ENERGY TRANSITION

The decarbonisation challenge

Clear road ahead – a fundamental shift is underway towards renewables dominated power supply

Photo: Pixabay

The relationship between the energy transition and progress towards a decarbonised energy system is explored by *Hugo Lidbetter*, Partner, Energy & Natural Resources, Fieldfisher, in the second of a two-part feature.*

The key pathway towards a decarbonised energy system is through greater electrification of energy consumption and the associated decarbonisation of electricity generation. Bearing in mind that electricity only makes up 20% of total global energy consumption and only a minority of electricity is currently produced through low carbon or renewable sources. Transitioning to a fully decarbonised energy system is, therefore, a monumental undertaking.

The climate targets within the Paris Agreement are extremely challenging, and even the 2°C target looks enormously ambitious. The most obvious way of delivering the emission reductions required by the Paris Agreement is through the wholesale decarbonisation of the energy system.

A fundamental aspect of this transition is a shift towards a renewables dominated power supply, balanced by a sizeable capacity of energy storage and interconnection. Supported by a firm low carbon baseload capability, for grid stability and to account for weather variation. Depending on regional variances, that baseload could be a combination of nuclear and gas with carbon capture, both of which have a low carbon emissions profile.

With the possibility of inter-seasonal storage through energy vectors such as hydrogen or ammonia, it may well be that some electricity systems could become 100% renewable. Although not covered here, there is also an important role for decarbonised gas in power, transportation and heating, including a particularly heavy burden of expectation on 'blue' and 'green' hydrogen.

Why decarbonise energy?

Even without concerns over rising levels of greenhouse gas emissions, there are sound reasons to promote decarbonisation beyond the Paris Agreement and net zero targets. Low carbon investment should not solely become an issue about the deliverability of 'politically agreed' targets. There are other important drivers:

- Decarbonised energy avoids the detrimental local pollution consequences of conventional fossil-fuelled generation, particularly coal.
- According to new data from IRENA (International Renewable Energy Association), renewable technology is generally the most cost-competitive form of generation. In fact, more than half of the new renewable capacity installed last year achieved lower electricity costs than the cheapest non-fossil fuel-fired option.
- Renewable generation, being fuel-free, offers energy security to nations otherwise dependent on imported primary fuels, ie mainly oil or gas.
- Renewable generation offers the potential for greater price stability than fossil fuelled generation, as it is uncoupled from international gas and oil commodity prices.

Progress towards decarbonisation

Globally, over the last decade, a remarkable $2.6tn was invested in renewable energy capacity, with photovoltaic solar and wind the primary beneficiaries. That is more than treble the amount of the previous decade.

Over that time, global developers installed more solar capacity than any other form of generating technology (fossil or renewable), with 638 GW of solar capacity being installed, utterly transforming the sector from the mere 25 GW of worldwide capacity in 2009. Not far behind, onshore wind capacity quadrupled over the decade and offshore wind grew by a factor of 15. At the start of 2010, wind and solar accounted for only 4% of global generating capacity. By the end of the decade that had risen to 18%, the result of a remarkable decade of sustained investment.

Onshore wind and solar are now moving beyond the fossil fuel price range to become a cheaper source of electricity than the least-cost fossil fuel alternative. The recalibration of renewable technology cost competitiveness shows how quickly the power landscape has changed. This financial parity has been driven by a spectacular improvement

in the cost-competitiveness of renewables. Over the decade, the global weighted-average 'levelised' cost of electricity came down 82% for solar PV and 39% for onshore wind.

Nonetheless, although more solar capacity was installed during the last decade than any other type of generating technology, coal was still second, with an additional 529 GW added worldwide. This means that although electricity generation is rising globally, coal power generation still provides the same contribution as renewables to this increase. Also, while the renewables share of total power generation increased to around 10% in 2018 (excluding hydro), coal still had the largest share of overall power generation at 38%. This highlights the scale of the decarbonisation challenge over the next 30 years.

Meanwhile, the UK is progressing steadily towards a low carbon power supply, mainly due to favourable wind resources, strong government support for offshore wind and prejudicial coal policy.

The contribution from fossil fuel generation last year was an all-time low at 43%, while a record 37% of the UK's generation came from renewable sources. Coal-fired generation has effectively been excluded from the system, and the UK went through May 2020 without any coal power. However, it was only in 2018 that the UK had its first 24-hour period without any coal generation since 1882.

Around 55% of UK generation now comes from low carbon sources, which is a combination of renewables (mainly wind, followed by solar and biomass) and ageing nuclear. In the absence of clear government policy on newbuild nuclear, interconnectors are playing an increasingly influential balancing role (last year interconnectors provided over 6% of supply) and a revived government interest in carbon capture and storage projects has given renewed hope to conventional gas-fired generation and conversion to hydrogen.

Challenges to overcome

The COVID-19-induced lockdown has provided a glimpse through the curtain of some of the challenges presented by a renewable-dominated power mix. The ~20% fall in power demand resulted in fuelled generation being called off the system, leaving renewable generation to make up a larger proportion. This has brought to the surface three particular consequences of a future decarbonised power mix:

Low and negative capture prices: In the UK, the unprecedented drop in demand associated with the lockdown has seen record low day-ahead baseload prices and a new monthly record for negative day ahead hourly auction prices (Note: negative day ahead prices were not seen in the UK until December last year). Capture prices for both wind and solar have been around 10% below baseload levels, as these technologies have made up a greater proportion of the energy mix and 'chased down' market prices. This has exacerbated a phenomenon known as wholesale market price cannibalisation.

Forecasting and imbalance challenges: A renewables dominated energy mix has resulted in much higher price volatility, largely due to the challenges of accurately forecasting wind and solar output. Compounded by the fact that these plants all produce together when conditions are optimal. A combination of record low demand and an oversupply of wind on the system caused the UK imbalance price to be negative for almost 30% of all settlement periods over the 22–25 May 2020 bank holiday weekend – costing around £51mn in balancing payments.

Additional sources of flexibility required: Accordingly, it is clear that the system operator needs even more sources of flexibility to balance a renewable intensive power mix. Recent examples have included:

- Instructing wind generators to turn down output (ie being paid to not generate) and pumped storage operators to increase demand.
- Moving beyond traditional markets (wholesale and balancing) and auctions (ancillary services) by entering into bilateral contracts with generators, including very unusual requests for nuclear operators to turndown output.
- Early use of the new Operational Downward Flexibility Management scheme, to instruct generators to reduce generation or energy intensive users to increase demand.
- Implementing the new Last Resort Disconnection of Embedded Generation scheme, to disconnect embedded generators if forced to do so.

COVID-19 impact

According to the International Energy Agency's (IEA) *Global Energy Review 2020*, the impact of COVID-19 on energy demand this year will be more than seven times greater than the impact of the 2008 financial crisis. The IEA forecast of a 6% contraction in energy demand would be the largest in 70 years in percentage terms and the largest ever in absolute terms. The IEA foresees every fuel type except renewables experiencing significant drops in demand over 2020. Renewables demand alone is anticipated to increase, largely because of its low operating costs and preferential grid access in most countries.

The IEA has also forecast a 20% fall in energy investment due to COVID-19, equating to almost $400bn. Although the majority of the reduction will fall on the oil sector (32%), investment in renewable projects is still anticipated to reduce by around 10% over 2020, both as result of the logistical challenges of lockdown and the reduced income associated with falling demand.

But with decarbonisation in mind, reduced energy consumption also means lower carbon emissions, and the IEA projects an 8% decline in global CO_2 emissions over 2020, to levels last seen a decade ago. That contraction would be the largest ever – six times greater than the current record reduction following the 2008 financial crisis and twice as large as the total of all previous reductions since the end of World War II.

COVID-19 may, therefore, do to emissions in one year what the target of net zero by 2050 demands every year. Towards the end of 2019, the UN reported that the Paris Agreement 1.5°C target would require a 7.6% drop in emissions each year to 2030. If nothing else, the COVID-19-induced demand contraction and the associated drop in emissions has demonstrated the previously abstract scale of net zero.

The issue is, of course, how to balance the upside of forecast reduced emissions in 2020 with anticipated growth in power demand over the coming 30 years. It is crucial to ensure these arrested emissions are not subsequently lost in the recovery period, and that decarbonisation and green investment forms the foundation of the post-COVID economic recovery. ●

*Part 1 of this article on decarbonising and electrifying energy was published in the June 2020 issue of *Petroleum Review*.

Both articles are based on Hugo Lidbetter's book, *Decarbonising energy: The pathway to net zero*, published by Global Law and Business. EI members can receive a 10% discount.