

ESS study for Denmark



Danish energy system characteristics year 2000

Power sector

- Large share of coal (43%) and natural gas (24%)
- Extensive use of combined heat and power (very efficient power plants).
- Large share of wind (18 %)

Residential sector

- Generally good insulation
- Warming mainly from combined heat and power and natural gas boilers, only little cooling (not needed so far north)
- Extensive use of electrical appliances

Personal transport

- Large car park, small and medium sized cars
- Good public transport
- Little use of domestic air and ship transport (but large international use)

Freight transport

- Major transport mode is medium / large truck
- Little use of rail, plane and ship for domestic transport



Future baseline trend.....

Relative constant emissions of about 50 Mt CO₂/yr in the next decades since emissions and economic growth are decoupled



Countermeasure vision: Green and Dynamic

- Danish population remains stable
- Generally unchanged urban/rural structure
- Economic growth of 2-3 %
- Little change in primary, secondary and tertiary sector. Strong focus on R&D.
- Strong public support for use of renewables and new energy technologies, high status on environmental sound behavior.
- People are ready to change habits if it benefits the environment.
- People still wants to maintain the convenient lifestyle obtained at the beginning of the 21st century
- People are happy with the European working environment and would like also to have time with family and friends.
- Economic wealth is attractive, but most people have already reached a high living standard
- Denmark continues to have very high equality and there is strong public support for the social welfare system.

Power sector - changes

- Reduced fossil fuel use
 - Increased efficiency
 - Large-scale use of CCS
 - Significant increase in renewables
- Electricity emission factor decreases from 1,65 to 0,12 MtC/Mtoe

Share of electricity supply		2000	2050
Total		100%	100%
COL		43%	20%
Oil		3%	3%
Gas		24%	10%
NUC		0%	0%
HYD		0%	1%
HYD(P)		0%	0%
GEO		0%	3%
BMS		11%	23%
S/W		18%	40%
Thermal Efficiency			
COL		38,6%	44,0%
OIL		35,1%	38,0%
GAS		37,9%	65,0%
BMS		25,6%	40,0%

Residential sector – key demand changes

- Reduction in space heating (46 %)
- Reduction in hot water heating (28%)
- Reduction in lighting (28%)
- Small increase in appliances use (5%)

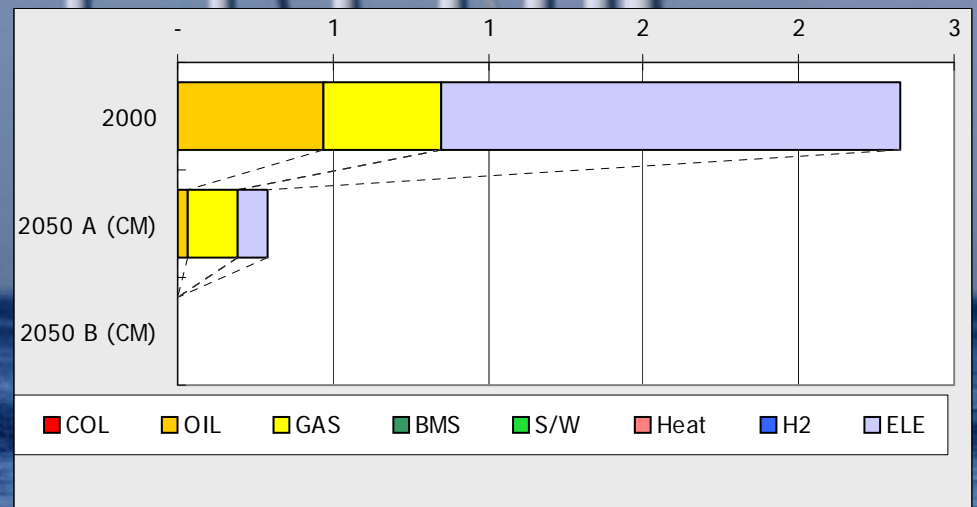
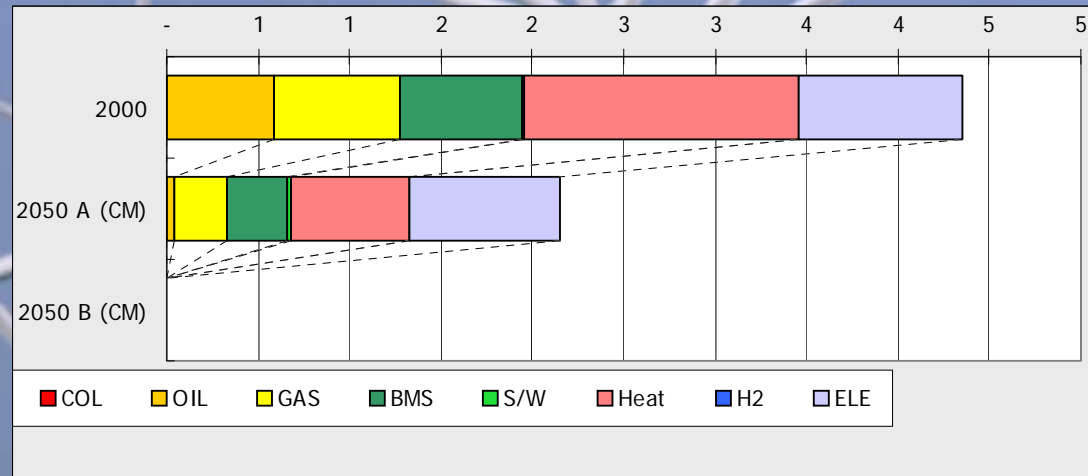


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Results for residential sector

- Reduction in energy consumption of ~ 50%

- Reduction in CO2 emissions of ~ 90%



Passenger transport – changes in demand

Demand changes

- Slight decrease in car use
- Increase in bus and rail use.

	Unit	2000	2050					
			REF		CM		CM/REF	
			A	B	A	B	A	B
Motorbike	B p-km	0	0		0	0	100%	
Car	B p-km	61	49		49	0	100%	
Bus	B p-km	13	17		17	0	100%	
Railway	B p-km	5	11		11	0	100%	
Aviation	B p-km	1	1		1	0	100%	
Maritime	B p-km				0	0	100%	

Passenger transport – changes in service share and efficiency

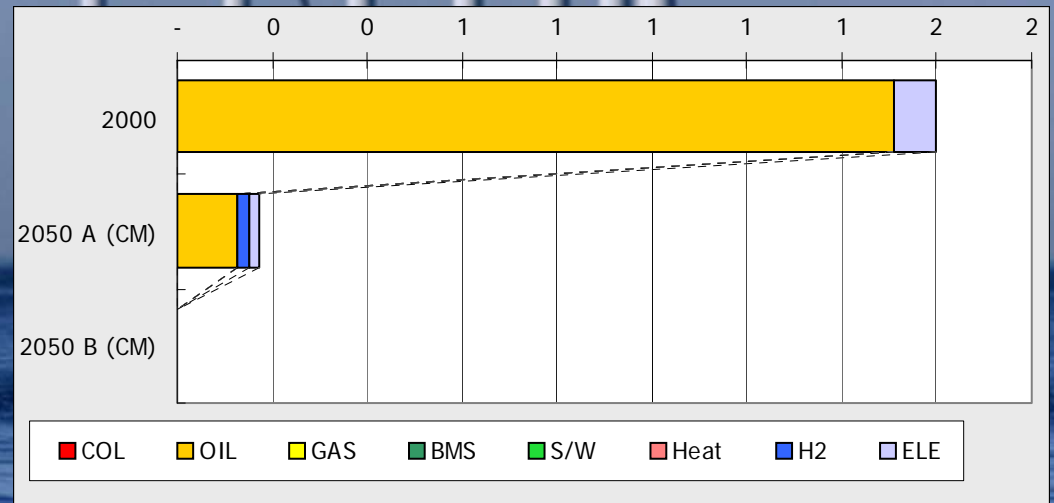
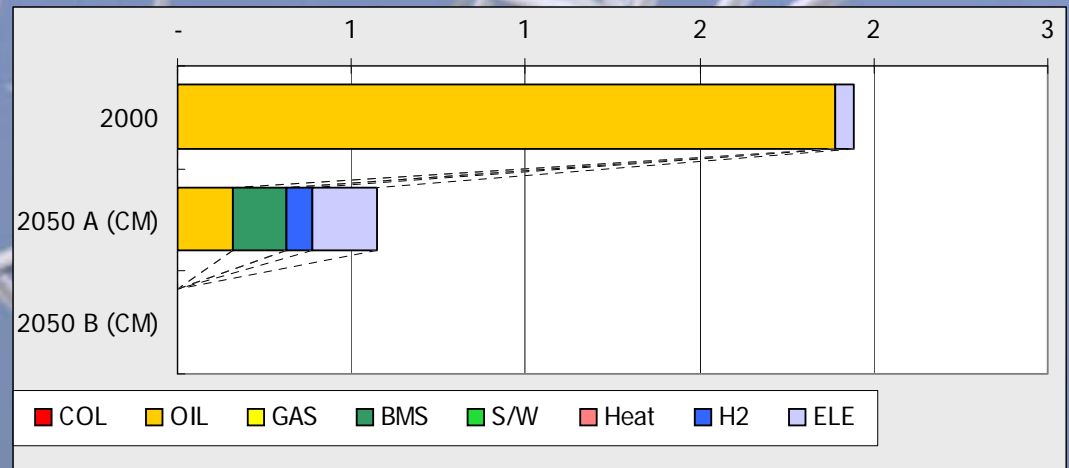
	Unit	2000									2050 A-scenario											
		COL	OIL	GAS	BMS	S/W	Heat	H2	ELE	Total	COL	OIL	GAS	BMS	S/W	Heat	H2	ELE	Total			
Motorbike	-	100%								100%	30%				30%	10%				30%	100%	
Car	-	96%								4%	100%	30%				30%	20%				20%	100%
Bus	-	100%								100%	10%				30%	20%				40%	100%	
Railway	-	71%								29%	100%	5%				5%	90%				100%	
Aviation	-	100%								100%	30%				70%						100%	
Maritime	-									0%		30%				70%						100%
	-									0%												0%
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Results for passenger transport

- Reduction in energy consumption of ~ 70%

- Reduction in CO2 emissions of ~ 90%



Freight transport – changes in demand

Demand changes

- Slight increase in use of large freight vehicles
- Slight increase in rail use

	Unit	2000	2050					
			REF		CM		CM/REF	
			A	B	A	B	A	B
Small Freight Vehicle	B t-km	0	0		0		100%	
Large Freight Vehicle	B t-km	18	21		21		100%	
Freight Train	B t-km	2	3		3		100%	
Freight Ship	B t-km	1	1		1		100%	
Freight Air	B t-km	0	0		0		100%	

Freight transport - changes in service share and efficiency

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Results for freight transport

- Reduction in energy consumption of ~ 70 %

- Reduction in CO2 emissions of ~ 90%

