THE CHEAP ENERGY CAMPAIGN

A CONCISE COMPARISON OF NUCLEAR, WIND AND SOLAR

ABILITY TO MEET DEMAND (2024 /25 figures)

WIND — In 2024 electricity supplied to the grid from wind farms amounted to only **28.2% of grid demand**[1]. There were also long periods (up to 178 hours) when wind failed to meet 20% of demand even though. if operating at full named capacity, wind could theoretically meet 100% of demand.

A recent low point was on 22nd January 2025 at 04:40 hrs when wind produced just 131 MW or about **0.27% of demand.**[2]

SOLAR — Solar is of course not available on dark cold nights in winter when demand is at its peak. Even if we take a look at a whole year the supply of wind to the grid was a very marginal **5.5% of demand**
The World Bank rated Britain 229th out of 230 countries as a place to build solar.

NUCLEAR — Just like natural gas power stations nuclear power can be varied to meet demand. There is a basic misconception that nuclear power can only be baseload. This was true in the past but will not be true in the future. Many modern designs[3] of nuclear reactor will be able to vary their output to meet demand. Typically they are designed so that they can ramp up and down at a rate of 5% per minute from a low of 25% of capacity.

LAND USE

A massive expansion of onshore wind and solar will blight the UK countryside and reduce our ability to grow our own food. Set out below are the comparative land use figures for wind, solar and small nuclear reactors:

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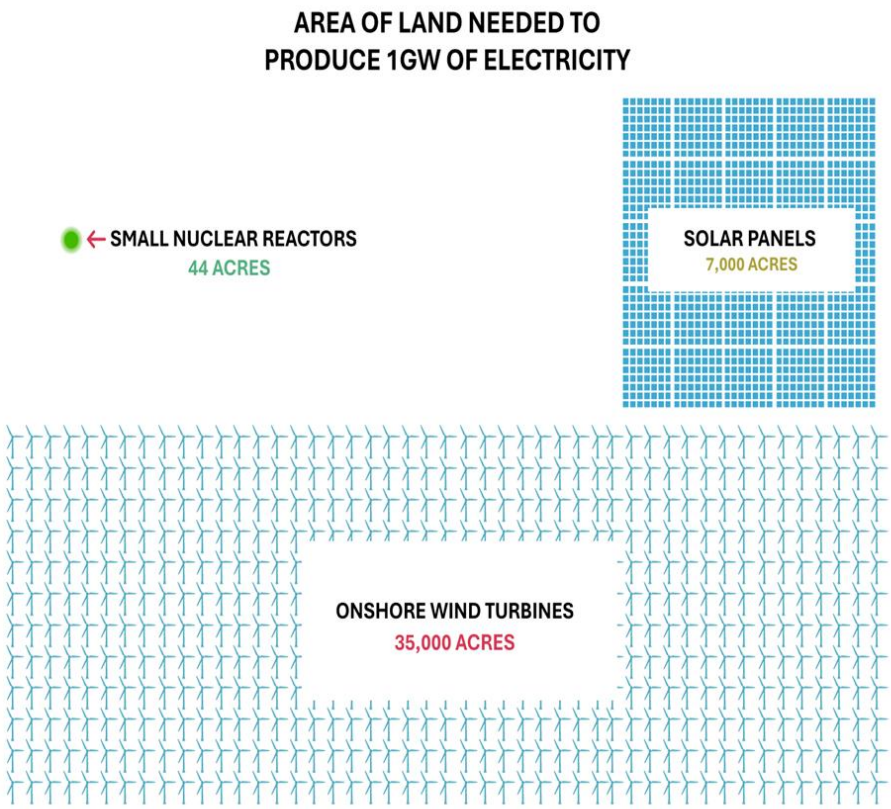
[1] https://data.nationalgrideso.com/carbon-intensity1/historic-generation-mix/r/historic_gb_generation_mix
[2] Elexon BMRS figures produced at five minute intervals.
[3] Terrestrial Energy, Arc Cleantech, NewCleo, Westinghouse eVinci, X- Energy

WIND 55,000 acres per MW

SOLAR 7,500 acres per MW

NUCLEAR 0.25 acres per MW

The comparative footprints are best shown in this graphic. The green spot is nuclear pro-rata in size to wind and solar.



LOCATION

WIND The best wind locations are offshore and far from where electricity is needed. Onshore wind farms can be placed closer to where electricity is needed but produce on average 2/3 less power from the same sized turbine.[4]

SOLAR Solar farms can be located much closer to where power is needed but do not supply much in winter and obviously never at night.

NUCLEAR Modern nuclear designs do not need large quantities of water for cooling and therefore can be placed anywhere even underground or offshore on a ship or floating barge. The Akademik Lomonosov, a

[4]https://assets.publishing.service.gov.uk/media/672270c287df31a87d8c49af/Regional_renewable_electricity_in_2023.pdf

Russian floating nuclear power plant, has been operational since May 2020.

COST

Any realistic comparison between wind, solar and nuclear should take account of the need for back up. The simplest way to do this is to adjust the capital cost by a factor which uses the load factor. (There are more complicated methods using Full System Analysis[5]). The claimed average load factor for offshore wind is at best 42.5% the load factor for onshore wind is at best 28.8%[6], the load factor for solar is 9.7%, the load factor for nuclear is at least 90% and should reach 95% with modern designs. Using these figures the comparative capital cost figures per MW of capacity are set out below. The cost for SMRs is based on volume production.

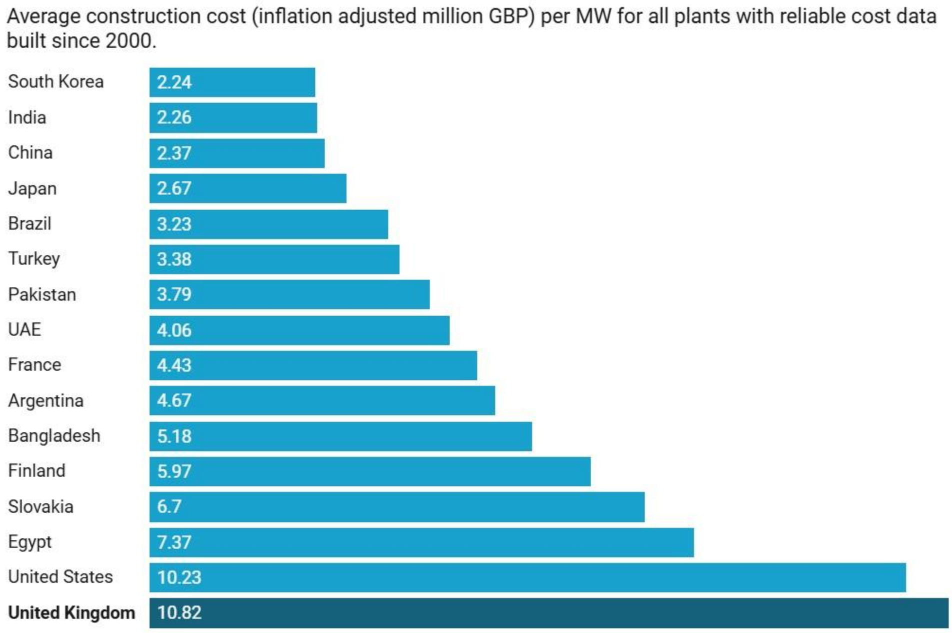
	CAPITAL COST £m PER MW	LOAD ADJUSTED COST PER MW
OFFSHORE WIND	£4.5m	£10.5m
ONSHORE WIND	£2.5m	£8.7m
SOLAR	£0.8m	£8.3m
SMALL NUCLEAR	£2.0m to £4.3m	£2.2m to £4.8m

Even the UK uses some GW scale reactors we ought to be able to build them cheaper as the table below shows.

[5] https://zionlights.substack.com/p/lfscoe-is-the-new-metric-in-town https://www.sciencedirect.com/science/article/abs/pii/S0360544222018035

[6] These figures seem optimistic. In 2024 onshore and offshore wind combined supplied just 28.2% of demand, Source https://data.nationalgrideso.com/carbon-intensity1/historic-generation-mix/r/historic_gb_generation_mix

Construction Costs for Large Nuclear [7]



SAFETY

Nuclear power has the best safety record of any major industry. Deaths in the coal industry are 60 deaths per TWh of electricity produced, deaths in the wind industry are 0.15 deaths per TWh and in the nuclear industry there are 0.04 deaths per TWh [8]. There have been three major nuclear accidents. Three Mile Island (USA) Fukushima (Japan) and Chernobyl (Ukraine). There were no deaths at Three Mile Island and the radiation emitted was only 1.4 mrem [9] i.e. less than that of a chest x-ray (3.2 mrem), There were no radiation related deaths at Fukushima – all the deaths were tsunami related. In the first few months after Chernobyl there were 30 deaths amongst the firefighters and first responders[10]. Longer term there were 15 deaths from thyroid cancers but many of these could have been avoided had iodine tablets been available. There have been many more deaths from li-ion batteries and the emissions from li-ion fires can also be toxic.

Nuclear waste is a manageable problem. The techniques for dealing with nuclear waste have been well proven over the last 70 years. The volume of high level waste is relatively small. A 1 GW nuclear reactor produces 6 cubic metres of waste stored in canisters per year[11]. If the UK's nuclear capacity reaches 75 GW, the amount of high level waste produced annually would be 450 cubic metres the same volume as one medium sized house. (It could actually be less than this since some of the modern SMR designs are nuclear waste burners).

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[7]https://institute.global/insights/climate-and-energy/a-new-nuclear-age
Chart credit : Britain Remade (www.britainremade.co.uk)
[8] https://www.nextbigfuture.com/2011/03/deaths-per-twh-by-energy-source.html
[9] https://en.wikipedia.org/wiki/Three_Mile_Island_accident
[10] https://world-nuclear.org/information-library/safety-and-security/safety-of-plants/chernobyl-accident
[11]https://world-nuclear.org/information-library/nuclear-fuel-cycle/introduction/nuclear-fuel-cycle-overview

CONSTRUCTION TIME

The nuclear industry has a reputation for delivering late and over budget. The recent European construction times for large scale reactors have been in the range 16-18 years[12]. The construction time in Abu Dhabi using Korean AP1400 reactors was 8 years.

However the estimated construction times for Small Modular Nuclear Reactors ("SMRs") will be very much shorter. There are two reasons for this:

(A) GW scale reactors need large amounts of concrete to be poured but SMRs mainly involve metal fabrication

(B) SMRs can be built on an assembly line and shipped to site. A comparison can be made with the way ships were constructed in WW2. Liberty Ships[13] initially took 230 days to construct but using modular construction this was reduced to 21 days (and the fastest was built in under 5 days). The best estimates for SMR construction time if a production line is set up are 24 months [14] to 36 months [15]. More cautious estimates are 4 years[16]. Some companies claim that if there were sufficient demand they could supply 15GW[17] to 20GW[18] of capacity per year. Offshore wind farms typically take 4 years to construct.

CONCLUSION

On every test nuclear is a better solution to meeting demand than wind or solar. The UK could have cheap reliable electricity if, like France, 70% of its electricity supply were provided by nuclear power.

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[12] Hinkley Point 16 years, France 17 years, Finland 18 years
[13] https://www.defensemedianetwork.com/stories/henry-j-kaiser-and-the-liberty-ships/
[14] Terrestrial, Arc Cleantech, Last Energy
[15] Kairos, GE Hitachi
[16] Terrapower, Rolls Royce
[17] Copenhagen Atomics
[18] Thorcon