

Renewables – the last 10 years; lessons for the future?

Jonathan Johns, Guest Columnist

In my last article, "It's not all down to Copenhagen," I suggested that the summit was unlikely to deliver all the answers and that a 12- to 15-month time-frame would be needed to make global progress. That has turned out to be the case, with the prospect that post-Copenhagen conferences will face material challenges. As we enter the next decade, it is perhaps salutary to remind ourselves of the progress made in the last 10 years, notwithstanding the relatively slow pace of global progress (such as the time taken to achieve ratification of Kyoto), and to anticipate what may come. In the past decade, the renewables industry has been able to achieve stunning levels of compound growth – despite occasional regulatory setbacks – and is likely to grow strongly in the next decade as it enters the mainstream energy supply.

At the close of the last millennium, post the Rio summit and Kyoto, support mechanisms for the generation of electricity from renewables had been put place in many of the world's developed global economies, making them a commercial proposition – but only where government support was adequate.

In countries with strong feed-in tariffs such as Germany, Denmark and Spain, both renewable manufacturing industry and installed capacity tended to flourish. Those with quota-based tendering systems, for example the UK, France and Ireland, tended to have lower levels of capacity installed and few manufacturing facilities. In the US, a stop-start tax-based system, the PTC, when on tap, led to large capacity build but less growth in manufacturing capacity itself. With the exception of India, the emerging markets were barely on the horizon.

Hence in 2000, in the wind sector the top five wind turbine manufacturers were drawn from Denmark, Germany and Spain, and the top solar manufacturers from Japan, Germany, Spain and the US – all of which had strong campaigns for rooftop PV.

By today's standards, there were no real global players among operators, although strong national and regional champions were emerging in Spain and the US in particular, and these vied to assemble portfolios of circa 1000MW.

It is interesting to reflect on the expectations in 2000 for the coming decade. At that time in the wind sector, nearly 50% of shipments were for sub 750kW turbines with total global wind capacity amounting to about 18GW. Globally, growth was expected to exceed 20% per annum. In Europe, offshore wind was expected to become well established and to take a significant proportion of installations by 2010.

Concentrating solar power and thin film solar were viewed as embryonic technologies, likely to challenge conventional PV only towards the end of the decade. Total solar deployment in 2000 was only around 290MW.

Conventional biomass electricity generation was expected to flourish, with few concerns expressed about the sustainability of fuel supplies. Gasification, pyrolysis and anaerobic digestion were viewed as promising, but difficult to finance.

Wave and tidal were seen as technologies that would in all probability need the next 10 years to prove themselves.

Furthermore, it was anticipated that there would be a shift in installed capacity towards the US, with the Asian market starting to become established. Europe was anticipated to still predominate, mainly due to the strength of its support mechanisms.

In terms of government policy, deregulation in some countries led to new market-based mechanisms as an alternative to feed-in tariffs; for example, Australia's pioneering REC system introduced in 2000 and the UK's ROC system. Some commentators anticipated that these systems together with a federal RPS in the US, would challenge feed-in tariffs as the predominant support mechanism.

As it turns out, the first decade of the millennium has seen great success for the renewables industry.

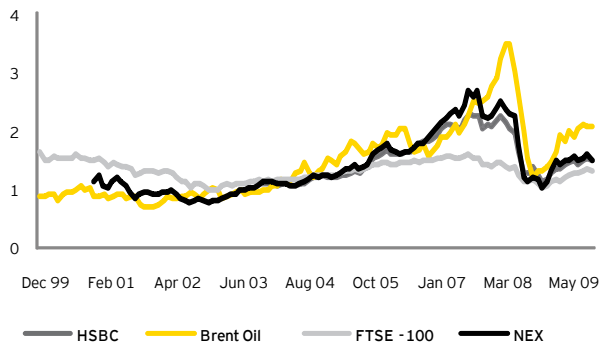
Total installed wind capacity at the end of 2009 was 158GW, up from around 13GW 10 years earlier. Meanwhile, total solar capacity grew from less than 1GW to 20GW: representing compound annual growth rates of 28% and 35% respectively. In 2000, Ernst and Young (in a report for the DTI) suggested that cumulative capital spend in the sector could be as much as US\$300b (€209.1m) to 2010; although perceived as optimistic at the time this total has been exceeded by US\$100b (€69.7m) to US\$200b (€139.4m) according to various sources of industry to date.

During this time, the industry has become increasingly globalized, with large-scale players emerging, such as Iberdrola which now has in excess of 10GW of wind capacity, i.e., more than 50% of the world's total capacity in 2000.

In Europe and some other territories, additions to renewable capacity (mainly wind) now routinely exceed those for conventional technologies.

There have been challenges on the way: the German market dealing with the withdrawal of tax-based KG finance structures; the US responding to further delays in PTC/ITC renewal around some presidential election years; Spain reacting to changes in its support mechanism for PV; and most recently, the industry as a whole coping with the impact of the credit crunch on project and corporate finance.

Relative changes over the last decade for HSBC Climate Change, Brent crude oil, FTSE-100, and Wilderhill indices



Source: Ernst & Young

While those contemplating the gradual decline of the feed-in tariff system have found that reports of its death were premature.

In Australia, for political reasons the REC system has not really taken off, while in the UK, the ROC system has improved delivery to a degree but never really caught up the ground lost in the 1990s, partly due to planning delays and grid connection issues. Thus, at the end of the decade, the wide-scale adoption of the feed-in tariff mechanism rather than market-based mechanisms has been a worldwide trend, with France, China, India (with solar) and Ontario now following the feed-in tariff route. In the US, the ability to swap tax credits for 30% treasury grants (as part of the

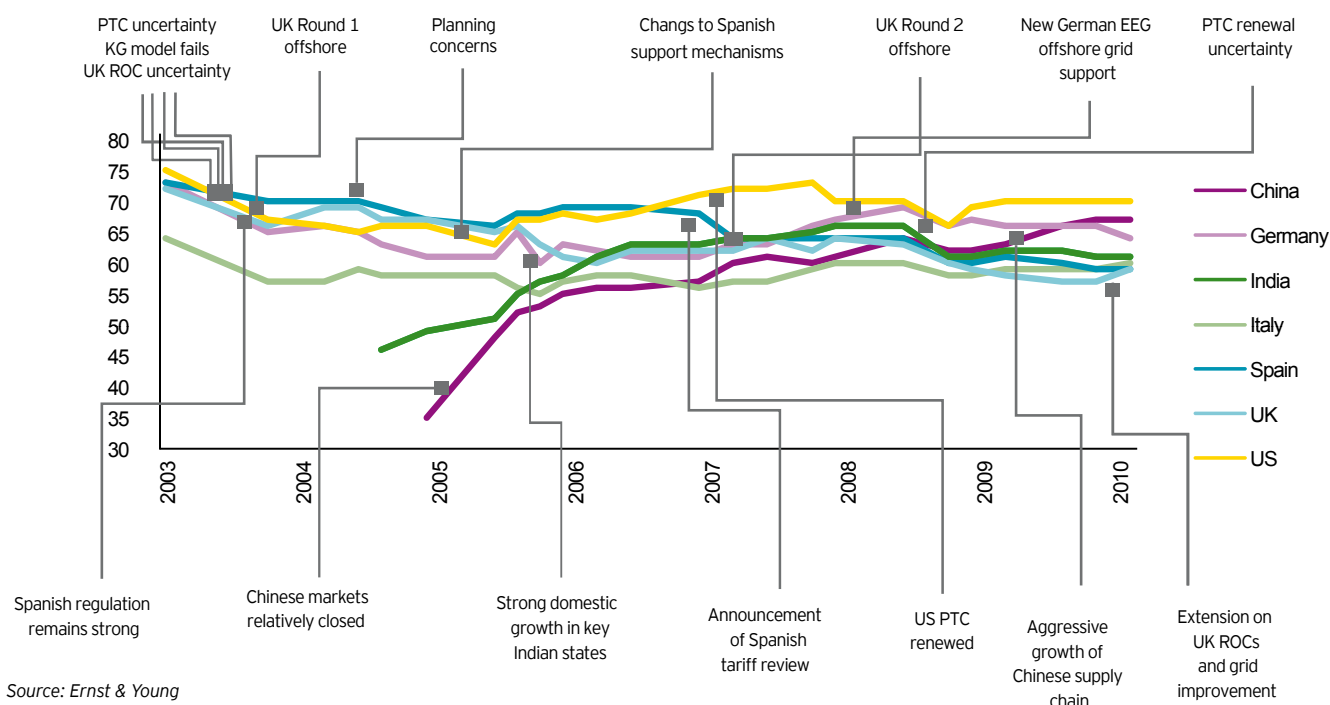
American Recovery and Reinvestment Act) provides an even stronger known return incentive.

Even in the UK, a feed-in tariff is shortly to be introduced for sub 5MW projects and Ofgem (the UK regulator) has implied that the remaining ROC system may need to be replaced as part of a wider overhaul of electricity market mechanisms – perhaps with capacity tenders.

Just as the move towards economic ascendancy in emerging (or rather new) markets has been the biggest economic story of the decade, the growth of renewables manufacturing and installed capacity in China (and to a lesser extent India) has been the most significant event in the renewables industry.

In 2009, more wind capacity was installed in China than anywhere else, and China announced a huge domestic solar program having previously focused on exports. China now makes most of the world's PV panels and Chinese wind turbine manufacturers now appear in the world's top 10 (although not yet as significant exporters). The speed with which this has been accomplished was not widely anticipated. At the beginning of 2000, UK wind capacity was about 360MW whereas that in China was only 260MW, while at the end of 2009, installed capacity in the UK was just over 4GW and that in China more than 25GW. The Ernst & Young all renewables index which commenced in 2003 with coverage of 15 countries, now expanded to 27, first included China in December 2004 at rank 19 out of 20 - it is now ranked 2 (behind the US) with only market access issues preventing it from being top of the index.

All renewables index score change since 2003 for selected countries



Source: Ernst & Young

On the technology front, there has been steady progress in wind and solar: the average size of wind turbines has greatly increased bringing down costs per kWh of electricity generated, and the solar industry has delivered major cost savings.

But in both cases, the cost curve has not been as relentlessly downward as originally anticipated: towards the end of the decade, supply chain shortages and rising steel and copper costs led to strong upward pressures. More recently, the drop in demand from the credit crunch has re-introduced the downwards cost trend – most markedly in the case of solar. As demand increases again, raw material-led price inflation may well affect wind in particular and supply chain pressures could remerge – possibly tempered by the extent to which China, India and Korea focus on export markets.

From an investor's perspective, there are already signs that this should be the decade when concentrated solar and thin film installations vie successfully with conventional PV and when the geothermal industry enjoys a resurgence (possibly competing with clean coal for access to aquifers).

Conventional onshore wind may also see new improved technologies being deployed which focus on greater load factors through improved design (and reliability) rather than just increasing the swept area of the blade. There could also be a renewed market for sub 2.5MW, possibly sub 1.5MW, community-sponsored wind turbines.

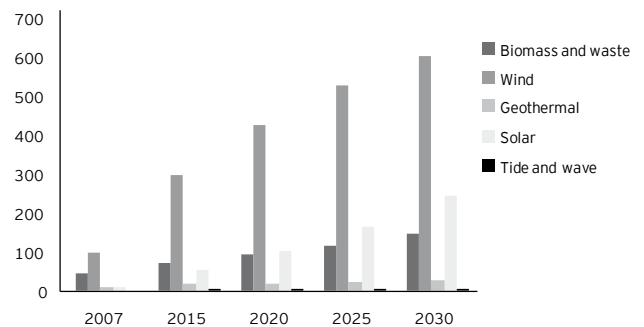
Offshore wind still has many challenges but it is now building significant momentum in the UK and Germany in particular, with 5MW to 10MW turbines likely to become the norm. In the UK there are still concerns over the delivery of the required grid infrastructure, and the ROC system to date has needed periodic renewals of enhanced levels to provide sufficient investor returns; a process that is likely to need repeating to make a success of the recently awarded third round licenses.

It is perhaps inevitable that not all technologies have progressed at the speed many would have liked and in some cases the message has been that ambitious technological change in the industry takes time to deliver: with the movement from prototype through to demonstration and thence to commercialization proving challenging. In some cases technological progression has been held up by regulatory policies that do not move at an appropriate and complementary pace. Unfortunately, some of these lessons appear to be learned many times over. For example, the wave and tidal industry on the whole has not received the scale of support it needs to achieve breakthrough.

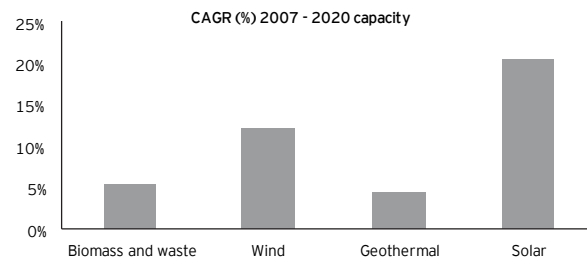
The coming decade should be one in which conventional biomass with carefully sourced feedstocks (and ideally combined with renewable heat offtake to improve efficiencies) delivers significant capacity to many countries' networks. The new biomass technologies (such as pyrolysis, gasification and

anaerobic digestion) should become more proven from a financing perspective, allowing the biomass component of waste streams to enter the energy equation. However, many in the financial community state that these technologies tend to be underperforming relative to their initial business plans – sadly a symptom of many newly deployed technologies.

Cumulative installed capacity (GW)



Compound Annual Growth Rate (%)



Source: IEA 2009 Reference Scenario and Ernst & Young analysis

When this is combined with the need to replace ageing nuclear and fossil fuel fleets, the next decade may well end with power outages being relatively commonplace, perhaps dressed up in the form of demand restriction agreements with heavy energy users: a prospect confirmed by a recently published report by the UK's Ofgem, but also a risk for some other mature energy markets.

The renewable electricity industry is also likely to end the decade as part of a broader renewable energy and energy efficiency industry – encompassing transport and heat with many linkages to the waste industry (as it provides feedstock that may otherwise be landfilled producing carbon emissions). It will be interesting to see the extent to which large utilities and specialist players address the market across this broader spectrum rather than concentrating on what will be one sub-sector alone. New business models and new players could well emerge, particularly in the

provision of renewable electricity, heat and energy efficiency measures to the built environment.

The significance of this change is that there will be further competition for incentive monies especially as economies emerge from the recession. Governments which in the past have used support mechanisms to grow renewable capacity are more likely, where markets are established, to use the mechanisms as a means of driving down costs and reducing consumption. Just as Spain and more recently Germany have done in the solar PV market to the shock of established manufacturers.

In the next decade, value for money in terms of cash impact on taxpayers and consumers and in terms of cost per carbon tonne saved are likely to be paramount, together with the impact on low carbon industrial strategy. The measures required to drive through investment are likely to lead to rising energy costs, putting pressure on the rollout of renewable solutions to the fuel poor. Renewables and energy efficiency may well be the weapons of choice in dealing with the carbon agenda but the consumer and the taxpayer are unlikely to be willing to sign a blank check. The industry needs to prepare itself to deliver value in the long term.

In 2000, the hope was that at the end of the decade mature renewable technologies would be much closer to “grid parity.” The challenge the industry faces now is that by 2020 this may well be an essential requirement. Of course, it is conceivable that at some future climate change summit much more ambitious targets to 2050 become accepted and that a new norm emerges. Renewables could take up such a significant proportion of generating capacity that they themselves define the grid parity price and are used as a reference point for competing but similarly expensive technologies such as nuclear and clean coal, with gas the only cheaper alternative used as a flexible reserve.

More fundamentally, the renewable electricity industry is likely to become a core part of most energy economies – creating challenges to current base load models. Electrification of transport may well produce demands for additional generation capacity (whether conventional or renewable) that are in excess of what build programs can deliver.

By 2020 onwards, there should be the prospect of tens of thousands of megawatts of offshore wind and hopefully wave capacity, with a more broadly developed onshore renewables sector and tidal schemes. In addition, a significant proportion of waste should be diverted to energy. In desert areas such as North Africa, “hyper solar projects” could well emerge exporting power to Europe – if efficiencies can be improved in the dust prone environment.

One thing is clear, all technologies (including non-renewable technologies) pose significant challenges and the days of “cheap and easy” energy are gone.

In the 2020s we should be incorporating heat pumps and solar PV as a matter of routine in the built environment, combined through smart grids with aggressive demand management.

As has been the experience to date, there will be “optimism bias,” regarding the costs and time taken for grid infrastructure investment, both national and transnational. The availability of the immense sums of capital required for the sector to develop freely may also be being incorrectly presumed. From the current post credit crunch standpoint, without further reforms, the capital flows required are in all probability too much for even the largest utility to bear and many governments are severely financially constrained.

In individual countries, new techniques and institutions are likely to be needed to raise the sums required without stretching state finances – possibly involving the use of green and tax-exempt bond structures to provide a direct channel for savings and pension funds matched to long-term projects. Sovereign wealth funds and investors from new markets such as China and India could well emerge as significant players in the West’s energy industry, based on financial strength derived from their home markets.

For the renewables industry as a whole, growth levels of at least 15% to 20% are likely to be the norm. Some existing markets are likely to grow very strongly (such as Brazil), while further new markets are likely to emerge – perhaps not in such a spectacular fashion as in China but significant nonetheless – and these may well include South Korea, Taiwan, Mexico, Chile, Egypt, Morocco, and various Eastern European countries and perhaps a ‘wildcard’: Russia.

Whatever the outcome, one thing is certain: competition for new green jobs. The coming decade is probably the defining moment for a new broader renewable energy (and efficiency) industry and the economic activity it provides. For economies left behind, the danger is that dependence on increasingly expensive fossil fuels is replaced by dependence on imported low carbon technologies, with consequently lower returns for the colossal levels of investment nevertheless required to de-carbonize an economy.