SONE

Supporters of Nuclear Energy

Newsletter

No 230 January 2018

Members of SONE should know that our Chairman, Sir William McAlpine, was taken gravely ill at the beginning of December and at the time of writing remains in intensive care. We all pray for his early recovery and our wishes go out to Lady McAlpine and family at this difficult time.

New Year Resolutions

The year 2017 has seen some real progress in plans to build new nuclear power stations in the UK. That this progress has been slow is the fault of finance, regulation and public opinion. Each of these has been weighed down by a lack of understanding and confidence. For 2018 these letters promise to disseminate and expand on news of prospects for nuclear power in the UK.

Financial markets seem unwilling to support investments with long pay-back times, generally. This is not peculiar to the UK or nuclear, although the lifetime of a nuclear power station at 60-80 years is at the longer end of a spectrum that includes student education, railways, hospitals and other infrastructure projects. It is no surprise that, by mistakenly focusing on short-term interest (like 6% on student education), any investment for the public good can be made to seem unaffordable. Devious accounting devices like the Private Finance Initiative (PFI) that hide public debt, while charging current outgoings, contribute to inequity.

The question should not be *Can we afford nuclear power?*, but *Is nuclear power the right solution?* That we need a solution to climate change as an existential problem was made particularly clear by the events of 2017. Those who still doubt the evidence should see nuclear power as an insurance against a threat that has a 90% chance of striking.

The Paris Agreement seems now to be accepted by everyone in the world, except Trump and his disjoint band of followers. The question then becomes *Where should we get carbon-free energy from?* This excludes coal, oil, gas and biofuels. Labelling the use of biofuels as *renewable* and *green* is a mistake: organic growth

by photosynthesis is the only large-scale available way to *remove* atmospheric carbon. The discharge of this captured carbon back into the atmosphere by burning biofuels is the very opposite of what needs to be done. The conversion of Drax power station to the use of wood pellets imported from North America is the kind of inept policy that could only be achieved with ignorance. That such development has been supported by a subsidy has made it worse.

Electrical energy supply should meet two further requirements in addition to being carbon-free: there should be no break in supply and its impact on the environment should be minimised. How do the various carbon-free sources match these requirements? Many like geo-thermal and tidal are only available in particular places. Generally, that leaves solar, wind, hydro and nuclear.

Continuity of supply is not a problem for hydro and nuclear. A nuclear reactor typically contains more than a year's supply fuel at any one time, and most refueling breaks involve redistributing it so as to maintain an even burn. Apart from these occasional planned breaks and maintenance, keeping a steady output of energy is preferred. Any fluctuation in demand can be balanced with a secondary energy need such as desalination or hydrogen production by electrolysis. Hydro can follow demand fluctuations more easily than nuclear and can provide guaranteed output too, precipitation and the melting of glaciers permitting. However, it has a major environmental impact.

Solar and wind do not provide a constant supply and do not come with a natural reservoir that can store energy at times of plenty and discharge it when the sun does not shine and the wind does not blow. Media stories of giant batteries are distorted. The battery recently supplied to South Australia can store 129 MWh, equal to the electrical energy consumed by the UK in 12 seconds. Neither the cost, nor the supply of lithium needed to make such a battery, suggests that this could be scaled up realistically. Hydro pump-storage systems do better, but can be built only in exceptional places. The existing one at Dinorwig stores enough energy to supply 5% of UK power for two or three hours. Developments are being studied: http://energystorage.org/energy-storage/technologies/pumped-hydroelectric-storage. However, the environmental hurdles for wind, solar and hydro are substantial.

Each power source has a typical power density – in the environmental context this is the power in kilowatts (kW) that can be supplied per horizontal square metre of land (or sea). This is not the only measure of environmental impact, but an important one. For offshore wind David MacKay reckons 3 Wm^{-2}. For solar he reckons 10 Wm^{-2} at 10% efficiency. For nuclear a 1 GW

power station takes 14 hectares, including cooling tower, new and used fuel storage, that is 7000 Wm^{-2}. So the *footprint* of nuclear is about a thousand times smaller than solar or wind.

In summary, even before any mention of cost, nuclear stands out as providing the most reliable available energy source for electricity generation with by far the least impact on the environment. The fuel cost is irrelevant, being close to zero for solar, wind and nuclear. There is no waste and no environmental hazard for any power source, compared with what industrialised economies have accepted from carbon-based fuels for two centuries. Fear of nuclear technology is a separate matter and the subject of the books *Nuclear is for Life* (2015) and *Radiation and Reason* (2009).

With a life expectancy of up to 80 years a modern nuclear power station compares well with those of solar and wind farms, said to be 25 years. The changing climate threatens an increase in extreme weather events. In 2017 the hurricanes Harvey, Irma and Maria caused severe damage to wind and solar farms that were unprotected. The two South Texas nuclear power stations continued operating and delivering 2.3GW without incident throughout Harvey. Nuclear power stations are extremely robustly built.

When it comes to cost, the industries with an interest compete and make bids. However, normal commercial competition is ill matched to an existential threat such as climate change. Nobody doubted the need to engage Hitler in the Second World War on the grounds of money. What was important was the availability of resources, not the product of some accounting calculation. The most important resource for deploying nuclear power is experienced and knowledgeable manpower. The UK is short of this but the French, Japanese, Korean and Chinese are keen to help. With the experience of working with them and the good sense of our educated young people, we should catch up. This should benefit the whole UK economy in the medium and longer term, while many competitors suffer from their lack of confidence in nuclear technology.

Offshore wind is now priced at £57.50 per MWh for 2022/23, 50% lower than in 2015. Meanwhile the Rolls Royce small modular reactor (SMR) consortium is suggesting a figure of £60 per MWh, far below that agreed for Hinkley C at £92.50 per MWh. There is now intense competition between different SMR designs. We should be keeping our eye firmly fixed on developing the interests of UK industry, the education of our young people and the public. Meanwhile the media will focus on the money and any tale that starts from *the pound in your*

pocket. They always do.

Where the energy comes from

Watching real data as it comes in is riveting. Everyone should take a look at the sources of the UK electricity supply right now by visiting http://www.gridwatch.templar.co.uk/index.php . You can see our reliance on gas (labelled CCGT), nuclear and wind – except on the days when the wind fails. In winter solar does little, even at midday, but hydro and biofuels make significant contributions, as do the imports from France and Holland. For the environment gas and biofuels should be phased out and replaced with nuclear power sited close to centres of population, such as Drax and Didcot. The display for France http://www.gridwatch.templar.co.uk/france/ shows that they generate 55-60 GW of electricity by nuclear without using gas. The UK network only uses 35-50 GW, showing how heavily we rely on gas for heating and industry. It is not too late to copy the French.

The situation in the rest of Europe can be watched in real time too https://www.electricitymap.org/?wind=true&solar=false&page=country&countryCode=GB . Data from many areas remains to be added, but coverage is increasing.

We should encourage everybody, especially young people, to study these displays. The stories that they tell are crucial to the decisions that have to be made for the future.

And last but not least

I have to report the loss of a member. Unfortunately this happens from time to time. In this case the member is also a member of the Committee who was elected in October 2017 with the high hope that he might lead our plans to recruit from the younger generation. **John Lindberg** wrote to Sir William at the beginning of December and resigned, explaining that he had accepted the offer of a post at BEIS and was concerned about possible conflicts of interest. Since he fully appreciates the nuclear case he will be a valuable addition to their team. In the long run he may well be able to do much good in his new position and I am sure that we should wish him every success in that. He knows that we will send him our opinions in any event.

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