

Guidelines for Global DSDs on SEEA

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Introduction, governance and scope

The Ownership Group for SDMX implementation for macro-economic statistics (SDMX-MES OG) mandated a technical sub-group to propose global Data Structure Definitions (DSDs) for the implementation of SDMX in SEEA. The SDMX-MES OG is already responsible for SDMX DSDs in the areas of National Accounts (incl. Government Finance), Balance of Payments, Foreign Direct Investment and Price Indices. More information on the mandate of the SDMX-MES OG and the existing packages can be found on the SDMX website:

SDMX-MES package on National Accounts and Government Finance: https://sdmx.org/?page_id=1498

SDMX-MES packages on Balance of Payments and Foreign Direct Investment: https://sdmx.org/?page_id=1747

SDMX-MES pilot package on Consumer Price Index (CPI and HICP): https://sdmx.org/?sdmx_news=pilot-review-global-dsds-for-consumer-price-indices-cpi-and-harmonised-indices-of-consumer-prices-hicp

The sub-group on SDMX for SEEA is composed of representatives from Eurostat, FAO, OECD, UNECE, UNSD and UN Environment. The overall scope of the work has been defined to cover the following SEEA priority accounts as mandated by the UN Statistical Commission:

1. Air emissions
2. Energy flows
3. Material flows
4. Water flows
5. Land (land use and land cover)

It is noted that some of these accounts will deliver indicators to monitor sustainable development goals (SDGs). In particular, the information in the material flow accounts and water flow accounts can be directly used for SDG indicators. The other priority accounts can also contribute to SDGs depending on what is the main data source for SDG indicators. The methodology and data sources for many SDG indicators are still under discussion (indicators Tier III) and thus there is an opportunity to have other SEEA aligned SDG indicators.

The scope of the work includes some reference metadata which is "close to the data" and is usually transmitted together with data. Other more high level reference metadata (e.g. methodological notes) are currently out of scope. This aspect would be picked up once discussion on Metadata Structure Definitions (MDSs) is elaborated for all domains within the MES area.

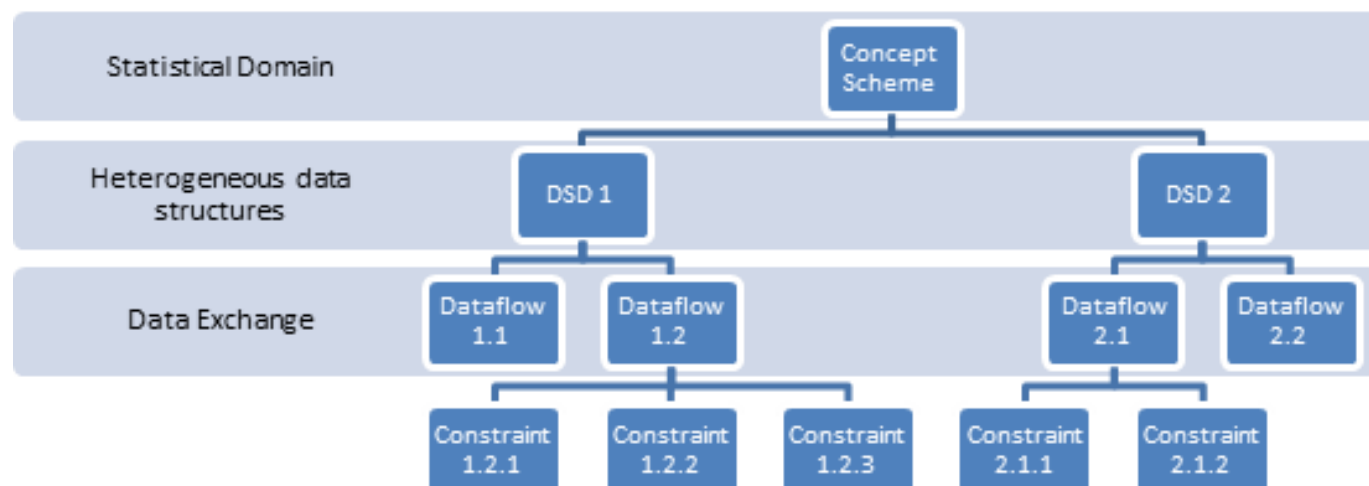
The process follows the generic "Checklist for SDMX Design Projects" that is available on the SDMX website: https://sdmx.org/?sdmx_news=checklist-for-sdmx-design-projects. An important milestone in every SDMX project is the pilot review phase. It consists of two phases: a content review and a technical 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". The aim of the technical review is to test that the project's SDMX artefacts can be implemented at system level as efficiently as possible. It includes to test material such as example data messages and xml-schemas. The SDMX artefacts should be available in a registry, and the implementation & usage guidelines are sent for documentation. Further details on the process can be found in the checklist mentioned above.

For this project it was decided to conduct the content and technical reviews in parallel. This guideline document should support participants conducting the pilot review. Please send any comments you may have on the package to ESTAT-SUPPORT-SDMX@ec.europa.eu and Daniel.Suranyi@ec.europa.eu by **31st July 2018**. The group will review the comments received during the pilot consultation and publish decisions on any follow-up actions taken and created an updated version of the package as needed in due time after that.

Content review information

Implementation Model

The model chosen to implement SDMX for SEEA follows the basic model used also in SDMX for National Accounts. The approach is also expressed in the guidelines for "Modelling a Statistical Domain for Data Exchange in SDMX" available from the SDMX Statistical Working Group: https://sdmx.org/?page_id=4345#Modelling. The document suggests a generic implementation model pictured below:



Following this generic model, the outcome of the design project so far are:

- 1 Concept Scheme covering the area of SEEA
- 2 One Data Structure Definition per priority area (i.e. 5 DSDs in total).

Data Flow and Constraint artefacts are not yet created for the pilot review. Further mapping and creation of artefacts will only be done once the overall model is approved. Some examples are provided as part of the pilot package.

SEEA SDMX Data Model

General aspects (DSD Matrix)

Within a data message, dimensions are used to uniquely identify the observation. They are always mandatory. Attributes can be used to further describe the data. They can be linked to several levels (dataset, series, observation) and can be mandatory or optional. All concepts can be coded (linked to a code list) or be defined through a data type (e.g. String, DateTime, ...).

The group has defined a "DSD Matrix" as an inventory for structuring the relevant data flows in the area of environmental-economic accounts. The Matrix file summarised all concepts and code lists contained in the reporting framework. Those have been selected from various sources along the data flows documented in annex 1. The codification of domain concepts in the DSDs has to be descriptive and comprehensive enough to fulfil any current and future data exchange requirements within the scope of SEEA.

It contains the following sheets:

- **Overview DSDs**, showing the concepts used, their representation and the link to the DSDs;
- **Matrix sheet**, kept as a placeholder for showing the relationship between the data flows and concepts once implemented;
- **Code list sheets**, showing the contents of each of the code lists used and some additional comments like for instance integrity rules.

Code lists marked in green are sourced from cross-domain code lists; code lists marked in yellow are MES shared code lists. Note that for some shared code lists, several codes on top are marked in yellow as well. Those are suggested additions which will be merged into the existing code lists upon completion of the pilot.

SEEA Coding Model Overview

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, households, accumulation and the rest of the world (INTERACTORS). This corresponds to the columns in a physical supply-use table, see e.g. SEEA CF Table 2.1. This concept is used by all four flow accounts. 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. This corresponds to the rows in a physical supply-use table, see e.g. SEEA CF Table 2.1. They are: AIRPOL for air emissions, ENERGY_FLOWS for energy flows, MATERIAL for material flows, WATER_FLOWS for water accounts, LAND_COVER and LAND_USE for land accounts.
- One concept was created to report bridging items (BRIDGE_ITEM), i.e. to reconcile between aggregated data for units resident in the economy and aggregated data for national units. This is used for air emissions and energy (NB: The data matrix has entries also for MFA and water).
- One concept was created to distinguish footprints (of air emissions, energy, materials or water), also known as demand-based measures, from production-based measures (DEMAND_PROD). This is a future-proof feature to allow for the reporting of footprints. (Placeholder to explain here how to use it)
- Raw material equivalents used from imports and exports in material flow accounts are modelled as a new unit (entry T_RME in code list CL_UNIT). Even though raw material equivalents are used to produce the aggregate raw material consumption (RMC), which is a footprint recorded as such along a specific dimension of the DSD, 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. It is for this reason that raw material equivalents and footprints are distinguished in the DSD. (Placeholder to explain here or somewhere below how to use it)
- One concept for product (PRODUCT) was necessary for breakdowns of footprints by product according to the classifications CPC/CPA, e.g. energy footprints by CPC. This is used for air emissions, energy flows and material flows.
- One concept was necessary for the geographical code of counterpart areas in imports and exports (AREA). This was necessary in particular in Europe, where questionnaires distinguish between intra EU and extra EU imports/exports. The same code list was used as in the DSDs for national accounts.
- 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 (CL_LAND_COVER and CL_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). This is LAND_COVER_TO. It uses the same code list CL_LAND_COVER and concept LAND_COVER
- 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. This is modelled in the concept NA_STO. In particular, opening stocks are coded with code LS in CL_NA_STO, closing stocks are coded with code LE, changes in stock are coded with code LX. Additions to stock are changes with positive value and reductions from stock are changes with negative value.

Concepts and Coding

Note that as done in the other DSDs within macro-economic statistics, we work with a single measure (OBS_VALUE). No multiple measures are used. Thus only dimensions and attributes are described below. For the coded dimensions and attributes, code lists have been taken as far as available in that order from:

- existing cross-domain code lists (e.g. CL_FREQ)
- existing code lists from other MES DSDs (e.g. CL_UNIT, CL_ACCOUNT_ENTRY). In three cases existing code lists were extended: first in CL_UNIT more physical units (i.e. non-monetary units) were added, such as 'Tonns of CO2 equivalents'. Secondly, in CL_ACCOUNT_ENTRY, a few codes were added e.g. flows from the environment to the economy and from the economy to the environment. Thirdly, in CL_NA_STO a few codes were added for main aggregates such as 'Domestic Material Consumption'
- derived from existing classifications, e.g. CL_ENERGY_FLOWS derived from classifications of energy products used in energy statistics

- new code lists created by the group for the needs of SEEA, e.g. CL_AIRPOL with list of greenhouse gasses and air pollutants, and other similar lists for the other SEEA priority accounts.

For the last three cases, the guidelines for the Creation and Management of SDMX Code Lists have been used (https://sdmx.org/?page_id=4345#CodeListGuideline). Some existing code lists have been extended. In order not to impact the existing DSDs, they have been created in the pilot registry with ESTAT maintenance agency and a different version number for the purpose of the pilot. Once approved, the original Code Lists would be updated and used across all MES DSDs. These are marked in red in the DSD matrix for "draft maintenance agency / version for pilot use".

Consequently, the following concepts are used in the DSD for each environmental account:

Air emissions

DEMAND_PROD: distinguishes between production-based accounts and demand-based accounts (i.e. footprints)

ACCOUNTING_ENTRY: Generic national accounts list to distinguish assets and flows. Further distinguishes flows inside economy, from economy to environment (and viceversa), incoming flows (credits) and outgoing flows (debits), etc. All the entries in air emission accounts are flows from the economy to the environment

COUNTERPART_AREA: needed for international transactions. This is to attribute emissions to other economies in the case of footprints

INTERACTORS: represents units in the economy or the environment. The former are further distinguished between production units, broken down by ISIC/NACE, and households, broken down by activity types. In the case of air emission accounts, all the economic units act as emitters and the environment absorbs the emissions

BRIDGE_ITEM: bridging items to reconcile the economy as defined in terms of units resident in the territory (in the sense of national accounts) and units physically located in the territory

AIRPOL: list of greenhouse gases and air pollutants

STO: list of transactions and aggregates from SNA with additional transactions and aggregates from SEEA. For air emission accounts only needed for footprints to attribute to types of final demand

SECTOR: institutional sectors from SNA, needed in SEEA e.g. to distinguish between final consumption by government sector and final consumption by household sector

Energy accounts

DEMAND_PROD: distinguishes between production-based accounts and demand-based accounts (i.e. footprints). This is future-oriented as presently there are no energy footprints

ACCOUNTING_ENTRY: distinguishes assets and flows. Further distinguishes flows inside economy, from economy to environment (and viceversa), incoming flows (credits) and outgoing flows (debits), etc. Only flows, of different types, used in energy accounts.

COUNTERPART_AREA: needed for international transactions (imports/exports)

INTERACTORS: represents units in the economy or the environment. The former are further distinguished between production units, broken down by ISIC/NACE, and households, broken down by activity types

BRIDGE_ITEM: bridging items to reconcile the economy as defined in terms of units resident in the territory (in the sense of national accounts) and units physically located in the territory

ENERGY_FLOWS: list of energy-related natural inputs, energy products and energy-related residuals

STO: list of transactions and aggregates from SNA with additional transactions and aggregates from SEEA. For energy accounts not strictly needed, as imports/exports/output/intermediate consumption etc. can be distinguished from combinations of other concepts, but temporarily left in for transparency

SECTOR: institutional sectors from SNA. Not really needed for energy accounts but temporarily left in case the data model is adjusted

Material flow accounts

DEMAND_PROD: distinguishes between production-based accounts and demand-based accounts (i.e. footprints)

ACCOUNTING_ENTRY: distinguishes assets and flows. Further distinguishes flows inside economy, from economy to environment (and viceversa), incoming flows (credits) and outgoing flows (debits), etc. Only flows, of different types, used in material flow accounts

COUNTERPART_AREA: needed for international transactions

BRIDGE_ITEM: bridging items to reconcile the economy as defined in terms of units resident in the territory (in the sense of national accounts) and units physically located in the territory

MATERIAL: list of materials for MFA, materials by stage of manufacturing for imports/exports

STO: list of transactions and aggregates from SNA with additional transactions and aggregates from SEEA. MFA aggregates added for transparency and due to their importance (some of them are SDG indicators).

SECTOR: institutional sectors from SNA. Not really needed for energy accounts but temporarily left in case the data model is adjusted

Water accounts

DEMAND_PROD: distinguishes between production-based accounts and demand-based accounts (i.e. footprints). This is future-oriented as presently there are no water footprints

ACCOUNTING_ENTRY: distinguishes assets and flows. Further distinguishes flows inside economy, from economy to environment (and viceversa), incoming flows (credits) and outgoing flows (debits), etc. Only flows, of different types, used in water flow accounts

COUNTERPART_AREA: needed for international transactions (imports/exports)

INTERACTORS: represents units in the economy or the environment. The former are further distinguished between production units, broken down by ISIC/NACE, and households, broken down by activity types

WATER_FLOWS: list of water flows

Land accounts

DEMAND_PROD: distinguishes between production-based accounts and demand-based accounts (i.e. footprints). This is future-oriented as presently there are no land footprints

ACCOUNTING_ENTRY: distinguishes assets and flows. Further distinguishes flows inside economy, from economy to environment (and viceversa), incoming flows (credits) and outgoing flows (debits), etc. Flows and stocks are used in land accounts

LAND_COVER and LAND_COVER_TO: lists of land cover types (origin/destination)

LAND_USE and LAND_USE_TO: lists of land use types (origin/destination)

Generic concepts used in all the DSDs:

UNIT_MEASURE: unit of measure

UNIT_MULTPRODUCT: multiplier of unit of measure

FREQ: frequency of the data (for SEEA: normally annual)

OBS_STATUS: to distinguish normal estimates, provisional estimates, forecasts, etc.

CONF_STATUS: to distinguish e.g. confidential data from non-confidential data

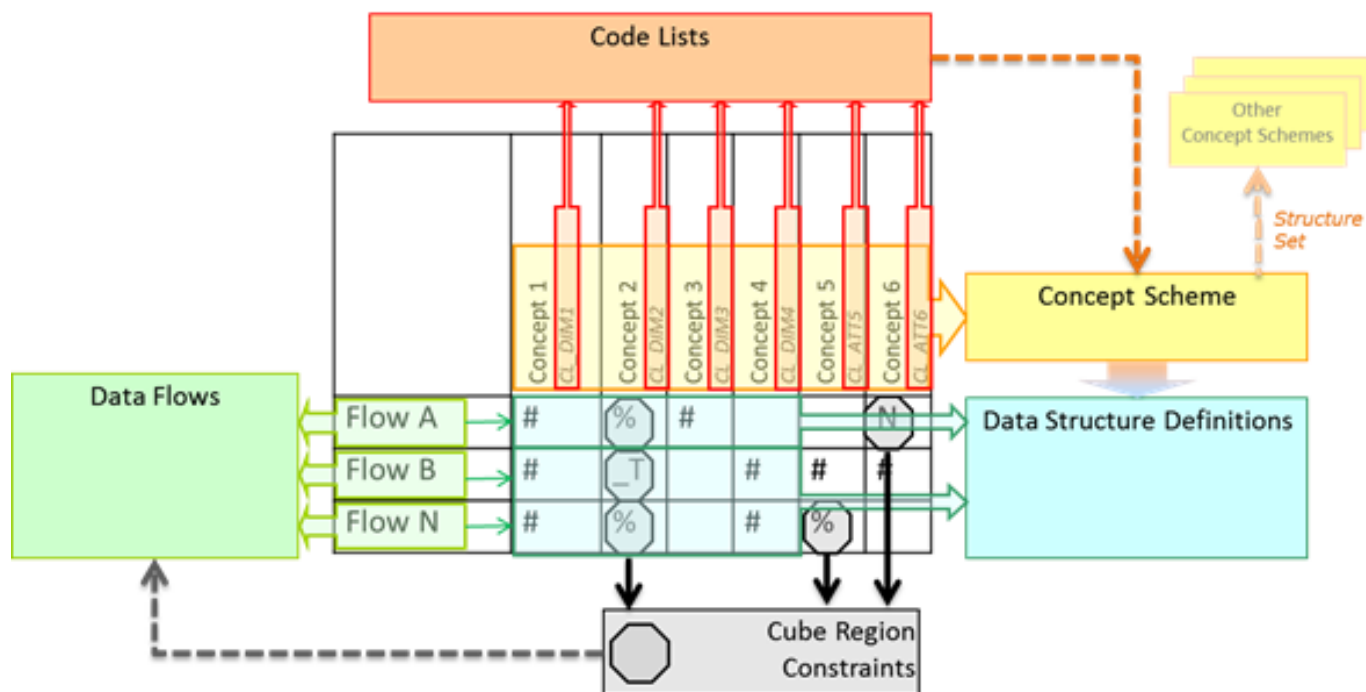
DECIMALS: number of decimal digits

ORGANISATION: international organisation running the data collection

Pilot review information

Link between the DSD matrix and the SDMX artefacts

Following the generic implementation model, the DSD matrix is linked to the SDMX artefact as follows:



For the pilot review, the matrix documents the Concepts Scheme, the DSDs and the Code Lists. Data Flows have been used to analyse the Concepts and Code Lists but will only be fully documented after the pilot review (see also annex 1 for data flows included for final implementation).

SDMX artefacts

The pilot artefacts can be accessed through the Fusion Cloud registry (<https://registry.sdmxcloud.org/>). Once approved, the final artefacts will be published in the Global SDMX Registry (<https://registry.sdmx.org/>). Note that the interfaces look different, but both registries allow user interface as well as web service access. The DSD identifiers and URLs to the pilot DSDs are the following:

DSD ID	Pilot DSD version	REST URL (SDMX 2.1, all references)
SEEAIR	0.1	https://registry.sdmxcloud.org/ws/public/sdmxapi/rest/datastructure/ESTAT/SEEAIR/0.1/?format=sdmx-2.1&detail=full
SEEANRG	0.1	https://registry.sdmxcloud.org/ws/public/sdmxapi/rest/datastructure/ESTAT/SEEANRG/0.1/?format=sdmx-2.1&detail=full
SEEAAMFA	0.1	https://registry.sdmxcloud.org/ws/public/sdmxapi/rest/datastructure/ESTAT/SEEAAMFA/0.1/?format=sdmx-2.1&detail=full
SEEAWTR	0.1	https://registry.sdmxcloud.org/ws/public/sdmxapi/rest/datastructure/ESTAT/SEEAWTR/0.1/?format=sdmx-2.1&detail=full
SEEAALND	0.1	https://registry.sdmxcloud.org/ws/public/sdmxapi/rest/datastructure/ESTAT/SEEAALND/0.1/?format=sdmx-2.1&detail=full

Note that the maintenance agency for the DSDs is currently Eurostat for purposes of the pilot only. The final maintenance agency for the DSDs might change depending on Ownership Group agreement after the pilot and before the DSDs are finally published in the global DSD registry. Other parameters of the REST URL can be modified as needed by the implementer.

Detailed coding instructions

This section provides more detailed instructions for each of the SEEA priority accounts and the datasets for each account.

Air emissions

The data model for air emissions accounts is based on existing data collections and dissemination standards in place in Eurostat, OECD and FAO.

The SDMX data model considers five datasets related to air emissions. A first dataset is for data collections of air emission accounts. This is represented e.g. in SEEA CF Table 3.7. This table corresponds to the Eurostat questionnaire (although the Eurostat questionnaire has rows, columns and layers arranged differently this has no consequences for the SDMX encoding).

Moreover, the tables in the Eurostat questionnaire have a second part, at the bottom of each table, collecting bridging items. This is a reconciliation of the accounts, based on the residence principle from national accounts, with the territorial principle used in the greenhouse gas inventories and air pollution inventories. As said, in the Eurostat questionnaire, the bridging items are part of the same table, but for the purpose of the SDMX encoding it is helpful to imagine them as two different (sub)tables: one as SEEA CF Table 3.7 on the top, and one with the bridging items at the bottom.

The (sub)table at the top of the Eurostat questionnaire, corresponding to SEEA CF 3.7 and with no bridging items, should be encoded as follows:

- All measures are production-based, i.e. the accounts are broken-down by producers of the emissions. They are coded DEMAND_PROD=P.
- The types of substances in the rows of SEEA CF Table 3.7 correspond to the concept AIRPOL; the code list of air pollutants (CL_AIRPOL) encompasses codes in use by Eurostat, OECD and FAO.
- The columns of SEEA CF Table 3.7 follow the concept INTERACTORS. The item 'accumulation' in this list corresponds to emissions from controlled landfills.
- All entries in the table are flows from economic units into the environment and they are coded as ACCOUNTING_ENTRY=EC. This is true for all the air emission accounts.
- Other concepts with fixed values are: COUNTERPART AREA must be coded W2 meaning all the emissions are attributed to the domestic economy; PRODUCT=T meaning no breakdown by product; SECTOR=S1 meaning no breakdown by institutional sector; BRIDGE_ITEM=RES meaning emissions by residents; STO=Z meaning not applicable i.e. there are no monetary national accounts transactions.
- The code list for units CL_UNIT is based on national accounts, but additional codes were created for tonnes of gases i.e. tonnes of CO₂-equivalent, SO₂-equivalent, NO₂-equivalent and NMVOC equivalent.
- Other concepts that must be used as needed are the standard SDMX attributes (and the associated code lists) UNIT_MULT, DECIMALS, FREQ, OBS_STATUS, CONF_STATUS, with no particular instructions.
- ORGANISATION must be coded according to the receiving organisation.

The (sub)table at the bottom of the Eurostat questionnaire, corresponding to the bridging items, should be encoded as follows:

- The types of substances in the rows of SEEA CF Table 3.7 correspond to the concept AIRPOL.
- The different items of the concept BRIDGE_ITEM must be reported with the codes in CL_BRIDGE_ITEM.
- The bridging items are not reported separately for each economic activity nor the households. INTERACTORS takes the value ATU_HH (All NACE and households activities).
- Other concepts with fixed values are: DEMAND_PROD=P; ACCOUNTING_ENTRY=EC; COUNTERPART AREA=W2; PRODUCT=T; SECTOR=S1; STO=Z;
- Other concepts that must be used as needed are: UNIT_MEASURE, UNIT_MULT, DECIMALS, FREQ, OBS_STATUS, CONF_STATUS, with no particular instructions.
- ORGANISATION must be coded according to the receiving organisation.

A second dataset corresponds to the air emission accounts for dissemination by Eurostat. This is encoded in the same way as SEEA CF Table 3.7 or bridging items explained above, with the only difference that there are additional unit codes in CL_UNIT for dissemination indicators such as tonnes of CO₂-equivalents per euro at current prices (and also for SO₂, NO₂, NMVOC), tonnes of CO₂-equivalents per euro in chain-linked volumes (and also for SO₂, NO₂, NMVOC) and tonnes of CO₂-equivalents per capita.

A third dataset corresponds to air emission intensities for dissemination by Eurostat. This is encoded in the same way as SEEA CF Table 3.7 with the following differences:

- INTERACTORS are only ISIC/NACE industries but not households.
- BRIDGE_ITEM=RES.
- STO can be P1 or B1G according to the reference used to calculate the intensities (output or value added).

A fourth dataset corresponds to emissions with breakdown by product (in sense of CPC/CPA), rather than by air pollutant. These are published by FAO. These are not demand-based estimates (footprints) but production-based estimates. The encoding would be as follows:

- DEMAND_PROD=P
- AIRPOL=T
- The concept PRODUCT follows the list CL_PRODUCT, which in turn has CPC/CPA codes
- The concept BRIDGE_ITEM = TER
- The concept UNIT takes the code KG of CO₂E by KG of Product
- All entries in the table are flows from economic units into the environment and they coded as ACCOUNTING_ENTRY=EC. Other concepts with fixed values are: COUNTERPART AREA=W2; SECTOR=S1; STO=Z; The concept INTERACTORS must be valued Z
- Other concepts that must be used as needed are: UNIT_MULT, DECIMALS, FREQ, OBS_STATUS, CONF_STATUS, with no particular instructions
- ORGANISATION must be coded according to the receiving organisation

A fifth dataset corresponds to emissions induced by final use (footprints). This is future-focused. Presently there are no data transmissions of carbon footprints or pollutant footprints, but Eurostat disseminates air emission footprints. Air emission footprints should be encoded as follows:

- Footprints are primarily identified with the code DEMAND_PROD=D

- The concept AIRPOL takes values from CL_AIRPOL
- The concept INTERACTORS takes the values ATU (i.e. all ISIC/NACE producers) and HH (i.e. households) of CL_INTERACTORS
- STO could be coded using potentially any final demand code. Eurostat only uses P3, P5, P51G, P52, P53 and P6.
- Potentially there may be sector breakdowns of final use categories, e.g. final consumption by sector or capital consumption by sector. This is coded together with STO. However not all possible combinations make sense, e.g. STO=P6 (exports) do not make sense broken down by sector. Eurostat only has sector breakdowns for STO =P3 (i.e. final consumption) and SECTOR can be coded S13 or S14 or S15. In any other case sector should be coded SECTOR=S1 meaning no breakdown by institutional sector
- The concept COUNTERPART AREA takes values from CL_AREA. If footprints are reported without geographical origin, COUNTERPART AREA must be coded W0 meaning that the footprint includes emissions embodied in imports and hence originating from elsewhere in the world. If values are reported for the domestic economy and rest-of-the-world, codes W2 (domestic/reference area) and W1 (rest of the world) should be used. In case the modelling framework is based on source data with multiple interlinked economies (e.g. so-call multi-regional input-output tables), COUNTERPART AREA may also use other codes from CL_AREA to identify the countries/regions where the emissions occur.
- Other concepts with fixed values are: All entries in the table are flows from economic units into the environment and they coded as ACCOUNTING_ENTRY=EC
- The concept PRODUCT takes the different values of CL_PRODUCT.
- BRIDGE_ITEM=RES meaning emissions by residents
- The code list for units CL_UNIT is based in national accounts, but additional codes were created for tonnes of gases i.e. tonnes of CO2-equivalent, SO2-equivalent, NO2 equivalent and NMVOC equivalent
- Other concepts that must be used as needed UNIT_MULT, DECIMALS, FREQ, OBS_STATUS, CONF_STATUS, with no particular instructions
- ORGANISATION must be coded according to the receiving organisation

Energy accounts

The data model for physical energy flow accounts is based on existing data collections in place in Eurostat and upcoming work by UNSD. A simplified version of the tables in the existing data collections is represented in SEEA CF Table 3.5 (physical supply-use table for energy flows).

- In such dataset, all measures are production-based, i.e. they are not footprints. They are coded DEMAND_PROD=P
- The energy flows in the rows of SEEA CF Table 3.5 follow the concept ENERGY_FLOWS; The code list of energy flows (CL_ENERGY_FLOWS) encompasses codes in use by Eurostat and UNSD, both based on the international classification SIEC as regards energy products (to which natural inputs and residuals are added in the code list of energy flows).
- The column of SEEA CF Table 3.5 follows the concept INTERACTORS. The item 'accumulation' in this list corresponds to changes in stocks
- All entries in the supply table (Eurostat questionnaire, Table A) which are flows between economic units (i.e. not with the environment) are coded ACCOUNTING_ENTRY=C. The flows from the environment into the economy in the supply table are coded as ACCOUNTING_ENTRY=EN
- All entries in the use table (Eurostat questionnaire, Table B and C and sub-tables B.1, B.2) which are flows between economic units (i.e. not with the environment) are coded ACCOUNTING_ENTRY=D, with further sub-codes DT, DE and DER for transformation use and end use, as relevant. The flows to the environment in the use table are coded as ACCOUNTING_ENTRY=EC
- The concept COUNTERPART AREA is only relevant for imports in the supply table and for exports in the use table
- The concept PRODUCT must be coded T (meaning no product breakdown) and SECTOR must be coded S1 (meaning no institutional sector breakdown)
- Other concepts that must be used as needed are UNIT=TJ, UNIT_MULT, DECIMALS, FREQ, OBS_STATUS, CONF_STATUS, with no particular instructions
- ORGANISATION must be coded according to the receiving organisation
- The Eurostat questionnaire Table E on Bridge items is coded with the corresponding entries of concept BRIDGE_ITEMS and with DEMAND_PROD=P, ACCOUNTING_ENTRY=D, INTERACTORS=T, ENERGY_FLOWS=T, PRODUCT=T, SECTOR=S1, UNIT=TJ

The data model also has a solution for energy footprints. This is future-proof, as there are presently no data transmissions of energy footprints. Footprints will be primarily identified with the code DEMAND_PROD=D.

Material flow accounts

The data model for material flow accounts is based on existing data collections in place in Eurostat and UN Environment. The reporting of physical flow accounts for materials consists of several datasets. For convenience this is explained separately here although they may all be bundled as part of the same data transmission.

A first dataset is about domestic extractions broken down by material flows (input side of the material flows). This corresponds to the Eurostat questionnaire, table A. All the flows are extractions from the environment and there are no flows with other economies (imports/exports). In this case we are not considering measures in raw material equivalents (footprints).

- In such dataset, all measures are production-based, i.e. they are not footprints. They are coded DEMAND_PROD=P
- The code list of material flows (CL_MATERIALS) encompasses codes in use by Eurostat and UN Environment. This code list also includes some memo items.
- All the flows are from the environment into the economy and are coded as ACCOUNTING_ENTRY=EN
- STO must be coded MDE (meaning domestic extraction) or BDMI (meaning domestic material inputs), as corresponds.
- Units are measured in UNIT=T (i.e. Tonne), UNIT_MULT=1000, i.e. thousand tonnes
- COUNTERPART_AREA must be coded Z (meaning not applicable, as all flows are between the environment and the national economy)

- SECTOR must be coded S1 (meaning no institutional sector breakdown)
- BRIDGE_ITEM must be coded RES (meaning all the values are accounted following the residence principle)
- Other concepts that must be used as needed are DECIMALS, FREQ , OBS_STATUS, CONF_STATUS, with no particular instructions
- ORGANISATION must be coded according to the receiving organisation

A second dataset is about imports/exports of material flows. This corresponds to the Eurostat questionnaire, tables B to E. Whenever they are measured in 'normal terms' i.e. not as footprints, they should be encoded as follows:

- All measures are production-based, i.e. they are not footprints. They are coded DEMAND_PROD=P
- The code list of material flows is CL_MATERIALS. In particular there are codes for imports/exports according to the stage of manufacture of the traded product: raw, semi-finished and finished products.
- All the flows are between economic units (i.e. not with the environment) in different countries. Imports are coded ACCOUNTING_ENTRY=C, exports are coded ACCOUNTING_ENTRY=D. Physical trade balance is not reported but derived automatically.
- STO must be coded P6 (exports) or P7 (imports) or PPTB (physical trade balance) as corresponds.
- Units are measured in UNIT=T (i.e. Tonne), UNIT_MULT=1000, i.e. thousand tonnes
- COUNTERPART AREA must be coded according to the country of origin of imports or destination of exports, or W1 (rest of the world) if the country detail is not available.
- SECTOR=S1 (meaning no institutional sector breakdown)
- BRIDGE_ITEM must be in general coded RES (meaning all the values are accounted following the residence principle). Material MF4 and its breakdown (Fossil energy materials/carriers) might be reported following the territory principle. Then the BRIDGE_ITEM code must be TER and the adjustment for residence principle (MF423) must be reported with code RES_ABR i.e. residents abroad (See table below, column BRIDGE_ITEM Opt.2). When MF4 is reported following the residence principle, then the adjustment (MF423 and its breakdown) must be reported as _Z, i.e. not applicable (See table below, column BRIDGE_ITEM Opt.1).

MATERIAL	BRIDGE_ITEM Opt.1	BRIDGE_ITEM Opt.2
D.4 Fossil energy materials/carriers, raw and processed	RES	TER
D.4.1 Coal and other solid energy products, raw and processed	RES	TER
D.4.1.1 Lignite (brown coal)	RES	TER
D.4.1.2 Hard coal	RES	TER
D.4.1.3 Oil shale and tar sands	RES	TER
D.4.1.4 Peat	RES	TER
D.4.2 Liquid and gaseous energy products, raw and processed	RES	TER
D.4.2.1 Crude oil, condensate and natural gas liquids (NGL)	RES	TER
D.4.2.2 Natural gas	RES	TER
D.4.2.3 Adjustment for residence principle: Fuel bunkered by non-resident units domestically	_Z	RES_ABR
D.4.2.3.1 Fuel for land transport	_Z	RES_ABR
D.4.2.3.2 Fuel for water transport	_Z	RES_ABR
D.4.2.3.3 Fuel for air transport	_Z	RES_ABR
D.4.3 Products mainly from fossil energy products	RES	TER

- Other concepts that must be used as needed are DECIMALS, FREQ , OBS_STATUS, CONF_STATUS, with no particular instructions
- ORGANISATION must be coded according to the receiving organisation

A third dataset is about the output flows the material accounts (i.e. from the economy into the environment) and balancing items i.e., domestic processed outputs, net additions to stock and balancing items. This corresponds to the Eurostat questionnaire, tables F to H. This is encoded as follows:

- All measures are production-based, i.e. they are not footprints. They are coded DEMAND_PROD=P
- The code list of material flows is CL_MATERIALS. This code list includes not only codes for material inputs but also for the categories of domestic processed outputs and balancing items.
- All the flows are from the economy into the environment (which are the majority in this table) and are coded as ACCOUNTING_ENTRY=EC; codes from the environment to the economy (such as oxygen for combustion, water for drinking) are coded as ACCOUNTING_ENTRY=B. Net additions to stock are coded as ACCOUNTING_ENTRY=D
- STO can be coded MDPO (domestic processed output) or KNAS (net additions to stock) or BBI (balancing items), as needed

- Units are measured in UNIT=T (i.e. Tonne), UNIT_MULT=1000, i.e. thousand tonnes
- COUNTERPART AREA=Z
- SECTOR=S1 (meaning no institutional sector breakdown)
- Other concepts that must be used as needed are DECIMALS, FREQ , OBS_STATUS, CONF_STATUS, with no particular instructions
- ORGANISATION must be coded according to the receiving organisation

A fourth dataset is about material flow accounts in raw material equivalents (MFA-RME) The data model has a solution for MFA-RME in use by Eurostat and UN Environment. This corresponds to the Eurostat questionnaire, table I. Raw material equivalent mean, as regards imports and exports, that the products crossing the border are not measured in terms of the weight of those products but rather as the weight of the natural resources needed to produce them. These raw material equivalents represent the material footprint for those products. Building on imports and exports measured in RME, other indicators can be constructed, such as raw material consumption and raw material input (codes for them have been created in CL_STO). They should be encoded as follows:

- All measures are consumption-/demand-based. They are coded DEMAND_PROD=D
- The code list of material flows is CL_MATERIALS.
- ACCOUNTING_ENTRY can take several codes depending on the variable. Imports are coded ACCOUNTING_ENTRY=C and exports are coded ACCOUNTING_ENTRY=D. RMC and RMI are coded ACCOUNTING_ENTRY=D (meaning they are demand perspective)
- STO can be coded P6 (exports) or P7 (imports) or BRMC (RMC) or BRMI (RMI), as needed. If available, subcategories of RMC can be coded using STO codes P3, P5, P51G, P52, P53.
- Units are measured in UNIT=T_RME (i.e. Tonnes in raw material equivalents), UNIT_MULT=1000, i.e. thousand tonnes in raw material equivalents.
- COUNTERPART_AREA must be coded according to the country of origin of the materials if this information is available. If no geographical breakdown is provided, COUNTERPART_AREA=W0.
- Potentially there may be sector breakdowns of final use categories, e.g. final consumption by sector or capital consumption by sector. This is coded together with STO. However not all possible combinations make sense, e.g. STO=P6 (exports) do not make sense broken down by sector. Eurostat only has sector breakdowns for STO =P3 (i.e. final consumption) and SECTOR can be coded S13 or S14 or S15. In any other case sector should be coded SECTOR=S1 meaning no breakdown by institutional sector
- Other concepts that must be used as needed are DECIMALS, FREQ , OBS_STATUS, CONF_STATUS, with no particular instructions
- ORGANISATION must be coded according to the receiving organisation

Water accounts

The data model for physical water flow accounts is based on methodological work by UNSD. A simplified version of the tables in the existing data collections is represented in SEEA CF Table 3.6 (physical supply-use table for water flows).

- In such dataset, all measures are production-based, i.e. they are not footprints. They are coded DEMAND_PROD=P
- The water flows in the rows of SEEA CF Table 3.6 follow the concept WATER_FLOWS; The corresponding code list is CL_WATER_FLOWS
- The columns of SEEA CF Table 3.6. follow the concept INTERACTORS. The item 'accumulation' in this list corresponds to changes in stocks
- All entries in the supply table which are flows between economic units (i.e. not with the environment) are coded ACCOUNTING_ENTRY=C. The flows from the environment into the economy in the supply table are coded as ACCOUNTING_ENTRY=EN
- All entries in the use table which are flows between economic units (i.e. not with the environment) are coded ACCOUNTING_ENTRY=D. The flows to the environment in the use table are coded as ACCOUNTING_ENTRY=EC
- The concept COUNTERPART AREA is only relevant for imports in the supply table and for exports in the use table
- The concept UNIT must be coded M3 (cubic meters of water); BRIDGE_ITEMS must be coded as TER, meaning production and consumption activities on the territory; PRODUCT must be coded T (meaning no product breakdown); SECTOR must be coded S1 (meaning no institutional sector breakdown); STO=Z (meaning not applicable i.e. there are no monetary national accounts transactions)
- Other concepts that must be used as needed are: UNIT_MULT, DECIMALS, FREQ , OBS_STATUS, CONF_STATUS, with no particular instructions
- ORGANISATION must be coded according to the receiving organisation

Land accounts

The data model for land accounts (physical account for land use, land use change matrix, physical account for land cover, land cover change matrix) is based on existing data sets and upcoming improvements by FAO. The code lists of land cover and land use encompass codes in use by this institution. Data structure definitions are created for four datasets. For convenience they are explained separately although they may all be bundled as part of the same data transmission.

A first dataset is a physical account for land cover, see e.g. SEEA CF Table 5.13. This is an asset table reporting in the rows: opening stock, additions to stock (plus types), reductions in stock (plus types) and closing stock. This has the structure of a balance sheet in National Accounts. The column report a breakdown by land cover types. This is reported as follows:

- All measures are production-based, i.e. they are not footprints. They are coded DEMAND_PROD=P
- The entries in the rows (opening stock, additions to stock (plus types), reductions in stock (plus types) and closing stock) are reported with the following combinations of concepts ACCOUNT_ENTRY, STO and sign of the value:

	ACCOUNT_ENTRY	STO	Value
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opening stock	N	LS (opening balance)	Must be positive
additions to stock (plus types)	AI	LX (changes in balance)	Must be positive
reductions in stock (plus types)	AD	LX (changes in balance)	Must be negative
closing stock	A	LE (closing balance)	Must be positive
Changes in stock	N	LX (changes in balance)	Can be positive or negative

- The types of land cover follow the concept LAND_COVER
- LAND_COVER_TO must be coded to T
- The concept UNIT must be coded HA (hectare) or other unit of area. Land cover can only be measured in units of area
- Other concepts that must be used as needed are: UNIT_MULT, DECIMALS, FREQ , OBS_STATUS, CONF_STATUS, with no particular instructions
- ORGANISATION must be coded according to the receiving organisation

A second dataset is a land cover change matrix, see e.g. SEEA CF Table 5.14. This table has a typology of land cover in rows and columns, and the changes happening during the year reported in the cells. This is reported as:

- All measures are production-based, i.e. they are not footprints. They are coded DEMAND_PROD=P
- The types of land cover in the rows follow the concept LAND_COVER. The types of land in the columns follow the concept LAND_COVER_TO. Both concepts use the same code list CL_LAND_COVER
- ACCOUNT_ENTRY must be coded to A (net acquisition of assets); STO must be coded as LX (changes in balance)
- The entries in the rows (opening stock, additions to stock (plus types), reductions in stock (plus types) and closing stock) are reported with the following combinations of concepts ACCOUNT_ENTRY, STO and sign of the value:

	ACCOUNT_ENTRY	STO	Value
opening stock	N	LS (opening balance)	Must be positive
additions to stock (plus types)	AI	LX (changes in balance)	Must be positive
reductions in stock (plus types)	AD	LX (changes in balance)	Must be negative
closing stock	A	LE (closing balance)	Must be positive
Changes in stock	N	LX (changes in balance)	Can be positive or negative

- The types of land cover follow the concept LAND_COVER
- LAND_COVER_TO must be coded T
- The concept UNIT must be coded HA (hectare) or other unit of area
- Other concepts that must be used as needed are: UNIT_MULT, DECIMALS, FREQ , OBS_STATUS, CONF_STATUS, with no particular instructions
- ORGANISATION must be coded according to the receiving organisation

A third dataset is about physical account for land use. It is identical to the first dataset above but using the concept LAND_USE and the code list CL_LAND_USE instead of LAND_COVER and CL_LAND_COVER, respectively. The only possible unit for land use is UNIT=HA. This dataset is found in the SEEA Agriculture, Forestry and Fisheries.

A fourth dataset is about land use change matrix. This dataset is presently conceptual and not yet used. It is identical to the second dataset above but using the concepts LAND_USE and LAND_USE_TO as well as the code list. CL_LAND_USE instead of LAND_COVER, LAND_COVER_TO and CL_LAND_COVER, respectively. Besides, the measurement units for land use can either be UNIT=HA, other unit of area or monetary units for monetary estimates.

Annex

Annex 1 - Data Flow documentation

All SEEA related data flows (marked in green) shown in the diagram below have been used to analyse the requirements for SDMX Concepts. Non-SEEA flows (marked in blue) have been added for documentary purposes.

DIAGRAM LEGEND

SEEA flows
non-SEEA flows
(not all are represented)

International Organisations

Data Providers

<Database>

