

CLEAN POWER

Nuclear or gas on the path to net zero?



We can all agree that renewables are the future for clean electricity generation, but what should support this growing sector – gas with carbon capture or nuclear power, or both? If nuclear, are the days of building full-scale reactors coming to an end, to be replaced with modular alternatives? Nick Cottam ponders.

Politicians love big projects with big numbers and the current UK administration is no exception. HS2, Hinkley Point, Sizewell C, even the much-derided track and trace for virus detection – all of these mega projects have conjured up eye wateringly large sums of money and all have proved difficult to quantify and evaluate. Perhaps this is why politicians love them so much.

Nuclear power, in terms of both cost and necessity, is a particular conundrum. Do we need a new generation of vastly expensive, long lead-in nuclear power stations now we have so much renewable capacity? Can we not carry on relying on gas and LNG to fill the load on those calm, cloudy days – at least in the short to medium term? At a recent IP Week event, held online in February, there was some debate about whether LNG was now a transition or still a so-called destination fuel.

‘At the end of the day, customers want reliable energy and gas offers

this flexibility,’ noted one of the speakers, Total’s CEO Patrick Pouyanné. The fast-talking Pouyanné went even further: ‘the word transition doesn’t mean we can do everything in a minute.’

Huge investment

The reality is that Total and other oil and gas majors are juggling on the road to net zero and so are our politicians – the problem being that it really does take time and huge investment to build new energy infrastructure at scale. If nuclear commitment continues to wobble in the UK and gas is seen as an acceptable destination fuel for the foreseeable future, then another big ticket investment like carbon capture and storage (CCS) would surely have to become part of the mix.

The quandary then remains – grow renewables as fast as possible but stick with gas and a large injection of carbon-gobbling CCS to cover baseload requirements for electricity, or wind down the gas,

keep costly CCS to a minimum and make it renewables plus next generation nuclear.

The latest *Drax Electric Insights* report for Q4 2020 headlines the fact that renewables, in the form of wind, solar, biomass and hydro, provided just under 40% of UK electricity over the whole of 2020. While renewables output has increased ten-fold since 2010, fossil fuel output has fallen 60%, it noted.

In short, renewables plus nuclear are doing much of the heavy lifting but there’s also a new generation of gas fired power stations in service and gas is still providing important back-up when either renewables or nuclear fall back for one reason or another. Add to this the fact that all but one of the UK’s existing fleet of nuclear power stations will be decommissioned by 2030 and you can see why the pressure on decision makers is mounting.

That said, the UK’s decision-making process for next generation nuclear has been sclerotic to say the least. Love of large, grandstanding

A suitably futuristic image of a Rolls Royce Small Modular Reactor

Image: Rolls Royce

projects just doesn't seem to be enough when a project like Hinkley Point C in Somerset will only deliver electricity at an agreed price of over £90 per MWh; this compared with a future renewables price likely to dip below £60 per MWh for the new generation of offshore wind farms.

As the cost of wind and solar developments continues to fall, Hinkley Point's development costs have risen by a whopping £5bn to over £23bn in the last five years and the station will cost almost double that projected in 2008, although developer EDF will be picking up the construction bill.

Ageing nuclear

While the pandemic has pushed back Hinkley C's expected start-up date to mid-2026 and added another £500mn to costs, most of Britain's ageing fleet of nuclear reactors are stuttering towards end of life. Only Sizewell B in Suffolk will still be running after 2030 and other stations could well be out of action long before 2030 for essential maintenance work – another factor helping to concentrate political minds. This means more pressure on gas and renewables to take up the strain and more reason to get on and make a proper decision about nuclear.

'Nuclear power, in partnership with renewables, is essential to reaching net zero' noted Tom Greatrex, Chief Executive of the Nuclear Industry Association, recently. He also added that: 'the time has come to build a new fleet. That investment, as part of a robust zero carbon mix, will kickstart a green recovery and our transition to a green economy.'

Waiting in the wings is Sizewell C, which could generate 3.2 GW of electricity, enough to meet 7% of the UK's electricity needs according to EDF. 'The electrical output would provide a low carbon source for over 20% of the UK's homes and, based on current grid intensity, offset approximately 7mn tonnes of carbon dioxide per annum,' notes the company in its Sustainability Statement. 'The development of the Sizewell C project would therefore play a significant role in the UK's transition to a low carbon economy,' it projects.

Aside from filling baseload, net zero is the holy grail and if you put aside the cost factor, nuclear looks a good bet for consistent, load-filling clean energy. The big caveat from the Stop Sizewell C (SSC) campaign are the emissions, which would result from a protracted construction process, which EDF itself puts at 5.7mn tonnes of

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carbon equivalent. SSC has called for a lifetime assessment of the carbon footprint of both Hinkley Point C and Sizewell C but as yet this has not been forthcoming and EDF has apparently declined requests on the grounds of commercial sensitivity.

What price carbon?

In terms of future UK energy options, it's important to distinguish between what's on the table, what's down the line and what could happen with enough nudges and favourable investment decisions. If the COP26 meeting in Glasgow in November, for example, has the courage to set a carbon price, this would almost certainly make CCS seem like a better bet for energy companies.

Will the UK and other countries do more to skew the market in favour of hydrogen? Can there be new funding/electricity pricing arrangements for Sizewell C and any other future nuclear stations deemed necessary? These are all factors which will have an impact on the future energy mix – eg the load-bearing share of gas and nuclear.

Offshore wind and solar will continue to power on, but more sophisticated storage solutions are needed here. Gas is a lower carbon alternative to coal and oil but all fossil fuels must factor in CCS if the UK is serious about reaching net zero by 2050.

Hydrogen is emerging at speed but, as noted, it needs lots of help/investment to scale up. As BP's CEO Bernard Looney said at IP Week: 'hydrogen has the attraction of being almost an LNG-type business in its infancy. As we look at the period 2030 plus, hydrogen is going to play a significant role. BP would like to capture about 10% of the key markets when the key markets evolve.'

Rolls-Royce trumpets SMRs

That leaves nuclear, still on the table as the other large-scale clean energy source but, in the UK at least, the government is still scrambling around for acceptable funding models. Looney maintains that you have to believe in scale for individual projects – the oil man's narrative – but how much scale in the case of nuclear? The alternative is the type of small modular reactor (SMR) now being promoted by Rolls-Royce which could be built for under £2bn in a fraction of the time and disruption of a Hinkley or Sizewell and apparently still power a city the size of Leeds.

According to Rolls-Royce's Chief Technology Officer Paul Stein, the SMR is very much on the table as an

option. 'This is real,' he says, claiming that the company now has an investable design which could be produced in the high hundreds and above for use in the UK and overseas. 'This is a realistic and low risk programme,' he said recently.

'One of the key scaling factors in the design is the use of digital twinning. Right from the start we've looked at a hybrid licensing model where initially the UK consortium makes all the power stations but as we get foreign interest, parts can be exported and other and other parts can be made by those countries that subscribe to the right licensing authority,' adds Stein.

While Tom Greatrex claims that nuclear power can kick start a green recovery: 'and our transition to a green economy,' his most recent NIA statement is all about building a new nuclear fleet – scale again – rather than the SMR approach. Advocates tend to agree that bigger is usually better with nuclear, which either suggests the SMR approach is dead in the water or that the big project advocates are missing something fundamental.

RR's Stein adds: 'One of the beauties of the SMR approach is it becomes quite a low-cost source of energy for other parts of the decarbonisation scene, such as hydrogen and synthetic fuel. One UK SMR and plant will be able to produce 170 tonnes of hydrogen or 280 tonnes of net zero synthetic fuel per day.' Here then is a red-blooded manufacturing approach to nuclear energy – power in bite-sized chunks distributed to exactly where it is needed but not the grandstanding capex solution of a Hinkley or a Sizewell.

Stein again: 'The UK SMR heralds a new approach to the cost of nuclear power by broadly rethinking the manufacturing and construction methods and by the extensive use of digital twinning, whilst keeping the physical package exactly the same. This is a pressurised water reactor of the type we know and love.'

In reviewing all these arguments, one is left with the conclusion that the UK needs some brave and thoughtful decision making to get the right energy mix. Can a choice be made between gas and CCS to support renewables, and the alternative of nuclear plus renewables? Or is there a fudge which says we can carry on throwing a bit of everything into the mix? A cost of £45bn for two new nuclear power stations suggests not – even in an age of COVID. ●