UNIVERSITE MONTPELLIER 1

Organizational Forms, Competences and Industrial Strategies : the Relations between Manufacturers and Operators in the European Wind Energy Sector

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Aim of the presentation

- Try to answer to some questions :
  - ✓How evolved the wind industry until today ?
  - ✓ What was the role of the various wind technological systems ?
  - ✓ What are the main actors and their strategic positions ?

In which conditions technological knowledge was created in the wind energy industry ?

We can identify two salient phases in the evolution of the organization of the wind industry (Johnson, Jacobsson [2002]):

- **The phase of experimentation** : from the 1970's to late 1980's
- **The phase of growth and maturity** : since the 1990's

The phase of experimentation :1970 - 80's

- Technological variety and uncertainty with various competing design for wind turbines
- Two types of policies were implemented to foster wind energy after the oil crisis :
  - ✓'Technology push' policies (R&D) in many IEA countries with the will to make multi MW turbines by using existing technologies ('top down' strategy)
  - ✓In Denmark an evolutionary model based on 'technology push' and 'demand pull' policies to develop a specific technological trajectory from small designs ('bottom up' strategy)

- **Different actors were involved in the development of national wind industries** (Dk, Germ., Neth., Swed.)

  ✓Public institutions (R&D laboratories, agencies, universities)

  ✓Some large firms (aeronautical, electrical, mechanical) with no specific competences to develop MW turbines

  ✓Electric utilities in some demonstration projects (Ex : Elsam in Denmark)

- ✓Many smaller manufacturers with a variety of competences and a fragmented knowledge base (shipbuilding, electrical agriculture machinery)
- ✓Local private owners of turbines, mostly cooperatives, individuals and farmers which played a crucial role in Denmark and Germany

- **Caracteristics of the early wind technological systems** (Dk, Germ, Neth, Swed)

  ✓**On the manufacturing side**

  . No scale economies, low degree of assets specificity, non-high tech components and many (potential) suppliers

  . According to Transaction costs theory (Williamson [1975,1985]) no vertical integration between suppliers, manufacturers and operators

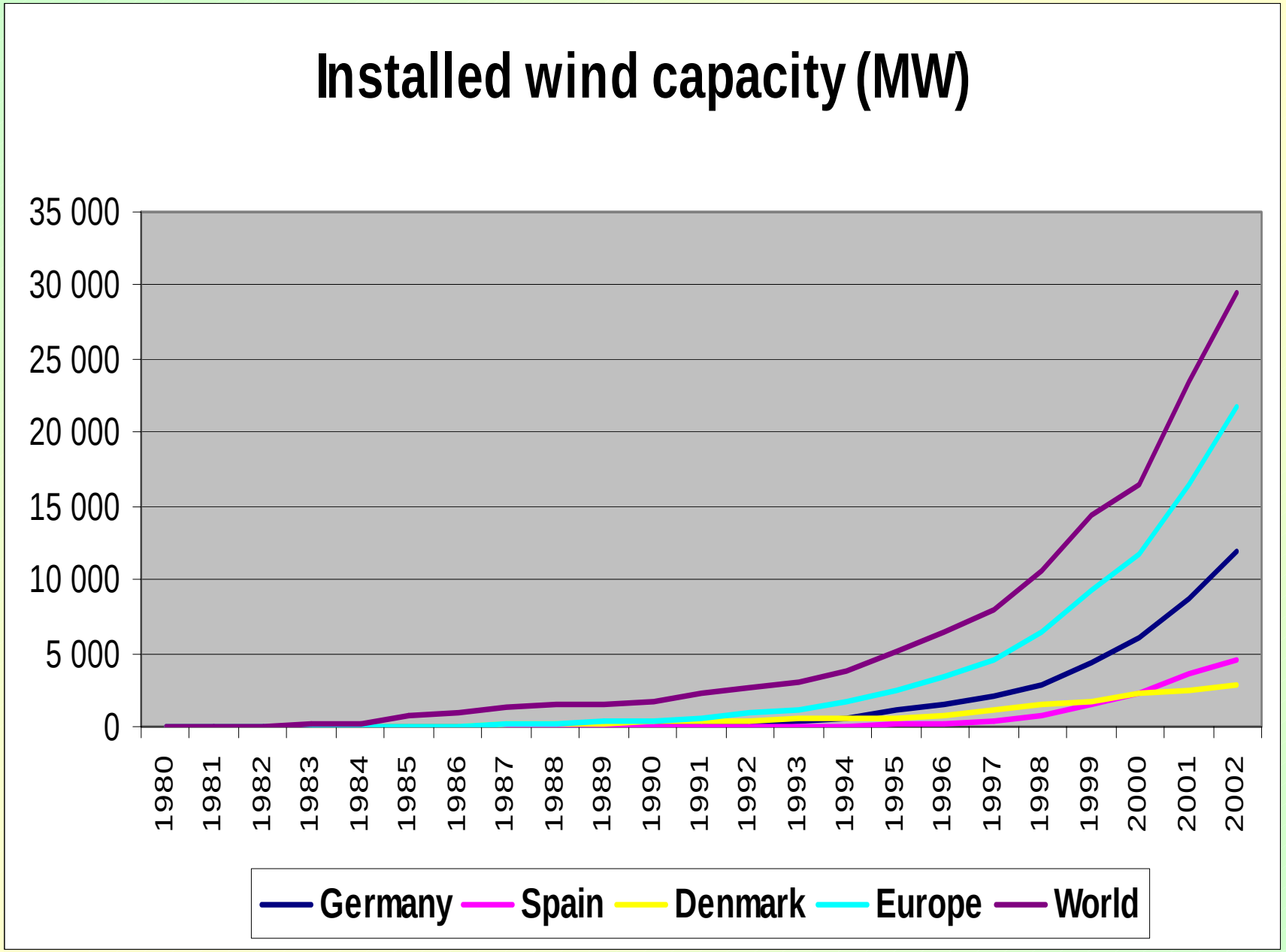
- ✓ **On the technology side**

  . In the 1980's MW size projects never left the prototype stage due to a lack of experience regarding the technology

  . The small 'danish horizontal-axis three bladed' design was selected in part due to the learning effects created by the 'Californian wind energy boom' (1000 MW installed in 1987)

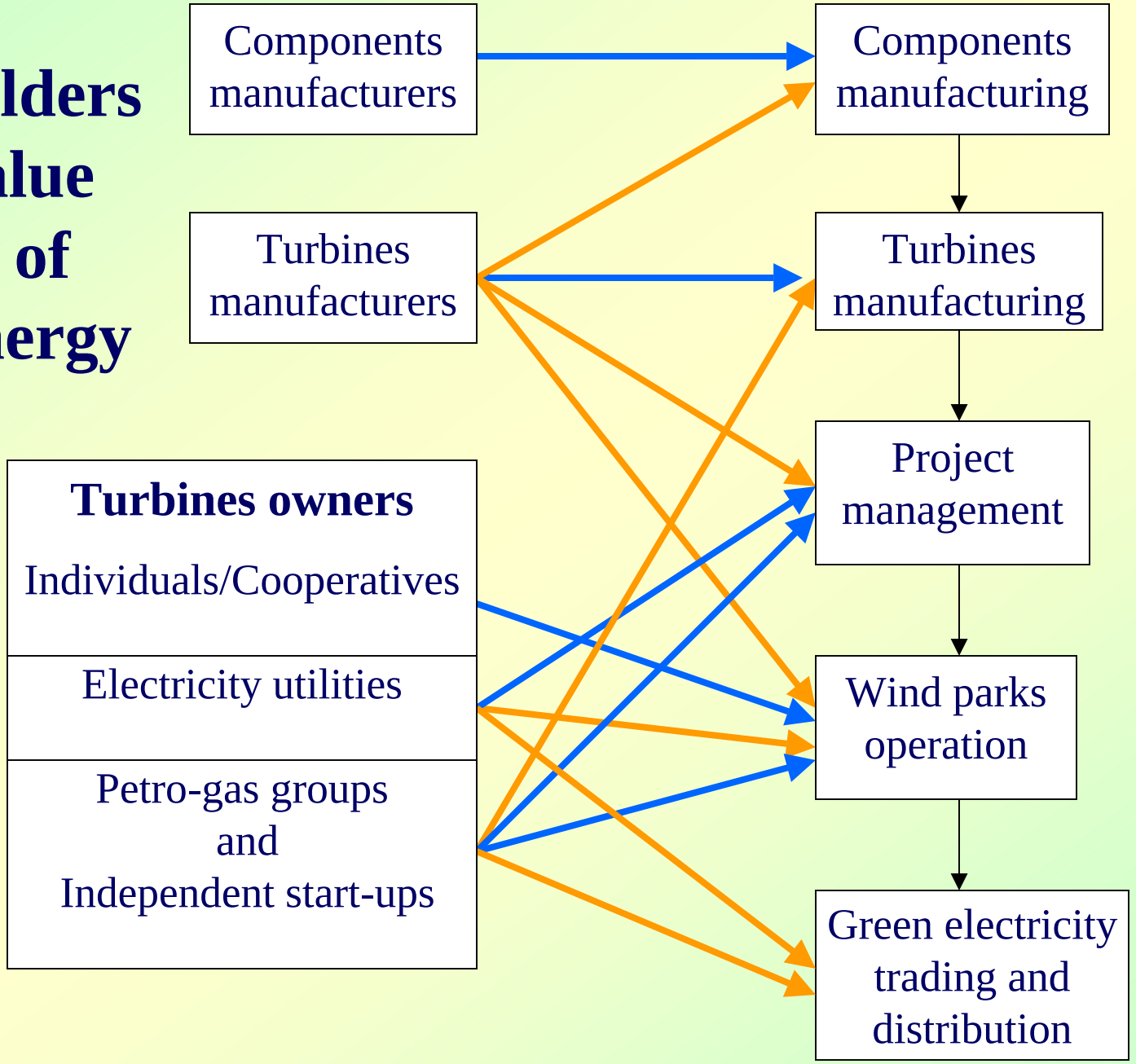
The phase of growth : since the 1990's

- Wind energy received an institutionnal backing in Europe :
  - ✓Several countries set up their first wind energy programmes : Germany, Spain (fixed feed-in tariffs)
  - ✓The Electricity Directive (1996) introduced provisions which can be used for RES : public service obligations, fair access to the grid, etc...
  - ✓The RES Directive (2001) fixed the target to double the total share of RES from 6 to 12% by 2010


Installed wind capacity (MW)
35 000
30 000
25 000
20 000
15 000
10 000
5 000
0
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
Germany
Spain
Denmark
Europe
World

- From a mechanical and electrical engineering knowledge base the wind energy sector became an international high tech industry with specific components (aerodynamics engineering, software)
- The average size of commercial turbines increased (50 kW in 1985, 1 MW in 2000) and costs dropped : - 50% between 1991 and 1998 in Germany
- The offshore technology (turbines ≥ 2MW) is now available and secure for large wind parks

Stakeholders and value chain of wind energy



Competitive positions and industrial strategies

- Wind turbines manufacturers
  - ✓Oligopolistic sector with strong positions of the danish « historical » incumbents
  - ✓In 2001 the market shares of the first seven manufacturers represented 87 % : Vestas (Dk) : 23.3%, Enercon (Germ) : 14.1 %, Neg Micon (Dk) : 12.5 % GE Wind Energy (USA) : 12.3 %
  - ✓From their core competences in manufacturing many are integrated in upstream for the crucial components and in downstream through wholly owned local subsidiaries to protect their technology

- Wind parks projects managers and operators
  - ✓Competitive sector : individuals, a lot of new entrants often by mergers, to acquire new competences from their core business in consulting and operating
  - ✓From a strong national base some firms developed international subsidiaries with global competences : EHN, RES Ltd, IVPC
  - ✓Growing presence of electric utilities and petro-gas groups (Iberdrola, ENEL Green Power, BP Renewables, Shell Renewables) : they try to develop distinctives competences in green electricity production and trading following market's tranformations