The Nuclear Industry in 2023: A Year in Review and What to Expect in 2024

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There has been lots of ink spilt on the topic of the clean energy transition and on the role that nuclear technology plays in that transition. Promising headlines of imminent progress build excitement for observers and supporters, whose hopes are then dashed with the announcement of the next setback. It is challenging to make sense of where the nuclear industry is headed due to the consistent volatility in the news.

Nuclear energy, although not suitable for all circumstances, will prove to be a pivotal part of the forthcoming clean energy transition. Developing new hard-tech is challenging, and takes time, and money. Fluctuations between successes and failures are a normal part of innovation, although the pace is slower than what one might expect from other sectors such as consumer electronics or software. A disciplined long-term approach and risk minimization on multiple fronts is required. 2023 has seen key developments (and setbacks) in technology, business, domestic and international policy that have added to the growing momentum of the nuclear energy industry on its path towards commercialization. The below list of key events is by no means exhaustive.

Technology

Technology developers have been steadily progressing their designs, while supporting infrastructure is being developed.

On the advanced reactor front, Kairos Power went through hot commissioning of their non-nuclear Engineering Test Unit in Albuquerque, NM. It is the largest Flibe system ever built and it operates at prototypical conditions. In addition, they received a construction permit application for their Hermes demonstration reactor in Oak Ridge, TN from the U.S. Nuclear Regulatory Commission (NRC).[1]

Nuscale's 50 MW reactor module received design certification from the U.S. NRC. However, the Carbon Free Power Project, based on a six-module VOYGR design was cancelled. This was due to insufficient customer subscription and the same inflationary and interest rate pressures that have hit the energy industry more broadly.[2]

Researchers at Idaho National Laboratory completed the design of their MARVEL microreactor and have commissioned an electrically-heated prototype for testing of non-nuclear systems.[3]

Westinghouse, expanding its commitment to its eVinci microreactor, launched an 87,000 square foot microreactor accelerator hub that will be home to engineering and licensing operations, testing, prototype trials, business development and sales.[4]

Centrus produced the first domestic batch of HALEU as part of the HALEU demonstration

project in Piketon, Ohio. It will ramp up production in 2024 as reliable domestic source of HALEU is necessary to fuel advanced reactor designs.[5] In that respect, Oklo signed an MOU with Centrus for supply of HALEU.[6]

On the conventional reactor front, Vogtle 3 became the first new reactor to be connected to the grid in the U.S. in three decades[7], while Barakah 3 was also connected to UAE grid.[8]

In China, Tsinghua University's gas-cooled pebble-bed HTR-PM entered commercial operation[9], while the Shanghai Institute of Applied Physics received an operating permit for its liquid -fueled Thorium Molten Salt Reactor demonstration.[10] This is a reminder that the competition to innovate and deploy nuclear is global.

Business

A flurry of business development activity, domestically and internationally, demonstrates the serious interest in both conventional and advanced nuclear energy.
Westinghouse secured Saskatchewan Research Council as its first customer for its eVinci micoreactor.[11]

X-Energy cancelled its IPO via SPAC due to volatile market conditions .[12] It however raised a significant series C round of $235 million shortly thereafer.[13] Flexibility in business strategy and company financing are important in maintaining momentum in development.

Utilities are including firm advanced nuclear in their integrated resource plans, demonstrating the need for firm clean power as they transition. Pacificorp added a further two Natrium reactors to its Integrated Resource Plan for 2033[14], while Duke included advanced nuclear in a number of its decarbonization scenarios.[15]

Internationally, countries are gearing up to either introduce or expand their nuclear footprint. In Bulgaria, Westinghouse signed a FEED contract for the deployment of its AP-1000 at Kozloduy.[16] Poland issued two decisions-in-principle for a two-unit South Korean APR-1400 and for six SMR sites based on GE's BWRX-300 SMR.[17] In Czechia, EDF, Westinghouse, and KHNP all submitted their bids for newbuild reactors.[18] Meanwhile, Fermi Energia announced the downselection of GE's BWRX-300 for potential deployment in Estonia.[19] Finally, in the Philippines, the country's largest electric distribution utility signed a cooperative agreement with USNC to study the deployment of its MMR.[20]

South Korea has also signed several MOUs with the United Arab Emirates to deepen and accelerate collaboration in the peaceful nuclear sector. Within these MOU agreements, it is specified that the two countries will pursue additional nuclear projects within the UAE or third countries, implying that a joint export model may be developed between South Korea and the UAE for other customer countries in the region.[21] Additionally, KHNP has formed a joint special purpose vehicle with Polish companies PGE and ZE PAK to implement a privately developed nuclear plant based on APR-1400 technology.[22] A legal hurdle to the project was also cleared with the dismissal of the Westinghouse lawsuit against KHNP on export controls grounds.[23] These are just a coupe of examples of multi-country, multiparty collaborative development efforts forming across the industry to better leverage individual expertise and appropriately allocate risk.

Domestic Policy

State initiatives and policies in support of nuclear were in no short supply, demonstrating the growing momentum across the U.S. A few examples are listed below.

Illinois, a state that receives more than half its power from nuclear, repealed its moratorium on nuclear new builds.[24] Wyoming continues to support the deployment of advanced nuclear, with the Wyoming Energy Authority signing a contract with BWXT to evaluate the deployment of its microreactor in the state.[25] Nebraska Public Power District received state funding for an SMR siting study.[26] The Texas Public Utility Commission formed an advanced nuclear working group to delineate an advanced

nuclear strategy.[27] Similarly, a state-backed council was formed in Tennessee to promote nuclear power.[28] Alaska simplified its microreactor siting process.[29]

International Policy

Nuclear energy played a prominent role in national policies for several countries and also led to multilateral cooperation in high-level fora. The most prominent display of support for nuclear energy came at the end of the year at COP28 in Dubai. Twenty-two countries signed a declaration recognizing the importance of nuclear energy and pledged to triple their nuclear capacity by 2050.[30] This was the first time that nuclear was prominently featured at a COP.

In Europe, a nuclear coalition of eleven countries was launched to promote the equal treatment of nuclear under the EU's transition to clean energy. This led to the inclusion of a green label for nuclear-produced hydrogen and support for the deployment of SMRs at a continental level.[31] This is significant because the EU's decarbonization strategy is heavily premised on clean hydrogen.

At an individual country level, the Netherlands, Sweden, U.K. and South Korea declared nuclear power to be part of their national energy policy and committed resources accordingly.[32] [33] [34] [35] Belgium extended the life of two nuclear reactors by ten years, a partial reversal of the previous phaseout policy.[36] Italy has began considering including nuclear as part of its energy mix, a sharp reversal from its previous stance.[37] Ghana and the U.S. signed a support agreement to establish an SMR regional training hub for workforce and capacity development.[38]

However, nuclear energy also played a significant role for Russia and China. Russia signed agreements with Zimbabwe and Ethiopia to cooperate on nuclear energy[39], showing that the race for geopolitical partnership with Africa has already begun with Russia leading in nuclear energy. Russia and South Africa have also signed an MOU for cooperation in nuclear fuel and component manufacturing.[40] These and prior agreements add potential future clients to Rosatom's already significant export orderbook. Meanwhile, China added six new reactors to its construction pipeline, bringing its total under construction reactors to 26.[41] Its significant newbuild program and intended standardization across its fleet to the Hualong One are creating the base for a proven demonstration and export supply chain.

Saudi Arabia has also emerged as a country with civil nuclear aspirations, and it remains to be seen which nuclear vendor will succeed in bidding into this project. Saudi officials have stated that their preference is for the South Korea's KEPCO to build the plant's reactor with the involvement of US operational expertise. Other potential supplier countries include the U.S., China, Russia, and France; the final offerings however will depend on additional issues such as non-proliferation, export control restrictions, and further policy considerations.[42]

Concluding Remarks

Coming out of 2023 and into 2024, it is becoming evident that there is growing momentum for nuclear energy to be a key part of the clean energy transition. There are strong tailwinds both for conventional and advanced nuclear technologies. Technology developers progress in their design evolution and product development cycles and new infrastructure and supply chains are being established. Business development is expanding, whether it be in project initiation, equity investments, or multicompany collaborations. Domestic and international policy are clearing the ground and slowly evening the playing field for nuclear energy to be deployed. Of course, this is not to say that there will not be setbacks along the way. Projects might get cancelled, companies might have to reduce staffing or could even close shop. But from a macroscopic perspective, this is all part of a healthy and growing innovation ecosystem.

With the pledges made at COP28 to triple global nuclear capacity by 2050, significant opportunity remains internationally, both in established nuclear power countries and in new and emerging markets such as the Middle East or Africa. However, given the strong national policy support and commitment to nuclear, the US and its allies are well positioned to retake nuclear export leadership in 2024 and beyond.

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