

UK's nuclear power programme: Phasing out by failure

Presentation to the Renewable Energy Institute

March 10, 2021

Steve Thomas (stephen.thomas@gre.ac.uk)

Emeritus Professor of Energy Policy

PSIRU (www.psiru.org), Business School

University of Greenwich

Outline

- 1990: Privatisation
- 2006: Nuclear 'back with a vengeance'
- 2013: Contracts for Differences, Hinkley Point C
- 2017+: Other projects
- 2019: Regulated Asset Base model
- 2020: Small Modular Reactors
- Likely outcomes

1990: What privatisation revealed

- Attempts to privatise forced UK to identify the costs of the existing reactors
- Oldest reactors, 10 remaining Magnoxes, were 18-34 years old, very expensive to run (reprocessing costs) & expected to be retired very soon, before 2000
- 7 AGRs, 1-14 years old, were so unreliable & expensive to run, most were expected to be abandoned soon with the others closing after 25 years operation
- 1 PWR under construction, Sizewell B, since 1987, only surviving project from Thatcher's 1979 programme of 10 reactors. Too expensive to justify completion?
- Phase-out by 2000?

1990: Outcome

- Magnoxes continued in operation for about 40 years life-time, last closed in 2015
- AGR reliability improved & none shut down by 2021
- But 2 AGRs recently closed for 3 years & will close permanently in 2022. 1 closed for 3 years, will it re-open? 2 expected to close 2024. 2 expected to close 2030
- PWR completed 1995 but so uneconomic that to privatise in 1996, it was given away despite it costing consumers £3+ bn. Expected to operate to 2035+

2006: Back with a vengeance

- Tony Blair decided nuclear 'back with a vengeance'. Convinced by 'Nuclear Renaissance' rhetoric?
- New nuclear would be built by different utilities with different technologies to find the best options
- 2008: Government claimed cost of power competitive with gas & owners would get no public subsidy. An EPR expected to cost £2.8bn
- 2010: 3 consortia (7 European utilities) formed to build new nuclear & 5 sites (2/3 reactors per site) existing ones allocated by government. 5 designs started review by UK regulator. 3 successfully completed, 1 abandoned, 1 underway
- EDF consortium claimed first power for Hinkley (2 EPRs supplied by Areva) by 2017. Sizewell to follow
- 2012/13: All utilities except EDF sold their projects, Horizon to Hitachi (Wylfa & Oldbury), NuGen (Moorside) to Toshiba, owner of Westinghouse, so they could build their own designs, ABWR & AP1000
- 2013: Terms of deal for EDF consortium to build Hinkley announced

2013: Contract for Differences

- Hinkley deal based on a contract for government to buy all the output for 35 years at a guaranteed fixed real price. Loans to be guaranteed by UK government, but if costs escalated, EDF took the hit
- Expected cost £14bn, completion 2023. But power cost, £92.5/MWh (2012 money) or £112/MWh 2020 money (US\$15.5/MWh), more than double wholesale electricity price & more than double price of offshore wind
- Contract only signed in 2016 & agreement for China General Nuclear (66.5%) & EDF (33.5%) to part fund & build their own Hualong One technology (2 reactors) at another site, Bradwell
- 2016: Areva collapsed & EDF forced to buy reactor division
- Loan guarantees not taken up. Hinkley initially funded by EDF asset sales & diverting profits. How will the rest of the project be funded?
- 2021: EDF close to financial collapse, Hinkley costs up 70% compared to 2013, completion 2028

Other consortia

- 2018: Toshiba abandoned Moorside, sold Westinghouse to a Canadian venture capital company, Brookside, & narrowly avoided bankruptcy itself
- 2019: Hitachi suspended Wylfa (Oldbury never progressed) because insufficient investors. UK government offered to take 30%, Japanese government claimed it would bring in 30% but failed. Hitachi could not afford to take the rest. 2020, Wylfa completely abandoned
- CGN technology under review by UK safety regulator since 2017, expected completion 2021. Major objective for CGN as UK approval expected to be selling point in other markets
- Increasing opposition in UK government to Chinese participation in strategic facilities & in 2021 work on Bradwell essentially suspended

2018: Regulated Asset Base (RAB) model

- Hinkley deal unrepeatable because of high price. Claimed to be because risk was making cost of capital too expensive & that new finance model needed
- By 2018, EDF in serious financial difficulty & admitted they could not finance Sizewell. But they wanted the profits from selling, building, operating & maintaining the reactors without the risk of owning them. EDF proposed RAB.
- Under RAB institutional investors (pension funds etc) would finance & own the plant & in return be guaranteed a fixed return on the money invested. If the plant cost £20bn & the guaranteed return was 6%, consumers would pay £1.2bn/year plus operating costs
- Clear that investors will only be interested if all risks (cost overrun, poor reliability etc) are borne by consumers – they must pay whatever costs are incurred
- Government consulted & said, in principle, RAB is only an option. Risk on consumers makes the model unpopular & UK Treasury opposes it because of risk of public money

Small Modular Reactors (1)

- Claim for SMRs is that use of factory production lines & minimal site work would more than compensate for lost scale economies
- Two basic types: Scaled down existing types, PWRs. Innovative new designs (Generation IV), eg molten salt reactors, sodium-cooled fast reactors
- Scaled down PWRs likely to be technologically feasible
- Innovative designs talked about for decades & some built to demo size but with poor results. Generation IV Forum says they won't be available before 2045

Small modular reactors (2)

- 2015: UK Government announced £250m funding to identify the 'best' SMR for UK & promised a roadmap to deployment by 2017. Money not spent & roadmap forgotten
- 2020: Small parcels of money, ~£15m, to various developers, some PWRs, some Gen IV, to progress designs
- Front runner thought to be Rolls Royce PWR, which supplies UK nuclear submarines
- But design only announced in 2017 so far from complete. It isn't small (470MW), it isn't modular in the sense of being designed to be built in clusters & it is very 'old school'
- Rolls Royce will only proceed if UK government agrees to pay half the development costs, pays for the factory production lines & guarantees orders for 16 reactors now
- How could government take this risk with completely unproven technology with untested economics?

Small Modular Reactors

- *Advanced nuclear has become the catch-all for the knight-in-shining-armor reactors that promise to address issues that have kept nuclear a marginal electricity player since its inception. But we need more than this open-ended definition. The Biden administration should support projects only if they can compete with renewables and storage on deployment cost and speed, public safety, waste disposal, operational flexibility and global security. There are none today. –*
- *Gregory Jaczko, Former Chair US Nuclear Regulatory Commission, Feb 2021*

Likely outcomes

- AGRs all closed by 2030 at the latest
- Sizewell B will continue in operation to 2035+
- It would make sense to abandon Hinkley Point C even now but it would be too politically embarrassing so will be completed maybe around 2030
- Any RAB proposal attractive enough to bring in investors will be unacceptable politically – too risky to UK public - & any proposal politically acceptable will not attract investors
- SMRs will be quietly forgotten as costs escalate
- What will it take for UK government to stop giving nuclear industry one more chance?
- What opportunities are we not exploring because government assumes nuclear will solve the problems?