Energy Balances

Environment and Energy Statistics Workshop for the Arab Region

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Environment and Energy Statistics Branch
United Nations Statistics Division

Overview

- Why Energy balances?
- Template for energy balances
- Main principles
- Example of energy balances

- An energy balance is an accounting framework for compilation and reconciliation of data on all energy products entering, exiting and being used within the national territory of a given country during a reference period (IRES paragraph 8.1)

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Why energy balances?

- Allow comparisons across energy products in a common unit
- Provide comprehensive information on the energy supply and demand on the national territory
- Provide data for the calculation of basic energy indicators (energy consumption/capita, imported oil dependence, power generation shares, basic thermal power plant efficiency)
- Serve as a tool for data quality control (e.g. inputs/outputs to transformation processes)
- Provide an input for modeling and forecasting

Template for energy balances

Top block - Energy Supply

Middle block - Transformation, losses, energy industry own use

Bottom block - Final consumption

Expressed in the same units (e.g. TJ, Toe, Tce)

Item code	Flows	Energy products				
		Hard Coal	Brown Coal	...	Total	*of which: Renewables*
1.1	Primary production					
1.2	Imports					
1.3	Exports					
1.4	International Bunkers					
1.5	Stock change (closing-opening)					
1	**Total energy supply**					
2	***Statistical difference***					
3	***Transfers***					
4	**Transformation**					
	...					
	...					
5	**Energy Industries own use**					
	...					
6	**Losses**					
7	**Final consumption**					
7.1	**Final energy consumption**					
7.1.1	Manufacturing, const. and non-fuel mining industries					
	Iron and steel					
	Chemical and petrochemical					
	Other Industries					
7.1.2	Transport, total					
	Road					
	Rail					
	Domestic aviation					
	Domestic navigation					
	Other Transport					
7.1.3	Other, total					
	Of which: Agriculture, forestry and fishing					
	Households					
7.2	**Non energy use**					

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Main principles

- Choice of unit
- Net vs. gross calorific values
- Choice of conversion factors
- Choice of primary energy form for energy that is not combusted
- Primary energy equivalent (physical energy content vs. substitution method)
- Temperature adjustments
- Fiscal year vs. calendar year

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Choice of the unit

- Energy units are used to compile energy balances (Terajoules, Toe, Tce, Btu, etc.)
- IRES **recommends** that Joule is used for this purpose, though countries could use other energy units
- The conversion between energy units should be through the application of appropriate ***conversion factors*** and the applied factors should be reported with the energy balance to make any conversion from physical units to joules or other units transparent and comparable

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Net vs. Gross Calorific values

Calorific values express the amount of heat contained in one unit of the energy product

The *gross calorific value* (GCV) measures the total (maximum) amount of heat that is produced by combustion

The *net calorific value* (NCV) excludes this latent heat

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Net vs. Gross Calorific Values

- The difference between net and gross values ranges between 5% (Oil and Coal) and 10% (Natural gas)

- IRES **recommends** the use of Net calorific values
- If gross calorific values are used in a country because of the recuperation of latent heat or for maintenance of historical data series, the corresponding conversion factors should be reported and countries should clearly identify which method is used

- UNSD, IEA and Eurostat use Net calorific values

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Choice of conversion factors

IRES **recommends** the use of country specific conversion factors

For some products (e.g. coal and crude oil) different calorific values may be needed for production, imports, exports and several major uses

IRES **recommends** to provide metadata on calorific values, for example:

- what values are used
- gross or net calorific values
- default or specific values

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Choice of primary energy form for energy that is not combusted

First energy form downstream for which multiple energy uses are practical

Electricity

- Hydro
- Wind
- Wave/ocean
- Photovoltaic solar electricity production

Heat

- Nuclear heat production
- Geothermal heat production
- Solar heat production

Primary energy equivalents

Two ways to assign a primary energy equivalent to electricity and heat produced from non-combustible energy sources

- physical energy content method
  - the normal physical energy value of the primary energy form is used for the production figure
- partial substitution method
  - the primary energy value is equal to the hypothetical amount of the fuel required to generate an identical amount of electricity in a thermal power station using combustible fuels

IRES **recommends** the use of the physical energy content method

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Choice of the reference year

- fiscal year vs. calendar year => different results and affect cross-counties comparability
- IRES **recommends** countries make their energy data available on a calendar period basis
- Countries which use the fiscal year, should undertake efforts to report annual data according to Gregorian calendar

Important that this information is made available in the metadata

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Example of data checks in the energy balances

- No energy gains in transformation
- Relative size of the statistical difference
- Input/output in transformation (secondary products have corresponding input into transformation)
- Transformation efficiencies should be "reasonable"

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Balance Example

Name	Crude oil and NGL	Light oil products	Heavy oil products	Other oil products, LPG and Refinery Gas	Natural gas	Electricity	Total Biofuels	Total energy
Production of primary energy	51				5711	230	2842	8834
In	7407	18349	41367	11072	90110	7016	378	315698
E			-4312					-4922
M		-5418	-692					-6110
S	-1933	-1973	-1215	173				-4948
T	**5525**	**10958**	**35148**	**11245**	**95821**	**6646**	**3210**	**308552**
Energy sector	**-145542**	**51590**	**43307**	**12377**	**-95821**	**52974**	**-1119**	**-82235**
Petroleum refineries	-145542	51590	82515	12377				940
Electric power plants			-39208		-95821	52974	-2275	-84330
Other conversion industries							1156	1156
Consumption by energy sector			-6331	-1090		-2927		-10349
Losses in transport and distribution						-11171		-11171
Con				-7070				-7070
Stat	**-17**			**339**	**0**	**724**		**-1992**
Fina								**199720**
By industry and construction								**42898**
Iron and steel industry								0
Chemical industry						457		457
Other industry and construction		259	30865	41		11275		42441
By transport		**59337**	**27063**					**86400**
Road		48758	26772					75530
Air		10580						10580
Other transport			290					290
Households and other consumers		**2838**	**15222**				**1090**	**70422**
Households		2722	5737				568	39845
Agriculture								7855
Other consumers		117	9485	3735		7862	1522	22721

In a balance, production of secondary products such as gasoline and diesel is zero; these appear as outputs of oil refineries in the transformation line.

Transformation losses

Size of statistical difference

Electricity production only refers to primary electricity (such as hydro); generation from fossil fuels is seen as an output of the power plants line

Balance provides a total power generation efficiency. Here 52974/(39208+95821+2275)=38.5%

Most oil products are consumed in road, household consumption actually only refers to oil used for heating and cooking, differing from ISIC methodology

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Thank you!

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