# Written evidence submitted by the Claverton Energy Group

On the 20th July 2022, the UK Government gave the go-ahead for the development of the Sizewell C nuclear power plant. The plant is being developed by the French state energy giant EDF at an initial expected cost of £20bn, and the company claims it will generate about 7% of the UK's electricity needs and operate for 60 years [1].

The move has prompted the Claverton Energy Research Group, an elite and independent European energy think tank, to publicly join the large and growing number of scientists, academics, energy professionals, and campaigners in opposing new nuclear development on purely economic grounds. The move is particularly unusual as the group has continuously debated energy technologies and energy policies online for 20 years and so does not have unanimous agreement on nuclear power or any other energy technologies and policies however, many of its members are of the view that the economic case against nuclear power is now so strong that the group should intervene in the public discourse. The think tank is composed of over 100 highly experienced engineers, scientists, and academics who have worked in the energy field (nuclear, renewable energy, low energy housing, heat pumps, district heating, transport, electrical grids, power stations, energy politics, etc) often for their entire careers, who are invited to join in recognition of their substantial contributions to their fields.

The turning point in the group's discussion comes from research by Prof Mark Barratt at University College London (UCL) who has modelled the comparative costs and performance of nuclear and renewable power, using hour-by-hour wind and solar data and 35 years of weather data. Prof Barratt said, *"Nuclear power is more expensive and slower to build than renewables, particularly offshore wind. 7 GW of wind will generate about 40% more electricity than Hinkley at about 30-50% of the cost per kWh and will be built in half the time. Neither wind nor nuclear plant operates all the time, so both will need backup. Modelling shows the total cost of a renewable generation to be less than nuclear and to be just as able to provide continuous power even with wind and solar droughts."* [2]

David Andrews, C.Eng. M.Inst Energy, who was an invited expert on power generation for the EU's Energy Research Labs and is Chair of the Claverton Energy Research Group said *"Sizewell C is an ill-advised investment because when analysed proven renewables:- wind, solar, storage and low carbon wind-drought back up in combination in detailed are much cheaper and more reliable than nuclear energy and can be built in about 1/3 the time"*.

The latest research by members of the group and others shows that so-called "baseload generators" such as nuclear power plants are not needed in an all-renewable future and their use will almost certainly increase overall costs to consumers. The 'baseload argument', which can be summarised as the need for a minimum consistent level of electricity supply to the grid, has long been used as an argument in favour of nuclear power. However, proponents of renewable energy argue that this argument is not only technically out of date, for example as demonstrated by Scottish Power's achievement of a 'black start' of the grid from wind power in 2020 [3], but also that continued development of nuclear power will add substantially to household energy bills and drive even more people into fuel poverty.

Dr Keith Baker FRSA, a Research Fellow in Fuel Poverty and Energy Policy at Glasgow Caledonian University, Convenor of the Energy Working Group at the Scottish 'think and do' tank Common Weal, and a member of the Claverton group, said, *"Building new nuclear plants will only exacerbate*

*fuel poverty. Any talk of a nuclear renaissance, particularly when spiralling energy prices are pushing more and more households into fuel poverty, smacks of desperation from an industry that should already be consigned to the dustbin of history. It's a simple case of buy now, pay now, pay even more later."*

Dr Paul Dorfman, another member of the Claverton group and Chair of the Nuclear Consulting Group, raised further concerns, saying, *"The central message, repeated again and again, that a new generation of nuclear will be clean and safe is a fiction. The reality is nuclear is an extremely costly and inflexible technology with the potential to cause significant harm. Not forgetting that coastal nuclear is at ramping risk from climate-driven sea-level rise, storm surge and flooding – with the nuclear industry and regulatory mitigation efforts becoming increasingly obsolete."*

The results of detailed modelling conducted by Prof Barratt and other researchers show that [4-11]:

- The continuing fall in wind and solar energy costs, along with cheaper storage of heat and power means that an entirely renewable and highly reliable power supply as a replacement for fossil fuels for heating and transport through electrification is available to the UK at a lower cost than any alternative, even when wind and solar droughts (i.e., periods of low wind or solar) or imported fuel hiatus are considered.
- It is a myth to claim that nuclear energy is needed to provide baseload power. This power can be provided by any suitable mix of generators including variable wind and solar if backup sources eg renewable fuelled generators and storage are provided. These costs are allowed for in the Barrett analysis
- Because nuclear cannot readily be turned off for economic reasons, its presence on the grid limits the amount of much cheaper renewables that can be used, as nuclear would have to take precedence over nuclear – thus they increase the total cost by blocking cheaper renewables
- Simulations of the entire power grids needed to sustain the UK, including meeting the demand for electrical vehicles, shipping fuel, heating buildings heating energy, based on up to 35 years of hourly weather data (including several winds and solar droughts/deficits), found that mix of hydrogen-fuelled generators, plus wind, solar, and energy storage can meet the need for baseload power at a substantially lower cost.
- The simulations modelled a huge variety of different mixes of wind, solar, nuclear, heat and power storage, insulation levels, heating systems, district heating, heat pumps, and interconnection to Europe – with a total of 15 different system elements operating in various configurations. The analysis included the costs of the different sources and elements and repeatedly rejected nuclear from the mix as it increases costs without increasing reliability.
- The simulations also show that hydrogen heating for buildings is roughly twice as expensive as individual heat pump solutions and district heating with heat pumps.
- Since wind and solar, is so much cheaper in capital cost and operating cost, even if the attendant costs of storage are included, adding nuclear makes the whole mix of plant and its operation more expensive.
- Even during winter peak demands, all power can come from renewable resources, with the surplus going energy to stores (including powering electrolysers to produce hydrogen), and

during periods of low output from solar and wind (wind and solar droughts), sufficient energy can be withdrawn from those stores.

- Renewable electricity can also be used to drive negative emission technologies so as to balance remaining emissions from hard to decarbonise sectors such as aviation and cement making, effectively making these zero carbon.

The group of experts also note that nuclear power in the UK and Europe has proven to be unreliable, and the nuclear waste problem is essentially unsolved in the UK. French nuclear is currently only 50% available. Furthermore, wind and solar can be built in around 4 years and then function reliably, (albeit varying output with the wind and sunshine) whereas nuclear is notoriously likely to be many years late and over budget. They also point to the fact that the Hinkley C plant is now 10 years late and many recent reactors have had to be taken offline due to faults that take a long time to address – the Chinese version of the technology being installed at Hinkley C has been offline for over a year, since its start-up 3 years ago.

**References**

[1] https://www.bbc.co.uk/news/uk-england-suffolk-62235221

[2] Full quote: "Our careful modelling utilizing 35 years of weather data shows that nuclear power is more expensive and slower to build than renewables. The contract for the Hinkley C nuclear power plant provides a Strike Price for the developer of £92.50/MWh (at 2012 prices), but inflation between 2012 and 2022has been around 30% so the Hinkley strike price in today's money is about £120/MWh. Hinkley's initial construction work started around 2015 and is due to start generating perhaps in 2026-2027 – 10 or more years' build time.

A recent offshore wind capacity auction of 7 GW resulted in a strike price of £43/MWh (in today's money) to be built in 5 years and operating in 2027. BEIS project wind costs to continue falling.

This latest 7 GW of wind will generate about 40% more electricity than Hinkley at 30-50% of the cost per kWh and will be built in half the time. Neither wind nor nuclear plant operates all the time, so both will need back-up, though the wind will need more than nuclear, assuming the latter operates reliably our modelling shows the extra cost to the wind of the backup is significantly below the alternative cost of nuclear. And unlike nuclear power, renewables do not pose waste and security problems."

[3] https://www.scottishpowerrenewables.com/news/pages/global_first_for_scottishpower_as_cop_countdown_starts.aspx

[4] Barrett, M, Gallo Cassarino, T, (2021), Heating with steam methane reformed hydrogen, Research Paper, https://www.creds.ac.uk/publications/heating-with-steam-methane-reformed-hydrogen-a-survey-of-the-emissions-security-and-cost-implications-of-heating-with-hydrogen-produced-from-natural-gas/

[5] Relative costs of nuclear, wind gas etc: https://www.lazard.com/media/451419/lazards-levelized-cost-of-energy-version-140.pdf

[6] Gallo Cassarino, T. et al. (2019) 'Is a 100% renewable European power system feasible by 2050?', Applied Energy. Elsevier, 233–234(January 2018), pp. 1027–1050. doi: 10.1016/j.apenergy.2018.08.109.

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[11] Dr.-Ing. Dipl.-Phys. Gregor Czisch Low Cost but Totally Renewable Electricity Supply for a Huge Supply Area. http://transnational-renewables.org/Gregor_Czisch/projekte/LowCostEuropElSup_revised_for_AKE_2006.pdf

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