

U3A Science and Technology Group
Meeting 12 June 2023
Small Nuclear Reactors and meeting the need for power

Originally, Phil Johnson's talk was to be about the design, development and use of Small Nuclear Reactors (SNR) – when the talk was first planned there was a lot of optimism about the devices and plans for major investments. However, everything has stalled in the UK. So, Phil broadened his talk to the need for power and the options available for meeting increased demand.

All current UK electricity generating nuclear reactors are massive, very expensive, bespoke and take decades of planning and negotiation to design and build. SNRs are a small fraction of the size and cost, are standardised designs, built in production lines, and would be located much closer to the areas of high electricity demand. In the UK, Rolls-Royce (RR) is halfway through a 4-year Government evaluation programme for 16 SNRs (4 sites identified so far) based on the very successful design used in nuclear submarines. The programme stalled this year due to funding issues.

The RR SNR is a pressurized water reactor using uranium fuel. Although this technology is very well understood and would be effective, the use of uranium fuel is not optimal for SNRs. Reactors using thorium as fuel have many advantages in terms of simpler design and inherent safety. Large thorium reactors are currently operational, particularly in Canada, so their technology, design, operation and costs are well understood.

In the UK, there is still the need to meet an increasing demand for electricity. A major problem is that the National Grid high voltage distribution network was built around the many coal power stations located close to centres of demand. The major wind, solar, tidal, hydroelectric and large nuclear generators are in remote locations on the edges of the Grid, and wind and solar generators have very variable outputs leading to problems of load balancing on the Grid. Megawatt (if not gigawatt) batteries are needed to smooth out variations. Large installations of lithium batteries have been built recently and pumped water storage (e.g. Cruachan) has been operational for decades. High pressure gas storage in large caverns is being investigated, making use of old mines.

Phil's talk showed that SNRs are part of the solution to increased demand, but there are many issues around implementation and the electrical Grid that need to be solved as well.