

# Strategic Research Agenda and Roadmaps in Denmark: the Wind Example

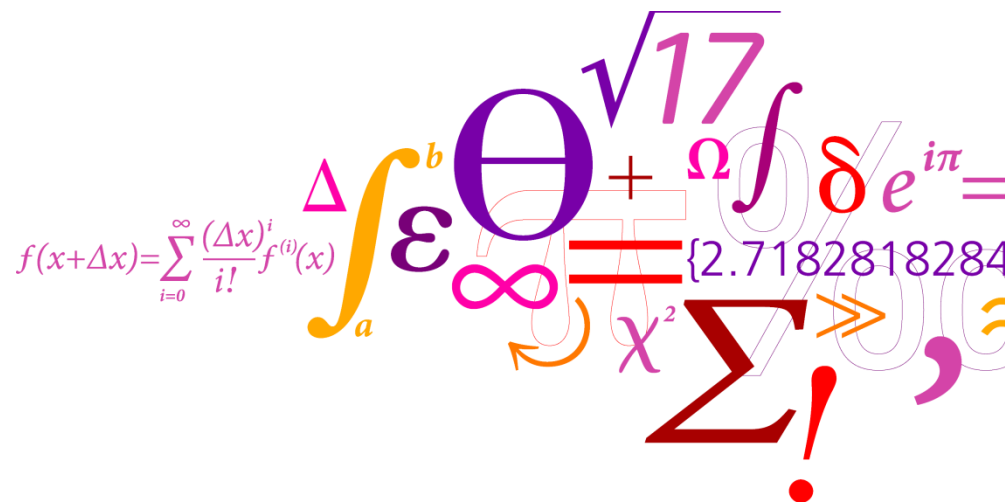
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Presentation for:

IEA Committee on Energy Research and Technology

EXPERT GROUP ON R&D PRIORITY SETTING AND EVALUATION: FROM ROADMAPS TO IMPLEMENTATION

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# Agenda

- Wind industry - an important role for the economy
- Vision of wind targets to be achieved by 2050
- Identification of roles and responsibilities among partners for meeting targets
- Role of RDD&D funding for energy technologies
- Strategic technology objectives to be met
- Critical RDD&D activities for meeting objectives
- Next steps for implementation of more wind power in DK
  - Barriers and deployment policies

# Industry

- The industry employs more than 28.000 people in Denmark and had a turnover of €11Bn on a global level in 2008.
- Large wind turbine manufacturers; Vestas, Siemens + R&D departments of additional manufacturers (e.g. Suzlon)
- Large number of suppliers – not only to the Danish manufacturers
- Energy technology constitutes approx. 10 % of the total Danish exports (2008) (expecting to grow).

Industry policy concerns might be as important as energy and climate policy concerns.

# Vision & targets of the Danish Government

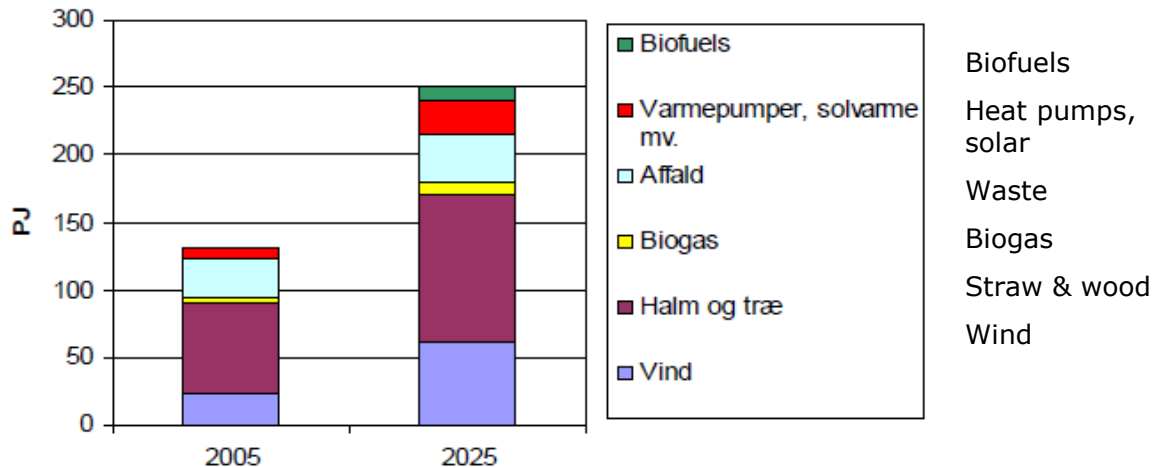
- Total independency of fossil fuels (Maybe 2050)
- All other perspectives have a time horizon of 2025.
- Doubling of RE to at least 30% of Denmark's energy supply by 2025
  - Wind (50% of electricity consumption in 2025)
  - Biomass and waste in CHP (ca. 500 large plants in 2025)
  - Heatpumps in private households (100,000 households in 2025)
  - 2nd generation biofuel for transport (20% in 2020)
- Annual 1.25% savings in energy consumption

Source: En visionær dansk energipolitik 2025, januar 2007, Transport- & Energiministeriet

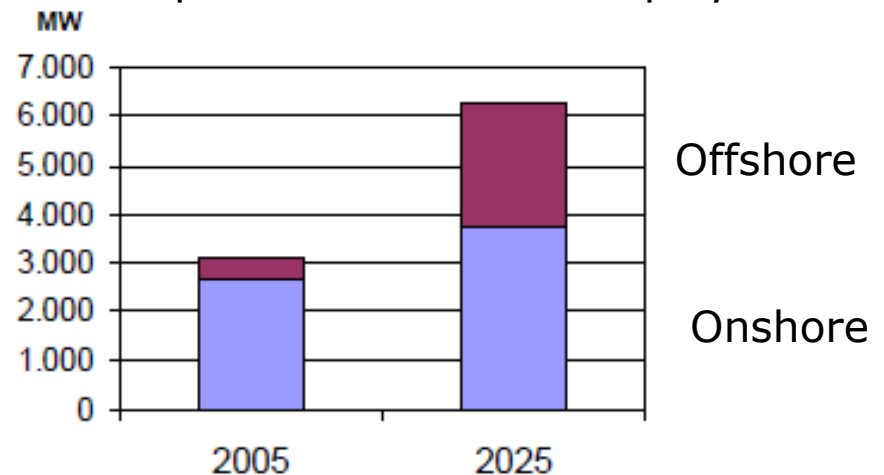
# Visionary Danish Energy Policy

No technology specific targets – but examples on future energy supply

Example on 30% RE in 2025



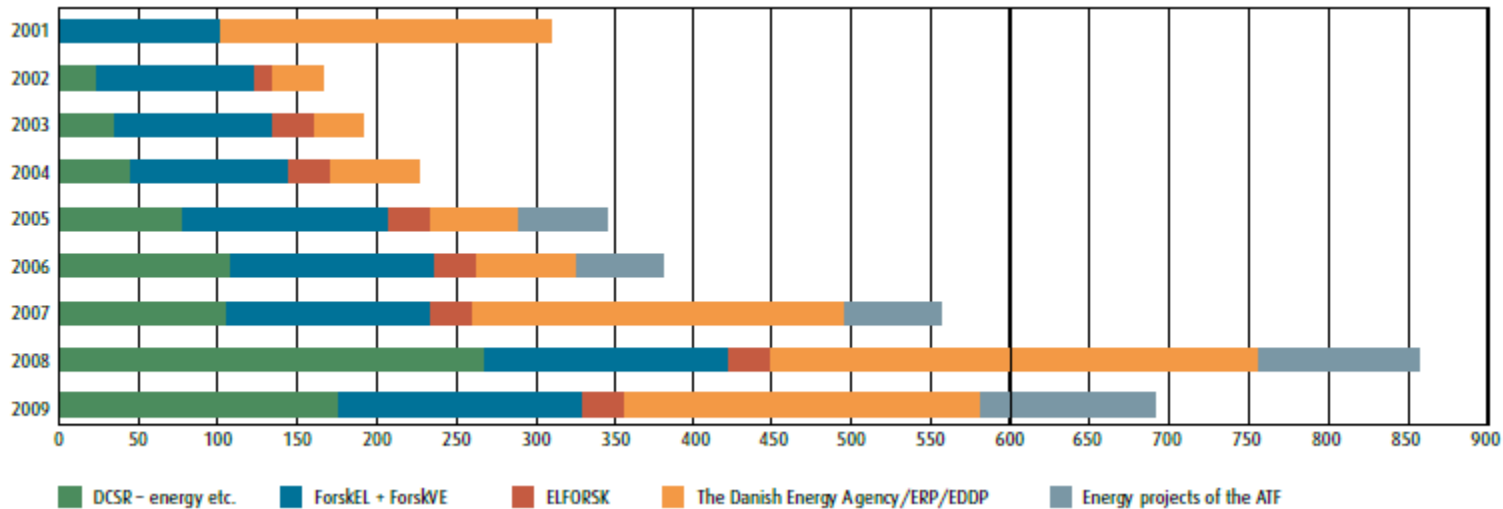
Example of wind turbine deployment 2025



Source:

En visionær dansk energipolitik 2025, januar 2007,  
Transport- & Energiministeriet

# Public R&D programme structure



→ No distinct budget for single technologies - **but competition between technologies, firms and universities.**

## Planned public energy RD&D budgets

Amounts in DKK	2007	2008	2009	2010
The Energy Technology Development and Demonstration Program (EUDP)	236	219	300	408
The Danish Council for Strategic Research	108	94	170	299
PSO – programs - ELFORSK	155	180	180	180
- ForskEL				
- ForskVE				
The Danish National Advanced Technology Foundation	45	65	55	103
Others	49	49	49	49
<b>Total</b>	<b>593</b>	<b>607</b>	<b>754</b>	<b>1039</b>

Source: Estimate by Danish Energy Agency

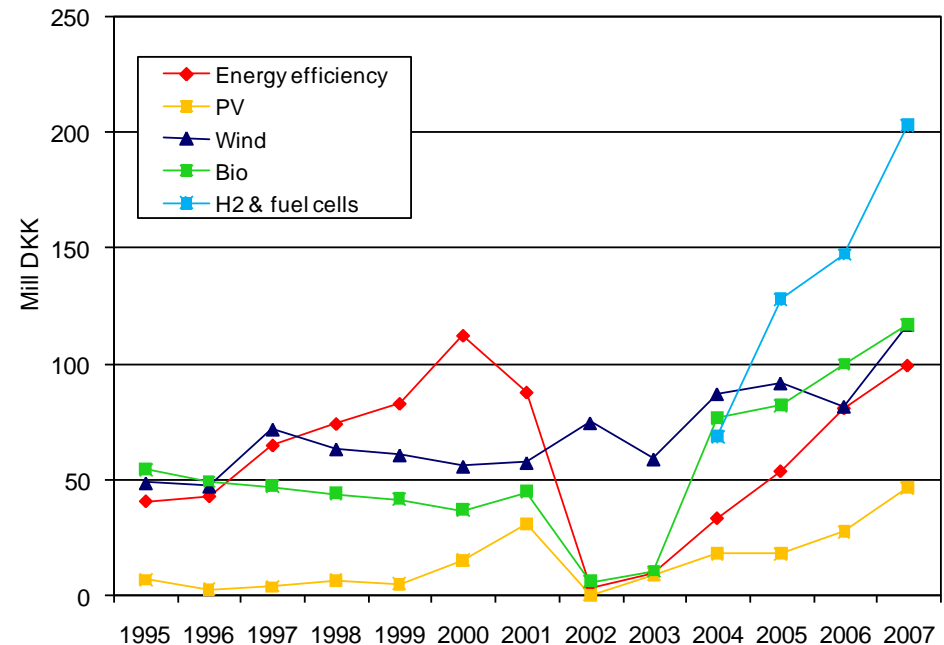
# Pro and cons on the many funding programmes

**Critique:** Difficult to coordinate and get the big picture

**Pro:** Diversity!

## Public R&D budgets for selected technologies

Wind has stayed "stable" in Public R&D programme



Source: IEA R&D Statistics (2007 Edition)

# Changed roles and responsibilities

## **R&D programmes (call for proposals and priorities between applications)**

- Earlier the Danish Energy Agency (on behalf of the Minister) made the final decisions
- Now independent boards (appointed by the Minister and with significant industry participation) make the final decisions within frames set-up by the ministry

## **Strategy formulating**

- Earlier strategy formulating was led by the Danish Energy Agency in consultation with industry, research and interest groupings
- Now strategy formulating is carried out by industry-led public-private partnerships (e.g. Megavind)

A change in government's role and responsibility: The arm's length principle



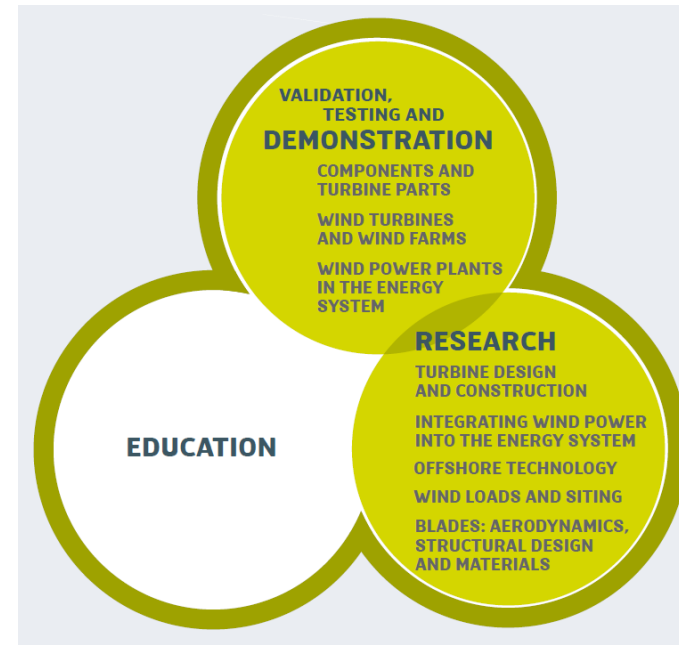
# Actors in Megavind

The partnership has the following partners:

- Vestas Wind Systems A/S
- Siemens Wind Power A/S
- DONG Energy A/S
- DTU Technical University of Denmark (Risø DTU)
- Aalborg University
- Energinet.dk
- The Danish Energy Authority
- Secretariat: The Danish Wind Industry Association

The following companies are collaborating in the industrial group:

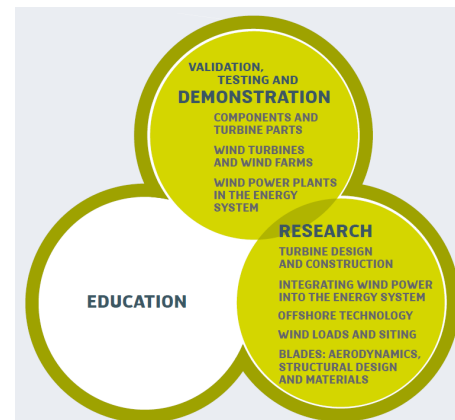
- Vestas Wind Systems A/S,
- Gamesa Wind Engineering A/S,
- LM Glasfiber A/S,
- ABB A/S,
- DNV,
- BALLUFF
- and Force Technology.



# Vision and ambition of industry

## Megavind strategy

- Megavind's vision is that Denmark must continue to be the world's leading centre of competence within the field of wind power.
- It is Megavind's ambition that Denmark must provide the most effective wind power – wind power plants – that ensure the best possible integration of wind power in the accumulated energy system so that Denmark, also in the future, can provide wind power technology to energy systems with a very large proportion of wind power.



# Strategic objectives & RDD&D Activities

## - Megavind strategy - **Demonstration**

### **Validation, testing and demonstration of components and turbine parts.**

Objectives:

- To validate components and turbine parts under conditions that, in the best possible way, correspond to the influences, etc. that occur during regular operation of a wind power plant.
- The ambition is that of a “maintenance-free turbine”.

### **Validation, testing and demonstration of wind turbines and wind farms.**

Objectives:

- To establish testing and demonstration facilities that can test the entire turbine (0-series and prototypes).
- The ambition is to develop the self-regulating intelligent turbine.

### **Validation, testing and demonstration of wind power plants in the energy system.** Objective:

- To establish testing and demonstration facilities in order to test system-integration and collaboration with other forms of energy in the accumulated energy system.
- The ambition is to develop the self-regulating wind power plant that can collaborate with other types of energy in an intelligent electricity supply system.

# Strategic objectives & RDD&D Activities

## Megavind strategy – Strategic Research Areas I

### Objective 1: More effective and reliable machines

- RDD&D activity: Turbine design and construction of turbines in regards to:
  - Continuous expansion of competence within blades, transmission systems, gears, brakes, support structures, effective electronics and the effects of geophysical conditions on the turbine
  - Gaining more knowledge of the collaboration between the individual part of the turbine in order to enhance efficiency and reliability

### Objective 2. Efficiently utilisation of wind

- RDD&D activity: Blades – aerodynamics, structural design and materials with reference to:
  - Developing lighter (cheaper) blades with high efficiency, reliability and durability
  - Reducing the stress from the blades on the rest of the construction during both passive and active regulation
  - Acoustic conditions and innovative designs

# Strategic objectives & RDD&D Activities

## Megavind strategy – Strategic Research Areas II

### Objective 3: Optimal placement of the wind turbine – wind power plant

- RDD&D activity: Wind loads and siting with reference to:
  - Gaining greater knowledge of wind profiles and wind resources as a result of terrain and atmospheric conditions
  - To enhance the insight into the shelter effect of turbines in order to minimise production-losses and loads

### Objectiv 4: Highest possible amount of wind power into the energy system

- RDD&D activity: The integration of wind power into the energy system with reference to:
  - Better introduction of the individual turbine and wind park into the grid
  - Better introduction of large quantities of wind power into the grid including steering and regulation of the wind turbines so they can deliver a high level of power quality
  - Developing system services so the wind turbines can act like conventional power plants

# Strategic objectives & RDD&D Activities

## Megavind strategy – Strategic Research Areas III

### Objective 5: How do we take the next step offshore?

- RDD&D activity: Offshore technology with reference to:
  - Improving the economy from offshore turbines primarily through optimised concepts of infrastructure (foundations and transmission systems)
  - Optimising dependability with new systems of fail-safe design, redundancy and fault tolerance

# Next steps for more wind power in Denmark

## – government initiatives 2008-2011

### Cost and competition with other technologies

- Increased operation subsidies for new wind turbines (0.24 DKK/kWh) – but with a maximum and considerations to balance costs
- Special subsidies for turbines under dismantling schemes

### Availability of sites onshore

- Agreement with municipalities on reservation of sites

### Public acceptance (mostly onshore)

- A fund for supporting local initiatives and local ownership
- Compensation scheme for neighbours to wind turbines (loss of property value)

### Cost and availability of sites of offshore wind farms

- Tender for two offshore wind farms at each 200 MW to be inaugurated in 2012.
- Action plan for future offshore wind farm siting

Source: Aftale mellem regeringen (Venstre og Det Konservative Folkeparti), Socialdemokraterne, Dansk Folkeparti, Socialistisk Folkeparti, Det Radikale Venstre og Ny Alliance om den danske energi-politik i årene 2008-2011, Den 21. februar 2008

# Conclusions

- Industry policy concerns might be as important as energy and climate policy concerns.
- No distinct budget for single technologies - but competition between technologies, firms and universities.
- A change in government's role and responsibility: The arm's length principle - independent boards on calls and prioritizing & PPP on strategy formulation.
- Vision and strategy for Denmark as a leading competence center in wind power- industrial development – **Megavind**
- Visions for deployment of wind power in Denmark (2050 -free of fossil fuel) – **Government initiative**

Thank for your attention!