



## Industrial decarbonisation – can SMRs save British Industry?

### Minutes

The meeting took place in Room P, Portcullis House between 1pm and 2pm on Wednesday 15<sup>th</sup> May 2024.

#### Parliamentary Attendees

- Virginia Crosbie MP
- Lord Whitty
- Lord Grantchester
- Viscount Trenchard
- Trudy Harrison MP

#### Other attendees included:

- Ruth Coleman, Civil Nuclear Constabulary
- Jack Clappen, Field Consulting
- Harriet Kaye, Lodestone Communications – X-energy
- Ben Russell, Lodestone Communications
- Tris Denton, MoltexFLEX
- Evan Byrne, Madano
- Biplab Rakshi, East of England IoD, also runs Atomic Acquisitions
- Amanda Moslé Friedman, IP3 US energy and security
- John Thompson NIA
- Daniel Paterson, Make UK Modular
- Chris Pook, Nuclear AMRC
- Michael Jenner, CEO UK, Last Energy.

#### Apologies

Chi Onwurah MP, Lord Moynihan, Sukhbinder Singh (Frazer Nash), Michelle Brechtelsbauer (Last Energy).

The session focussed on the role of nuclear and SMRs, and in particular, on industrial decarbonisation.

**Synopsis:** Many high-energy UK industries are facing increasing challenges in meeting carbon reduction requirements and sourcing energy at globally competitive prices. With the UK's steel industry moving away from raw steel production entirely, can ASMRs fulfil the need for low cost, carbon free energy for industrial users?

#### Leon Flexman, Corporate Affairs Director, X Energy

X-Energy was the designer of high temperature gas reactor XE100 80Mw electric 200 mw thermal pebble bed. It used TRISO-X fuel which was invented for the pebble bed reactors around in the 1960s and pioneered in the UK. The pebbles are small enough to go in a pocket.

LF handed around a billiard ball pellet, for attendees to hold



The advantage of TRISO-X was that fission products could not escape. Furthermore, TRISO-X could not melt. It would cool down on its own. Hence it was passively safe fuel. The plan was to use the electricity and the heat from the reactors in industrial clusters. TRISO-X-powered reactors could generate steam at 565 degrees – this was higher than light water reactors. The XE100 could therefore decarbonise process steam, hydrogen, ammonia, or synthetic aviation fuels. X-Energy was focused on this as a deployment opportunity in the UK.

X-Energy had a project in the US with £1bn Department of Energy (DOE) backing. It was a customer, site and project for Dow Chemical, and consisted of a 4,000-acre chemical plant which needed decarbonising. Dow also required reliability. It could not afford interruptions. The aim was to replace gas combined heat and power (CHP), as renewables don't give the same degree of reliability. X-Energy was building a four-pack of reactors; 2 units of electricity and steam, in the configuration they needed. Whilst they are there, the reactors would also put electricity into the grid in Texas

Consequently, the first project in the UK would be the first of a new kind. This is a huge head start.

Turning to the UK, X-Energy thought that there is an opportunity to deploy in industrial clusters. They are looking at starting in Hartlepool. This was already on a national policy list for nuclear. They hope to have further sites. There was also a grid connection there, which could be inherited so could sell to the grid and to the Teesside industrial cluster. There was demand for heat for hydrogen, and for process industrials.

Hartlepool's EDF-run advanced gas reactor was slated to close. There were many synergies and similarities between the technologies at the existing site as in the new site. This was a fantastic opportunity.

There was an enormous opportunity for UK companies to be involved, since 80% of value of the project flows to UK companies. Nuclear island has an existing supply chain, but then there were a lot of off-the-shelf materials which could be provided by others. We are currently looking for regulatory engagement to get the design licenced. Also interested in the siting process and the policy statements. We wanted to come to arrangement with EDF for access to the land in Hartlepool.

**Simon Barber, UK Managing Director, Assystem**

Assystem were consulting engineers, designers and digital consultants. The firm was technology-agnostic. Assystem supported a number of SMR and AMR companies in the UK and internationally.

Could SMRs and AMRs fulfil the need for low cost zero carbon? There were over 75 different designs being developed globally. Some could be seen as solutions looking for a problem. However, there were also a number of very credible designs. Whether it was onsite baseload, heat and process heat or the production of electricity. There was a need amongst heavy energy users for this technology across the industrial landscape in the UK.

Wherever there UK went to next with hydrogen, there was also a pathway for the hydrogen sector in the UK. We have worked in "SMR land" since 2016, at the pace at which the UK was moving. There had been early challenges, in terms of routes to the market, to secure funding. This took 4 years for RR. There had been an acceleration in the last 18 months. GBN were working really hard and "at pace" to conclude the SMR competition.

As part of the supply chain, it was vitally important this concluded quickly. There was a need for SMR and three – no more than four – AMR technologies. It was like asking a team with a squad of



40 players. The supply chain was being diluted at the moment. There were any number of SMRs and AMRs. This dilution means that the expertise is needed to focus on 1 or 2 technologies that can come quickly to market. There was a need to move at pace on technology selection.

In terms of routes to markets, those firms had different financing models and approaches and aspirations in terms of the supply chain. Flexibility was required in terms of routes to the market to happen. There was a need to keep accelerating and moving at pace.

**Viscount Trenchard (VT):** was a supporter closing the fuel cycle – could TRISO be recycled?

**LF:** TRISO sat within the technology in the UK not to have a closed cycle. One of the workstreams was to manage the base fuel.

**VT:** Could it not be cracked open and recycled?

**VC:** asked about green taxonomy

**LF:** X-Energy had raised £1 billion in private capital. They are looking to raise funding through a vehicle. There was a general appetite. All nuclear projects in the UK needed a government partnership.

Looking at revenue support similar to RAB for X-energy for heat as well as electricity; if there was a possibility to use expertise in GBN. Or indeed GBE if there was a change of government.

The Government would have a role to play in the pre-financial investment decision. Co-founding had been offered for SMRs in the GBN competition. This might leverage more private investors to come in earlier. These were a few billion for a four pack at this stage.

**Trudy Harrison MP (TH)** – keen to understand from X-Energy and from Assystem about the role for the national grid. She had recently had a devastating meeting with national grid, where they set out the challenges of Net Zero, i.e. Cumbria generates 20GW but only uses half a GW. There was a lot of generation in Cumbria, but fewer users. This meant that there was a lot of opposition to unsightly pylons. Only 17% of energy was electricity, the rest was transport and process heat.

**TH:** asked how firms found working with the national grid?

**LF:** national grid connection and also looking at offtakes for the heat. There were people who were interested in private wire agreements, as well as grid connections. There were also developers who had secured grid connections, and were then looking for projects to deliver against. This needs to be joined up, so that supply matched demand, and grid reinforcement took place where it was necessary. Nuclear stations typically have a 60-year lifetime. Have 800 lb gorilla of Dow Chemical so lower risk but also a grid backup. So, the question was whether connection was through private agreements, so relying on customers.

**SB:** the challenge of national grid had paled into comparison. Historically, there was a grid system connected for generating from coal in the north and flowing down in the south. Now there was a hugely complex system of renewables and intermittent power. This made system design very difficult. Leon's point was absolutely valid. SMRs could look to existing nuclear sites with grid connections in place and there were opportunities to upgrade and rewire these. The use of the T Pylons to minimise the visual impact had been successful.



Similarly to Dow Chemical putting the power close to the site minimised the connection requirement. There were already large feeds coming in, so they could export.

**Lord Grantchester:** thought that the TRISO fuel was an impressive pellet. What was the difference between TRISO and HALEU?

**LF:** HALEU or High-Assay Low-Enriched Uranium was the TRISO feedstock. Low Enriched Uranium (LEU) was low enriched uranium 10% enriched with uranium 235. High-Assay was up to 20% enriched. This meant they could be used for different purposes. HALEU was used in advanced fuels such as TRISO.

**SB:** GBN remit in the short term was around gigabit scale, and SMR. In terms of the current funding through AMR for DESNZ, these were not as mature technologies, so it is right to have more AMRs in the mix before that once selection took place. With high temperature gas, the UK had 60 years' experience of operating. The relationship and collaboration with Japan, to explore how their reactor operating since the 80s could be adapted and licensed to work in the UK. This also presented a fast-track opportunity for high temperature gas in the UK.

**LF:** the government has come a long way since the terms were set for SMR last year. Light water SMRs were the quick off the block. However, the likes of X-Energy had demonstrated that some of the AMRs were more mature than understood, and there was under-deployment in the US. The founder put money into technology developed by the UK government, including its investment in the South African pebble bed reactor. If we had a technology capable of delivery in that time frame, then this would be the fast track in the UK. Looking at even higher temperatures in future could ensure delivery of more benefits.

The other big step forward as part of fuel was the government's investment in URENCO at Capenhurst. It showed the government was serious about advanced reactors. Previously, the source of HALEU was primarily Russia. The UK was now ahead of the US. Low Assay enriched uranium was fabricated into TRISO, or TRISO could be made in the UK, given the expertise found in the UK. So, this would give X-Energy and the UK export possibilities.

**VT:** Could Springfield produce the TRISO?

**LF:** cannot really know

**John Thompson (JT) NIA** – to what level have local relations been built with Metro Mayors, etc? How much have you worked with local metro mayors to bring forth their opinions?

**SB:** - Being tech-agnostic means building relations amongst all.

**LF:** – have never had stronger public opinion; polling on acceptance was very positive. Should caution taking for granted nuclear in non-nuclear areas. Just in the last month there had been engagement with the Welsh Government. Ben Houchen was very much up for this, as were those in other industrial clusters. There was a need for political leadership. In the early 2000s, advocacy by politicians had led the way and both Virginia and Trudy had been strong advocates.



This was true of fusion too. Therefore, people had been nervous about this. Now people saw fusion as a great scientific endeavour giving global leadership and offering employment for generations.

**VC:** Suggested that attendees watch the Oliver Stone SMR movie

**TH:** big shout out to the NIA. When things were going well, it had not been difficult to sell. However, when a difficult incident happened, you would be hard pushed to get politicians to stick their head above the parapet.

On Zaporizhzhia, the NIA and Dr Tim Stone CBE, NIA Chairman, had produced a briefing. We would encourage everybody with the knowledge and experience in the industry to reach out and provide advice, lines to take etc. Politicians really struggled at times.

**TH:** Sellafield had become good at getting to the crux of the issues and those outside the industry had found this very helpful.

**LF:** there was also a major task for project delivery in local communities. The biggest complaint in Wylfa and Hartlepool was why had things not moved faster. Even with SMRs, we will see local complaints, just as we would with any other form of infrastructure. This was something not to lose sight of.

**Biplab Rakshi (BR)** challenging embedded generation or should be backing technology already backed by funding?

The Ultra Safe Nuclear Corporation's Generation IV High Temperature Gas Reactor had received £22.5 million from DEZNES to push forward this design.

**BR:** asked if there was going to be government backing for others?

If Government had already incentivised things, it was good to take part in the competition. Simon Bowen or Andrew Bowie were consistent in seeking private sector involvement. Finland is 70% cheaper to build in, etc. When speaking to Charlotte Vere, there were still massive delays on green taxonomy in treasury. "Both" was the simple answer.

**VC:** the government was putting all the building blocks in place for private investment. The nuclear roadmap, and the Wylfa purchase, look set to take the uncertainty out of the market. This fact meant that GBN and the nuclear minister demonstrated government commitment, but the private sector needed to do it as part of the deal.

**TH:** a red flag was when we met with companies, but we could still do with treasury support. DESNEZ lacked some checks and balances.

**BR:** Government are having to facilitate it; did this allow others to get involved?

**TH:** How does X-Energy work in US?

**LF:** what was the funding for the rest of the capex after DOE? Funding had been £1.2 billion from DoE. This was significant funding to get up and running, and X-Energy had match-funded. There was an escalating amount of interest from investors and customers in the US. Another project, Energy North West, wanted 12 reactors for flexible electricity. There had been the plan to list on



the US stock exchange. So, X energy was raising money through capital fundraising. On the general point: if I was an investor, I would be looking at how I could de-risk the investment and make a return. All of these counted in the de-risking side of the ledger.

Or else an investor could come in at the back end, like a pension fund dependent on the level of risk or the level of return.

The UK government was putting up a few million pounds. But the first project was a few billion pounds, so some sort of partnership for the first-of-a-kind was important.

**BR:** tax incentives and loan guarantee had a part to play, which the UK currently lacked. Regulatory hurdles were streamlined, and would reduce return time. Hence investors would get their money back. Waiting 10 years did not work for the commercial worked. So, if policy makers could facilitate this and amplify it, then that would help get the funding.

5/10/30/ 300 mw capacity don't have to apply in multiple jurisdictions.

**TH:** had a particular problem in the UK with using energy or pink hydrogen as an environment minister in DEFRA; layer upon layer of planning with policies. But we have the most protracted planning system in the world, while also having one of the most depleted ecosystems, with the challenge of a small island.

When you try and unpick that, you get accused of "attacking nature". There was a resistance to removing restrictions. There was a huge amount of scepticism about anything nuclear.

Asked Julia Pyke from Sizewell – wanted to front load the information, rather than following the existing system. Green NGOs thrive on hate, and this drives membership.

There are too many people who worry about the waste and have perceptions about safety. Some conflation defence and energy. Steven's point about the circular economy was important. The waste remained a fear, even when talked about the waste and its volume. Conversations at the APPG were preaching to the converted.

Destination nuclear was a great programme.

**Daniel Paterson (DP) Make UK:** had hesitance towards nuclear started to shift. Was opposition softening?

**TH:** there had been a sea change in attitudes with the cost-of-living crisis, and Putin's actions, and the need for energy security. The UK had come a long way.

**DP:** had there been a reduction in numbers of those implacably opposed? The numbers were still there. However, their business model needed to object to nuclear to secure their members. Greenpeace and Friends of the Earth were very opposed and incredibly well funded and active with their judicial reviews.

**VT:** geological disposals going nowhere. Was there an attenuation of the effort?

**TH:** wanted the GDF in Sellafield. There were two of the three sites in Copeland. There was a great deal of community acceptance. At the moment most schools and community groups were very supportive.



**Evan Byrne, Madano:** Nuclear Waste services, the work was ongoing.

**BR:** the fact that the nuclear industry liked speaking to itself was an issue. As chair of the IoD, I represented 3,000 firms in the east of England who don't get much engagement with the nuclear fraternity, even through pro-zero carbon. The comment from our members was "Where is the cost?" and "When can I get it?"

The commercial bits were important.

**Chris Pook:** look at tier 2, and three firms work across multiple engineering sectors and making that bridge. Need to give a clear signal on the supply chain.

**VC:** this was an action for the APPG - to get a clear signal on the supply chain. Had 6 things we wanted to achieve. Have a list of the top six priorities and push for those. The Green Taxonomy was top!

**Amanda Moslé Friedman, IP3:** listening to the opposition in changing the narrative – room for everybody. Raising the profile of nuclear was universal. Renewables could hurt the environment for a lot of reasons.

**TH:** reduced cable mileage and project land take nuclear was massively advantageous. The UK was already so nature-depleted, due to loss of habitat. 70% of UK land was farmed. Meanwhile, the NDA estate was 5,000 hectares. This was a small for the amount of electricity produced.

**TH:** had taken nuclear to DAVOS in 2022 and were welcomed. There were ways to change attitudes.

**Meeting closed at 2pm**