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Global data structure definitions

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***Abstract**: SDMX is the most established standard for statistical data and metadata transmissions. Data Structure Definitions (DSDs) are part of the SDMX standard and are necessary for any SDMX data transmission. The DSD describes how the information in a specific dataset is structured. The DSD provides the IT system with the knowledge of the data structure.*

Each statistical domain (e.g. environmental accounts) must have one or several DSDs. While other domains had already defined their DSDs (e.g. national accounts), this is new for environmental accounts. The development of environmental accounts global DSDs for data exchange is part of the SEEA CF research agenda.

This paper will report progress on the international work to develop global DSDs for environmental accounts. In particular, the governance of the process was taken over by the SDMX macroeconomic statistics ownership group (SDMX-MES OG) in December 2016. This is a group of international organisations managing the SDMX structures for national accounts, balance of payments, foreign direct investment and prices. Its members are Eurostat, IMF, OECD, World Bank, the European Central Bank and the Bank for International Settlements. A sub-group of SDMX-MES OG was set up to develop specific DSDs for SEEA. These will probably not be integrated in the DSDs for national accounts, but will share as many possible concepts and code lists with the existing national accounts DSDs. This paper will report draft versions of DSDs and will seek input from the London Group to feed this international work.

1. Introduction to SDMX for global SEEA databases

The development of global SEEA databases is one of the priorities of UNCEEA for the period 2017-2020. The existence of standards for data exchange is a technical precondition for setting up global SEEA databases because they are fed from international data flows involving countries and agencies.

The statistical data and metadata exchange (SDMX) is the most established standard for statistical data and metadata transmissions. SDMX is sponsored by seven international organisations. The SDMX technical specifications and guidelines are publicly available.[1] SDMX is not just a format for data exchange, it is also a set of guidelines, IT architecture and tools to improve statistical business processes.

Whereas the benefits of SDMX are more immediate and tangible for international agencies involved in international flows, countries reporting questionnaires to international agencies can also benefit from implementing SDMX. SDMX opens several possibilities to work more efficiently such as sharing of tools, statistical services and also experience across the whole data life cycle.

In most cases SDMX implementation is voluntary.[2] In any case, data providers could choose among several implementation options, depending on the local IT strategy. One option would be to use a questionnaire, e.g. an Excel questionnaire, with a converter which generates SDMX files for transmission. The converter would be supplied by the international agency

[1] https://sdmx.org/

[2] Exceptionally, SDMX transmission is mandatory for European countries subject to Regulation (EU) 691/2011 in their reporting to Eurostat

running the data collection. The converter may be integrated behind-the-scenes embedded in the questionnaire or be a standalone application. Another option would be to generate a file in csv format directly from the national production system (database) using a specific tool. Another option would be to set up automatic machine-to-machine communication between their production databases and the databases of international agencies. This is more resource-intensive to set up but afterwards there is zero work to transmit data to agencies and there is no questionnaire to be filled. Those three options are ordered from low to high in terms of implementation cost for the countries and also in terms of benefits of integration and automatisation. Before taking a decision on the implementation strategy, the organisation should take into account cross-domain benefits. SDMX is not only in place for a specific statistical domain e.g. SEEA, but is and will be present across many areas e.g. macro-economic statistics.

1.1. The need for data structure definitions

SDMX is applicable to different statistical domains. Each statistical domain must develop SDMX data structure definitions (DSDs), which provide the IT system with the knowledge of the structure of information in a specific dataset. A set of concepts is defined that can be used to describe all aspects of the data in the datasets. The Concepts are then classified as measures (the observation value), dimensions (used to identify the data), and attributes (non-identifying information sent with the data) of a data "cube" (structural metadata). Each statistical domain may have one or several DSDs. For instance, national accounts presently have five DSDs comprising 28 dimensions and code lists in total.[3]

Global DSDs for environmental accounts are not defined yet. This is one item in the SEEA CF research agenda and Eurostat is in the lead. This task requires a joint effort by IT experts on SDMX and content experts on SEEA. Work is in progress for five SEEA CF accounts considered as high priority by the UNCEEA. The goal is to finalise those DSDs between end-2017 and mid-2018. This document explains the development process of SEEA DSDs and the actors involved (section 2), describes the main technical elements of the SEEA DSDs (section 3) and asks some questions to the London Group (section 4).

2. Development process

In June 2016, the UNCEEA agreed to develop global SEEA databases as one of the streams of work for the period 2017-2020. The OECD is the UNCEEA Bureau member charged to lead this area of work, in close co-ordination with Eurostat, FAO and the UNSD. The UNCEEA advised to rely on a pragmatic approach to build global SEEA databases, namely starting with a small set of priority accounts and progressively increasing the number of accounts and level of detail. The UNCEEA decided to develop five accounts in priority: air emission accounts, material flow accounts, energy flow accounts, water flow accounts and land accounts.

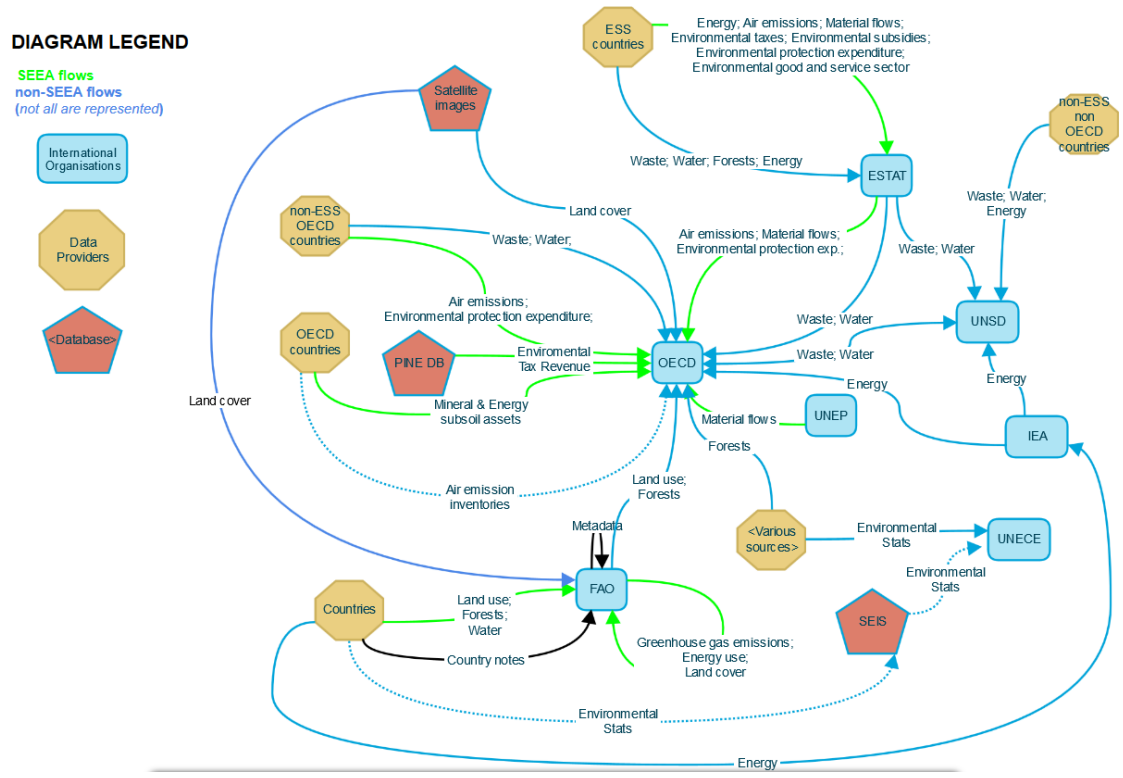
[3] https://sdmx.org/?page_id=1498

In December 2016 the governance of the process to develop SDMX DSDs for SEEA was taken over by the Ownership Group for SDMX in macro-economic statistics (SDMX-MES OG). This is a group of international organisations managing the SDMX structures for national accounts (incl. government finance statistics), balance of payments, foreign direct investment and prices. Its members are Eurostat, the IMF, the OECD, the World Bank, the European Central Bank, the Bank for International Settlements and the United National Statistics Division. The advantages of SDMX-MES OG taking ownership of the process is that the governance structures are already in place, it has experience and skills creating and maintaining DSDs and it will ensure coherence with DSDs for national accounts. The UNCEEA has the ownership as regards contents (SEEA).

The SDMX-MES OG mandated a technical sub-group to develop a proposal for SEEA DSDs within the SDMX-MES framework. This is a small scale, operational group to advance the technical work. The members are Eurostat, the OECD, FAO, the UNECE and the UNSD. UNEP joined the group later. The technical sub-group is a blend of IT experts in SDMX and SEEA experts. Their task is to identify relevant stakeholders, identify existing international flows for the five SEEA priority accounts, create a data model (including DSDs) for those data flows (see section 3), optimise it and present a proposal for approval to the UNCEEA and the SDMX-MES OG.

The technical sub-group met 3 times in 2017, in June, July and September. In the first meeting on 6-7 June the technical sub-group identified the existing international SEEA flows and some related non-SEEA flows for the five priority accounts (see preliminary presentation in Figure 1) and stakeholders such as the London Group or working groups of Eurostat and the OECD.

Figure 1



In this meeting the sub-group made a first identification of the SDMX concepts needed for the existing data flows. The sub-group reported progress to the UNCEEA in the 22 June meeting and the UNCEEA endorsed this work.

In the second meeting on 12-13 July, the technical sub-group further developed the data model, in particular refining the concepts and compiling draft code lists. In the third meeting on 19-20 September the data model and the code lists were completed and draft DSDs suggested (at the time of this writing, immediately after the third meeting, some finalization work is still pending).

The next steps of the process are as follows: first, some stakeholders, such as the London Group, are being consulted. In October-November the sub-group will write explanatory notes to document the data model ('DSD guidelines'). In December, a package of data model, code lists and documentation will be presented to the SDMX-MES OG for review and to seek approval to launch a 'public review' in 2018. This public review will consist of a conceptual review and tests, and it will last several months. Afterwards a version 1.0 of the SDMX data structure definitions for SEEA will be finalised and made publicly available. Future maintenance of will be ensured through the maintenance agreement in pace within the Ownership Group.[4]

3. DSDs for priority environmental accounts

This section explains in more detail the SDMX technical aspects and the proposal under development.

3.1. SDMX artefacts

A DSD specifies:

1. A set of concepts which describe and identify a set of data. Concepts can be cross-domain (such as units, time) or domain-specific (such as air pollutants for air emission accounts). Concepts that identify the data correspond to dimensions in a data cube, whereas concepts that provide additional information on the data are attributes.
2. The different levels of the data file at which the attribute concepts are attached (such as series or observation level).
3. Code lists which establish acceptable values for the concepts.

The technical representation of the data structures and related concepts and code lists is stored as SDMX artefacts in an SDMX registry. For Global DSDs, this is the SDMX Global Registry.[5]

The work to identify the concepts and code lists can start from existing data flows and international reporting templates. SEEA CF sample tables and existing reporting questionnaires (Figure 1) have been used in that context.

[4] https://sdmx.org/wp-content/uploads/SDMX-MES_OG_TermsOfReference.pdf
[5] https://registry.sdmx.org/

For example, let's take the physical supply table for energy (Figure 2). This table is taken from SEEA CF. The table represents energy inputs, products and residuals in rows, and the economic units supplying them in columns. In the SDMX data model, the rows represent one SDMX concept with a code list (i.e. the corresponding list of natural inputs, energy products and energy residuals) associated. The technical sub-group has provisionally named this concept 'energy flows'.[6] The columns in the supply table may be articulated into one or several SDMX concepts/dimensions: industries plus households plus accumulation plus rest of the world may be considered one single concept or two concepts (industries plus households plus RoW; accumulation) or three concepts (industries plus RoW; households; accumulation) or four concepts (industries; households; accumulation; RoW). Other options are possible too. As it can be seen, there is a trade-off between the number of concepts/dimensions and the number of codes attached to each of them. The choice is one of the decisions taken during the creation of the data model. This choice must be based on logic, re-utilisation of concepts in other accounts (e.g. does a similar concept exist in national accounts?) and consequences on the code lists (e.g. is it more meaningful to have a code list only with ISIC categories or ISIC plus household emission types, etc.)

Once the concepts are identified, one code list must be drawn for each concept. This list must consist of codes in use in current international flows. Whenever this work is based on existing data flows, if several agencies use different code lists for the same concept, in principle both must be added (to ensure the DSD is valid for existing flows) but a rationalisation and harmonisation process should follow.

It is also possible and recommended, albeit not required, to indicate impossible combinations of the codes and concepts. They would correspond to the dark grey cells in Figure 2.

[6] They are actually products, however the term 'energy products' was avoided because it goes beyond SNA products and it goes beyond 'energy products' in energy statistics. Lacking a better name, 'energy flows' is provisionally used.

Figure 2

Table 3.5
Physical supply and use table for energy *(joules: net calorific units)*

Physical supply table for energy

	Production (including household production on own account); generation of residuals								Flows from the rest of the world		
	Agriculture, forestry and fishing ISIC A	Mining and quarrying ISIC B	Manufac-turing ISIC C	Electricity, gas, steam and air condition-ing supply ISIC D	Transporta-tion and storage ISIC H	Other industries	Households	Accumula-tion	Imports	Flows from the environ-ment	Total supply
Energy from natural inputs											
Natural resource inputs											
Mineral and energy resources										1 161.0	1 161.0
Timber resources										5.0	5.0
Inputs of energy from renewable sources											
Solar										20.0	20.0
Hydro										100.0	100.0
Wind										4.0	4.0
Wave and tidal											
Geothermal											
Other heat and electrical											
Other natural inputs											
Energy inputs to cultivated biomass										2.0	2.0
Total energy from natural inputs										1 292.0	1 292.0
Energy products											
Production of energy products by SIEC class											
Coal									225.0		225.0
Peat and peat products											
Oil shale/oil sands											
Natural gas (extracted)		395.0									395.0
Natural gas (distributed)				369.1							369.1
Oil (e.g., conventional crude oil)		721.0									721.0
Oil (oil products)			347.0						930.0		1 277.0
Biofuels	5.3		0.2	1.5							7.0
Waste	39.0		54.5						16.9		110.4
Electricity				212.0					22.0		234.0
Heat				78.5							78.5
Nuclear fuels and other fuels n.e.c.											
Total energy products	44.3	1 116.0	401.7	661.1					1 193.9		3 417.0
Energy residuals											
Losses during extraction		45.0									45.0
Losses during distribution				12.0							12.0
Losses during storage			6.0								6.0
Losses during transformation			7.0	204.4							211.4
Other energy residuals	50.3	3.2	418.7	90.6	632.0	96.0	240.0				1 530.8
Total energy residuals	50.3	48.2	431.7	307.0	632.0	96.0	240.0				1 805.2
Other residual flows											
Residuals from end use for non-energy purposes			51.0								51.0
Energy from solid waste								93.5			93.5
Total supply	94.6	1 164.2	884.4	968.1	632.0	96.0	240.0	93.5	1 193.9	1 292.0	6 658.7

The decisions taken on the data model lead – after some optimisation steps – to a set of DSDs and other related SDMX artefacts. The full process can also be reviewed in the "Checklist for SDMX Design Projects"[7] and more specifically the guidelines on "Modelling a Statistical Domain for Data Exchange in SDMX".[8]

[7] https://sdmx.org/?sdmx_news=checklist-for-sdmx-design-projects
[8] http://sdmx.org/wp-content/uploads/Modelling-domain-SDMX-discussion-paper-v1-201503.pdf

3.2. SEEA DSDs

This section explains the main decisions taken during the development of SEEA DSDs and the presents the status of advancement. This is work in progress but close to finalisation.

An early strategic decision was whether to extend the existing DSDs for national accounts to serve also the needs of SEEA or to create separate DSDs for SEEA. It was decided for the latter, i.e. DSDs not integrated with those for national accounts but sharing as many possible concepts and code lists with them (especially from supply-use and input-output tables).

Four of the five priority SEEA accounts are about flows (air emissions, materials, energy and water) and one is about stocks and changes in stocks (land accounts). It was decided to distinguish flows from stocks (including inflows, outflows, opening stocks, closing stocks, etc.), and supply from use with the same approach as in the DSDs for national accounts. A concept named 'accounting entry' is used for this purpose. The same code list as in national accounts is used. Thus a code 'Credit (resources)' (C) represents a supply of resources (e.g. in a supply table), a code 'Debit (uses)' (D) represents a use of resources (e.g. in a use table), a code 'Assets' (A) represents a stock of resources (e.g. in a land account), etc. It was decided to create two additional codes, for flows between the environment and the economy and between the economy and the environment. These codes do not exist in national accounts because the latter only consider flows within the economy. It is here that SEEA works as an extension of national accounts.

Unsurprisingly, the four flow accounts have many elements in common and differ from the stock account. For flow accounts:

- It was decided to create one single concept 'interactors' for industries (ISIC/NACE), households, accumulation and the rest of the world (see example in section 3.1). This corresponds to the columns in Figure 2. This concept is used by all four flow accounts.[9] As in the SEEA CF, the item 'accumulation' has a different meaning for each account: for air emissions it corresponds to emissions from controlled landfills, for energy and water it corresponds to changes in stocks.
- One concept was created for the 'products' of each of the four flow accounts. The rows in Figure 2 correspond to the concept for energy accounts; other concepts were created for air emissions, water and material flows. These four concepts may be merged into one; there are pros and cons and this decision has not been taken yet. So far the decision is not to merge them.
  It is very important that the code lists corresponding to those four concepts include all codes in use in international data flows.
- One concept was created to report bridging items. This is used for air emissions and energy.
- One concept was created to distinguish footprints (of air emissions, energy, materials or water) from production-based measures. This is a future-proof feature to allow for the reporting of footprints.

[9] Not all codes of this concept are used in all accounts. For instance the code 'rest of the world' is used to record imports and exports in energy and material flow accounts, but it is not used for air emission accounts.

- Raw material equivalents used in material flow accounts are modelled as a new unit. Even though raw material equivalents are used to produce raw material consumption (RMC), which is a footprint recorded as such along a specific dimension of the DSD (see above), their initial purpose is to measure imports and exports of products on comparable weight terms to domestic extractions of materials. In this sense, raw material equivalents simply correspond to a new unit of measure. This is why raw material equivalents and footprints are distinguished in the DSD.
- One concept for product (CPC/CPA) was necessary for breakdowns of footprints by product, e.g. energy footprints by CPC.
- One concept was necessary for the geographical code of counterpart areas in imports and exports. This was necessary in particular in Europe, where questionnaires distinguish between intra EU and extra EU imports/exports.
- It was decided to model the flows in land accounts closer to the stocks in land accounts than to the flows in the other accounts (see next).

For the land accounts (land cover and land use), which encompass flows and stocks:

- There is one code list for land cover and one for land use.
- A second concept was necessary for double-entry tables of changes in land cover from one type to another (land cover change matrix, see SEEA CF Table 5.14).
- One concept was necessary to distinguish opening stock of resources, additions to and reductions from stock, and closing stock. The same approach as in the DSDs for national accounts was followed.

The number of DSDs for SEEA has not been decided yet (as of this writing). This decision depends on the optimisation of the DSDs (i.e. number of DSDs and number of dimensions): e.g. it is possible to have 1 DSD with all the concepts or 2 DSDs with fewer concepts each, etc. It is likely that there will be five separate DSDs for air emissions, material flows, energy flows, water accounts and finally land cover and land use.

4. Questions for the London Group

Because the development of SEEA DSDs is part of the SEEA CF research agenda, the London Group has an important role to play in providing technical expertise. Unfortunately, there is a very narrow time window between the last meeting of the technical sub-group (in September 2017), the London Group discussion of this matter (in October) and submission for approval by the SDMX-MES OG (in December). At this stage input from the London Group is sought on very specific questions. More input can be provided later on (see below).

In particular, input from the London Group is sought about the following:

- Please check in particular the 6 code lists for: greenhouse gases and air pollutants, material flows, energy flows, water flows, land cover and land use (Annexes 1 to 6). Indicate if some codes are missing, or if further aggregation or disaggregation codes would be needed.

- Idem for the code list for 'interactors': completeness, aggregation and disaggregation needs (Annex 7)
- Idem for the code list for 'bridging items': completeness, aggregation and disaggregation needs (Annex 8)
- Please indicate if you are aware of any table for the five priority SEEA accounts which is actually compiled and cannot be modelled with the SDMX concepts introduced in section 3.2.

This feedback would greatly benefit the completeness and robustness of the first pilot package. Of course it will not be the last opportunity to comment on the outcome of the work.

A public consultation of the whole package will be organised in the first half of 2018. At that point any further comments can still be integrated. Please let us know if you consider engaging actively in that consultation either now or once the consultation is officially launched.

The final approach for running the public consultation and pilot review for SEEA was not yet decided. However, it would follow largely of what has been done for other global SDMX reporting frameworks. There are two typical phases in the checklist.

- **Content review**: The aim of the content review is that the project's design stage material is understandable, well-designed, and that it covers the scope of the project. The main deliverable for review is the "DSD matrix" as this contains the Concept Scheme, Code Lists, and DSDs.
- **Technical review**: The aim of the technical review is to test that the project's artefacts can be implemented at system level as efficiently as possible. The SDMX artefacts and further test material such as example data messages are sent to the pilot participants for review. The SDMX artefacts should be available in a registry, and the implementation and usage guidelines are sent for documentation.

It is also possible to run both phases in parallel if the material has a certain level of maturity. Feedback from the pilot participants is collected in an issue log and followed up by the design group.

Annex 1: Code list greenhouse gases and air pollutants

Code	Description
_Z	Not applicable
SOX	Sulphur oxides
NOX	Nitrogen oxides
NH3	Ammonia
CO	Carbon monoxide
NMVOC	Non-methane volatile organic compounds
CH4	Methane
N2O	Nitrous oxide
SF6	Sulphur hexafluoride
CO2	Carbon dioxide
CO2_BIO	Carbon dioxide from biomass used as a fuel
HFC	Hydrofluorocarbons
PFC	Perfluorocarbons
PM10	Particulates < 10µm
PM2_5	Particulates < 2.5µm
NF3	Nitrogen trifluoride
NF3_SF6	Nitrogen trifluoride and sulphur hexafluoride

Annex 2: Code list material flows

Code	Description
_T	Total
_Z	Not applicable
MF1	Biomass
MF11	Crops (excluding fodder crops)
MF111	Cereals
MF112	Roots, tubers
MF113	Sugar crops
MF114	Pulses
MF115	Nuts
MF116	Oil-bearing crops
MF117	Vegetables
MF118	Fruits
MF119	Fibres
MF11A	Other crops (excluding fodder crops) n.e.c.
MF12	Crop residues (used), fodder crops and grazed biomass
MF121	Crop residues (used)
MF1211	Straw
MF1212	Other crop residues (sugar and fodder beet leaves, etc.)
MF122	Fodder crops and grazed biomass
MF1221	Fodder crops (including biomass harvest from grassland)
MF1222	Grazed biomass
MF13	Wood
MF131	Timber (industrial roundwood)
MF132	Wood fuel and other extraction
MF13MEMO	Net increment of timber stock (memo item)
MF14	Wild fish catch, aquatic plants and animals, hunting and gathering
MF141	Wild fish catch
MF142	All other aquatic animals and plants
MF143	Hunting and gathering
MF15	Live animals and animal products (excluding wild fish, aquatic plants and animals, hunted and gathered animals)
MF151	Live animals (excluding wild fish, aquatic plants and animals, hunted and gathered animals)
MF152	Meat and meat preparations
MF153	Dairy products, birds? eggs, and honey
MF154	Other products from animals (animal fibres, skins, furs, leather, etc.)
MF16	Products mainly from biomass
MF2	Metal ores (gross ores)
MF21	Iron
MF22	Non-ferrous metal
MF221	Copper
MF222	Nickel
MF223	Lead
MF224	Zinc
MF225	Tin

MF226	Gold, silver, platinum and other precious metals
MF2261	Gold
MF2262	Silver
MF2263	Platinum and other precious metal ores
MF227	Bauxite and other aluminium
MF228	Uranium and thorium
MF229	Other non-ferrous metals
MF2291	Tungsten
MF2292	Tantalum
MF2293	Magnesium ores
MF2294	Titanium
MF2295	Manganese
MF2296	Chromium
MF2297	Other non-ferrous metals n.e.c.
MF23	Products mainly from metals
MF3	Non-metallic minerals
MF31	Marble, granite, sandstone, porphyry, basalt, other ornamental or building stone (excluding slate)
MF32	Chalk and dolomite
MF33	Slate
MF34	Chemical and fertiliser minerals
MF35	Salt
MF36	Limestone and gypsum
MF37	Clays and kaolin
MF38	Sand and gravel
MF39	Other non-metallic minerals n.e.c.
MF3A	Excavated earthen materials (including soil), only if used (optional reporting)
MF3B	Products mainly from non metallic minerals
MF4	Fossil energy materials/carriers
MF41	Coal and other solid energy materials/carriers
MF411	Lignite (brown coal)
MF412	Hard coal
MF413	Oil shale and tar sands
MF414	Peat
MF42	Liquid and gaseous energy materials/carriers
MF421	Crude oil, condensate and natural gas liquids (NGL)
MF422	Natural gas
MF423	Fuels bunkered (Imports: by resident units abroad); (Exports: by non-resident units domestically)
MF4231	Fuel for land transport
MF4232	Fuel for water transport
MF4233	Fuel for air transport
MF43	Products mainly from fossil energy products
MF5	Other products
MF6	Waste for final treatment and disposal
MF71	Emissions to air
MF711	Carbon dioxide (CO2)
MF7111	Carbon dioxide (CO2) from biomass combustion

MF7112	Carbon dioxide (CO2) excluding biomass combustion
MF712	Methane (CH4)
MF713	Dinitrogen oxide (N2O)
MF714	Nitrous oxides (NOx)
MF715	Hydroflourcarbons (HFCs)
MF716	Perflourocarbons (PFCs)
MF717	Sulfur hexaflouride
MF718	Carbon monoxide (CO)
MF719	Non-methane volatile organic compounds (NMVOC)
MF71A	Sulfur dioxide (SO2)
MF71B	Ammonia (NH3)
MF71C	Heavy metals
MF71D	Persistent organic pollutants (POPs)
MF71E	Particles (e.g. PM10, Dust)
MF71F	Other emissions to air
MF72	Waste disposal
MF721	Disposal of municipal waste to the environment
MF721MEMO	Disposal of municipal waste to controlled landfills (memo item)
MF722	Disposal of industrial waste to the environment
MF722MEMO	Disposal of industrial waste to controlled landfills (memo item)
MF73	Emissions to water
MF731	Nitrogen (N)
MF732	Phosphorus (P)
MF733	Heavy metals
MF734	Other substances and (organic) materials
MF735	Dumping of materials at sea
MF74	Dissipative use of products
MF741	Organic fertiliser (manure)
MF742	Mineral fertiliser
MF743	Sewage sludge
MF744	Compost
MF745	Pesticides
MF746	Seeds
MF747	Salt and other thawing materials spread on roads (including grit)
MF748	Solvents, laughing gas and other
MF75	Dissipative losses
MF81	Balancing items: input side
MF811	Oxygen for combustion processes
MF812	Oxygen for respiration of humans and livestock; bacterial respiration from solid waste and wastewater
MF813	Nitrogen for Haber-Bosch process
MF814	Water requirements for the domestic production of exported beverages
MF82	Balancing items: output side
MF821	Water vapour from combustion
MF8211	Water vapour from moisture content of fuels
MF8212	Water vapour from the oxidised hydrogen components of fuels
MF822	Gases from respiration of humans and livestock (CO2 and H2O), and from bacterial respiration from solid waste and wastewater (H2O)
MF8221	Carbon dioxide (CO2)
MF8222	Water vapour (H2O)
MF823	Excorporated water from biomass products

SM_FIN	Stage of Manufacturing - finished products
SM_SFIN	Stage of Manufacturing - semi-finished products
SM_RAW	Stage of Manufacturing - raw products
AGG3A	Non-metallic minerals - construction dominant
AGG3B	Non-metallic minerals - industrial or agricultural dominant

Annex 3: Code list energy flows

Code	*Description*
N00	**Energy natural resource inputs**
NM00	Mineral and energy resources
NM01_02_03	Fossil non-renewable natural energy inputs
NM01	Oil resources
NM02	Natural gas resources
NM03	Coal and peat resources
NM04	Uranium and other nuclear
NT00	Timber resources (natural)
NT06	Timber resources (natural)
NT06_NO13	Biomass based renewable natural energy inputs
NR00	Inputs of energy from renewable sources
NR07	Solar
NR08	Hydro
NR09	Wind
NR10_11_12	Other renewable natural energy inputs
NR10	Wave and tidal
NR11	Geothermal
NR12	Other heat and electrical
NO00	Other natural inputs
NO13	Energy inputs to cultivated biomass
P00	**Energy products as listed in SIEC**
P0	Coal
P01	Hard coal
P0110	Anthracite
P012	Bituminous coal
P0121	Coking coal
P0129	Other bituminous coal
P02	Brown coal
P0210_0220_1110_1120_2000	Brown coal and peat
P0210	Sub-bituminous coal
P0220	Lignite
P03	Coal products
P0311_0312_0320_0330_0340_039_1210_1290	Secondary coal products (coke, coal tar, patent fuel, BKB and peat products)
P031	Coal coke
P0311	Coke oven coke
P0312	Gas coke
P0313	Coke breeze
P0314	Semi cokes
P0320	Patent fuel
P0330	Brown coal briquettes (BKB)
P0340	Coal tar

P0350_0360_0371_0372_0379	Derived gases (= manufactured gases excl. biogas)
P0350	Coke oven gas
P0360	Gas works gas (and other manufactured gases for distribution)
P037	Recovered gases
P0371	Blast furnace gas
P0372	Basic oxygen steel furnace gas
P0379	Other recovered gases
P0390	Other coal products
P1	Peat and peat products
P11	Peat
P1110	Sod peat
P1120	Milled peat
P12	Peat products
P1210	Peat briquettes
P1290	Other peat products
P2	Oil shale / oil sands
P20	Oil shale / oil sands
P2000	Oil shale / oil sands
P3	Natural gas
P30	Natural gas
P3000	Natural gas
P4	Oil
P4100_4200_4500	Crude oil, NGL, and other hydrocarbons (excl. bio)
P41	Conventional crude oil
P4100	Conventional crude oil
P42	Natural gas liquids (NGL)
P4200	Natural gas liquids (NGL)
P43	Refinery feedstocks
P4300_4400_4691_4692_4693_4694_4695_4699	Other petroleum products incl. additives/oxygenates and refinery feedstocks
P4300	Refinery feedstocks
P44	Additives and oxygenates
P4400	Additives and oxygenates
P45	Other hydrocarbons
P4500	Other hydrocarbons
P46	Oil products
P4610_4620_4630	Refinery gas, ethane and LPG
P4610	Refinery gas
P4620	Ethane
P4630	Liquefied petroleum gases (LPG)
P4640	Naphtha
P465	Gasolines
P4651_4652	Motor spirit (without bio)
P4651	Aviation gasoline
P4652	Motor gasoline
P4653_4661_4669	Kerosenes and jet fuels (without bio)

P4653	Gasoline-type jet fuel
P466	Kerosenes
P4661	Kerosene-type jet fuel
P4669	Other kerosene
P467	Gas oil / diesel oil and Heavy gas oil
P4671	Gas oil / Diesel oil
P46711	Transport diesel (without bio)
P46712	Heating and other gasoil (without bio)
P4672	Heavy gas oil
P4680	Fuel oil
P469	Other oil products
P4691	White spirit and special boiling point industrial spirits
P4692	Lubricants
P4693	Paraffin waxes
P4694	Petroleum coke
P4695	Bitumen
P4699	Other oil products n.e.c.
P5	Biofuels
P51	Solid biofuels
P511	Fuelwood, wood residues and by-products
P5111_5119_5120_5130_5140_5150_5160	Wood, wood waste and other solid biomass, charcoal
P5111	Wood pellets
P5119	Other Fuelwood, wood residues and by-products
P5120	Bagasse
P5130	Animal waste
P5140	Black liquor
P5150	Other vegetal material and residues
P5160	Charcoal
P52	Liquid biofuels
P5210_5220_5230_5290	Liquid biofuels
P5210	Biogasoline
P5220	Biodiesels
P5230	Bio jet kerosene
P5290	Other liquid biofuels
P53	Biogases
P531	Biogases from anaerobic fermentation
P5311_5312_5319_5320	Biogas
P5311	Landfill gas
P5312	Sewage sludge gas
P5319	Other biogases from anaerobic fermentation
P5320	Biogases from thermal processes
P6	Waste
P61	Industrial waste
P6100	Industrial waste

P62	Municipal waste
P6200	Municipal waste
P7	Electricity
P70	Electricity
P7000	Electricity
P8	Heat
P80	Heat
P8000	Heat
P9	Nuclear fuels and other fuels n.e.c.
P91	Uranium and plutonium
P910	Uranium and plutonium
P9101	Uranium ores
P9109	Other uranium and plutonium
P92	Other nuclear fuels
P9200	Other nuclear fuels
P99	Other fuels n.e.c.
P9900	Other fuels n.e.c.
R0	**Energy residuals**
R01_02_03_04_05	Energy losses all kinds of (during extraction, distribution, storage and transformation, and dissipative heat from end use)
R01	Losses during extraction
R02	Losses during distribution
R03	Losses during storage
R04	Losses during transformation
R05	Other energy residuals
OR0	Other residual flows
OR01	Residuals from end-use for non-energy purposes
OR02	Energy from solid waste
OR021	Renewable waste
OR021	Non-renewable waste

Annex 4: Code list water flows

Code	Description
S00	Sources of abstracted water
SI00	Inland water resources
SI01	Surface water
SI02	Groundwater
SI03	Soil water
SO00	Other water sources
SO04	Precipitation
SO05	Sea water
A00	Abstracted water
A06	For distribution
A07	For own-use
W00	Wastewater and reused water
WW00	Wastewater
WW08	Wastewater to treatment
WW09	Own treatment
RW00	Reused water produced
RW10	For distribution
RW11	For own use
R00	Return flows of water
RI00	To inland water resources
RI12	Surface water
RI13	Groundwater
RI14	Soil water
RO00	To other sources
RO15	To other sources
R16	Total Return flows of which: Losses in distribution
E00	Evaporation of abstracted water, transpiration and water incorporated into products
E17	Evaporation of abstracted water
E18	Transpiration
E19	Water incorporated into products
_T	Total

Annex 5: Code list land cover types

Code	Name
LC6970	Artificial surfaces (including urban and associated areas)
LC6982	Coastal water bodies and intertidal areas
LC6983	Grassland
LC6971	Herbaceous crops
LC6981	Inland water bodies
LC6975	Mangroves
LC6973	Multiple or layered crops
LC6980	Permanent snow and glaciers
LC6976	Shrub-covered areas
LC6977	Shrubs and/or herbaceous vegetation, aquatic or regularly flooded
LC6978	Sparsely natural vegetated areas
LC6979	Terrestrial barren land
LC6974	Tree-covered areas
LC6972	Woody crops

Annex 6: Code list land use types

Item Code	Name
LU6600	Country area
LU6601	Land area
LU6610	Agricultural area
LU6671	Agricultural area organic, total
LU6672	Agricultural area certified organic
LU6673	Agricultural area in conversion to organic
LU6611	Agricultural area actually irrigated
LU6620	Arable land and Permanent crops
LU6621	Arable land
LU6630	Temporary crops
LU6640	Fallow land (temporary)
LU6650	Permanent crops
LU6655	Permanent meadows and pastures
LU6659	Perm. meadows & pastures - Nat. growing
LU6661	Forest
LU6714	Primary forest
LU6717	Other naturally regenerated forest
LU6716	Planted forest
LU6670	Other land
LU6690	Total area equipped for irrigation

Annex 7: Code list interactors

Code	Description
_T	Total - All activities
_Z	Not applicable
_X	Not allocated
ATU	All NACE activities
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
B05	Mining of coal and lignite
B06	Extraction of crude petroleum and natural gas
B07	Mining of metal ores
B08	Other mining and quarrying
B09	Mining support service activities
C	Manufacturing
C10	Manufacture of food products
C10T12	Manufacture of food products; beverages and tobacco products
C11	Manufacture of beverages
C12	Manufacture of tobacco products
C13	Manufacture of textiles
C13_14	Manufacture of textiles and wearing apparel
C13T15	Manufacture of textiles, wearing apparel, leather and related products
C14	Manufacture of wearing apparel
C15	Manufacture of leather and related products
C16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
C16T18	Manufacture of wood, paper, and their products; printing and reproduction of recorded media
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
C22_23	Manufacture of rubber and plastic products and other non-metallic mineral products
C23	Manufacture of other non-metallic mineral products
C24	Manufacture of basic metals
C24_25	Manufacture of basic metals and fabricated metal products, except machinery and equipment
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
C29_30	Manufacture of motor vehicles, trailers, semi-trailers and of other transport equipment
C30	Manufacture of other transport equipment
C31	Manufacture of furniture
C31_32	Manufacture of furniture; other manufacturing
C31T33	Manufacture of furniture; jewellery, musical instruments, toys, etc.; repair and installation of machinery and equipment
C32	Other manufacturing
C33	Repair and installation of machinery and equipment
D	Electricity, gas, steam and air conditioning supply
D35	Electricity, gas, steam and air conditioning supply
E	Water supply; sewerage, waste management and remediation activities
E36	Water collection, treatment and supply
E37	Sewerage
E37T39	Sewerage, waste management, remediation activities
E38	Waste collection, treatment and disposal activities; materials recovery
E39	Remediation activities and other waste management services
F	Construction
F41	Construction of buildings
F42	Civil engineering
F43	Specialised construction activities
GTUXH	Services (except transportation and storage)
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
GTU	Services
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
ITU	Services (except wholesale and retail trade, transportation and storage)
I	Accommodation and food service activities
I55	Accommodation
I56	Food and beverage service activities
J	Information and communication
J58	Publishing activities
J58T60	Publishing, motion picture, video, television programme production; sound recording, programming and broadcasting activities
J59	Motion picture, video and television programme production, sound recording and music publishing activities

J59_60	Motion picture, video, television programme production; programming and broadcasting activities
J60	Programming and broadcasting activities
J61	Telecommunications
J62	Computer programming, consultancy and related activities
J62_63	Computer programming, consultancy, and information service activities
J63	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	Imputed rents of owner-occupied dwellings
L68B	Real estate activities excluding imputed rents
M	Professional, scientific and technical activities
M69	Legal and accounting activities
M69_70	Legal and accounting activities; activities of head offices; management consultancy activities
M69T71	Legal and accounting activities; activities of head offices; management consultancy activities; architectural and engineering activities; technical testing and analysis
M70	Activities of head offices; management consultancy activities
M71	Architectural and engineering activities; technical testing and analysis
M72	Scientific research and development
M73	Advertising and market research
M73T75	Advertising and market research; other professional, scientific and technical activities; veterinary activities
M74	Other professional, scientific and technical activities
M74_75	Other professional, scientific and technical activities; veterinary activities
M75	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	Security and investigation activities
N80T82	Security and investigation, service and landscape, office administrative and support activities
N81	Services to buildings and landscape activities
N82	Office administrative, office support and other business support activities
O	Public administration and defence; compulsory social security
P	Education
P85	Education
Q	Human health and social work activities
Q86	Human health activities
Q87	Residential care activities

Q87_88	Residential care activities and social work activities without accommodation
Q88	Social work activities without accommodation
R	Arts, entertainment and recreation
R90	Creative, arts and entertainment activities
R90T92	Creative, arts and entertainment activities; libraries, archives, museums and other cultural activities; gambling and betting activities
R91	Libraries, archives, museums and other cultural activities
R92	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
T97	Activities of households as employers of domestic personnel
T98	Undifferentiated goods- and services-producing activities of private households for own use
U	Activities of extraterritorial organisations and bodies
ATU_HH	All NACE and households activities
HH	Activities by households
HH_TR	Transport activities by households
HH_HEAT	Heating and cooling activities by households
HH_OTH	Other activities by households

Annex 8: Code list bridging items

Code	Description
RES	Production and consumption activities by residents
RES_ABR	Production and consumption activities abroad by residents
RES_ABR_FWTR	Fishing vessels operated abroad by residents
RES_ABR_LTR	Land transport operated abroad by residents
RES_ABR_WTR	Water transport operated abroad by residents
RES_ABR_ATR	Air transport operated abroad by residents
TER_NRES	Production and consumption activities on the territory by non-residents
TER_NRES_LTR	Land transport operated on the territory by non-residents
TER_NRES_WTR	Water transport operated on the territory by non-residents
TER_NRES_ATR	Air transport operated on the territory by non-residents
ADJ_SD	Adjustments and statistical discrepancy
TER	Production and consumption activities on the territory
RUT	Resident units in the territory