

From energy balances to energy accounts

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11 April 2023

A short overview of IEA energy balances

- Aim of the balances: bring together information on energy to better understand how products are transformed using a common unit (Joules or tones of oil equiv.)
- Displays row-wise a series of energy flows, which are related to individual products (or groups of products)
- 3 main blocks (rows)
 - Supply
 - Transformation
 - Final energy consumption
- 63 products/product categories (for the detailed energy balances, columns)
- Very good starting point for compiling the Energy PSUT; there is a UNSD tool to help start the process

An example to concretize things—natural gas in TJ

UNIT: TJ	
	Natural gas
Production	5824348
Imports	682308
Exports	-2762795
International marine bunkers	0
International aviation bunkers	0
Stock changes	-100266
Total primary energy supply	3643594
Transfers	0
Statistical differences	392169
Transformation processes	-744643
Main activity producer electricity plants (tr	-203711
Autoproducer electricity plants (transf.)	-272457
Main activity producer CHP plants (transf.)	-134299
Autoproducer CHP plants (transf.)	0
Main activity producer heat plants (transf.)	0
Autoproducer heat plants (transf.)	0
Heat pumps (transf.)	0
Electric boilers (transf.)	0
Chemical heat for electricity production (tr	0
Blast furnaces (transf.)	0
Gas works (transf.)	0
Coke ovens (transf.)	0
Patent fuel plants (transf.)	0
BKB/peat briquette plants (transf.)	0
Oil refineries (transf.)	0
Petrochemical plants (transf.)	0
Coal liquefaction plants (transf.)	0
Gas-to-liquids (GTL) plants (transf.)	0
For blended natural gas (transf.)	0
Charcoal production plants (transf.)	0
Non-specified (transformation)	-134176

UNIT: TJ	
	Natural gas
Energy industry own use	-1311408
Coal mines (energy)	-3569
Oil and gas extraction (energy)	-1252378
Blast furnaces (energy)	0
Gas works (energy)	0
Gasification plants for biogases (energy)	0
Coke ovens (energy)	0
Patent fuel plants (energy)	0
BKB/peat briquette plants (energy)	0
Oil refineries (energy)	-55461
Coal liquefaction plants (energy)	0
Liquefaction (LNG) / regasification plants (e	0
Gas-to-liquids (GTL) plants (energy)	0
Own use in electricity, CHP and heat plants	0
Pumped storage plants (energy)	0
Nuclear industry (energy)	0
Charcoal production plants (energy)	0
Non-specified (energy)	0
Losses	0

An example to concretize things—natural gas in TJ

UNIT: TJ	
	Natural gas
Total final consumption	1979712
Industry	595280
Iron and steel	68831
Chemical and petrochemical	186466
Non-ferrous metals	28324
Non-metallic minerals	31810
Transport equipment	13638
Machinery	28660
Mining and quarrying	25842
Food and tobacco	62745
Paper, pulp and print	67846
Wood and wood products	27456
Construction	15730
Textile and leather	3805
Non-specified (industry)	34127
Transport	149791
World aviation bunkers	x
Domestic aviation	0
Road	1581
Rail	0
Pipeline transport	146279
World marine bunkers	x
Domestic navigation	0
Non-specified (transport)	1931
Other	1112714
Residential	618073
Commercial and public services	459583
Agriculture/forestry	35059
Fishing	0
Non-specified (other)	0

UNIT: TJ	
	Natural gas
Non-energy use	121927
Non-energy use industry/transformation/e	121927
Memo: Non-energy use chemical/petrod	121927
Non-energy use in transport	0
Non-energy use in other	0
Electricity output (GWh)	67181
Electricity output (GWh)-main activity prod	25510
Electricity output (GWh)-autoproducer elec	26222
Electricity output (GWh)-main activity prod	15449
Electricity output (GWh)-autoproducer CHP	0
Heat output	21049
Heat output-main activity producer CHP pla	21049
Heat output-autoproducer CHP plants	0
Heat output-main activity producer heat pl	0
Heat output-autoproducer heat plants	0

Balances and accounts

Energy balances	Energy accounts
Based on energy statistics	Based on energy statistics and balances
Supply and use balances	Supply and use balances
Various formats (IEA, Eurostat, UN)	Uses national accounts SUT format
Rearrangement of industries' energy use according to purpose (transport, auto-producers, heat for sale)	No re-arrangement of industries' energy use
Detailed description of energy sector including technologies	Energy "sector" described by ISIC, no description of technologies
All transport in one separate sector	Own account transportation included in industries' activities
Territory principle	Resident principle
Statistical differences	No statistical differences
Physical	Physical and monetary

Structure of PSUT

PHYSICAL SUPPLY TABLE (unit: PJ)	Production (incl. household own account) and generation of residuals							Accumulation	Flows from the rest of the World (Imports)	Flows from the environment	TOTAL	
	Industries (by ISIC)											Households
	Agriculture, Forestry and Fishery	Mining and Quarrying	Manufacturing	Electricity, gas, steam and air conditioning supply	Transportation and storage	Other industries	Total Industry					
	ISIC	A	B	C	D	H						
1 Energy from natural inputs:												
Natural resource inputs											0	
Inputs of energy from renewable sources											0	
Other natural inputs											0	
2 Energy products:												
<i>Production of energy products by SIEC class:</i>												
Coal							0				0	
Peat and peat products							0				0	
Oil shale / oil sands							0				0	
Natural gas							0				0	
Oil							0				0	
Biofuels							0				0	
Waste							0				0	
Electricity							0				0	
Heat							0				0	
Nuclear fuels and other fuels							0				0	
3 Energy residuals:												
Total energy residuals							0				0	
4 Other residual flows:												
Residuals from end-use for non-energy purposes							0				0	
Energy from solid waste							0				0	
5 TOTAL SUPPLY	0	0	0	0	0	0	0	0	0	0	0	

Structure of PSUT

PHYSICAL USE TABLE (unit: PJ)	Intermediate consumption, use of energy resources, receipt of energy losses							Final Consumption Households	Accumulation	Flows to the rest of the World (Exports)	Flows to the environment	TOTAL
	Industries (by ISIC)											
	Agriculture, Forestry and Fishery	Mining and Quarrying	Manufacturing	Electricity, gas, steam and air conditioning supply	Transportation and storage	Other industries	Total Industry					
ISIC	A	B	C	D	H							
1 Energy from natural inputs:												
Natural resource inputs							0					0
Inputs of energy from renewable sources							0					0
Other natural inputs							0					0
2 Energy products:												
<i>Transformation of energy products by SIEC class:</i>												
Coal							0					0
Peat and peat products							0					0
Oil shale / oil sands							0					0
Natural gas							0					0
Oil							0					0
Biofuels							0					0
Waste							0					0
Electricity							0					0
Heat							0					0
Nuclear fuels and other fuels							0					0
<i>End-use of energy products by SIEC class:</i>												
Coal							0					0
Peat and peat products							0					0
Oil shale / oil sands							0					0
Natural gas							0					0
Oil							0					0
Biofuels							0					0
Waste							0					0
Electricity							0					0
Heat							0					0
Nuclear fuels and other fuels							0					0
End-use of energy products for non-energy purposes							0					0
3 Energy residuals:												
Total energy residuals												0
4 Other residual flows:												
Residuals from end-use for non-energy purposes												0
Energy from solid waste							0					0
5 TOTAL SUPPLY		0	0	0	0	0	0	0	0	0	0	0

How can we use the information in the balances?

	Energy flow	Target column in PSUT
Supply	Production	1toN
	Imports	Flows from the rest of the World (Imports) (table supply)
	Exports	Flows to the rest of the World (Exports) (table use)
	International marine bunkers	H (ISIC 50)
	International aviation bunkers	H (ISIC 51)
	Stock <u>changes</u>	Accumulation (table use)
	Total primary energy supply	
	Statistical differences	1toN
	Transfers	C (ISIC 19)

How can we use the information in the balances?

Derivation of natural inputs in the PSUT from the products in the IEA detailed energy balances

Natural inputs in PSUT		Product to approximate the natural input flow		
Category	Flow	Product in IEA detailed energy balance	SIEC code	SIEC label
Natural resource inputs	Oil resources	Conventional crude oil	4100	Conventional crude oil
		Natural gas liquids (NGL)	4200	Natural gas liquids (NGL)
		Other hydrocarbons	4500	Other hydrocarbons
	Natural gas resources	Natural gas	3000	Natural gas
	Coal and peat resources	Anthracite	0110	Anthracite
		Coking coal	0121	Coking coal
		Other bituminous coal	0129	Other bituminous coal
		Sub-bituminous coal	0210	Sub-bituminous coal
		Lignite	0220	Lignite
		Peat	11	Peat
		Oil shale / oil sands	2000	Oil shale / oil sands
	Uranium and other nuclear	Nuclear ⁴	9	Nuclear fuels and other fuels n.e.c.

How can we use the information in the balances?

What about industry? (what column do we put the numbers in the use table?)

Product in IEA detailed energy balance	SIEC		Target ISIC for « production »
	Code	Label	
Anthracite	0110	Anthracite	B (ISIC 05)
Coking coal	0121	Coking coal	B (ISIC 05)
Other bituminous coal	0129	Other bituminous coal	B (ISIC 05)
Sub-bituminous coal	0210	Sub-bituminous coal	B (ISIC 05)
Lignite	0220	Lignite	B (ISIC 05)
Peat	11	Peat	B (ISIC 08)
Oil shale and oil sands	2000	Oil shale / oil sands	B (ISIC 06)
Natural gas	3000	Natural gas	B (ISIC 06)
Crude oil	4100	Conventional crude oil	B (ISIC 06)
Natural gas liquids	4200	Natural gas liquids (NGL)	B (ISIC 06)
Additives/blending components	4400	Additives and oxygenates	C (ISIC 20)

How can we use the information in the balances?

Some things to keep in mind about the natural inputs and imports/exports:

- * Primary solid biofuels in the balances includes several SIEC energy products that are usually used by different industries
- * Nuclear fuel is assumed to be extracted domestically, though this is usually not the case.
- * Need to add information on flaring and venting if available
- * Imports and exports need to be adjusted for residency principle

Dealing with transformations

	Energy flow in IEA detailed energy balance	Target column in PSUT tables
Transformation	Transformation processes	
	Main activity producer electricity plants	D (ISIC 35)
	Autoproducer electricity plants	1toN
	Main activity producer CHP plants	D (ISIC 35)
	Autoproducer CHP plants	1toN
	Main activity producer heat plants	D (ISIC 35)
	Autoproducer heat plants	1toN
	Heat pumps	D (ISIC 35)
	Electric boilers	D (ISIC 35)
	Chemical heat for electricity production	D (ISIC 35)
	Blast furnaces	C (ISIC 24)
	Gas works	D (ISIC 35)
	Coke ovens	C (ISIC 19)
	Patent fuel plants	C (ISIC 19)
	BKB/peat briquette plants	C (ISIC 19)
	Oil refineries	C (ISIC 19)
	Coal liquefaction plants	C (ISIC 19)
	Gas-to-liquids (GTL) plants	C (ISIC 19)
	For blended natural gas	D (ISIC 35)
	Petrochemical plants	C (ISIC 20)
Charcoal production plants	C (ISIC 20)	
Non-specified (transformation)	1toN	

How can we use the information in the balances?

Some things to keep in mind about transformation:

- * Generally, there is a 1-1 match of flows between balances and accounts
- * Auxiliary information is needed for the autoproducers
- * Transformation is generally recorded as follows:
 - * Use of an energy product (primary or secondary) by an industry;
 - * Supply of another product (secondary) by the industry;
 - * Supply of energy residuals (losses) by the industry;
 - * Use of residuals by the environment.

Dealing with energy industry own use

	Energy flow in IEA detailed energy balance	Target column in PSUT
Energy sector	Energy industry own use	
	Coal mines	B (ISIC 05)
	Oil and gas extraction	B (ISIC 06)
	Blast furnaces	C (ISIC 24)
	Gas works	D (ISIC 35)
	Gasification plants for biogases	D (ISIC 35)
	Coke ovens	C (ISIC 19)
	Patent fuel plants	C (ISIC 19)
	BKB/peat briquette plants	C (ISIC 19)
	Oil refineries	C (ISIC 19)
	Coal liquefaction plants	C (ISIC 19)
	Liquefaction (LNG) / regasification plants	B (ISIC 09)
	Gas-to-liquids (GTL) plants	C (ISIC 19)
	Own use in electricity, CHP and heat plants	D (ISIC 35)
	Pumped storage plants	D (ISIC 35)
	Nuclear industry	D (ISIC 35)
Charcoal production plants	C (ISIC 20)	
Non-specified (energy)	1toN	

How can we use the information in the balances?

Some things to keep in mind about energy industry:

- * In the accounts we follow the ISIC classification-> need to sort out the relevant ISIC category
- * Energy own use here is end use in accounting terminology

Dealing with final consumption

	Energy flow in IEA detailed energy balance	Target column in PSUT
Industry	Industry	
	Iron and steel ⁵	C (ISIC 24)
	Chemical and Petrochemical	C (ISIC 20 and 21)
	Non-ferrous metals ⁶	C (ISIC 24)
	Non-metallic minerals	C (ISIC 23)
	Transport equipment	C (ISIC 29 and 30)
	Machinery	C (ISIC 25 to 28)
	Mining and quarrying	B (ISIC 07, 08 and 099)
	Food and tobacco	C (ISIC 10 to 12)
	Pulp, paper and print	C (ISIC 17 and 18)
	Wood and wood products	C (ISIC 16)
	Construction	Other industries (ISIC 41 to 43)
	Textile and leather	C (ISIC 13 to 15)
	Non-specified (industry)	C (ISIC 22, 31 and 32)

Dealing with final consumption

	Energy flow in IEA detailed energy balance	Target column in PSUT
Transport	Transport	
	Domestic aviation	H (ISIC 51)
	Road	1toN
	Rail	H (ISIC 49)
	Pipeline transport	H (ISIC 49)
	Domestic navigation	H (ISIC H50)
	Non-specified (transport)	1toN
Other	Other	
	Residential	Households
	Commercial and public services	1toN
	Agriculture/Forestry	A (ISIC 01 and 02)
	Fishing	A (ISIC 03)
	Non-specified (Other)	1toN

How can we use the information in the balances?

Some things to keep in mind about end use:

Possible data sources to be used to calculate a distribution key for road transport by industry:

- * Transport statistics;
- * National vehicle registers;
- * Detailed monetary use tables providing information on use of fuels per industry;
- * Taxes

Dealing with final consumption

	Energy flow in IEA detailed energy balance	Target column in PSUT
Non-energy use	Non-energy use	
	Non-energy use industry/transformation/energy	1toN
	Memo: non-energy use chemical/petrochemical	C (ISIC 20)
	Non-energy use in transport	1toN
	Non-energy use in other	1toN