United Nations Statistics Division

Energy Balances

Leonardo Rocha Souza

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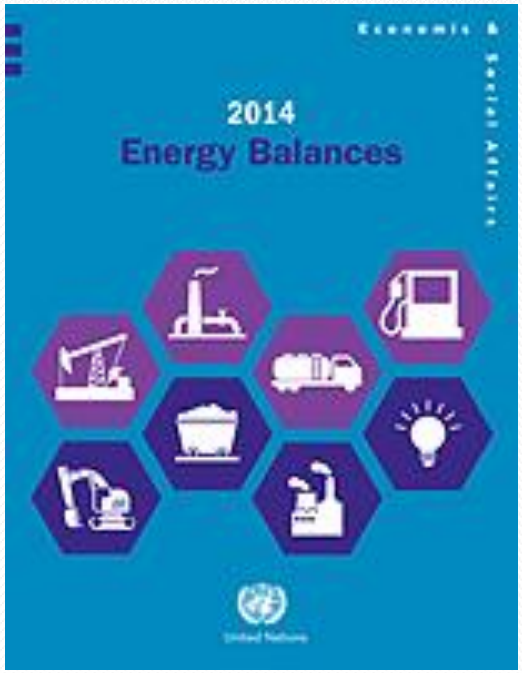
http://unstats.un.org/unsd/energy

Energy balance methodology



The energy balance is a snapshot of all flows of energy products in an area (country) in a period of time (year).

It is presented in a common unit – terajoules, for example – and with products aggregated by category: coal, oil, petroleum products, gas, biomass, etc.

Some advantages:

- → **It allows to compare the share of each source in the energy supply of a country and in each sector of the economic activity.**
- → **With an energy balance it is possible to analyse the efficiency of energy industries in a country.**
- → **Many relevant energy indicators can be drawn from an energy balance.**
- → **It provides a very effective 'extra check' on the data**

Commodity balances

- A commodity balance describes all flows of a single energy product, where supply and uses can be measured and compared.

- Products are as defined by the current energy product classification – ideally harmonized with SIEC

Commodity balances

Commodity balances (and the UNSD energy stats questionnaire) display basic energy statistics only

- Basic energy statistics comprised of combinations of products and flows

- All flows relevant to a given commodity are grouped under the commodity header

What are the limitations of basic energy statistics?

- Different reporting units and different calorific values make statistics between commodities incomparable.

Hard Coal (CL); Metric tons, thousand		2011	2012
CL01	Production	34621	35375
CL03	Imports	9184	7821
CL04	Exports	33552	34648
CL06	Stock changes	-167	-138
CLGA	Total energy supply	10420	8686
CLSD	Statistical differences	-41	-1412
CL08	Transformation	8093	7730
CL088	Transformation in electricity, CHP and hea	4391	4037
CL08811	Electricity plants - Main activity producer	4390	4036
CL08812	Electricity plants - Autoproducers	1	1
CL081	Coke ovens	3702	3693

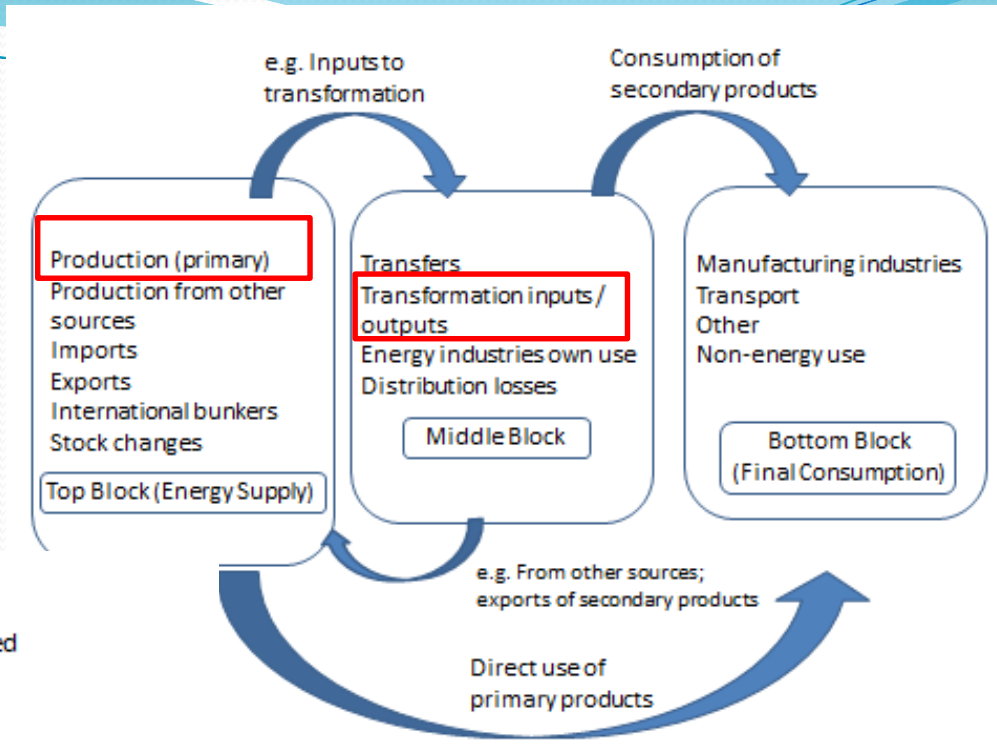
Motor Gasoline (MO); Metric tons, thousand		2011	2012
MO01	Production	28587	29584
MO03	Imports	4092	2938
MO04	Exports	5579	6086
MO06	Stock changes	-21	-96
MOGA	Total energy supply	27121	26532
MO12	Final energy consumption	30687	31676
MO122	Transport	30687	31676
MO1221	Road	30687	31676

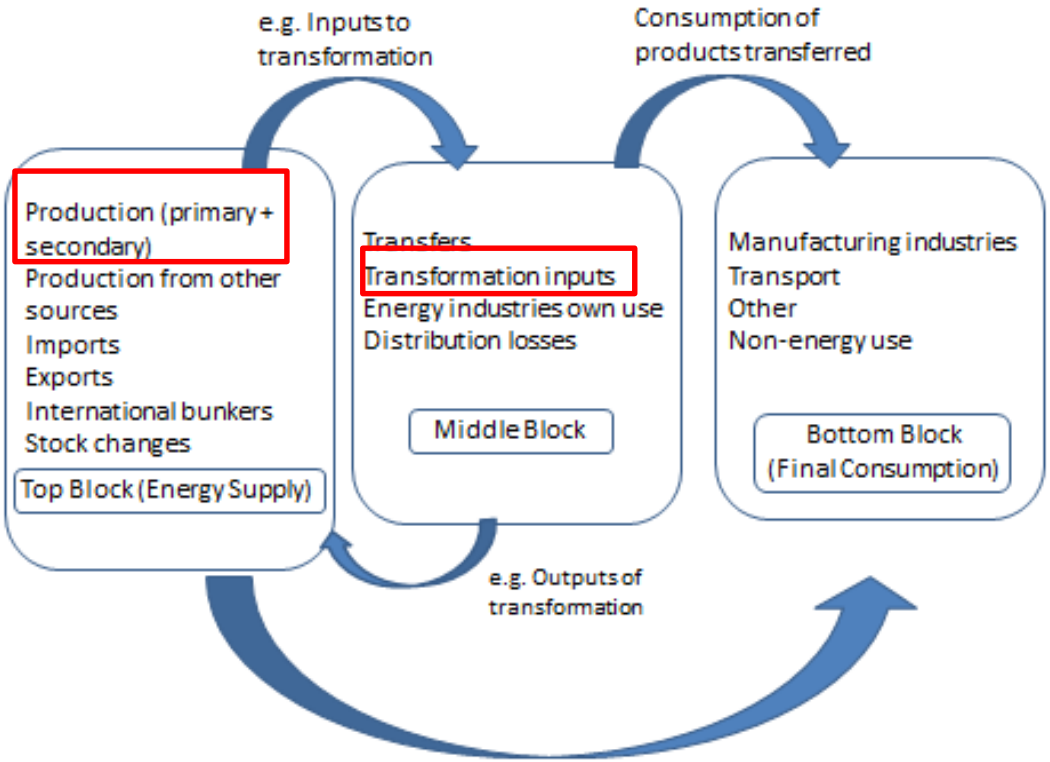
Fuelwood (FW); Cubic metres, thousand		2011	2012
FW01	Production	31200	30094
FW03	Imports	320	384
FW04	Exports	2555	2854
FW088	Transformation in electricity, CHP an	8532	8531
FW08812	Electricity plants - Autoproducers	8532	8531
FW1231	Households	11334	11569

Energy Balances

- The energy balance describes all the physical flows of energy that are embodied in energy products.
- These flows are expressed in a same energy unit (e.g., terajoule, tons of oil equivalent).
- It shows all relevant commodity balances together (grouped by types of products), displaying their interrelationships.
- Flows are defined by the current energy classification (be it particular to a country or common to the members of an organization)
  - The work of InterEnerStat and the International Recommendations for Energy Statistics (IRES) constituted a huge step towards harmonization of these classifications.
- While for the country the energy balance is mostly an energy policy tool, it can also be a tool for checking data consistency, because laws of Physics should be observed in the measured energy flows.

Energy balance →





← Commodity balance

Energy balance
Conversion to energy units

- Physical units (tons or m^3) are converted to energy units using Net calorific values (NCV) [kJ/kg], which ideally are measured frequently for different processes and sources and then averaged for the country/flow.
  - Specific NCV for different flows, when available (most importantly, Production and Imports)
  - Weighted-average NCV for all other flows (if only NCVs for Production and Imports are available).
  - Default NCV if no information available (undesirable case)
- If commodities are reported in energy units (such as kWh for electricity or TJ for natural gas), the appropriate conversion to a common unit must be made

Products grouped into types

Bhutan

Terajoules

2012	All Coal	All Oil	Natural Gas	Primary biofuels / Waste	Charcoal	Electricity	Total energy	of which: renewables
Primary production	2547	..	..	45218	..	24575	72341	69794
Imports	..	6012	..	..	2112	132	8257	2112
Exports	-1202	..	..	..	-69	-17604	-18876	-69
International marine bunkers	..	..	..	..	..	..	..	..
International aviation bunkers	..	-74	..	..	..	..	-74	..
Stock changes	..	..	..	..	..	..	..	..
Total energy supply	1345	5939	..	45218	2043	7103	61648	71837
Statistical Difference	0	-2	..	0	0	303	301	0
Transfers	..	..	..	..	..	..	..	..
Transformation	..	*-2	..	*-1535	826	1	*-710	*-709
Electricity plants	..	*-2	..	..	[illegible]	1	*-1	..
Charcoal plants	[illegible]	[illegible]	[illegible]	*-1535	826	[illegible]	*-709	*-709
Other transformation	..	0	..	0	..	..	0	0
Energy industries own use	..	..	..	..	..	-1	-1	..
Losses	..	..	..	..	..	-430	-430	..
Final consumption	*1345	5939	..	*43684	*2869	6370	*60206	*46553
Final energy consumption	*1345	5917	..	*43684	*2869	6370	*60185	*46553
Manufacturing, const., mining	*1345	..	..	[illegible]	[illegible]	5264	6609	..
Transport	..	5369	..	..	..	..	5369	..
Road	..	983	..	..	..	..	983	..
Domestic aviation	..	..	..	..	..	..	..	..
Domestic navigation	..	..	..	..	..	..	..	..
Other transport	..	4386	..	[illegible]	[illegible]	[illegible]	4386	..
Other	..	547	..	*43684	*2869	1106	*48206	*46553
Agriculture, forestry, fishing	[illegible]	[illegible]	..	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Commerce and public services	..	[illegible]	..	[illegible]	[illegible]	173	173	..
Households	..	[illegible]	..	[illegible]	[illegible]	[illegible]	[illegible]	46461
Other consumers	..	[illegible]	..	[illegible]	[illegible]	[illegible]	363	*91
Non-energy use	..	22	..	..	..	..	22	..

Primary production only

Secondary production reported here, together with inputs to transformation (net value)

Final energy consumption with break-down

Negative: fuel burned to generate electricity

Negative: Fuelwood transformed into charcoal

Positive: electricity generated from combustible fuels

Positive: Charcoal produced

Efficiency of the transformation sector

2016	Primary coal and peat	Coal and peat products	Primary oil	Oil products	Natural gas	Biofuels and waste	Nuclear	Electricity	Heat	Total energy	*of which: renewable*
Transformation	**-2201**	**270**	**-1680**	**1640**	**-300**	**-780**	**-67**	**870**	**587**	-1661	**-124**
Electricity plants	-1601				-300		-67	701		-1267	
CHP plants	-300					-780		169	587	-324	-124
Heat plants										0	
Coke ovens	-257	240								-17	
Briquetting plants	-43	40								-3	
Liquefaction plants										0	
Gas works										0	
Blast furnaces		-10								-10	
NGL plants and gas blending			-200	190						-10	
Oil refineries			-1480	1450						-30	
Other transformation										0	
Energy industries own use	-87	-31	-30		-43			-89	-124	-404	X

- Sector-wise, you can have an idea of the transformation efficiencies by type of transformation, by using an energy balance
- However, you need more detailed energy statistics to know it more precisely (and specific NCVs!)
- And maybe microdata to know individual plant efficiencies

Importance of specific NCVs - emissions

2016	Coal (kt)	Default NCV	Specific NCVs	Coal (TJ) default NCV	Coal (TJ) specific NCV	Default emission factor for coal (t CO2/TJ)	CO2 (tons) default NCV	CO2 (tons) specific NCV
Primary production	131.8	25.8	20.10	3400	2649			
Imports	29.0	25.8	23.20	748	673			
Exports	-12.4	25.8	28.20	-319	-349			
Stock changes	-0.5	25.8	20.10	-14	-11			
Total energy supply	147.9			3,815	2,962	94.6	360,899	280,193

- 29% higher CO_2 emission estimates by using default NCVs

Renewable energy supply (% of TES) from energy balance – top block

country

Terajoules

YEAR	Primary coal and peat	Coal and peat products	Primary oil	Oil products	Natural gas	Biofuels and waste	Nuclear	Electricity	Heat	Total energy	*of which: renewable*
Primary prod.	3400		1234		345	4567	67	234	34	9881	4835
Imports	748	158	420	1024	180	10		81		2621	10
Exports	-319	-265	-101	-873	-40	-6		-12		-1616	-6
Int'l mar. bunkers				-28						-28	
Int'l av. bunkers				-78						-78	
Stock changes	-14		170	-81						75	
TES	**3815**	**-107**	**1723**	**-36**	**485**	**4571**	**67**	**303**	**34**	**10855**	**4839**

In this case, the indicator would be 4839/10855 = 44.6%

Renewable energy supply (% of TES)
Importance on specific NCVs

	Primary coal	Biofuels and waste	Total energy	*of which: renewable*	default Coal NCVs	default fuelwood NCVs
2016						
Primary production	3400	4567	9881	4835	25.80	9.135
Imports	748	10	2621	10	25.80	9.135
Exports	-319	-6	-1616	-6	25.80	9.135
Stock changes	-14		75		25.80	
Total energy supply	**3815**	**4571**	**10855**	**4839**		

Indicator: **44.6%**

					Specific NCVs	default NCVs
2016						
Primary production	2649	4567	9130	4835	20.10	9.135
Imports	673	10	2546	10	23.20	9.135
Exports	-349	-6	-1646	-6	28.20	9.135
Stock changes	-11		78		20.10	
Total energy supply	**2962**	**4571**	**10002**	**4839**		

Indicator: **48.4%**

					Specific NCVs	Specific NCVs
2016						
Primary production	2649	5749	10312	6017	20.10	11.50
Imports	673	13	2548	13	23.20	11.50
Exports	-349	-8	-1647	-8	28.20	11.50
Stock changes	-11		78		20.10	
Total energy supply	**2962**	**5754**	**11185**	**6012**		

Indicator: **53.8%**

Based on an a assumption that the energy balance in the previous page was based on applying default NCVs from physical quantities:

- 25.8 GJ/ton for coal (other bituminous coal)
- 9.135 GJ/m³ for fuelwood (making all biomass)

Proportion of bioenergy in total renewable energy production (from balances)

country

Terajoules

	Primary coal and peat	Coal and peat products	Primary oil	Oil products	Natural gas	Biofuels and waste	Nuclear	Electricity	Heat	Total energy	*of which: renewable*
2016											
Primary prod.	3400		1234		345	4567	67	234	34	9881	4835
Imports	748	158	420	1024	180	10		81		2621	10
Exports	-319	-265	-101	-873	-40	-6		-12		-1616	-6
Int'l mar. bunkers				-28						-28	
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Stock changes	-14		170	-81						75	
TES	**3815**	**-107**	**1723**	**-36**	**485**	**4571**	**67**	**303**	**34**	**10855**	**4839**

In this case, the indicator would be 4567/4835 = 94.5%

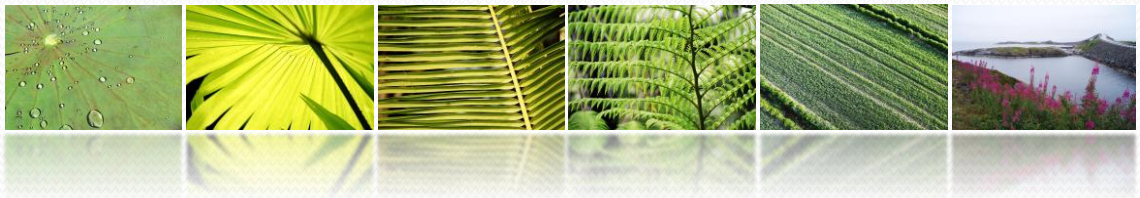
Proportion of bioenergy in total renewable energy production (specific NCVs)

2016	Biofuels and waste	Total energy	*of which: renewable*	default fuelwood NCVs	Indicator
Primary production	4567	9881	4835	**9.135**	**94.5%**
Imports	10	2621	10	**9.135**	
Exports	-6	-1616	-6	**9.135**	
Stock changes		75			
Total energy supply	**4571**	**10855**	**4839**		

2016				Specific NCVs	
Primary production	5749	10312	6017	**11.50**	**95.5%**
Imports	13	2548	13	**11.50**	
Exports	-8	-1647	-8	**11.50**	
Stock changes		78			
Total energy supply	**5754**	**11185**	**6012**		

Based on an a assumption that the energy balance in the previous page was based on applying default NCVs from physical quantities:

- 9.135 GJ/m^3 for fuelwood (making all biomass)
- In this case, not a big difference because the indicator was already close to 100%



Thank you.

http://unstats.un.org/unsd/energy/