Climate change-related statistics overview

Sub-regional Training Course on Climate Change-Related Statistics
17-21 September 2018, Nandi, Fiji

UNITED NATIONS
SIAP
Statistical Institute for
Asia and the Pacific

Learning objectives

Develop an understanding of:

- Climate change science

- Environment statistics

- Climate change statistics & climate change-related statistics

- Approaches to development of climate change-related statistics & indicators

- Needs for national data, statistics & indicators related to climate change

Slide 1

In the news

To beat hunger and combat climate change, world must 'scale-up' soil health – UN

13 August 2018 | Global

Nations begin drafting 'operating manual' for climate action at UN conference in Bonn

How to avoid a catastrophic 'Hothouse Earth'

Humanity only has a handful of decades to determine the future of our planet.

UNEP GRID Arendal/Lawrence Hislop

Slide 2

Climate change …

*… is a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is **in addition to natural climate variability** observed over comparable time periods*
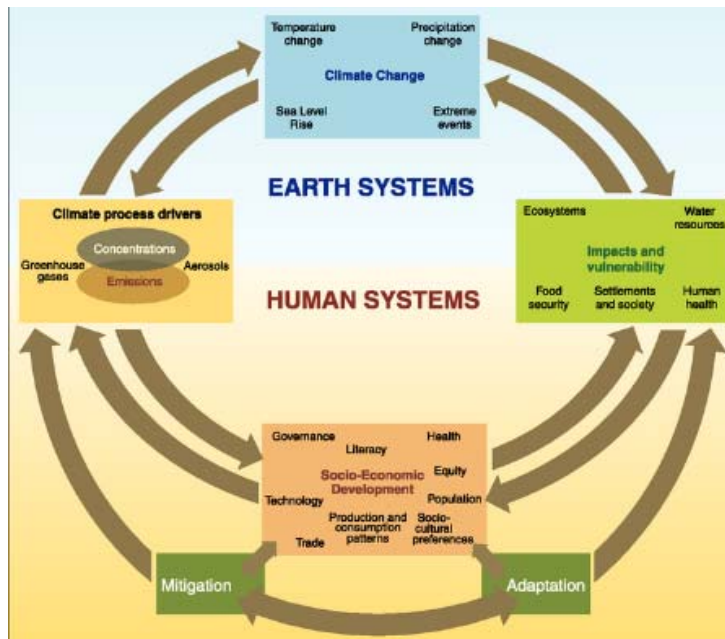
United Nations Framework Convention on Climate Change (1992)

➜ a complex set of human and environment interactions…

Anthropogenic drivers, impacts of & responses to climate change, & their linkages

What are some examples of:
- Mitigation
- Adaptation

Mitigation = reducing impacts
Adaptation = living with impacts

Intergovernmental Panel on Climate Change (IPCC) Climate Change 2007: Synthesis Report
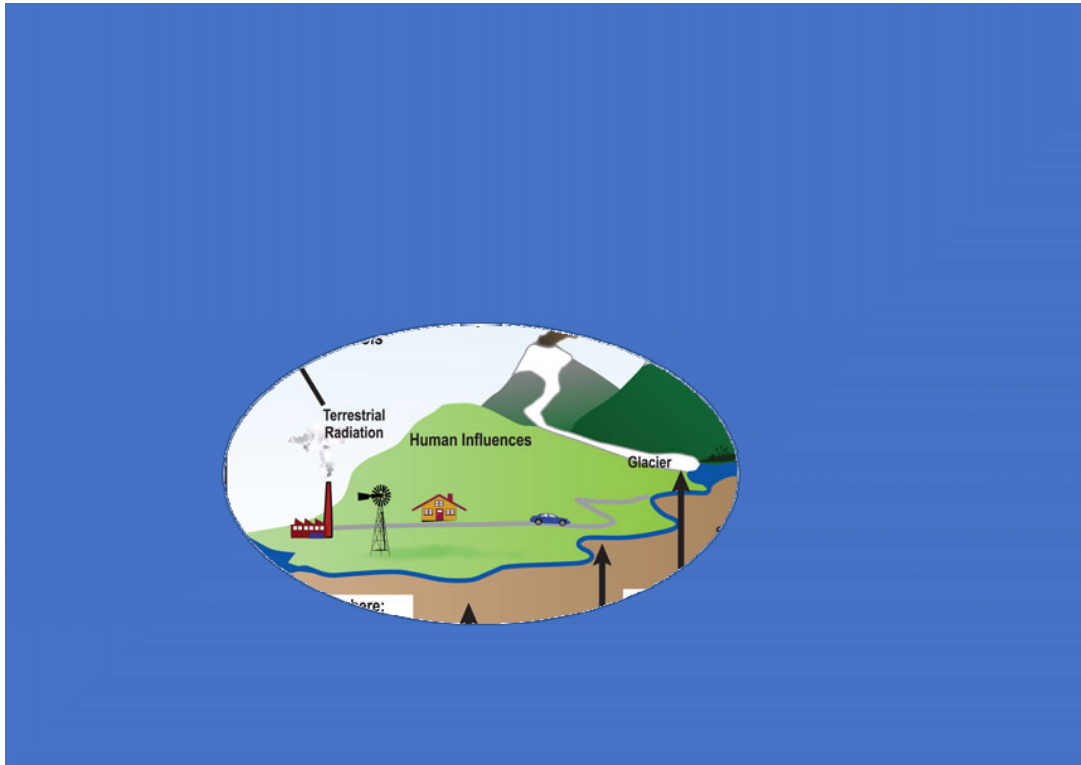

Two quotes on climate change…

"Greenhouse gas emissions could be cut in half by applying current technologies including conservation"

International Energy Agency, 2009

"There's no profit in conservation."

Michael Bordt, 2010

Climate science 101

The Earth's atmosphere absorbs heat from the sun

- Some is reflected back
- How much is absorbed depends on its composition
- **Radiative forcing**: is the difference between the amount absorbed and the amount reflected back
- If more is absorbed than reflected back there is a net gain of energy and **the atmosphere will warm.**
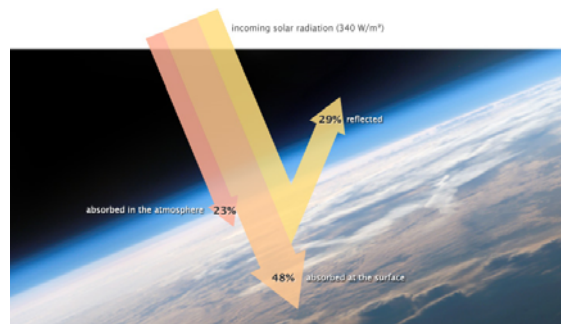
https://en.wikipedia.org/wiki/Radiative_forcing

- Greenhouse gases (GHGs) and aerosols increase the capacity of the atmosphere to absorb energy

Climate science 101

- Since the 1950s, the concentration of greenhouse gases have been increasing
- Mainly due to human activities:
  - fossil fuel combustion
  - biomass combustion
  - release of aerosols
  - land use change (reduction in plants that absorb CO_2, increases in artificial surfaces)

Environment statistics: FDES

- **Framework for the Development of Environment Statistics**
  - FDES 2013
  - Developed by United Nations Statistics Division with guidance of national & international experts
- **Scope**: biophysical aspects of environment & aspects of socio-economic system that directly influence & interact with environment
  - Scope of environment, social & economic statistics overlap
- **Structure**
  - Components (6)
    - Sub-components (23)
      - Statistical topics (60)
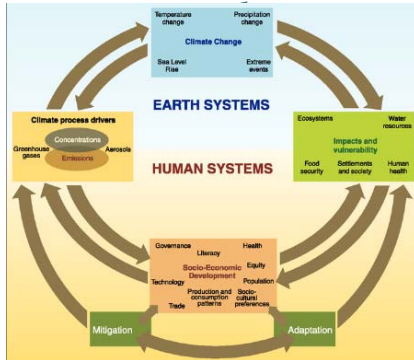   - Statistics (458)

FDES components

FDES (cont.)

- Seeks to be compatible with **related frameworks & systems**, e.g.:
  - System of Environmental-Economic Accounting (SEEA)
  - Driving-force Pressure-State-Impact-Response (DPSIR)
  - Sustainable Development Goals (SDGs) indicators
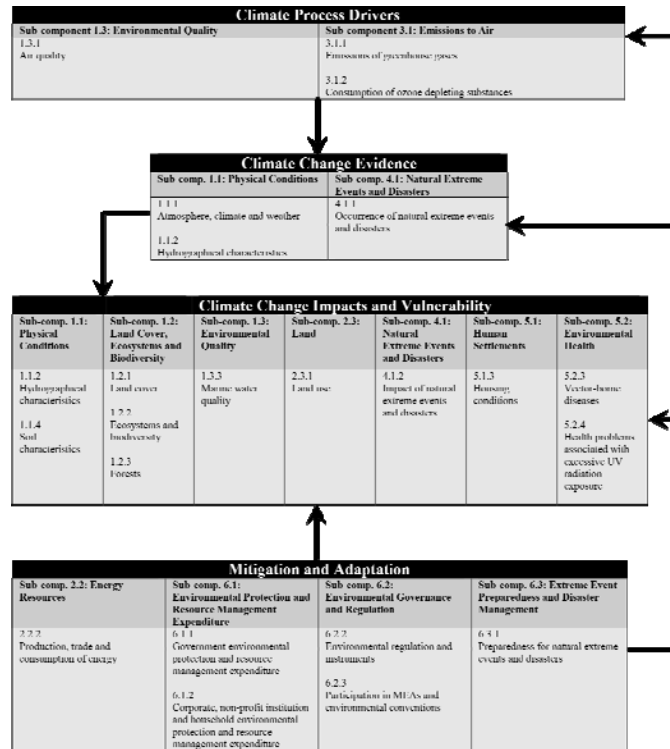- Contains a **Core Set of Environment Statistics**
  - with 3 tiers

Climate change-related topics in FDES

- What's missing?

3.1 Emissions to air

3.1 Emissions to Air

- 3.1.1: Emissions of greenhouse gases
- 3.1.2: Consumption of ozone depleting substances
- 3.1.3: Emissions of other substances

- 3.1.1 Emissions of greenhouse gases (GHGs)
  - Why important? GHGs increase capacity of atmosphere to hold heat ➔ climate change!
  - Data types: Quantities and sources of:
    - Carbon Dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O), Sulphur Dioxide (SO_2), Nitrogen Oxides (NO_x), non-methane volatile organic compounds (NM-VOCs)
    - Guidelines by Intergovernmental Panel on Climate Change (IPCC) under UN Framework Convention on Climate Chance (UNFCCC)
      - BUT categories on process-based sources ➔ need to break down by economic activity
  - Data sources: Estimated from processes and fuel consumption
  - Challenges:
    - Getting data on processes used by industry
    - Distinguishing Direct (controlled by reporting entity); Indirect (embedded in products)
- Ambient concentrations ➔ FDES 1.3.1 (Air quality)
- SEEA ➔ Emissions to Air, Energy Accounts, Material Flows

The indicators:

Table 3.3.1.1: Statistics and Related Information for Topic 3.1.1

Component 3: Residuals

Sub-component 3.1: Emissions to Air

Topic 3.1.1: Emissions of greenhouse gases

Statistics and Related Information (Bold Text - Core Set/Tier 1; Regular Text - Tier 2; *Italicized Text - Tier 3*)	Category of Measurement	Potential Aggregations and Scales	Methodological Guidance
a. Total emissions of direct greenhouse gases (GHGs), by gas:		• By ISIC economic activity	• IPCC Emission Factor Database
1. **Carbon dioxide (CO_2)**	Mass	• By tourists	• UN Framework Convention on Climate Change (UNFCCC) Reporting Guidelines
2. **Methane (CH_4)**	Mass	• National	
3. **Nitrous oxide (N_2O)**	Mass	• Sub-national	
4. Perfluorocarbons (PFCs)	Mass	• By IPCC source categories	• UNECE Standard Statistical Classification of Ambient Air Quality (1990)
5. Hydrofluorocarbons (HFCs)	Mass		
6. Sulphur hexafluoride (SF_6)	Mass		• UNSD: MDG Indicator 7.2 Metadata
b. Total emissions of indirect greenhouse gases (GHGs), by gas:			• WHO
1. **Sulphur dioxide (SO_2)**	Mass		
2. **Nitrogen oxides (NO_x)**	Mass		
3. Non-methane volatile organic compounds (NM-VOCs)	Mass		
4. Other	Mass		

Set of core climate change-related statistics & indicators using SEEA

- Agreed to as basis for pilot testing by United Nations Economic Commission for Europe **Conference of European Statisticians (CES)** in 2017
  - UN ECE: sister regional commission of UN ESCAP
  - SIAP is a regional institution of ESCAP
- Part of ongoing work of CES **Task Force** on a set of core climate change-related statistics using SEEA
  - Objective to define an internationally comparable set of core climate change-related statistics & indicators that can be derived from SEEA & FDES

Scope of climate change-related statistics

"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"

CES Task Force on climate change statistics

To narrow scope in context of the statistical system, focus is on statistics that measure 5 climate change-related areas:

1. **Drivers:** human causes of climate change that deal with sources of emissions
2. **Emissions**: greenhouse gas (GHG) emissions and their human causes
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

Related global policy initiatives

- 2030 Agenda for Sustainable Development, including the Sustainable Development Goals (SDGs)
- Sendai Framework for Disaster Risk Reduction 2015 – 2030
- Paris Agreement
- Regional & sub-regional
  - Pacific SDG indicator set

Sustainable Development Goals (SDGs)

- **SDG 13**: *Take urgent action to combat climate change and its impacts*
  - With 5 targets & 7 indicators (adapt, risk reduction, awareness)
- Other **targets** directly related to climate change:
  - 1.5 (vulnerability of poor)
  - 2.4 (adaptation of food production)   How are these related?
  - 3.d (early warning and risk reduction)
  - 7.2, 7.3, 7.a & 7.b (renewable energy, energy efficiency)
  - 11.b (cities adaptation and resilience)
  - 12.c (fossil fuel subsidies)
  - 14.3 (ocean acidification!)
  - 15.2 (sustainable forest management)
- 9 SDG indicators in CES core climate change-related indicators under areas of **impacts** & **adaptation**

Sendai Framework for Disaster Risk Reduction 2015 – 2030

- Adopted at 3rd UN World Conference in Sendai, Japan in 2015
- 7 global targets

Sendai Framework targets

a. Substantially reduce global disaster **mortality** by 2030, aiming to lower average per 100,000 global mortality rate in 2020–2030 compared to 2005–2015

b. Substantially reduce number of **affected people** globally by 2030, aiming to lower average global figure per 100,000 in 2020–2030 compared to 2005–2015

c. Reduce direct disaster **economic loss** in relation to GDP by 2030

d. Substantially reduce disaster **damage to critical infrastructure & disruption of basic services**, among them health & educational facilities, including through developing their resilience by 2030

e. Substantially increase number of countries with national & local disaster **risk reduction strategies** by 2020

f. Substantially enhance **international cooperation** to developing countries through adequate & sustainable support to complement their national actions for implementation of present Framework by 2030

g. Substantially increase availability of & access to multi-hazard **early warning systems** & disaster **risk information & assessments** to people by 2030

Sendai Framework indicators

- Developed by Open-ended Intergovernmental Expert Working Group on indicators and terminology relating to disaster risk reduction (OEIWG)

- Report adopted by United Nations General Assembly on 2 Feb 2017
  - Provides definitions of **hazard** & **disaster** linked to context of climate change
  - Contains 32 indicators
  - of which 4 are in CES core climate change-related indicators, all under area of **impacts**

Paris Agreement

- Builds upon United Nations Framework Convention on Climate Change (UNFCC)
- Entered into force on 5 Oct 2016
- Aims to strengthen global response to threat of climate change
  - by keeping global temperature rise this century **well below 2°C above pre-industrial levels**
  - and to pursue efforts to limit temperature increase even further to 1.5°C
- Also aims to strengthen ability of countries to deal with impacts of climate change through:
  - Appropriate financial flows
  - A new technology framework and
  - An enhanced capacity building framework

Paris Agreement (cont.)

- Parties required to put forward their best effort through **nationally determined contributions** (NDCs)
  - and to strengthen these over time
- Includes **regular reporting** on **emissions** and implementation efforts
  - To start in 2018, and every 5 years thereafter
- **Data requirements** not yet elaborated
  - But likely to build on existing reporting & review processes under UNFCCC

Statistical frameworks supporting production of climate change-related statistics

- SEEA (evidently)
  - 24 of CES core climate change-related indicators can be produced from System of Environmental-Economic Central Framework (SEEA-CF) accounts
  - And several others from SEEA Experimental Ecosystem Accounts (SEEA-EEA)
- FDES (evidently)
  - Remember components, sub-components…

- Why "evidently"?
- Neither really cover all of it…
  - Need to mix & match and add some new ones
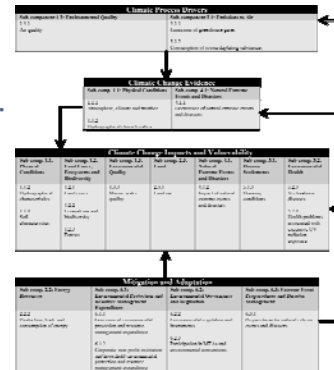
CES 39 core climate change-related indicator areas & sub-areas (number of indicators)

Sub-areas	Areas				
	Drivers	Emissions	Impacts	Mitigation	Adaptation
National total	4	3			
Production	3	2			
Consumption	1	2			
Physical conditions			2		
Land, land cover, ecosystems and biodiversity			3	0	0
Extreme events and disasters			4		0
Water resources			1		1
Human settlements and environmental health			2	0	1
Agriculture, forestry and fishery			1	0	2
Expenditures				1	1
Energy resources				1	
Environmental governance and regulation				4	0
Total	8	7	13	6	5

Why the blanks?

Why the zeros?

Drivers

SEEA Agriculture, Forestry and Fisheries

Area	Sub-area	No.	Indicator	Tier	Indicator conceptually identical with		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

No exact SDG indicators
Not in Sendai Framework
Can be produced by SEEA

Emissions

Area	Sub-area	No.	Indicator	Tier	Indicator conceptually identical with		Can be produced from SEEA-CF accounts
					SDGs	SF DRR*	
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

Area	Sub-area	No.	Indicator	Tier	Indicator conceptually identical with — SDGs	Indicator conceptually identical with — SF DRR*	Can be produced from SEEA-CF accounts
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
	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	

SEEA Ecosystems (conditions)

What's missing? Inappropriate?

Mitigation

Area	Sub-area	No.	Indicator	Tier	Indicator conceptually identical with — SDGs	Indicator conceptually identical with — SF DRR*	Can be produced from SEEA-CF accounts
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)		

Adaptation

Area	Sub-area	No.	Indicator	Tier	Indicator conceptually identical with		Can be produced from SEEA-CF accounts
					SDGs	SF DRR*	
Adaptation	Expenditures	35	Share of government adaptation expenditure to GDP	III			Transactions
	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	??? Explain		
	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)		

This week covering:
- FDES Extreme Events and Disasters
- SEEA: Water, Solid Waste, Land, Energy

Take home points

- Climate change refers to human induced changes in earth conditions and cycles that affect temperature
- There's no profit in conservation
- There are many frameworks for action
- There are a few frameworks for statistics
- The UN-ECE list of climate change-related statistics is a useful list, mostly linked to SEEA and FDES
- SEEA and FDES implementation can
  - Build capacity to produce nationally-relevant indicator sets
  - Ensure coherence between related data collection
- **Use existing guidelines when you can!**

Questions?

References (selected)

- United Nations Framework on Climate Change, 1992
- IPPCC, Climate Change 2007: Synthesis Report
- SEEA-CF, 2012
- SEEA-EEA, 2012
- FDES, 2013
- SDG global indicator framework
- Paris Agreement
- OEIWG Report, 2017
- CES Task Force on a set of key climate change-related statistics using SEEA final report with the set of indicators, 2017

Time to do some work!

- See handout
- Conduct research on:
  - Country priorities
  - Sources of data
  - Select 3-4 key indicators
  - Report on
    - Priorities
    - Status
    - Additional indicators (what does CES not cover?)
    - Work in country required to produce key indicators

Country research (Day 1)

1. Review most recent **national documentation** on climate change (e.g., National Communications, other reports)

2. Assess whether specified indicator from UN-ECE list is relevant or a **priority** in your country.

3. Review "metadata" for **priority** indicators in your country.

4. Discuss possible **additional indicators** that are relevant for your country. Select highest priority additional indicators.

Country research (Day 2-4)

5. Review which "series" are required to calculate the selected indicators (e.g., Share of fossil fuels in total primary energy supply (TPES) requires **TPES** and **total fossil fuels supplied**).

6. Search ESCAP database for indicators for your country. Also search national, other international and academic sources.

7. Record data, if available, **in the spreadsheet** for recent and one year in the past. Note if "proxies" available (not exactly the same definition)

Country research (Day 5)

8. Complete data recording for priority indicators.

9. Finalize indicators (calculate final indicators). Begin country report (5-minute verbal or PPT presentation).

10. **Outline for country presentation:**
   - My country is concerned about climate change because….
   - To address this concern, we should be producing the following key indicators as official statistics [choose 3]
   - We have added indicator (x) to the list of priority indicators.
   - We have national data for (x) out of 3 of these indicators and the indicators show…[good/bad trends]
   - To develop (x) indicator as an official statistic, we would need to…[elements of work plan]
   - To be more relevant to our country, we would suggest adding the following indicators to the list of priority indicators…

Research template

Links to metadata

Area	Sub-area	No.	Indicator	Series required	Source	Past value	Recent value	Trend (good / bad)
Drivers	National total	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					
		4	Total support for fossil fuels / GDP					
	Production	5	Total energy intensity of production activities					
		6	CO2 intensity of energy for the economy					
		7	Emission intensity of agricultural commodities					
	Consumption	8	Energy consumption by households / capita					

From national reports:
- Select 3-4 relevant indicators
- Add indicators if required
- Read metadata
- Document series required
- Find data online
- Assess trend (good/bad)
- Calculate indicators
- Report on priorities and data needs