



2005
**COPENHAGEN
OFFSHORE WIND**
Conference & Exhibition 26- 28 October

Years Review
International Wind
2004
until 2015
in scenario to 2025



Emerging offshore wind power markets

- *Conditions, quantities and timetable*

Copenhagen Offshore Wind
Conference, October 27 - 2005

By Birger T. Madsen, BTM Consult ApS

BTM Consult ApS - October 2005

Topics for the presentation

- The offshore segment in a broader Wind Power context - Status & Perspectives
- All offshore markets are "emerging" !
- Why go offshore ? Pro's & Con's
- Northern Europe - on track as a market
- Emerging markets outside N. Europe: Spain, France, (Norway),US and Japan
- Challenges faced for offshore development

European Offshore Wind Power potential is enormous

Study of Offshore Wind Energy in the EC.

By Garrad Hassan & Germanisher Lloyd in 1995 :

Potential within 10 km offshore: 1,852 TWh
Potential within 20 km offshore: 2,615 TWh
Potential within 30 km offshore: 3,028 TWh

- 1) Water depth from 10 to **40 m !**
- 2) The potential reduced - **IEA rapport Year 2000** - to *“practical exploitable”* (“Year 2000” technological context!)
- 3) Eliminating\ water depth > 20 meter, 10 % utilisation of area within 10 km and 50% in the 10-20 km zone.

Net- potential of 313,6 TWh, equal to 70-80.000 MW

Installed offshore wind power in the World (2003 and 2004)

 Country	Installed MW 2003	Accu. MW 2003	Installed MW 2004	Accu. MW 2004
Denmark	165	397.9	0	397.9
Ireland	25	25	0	25
The Netherlands	0	18.8	0	18.8
Sweden	0	23.3	0	23.3
UK	60	64	60	124
Total capacity - World	250	529	60	589

Source: BTM Consult ApS - March 2005

Another 180 MW will be added in 2005-06, as Kentish Flat and Barrow (both UK) will be commissioned by end of year 2005

Operating offshore wind farms in the World by the end of 2004

Country	WTG`s	MW	Type foundations	Construction
Vindeby (DK)	11 x 450 kW, Bonus	4.95	Concrete caisson	1991
Lely (NL)	4 x 500 kW, NEG Micon	2.0	Driven monopile	1994
Tunø Knob (DK)	10 x 500 kW, Vestas	5.0	Concrete caisson	1995
Dronten Isselmeer (NL)	28 x 600 kW, NEG Micon	16.8	Driven Monopile	1996
Bockstigen (S)	5 x 550 kW, NEG Micon	2.75	Drilled Monopile	1997
Utgrunden (S)	7 x 1.5 kW, GE Wind	10.5	Driven Monopile	2000
Blyth (UK)	2 x 2 MW, Vestas	4.0	Drilled Monopile	2000
Middelgrunden (DK)	20 x 2 MW, Bonus	40.0	Concrete caisson	2000
Yttre Stengrund (S)	5 x 2 MW, NEG Micon	10.0	Drilled Monopile	2001
Horns Rev (DK)	80 x 2 MW, Vestas	160.0	Driven Monopile	2002
Palludan Flak (DK)	10 x 2.3 MW, Bonus	23.0	Driven Monopile	2002
Nysted Havmøllepark (DK)	72 x 2,3 MW, Bonus	165.6	Concrete caisson	2003
Arklow Bank Phase I (IRL)	7 x 3,6 MW, GE Wind	25.2	Driven monopile	2003
North Hoyle (UK)	30 x 2 MW, Vestas	60.0	Driven Monopile	2003
Scroby Sands (UK)	30 x 2 MW, Vestas	60.0	Driven Monopile	2004
Total	Number of WTGs: 321	589.8 MW		

Source: BTM Consult ApS - March 2005

The 589.8 MW counts for 1.2 % of the world's aggregated wind power

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Forecast 2005-2009 (ONLY OFFSHORE)

	Cumulative installed capacity (MW) by end of in 2004	Installed capacity (MW) in 2004	Forecast 2005-2009 (only Offshore)					Installed capacity 2005-2009 between 2009	Cumulative installed capacity (MW) by end of 2009
	2004	2004	2005	2006	2007	2008	2009	Sum	Accu.
Belgium	0	0	0	21	63	55	55	194	194
Denmark	398	0	0	0	200	200	0	400	798
France	0	0	0	58	0	0	0	58	58
Germany	0	0	0	300	444	672	1,220	2,636	2,636
Ireland (Rep.)	25	0	0	0	25	25	200	250	275
Netherlands	19	0	60	60	100	0	0	220	239
Spain	0	0	0	20	0	200	0	220	220
Sweden	23	0	0	116	100	70	70	356	379
UK	124	60	198	466	750	1,000	1,000	3,414	3,538
Total Europe	589	60	258	1,041	1,682	2,222	2,545	7,748	8,337
Canada	0	0	0	0	20	0	0	20	20
USA	0	0	0	0	0	200	0	200	200
Others	0	0	0	0	50	50	100	200	200
Total Others	0	0	0	0	70	250	100	420	420
Total World	589	60	258	1,041	1,752	2,472	2,645	8,168	8,757
Offshore's global share (% of MW)			2.5%	8.4%	13.2%	15.8%	15.0%	12%	7%
Accu. capacity (MW)	589		847	1,888	3,640	6,112	8,757		

Source: BTM Consult ApS - March 2005

Why offshore wind power ?

Pro's

- More windy climate = more energy
- Space for larger WTG's
- Visual impact not sensitive
- Opportunities for very large wind farms: 200 to 1,000 MW
- Less turbulence = reduced loads
- Options for siting near load centres

Con's

- Investment Cost: + 50 to 100 %
- Daily O&M more complex (sea- environ.)
- Additional loads from waves & ice
- Foundation costly
- Expensive sea-cables
- Access to connection on shore ?

Emerging markets for offshore

3/4 of the Earth's surface is covered by water, but only in a few locations offshore wind power have been considered so far

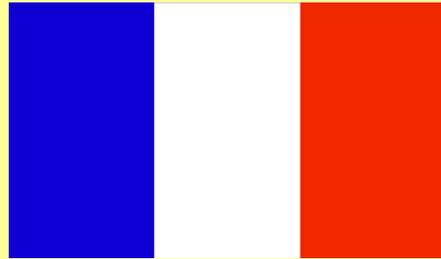
- * **France**
- * **Spain**
- * **Norway**
- * **US - North America**
- * **Japan**



Spain

Cadiz : 200 MW (EHN) 2007/ 08

Cabo de Trafalgar : 20 MW 2007



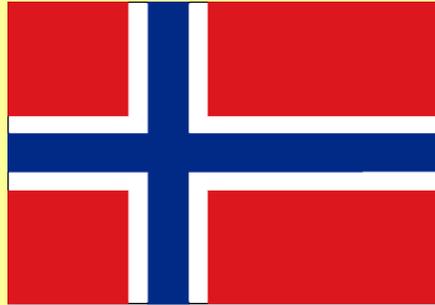
France

La Rochelle : 1.5 MW 2005

Port la Nouvelle: 50 MW 2006

Coast of Seine-Maritime : 105 MW 2007/08

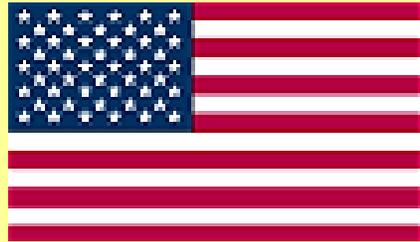
The only project (10 applications) awarded from the French Industry Minister's tender (Sept. 14 - 2005) was **ENERTRAG** Côte d'Âbâtre SAS /**Prokon Nord's** project : ***21 units of the Multibrid 5 MW***



Norway

Møre - Romsdal : 1,400 MW

Havgul AS are the company behind the planning of the four phases : Havgul I, II, III, IV. No timetable announced for the projects, which alone surpassing the official targets for Norwegian wind power by a factor 1.5 (estimated yield : 4.4 TWh per year)

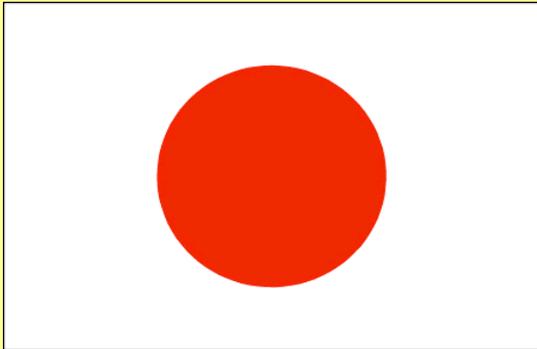


USA

Cape Cod : 420 MW (*Cape Wind*) 2007(?)
130 units of 3.6 MW

Long Island : 140 MW (*FPL/US-Army*) 2008
40 units of 3.5 MW

*The Cape Cod project (Massachusetts coast)
has been under way for long time
A long process of environmental consent
GE seems to be the selected supplier.*



Japan

No specific projects identified so far , but...

Offshore feasibility assessment indicates:

- * Within 1 km offshore: 94-255 TWh/year
 - * Within 3 km offshore: 281-765 TWh/year
- (For comparison : Onshore total : 34 TWh/year)*
- * Offshore feasible at wind speeds 6.7-8.7 m/sec,
but WTGs must be larger than 2 MW.
 - * Best wind sites: Hokkaido, west coast and
outside the coast of Akita Prefecture (Honshu North)

Source: Prospect of Offshore Wind Energy Development in Japan

by. Tetsuya Kogaki at AIST Conference in Washington DC, October 2004

Challenges and threats

- ***COE must down ! Otherwise offshore wind power competes in another market regime (CO2 sequestration, bio-mass electricity a.o)***
- ***Operational reliability shall be optimised***
- ***The players have to resolve the topic of how to "sharing risk's" (insurance?)***
- ***Track records from well operated full scale projects are still sparse !***
- ***Logistics around construction & O&M calls for innovative solutions.***
- ***Commercial proven technology in the range of 4-6 MW WTG's does not yet exist - it will take another couple of years !***
- ***Offshore foundations for + 25 meter water depth ?***

Ten Years Review of the International Wind Power Industry 1995-2004



- Forecast until 2015
- Long term scenario to 2025

- *A Danish Consultancy Company* -

Specialized in Wind Energy Utilization

Contact information:

BTM Consult ApS

I. C. Christensens Allé 1

DK-6950 Ringkøbing - Denmark

Tel: +45 97 32 52 99, Fax: +45 97 32 55 93

E-mail: btm@btm.dk & pk@btm.dk

<http://www.btm.dk>

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