20/20 targets: are we doing enough to keep the lights on?

Guest columnist: Jonathan Johns

At the time of writing, India was in the throes of two days of major power cuts due to the collapse of its Northern grid infrastructure — bringing home the vulnerability of rapidly growing economies to often under-invested energy infrastructure.

India has missed its power sector investment targets most years since 1951, with the consequence that its peak demand deficit is nearly 10% (compared with the 10%–20% surplus typically maintained by mature energy economies). This in an economy where 40% of the population is not connected to the grid.

Its been estimated that US$400b (€322b) of investment may be required in the Indian power sector in the next five years to provide improved grid infrastructure and an additional 76GW of capacity by 2017, according to India's new Five-Year Plan. Overlaid on this is a desire to have 15% of its electricity (excluding large-scale hydro) from renewable sources by 2020, compared with a previous target of 6.4%. This equates to an additional 30GW of renewables capacity in the next five years, compared with 23GW to date.

Underlying the policy shift in renewable electricity is the desire for solar and wind to achieve grid parity with thermal coal by the early 2020s, reducing dependency on coal for its source of power. This would also offer the prospect of providing more off-grid power access (similar to the position adopted by Australia and Italy, for example).

The outage has occurred at a politically inconvenient time, when there are strong budgetary pressures on the Indian economy as growth slows-partly due to the impact of the euro crisis.

In some ways, India displays, albeit through a different lens, the energy challenges faced by a large proportion of economies:

- The need for huge levels of energy infrastructure investment in relation to generation capacity and grid infrastructure, in a climate when both government and private sector funds (particularly in the form of bank finance) are constrained
- The desire to diversify toward a more mixed energy economy with a significant component of renewables by 2020, with a view to taking further advantage of those technologies (once grid parity is achieved), thereby lessening the dependence on imported fossil fuels
- Political pressures to both keep the lights on and to ensure cost burdens are not too high for consumers, while maintaining the levels of investment required

While high economic growth is not a driver for energy infrastructure investment in mature Western economies, the need to replace aging fossil fuel and nuclear capacity is, particularly with the prospect of electrification of vehicle transport, producing a further 20%–30% requirement in capacity. Other special factors such as some countries' desire to migrate away from nuclear and increased electrification of heat production will accentuate the need for more electricity.

A criticism has been made that successive governments in India have invested too little in energy infrastructure — so that material damage to a burgeoning economy has been risked — as evidenced by the recent power failures. This is a lesson for all economies.

It is probable that the strength of the German economy and the advanced nature of its policies mean that it is well placed to achieve the transition to a low carbon energy infrastructure, but elsewhere in Europe, things are less clear.

While many economies have evolved policies to provide the necessary investment, these are in some cases overcomplicated, causing investment to stall (e.g., in the UK with its proposed contract for difference regime). Other economies are suffering from increasing funding gaps caused by budgetary constraints (e.g., in Spain, where renewable incentives have been greatly curtailed, if not reversed). Italy signaled recently that it could soon run out of funds to support its feed-in tariff (FIT) regime. Almost everywhere there remains a lack of bank project finance to meet the scale of demand without European Investment Bank or German Development Bank (KfW) style support.

Accordingly, it is not inconceivable or alarmist to state that in some mature Western jurisdictions, limited regional lower-scale blackouts could start to occur as we approach 2020. They have occurred in the past due to a combination of hot summers increasing air-conditioning demand and due to underinvested grid infrastructures; For example, in 2006, in Europe and 2003 in North America.

If climate change brings hotter summers and lower river levels, this in itself will lead to difficulties, as lower river levels potentially reduce output from water-cooled nuclear and thermal generation plants (as occurred in France in 2003). The intermittency of renewables entering the energy mix will also bring its challenges to grid infrastructure, as will the transition to smart grids.

In retrospect, working back from 2020, it is relatively safe to say there is likely to be a difference between expectations and delivery. The remainder of this article sets the overall context for renewables as part of the energy equation before focusing on the renewable electricity gap that could emerge if policy expectations are not met by delivery.

20/20 targets: are we doing enough to keep the lights on? (cont'd)

Figure 1 maps the current carbon intensity of grid electricity against the gap between 2010 levels of renewable energy and 2020 levels after taking account of expected energy efficiency measures. (This data is based on European targets in gray and International Energy Agency (IEA) expectations in yellow.) As an aid to judging the significance of a country to the overall equation, the size of the gray or yellow circle is scaled by GDP.

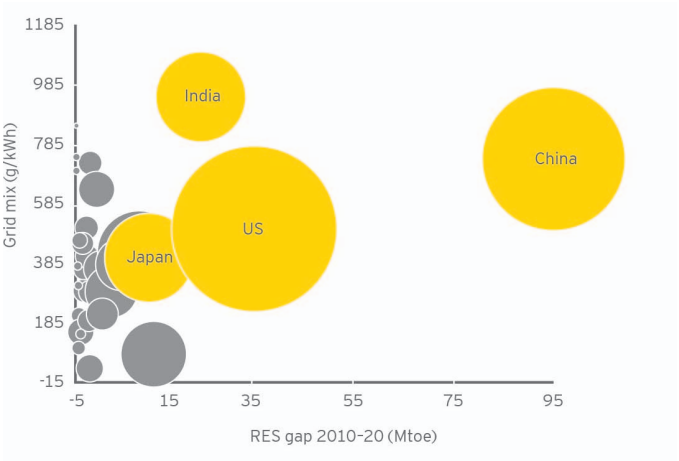
What is particularly striking from this analysis is the degree to which the heavy-hitting and high-GDP non-European countries have high levels of carbon intensity and relatively large gaps in terms of renewable energy investment required to meet implied targets. (Russia has been excluded from the analysis as it does not, at present, feature in the renewable economy.)

Within Europe, it is interesting to note the scale of challenge still faced by the majority of top five countries by GDP, even those who could be thought to be well advanced in renewables. These often have a stubbornly high carbon intensity because of the reliance on coal for power generation. France is an outlier, with very low carbon intensity due to its heavy investment in nuclear, and a relatively large renewables gap due to its only relatively recent focus on the sector.

Figure 2 shows how much the remaining gap has been affected by assumed energy efficiency measures, with Sweden's ambitious targets perhaps having more credibility than the targets put forward by some other countries – while the energy efficiency targets for the UK look conservatively low.

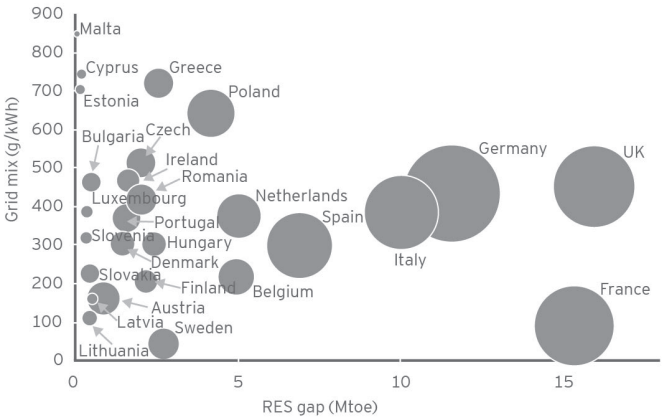
It is arguable that energy efficiency remains the poor relation of energy policy in many jurisdictions, despite having the shortest payback periods. The figures below precede any national action plans likely to be introduced following the new European Energy Efficiency Directive passed in June, which targets 17% of savings by 2020. Unlike the renewables directive, the target is not mandatory on an EU-wide basis, with savings achieved before the 2014 implementation date (2010–14) and also prospective savings in 2020–23 both taken into account. It will be interesting to see whether, in line with this lighter touch approach, the UK's Green Deal and Energy Company Obligation will have the impact planned,

Figure 1a: RES gap 2010–20*



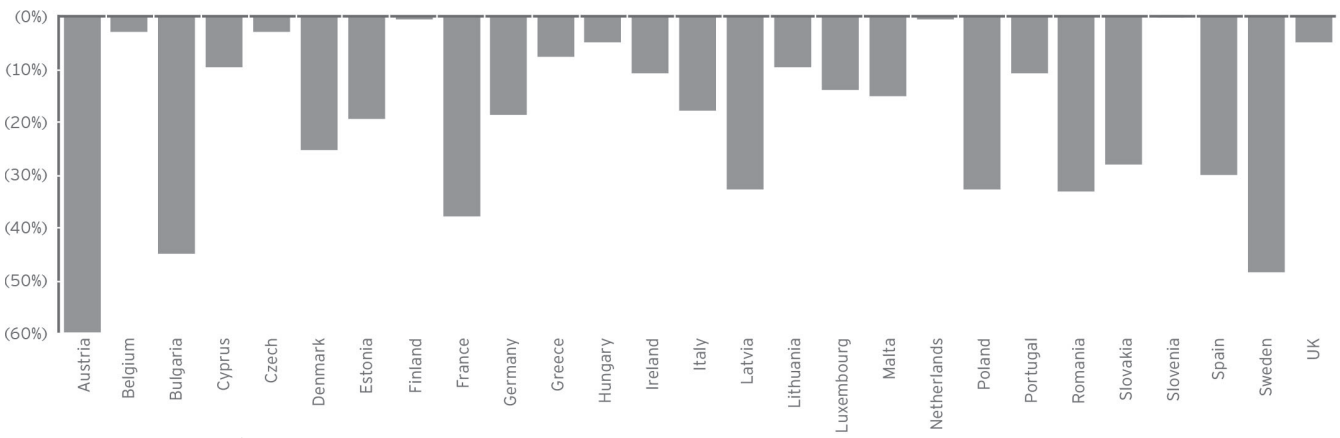
* Grey circles represent EU27 countries, shown in more detail below. Yellow circles represent selected non-EU countries and are based on a 2011–20 RES gap

Figure 1b: RES gap 2010–20 (EU27 countries only)



Source: Page 7 sources 1, 2, 3 and 5

Figure 2: Impact of energy efficiency assumptions on RES gap (%)



Source: Page 7 sources 1 and 2

given that the country is not primed by the relatively cheap sources of finance that support alternative measures in other jurisdictions such as Germany. Notwithstanding the lack of mandatory targets, it would certainly help if, in the future, as much emphasis was given by Governments to national energy efficiency action plans as is given to renewable energy policy support – not just in Europe but in all major economies.

Of course, the level of risk to an economy does vary according to the level and price of indigenous fossil fuels available to it. Figure 3 compares the fuel mix in the principal economies surveyed, showing the fuel mix in each economy and the degree of reliance on imports.

This chart really brings out the challenges posed by India and China where there is a huge dependence on coal as part of the fuel mix. Coal is likely to remain a significant proportion in 2020, despite both countries making extensive investments in renewables. As a consequence of high economic growth, energy consumption is forecast to increase 40%-50%.

What is also clear from the analysis is that, due to a high level of fossil fuel imports, the economies of Italy, Japan and Spain (and, to lesser extent, Germany) are exposed to rising fossil fuel prices that could have a significant effect on the competitiveness of their exports as 2020 nears.

While Spain has a degree of protection from its existing investment in renewables and nuclear, it is not clear that its current policies will lead to that advantage being preserved in the longer term.

The effect of Germany's continued strong investment in renewables (with even more ambitious targets to 2050) makes it likely that it will both significantly reduce its economic dependence on fossil fuels and move away from nuclear power.

Of all major Western economies, the US is arguably one of the most comfortably placed, with a low level of exposure to imports. Moreover, the availability of cheap gas from "fracking" has made the renewable energy investment proposition more difficult to espouse in the US, as both the level of carbon emissions and energy prices have been reduced below levels previously expected; perhaps accounting for the current difficulty, notwithstanding the best efforts of the US Senate Finance Committee in gaining sufficient momentum for the renewal of the production tax credit (PTC), the key driver for investment in onshore wind).

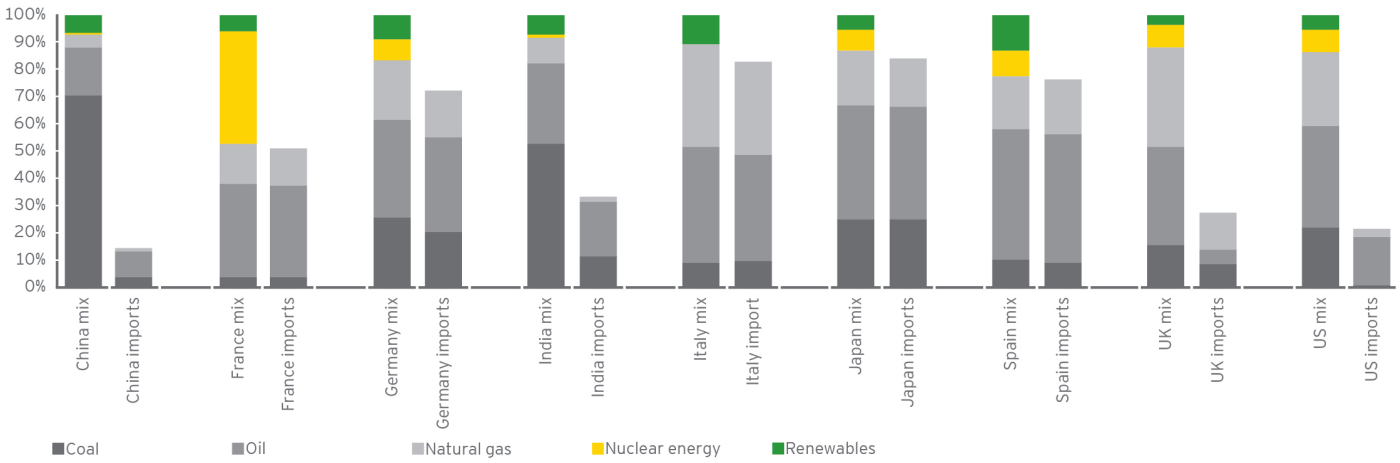
The position of the US may not be what the renewables industry desires but, in the land of hard economics, growth of renewables to a similar proportion of the energy mix as Europe may be some way off, unless its collective position on climate change radically moves.

As discussed in previous articles, the advent of fracking has led to a significant regional shift in natural gas prices in North America (the cheapest) compared with Europe (more expensive) and Asia (the most expensive). This is having a significant impact on global energy infrastructure investment decisions and is not going unnoticed in many jurisdictions.

While the UK's relatively low level of fossil fuel imports may be viewed as attractive, this reflects the current benefits of North Sea oil and gas. With this sector due to decline, it appears to some commentators that the exploitation of shale gas reserves through fracking is more attractive to the UK Treasury than an aggressive pursuit of renewables capacity, with stricter financial rationing of support measures.

However, the cheap natural gas revolution may not go worldwide if the US decides to limit exports by restricting port facilities for export, and other jurisdictions limit the exploitation of the new technologies, e.g., France, where environmental reservations over fracking remain strong.

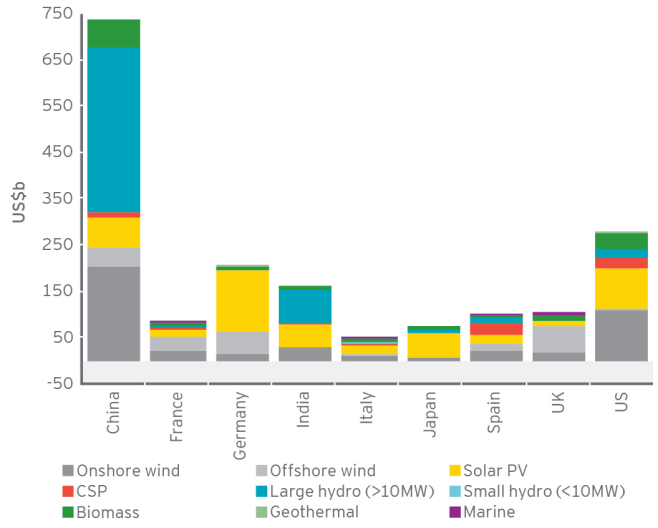
Figure 3: Energy mix by country (%) and proportion of energy imported by fuel type (%)



Source: Page 7 sources 6 and 7

20/20 targets: are we doing enough to keep the lights on? (cont'd)

Figure 4: Estimated cost to meet RES gap (2010–20)



Source: Page 7 sources 1, 2, 3 and 4

One feature of energy policy appears to be that different cultures have different attitudes to which tools are best selected to achieve a transition to a low carbon economy (e.g., nuclear versus gas fracking versus offshore versus onshore wind versus domestic solar). Consequently, politicians focus not on the lowest cost per carbon tonne saved, but rather on the most politically acceptable energy mix.

To date, it has been noticeable that the most politically acceptable policy has not always equated to the cheapest solution or exploited the most prolific indigenous renewable resources. For example, the UK has chosen to focus on the less politically problematic (but much more expensive) offshore renewable sector rather than the cheaper but more controversial onshore sector – consequently (other than in Scotland), it has greatly underexploited one of the best overland wind regimes in Europe.

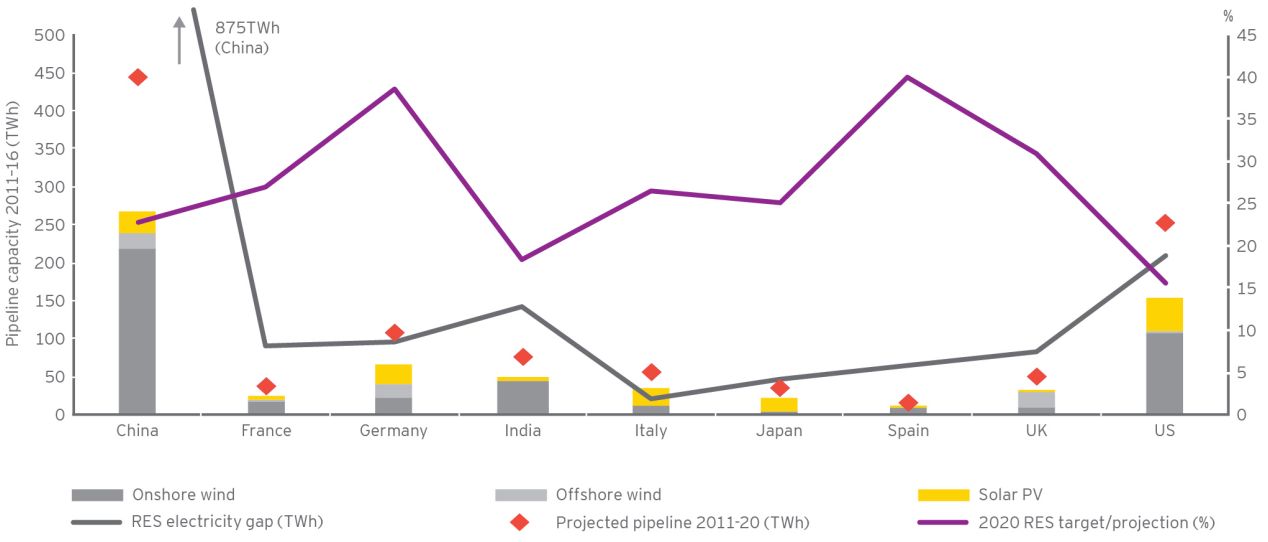
Similarly, but more positively, Germany has invested a large amount of its renewable budget on relatively expensive solar, even though its solar irradiance is relatively poor compared with southern European countries which have invested less.

The impact of technology choice on investment costs is illustrated by Figure 4. This shows Germany's investment disproportionately skewed toward solar and China's already high costs likely to be increased if it implements the forecast level of hydro, rather than continuing to rely on low-cost onshore wind to meet its targets.

To provide an indication of what this investment achieves and what the delivery risk could be, we show in Figure 5 the renewable electricity targets for 2020 together with the renewable electricity gap from 2011 to 2020. The chart also displays Ernst & Young's assessment of the current project pipeline 2011–16 (bar chart by technology) and provides an extrapolation calculated on a straight-line basis to 2020, to provide an indication of whether the gap is likely to be undershot or exceeded.

The graph does need to be interpreted with a degree of caution. For example, the implied undershoot of China and India reflects the huge increase in hydro investment required to achieve the desired share of a remorselessly expanding power sector.

Figure 5: Forecast capacity pipeline (wind and solar only) 2011–16 and RES electricity gap 2011–20



Source: Page 7 sources 1, 2, 3 and 5

Pipeline wind and solar capacity from MAKE, BTM Consulting and LUX forecasts

The challenge for China is not only to continue investment (which, given its state planning approach, it is likely to do), but also to ensure that its renewables are actually grid-connected (with an estimated 20% to 25% of wind not yet connected).

In the case of India, the challenge is the gap that often exists between the budget needed to achieve investment ambitions and that actually allocated. Currently lobbying is taking place for an unprecedented 1% of the overall government budget to be allocated to renewables.

For Germany, the target based on the extrapolated pipeline appears secure. Germany's target should be achieved unless offshore grid connection difficulties become protracted.

In relation to Italy's ambitious targets, while recent experience has been encouraging, the projected overshoot is very dependent on attractive policies being maintained: were these to be removed for fiscal reasons (as may occur) then undershoot rather than overshoot is likely to occur. However, grid parity for solar PV has nearly been reached, particularly in southern Italy, and therefore momentum may well be maintained if technology prices continue to drop and onshore wind investment also continues.

The adverse impact of a drastic reduction in renewables support is illustrated by the poor state of Spain's pipeline, with undershooting of targets almost inevitable.

In France, targets may also not be met due to a strong reliance on 6GW offshore wind target, but only around 1GW in current pipeline. Only 1.9GW was awarded in April for a 3GW tender, and a second tender round has recently been delayed to 2013.

For all three of these countries, there could be one saving grace, however; all of the targets submitted to the EU were based on relatively high levels of growth (around 20%), which are unlikely to transpire given the effects of the euro crisis on their economies.

While the US is likely to achieve a target of 15% of electricity from renewables, this is predicated on the PTC being renewed or replaced by an equivalent measure. Without that support, even the current pipeline could be under threat, given the low natural gas prices.

For the UK, although steady progress in renewable capacity is likely to continue (particularly given the momentum in offshore wind), undershoot of ambitious targets is likely to occur, given the uncertain policy and investment climate and supply chain issues. While its offshore pipeline is well developed, significant delivery challenges remain, given the scale of the challenge.

By contrast, Japan's determination to shift investment toward renewables is reflected in new, markedly more favorable, support measures. This means that there is every prospect that the next five years' installations will exceed the pipeline shown, which was based on assessment of the previous regime. The main challenge is whether infrastructure investment can be mobilized with sufficient speed to achieve the 14% electricity target we have estimated, compared with 10% in 2011.

So, apart from a few honorable exceptions, such as Germany and China, given its planned economy, and perhaps Japan, given its post Fukushima ambition, it is likely that many renewables targets for 2020 will not be met.

Although growth in the sector will still be high, relative to many other sectors of the economy, it is unlikely to be sufficient to prevent further industry consolidation, given substantial overcapacity and continued pressure on margins as governments are increasingly explicit about the need to achieve greater value for money. Further deterioration in Europe's economy could adversely affect even this suggested outcome.

In June, the European Commission suggested that energy policies should be updated from 2020 to provide a more coordinated approach to renewables growth-encouraging exploitation of resources where it is cheaper and driving down costs by greater competition, with support measures gradually declining to encourage cost reduction. Otherwise, there is a concern that investment in renewables will radically reduce from historic levels.

Based on the analysis in this article, it would appear that radical reform should be brought forward to provide further stimulus to the market now, rather than later. This would provide much needed investment opportunities for many economies and increase the likelihood that 2020 targets are met, reducing exposure to future fossil price shocks. The conundrum is, of course, where the money would come from and whether the EU has the remit to move before the expiry of the current directive.

In this respect, the application of Indian climate change lobbyists for 1% of its budget to be allocated to renewables may meet with more success. By 2020, it could be increasingly clear that the Asian and other new economies are the prime drivers of the renewable industry rather than the EU; in a way reflecting a change that, in all probability, has already happened but is not yet fully recognized.

For Europe, the challenge remains to achieve an energy infrastructure mix that reduces exposure to fossil fuel price rises, allows its goods and services to be regarded by consumers as low carbon sourced, and keeps the lights on when economic growth returns. For the Asian economies, the latter challenge is likely to be a recurring theme. For the US, it will be interesting to see whether the shale gas boom will have allowed it to stand safely to one side and observe, or the time will again come when the issue of carbon will become an inconvenient truth.

Key sources:

1. National Renewable Energy Action Plans 2010, European Commission, 2010 (EU27 country-specific)
2. National Renewable Energy Action Plan progress reports, European Commission, 2011 (EU27 country-specific)
3. *World Energy Outlook 2011*, IEA, 2011
4. *World Energy Outlook 2010,* IEA, 2010
5. *BP Statistical Review of World Energy 2012,* BP plc, 2012
6. Gross inland energy consumption by fuel and fuel import dependence (EU27 countries), Eurostat (2010 data)
7. Non EU-27 country energy mix and fuel import dependence data from various publicly available sources