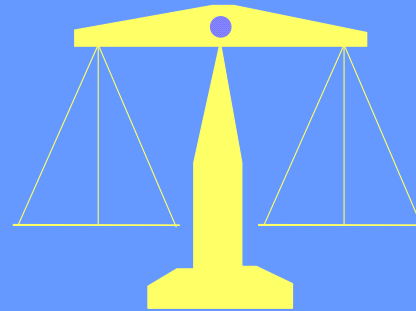




Workshop on Capacity Development for Mainstreaming Energy
SDGs, Targets and Indicators into Statistical Programmes in
Selected LA Countries

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UNSD Energy Statistics



Energy Balances - Introduction

Alex Blackburn and Leonardo Souza

Industrial & Energy Statistics Section - United Nations Statistics Division



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:

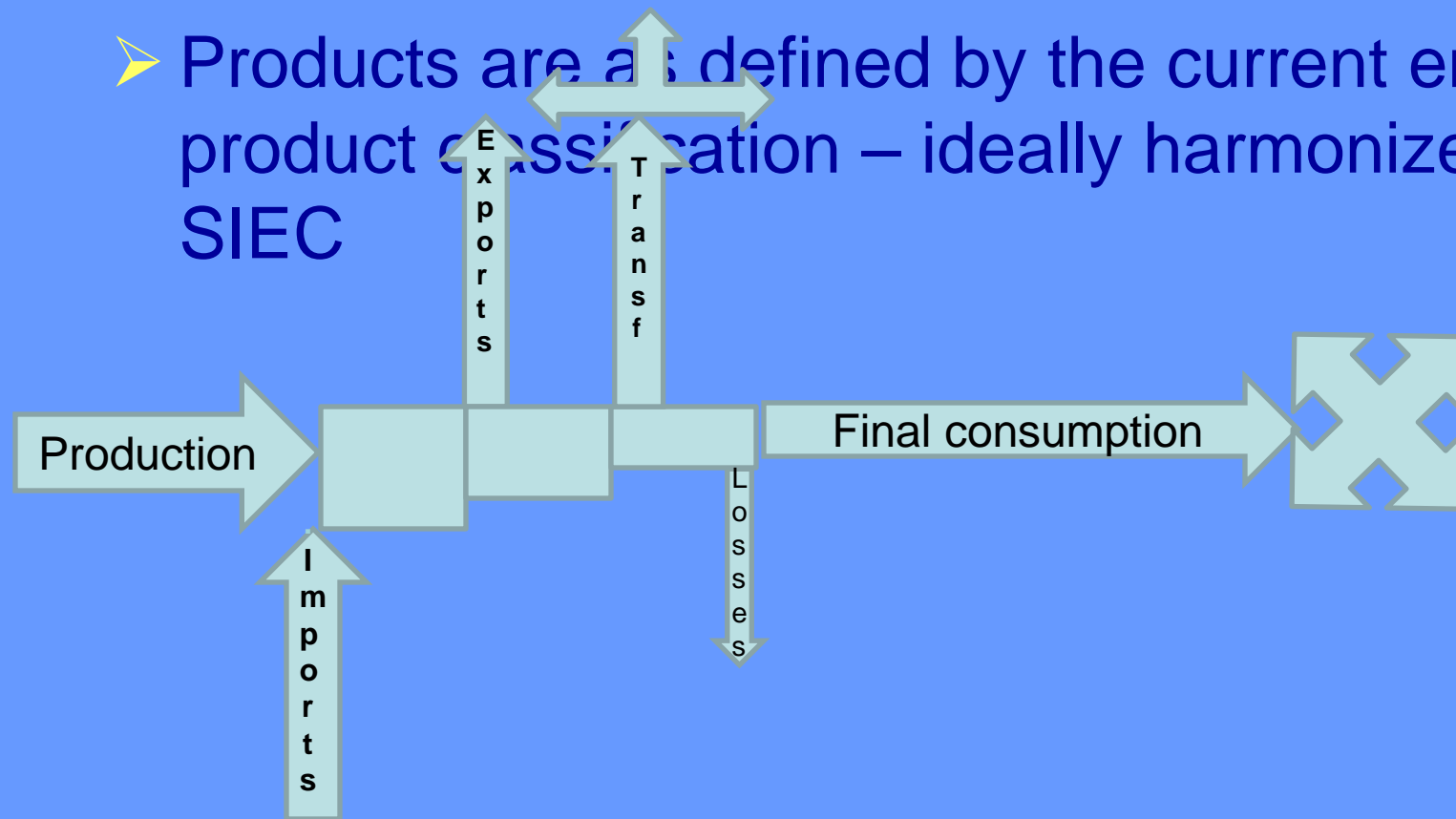
- It allows to compare the share of each source in the energy supply of a country and in each sector of the economic activity.
- With an energy balance it is possible to analyse the efficiency of energy industries in a country.
- Many relevant energy indicators can be drawn from an energy balance.
- 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 also defined by the current energy product classification – ideally harmonized with SIEC





Commodity balances – supply and use

Gas Oil/ Diesel Oil (DL); Metric tons, thousand		2007	2008	2009	2010	2011	2012
DL01	Production	31223	30875	30428	30880	30177	31547
DL022	Receipts from other sources	1	11	16	235	361	433
DL03	Imports	1527	3316	1578	696	1677	763
DL04	Exports	7048	7768	7607	6967	6335	8097
DL051	International marine bunkers	56	54	35	45	27	23
DL06	Stock changes	8	158	-169	121	190	83
DLGA	Total energy supply	25639	26222	24549	24678	25663	24540
DL 07	Transfers and recycled products	-1368	-234	-247	-551	-888	-1476
DLSD	Statistical differences	-917	-1395	-829	-2830	-2932	-2570
DL08	Transformation	274	224	228	229	215	238
DL088	Transf in electricity, CHP and heat plants	274	224	228	229	215	238
DL09	Energy industries own use	29	13	13	16	26	36
DL0925	Oil refineries	29	13	13	16	26	36
DLNA	Final consumption	27621	27614	25384	27814	29242	28312
DL11	Non-energy uses	4	3	0	0	0	0
DL12	Final energy consumption	27617	27611	25384	27814	29242	28312
DL121	Manufacturing, construction	4372	4377	3900	4564	4798	4708
DL122	Transport	15686	16396	15594	17137	17891	17694
DL123	Other	7559	6838	5890	6113	6553	5910

- Statistical differences: balance b/w supply & use – the smaller the better, but it should not be made zero artificially as it indicates data problems



Commodity balance – detailing the consumption side

Gas Oil/ Diesel Oil (DL); Metric tons, thousand		2007	2008	2009	2010	2011	2012
DL12	Final energy consumption	27617	27611	25384	27814	29242	28312
DL121	Manufacturing, construction	4372	4377	3900	4564	4798	4708
DL1211	Iron and steel	2	1	3	2	0	0
DL1213	Chemical and petrochemical	0	0	2	3	0	0
DL1214	Other manuf., const. and non-fuel min. ind	4370	4376	3895	4559	4798	4708
DL122	Transport	15686	16396	15594	17137	17891	17694
DL1221	Road	12676	13345	13461	14484	14929	14836
DL1222	Rail	2123	2250	1455	1879	2151	2169
DL1224	Domestic navigation	870	783	660	766	811	689
DL1226	Pipeline transport	17	18	18	8	0	0
DL123	Other	7559	6838	5890	6113	6553	5910
DL1231	Households	2729	2427	2362	2174	2108	1785
DL1232	Agriculture, forestry and fishing	2636	2681	2037	2433	2749	2623
DL1235	Commerce and public services	2194	1730	1491	1506	1696	1502

- The commodity balance should be as detailed as needed for policy and other purposes



UNSD Energy Stats Questionnaire

QUESTIONNAIRE ON ENERGY STATISTICS

UNITED NATIONS STATISTICS DIVISION

Country/Area: Brazil (76)

Hard Coal (CL); Metric tons, thousand (WSR)		Unit	2007 fn	2008 fn	2009 fn	2010 fn	2011 fn	2012 fn
CL01	Production	WSR	5965	6611	5061	5415	5505	6617
CL03	Imports	WSR	14864	15311	12462	15909	18007	16486
CL04	Exports	WSR					71	0
CL06	Stock changes	WSR	-86	1100	-145	-383	574	-515
CLGA	Total energy supply	+CL0 WSR	20915	20822	17668	21707	22867	23618
CLSD	Statistical differences	-CL08 WSR	5	174	51	6	-4	-1
CL08	Transformation	+CL08 WSR	15554	15166	13233	15706	15936	17048
CL088	Transformation in electricity, CHP and heat plants	WSR	5173	4821	3952	4753	4585	6207
CL08811	Electricity plants - Main activity producers	WSR	5075	4511	3860	4412	4295	5907 *
CL08812	Electricity plants - Autoproducers	WSR	98	310	92	341	290	300 *
CL081	Coke ovens	WSR	10381	10345	9281	10953	11351	10841
CL101	Losses	WSR	30	0	48	40	80	19
CLNA	Final consumption	+CL1 WSR	5326	5482	4336	5955	6855	6552
CL12	Final energy consumption	+CL1 WSR	5326	5482	4336	5955	6855	6552
CL121	Manufacturing, construction and non-fuel mining industry	+CL1 WSR	5326	5482	4336	5955	6855	6552
CL1211	Iron and steel	WSR	3406	3601	2773	3114	3378	3253
CL1213	Chemical and petrochemical	WSR	155	208	160	281	236	333
CL1214	Other manuf., const. and non-fuel min. ind.	WSR	1765	1673	1403	2560	3241	2966
Coke Oven Coke (OK); Metric tons, thousand (WSR)		Unit	2007 fn	2008 fn	2009 fn	2010 fn	2011 fn	2012 fn
OK01	Production	WSR	8315	8286	7259	9189	9683	9683
OK03	Imports	WSR	1576	1900	434	1801	2142	1591
OK04	Exports	WSR	2	1				
OK06	Stock changes	WSR	120	325	-15	82	-82	-328
OKGA	Total energy supply	+OK0 WSR	9769	9860	7708	10908	11907	11602
OKSD	Statistical differences	-OK08 WSR	9	112	-1	-1	0	0
OK101	Losses	WSR	26	33	15	15	10	10
OKNA	Final consumption	+OK1 WSR	9734	9715	7694	10894	11897	11592
OK12	Final energy consumption	+OK1 WSR	9734	9715	7694	10894	11897	11592
OK121	Manufacturing, construction and non-fuel mining industry	+OK1 WSR	9734	9715	7694	10894	11897	11592
OK1211	Iron and steel	WSR	9310	9287	7334	10523	11371	10997
OK1214	Other manuf., const. and non-fuel min. ind.	WSR	424	428	360	371	526	595
Conventional crude oil (CR); Metric tons, thousand (WSR)		Unit	2007 fn	2008 fn	2009 fn	2010 fn	2011 fn	2012 fn
CR01	Production	WSR	78944	82954	89823	95043	97550	95652
CR03	Imports	WSR	21081	19335	19020	17182	16831	17495
CR04	Exports	WSR	21373	21970	26660	32028	30660	27051



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.

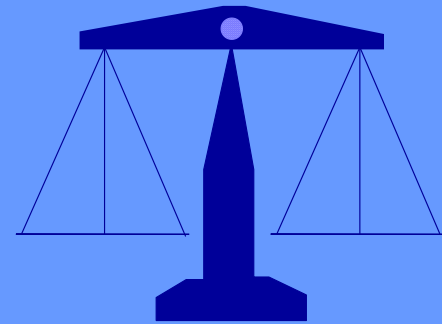
Hard Coal (CL); Metric tons, thousand		2011	2012
CL01	Production	34621	35375
CL03	Imports	9184	7821
CL04	Exports	33552	34648
CL06	Stock changes	-167	-138
CLGA	Total energy supply	10420	8686
CLSD	Statistical differences	-41	-1412
CL08	Transformation	8093	7730
CL088	Transformation in electricity, CHP and heat	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 and heat	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.



The energy balance: conversion to energy units (1)

COAL

Physical units (tonnes) 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)



OIL AND OIL PRODUCTS

NCV (can vary over time) [kJ/kg]

Specific NCV, Weighted-average NCV and default NCV as in the case of coal.





The energy balance: conversion to energy units (2)



NATURAL GAS: figures collected in Mm³ and gross TJ (energy unit), then converted to net TJ (~ 0.9·gross TJ)

OTHER GASES: data collected in gross TJ, then converted to net TJ.



ELECTRICITY

Figures collected in TWh, then electricity production is converted to TJ. **1 GWh = 3.6 TJ**

Net Electricity production excludes Own Use in electricity plants (including for pumped storage), shown separately in the balance (negative number).



Energy Balances

Products grouped into types

Panama Terajoules							Panama Terajoules						Sources et produits d'énergie		
Energy sources and products →	Hard coal, brown coal and peat Houille, lignite et tourbe	Coal products and peat products Produits de charbon et de tourbe	Primary oil Pétrole brut, LGN, autres hydrocarbures	Light oil products Produits pétroliers légers	Heavy oil products Produits pétroliers lourds	Other oil products Autres produits pétroliers	LPG, refinery gas, ethane GPL, gaz de raffinerie, éthane	Natural gas Gaz naturel	Manufactured gases Gaz manufacturés	Electricity Électricité	Primary biomass/waste Biomasse primaire/déchets	Charcoal Charbon de bois	Heat Chaleur	Total energy Energie totale	
Production and utilisation ↓	2011														Production et utilisation
1 Production of primary energy	14753	16574	..	..	31327	1 Production d'énergie primaire
2 Imports	6946	2228	..	46370	153477	5025	7190	..	..	259	..	..	..	221494	2 Importations
3 Exports	-29	..	..	..	-74	3 Exportations
4 Marine / aviation bunkers	-17155	-100509	..	..	..	..	..	..	..	..	-117664	4 Soutes
5 Stock changes	3005	22273	-2291	47	..	..	..	..	..	..	23034	5 Variations des stocks
6 Total energy supply	6946	2228	..	32220	75241	2693	7232	..	..	14983	16574	..	..	158117	6 Approv. totaux en énergie
7 Transformation	-6946	..	..	..	..	-30100	..	..	..	13534	-2569	148	..	-25964	7 Transformation
8 Briquetting plants	8 Usines de briquettes
9 Coke ovens	9 Cokeries
10 Gas works	10 Usines de gaz
11 Blast furnaces	11 Hauts fourneaux
12 Oil refineries	12 Raffineries de pétrole
13 NGL plants and gas blending	13 Usines de LGN et mélange de gaz
14 Electric power plants	-6946	..	..	..	..	..	..	..	..	..	..	..	..	-25734	14 Centrales électriques
15 Heating plants	15 Centrales thermiques
16 Other transformation	16 Autre transformation
17 Net transfers	17 Transferts nets
18 Energy industries own use	18 Util. propre de l'ind. énergétique
19 Losses in transport and distribution	-3888	..	..	..	-3888	19 Pertes trans. et distrib.
20 Cons. for non-energy uses	20 Utilis. à fins non énergétiques
21 Statistical differences	0	0	..	3617	-2448	-44	..	..	..	..	..	..	..	69	21 Ecarts statistiques
22 Final energy consumption	..	2228	..	28603	47598	2738	7190	..	..	14724	16574	..	..	14726	22 Consommation d'énergie finale
23 By industry and construction	..	2228	..	2378	20200	2693	2129	..	..	2376	3573	..	..	35576	23 Industries et construction
24 Iron and steel industry	24 Industrie sidérurgique
25 Chemical industry	25 Industrie chimique
26 Other industry and construction	..	2228	..	2378	20200	2693	2129	..	..	2376	3573	..	..	35576	26 Autres industries et construction
27 By transport	25650	25499	40	47	..	..	..	..	..	..	51236	27 Transports
28 Road	25650	25499	..	..	..	..	..	..	..	..	51149	28 Transports routiers
29 Rail	29 Transports ferroviaires
30 Air	30 Transports aériens
31 Inland and coastal waterways	31 Transports fluviaux cabotage
32 By other modes of transportation	40	..	..	47	..	..	..	88	32 Autres modes de transport
33 By households and other consumers	579	1889	4	5014	..	..	21726	10408	148	..	39763	33 Ménages et autres consom.
34 Households	89	..	..	4919	..	..	7560	10408	89	..	23063	34 Ménages
35 Agriculture	44	516	..	..	..	..	..	..	..	..	560	35 Agriculture
36 Other consumers	448	1373	4	95	..	..	14166	..	59	..	16140	36 Autres consommateurs

Primary production only

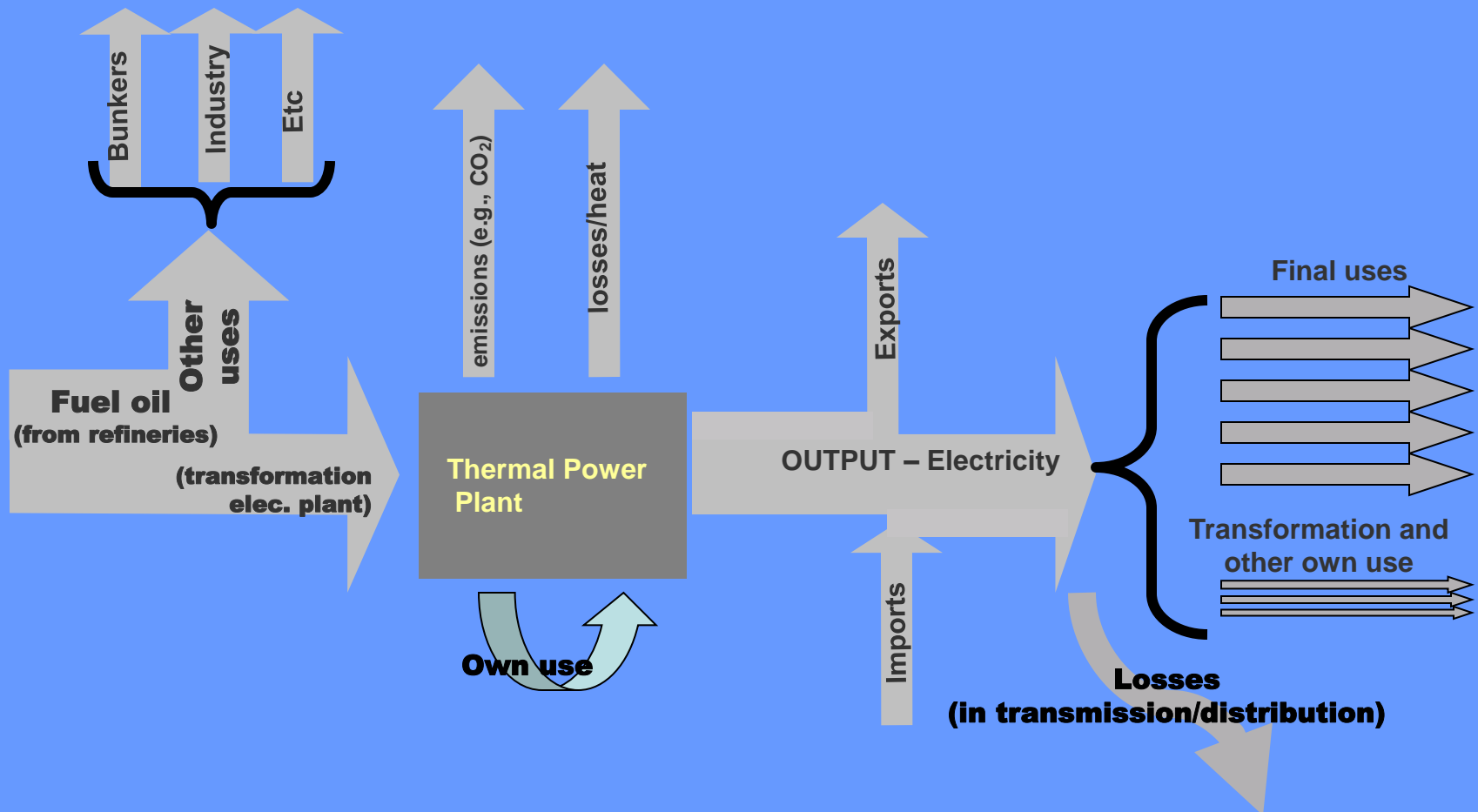
Secondary production reported here, together with inputs to transformation (net value)

Final consumption with break-down
Negative: fuel burned to generate electricity

Positive: electricity generated from combustible fuels
Summary of all products – losses, efficiency can be assessed



Energy flows – RF from refineries to thermal power plants





Energy Balances

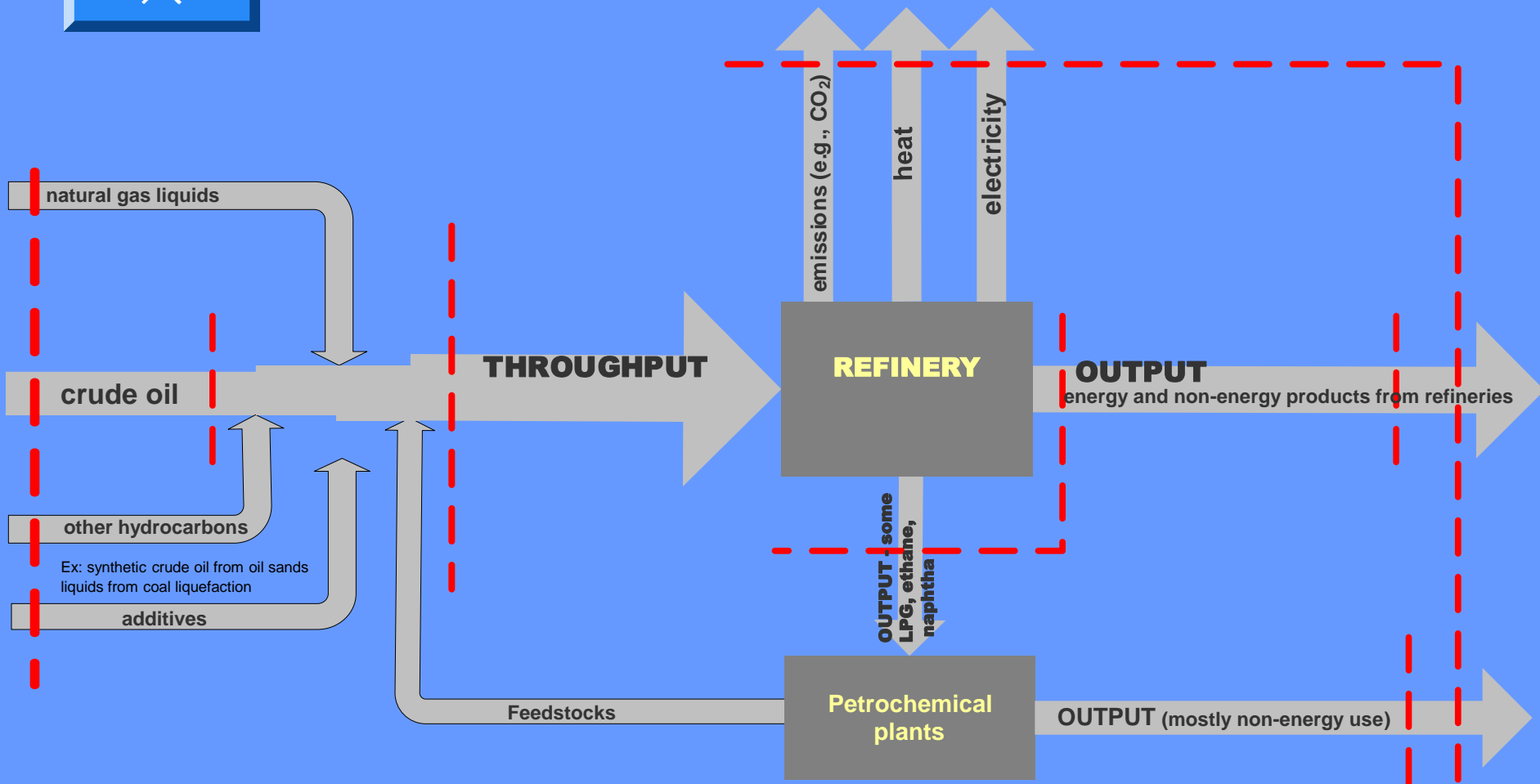
Cuba Terajoules								Cuba Térajoules						Sources et produits d'énergie	
Energy sources and products →	Hard coal, brown coal and peat	Coal products and peat products	Primary oil	Light oil products	Heavy oil products	Other oil products	LPG, refinery gas, ethane	Natural gas	Manufactured gases	Electricity	Primary biomass/waste	Charcoal	Heat		Total energy	Production et utilisation
	Houille, lignite et tourbe	Produits de charbon et de tourbe	Pétrole brut, LGN, autres hydrocarbures	Produits pétroliers légers	Produits pétroliers lourds	Autres produits pétroliers	GPL, gaz de raffinerie, éthane	Gaz naturel	Gaz manufacturés	Électricité	Biomasse primaire/déchets	Charbon de bois	Chaleur	Energie totale	
2011															2011
1 Production of primary energy			127408					39801		356	42835			210400	1 Production d'énergie primaire
2 Imports	59	85	207989	42945	85574	643	4399							341694	2 Importations
3 Exports															3 Exportations
4 Marine / aviation bunkers				*-5909	*-1290										4 Soutes
5 Stock changes														*-7199	5 Variations des stocks
6 Total energy supply	59	85	335397	37036	84284	643	4399	39801		356	42835			544894	6 Approv. totaux en énergie
7 Transformation		*-85	*-317927	49061	53073	5413	4048		3976	63576	*-33407	1564		*-170708	7 Transformation
8 Briquetting plants															8 Usines de briquettes
9 Coke ovens															9 Cokeries
10 Gas works		0							3852					3852	10 Usines de gaz
11 Blast furnaces		*-85							*124					*39	11 Hauts fourneaux
12 Oil refineries			*-209893	49061	146312	5413	4048							*-5058	12 Raffineries de pétrole
13 NGL plants and gas blending															13 Usines de LGN et mélange de gaz
14 Electric power plants			*-108034		*-93239					63576	*-30502			*-168199	14 Centrales électriques
15 Heating plants															15 Centrales thermiques
16 Other transformation											*-2905	1564		*-1341	16 Autre transformation
17 Net transfers															17 Transferts nets
18 Energy industries own use														-5092	18 Consom. propre de l'ind. énergétique
19 Losses in transport and distribution										-3409				-10033	19 Pertes trans. et distrib.
20 Cons. for non-energy uses						-4904				-10033				-4904	20 Utilis. à fins non énergétiques
21 Statistical differences	0	0	0	50134	-1650	1419	5189	0	-13446	-2874	-30	39667			21 Ecarts statistiques
22 Final energy consumption	59	0	*17470	*35963	139007	228	5345	34612	3976	63936	12302	1593		314490	22 Consommation d'énergie finale
23 By industry and construction	59	0	*17470	5111	106580	228	378	34573	494	17212	1215			183319	23 Industries et construction
24 Iron and steel industry		0												*124	24 Industrie sidérurgique
25 Chemical industry															25 Industrie chimique
26 Other industry and construction	59		*17470	5111	106580	228	378	34573	370	17212	1215			183195	26 Autres industries et construction
27 By transport					*20482	8643				914				*30040	27 Transports
28 Road					*11740	8643								*20383	28 Transports routiers
29 Rail										914				914	29 Transports ferroviaires
30 Air					6528									6528	30 Transports aériens
31 Inland and coastal waterways															31 Transports fluviaux cabotage
32 By other modes of transportation					2215									2215	32 Autres modes de transport
33 By households and other consumers				10370	23784		4967	39	3482	45810	11087	1593		101132	33 Ménages et autres consom.
34 Households				5896	3010		3169		2691	24764	609	590		40730	34 Ménages
35 Agriculture				266	6480					1148	877			8771	35 Agriculture
36 Other consumers				4208	14294		1737		39	791	19897	9601	1003	51631	36 Autres consommateurs

**Refinery row –
summary of inputs
and outputs**

**Non-energy uses (including as
feedstocks for petrochemical plants)**



Refinery flows and energy/mass balances





➤ Thank you for your attention!

➤ ¡Gracias por su atención!