

# House of Commons Welsh Affairs Committee's Inquiry into Nuclear Energy in Wales

**Submission: Dr Paul Dorfman**  
**Associate Fellow, Science Policy Research Unit (SPRU), Sussex Energy Group (SEG), University of Sussex; Member, Irish Govt. Environment Protection Agency (EPA) Radiation Protection Advisory Committee (RPAC), Chair of Nuclear Consulting Group (NCG).**

24 Feb 2023

## Back with a vengeance

Fissile Fuel is back - so say UK policy and press. Fact or fiction – what's the evidence?

## RAB: Failing to learn from history

1. The fact is, RAB and nuclear have been tried before. The US version of RAB - ECR (Early Cost Recovery) failed, leaving the usual vast cost and time over-runs, and they've quietly dropped the idea. The point is, apart from a few reassuring words, there's no real data or information from BEIS as to why UK nuclear RAB could or would work any better, or risk failure.
2. UK and France can sign any deal they like - but if finance market investors don't take up the remaining majority construction costs, Sizewell C or new nuclear at Wylfa are going nowhere.
3. And the augers aren't good. Sir Nigel Wilson, Group CEO of Legal & General, UK's biggest asset group with £1.3 trillion investments, told BBC R4 'Today' program that *"We are not big fans of Sizewell C."* Given that project's still deeply unfinanced, perhaps the PM should take the Treasury's concerns more seriously.<sup>1</sup>

## Doing the same thing over and over again and expecting different results

4. The EPR reactor design is vastly over-cost and over-time everywhere its built, and shut down for nearly a year in Taishan China with safety faults. And don't let EDF tell you things are going to plan at Hinkley Point C, where they're working on a 'contingency option' to avoid construction delay penalties,<sup>2</sup> just as as construction costs at Hinkley C ramp to £33 billion.<sup>3</sup>

---

<sup>1</sup> <https://www.bbc.com/news/uk-politics-60903879>

5. The fact is, BEIS clearly state that nuclear costs and construction delays always ramp significantly, putting first generation from Sizewell C between 2036 and 2040 – far too late for our energy and climate crises.
6. Not forgetting the horrible mess across the channel, with more than half of France's nuclear reactor fleet offline in 2022,<sup>4</sup> EDF are in deep trouble - essentially bankrupt. €64 billion in debt, reporting a record €19 billion loss this year,<sup>5</sup> with exponential radioactive waste and decommissioning costs on the horizon. With an estimated €50-100-billion bill for reactor safety upgrades,<sup>6</sup> Macron is now forced to fully nationalise the ailing and ageing French nuclear corporation.<sup>7</sup>

### Variability and 'load-follow'

7. Nuclear isn't just slow and expensive, but too inflexible to go up and down with the swings of demand. Variability of wind and solar technology are far more easily integrated into evolving flexible electricity grids.
8. Whilst nuclear claims it can 'load-follow' in a limited and constrained way - as UK Parliamentary Office of Science and Technology reports: 'Nuclear stakeholders claim existing reactor types can, to a limited extent, moderate generation to match demand depending on the reactor type. However, this has not substantially been observed in practice.'<sup>8</sup>
9. Now, modern grid operators emphasise diversity and flexibility rather than nominally steady but less flexible baseload. Diversified renewable portfolios don't fail as massively, lastingly, or unpredictably as big thermal power stations. A nuclear plant or fleet might unexpectedly have to be shut down for safety reasons, as was half of the EDF French nuclear fleet in 2022.<sup>9</sup>
10. To pick a much tougher case, '*Dunkelflaute*' or 'dark doldrums' of UK and European winters are often claimed to need significant battery storage for an all-renewable electrical grid. But experience shows that grid operators find Europe needs only one to two weeks of renewably derived backup - not a huge challenge. The bottom line is that electricity grids can deal with much larger fractions of renewable energy at modest cost, and this has been known for quite some time.<sup>10</sup>

---

<sup>2</sup> <https://www.constructionnews.co.uk/news/edf-seeks-to-activate-contingency-clause-for-hinkley-point-c-contract-25-07-2022/>

<sup>3</sup> <https://www.reuters.com/business/energy/cost-edfs-new-uk-nuclear-project-soars-40-bln-2023-02-20/>

<sup>4</sup> <https://www.nytimes.com/2022/11/15/business/nuclear-power-france.html>

<sup>5</sup> <https://www.reuters.com/business/energy/edf-slumps-record-179-bln-euro-loss-low-nuclear-output-2023-02-17/>

<sup>6</sup> <https://www.energyintel.com/0000017b-a7d1-de4c-a17b-e7d3c8f40000>

<sup>7</sup> <https://www.latribune.fr/entreprises-finance/industrie/energie-environnement/nationalisation-d-edf-l-autorite-des-marches-financiers-se-prononce-aujourd-hui-des-actionnaires-jouent-leur-va-tout-939846.html>

<sup>8</sup> <https://post.parliament.uk/research-briefings/post-pn-0687/>

<sup>9</sup> <https://e360.yale.edu/features/three-myths-about-renewable-energy-and-the-grid-debunked>

## Waste

11. The nuclear waste problem has not gone away. As the former Chair of the UK Nuclear Decommissioning Authority recently stated: *“Nuclear disposal cost is enormous, with no certainty they will perform long-term task required ... These considerations sadly receive little attention in current debates about new nuclear-generation capacity.”*<sup>11</sup> Whilst Dan Bowman, head of operations at Sellafield’s waste storage ponds says: The decommissioning programme is *“laden with assumptions and best guesses.”*<sup>12</sup>

## Climate impact

12. In terms of CO2 mitigation, the International Energy Agency’s ‘World Energy Outlook 2022’, concluded that *‘renewables are the most important way to reduce CO2 emissions in the electricity sector.’*<sup>13</sup>
13. Meanwhile, the unfortunate truth is that Greenland's glaciers are melting 100 times faster than estimated,<sup>14</sup> which means coastal nuclear will be at ramping risk from sea-level rise driven storm surge flooding.<sup>15</sup>
14. As the Parliamentary Office of Science and Technology have recently noted: *“Climate change has also been highlighted as increasing the investment risk profile of nuclear.... The coastal location of UK nuclear power stations makes rising sea levels and storm surge flooding a future risk that will need to be considered.”*<sup>16</sup>
15. In the U.S., the Nuclear Regulatory Commission (NRC) say that 55 U.S. nuclear sites already experienced flooding hazard beyond design-base.<sup>17</sup> And the U.S. Army War College states that nuclear power facilities are at high risk of temporary or permanent closure due to climate threats – with 60% of U.S nuclear capacity vulnerable to major risks including sea-level rise, severe storms, cooling water shortages.<sup>18</sup>
16. All this means is that UK coastal nuclear sites are literally on the front line of climate change, but not in a good way,<sup>19</sup> with the UK Institute of Mechanical Engineers saying UK coastal nuclear infrastructure, including Sizewell, may

---

<sup>10</sup> (Ibid).

<sup>11</sup> <https://www.theguardian.com/environment/2022/dec/22/we-need-more-honesty-on-nuclear-powers-long-legacy-of-hazardous-waste>

<sup>12</sup> <https://www.theguardian.com/environment/2022/dec/15/dismantling-sellafield-epic-task-shutting-down-decommissioned-nuclear-site>

<sup>13</sup> <https://www.iea.org/reports/world-energy-outlook-2022>

<sup>14</sup> <https://phys.org/news/2022-12-greenland-glaciers-fast-previously-thought.html>

<sup>15</sup> <https://www.nuclearconsult.com/wp/wp-content/uploads/2021/06/Climate-Change-UK-Nuclear-June-2021.pdf>

<sup>16</sup> <https://post.parliament.uk/research-briefings/post-pn-0687/>

<sup>17</sup> <https://www.nrc.gov/docs/ML1713/ML17138A169.pdf>

<sup>18</sup> <https://climateandsecurity.files.wordpress.com/2019/07/implications-of-climate-change-for-us-army-army-war-college-2019.pdf...>

<sup>19</sup> <https://www.nuclearconsult.com/wp/wp-content/uploads/2021/06/Climate-Change-UK-Nuclear-June-2021.pdf>

need considerable investment to try to defend against rising sea levels, even relocation or abandonment.<sup>20</sup>

17. Importantly, Sir David King, UK's former chief scientific adviser and a long-standing nuclear supporter, says new nuclear at Sizewell C would be “*very difficult to protect from flooding*” due to rising sea levels on the Suffolk coast.<sup>21</sup>

### The SMR that never was

18. So, with large nuclear struggling, the next thing is the small modular reactor (SMR) concept.
19. SMR technology is defined as reactors that generate up to 300 MW power.<sup>22</sup> But at 470 MW, the Rolls Royce design is simply not an SMR.<sup>23</sup> It's larger than the UK Magnox reactor, half the size of the 900 MW reactors that make up the bulk of the French nuclear fleet – and about a third the size of the very large EPR reactor design.
20. This matters because the Rolls design will need big sites, standard nuclear safety measures, exclusion zones, core catchers, aircraft crash protection, and security. It's unsettling to reflect that all UK civil nuclear infrastructure are uniquely implicated in all four ‘Tier 1 Threats’ identified in the UK National Security Strategy.<sup>24</sup>
21. All this is important because in calling their design an SMR, or small, Rolls have been economical with the truth - and all that implies for their other claims, especially about time and cost.
22. Speaking of which, the US NuScale Power SMR cost has nearly doubled in price, despite being heavily subsidized.<sup>25</sup> An early cost estimate was \$55 per MWh and the new price is \$90 to 100/MWh – and no doubt set to continue to ramp.

### Cheaper, faster, better

23. Help is at hand. In 2021, solar and wind made up three-quarters of total new electricity generation capacity installed world-wide. With other renewables, the total figure was 84%,<sup>26</sup> with nuclear nowhere.

---

<sup>20</sup> Institute of Mechanical Engineers (IME) (2009): Climate Change: Adapting to the Inevitable, IME 2009. <https://www.imeche.org/policy-and-press/reports/detail/climate-change-adapting-to-the-inevitable>

<sup>21</sup> <https://twitter.com/lbc/status/1597660294192545792>

<sup>22</sup> <https://www.iaea.org/topics/small-modular-reactors>

<sup>23</sup> <https://www.rolls-royce.com/innovation/small-modular-reactors.aspx#/>

<sup>24</sup> HMG [Her Majesty's Government] (2010) : A Strong Britain in an Age of Uncertainty: The National Security Strategy, Presented to Parliament by the Prime Minister, October 2010, Cm. 7953, Stationery Office, London.

<sup>25</sup> [@ieefa\\_institute](https://ieefa.org/resources/small-modular-reactor-update-fading-promise-low-cost-power-uamps-smr)

<sup>26</sup> <https://reneweconomy.com.au/renewables-snapshot-are-we-on-track-to-decarbonise-the-globe/>

24. More recently, wind and solar produced a quarter of EU electricity since the war began, avoiding €11 billion in gas costs.<sup>27</sup> Perhaps because world-leading financial advisory and asset management firm Lazard find that whilst nuclear levelized cost of electricity is \$151 per MWh, renewables come in at just \$41 per MWh.<sup>28</sup>
25. That's why renewables supplied 40% of UK electricity in 2021<sup>29</sup> and a quarter of US electricity during the first half of 2022.<sup>30</sup> All this, because utility-scale renewables can be built on time and to budget.
26. With a former UK Govt. Investment Minister noting that North Sea wind power will be more valuable to the UK than the oil and gas industry,<sup>31</sup> there's no-one left to dispute the fact that UK net-zero heavy-lifting will be done by renewable energy.
27. As recent Oxford University<sup>32</sup> and UCL research notes, utility scale renewable systems are comfortably the cheapest and most effective form of electricity production and CO2 mitigation, with UCL stating that *"the current favourable UK Government policy towards nuclear is becoming increasingly difficult to justify."*<sup>33</sup>
28. As for the idea that renewables are too variable to hack it, McKinsey & Co. leading international consultants to governments, corporations and institutions say renewables are on track to dominate new electricity supply for global energy markets.<sup>34</sup> The reality is, it's entirely possible to sustain a reliable electricity system based on renewable energy.<sup>35</sup>
29. It's not just that nuclear is slow and expensive – it's far too inflexible to ramp up and down with the swings of demand. In contrast, the variability of wind and solar technologies can more easily be integrated into evolving, flexible electricity grids. If there's one thing that half of French nuclear reactors offline proves, nuclear is deeply intermittent.
30. Not forgetting the lowest hanging fruit – energy efficiency. Reducing the UK's overall energy demand is at the heart of a fair, affordable, and sustainable net-zero.<sup>36</sup> The UK Centre for Research into Energy Demand Solutions has done the most comprehensive assessment to date, and it turns out that our

---

<sup>27</sup> <https://ember-climate.org/press-releases/eus-record-growth-in-wind-and-solar-avoids-e11bn-in-gas-costs-during-war/>

<sup>28</sup> <https://lazard.com/media/451881/lazards-levelized-cost-of-energy-version-150-vf.pdf>

<sup>29</sup> <https://www.businessgreen.com/news/4053954/official-renewables-provided-cent-britains-electricity-2021>

<sup>30</sup> <https://www.eia.gov/todayinenergy/detail.php>

<sup>31</sup> <https://www.thetimes.co.uk/article/growth-in-north-sea-wind-farms-will-eclipse-value-of-oil-and-gas-bgk6vxs08>

<sup>32</sup> [https://www.cell.com/joule/fulltext/S2542-4351\(22\)00410-X](https://www.cell.com/joule/fulltext/S2542-4351(22)00410-X)

<sup>33</sup> <https://discovery.ucl.ac.uk/id/eprint/10156347/>

<sup>34</sup> <https://www.mckinsey.com/~media/McKinsey/Industries/Oil%20and%20Gas/Our%20Insights/Global%20Energy%20Perspective%202022/Global-Energy-Perspective-2022-Executive-Summary.pdf>

<sup>35</sup> <https://e360.yale.edu/features/three-myths-about-renewable-energy-and-the-grid-debunked>

<sup>36</sup> <https://www.creds.ac.uk/publications/energy-demand-reduction-options-for-meeting-national-zero-emission-targets-in-the-united-kingdom/>

energy use can be hugely reduced, maintaining energy security and quality of life.<sup>37</sup>

### Evidence-based policy

31. With millions struggling under the cost-of-living and energy crisis, effectively stuffing huge sums of public money into the deep pockets of nuclear corporations under RAB won't look good to people, policy, and press.
32. In terms of cost, time, and do-ability – it's renewable expansion in all sectors, energy efficiency and management, rapidly advancing storage technologies, grid modernisation, interconnection, and market innovation from supply to service provision that will power the UK net-zero energy transition.
33. The weight of evidence shows that due to the pace, scale, and economics of the renewable evolution, all nuclear can do is make promises it just can't keep.

*February 2023*

---

<sup>37</sup> <https://www.creds.ac.uk/wp-content/uploads/CREDS-Role-of-energy-demand-report-2021.pdf>