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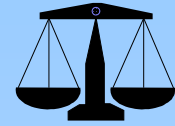


Principles of Energy Balances

Fourth meeting of the Oslo Group on Energy Statistics

Ottawa, 2-6 February 2009

Energy Balance Principles



ENERGY BALANCES OF OECD COUNTRIES, 1997-1998 - XIX

OECD Total / OCDE Total : 1998

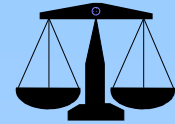
Mittelwerte der Versorgung / Mittel des Verbrauches

SUPPLY AND CONSUMPTION	Coal	Crude Petroleum	Gas	Nuclear	Hydro	Geothermal	Solar	Wind	Other	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	
																						Electricity	Heat	Other	Losses	Other
APPRECIATION ET DEMANDE	Coal	Crude Petroleum	Gas	Nuclear	Hydro	Geothermal	Solar	Wind	Other	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total
Hydrogen Production																						
Imports																						
Exports																						
Net Supplies																						
Losses																						
DEMAND																						
Industry																						
Electricity Plants																						
Other																						
Transport																						
Other																						
Losses																						
Other																						
Losses																						

- > Why calculate an energy balance?
- > Choice of units
- > Choice of calorific values
- > Conventions
- > Energy balance layout



□ Why Calculate an Energy Balance? (1)



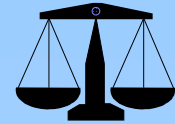
The energy balance is a way of reporting energy data in a common unit and with products aggregated by category: coal, oil, petroleum products, gas, biomass, etc.

Advantages of having an EB:

- > allows comparison of the shares of each source in the energy supply of a country and in each sector of economic activity
- > is possible to analyse energy efficiency
- > a country can determine its dependence on energy imports or exports
- > different countries can be compared when they are calculated with the same methodology
- > good for quality control: can check inputs/outputs in the transformation sector



□ Why Calculate an Energy Balance? (2)



Without an energy balance the message can differ

Which data to use/trust when assessing legally binding commitments?

- > What is the importance of renewables in the energy mix?
- > What is happening with CO₂ emissions (Kyoto targets)?
- > General confusion by users (could cause speculation)

Example:

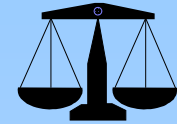
What is the importance of renewables in the energy mix?

Answer will depend on:

- > Principles: calculation of the primary energy equivalent of electricity from non-combustion processes
- > Classification / definitions: peat is sometimes included with fossil and sometimes with renewables



Choice of Units

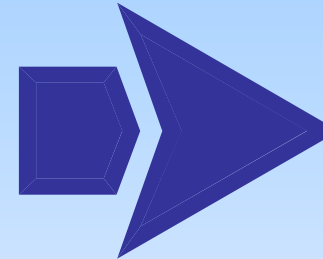


MBtu

kilowatt-hours



Mtce



Mtoe

kbep

terajoules

ENERGY BALANCES OF OECD COUNTRIES, 1987-1998 - B.17

OECD Total / OCDE Total: 1998

Category	Coal	Oil	Gas	Nuclear	Hydro	Geothermal	Solar	Wind	Other	Total
SUPPLY AND CONSUMPTION										
APPROPRIATION	1065.56	1084.05	674.91	553.59	111.08	30.05	188.64	5.10	0.51	2303.37
Losses	-288.37	-188.25	-368.52	-	-	-	-	9.85	0.00	-735.14
Final Energy	-776.19	-895.80	-322.39	-158.46	-	-	-	-0.15	-0.51	-1570.35
Losses	-	-	-	-	-	-	-	-	-	-
Final Energy	1065.56	1084.05	674.91	553.59	111.08	30.05	188.64	5.10	0.51	2303.37
INDUSTRY										
Manufacturing	48.23	34.41	-	-	-	-	-	-	-	82.64
Construction	-	-	-	-	-	-	-	-	-	-
Transportation	-	-	-	-	-	-	-	-	-	-
Commercial	-	-	-	-	-	-	-	-	-	-
Electricity	-	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-	-
Industry Total	48.23	34.41	-	-	-	-	-	-	-	82.64
TRANSPORT										
Sea	-	-	-	-	-	-	-	-	-	-
Air	-	-	-	-	-	-	-	-	-	-
Road	-	-	-	-	-	-	-	-	-	-
Rail	-	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-	-
Transport Total	-	-	-	-	-	-	-	-	-	-
RESIDENTIAL										
Residential	-	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-	-
Residential Total	-	-	-	-	-	-	-	-	-	-
OTHER SECTORS										
Electricity	-	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-	-
Other Total	-	-	-	-	-	-	-	-	-	-
TOTAL										
Final Energy	1065.56	1084.05	674.91	553.59	111.08	30.05	188.64	5.10	0.51	2303.37

IEA opted for: Mtoe

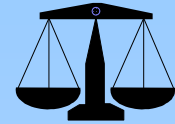
tonne of oil equivalent – Eurostat, France

joules – UN, Austria, Australia

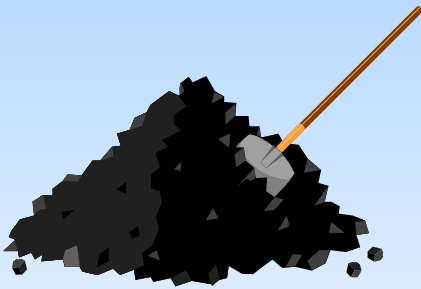
barrel of oil equivalent - OLADE



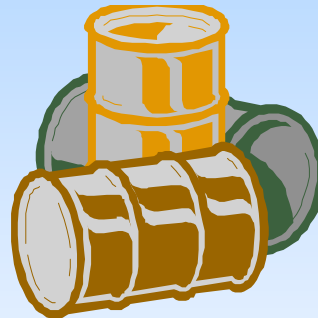
□ Choice of Net vs. Gross Calorific Values



- > Difference between NCV and GCV is latent heat of vaporisation of the water produced during combustion



5 %



5 %



9-10 %

IEA opted for: net calorific values

Most balances are done on a NCV basis

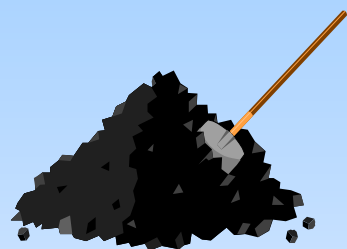
Australia and NZ use a GCV basis



□ Conversion to Energy Units at the IEA (1)



COAL



Physical units (tonnes) are converted to energy units using NCV [kJ/kg], reported in the questionnaires (varies over time)

Specific NCV for Production, Imports, Exports, Inputs to Public Power Plants, Coal used in Coke Ovens, Blast Furnaces and Industry

Average NCV for all other flows

OIL AND PETROLEUM PRODUCTS

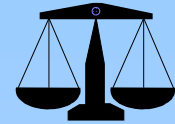
Using NCV [kJ/kg]

Primary oil - Specific NCV for Production, Imports and Exports, reported in the questionnaires (varies over time)

Petroleum products - region specific default values



□ Conversion to Energy Units at the IEA (2)



NATURAL GAS

Figures collected in Mm^3 and gross TJ (energy unit). They are converted to net TJ ($0.9 \cdot \text{gross TJ}$) and then to Mtoe ($1 \text{ PJ} = 0.02388 \text{ Mtoe}$)

OTHER GASES

Data collected in gross TJ, then converted to net TJ ($0.9 \cdot \text{gross TJ}$) and then to Mtoe ($1 \text{ PJ} = 0.02388 \text{ Mtoe}$)

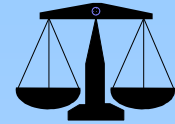
ELECTRICITY

Figures collected in TWh, then electricity production is converted to Mtoe ($1 \text{ TWh} = 0.086 \text{ Mtoe}$)

Gross electricity production is shown and the own use and losses are shown separately



Choice of Primary Energy Form

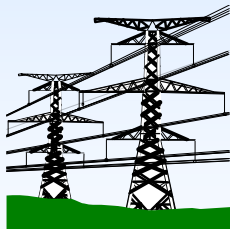


IEA opted for: first energy form downstream for which multiple energy uses are practical



> Heat

- nuclear heat and electricity production
- geothermal heat and electricity production
- solar heat production



> Electricity

- hydro
- wind
- wave/ocean
- photovoltaic solar electricity production



□ Choice of Method for Calculating Primary Energy Equivalent



> Partial substitution method

- represents the amount of energy necessary in conventional thermal plants
- difficult to choose efficiency
- not relevant for countries with a high share of hydro

IEA opted for:

> Physical energy content method

- uses physical energy content of the primary energy source
- nuclear 33%
- geothermal 10%
- solar, wind, etc. 100%

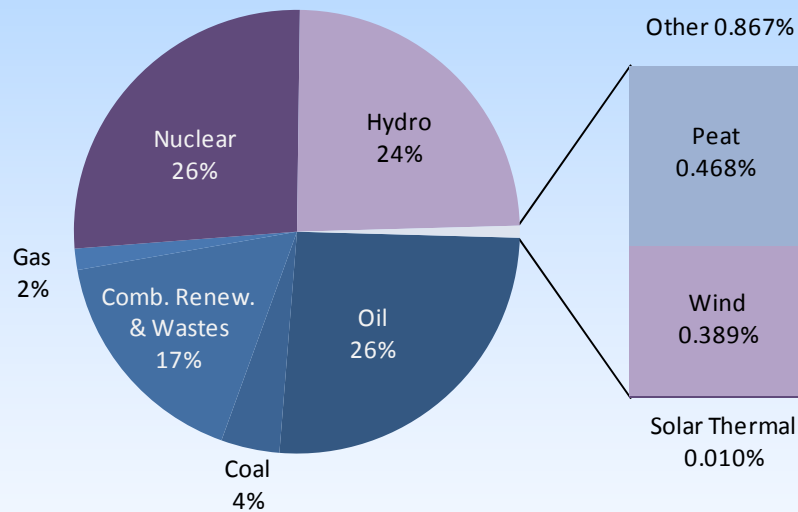
For nuclear,
hydro,
geothermal,
solar, etc.



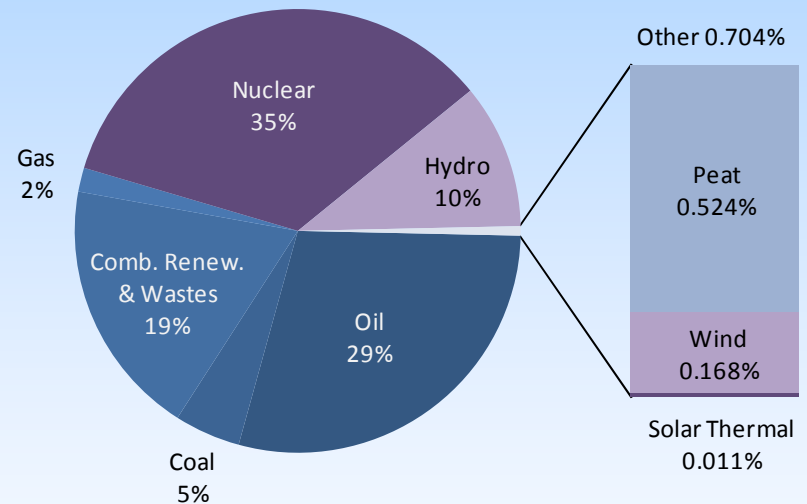
□ Partial Substitution vs. Physical Energy Content

Example: Sweden 2006 TPES

Partial Substitution Method



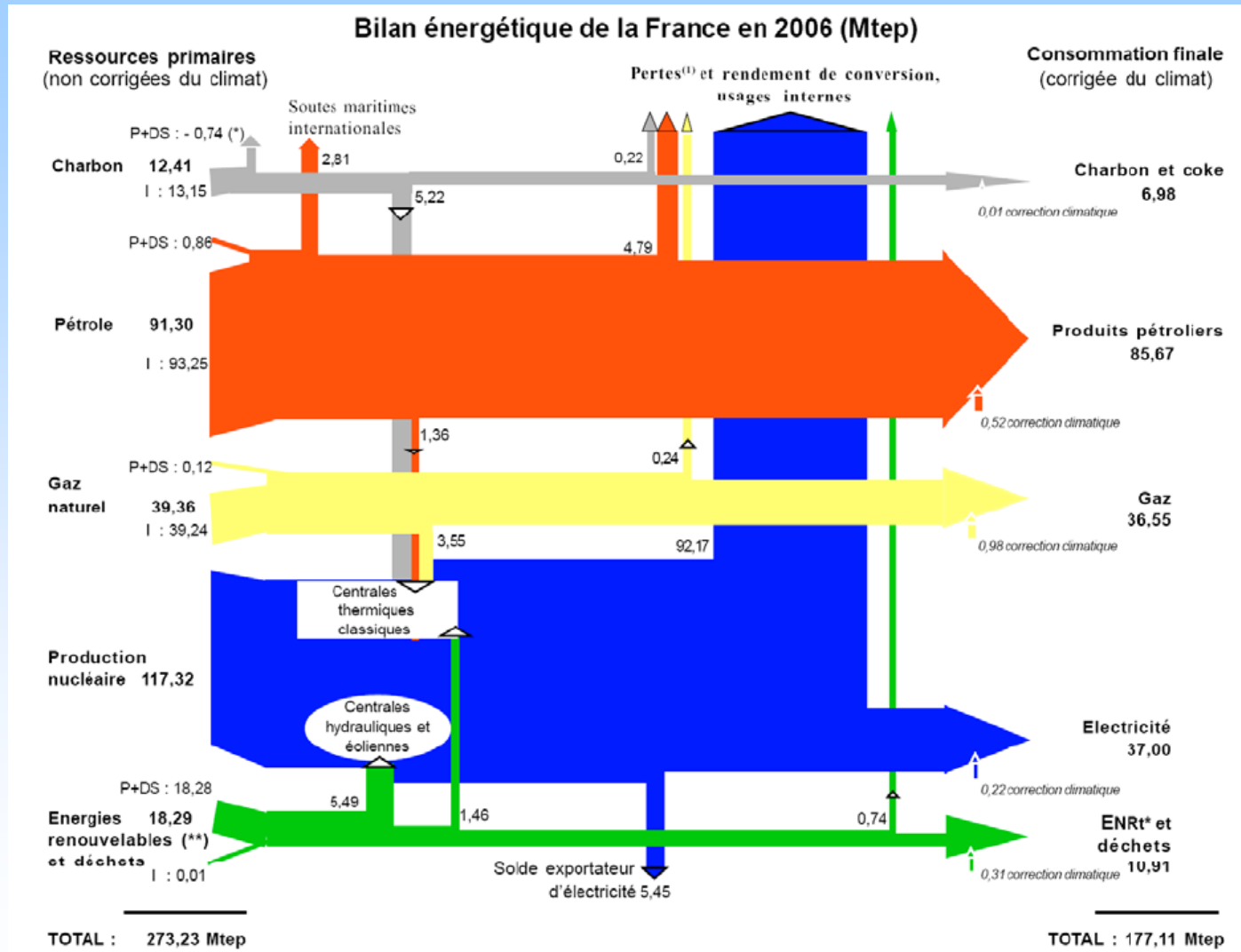
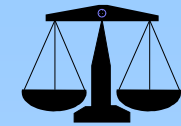
Physical Energy Content Method



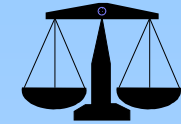
**Nuclear, hydro, wind, solar thermal, solar PV and geothermal:
can have very different shares!**



Energy Balance Flow Chart



IEA Energy Balance Layout



Mexico / Mexique : 2006

- Flows
- Supply
- Transformation and Energy Sectors
- Consumption
- Industry
- Transport
- Other Sectors
- Non-Energy Use
- Electricity and Heat Output

		Million tonnes of oil equivalent / Million de tonnes d'équivalent pétrole								Total		
SUPPLY AND CONSUMPTION		Coal & peat	Crude oil	Petroleum products	Gas	Nuclear	Hydro	Geotherm. solar etc.	Combust. ren. & waste etc.	Electricity	Heat	Total
APPROVISIONNEMENT ET DEMANDE		Charbon & tourbe	Pétrole brut	Produits pétroliers	Gaz	Nucléaire	Hydro	Géotherm. solaire etc.	Comb. ren. & déchets etc.	Electricité	Chaleur	Total
Production		5.51	190.45	-	40.52	2.63	2.61	5.65	6.10	-	-	255.97
Imports		3.93	0.46	18.33	8.29	-	-	-	-	0.04	-	31.61
Exports		-0.04	-	-	-	-	-	-	-	-	-	-108.26
Intl. marine bunkers		-	-	-	-	-	-	-	-	-	-	-0.88
Stock changes		-0.61	-0.31	-0.35	0.04	-	-	-	-	-	-	-0.91
TPES		8.74	87.43	17.88	48.86	2.63	2.61	5.65	6.10	0.04	-	177.43
Transfers		-	-	-	-	-	-	-	-	-	-	1.31
Statistical differences		0.18	-	-2.37	-4.77	-	-	-	-	-	-	2.39
Electricity plants		-7.10	-	-13.60	-20.73	-2.63	-2.61	-5.75	-1.13	21.47	-	-38.49
CHP plants		-	-	-	-	-	-	-	-	-	-	-
Heat plants		-	-	-	-	-	-	-	-	-	-	-
Gas works		-	-	-	-	-	-	-	-	-	-	-
Petroleum refineries		-	-75.00	69.12	-	-	-	-	-	-	-	-5.89
Coal transformation		-0.19	-	-	-	-	-	-	-	-	-	-0.19
Liquefaction plants		-	-	-	-	-	-	-	-	-	-	-
Other transformation		-	-	-	-	-	-	-	-	-	-	-
Own use		-0.02	-	-	-	-	-	-	-	1.54	-	-19.68
Distribution losses		-	-	-	-	-	-	-	-	-3.45	-	-3.45
TFC		1.61	73.13	56.22	28.13	2.63	2.61	7.04	15.41	-	-	113.43
INDUSTRY SECTOR		1.61	-	5.4	3.08	-	-	1.13	9.55	-	-	28.10
Iron and steel		1.38	-	0.26	3.08	-	-	-	0.69	-	-	5.42
Chemical and petrochem.		-	-	0.40	2.66	-	-	-	0.50	-	-	3.55
Non-ferrous metals		-	-	0.00	0.03	-	-	-	0.08	-	-	0.11
Non-metallic minerals		0.11	-	0.68	0.83	-	-	-	0.61	-	-	2.22
Transport equipment		-	-	-	0.05	-	-	-	0.17	-	-	0.22
Machinery		-	-	0.01	-	-	-	-	-	-	-	0.01
Mining and quarrying		0.12	-	0.31	0.76	-	-	-	0.52	-	-	1.71
Food and tobacco		-	-	0.49	0.29	-	-	-	1.13	0.17	-	2.08
Paper, pulp and printing		-	-	-	-	-	-	-	-	-	-	0.87
Wood and wood products		-	-	-	-	-	-	-	-	-	-	-
Construction		-	-	0.19	-	-	-	-	0.04	-	-	0.23
Textile and leather		-	-	-	-	-	-	-	-	-	-	-
Non-specified		-	-	-	-	-	-	-	-	-	-	11.67
TRANSPORT SECTOR		-	-	49.89	1.01	-	-	-	0.10	-	-	51.00
International aviation		-	-	-	-	-	-	-	-	-	-	2.85
Domestic aviation		-	-	-	-	-	-	-	-	-	-	0.02
Road		-	-	-	-	-	-	-	-	-	-	45.50
Rail		-	-	-	-	-	-	-	-	-	-	0.75
Pipeline transport		-	-	-	0.99	-	-	-	-	-	-	0.99
Domestic navigation		-	-	0.89	-	-	-	-	-	-	-	0.89
Non-specified		-	-	-	-	-	-	-	-	-	-	-
OTHER SECTORS		-	-	11.95	1.06	-	-	0.09	5.90	6.76	-	25.76
Residential		-	-	7.70	0.84	-	-	-	5.90	4.16	-	18.60
Comm. and public service		-	-	1.67	0.22	-	-	0.09	1.85	-	-	3.83
Agriculture/forestry		-	-	2.58	-	-	-	-	0.74	-	-	3.33
Fishing		-	-	-	-	-	-	-	-	-	-	-
Non-specified		-	-	-	-	-	-	-	-	-	-	-
NON-ENERGY USE		-	-	6.36	2.21	-	-	-	-	-	-	8.58
in industry/transf./energy		-	-	6.36	2.21	-	-	-	-	-	-	8.58
of which: feedstocks		-	-	5.28	2.21	-	-	-	-	-	-	7.49
in transport		-	-	-	-	-	-	-	-	-	-	-
in other sectors		-	-	-	-	-	-	-	-	-	-	-
Elec. generated - TWh		31.74	-	53.84	113.61	10.87	30.39	6.75	2.45	-	-	249.65
Electricity plants		31.74	-	53.84	113.61	10.87	30.39	6.75	2.45	-	-	249.65
CHP plants		-	-	-	-	-	-	-	-	-	-	-
Heat generated - PJ		-	-	-	-	-	-	-	-	-	-	-
CHP plants		-	-	-	-	-	-	-	-	-	-	-
Heat plants		-	-	-	-	-	-	-	-	-	-	-

Totals

Comparable Information for all Products

Comparable Energy Units of Mtoe

Global picture of energy situation in a country



□ IEA Energy Balance: oil and petroleum products

Mexico		2006		
	Unit: ktoe			
	Crude Oil	Motor Gasoline	Gas/ Diesel Oil	
Production	177611	0	0	
Net Imports	-103207	7637	2946	
International Marine Bunkers	0	0	-774	
Stock Changes	-310	82	-157	
Total Primary Energy Supply	74094	7719	2015	
Transfers	0	3176	0	
Statistical Differences	0	-882	-1801	
Transformation Sector	-74094	22105	17578	
Electricity Plants	0	0	-423	
Petroleum Refineries	-74094	22105	18001	
Energy Sector	0	-325	-713	
Total Final Consumption	0	31793	17078	
Industry Sector	0	0	1048	
Transport Sector	0	31793	13574	
Other Sectors	0	0	2456	
<i>Commercial and Public Services</i>	0	0	96	
<i>Agriculture/Forestry</i>	0	0	2361	
Non-Energy Use	0	0	0	

Supply

- Refined products are secondary energy: production is 0

Transformation

- Negative value represents an input, positive value represents an output

- Transformation **losses** appear in the **Total** column as negative figures



□ IEA Energy Balance: electricity production



Mexico		2006	
		Unit: ktoe	
	Gas/Diesel Oil	Electricity	
Production	0	0	
Net Imports	2946	-67	
International Marine Bunkers	-774	0	
Stock Changes	-157	0	
Total Primary Energy Supply	2015	-67	
Transfers	0	0	
Statistical Differences	-1801	0	
Transformation Sector	17578	21470	
Electricity Plants	-423	21470	
Petroleum Refineries	18001	0	
Energy Sector	-713	-1542	
Distribution Losses	0	-3449	
Total Final Consumption	17078	16412	
Industry Sector	1048	9551	
Transport Sector	13574	102	
Other Sectors	2456	6758	
<i>Residential</i>	0	4160	
<i>Commercial and Public Services</i>	96	1854	
<i>Agriculture/Forestry</i>	2361	745	
Non-Energy Use	0	0	

Supply

- TPES for electricity can be either positive or negative

Transformation

- Negative value represents an input, positive value represents output (incl. hydro, nuclear, solar, etc.)

- Transformation losses appear in the **Total** column as negative figures



UN Energy Balance Layout



Brazil							
Energy sources and products →	Hard coal, lignite and peat	Briquettes cokes	petroleum and NGL	Light petroleum products	Heavy petroleum products	Other petroleum products	LPG and refinery gas
Production and utilisation ↓	Houille, lignite et tourbe	Agglomérés et cokes	Pétrole brut et GNL	Produits pétroliers légers	Produits pétroliers lourds	Autres produits pétroliers	GLP et gaz de raffinerie
	2005						
1 Production of primary energy	116343	..	3670411	..	..	..	..
2 Import	418367	53201	728796	198028	111800	112139	23273
Marine / aviation bunkers	..	..	-582928	-110435	-233003	-27391	-3735
	930	-5894	-7076	-46051	-146425	..	..
6 Total energy requirements	535640	47306	3809203	38267	-256951	83313	19812
7 Energy converted	-397397	237357	-3860617	1076377	1948470	298687	453778
8 Briquetting plants	..	..	..	..	..	..	..
9 Coke ovens and coke plants	-260492	237357	..	..	..	..	..
10 Gasworks	..	..	..	0	..	..	..
11 Blast furnaces	..	..	..	..	..	..	..
12 Petroleum refineries	..	..	-3666381	1062774	2059632	250161	416501
13 NGL processing plants	..	..	-194237	13603	..	54050	44041
14 Electric power plants	-136905	..	..	..	-111162	-5524	-6764
15 Heating plants	..	..	..	..	..	..	..
16 Other conversion industries	..	..	..	..	..	..	..
17 Net transfers	..	..	50074	179236	0	27755	3325
18 Consumption by energy sector	..	..	..	0	-52783	..	-178073
19 Losses in transport and distribution	-1876	-519	..	0	-2247	-1674	-2612
20 Cons. for non-energy uses	..	..	..	-342596	..	-144418	-7769
21 Statistical differences	1902	0	-1340	-390	8755	-428	-46
22 Final consumption	134466	284144	..	951674	1627735	264090	288506
23 By industry and construction	134466	284144	..	302	210336	264090	27630
24 Iron and steel industry	85964	272600	..	43	7971	25990	4190
25 Chemical industry	5815	..	..	0	31343	86167	4038
26 Other industry and construction	42687	11544	..	259	171021	151934	19402
27 By transport	..	..	..	950638	1195297	..	..
28 Road	..	..	..	840190	1123764	..	..
29 Rail	..	..	..	..	24563	..	..
30 Air	..	..	..	110447	..	..	..
31 Inland and coastal waterways	..	..	..	..	46970	..	..
32 By other modes of transportation	..	..	..	..	..	..	..
33 By households and other consumers	..	..	..	734	222102	0	260876
34 Households	..	..	..	734	..	..	229769
35 Agriculture	..	..	..	..	208805	..	911
36 Other consumers	..	..	..	..	13297	0	30196



□ Eurostat Energy Balance Layout (1)



EU-27		Year: 2005					
	Total all products	Hard coal	Patent fuels	Coke	Total lignite	Brown coal briquettes	
		1000 toe					
Primary production	891 431				95 912	-	
Recovered products	8 445	1 186	-	-	-	-	
Imports	1 457 058p	145 143	117	8 129p	627	95	
Stock change	-9 483p	-2 455	5	-641p	93	-5	
Exports	470 870	21 313	57	5 183	395	451	
Bunkers	50 903	-	-	-	-	-	
Gross inland consumption	1 825 679p	221 741	66	2 305p	96 237	-361	
	1 520 681	188 882	-	14 665	93 621	912	
	370 398	134 550	-	-	86 420	844	
	52 672	5 193	-	-	2 065	80	
	257 360	-	-	-	-	-	
Patent fuel and briquetting plants	4 497	342	-	-	4 152	-	
Coke-oven plants	45 700	45 081	-	116	31	-	
Blast-furnace plants	14 538	-	-	14 538	-	-	
Gas works	747	-	-	-	607	-	
Refineries	758 172	-	-	-	-	-	
	15 803	3 677	-	11	348	-	
	1 108 685p	-	321	33 960	-	3 517	
	173 355p	-	-	-	-	-	
	24 802p	-	-	-	-	-	
Asynchronous power stations	85 943	-	-	-	-	-	
Nuclear power stations	3 838	-	321	-	-	3 517	
Patent fuel and briquetting plants	42 603	-	-	33 960	-	-	
Coke-oven plants	14 601	-	-	-	-	-	
Blast-furnace plants	531	-	-	-	-	-	
Gas works	748 911	-	-	-	-	-	
Refineries	14 093p	-	-	-	-	-	
District heating plants							
Exchanges and transfers, returns	323	-	-	-	-	-	
Interproduct transfers	614	-	-	-	-	-	
Products transferred	57	-	-	-	-	-	
Returns from petrochem. industry	-348	-	-	-	-	-	
Consumption of the energy branch	94 902p	763	-	225p	349	17	
Distribution losses	28 312p	13	-	5	7	0	
Available for final consumption	1 290 792p	32 084	386	21 370p	2 261	2 226	
Final non-energy consumption	115 812p	276	-	258p	27	122	
Chemical industry	84 243p	60	-	16p	-	-	
Other sectors	31 570p	216	-	242p	27	122	
Final energy consumption	1 172 293p	28 638	325	20 640p	2 695	1 911	
Industry	325 641p	20 011	-	20 286p	1 755	1 253	
Iron & steel industry	62 627p	9 967	-	19 024p	26	19	
Non-ferrous metal industry	11 600p	323	-	346	51	50	
Chemical industry	59 234p	2 092	-	164	954	124	
Glass, pottery & building mat. industry	43 481p	4 099	-	407p	209	851	
Ore-extraction industry	3 339p	123	-	14	4	36	
Food, drink & tobacco industry	30 126p	1 479	-	120p	91	101	
Textile, leather & clothing industry	7 908p	152	-	1	29	0	
Paper and printing	35 257p	1 023	-	1	295	55	
Engineering & other metal industry	29 114p	236	-	99p	41	0	
Other industries	43 091p	533	-	110	12	14	
Transport	362 392p	3	-	-	-	2	
Railways	9 437p	3	-	-	-	2	
	297 744	-	-	-	-	-	
	49 869	-	-	-	-	-	
	5 342	-	-	-	-	-	
Households, shops, pub. adm., etc.	484 259p	8 624	325	353	940	655	
Households	308 091p	6 627	324	237	581	520	
Agriculture	29 876p	927	-	29	78	5	
Statistical difference	2 687p	3 169	61	473p	-461	194	

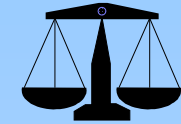
Transformation Input

Transformation Output

Air Transport



□ Eurostat Energy Balance Layout (2)



Year: 2005 EU-27

Total renew. energy	Solar heat	Geothermal heat	Wind, Hydro and Solar PV	Electrical energy
1000 toe				
119 440	682	5 331	80 847	6 061
2 662	-	-	2 662	-
-64	-	-	-64	0
1 432	-	-	1 432	3
120 606	682	5 331	82 012	6 061
32 745	2	4 702	28 042	816
18 496	0	4 645	13 851	180
10 448	0	-	10 448	598
3 336	1	58	3 277	37
-32 580	-	-	-6 061	26 335
-32 580	-	-	-	-
102	-	-	102	36
0	-	-	0	4 765p
55 178	681	629	53 868	2 806
55 180	681	629	53 871	2 806
16 471	2	2	16 467	2 775
3	-	-	3	26
6	-	-	6	24
187	-	-	187	2 070
890	-	0	890	454
2	-	-	2	0
538	0	-	537	6
67	0	0	67	0
9 823	-	-	9 823	55
39	-	1	37	1
4 616	1	0	4 614	137
3 131	-	-	3 131	-
3 131	-	-	3 131	-
35 579	579	626	34 273	30
32 008	564	231	31 214	-
1 497	1	25	1 471	0
-2	0	0	-2	0

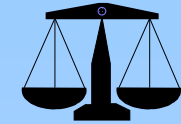
Interproduct Transfers

- inputs

+ output



OLADE Energy Balance Layout



3.1 AMÉRICA LATINA Y EL CARIBE

3.1 LATIN AMERICA AND THE CARIBBEAN

AÑO 2006

YEAR 2006

UNIDAD - kbp

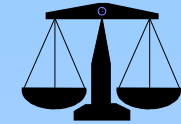
UNIT - kboe

kbp: 1000 barrels of oil equivalent

	Carbón Coal	Hidro- energía Hydroenergy	Geotermia Geothermal	Nuclear Fission Nuclear	Leña Firewood	Prod. Caña Cane Products	Otras Primarias Other Pr. Primary	Total Primarias Primary	Electricidad Electricity	Gas Licuado L.P.G.	Gasolinas Gasoline + Alcohol	Kerosene + Turbo	Diesel Oil	Fuel Oil	Coques Coke	Carbón Vegetal Charcoal	Gases	Otras Secundarias Other Sec.	No Energético Non Energy	Total Secund. TOTAL			
IMPORTACION	11,374	153,170	-	-	-	-	70,825	7,429,878	727,122	198,435	667,957	112,301	668,334	468,317	59,023	55,739	53,088	70,650	141,907	3,222,874	7,429,878	PRODUCTION	
EXPORTACION	2,066,726	234,943	349,927	-	-	-	15,768	2,667,364	33,056	31,322	137,022	49,139	102,552	258,814	1,504	189	26	1,786	23,621	639,031	3,306,395	IMPORT	
VARIACION DE INVENTARIO	-6,399	-134,104	-13,276	-	-	-5	-	-153,785	-	-1,751	14,991	6,204	6,531	19,151	3,310	-	-192	407	4,669	53,321	-100,463	STOCK CHANGES	
NO APROVECHADO	260	122,712	-	2,587	-	6,599	605	132,763	-	-	-	-	-	-	-	-	-	-	-	-	132,763	UNUSED	
OFERTA TOTAL	2,263,699	1,329,555	282,259	455,679	14,513	44,411	460,123	321,558	54,452	5,226,249	728,967	218,430	983,358	85,544	712,479	295,725	91,284	56,397	52,872	86,303	3,160,665	5,164,040	TOTAL SUPPLY
REFINERIA	-2,222,695	-12,075	-	-	-	-	-	-2,234,669	-	67,913	556,906	112,144	666,838	468,157	10,715	-	34,477	56,092	-	116,366	2,089,607	-145,063	REFINERY
CENTRALES ELECTRICAS	-695	-235,086	-132,741	-444,352	-14,026	-44,413	-535	-1,803	-332	-873,874	643,420	-	-733	-34,442	-154,238	-3,260	-	-	-	-	643,420	-423,128	POWER PLANTS
AUTOPRODUCTORES	-606	-108,932	-1,283	-11,324	-487	-6,874	-24,777	-8,105	-162,387	83,701	-	-133	-2	-9,862	-10,570	-	-	-3,891	-2,416	-	83,701	-105,560	AUTOPRODUCERS
CENTRO DE GAS	-	-259,476	-	-	-	-	-	-259,476	-	129,770	43,800	157	1,064	161	-	-	216	-	23,294	198,461	-61,015	GAS TREATMENT PLANT	
CARBONERA	-	-	-	-	-	-117,985	-	-117,985	-	-	-	-	-	-	-	55,739	-	-	-	-	55,739	-62,246	CHARCOAL PLANT
COQUERIA/ALTO HORNO	-	-	-93,771	-	-	-	-	-93,771	-	-	-	-	-	48,309	-	-	18,122	-4,395	2,248	68,679	-29,487	COKE / BLAST FURNACE	
DESTILERIA	-	-	-	-	-	-69,483	-	-69,483	-	-	67,252	-	-	-	-	-	-	-	-	67,252	-2,231	DISTILLERY	
OTROS CENTROS	-	-	-	-	-	-424	-	-424	-	753	-15,180	-	432	-	-835	-	272	14,558	-	16,015	-425	OTHER CENTERS	
TRANSFORMACION TOTAL	-2,223,785	-615,568	-227,795	-455,676	-14,513	-44,413	-125,395	-95,063	-8,851	-3,812,070	-	-16,046	-2	-44,304	-164,808	-4,095	-	-3,891	-5,812	-	-239,958	-829,153	TOTAL TRANSFORMATION
CONSUMO PROPIO	3,017	198,408	38	-	-	111	64,547	266,120	26,983	7,099	2,961	54	8,185	25,759	170	94	37,876	26,732	629	136,542	402,662	OWN CONSUMPTION	
PERDIDAS	6,270	5,929	705	-	-	-	73	12,978	116,735	68	1,147	35	219	55	126	1,432	115	645	266	120,844	133,822	LOSSES	
AJUSTE	3,133	-2,358	-5,376	3	-2	-2,082	1,697	46	-4,939	124	721	-5,530	-1,583	4,088	-7,388	869	-25	-699	374	345	-8,782	-13,721	ADJUSTMENT
TRANSPORTE	481	39,942	-	-	-	0	-	40,423	2,472	13,023	593,712	74,076	501,196	18,060	-	-	-	-	3	1,447	1,203,990	1,244,413	TRANSPORTATION
INDUSTRIA	26,851	267,123	51,806	-	-	70,459	153,018	42,699	611,956	235,113	21,923	1,794	47,815	68,042	76,241	42,938	10,303	48,480	1,761	556,193	1,168,148	INDUSTRY	
RESIDENCIAL	-	71,752	494	-	-	241,729	-	1,859	315,834	151,159	141,906	676	10,250	331	183	-	10,838	99	-	315,443	631,277	RESIDENTIAL	
COMERCIAL, SERV., PUBL.	49	16,974	32	-	-	1,718	-	2	18,775	119,728	20,173	1,408	579	7,407	1,945	-	851	99	-	152,192	170,967	COMMERCIAL, SERV., PUBL.	
AGRO, PESCA, MINERIA	10	7,318	6,764	-	-	22,765	2,815	787	40,459	29,666	2,942	753	211	90,883	21,696	2,666	170	-	2,292	151,277	191,736	AGRICULT, FISH, MINING	
CONSTRUCCION, OTROS	71	17,523	-	-	-	29	-	113	17,736	46,986	5,480	1,050	12	8,045	2,569	7,127	98	-	11,686	83,053	100,789	CONSTRUCTION, OTHER	
CONSUMO ENERGETICO	27,462	420,633	59,097	-	-	336,699	155,832	45,460	1,045,182	585,124	205,447	599,381	86,923	655,677	112,495	86,034	54,895	10,502	50,776	14,894	2,462,148	3,507,330	ENERGY CONSUMPTION
NO ENERGETICO	32	91,375	-	-	-	3,346	85	94,838	-	5,095	69,413	113	7	6	-	-	1,187	964	123,170	199,955	294,793	NON ENERGY CONSUM	
CONSUMO FINAL	27,493	512,008	59,097	-	-	336,699	159,178	45,545	1,140,020	586,124	210,542	668,793	87,036	655,684	112,501	86,034	54,896	11,689	51,739	138,064	2,662,103	3,802,123	FINAL CONSUMPTION



French Energy Balance Layout



BILAN DE L'ÉNERGIE 2006

Mtoe

	CHARBON		PÉTROLE		GAZ		ELECTRICITÉ		ENRGS déchets	TOTAL
	Houille Lignite PR	Coke Agglomérés	Brut	Raffiné	Naturel	Industriels	Production brute	Consom- mation		
APPROVISIONNEMENT										
PRODUCTION ÉNERGIE PRIMAIRE (P)	0,18		1,06	0,20	1,02		H: 5,49 N: 117,32		12,79	138,06
Imports	12,64	1,07	82,13	36,61	36,92	-	0,73		0,01	173,31
Exports	-0,09	-0,47	-	-25,69	-0,68	-	-6,18		-	-33,11
Stocks (+=déstockage, -=stockage)	-1,02	+0,10	-0,36	-0,04	-0,90	-			-	-2,22
Soutes maritimes Internationales				-2,61						-2,61
TOTAL disponibilité (D)	12,41		82,83	8,47	39,36	-	117,36		12,80	273,23
Indépendance énergétique (P/D)	1,5%		1,4%		2,6%		104,6%		99,9%	50,5%
EMPLOIS										
Consommation de la branche énergie										
Raffinage										5,09
Perles et...										91,46
TOTAL (A)	0,20	2,96	0,03	0,62	0,53	-1,40	0,96	-	2,20	98,16
Consommation finale énergétique (corrigeée du climat)										
Sidérurgie	1,98	2,96	0,03	0,62	0,53	-1,40	0,96	-		6,08
Industrie	1,13	0,42		5,93	11,66	-	10,73	1,25		31,32
Résidentiel Tertiaire	0,31	0,06		14,72	22,56	-	23,98	6,93		70,56
Agriculture	-	-		2,22	0,30	-	0,29	0,05		2,86
Transports (*)	-	-		49,09	0,06	-	1,04	0,68		50,87
TOTAL (B)	3,42	3,44	71,99	35,40	-0,47	37,00	10,31	161,69		
Consommation finale non énergétique										
TOTAL (C)	-	0,12	13,68	1,62	-	-	-	-	-	15,42
Consommation totale d'énergie primaire (corrigeée du climat)										
TPES (temperature adjusted)	91,82	40,34	117,58	13,11	275,27					
	0,52	0,98	0,22	0,31	2,04					

Transformation input is shown as a positive consumption and output is shown as negative consumption



Austrian Energy Balance Layout



Overall energy balances 1970 to 2007

in Terajoules	1970	1980	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Indigenous	366 230	333 443	341 097	368 155	363 935	369 607	374 234	409 941	412 490	416 072	428 322	430 408	433 788	420 105	440 087	458 895
Imports	485 154	735 861	775 749	835 883	929 084	911 901	974 107	925 879	925 661	982 088	1 030 181	1 127 142	1 171 270	1 238 495	1 284 908	1 246 071
Stock rotation	-23 970	-45 165	-13 478	12 084	2 266	26 027	-8 785	15 548	8 995	38 459	262	-7 510	-6 581	-9 227	-28 876	-15 570
Exports	30 588	33 492	51 169	76 341	83 933	96 888	110 684	124 849	125 265	145 134	142 647	158 791	189 587	202 920	232 179	288 368
Transformation Input	796 846	990 647	1 052 198	1 139 780	1 211 352	1 210 648	1 228 873	1 226 319	1 221 882	1 291 483	1 316 119	1 391 250	1 408 870	1 446 452	1 463 941	1 421 029
Transformation Output	772 203	772 460	772 460	811 508	842 390	874 923	859 428	853 660	802 857	843 751	844 282	837 429	851 374	879 686	868 993	894 908
Final energy consumption	567 233	701 433	766 514	844 834	918 920	898 702	926 474	935 362	944 384	998 738	1 016 802	1 076 415	1 081 322	1 106 325	1 118 216	1 082 621
of which:																
Burgenland	.	.	21 690	25 005	27 416	27 170	27 470	27 558	27 200	29 915	30 338	32 135	31 509	32 989	33 168	31 894
Carinthia	.	.	58 064	63 362	65 485	64 723	69 563	69 537	68 139	74 912	75 718	82 267	83 001	85 003	86 787	83 128
Lower Austria	.	.	155 825	177 893	198 233	199 664	194 893	205 149	211 815	224 848	223 518	231 354	234 488	242 841	243 299	241 762
Upper Austria	.	.	159 155	170 131	188 807	181 824	187 801	193 052	196 023	207 643	213 953	229 240	227 288	229 208	233 316	228 010
Salzburg	.	.	49 830	55 822	60 093	58 524	61 048	60 986	59 162	63 691	65 730	70 980	71 218	73 072	75 752	72 551
Styria	.	.	132 388	136 476	145 667	146 688	147 482	148 169	153 229	156 132	155 975	161 383	164 171	168 029	169 227	163 059
Tyrol	.	.	62 481	70 972	76 225	75 325	79 479	77 504	79 531	83 899	88 355	96 959	97 985	100 580	100 470	96 188
Vorarlberg	.	.	29 343	31 033	33 598	31 865	32 964	33 337	32 403	34 058	34 998	35 919	35 750	36 021	36 070	34 449
Vienna	.	.	97 741	114 140	125 396	122 819	125 985	120 069	118 881	123 652	128 222	136 177	135 955	138 621	140 127	131 580
of which:																
Agriculture	31 474	30 070	24 497	22 499	23 514	23 532	23 574	24 497	23 897	25 329	25 599	27 345	27 226	26 581	26 183	25 547
Industry	198 508	224 378	216 671	218 416	224 566	242 768	237 072	233 352	253 788	249 989	254 519	252 126	261 657	283 142	309 803	314 121
Traction	111 981	165 616	208 838	244 689	269 494	256 820	286 980	280 811	296 208	312 070	335 461	359 032	371 725	384 980	372 443	378 690
Services	52 453	73 271	74 127	98 389	115 857	113 689	111 045	116 713	98 197	119 408	109 708	119 849	119 458	109 158	119 462	101 621
Private households	172 836	208 099	242 482	262 860	286 489	261 893	266 902	280 188	272 298	291 943	291 515	318 062	301 255	302 464	291 326	282 643
Transport	.	.	.	255 110	278 907	267 228	297 376	296 569	313 225	328 748	351 941	370 389	383 054	395 330	382 732	402 324
Space heating & cooling, water heating	.	.	.	287 195	322 998	299 601	298 954	316 851	295 793	331 466	322 828	353 066	338 934	336 772	340 843	302 446
Lighting & computing	.	.	.	25 158	27 086	28 164	28 792	26 854	26 392	27 422	27 097	28 377	28 348	27 979	28 130	27 551
Steam production	.	.	.	66 047	65 158	73 542	68 728	72 179	79 378	78 790	80 823	75 392	77 845	81 965	88 283	89 077
Stationary engines	.	.	.	124 898	135 841	142 224	141 830	141 167	143 949	144 164	145 544	154 777	153 035	156 020	162 146	159 044
Electrochemical purposes	.	.	.	85 347	87 695	86 578	89 397	81 756	85 443	87 935	88 359	94 201	99 664	107 995	115 799	101 895
	.	.	.	1 080	1 235	1 367	1 399	184	207	213	210	212	243	263	283	284

September 2006. - Rounding differences caused by calculation. - 1) Broken down by the structure of useful energy survey 2005. - 2) Transport is the sum of traction and agricultural off road traction.

Transport
Space heating & cooling, water heating
Lighting & computing
Steam production
Stationary engines
Electrochemical purposes



Australian Energy Balance Layout



A1 Australian energy supply and disposal, 2006-07 - energy units

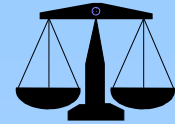
Petajoules (on a GCV basis)

	Black coal	Brown coal	BKB briquettes	Met. coke	Coal by-products	Natural gas, CSM	Crude oil and ORF	Propane, butane, LPG	Refined products	Liquid/gas biofuels	Biomass wood	Biomass bagasse	Solar/wind electricity	Hydro-electricity	Total electricity	Solar hotwater	U ₃ O ₈ Uranium	Total
	PJ	PJ	PJ	PJ	PJ	PJ	PJ	PJ	PJ	PJ	PJ	PJ	PJ	PJ	PJ	PJ	PJ	PJ
Supply																		
Primary indigenous	8 650.3	642.4				1 792.6	1 056.6	120.6		12.8	93.8	110.8	22.5	52.0		5.9	4 509.0	17 069.4
plus all imports						214.0	984.9	19.2	642.3									1 860.4
less all exports	6 943.3					826.9	593.9	72.6	144.1									4 473.9
less stock changes																		35.1
Domestic availability																		105.3
			- 6.6	21.1		22.0	- 60.4	6.8	77.0									
			6.6	- 21.1		1 157.8	1 508.1	60.4	421.2	12.8	93.8	110.8	22.5	52.0		5.9		5 769.8
less conversions																		
Coke ovens	136.6			- 97.4	- 26.0				0.9									0.1
Briquetting		6.3	- 1.8															0.2
Petroleum refining						22.3	1 514.2	- 36.0	- 1 478.2									7.1
Gas manufacturing						3.7		1.4										0.1
Electricity generation a	1 373.4	668.2	2.9		5.7	284.2		0.1	25.3	7.3	4.7		22.5	52.0	- 901.0			1 545.3
Other conversion				67.2	- 25.0		- 8.9	- 7.4	14.9						- 46.0			- 5.2
Fuel use in conversion						24.6		2.1	120.1									134.7
Final domestic availability	154.3		5.5	9.1	45.4	823.0	2.7	100.2	1 738.2	5.6	89.2	110.8				804.8	5.9	3 894.8
Disposal																		
Agriculture						0.1		1.6	83.2									6.7
Mining	5.6		0.5	0.2	1.5	242.2	1.3	1.2	147.5									69.4
Food, beverages, textiles	9.6		0.7		3.1	38.6	0.6	1.0	15.3	1.8	4.7	110.8						29.1
Wood, paper and printing	11.9					20.7		0.8	1.5		18.7							21.1
Chemical	2.3		1.5	0.9	7.8	88.2		14.2	61.2									22.7
Iron and steel	22.3			1.4	32.0	26.2		0.5	1.8									27.3
Non-ferrous metals	66.3			6.3	0.6	144.8	0.8	0.6	49.2		2.3							185.4
Other industry	30.1			0.3	0.4	80.1		5.3	10.7	1.9	0.9							25.9
Construction						3.1		0.3	22.7									0.3
						1.6		61.4	951.0	1.9								27.7
									217.8									8.1
Water transport						0.1			61.7									
Commercial and services	0.9		2.8			43.8		3.0	23.0		0.3							178.2
Residential	0.1		0.1			133.5		10.2	1.3		62.3							230.5
Lubes, bitumen, solvents									62.7									62.7
Gross final energy disposal	154.3		5.5	9.1	45.4	823.0	2.7	100.2	1 738.2	5.6	89.2	110.8				804.8	5.9	3 894.8

Air Transport
Water Transport



□ Presentational Issues Related to Layout (1)



International marine and aviation bunkers

- > Variation 1: subtract international marine and air bunkers out of supply – UN, IEA (starting with 2009 balances)
- > Variation 2: only subtract international marine bunkers from supply; air bunkers are included in transport – Eurostat, IEA (up until this year), France
- > Variation 3: include both in supply and in transport sector – OLADE, Austria, Australia

Could cause large differences in supply and consumption for some countries



□ Presentational Issues Related to Layout (2)



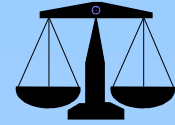
Transformation Sector

- > Variation 1: show transformation items on one line with inputs as negative numbers and outputs as positive numbers – IEA, UN, OLADE
- > Variation 2: show transformation items on one line with inputs as positive consumption and outputs as negative consumption – France, Australia
- > Variation 3: show the transformation input separately from the transformation output – Eurostat, Austria

not a major difference and should not cause any misinterpretation of the data



□ Presentational Issues Related to Layout (3)



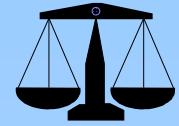
Transfer of nuclear, hydro, wind and solar to the electricity column

- > Variation 1: treat nuclear, hydro and wind in the same way as other transformation process with inputs and outputs on the same line in the transformation sector – IEA, OLADE, Australia
- > Variation 2: treat nuclear as a regular transformation with transformation input and transformation output sectors; treat hydro, wind and solar PV as an “interproduct transfer” - Eurostat
- > Variation 3: only show total electricity production (can't see how much came from nuclear, hydro, etc. – UN, France

again, this is not a major difference



In conclusion, a good energy balance:



- Is a compact source of energy information, but is only as good as the statistics used to build it (original data, calorific values)
- Allows consistency checks on the energy statistics (transformation efficiencies...)
- Is the foundation for basic energy indicators and for CO₂ emissions estimates
- **Will be transparent so that users understand how it is calculated and can compare to balances from other sources**
- ...Is not necessary, but highly recommended!

