Wind Energy Development and Market Introduction Schemes in Europe

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The European Wind Energy Association

EWEA Goals and Objectives

- Create a Sustainable Future by Maximising the Use of Wind Power
- Create Awareness of the Potential of Wind Energy
- Represent the Interests of the Wind Energy Sector Across Europe

Members (>15,000)

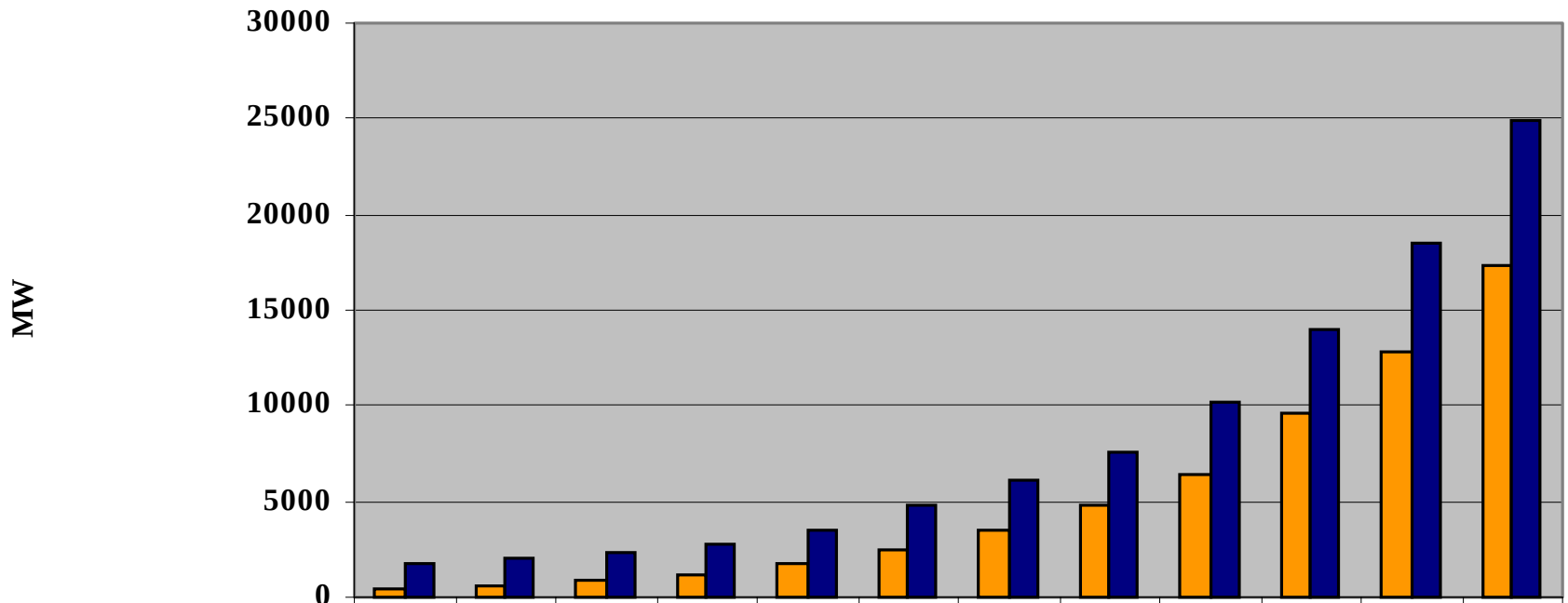
- The industry: manufacturers, utilities, developers, R&D institutes and universities, financiers, etc.
- National associations, individuals

Overview of Contents

- Wind Energy **Market Development**
- **Support Systems** for Wind Power in Europe
- **Key Elements of** EU RES policy
- Future Projections and Perspectives
- Conclusions, Lessons Learnt

Wind Energy Market Development

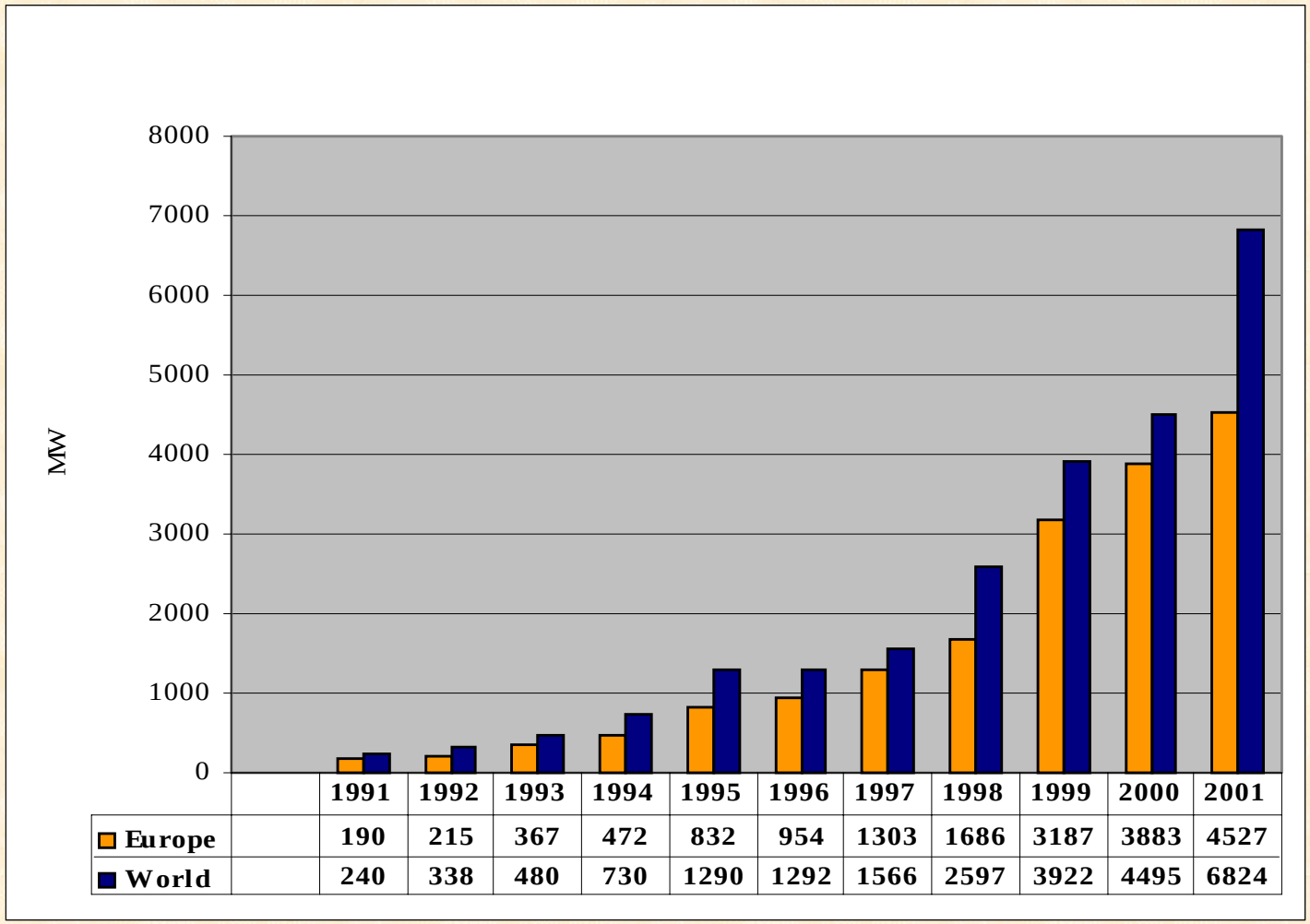
Cumulative Global and EU Wind Capacity (1990-2001)



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
European Union	439	629	844	1211	1683	2515	3469	4772	6458	9645	12822	17319
World	1743	1983	2321	2801	3531	4821	6104	7636	10153	13932	18449	24927

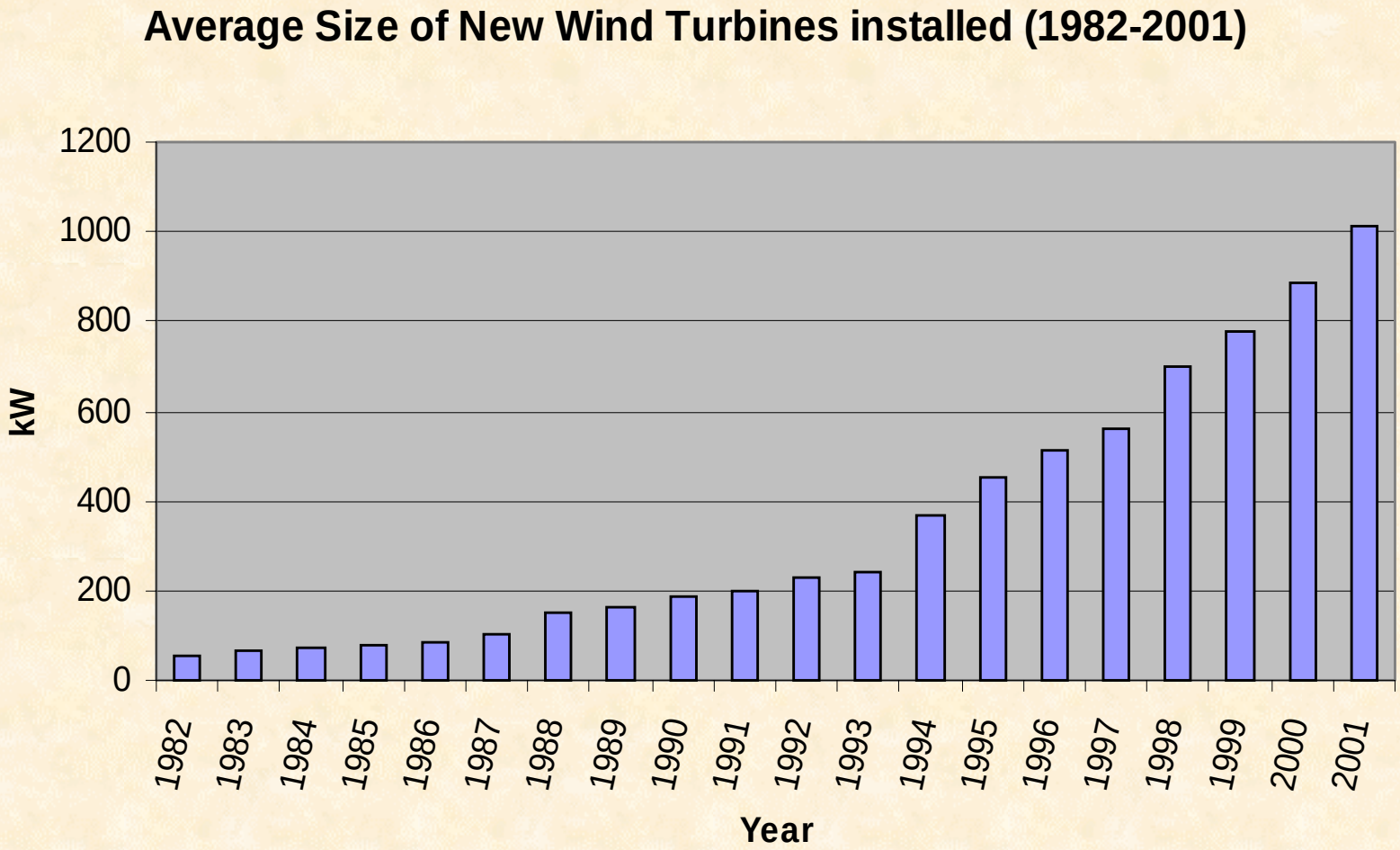
Wind Energy Market Development

New Wind Energy Capacity Installed/yr.



	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Europe	190	215	367	472	832	954	1303	1686	3187	3883	4527
World	240	338	480	730	1290	1292	1566	2597	3922	4495	6824

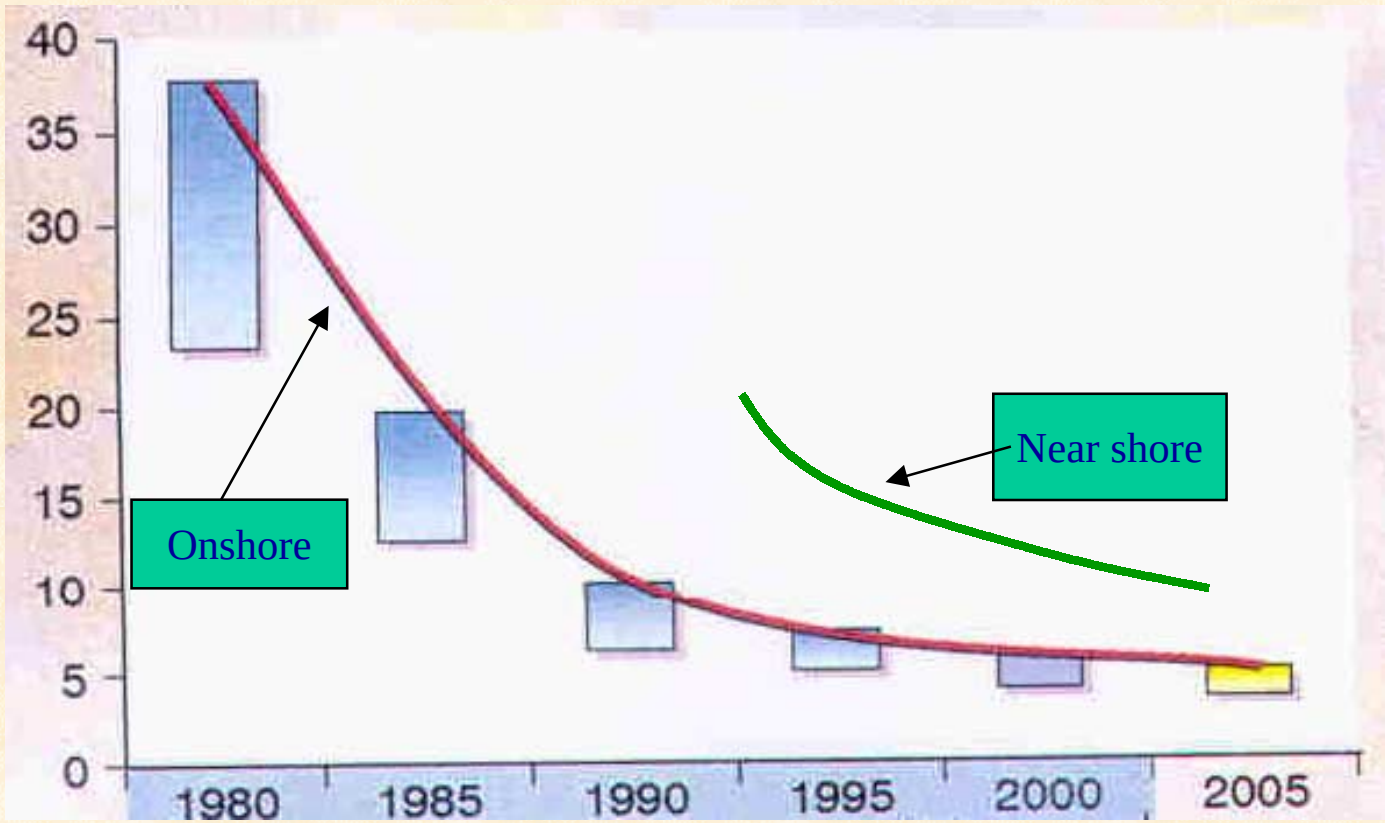
Technological Innovation



Cost Reduction

Wind Energy Generation Cost Development*

cEuro/kWh



* at very good sites (>8 m/s)

Wind Energy Benefits - *Employment*

Major Areas of Job Creation

- ✓ Component Manufacturing and Engineering
- ✓ Wind Turbine Assembly and Engineering
- ✓ Construction and Grid Connection
- ✓ Wind Farm Operation
- ✓ Project Development
- ✓ Research and Development
- ✓ Approval and Certification
- ✓ Operation, Service and Maintenance

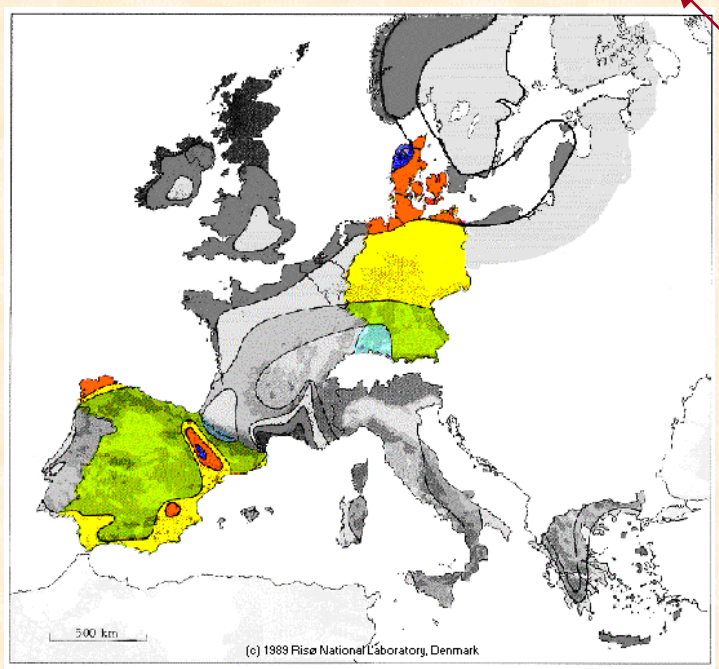
Total:

---> 35,000 jobs (direct/indirect) created since 1990 **in Germany,**

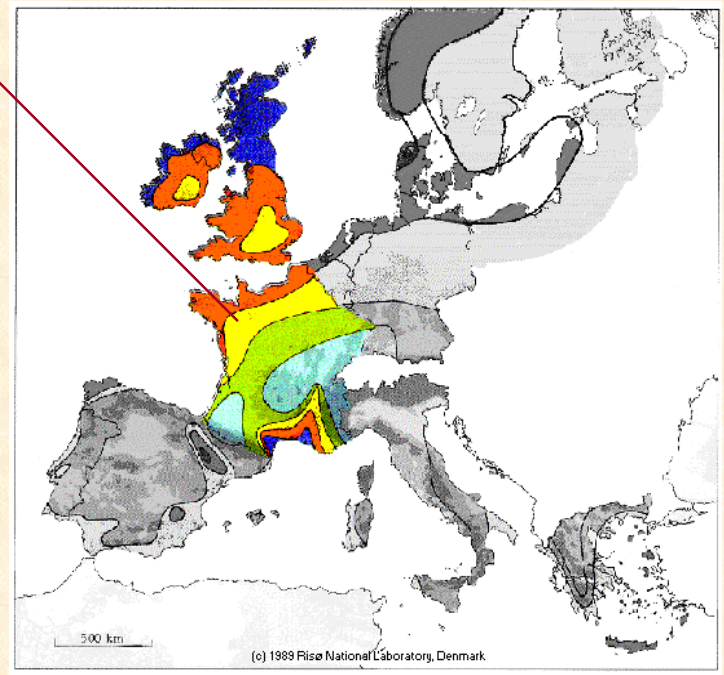
---> 70,000 jobs in Europe

National Support Systems in the EU

***REFITs** (RE Feed in Tariffs)*



Tendering ➔ RECs



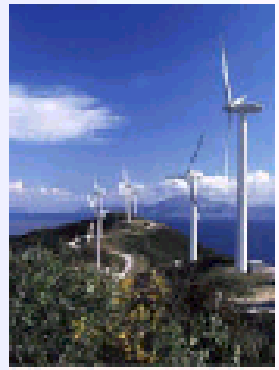
Total installed capacity

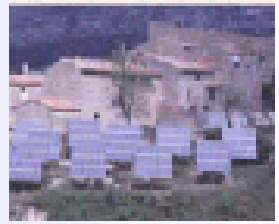
by 2001	**14,508 MW**	**677 MW**
Growth in 2001	**3,860 MW**	**87 MW**

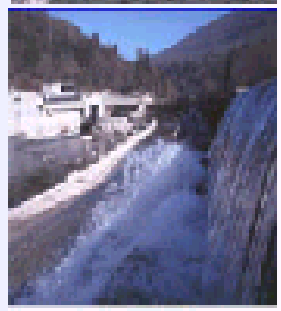
Note: **France** introduced REFITs for wind power on 8 June 2001

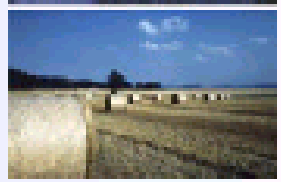
EU Energy Policy

a Case for Renewables

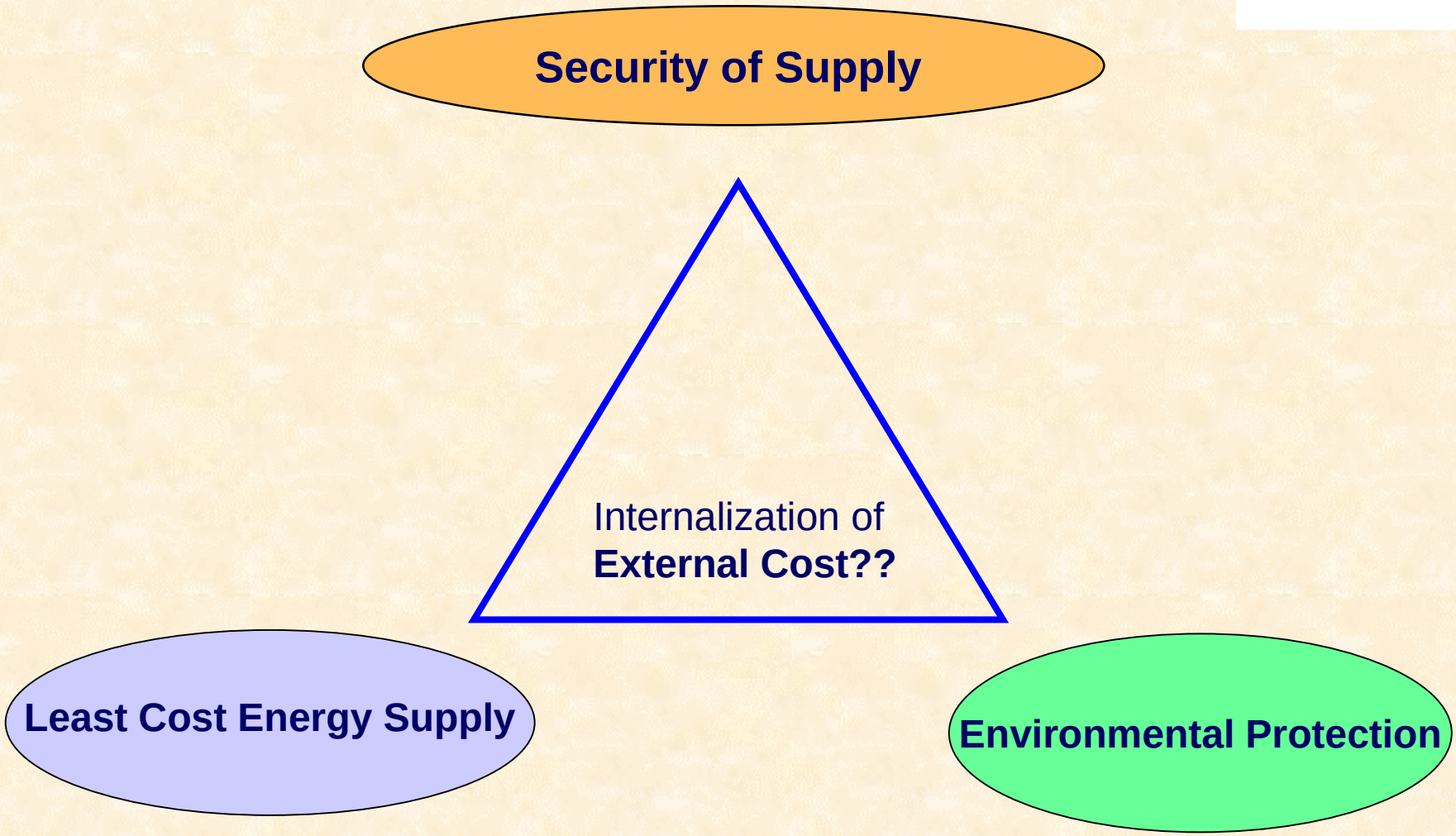






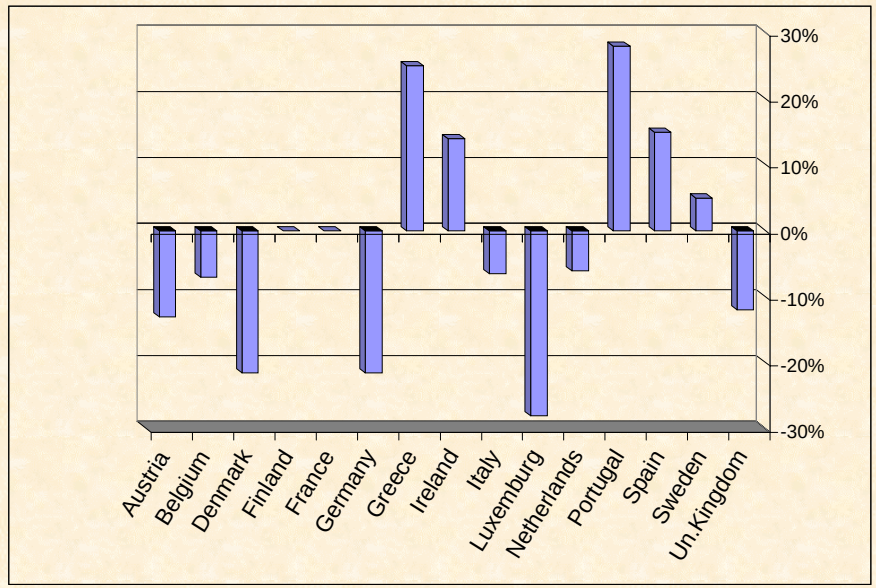


(European) Energy Policy - The Magic Triangle



EU RES Policy - Reasoning

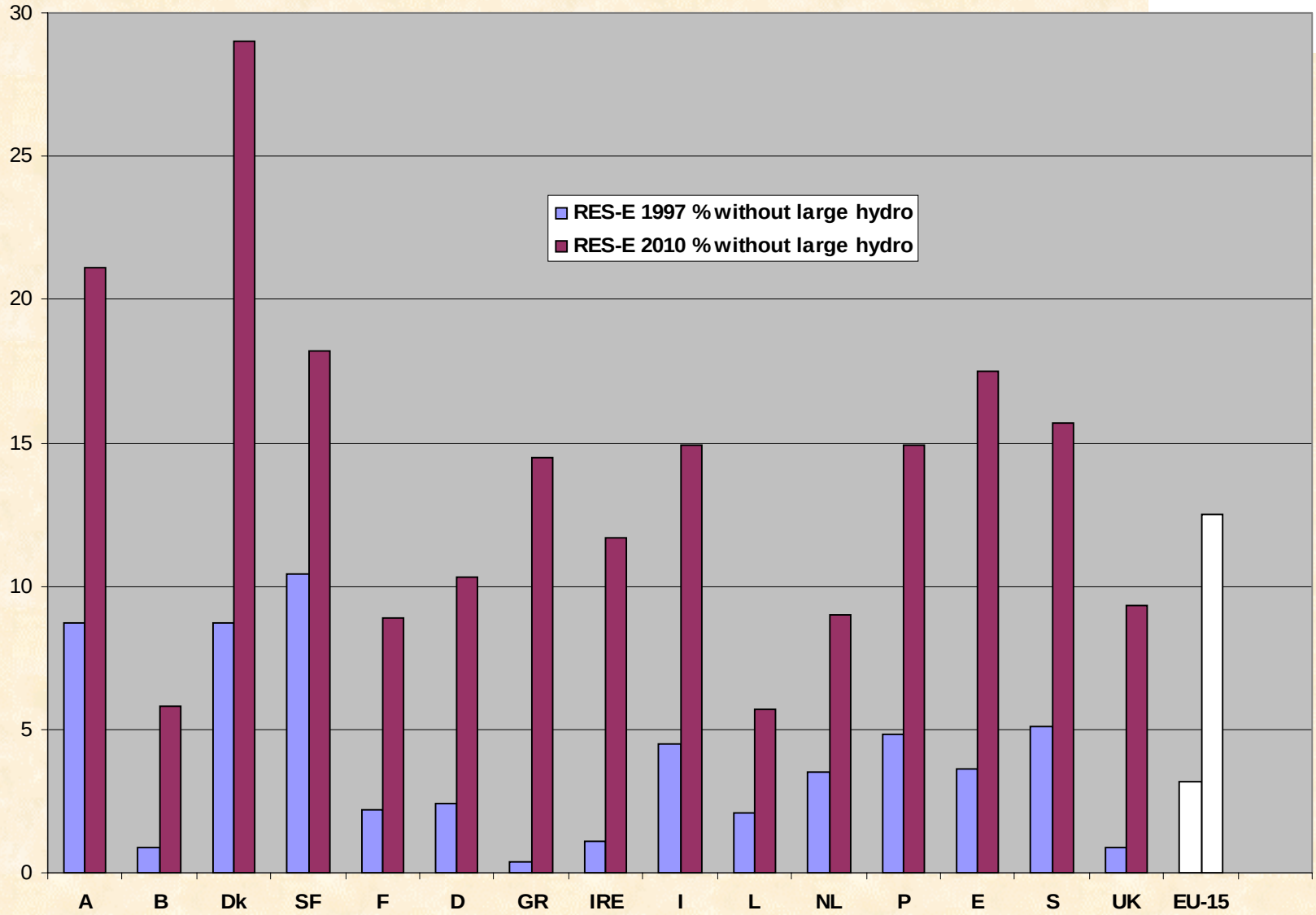
- Climate Change Obligations
- Security of Supply
- Regional Development
- Job Creation
- International Competitiveness
- Future Cost Reduction



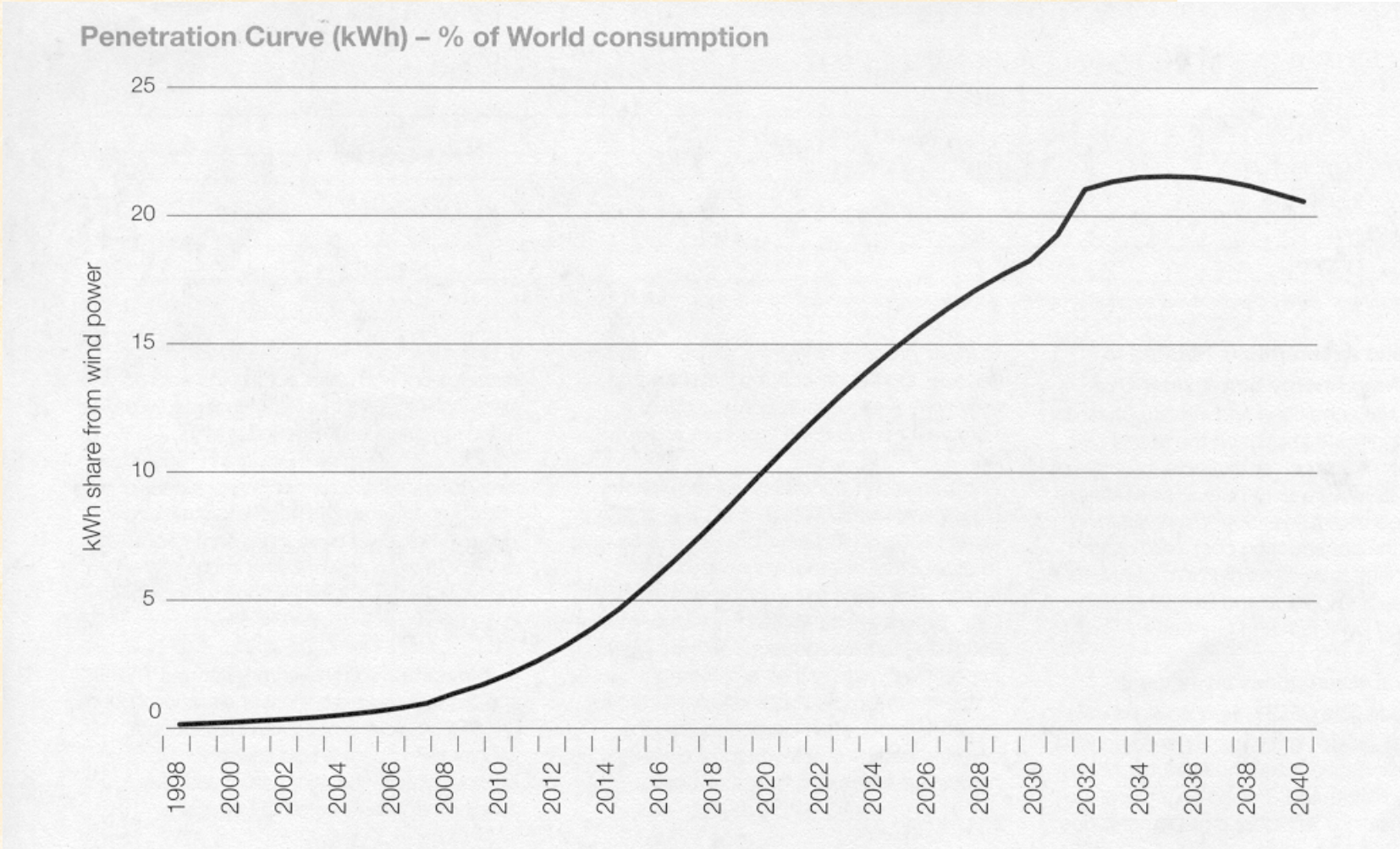
EU RES Directive

- Entered into Force on 27 Oct. 2001
- **Ambitious Targets** - from 14 % to 22.1 % by 2010
- **National Support Systems** (Subsidiarity)
  Evaluation by the EU Commission after 4 years
- **Certificates of Origin** for Green Electricity
- **Grid Access** - Transparent and Non-Discriminatory
- **Administrative Procedures**
  Simplification of Permission and Authorization
- **Monitoring** of Progress made, Evaluation Report

EU RES Directive - national targets (2010)



Projections & Perspectives



Wind Force 10

A blueprint to achieve 10% of the World's Electricity from Wind Power by 2020*

Benefits:

- 1,200 GW total installed wind capacity by 2020
- Annual CO2 savings of 69 mio. tonnes in 2005, 267 mio. tonnes in 2010 and 1780 mio. tonnes in 2020
- or a cumulative CO2 reduction of 9 530 tonnes by 2020
- 1.7 million jobs created
- at a cost of US$ 3 billion in 1999 reaching $78 billion in 2020 (a fraction of total global energy investment of $170-200 billion per year in 1990s)

* Published by EWEA, Greenpeace, et al., Brussels-Amsterdam 1999

Contribution of wind energy to the CO_2 emission reductions in the EU

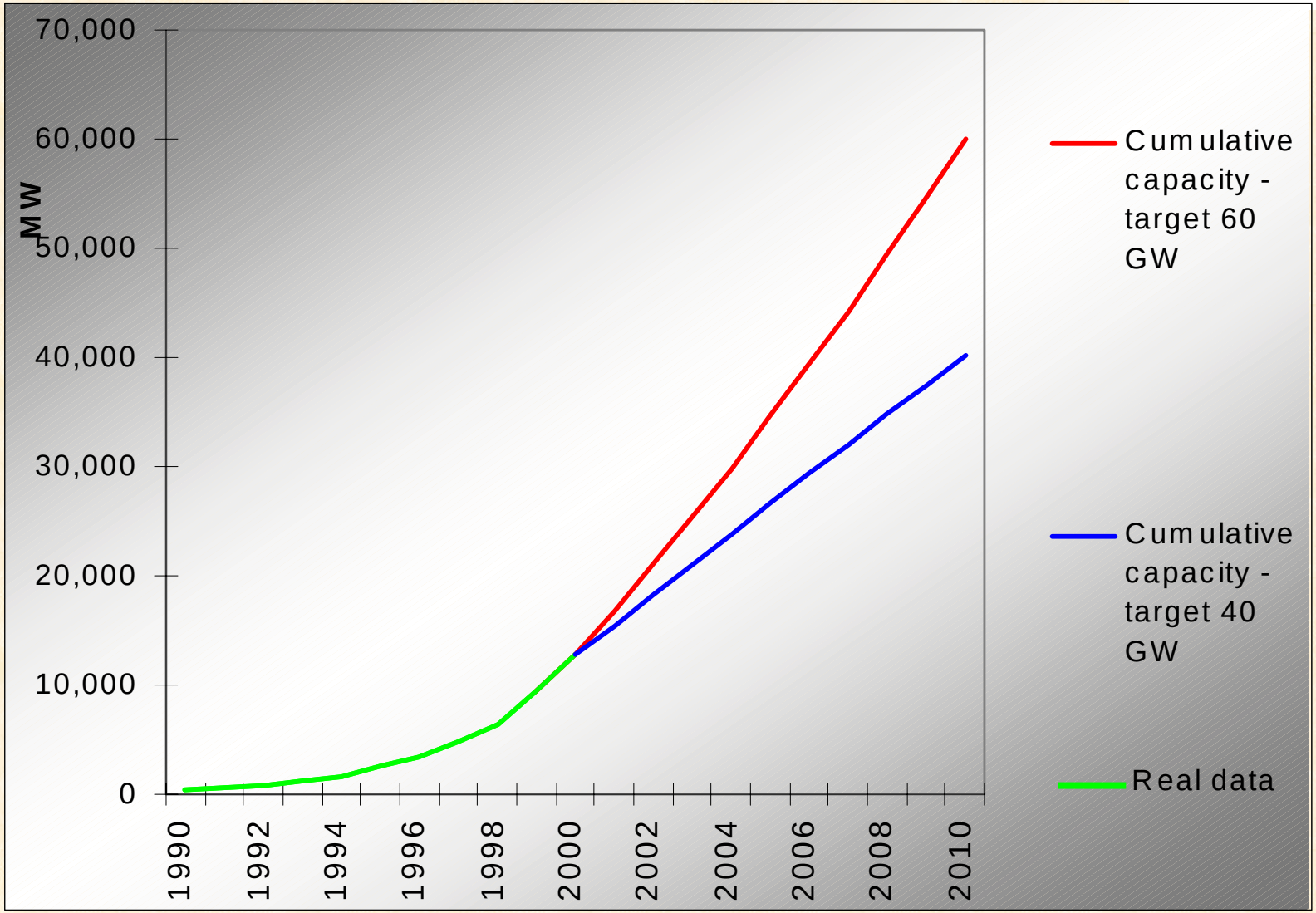
	1990	1995	2000	2005	2010	2020
CO2 emission reductions from wind energy Mtn/year	0.7	3.6	23	60	107	273
Total CO2 emissions Mtn/year	3079	3035	3135	3244	3298	3508
% contribution of wind energy	0.023%	0.12%	0.74%	1.9%	3.2%	7.8%
CO2 emissions from electricity and steam Mtn/year	1212	1162	1148	1192	1201	1419
% contribution of wind energy	0.058%	0.31%	2.0%	5.0%	8.9%	19%

EWEA Projections - past and present

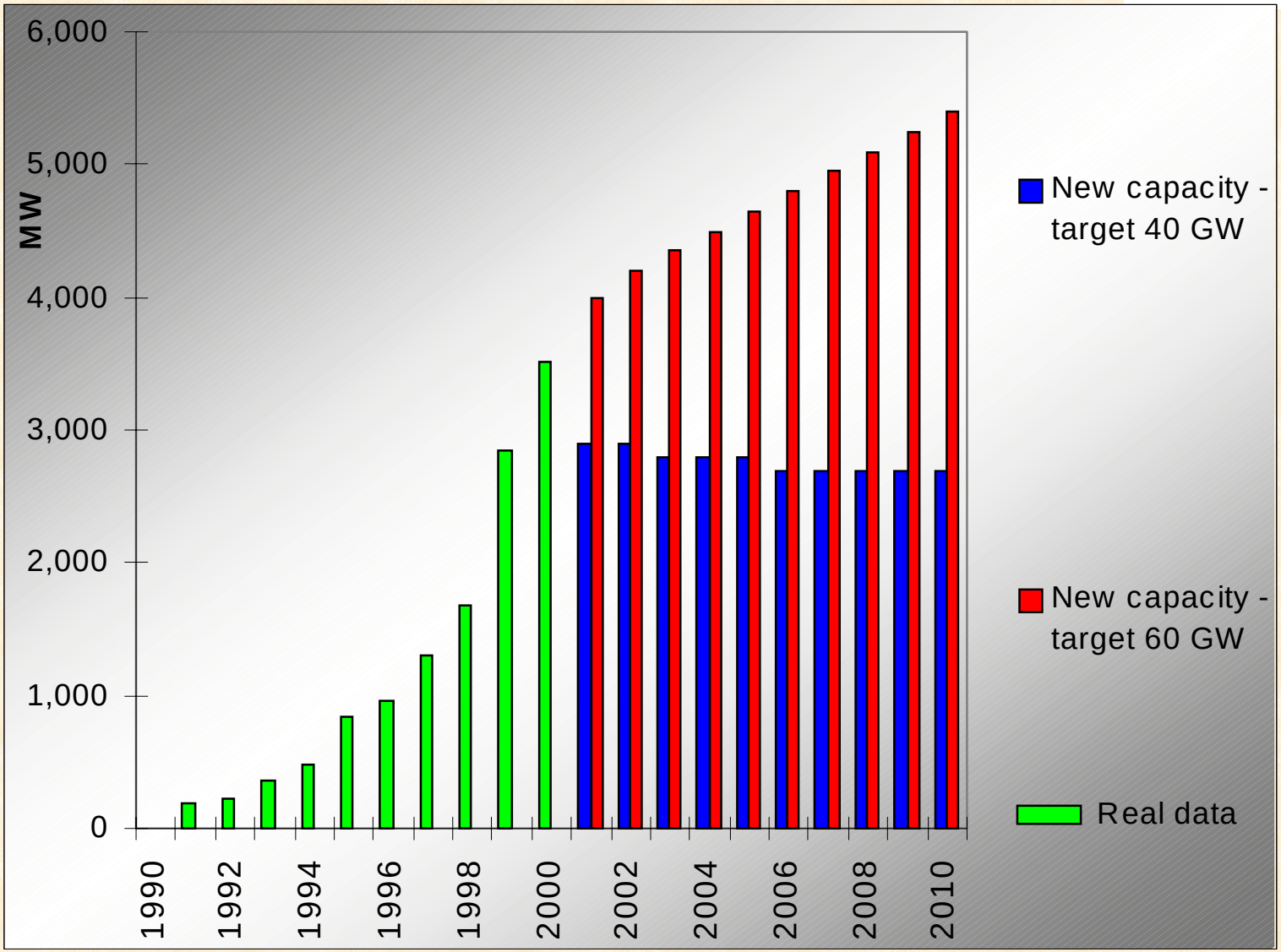
EWEA Targets:

Predicted in:	Target
1991	4,000 MW in 2000 (100,000 MW in 2030)
1997	8,000 MW in 2000 (100,000 MW in 2020 !) 13,000 MW realised in 2000! 40,000 MW in 2010
2000	60,000 MW in 2010 (incl. 5,000 MW offshore) 150,000 MW in 2020 (incl. 50,000 MW offshore)

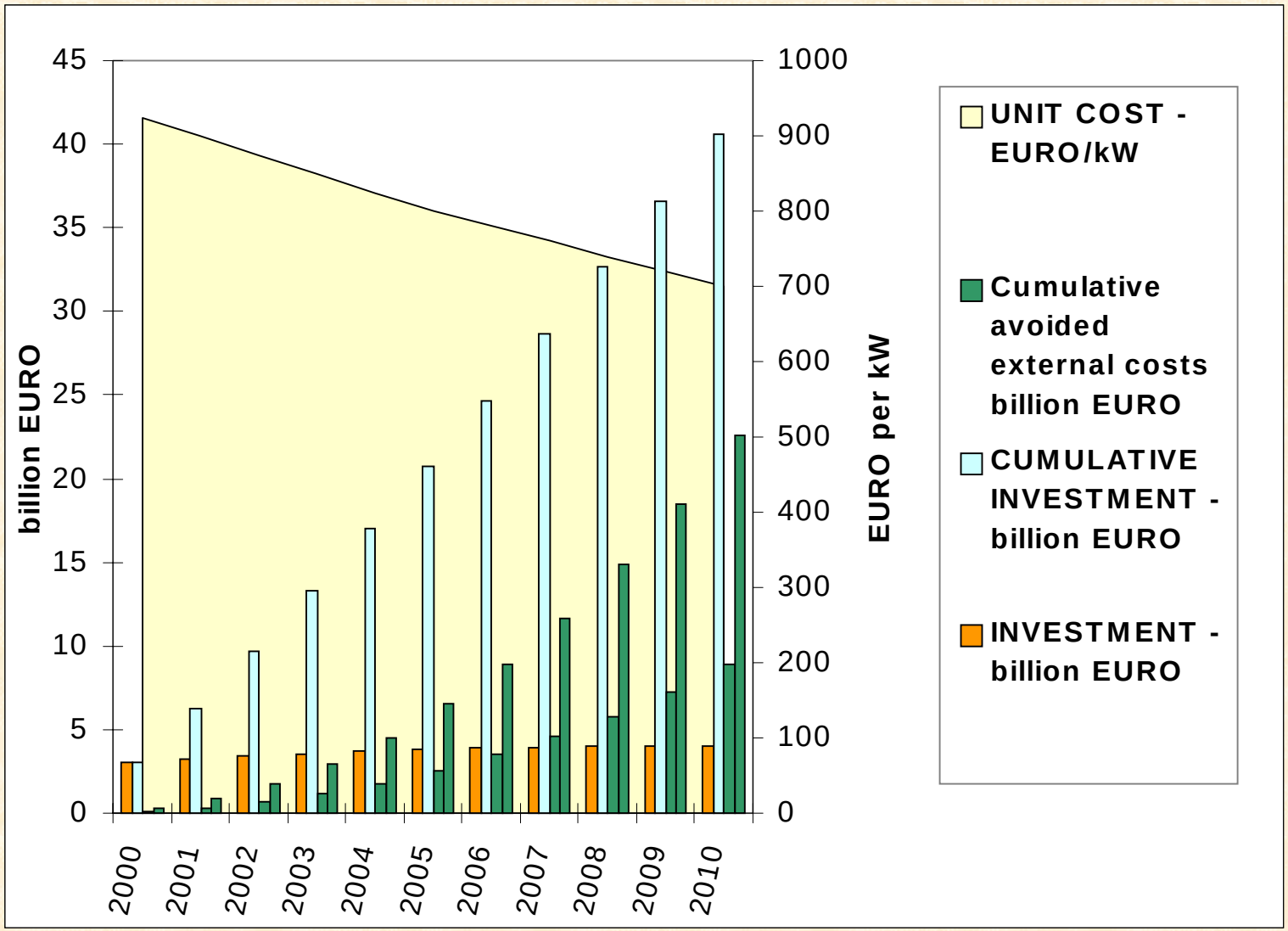
EWEA Projections of Cumulative Capacity



EWEA Projections (2001 – 2010) of Annual Installations

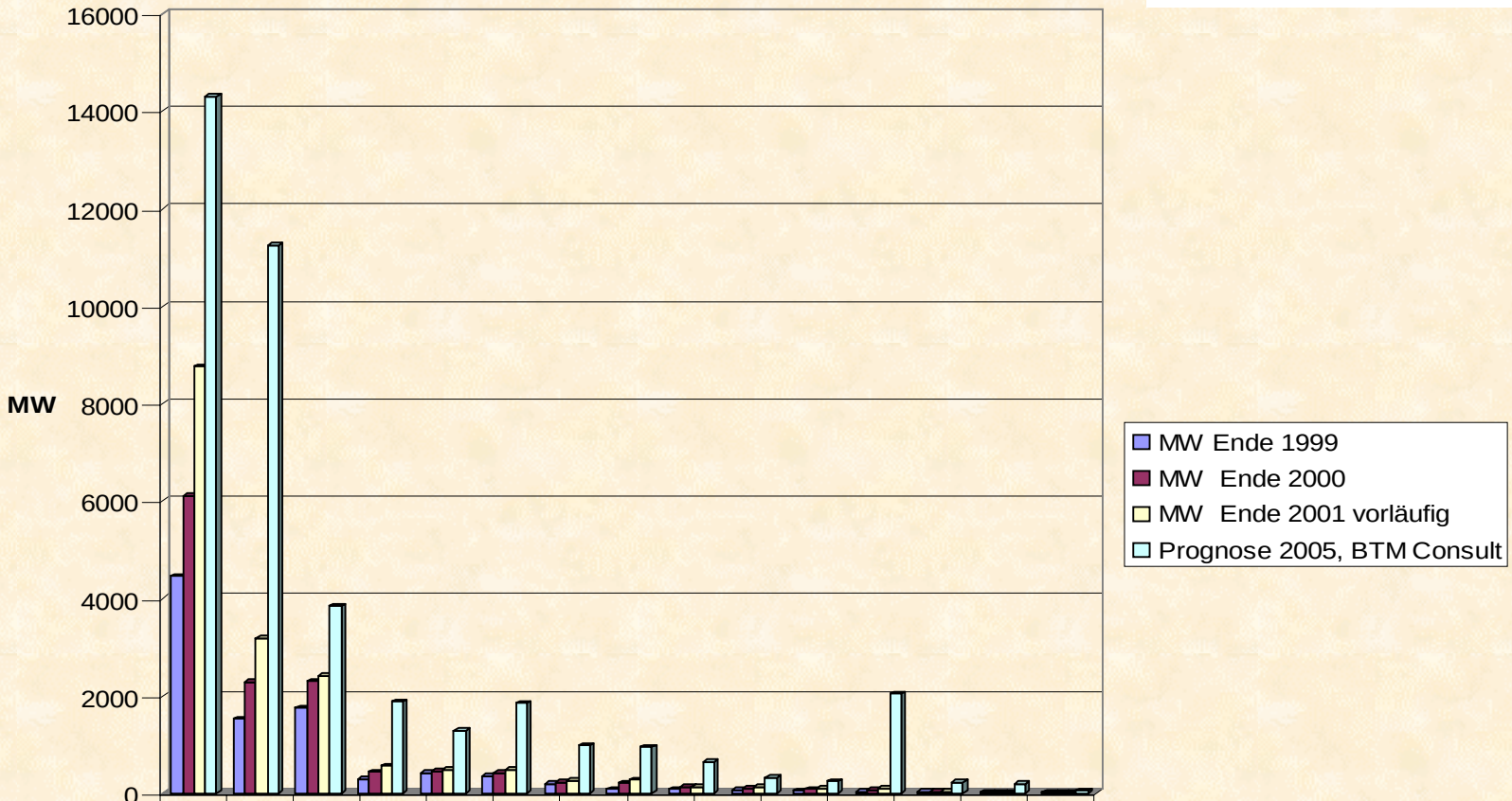


Investments and Avoided External Costs



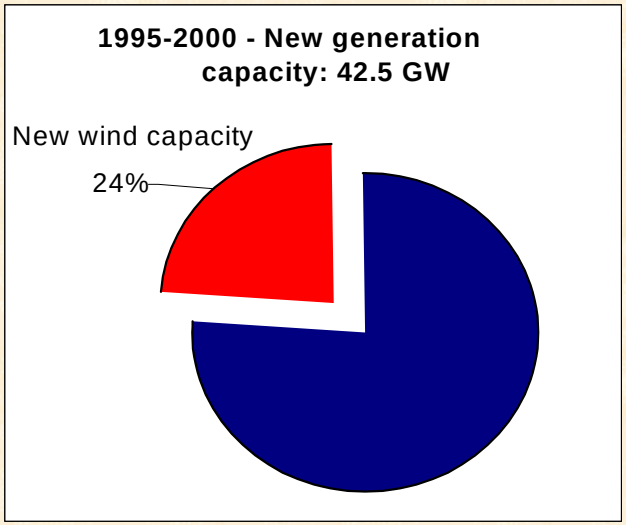
Wind Energy Development in Europe

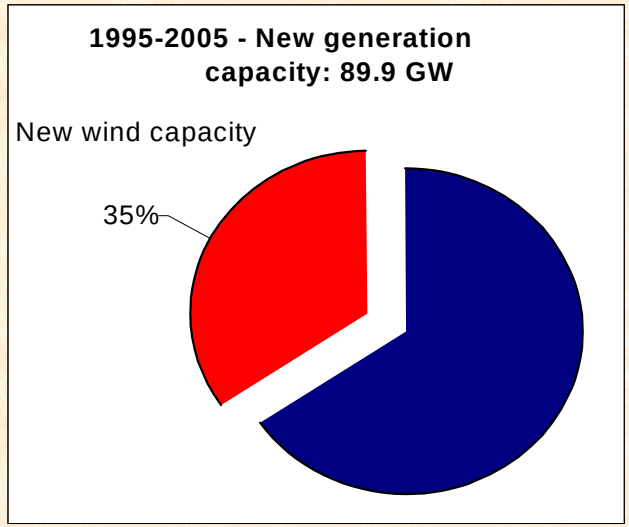
1999-2001, Short-Term Forecast 2005

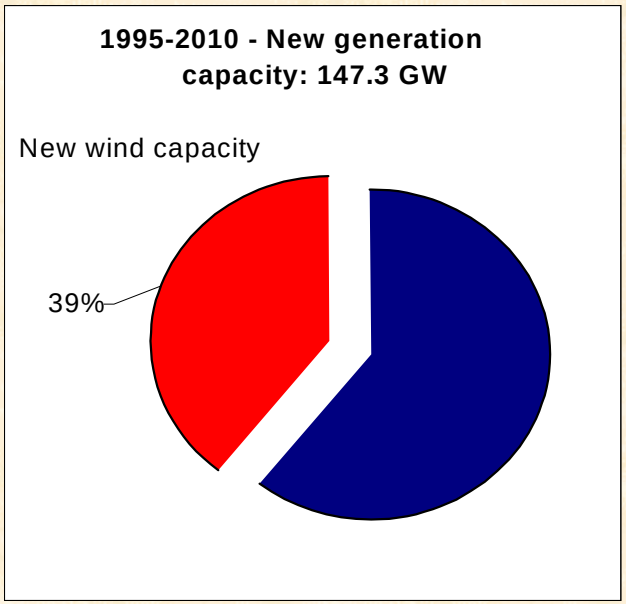


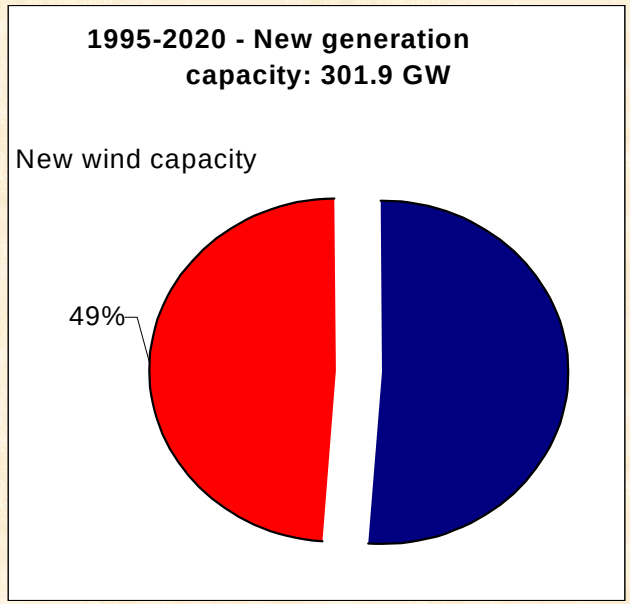
	D	ES	DK	It	NL	UK	S	Ir	P	A	F	Fin	B	L
MW Ende 1999	4443	1522	1748	283	409	343	195	73	60	42	22	38	9	10
MW Ende 2000	6113	2270	2300	427	446	406	231	118	100	77	66	38	13	10
MW Ende 2001 vorläufig	8754	3175	2417	560	483	477	264	132	127	86	87	39	18	10
Prognose 2005, BTM Consult	1430	1123	3841	1874	1288	1850	980	637	311	244	2038	219	189	50

New Wind Capacity as a Percentage of the New Generation Capacity



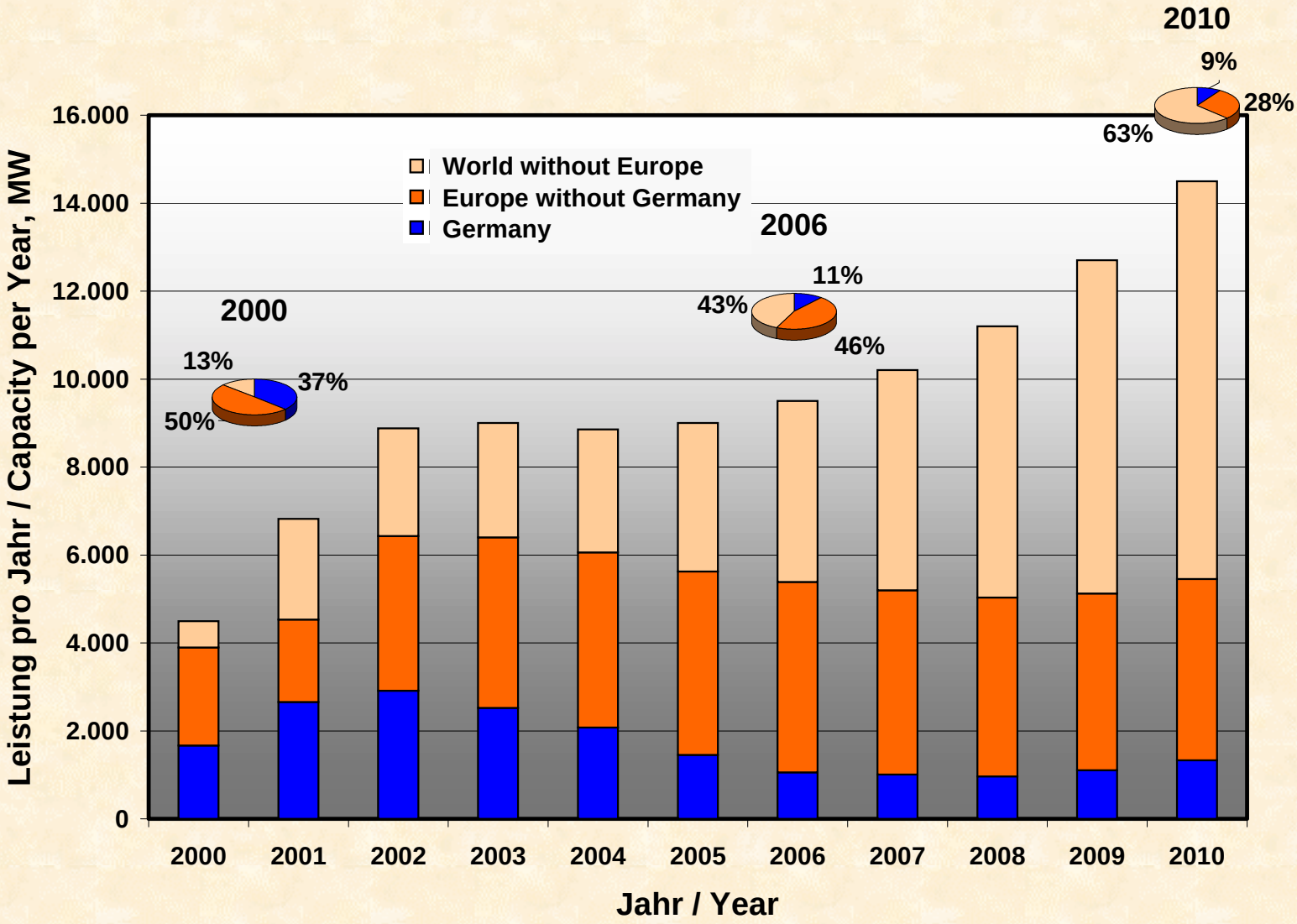






New Capacity per Year, MW (2000-2010)*

*WindEnergy-Studie 2002 Market Development expected by the Wind Industry until 2010
performed by Deutsches Windenergie-Institut GmbH on behalf of Hamburg Messe und Congress GmbH



Cumulated Wind Capacity, MW (2000-2010)*

*WindEnergy-Studie 2002 Market Development expected by the Wind Industry until 2010
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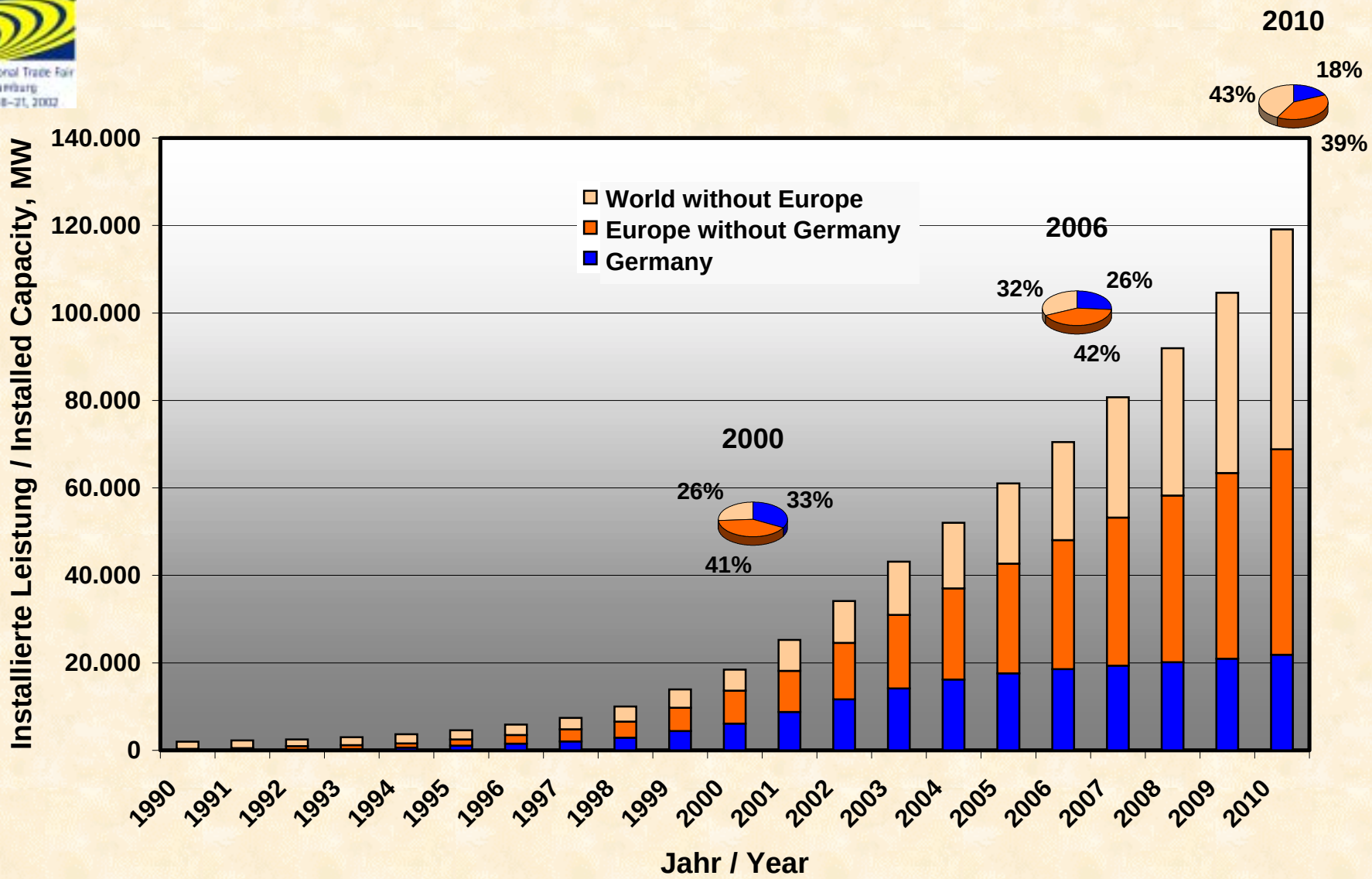


Conclusions - Lessons Learnt

To achieve the benefits of renewable energy generation, some sort of market intervention is required……

Conclusions - Lessons Learnt

Market Intervention to support Wind Energy

- **Investment/ Capital cost support:**
  - Grants/ low interest loans available in some countries (Greece, Sweden, Luxemburg, Portugal) - combined with operating support
- **Operating Support:**
  - ***Price-based intervention***: fixed price or premium on average market price
    D, E, F (new!), P, GRL, (I), (Dk), (B)
  - ***Quantity-based intervention:*** UK, (F), IRL, NL, B, I, Dk?
    - 'auctions' such as NFFO, AER or Eole programme; or
    - percentage obligations with green certificate trading

Premium Price and Tendering Quota Systems

	Country	Installed capacity (1999)	New installation (1999)	European market share (1999)	Installed capacity (2000)	New installation (2000)	European market share (2000)
Premium price markets		MW	MW	%	MW	MW	%
	Germany	4,442	1,567	47.7	6,113	1,671	47.7
	Denmark	1,738	290	18.6	2,300	562	17.9
	Spain	1,495	661	16.0	2,270	775	17.7
	Total	7,675	2,518	82.5	10,683	3,008	83.4
Tendering fixed quota system markets	UK	362	29	3.9	406	44	3.2
	Ireland	74	1	0.8	118	44	0.9
	France	25	6	0.2	66	41	0.5
	Total	461	36	5.0	590	129	4.6

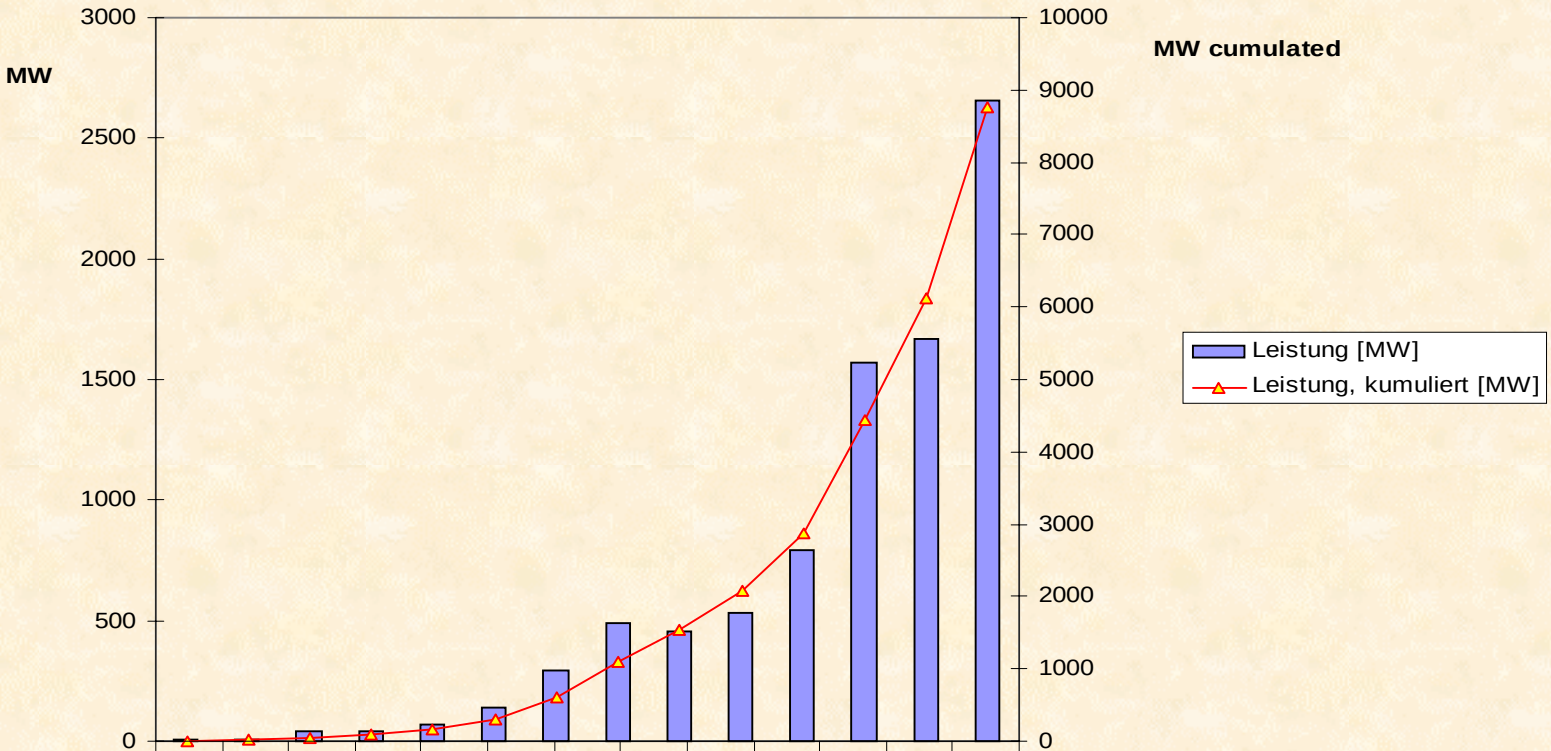
Conclusions - Lessons Learnt

- **Market intervention** needed to allow wind to compete whilst market failures persist -
  → Need to create a **level-playing field**
- **Price-based support systems** best for ensuring an effective and rapid market introduction of wind power
- Existing patterns of development show the importance of **political will** and a **stable regulatory framework** to support renewables
- **Barriers** still to be addressed,
  e.g. grid connection and grid reinforcement, planning, electricity trading issues, etc.
- **Monitoring** and information exchange important
- Optimism about future development (EU Directive)

Conclusions - Lessons Learnt

Follow the best examples - The German Success Story

Installed Wind Capacity, 1988-2001



	1988	1989	1990	1991	1992	1993	1994	1996	1997	1998	1999	2000	2001
Leistung [MW]	5	10	41	42	69	143	295	453	535	793	1569	1668	2659
Leistung, kumuliert [MW]	5	15	56	98	167	310	605	1547	2082	2875	4444	6112	8771