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China lead in thorium research may bag it prize for clean, cheap, safe nuclear power [2]

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Princeling Jiang Mianheng, son of former leader Jiang Zemin, is spearheading a project with a start-up budget of $350m. He has already recruited 140 PhD scientists, working full-time on thorium power at the Shanghai Institute of Nuclear and Applied Physics. The aim is to break free of the archaic pressurised-water reactors fuelled by uranium - designed for US submarines in the 1950s - opting instead for thorium reactors that produce far less toxic waste and cannot blow their top like Japan's Fukushima plant.

"China is the country to watch," said Baroness Bryony Worthington, head of the All-Parliamentary Group on Thorium Energy, who visited the Shanghai operations recently with a team from Britain's National Nuclear Laboratory. "They are really going for it, and have talented researchers. This could lead to a massive breakthrough."

The thorium story is by now well-known. Enthusiasts think it could be the transforming technology needed to drive the industrial revolutions of Asia.

At the least, it could do for nuclear power what shale fracking has done for natural gas - but on a bigger scale, for longer, and with near zero CO2 emissions.

The Chinese are not alone. Norway's Thor Energy began a test last month with Japan's Toshiba-Westinghouse to see whether they could use thorium at the conventional Halden reactor in Oslo.

The Japanese want to go further, knowing they have to come up with something radical to regain public trust. Japan's International Institute for Advanced Studies (IIAS) - led by thorium enthusiast Takashi Kamei - is researching molten salt reactors. The Chinese aim to beat them to it. Technology for the molten salt process already exists. The Oak Ridge National Laboratory in Tennessee built such a reactor in the 1960s.

It was shelved by the Nixon Administration, when the Pentagon needed plutonium residue from uranium to build nuclear bombs. The thorium blueprints gathered dust until retrieved by former Nasa engineer Kirk Sorensen. The US largely ignored him: China did not. Jiang - who says China's energy shortage is becoming "scary" - visited Oak Ridge in 2010 and obtained the designs.

His team concluded that a molten salt reactor may be an answer to China's prayers. They plan to build a 2MW plant using liquid fluoride fuel by the end of the decade, before scaling up over the 2020s. He estimates that China has enough thorium to power its electricity needs for 20,000 years. So does the world. The radioactive mineral is scattered across Britain. The Americans have buried tonnes of it, a by-product of rare earth metal mining.

The beauty of thorium is that you cannot have a Fukushima disaster. Professor Robert Cywinksi from Huddersfield University, who anchors the UK's ThorEA network, said the metal must be bombarded with neutrons to drive the process. "There is no chain reaction. Fission dies the moment you switch off the photon beam," he said.

"People are beginning to realise that uranium isn't sustainable. We're going to have to breed new nuclear fuel. If we are going to the trouble of breeding, we could start to use thorium instead," he said.

Thorium has its flaws. The metallurgy is complex. It is "fertile" but not fissile, and has to be converted in Uranium 233. Yet it leaves far less toxic residue. Most of the mineral is used up

in the process, while uranium reactors use just 0.7pc. It can even burn up existing stockpiles of hazardous waste. Cambridge scientists published a tantalising study in February showing that it is possible to "achieve near complete transuranic waste incineration" by throwing the old residue into the reactor with thorium.

In other words, it can help clean up the mess created over the last half century instead of transporting it to be encased in concrete and buried for millennia. It is why "greens" such as Baroness Worthington - a former Friends of the Earth activist - are embracing thorium.

The thorium molten salt process takes place at atmospheric pressures. It does not require vast domes, so costly, and such an eyesore. You could build pint-size plants below ground, powering a small town the size of Tunbridge Wells or Colchester. There would be shorter transmission lines, and less leakage. The elegance is irresistible.

Sorensen says his group Flibe Energy is exploring 250MW reactors that could be tailor-made to power a single steel plant. They never reach critical heat. In an emergency, a plug melts and the salts drain into a pan. "The reactor saves itself," he said.

Major players in the nuclear industry have had a vested interest in blocking thorium. They have sunk huge costs in old technology, and they have bent the ears of cash-strapped ministers.

But this cannot go on forever. The cost fiasco of Areva's Olkilouto reactor in Finland should have cured them of any illusions.

China's dash for thorium is now changing the game. Britain has begun to hedge its bets. Chief scientific adviser Sir John Beddington said in September that the benefits of thorium are "often overstated" but conceded "theoretical advantages" in sustainability, toxic waste, and proliferation risk. He noted rising global interest. "It may be judicious for the UK to maintain a low level of engagement in thorium fuel cycle research."

Xu Hongjie, director of Shanghai's project, says the US energy department has begun to take a close interest in China's plans and is now seeking a tie-up. You can view it as a technology race or a joint venture in the common interest. It hardly matters.

If the Chinese can crack thorium, the world will need less oil, coal, and gas than feared. Wind turbines will vanish. There will be less risk of a global energy crunch, less risk of resource wars, and less risk of a climate tipping point.

Who can object to that?

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