

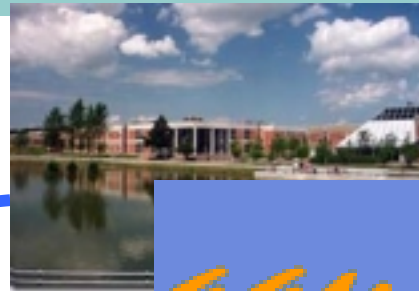
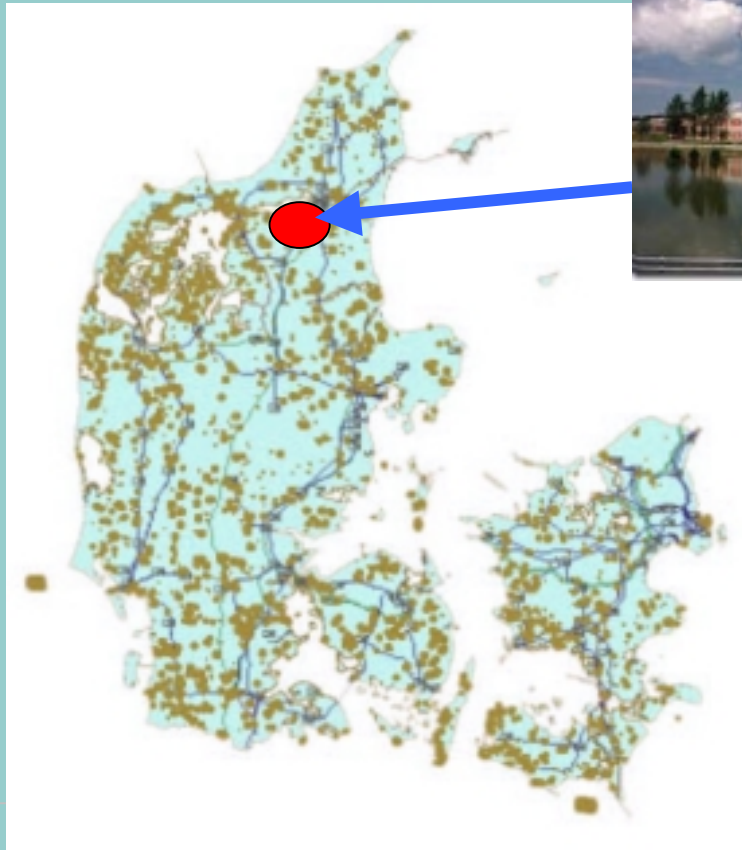
A Renewable Energy strategy for Denmark

European Nuclear –Critical Conference

11 November 2007

F. Hvelplund

Aalborg University, Denmark

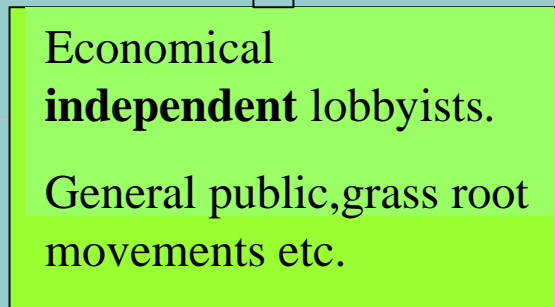
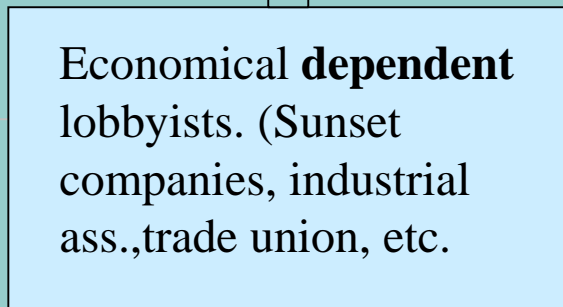
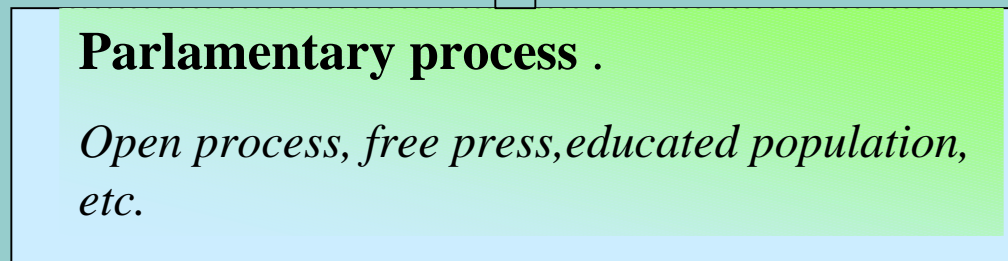
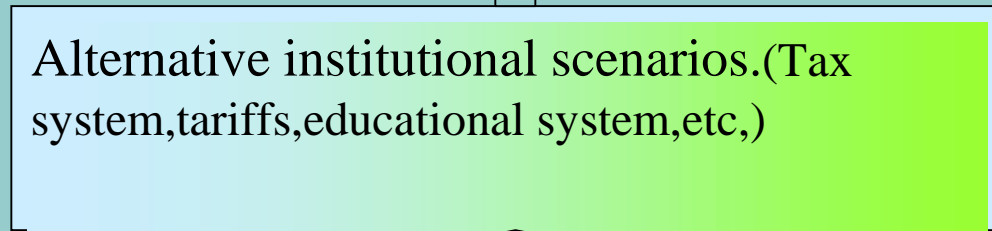


Denmark:

- 20% wind power (120,000 owners)
- 85% of the world's offshore power (2003)
- 30% Distributed Generation
- 50% of electricity supplied by CHP
- 14% of total energy from renewable energy

1. Danish Energy Policy 1975-2001

Approach:
Political process and technological change



Policy and markets

The Danish experiences 1974-2001

a. Bottom up policy demands for new goals and new market rules

b. Top down design and implementation of new market rules

c. Bottom action within these new rules

This is a process of ***innovative democracy***, and it is developed by introducing a set of measures, which we here will define as ***political liberalisation***.

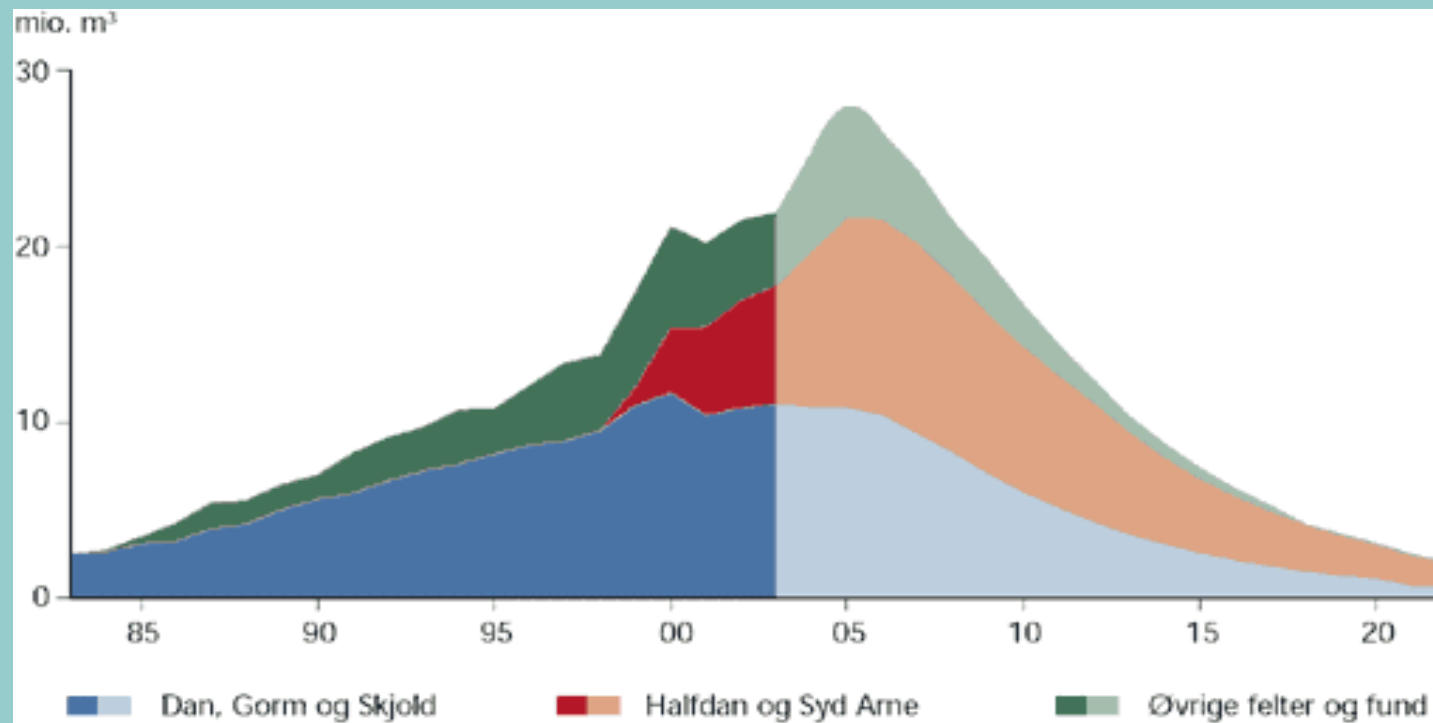


Results

1. Renewable energy generates almost 26% of electricity consumption (20% wind energy).
2. Export for around 5 Billion EURO annually.
3. Around 30.000 persons employed.
4. The Danish GDP has increased by 80% since 1973 without any increase in energy consumption.



Danish oil production and prognosis



The Danish Energy Authority, 2002

2. A need for an revival of the energy policy

Danish Association of Engineers 2007

Henrik Lund and Brian Vad Mathiesen
Aalborg University

The IDA “Energy year 2006” project.

IDA is the Danish Association of Engineers.

In the “Energy year 2006” process up to 1600 engineers were participating by giving information about their specific field of knowledge.

Three targets in the IDA Energy Year 2006



- To maintain security of energy supply
- To cut CO₂ emissions by 50 % by year 2030 compared to the 1990 level
- To create employment and to quadruple the export in the energy industry

180 degree policy change?
New strategy 2006-2007...!

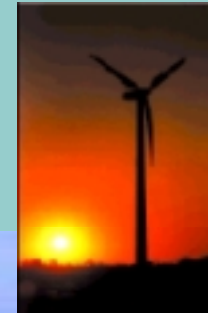
Prime minister in
2006: Target of 100
percent Renewable
Energy Supply in
Denmark year ...??
(long-term)



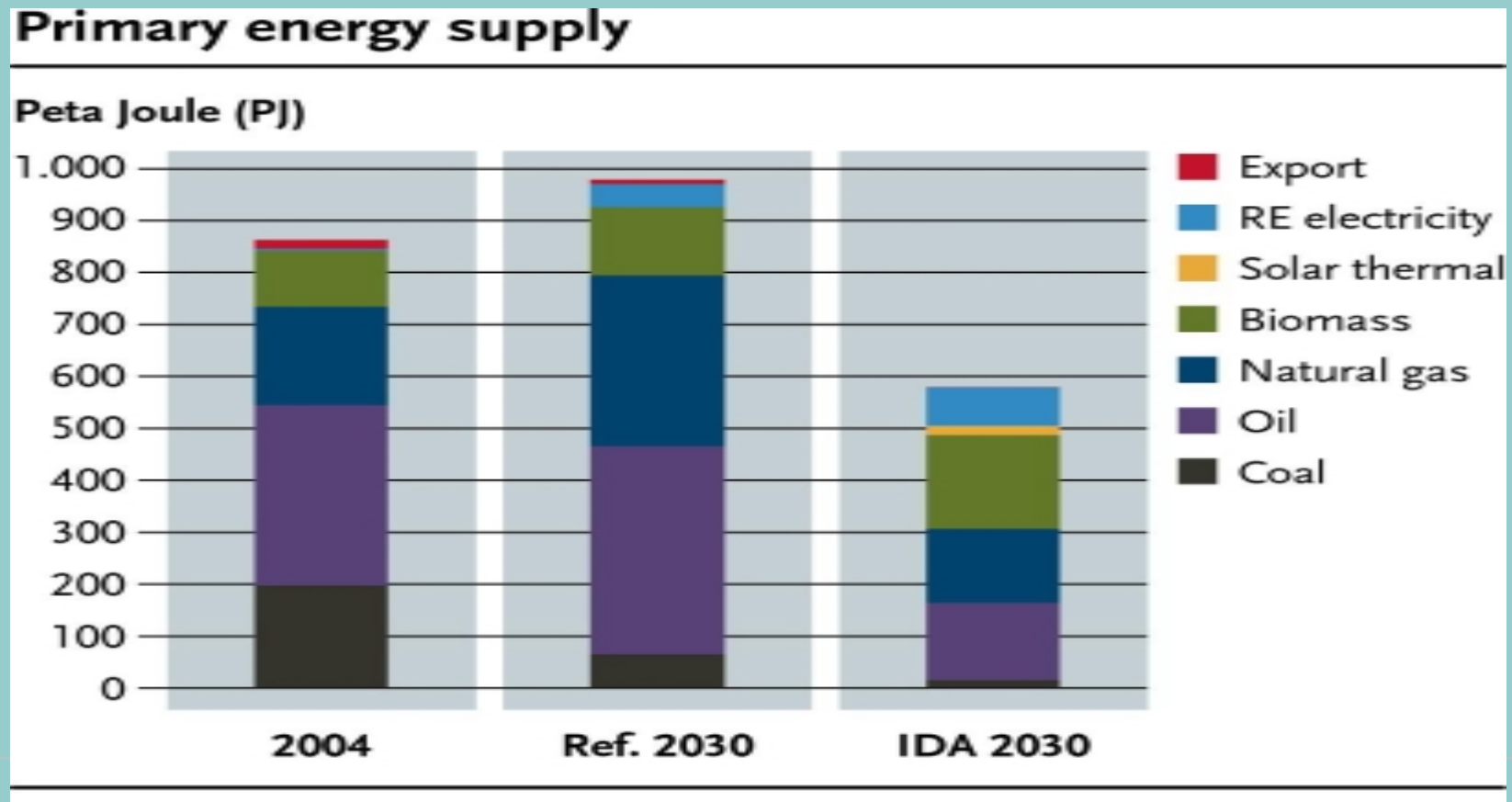
New Energy Strategy
being negotiated:
30-45% percent RES
in 2025.

Wind, photo voltaic and wave power

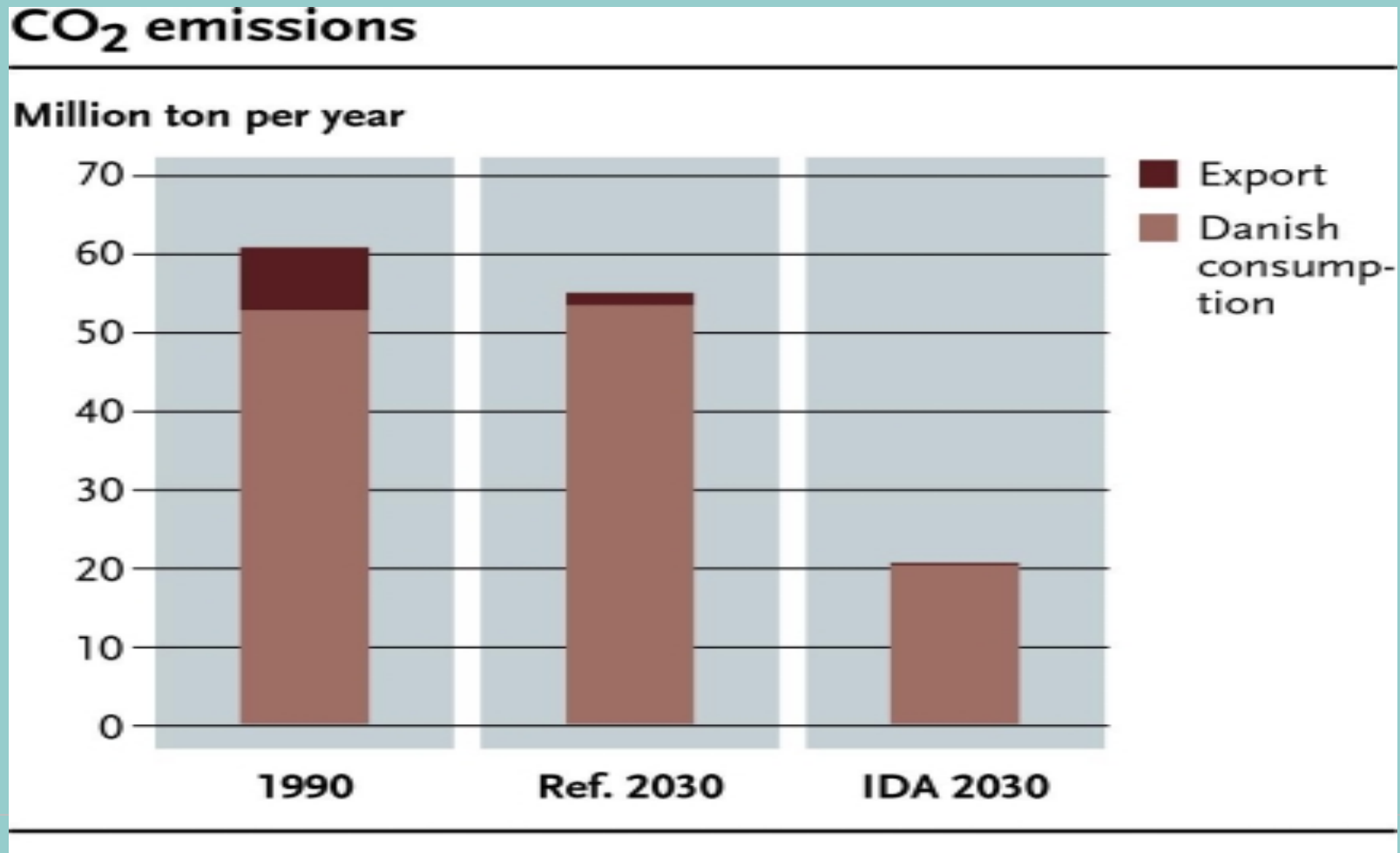
- Doubling the wind power from 3100 MW now to 6000 MW in 2030, half of which is off-shore.
- 5 % of the electricity demand supplied by wave power (500 MW).
- 2 % of the electricity demand supplied by building integrated photo voltaic (700 MW)



The IDA plan: 40% of today's fossil fuel consumption by 2030



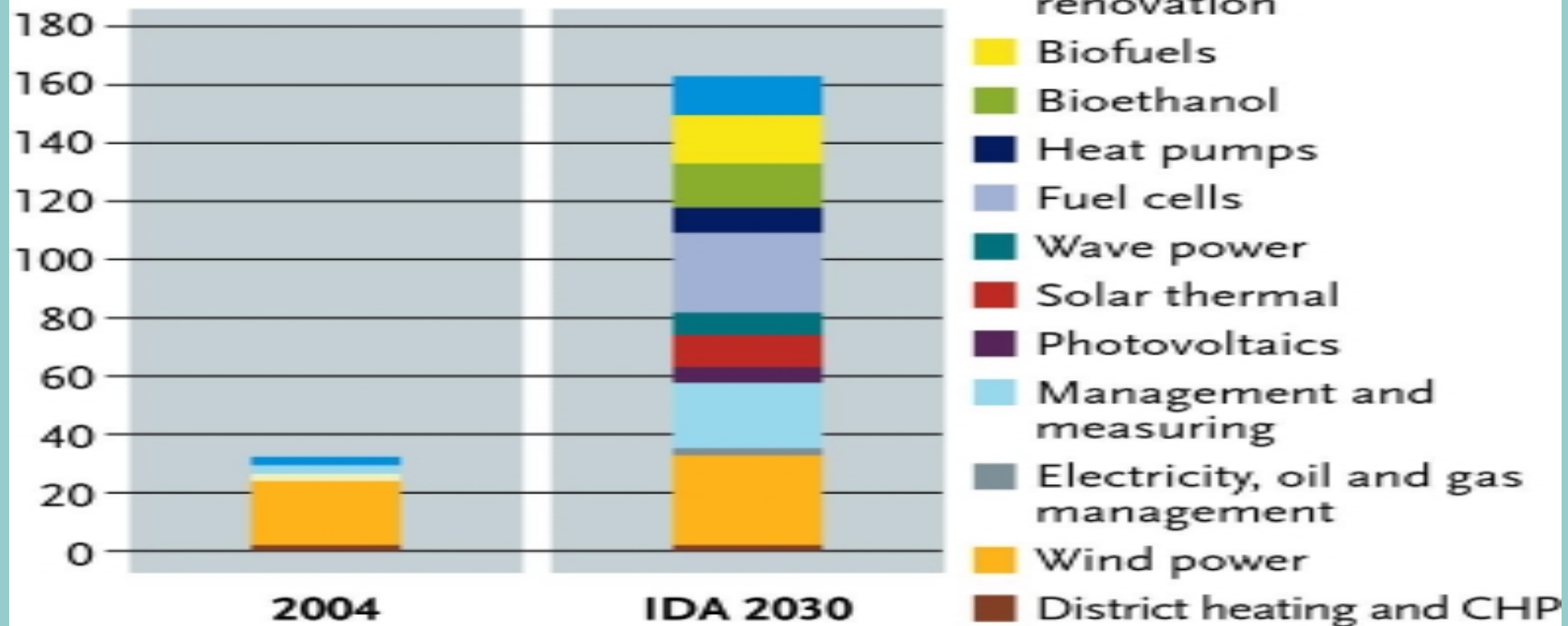
The IDA plan: From 60 mill. to 20 mill. tons CO₂ per year by 2030



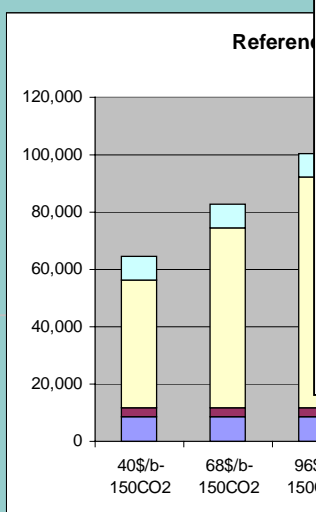
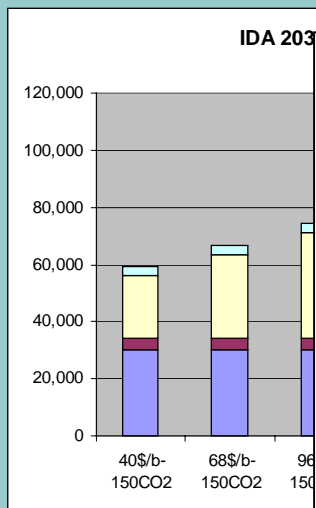
An opportunity not a burden

Business potential

Export in billion DKK per year

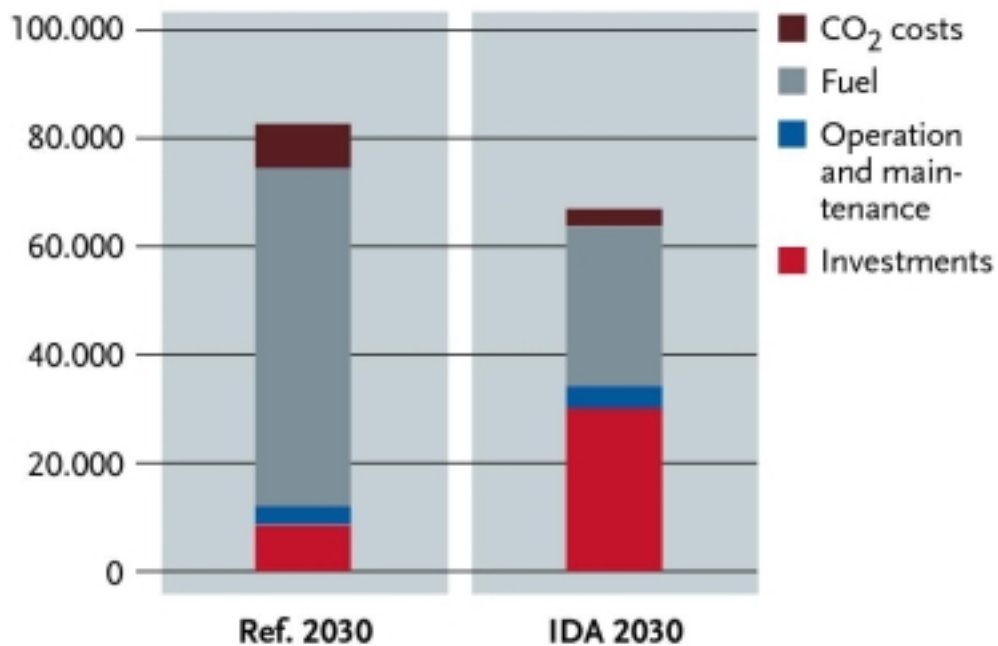


Socio-economic costs and benefits

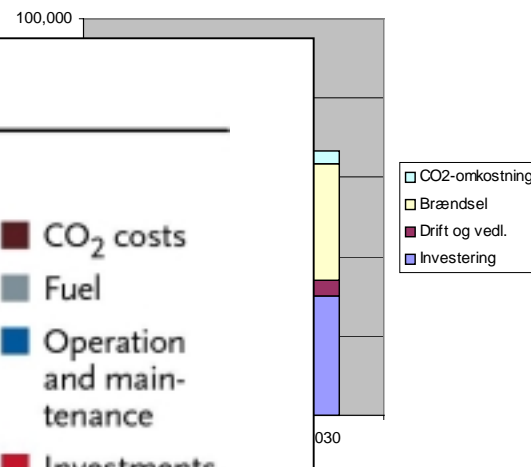


Economic costs

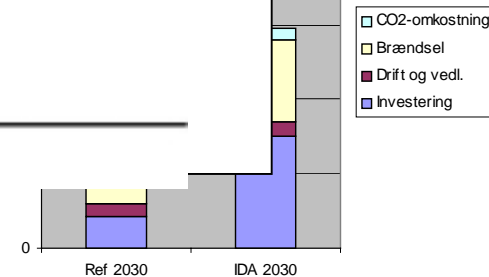
Million DKK per year



Samfundøkonomiske omkostninger ved svingende oliepriser, mio.kr./år



omkostninger ved svingende oliepriser)

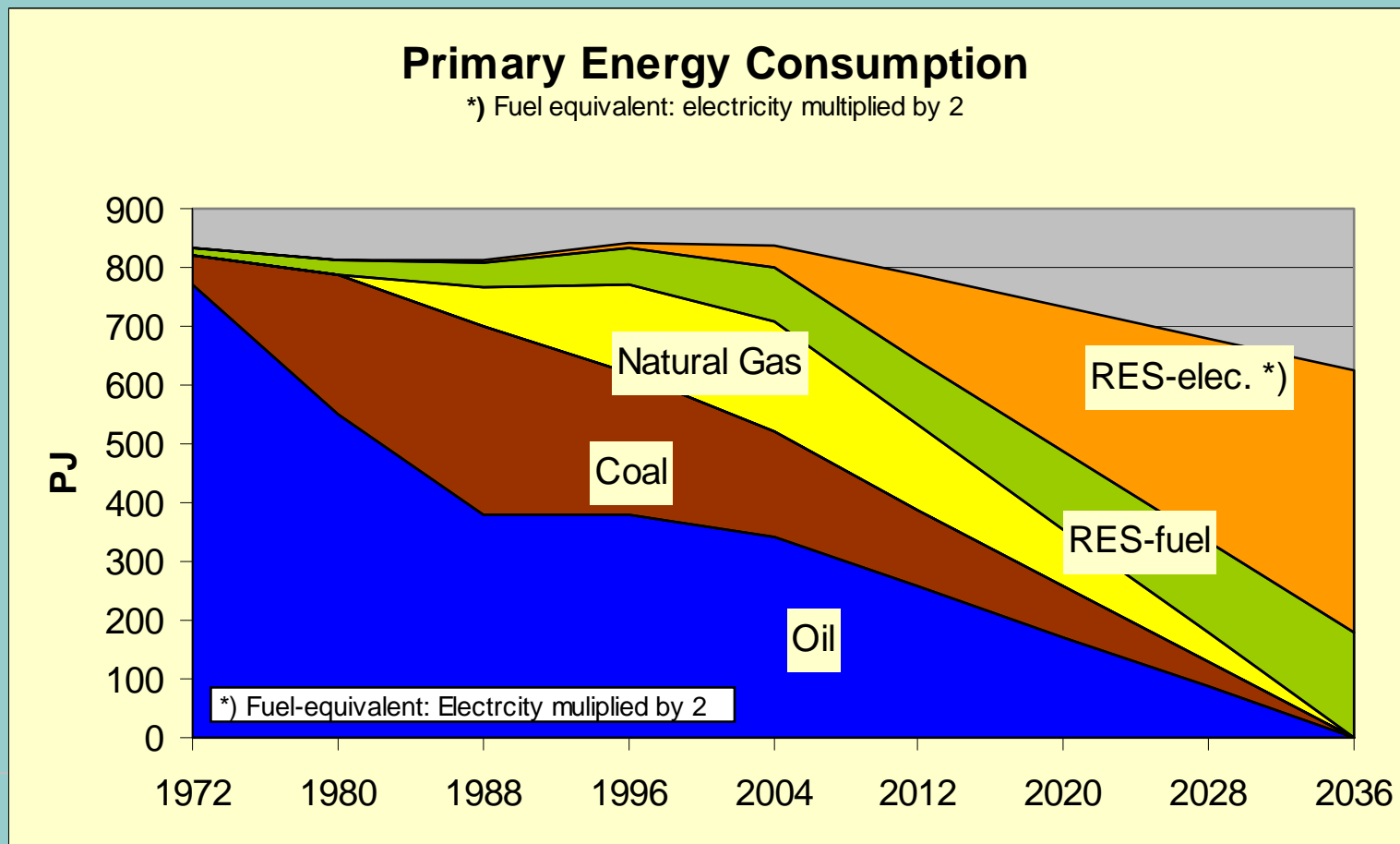


3. 100% Renewable Energy in Denmark is possible

Henrik Lund 2006



Danish 100% RES alternative



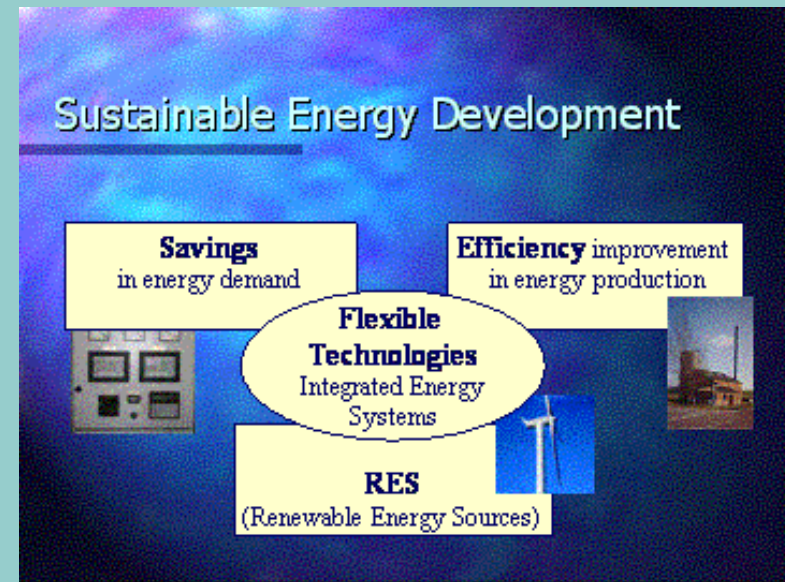
Perspective

- Between 15 and 27 GW installed wind power is necessary to convert to 100 percent RES in Denmark
- 15 GW can be reached by installing 500 MW/year
- Today Danish manufacturers produce app. 3000 MW/year



Conclusions

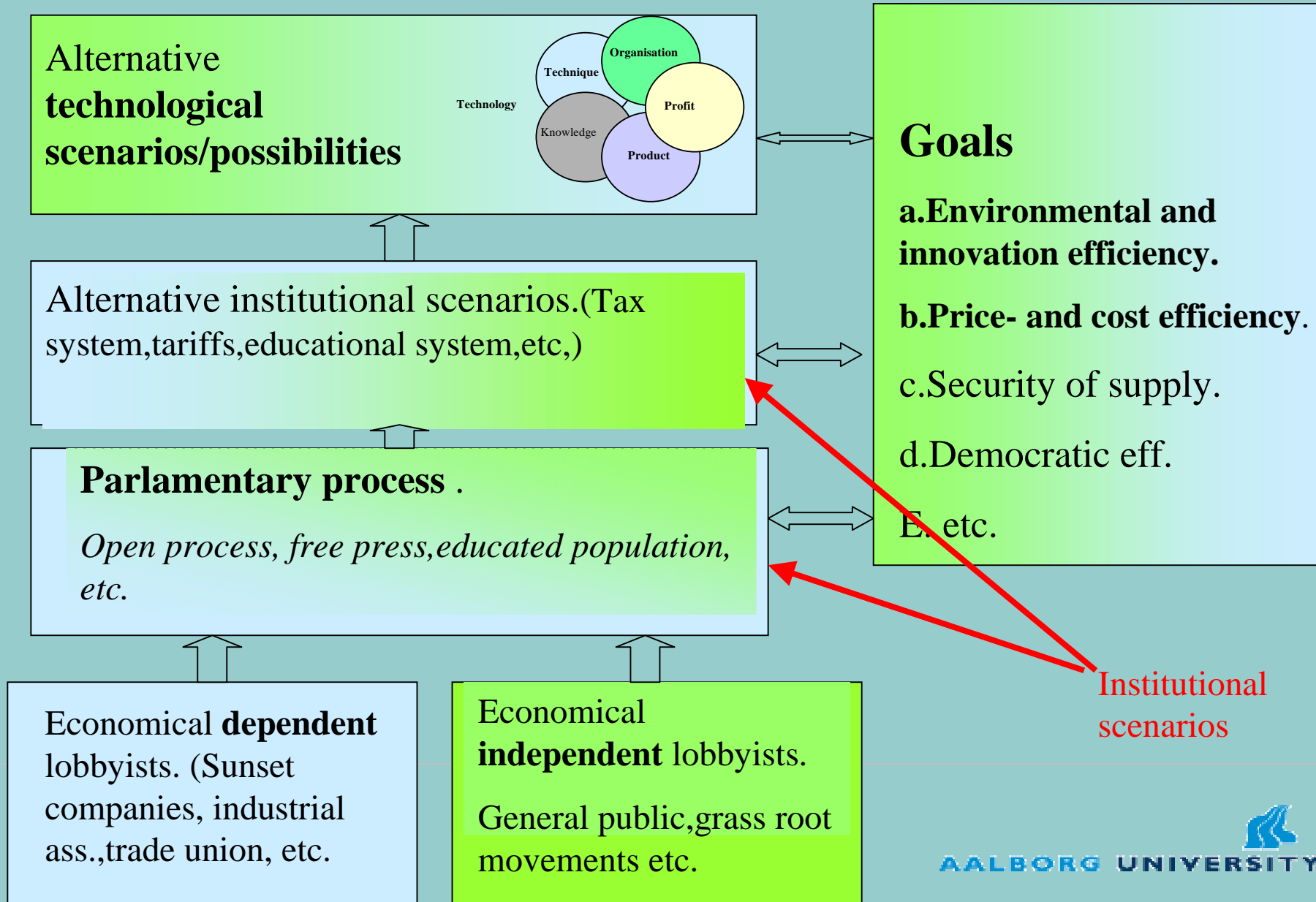
- A 100 percent RES is technically possible
- Combination of Savings, Efficiency improvements RES is necessary
- Technologies of replacing oil for transportation are key elements
- Flexible technologies such as CHP regulation, Heat pumps, electrolysers etc. are also key technologies



4. The needed policy



Approach:
Political process and technological change



11 essential proposals

1. Foundation for savings in industry
2. Foundation for heat savings
3. Large expansion of rail transport
4. One bn. for research, development and demonstration
5. Prolonging the energy savings scheme
6. Initiative for innovative energy markets
7. Feed-in tariffs for renewable energy
8. Resurrection of the public engagement and co-ownership
9. CO2 emissions are all auctioned
10. Service-check of the tax and levy structure
11. Establishment of a 100 % renewable energy city



Post plan discussions

- New energy strategy is being discussed during election campaigns.
- Parties representing 70%-90% of the members of Parliament aims at 100% renewable energy as long term goal. And at least 30%-50% as 2025 goal.

