The Energy Accounts

# The balancing of the energy accounts is essential to

- make credible scenarios and projections of a future energy system
- show how the development of new energy technologies and new concepts, will affect the energy system
- show status and the historical development of an energy system
- make economic calculations for an energy system
- prepare environmental accounts for an energy system

Energy accounts are drawn in the following situations

- DEA prepares each year a historic energy accounts and a budget for the coming year for Denmark, which shows energy consumption and types of energy forms used. By comparing with previous years' accounts, one can see trends and whether they are consistent with the policy objectives

- A number of municipalities prepare regular energy accounts. With the desire to municipalities make strategic energy plans, this trend is increased

- Energinet.dk, The Danish Energy Association, the Danish District Heating Organization, the energy companies and a number of consultancy firms draw energy accounts for parts of the energy system, in connection with specific analyzes and balance sheet

Energy accounts must **always** balance

Energy flows
into the system

Storage

Consumption

Export of energy
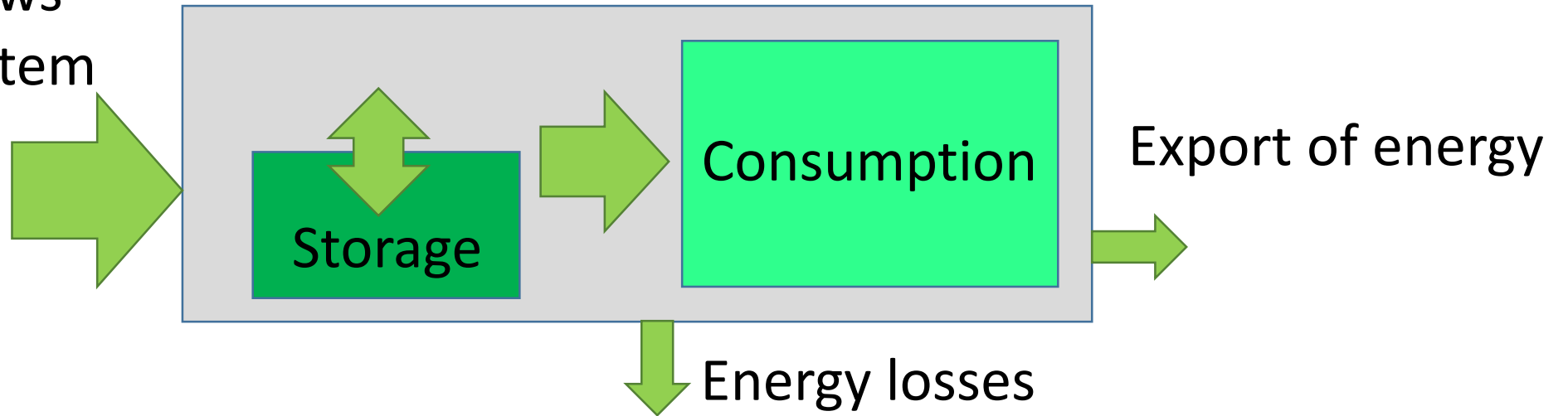
Energy losses

energy imports = consumption + storage movements + losses + exports

The financial accounts includes various currencies. The energy accounts includes various types of energy

- Coal, oil, natural gas, biomass, wind, electricity, district heating, gas, etc.

- The forms of energy that are not processed, we call "Primary enfergy"

- The forms of energy that are processed so that they become more manageable and usable, we call "secondary energy"

- The lost energy is heat that is not converted into energy services

Primary energy				Local primary energy	Secondary energy				Loss
Oil	Coal	Natural gas	Nuclear E.	Renewable E.	Renewable E.	Electricity	Dis. heating	Pet. products	Synthetic fuels	Loss

Just as the financial accounts are broken down into a number of different types of income and expense items - are energy accounts broken down into different types of segments:

- Consumption Sectors: Domestic, Transport, Trade & Service and Industry and its subdivisions

- Types of energy services: Heating, cooling, lighting, pumping, PC, etc.

- Energy Conversion Systems: Wind turbines, central power plants, decentralized CHP, etc.

- The exchange and storage: Export, import and storage movements

In the same way that it is difficult for non-experts to get an overview of the economic accounts, it is also difficult to know the energy balance

- We have therefore developed the E2G platform, that among other things, visualizes the energy balance through a picture of the total energy flows

- In the visualization, it is possible to put notes into the energy flow pictures, so that the user can easily obtain further information regarding accounts

In the same way as for the financial accounts, we most often use worksheets to describe the energy accounts

- There are many types of spreadsheet models to calculate the energy accounts, and unfortunately it is not always that there is consistency between the principles used to structure and define the various items in the models

- For users of the accounts it would be much easier if we could agree on accounting principles, in the same way as it is on the economics area

- Energy-Together concept is also intend to create this consensus

In the following slides we exam energy accounts for a larger geographic area. The energy accounts are covering a year but could cover other time periods
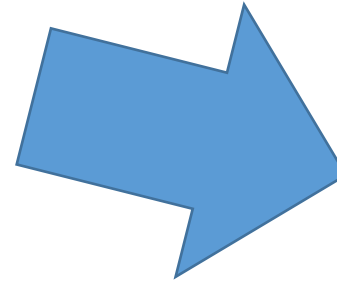
- The spreadsheet used as example was developed by the SEP project for municipalities in South Denmark, but the structure is almost the same as those used by the DEA and the consulting companies
- We always start with the demand side, where energy is converted into energy services
- So we investigate the losses in the transport system
- Then we look at the part of the energy system, where the energy is converted from primary energy to secondary energy
- Finally, we look at export and import and storage movements, and in this context we also make the total energy balance

In the spreadsheet we insert the annual consumption of different types of energy (coal, oil, electricity, etc.) divided into segments (transport, households, etc.), which the DEA uses in connection with the establishment of the Danish energy accounting
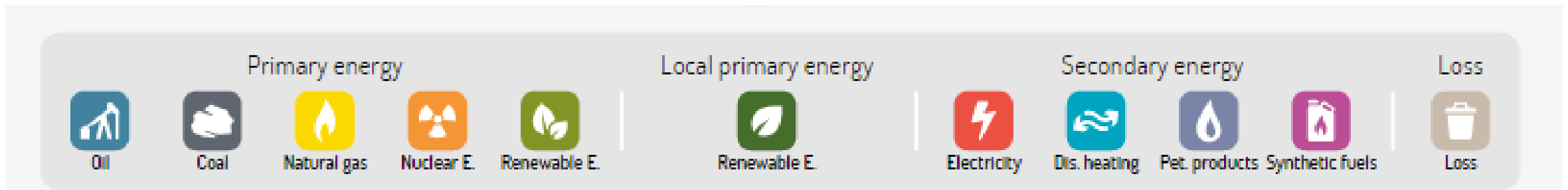
Final consumption of different energy forms						Consumption-categories
Coal	Natural Gas	Power	District heating	Etc.	Etc.	
						Transport
						Households
						Trade & Services
						Agriculture & Industry
						Non-energy purposes

The E2G platform visualizes this part of the energy balance in the following manner

Final consumption of different energy forms						Consumption-categories
Coal	Natural Gas	Power	District heating	Etc.	Etc.	
						Transport
						Households
						Trade & Services
						Agriculture & Industry
						Non-energy purposes

The thickness of flows corresponding to the input data regarding energy consumption in the spreadsheet

Transport
Household
Commerce and services
Agriculture and Industry
Non-energy purposes

Primary energy
Oil   Coal   Natural gas   Nuclear E.   Renewable E.

Local primary energy
Renewable E.

Secondary energy
Electricity   Dis. heating   Pet. products   Synthetic fuels

Loss
Loss

In the spreadsheet we insert for each type of conversion (wind turbines, decentralized CHP, etc.) the amount of secondary energy (electricity, district heating, etc.) produced and the amount of energy in the form of coal, oil, biomass, etc.. which are consumed in the conversion
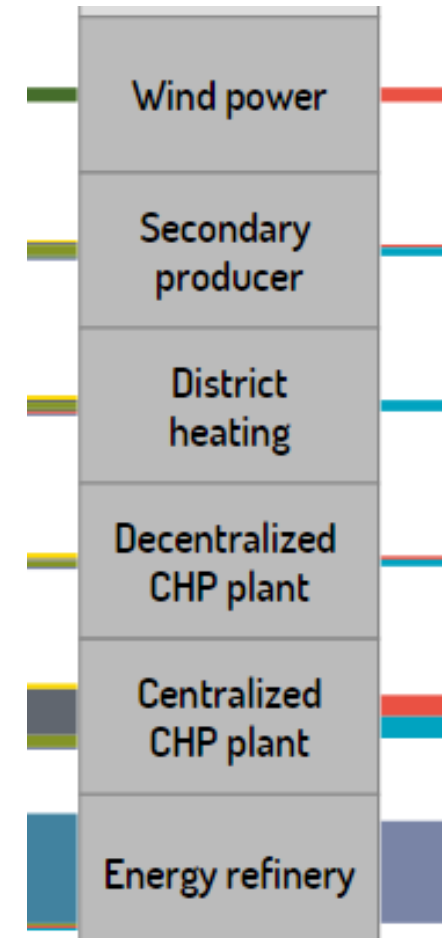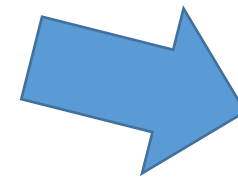
Energy into the conversion system

Energy output from the conversion system

Primary energy converted					Types of conversion units	Secondary energy produced			
Coal	Oil	Biomass	Etc.	Etc.		Power	District heating	Etc.	Etc.
					Wind Turbines				
					Decentralized CHP				
					Centralized CHP				
					Etc.				
					Etc.				

The E2G platform visualizes this part of the energy balance in the following manner

Primary energy converted					Types of conversion units	Secondary energy produced			
Coal	Oil	Biomass	Etc.	Etc.		Power	District heating	Etc.	Etc.
					Wind Turbines				
					Decentralized CHP				
					Centralized CHP				
					Etc.				
					Etc.				

The thickness of flows corresponding to the input data regarding energy conversion in the spreadsheet
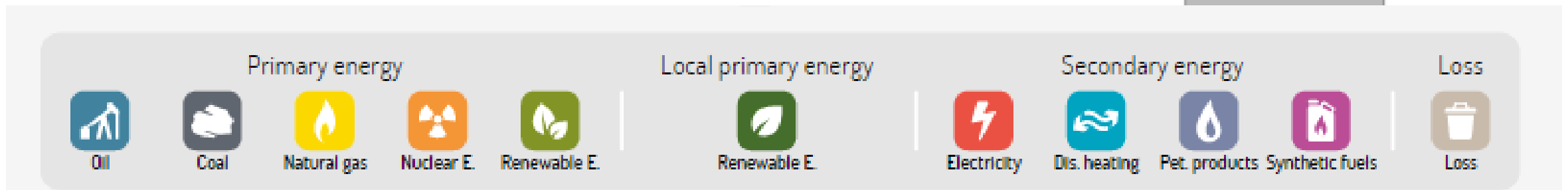
Managing internal consumption

- Internal consumption of secondary energy sources produced in a given conversion plant, deducted production, so that only net production displayed

- Consumption of secondary forms of energy in conversion plants that do not produce these energy forms appear as an input to the plant, and deducted output from the total production sent out from the entire conversion system

- The example on the right shows electricity used for production of district heating and oil products, and that this power is deducted from the total amount of electricity that is sent out of the conversion system. Internal consumption, for example for the central CHP plants, does not figure as a power flow into the plants, but deducted the output from the plants, so that the net production in the example, 60 PJ
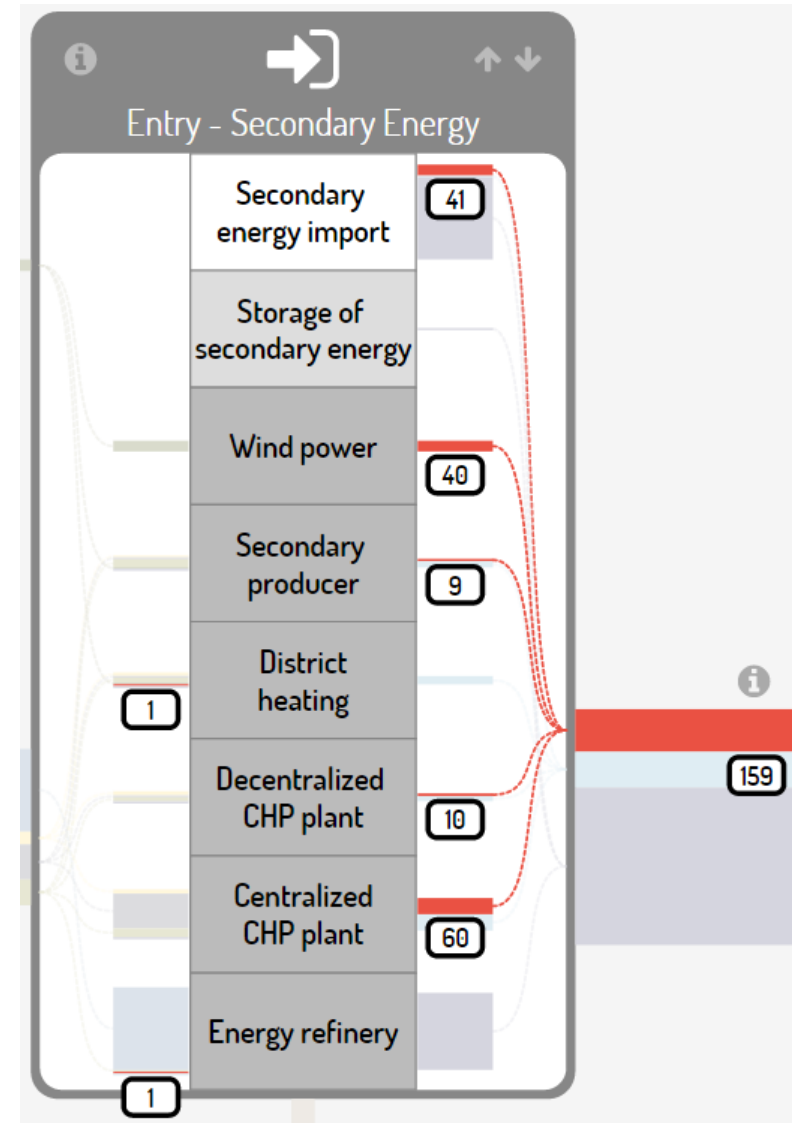
The total consumption of primary energy is found by adding the quantity of primary energy used in final consumption and the quantity of primary energy used in the conversion stage

Primary energy input to conversion					Conversion units	Production of secondary energy			
Coal	Oil	Biomass	Etc.	Etc.		Power	District heating	Etc.	Etc.
					Wind Turbine				
					Decentralized CHP				
					Centralized CHP				
					Etc.				
					Etc.				

Primary energy converted to end use					Consumption categories
					Transport
					Households
					Trade and Services
					Agriculture and Industry
					Non-energy purposes

Total consumption of primary energy				
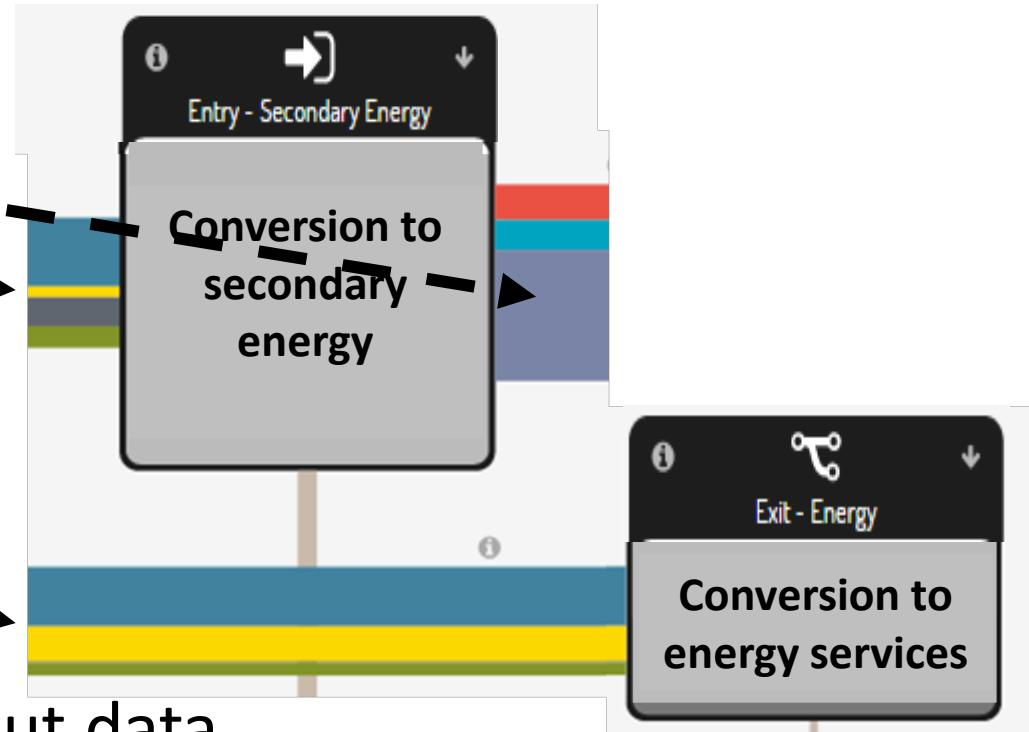
The E2G platform visualizes this part of the energy balance in the following manner

The thickness of flows corresponding to the input data regarding energy consumption in the spreadsheet
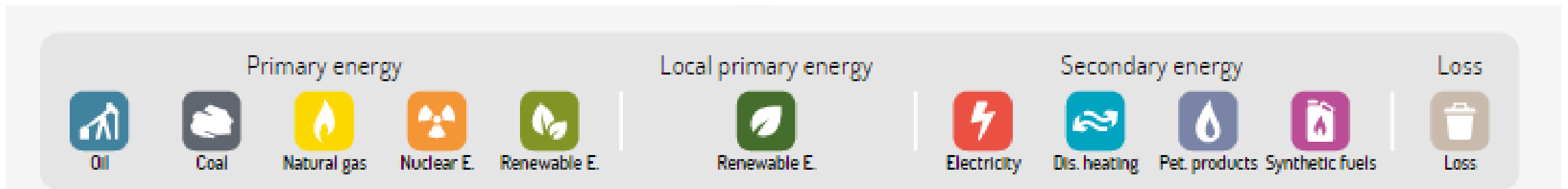
Statement of balance: Example electricity

Electricity balance	Electricity consumption	Electricity production
Final consumption		
Transport losses		
Export		
Conversion technology 1		
Conversion technology 2		
Etc.		
Import		
Balance		

The balance is calculated for all secondary forms of energy. For the energies, where appropriate, storage movements are included in the balance

The spreadsheet for the Danish Energy Accounts is available at the following address:

http://www.ens.dk/en/info/facts-figures/energy-statistics-indicators-energy-efficiency/annual-energy-statistics