The Pitfalls of an "Unbalanced" Energy Balance. Why Make the Effort?

"From macro to micro energy indicators"

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Overview

- Objective
- Relevance of energy balance
- National data collection/sources
- Discrepancies and consequences
- Conclusion

Objective

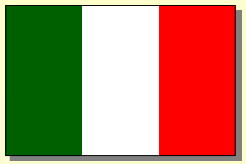
To highlight the relevance of a sound energy balance as a starting point for the development of energy indicators

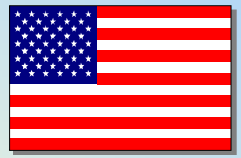
Relevance of Energy Balances for the Indicators Work

- Energy balances are a first step towards an energy supply & demand statistical equilibrium
- Sets the boundaries of the economic sectors and is the starting point for end-use mapping
- Enables the production of the top-down side of the energy indicators equation
- It may be a challenge to build a sound energy balance, but it could be even more challenging to use an “unbalanced” energy balance for analysis

Any error occurring in the energy balances may be amplified when working on detailed indicators

National Data Collection

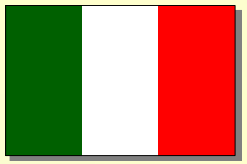


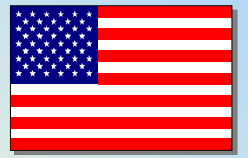



National system reflects national culture

- Federal or Central Government Structure
- Ownership of Energy Producing Industries
- Extent of Regulation, Control and Legislation
- Openness of Economy
- Statistical Agency vs. Energy Department

National Data Sources

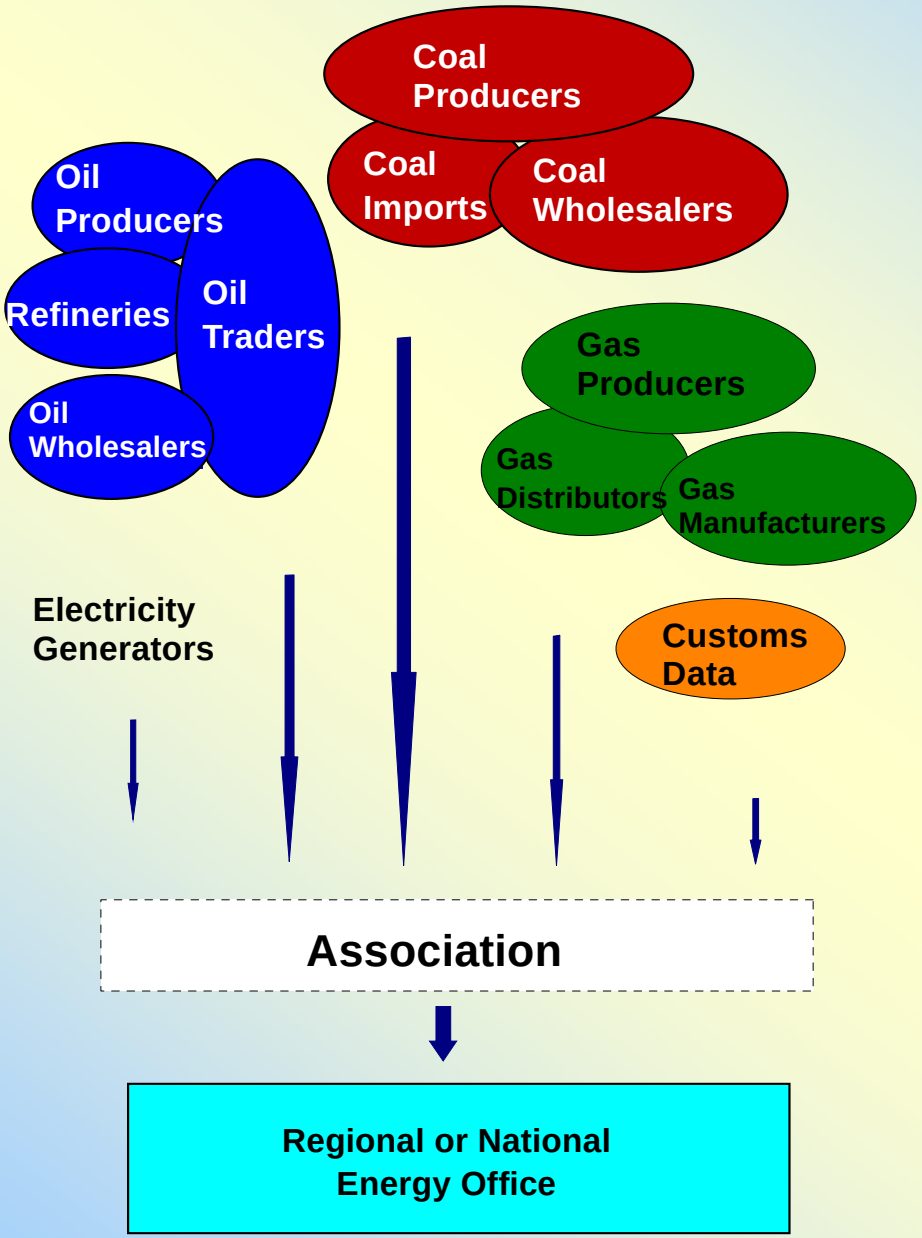


Primary Sources of Information

- Questionnaires: sample surveys, census
  - frequency depends on policy needs, cost, fuel and use
  - US EIA collects data on 83 different questionnaires
- Industry licenses (e.g. monthly UK petroleum data)
- Customs trade data (monthly)
- Industry Associations

Between privatisations and liberalisation of energy markets, it is becoming more and more difficult to collect market-sensitive information



- There are many different sources of energy data within a country
- Statisticians must make a judgement on which data is most appropriate
- Judgement driven by market knowledge

What Can We See from an Energy Balance?

SUPPLY AND CONSUMPTION	Coal	Crude Oil	Petroleum Products	Gas	Nuclear	Hydro	Geotherm. Solar	Combust. Renew.	Electricity	Heat	Total
Production	956.95	1019.25	-	924.78	579.51	106.80	35.87	178.4			
Imports	338.57	1605.23	463.10	489.38	-	-	-	1.2			
Exports	-210.97	-448.72	-350.66	-226.81	-	-	-	-0.3			
Intl. Marine Bunkers	-	-	-79.74	-	-	-	-				
Stock Changes	21.42	-10.11	-1.79	1.34	-	-	-	-0.0			
TPES	**1105.97**	**2165.65**	**30.90**	**1188.68**	**579.51**	**106.80**		**35.87**		**179.4**	
Distribution Losses	-0.67	-0.00	-0.00	-2.18	-	-	-0.19	-0.00	-57.60	-4.34	-65.00
TFC	**126.85**	**1.50**	**1975.35**	**746.86**	**-**	**-**	**6.59**	**118.48**	**728.67**	**49.23**	**3753.53**
INDUSTRY SECTOR	**110.33**	**1.50**	**345.36**	**304.29**	**-**	**-**	**0.58**	**60.50**	**276.47**	**17.05**	**1116.07**
Iron and Steel	38.98	-	5.93	28.30	-	-	-	0.03	28.50	0.50	102.24
Chemical and Petrochem.	12.20	1.50	236.42	108.97	-	-	-	1.94	48.56	8.11	417.69
of which: Feedstocks	-	*1.45*	*212.28*	*34.52*	-	-	-	-	-	-	*248.25*
Non-Ferrous Metals	2.34	-	3.20	13.90	-	-	0.00	0.13	26.13	0.34	46.04
Non-Metallic Minerals	22.48	-	17.94	28.91	-	-	-	1.57	13.87	0.15	84.91
Transport Equipment	0.45	-	3.36	8.89	-	-	0.00	0.00	9.78	0.50	22.98
Machinery	0.83	-	6.07	18.33	-	-	0.00	0.02	25.57	0.43	51.26
Mining and Quarrying	0.62	-	5.23	6.70	-	-	0.05	0.00	8.42	0.10	21.13
Food and Tobacco	5.93	-	12.49	27.82	-	-	0.01	4.33	19.16	1.20	70.94
Paper, Pulp and Printing	7.20	-	11.31	25.36	-	-	0.27	39.91	33.18	1.58	118.80
Wood and Wood Products	0.30	-	2.63	2.47	-	-	-	8.41	4.95	0.28	19.04
Construction	1.40	-	11.74	1.32	-	-	0.00	0.08	1.45	0.05	16.05
Textile and Leather	0.66	-	4.17	7.93	-	-	0.00	0.11	8.62	0.76	22.24
Non-specified	16.95	-	24.87	25.38	-	-	0.25	3.97	48.27	3.05	122.74
TRANSPORT SECTOR	**0.06**	**-**	**1231.00**	**21.66**	**-**	**-**	**-**	**3.09**	**9.41**	**-**	**1265.23**
International Aviation	-	-	71.09	-	-	-	-	-	-	-	71.09
Domestic Aviation	-	-	85.09	-	-	-	-	-	-	-	85.09
Road	-	-	1034.88	1.10	-	-	-	3.04	-	-	1039.02
Rail	0.01	-	16.33	-	-	-	-	0.00	7.80	-	24.14
Pipeline Transport	-	-	0.02	20.55	-	-	-	-	0.37	-	20.95

Industry

Transport

	Coal	Crude Oil	Petroleum Products	Gas	Nuclear	Hydro	Geotherm. Solar	Combust. Renew.	Electricity	Heat	Total
Electricity Generated - TWh	***3842.57***	***-***	561.24	***1728.14***	***2223.37***	***1241.84***	***96.23***	***169.46***	***-***		9 862.85
Electricity Plants	*3522.81*	*-*		*1256.32*	*2194.49*	*1241.84*	*95.10*	*92.07*	*-*		
CHP plants	*319.76*	*-*	*87.24*	*471.82*	*28.88*	*-*	*1.13*	*77.39*	*-*	*-*	*986.21*
Heat Generated - PJ	***821.89***	***-***	***177.96***	***1008.72***	***3.56***	***-***	***13.52***	***338.99***	***6.89***	***24.82***	***2396.33***
CHP plants	*658.44*	*-*	*133.03*	*843.60*	*3.56*	*-*	*8.54*	*239.42*	*0.76*	*3.99*	*1891.33*
Heat Plants	*163.44*	*-*	*44.93*	*165.12*	*-*	*-*	*4.99*	*99.57*	*6.14*	*20.83*	*505.01*

	Total
Production	3 801.98
TPES	5 394.71

Self-sufficiency: 70.5%

Oil share in electricity production: 5.7%

Discrepancy between Supply and Consumption in the Basic Data

- Problems with production
- Trade discrepancies
- Stock change information not accurate
- Inaccurate domestic / international split
- Supply vs. consumption

Large statistical differences

Trade Discrepancies

Country X reports that they imported the following amounts from Country Y in 2003

BITCOAL	SUBCOAL	LIGNITE
1 kt	0 kt	188 kt

Country Y reports that they exported the following amounts to Country X in 2003

BITCOAL	SUBCOAL	LIGNITE
93 kt	35 kt	0 kt

Country X (ktoe)	BITCOAL	SUBCOAL	LIGNITE
Production	0	129	0
Imports	2752	0	198
Exports	-172	-35	0
Stock Changes	-42	16	0
TPES	2534	158	187
Stat Diff.	-359	6	1

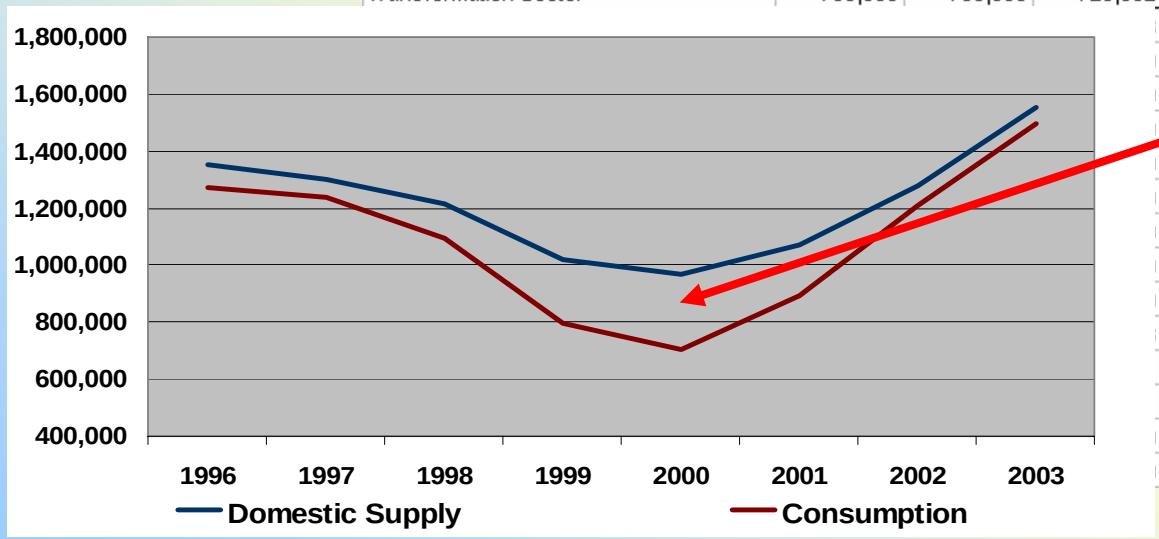
Because bituminous coal has higher calorific value than lignite, the difference in the energy balance is even bigger

Large Statistical Differences

Unit: 000 metric tons

PRODUCT	Hard Coal							
COUNTRY	People"s Republic of China							
	1996	1997	1998	1999	2000	2001	2002	2003
Indigenous Production	**1,302,524**	**1,272,432**	**1,188,429**	**979,452**	**931,163**	**1,096,895**	**1,308,508**	**1,558,557**
From Other Sources - Coal	72,200	77,280	49,978	50,633	52,425	49,380	54,318	82,450
From Other Sources - Natural gas	0	0	0	0	0	0	0	0
From Other Sources - Oil Products	0	0	0	0	0	0	0	0
From Other Sources - Renewables	0	0	0	0	0	0	0	0
From Other Sources - Non-Specified	0	0	0	0	0	0	0	0
Import	3,217	2,013	1,586	1,673	2,178	2,661	11,258	11,098
Export	-36,485	-35,331	-32,297	-37,437	-55,057	-90,125	-83,887	-93,986
International Marine Bunkers	0	0	0	0	0	0	0	0
Stock Changes	8,687	-13,406	8,812	26,622	36,603	11,493	-11,321	-5,049
Domestic Supply	**1,350,143**	**1,302,988**	**1,216,508**	**1,020,943**	**967,312**	**1,070,304**	**1,278,876**	**1,553,070**
Statistical Differences	**77,446**	**64,428**	**227818**	**263,734**	**177,429**	**70,146**	**58,370**	
Transformation Sector	750,093	760,638	729,092				1,131,851	
							779,765	
							0	
					0	0	0	
					0	0	0	
					64,729	66,921	69,615	74,737	95,955
					0	0	0	0	0
					0	0	0	0	0
					0	0	0	0	0
					0	0	0	0	0
					7,638	6,431	6,770	7,690	9,184
					149,417	150,004	154,364	182,097	236,399
					8,476	8,100	8,938	9,733	10,548
					0	0	0	0	0
					0	0	0	0	0

Huge stat. diff. !!!!!



Clear Picture of Stock Changes

Ideal		Alternative 1		Alternative 2	
Hard Coal	(Mt)	Hard Coal	(Mt)	Hard Coal	(Mt)
Production	358,385	Production	358,385	Production	358,385
Imports	21,683	Imports	21,683	Imports	21,683
Exports	-1,627	Exports	-1,627	Exports	-1,627
Stock Change	-4,423	Stock Change	-1,897	Stock Change	-1,897
Dom. Supply	374,018	Dom. Supply	376,544	Dom. Supply	376,544
Stat. Diff.	0	Stat. Diff.	-2526	Stat. Diff.	0
Consumption	374,018	Consumption	374,018	Consumption	376,544

Ideal: All stocks accounted for and supply = consumption

Alternative 1: Only pit-head stock changes available and difference goes into statistical difference

Alternative 2: Only pit-head stock changes available and consumption is set equal to supply

Discrepancies within Consumption

- Electricity, CHP and heat plants
  - Different classifications of fuel and plant type
  - Missing inputs or output
  - Unable to calculate detailed plant efficiencies
- Coke ovens
  - Missing inputs or output
  - May affect the consumption of secondary products
  - May unbalance the supply/consumption of primary products

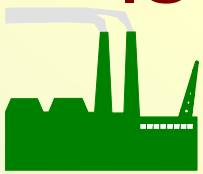
Input/Output Problems for Electricity, CHP and Heat Production

Inputs (ktoe)	Bituminous	Lignite
Electricity Plants	-658	0
CHP Plants	-2114 -1404	n.a.
Heat Plants	-1203	0

Outputs		Bituminous	Lignite
ktoe	Elec Output ele plants	232	0
	Elec Output CHP plants	247	141
	Heat Output CHP plants	1439 621	342
	Heat Output heat plant	n.a.	0

Plant Efficiency	Bituminous	Lignite
Electricity Plants	35%	0%
CHP Plants	102% 62%	n.a.
Heat Plants	n.a.	0%

What If Output of Coke Oven Gas Is Missing…



Coke Ovens in Country A (Mtoe)

Inputs to Coke Ovens		Ouputs from Coke Ovens			
Coking Coal	Residual Fuel Oil	Oven Coke	Coke Oven Gas	Total (losses)	Efficiency
-3.50	-0.02	2.36	0.62	-0.54 -1.16	86% 67%

Consumption of Coke Oven Gas is as follows

Coke Ovens (energy sector)	0.11 Mtoe
Iron & Steel Industry	0.55 Mtoe
Mining and Quarrying	0.03 Mtoe

In this example, total consumption by the Iron and Steel Industry in country A accounts for 2.33 Mtoe, so if 0.55 Mtoe of coke oven gas is not included, then nearly 24% of that sector's consumption is not reported

Conclusions

- Energy balances provide the big picture which defines the boundaries of the economic sectors and is the starting point for the end-use mapping of energy and activities used for indicators

- Countries that have their own energy balances have a stronger data foundation for the development of energy indicators

Better Balances =
Better Energy Market Picture

(and better energy indicators)