Wind Energy Worldwide – Status and Prospects

World Green Energy Forum 2010
Gyeoungju, 18 November 2010

A Founding Father of WWEA

Dr Hermann Scheer (1944-2010), World Wind Energy Award 2004

„You have to move now fast!“

(during WWEA founding meeting in Copenhagen, July 2001)

World Wind Energy Association

Founded in July 2001 in Copenhagen, Denmark,
Head Office since July 2003 in Bonn, Germany

The Members:

National associations, scientific institutes, companies, public bodies and individuals from currently **96 countries** on all continents

The Aims:

Promoting the worldwide utilisation of wind energy by

- being a communication platform for all wind energy actors world-wide
- advising national and international policies in favour of wind energy
- enhancing international technology transfer

World Wind Energy Association

The Activities:

- World Wind Energy Conferences:
  WWEC2010: Istanbul
  WWEC2011: Cairo, 2-4 May 2011

- World Summit for Small Wind Turbines (Husum, in March)

- Several working groups:
  community power, small&hybrid systems, sustainability guidelines, repowering, education, CDM

WWEA's international cooperation

- WWEA has **Special Consultative Status at UN**, and works with other international organisations

- WWEA has supported the establishment of the **International Renewable Energy Agency**

International Renewable Energy Alliance:

- WWEA founded the **REN Alliance** with the International Solar Energy Society, the International Geothermal Association, the International Hydropower Association and the World Bioenergy Association

WWEA's Members

Members and World Wind Energy Conferences & Exhibitions:

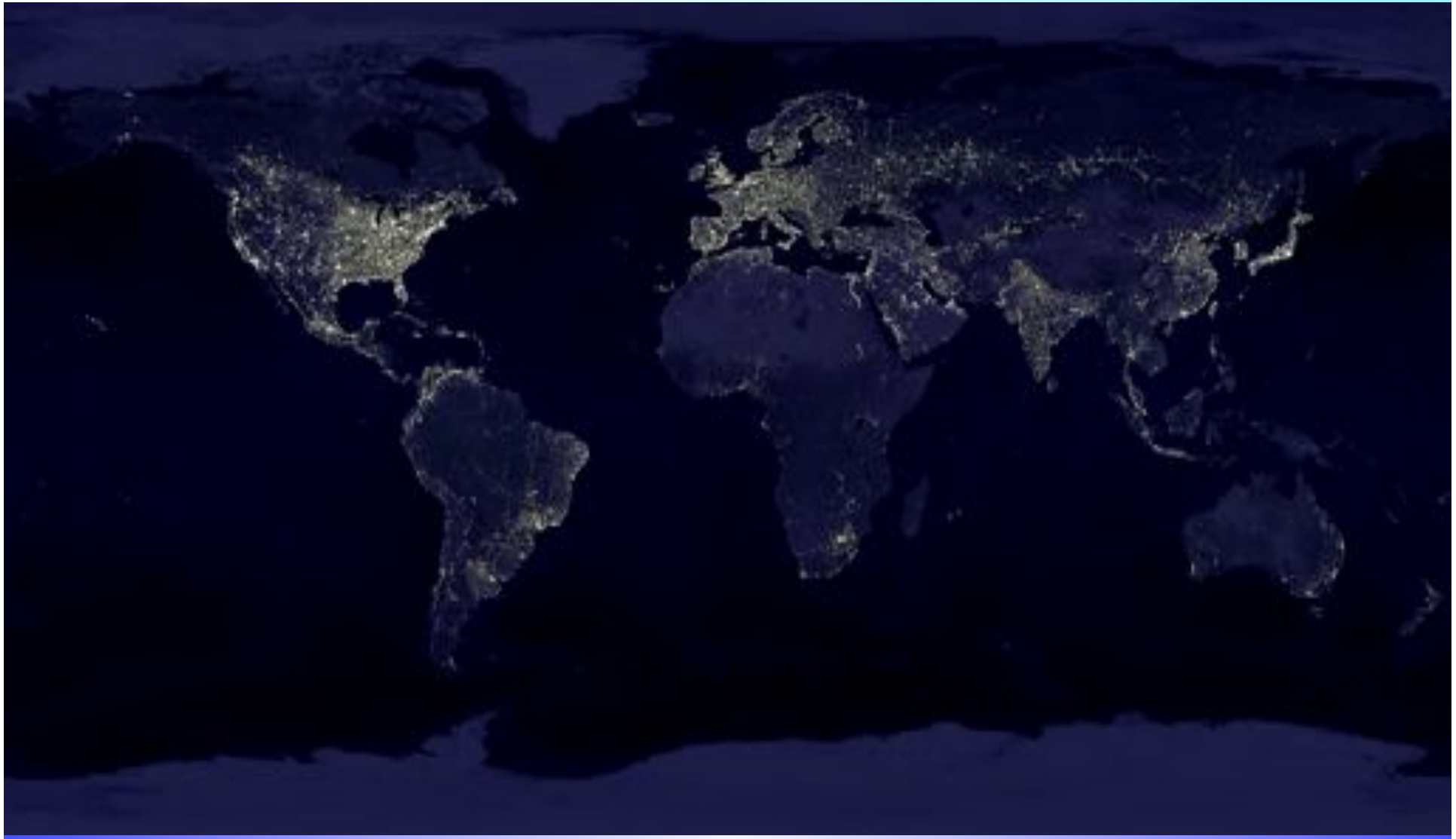
The key drivers of wind energy:

Secure & domestic energy supply

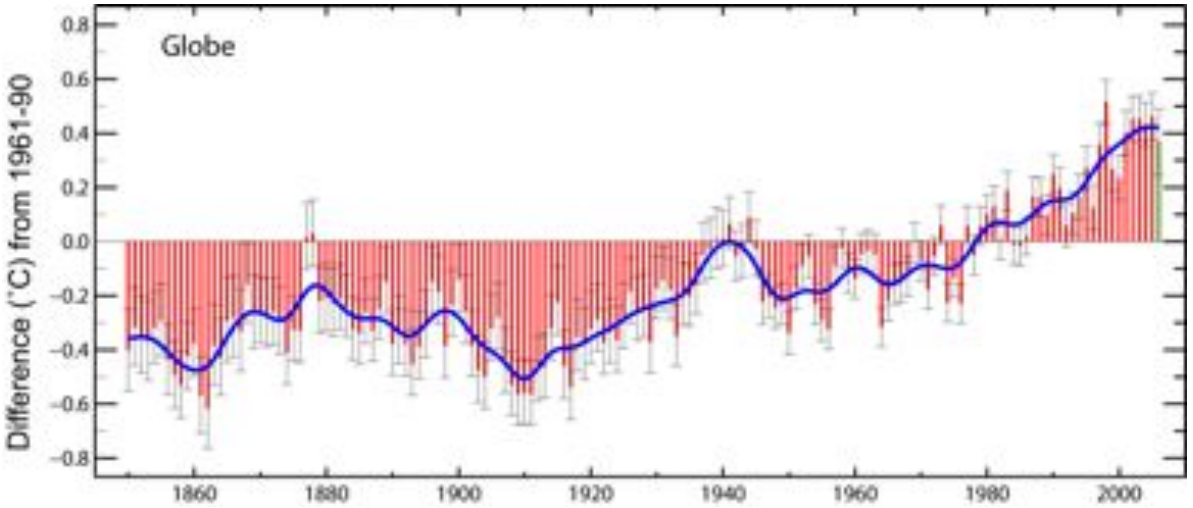
Environmental sustainability

Economics: affordable & low-risk

Mankind needs Energy

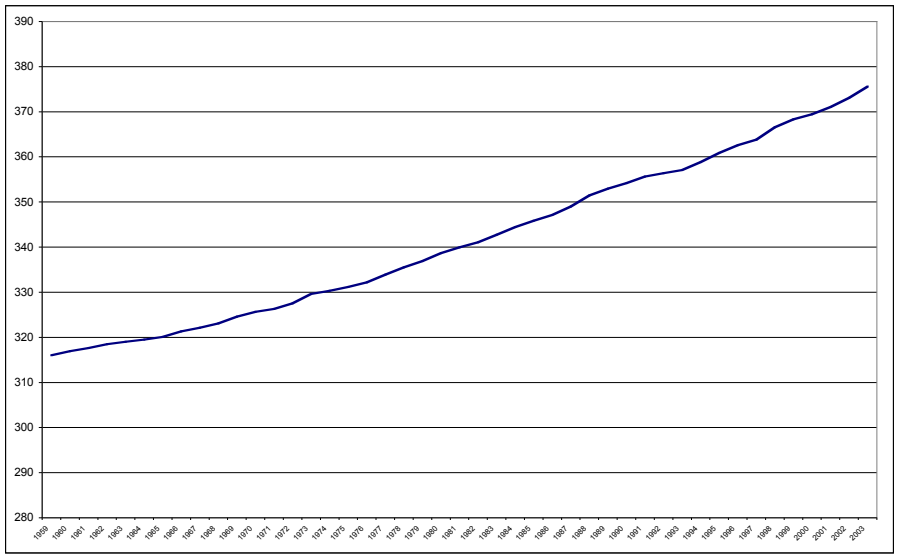


Consequences of Fossil Energy Utilisation



Global average temperature 1860-2005

CO2 concentration 1959-2003 at Mauna Loa, Hawaii

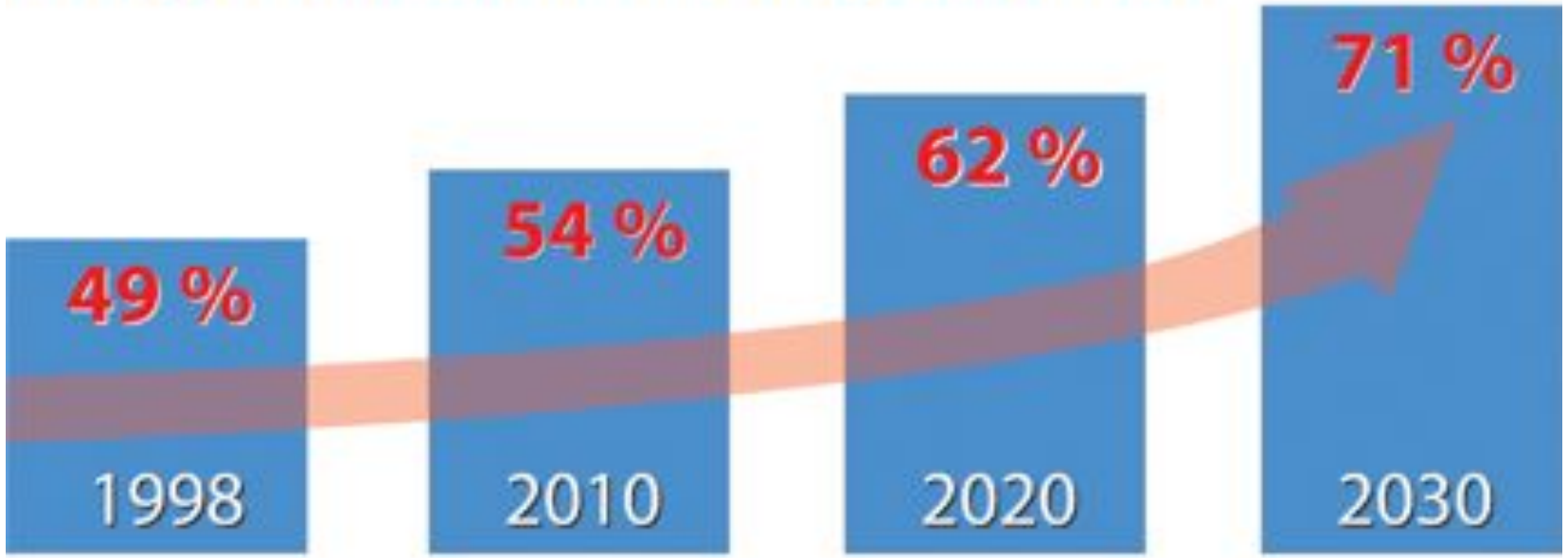


Source: IPCC

Digging for Brown Coal in Germany

The case of security of energy supply

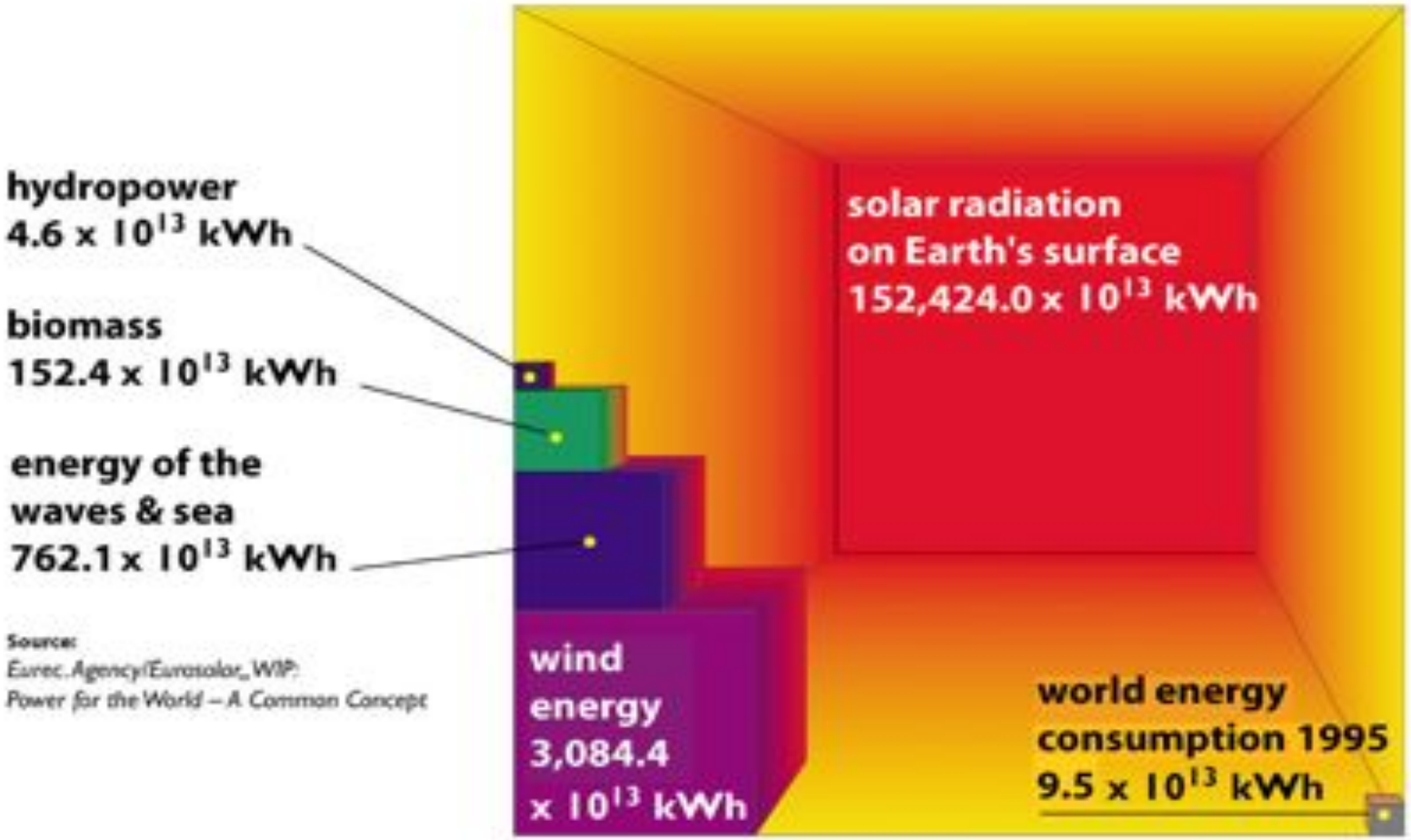
Projected Import Dependance on Raw Materials for Energy Production in the European Union



The Dependance on Raw Material Imports will increase dramatically in Europe if current modes of Power Production are retained.

Source: European Commission

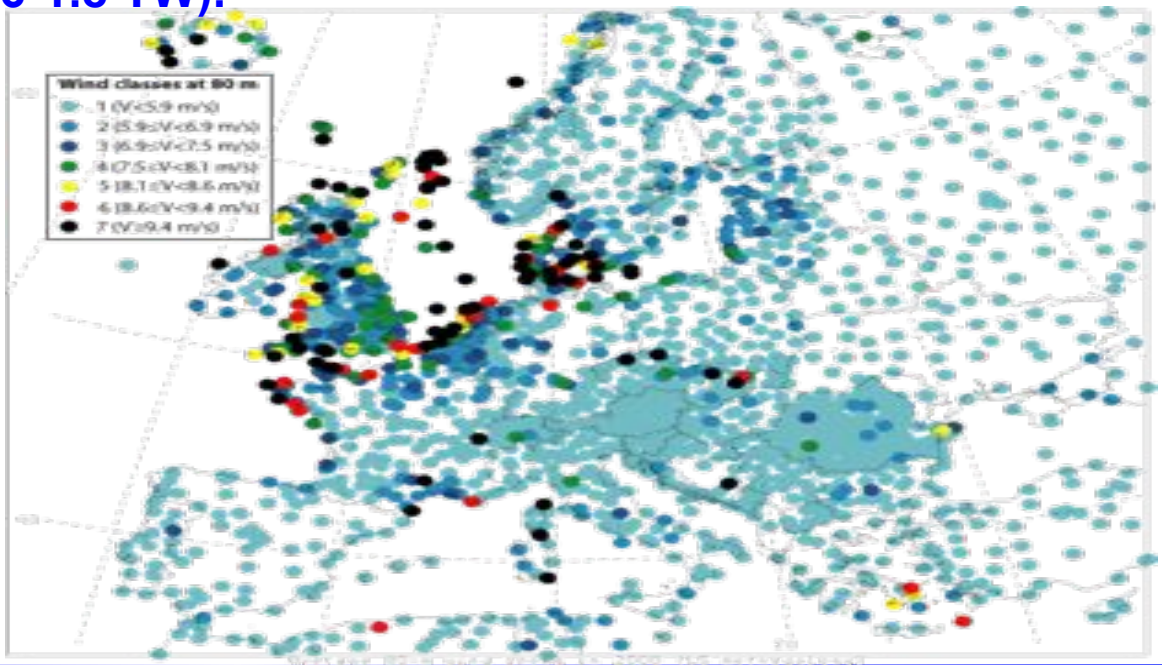
The Solution: Renewable Energy



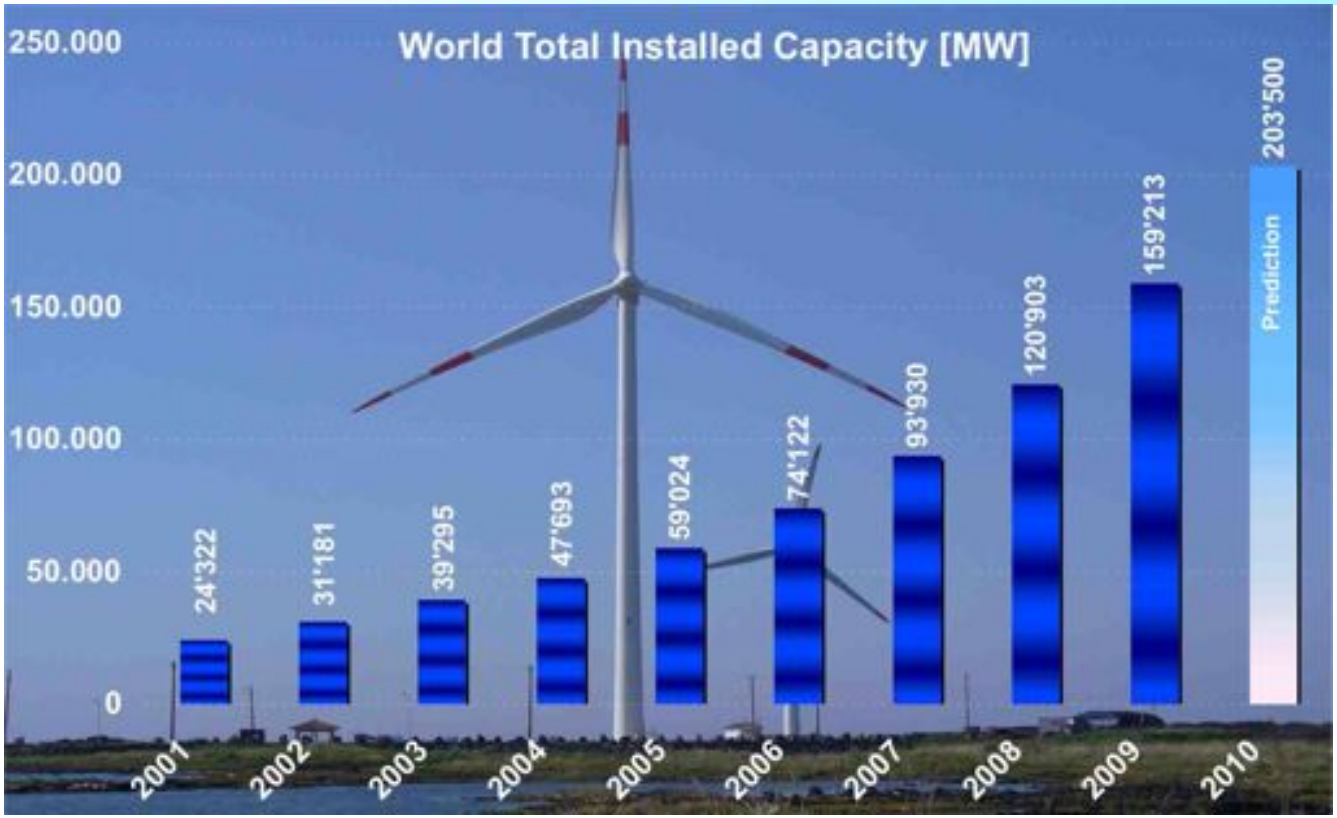
Evaluation of Global Wind Power

"Assuming that statistics generated from all stations analyzed here are representative of the global distribution of winds, global wind power generated at locations with mean annual wind speeds ≥ 6.9 m/s at 80 m is found to be ~72 TW (~54,000 Mtoe) for the year 2000.

Even if only ~20% of this power could be captured, it could satisfy 100% of the world's energy demand for all purposes (6995-10177 Mtoe) and over seven times the world's electricity needs (1.6-1.8 TW)."



Source: Cristina L. Archer and Mark Z. Jacobson (Stanford University), 2005

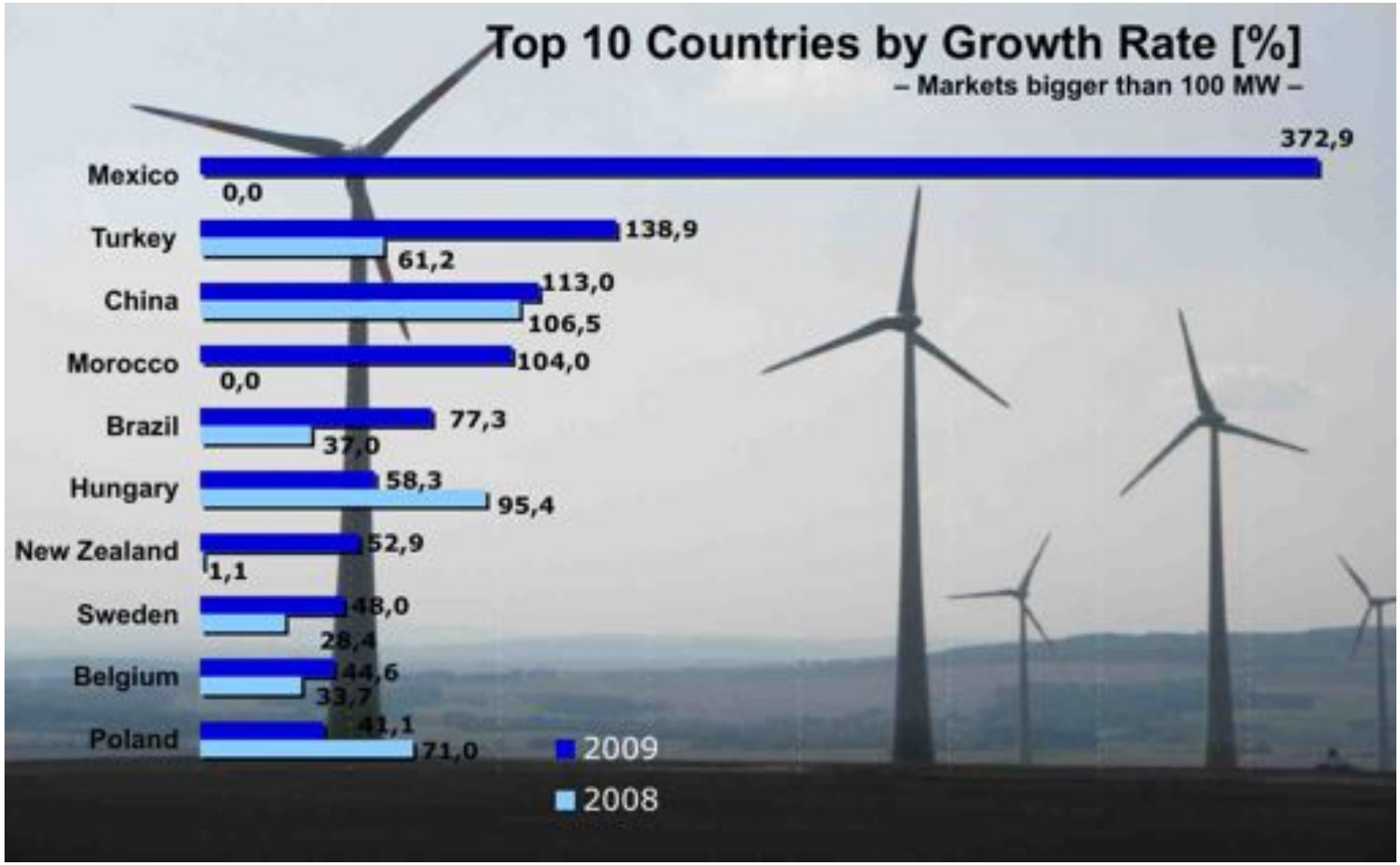


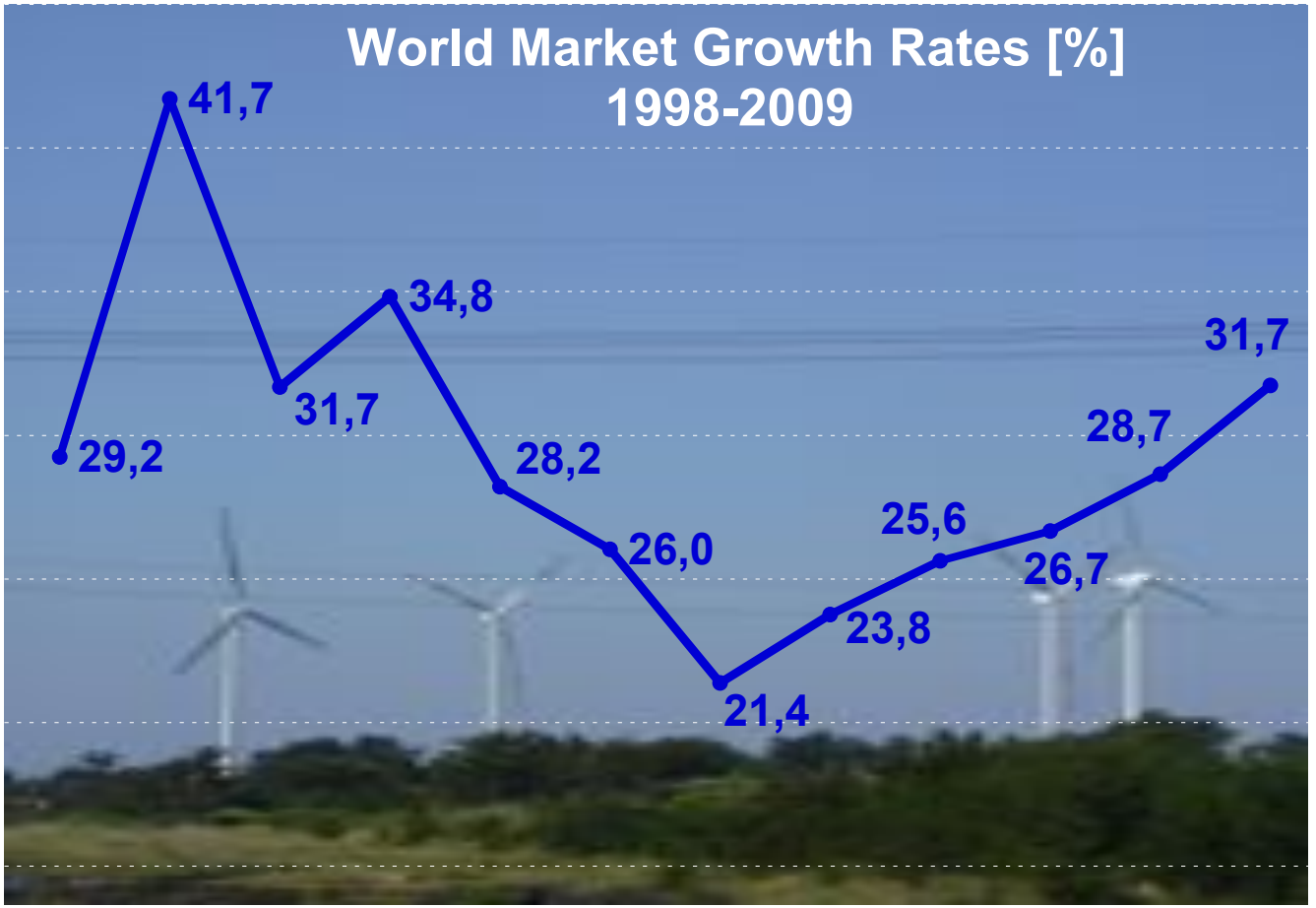
Electricity generated: **340 TWh, equal to Italy's electricity demand**
Share in global electricity demand: **~2 %**
Countries with high wind shares:

Denmark	>20 %	Portugal	18 %
Spain	14 %	Germany	9 %

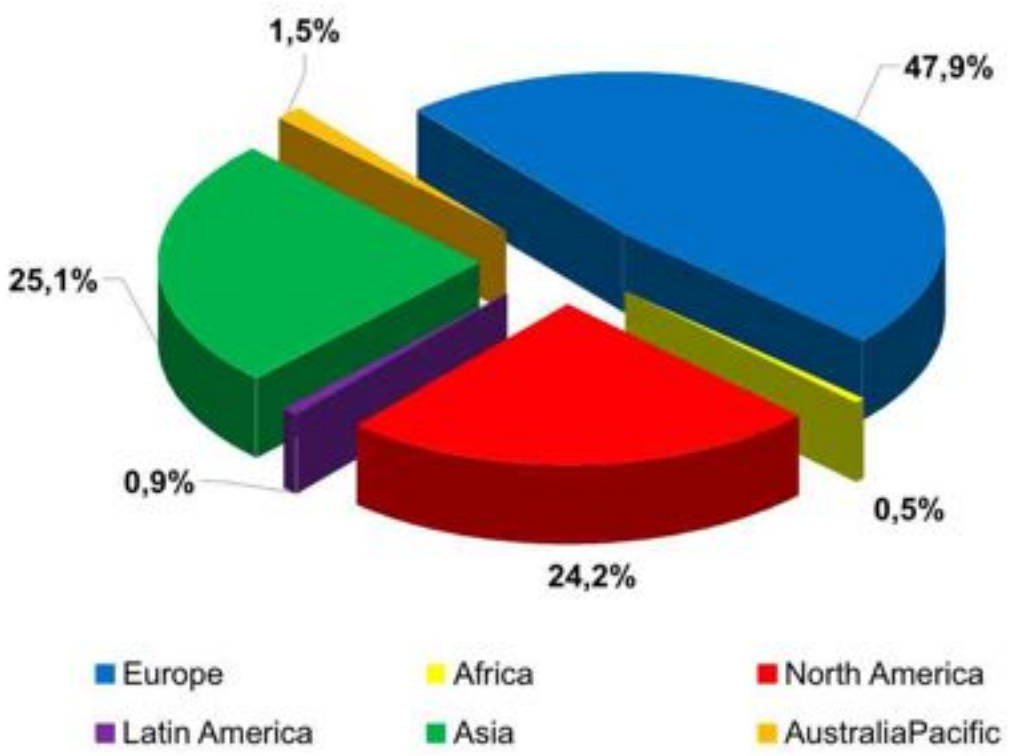
Wind Power Worldwide June 2010

Position	Country	Total capacity June 2010 [MW]	Added capacity June 2010 [MW]	Total capacity end 2009 [MW]
1	USA	**36.300**	1.200	35.159
2	China	**33.800**	7.800	26.010
3	Germany	**26.400**	660	25.777
4	Spain	**19.500**	400	19.149
5	India	**12.100**	1.200	10.925
6	Italy	**5.300**	450	4.850
7	France	**5.000**	500	4.521
8	United Kingdom	**4.600**	500	4.092
9	Portugal	**3.800**	230	3.535
10	Denmark	**3.700**	190	3.497
	Rest of the World	**24.500**	2.870	21.698
Total		**175.000**	**16.000**	**159.213**

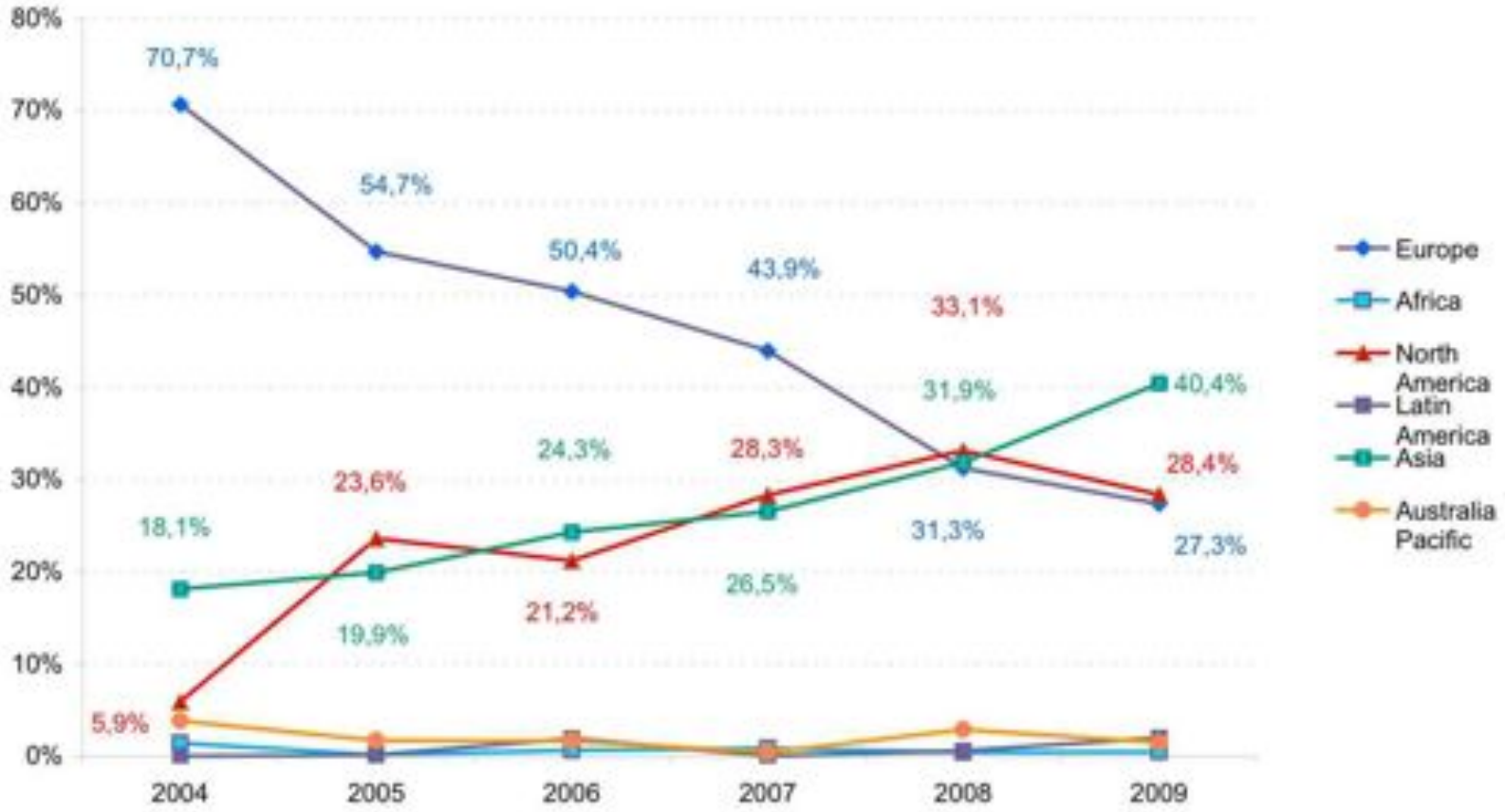

Top 10 Countries by Growth Rate [%]
– Markets bigger than 100 MW –
Mexico
0,0
372,9
Turkey
61,2
138,9
China
106,5
113,0
Morocco
0,0
104,0
Brazil
37,0
77,3
Hungary
95,4
58,3
New Zealand
1,1
52,9
Sweden
28,4
48,0
Belgium
33,7
44,6
Poland
71,0
41,1
2009
2008

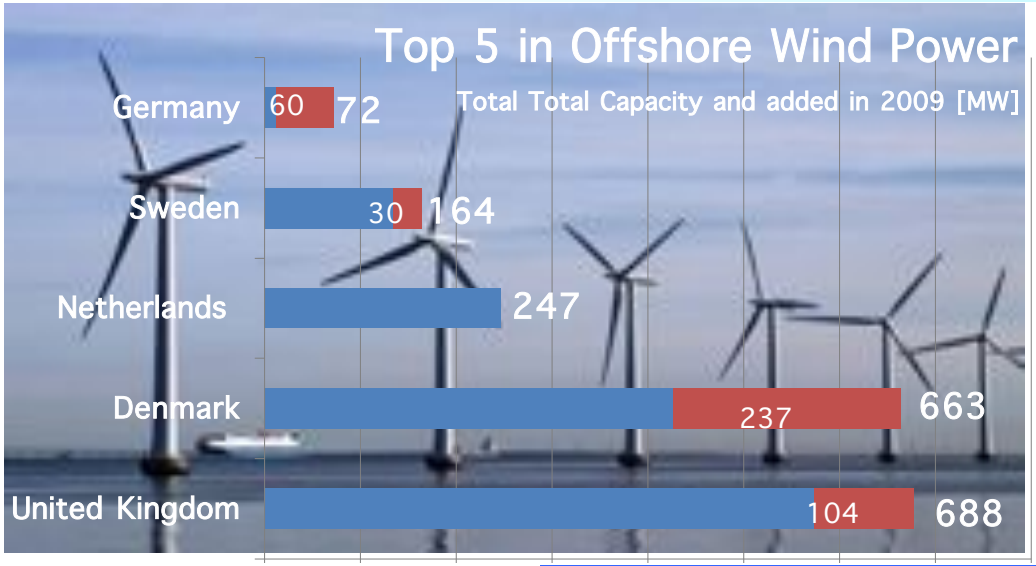

World Market Growth Rates [%]
1998-2009
41,7
29,2
31,7
34,8
28,2
26,0
21,4
23,8
25,6
26,7
28,7
31,7

Continental Share in Total Capacity 2009

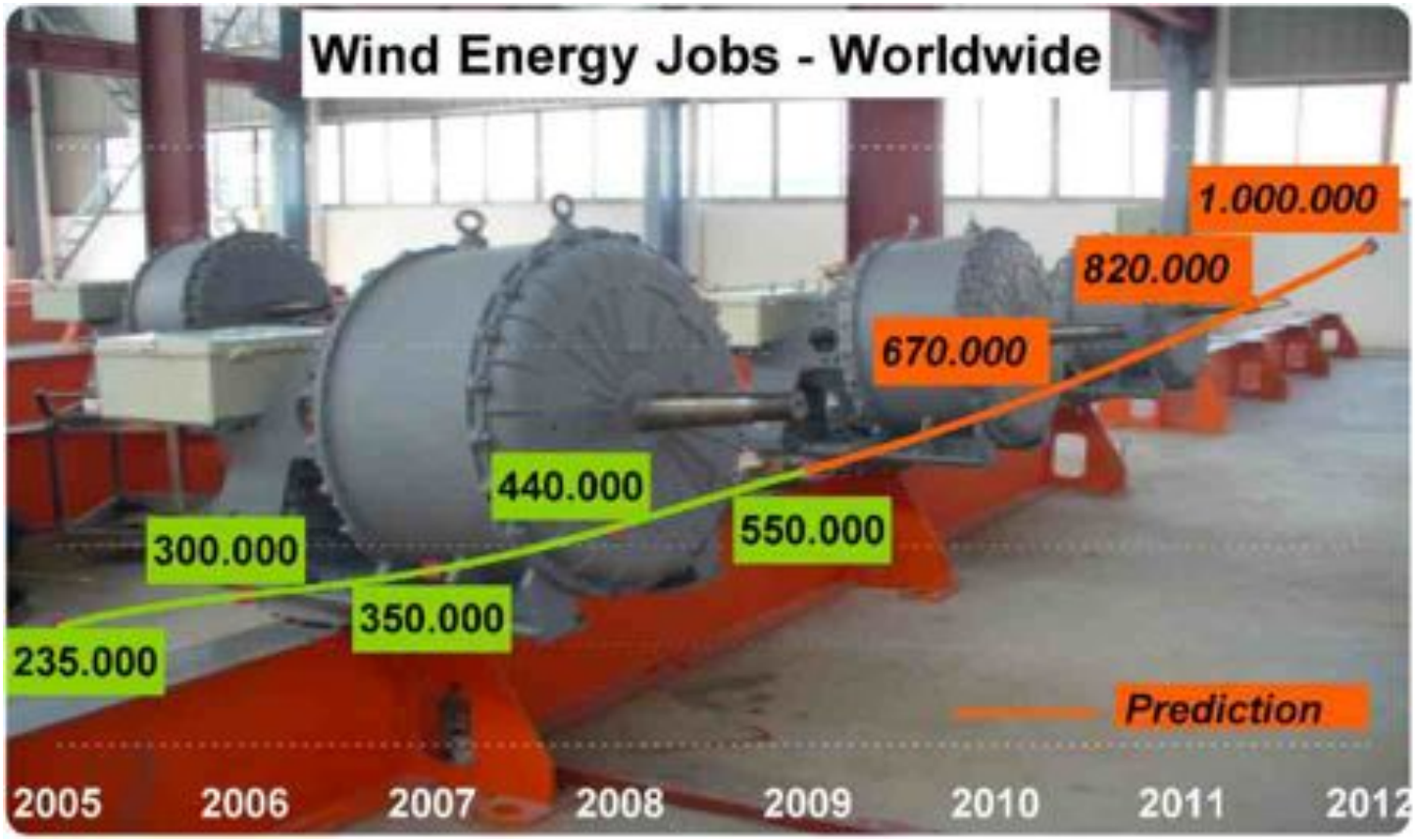


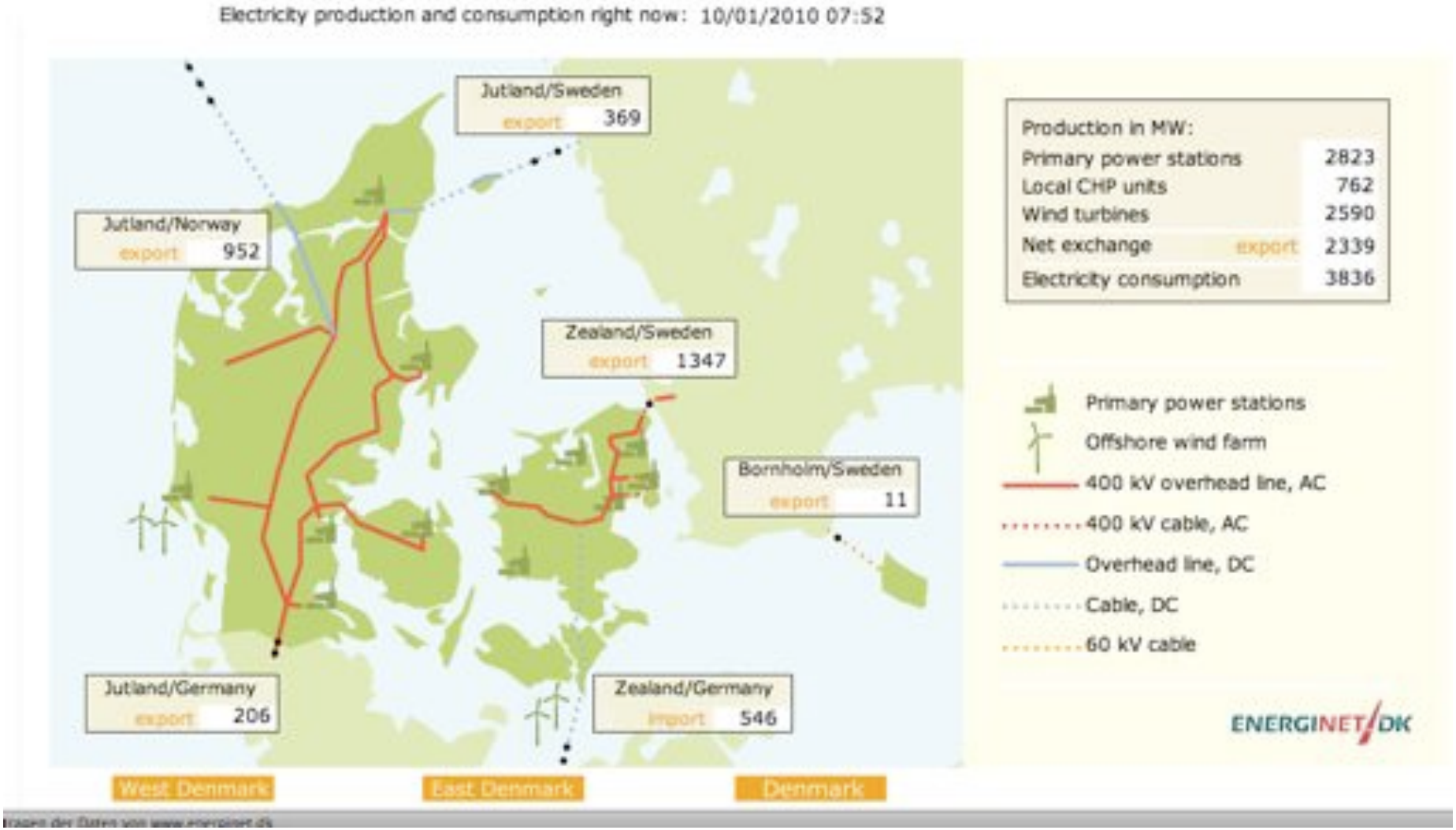
Continental Shares in New Wind Capacity

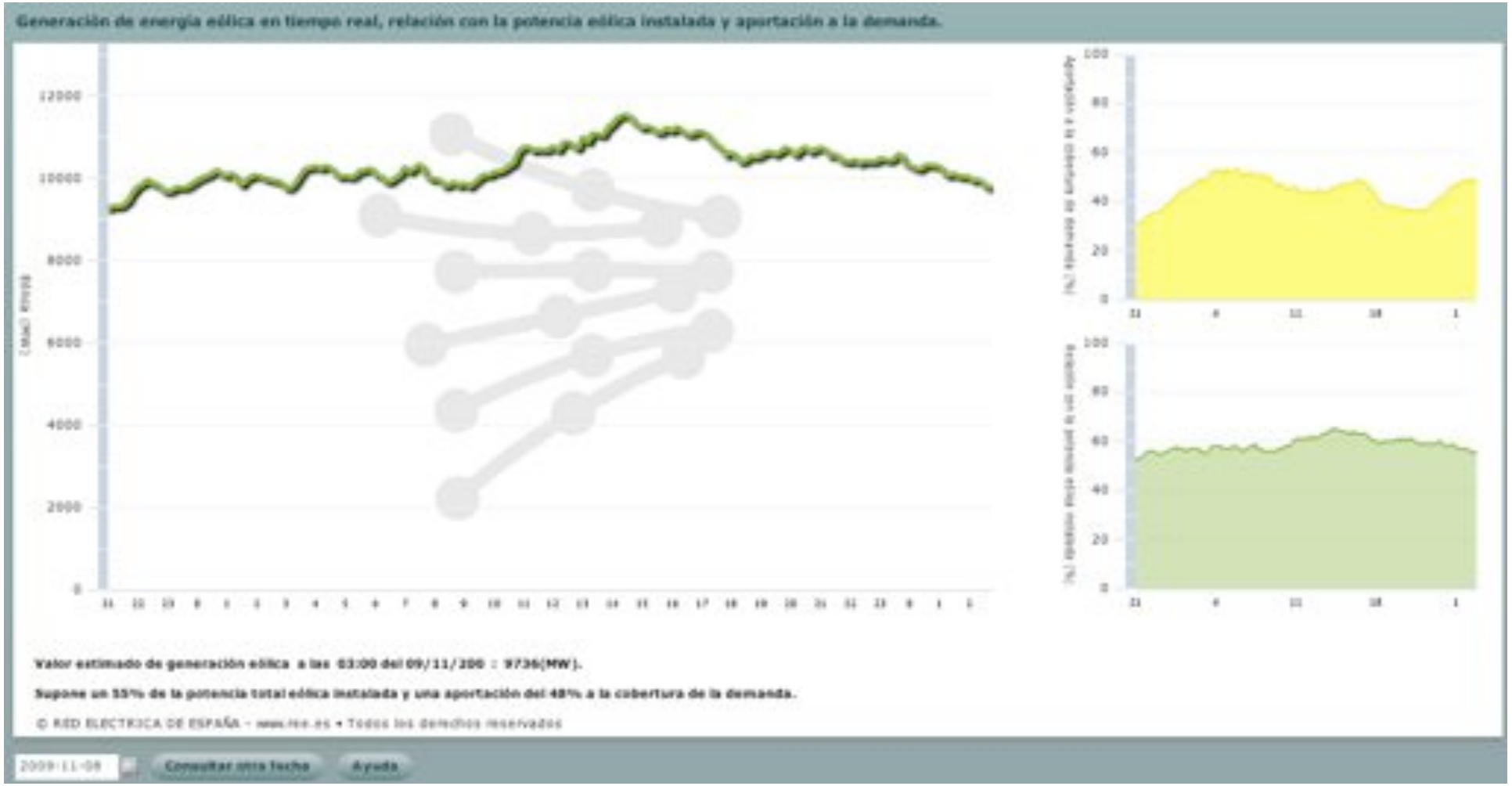




Position 2009	Country	Total Offshore Capacity [MW] end 2009	New Offshore Capacity [MW] installed in 2009	Total Offshore Capacity [MW] end 2008	Rate of Growth [%]
1	**United Kingdom**	**688,0**	104,0	574,0	18,1
2	**Denmark**	**663,6**	237,0	426,6	55,6
3	**Netherlands**	**247,0**	0,0	247,0	0,0
4	**Sweden**	**164,0**	30,0	134,0	22,4
5	**Germany**	**72,0**	60,0	12,0	500,0
6	**Belgium**	**30,0**	0,0	30,0	0,0
7	**Finland**	**30,0**	0,0	30,0	0,0
8	**Ireland**	**25,0**	0,0	25,0	0,0
9	**China**	**23,0**	21,0	2,0	1050,0
10	**Spain**	**10,0**	0,0	10,0	0,0
11	**Norway**	**2,3**	2,3	0,0	/
12	**Japan**	**1,0**	0,0	1,0	0,0
	TOTAL	**1955,9**	**454,3**	**1491,6**	**30,5**


Wind Energy Jobs - Worldwide
235.000
300.000
350.000
440.000
550.000
670.000
820.000
1.000.000
Prediction
2005
2006
2007
2008
2009
2010
2011
2012


Electricity production and consumption right now: 10/01/2010 07:52
Jutland/Sweden
export 369
Jutland/Norway
export 952
Zealand/Sweden
export 1347
Bornholm/Sweden
export 11
Jutland/Germany
export 206
Zealand/Germany
import 546
West Denmark
East Denmark
Denmark
Production in MW:
Primary power stations 2823
Local CHP units 762
Wind turbines 2590
Net exchange export 2339
Electricity consumption 3836
Primary power stations
Offshore wind farm
400 kV overhead line, AC
400 kV cable, AC
Overhead line, DC
Cable, DC
60 kV cable
ENERGINET.DK


Generación de energía eólica en tiempo real, relación con la potencia eólica instalada y aportación a la demanda.
12000
10000
8000
6000
4000
2000
0
Valor estimado de generación eólica a las 03:00 del 09/11/200 : 9736(MW).
Supone un 55% de la potencia total eólica instalada y una aportación del 48% a la cobertura de la demanda.
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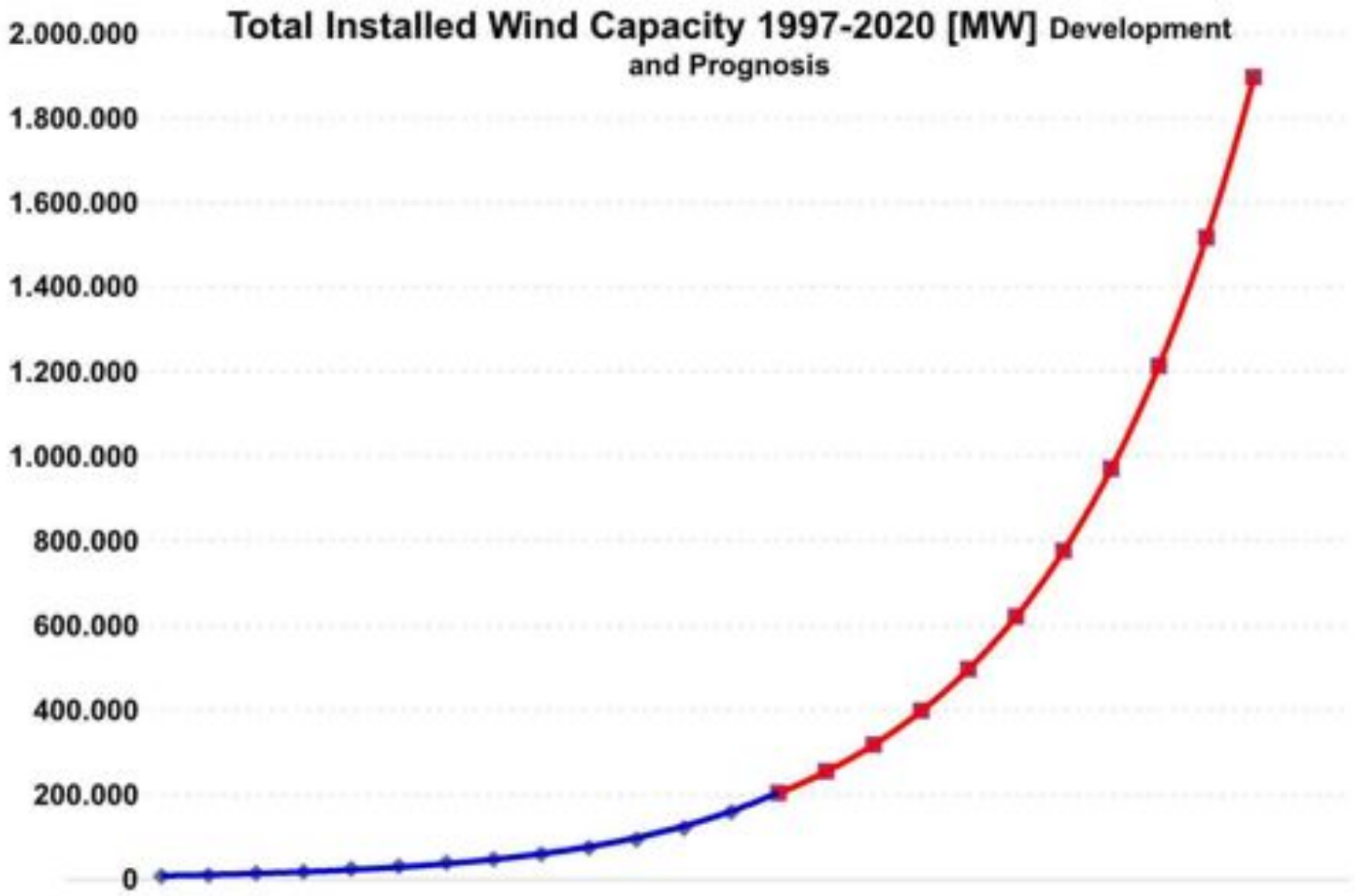
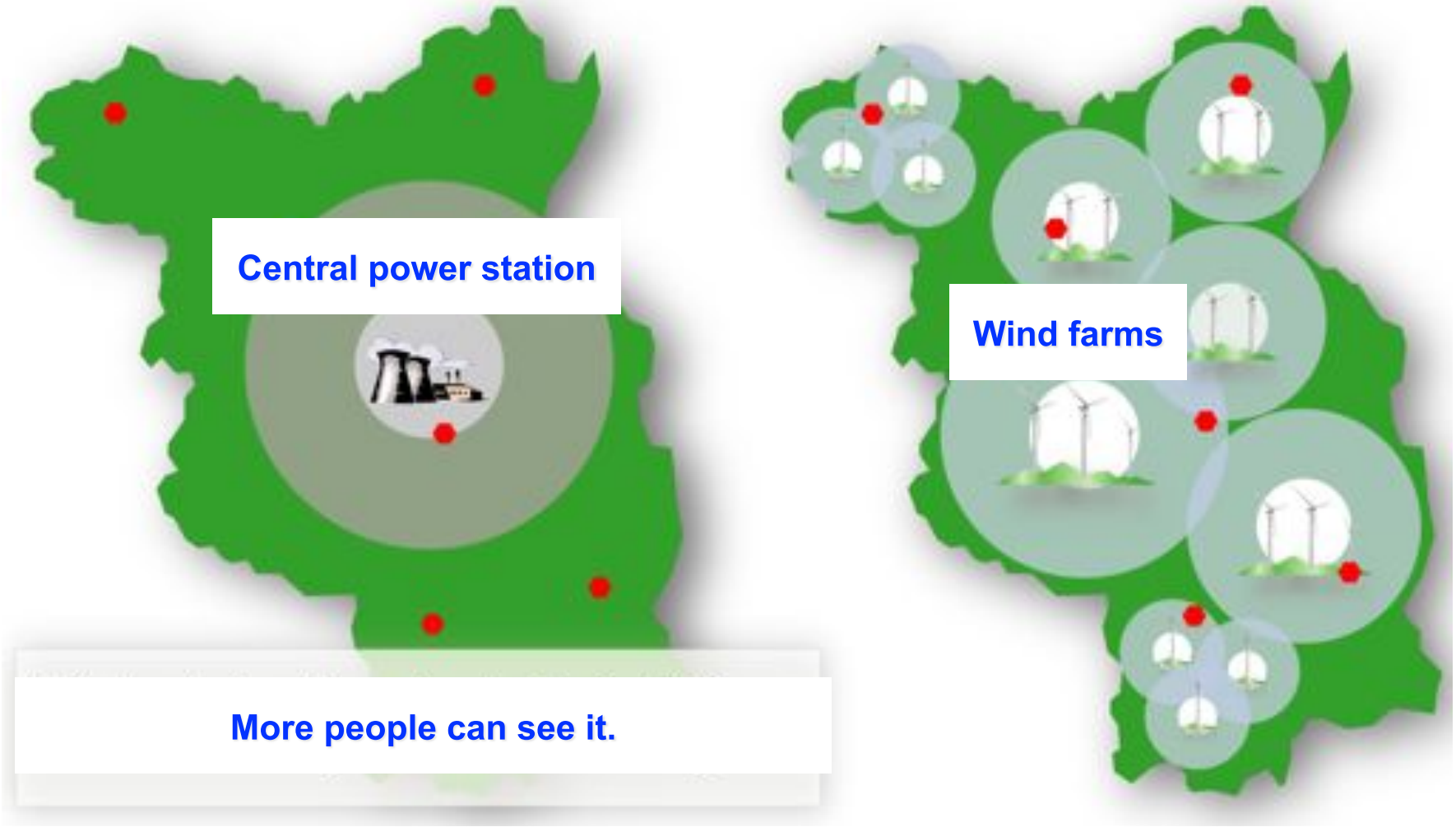
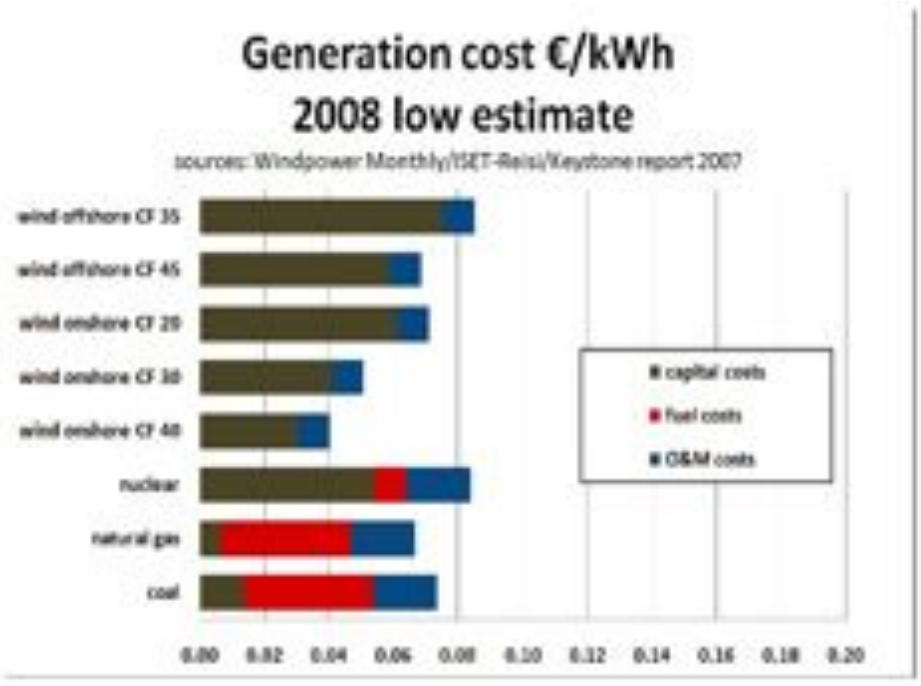
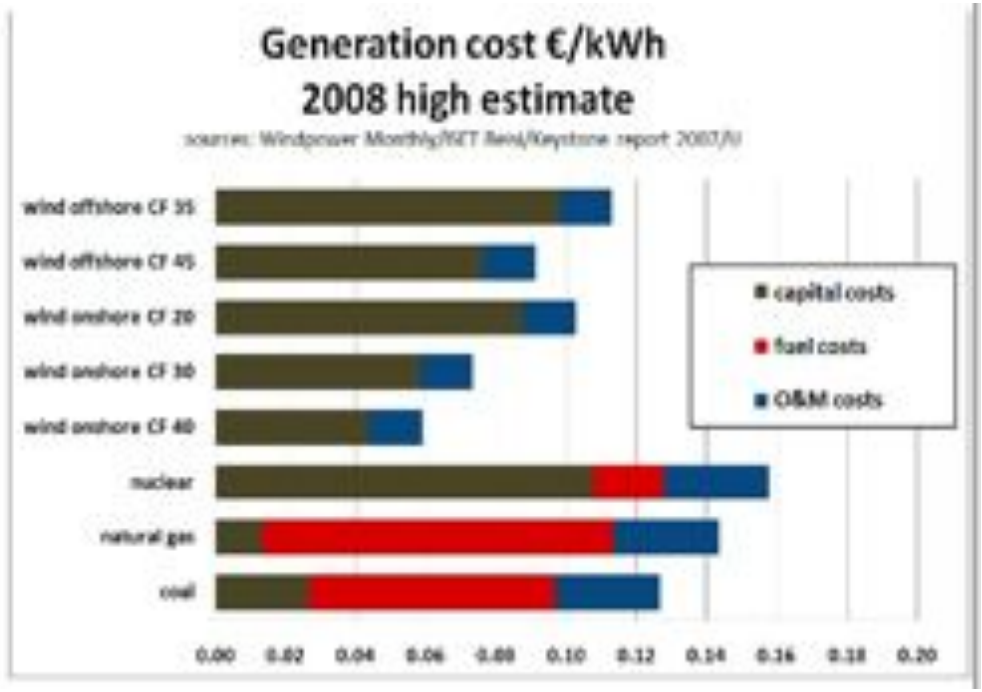
2009-11-09
Consultar otra fecha
Ayuda


Total Installed Wind Capacity 1997-2020 [MW] Development and Prognosis
2.000.000
1.800.000
1.600.000
1.400.000
1.200.000
1.000.000
800.000
600.000
400.000
200.000
0

Decentralised renewable energy utilisation

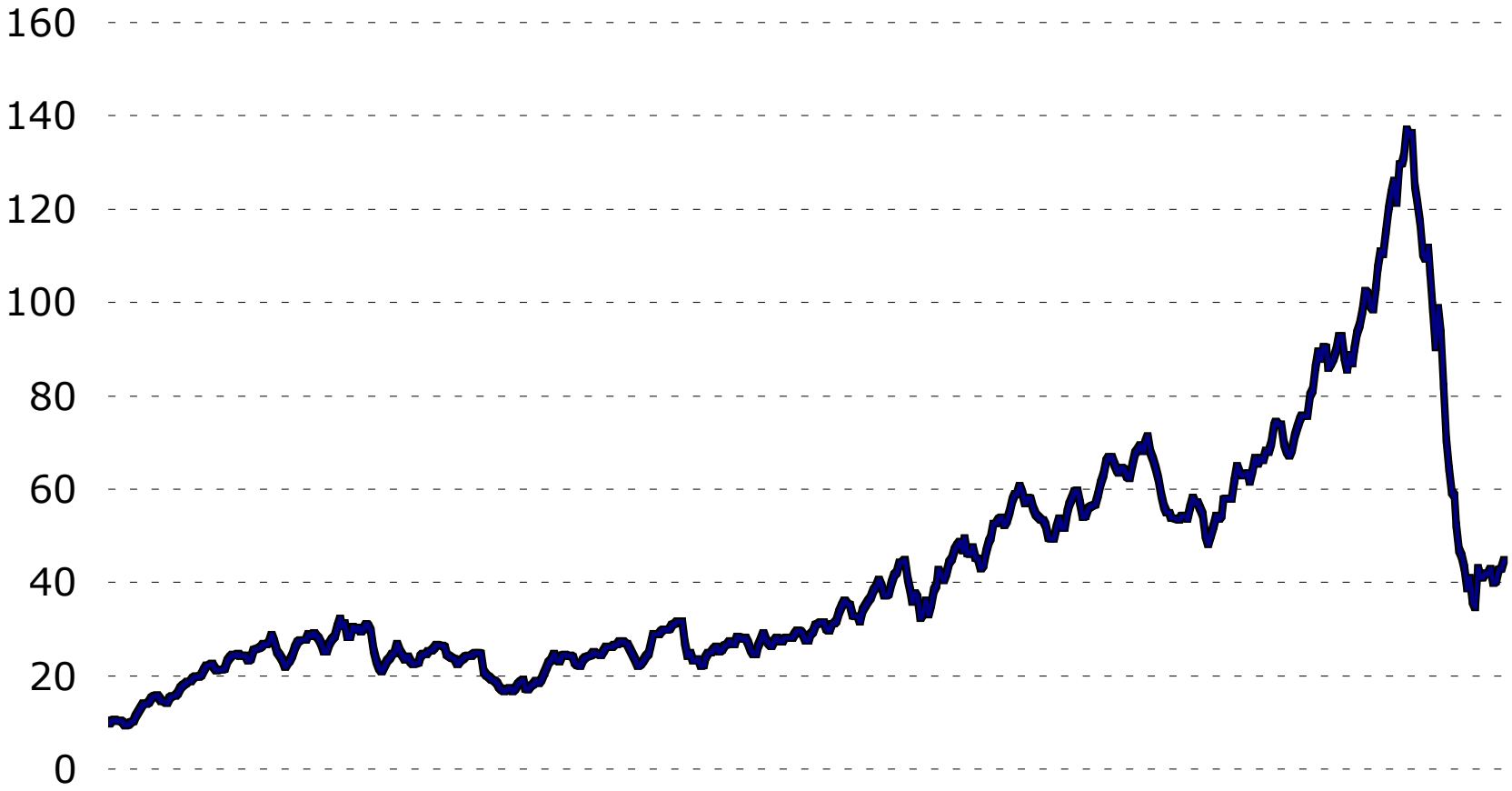






Source: EWG/Rechsteiner: Wind Power – Green Revolution Scenarios

Volatile Oil Price (USD) 1999-2009



Importance of capital cost

Specific investment structure:

high share of initially fixed cost (~80 %)
& low share of operating cost

==> Capital cost are decisive

Economic improvement practically impossible
after project implementation

==> Focus on equipment market

Successful policy principles

Create **level-playing field**

Communities have to benefit directly

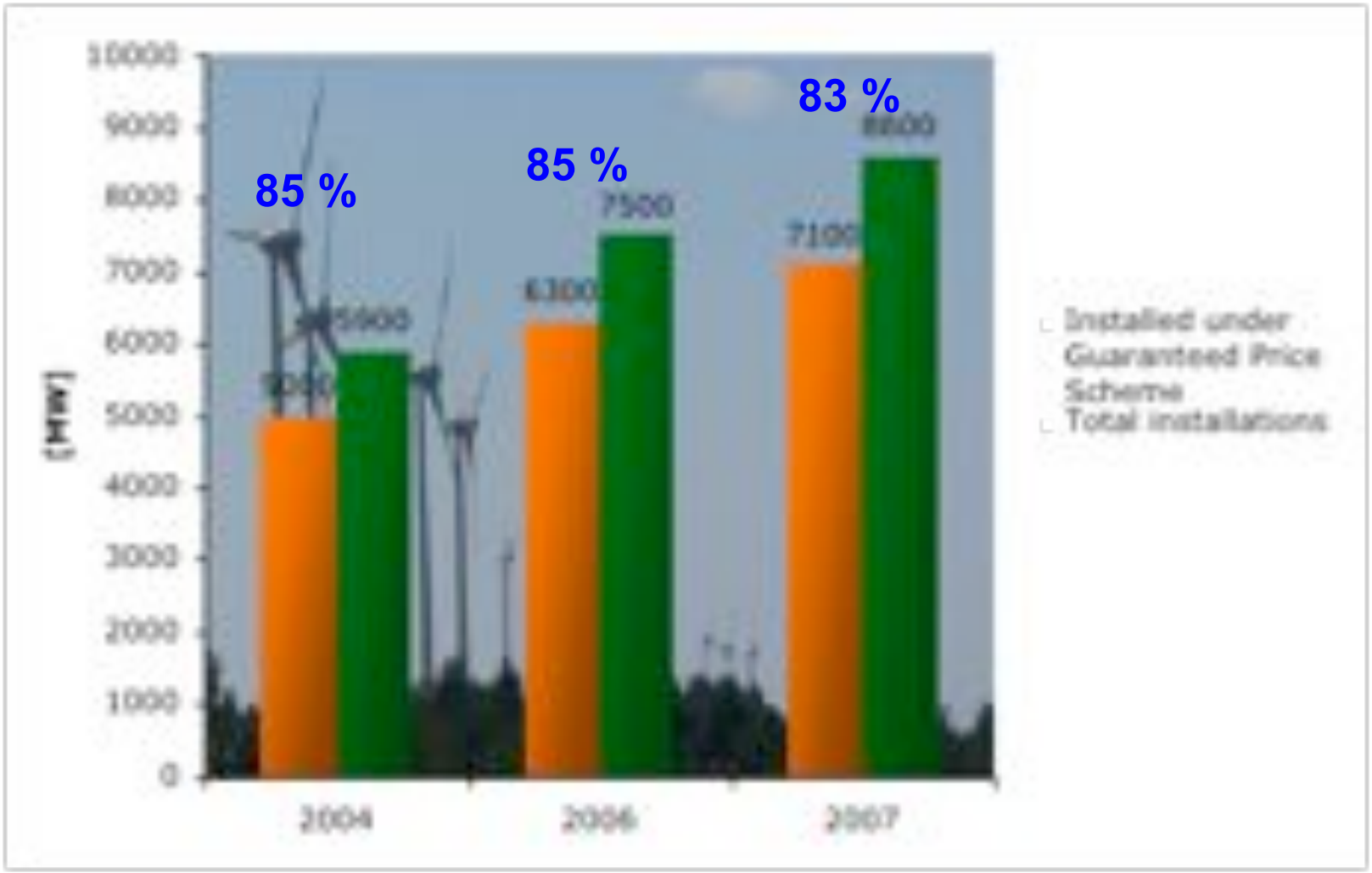
Provide **investment security**

Secure **efficiency**

Provide **access** for newcomers

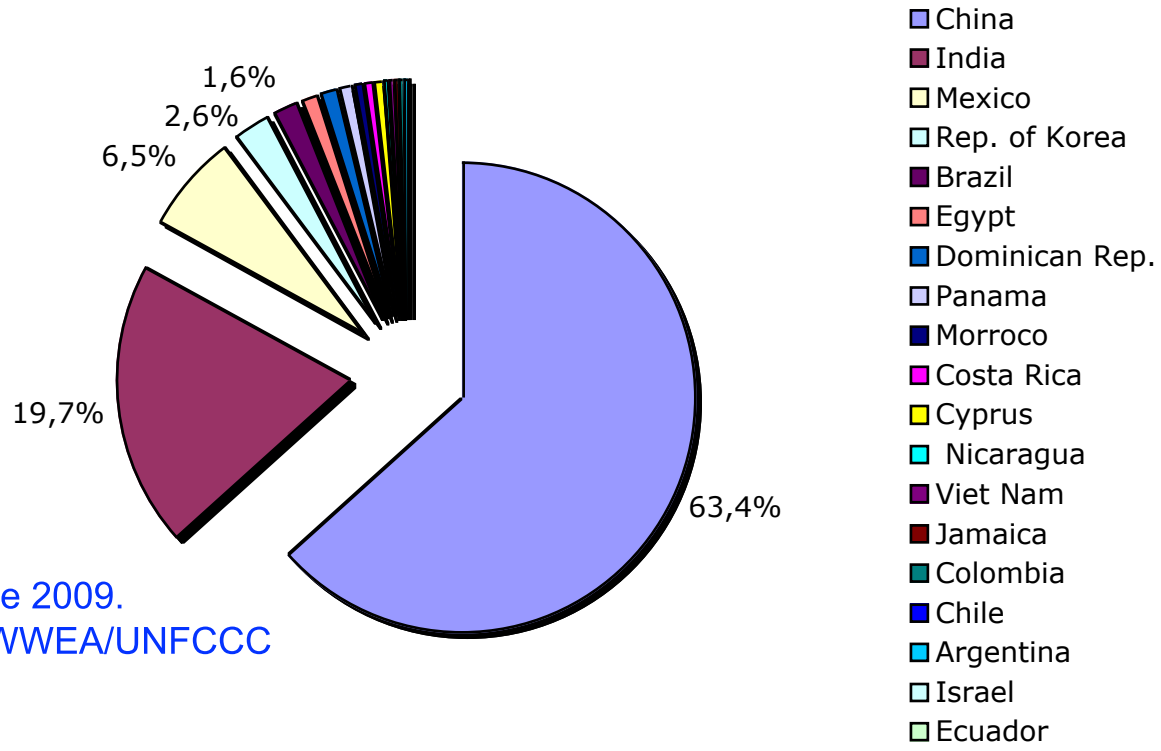
=> On national level well-designed feed-in tariffs!

Wind energy: Effectiveness by policy tools in the EU



CDM and Wind Power

Share of Total Capacity Registered by Country



As of June 2009.
Source: WWEA/UNFCCC

The problems:

price gap, investment security, administrative hurdles, additionality, etc

Financing Renewable Energies in Developing Countries

REN Alliance proposal at COP15:
„Scaling-Up for a Renewable Future“

Global Fund for Renewable Energy Investment should support and incentivise renewables initiatives such as:

- Strategic development of the renewable energy systems of developing countries.
- Implementation of the Global Feed-In Tariff Programme.
- Establishment of Storage and Ancillary Service Markets.
- Electrification of remote, unserved areas.

Full REN Alliance paper on:
www.WWindEA.org – www.ren-alliance.org

Technology development

Iran: The oldest windmills

Since 1978 in operation: Tvind wind turbine (2 MW) in Denmark

www.tvindkraft.dk

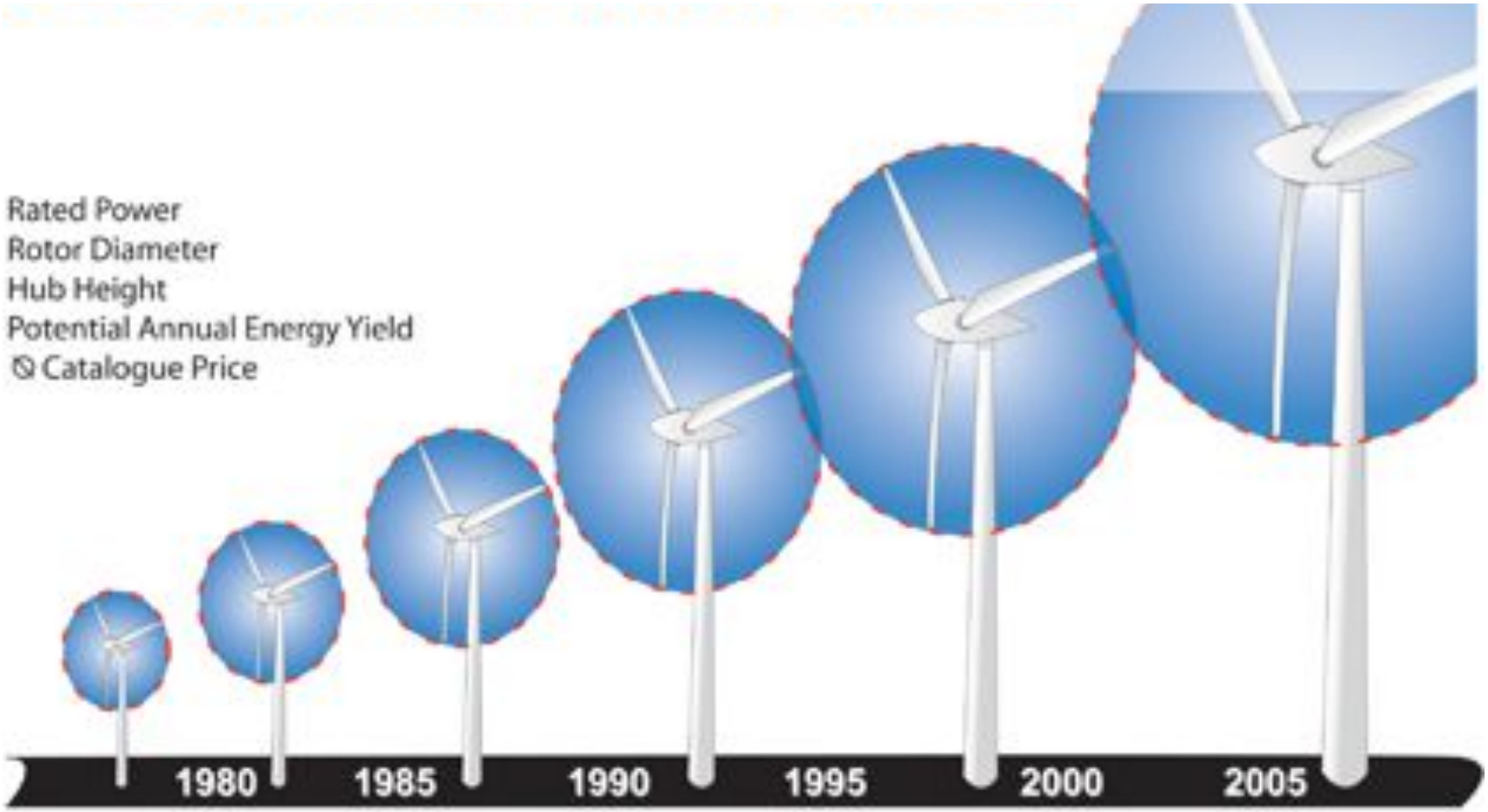
„Failures“

GROWIAN (MAN - HEW, Schleswag, RWE):
3 MW, erected 1983, decommissioned in 1987

„We need Growian (…), in order to demonstrate that it does not work.“
(Günter Klätte, RWE Board, February 1982)

FIAT/ENEL „fail“ with 55 kW turbine:

Growth of wind turbines



	1980	1985	1990	1995	2000	2005
R-Power :	30 kW	80 kW	250 kW	600 kW	1.500 kW	5.000 kW (Offshore)
Rotor :	15 m	20 m	30 m	46 m	70 m	115 m
Hub Height:	30 m	40 m	50 m	78 m	100 m	90 m
Yield/a :	35.000 kWh	95.000 kWh	400.000 kWh	1.250.000 kWh	3.500.000 kWh	ca. 17.000.000 kWh

Mulit-Megawatt Wind Turbines

Enercon E-112/126
Prototype: 2002
4,5/6/7,5 MW, 112/126 m diameter

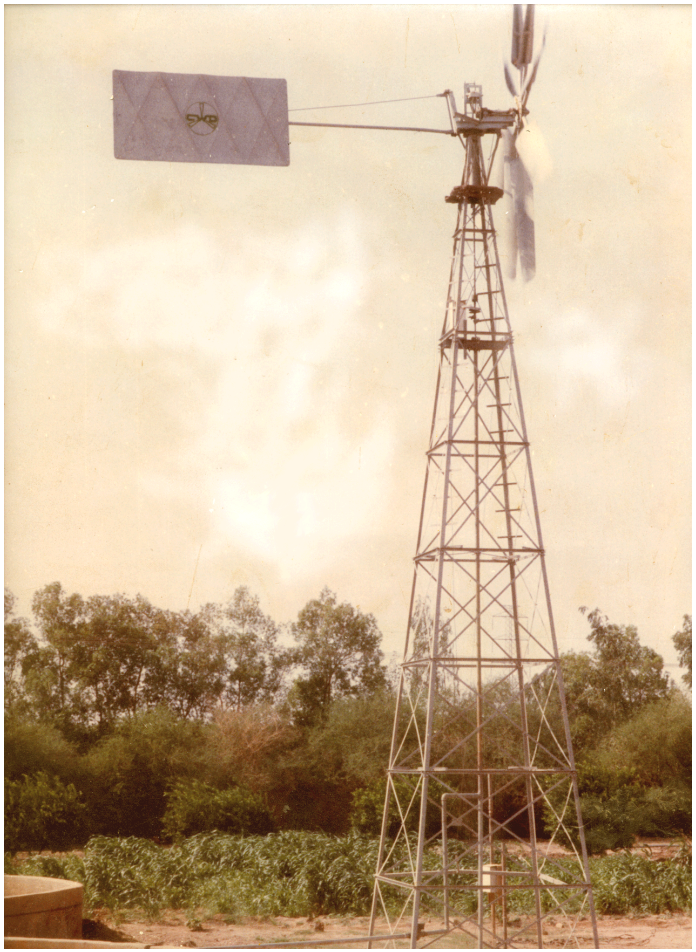
REpower M5/M6
Protoype: November 2004
5/6,125 MW, 126 m diameter

Multibrid M5000
Prototype: December 2004
5 MW, 116 m diameter

On of the World‘s Biggest Wind Turbines: 6 MW

The full range is needed

Wind pumps in Sudan and Australia



Small wind turbines in China (~ 400.000) and North Korea

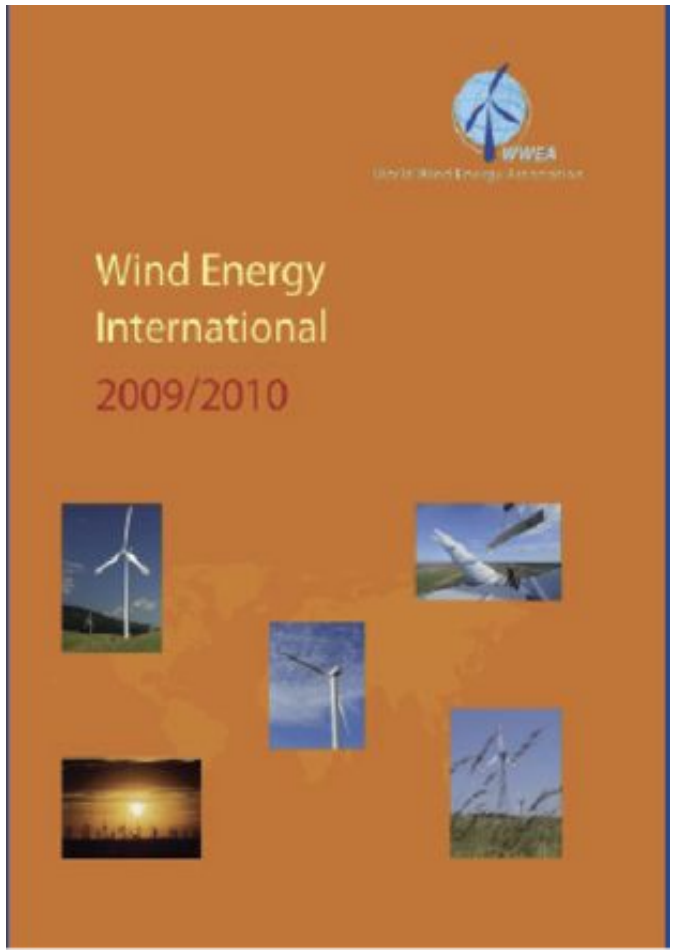
Further information

Wind Energy International 2009/2010

Comprehensive country reports covering 100 countries

Special Reports on Policies, Industrial Trends, Economy, Financing Issues, Education and Training, Integrating Renewable, Small Wind and Hybrid Systems and R&D of Technology

"If you want to know the status of wind energy development worldwide and you only can afford one book, this is the one.", Paul Gipe, USA
"This yearbook is a kind of a Wind Bible and is a must-have!"
Emma Sanan, South Africa



Order form at www.WWindEA.org

Join the World of Wind Energy

WWEC 2011

10TH World Wind & Renewable Energies Exhibition

المؤتمر الدولى العاشر لطاقة الرياح ومعرض الطاقات المتجددة

See you in Cairo/Egypt: 2-4 May 2011