Australian Bureau of Statistics

Energy Accounts

Compilation

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Malaysia 2016

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Compiling Energy Accounts

Overview

Physical Supply Use Tables

- Natural inputs
- Energy products supply
- Transformation of energy
- Energy end use
- Residuals

Monetary accounts

Asset accounts

Compiling Energy Accounts

Supply Tables

Physical supply table for energy

	Production (including household production on own-account); Generation of residuals							Accumulation	Flows from the rest of the world: Imports	Flows from the environment	Total supply
	Agriculture, forestry and fishing ISIC A	Mining and quarrying ISIC B	Manufacturing ISIC C	Electricity, gas, steam and air conditioning supply ISIC D	Transportation and storage ISIC H	Other industries	Households				
Energy from natural inputs											
Natural resource inputs											
Mineral and energy resources											
Oil resources										744.0	744.0
Natural gas resources										417.0	417.0
Coal and peat resources											
Timber resources										5.0	5.0
Inputs of energy from renewable sources											
Solar										20.0	20.0
Hydro										100.0	100.0
Wind										4.0	4.0
Wave and tidal											
Geothermal											
Other heat and electrical											
Other natural inputs											
Energy inputs to cultivated biomass										2.0	2.0
Total energy from natural inputs										1 292.0	1 292.0
Energy products											
Production of energy products by SIEC class											
Coal									225.0		225.0
Peat and peat products											
Oil shale/ oil sands											
Natural gas (extracted)		395.0									395.0
Natural gas (distributed)				369.1							369.1
Oil (e.g. conventional crude oil)		721.0									721.0
Oil (oil products)			347.0						930.0		1 277.0
Biofuels	5.3		0.2	1.5							7.0
Waste	39.0		54.5						16.9		110.4
Electricity				212.0					22.0		234.0
Heat				78.5							78.5
Nuclear fuels and other fuels nec											
Energy for own use											
Total energy products	44.3	1 116.0	401.7	661.1					1 193.9		3 417.0
Energy residuals											
Losses during extraction		45.0									45.0
Losses during distribution				12.0							12.0
Losses during storage			6.0								6.0
Losses during transformation			7.0	204.4							211.4
Other energy residuals	50.3	3.2	418.7	90.6	632.0	96.0	240.0				1 530.8
Total energy residuals	50.3	48.2	431.7	307.0	632.0	96.0	240.0				1 805.2
Other residual flows											
Residuals from end-use for non-energy			51.0								51.0
Energy from solid waste								93.5			93.5
Total supply	94.6	1 164.2	884.4	968.1	632.0	96.0	240.0	93.5	1 193.9	1 292.0	6 658.7

Energy from natural inputs

Energy products

Residuals & other flows

Compiling Energy Accounts

Use Tables

	Intermediate consumption; Use of energy resources; Receipt of energy losses						Final consumption	Accumulation	Flows to the rest of the world	Flows to the environment	Total use
	Agriculture, forestry and fishing	Mining and quarrying	Manufacturing	Electricity, gas, steam and air conditioning supply	Transportation and storage	Other industries	Households		Exports		
Energy from natural inputs											
Natural resource inputs											
Mineral and energy resources											
Oil resources		744.0									744.0
Natural gas resources		417.0									417.0
Coal and peat resources											
Timber resources	5.0										5.0
Inputs of energy from renewable sources											
Solar				20.0							20.0
Hydro				100.0							100.0
Wind				4.0							4.0
Wave and tidal											
Geothermal											
Other heat and electrical											
Other natural inputs											
Energy inputs to cultivated biomass	0.3		0.2	1.5							2.0
Total energy from natural inputs	5.3	1 161.0	0.2	125.5							1 292.0
Energy products											
Transformation of energy products by SIEC class											
Coal				223.0							223.0
Peat and peat products											
Oil shale/ oil sands											
Natural gas (extracted)				395.0							395.0
Natural gas (distributed)				87.0							87.0
Oil (e.g. conventional crude oil)			360.0								360.0
Oil (oil products)				16.0							16.0
Biofuels											
Waste				31.0							31.0
Electricity											
Heat											
Nuclear fuels and other fuels nec											
Total transformation of energy products			360.0	752.0							1 112.0
End-use of energy products by SIEC class											
Coal	2.0	0.1	17.0				1.0	- 21.0	1.9		1.0
Peat and peat products											
Oil shale/ oil sands											
Natural gas (extracted)											
Natural gas (distributed)	2.0		39.0	0.1		12.0	26.0	2.0	201.0		282.1
Oil (e.g. conventional crude oil)									361.0		361.0
Oil (oil products)	34.0	2.0	326.0		621.0	49.0	102.0	- 3.0	80.0		1 211.0
Biofuels	0.3		0.2	1.5			5.0				7.0
Waste	3.0	0.1	4.0	37.0		1.0	33.0	0.3	1.0		79.4
Electricity	7.0	1.0	22.0	50.0	10.0	15.0	29.0		100.0		234.0
Heat	2.0		10.5	2.0	1.0	19.0	44.0				78.5
Nuclear fuels and other fuels nec											0.0
Total end-use for energy purposes	50.3	3.2	418.7	90.6	632.0	96.0	240.0	- 21.7	744.9		2 254.0
End-use of energy products for non-energy purposes			61.0								61.0
Energy residuals											
Losses during extraction										45.0	45.0
Losses during distribution										12.0	12.0
Losses during storage										6.0	6.0
Losses during transformation										211.4	211.4
Other energy residuals										1 530.8	1 530.8
Total energy residuals										1 805.2	1 805.2
Other residual flows											
Residuals from end-use for non-energy purposes								51.0			51.0
Energy from solid waste	39.0		54.5								93.5
Total use	94.6	1 164.2	884.4	968.1	632.0	96.0	240.0	29.3	744.9	1 805.2	6 658.7

Energy from natural inputs

Energy products Transformation & End-Use

Residuals & other flows

Compiling Energy Accounts

Supply and Use Tables

SUPPLY TABLE						
	Industries	Households	Accumulation	Rest of the World	Environment	Totals
Energy from natural inputs					Energy inputs from the environment	Total supply of energy from natural inputs
Energy products	Output			Imports		Total supply of energy products
Residuals related to energy	Energy-related residuals generated by industry	Energy-related residuals generated by household consumption	Energy-related residuals from accumulation			Total supply of energy-related residuals

USE TABLE						
	Industries	Households	Accumulation	Rest of the World	Environment	Totals
Energy from natural inputs	Extraction of natural energy inputs					Total use of energy from natural inputs
Energy products	Intermediate consumption	Household consumption	Inventories etc.	Exports		Total use of energy products
Residuals related to energy	Collection & treatment of energy-related residuals		Accumulation of energy-related residuals		Energy-related residual flows direct to environment	Total use of energy-related residuals

Compiling Energy Accounts

Energy from natural inputs

Measures products from the environment

Supply

Natural input	Industry	Households	Accumulation	Imports	Environment	Total supply
Coal					52	52
Oil					110	110
Gas					22	22
Solar					1	1
Hydro					5	5
Natural Inputs	**-**	**-**	**-**	**-**	**190**	**190**

Use

Natural input	Industry	Households	Accumulation	Exports	Environment	Total use
Coal	52	0				52
Oil	110	0				110
Gas	22	0				22
Solar	0.5	0.5				1
Hydro	5	0				5
Natural Inputs	**189.5**	**0.5**				**190**

Compiling Energy Accounts

Energy from natural inputs

Supply

- Includes all raw production
- Usually need to calculate some factor for extraction losses

Use

- Raw production by industry
- Allocate or direct calculation of extraction losses

Compiling Energy Accounts

Energy from natural inputs

Data sources

- Commodity reports
- Annual reports
- Direct survey (usually a small number of units)
- Increase production estimates to allow for losses
- Don't forget solar and solar hot water
- Royalty payments.
- Other administrative data?

Compiling Energy Accounts

Supply of primary inputs and imports

Measures products from industry and imports

Supply

Energy products	Industry	Households	Accumulation	Imports	Environment	Total supply
Black coal	50	0		10		60
Crude oil	100	0		50		150
Natural gas	20	0		40		60
Solar	0.5	0.5		-		1
Hydro	5	0		-		5
Electricity	0	0		10		10
Petroleum prod	0	0		40		40
Total Products	**175.5**	**0.5**		**150**		**326**

Compiling Energy Accounts

Supply of primary inputs and imports

- Counts production by industry
- Uses transactions of energy products or 'gross' view
- Provides information about ownership of energy products from sources
- Includes imports of primary and secondary products
- Double counting occurs in total supply

Compiling Energy Accounts

Supply of primary inputs and imports – data sources

- Energy balances are a reasonable start
- Imports data from trade statistics
  - Converted monetary or physical if available
- Energy surveys
- Administrative data (eg electricity generation)
- Annual reports (transformation industries)

or

- Use information if that is better.

Compiling Energy Accounts

Supply of primary inputs and imports – points of interest

Optional attribution in SEEA-Energy

- Coal mines owned by electricity generators
- Solar from households
- Wood production by households
- Gathering own account production of energy

Compiling Energy Accounts

Transformation of energy products

Accounts for transformation of primary products into secondary energy products.

Energy products	Available energy	Industry 1 (petrol refining)	Industry 2 (elec generation)	Industry 3 (manufacturing)	Energy for end uses
Black coal	60	0	-50	-10	0
Crude oil	150	-120	0	0	30
Natural gas	60	-10	-40	0	10
Solar	1	0	-1	na	0
Hydro	5	0	-5	na	0
Electricity	10	0	35	5	50
Petroleum prods	40	100	0	0	140

Compiling Energy Accounts

Transformation of energy products

- Measures change from primary energy to secondary energy.
- Calculates energy available for end uses
- 'Net' out duplicate energy flows
- Residuals are generated from transformation activities
- Creates intermediate use of energy generation industries
- Includes inputs into own account production
- Useful to attribute energy transformation to the industries undertaking the activity before consolidation

Compiling Energy Accounts

Transformation of energy products – data sources

- Energy balances
- Energy surveys
- Administrative data
  - Annual reports of energy generators
- Models
  - Inputs to energy generations x efficiency factor
  - Eg. 100PJ black coal is about 33PJ electricity
  - Balance between supply and end uses
  - Eg. 1000PJ crude oil supply, 400PJ exported, 50 energy end use = 550PJ allocated to conversion and storage.

Compiling Energy Accounts

Transformation of energy products – points to note

- Cogeneration
  - Can be high uptake for some industries, eg Australian iron and steel has 80% own account generation of electricity and 96% from cogeneration
- Energy plant leasing
  - Examine economy for leasing arrangement between energy generators and other industry
- Own account production
  - Hard to evaluate without a specific collection
- More detail is better
  - Some industries use the same energy type for different purposes!
  - Disaggregation helps to monetise the accounts later.

Compiling Energy Accounts

Energy end use

Measures energy end uses

Energy products	Industry	Accumulation	Households	Exports	Environment	Total end uses
Black coal	0	0	0	0		0
Crude oil	0	5	0	25		30
Natural gas	8	0	2	0		10
Electricity	20	0	30	0		50
Petroleum prods	50	10	70	10		140
Total Energy End Uses	**78**	**15**	**102**	**35**	**-**	**230**

Compiling Energy Accounts

Energy end use

- Measures end use of energy products to produce goods and services in the economy.
- Measures final uses of energy products for export and households.
- Measures the inventories of energy products for later use.

Compiling Energy Accounts

Energy end use – data sources

- Energy balances
  - Activity based, needs some translation to industry
  - Transport (case study)
- Energy surveys
- Administrative data
  - Trade data (exports)
  - Annual reports
  - Emissions trading
  - Electricity and gas billing
- Models
  - Residential use (motor vehicle use)
  - Road transport
  - Bunkers (see next slide)
  - Domestically collected fuels (wood)

Compiling Energy Accounts

Energy end use – data sources

Transport case study

- Activity estimates collect all road transport (residential and industrial)
- Need to convert from activity to industry totals
- Need to allocate to industry
- Need to factor in non-transport use of energy (diesel generators)

Possibly the most important component of the energy accounts for policy.

Compiling Energy Accounts

Energy end use – points to note

- Most of the time spent on the energy accounts.
- Usually poor quality or no data sources.
- Unfortunately, the most interesting to policy.
- Allocation to industry enables monitisation for intermediate use.

Compiling Energy Accounts

Residuals

Measures residuals (mainly heat) from energy uses

Supply

Residuals	Industry	Households	Accumulation	Imports	Environment	Total supply
Extraction losses	14	0				14
Transformation losses	96	0				96
Distribution and storage losses	0	0				0
Other residuals	78	102				180
Total Residuals	188	102	-	-	-	290

Use

Residuals	Industry	Households	Accumulation	Exports	Environment	Total use
Extraction losses					14	14
Transformation losses					96	96
Distribution and storage losses					0	0
Other residuals					180	180
Total Residuals	**-**	**-**	-	-	**290**	**290**

Compiling Energy Accounts

Residuals

- Measures heat lost by the economy.
- They are not emissions accounts!
- Extraction losses
  - Eg Losses due to mining
- Distribution and storage losses
- Transformation losses
  - From the transformation of energy products table
- Other losses
  - Includes all of energy end use by industry and households.
- Issues
  - Cogeneration?
  - What about losses in renewable technology?

Compiling Energy Accounts

Residuals – data sources

- Supply and end use of energy products
- Transformation of energy products
- Administrative data
  - Annual reporting
  - Emissions trading
  - Greenhouse gas inventories
- Academic articles
  - Life cycle analysis
  - Storage losses
  - Efficiency of power generation facilities by type of fuel

Compiling Energy Accounts

Residuals – points to note

- Reason for residual accounts are not clear to policy
  - Distinction from greenhouse gas inventories
- Could be considered a 'final use' of energy as it flows back into the environment.

Compiling Energy Accounts

Supply and Use Tables

SUPPLY	Industry	Households	Accumulation	Imports	Environment	Total supply
Natural Inputs	-	-	-	-	190	190
Energy Products	175.5	0.5		150		326
Residuals	188	102	-	-	-	290
Total Supply	363.5	102.5		150	190	806

USE	Industry	Households	Accumulation	Exports	Environment	Total Use
Natural Inputs	189.5	0.5	-	-	-	190
Products - transformation	96					96
Products – end use	78	15	102	35	-	230
Residuals	-	-	-	-	290	290
Total Use	364	15.5	102	35	290	806

Compiling Energy Accounts

In the next session we will look at the analysis and application of energy accounts – with a couple of Australian examples thrown in!

Thankyou!