The Telegraph

Technology revolution in nuclear power could slash costs below coal

A report by UBS said the latest reactors will be obsolete by within 10 to 20 years, yet Britain is locking in prices until 2060

Scientists have already designed better reactors based on molten salt technology that promise to slash costs by half or more Photo: Getty Images

By Ambrose Evans-Pritchard

9:23PM BST 24 Sep 2014

The cost of conventional nuclear power has spiralled to levels that can no longer be justified. All the reactors being built across the world are variants of mid-20th century technology, inherently dirty and dangerous, requiring exorbitant safety controls.

This is a failure of wit and will. Scientists in Britain, France, Canada, the US, China and Japan have already designed better reactors based on molten salt technology that promise to slash costs by half or more, and may even undercut coal. They are much safer, and consume nuclear waste rather than creating more. What stands in the way is a fortress of vested interests.

The World Nuclear Industry Status Report for 2014 found that 49 of the 66 reactors under construction - mostly in Asia - are plagued with delays, and are blowing through their budgets.

Average costs have risen from $1,000 per kilowatt hour to around $8,000/kW over the past decade for new nuclear, which is why Britain could not persuade anybody to build its two reactors at Hinkley Point without fat subsidies and a "strike price" for electricity that is double current levels.

All five new reactors in the US are behind schedule. Finland's giant EPR reactor at Olkiluoto has been delayed again. It will not be up and running until 2018, nine years late. It was supposed to cost €3.2bn. Analysts now think it will be €8.5bn. It is the same story with France's Flamanville reactor.

We have reached the end of the road for pressurised water reactors of any kind, whatever new features they boast. The business is not viable - even leaving aside the clean-up costs - and it makes little sense to persist in building them. A report by UBS said the latest reactors will be obsolete by within 10 to 20 years, yet Britain is locking in prices until 2060.

The Alvin Weinberg Foundation in London is tracking seven proposals across the world for molten salt reactors (MSRs) rather than relying on solid uranium fuel. Unlike conventional reactors, these operate at atmospheric pressure. They do not need vast reinforced domes. There is no risk of blowing off the top.

The reactors are more efficient. They burn up 30 times as much of the nuclear fuel and can run off spent fuel. The molten salt is inert so that even if there is a leak, it cools and solidifies. The fission process stops automatically in an accident. There can be no chain-reaction, and therefore no possible disaster along the lines of Chernobyl or Fukushima. That at least is the claim.

The most revolutionary design is by British scientists at Moltex. "I started this three years ago because I was so shocked that EDF was being paid 9.25p per kWh for electricity," said Ian Scott, the chief inventor. "We believe we can achieve parity with gas (in the UK) at 5.5p, and our real goal is to reach 3.5p and drive coal of out of business," he said.

The Moltex project can feed off low-grade spent uranium, cleaning up toxic waste in the process. "There are 120 tonnes of purified plutonium from nuclear weapons in Britain. We could burn that up in 10 to 15 years," he said. What remained would be greatly purified, with a shorter half-life, and could be left safely in salt mines. It does not have to be buried in steel tanks deep underground for 240,000 years. Thereafter the plant could be redesigned to use thorium, a cleaner fuel.

The reactor can be built in factories at low cost. It uses tubes that rest in molten salt, working through a convection process rather than by pumping the material around the reactor. This cuts corrosion. There is minimal risk of leaking deadly cesium or iodine for hundreds of miles around.

Transatomic Power, in Boston, says it can build a "waste-burning reactor" using molten salts in three years, after regulatory approval. The design is based on models built by US physicist Alvin Weinberg at Oak Ridge National Laboratory in the 1960s, but never pursued - some say because the Pentagon wanted the plutonium residue for nuclear warheads.

It would cost $2bn (overnight cost) for a 550-megawatt plant, less than half the Hinkley Point project on a pro-rata basis. Transatomic says it can generate 75 times as much electricity per tonne of uranium as a conventional light-water reactor. The waste would be cut by 95pc, and the worst would be eliminated. It operates in a sub-critical state. If the system overheats, a plug melts at the bottom and salts drain into a cooling basin. Again, these are the claims.

The most advanced project is another Oak Ridge variant designed by Terrestrial's David LeBlanc, who worked on the original models with Weinberg. It aims to produce power by the early 2020s from small molten salt reactors of up to 300MW, for remote regions and industrial plants. "We think we can take on fossil fuel power on a pure commercial basis. This is a revolution for global energy," said Simon Irish, the company's chief executive.

Toronto-based Terrestrial prefers the "dry tinder" of uranium rather than the "wet wood" of thorium, which needs a blowtorch to get started and keep going, typically plutonium 239. But it could use either fuel.

A global race is under way, with the Chinese trying everything at the Shanghai Institute of Nuclear and Applied Physics, reportedly working under “warlike” pressure. They have brought forward their target date for a fully-functioning molten salt reactor - using thorium - from 25 to 10 years.

Ian Scott, at Moltex, originally planned to sell his technology to China, having given up on the West as a lost cause. He was persuaded to stay in Britain, and is talking to ministers. "The first stage will cost around £1bn, to get through the regulatory process and build a prototype. Realistically, only the government can do this," he said.

A state-venture of such a kind should not be ruled out. The travails of Hinkley Point show that the market cannot or will not deliver nuclear power on tolerable terms. The project has degenerated into a bung for ailing foreign companies. We have had to go along with it as an insurance, because years of drift in energy policy have left us at an acute risk of black-outs in the 2020s.

There is no reason why Britain cannot seize the prize of molten salt reactors, if necessary funded entirely by the government - now able to borrow for 10 years at 2.5pc - and run like a military undertaking. A new Brabazon Committee might not go amiss.

The nation still has world-class physicists. The death of Britain's own nuclear industry has a silver lining: there are fewer vested interests in the way. We start from scratch. The UK's "principles-based" philosophy of regulation means that a sudden pivot in technology of this kind could be approved very fast, in contrast to the America's "rules-based" system. "I would never even think of doing it in the US," said Dr Scott.

It would be hard to argue that any one of the molten salt technologies would be more expensive than arrays of wind turbines in the Atlantic. Indeed, there is a high likelihood that the best will prove massively cheaply on a kW/hour basis.

Such a project would kickstart Britain's floundering efforts to rebuild industry. It would offer some hope of plugging a chronic and dangerously high current account deficit, already 5pc of GDP even before North Sea oil and gas fizzles out. It is fracking on steroids for import substitution.

Britain split the atom at the Cavendish Laboratory in Cambridge in 1911. It opened the world's first commercial reactor at Calder Hall in 1956. Surely it can rise to the challenge once again. If not, let us cheer on the Chinese.