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Danish Energy Policy and Renewable Energy

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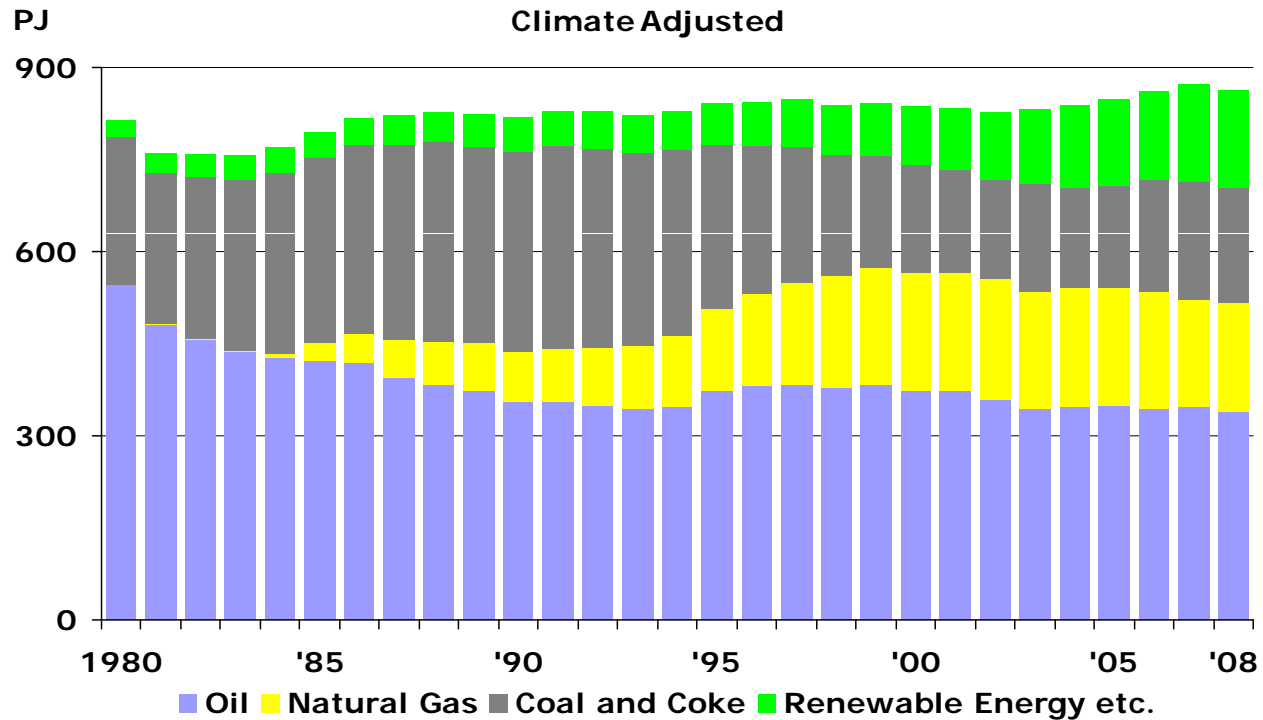
Danish Energy Policy and Renewable Energy



Poul Erik Morthorst
Risø National Laboratory
The Technical University of Denmark

Denmark in Perspective

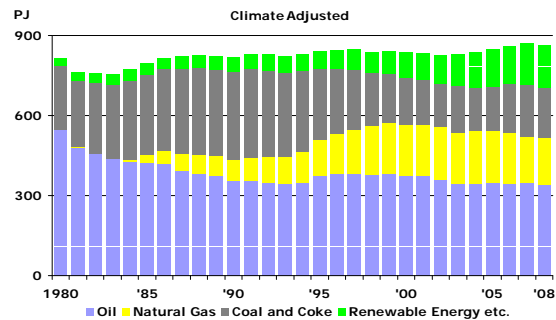
Gross Energy Consumption by Fuel



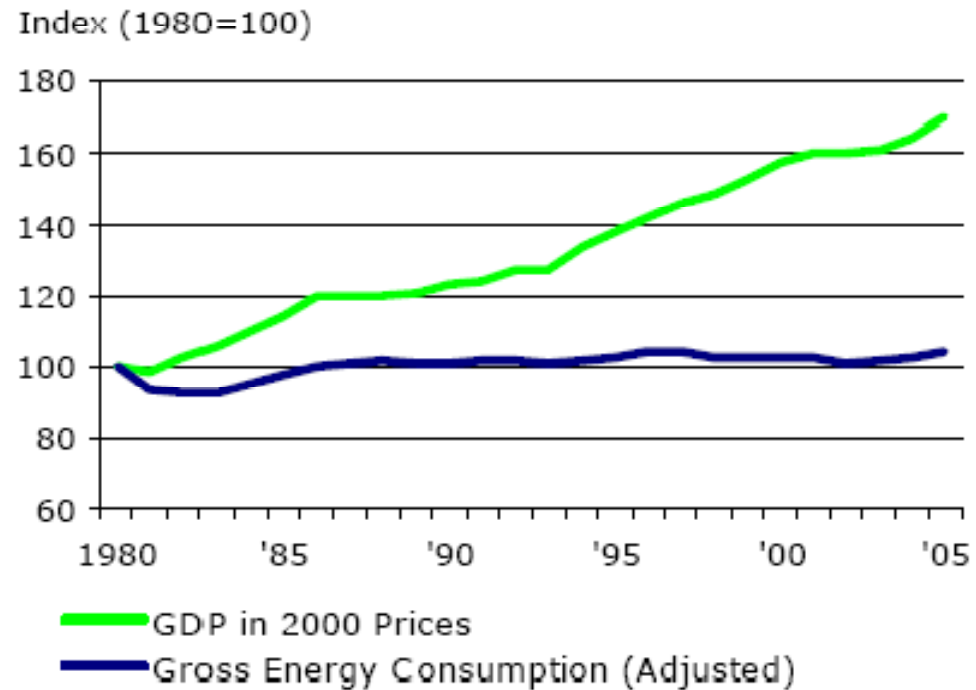
Source: The Danish Energy Authorities

Constant Energy Consumption in spite of strong growth in GDP

Gross Energy Consumption by Fuel



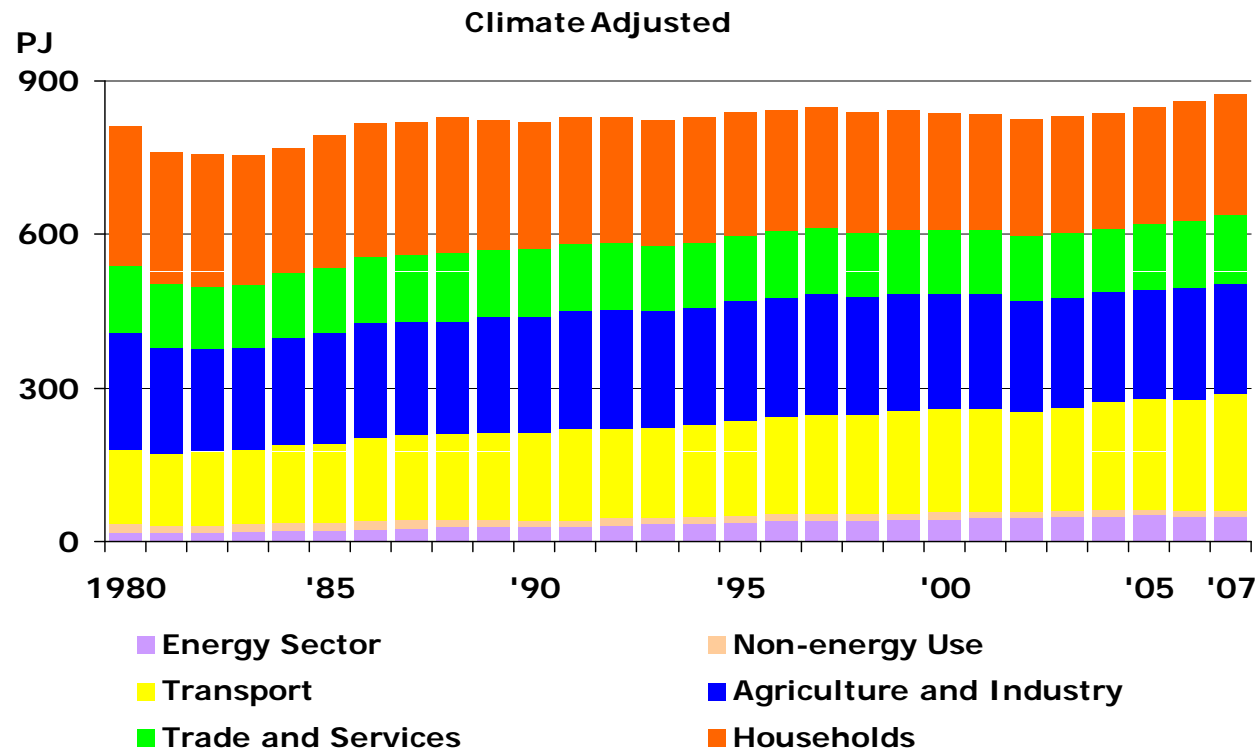
GDP and Gross Energy Consumption



Source: The Danish Energy Authorities

Gross Energy Consumption by Sectors

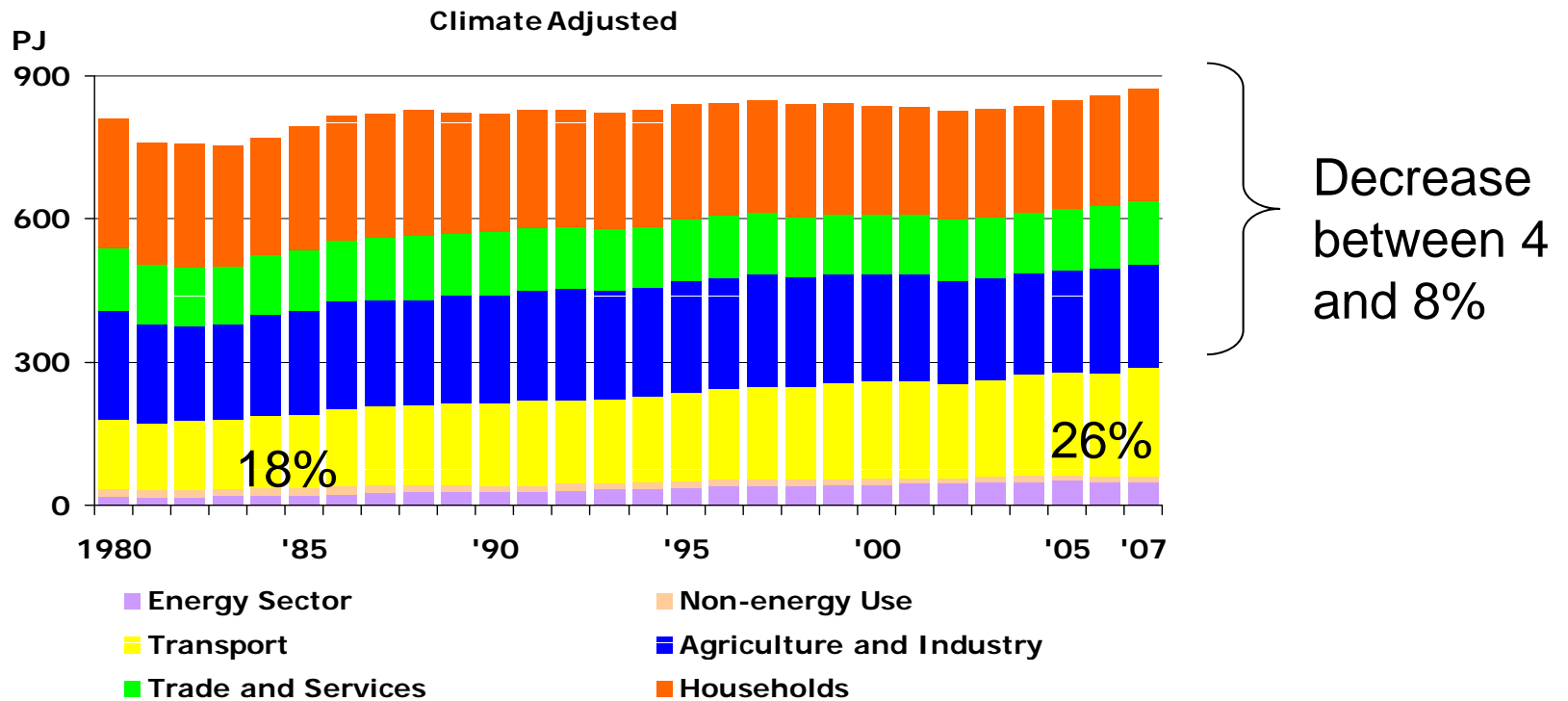
Gross Energy Consumption by Use



Source: The Danish Energy Authorities

Gross Energy Consumption by Sectors

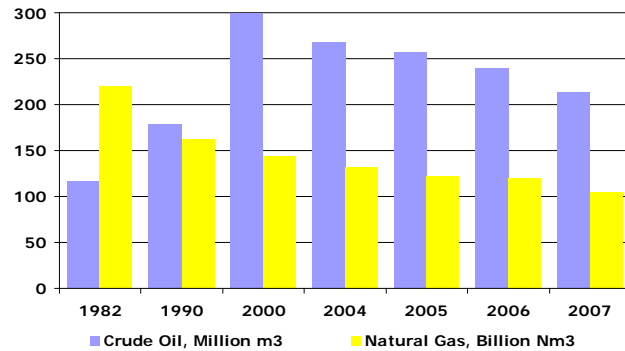
Gross Energy Consumption by Use



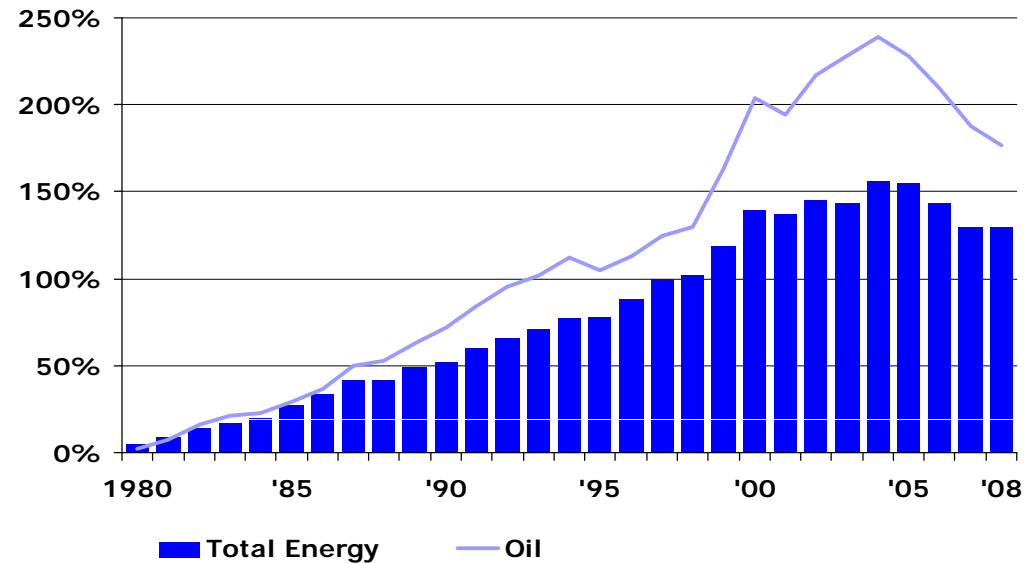
Source: The Danish Energy Authorities

Large Domestic Production of Oil and Natural gas

Oil and Gas Reserves



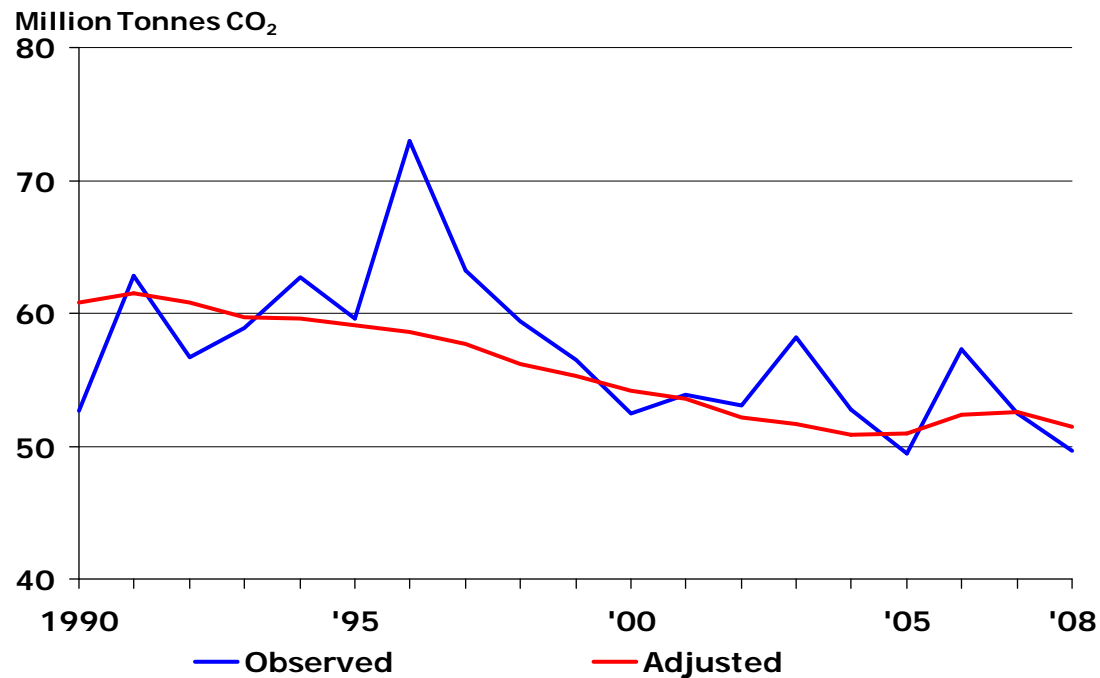
Degree of Self-sufficiency



Source: The Danish Energy Authorities

CO2-emissions

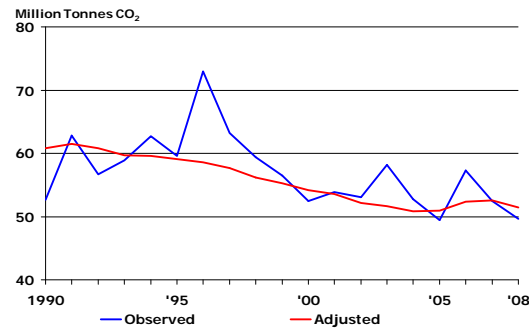
CO₂ Emissions from Energy Consumption



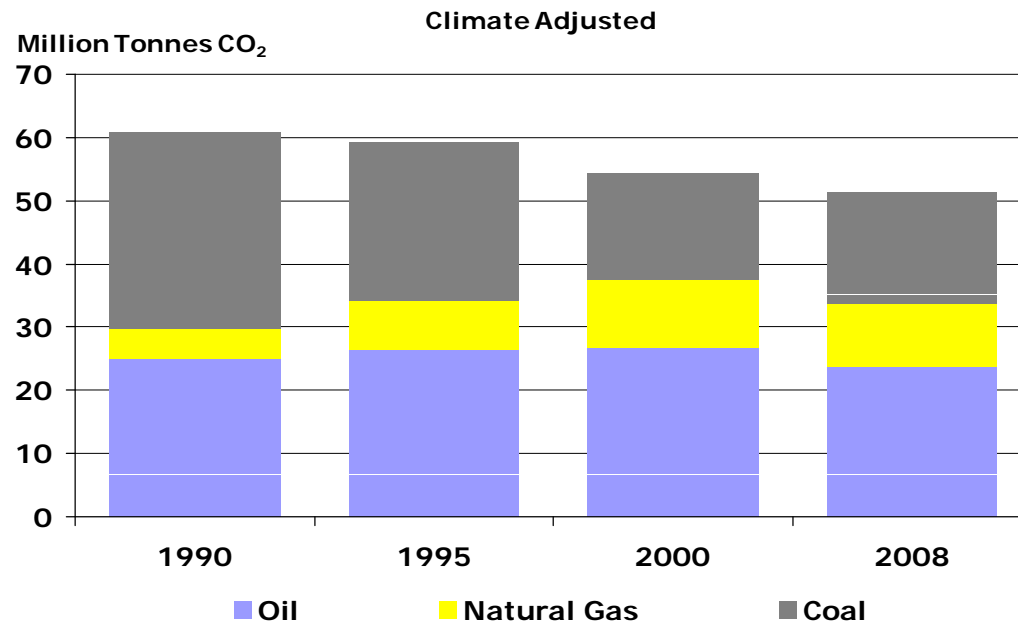
Source: The Danish Energy Authorities

CO₂-emissions

CO₂ Emissions from Energy Consumption



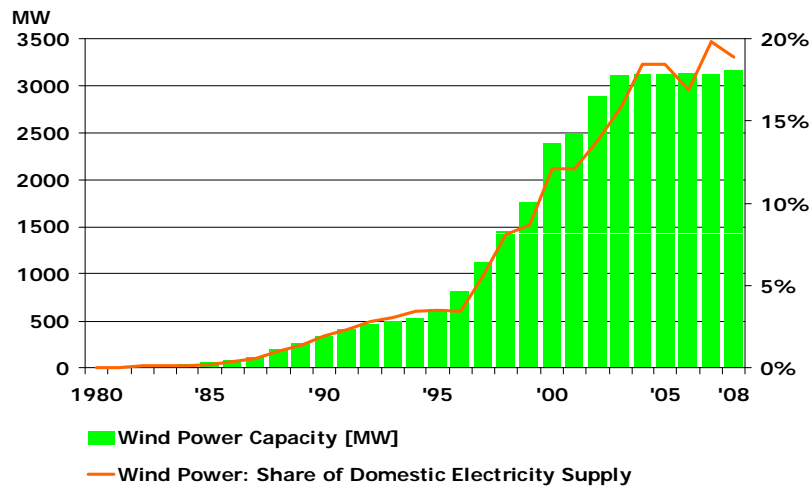
CO₂ Emissions by Fuel



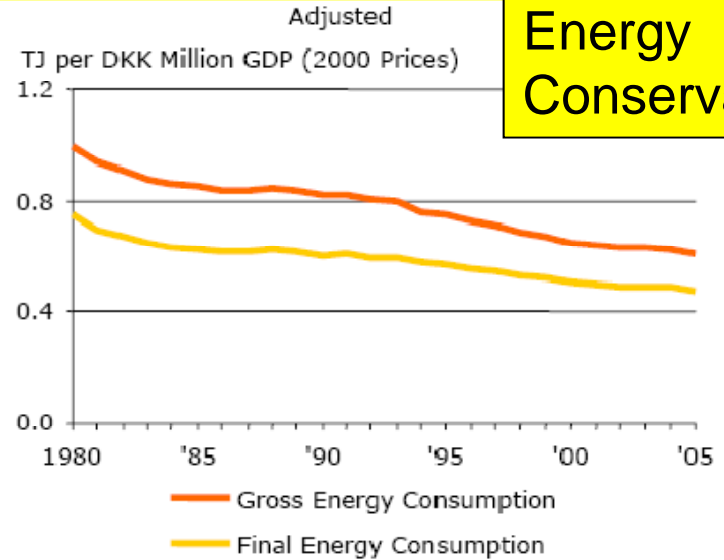
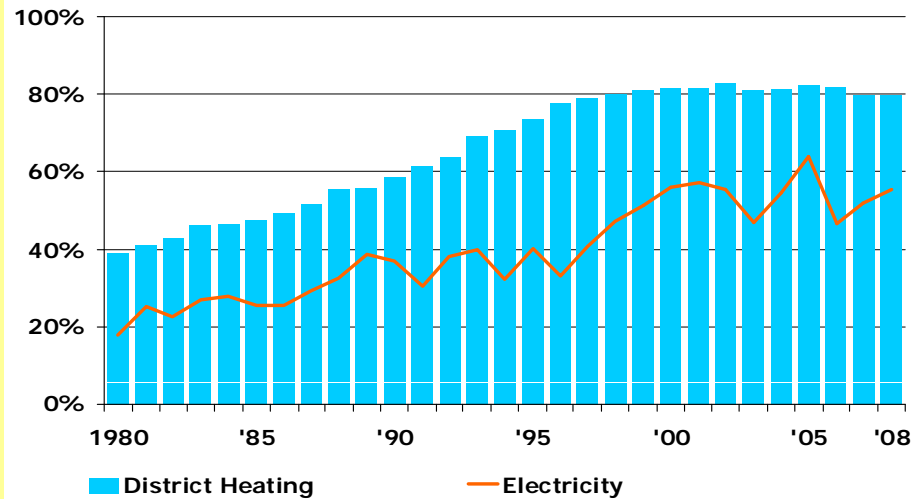
Source: The Danish Energy Authorities

Three cornerstones in Danish Energy Policy

Renewables



Combined Heat and Power



Energy Conservation

Danish Energy Policy

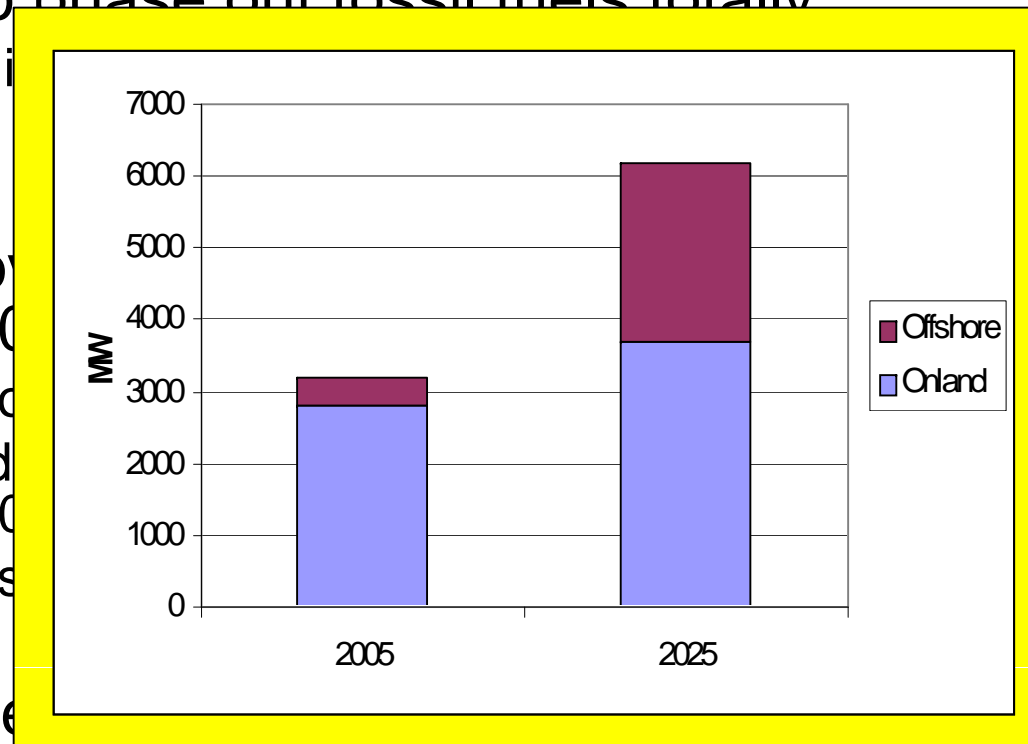
- EU 20 – 20 – 20 targets
- Energy conservation and development of new Energy Technologies
 - Stabilise gross energy consumption until 2025
- In the long term to phase out fossil fuels totally
 - Commission on climate change to give solutions by this year
- Renewables to cover 30% of Gross Energy Consumption in 2025
 - The share is approx. 15% today
 - Wind Power could cover 50% of Danish Power Consumption in 2025
 - A share of biofuels in transport of 10%

Danish Energy Policy

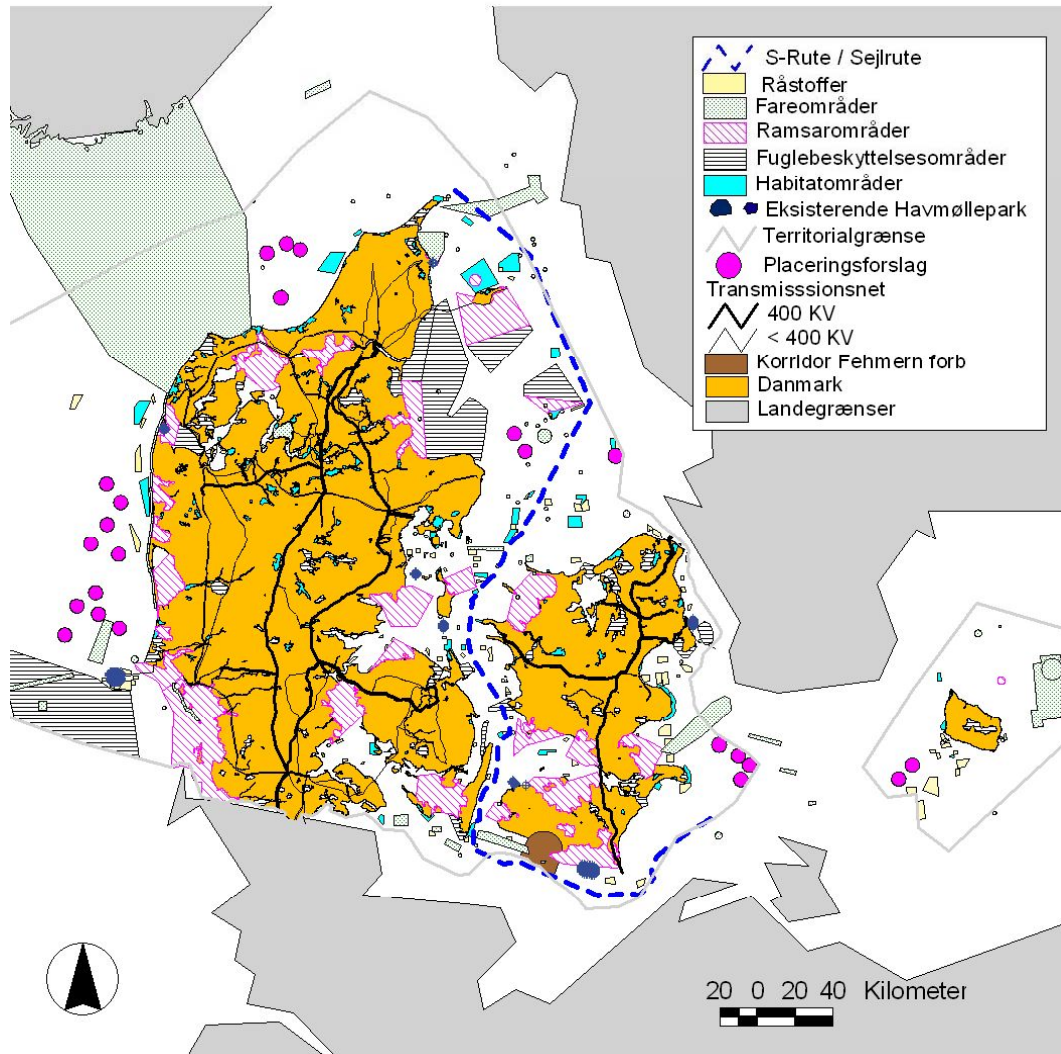
- Energy conservation and development of new Energy Technologies
 - Stabilise gross energy consumption until 2025

- In the long term to phase out fossil fuels totally
 - Commission on climate change 2005
year

- Renewables to cover 50% of total
Consumption in 2025
 - The share is approx. 40% in 2005
 - Wind Power could cover 30% of total
Consumption in 2025
 - A share of biofuels

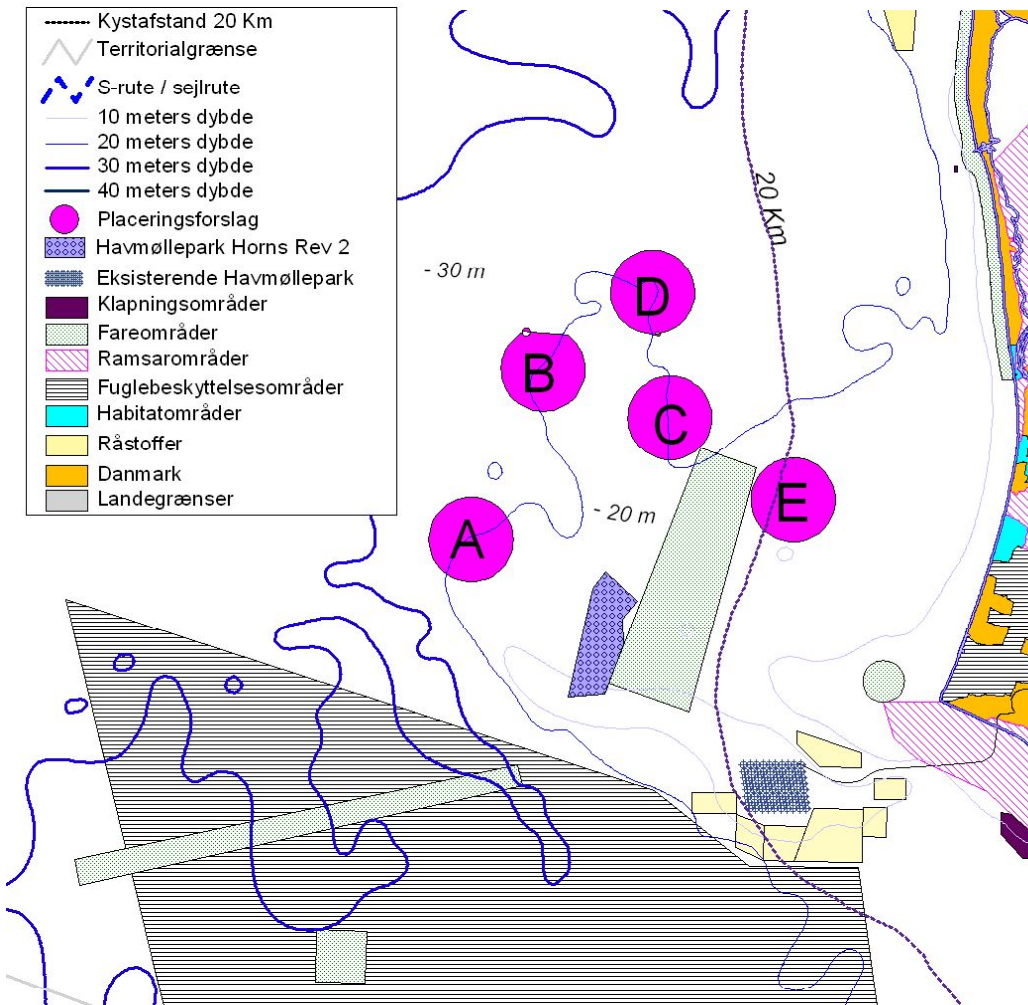


- Development of new



- 23 sites of 200 MW identified
- 4600 MW
- Equivalent to 8 % of total demand or 50% of electricity demand

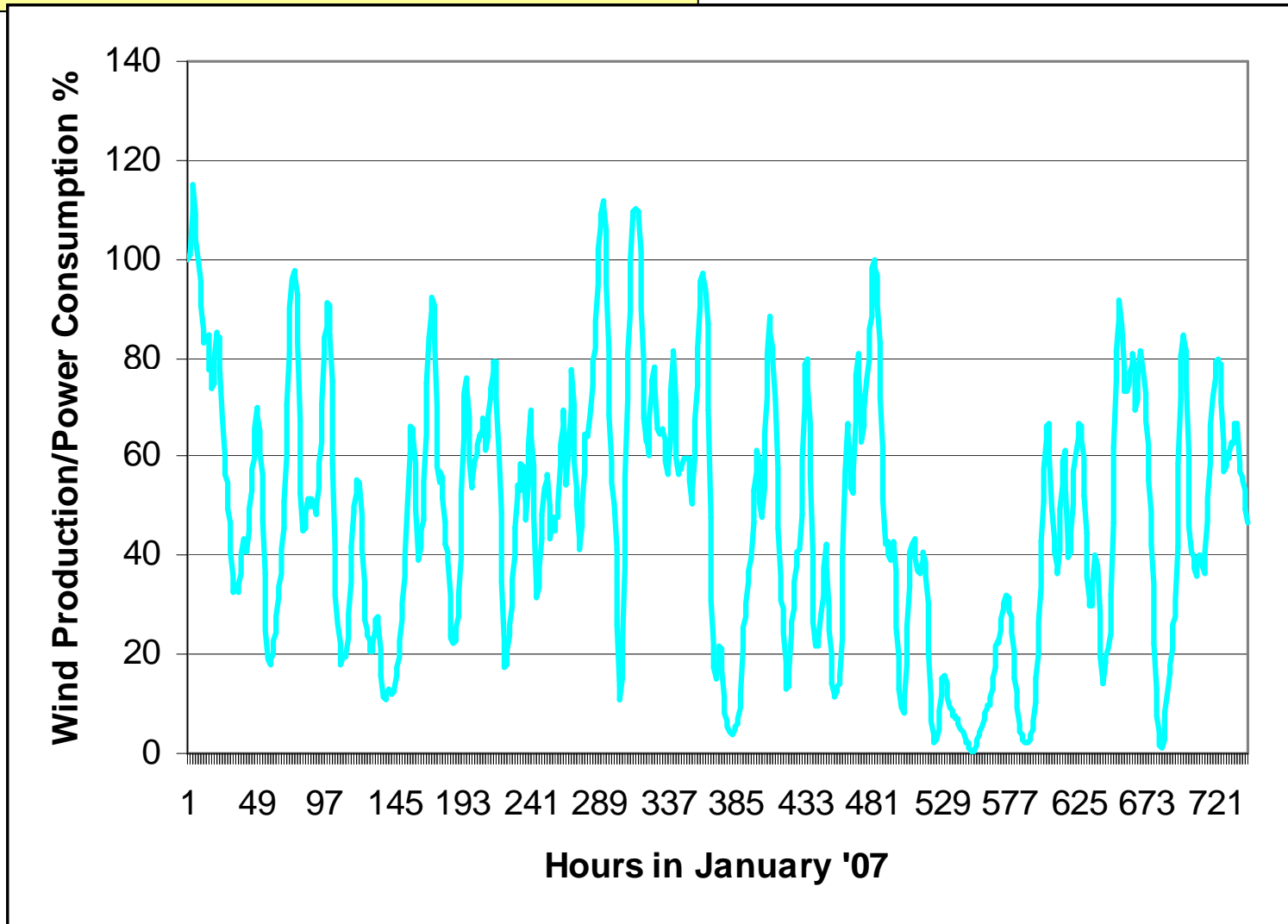
Source: The Danish Energy Authority



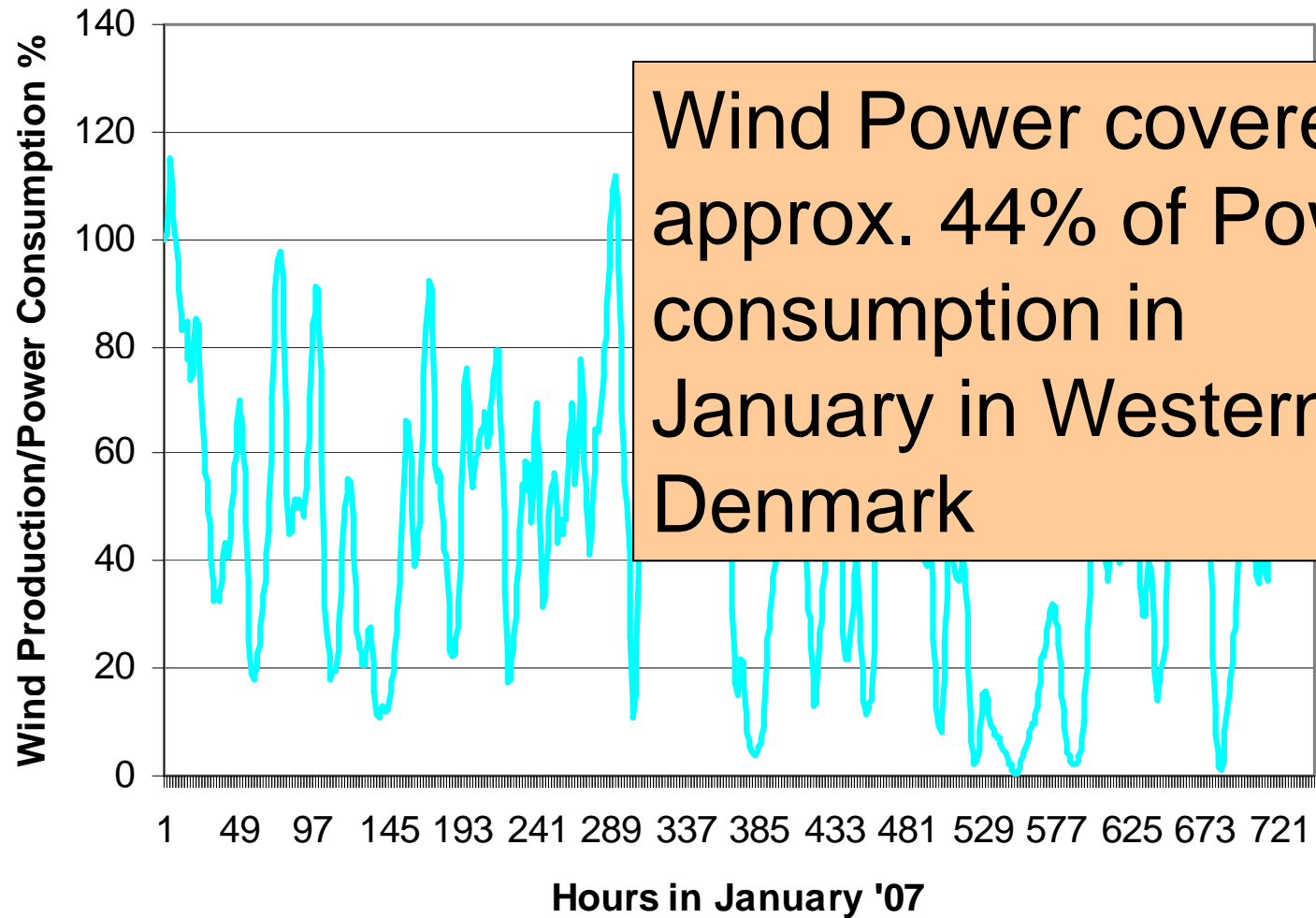
- Wind resource:
 - 10.1-10.3 m/s at 100 m
- More than 4000 full load hours
- Water dept:
 - 10-25 m

Source: The Danish Energy Authority

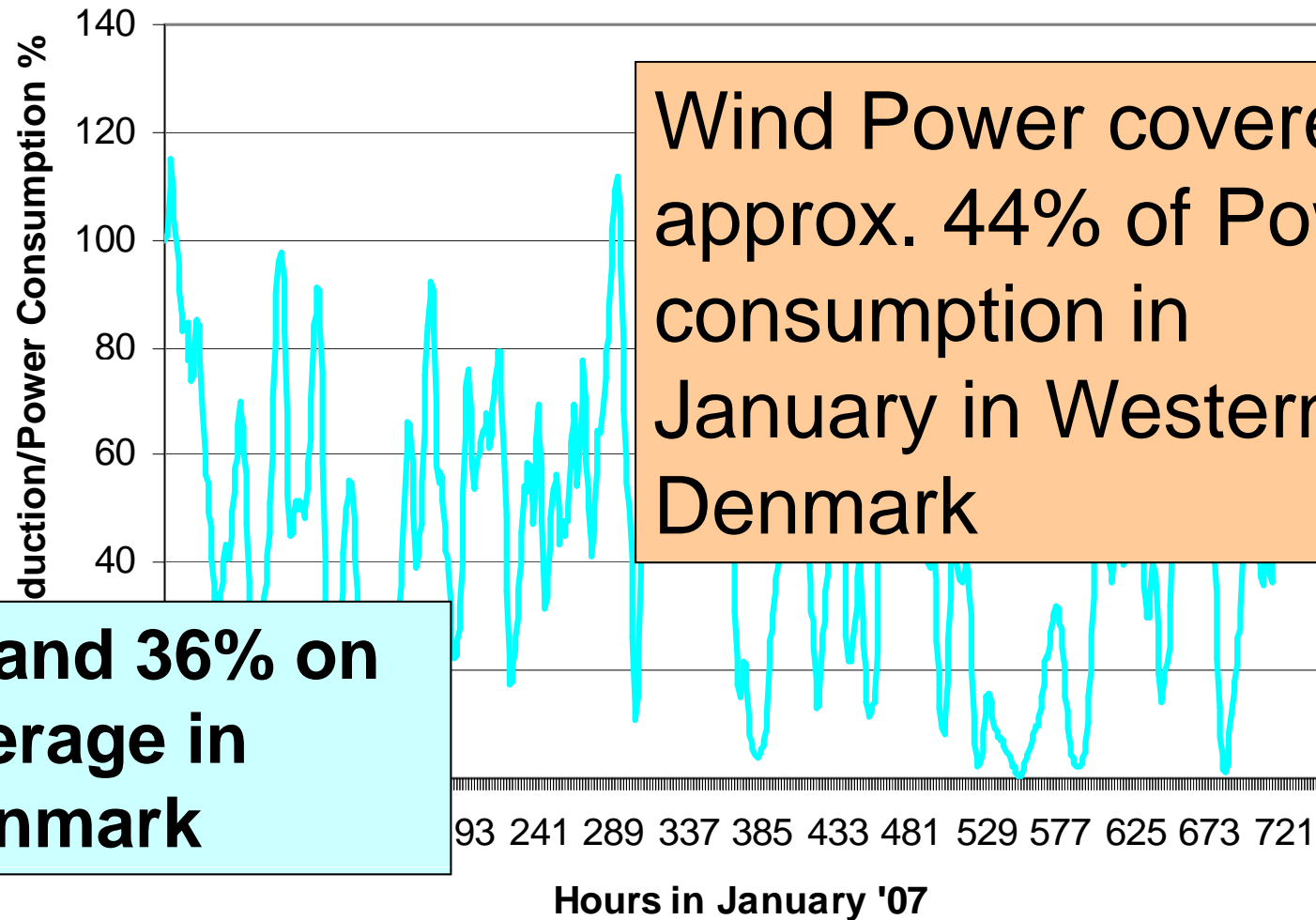
Wind power in Western Denmark



Wind power in Western Denmark



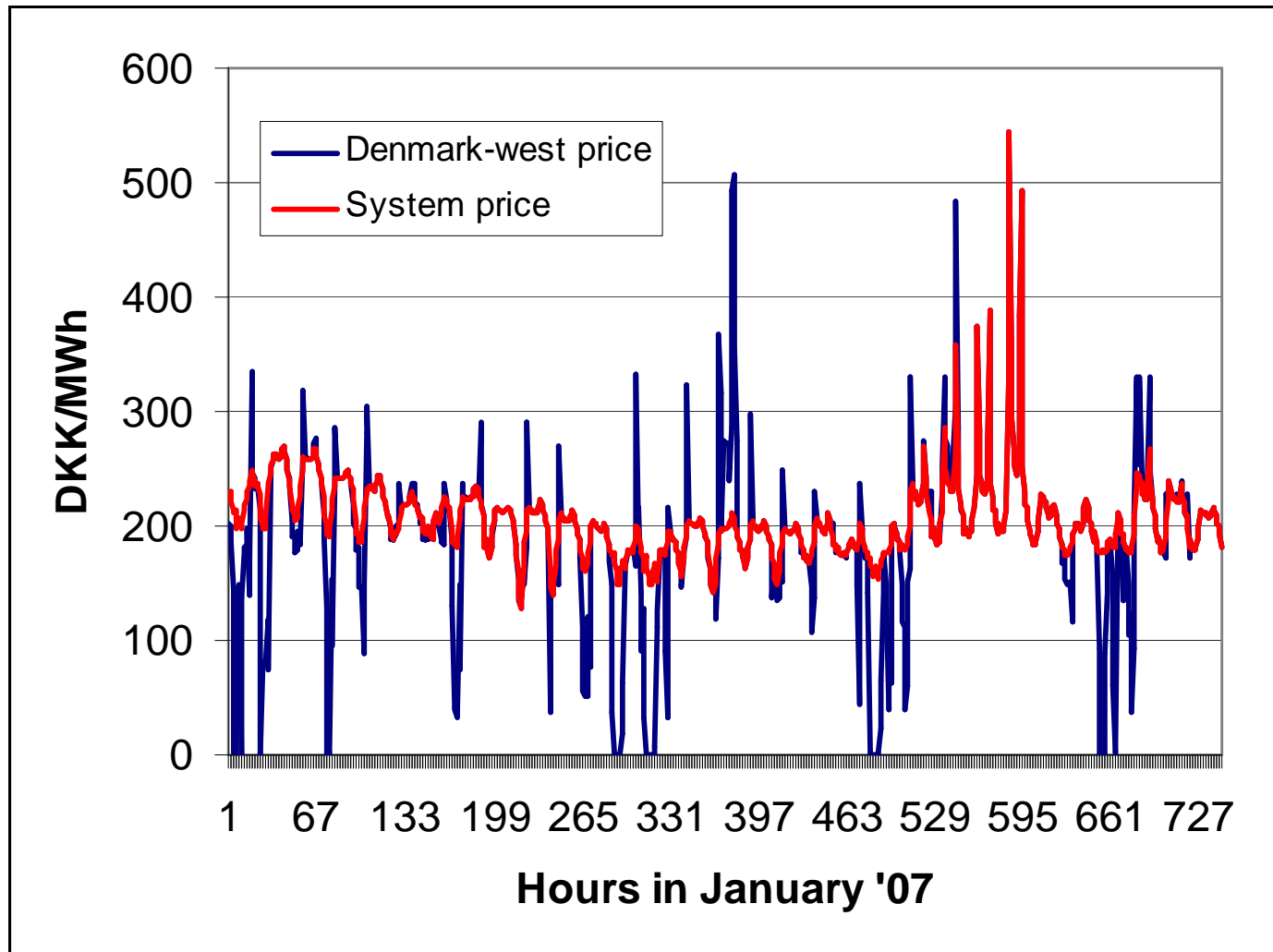
Wind power in Western Denmark



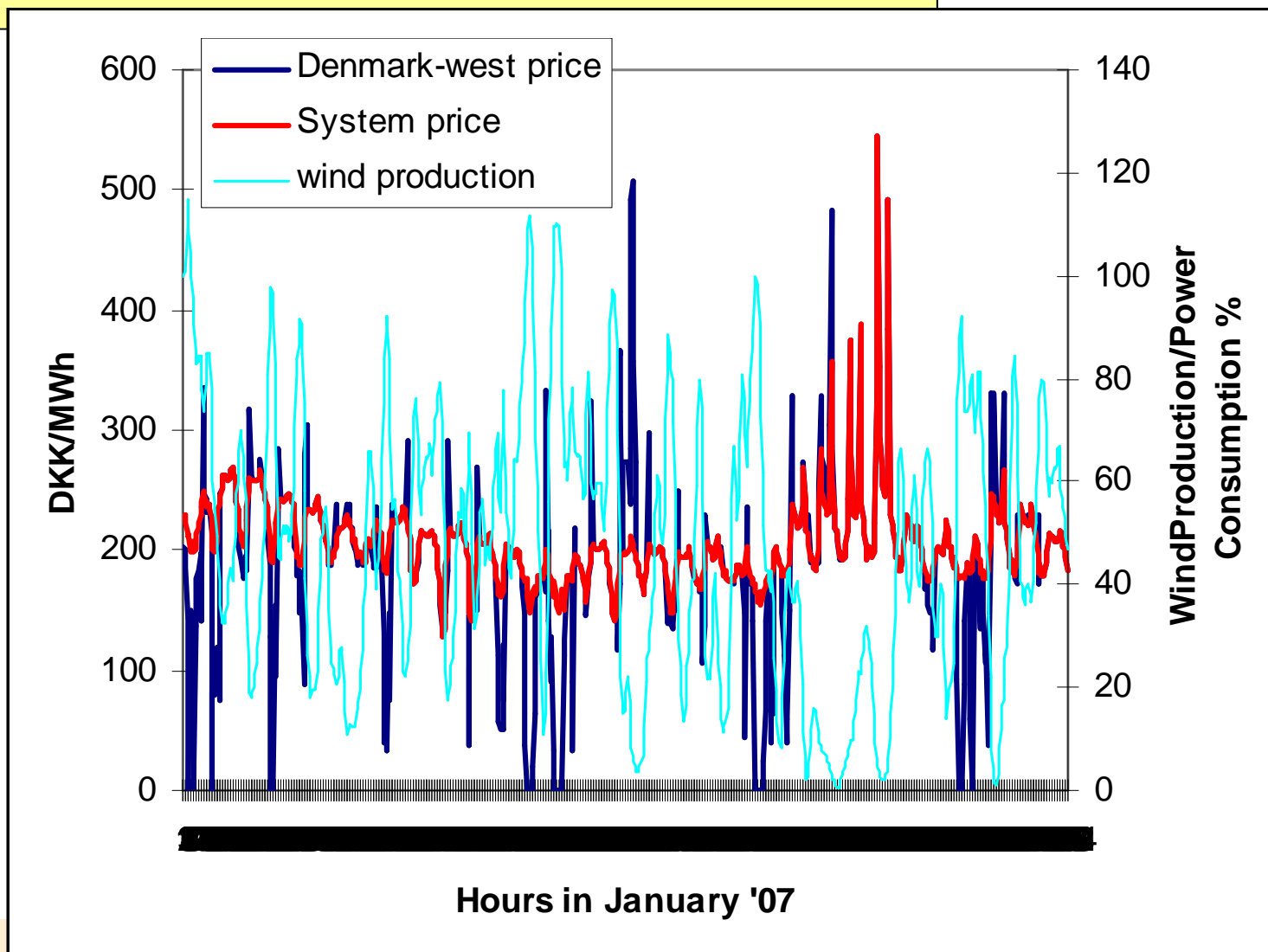
Wind Power covered approx. 44% of Power consumption in January in Western Denmark

... and 36% on average in Denmark

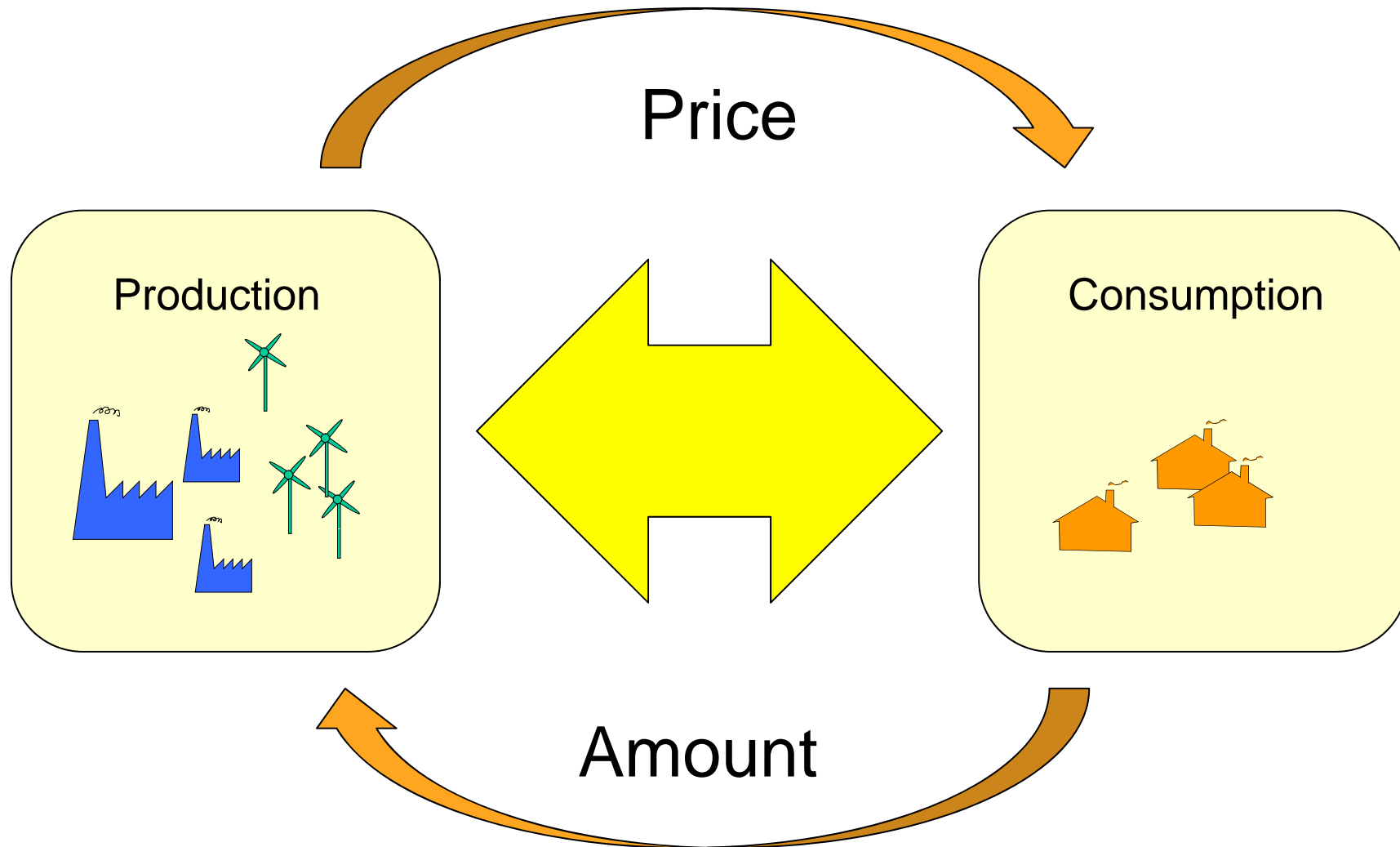
Sometimes there is a huge impact on the area spot price



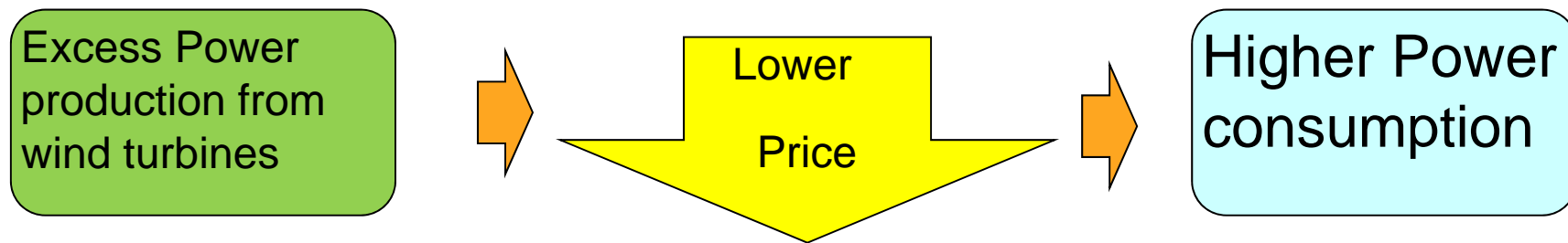
... and Wind Power certainly influences the Power spot price



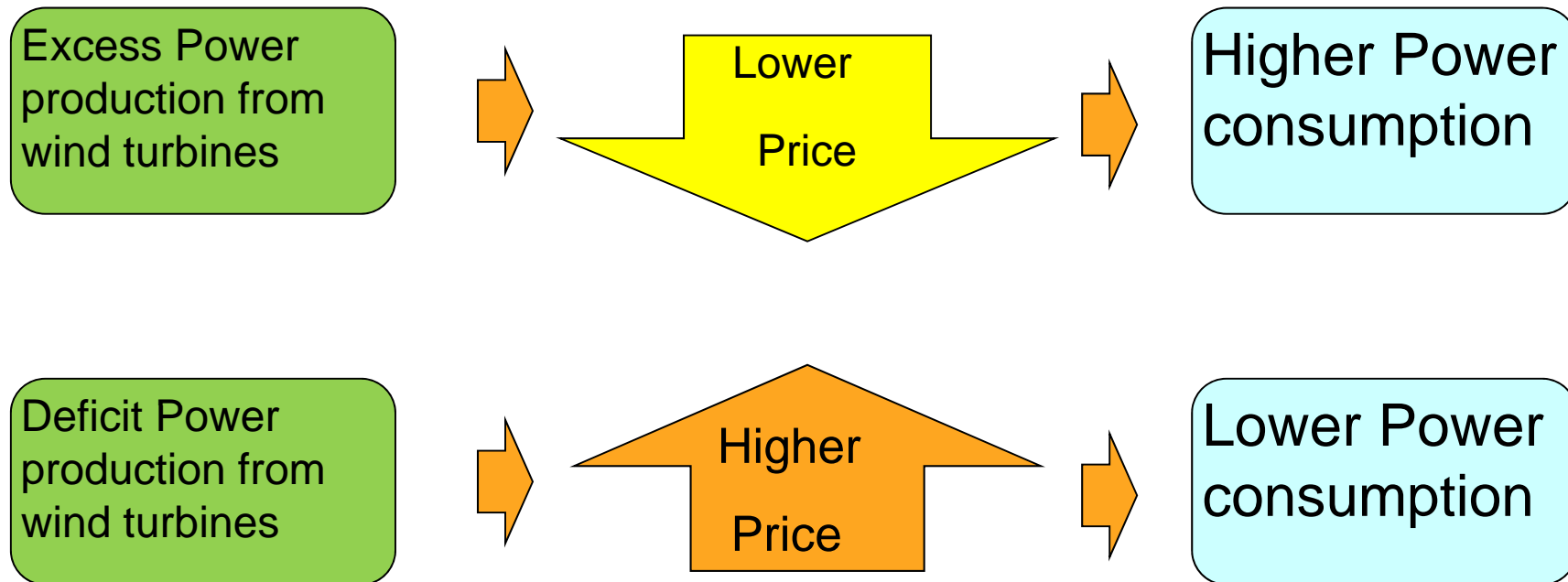
Two-Way Communication



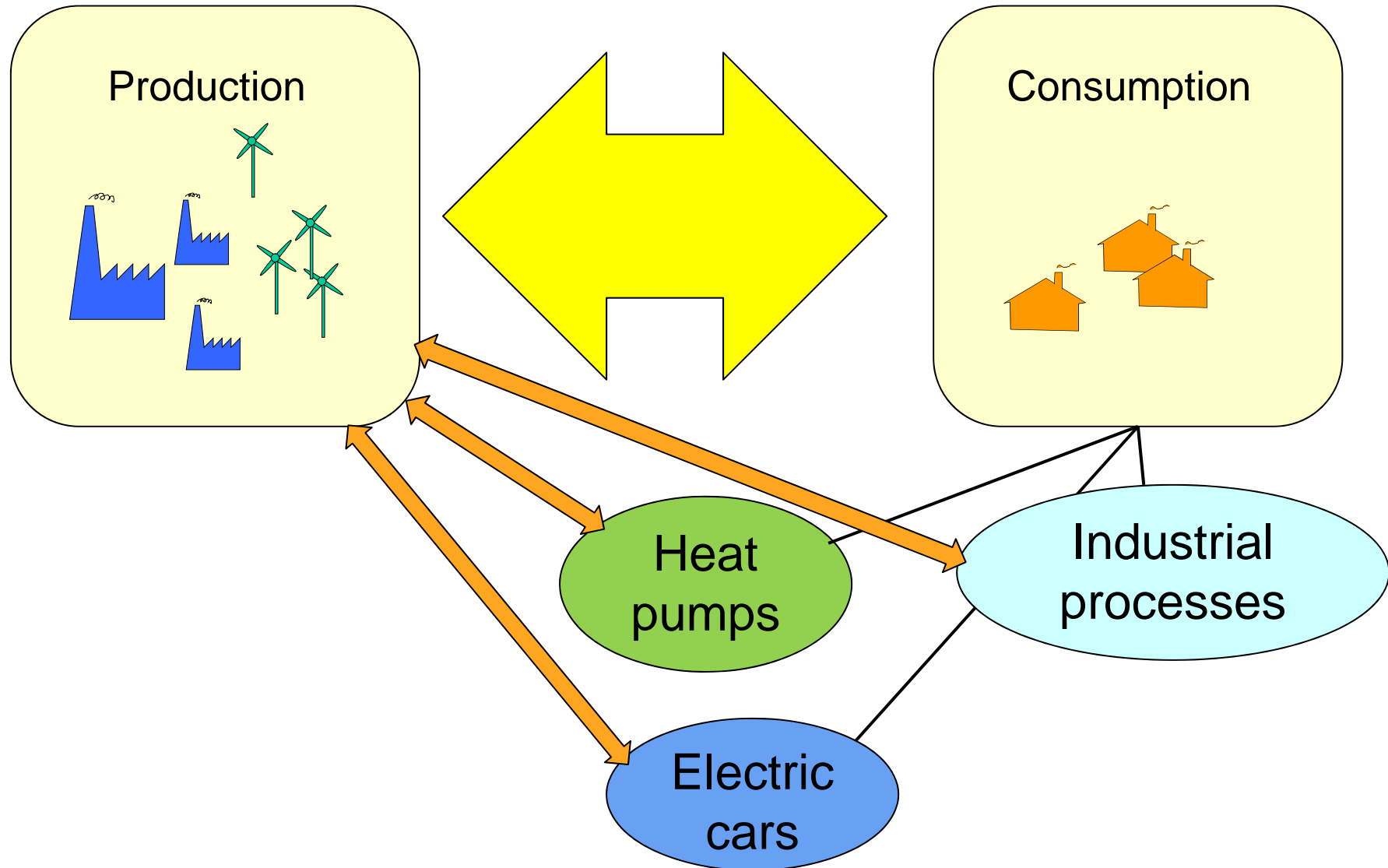
Fast Responding System



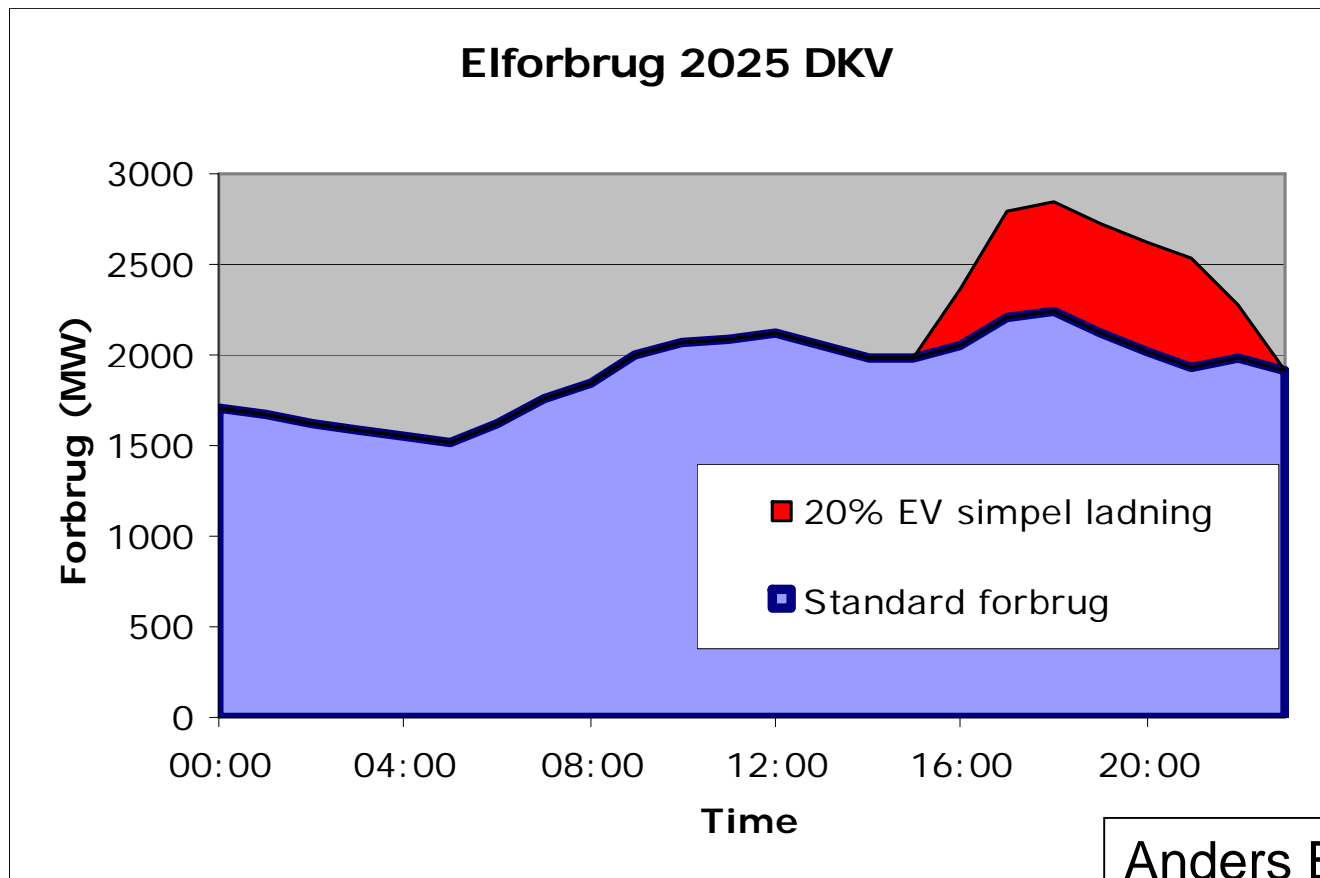
Fast Responding System



Go for Specific areas

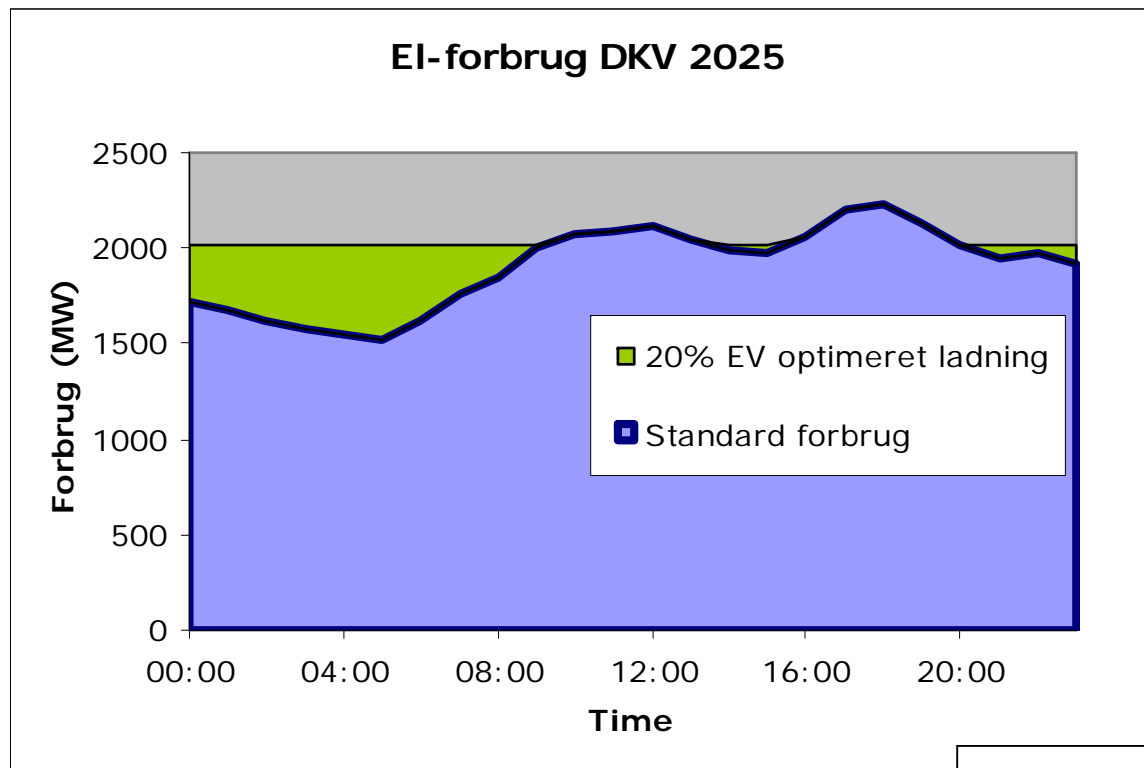


Simple Charging of Electric Cars



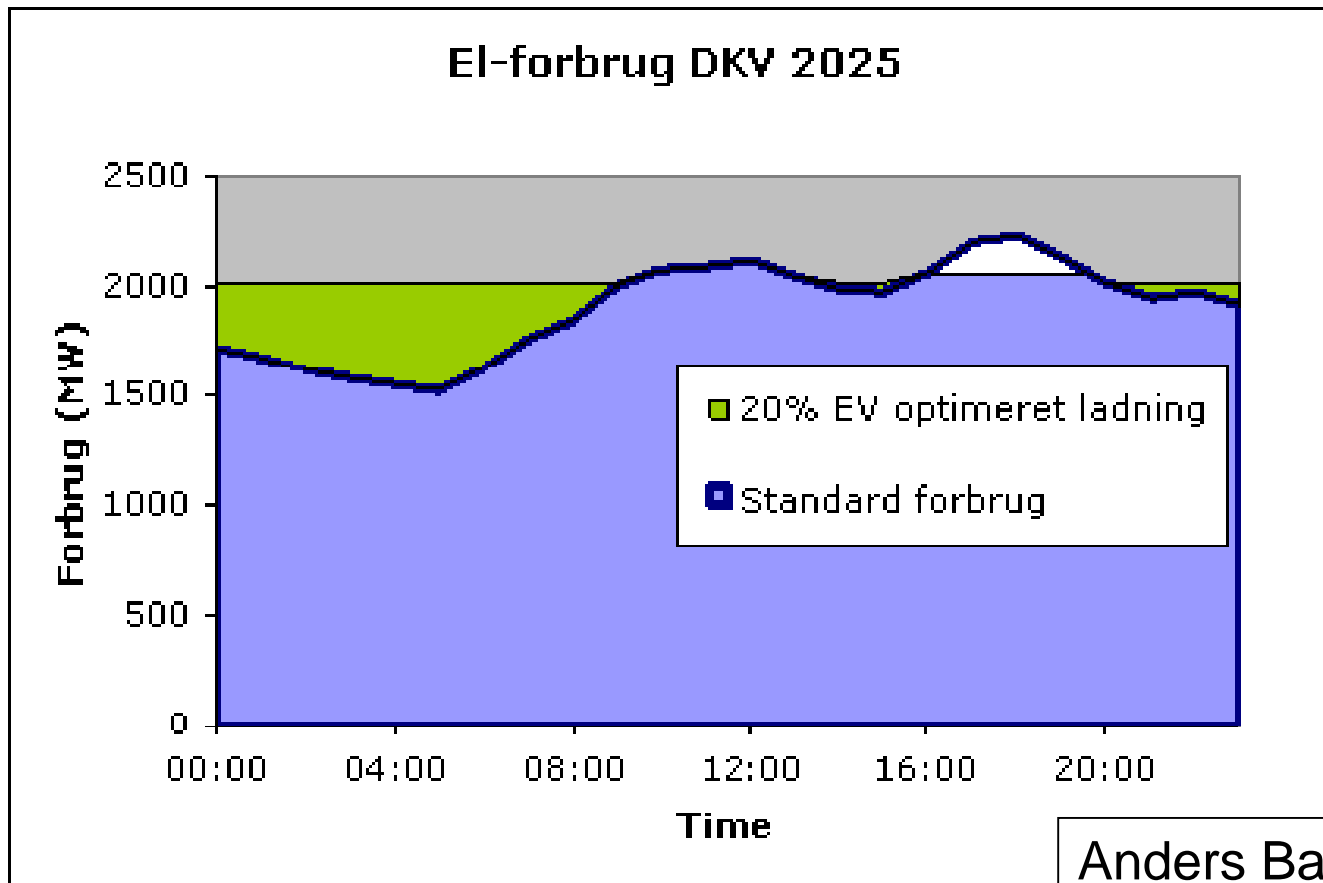
Anders Baunhøj
Hansen, Energinet.dk

Optimised Charging of Electric Cars



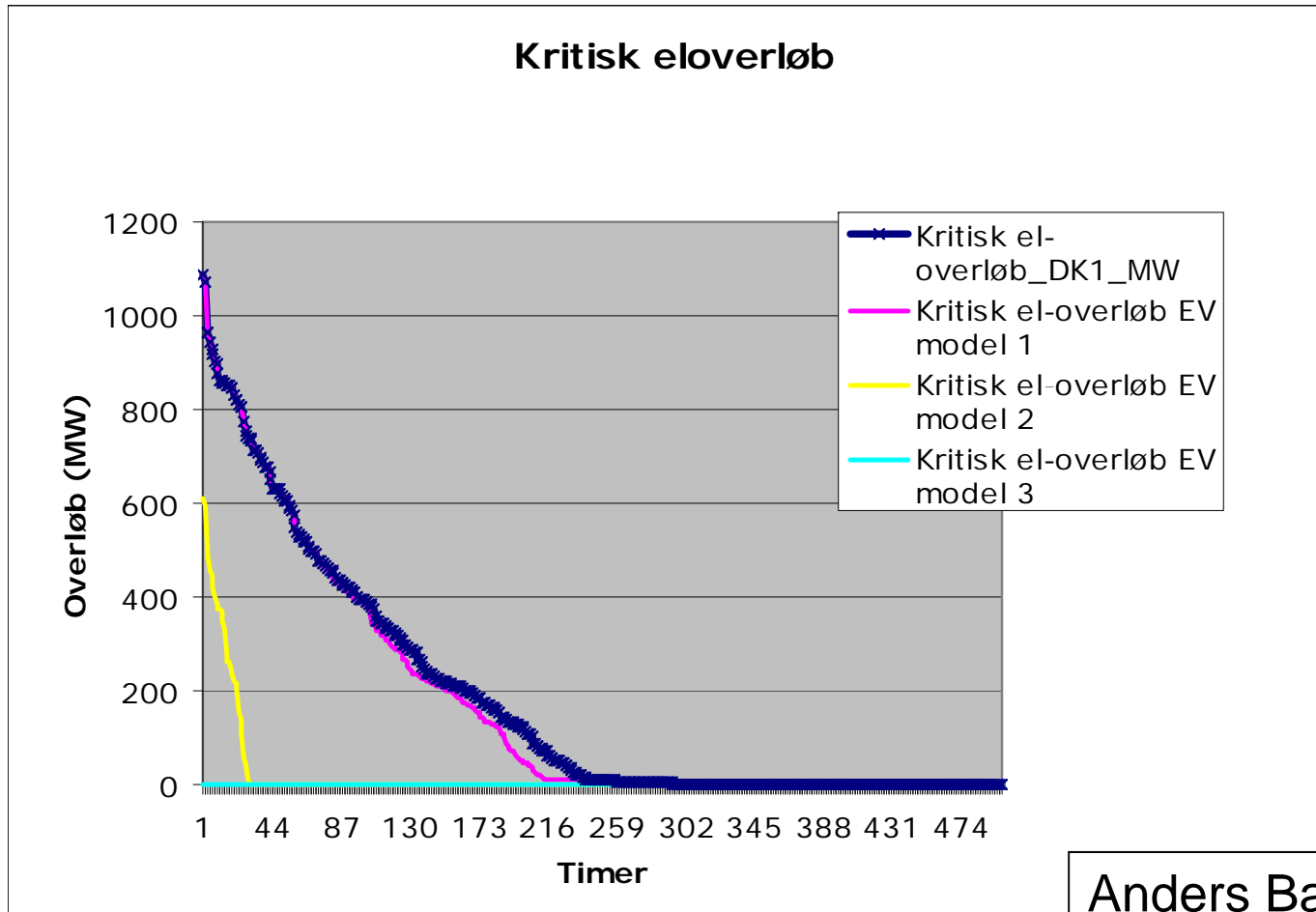
Anders Baunhøj
Hansen, Energinet.dk

Using Batteries as Storage Facility



Anders Baunhøj
Hansen, Energinet.dk

Impact on Critical Excess Power Supply



Anders Baunhøj
Hansen, Energinet.dk

Conclusions

- **Renewables will play a strong role in the future energy system**
 - Wind power, but also solar and biomass

- **To reach a fossil free future we need to develop an entirely new energy system philosophy**
 - Close connections between supply and demand

- **Political will is essential**
 - Long term targets and planning
 - Research for developing new technologies and system