



Wind power: some lessons from 2006

Posted by [Jerome a Paris](#) on June 3, 2007 - 11:27am

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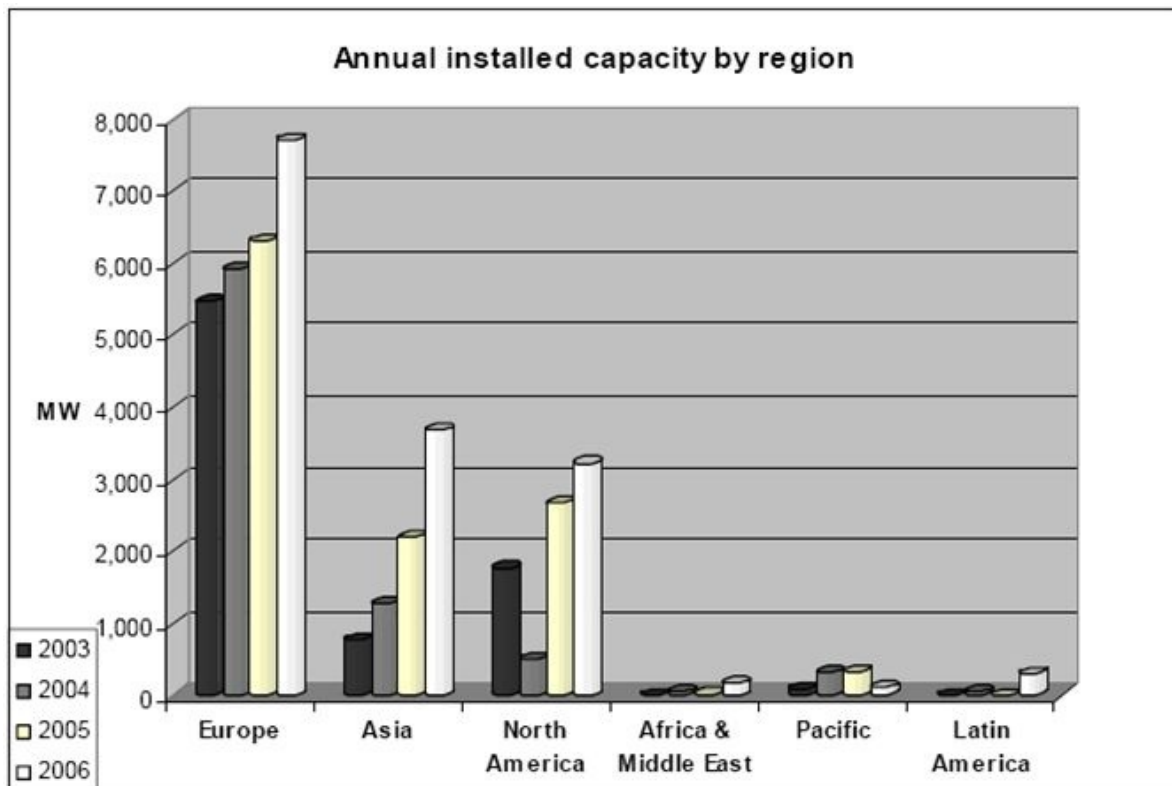
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The Department of Energy's Energy Efficiency and Renewable Energy (EERE) center has published its [Annual Report on U.S. Wind Power Installation, Cost, and Performance Trends: 2006](#) (pdf - the graphs below come from the accompanying powerpoint [presentation](#) - also pdf).

I've cherry-picked a few tidbits of information that underline what are in my view interesting lessons from last year for the wind power sector.

Disclaimer: I [finance wind farms](#). While that means in practice that I make sure that the projects I work on have as few vulnerabilities (technical, economic, legal, or political) as possible, I am naturally interested in the growth of the industry that underpins my job. So take this diary with the grain of salt you think it accordingly deserves.

2006 was another good year for wind power, with a (via [GWEC](#)) 32% growth in capacity installed over the year:



For the second year running, the USA was the first country by MW installed in that year, although not the first by cumulative capacity, with Germany still far ahead, and Spain still ahead of it.

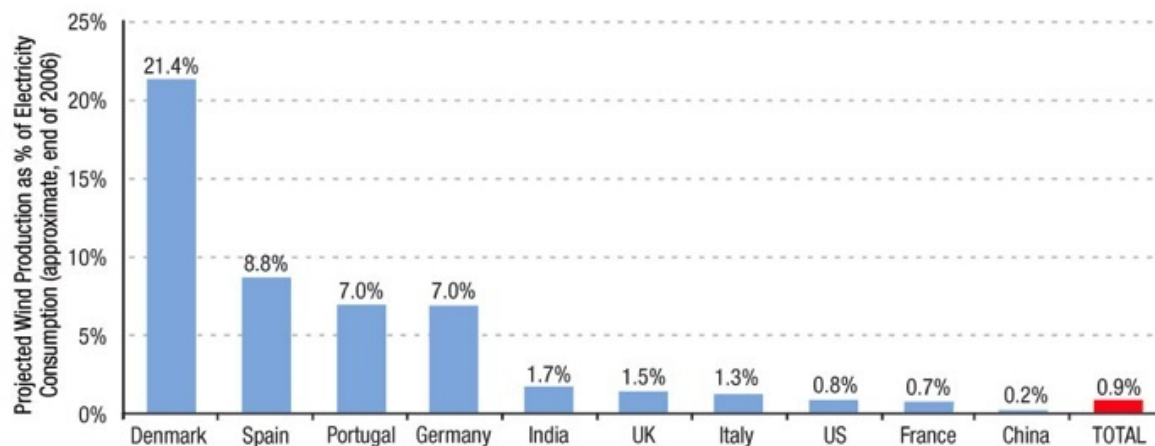
Table 1. International Rankings of Wind Power Capacity

Cumulative Capacity (end of 2006, MW)		Incremental Capacity (2006, MW)	
Germany	20,652	US	2,454
Spain	11,614	Germany	2,233
US	11,575	India	1,840
India	6,228	Spain	1,587
Denmark	3,101	China	1,334
China	2,588	France	810
Italy	2,118	Canada	776
UK	1,967	UK	631
Portugal	1,716	Portugal	629
France	1,585	Italy	417
Rest of Wold	11,102	Rest of World	2,305
TOTAL	74,246	TOTAL	15,016

Source: BTM, 2007; AWEA/GEC dataset for U.S. cumulative capacity.

The strong position of China, and even more of India (home of manufacturer Suzlon, which has just won the battle to buy German manufacturer Repower, and purchased Belgian gearbox subcontractor Hansen last year) should be noted.

However, in terms of capacity relative to domestic electricity markets, the European pioneers (Denmark, then Germany and Spain) are still far ahead:



Source: Berkeley Lab estimates based on data from BTM and elsewhere.

Note: Figure only includes the 10 countries with the most cumulative installed wind capacity at the end of 2006

We're beginning to see countries where wind penetration is large enough to provide a visible portion of total electricity (and note - this is the fraction of actual kWh consumed, *after* taking into

account the lower availability of wind power generation capacity) - and these numbers are set to keep on growing significantly in the coming years, as more capacity comes online. Even though most of market growth now comes from newcomers, like France or Canada, countries like Spain and Germany are still adding 10-15% new capacity to their existing stock each year. As I wrote in an earlier diary ([No technical limitation to wind power penetration](#)), there's still a lot to go before integration of wind into the grid becomes an issue. The EERE has a table which confirms this, with the additional cost of dealing with wind power between 0.2 and 0.5 c/kWh:

Table 6. Key Results from Major Wind Integration Studies Completed 2003-2006

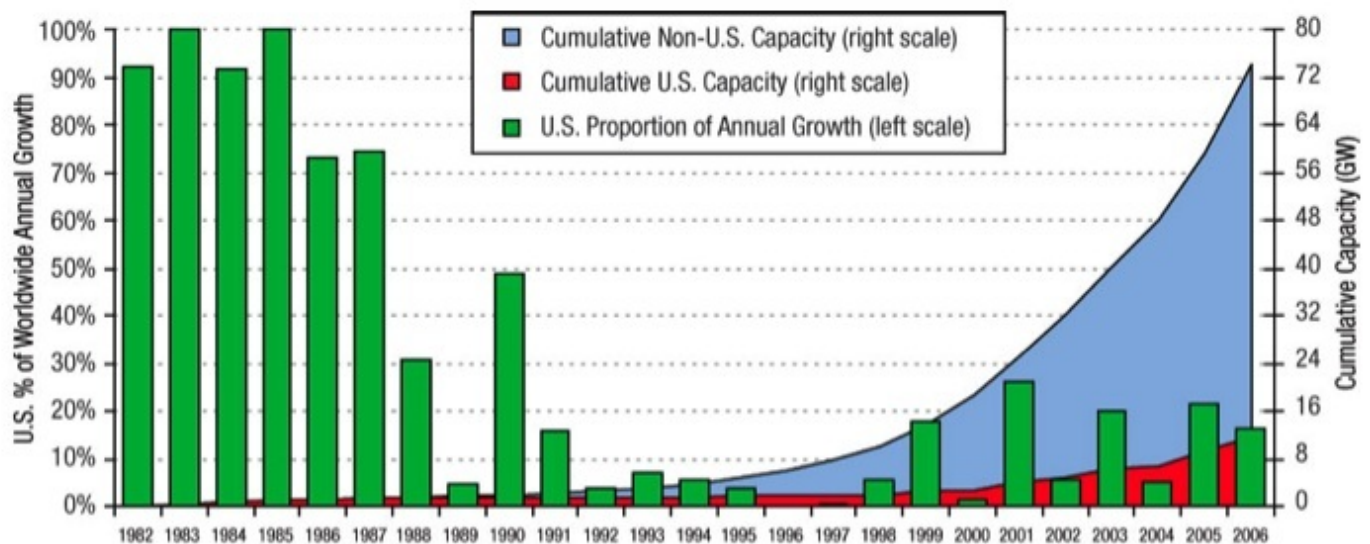
Date	Study	Wind Capacity Penetration	Cost (\$/MWh)				TOTAL
			Regulation	Load Following	Unit Commitment	Gas Supply	
2003	Xcel-UWIG	3.5%	0	0.41	1.44	na	1.85
2003	We Energies	4%	1.12	0.09	0.69	na	1.90
2003	We Energies	29%	1.02	0.15	1.75	na	2.92
2004	Xcel-MNDOC	15%	0.23	na	4.37	na	4.60
2005	PacificCorp	20%	0	1.6	3	na	4.60
2006	CA RPS (multi-year)	4%	0.45*	trace	na	na	0.45
2006	Xcel-PSCo	10%	0.2	na	2.26	1.26	3.72
2006	Xcel-PSCo	15%	0.2	na	3.32	1.45	4.97
2006	MN-MISO 20%	31%	na	na	na	na	4.41**

* 3-year average ** highest over 3-year evaluation period

Source: National Renewable Energy Laboratory

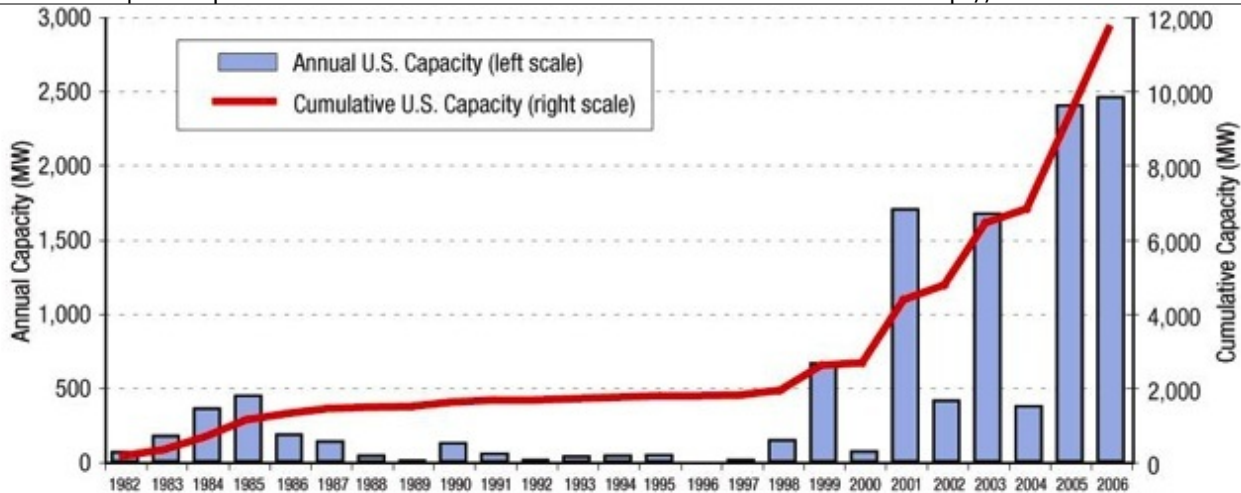
(Just for clarity: 1c/kWh is the same thing as \$10/MWh)

To get back to the previous graph, using the word "pioneer" to describe today's wind leaders is not really adequate, as the undisputed pionner in the 80s was the USA, as the graph below shows: essentially ALL the wind power capacity built in the 80s was in the USA. That lead was abandoned, and in the 90s, Denmark (with manufacturers Vestas, Neg-Micon (now part of Vestas) and Bonus (now Siemens)) created the modern, large-scale version of the industry and never looked back.



Source: Earth Policy Institute; BTM Consult; AWEA/GEC dataset

In fact, what's been striking about the US wind industry has been the stop-and-go nature of its development in recent years, with boom years alternating with dead years.



Source: AWEA/GEC database.

That unhealthy trend, caused exclusively by the instability of the federal regulatory framework, has caused havoc in manufacturing processes (how do you run a big factory where demand is 100 one year, 0 the next, 150 the next - without knowing at the beginning of the year what it will be?!) and almost bankrupted several of the leading companies in the sector (Vestas had losses, Repower had to be bailed out, others were gobbled up by big outsiders like GE and Siemens). It's difficult enough for smallish companies in a heavy manufacturing sector to deal with rapid growth rates: 20-30% growth per year sound great, until you realize that betting on it being more or less each creates problems (immobilized capital from overoptimistic investment, or loss of markets from falling behind the competition); but if you have to additionally deal with uncertainty until the last minute on whether 20% of the market will exist or not...

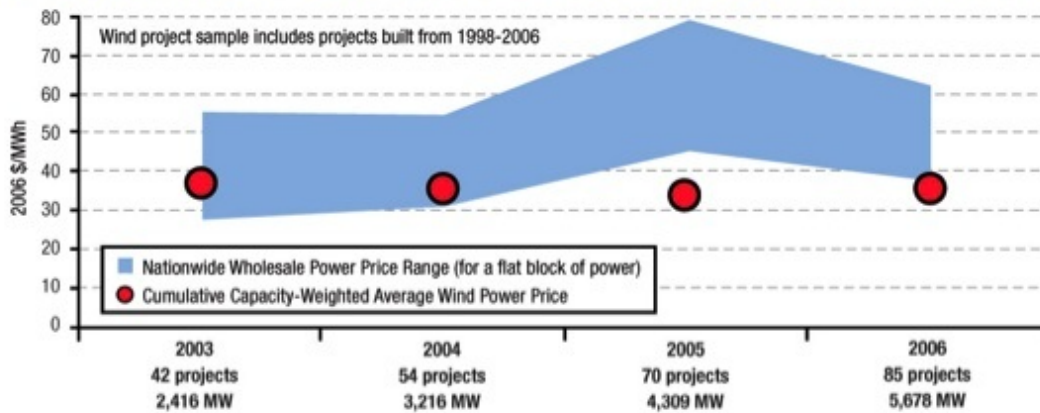
That phenomenon was caused by the fact the the main regulatory support for wind in the US, the PTC, expired in 2001 and was only renewed very late, and only for 2 years at a time. For 2004 and 2005, the PTC was only renewed in spring 2004, which means that projects meant to be built that year had been suspended until that renewal, which led to no construction whatsoever for most of 2004, and a rush after that.

The lesson here is that a regulatory framework has to be stable - or at least to evolve in predictable ways. The PTC saga was the exact opposite, and has had one simple consequence: the reluctance of turbine manufacturers to set up factories in the US, in the face of uncertainty on the demand side.

This is all the more depressing that the PTC works fine - my bank and others finance lots of projects on its basis, and it is one of the cheapest support mechanisms around: it costs the federal budget 2c/kWh, when European support mechanisms are often in the 3-5c/kWh range).

As we are now speaking of prices, one of the most interesting graphs in the EERE report is this one, which shows that wind power is extremely competitive for power purchasers: the actual sale price of wind power has been in the lower half, or even below the range in which wholesale prices for electricity moved for the past 4 years:

Nationally, Wind Has Been Competitive with Wholesale Power Prices in Recent Years



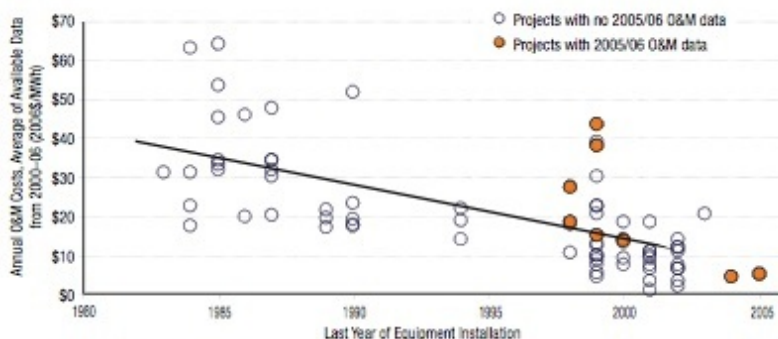
Source: FERC 2006 and 2004 "State of the Market" reports, Berkeley Lab database.

In particular, wind power prices went down in 2005 when electricity prices, pushed up by record natural gas prices, were going sharply up: those utilities that had the foresight to enter into purchase agreements with wind producers saved a lot of money then, and still do now.

Note - the prices above for wind power are those for the sale of electricity only; wind power producers also earn the PTC discussed above, equal to \$19/MWh last year. But that means that wind power is fully competitive without subsidies with power prices in the \$50-60/MWh range - and that's, of course, without taking into account the fact that wind causes no pollution and no carbon emissions.

Two trends are driving wind power prices: lower O&M costs and slightly increasing construction costs.

As noted in the EERE report, O&M costs have gone down from \$30/MWh for turbines built in the 80s to \$8/MWh for turbines built in the last few years. As the report notes, it is still hard to tell how much of that is simply a reflection that older turbines require more maintenance, and how much is a genuine lowering of costs, but the trend is down (and I have in house studies which I cannot post here which make the same point on Danish turbines).



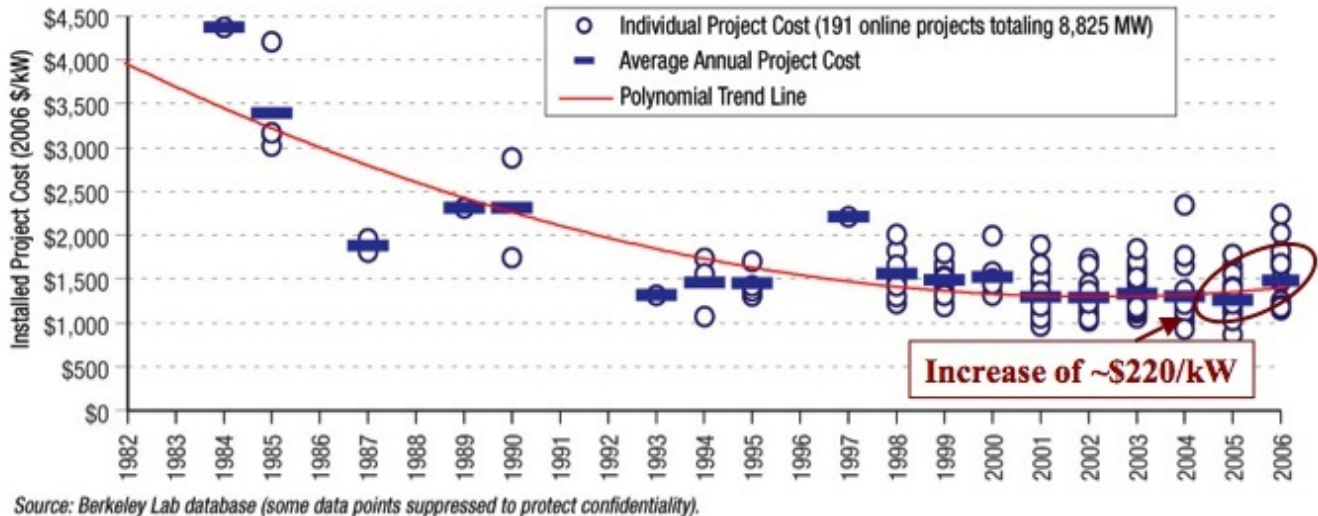
Source: Berkeley Lab database; five data points suppressed to protect confidentiality.

Figure 24. Average O&M Costs for Available Data Years from 2000-2006, by Last Year of Equipment Installation

On the initial investment side, costs have been going up somewhat lately. This reflects two things - one is the scarcity of turbines, as manufacturers, made wary by earlier years, have not

anticipated demand growth and need to catch up with production capacities - and sell their available models for more today; the other is that, like in all industrial sectors, the cost of raw materials that are used have gone up, which impacts prices.

Installed Project Costs Are On the Rise, After a Long Period of Decline



The report by EERE suggests that the economies of scale from building large windfarms are not that big, which should be an encouragement for people to team up, as they have in Denmark and Germany, to invest in one or two windfarms in their community if they have the space to do so - and most rural areas could do that.

Anyway, the conclusions I draw from all of this are as follows:

- windpower is booming, and is reaching a stage where it becomes a noticeable source of electricity in a number of countries. This is not the time to stop supporting it - it's time to make the essential part of electricity production: any kWh from wind lessens the need for coal-fired plants - or for nuclear. As such, the US is still really far behind and needs a sustained effort to catch up. Germany has twice the capacity with one twentieth of the land;
- windpower still depends on having a stable and clear regulatory framework. It is close to being competitive in absolute terms, but given the powers of incumbency of other power sources (gas, coal, nuclear), and the more or less hidden subsidies that go with it, it still requires a lot of support - including grassroots support. That matters to get the manufacturing capacity and the local jobs that come with wind power;
- windpower is a good bet for utilities: its cost will not increase with the price of gas and oil, and is already lower than other sources. It is a perfect *business* hedge against oil & gas dependence.

And it looks, and is, **peaceful** energy:



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