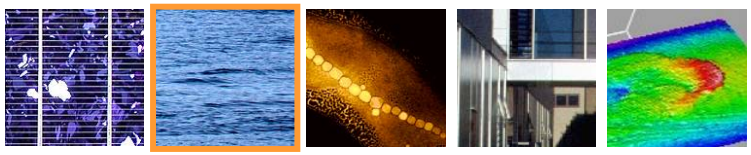
Theme 4 socio-economic benefits

Job creation in Europe from Ocean Energy



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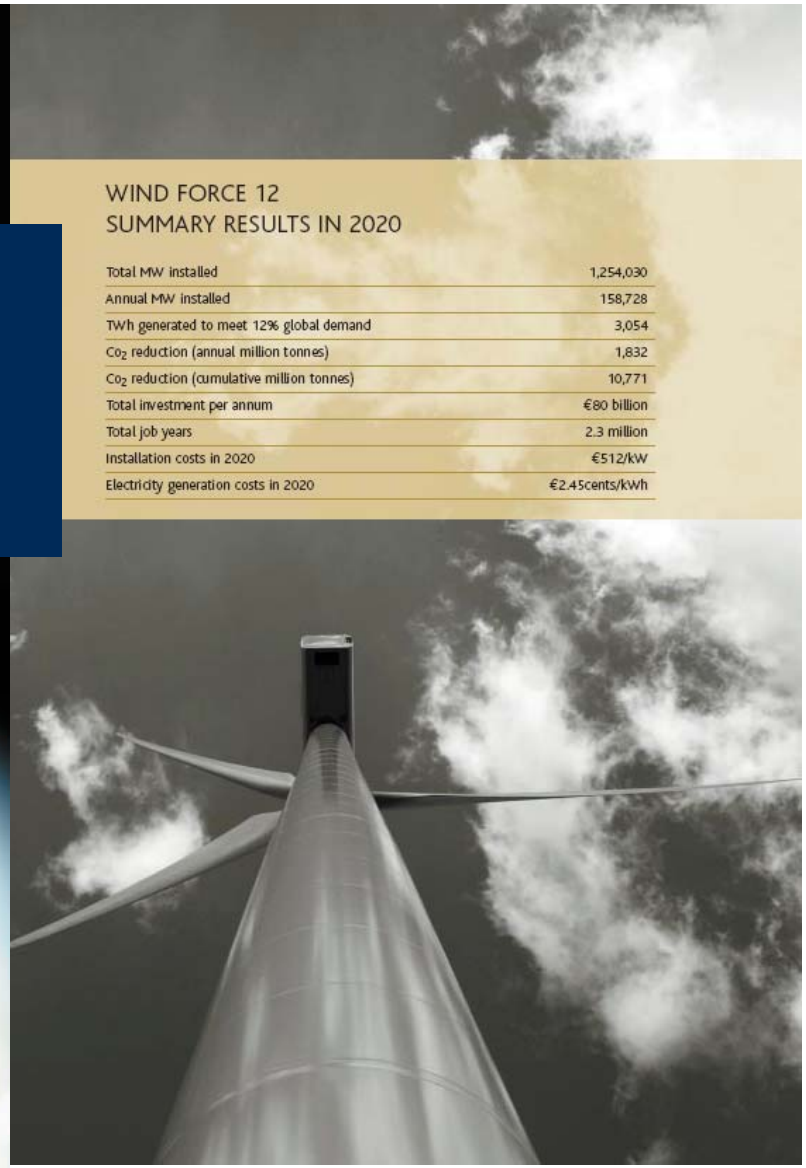
Introduction

- **In order to predict future employment**
  - Expected growth rates
  - Installation costs
  - Employment multipliers based on sector
- **All of the above are combination of best guess**
  - What you need to believe

1 TW of Wind by 2020

GWEC
GLOBAL WIND ENERGY COUNCIL

- If 1TW is possible by 2020 exponential growth faster than the current is required.
- Installation cost of just 512 Euro/kW



EWEA targets

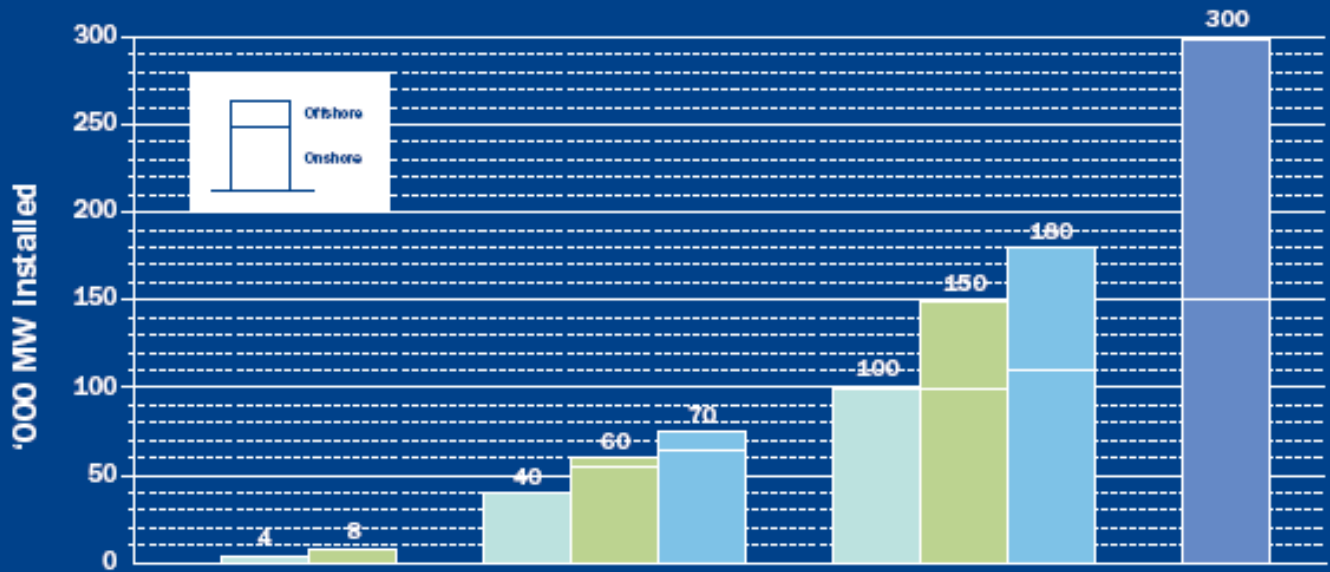
In 1991 EWEA set a target to install 4,000 MW of wind in 2000. This was revised in 1997 to 8,000 MW. In 2000 the actual wind installed in Europe was 12,887 MW three times higher than the figure set nine years previously.

In 1997 EWEA set a target of 40 GW installed in 2010 (the same target as the Commission White Paper) and 100 GW in 2020. In 2000 EWEA set a target of 60 GW in 2010 and 150 GW in 2020.

Three years later in 2000 EWEA revised its target to 60,000 MW by 2010 (including 5,000 MW offshore) and 150,000 MW by 2020 (including 50,000 MW offshore).

In 2003, EWEA further revised its target to 75,000 MW by 2010 and 180,000 MW by 2020 (including 70,000 MW offshore).

Today in 2005, EWEA has updated this target and extended the period to 2030, resulting in a total installation of 300 GW, 150,000 MW of this offshore.



	Targets for 2000		Targets for 2010			Targets for 2020			Targets for 2030
	Set in 1991	Set in 1997	Set in 1997	Set in 2000	Set in 2003	Set in 1997	Set in 2000	Set in 2003	Set in 2003
onshore	4,000	8,000	40,000	55,000	65,000	100,000	100,000	110,000	150,000
offshore	-	-	-	5,000	10,000	-	50,000	70,000	150,000

Carbon Trust - Future of Marine Energy

CARBON TRUST
Making business sense of climate change

Future Marine Energy

Results of the Marine Energy Challenge:
Cost competitiveness and growth of wave and tidal stream energy

Potential resource and industry status

Wave and tidal stream energy have the potential for bulk electricity supply in the UK and worldwide. The potential energy resources are significant, particularly offshore wave energy. Between 15% and 20% of current UK electricity demand could be met by wave and tidal stream energy, which is equivalent to carbon dioxide abatements of several tens $MtCO_2$. Estimates of market size are approximate, but the market is likely to be sufficiently large to merit considerable interest in its commercial development.

Figure 15 Conclusions from growth model to 2020 across Europe

	Wave energy	Tidal stream energy
Total installed capacity (MW)	1,000 to 2,500	1,000 to 2,500
Total capital deployed (£m)	1,000 to 2,500	1,000 to 2,500
NPV cost of support above base electricity cost (£m)	700 to 2,200	500 to 2,000
Annual carbon dioxide abatement ($MtCO_2$/y)	1.0 to 3.3	1.0 to 3.7

BWEA – forecasts for marine energy

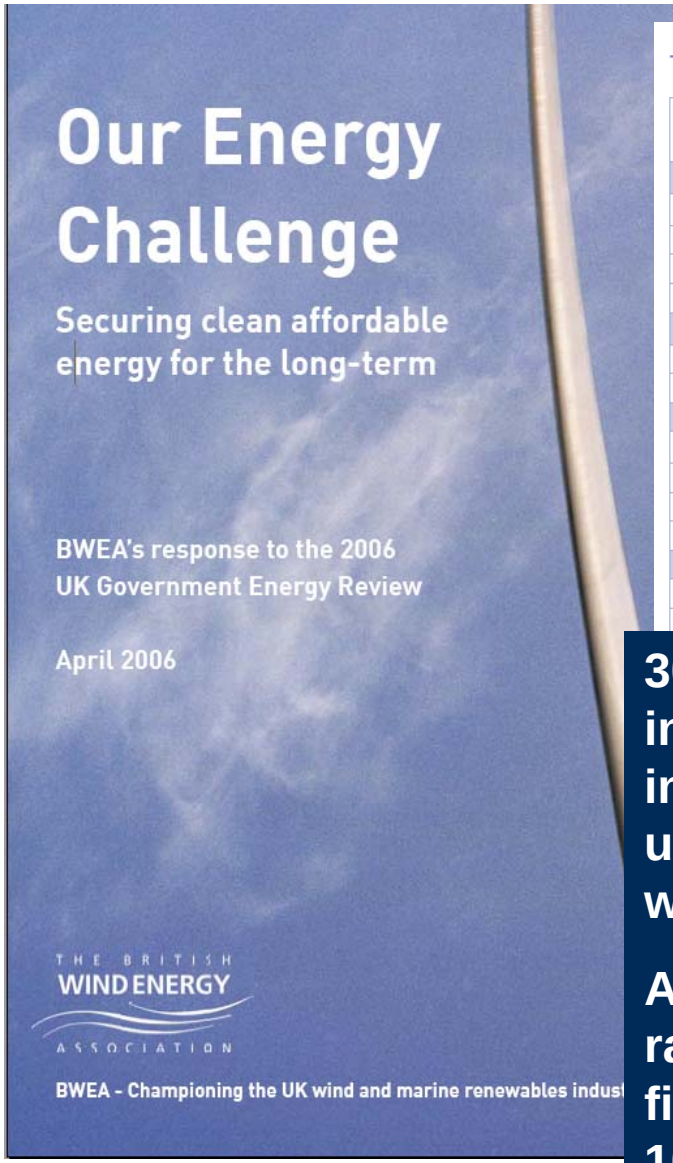


Table D2. Capacity and energy estimates for wind and marine renewables

		2010		2020		Notes
		MW	TWh	MW	TWh	
Onshore	Lower	4,700		12,000		
	Upper	7,500		15,000		
	Baseline	6,220	16.35	12,500	32.85	1
	Percentage of supply		4.7%		8.8%	
Offshore	Baseline	1,500	4.60	11,500	35.26	1
	Percentage of supply		1.3%		9.4%	
Marine	Lower	70		2,000		
	Upper	70		5,000		
	Baseline	70	0.21	3,000	7.88	1
	Percentage of supply		0.06%		2.1%	
Micro & Mini	Micro				0.5	2
	Mini			1,200	2.10	3
	Percentage of supply				0.7%	
					78.60	
					374	4
					21.01%	

shore
rther analysis

3000 MW installed by 2020 in the UK requires installation of 6 Pelamis units or equivalents per week

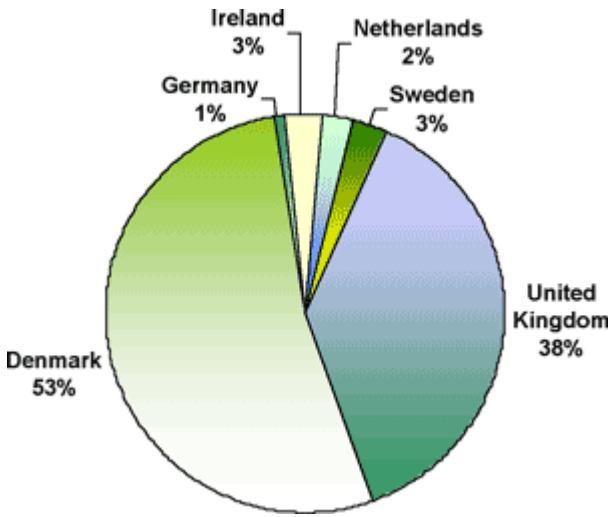
Assuming a similar growth rate as offshore wind this figure would be closer to 1000 MW

First offshore wind farms

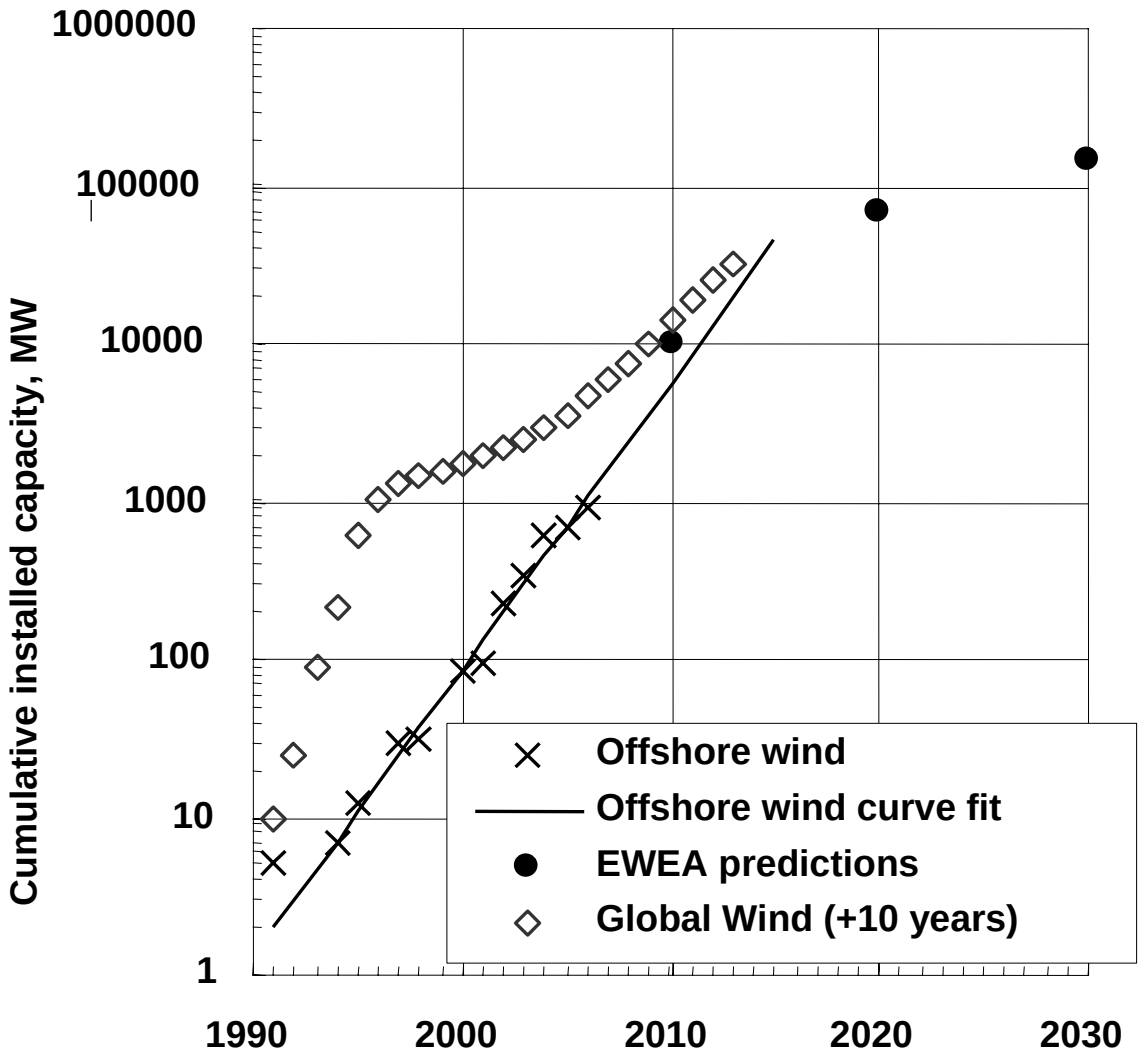
Location	Country	Installed Capacity (MW)	Year	Cumulative Installed Capacity (MW)
Vindeby	Denmark	5	1991	5
Lely Ijsselmeer	The Netherlands	2	1994	7
Tunø Knob Jutland	Denmark	5	1995	12
Dronton Ijsselmeer	The Netherlands	17	1997	29
Bockstigen-Valor	Sweden	3	1998	32
Blyth	UK	3.8	2000	36
Middelgrunden Copenhagen	Denmark	40	2000	76
Utgrunden	Sweden	10	2000	86
Yttre Strengrund	Sweden	10	2001	96
Samsø	Denmark	23	2003	119
North Hoyle	UK	60	2003	179
Horns Rev	Denmark	160	2003	339
Nysted	Denmark	158.4	2003	497.4
Arklow Bank	Ireland	25	2003	522.4

- By 2005 804 MW were installed throughout Europe

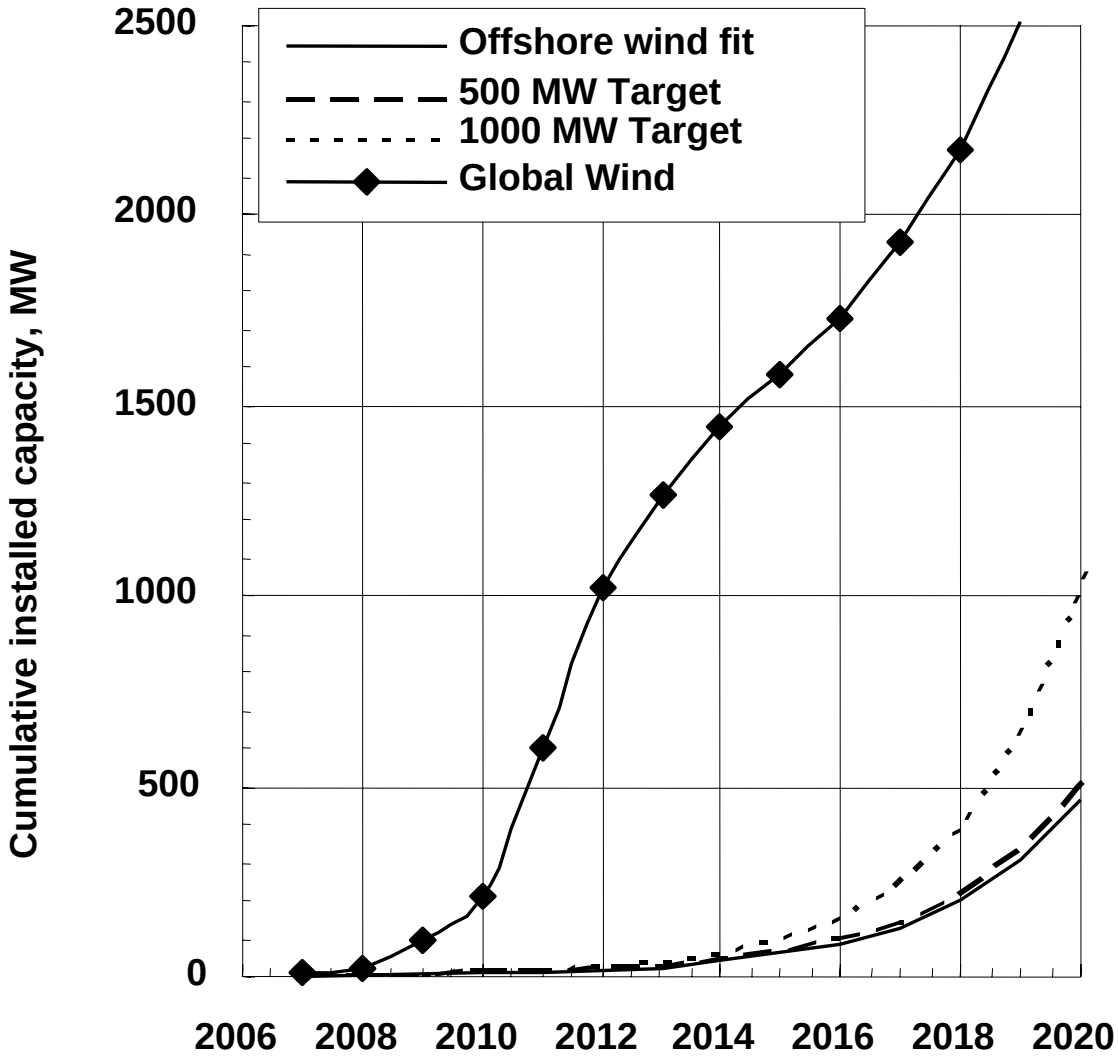
http://www.ieawind.org/Annex_XXIII.html



Wind growth rates



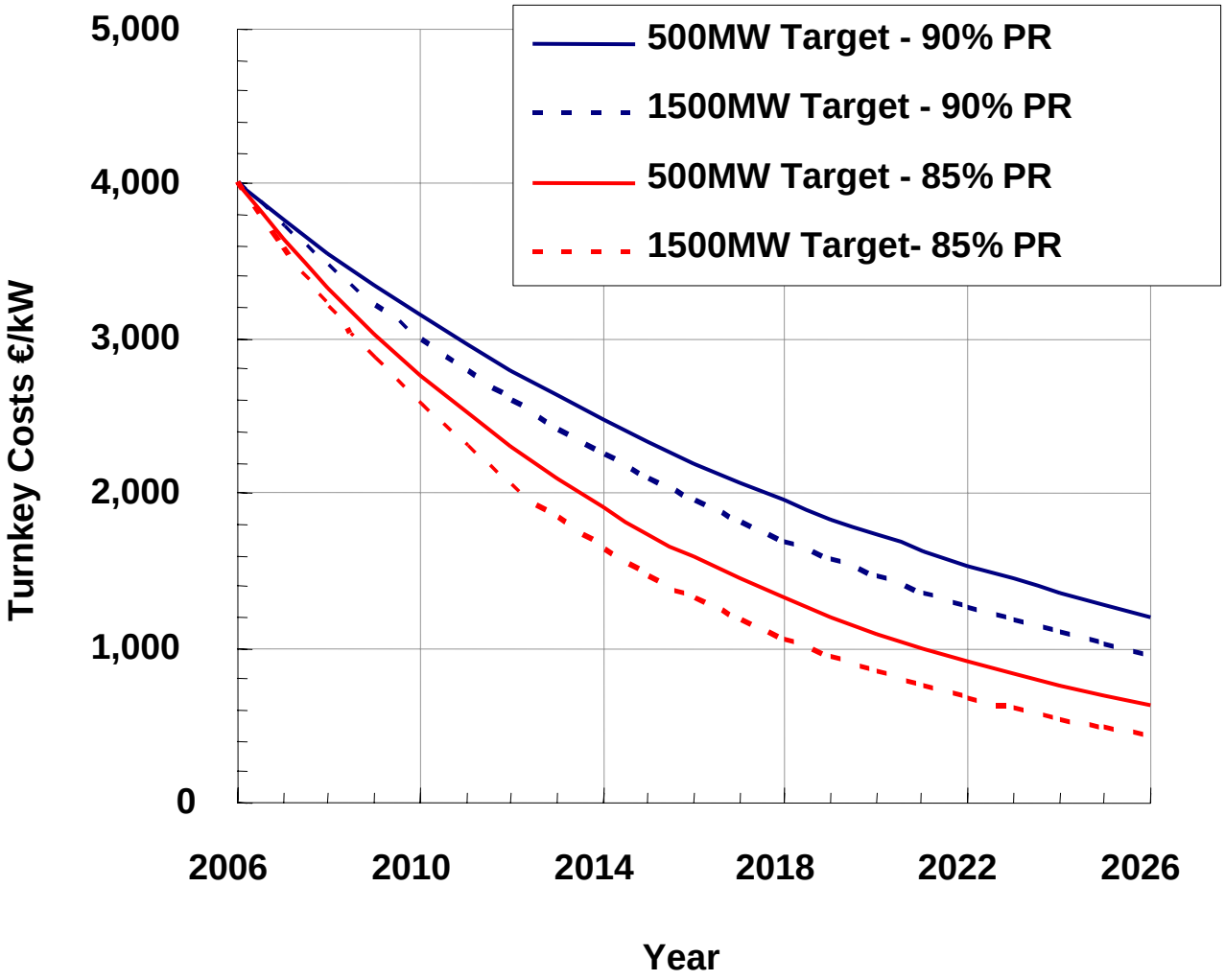
Plausible Ocean energy target?



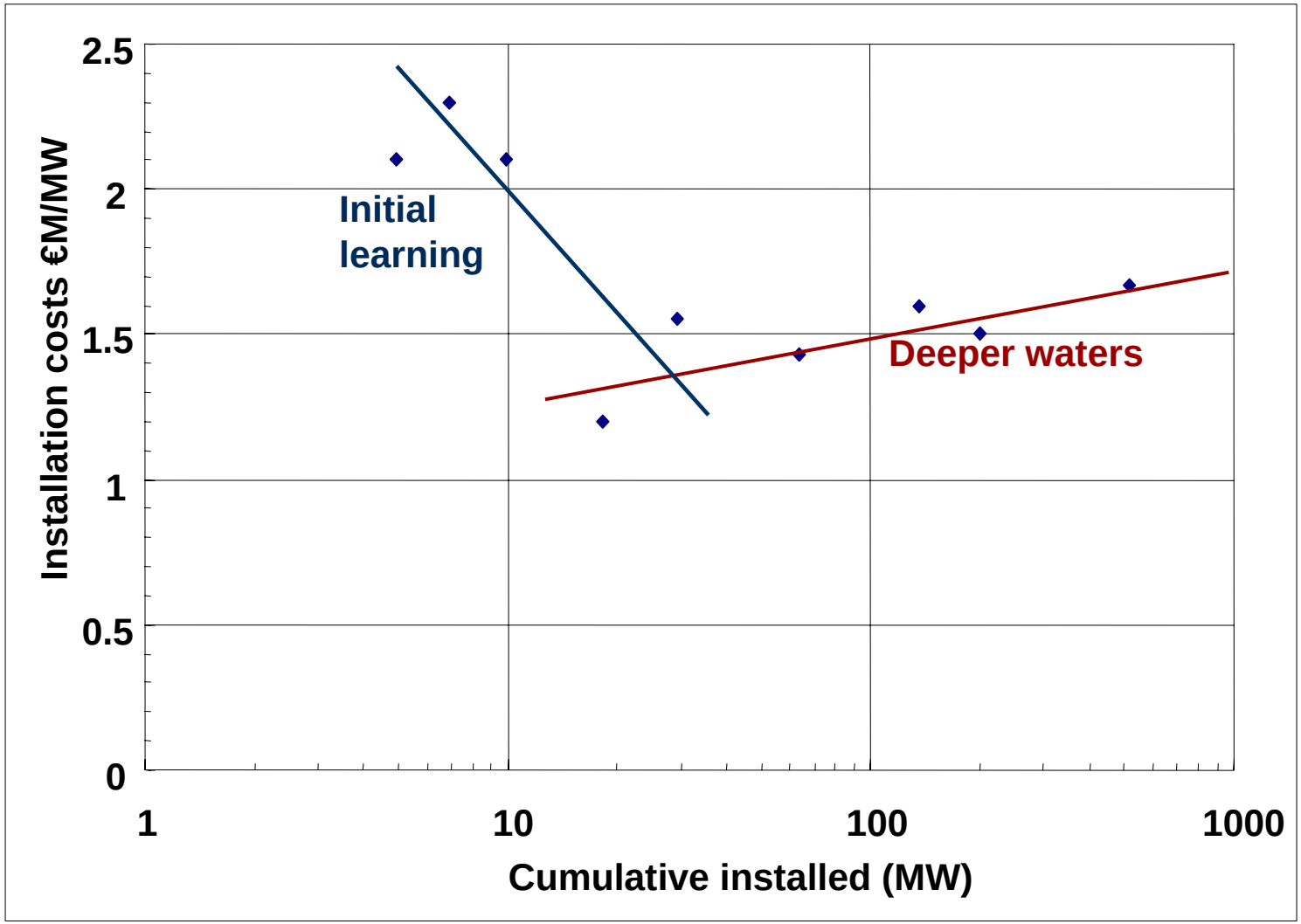
Where learning can come from?

Areas for cost changes within the ocean energy industry		
Part	**Specific developments**	**Exogenous developments**
Device	Up-scaling Improved design Standardisation Economics of scale	Development in offshore wind Raw material prices
Foundations/ Mooring	Standardisation Improved under-standing of loads Economics of scale	Raw material prices
Grid connection	Standardisation of design Economics of scale	Advances in offshore wind Developments in high voltage DC interconnections
Installation	Learning-by-doing Purpose built vessels	Vessel rental prices

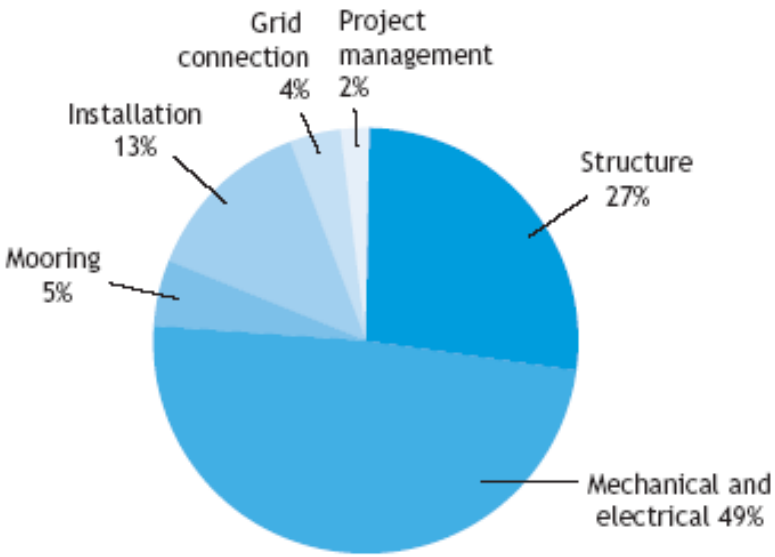
Learning Marine Energy



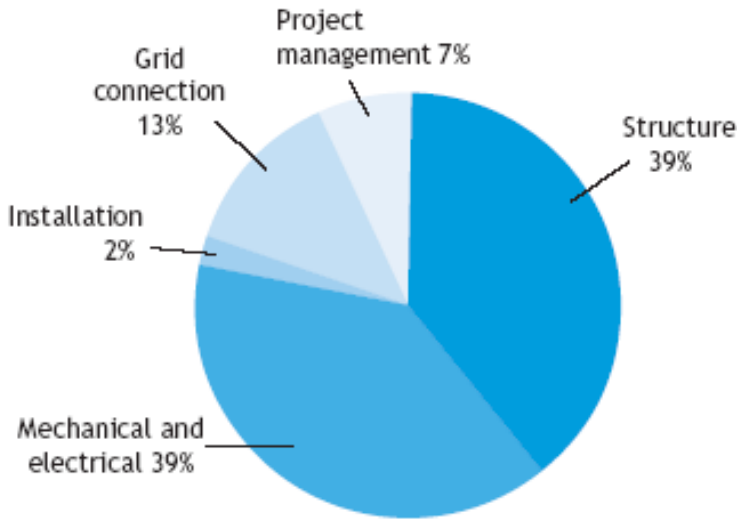
Costs of the first European offshore wind farms



Breakdown of costs – Employment multipliers



Wave farm

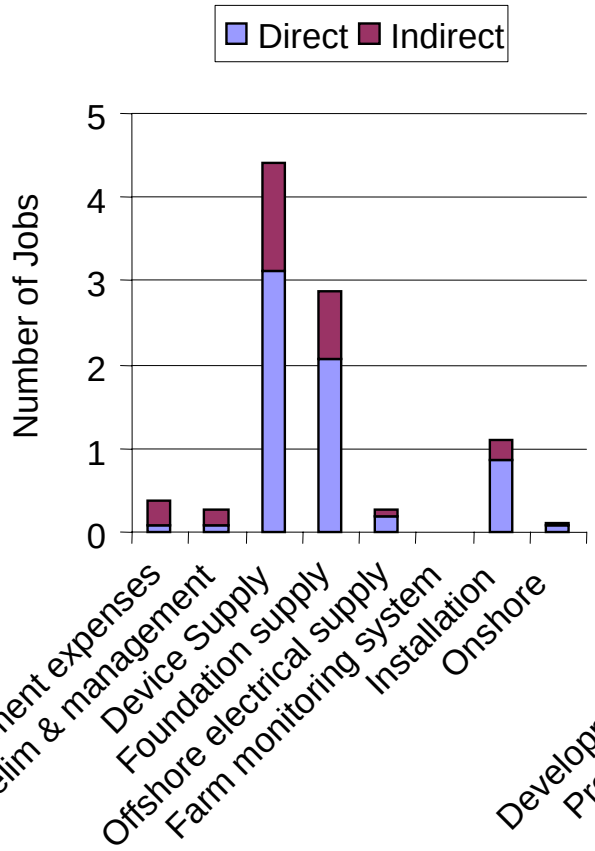


Tidal farm

- **Basis of Calculation**
  - Based on the breakdown of costs
  - EU employment multipliers can then be assigned the different parts of the costs

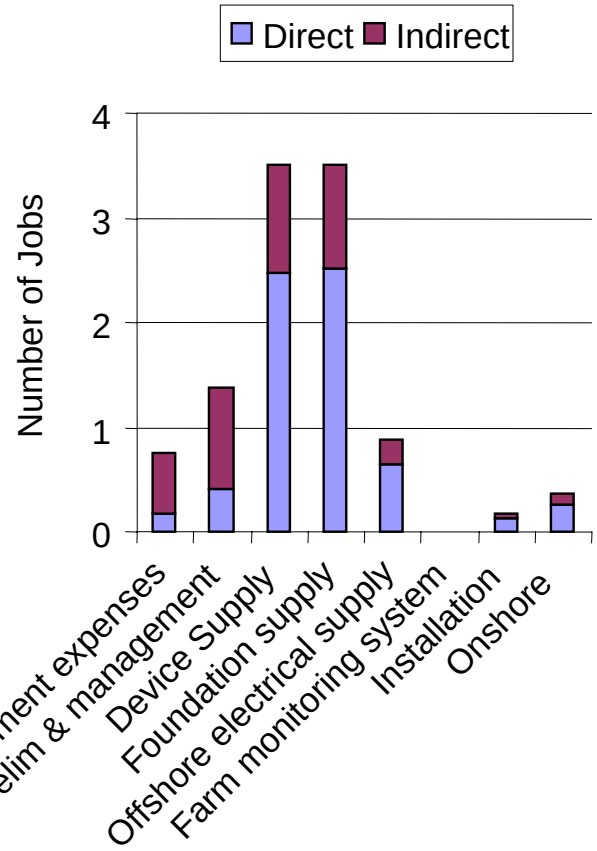
Employment per million Euro

Wave farm



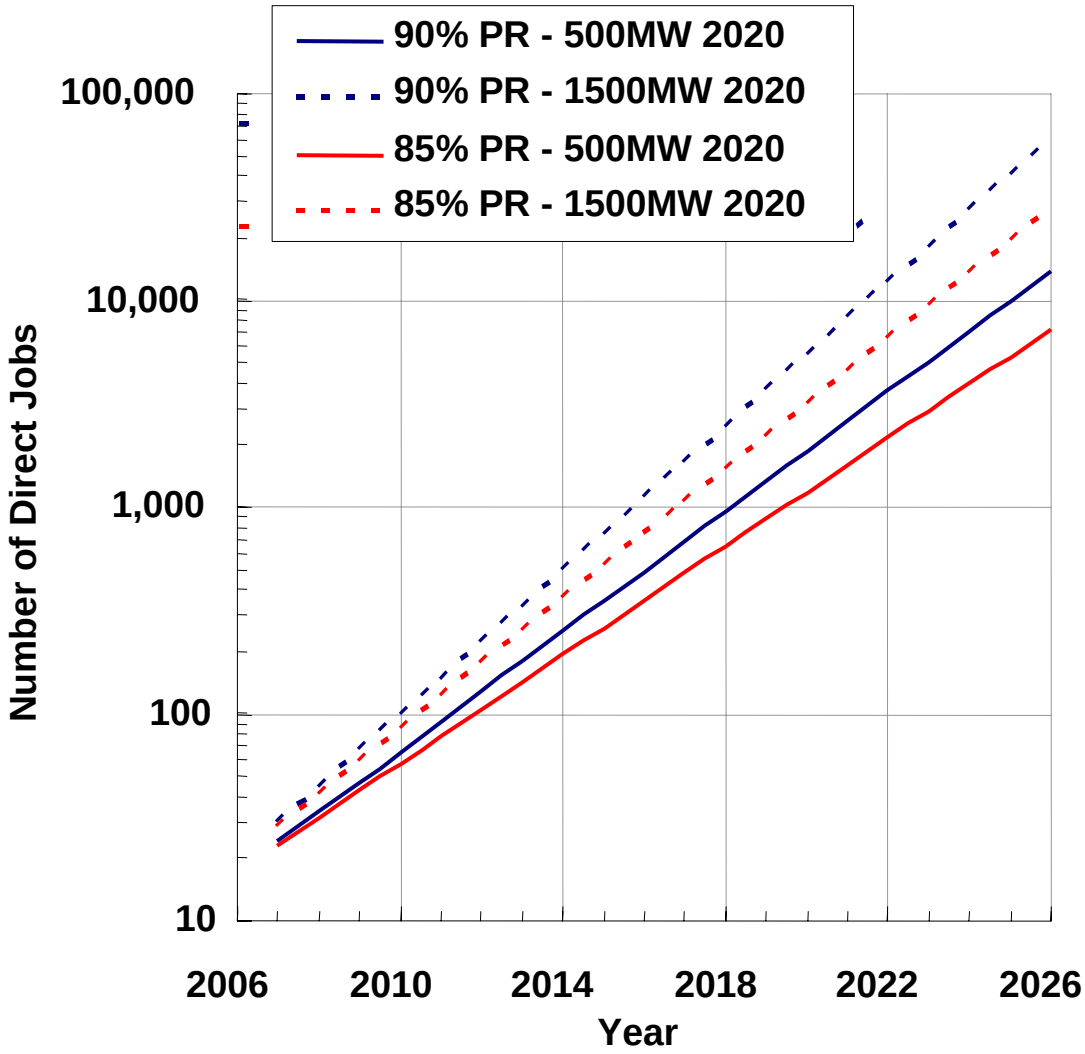
- 6.5 direct
- 3.0 indirect
- 9.5 total

Tidal farm



- 6.6 direct
- 4.0 indirect
- 10.6 total

Direct Employment



Direct jobs in device and foundation

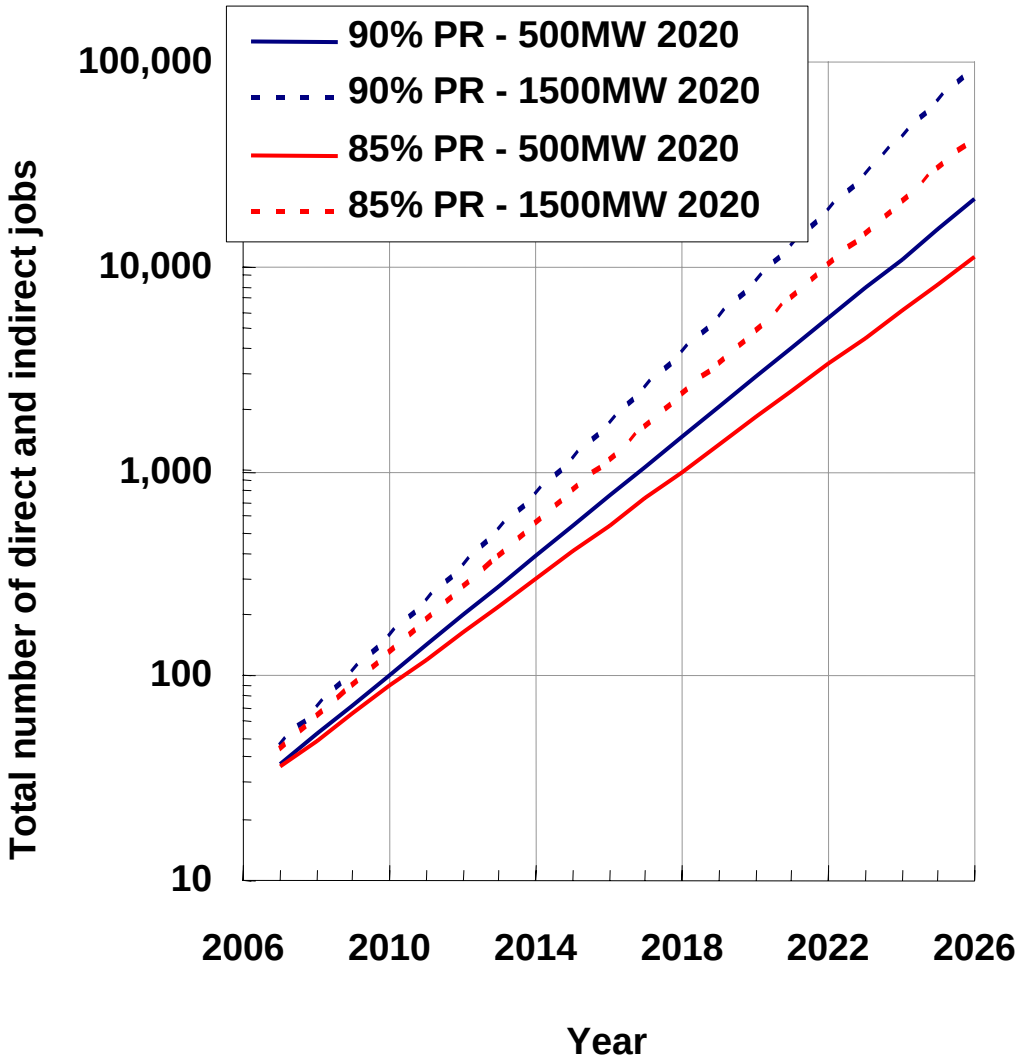
Current estimate

10 jobs/MW

2020 estimate

3.5 jobs/MW

Total Employment



Total direct and indirect jobs

Current estimate
19 jobs/MW

2020 estimate
7 jobs/MW

Conclusions

- **Growth targets of over 500 MW by 2020 is plausible with strong growth in several different concepts**
- **Initial learning may be masked as devices are taken further offshore**
- **Direct jobs in device and foundation**
  - Current 10 jobs/MW falling to 3.5 jobs/MW
- **Direct jobs in device and foundation**
  - Current 19 jobs/MW falling to 7 jobs/MW
- **Total employment by 2020 could be between 2000 and 6000 assuming installed capacities of 500 MW – 1500 MW**