

Paul Tes: Thank you for joining me. I'm your host Paul Tes. And on this episode of [IF 00:00:17] win, we explore the topic of small and advanced modular reactors and the role they play in the promotion of clean energy with me today are Rich Deakin, UK research and innovations, industrial strategy challenge fund, low cost nuclear challenge [00:00:30] director and Andrew Bailey, sales and strategy lead for Jacob's Critical Mission Solutions, international technology and innovation business, Rich and Andrew, thank you both for joining me today. To start our discussion. First question is for you Rich, you have a background in clean energy in the UK and the USA prior to your work with the UK government first with the department for business energy and industrial strategy and then with UKRI, could you give our listeners an insight [00:01:00] into how you've seen the clean energy landscape over the past five years?

Rich: Sure Paul and thanks for the opportunity to be recorded and speak, looking forward to it. So what I might say is it's kind of been circular in one respect, a slow boom, but slowly accelerating, no pun intended. So I'm going to go little bit further back than kind of five years and say the UK's been on a trajectory [00:01:30] towards decarbonization and recently calling it net zero since around 2007. In June 2019, we moved to the UK net zero target, which is a hundred percent really reduction in net emissions, both emitters and reduction in terms of what's already out there. So emitters and users by 2050, again, relative to the 1990 levels. The other thing you've seen in the landscape [00:02:00] is a huge increase in people interested in taking a slice of that challenge in terms of industrial technology.

The landscape really started to shift in the UK with a publication that I draw people's attention to called market framework for financing small nuclear, which the UK government published in 2018, that document was drafted by an expert group called the Expert Finance Working Group, which is essentially a bunch [00:02:30] of financiers or a group of financiers who knew nothing about nuclear, but they were asked the question, could small nuclear attract private investment? And happily the answer was yes, given certain conditions and essentially that really set yeah.

That shifted the dial put certainly in the UK where we start to say, okay, so there's a different delivery model, there's a different risk profile, there's a different economic model. Small nuclear can now compete with large nuclear. And [00:03:00] really it's been on an upward trajectory ever since then, lots and lots of people are working on this. It's been recently reinforced with the energy white paper powering net zero, which signaled the UK wanting to step forward into small module reactors. Talk about that slightly later on.

Paul Tes: When Rich was talking, he'd mention small modular reactors and then advanced modular reactors. And so for our listeners who may [00:03:30] not be familiar with the differences there, how do they differ from large scale GW reactors and how might they be deployed or used?

Andrew: So keeping it really simple Paul, small modular reactors are as they sound, first of all, they are smaller than [gigot 00:03:47] reactors and secondly, they are produced in a modular fashion in factories so that the installation at site is minimized and therefore

installation time and cost is reduced. Small modular [00:04:00] reactors are typically defined by the International Atomic Energy Authority as being below 300 megawatts in size. In reality, that's not a hard fixed number.

There are small modular reactors such as the UK SMR that Jacobs is involved in co-investing in, which is larger than 300 megawatts. But the use of the phrase AMR or advanced module reactor is fairly unique probably to [00:04:30] the UK government. It's a terminology that was introduced in the UK to recognize that there are what we call generation four reactors, or next technology reactors offer additional benefits beyond the current generation and the UK governments wanted to denote that with a separate name and so called them advanced modular reactors, but essentially they are still small modular reactors just of the next generation. And I think that the key points [00:05:00] about it are small modular reactors essentially, we work together with larger gigawatt reactors. It's not an either or situation. They both complement each other within an electricity network.

Paul Tes: Now, Andrew, to look from the commercial side of things, you've been leading the Jacob's strategy and delivery on small and advanced modular or nuclear reactors since 2016. How have you seen the focus on clean energy develop globally during this time and [00:05:30] how has nuclear featured within this mix?

Andrew: I guess, to build and build upon and endorse what Rich has said. Jacob's nuclear business was involved assisting in the UK government to come up with a kind of a white paper check back in about 2014, that looked at the viability of SMRs if you like small modular reactors within a clean energy mix, in the six years or seven years of the past since then, [00:06:00] I agree totally with Rich that it's almost been a curve that has been increasing very rapidly recently. And I think there've been a number of factors that have all happened together if you like at a macro level, we see the high partner city events such as the like Greta Thunderbird, for example, David [Abra 00:06:22], all those guys in the press are definitely driving policy or thinking behind policy for governments globally.

[00:06:30] In the UK, I think that there is a strong focus at the moment on what is called net zero by 2050. The UK is hosting the COP26 clean energy conference at the end of this year, which is very important on a global basis. We're all seeing electric cars becoming more and more common. It's now a common conversation people think about electric car infrastructure. Five, six years ago that was [00:07:00] much less normal if you like. And I think that the increase dramatically in the take up of renewables, such as solar and probably more so wind actually has helped the conversation with regard to nuclear because people are really realizing that you need a blend of clean energy to achieve the 2050 ambitions. In other words, renewables, such as wind and [volter 00:07:29] solar will [00:07:30] provide energy when the sun is shining and the wind is blowing, but when neither those things are happening, you need base load electricity provided by a clean energy source, which is nuclear power.

Paul Tes: Can you Andrew, describe for us the approach that Jacobs is taking to small modular reactors and advanced modular reactors in terms of focus and investment.

Andrew: Within a business case we've taken a decision over the last few years to invest in the UK SMR which is [00:08:00] a reactor that Rich is the challenge director representing government interest on that development government is providing matched funding into that program. Jacobs has invested to date in phase that program and is now looking at phase two. And that program is a collaboration between UK government and key industrial players to move a design forward to a viable power plant. [00:08:30] So for Jacobs that represents an exciting opportunity, both for investment, but also for technology development, capability development and also enablement of the supply chain for the future if you will.

So we are supporting a number of reactive technologies that the UK government is backing currently. We are supporting the U-Battery by Urenco. We are also supporting the Westinghouse [00:09:00] led past reactor, with a view to the future and with a view to developing skill sets that will be future proof for not just yours, but for decades going forward.

Paul Tes: So, Rich kind of taking a look at like the government perspective here, it's always a difficult balance for a government to make in terms of enabling a market and how to best do this through policy or direct investment. Can you give your view as to how this might be shaped and the factors which are likely to shape this challenge [00:09:30] for the nuclear energy supply chain?

Rich: First of all, there are lots of tech vendors out there want to move forward in terms of progressing technologies design and maturation levels if you like and its ability to come to market. Nobody invests significant money in doing that because developing nuclear products is expensive and complex, whatever the number is, nobody invests in doing that unless they believe there's going to [00:10:00] be a route to market. So the first enabler is the government has to somehow scale the market and say that it's intensely moving forward in the arena. So the energy white paper kind of does that. It's the first signal and the analysis the it is where I drew the five to 15 and the various scales of that market potential. So first of all, is there going to be somewhere to sell your product? Yeah. Now, if you then think about what comes after that, well, you only sell your product if you can deploy it, so you need sites.

[00:10:30] So I think it's then incumbent on the government, in the UK to in terms of enabling the supply chain to come forward with a policy that supports the sighting and reduces the risk of eventual deployment. So you'll probably recall people I'm sure listening to this will be aware of previous national policy statements in the UK that specifically enable or referenced sites for potential reactors. [00:11:00] It's likely to be refreshed and would need refreshing. So government will have to step in to do that. There's another thing which is kind of interesting, which is fundamentally at one of the roots of this and the shift in the thinking here is, who's the customer?. So somebody has to actually be the customer for the unit and the of power. In the UK. That's traditionally been often conflated with the utility and in other regions that's quite easy because a lot of the utilities are these state utilities.

[00:11:30] It doesn't necessarily need to be sold. So if a product can come forward that can deliver power on an economic basis so it can be dispatched into the grid. The national grid for instance, would purchase that to support the UK. A commercial investor could own that, and just basically invest in it as a revenue generating stream, which then gets you into... Well, government's got to show a route and a pathway to how that investment would be recovered. [00:12:00] It might be a contract for difference in the UK, which essentially is a price risk mitigation mechanism. It might be some sort of regulated asset base where the government takes a share of the risk in building the infrastructure. It may be some direct share of that, or it may even be something that's starting maybe to emerge a sharing, building the infrastructure that to deliver the modules or the units. Kind of an interesting way to go.

So [00:12:30] there's a customer side, which the government needs to enable and balance. There's a site policy statements that need to come forward that support to tech vendors and I've mentioned the advanced nuclear fund where it's essentially seed funding and sharing the risk of the development. It's probably less about the magnitude of the funding, Paul, and more about the signal of intent that you are looking to enable the market. It's fairly reasonable. Think that most logical people would say, well, [00:13:00] would the UK government essentially match fund a half a billion pound program to bring forward a small module reactor? If it didn't see foresee itself having to enable a eventual deployment of that either within the UK or abroad and the answer is both.

And finally it has to make access to the regulator available. So in the UK, most people recognize that as an entry point through what's called the generic design assessment, in Canada, it would be [00:13:30] the vendor design assessment. And in the US, it would be the NRC process. In the UK you can anticipate at some point that the generic design assessment process will open up and be available for applicants, for technologies, wishing to be deployed in the UK, and they'll be assessed.

Paul Tes: How big do you see the potential market for SMRs? And when might we see them deployed?

Andrew: So the [00:14:00] potential market now, Rich has talked about that a little bit in his previous dialogue. We were involved in a study back in 2014 that proposed that the potential market for SMRs back in 2014 was about 85 gigawatts. That was very much a sort of [Inriair 00:14:22] assessment. I think at that time, since then, Rich and I have discussed on this podcast, know the fact that the world has moved on quite significantly.

[00:14:30] There's a lot of development in the areas of things like electric cars and other areas. So you can basically say that potential market is probably many multiples of that number, depending on what decarbonization scenario you exactly follow. You know, certainly if you start to, to look at the scenario where electric cars become wide scale by sort of the 2030s, if you start to look at a scenario where [00:15:00] the decarbonization of heavy goods vehicles, for example, is achieved primarily by hydrogen usage and another forms of, for high intensity fuel, for example, then you can see a scenario very

quickly where the amount of clean energy electricity needed is, you know, as many times what it is today.

I think if you look at the type of potential market, it then breaks down into sort of several areas. First of all, [00:15:30] in terms of on grid electricity, SMRs have a place to play with Gigot reactors because when I talk to my colleagues in the infrastructure part of Jacobs, they will very quickly tell me about the fact that you need to balance electricity networks and you need to have an infrastructure that is very balanced and very organized. Clearly that's not my skill set, but deferring to their skill sets. You know, clearly that is something that's very important. So SMRs [00:16:00] clearly can play very heavily into that balance network approach first of all. Secondly, we've seen a move in recent years towards the recognition of the language of clean energy parks and clean energy parks may be defined as entities that would have a range of clean energy sources on that site producing a balanced output potentially with linked high technology entities also [00:16:30] on those same parks.

So I think that is a sort of something that we'll see in the future. I think that I alluded earlier on to the fact that high temperature actors probably will have a part to play with regard to the high heat output and whether they can swing the dial a bit in terms of the adoption of hydrogen from that sort of green clean hydrogen perspective. And also referring to micro reactors we are working with Urenco on the new battery at the moment [00:17:00] that is a high temperature reactor, but it's also a micro reactor. And as the world develops, if we move beyond the UK and look globally, there's a huge world out there that is developing very quickly of the number of remote habitations that exist, but also the number of villages that are becoming towns.

Paul Tes: So Rich in your current role as a UK RI challenge director and the program director for the UK small modular reactor [00:17:30] program, you're aware of the wider challenge for UK RI and the challenges of enabling a specific program such as, the UK SMR. Can you give an insight into how your organization will look to enable technology development in one area of clean energy, such as nuclear to benefit a wider clean energy agenda for the UK?

Rich: So my particular challenge, the SMR challenge sits as one of it's [00:18:00] one of the larger funded programs, one of 20 industrial strategy challenge funded programs yeah. Of which four or five very significant ones are very much targeted at clean growth and clean energy agenda. So the ones that are sitting in there are the industrial decarbonization. So a fellow challenge director of mine, who I work very closely with is leading the IDC, Industrial Decarb Challenge. [00:18:30] There's another one that is transforming foundation industries, which is really interesting. So I work quite closely with the guys running that. I also pull together and work with a challenge director is leading the construction sector challenge, which essentially is looking to change the way that infrastructure is fabricated. So I guess in the round, what we've almost got, there is a cluster of industrial [00:19:00] programs that are running in parallel, but actually you've got synergies and links.

This transcript was exported on Mar 15, 2022 - view latest version [here](#).

Paul Tes: Well, Rich and Andrew, I want to thank you both for a very enlightening, bad pun, but very enlightening discussion today. Really appreciate it and thank you for helping me and our listeners learn more about small and advanced modular reactors. So thank you both very much.