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Do we have to have a 'dash for gas' or new nuclear reactors?

The Nuclear Free Local Authorities (NFLA) reproduces in this edition of New Nuclear Monitor a detailed briefing by Pete Roche, its NFLA Scottish Forum Policy Advisor for the website 'No2NuclearPower.org'. Pete has kindly agreed to its reproduction to allow NFLA member authorities an overview of one of the key issues being discussed in the UK Government's future Energy Bill, which is expected to be published shortly. The NFLA thanks Pete for agreeing to let the briefing be published on the NFLA website.

1. Introduction

At the beginning of October 2012 two groups of companies called on the Government to set a binding 2030 target for decarbonisation of the power sector. One group included more than 50 businesses, such as Asda, Sky and PepsiCo, (1) but the other included nuclear, renewable and carbon capture and storage (CCS) companies. (2) Both groups were in effect supporting the Committee on Climate Change's (CCC) call for almost all of the UK's electricity to come from low-carbon sources by 2030.

CCC wants to see emissions reduced to 50 grams of carbon dioxide per kWh (gCO2/kWh) on average compared with 600gCO2/kWh now. (3) The committee's scenario for 2030 shows unabated gas generating 8% of electricity, compared with 30% now, 14% is generated by coal or gas with carbon capture and storage, 40% comes from renewables, but 38% is from nuclear – almost a tripling of nuclear output compared with 2009. (4)

Chancellor George Osborne's aides have made it clear he is against a 2030 target and that he supports a new "dash for gas" and the building of about 20 new gas-fired power stations. At the same time the Government's attempt to revive the nuclear industry are beginning to look like a train wreck and EDF Energy is demanding subsidies which are double or even triple the current cost of electricity. This must be raising questions about how much the Chancellor's support for gas has been influenced by the growing uncertainty that nuclear stations will ever get built. But do we really need to make a choice between a dash for gas and new nuclear reactors?

The Government's plans for gas are unclear, perhaps because it is waiting to see how far the nuclear programme progresses. The Department of Energy and Climate Change (DECC) says it is considering how to square gas power with carbon targets as part of the work underpinning its forthcoming gas generation strategy - due to be published this autumn. But DECC has endorsed 20GW of new gas plant and ambitious carbon targets for 2030 with no explanation yet of how these two are compatible.

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Generating electricity using gas produces an average of 405gCO2/kWh - so using too much gas is incompatible with the CCC's recommended 2030 decarbonisation target. Ultimately this could mean the UK misses its binding 2050 emissions target contained in the climate change act. But Ed Davey says he sees unabated gas playing an increasing role throughout the 2020s and increasingly as back-up or with carbon capture and storage through the 2030s and 2040s. (5)

At the moment the Energy Bill does not have a target for carbon emissions from the electricity sector by 2030, but despite calls from the Liberal Democrats conference for an emissions target of between 50 and 100gCO2/kWh by 2030 to be included in the Energy Bill, Ed Davey has hinted the bill could include a target range, rather than a specific decarbonisation figure, arguing that such an approach would allow for greater flexibility based on the pace of development of low carbon technologies. Friends of the Earth says adopting a decarbonisation "range" instead of a specific target could result in the UK failing to deliver the necessary emissions cuts. (6) All this is beginning to suggest that the Government believes that nuclear could well turn out to be too expensive so we had better keep open the possibility of allowing a dash for gas to avoid the lights going out. But are these really our only choices?

2. Electrification of Demand

The Government's Overarching National Policy Statement for Energy (EN-1) (7) argues that, despite major improvements in overall energy efficiency, demand for electricity is likely to increase as significant sectors of energy demand (such as industry, heating and transport) switch from being powered by fossil fuels to using electricity. As a result of this electrification total electricity consumption (measured in terawatt hours over a year) could double by 2050, and if there is a high level of dependence on intermittent electricity generation, then the capacity of electricity generation could need to triple.

EN-1 says the UK is likely to require at least 113 GW of total electricity generating capacity by 2025 (compared to around 85 GW now), of which at least 59 GW would be new build. Of this 33GW would need to come from renewables to meet renewable energy commitments. This leaves 26GW which would be left for industry to determine the exact mix. (8) In April 2010 around 2 GW of renewables and 8 GW of non-renewable technologies were already under construction. The UK Government says it would like to see 18GW come from new nuclear.

These numbers are based on an analysis done for DECC by Redpoint but this was not an assessment of need - it merely adds up the effect of Government policies to arrive at the 59GW figure. (9) In fact Redpoint points out that the potential for renewable is far greater than the 28-29% (35GW) it was asked to look at. (10)

In March 2011 the UK Coalition Government published Pathways 2011 (11) which presented 17 different scenarios, detailing various ways forward regarding energy policy in order to both keep the lights on and achieve 80% CO2 reductions by 2050. Of these 17 Pathways only nine showed anything like a doubling of electricity demand. The others resulted in electricity demand levels ranging from a decrease of 5% to an increase of 53%.

Ravi Gurumurthy, DECC's Director of Strategy, says:
"*All of our main scenarios for 2050 tell us that we need to plan to meet an increase in demand of between a third and two thirds, as transport and heating shift onto the electricity grid*." (12)

Not a doubling of demand at all.

Following the Fukushima accident, and public concern about nuclear safety, the UK Government Minister responsible for nuclear power at the time, Charles Hendry MP, admitted on Radio 4 that energy security and 80% CO2 reductions could be achieved without new nuclear power – but claimed that it would cost more. (13) That claim is now beginning to look increasingly unfounded.

The Government's message appears to be that *a substantial level of electrification of heating, transport and industry is needed* to significantly reduce greenhouse gas emissions. Whilst electricity will undoubtedly play an important role in sectors such as transport and heat over the next 40 years, WWF-UK argues that the overall level of electricity demand may in fact only have to increase moderately given the potential for achieving significant energy demand efficiencies across all sectors of the economy, including those that are to be electrified.

For example, according to new research commissioned by WWF-UK on electric vehicles (EVs), additional average annual electricity demand from EVs is less than 1.5% of total forecast electricity demand in 2020 for all three of the scenarios that were considered. Even in the case of an extremely ambitious scenario for the deployment of EVs (approximately 26.3 million EVs by 2030, representing 75% of the car stock by that date), additional annual electricity demand would amount to less than 10% of forecast electricity demand for all end users. (14)

3. Energy Efficiency Capacity Ignored

None of the Pathways 2011 scenarios assume penetration of basic energy-saving measures like solid wall insulation into more than 1 in 3 homes. Similarly, it is assumed that the commercial sector can only improve its energy efficiency by just 20% over the next 40 years – so far below what has been achieved historically as to be inexplicable. (15) Germany, which is planning an entirely non-nuclear route, even with the same 2050 objective of an 80% reduction in greenhouse gases, expects electricity demand to be 25% below present levels – compared with our doubling - by implementing energy efficiency programmes. (16) If, instead of planning for a doubling or tripling of electricity demand by 2050, the UK Government was planning for a reduction of 25%, as in Germany, then the capacity required by 2025 would fall by around 15%, removing the need for new reactors.

Germany also plans to cut primary energy consumption by 20 % by 2025 (compared with 2008) and 50 % by 2050. This plan is to be partly achieved by renovating 2% of the total building stock every year, and reducing final energy consumption in the transport sector by about 10 % by 2020 and by about 40 % by 2050 (compared with 2005). The minimum efficiency standards for buildings will gradually be raised and there is a long-term modernisation plan developed for the existing stock of buildings. Overall, primary energy demand of buildings should fall 80% by 2050.

The German KfW banking group borrows freely in order to transform the energy efficiency of the nation's homes. Funding for KfW's CO2 building rehabilitation programme is raised from international markets at low interest rates. The UK's fledgling Green Investment Bank will neither borrow nor support energy efficiency programmes. Since 2001, KfW loans have helped insulate and seal over 2m homes, employing 200,000 people a year in the process. The key is very low interest rates, currently 1-2%, compared with plans for the Green Deal to charge up to 7.5%. (17)

The UK government plans Green Deal loans around £10,000. German homeowners can borrow up to €75,000 via KfW. The latter sum provides a very cosy and efficient home often including some domestic low carbon power generation. In the KfW scheme, the higher the aim, the better the deal. For the most efficient homes – 'Passivhaus' standard 1 - the householder gets up to 12.5% of the loan handed back to them. Householders who don't like loans can get grants of up to 20% instead.

It all adds up to a massive commitment to energy efficiency. (18)

Not only is energy demand reduction compelling from an economic point of view, because it is far cheaper than building new generating capacity, but it is also key to reducing CO2 emissions without driving thousands more householders into fuel poverty. It seems to be widely agreed that energy prices will increase over the next 20 years, regardless of whether we switch to low carbon generation. (19)

The Coalition Government is committed to eradicating fuel poverty by 2016 "*as far as reasonably practical*", so there clearly needs to be a huge national effort on energy efficiency for low income

households in any case. (20) Added to that there are 26 million UK households responsible for around 27% of greenhouse gas emissions which will have to be tackled in order for the domestic sector to make the required contribution to the UK's target of reducing greenhouse gas emissions by 80% by 2050. So the obvious question is why is the UK Government not planning to refurbish existing households at around 700,000 houses per year? (21)

4. Renewable Potential

Several well respected reports such as the European Climate Foundation's Roadmap 2050 report (22) and the Offshore Valuation Report (23) have made it clear that it is technically feasible for the UK and the EU to receive the overwhelming majority of their electricity from renewable sources without endangering the reliability of the electricity system (and at costs not substantially higher than other ways of decarbonising the power sector), as long as the UK significantly improved its interconnection *(see footnote below)* infrastructure with other European grids. In particular the Offshore Valuation Report highlights that by using 29% of the UK's practical offshore resource, the offshore renewables industry could enable the UK to install 169GW of offshore renewable capacity, thus allowing the country to become a net exporter of electricity by 2050.

A WWF report published in October 2011 shows that renewable sources could meet 60% or more of the UK's electricity demand by 2030. By using this amount of renewable energy, we can decarbonise the power sector without resorting to new nuclear power. We will also be able to maintain system security – that is, provide enough electricity at all times to make sure there's never a risk of the 'lights going out'. WWF commissioned GL Garrad Hassan (GL GH) to develop six scenarios for where the UK's electricity will come from in 2030. The scenarios all achieve the near decarbonisation of the power sector by 2030 without new nuclear power. In all cases, the scenarios make full provision for ambitious increases in electric vehicles (EVs) and electric heating.

Energy efficiency and behavioural change lead to the reductions in demand in the ambitious demand scenarios. (24)

5. The alternative to nuclear is not gas

The Appraisal of Sustainability (AoS) for the National Policy Statement on Nuclear Power (25) only looked at a scenario in which new reactors are replaced by gas-fired generating stations. It doesn't evaluate, for example, an alternative strategy based on a high level of Government support for decentralised energy and combined heat and power.

A study undertaken by Imperial College and Surrey University for the CHP Association (26) says that while an all-electric future could be low carbon, it isn't necessarily the best way of doing things. Heat is a very important end-use of energy in the current energy system and is expected to remain so in 2050. In 2007, heat represented 41% of total final energy consumption in the UK. Over half of this heat demand comes from the domestic sector, highlighting the significant challenge associated with decarbonising this sector particularly. No route to low carbon heat is without challenges, but the all electric future would not necessarily be optimally efficient, since thermal losses from power generation are large. The all-electric scenario would also be contingent on overcoming certain critical issues, which are neither easy nor fully understood. If the roll-out and performance of heat pumps, insulation and low carbon generation is not as expected, then the scenario will not be able to deliver the emission reductions required. It also gives rise to a set of challenges associated with the management of power flows. On the other hand, a diverse combination of technologies can help overcome some of these problems, and provide a more robust energy system in the long run.

Footnote - Meaning the heating requirement in a 'Passivhaus' is reduced to the point where a traditional heating system is no longer considered essential. http://www.passivhaus.org.uk/standard.jsp?id=122)

An integrated approach would use a range of heat options, not just gas-fired CHP, including biomass fired CHP plant, and even CHP with carbon capture and storage technologies. Once district heating networks are established geothermal heat, waste heat from industrial processes, heat pumps using boreholes or rivers, solar heat, and so on can also be used.

One of the authors of the report, Dr Rob Gross, explains:
"No route to 80% carbon reduction is without challenges. But it seems clear that improvements can be made to the "all electric" approach we are currently pursuing. The integrated scenario we have identified offers a potentially extremely valuable contribution to efforts to green our energy system."

A study by Pöyry Energy Consulting looked at industries across the UK which could generate as much electricity as 10 nuclear power stations and halve gas imports by installing or extending CHP plants. (27) Implementing a decentralised energy strategy which makes the most of CHP and district heating need not be locking the UK into using fossil fuel gas. For a start, as the Poyry study shows, it could lead to dramatic reductions in gas consumption much sooner than would otherwise be the case. Secondly, once the district heating networks are established they can be converted to run on other fuel sources such as biomethane, biomass, geothermal and solar in the future. The Government's all electric vision is tending to lead to proposals for new types of wasteful electricity generating plant, such as some of the large biomass proposals which will not be capturing a significant percentage of the waste heat.

As moves towards higher penetration rates for renewable electricity gain momentum, the electricity supply system has to be able to manage a significant increase in periodic renewables, while still maintaining supply to the customers. The intermittency of renewables, and wind in particular, demands flexibility of response for operation from other suppliers on the grid. That is why the successful combination of CHP and renewables is attracting increasing attention. Presently in Denmark, when the wind speed drops by 1 metre per second the country needs to find an additional 350 MW of electric power capacity. Gas CHP has the capacity to respond quickly to such fluctuation, but to maintain high efficiency the system must also find a use for the heat produced when generating electricity. In Europe, traditional CHP users are beginning to find new ways (such as temporary heat storage or buffering) to meet this need for flexibility. Danish district heating companies are increasingly providing the grid with balancing services, and the Danish model shows how a combination of a high wind generating capacity and CHP can run together smoothly. (28)

If CHP is not promoted as a way of balancing renewable, non-CHP gas-fired electricity generating stations will most likely be used, so, as shown by Poyry in the case of industrial CHP, gas consumption could end up being higher in the all-electric scenario. A study by PB Power for the Mayor of London and Greenpeace UK concludes that a Decentralised Energy (DE) strategy could reduce CO2 emissions from London by 27.6% by 2025. Despite the increased use of gas for CHP, gas consumption could be 15% lower under a high DE scenario compared with a high nuclear scenario. (29)

A similar report by PB Power for the City of Edinburgh Council, Greenpeace and WWF, concluded that the most cost effective way for Edinburgh to reduce its carbon emissions and increase energy security is by following a DE pathway. (30)

6. **The role of microgeneration**

The UK Government's 2006 Microgeneration Strategy (31) quoted from a study commissioned by the DTI from the Energy Saving Trust (EST) which suggested that by 2050, microgeneration could provide 30-40% of the UK's electricity needs and help to reduce household carbon emissions. A target of 10% for 2020 could be well within reach. This would clearly obviate the need for new nuclear reactors. Domestic-scale CHP could be providing 20% of the UK's electricity, more than current UK nuclear capacity, not long after 2020, and much more quickly than new nuclear build. (32)

7. Conclusion

There is no need for a 'dash for gas' or a new nuclear programme. What is needed is a much larger energy efficiency programme with a focus on avoiding driving millions more of low and middle income households into fuel poverty, and making sure the domestic sector can achieve a reduction in carbon emissions which is commensurate with 2050 targets. The UK Government should be aiming to generate around 60% of UK electricity requirements with renewable energy by 2030 and any new gas-fired power stations should be part of a strategy to roll out district heating to large parts of the UK. The UK Government does not have to choose between reliance on imported gas and environmentally damaging shale gas or new nuclear reactors which produce a toxic waste which it still does not know what to do with.

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