The U.S. Nuclear Industry: A Look Ahead for 2025

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By Paul Murphy

As we look ahead to 2025 for the civilian nuclear industry, three themes underpin the discussion that follows:

- First, in looking back over 2024, the driving force for the nuclear industry has been the unprecedented demand coming from the hyperscaler / data center / artificial intelligence (AI) arena, as household names that are mega-companies – Amazon, Google, Meta, Microsoft – have jumped into the nuclear industry in a variety of ways, as they seek clean baseload power to support their business needs.

- Second, on January 20th, the former President Trump (Trump 1.0) takes his oath of office to become the new President Trump (Trump 2.0). How Trump 2.0 will view the nuclear industry and current government programs that have supported the nuclear industry – particularly, the Department of Energy's Loan Program Office (LPO) and the Inflation Reduction Act (IRA) – will have a strong influence over the U.S. nuclear industry in the short term.

- Third, the United States, Russia, and China do not play well together, and this current situation will continue in the near term.

1. Triples Are Hard !

- For the 2024 Major League Baseball season:

    - The top 20 home run hitters ranged between a low of 30 home runs and a high of 58.
    - The top 20 doubles hitters ranged between a low of 34 and high of 48.
    - The top 20 triples hitters ranged between a low of 5 and a high of 14.

    In short, hitting triples is hard !

- Chapter 64 of the Tao Te Ching: "A journey of a thousand miles begins with a single step."

At COP28, over twenty countries endorsed a declaration to triple nuclear

energy capacity by 2050. A year later, the Biden Administration announced a domestic energy target of tripling new nuclear energy capacity by 2050.

For the nuclear industry, these pronouncements represent major progress in the public arena. However, to say that tripling nuclear energy capacity by 2050 is hard would be a massive understatement. These pronouncements certainly set both tone and direction, but in order to achieve anything close to 3x, a number of factors need to align:

1. Financing – both public and private – needs to be mobilized at unprecedented levels;
2. Regulatory streamlining and harmonization needs to occur to support rapid deployments;
3. The supply chain needs to ramp up capacity;
4. Labor forces need to be mobilized and cultivated;
5. Viable projects need to be developed and structured; and
6. EPC contractors need to support viable projects (and new entrants in the nuclear sector probably need to be mobilized on the EPC front, even if the E, P, and C are separated).

In looking at the foregoing list, one might say, "*Congratulations, Captain Obvious!*" – however, that would miss the point of this section for two reasons. First, the section heading is about triples, so the main message here is that singles and doubles are pretty good, too. In more plain language, before the nuclear industry worries about achieving 3x, the first wave of projects needs to get done. Getting beyond first-of-a-kind (FOAK) risk is the key to moving down the learning curve and de-risking projects. However, it is also important to note that FOAK risks remain as projects move to new jurisdictions. In addition, it is not at all certain how quickly the industry moves from FOAK to next-of-a-kind and then to the Holy Grail of n^{th}-of-a-kind.

For the second reason, read on …

But, before you do, remember that those hyperscalers need a triple.

2. Nuclear Power Project Development is Hard !

- Psalm 23.4 – Yea, though I walk through the valley of the shadow of death, I will fear no evil, for thou art with me; Thy rod and thy staff comfort me.

- Coolio / Gangsta's Paradise

> *As I walk through the valley of the shadow of death*
> *I take a look at my life and realize there's nothin' left …*
>
> *Power and the money, money and the power*
> *Minute after minute, hour after hour*

The foregoing list in Section 1 notes the importance of structuring viable projects. Not only does an entity have to put all the pieces together and manage them, but it also has to assume project completion risk (both cost and schedule). The risk aspect of nuclear power project development becomes the proverbial "hot potato" that most private actors are unwilling to hold. Thus, if the "market" wants and needs clean baseload power, but private actors view nuclear project risks as a "bridge

too far," then governments can serve that bridging function, but not for all things and for all time.

For nuclear projects, the "Valley of Death" comes in two stages:

- The need for development capital to structure a project and advance it to Final Investment Decision (or Financial Close, take your pick), which will include advance commitments for long-lead items; and

- Construction period risk, in terms of dealing with cost and schedule overruns, necessitating a completion / cost overrun facility (source of funds), noting, too, the inability of EPC contractors to offer lump sum turnkey contracts.

To be clear, while climate change was a major talking point for the Biden Administration, it will not be a major theme under Trump 2.0. Natural gas will rise in emphasis, but the reality is that natural gas will probably also be a bridge fuel as nuclear projects are being scaled to meet demand. Most nuclear projects will take 10 years or better from development to commercial operation, and natural gas will be the most likely gap-filler until nuclear projects come online at pace.

That said, it is difficult to envision a Trump 2.0 that ignores nuclear energy, recognizing several key themes that fit the mindset of the incoming Administration:

1. Energy security as national security;
2. Countering Russia and China in the civilian nuclear export arena (a major theme of Trump 1.0);
3. AI as an engine of techno-economic growth;
4. AI as a national security priority;
5. Creating good jobs;
6. Bolstering American infrastructure and fostering overall economic growth.

The U.S. Government – through the LPO, the IRA, the cost-sharing under the Advanced Reactor Demonstration Program, USTDA funding (for overseas projects), and EXIM's *Engineering Multiplier Program* (for overseas projects) – has been a driving force for nuclear development. The harsh reality is that money is needed in the sector, both domestically and for U.S. nuclear exports, particularly at early stages of project development. Trump 2.0 will need to carefully consider these programs, as they pertain to the nuclear industry, and consider ways that such programs can both continue and be enhanced to achieve a multiplicity of objectives.

Thus, a more nuanced and focused approach might be expected of Trump 2.0, when it comes to the future of the LPO and the IRA. When combined with the unstoppable growth and insatiable energy needs of the hyperscalers, nuclear energy has to be part of the solution (as the only meaningful source of clean baseload power). While it might take some time for government fine tuning of the support mechanisms needed to support a vibrant nuclear industry, the reality is that government support is the one universal theme across the global nuclear

industry, and the United States cannot allow the momentum that has been building over the last year to stall. Trump 2.0 will need to come to terms with market limitations and the need to overcome FOAK and related challenges.

3. The More Things Change, the More They Stay the Same !

- French writer Jean-Baptiste Alphonse Karr: "Plus ça change, plus c'est la même chose"

- Led Zeppelin / The Song Remains The Same

> *Any little song that you know*
> *Everything that's small has to grow*
> *And it's gonna grow, push push, yeah ...*
>
> *Here we go, here we go*
> *All you gotta do, now*
> *All you gotta do, now*

Four completely different messages under this heading.

Message A:

As noted above, the imperative of countering Russian and Chinese civilian nuclear exports was a major theme of Trump 1.0, as evidenced by, among other things, the unprecedented Intergovernmental Agreements (IGAs) with both Poland and Romania. IGA usage continued under the Biden Administration (e.g., Bulgaria), underscoring the bipartisan aspect of this theme, as well as further emphasizing that nuclear energy has had deep and enduring bipartisan support that has spanned multiple administrations.

In sum, Trump 2.0 should mirror Trump 1.0 on the link between nuclear energy and geopolitics. It is also worth noting that the IGA with Romania focused on the Cernavoda nuclear power plant, which hosts CANDU reactors. This U.S.-Canada aspect of the IGA demonstrates that multi-flagged efforts should resonate with Trump 2.0.

Message B:

Those hyperscalers are all publicly traded. They are household names They have all made public decarbonization commitments. They have to answer to their shareholders and have to interact with a broader set of stakeholders. These companies have the ability to look “over the horizon” as they plan for their future needs. And, oh by the way, Trump 2.0 is only for the next four years and, as noted above, a nuclear power project development cycle is, conservatively, ten years. These companies will not hit the pause button for the next four years, recognizing that their nuclear interests are present (e.g., power purchase agreements for available power) and long-term (e.g., support new project development). Further, by making additional investments to support “over the horizon” planning, these companies will establish their own, personal energy security and, in turn, foster their comparative advantages.

Similar to the theme of "keep on keeping on," the rest of the world is focused on Net Zero goals, and a large number of countries recognize the importance of nuclear power in meeting those goals. If the U.S. wants to be relevant in global markets, it will need to provide credible and crafted nuclear solutions for, at a minimum, countries of geopolitical interest to the United States.

Message C-1: (with a special sub-quote)

> AC/DC / For Those About to Rock (We Salute You)
>
> *Stand up and be counted*
> *For what you are about to receive*
> *We are the dealers*
> *We'll give you everything you need ...*
>
> *We're just a battery for hire with a guitar fire*
> *Ready and aimed at you*
> *Pick up your balls and load up your cannon*
> *For a twenty-one gun salute*

Small modular reactors (SMRs) and Advance Reactors (ARs) have been the distinguished guests in nuclear discussions over the last five years (give or take). But now, those vendors have to stand up and be counted by turning technological development into project delivery. Moving from FOAK pricing and scheduling to a de-risked profile will be critical to overall success, as this sub-set of the nuclear industry needs to grow ... and grow quickly ... to meet rising needs of both hyperscalers and hard-to-abate industries (steel, cement, glass, chemicals), with the potential for energy/industrial hub project structures.

Message C-2: (with a special sub-quote)

> Simple Minds / Don't You (Forget About Me)
>
> *Don't you, forget about me*
> *Don't, don't, don't, don't*
> *Don't you, forget about me*

A few years ago, nobody in the United States was seriously talking about new large reactor projects. Vogtle 3&4 was the only game in town. However, the North American market is now talking again about large reactor projects (*see* The Nuclear Company in the U.S.; *see* Ontario's nuclear projections). Moreover, large reactor projects continue at pace in a number of countries overseas (Poland, Bulgaria, Czech Republic, United Kingdom, and India, just to name a few). Large reactors are well-positioned to meet growing energy demand globally, and several designs have progressed well beyond FOAK risks.

Concluding Thoughts

1. The transition to Trump 2.0 might be a little bumpy in the beginning, but nuclear energy is a critical component of both energy policy and foreign policy. While the order of the talking points might change a bit, the bipartisan support will endure.

2. Government and the nuclear industry are inexplicably linked, both

domestically and globally. Those project developers that can make the case (by crafting a viable project) for government support will be the ones that succeed, placing a priority on sourcing experiential knowledge at the earliest stages of project development.

3. The momentum built in 2024 from the hyperscaler / data center / AI arena will continue at pace in 2025 and beyond.

4. The nuclear industry is constrained in the near term. A "Team USA" approach might sound attractive, but a "Team Friends & Allies" approach (i.e. South Korea) is the more practical and more necessary. While Trump 2.0 should resume a theme of bilateral relationships (and personal relationships), the Romania IGA remains a reference point for the possibility of multilateral approaches to achieve U.S. foreign policy objectives. Those foreign companies and countries that can anticipate and align with such objectives should do well under Trump 2.0.

5. FOAK risk is real, and it does not dissipate quickly. Those entities that are able to progress their initial projects will have the competitive advantage relative to their peers. Unfortunately, there are too many SMR and AR reactor designs, and it is to be expected that a lead pack will emerge (and is already emerging), especially those vendors that can offer an integrated delivery solution, such that a viable, financeable project is created.

6. Given FOAK concerns, together with the rapidly increasing demand for clean baseload energy, we can expect that more large reactor projects will be developed, utilizing proven technologies in the near term.

7. With all the enthusiasm over the last year, a number of newcomers are looking at the nuclear sector. It would be incorrect to think that the ten-year development period means that a "wait and see" approach is prudent for financiers, potential supply chain participants, hard-to-abate industrials, and countries looking to develop nuclear projects. It would be nice to say that now is the time to jump in to get ahead of the curve, but the reality is that deals are being shaped now. Jumping in for the sake of jumping in would be reckless, but navigating the current environment would serve interested parties well. To make the point: "*If you choose not to decide, you still have made a choice*" (from Freewill by Rush).

8. The world remains a complicated and acrimonious place. Nuclear energy will be front and center of the geopolitical competition among Russia, China, and the United States. For the U.S. to be an effective competitor, it will need a vibrant domestic nuclear industry (as further supported by friends and allies) in order to offer a compelling alternative to the Russian and Chinese SOE packages. Remember, too, that it is not a fair fight, as U.S. companies compete with SOEs, so government will need to adjust the balance for U.S. companies (along with friends and allies) to succeed.

9. Certain key fundamentals – human resources (both professional and labor), building commodities, supply chain, and EPC delivery (in a variety of forms) – will be critical focal points of financial due diligence

concerning potential projects, as the project's overall deliverability is assessed. The ability to develop, manage, and deliver projects will be a function of these key elements, and market constraints will be a near-term challenge as the industry ramps up to meet demand.

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No confidential or sensitive information was used in the preparation of this note. All material used in the preparation of this note has been sourced from publicly available information. The views expressed herein are solely those of the author and do not represent the views of any other organization or any government.

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