

Towards Sustainable Energy Policy

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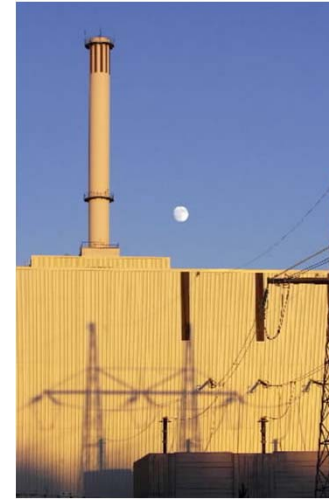
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Alternative energy futures



The introduction of renewable energy will depend on Sustainable Energy Policy incentives...



Some Myths...

- *"You can just buy whatever technology is needed"*
- *"If we throw enough money at this, we can make it happen quickly"*
- *"The solution is a massive R&D expenditures."*
- *"If prices (e.g., carbon prices) are right, innovation will take care of itself"*
- *"We can't take action now because the needed technologies are not available"*
- *"Technology X is the answer"*



How to support development and introduction of renewable energy technologies?

- A general conclusion is that technology policy can only be as effective as our understanding of the technology innovation and diffusion processes allows
- Policy analysis needs to capture the complexity and the interactive nature of the innovation processes

There is a need to provide guidance to policymakers how to positively (effectively, efficiently) influence the development and diffusion of new energy technologies



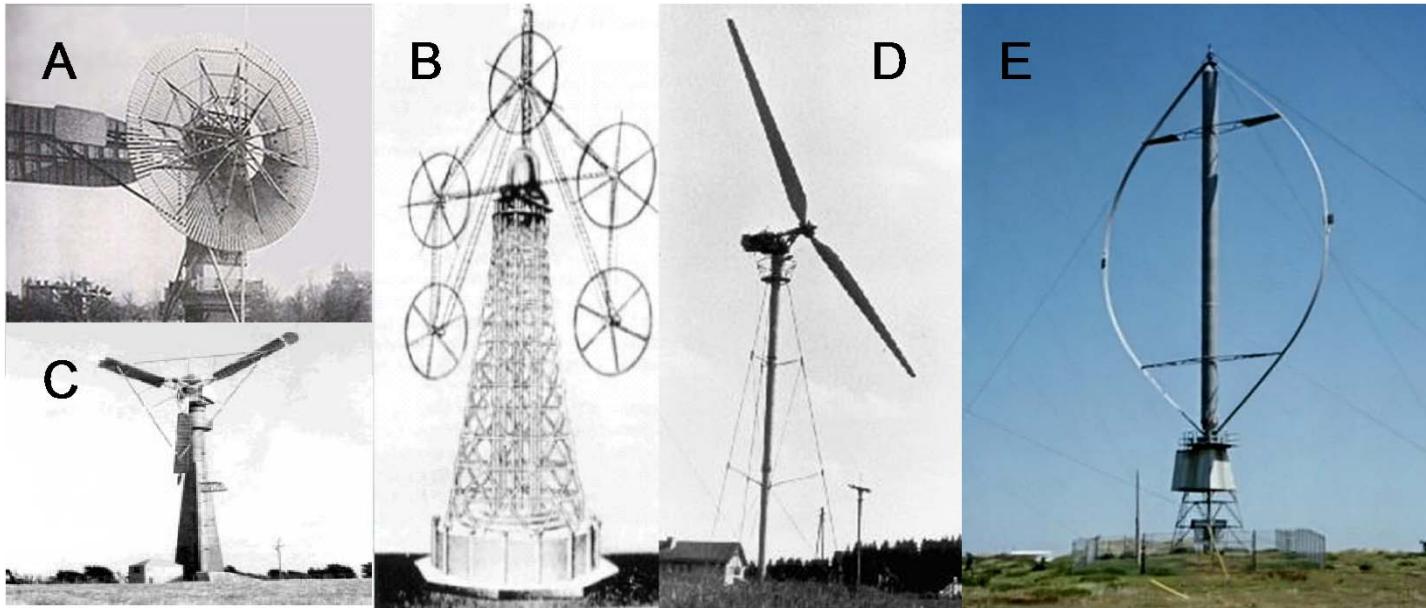
The story of wind energy



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Experimentation 1880-1970



Early movers in the 1970s and 1980s

- Denmark, the US, Germany, the Netherlands, Great Britain and Sweden.

...they were all early movers to support wind energy, however, with different approaches.





Large scale wind
turbines; advanced
turbines (2-4MW)

- Policy approach: R&D

- *Example: Germany
Grobian 3MW 1984*





1980s
22kW



1980s
30kW

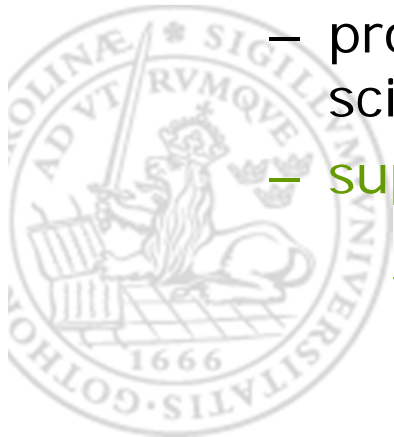
Smaller scale wind turbines; simple and reliable machineries

- Denmark, the Netherlands and the US
- Policy support: R&D, Investment and production subsidies



Early Test Stations for wind turbines

- Denmark established a Test Station for Wind Turbines (1978)
 - provided manufacturers with essential technical and scientific support
 - supported feed-back and networking
- The Netherlands established a Test Station for Wind Turbines (1981)
 - provided manufacturers with essential technical and scientific support
 - supported a competitive development



Some key factors for success:

Diversity in technology and market formation is essential

Type of turbines: large – small

Actors to be involved: large energy companies - small farmers and entrepreneurs



Some key factors for success:
RD&D is fundamental but not enough

The RD&D funding alone did not bring about any commercial turbines

RD&D expenditures until 1990:

- Denmark 47 Million EUR
- Germany 227 Million EUR



Some key factors for success:
Quality insurance is essential

- Test Station for Wind Turbines



Some key factors for success:
**To support interaction and
networking is essential**

- Danish Test Station for Wind Turbines
 - provided manufacturers with essential technical and scientific support
 - supported feed-back and networking



Some key factors for success:
Support needs to have a systemic approach

Wind policy in Denmark was systemic covering:

- Grid connection regulation
- Wind resource mapping
- Guidelines and regulation on municipal planning (permits)
- Information activities



Some key factors for success:
Support needs to be stable and continuous

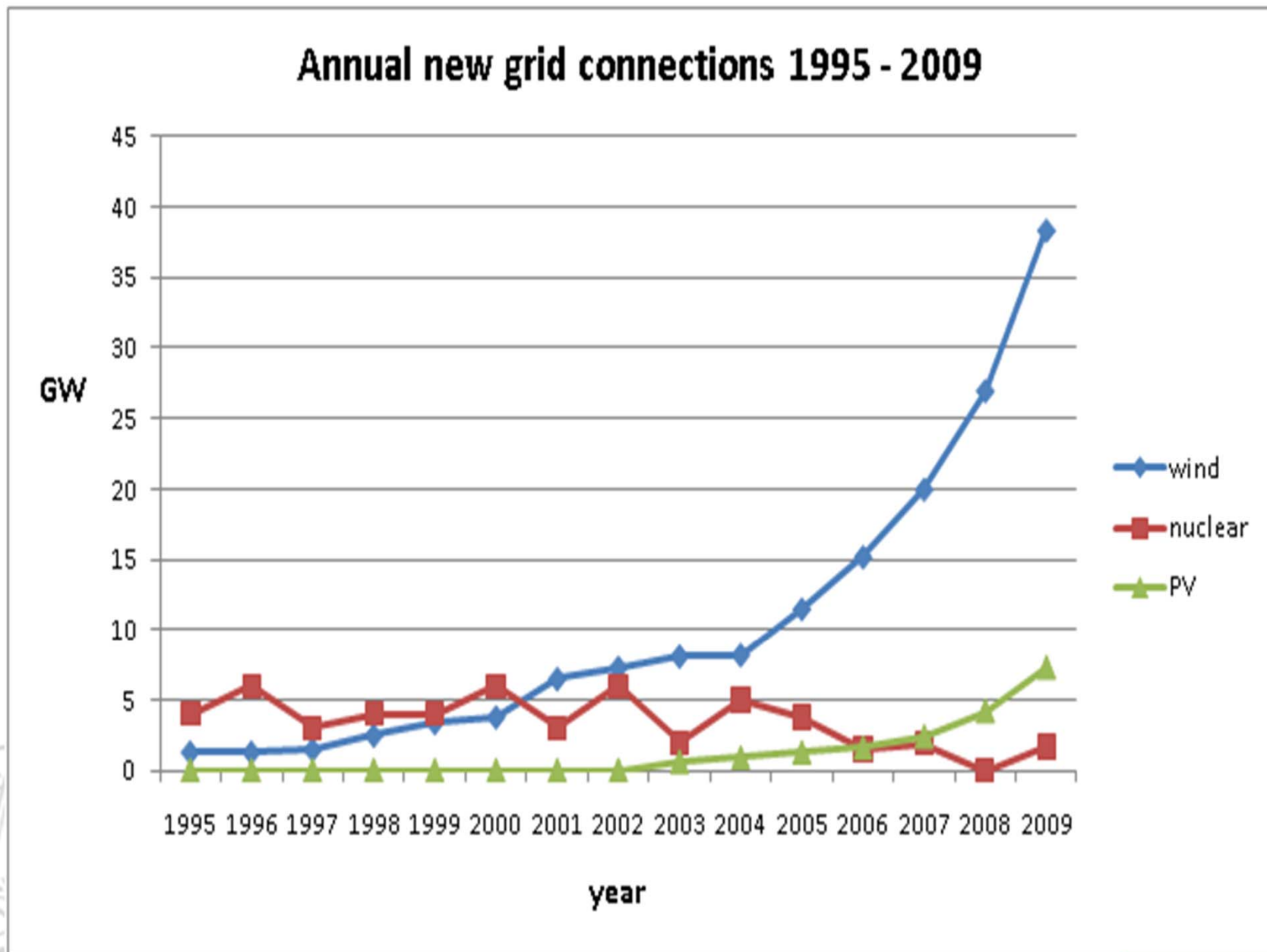
- The history of wind turbines development is long; it started already in the 1880s
- Many failures have occurred over time; technology failures, policy failures
- Denmark provided a continuous and stable support for the development of wind turbines since the mid 1970s



Booming markets in the 1990s and the 2000s

- Re-thinking in policy support structure - the successful Danish innovation path of the 1980s became the guiding-star.
- Over the years, many countries came to do develop their support structure in a similar way, e.g. Germany, Spain, the US, India and China.





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As a result of important learning...



- Size of wind turbines has increased dramatically
- Cost has been reduced
- New off-shore markets have been developed



Sustainable Energy Policy

Some results of the Global Energy Assessment (GEA) project

- **Create Knowledge!** *Or: How to enable technological learning while learning about technologies yourself*
- **Assure Feed-backs!** *Or: How to create/enable knowledge flows for technology learning and spillovers*
- **Globalize!** *Or: How to design local policies to support new energy technologies and the international flow of technologies*
- **Be stable!** *Or: How to create policy stability and credible commitments on which innovation depends*
- **Align Incentive Structures!** *Or: How to avoid confusing the market*
- **Experiment!** *Or: How to stop worrying about failure*



Thank you!

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