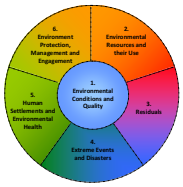
Environment and Energy Statistics Workshop for the Arab Region

Handout 4: FDES Application to Environment and Energy Cross Cutting Issue



Source: Section 5.2 FDES 2013

Energy is indispensable to all ecosystems and is a necessary input for human controlled processes. Energy incorporates the concept of the transformation of "available energy" to "unavailable energy" (e.g., burning of hydrocarbons) and conversion from an "unusable" to a "usable" form (e.g., hydropower to electricity). Energy, unlike all other natural resources, is not a material substance but instead is the capacity of a physical system to perform work. The amount of energy in a physical system remains constant, and is finite, though its quality or availability diminishes through transformation.

Energy production and consumption affects the environment in different ways. The first issue relates to depletion of non-renewable energy resources, for as mineral energy resources are extracted, depletion occurs. In addition, extraction of mineral energy resources involves mining operations which disturb ecosystems, restructure the land, remove soil and water, and produce wastes. Extraction techniques also result in the removal of large areas of surface vegetation, deep-well drilling and the use of heavy equipment for exploratory wells on land and off-shore oil rigs for exploration of ocean geology. The sheer quantity in the output of coal and the complex infrastructure required in oil and gas development have created large-scale environmental disturbances through the construction of pipelines, railways and large-scale terminal shipping facilities. This situation is further exacerbated by hazards of oil spills, well-head and pipeline explosion and fires, as well as the chemical pollution of the associated petrochemical industry.

The consumption of mineral energy resources also affects the environment. It is estimated that fossil fuels represented 81 percent of the total primary energy demand in 2010.[1] Combustion of fossil fuels pollutes the air, affects human health, and results in significant GHG emissions. Renewable energy does not face the depletion problem of mineral energy resources, but the harvesting of renewable energy can also affect the natural environment, particularly in large hydro energy facilities. Environment protection expenditure, environmental governance and regulation and extreme event preparedness and disaster management each have roles to play in the sustainable development, production and consumption of energy resources. Statistics that support these aspects of energy form an invaluable part of policy planning. Regardless of how energy is produced, its distribution requires facilities which can also change the land and affect natural areas. Each country must construct public policies to lead the required changes in their energy production and consumption in order to meet the demands of development in a sustainable and clean manner.

[1] International Energy Agency (2012). "World Energy Outlook 2012", OECD Publishing. Available from http://www.oecd-ilibrary.org/energy/world-energy-outlook-2012_weo-2012-en (accessed 24 January 2013).

Energy plays a critical role in socio-economic development. The outcome document of the Rio+20 United Nations Conference on Sustainable Development, "The future we want", addressed energy within the context of sustainable development.[2] Among other things, it called for action to ensure "access to sustainable modern energy services for all". It also reaffirmed support for cleaner energy technologies, citing "increased use of renewable energy sources and other low-emission technologies", "more efficient use of energy" and "greater reliance on advanced energy technologies" as parts of an appropriate energy mix for meeting developmental needs. This document urged governments to create enabling environments for investment in cleaner energy technologies. The core challenge facing policy makers in regards to energy production and consumption remains in balancing the demand and need for energy with the impacts from its production and consumption. There is therefore great need for coordination and harmonization over all levels, as data are needed for policy, regulation, science and to complement the economic and social aspects when doing analysis.

As such, reliable and robust energy statistics are a priority issue for the international statistical community. Energy statistics have been discussed by the United Nations Statistical Commission since its inception and at its forty-second session (February 2011), the Commission adopted the IRES.[3] Statistics on energy production and consumption are usually available in both physical and monetary units, the latter being the sale of and expenditure for energy commodities (e.g., fuel and electricity). The physical measures are of prime interest from an environmental perspective.

Application of the FDES to energy statistics

In the figures below, those aspects of energy statistics which are related to environment statistics using the FDES are described. The figures have been constructed to reflect the process from energy resources through their extraction, the production and consumption of energy and their environmental effects, to protection and mitigation activities.

The sequence depicted in *Figures 5.5* and *5.6* for the theme of energy contains four boxes. *Figure 5.5* presents this information at the topic level, while *Figure 5.6* goes into more detail and presents the individual environment statistics which can be used to assess energy production and consumption.

[2] United Nations (2012). Rio+20 outcome document, "The Future We Want". Available from http://www.uncsd2012.org/thefuturewewant.html (accessed 22 October 2012).
[3] United Nations Statistics Division (2011). "International Recommendations for Energy Statistics (draft version)". Available from http://unstats.un.org/unsd/statcom/doc11/BG-IRES.pdf (accessed 10 November 2012).

Figure 5.5: Topics in the FDES that relate to the production and consumption of energy

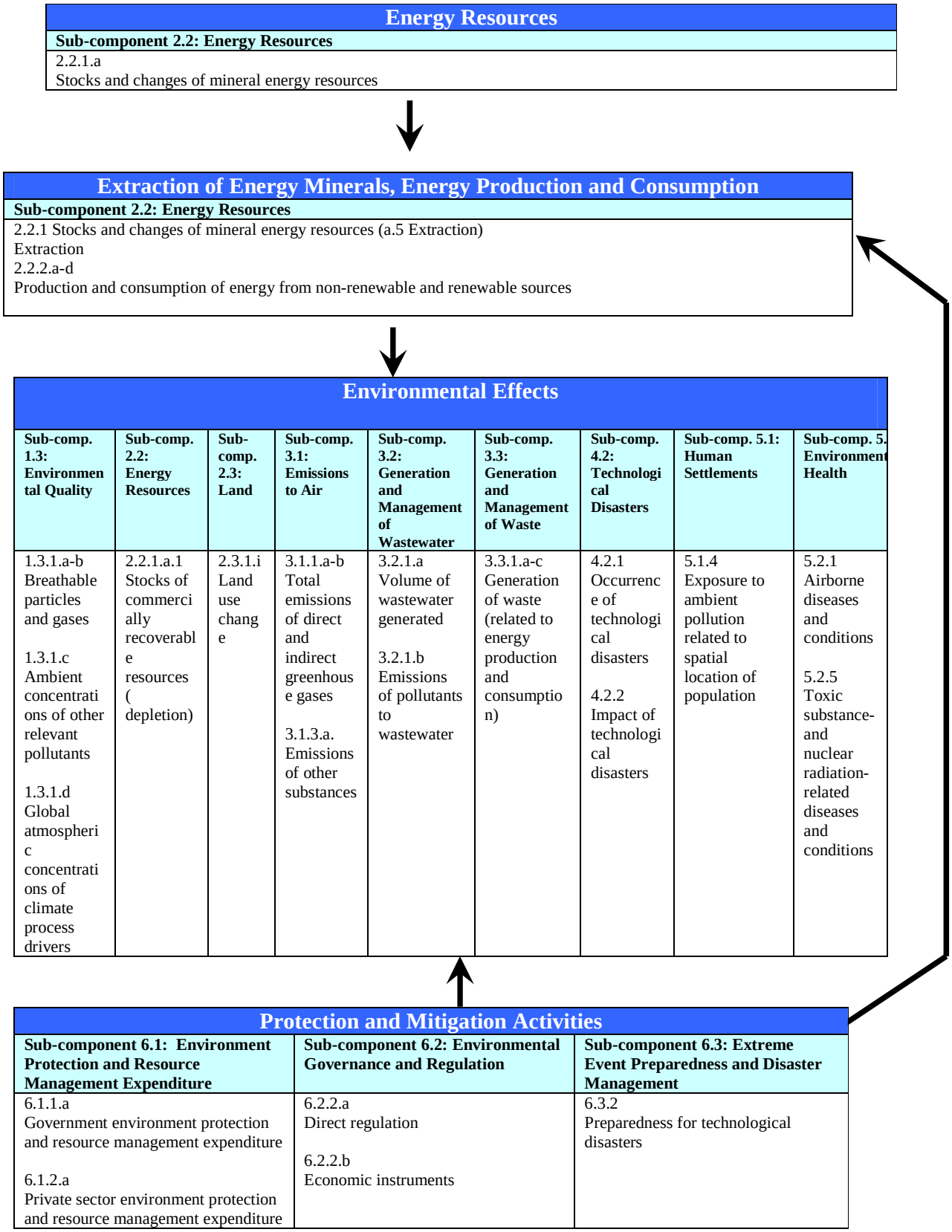


Figure 5.6: Energy production and consumption statistics in the Core Set and Basic Set of Environment Statistics

(Bold Text – Core Set/Tier 1; Regular Text – Tier 2; *Italicized Text – Tier 3***)**

Energy Resources

Sub-component 2.2: Energy Resources

2.2.1.a: Mineral energy resources
- **2.2.1.a.1: Stocks of commercially recoverable resources**
- 2.2.1.a.2: New discoveries
- *2.2.1.a.3: Upward reappraisals*
- *2.2.1.a.4: Upward reclassifications*
- **2.2.1.a.5: Extraction**
- *2.2.1.a.6: Catastrophic losses*
- *2.2.1.a.7: Downward reappraisals*
- *2.2.1.a.8: Downward reclassifications*
- 2.2.1.a.9: Stocks of potentially commercially recoverable resources
- *2.2.1.a.10: Stocks of non-commercial and other known resources*
- **2.2.1.a.11: Imports of energy minerals**
- **2.2.1.a.12: Exports of energy minerals**

Extraction of Energy Minerals, Energy Production and Consumption

Sub-component 2.2: Energy Resources

2.2.2.a: Production of energy from non-renewable and renewable sources
- **2.2.2.a.1: Total**
- **2.2.2.a.2: Non-renewable sources**
- **2.2.2.a.3: Renewable sources**

2.2.2.b: Production of energy
- **2.2.2.b.1: Primary energy production**
- **2.2.2.b.2: Secondary energy production**

2.2.2.c: Total consumption of energy

2.2.2.d.: Electric energy
- **2.2.2.d.1: Electricity production**
- **2.2.2.d.2: Installed capacities**

Environmental Effects

Sub-component 1.3: Environmental Quality

1.3.1.a: Breathable particles
- **1.3.1.a.1: Concentration levels of particulate matter (PM_{10})**
- **1.3.1.a.2: Concentration levels of particulate matter ($PM_{2.5}$)**
- 1.3.1.a.3: Maximum allowable levels
- 1.3.1.a.4: Number of days where maximum allowable levels were surpassed per year

1.3.1.b: Breathable gases
- **1.3.1.b.1: Concentration levels of tropospheric ozone (O_3)**
- **1.3.1.b.2: Concentration levels of carbon monoxide (CO)**
- 1.3.1.b.3: Maximum allowable levels
- 1.3.1.b.4: Number of days where maximum allowable levels were surpassed per year

1.3.1.c: Ambient concentrations of other relevant pollutants
- **1.3.1.c.1: Concentration levels of sulphur dioxide (SO_2)**
- **1.3.1.c.2: Concentration levels of nitrogen oxides (NO_X)**
- 1.3.1.c.3: Concentration levels of heavy metals
- 1.3.1.c.4: Concentration levels of non-methane volatile organic compounds (NMVOCs)
- *1.3.1.c.5: Concentration levels of dioxins*
- *1.3.1.c.6: Concentration levels of furans*
- 1.3.1.c.7: Other pollutants (related to energy production and consumption)
- 1.3.1.c.8: Maximum allowable levels
- 1.3.1.c.9: Number of days where maximum allowable levels were surpassed per year

1.3.1.d: Global atmospheric concentrations of climate process drivers
- 1.3.1.d.1: Global atmospheric concentration levels of carbon dioxide (CO_2)
- 1.3.1.d.2: Global atmospheric concentration levels of methane (CH_4)

Sub-component 2.2: Energy Resources

2.2.1.a: Mineral energy resources
- **2.2.1.a.1: Stocks of commercially recoverable resources**

Sub-component 2.3: Land

2.3.1.a: Land use (related to energy production and consumption)
- 2.3.1.i.1: Increase of area within category
- 2.3.1.i.2: Decrease of area within category
- **2.3.1.i.3: Change of land use category by origin and destination**

Sub-component 3.1: Emissions to Air

3.1.1.a: Total emissions of direct greenhouse gases (GHGs), by gas:
- **3.1.1.a.1: Carbon dioxide (CO_2)**
- **3.1.1.a.2: Methane (CH_4)**
- **3.1.1.a.3: Nitrous oxides (N_2O)**
- 3.1.1.a.4: Perfluorocarbons (PFCs)
- 3.1.1.a.5: Hydrofluorocarbons (HFCs)
- 3.1.1.a.6: Sulphur hexafluoride (SF_6)

3.1.1.b: Total emissions of indirect greenhouse gases (GHGs), by gas:
- **3.1.1.b.1: Sulphur dioxide (SO_2)**
- **3.1.1.b.2: Nitrogen oxides (NO_x)**
- 3.1.1.b.3: Non-methane volatile organic compounds (NM-VOCs)
- 3.1.1.b.4: Other

3.1.3.a: Emissions of other substances
- 3.1.3.a.1: Particulate matter (PM)
- 3.1.3.a.2: Heavy metals
- *3.1.3.a.3: Other*

Sub-component 3.2: Generation and Management of Wastewater

3.2.1.a: Volume of wastewater generated (related to energy production and consumption)

3.2.1.b: Emissions of pollutants to wastewater (related to energy production and consumption)

Sub-component 3.3: Generation and Management of Waste

3.3.1.a: Amount of waste generated by economic activity (related to energy production and consumption)

3.3.1.c: Generation of hazardous waste (related to energy production and consumption)
- **3.3.1.c.1: Amount of hazardous waste generated**

Sub-component 4.2: Technological Disasters

4.2.1.a: Occurrence of technological disasters (related to energy production and consumption)
- 4.2.1.a.1: Type of technological disaster
- *4.2.1.a.2: Location*
- *4.2.1.a.3: Date of occurrence*
- *4.2.1.a.4: Duration*

4.2.2.a: People affected by technological disasters (related to energy production and consumption)
- 4.2.2.a.1: Number of people killed
- *4.2.2.a.2: Number of people injured*
- *4.2.2.a.3: Number of people homeless*
- *4.2.2.a.4: Number of people affected*

4.2.2.b: Economic loss due to technological disasters (related to energy production and consumption)

4.2.2.c: Physical loss/damage due to technological disasters (related to energy production and consumption)

4.2.2.d: Effects of technological disasters on integrity of ecosystems (related to energy production and consumption)
- *4.2.2.d.1: Area affected by technological disasters*
- *4.2.2.d.2: Loss of vegetation cover*
- *4.2.2.d.3: Area of watershed affected*
- *4.2.2.d.4: Other* (e.g., for oil spills: volume of oil released into the environment, impact on ecosystem)

4.2.2.e: External assistance received (related to energy production and consumption)

Sub-component 5.1: Human Settlements

5.1.4.a: Population exposed to air pollution in main cities

Sub-component 5.2: Environmental Health

5.2.1.a: Airborne diseases and conditions (related to energy production and consumption)
- 5.2.1.a.1: Incidence
- 5.2.1.a.2: Prevalence
- *5.2.1.a.3: Loss of work days*
- *5.2.1.a.4: Estimates of economic cost in monetary terms*

5.2.5.a: Toxic substance- and nuclear radiation-related diseases and conditions (related to energy production and consumption)
- 5.2.5.a.1: Incidence
- 5.2.5.a.2: Prevalence
- *5.2.5.a.3: Loss of work days*
- *5.2.5.a.4: Estimates of economic cost in monetary terms*

Protection and Mitigation Activities

Sub-component 6.1: Environment Protection and Resource Management Expenditure

6.1.1.a: Government environment protection and resource management expenditure (related to energy production and consumption)
- **6.1.1.a.1: Annual government environment protection expenditure**

6.1.1.a.2: Annual government resource management expenditure 6.1.2.a: Private sector environment protection and resource management expenditure 6.1.2.a.1: Annual corporate environment protection expenditure *6.1.2.a.3: Annual non-profit institution environment protection expenditure* *6.1.2.a.5: Annual household environment protection expenditure*
Sub-component 6.2: Environmental Governance and Regulation
6.2.2.a: Direct regulation **6.2.2.a.1: List of regulated water pollutants and description** (e.g., by year of adoption and maximum allowable levels) 6.2.2.a.2: Description (e.g., name, year established) of licensing system to ensure compliance with environmental standards for businesses or other new facilities (related to energy production and consumption) 6.2.2.a.3: Number of applications for licenses received and approved per year (related to energy production and consumption) 6.2.2.a.5: Budget and number of staff dedicated to enforcement of environmental regulations (related to energy production and consumption) 6.2.2.b: Economic instruments *6.2.2.b.1: List and description (e.g., year of establishment) of green/environmental taxes* (related to energy production and consumption) *6.2.2.b.2: List and description (e.g., year of establishment) of environmentally relevant subsidies* (related to energy production and consumption) *6.2.2.b.3: List of eco-labelling and environmental certification programmes* (related to energy production and consumption) 6.2.2.b.4: Emission permits traded
Sub-component 6.3: Extreme Event Preparedness and Disaster Management
6.3.2.a: National technological disaster preparedness and management systems *6.3.2.a.1: Existence and description (e.g., number of staff) of public disaster management plans/programmes* (and private when available) *6.3.2.a.2: Expenditure on disaster preparedness, clean-up and rehabilitation* (and private when available)

Some of the most commonly used energy-related indicators that can be derived from the core and basic sets (and using relevant data on population, GDP and value added) are as follows:

- Reserve/production ratio (extraction as a proportion of stocks of resources)
- Energy production by fuel type
- Electricity generation by fuel type
- Energy intensity (population)
- Energy intensity (GDP, economy)
- Energy intensity (value added by economic activity)
- Energy efficiency (GDP, economy)
- Energy efficiency (value added by economic activity)
- Energy dependency (share of imports in energy consumption)
- Share of non-carbon fuels in energy consumption
- Share of energy from renewable sources in energy consumption
- Share of energy from renewable sources in electricity generation
- GHG emission intensity of energy production and use (per capita, total, by economic activity)
- Share of energy related GHG emissions in total GHG emissions
- Waste intensity of energy production and use
- Proportion of population with access to electricity
- Energy consumption per capita and by economic activity
- Share of households with/without electricity