The UNECE initial of set climate change indicators: the issue of dual measurement

Background paper for the UNCEEA 2018 meeting

1. Introduction

The purpose of this paper is to describe the ongoing effort of the *UNECE Task Force on a Set of core Climate Change related Statistics* to develop a set of core[1] climate change-related statistics and indicators which should be internationally comparable and paints the picture of the main phenomena of climate change.

Both the System of Environmental Economic-Accounting (SEEA-CF) and the UN Framework for the Development of Environment Statistics (FDES) provided important starting points for that work. Following its mandate, the Task Force explored which of the proposed indicators can be based on the SEEA-CF.

The paper gives an overview of the main steps of the work carried out by UNECE in the field of climate change-related statistics (chapter 2) and a brief outline of the methodological approach to develop an initial set of Climate Change-related Indicators (CCRI) (chapter 3). The main focus of the paper is on the specific case of 'dual indicators' i.e. indicators that can be related either to the economy of a country (consistently with the so-called residence principle) or to the geographic territory (so-called territory principle).

Comments from the UNCEEA on the approach chosen by the UNECE on the issue of dual indicators, as well as on the work on CCRI in general, will provide a fundamental input for current and future work.

2. Milestones of the work of the Task Force on a set of key Climate Change-related Statistics

The 2014 Conference of European Statistician (CES) plenary session endorsed the CES Recommendations on Climate Change-related Statistics[2] (CES Recommendations), that provide guidelines for improving the statistics related to climate change produced by national statistical systems; furthermore, it suggested to develop a set of key climate change-related statistics and indicators.

At the end of 2014 the CES established the *UNECE Task Force on a set of key Climate Change-related Statistics using SEEA* with the mandate to define an internationally comparable set of key climate change-related statistics and indicators derived from the SEEA-CF to the extent possible as well as from other sources, such as the FDES. The UN Sustainable Development Goals (SDGs), the Sendai Framework on Disaster Risk Reduction (Sendai Framework) and the requirements under the United Nations Framework Convention on Climate Change (UNFCCC), were also stated as important reference frameworks[3].

[1] Considering the final number of selected indicators (39) and following the terminology used in other indicator frameworks (such as the OECD Environmental Indicators, OECD, 2003), the term 'core climate change-related indicators' was used for 'key' climate change indicators.

[2] UNECE (2014): Conference of European Statisticians RECOMMENDATIONS ON CLIMATE CHANGE-RELATED STATISTICS, http://www.unece.org/index.php?id=37166

[3] For detailed information see: https://www.unece.org/statistics/networks-of-experts/task-force-on-a-set-of-key-climate-change-related-statistics-using-seea.html

Members of the Task Force represented the National Statistical Offices (NSOs) of 10 CES member states and 8 international organisations[4]. The United Nations Economic Commission for Europe (UNECE) provided the secretariat of the Task Force, while the work of the Task Force work was guided and overseen by the CES Steering Group on Climate Change-related Statistics. UNCEEA provided relevant input to the work as well during the 2016 meeting.

In June 2017, the Conference of European Statisticians endorsed the Task Force's Initial Set of 39 Key Climate Change-related Indicators. The full list is available in Annex 1 to this document.

Consistently with the TF mandate, over 50% (22 out of 39) of the proposed indicators can be produced from SEEA-CF accounts, several others are related to the SEEA Experimental Ecosystem Accounts (SEEA-EEA), 75% are linked with the Framework for Development of Environment Statistics, 25% (8) are SDG indicators (or conceptually identical) and 10% (4) were derived from the recommended global indicators for measuring the targets of the Sendai Framework on Disaster Risk Reduction.

A pilot survey was conducted in the second half of 2017 to test the initial set of core climate change-related indicators and results are available for 10 volunteer countries and the Food and Agriculture Organization of the United Nations (FAO)[5].

Based on the outcomes of the pilot testing, the Conference extended the mandate of the Task Force to refine the initial set of core climate change-related indicators, and to identify further methodologies, data sources and guidance for implementation, in the period 2017-2019.

The Task Force's progress on indicators is regularly presented and discussed at the annual UNECE Expert Forum for Producers and Users of Climate Change-related Statistics. The most recent meeting, hosted by FAO, took place from 3 to 5 October 2017 in Rome (https://www.unece.org/index.php?id=43954) and the next meeting will take place in Geneva from 2 to 4 October 2018.

The presentation of the Task Force's work in the SG Report on Climate Change Statistics to the 47th Session of the United Nations Statistical Commission (UNSC) in March 2016 spurred the UN decision 47/112 on the development of a global set of climate change statistics and indicators.

3. Definitions and outline of methodology

One of the main starting points for developing the initial set of 39 climate change-related indicators presented here, were the CES Recommendations on Climate Change-related Statistics mentioned above, specifically as concerns the scope of climate change-related statistics, defined as follows: "Environmental, social and economic data that measure the human causes of climate change, the impacts of climate change on human and natural systems, the efforts of humans to avoid the consequences as well as their efforts to adapt to the consequences".

[4] Member states: Italy (chair), Canada, Kyrgyzstan, Luxembourg, Mexico, Netherlands, Philippines, Romania, Russian Federation and Turkey. International organisations: the European Environment Agency (EEA), the Food and Agriculture Organization of the United Nations (FAO), the Organisation for Economic Co-operation and Development (OECD), the Statistical Office of the European Union (Eurostat), the United Nations Environment Programme (UNEP), the United Nations Framework Convention on Climate Change (UNFCCC), the United Nations Population Fund (UNFPA) and the United Nations Statistics Division (UNSD).

[5] the first outcomes of the pilot testing are available here: https://unstats.un.org/unsd/statcom/49th-session/documents/BG-Item3k-UNECE-E.pdf

To narrow the scope in the context of the statistical system, it was recommended to focus on environmental, social and economic statistics that measure the following five climate change-related areas:

1. Emissions: GHG emissions and their human causes;
2. Drivers: human causes of climate change that deal with sources of emissions;
3. Impacts: impacts of climate change on human and natural systems;
4. Mitigation: efforts of humans to avoid the consequences;
5. Adaptation: efforts to adapt to the consequences.

All of the five main areas are represented in the initial set of 39 CCRI, specifically:

- Drivers: 8 indicators
- Emissions: 7 indicators
- Impacts: 13 indicators
- Mitigation: 6 indicators
- Adaptation: 5 indicators

The 5 domains above (drivers, emissions, impacts, mitigation adaptation) are further split into sub-areas, which represent the most relevant themes per area; the aim of the sub-areas was to improve the comprehensiveness of the set, with a view to develop a coherent set of indicators, painting the "(big) picture of climate change-related issues".

The selection of indicators was based on a procedure that takes into consideration the three criteria relevance, methodological soundness and data availability. Important methodological choices were also taken during the selection procedure[6]. One of them is particularly relevant for the UNCEEA and relates to the so called *dual indicators*.

4. Dual indicators

The Terms of Reference of the Task Force explicitly mention that the internationally comparable set of key climate change-related statistics and indicators should be derived from the System of Environmental-Economic Accounting and other sources. This implies the choice of the residence principle as a first best for the indicators. The Task Force recognized that, in general the choice between the residence principle and the territory principle was not straightforward, and mostly for indicators related to air emissions and energy. For example, in the case of air emissions, although the implementation of SEEA-based accounts is increasing, most international and national GHG-related policy targets are consistent with the IPCC guidelines and their measurement refer to GHG inventories reported under the UNFCCC. GHG inventories refer to emissions within a geographical territory, including emissions generated by units who are residents of other countries, and excluding emissions of resident units which generate their emissions outside the geographical territory (e.g. trucks, ships or airplanes of international transport enterprises). The activity classification used by GHG inventories is not compatible with the International Standard Industrial Classification of All Economic Activities (ISIC)[7]. Thus, even if GHG inventories provide one of the most

[6] For details on the methodology, see the full report: https://www.unece.org/fileadmin/DAM/stats/documents/ece/ces/2016/mtg/19-Report_on_climate_indicators_final.pdf

[7] The Task Force took into consideration the explanations provided by Eurostat in the case of GHGs on the difference between residence principle based and territory based statistical information; http://ec.europa.eu/eurostat/statistics-explained/index.php?title=Greenhouse_gas_emission_statistics_-_air_emissions_accounts#Emissions_accounts_versus_emission_inventories

important data sources on GHG emissions, their use for integration with economic data and the development of indicators for further analysis (e.g. GHG emission intensities of different economic sectors, carbon footprint, etc.) has important limitations.

Taking this into consideration the Task Force decided for the selection of energy and GHG-related indicators on the following basis[8]:

a) The indicator should be defined on the information need rather than the underlying data sets. Climate change-related information needs can refer to both GHG emissions on the national territory (e.g. GHG reduction goals usually refer to emissions generated on the national territory) and GHG emissions of its resident entities (e.g. GHG emission intensities and carbon footprint can benefit from statistics following the residence principle).

b) There is an ongoing process to align SDG indicators with SEEA.

c) Conceptual differences between GHG inventories and SEEA Air Emission Accounts (AEA) can be described[9] and differences in the datasets can be clarified via bridge tables, i.e. tables that show the various elements bridging AEA totals to emission inventory totals[10].

d) SEEA Air Emission Accounts are among the priority accounts to be implemented (priority by international organisations and many countries). If SEEA Air Emission Accounts are recommended as data source for certain core climate change-related indicators, it could be an incentive for countries to start or accelerate the implementation.

Taking into consideration the above, and comments received from UNCEEA and the Steering Group in 2016, the Task Force adopted a **dual approach**: *for all indicators that can be derived also from other sources than SEEA a dual measurement should be foreseen in the short term.* This was also seen as being consistent with the ongoing process on aligning SDG indicators with SEEA.

The following indicators were identified as potentially dual:

N. in indicator list	Indicator name
1	Total primary energy supply (TPES)
2	Share of fossil fuels in total primary energy supply (TPES)
3	Losses of land covered by (semi-) natural vegetation
5	Total energy intensity of production activities
6	CO2 intensity of energy for the economy
7	Emission intensity of agricultural commodities
8	Energy consumption by households / capita
9	Total GHG emissions
10	CO2 emissions from fuel combustion
11	GHG emissions from land use

[8] Similar issues apply to energy-related indicators: energy data can originate either from energy balances following the territory principle and a specific industry classification (the reference framework here is the UN document *International recommendations for energy statistics* (IRES), adopted by the UN statistical Commission: https://unstats.un.org/unsd/energy/ires/) and/or SEEA Energy Accounts that follow the residence principle and ISIC.
[9] An example is provided by Eurostat (http://ec.europa.eu/eurostat/web/environment/air-emissions-inventories)
[10] Examples are the bridge tables as published by Eurostat (http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=env_ac_aibrid_r2&lang=en)

14	Direct GHG emissions from households
15	Carbon footprint
18	Level of water stress: freshwater withdrawal as a proportion of available freshwater resources
21	Proportion of land that is degraded over total land area
29	Renewable energy share in the total final energy consumption

The 2017 pilot testing highlighted that dual indicators needed further clarification, as the methodological sheets referred to both options the residence principle and the territory principle.

Extensive discussion within the Task Force in 2018 led to the following preliminary conclusions:

a) The SEEA approach is to be prioritized as it entirely follows statistical principles and allows multiples ways of data integration and analysis;
b) 3 indicators (18 – Level of water stress, 3 – Losses of land, 21 – Land degradation) will be defined according to the territory approach only, because they refer to specific territories and do not require an integration with economic data or National Accounts. Two of these indicators are SDG indicators (18 and 21) where the methodology also follows the territory principle;
c) All other dual indicators will be split into two indicators, of which one represents the SEEA approach and the other one the territory approach (typically linked to GHG inventories or energy balances). The indicators should be distinct by their name and underlying methodology. This will help both compilers and users to fully understand the indicators;
d) The SEEA-related indicators will become part of the core set of climate change-related indicators and countries will be encouraged to develop and use SEEA-accounts for their regular production;
e) The "other" indicators will become "contextual indicators"; it will be recommended to countries to use them as part of their national set of "core indicators" as long as the underlying SEEA-accounts are not available (proxy indicators);
f) The report of the Task Force will explain in detail why this approach has been chosen, and at the same time acknowledge the importance of the alternative (contextual) indicators for specific policy questions.

5. Conclusions

The work of the Task Force on developing this set of core climate change-related indicators has been widely recognized by expert communities working in climate change policies and official statistics. In 2016 the United Nations Statistical Commission requested UNSD to review and consider the UNECE set of climate change-related statistics and indicators as a basis for developing a global set of climate change statistics and indicators, applicable to countries at various stages of development.

The discussions within the Task Force and with other experts showed that there is an important need to clarify what should be recommended for indicators which can be calculated for both a national territory and a national economy. Both approaches have their advantages and disadvantages regarding policy-relevance and statistical soundness.

The territory approach is usually the one which defines national and international targets related to GHG emissions and the production and consumption of energy. UNFCCC GHG inventories and energy statistics are available for many countries in the world, and thus an important source for energy and GHG-related

indicators. However, there are certain limitations in using this type of data for integration with National Accounts and the production of environment-economy related indicators (such as emission intensity or energy efficiency of certain economic sectors). Some indicators may require global input-output tables (such as the carbon footprint) which cannot be produced from these data sources.

The residence principle follows conceptually the System of National Accounts and thus allows data integration and analysis. Globally, it is still easier to obtain data from GHG inventories than from air emission accounts. However, strategies and capacity building activities of the European Union (legal framework), OECD, UNSD and UNECE as well as the increased interest of countries in the implementation of SEEA, gradually increase the availability of the relevant SEEA accounts (i.e. air emission accounts and energy accounts).

Therefore, the Task Force fulfilled its mandate by following the SEEA-approach for its indicators, and at the same time recognizing the importance of the existing policies and data sets which follow the territory approach. Countries are encouraged to develop their national sets of indicators following the SEEA approach, and to use other existing data sets (i.e. GHG inventories and energy balances) for the calculation of proxy indicators as long as the underlying SEEA account is not available.

6. Questions to UNCEEA

1. Do you agree with the general approach regarding “dual indicators” as proposed in this paper? In particular, what is your opinion regarding the role of indicators derived from GHG inventories?
2. Do you have specific comments on some of the indicators?

ANNEX I Full list of 39 initial CCRI

Area	Sub-area	No.	Indicator	Tier	Indicator conceptually identical with (status January 2017)		Can be produced from SEEA-CF accounts
					SDGs	SF DRR*	
Drivers	National total	1	Total primary energy supply (TPES)	I			Energy
		2	Share of fossil fuels in total primary energy supply (TPES)	I			Energy
		3	Losses of land covered by (semi-) natural vegetation	III			Land
		4	Total support for fossil fuels / GDP	II			
	Production	5	Total energy intensity of production activities	II			Energy
		6	CO2 intensity of energy for the economy	II			Energy, air emission
		7	Emission intensity of agricultural commodities	II			AFF**
	Consumption	8	Energy consumption by households / capita	I			Energy
Emissions	National total	9	Total GHG emissions	I			Air emission
		10	CO2 emissions from fuel combustion	I			Air emission
		11	GHG emissions from land use	I			AFF
	Production	12	Total GHG emissions of production activities	I			Air emission
		13	GHG emission intensity of production activities	I			Air emission
	Consumption	14	Direct GHG emissions from households	I			Air emission
		15	Carbon footprint	III			Air emission
Impacts	Physical conditions	16	Annual average surface temperature	I			
		17	Percentage of land area suffering from unusual wet or dry conditions (Standard Precipitation Index)	I			
	Water resources	18	Level of water stress: freshwater withdrawal as a proportion of available freshwater resources	I	6.4.2 (tier 1)		Water

Area	Sub-area	No.	Indicator	Tier	Indicator conceptually identical with (status January 2017)		Can be produced from SEEA-CF accounts
					SDGs	SF DRR*	
	Land, land cover, ecosystems and biodiversity	19	Cumulative number of alien species	III			
		20	Carbon stock in soil	III			
		21	Proportion of land that is degraded over total land area	III	15.3.1 (tier 3)		Land
	Extreme events and disasters	22	Number of deaths and missing persons attributed to hydro-meteorological disasters, per 100,000 population	III	1.5.1 (tier 2), 11.5.1 (tier 2), 13.1.2 (tier 2)	A-1	
		23	Occurrence of extreme weather events	II			
		24	Direct economic loss attributed to hydro-meteorological disasters in relation to GDP	III	11.5.2 (tier 2)	C-1	
		25	Number of people whose destroyed dwellings were attributed to hydro-meteorological disasters	III		B-4	
	Human settlements and environmental health	26	Distribution of cases of vector-borne diseases	I			
		27	Heat-related mortality	II			
	Agriculture, forestry and fishery	28	Direct agricultural loss attributed to hydro-meteorological disasters	III		C-2	
Mitigation	Energy resources	29	Renewable energy share in the total final energy consumption	I	7.2.1 (tier 1)		Energy
	Expenditures	30	Share of climate change mitigation expenditure relative to GDP	III			Transactions
	Environmental governance and regulation	31	Share of energy and transport related taxes as percentage of total taxes and social contributions	I			Transactions
		32	Total climate change related subsidies and similar transfers / GDP	III			Transactions
		33	Average carbon price	I			
		34	Mobilized amount of USD per year starting in 2020 accountable towards the USD 100 billion commitment	III	13a.1 (tier 3)		
Ad ap	Expenditures	35	Share of government adaptation	III			Transactions

Area	Sub-area	No.	Indicator	Tier	Indicator conceptually identical with (status January 2017)		Can be produced from SEEA-CF accounts
					SDGs	SF DRR*	
			expenditure to GDP				
	Water resources	36	Change in water use efficiency over time	III	6.4.1 (tier 3)		Water
	Human settlements and environmental health	37	Proportion of population living in dwellings with air conditioners or air conditioning	III			
	Agriculture, forestry and fishery	38	Progress towards sustainable forest management	III	15.2.1 (tier 3)		
		39	Proportion of agricultural area under productive and sustainable agriculture	III	2.4.1 (tier 3)		

For each of the proposed indicators a metadata sheet was produced, which contains the following information:

a) Versioning (First publication, Last update)

b) Indicator (Number, Name)

c) Domain and subdomain

d) Presentation (Tier, Indicator description, Unit of measure, Classification systems, Coverage, Spatial aggregation, Reference period, Update frequency, Base period, Related operational indicators, Related contextual indicators)

e) Relevance (Policy context and targets, Link to SDGs, Link to Sendai Framework, Other, Policy references)

f) Methodology (Methodology for indicator calculation, Methodology for filling gaps, Methodology references, Methodology uncertainty, Data sets uncertainty)

g) Data sources (Main source, Data sources, Reference to UN-FDES, Reference to SEEA-CF, Geo-referenced data, Data availability)

h) Comments

Metadata sheets are available here:

https://www.unece.org/fileadmin/DAM/stats/documents/ece/ces/2016/mtg/19-_Add1-Climate_indicator_metadata_sheets_final.xlsx