Physical Energy Accounts

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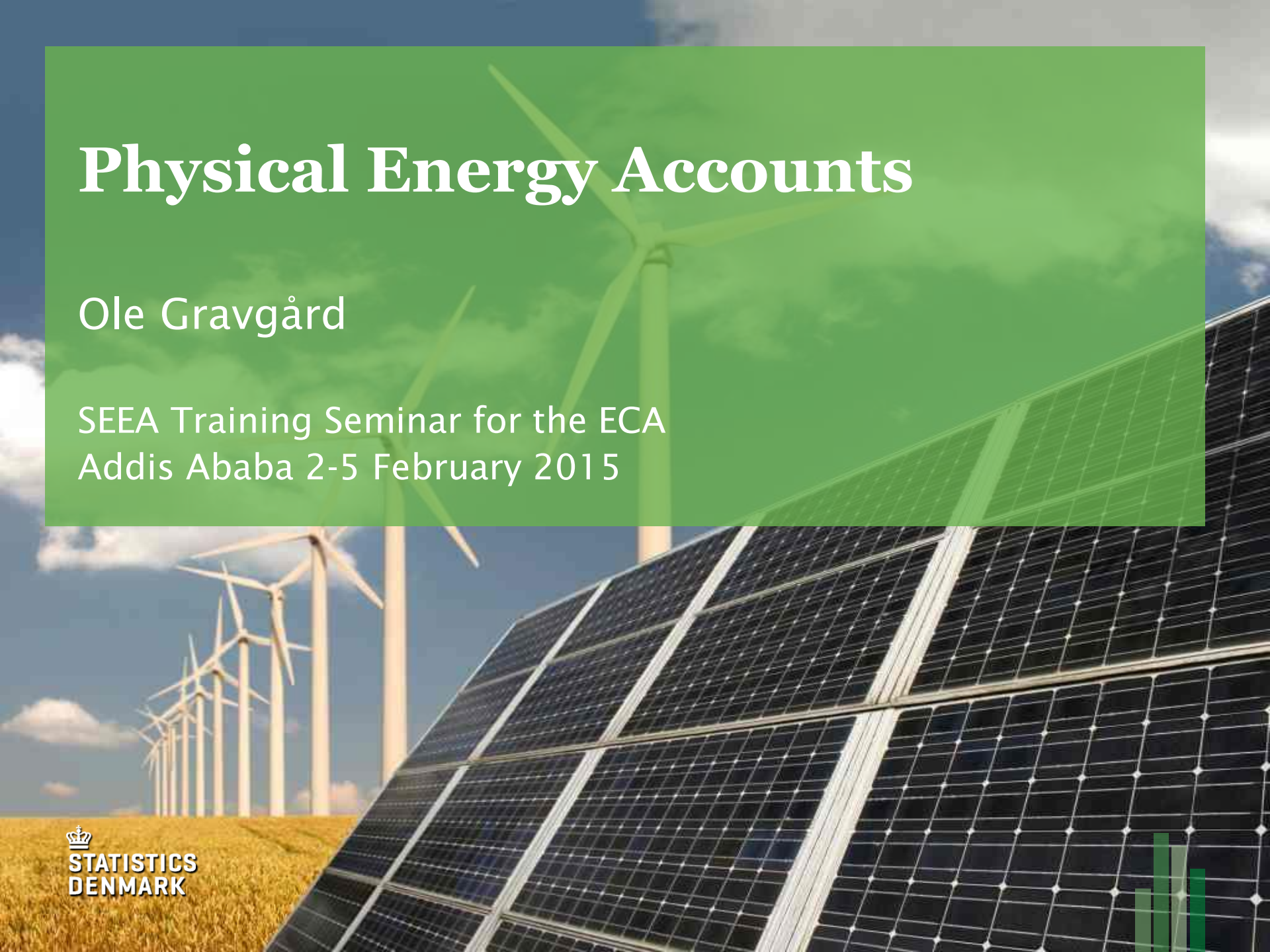

STATISTICS DENMARK

SEEA and Energy

Includes various accounts relevant for describing and analysing the role of energy in the economy and the links to the environment

- Methodology based on national accounts' definitions and framework
- Supply-use tables and balancing (supply = use)
- Asset accounts (opening stock + changes = closing stock)
- Physical and monetary
- Residence principle in stead of territory principle
- Same classifications as used in the national accounts, e.g. ISIC

Purpose of the physical energy flow accounts

- Describe
  - Extraction and capture of energy from environment
  - Transaction of energy within the economy
  - The losses of energy and residual flows back to the environment

- Measurement unit:
- In principle all *natural units* can be used (depending on purpose) Tonnes, cubic metres, litres, but most often practical to use a *common unit* like *Joules*

Natural energy resources

Table 3.2
Classes of natural inputs

1	**Natural resource inputs**
1.1	Extraction used in production
1.1.1	Mineral and energy resources
1.1.1.1	Oil resources
1.1.1.2	Natural gas resources
1.1.1.3	Coal and peat resources
1.1.1.4	Non-metallic mineral resources (excluding coal and peat resources)
1.1.1.5	Metallic mineral resources
1.1.2	Soil resources (excavated)
1.1.3	Natural timber resources
1.1.4	Natural aquatic resources
1.1.5	Other natural biological resources (excluding timber and aquatic resources)
1.1.6	Water resources
1.1.6.1	Surface water
1.1.6.2	Groundwater
1.1.6.3	Soil water
1.2	Natural resource residuals
2	**Inputs of energy from renewable sources**
2.1	Solar
2.2	Hydro
2.3	Wind
2.4	Wave and tidal
2.5	Geothermal
2.6	Other electricity and heat
3	**Other natural inputs**
3.1	Inputs from soil
3.1.1	Soil nutrients
3.1.2	Soil carbon
3.1.3	Other inputs from soil
3.2	Inputs from air
3.2.1	Nitrogen
3.2.2	Oxygen
3.2.3	Carbon dioxide
3.2.4	Other inputs from air
3.3	Other natural inputs n.e.c.

Nuclear fuels

Fuel wood

Energy products

Detailed structure and explanatory notes

Notes

CPC Ver.2

(Central Product Classification, Ver.2)

Click on any code to see more detail. Click here for top level only.

- 0 - Agriculture, forestry and fishery products
  - 01 - Products of agriculture, horticulture and market gardening
  - 02 - Live animals and animal products (excluding meat)
  - 03 - Forestry and logging products
  - 04 - Fish and other fishing products
- 1 - Ores and minerals; electricity, gas and water
  - 11 - Coal and lignite; peat
  - 12 - Crude petroleum and natural gas
  - 13 - Uranium and thorium ores and concentrates
  - 14 - Metal ores
  - 15 - Stone, sand and clay
  - 16 - Other minerals
  - 17 - Electricity, town gas, steam and hot water
  - 18 - Natural water
- 2 - Food products, beverages and tobacco; textiles, apparel and leather products
  - 21 - Meat, fish, fruit, vegetables, oils and fats
  - 22 - Dairy products and egg products
  - 23 - Grain mill products, starches and starch products; other food products
  - 24 - Beverages
  - 25 - Tobacco products
  - 26 - Yarn and thread; woven and tufted textile fabrics
  - 27 - Textile articles other than apparel
  - 28 - Knitted or crocheted fabrics; wearing apparel
  - 29 - Leather and leather products; footwear
- 3 - Other transportable goods, except metal products, machinery and equipment
  - 31 - Products of wood, cork, straw and plaiting materials
  - 32 - Pulp, paper and paper products; printed matter and related articles
  - 33 - Coke oven products; refined petroleum products; nuclear fuel
  - 34 - Basic chemicals
  - 35 - Other chemical products; man-made fibres
  - 36 - Rubber and plastics products
  - 37 - Glass and glass products and other non-metallic products n.e.c.
  - 38 - Furniture; other transportable goods n.e.c.
  - 39 - Wastes or scraps
- 4 - Metal products, machinery and equipment
  - 41 - Basic metals
  - 42 - Fabricated metal products, except machinery and equipment
  - 43 - General-purpose machinery
  - 44 - Special-purpose machinery
  - 45 - Office, accounting and computing machinery
  - 46 - Electrical machinery and apparatus
  - 47 - Radio, television and communication equipment and apparatus
  - 48 - Medical appliances, precision and optical instruments, watches and clocks
  - 49 - Transport equipment
- 5 - Constructions and construction services
  - 53 - Constructions
  - 54 - Construction services
- 6 - Distributive trade services; accommodation, food and beverage serving services; transport services; and electricity, gas and water distribution services
  - 61 - Wholesale trade services
  - 62 - Retail trade services
  - 63 - Accommodation, food and beverage services
  - 64 - Passenger transport services
  - 65 - Freight transport services
  - 66 - Rental services of transport vehicles with operators
  - 67 - Supporting transport services
  - 68 - Postal and courier services
  - 69 - Electricity, gas and water distribution (on own account)
- 7 - Financial and related services; real estate services; and rental and leasing services
  - 71 - Financial and related services
  - 72 - Real estate services
  - 73 - Leasing or rental services without operator
- 8 - Business and production services
  - 81 - Research and development services
  - 82 - Legal and accounting services
  - 83 - Other professional, technical and business services
  - 84 - Telecommunications, broadcasting and information supply services
  - 85 - Support services
  - 86 - Support services to agriculture, hunting, forestry, fishing, mining and utilities
  - 87 - Maintenance, repair and installation (except construction) services
  - 88 - Manufacturing services on physical inputs owned by others
  - 89 - Other manufacturing services; publishing, printing and reproduction services; materials recovery services
- 9 - Community, social and personal services
  - 91 - Public administration and other services provided to the community as a whole; compulsory social security services
  - 92 - Education services
  - 93 - Human health and social care services
  - 94 - Sewage and waste collection, treatment and disposal and other environmental protection services
  - 95 - Services of membership organizations
  - 96 - Recreational, cultural and sporting services
  - 97 - Other services
  - 98 - Domestic services
  - 99 - Services provided by extraterritorial organizations and bodies

Energy products: SIEC – Standard International Energy Classification

Table 3.1: Standard International Energy Product Classification (SIEC)

SIEC Headings			Correspondences	
Section / Division / Group	Class		CPC Ver.2	HS 2007
0		**Coal**		
01		**Hard coal**		
011	0110	Anthracite	11010*	2701.11
012		Bituminous coal		
	0121	Coking coal	11010*	2701.19
	0129	Other bituminous coal	11010*	2701.12
02		**Brown coal**		
021	0210	Sub-bituminous coal	11030*	2702.10*
022	0220	Lignite	11030*	2702.10*
03		**Coal products**		
031		Coal coke		
	0311	Coke oven coke	33100*	2704*
	0312	Gas coke	33100*	2704*
	0313	Coke breeze	33100*	2704*
	0314	Semi cokes	33100*	2704*
032	0320	Patent fuel	11020	2701.20
033	0330	Brown coal briquettes (BKB)	11040	2702.20
034	0340	Coal tar	33200*	2706
035	0350	Coke oven gas	17200*	2705*
036	0360	Gas works gas (and other manufactured gases for distribution)	17200*	2705*
037		Recovered gases		
	0371	Blast furnace gas	17200*	2705*
	0372	Basic oxygen steel furnace gas	17200*	2705*
	0379	Other recovered gases	17200*	2705*
039	0390	Other coal products	33500*, 34540*	2707, 2708.10*, .20*, 2712.90*
1		**Peat and peat products**		
11		**Peat**		
111	1110	Sod peat	11050*	2703*
112	1120	Milled peat	11050*	2703*
12		**Peat products**		
121	1210	Peat briquettes	11050*	2703*
129	1290	Other peat products	11050*, 33100*, 33200*, 33500*	2703*, 2704*, 2706*, 2712.90*
2		**Oil shale / oil sands**		
20		**Oil shale / oil sands**		
200	2000	Oil shale / oil sands	12030	2714.10
3		**Natural gas**		
30		**Natural gas**		
300	3000	Natural gas	12020	2711.11, .21
4		**Oil**		

Part of the International recommendations for Energy Statistics

http://unstats.un.org/unsd/statcom/doc11/BG-IRES.pdf

Also recommended for the SEEA energy Accounts

No one-to-one relationship between CPC and SIEC

Energy Residuals

Energy residuals, *Joules*

Losses of energy during
- extraction
- distribution
- storage
- transformation
- others (= end use of energy
- by industries and households)

Energy residuals – *weight*

Table 3.4

Typical components for groups of residuals

Group	Typical components
Solid waste (includes recovered materials)[a]	Chemical and health-care waste, radioactive waste, metallic waste, other recyclables, discarded equipment and vehicles, animal and vegetal wastes, mixed residential and commercial waste, mineral wastes and soil, combustion wastes, other wastes
Wastewater[a]	Water for treatment and disposal, return flows, reused water
Emissions to air	Carbon dioxide, methane, dinotrogen oxide, nitrous oxides, hydrofluorocarbons, perfluorocarbons, sulphur hexafluoride, carbon monoxide, non-methane volatile organic compounds, sulphur dioxide, ammonia, heavy metals, persistent organic pollutants, particulates (e.g., PM10 dust)
Emissions to water	Nitrogen compounds, phosphorus compounds, heavy metals, other substances and (organic) compounds
Emissions to soil	Leaks from pipelines, chemical spills
Residuals from dissipative use of products	Unabsorbed nutrients from fertilizers, salt spread on roads
Dissipative losses	Abrasion (tyres/brakes), erosion/corrosion of infrastructure (roads, etc.)
Natural resource residuals	Mining overburden, felling residues, discarded catch

[a] This list of typical components for groups of residuals can also be applied to certain flows defined as products.

SUPPLY table for energy - JOULES
I – NATURAL INPUTS

Table 3.5
Physical supply and use table for energy *(joules: net calorific units)*

Physical supply table for energy

	Production (including household production on own account); generation of residuals								Flows from the rest of the world		
	Agriculture, forestry and fishing ISIC A	Mining and quarrying ISIC B	Manufac-turing ISIC C	Electricity, gas, steam and air condition-ing supply ISIC D	Transporta-tion and storage ISIC H	Other industries	Households	Accumula-tion	Imports	Flows from the environ-ment	Total supply
Energy from natural inputs											
Natural resource inputs											
Mineral and energy resources										1 161.0	1 161.0
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

SUPPLY table for energy - JOULES
II – PRODUCTS AND RESIDUALS

	Production (including household production on own account); generation of residuals								Flows from the rest of the world		
	Agriculture, forestry and fishing ISIC A	Mining and quarrying ISIC B	Manufac-turing ISIC C	Electricity, gas, steam and air conditioning supply ISIC D	Transpor-tation and storage ISIC H	Other indus-tries	Households	Accumula-tion	Imports	Flows from the environment	Total supply
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 n.e.c.											
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 purposes			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	6658.7

USE table for energy - JOULES
I – NATURAL INPUTS and PRODUCTS

Table 3.5
Physical supply and use table for energy *(joules: net calorific units)* (cont'd.)

Physical use table for energy

	Intermediate consumption; use of energy resources; receipt of energy losses						Final consumption		Flows to the rest of the world		
	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	Accumulation	Exports	Flows to the environment	Total use
Energy from natural inputs											
Natural resource inputs	5.0	1 161.0									1 166.0
Inputs of energy from renewable sources				124.0							124.0
Other natural inputs	0.3		0.2	1.5							2.0
Total energy from natural inputs	5.3	1 161.0	0.2	225.5							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 n.e.c.											
Total transformation of energy products			360.0	752.0							1 112.0

USE table for energy - JOULES
II – PRODUCTS (cont'd) and RESIDUALS

	Intermediate consumption; use of energy resources; receipt of energy losses						Final consumption		Flows to the rest of the world		
	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	Accumulation	Exports	Flows to the environment	Total use
Energy products (cont'd)											
End-use of energy products by SEC 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 n.e.c.											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			51.0								51.0
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

Note: Dark grey cells are null by definition.

Various balances in the supply and use tables must apply

Balances for ”energy”:

- Supply of products=use of products
- Supply of natural inputs=use of natural inputs
- Supply of residuals=use of residuals
- Total supply = total use

Balances for industries and households:

Total inputs must equal total outputs + Net additions to stocks (accumulation)

Implementation in countries

The SEEA Central Framework tables are generic:

- Not all items are relevant for all countries
- In some cases it is useful with more details

- You need to decide what is most relevant and where to start

- Start with what is available and focus on the elephants – not the mices

Sources, etc. for the energy accounts

- Energy statistics
- Energy balances
- Foreign trade statistics
- Production statistics
- Agricultural/forestry statistics, etc.
- Monetary data and unit prices

- Often necessary to make estimations and assumptions

- Note that defintions and borderlines may be different in different statistical sources

Physical units

Physical and monetary units

Basic Energy Statistics

Statistics on crude oil

Statistics on natural gas

Statistics on oil products

Statistics on electricity

Statistics on biomass

Etc.

- Energy statistics serves different purposes and are presented in different ways

Energy Balances

Geographic area

- Energy statistics put together on standardised form
- Production and consumption
- Territory principle
- Detailed description of the energy sector
- Transport treated as individual sector

Other sources

- International transportation between third countries
- Prices and values
- Etc

Energy Accounts

Economy as described in the national accounts

- The basis is the energy balances
- Complemented with data on international transportation etc
- Information on prices and values
- Supply always equals the use
- National accounts concepts
- Residence principle
- No statistical discrepancies

Other publications that are useful for energy accounting

International Recommendations for Energy Statistics (IRES)

Adopted by the United Nations Statistical Commission, in 2011.

- Complete set of recommendations covering all aspects of the statistical production process framework, from basic concepts, definitions and classifications to data sources, data compilation strategies, energy balances, data quality and statistical dissemination.

Energy Statistics

- Description of Activities
- International Recommendations for Energy Statistics (IRES)
- Energy Statistics Compilers Manual (ESCM)
  - Country Practice Template
- Energy Yearbook
- Energy Balances and Electricity Profiles
- Energy Statistics Database
  - UNSD Annual Energy Questionnaire
- Supporting developing countries measure progress towards achieving a Green Economy NEW!
- Global Assessment on Energy Statistics and Energy Balances
- Joint Organizations Data Initiative (JODI)
- Oslo Group
- Intersecretariat Working Group on Energy Statistics
- Meetings and Workshops
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May 2013

International Recommendations for Energy Statistics

The United Nations Statistical Commission, at its forty-second session held in New York, 22 to 25 February 2011, adopted the *International Recommendations for Energy Statistics* (IRES).

IRES unedited version

The *International Recommendations for Energy Statistics* provide data compilers with a complete set of recommendations covering all aspects of the statistical production process framework, from basic concepts, definitions and classifications to data sources, data compilation strategies, energy balances, data quality and statistical dissemination.

IRES was prepared in accordance with the Commission's endorsement, during its fortieth session in February 2009, of the United Nations Statistics Division's strategy to prepare the *International Recommendations for Energy Statistics*. IRES was prepared by UNSD in close cooperation with the Oslo Group on Energy Statistics and the Intersecretariat Working Group on Energy Statistics (InterEnerStat). Consultations with specific groups of experts took place during the preparation process, such as the Committee of Experts on Environmental-Economic Accounting, the Expert Group on International Economic and Social Classifications and the London Group on Environmental Accounting.

More information on the preparation process can be found here.

With the adoption of IRES by the United Nations Statistical Commission, UNSD started the preparation of the *Energy Statistics Compilers Manual* (ESCM), which will contain further and more detailed explanations of the recommendations and provide practical guidance for compilers of energy statistics, balances and accounts.

SEEA Energy

- SEEA-Energy, a SEEA 'sub-system', is under development to provide compilers and analysts with agreed concepts, definitions, classifications, tables, and accounts for energy and energy-related air emission accounts. SEEA-Energy elaborates and expands the guidance on accounting included in the IRES and is fully coherent with the broader SEEA.