



Supporters of Nuclear Energy

Newsletter

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HOW MUCH CHOICE DO WE HAVE?

The World Wide Web adds colour to my thoughts. How quickly it tells me that Thomas Hobson owned a stable in Cambridge in the 17th Century! If a customer asked which of his many horses was available today, he was always told there was just one, take it or leave it. Well, the situation is the same today when we ask for an energy workhorse suitable for the post-carbon era. Discussion leads to the conclusion that nuclear energy is Hobson's Choice: each of the other energy sources fails one of the requirements: it is too intermittent to be the mainstay of a stable electricity grid; it is not available on the scale of the nation's energy needs; or it releases carbon into the atmosphere.

I presume that Thomas Hobson earned his reputation through arguments with stubborn customers. In considering nuclear power we should listen like them to the arguments and decide whether it is reasonable to walk away. Some may resist the conclusion clinging doggedly to a few facts that they have understood, otherwise relying on belief or quoting from an expert. Most people though admit their lack of knowledge and want to know more.

With time the truth becomes clearer, even to some of those who previously misunderstood. More has become clear this summer. The hurricanes in the Caribbean have silenced many who still believed that the climate is more or less stable. Almost everybody now agrees that carbon emissions should be cut dramatically, even if the extent to which these affect the climate, now and in the future, is not fully predictable. The hurricanes disabled many oil facilities, shut down wind generators and flooded or destroyed arrays of solar panels. Meanwhile throughout the Storm Harvey both nuclear stations in the Houston region continued working at full capacity. (As it happens, on 28 September the licences of both reactors at the South Texas Plant were granted extensions to 60 years by the NRC). Similarly two out of three in Florida kept working with one turned off as a "precaution" during the hurricane. Without a stable power grid modern life is severely threatened, as when hurricane Maria destroyed the infrastructure in Puerto Rico. Such a loss of grid supply is not infrequent (South

Australia Sept 2016, Taiwan Aug 2017).

However the most important question addressed by several reports in 2017 concerns the stability of an electricity grid when fed by intermittent sources of power. Wind and solar are inherently intermittent but the demand is not. Demand can be modulated to some extent, essentially by making it cheaper as supply increases and more expensive as supply decreases. Some short term variations over a few hours may be smoothed by pumped storage - but this is rarely possible on a scale that matches the intermittency. Investors and commentators seem to follow Mr Micawber in their optimism about energy storage (in particular, batteries):

I have no doubt I shall... live in a perfectly new manner, if - if, in short, anything turns up.

My understanding of physical science leads me to think that they will be disappointed - but that is for the future.

There have been several new studies of the stability of a grid relying only on wind, solar and hydro as energy sources. In Dec. 2015 Jacobsen et al [www.pnas.org/cgi/doi/10.1073/pnas.1510028112] published a study in a major periodical claiming that such a grid could be stabilised. In June 2017 Clack et al strongly disagreed [www.pnas.org/cgi/doi/10.1073/pnas.1610381114]. What do other studies find? In Sept 2017 Heard and Brook published a comprehensive review of 24 studies of 100% renewable-electricity systems. They also disagree with Jacobsen [www.sciencedirect.com/science/article/pii/S1364032117304495].

There have been official inquiries and reports. In Aug 2017 by the US Department of Energy published a Report on Electricity Markets and Reliability [[energy.gov/sites/prod/files/2017/08/f36/Staff Report on Electricity Markets and Reliability_0.pdf](http://energy.gov/sites/prod/files/2017/08/f36/Staff_Report_on_Electricity_Markets_and_Reliability_0.pdf)]. This recommends major changes to relax the draconian safety and regulatory restrictions imposed solely on nuclear energy. Firstly it encourages the NRC to “revisit nuclear safety rules under a risk-based approach”. This is a carefully worded recommendation that the safety of radiation should be brought into line with modern radiobiology, as urged by many radiation professionals around the world. Secondly it is concerned by the unequal treatment of nuclear energy. “Nuclear plants are also affected by other regulatory factors and fees that are not imposed on other types of power plants. Recent examples include major safety reviews following the Fukushima Daiichi nuclear plant failures in 2011. A recent study found that the rising regulatory costs of nuclear energy—which approach \$60 million per year—exceed the profit margins of many of these plants.” This unequal treatment is closely linked to the unbalanced safety treatment referred to in the first point. These comments

refer to the situation in the USA but are appropriate worldwide.

In January 2017 in Europe a White Paper was issued by the Council of European Energy Regulators (CEER) that “welcomed the European Commission’s proposals to remove priority dispatch”. This would expose all generator sources to the same “real-time value of energy”, meaning wind and solar would have to compete with other generators on level terms at any time. Then in mid-May 2017 the Agency for the Cooperation of Energy Regulators (ACER) joined CEER in issuing a press release, adding that the 90% compensation for curtailed renewable power should be done away with as well. Then wind and solar would not be compensated for their power when it was surplus to requirement, as determined by the spot market. Then all technologies would have to compete fairly in the market to deliver the lowest possible cost to consumers. The Energiewende website draws the conclusion as far as further investment is concerned “You might as well say you don’t want wind or solar.” [<https://energytransition.org/2017/06/new-proposals-would-kill-solar-and-wind-in-eu/>]. This summary from the epicentre of European thinking on energy is significant.

So back to Thomas Hobson - he is offering us a choice of one clear policy. No carbon fuels, no biofuels because they release carbon too, not much more wind and solar than we have now, but we do need a major expansion of nuclear as the baseload supply to replace carbon and the output of the older retiring nuclear plant. That is the horse, even though Europe may not be politically prepared for it, yet. Is Europe listening to its own advice? There is every reason for the UK to act in any case.

But nothing seems to have been happening politically in the UK, even though the evidence has mounted rapidly over the summer. No scenario based on dominant offshore wind without a major share of nuclear can guarantee to keep the lights on – unless there is a large carbon component of carbon spinning idly in the background. Mr Hobson has already said that that horse is not available. Furthermore the recent claims reported in the media that offshore wind is now cheaper than nuclear are deceptive. A comparison of the recently reported cost of offshore wind with that of the equally recent Rolls Royce Small Modular Reactor (SMR) design shows little apparent difference. Anyway that is not the problem. Further provision of offshore wind will not cure the intermittency of supply, regardless of cost.

In early 2016 the UK Government launched a competition to find an SMR design suitable to be developed while the larger giga-watt plants at Hinkley, Wylfa and Moorside are constructed. In spite of the big talk and much serious work by NuScale, Rolls Royce and other consortia this initiative seems to be

stalled at present – Whitehall’s attention is locked on Brexit business apparently. This is no way to build a base for new nuclear in the UK but we hope to hear more news before young engineers choose another career somewhere else.

The UK is not alone in the belief that we stand at a crossroads and others are not waiting for us. While China, Russia and India build their futures on nuclear energy taking their customers with them as they do so, the USA studies what has gone wrong and what they should do about it. For example, on 26 Sept at the University of Chicago John Deutch, former head of the CIA and Director of Research at the Department of Energy, proposed an \$11.5 billion program over the next 15 years to reinvigorate the U.S. nuclear industry through a new quasi-independent corporation suitably insulated from political and financial meddling [www.youtube.com/watch?v=-fjvqXRRBwY&feature=youtu.be]. His group makes many recommendations, including a carbon price to help emissions-free nuclear power compete with natural gas. Meanwhile on 29 Sept. 2017 Secretary Perry announced a \$3.7 billion US rescue package for ailing nuclear construction [<https://energy.gov/articles/secretary-perry-announces-conditional-commitment-support-continued-construction-vogtle>].

These difficulties should not be seen as casting doubt on the science of a nuclear future but as a failure of economics. Capitalism does not seem to have found a way to fund long term investment. Student education, for example, is deeply beneficial to all concerned in society, but because the investment spans 50 years or more few financial regimes seem to have agreed how to share the costs and the benefits without creating upset and discord. With its span of 60 years any investment in a nuclear power station causes particular financial angst. For some reason in today’s more affluent times a decision to spend on necessary infrastructure is more fiercely contested than it was in times past. The pursuit of democratic decision making, though highly desirable, fails where public education has not reasonably shared a scientific picture of the issues with enough of the electorate. In the nuclear case, at least, the present score suggests that totalitarian regimes are effective while capitalism fails. If survival is at stake that is a serious conclusion.

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