provide advice.**

**In general, the discussion on the differences of the two principles seems to be better placed in the chapter of the scope of energy statistics and taken up again in the bridge tables with the energy accounts in chapter 11. The Oslo Group is invited to provide guidance on where this discussion is better placed].**

The residency principle is in use when energy products owned by residents of a given economy, irrespective of the physical location of those products are included in its total stock of energy products. Any changes in stocks resulting from the transactions between residents are treated as internal flows, while any changes in stocks due to transactions between residents and non-residents are considered external flows. For example, if the territory principle is applied the purchase of fuel in a country by non-residents is treated as (internal) consumption, while application of residency principle requires to consider this flow as exports. This distinction may lead to a significant difference in the size and classification of energy stocks and flows for some countries while for others it can be rather minor. (see Annex XXX for detailed definitions of economic territory, residents and other related the terms).