System of Environmental Economic Accounting

SEEA-Energy

An introduction

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What is SEEA-Energy

- **SEEA Energy** is a ”subsystem” to SEEA Central Framework, which in details decribes how information for energy flows and stocks and changes of energy resources should be organised
- **Agreed** concepts, definitions, classifications, tables, and accounts related to energy supply and use and stocks of energy resources

SEEA Energy includes three main types of information on energy

- The supply and use of energy (flows)
- The stocks of energy and the changes in them
- Other economic aspects related to energy

Important concepts and definitions

- The national economy, resident units and the rest of the world
- Imports and exports
- The residence principle
- Production, consumption and accumulation
- Natural inputs, products and residuals
- Physical and monetary units

Energy as natural inputs

- **Natural inputs:** This is energy resources i.e. energy as we find it in the environment, and which we may extract or capture

Energy natural resource inputs
Mineral and energy resources
Oil resources
Natural gas resources
Coal and peat resources
Uranium and other nuclear fuels
Naural timber resources
Inputs of energy from renewable sources
Solar
Hydro
Wind
Wave and tidal
Geothermal
Other electicity and heat
Other natural inputs
Energy inputs to cultivated biomass

Energy as products

- **Energy products:** This is energy in the form in which it is bought and sold or stored in inventories owned by companies. Products are always produced or generated by an economic unit belonging to the national or rest of the world economy.

Classes of energy products
0 Coal
1 Peat and peat products
2 Oil shale / oil sands
3 Natural gas
4 Oil
5 Biofuels
6 Waste
7 Electricity
8 Heat
9 Nuclear fuels and other fuels n.e.c

Energy as residuals

Energy losses are grouped into 4 groups:

- losses during extraction, e.g. when natural gas evaporates during extraction
- losses during distribution, e.g. when an oil tanker spills oil
- losses during storage, e.g. when petrol leaks from a tank
- losses during transformation, e.g. heat losses when coal is used for production of electricity

Physical and monetary units

- SEEA-Energy uses calorific values measured by Joules as a common unit for the physical accounts

- In practice often have to work with the data at natural energy units (Tonnes, m3, GWh) and may build the accounts around these units, and finally convert into joules by using conversion factors.

- For the monetary accounts the national currency will be the relavant unit for the accounts

Main types of SEEA-Energy accounts and tables

- Supply and use tables for recording of flows of energy
  - in the form of natural inputs, products and residuals
  - related to production, consumption and accumulation
  - between the national economy, the environment and the rest of the world
- Asset accounts for recording of the stocks of energy and changes in the stocks
  - the closing stock is equal to the opening stock plus changes in the period
  - only asset accounts for mineral and energy resources (and timber resources)

Energy statistics and balances

- Basic energy statistics should feed into the balances and accounts
- Basic energy statistics and energy balances provides the starting point in the compilation of physical flow energy accounts
- Some differences between accounts and balances
  - > Differences in terminology and concepts
  - > Conceptual differences territory principle / residence principle
  - > Treatment of transport

Applications of energy accounts

- Policy relevance
  - Inform decisions on supply and use of energy
  - Richer understanding of the role of energy in the economy
    - Decoupling indicators
  - Modeling and scenario analysis

- 2030 Sustainable Development Agenda
  - Goal 7 on Energy

Some further details on asset accounts

Details on asset accounts

- Deposits of oil resources, natural gas, coal and peat resources, thorium and uranium
- Known deposits categorized into 3 categories based on UNFC 2009 criteria
  - > Class A: Commercially recoverable resources
  - > Class B: Potentially commercially recoverable resources
  - > Class C: Non-commercial and other known deposits

Details on stocks of resources

Type of mineral and energy resource	Class of known deposit		
	Class A: Commercially recoverable resources	Class B: Potentially commercially recoverable resources	Class C: Non-commercial and other known deposits
Oil resources (‘000 barrels)	800	600	400
Natural gas resources (m3)	1 200	1 000	1 500
Coal & peat resources (‘000 tonnes)	600	50	50
Uranium and other nuclear fuels (tonnes)			

Details on physical asset accounts

	Type of mineral and energy resource (Class A: Commercially recoverable resources)			
	Oil resources ('000 barrels)	Natural gas resources (m3)	Coal & peat resources ('000 tonnes)	Uranium and other nuclear fuels (tonnes)
Opening stock of mineral and energy resources	800	1 200	600	
Additions to stock				
Discoveries				
Upwards reappraisals		200		
Reclassifications				
Total additions to stock		200		
Reductions in stock				
Extractions	40	50	60	
Catastrophic losses				
Downwards reappraisals			60	
Reclassifications				
Total reductions in stock	40	50	120	
Closing stock of mineral and energy resources	760	1 350	480	

Details on monetary asset accounts

	Type of mineral and energy resource (Class A: Commercially recoverable resources)
	(000's currency units
Opening value of stock of resources	
Additions to value of stock	
Discoveries	
Upwards reappraisals	
Reclassifications	
Total additions to stock	
Reductions in value of stock	
Extractions	
Catastrophic losses	
Downwards reappraisals	
Reclassifications	
Total reductions in stock	
Revaluations	
Closing value of stock of resources	

A short exercise on energy supply and use

Information available

- The mining industry extracts 150PJ of coal.
- In total 60PJ of electricity come from solar panels, 50 of which are produced in a photovoltaic power station and the rest by households.
- All the coal is sent for processing to the coal power plant. However due to losses during extraction, the coal power plant received 140PJ of coal.
- The remaining supply of coal is converted to energy and heat. The coal power plant produces 75PJ of electricity and 35PJ of heat. Losses during transformation account for the rest of the coal supply.
- The resulting electricity from solar and coal is used as follows: Mining-15PJ, manufacturing-20PJ, Electricity-32PJ and with households consuming the rest of the electricity.
- Households use 26PJ of heat, electricity sector uses 2 PJ and the rest is used by mining.

Supply and use table

PHYSICAL SUPPLY TABLE FOR ENERGY:

	Mining (ISIC B)	Manufacturing (ISIC C)	Electricity (ISIC D)	Households	Flows from the environment	Total
Energy from natural inputs						
Coal						
Solar						
Energy products						
Coal						
Electricity						
Heat						
Energy residuals						
Extraction						
Transformation						
Other						
Total						

PHYSICAL USE TABLE FOR ENERGY:

	Mining (ISIC B)	Manufacturing (ISIC C)	Electricity (ISIC D)	Households	Flows to the environment	Total
Energy from natural inputs						
Coal						
Solar						
Energy products–Transformation						
Coal						
Energy products–end use						
Coal						
Electricity						
Heat						
Energy residuals						
Extraction						
Transformation						
Other						
Total						

- The mining industry extracts 150PJ of coal.

PHYSICAL SUPPLY TABLE FOR ENERGY:

	Mining (ISIC B)	Manufacturing (ISIC C)	Electricity (ISIC D)	Households	Flows from the environment	Total
Energy from natural inputs						
Coal					150	150
Solar						
Energy products						
Coal						
Electricity						
Heat						
Energy residuals						
Extraction						
Transformation						
Other						
Total						

PHYSICAL USE TABLE FOR ENERGY:

	Mining (ISIC B)	Manufacturing (ISIC C)	Electricity (ISIC D)	Households	Flows to the environment	Total
Energy from natural inputs						
Coal	150					150
Solar						
Energy products--Transformation						
Coal						
Energy products--end use						
Coal						
Electricity						
Heat						
Energy residuals						
Extraction						
Transformation						
Other						
Total						

- In total 60PJ of electricity come from solar panels, 50 of which are produced in a photovoltaic power station and the rest by households.

PHYSICAL SUPPLY TABLE FOR ENERGY:

	Mining (ISIC B)	Manufacturing (ISIC C)	Electricity (ISIC D)	Households	Flows from the environment	Total
Energy from natural inputs						
Coal					150	150
Solar					60	60
Energy products						
Coal						
Electricity			60			60
Heat						
Energy residuals						
Extraction						
Transformation						
Other						
Total						

PHYSICAL USE TABLE FOR ENERGY:

	Mining (ISIC B)	Manufacturing (ISIC C)	Electricity (ISIC D)	Households	Flows to the environment	Total
Energy from natural inputs						
Coal	150					150
Solar			60			60
Energy products--Transformation						
Coal						
Energy products--end use						
Coal						
Electricity						
Heat						
Energy residuals						
Extraction						
Transformation						
Other						
Total						

- All the coal is sent for processing to the coal power plant. However due to losses during extraction, the coal power plant received 140PJ of coal.

PHYSICAL SUPPLY TABLE FOR ENERGY:

	Mining (ISIC B)	Manufacturing (ISIC C)	Electricity (ISIC D)	Households	Flows from the environment	Total
Energy from natural inputs						
Coal					150	150
Solar					60	60
Energy products						
Coal	140					140
Electricity			60			60
Heat						
Energy residuals						
Extraction	10					10
Transformation						
Other						
Total						

PHYSICAL USE TABLE FOR ENERGY:

	Mining (ISIC B)	Manufacturing (ISIC C)	Electricity (ISIC D)	Households	Flows to the environment	Total
Energy from natural inputs						
Coal	150					150
Solar			60			60
Energy products--Transformation						
Coal			140			140
Energy products--end use						
Coal						
Electricity						
Heat						
Energy residuals						
Extraction					10	10
Transformation						
Other						
Total						

- The remaining supply of coal is converted to energy and heat. The coal power plant produces 75PJ of electricity and 35PJ of heat. Losses during transformation account for the rest of the coal supply.

PHYSICAL SUPPLY TABLE FOR ENERGY:

	Mining (ISIC B)	Manufacturing (ISIC C)	Electricity (ISIC D)	Households	Flows from the environment	Total
Energy from natural inputs						
Coal					150	150
Solar					60	60
Energy products						
Coal	140					140
Electricity			135			135
Heat			35			35
Energy residuals						
Extraction	10					10
Transformation			30			30
Other						
Total						

PHYSICAL USE TABLE FOR ENERGY:

	Mining (ISIC B)	Manufacturing (ISIC C)	Electricity (ISIC D)	Households	Flows to the environment	Total
Energy from natural inputs						
Coal	150					150
Solar			60			60
Energy products--Transformation						
Coal			140			140
Energy products--end use						
Coal						
Electricity						
Heat						
Energy residuals						
Extraction					10	10
Transformation					30	30
Other						
Total						

- The resulting electricity from solar and coal is used as follows: Mining-15PJ, manufacturing-20PJ, Electricity-32PJ and with households consuming the rest of the electricity.

PHYSICAL SUPPLY TABLE FOR ENERGY:

	Mining (ISIC B)	Manufacturing (ISIC C)	Electricity (ISIC D)	Households	Flows from the environment	Total
Energy from natural inputs						
Coal					150	150
Solar					60	60
Energy products						
Coal	140					140
Electricity			135			135
Heat			35			35
Energy residuals						
Extraction	10					10
Transformation			30			30
Other						
Total						

PHYSICAL USE TABLE FOR ENERGY:

	Mining (ISIC B)	Manufacturing (ISIC C)	Electricity (ISIC D)	Households	Flows to the environment	Total
Energy from natural inputs						
Coal	150					150
Solar			60			60
Energy products--Transformation						
Coal			140			140
Energy products--end use						
Coal						
Electricity	15	20	32	68		135
Heat						
Energy residuals						
Extraction					10	10
Transformation					30	30
Other						
Total						

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- Households use 26PJ of heat, electricity sector uses 2 PJ and the rest is used by mining.

PHYSICAL SUPPLY TABLE FOR ENERGY:

	Mining (ISIC B)	Manufacturing (ISIC C)	Electricity (ISIC D)	Households	Flows from the environment	Total
Energy from natural inputs						
Coal					150	150
Solar					60	60
Energy products						
Coal	140					140
Electricity			135			135
Heat			35			35
Energy residuals						
Extraction	10					10
Transformation			30			30
Other						
Total						

PHYSICAL USE TABLE FOR ENERGY:

	Mining (ISIC B)	Manufacturing (ISIC C)	Electricity (ISIC D)	Households	Flows to the environment	Total
Energy from natural inputs						
Coal	150					150
Solar			60			60
Energy products--Transformation						
Coal			140			140
Energy products--end use						
Coal						
Electricity	15	20	32	68		135
Heat	7		2	26		35
Energy residuals						
Extraction					10	10
Transformation					30	30
Other						
Total						

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- Complete table and check supply-use and input-output identity

PHYSICAL SUPPLY TABLE FOR ENERGY:

	Mining (ISIC B)	Manufacturing (ISIC C)	Electricity (ISIC D)	Households	Flows from the environment	Total
Energy from natural inputs						
Coal					150	150
Solar					60	60
Energy products						
Coal	140					140
Electricity			135			135
Heat			35			35
Energy residuals						
Extraction	10					10
Transformation			30			30
Other	22	20	34	94		170
Total	172	20	234	94	210	730

PHYSICAL USE TABLE FOR ENERGY:

	Mining (ISIC B)	Manufacturing (ISIC C)	Electricity (ISIC D)	Households	Flows to the environment	Total
Energy from natural inputs						
Coal	150					150
Solar			60			60
Energy products--Transformation						
Coal			140			140
Energy products--end use						
Coal						
Electricity	15	20	32	68		135
Heat	7		2	26		35
Energy residuals						
Extraction					10	10
Transformation					30	30
Other					170	170
Total	172	20	234	94	210	730

THANK YOU

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