The low carbon transition to the grid parity age

Jonathan Johns, Guest columnist

Accepting that there is a wide degree of consensus in most developed countries that they need to take carbon out of their economies on a relatively aggressive basis over the next 20 years, it is reasonably expected that, post recession, the long-term prospects for the renewables industry are buoyant, notwithstanding pressures on the public purse and sluggish growth.

After all, renewables offer significant benefits in terms of improved security of supply, a hedge against future rises in energy costs, and for those countries prepared to make the necessary investment, the prospect of cleantech jobs.

However, the renewables industry cannot be complacent – there are considerable challenges in the short and medium term – particularly if the sector is to take a major (if not dominant) share of the energy mix as economies transition to a low carbon environment.

Detractors, particularly in the US, state that the cost of renewables puts a burden on general industry making it less competitive. Certainly this is currently making cap and trade difficult to implement. The voluntary carbon offset market is in widely reported difficulty, with the COP16 global summit at Cancun in November regarded as challenging. The latter particularly affects projects in the developing world which are often dependent on joint implementation/clean development mechanism (JI/CDM) and voluntary offsets.

For developed economies, it is unlikely to be sensible to base an economy wholly on fossil fuels. As discussed in the last issue of the CAI, the challenge for governments in developed countries is to select support mechanisms that are both cost-effective for the taxpayer/consumer, while sufficiently attractive to stimulate the vast quantities of investment required.

Obtaining capital remains difficult. As some economies take faltering steps to the restoration of growth, it is evident that a relatively high proportion of recent European projects have been reliant on **European Investment Bank** participation and in the US those projects that go ahead, more often than not, are those which benefit from US Treasury buyouts of the Production Tax Credit/Investment Tax Credit (PTC/ITC).

Government involvement in finance is critical going forward, and this is exemplified by the UK Coalition Government's welcome announcement of a Green Investment Bank as a conduit of public and private finance – but on terms subject to the rigours of a forthcoming spending review. And the impact of tightening government finances on support for renewables will be a recurring theme in the coming months in many jurisdictions.

All of this can be contrasted with the more planned economy in China where capacity build up is burgeoning (in some respects overly so) both in terms of generation and manufacturing, with Western manufacturers and some international developers vying for their slice of the pie. Small wonder that in this issue China has reached the sole number one position in the Country Attractiveness All Renewables Index for the first time, while the position of the US shows signs of slipping further if more action does not occur.

Yet for market-based economies in the developed world, the opportunity for renewables is greater than many perceive – as not only does fossil fuel capacity have to be replaced but also there is the requirement for a huge increase in electricity generation capacity overall as the energy market moves toward a greater use of electricity in relation to transport and the provision of heat. The implications of this are only just being thought through. For example, in the UK, this may lead to a doubling of electricity generation in the UK by 2050 notwithstanding radical measures to increase energy efficiency (as set out in the recently published *2050 Pathways Analysis*).

For governments, the challenge may well be the extent to which market-based solutions are able to provide the speed of change and scale of investment required to achieve carbon targets — or indeed match the level of investment in China. For corporates, the challenge is likely to be whether they are able to provide the levels of capital required for unprecedented growth or whether other players will enter the market.

The potential is that electricity suppliers and generators double their revenues in the next 20 to 30 years (which would, for example, move **E.ON** from 27th place in the Global Fortune 500 to 5th place). At present, many utilities are relying on joint ventures or infrastructure and sovereign wealth funds to meet the funding gap. Even these may have insufficient resources to plug the gap – perhaps leading to the need for asset-specific floats and bond issues, as was more common in the 19th century.

For some of those engaged in the more emerging renewable technologies, fiscal pressures in the West may cause difficulties. Without early support, there may be a misplaced assumption by policy-makers, that room will still be available for newer technologies in the marketplace even if their commercial deployment is delayed – either due to the rationing of finance due to fiscal pressures or intolerance of the inevitable early stage setbacks. It will require considerable resolution on the part of policy-makers to create an

environment to ensure that new technologies get the support they need when they need it.

Energy infrastructure tends to be there for the long term and once in place it has a significant incumbent advantage: with wind and solar installations likely to be successively replanted on existing sites at the end of their 20-year lives. Unless some of the emerging technologies are supported now, they may not be sufficiently advanced along their cost curves to supplement these core technologies in later years – with consequent effect on the achievement of long-term carbon targets.

Even for established manufacturers, there are likely to be winners and losers and some recognized names may well be challenged and possibly replaced by new entrants. It may be a mistake for currently strong incumbents to assume that the level of market growth referred to above provides room for all – not just because of strong competition from low cost Asian manufacturers, but also because cost pressures are likely to place increased emphasis on continuous innovation – favoring those with breakthrough technological solutions which either reduce the cost of the installations themselves, improve their operating efficiency, or reduce their operating costs.

Hence the race to ever improve the output of solar PV by improvement in cell efficiency and, for example, inverter design; and the shift in the wind industry towards more reliable direct drive gearboxes. Other than in the offshore environment, certainly wind can no longer just rely on the benefits of scaling up derived from the energy being the cube of the swept blade.

Developed countries are tending to support higher cost, higher tech solutions such as offshore wind (in the North Sea), concentrated solar power, i.e., CSP (in the US, Spain and Australia), building integrated solar PV (France), and thin film solar (US), as well as encouraging new technologies such as wave and tidal (UK) and carbon capture storage (US, Europe and Australia). Certainly "smartgrid" is widely regarded as a priority in most jurisdictions. Biomass is likely to be more greatly exploited: subject to land availability, sustainability criteria, and the demands of the biofuels industry (as in the case of aviation and haulage, it is the only viable means of decarbonization). Nor should the West assume that innovation is its prerogative; China , India, and South Korea are increasingly likely to take up the challenge of leading by technological as well as cost advantage.

It remains a feature of the global renewables market that manufacturers are still required to vary emphasis from one jurisdiction to another as the differing support regimes in each are harvested in order of their economic attractiveness. Although this by-product of government support is unlikely to change, it is not helpful for the orderly development of the industry.

It is of concern, for example, that the US market faces an imminent crisis (certainly in wind), as the support measures included in the first fiscal stimulus draw to a close and that the wounded PTC/ITC system – only temporarily made strong by the Treasury grants alternative – will have this vital crutch taken away unless a new tranche is authorized or a new mechanism put in place.

In the case of solar, the market is preparing for a shift from a dominant German market to other smaller hotspots, while Spain remains largely in the doldrums with the wind industry largely thought to have won out over solar.

It is surprising that talks over a climate change successor to Kyoto do not place greater emphasis on closer harmonization and coordination of renewables support measures: this is at least more of a possibility as more territories adopt feed-in tariffs – and may become a necessity as the use of interconnectors to transfer renewables between territories becomes common. Certainly this possibly utopian goal would allow manufacturers to more easily plan capacity build, encourage greater investment and more importantly lead to reduced prices per kWh and price per carbon tonne saved – increasingly likely to be the critical factors when compared with the retail price and wholesale price of electricity.

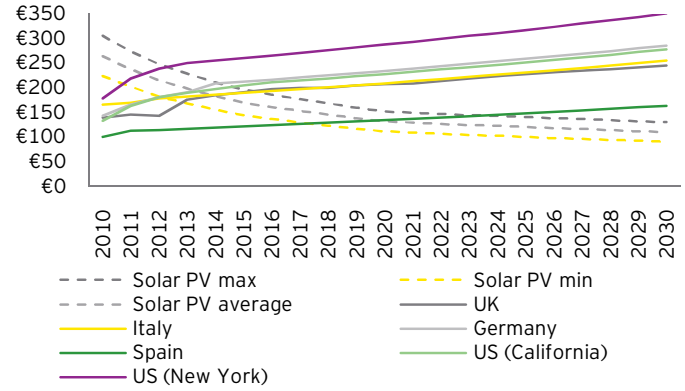
It is with this in mind that we have prepared graphs illustrating how technology trends may develop to 2030 compared with possible movements in electricity prices; effectively simulating the path towards "grid parity": the point at which subsidies may no longer be required. As is the case with all simulations, an open and sceptical mind is required in their interpretation. The central thesis envisages a relatively slow recovery into economic growth and takes account of learning curves for each technology. These are regarded as relatively muted for wind, for example, compared with solar, partly due to the impact improvements in PV technology have had on efficiency and manufacturing techniques on cost – with the industry having an avowed intention to target costs towards US$1 (€0.8) per Watt.

When translated into cost per kWh and compared by jurisdiction, these outcomes are further affected by resource quality across the jurisdiction, so that, for example, grid parity is likely to be achieved in solar earlier in southern Italy than in the north. In the case of onshore wind, Scotland is likely to win out over the southeast of England.

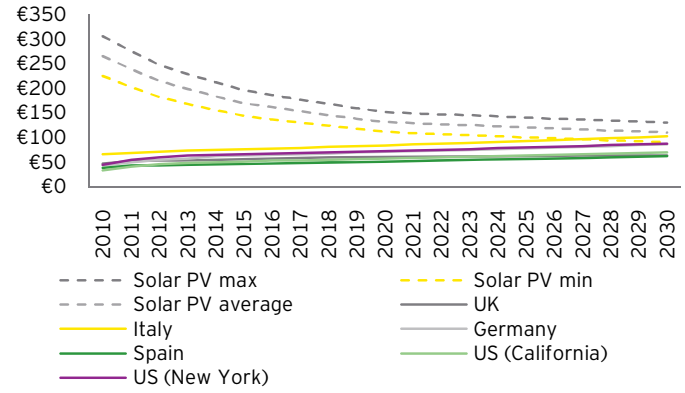
It is also interesting to note that because so much solar power is likely to be installed in the built environment (displacing electricity consumed from the buildings on which it sits), then solar grid parity is quite likely to be judged by reference to the *retail* price rather than wholesale price of electricity, with a deduction for the cost of the subsidy itself where it is recovered as part of that price.

The graphs shown do not provide that degree of refinement and therefore grid parity would come slightly later than the crossover points indicate if subsidies were removed: their presence is likely to be required for a transition period as they provide not just pure economic support but an incentive to change rather than stay with the status quo.

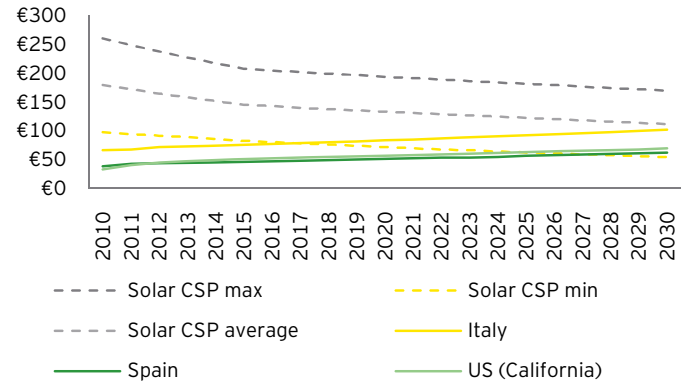
Retail grid parity – solar PV



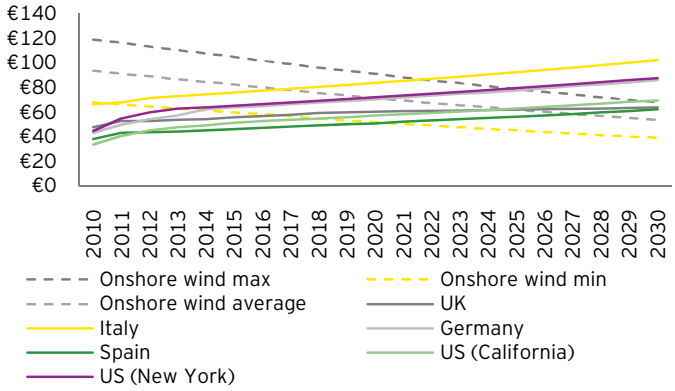
Wholesale grid parity – solar PV



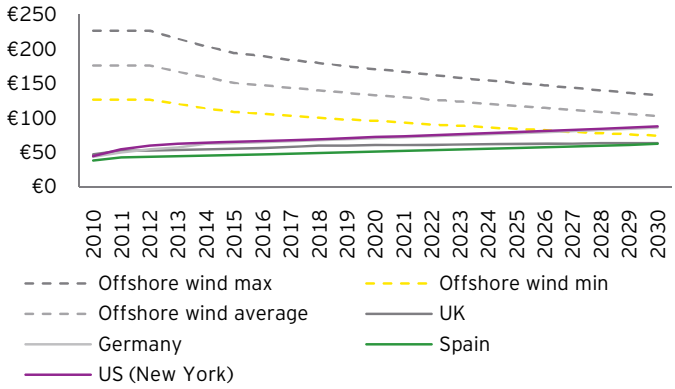
Wholesale grid parity – solar CSP



Wholesale grid parity – onshore wind



Wholesale grid parity – offshore wind



In the case of larger scale renewables, such as wind, where power tends to be remote from the point of use, grid parity is more likely to be judged in relation to the wholesale price (the *wholesale* price shown does tend to exclude the cost of renewables support itself).

An exception to this generalization is that, in the case of biomass and energy from waste, there are many examples emerging where plants are used to provide power for industrial processes such as whisky distilleries and cement and aluminium plants.

To date, legislators (perhaps with the exception of India) have not encouraged the widespread industrial ownership of renewables generation capacity in remote locations. A net metering arrangement which allows businesses to own generation sufficient to meet their own needs with charges for transmission and balancing, could in the medium to long term facilitate substantial business engagement in the decarbonization of the energy markets. It would also provide much needed inflows of capital and would facilitate the transition towards grid parity, as the investment trigger point would be at a price closer to business retail rather than wholesale price.

Grid parity rankings based on technology and cost type

Rank	Retail grid parity			Wholesale grid parity											
	Solar PV			Solar PV			Solar CSP			Onshore wind			Offshore wind		
	Country	Year	Cost type	Country	Year	Cost type	Country	Year	Cost type	Country	Year	Cost type	Country	Year	Cost type
1	US (New York)	2012	Max	Italy	>2030	Average	US (California)	2025	Min	UK	2017	Min	US (New York)	>2030	Average
2	US (California)	2012	Min	US (California)	>2030	Min	Spain	2027	Min	Italy	2017	Average	Germany	>2030	Average
3	Germany	2014	Max	US (New York)	>2030	Max	Italy	>2030	Average	US (New York)	2020	Average	UK	>2030	Min
4	Italy	2014	Average	Germany	>2030	Max				Germany	2025	Max	Spain	>2030	Average
5	UK	2015	Max	Spain	>2030	Min				Spain	2027	Average			
6	Spain	2017	Min	UK	>2030	Max				US (California)	2030	Max			

The analysis indicates that in the case of PV, *retail* grid parity may be reached generally between 2012 and 2015, with the US to the fore and the UK having the prospect of parity in 2015 if retail electricity prices rise as shown. Surprisingly, this is achieved ahead of Spain because of much lower retail prices anticipated there. However, if solar is judged by the harsher test of *wholesale* parity, then it is not achieved until about 2030 in Italy – with solar CSP achieving parity a few years earlier, between 2025 and 2027 in California and Spain.

In the case of *onshore* wind, the UK and Italy show signs of achieving parity around 2017, with other countries such as Germany and Spain not achieving it until at least 2025. In reality, even in the UK, *offshore* wind is unlikely to achieve grid parity on current cost trends until beyond 2030. There is clearly a great prize for innovation in the offshore sector – which still has the benefit of being able to scale up. If cost reductions occurred at the rate of 7.5% (2012-15) and 5% (after 2015) compared with the assumed 5% (2012-15) and 2.5% (after 2015), then grid parity for offshore wind would be brought forward to 2025 for the UK.

Of course, the above analysis can only be indicative. It illustrates the increased value of renewables to economies with high underlying energy costs, such as Italy and New York – provided the renewable technologies or the policy mechanisms used to support them are not disproportionately responsible for such costs which could occur where incentives are additional to the wholesale electricity price. It also illustrates the importance of choosing those renewable technologies best able to take advantage of the natural resource in a particular country – and, most importantly, for all technologies to continually reduce costs if they are to achieve the desired levels of penetration.

In the wind sector, reductions in the price of turbines are currently occurring due to excess capacity, partly caused by a decline of the US market and partly due to low gas prices (as shale gas facilities come on stream). Price reductions of 10% to 15% are reported with further reductions anticipated next year as the US market is likely to remain depressed. However, these reductions have not yet clawed back all of the price inflation that occurred pre-recession.

In the case of the solar sector, prices continue to fall – with the level of buoyancy or otherwise in Germany the key factor going forward. As mentioned above, solar in the built environment also has the advantage that investment decisions will tend to be triggered by retail price rather than wholesale price parity. For other technologies, the ability of businesses to benefit from net metering, even if the owned plant is remote, would provide a similar spur.

As policy-makers plan the transition to a low carbon economy in the period to 2030 and as far as 2050, they are likely to reflect on the timing of grid parity and the possibility of decoupling incentive mechanisms for established technologies – with residual support directed towards emerging technologies if countries are reliant on them for the final push towards decarbonization. It is inevitable that comparison with the cost of nuclear and carbon capture storage will form part of this debate.

For renewables as a whole, it is premature to say that decoupling from incentive mechanisms is an immediate prospect, but it is on the horizon. For example, if uncertainty remains in financial markets at the point of crossover then support measures may still be required at parity prices to provide contractual certainty for bank finance.

Moreover, if technology costs rise again due to inflationary pressures from commodity price increases or supply chain constraints, then grid parity will be delayed – not inconceivable given the vast increase in the demand that could occur from an aggressive electrification of the heat and transport sectors.

But one day grid parity will come, and through the low carbon transition the renewables industry will have come of age.

Sources

Generation cost: HSBC, IEA, Renewable UK, Roland Berger, Ernst & Young analysis

Electricity price: HSBC, DECC, Ernst & Young analysis