The Oil Drum: Europe
DISCUSSIONS ABOUT ENERGY AND OUR FUTURE

Why wind needs feed-in tariffs (and why it is not the enemy of nuclear)

Posted by Jerome a Paris on March 4, 2008 - 12:30am in The Oil Drum: Europe
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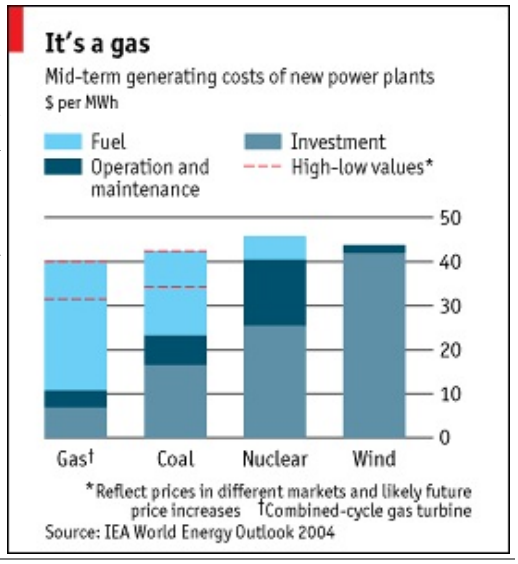
An argument often heard against wind is that it costs a lot in public subsidies for a solution that will always have a limited impact (because it still produces only a small fraction of overall needs, and because of its unreliability linked to its intermitten nature). This is an argument worth addressing in detail, especially when it is pointed out, as the graph shows, that wind is already almost competitive with the other main sources of electricity, which suggests that it might not even *need* the subsidies then (and the increase in commodity prices since that graph was prepared using 2004 data, only reinforces that argument).



> We are on the brink of a new energy order. Over the next few decades, our reserves of oil will start to run out and it is imperative that governments in both producing and consuming nations prepare now for that time. We should not cling to crude down to the last drop - we should leave oil before it leaves us. That means new approaches must be found soon.

The above, from an article by Fatih Birol, the increasingly strident chief economist of the International Energy Agency, suggests that we need to develop all non-carbon based energy sources as quickly as we can to avoid the coming energy crunch from oil depletion. He suggests to push nuclear energy, but that may not be enough - and, as I will show below, the best way to push nuclear is also the best way to promote wind power...

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Now, if you look at the graph above, it is very easy to see that the long term cost components of wind power and gas power are very different. Nuclear is quite similar to wind in that respect (more, in fact than the above graph suggests), and coal is quite similar to gas.

Wind turbines, once built, generate almost free electricity - they require only some basic maintenance and servicing. That means that they have a marginal cost of production close to zero (ie each additional kWh of production only requires more wind, but no actual spending); that also means that their main long term cost is the repayment of the initial construction cost, in the form of debt repayment and return on capital for the investors.

This has two simple consequences:

- the cost of wind power is essentially set at the time of construction, when the parameters of the financing of the initial investment are agreed, in the form of debt service plus a set return, over an agreed period of time, typically 15-20 years. That cost is **fixed** and will not vary in accordance with the price at which electricity is actually sold.

- once installed, wind power will always be dispatched - with its negligible marginal cost of production, it will always be cheaper than alternatives, and the only reason not to take such free power will be technical constraints from the network (which I'll discuss later). When dispatched, wind power will move the dispatch curve, and ensure that the marginal cost of production required at that point ot satisfy demand will be lower than if wind power were not available - ie wind power displaces the most expensive power source that would have been needed otherwise, typically a gas-fired plant.

The second argument, as the Economist noted, brings savings to all electricity consumers - in fact, in Denmark, such savings are now higher than the subsidy paid to wind power producers, thus creating a net gain for the country. This, in itself, is enough to justify subsidies, given that no other economic actor than the government can create such a gain, as it is diffuse and spread amongst all electricity users; by imposing a feed-in tariff, which similary spreads the extra money paid to wind power producers amongst all electricity users), the costs and benefits appear in the same place, and the gain is obvious and immediate. This is a perfect example of a smart regulation which benefits everyone.

The first consequence noted above is a bit more subtle and needs to be discussed in more detail.

As noted, wind power has high fixed costs, while gas power has low fixed costs but higher variable costs - the cost of procuring fuel. At a time of steadily increasing gas prices, that might seem like an advantage for wind, but, in fact, it is not. The reason for that is that, in today's liberalised markets whereby electricity prices are driven by the marginal cost of production, power prices tend to follow that of gas, since the marginal producer is usually a gas-fired plant. Thus, the variability of gas prices is mirrored in electricity prices, and a gas-fired plant does not really see its competitive position in the market change.

On the other hand, a wind farm, with its fixed costs, makes a lot of money when gas prices (and thus electricity prices) are high, but stands to lose money should at any point electricity prices come down again. The short term profitability of wind farms is driven by factors totally outside of their control (gas prices, which are themselves driven, in the medium term, by oil prices). Should that short term profitability be negative for too long, that can spell trouble for the investment (ie bank loans might be in default - even if temporarily - and the investors then stand to lose the project to the banks. And if that's too likely to happen, banks simply won't lend, because any default (even a temporary one) causes losses and headaches. Essentially, investors and banks must bet that gas prices will stay high enough *every single one of the next 15 years* for the project to avoid trouble.

To express things differently, the competitiveness of a wind farm - decided at the time of investment - depends on how low the gas prices might go over the next 15 years, whereas the competitiveness of a gas-fired plant depends mostly on the existing power plants - to know the plant's position on the dispatch curve, and thus its likely use. To a much lesser extent, the relative variations of gas and coal prices will also play a role, but this has a second-order impact on revenues.

In short, a gas-fired plant presents a much lower risk profile at the time of the investment, in the sense that the risk of catastrophic loss (from long term price movements) is much less, and that the somewhat higher short term price risk is easier to manage (and financial markets are happy

to provide their services there).

That different risk profile is, of course, the reason why wind power needs to be supported in some way by public authorities: markets, left to themselves, will invest in the very technologies (gas and coal) that are the source of all our worries, founded or nor, on the energy front: climate change (coming from carbon emissions), and security of supply (coming from the likely depletion of resources in the long term and the perceived unreliability of suppliers like Russia in the short term).

And the public authority has an actual incentive to encourage wind farms: the long term fixed nature of its price structure presents an unsurmountable risk for the private sector, but it does embed very real value for any entity able to bet on the very long term: a guarantee that prices will be no higher than that fixed cost, whatever the price of oil, in 20 years' time. The markets, except for very specific cases (energy intensive industrialists that know their energy needs in the long term, are not necessarily concerned about temporary interruptions and value long term average prices rather than short term ones), are currently unable to give a value to what is effectively a very long term option on electricity prices - but that value is there.

We know we'll still need electricity in the next 20 years; public policy that works to provide a cap to how high the price of that electricity can go sounds like smart policy - and smart politics.

In fact, on the basis of the value of that option, it can be argued that feed-in tariffs, which provide a stable, guaranteed price to wind power and thus allow the relevant investment to be made with the high-probability perspective of a decent return , are not a subsidy, but a fair transaction, whereby the public authority purchases the guarantee of capped prices in the future in exchange for somewhat higher prices today. The exemple of Denmark quoted above, and the current trends for oil prices, suggest that this is a transaction likely to be highly profitable in the long run, in fact, and thus not at all a subsidy.

Tax credits, as provided in the USA, are a similarly effective mechanism, as they provide a guaranteed minimum income to wind farms and thus ensure that the minimum long term power price threshhold required to make the investment in a wind farm a sensible one is much lower than it would otherwise be, and thus that such investments can be made today - and indeed they are, as the current boom in windpower in the US shows. And the cost-benefit analysis is likely to be similar once wind reaches a sufficient penetration in the market.

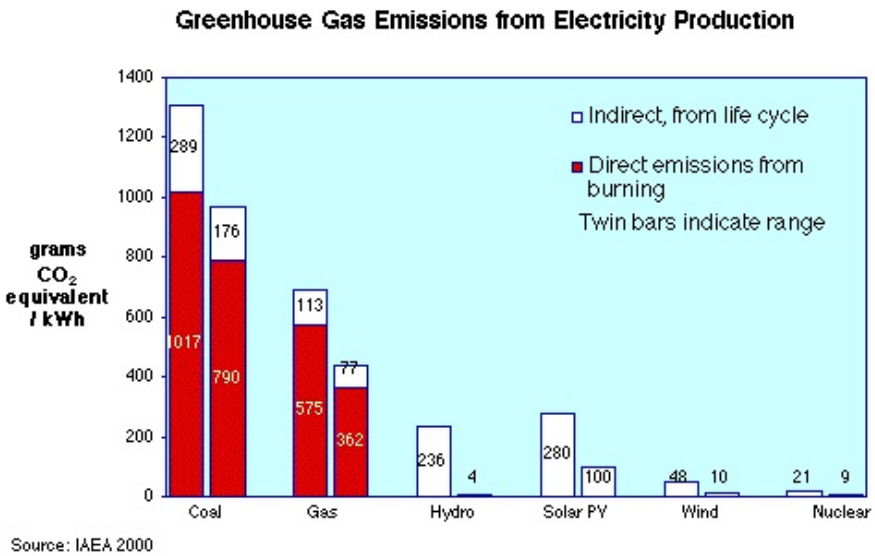
A third mechanism that would work as well is NOT the green certificate market regulations used in a few countries (the UK, Australia, Italy), but would rather consist in authorising public authorities to provide financing to the power sector. Given that the main cost of a wind turbine is the fixed financing cost, if you loser the aplicable interest rate and/or required return on capital, you also lower the long term cost of production. Public authorities can borrow money a lot more cheaply, and over much longer periods, than private sector entities, so the cost difference can be quite significant - it can halve the cost for nuclear plant, for instance. And they would not even need to actually provide funds, as this could take the form of payment guarantees. Thus, the public entity would bear that risk of periods of low power prices in exchange, once again, for having a growing portion of power generation coming from carbon-free, capped-cost sources. and the beauty of such guarantees is that they can be provided to all power sources (ie including gas and coal fired plants) in order to avoid the accusation of distorting competition: the cost impact is a lot bigger on wind or nuclear than on gas or coal, and thus the investment decisions will be correspondingly influenced. Charging a flat fee for such a guarantee would make the mechanism transparent and "fair."

2015 – Mean value	Nuclear EPR (European Pressurized water Reactor)	Combined-cycle gas turbine	Pulverized coal	Circulating fluidized coal bed
8% discount rate	28.4	35.0	33.7	32.0
5% discount rate	21.7	33.4	29.5	28.1
11% discount rate	37.0	36.9	38.5	36.4
CO_2 costs (€4/t and €20/t)		1.4-7.1	2.9-14.6	3-15

(Table 1 – Full-time production costs in 2015, with individualized CO_2 costs (2001€/MWh, $1 = €1)

The lesson from all this is that wind power does not need subsidies **if** you make it possible to take into account long term perspectives rather than short term risks. And the same argument applies to nuclear power, so the two technologies are perfectly aligned in that respect - one could even argue that mechanisms that allow to take into account the long term cost/benefit analysis would boost nuclear even more, given that nuclear power plants present the additional risk, from a private investor's perspective, that it is a huge discrete investment, ie it is hard ot invest a small amount in a nuclear plant, you need to sink at least a couple billion euros. Wind farms can at least come in chunks of a few million a piece but, with nuclear, you need to bet big each time, and very few private sector players can afford to concentrate their risks like this.

Of course, this discussion has **not even discussed the fact that most existing technologies other than wind are heavily subsidized**, either directly, or because they do not have to pay for the externalities they cause. The most obvious example being the lack of price paid, until emissions trading actually comes into force, for the carbon dioxide emissions from gas- or coal-fired plants, or the direct subsidies paid to coal mining in many countries.



QUANTIFIED MARGINAL EXTERNAL COSTS OF ELECTRICITY PRODUCTION IN GERMANY[2] (IN € CENT PER KWH)

	Coal	Lignite	Gas	Nuclear	PV	Wind	Hydro
Damage costs							
Noise	0	0	0	0	0	0.005	0
Health	0.73	0.99	0.34	0.17	0.45	0.072	0.051
Material	0.015	0.020	0.007	0.002	0.012	0.002	0.001
Crops	0	0	0	0.0008	0	0.0007	0.0002
Total	0.75	1.01	0.35	0.17	0.46	0.08	0.05
Avoidance costs							
Ecosystems	0.20	0.78	0.04	0.05	0.04	0.04	0.03
Global Warming	1.60	2.00	0.73	0.03	0.33	0.04	0.03

At this stage, nuclear advocates might agree with my points and conclude that we need to focus on building nuclear plants, given that wind, being unreliable and small-scale, can never "do the job."

I'd argue that, while personally favorable to nuclear, it's not the easiest solution to deploy in many countries. Given that the State will always bear the ultimate risk for very long term waste management, for catastrophic accident insurance (both impossible to price by the private sector) and for overall safety and security regulation, and that price "support" as proposed above further implicates public authorities, my position is that nuclear power should be run by publicly-owned entities - the EDF model. Under such a model, nuclear can indeed provide a large chunk of our electricity needs.

But even in countries where this model can be applied, there should be no limitation to the development of wind power, and no need for nuclear advocates to demean or mock wind power. Given that it is essentially the same regulatory framework that favors both technologies (with specific regulatory requirements for waste on the one side, and for network reinforcement on the other), they are objective allies in the public debate on energy.