

Capital Investment for Renewables

Presentation to the IEA Working Group

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Barclays Group – Renewables and Wind Farm Investment

Active in Renewables:

- Project financing for individual projects
- Lending to Renewables Corporates
- Providing access to capital markets
- Equity stakes in Renewables projects
- Investment banking advisory

Balance sheet summary

£bn	31-Dec-08	30-Jun-09
Total assets	2,053	1,545
Derivative gross-up	917	507
AUM on balance sheet	69	66
Settlement balances	30	35
Goodwill & Intangible assets	10	10
Adjusted tangible assets	1,027	927

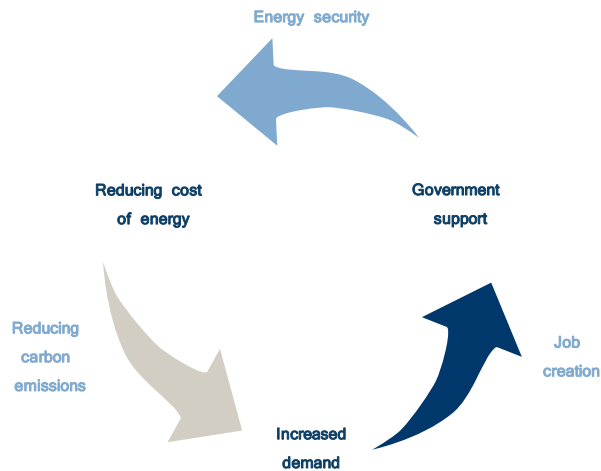
Key facts

- 300 years of history
- Operating in 50 countries
- 145,000 employees
- 49 million customers and clients

Corporate history

- 2009: Acquire Standard Life Bank
- 2009: Sale of BGI to BlackRock
- 2008: Acquire Lehman Brothers US operations
- 2005: Acquires majority stake in Absa

Renewables: demand drivers and cost of energy



Power generation	Cost of energy (USDc/kWh)	Capex 2009e (USD bn)	Capex 2008 (USD bn)	Capex 2007 (USD bn)
Large Hydro power	3-7	na	43	18
Nuclear power	3-6	na	na	na
Gas	5-7	na	na	na
Wind power	5-8	50	50	33
Coal	5-8	na	na	na
Biomass	5-12	7	7	7
Offshore Wind	7-12	2	1	na
Concentrated Solar Power	12-18	na	na	na
Solar photovoltaic	20-45	25	38	21

- Increasingly, job creation is being seen as an additional driver to support renewables in the current economic environment.
- Wind Power is the most commercial form of renewable power generation – and therefore is seen as least dependent upon subsidies and government incentives – while maintaining its position as the fastest-growing form of renewable power.
- Solar PV demand remains mainly driven by government incentives in a few countries that are aimed at generating economies of scale. We continue to believe that cost reduction will be the most significant driver for the industry.
- Concentrated solar power technologies offer a competitive, utility scale and storage advantages that, in our view, will continue to stimulate investment over the coming years.

Wind farm operators

Investment considerations

- Site selection
- Wind resource assessment
- Site design and technical requirement
- Permitting
- Regulatory support
- Turbine selection
- Project economics forecasting
- Construction risks and contractors
- Grid connection
- Hedging
- Testing and commissioning
- Project timing and risk management

Operational considerations

- Availability
- Power curve
- Seasonality
- Serviceability
- Warranty claims
- Performance monitoring

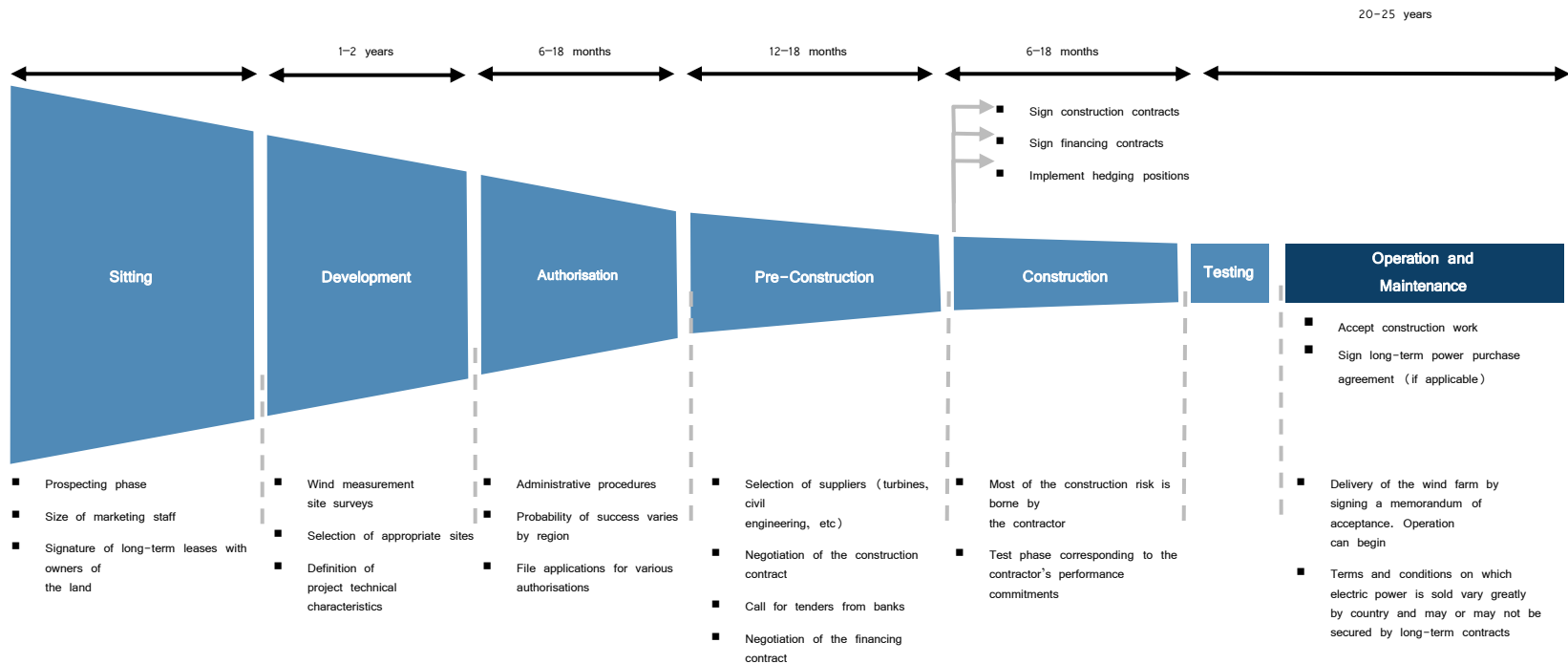
Financial considerations

- Leverage
- Residual value
- Finance costs
- Funding structure
- Project returns

Overall cost of energy might be lower or higher than base case scenario

Wind farm project development and valuation

- Valuation for wind projects, although values depend on a number of variables, and vary from country to country based upon tariffs, power prices, load factors and other factors.
- We suggest a value of EUR 1.4–1.6mn/MW for operational assets, EUR 0.7–0.8mn/MW for assets under construction, and EUR 0.1–0.2mn/MW for those under development.



Wind project economics – 50MW

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Revenue (EUR thd)		8,620	8,620	8,620	8,620	8,620	8,620	8,620	8,620	8,620	8,620	8,620	8,620	8,620	8,620	8,620	8,620	8,620	8,620	8,620	8,620
- O&M		-1577	-1608	-1641	-1673	-1707	-1741	-1776	-1811	-1847	-1884	-1922	-1961	-2000	-2040	-2081	-2122	-2165	-2208	-2252	-2297
- D&A		-2438	-2438	-2438	-2438	-2438	-2438	-2438	-2438	-2438	-2438	-2438	-2438	-2438	-2438	-2438	-2438	-2438	-2438	-2438	-2438
- Finance costs		-3250	-3147	-3038	-2922	-2799	-2668	-2529	-2381	-2224	-2058	-1880	-1692	-1492	-1280	-1054	-814	-559	-288	0	0
Pre-Tax		1356	1427	1504	1587	1676	1773	1877	1990	2110	2240	2380	2530	2691	2863	3048	3246	3459	3687	3930	3885
- Tax		-447	-471	-496	-524	-553	-585	-620	-657	-696	-739	-785	-835	-888	-945	-1006	-1071	-1141	-1217	-1297	-1282
Net Income		908	956	1007	1063	1123	1188	1258	1333	1414	1501	1594	1695	1803	1918	2042	2175	2318	2470	2633	2603
- Debt repayment		-1643	-1746	-1855	-1971	-2094	-2225	-2364	-2512	-2669	-2835	-3013	-3201	-3401	-3614	-3839	-4079	-4334	-4605	0	0
- D&A		2438	2438	2438	2438	2438	2438	2438	2438	2438	2438	2438	2438	2438	2438	2438	2438	2438	2438	2438	2438
FCF	-13,000	1703	1648	1590	1530	1467	1401	1331	1259	1183	1103	1019	931	839	742	640	533	421	302	5071	5041

Project parameters	
Total Capacity (MW)	50
Load Factor (EURmn/ MW)	24%
Capex/ MW	1.3
Price/ MWh	82
Operation (years)	20

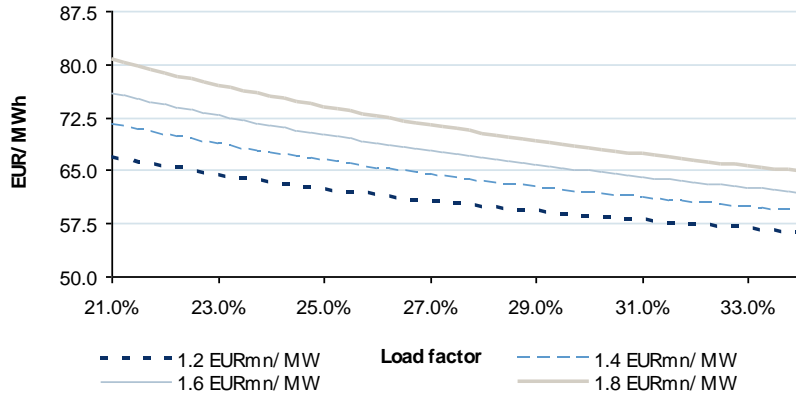
Operational assumptions	
Opex/ MW (EUR thd)	15
% Inflation p.a	2%
Depreciation period	20
On turbine cost	100%
Tax	33%

Capex Structure	
Turbine	75%
Civil work	20%
Other dvt costs	10%

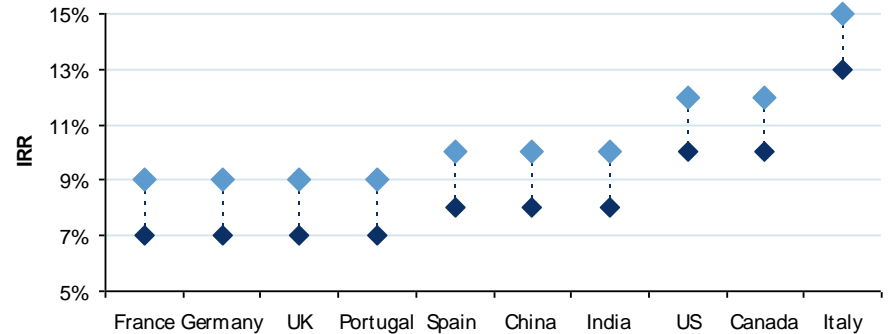
Debt structure	
Equity	20%
Debt	80%
Maturity (Year)	18
Cost of debt	6.25%

Project profitability	
NPV	16,064
Discount rate	6.25%
IRR	9.0%

Cost of Energy sensitivity analysis – Capex (EURmn)/ Load factor (%)



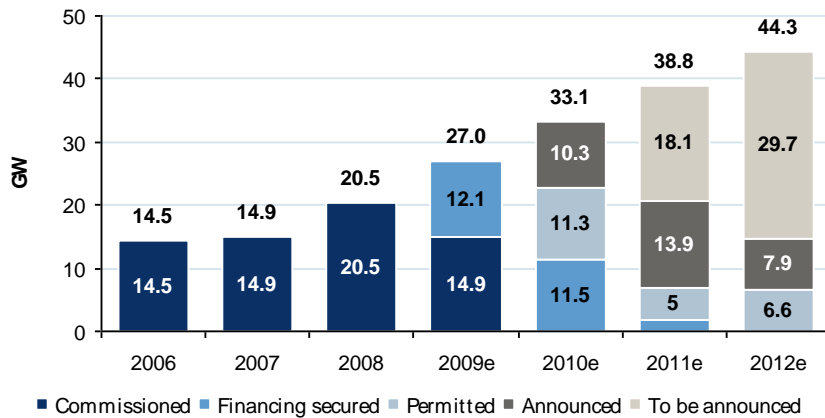
IRR comparison analysis



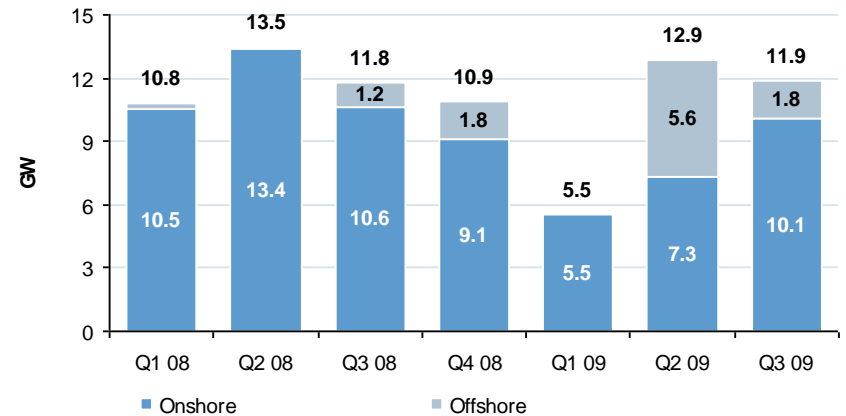
Wind project financing

- Due diligence from lending institutions increased from a project, counterparty, technology and warranty perspectives which have lengthened the financing approval process
- Activity levels in Q2 and Q3 2009 demonstrates wind as an asset class is remaining an attractive destination of capital
- Wind projects remain a less liquid asset which lacks a secondary market for the normalised flow of capital

Wind installations financing status 2006-2012e



Wind project financing – quarterly developments (Q1 08 – Q3 09)



Barclays Capital Wind Demand Forecast 2009–2013

	2007	2008	2009e	2010e	2011e	2012e	2013e
Global	19,647	26,963	26,979	33,110	38,829	44,286	49,511
Growth %	29.3%	37.2%	0.1%	22.7%	17.3%	14.1%	11.8%
Americas	5,686	8,968	7,470	10,443	12,087	13,495	14,834
Growth %	60.9%	57.7%	-16.7%	39.8%	15.7%	11.6%	9.9%
USA	5,189	8,346	6,405	8,812	10,193	11,075	12,025
Canada	387	526	625	1,037	1,104	1,384	1,463
C+S America	110	96	440	594	791	1,036	1,346
Asia Pacific	5,290	9,057	10,579	12,481	14,525	16,837	19,169
Growth %	39.8%	71.2%	16.8%	18.0%	16.4%	15.9%	13.8%
India	1,575	1,800	1,800	1,980	2,218	2,484	2,807
China	3,306	6,300	7,560	8,996	10,616	12,314	13,915
Japan	144	342	345	351	358	368	387
Australia	8	482	555	667	704	746	800
New Zealand	152	4	164	293	390	630	900
Others	105	129	155	194	240	295	360
EMEA	8,501	8,807	8,833	10,006	11,897	13,553	15,058
Growth %	9.6%	3.6%	0.3%	13.3%	18.9%	13.9%	11.1%
Germany	1,569	1,656	1,423	1,425	1,750	2,100	2,301
Spain	3,522	1,609	1,813	2,038	2,271	2,421	2,550
Italy	603	1,010	952	1,000	1,150	1,230	1,353
France	887	950	922	987	1,085	1,215	1,361
UK	440	835	902	1,114	1,347	1,660	1,894
Denmark	-11	55	224	25	225	25	225
Portugal	434	712	731	738	753	776	807
Netherlands	189	478	191	201	241	400	200
Sweden	217	233	256	295	354	432	531
Ireland	47	208	204	235	270	310	357
Austria	16	13	28	56	112	196	294
Greece	125	114	204	304	395	493	592
Poland	103	196	212	302	378	453	498
Turkey	96	286	337	416	520	624	686
Norway	1	102	107	193	347	468	609
Middle East and Africa	169	131	97	180	320	400	450
Ro EMEA	264	350	328	679	701	750	800

Americas – 10.6% 2009–2013e CAGR

- We forecast US installations to reach 6.4GW in 2009, a 23% demand contraction driven by the difficult financing environment and an extremely high level of activity in 2008.

Asia Pacific – 16.5% 2009–2013e CAGR

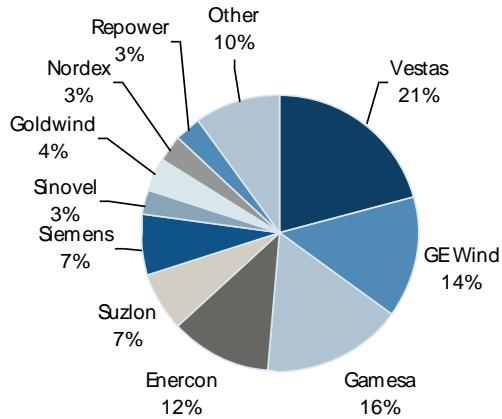
- Driven by increased energy demand, energy security challenges and an expanding manufacturing base, we believe China will be the largest contributor to growth in the region with new installations growing from 6.3GW in 2008 to 14.7GW in 2013.

EMEA – 11.7% 2009–2013e CAGR

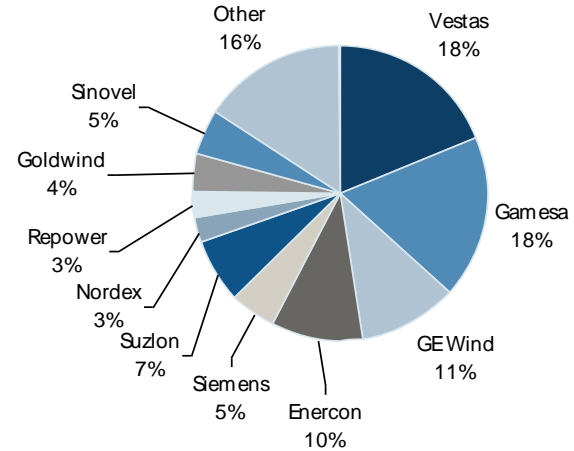
- We forecast wind installations to remain stable in 2009 driven by the relative resilience of Germany, Italy and France, and growth in the UK, Denmark, Turkey, Poland and Greece.

Turbine manufacturer's market share 2008

Top 10 suppliers 2007

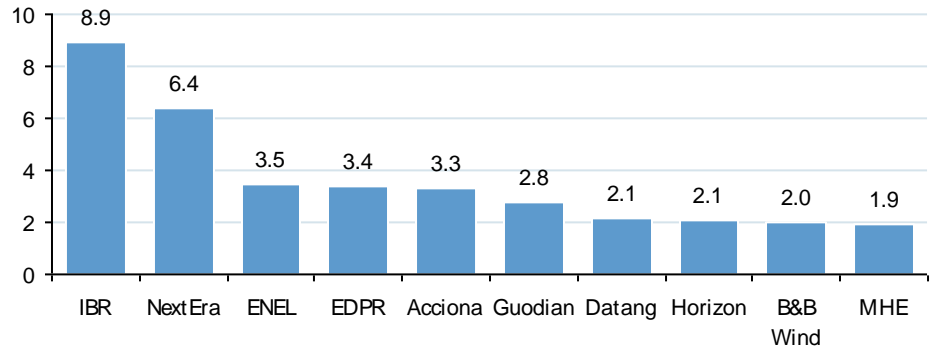


Top 10 suppliers 2008



- Vestas' market share declined as new entrants gained through the supply of smaller, lower technology turbines .
- We believe the rate of growth and attractive financial returns should restrict price competition with focus more likely to be on cost of energy, turbine size, reliability and warranty returns.
- The emergence of new entrants from China does not present a near-term threat, in our view, given existing turbine manufacturers' lead in product quality, turbine availability and global scale.

Top 10 Wind farm developers (2008)

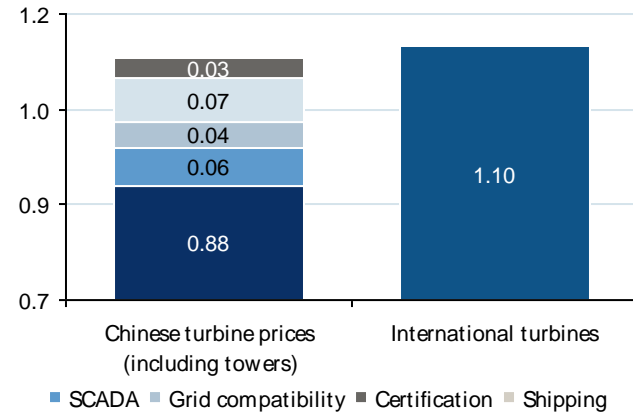


■ Installed capacity (GW)

Chinese turbines in the international market

- We do not expect to see Chinese turbine manufacturers expand into the European and US markets over the next two to three years
- Given the unproven track record and reported quality issues, we believe wind farm developers and financial institutions in mature markets are less likely to partner with Chinese turbine manufacturers
- In addition, the lower price per MW that is often quoted is not comparable to European peers

ASP comparison US\$/MW



Domestic Chinese turbine issues

Problem	Reason	Solution
Gear broken	Design failure	Recall and replacement
Oil drip of gear box	Design failure	Improve the design
Planetary gear loose	Process failure	Improve the strength
Main bearing broken	High rate of hydrogen in materials	Quality control at supply side
Oil drip of hydraulic cylinder at tip blade	Faulty cylinder production process	Select foreign brands
Twist of stall out control	Assembling process failure	Improve the process
Failure of electronic components	Common failure	Replacement
Lightening through the tower	Anti lightening design failure	Replacement
Cracks at the welding line	Design and welding failure	Redesign of tower

Source: Barclays Capital, Wind Power Commission



The Boeing approach

Lighter, efficient turbines that are easier to ship

Vestas V90 – 3.0MW turbine

- Compact, high performance turbine designed to optimise yield at medium and high wind sites
- Light weight design through use of carbon fibre and and lightweight materials – lower than a number of 2.0MW turbines in the market
- Designed for fast, easy transport by truck, barge or rail
- Focus on reliability, serviceability and turbine efficiency
- Capable of generating power equivalent to the annual consumption of approximately 2,000 homes



The Airbus approach

Larger, high output turbines

Gamesa G10x – 4.5MW turbines

- One of the largest on-shore turbines under development
- Aims to lower cost of energy by generating higher output per turbine
- Transportation of turbine potentially a challenge – Company has designed a modular design that can be shipped with no additional infrastructure compared to smaller turbines
- Capable of generating power equivalent to the annual consumption of approximately 3,000 homes
- Currently being tested at Saragossa, Spain

Offshore market

Key financing issues:

- Project execution risks: weather conditions, foundations, weight
- Limited track record on large turbine performance offshore
- Project serviceability
- Cost of energy

Company	Products	MW	Rated speed (m/s)	Weight (t)
GE Wind	3.6 MW	3.60	14.0	na
Clipper	Britannia	10.0	Na	na
Multibrid	M5000	5.00	12.0	276.0
REpower	5M	5.00	13.0	440.0
Siemens	SWT- 107	3.60	12.0	220.0
Vestas	na	6.00	na	na
Vestas	V90	3.00	15.0	111.0

Offshore installed capacity forecasts

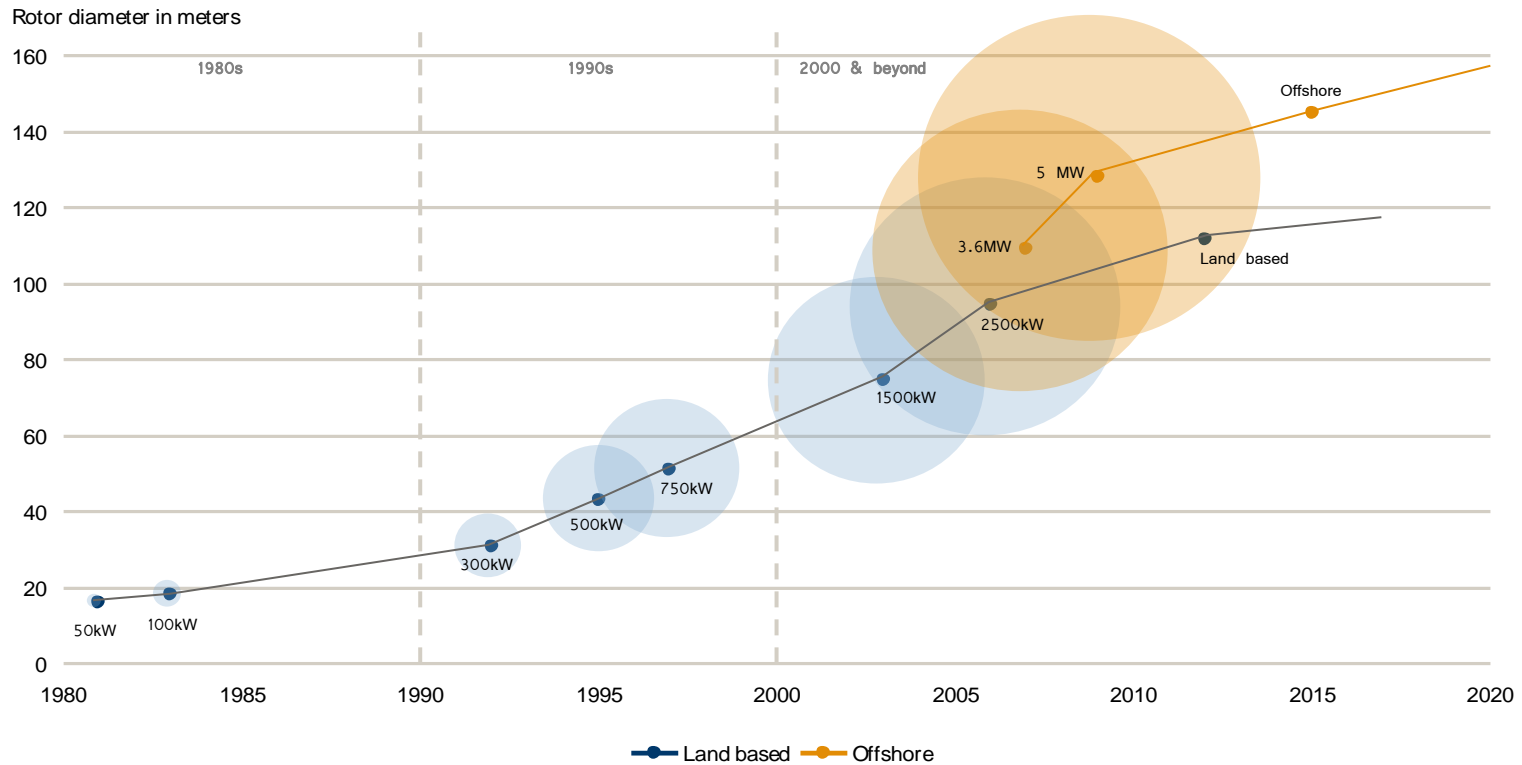
	2007	2008	2009e	2010e	2011e	2012e	2013e
Offshore cumulative capacity (MW)	1,084	1,446	2,209	3,191	4,706	7,465	11,005
Offshore new installations (MW)	200	362	764	982	1,515	2,759	3,540
% Growth	1%	81%	111%	29%	54%	82%	28%
United Kingdom	90	182	262	502	550	900	965
Sweden	110	0	0	0	0	0	150
Netherlands	0	120	0	0	50	150	0
Germany	0	30	173	225	550	950	1,200
Denmark	0	0	209	0	200	200	200
Belgium	0	30	90	180	165	165	216
Other	0	0	30	75	0	394	809

Question and Answers



Onshore wind technology

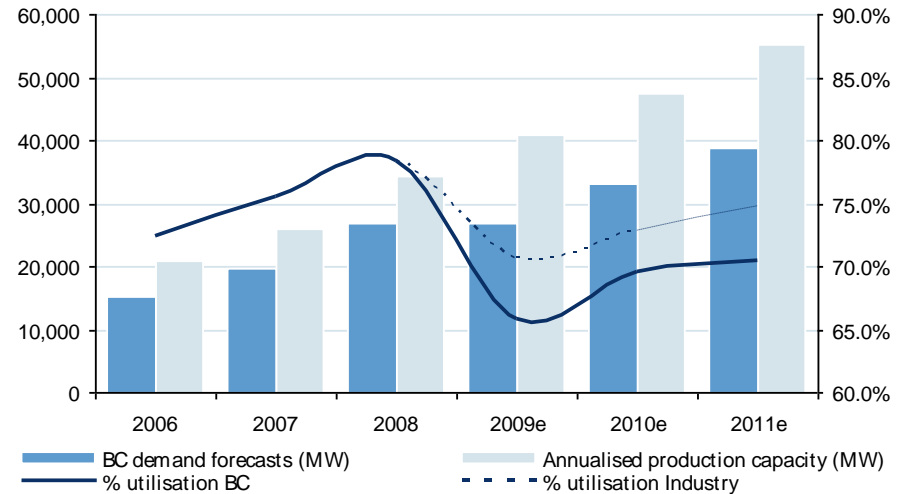
- Cost of energy, turbine size, reliability, availability and grid friendliness are key areas of focus.
- The current optimum onshore turbine size is 2–3.5MW, with bigger turbines under development. Gamesa (4.5MW) and Clipper (7.5–10MW) plan to build larger turbines and compete with Multibrind and REpower 5MW turbines.
- Future turbine design is focused on lighter and more reliable materials, blade aerodynamics, reliability of key components to bigger load and fatigue.



Supply chain and demand

- Traditionally, blades, bearings and gearboxes are seen as being the areas of greatest demand in the supply chain.
- We see all these available over the next 12-18 months given weakness in the capital equipment cycle.
- Tier 1 turbine manufacturers will be the largest contributors to the industry annualised production capacity growth over the next three years.

Annualized capacity utilization forecasts



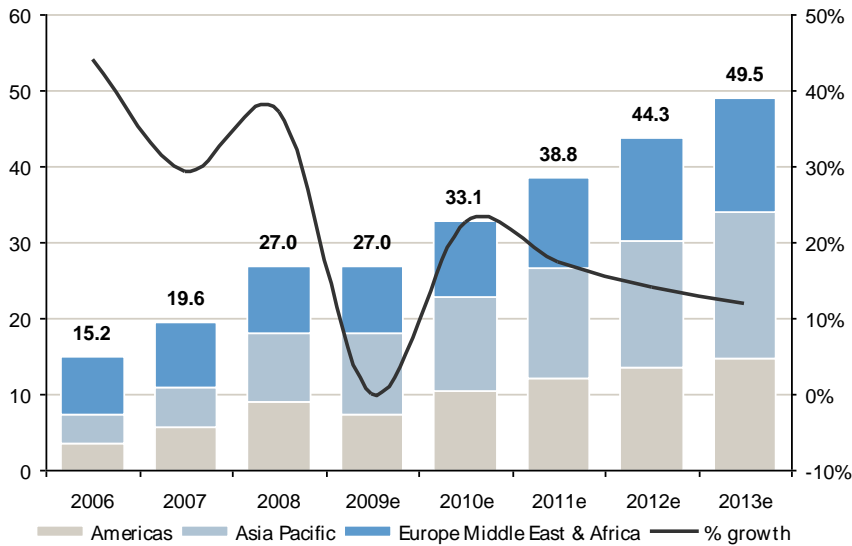
Wind turbine manufacturers' In-house manufacturing benchmark

Integration	Company	Blade (25%)	Gearbox (25%)	Control systems (25%)	Generators (15%)	Towers (10%)	Total
High	Enercon	23	25	25	15	5	88
	Gamesa	23	15	25	8	5	70
Relatively high	Suzlon	25	13	15	3	2	56
	Vestas	25	0	25	3	3	53
	Siemens	23	23	5	2	2	52
Relatively low	Clipper	0	25	0	0	0	25
	GE Wind	0	3	20	0	0	23
	Nordex	13	0	10	0	0	23
	REpower	9	0	5	0	0	14
Low	Sinovel	0	0	0	0	0	0
	Goldwind	0	0	0	0	0	0

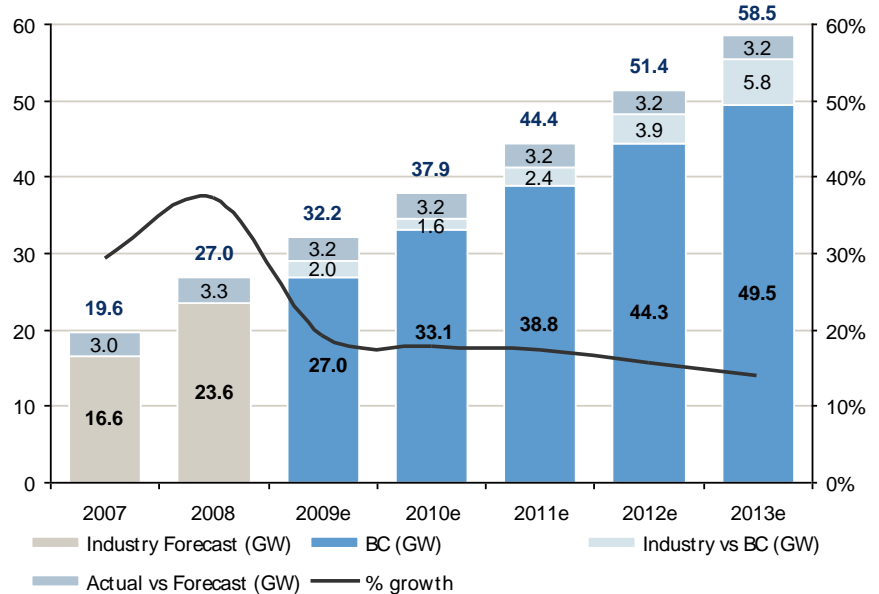
Barclays Capital Wind Demand Forecast 2009–2013

- We forecast new installations to remain stable at 27GW in 2009. We believe weakness in the US market will be offset by continued growth in Asia and a stable level of installations in Europe.
- Over the next five years, we forecast a 12.9% CAGR in new installations and a global installed capacity of 313.5GW at the end of 2013. We believe the US and China will remain the largest market drivers over the forecast period.
- Potential upside to our 2011–2013 forecasts in all regions exists in our perspective, should project finance availability normalise, supply chain and technology continue to improve.

BC new installation forecasts 2009–2013e (GW)

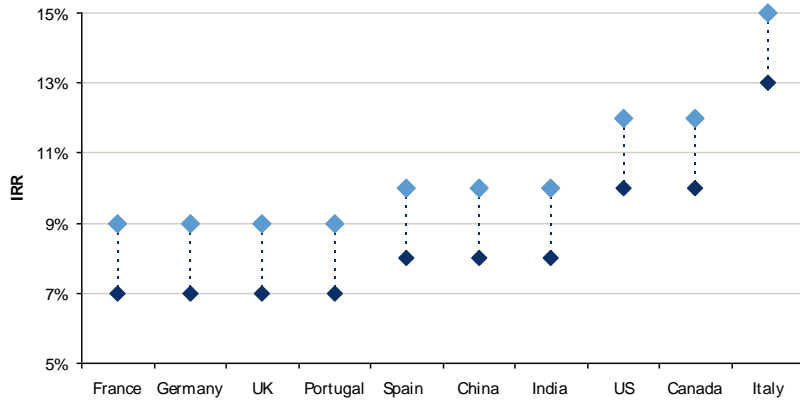


Upside scenario assuming historic pattern Actual vs. Industry forecast (GW)

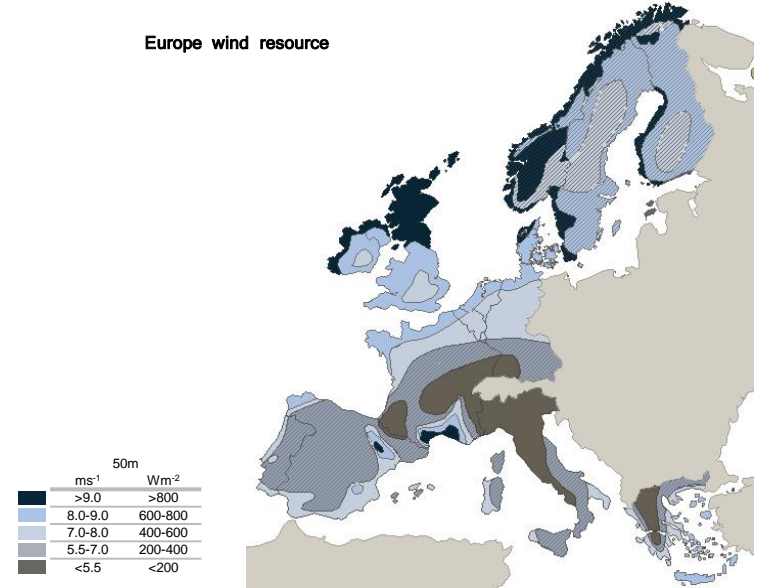


Wind farm resource and financial returns

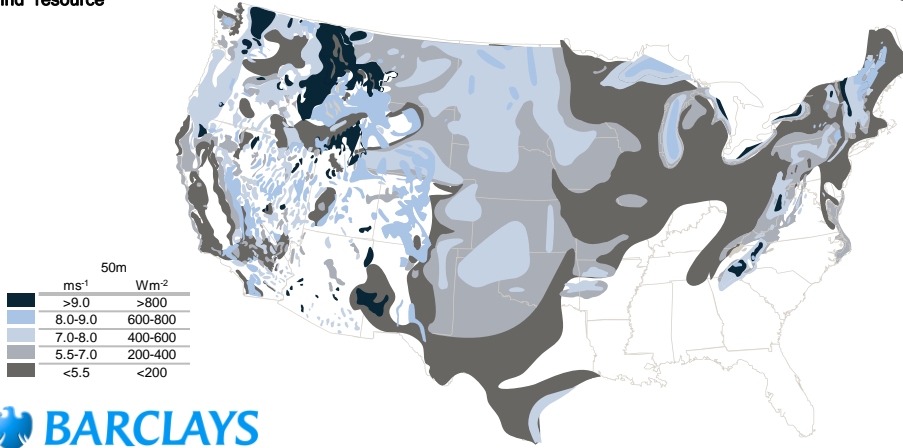
- Wind is competitive today at load factors above 25–30%. Expected IRRs range from 8% to 10% on average in our estimates, with the US at 10%+ and Italy around 14%.
- We believe that IRRs for new wind farms are likely to decline over the next three years and a broadly stable regulatory environment, higher cost of finance and relatively stable turbine pricing.



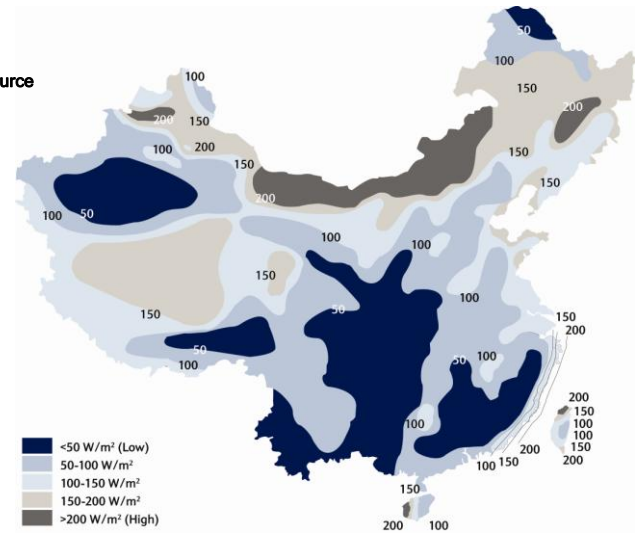
Europe wind resource



US wind resource



China wind resource



Barclays Capital Global Renewables Coverage

European Renewables (Rupesh Madlani, Arindam Basu, Julien Roques - London)

Wind		Solar			Energy Efficiency
Wind manufacturers	Wind operators	Upstream	Downstream	Equipment	
Vestas	1-OW EDP Renovaveis	1-OW REC	1-OW Phoenix Solar	1-OW Centrotherm	1-OW Outotec
Gamesa	1-OW Iberdrola Renovables	2-EW Wacker Chemie	1-OW SMA Solar	1-OW Roth & Rau	2-EW Abengoa
Clipper	1-OW Acciona	2-EW Q-Cells	2-EW Conergy	2-EW Meyer Burger	2-EW BioPetrol
Hansen	1-OW Terna Energy	2-EW SolarWorld	2-EW Solar Millennium	2-EW Manz Automation	3-UW AMG
Nordex	2-EW Theolia	2-EW PV Crystalox Solar	3-UW Solon	3-UW	3-UW
Repower	2-EW Greentech	3-UW	Solaria Energia	3-UW	
	EDF Energies Nouvelles	3-UW			

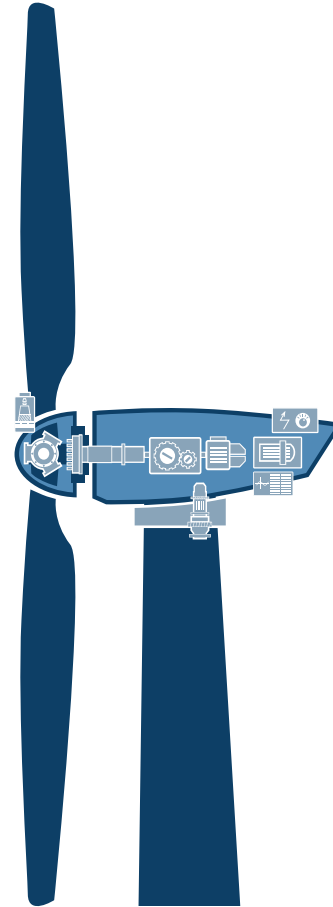
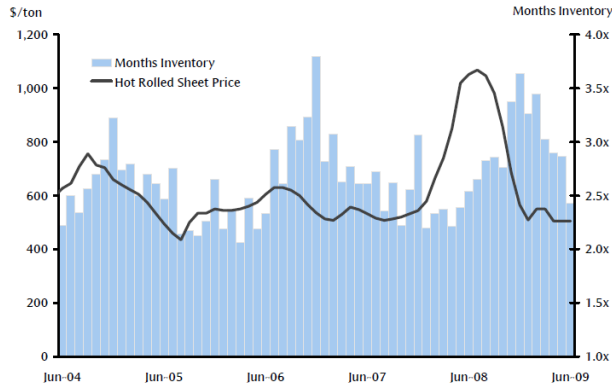
US Renewables (Solar: Vishal Shah - New York, Energy Efficiency: Gregg Orril, Daniel Ford - New York)








Wind		Solar			Energy Efficiency
Wind manufacturers	Wind operators	Upstream	Downstream	Equipment	
		MEMC	2-EW	GT Solar	2-EW Ormat Technology
		First Solar	2-EW		
		Evergreen	2-EW		
		Energy conversion	2-EW		
		SunPower	2-EW		








Asia Renewables (Rupesh Madlani, Arindam Basu, Julien Roques - London, Vishal Shah - New York)

Wind		Solar			Energy Efficiency
Wind manufacturers	Wind operators	Upstream	Downstream	Equipment	
Suzlon	2-EW	Yingli	1-OW Candian Solar	3-UW	
		Renesola	2-EW Solarfun	3-UW	
		LDK	2-EW		
		China Sunergy	2-EW		
		Trina	2-EW		

Turbine cost breakdown



	Tower 26.30%	
	<ul style="list-style-type: none"> Height: 40 - >100m 	
	Rotor Blades 22.20%	
	<ul style="list-style-type: none"> Length: up to and over 60m 	
	Rotor Hub 1.37%	
	<ul style="list-style-type: none"> Holds blades in position as they turn Made from cast iron 	
	Rotor Bearings 1.22%	
	<ul style="list-style-type: none"> Some of the many different bearings in a turbine 	
	Main Shaft 1.91%	
	<ul style="list-style-type: none"> Transfers the rotational force of the rotor to the gearbox 	
	Main Frame 2.80%	
	<ul style="list-style-type: none"> Made from steel, must be strong enough to support the entire turbine drive train, but not too heavy 	
	Gearbox 12.91%	
	<ul style="list-style-type: none"> Gears increase the low rotational speed of the rotor shaft in several stages to the high speed needed to drive the generator 	

	Generator 3.44%	
	<ul style="list-style-type: none"> Converts mechanical energy into electrical energy. 	
	Yaw System 1.25%	
	<ul style="list-style-type: none"> Mechanism that rotates the nacelle to face the changing wind direction 	
	Pitch System 2.66%	
	<ul style="list-style-type: none"> Adjusts the angle of the blades to make best use of the prevailing wind 	
	Power Converter 5.01%	
	<ul style="list-style-type: none"> Converts direct current from the generator into alternating current to be exported to the grid network 	
	Transformer 3.59%	
	<ul style="list-style-type: none"> Converts the electricity from the turbine to higher voltage required by the grid 	
	Brake System 1.32%	
	<ul style="list-style-type: none"> Disc brakes bring the turbine to a halt when required 	
	Nacelle Housing 1.35%	
	<ul style="list-style-type: none"> Lightweight glass fiber box covers the turbine's drive train 	

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Gamesa Corporacion Tecnologica S.A. (GAM.MC, 31-Aug-2009, EUR 15.27), 1-Overweight/1-Positive

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Meyer Burger Technology AG (MBTN.S, 31-Aug-2009, CHF 198.60), 2-Equal Weight/1-Positive

Nordex AG (NDXGk.F, 31-Aug-2009, EUR 12.77), 2-Equal Weight/1-Positive

Outotec Oyj (OTE1V.HE, 31-Aug-2009, EUR 20.23), 1-Overweight/2-Neutral

Phoenix Solar AG (PS4G.F, 31-Aug-2009, EUR 34.82), 1-Overweight/1-Positive

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Renewable Energy Corp. ASA (REC.OL, 31-Aug-2009, NOK 40.75), 1-Overweight/1-Positive

REpower Systems AG (RPWGn.DE, 31-Aug-2009, EUR 104.00), 2-Equal Weight/1-Positive

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Suzlon Energy Limited (SUZL.BO, 31-Aug-2009, INR 93.75), 2-Equal Weight/1-Positive

Terna Energy SA (TENr.AT, 31-Aug-2009, EUR 5.47), 2-Equal Weight/1-Positive

Theolia S.A. (TEO.PA, 31-Aug-2009, EUR 5.10), 2-Equal Weight/1-Positive

Vestas Wind Systems A/S (VWS.CO, 31-Aug-2009, DKK 372.50), 1-Overweight/1-Positive

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