

# Nuclear Energy for Data Centers – A short risk analysis with the Nuclear Pathfinders 8 Issues model

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## The 8 Issues model

Can SMRs and advanced nuclear technology, including fusion, deliver “copious and reliable clean energy for mankind”, or is it yet more “over-hyped, over-cost unachievable tech which will anyway be rendered obsolete by the march of renewables”?

For nuclear to succeed, significant effort needs to be invested and coordinated, across different fields of action, by many actors, over an extended period of time. Such early investment must be made far before success is assured. Interested parties need to navigate the following questions:

1. Which technology options are best suited to contributing to decarbonization at scale, under which assumptions?
2. What is their current status, where do they stand in relation to where they will need to be, to reach commercial viability for deployment at scale key issues?
3. How should an investor – Government, Public, or Private – proceed?

To help decision makers and their stakeholders deal with that dilemma, Nuclear Pathfinders (<https://nuclearpathfinders.com>) identified eight critical issues for nuclear deployment <sup>[i]</sup> and on that basis developed an assessment and tracking model.

In 2023 we used that model to review strategic options for the role of nuclear technologies globally to help meet Net Zero goals <sup>[ii]</sup>. Since then, the data center industry has emerged as a rapidly growing energy hungry use case and the large tech companies such as Amazon, Google and Microsoft are actively investigating the use of nuclear energy to provide long-term reliable support for the emerging class of large hyper-scaler data centres.

## The model's application to advanced reactor technology support to data centers

Our concomitant article “**Data Centers: a new dawn for nuclear energy?**” explores the reasons why nuclear energy is of interest to the tech companies, and the implications for the nuclear industry. Here, we apply the 8 Issues model to make an informed assessment of the status and challenges for a potential large growth scenario.

**Table 1** compares the assessment from our 2023 analysis of AR deployment to meet global net-zero targets (“AR for NZE”) with a revised scoring applicable to deployment for data centers (“AR for data centers”).

The outcome is shown in **Figure 1** where the two score sets are displayed graphically, with 10 being “commercially proven and scalable” and 0 “high risk”.

**Figure 1** shows that the area enclosed by the curve is greater for data center support, compared to the 2023 assessment, This implies that overall risk is lower, and makes the deployment of ARs for data center support marginally more attractive. We note that the scoring is a predominantly subjective analysis (see our original paper for a longer discussion on the methods and subjectivity) but demonstrates a trend in risk reduction for this technology. It also still shows large gaps and identifies the significant challenges that would still need to be overcome. In particular, the “(risk of) competition from other Tech” is most prominent for the particular use case (a strong buyers’ market with dynamic growth).



The 8 Issues

We limited this analysis to advanced reactor technology (AR) because these include technical innovation that likely will be important to future data centers and their business model in a decentralized market scenario; the case for GW Plants is more straightforward and aligned with our previous analysis.

We will revisit this analysis in the future to see how the perceived risk scores develop.

## References, Sources

- [i] From Smart Marketing to Building a New Energy System – Challenges for SMR Global Adoption’, J Warden & R Koenig, atw – International Journal for Nuclear Power vol 68, June 2023, <https://nuclear-economics.com/wp-content/uploads/2023/11/2023-06-01-atw-Challenges-for-SMR-Global-Adoption-Part-1.pdf>
- [ii] Navigating Net Zero: Success factors for nuclear energy fission and fusion technologies, R Koenig & J Warden, with a panel of experts – “Nuclear Pathfinders”; vgbe energy journal 8:2024; <https://nuclear-economics.com/wp-content/uploads/2024/10/2024-08-Navigating-Net-Zero-vgbe-energy-journal.pdf>

Issue	Definition	AR for NZE	Modification to 2023 score for data center energy support	AR for data centers
1 Finance	Likelihood of the financial system delivering the scale and profile of financing for large scale deployment of this technology	5	The tech industry has deep pockets, strong credit lines and appropriate risk appetite, allowing financing. But this is a tight market.	8
2 Supply chain	Ability of the global supply chain to develop the agility and capacity to support large scale deployment of this technology	5	Significant ramp-up needed but possible with strong tech industry demand signal.	6
3 Energy Market Design	Likelihood and ability of global and national energy markets to adapt to make best use of this technology at scale	5	Difficult regulatory decisions needed, depend on political will.	5
4 Design risk	Likelihood of this technology reaching a (commercially and regulatory) deployable and scalable design in a timescale suitable to support data center targets	7	AR designs remain unproven at commercial scale, and there is increased risk for this issue as they need to develop quickly.	6
5 Site licensing systems	Ability and desire of the local regulatory system to apply globally aligned regulatory principles to deploy large scale deployment of this technology	5	Licensing issues remain; positive signals and streamlined processes needed from regulators and governments.	5
6 Multiple site access	Ability of this technology to be deployed reliably and efficiently across multiple sites in different jurisdictions, requiring more effective and coordinated site allocation, permissioning and development.	6	Working with data center implementation across multiple sites provides resources and alignment with wider data center siting strategies.	7
7 Industry and social culture	Ability by society and culture to adapt their risk perceptions, and to support the deployment at scale of this technology	5	Still uncertain but deployment with data centers provides a logical reason for nuclear energy which will be a positive input to the social debate	6
8 Competition from other tech	Ability of this technology to develop and deploy at a pace to gain and hold market share against competition from other energy sources	7	More uncertain owing to need of data centers to grow more rapidly than nuclear can match; shorter data center life compared to nuclear plants	5

Table 1

The 8 Issues (scoring: 0 – unmitigated high risk; 9 – investment grade risk; 10 – commercially proven)

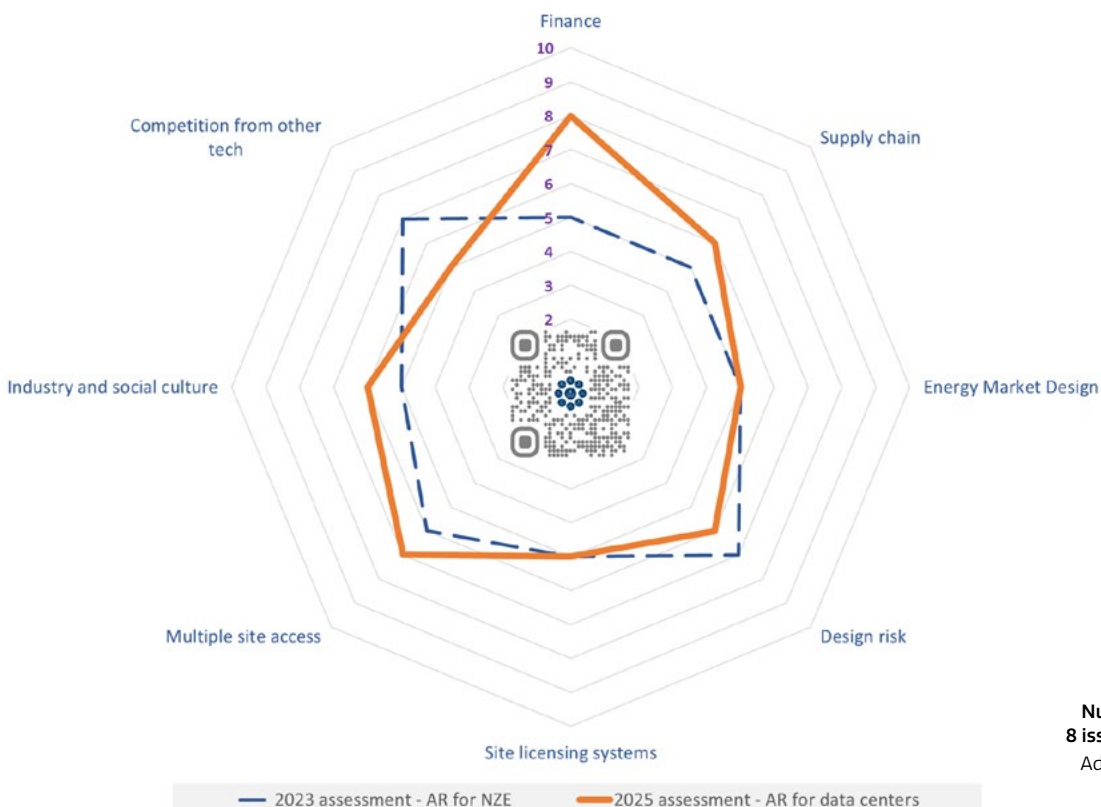


Figure 1  
Nuclear Pathfinder  
8 issues Assessment  
Advanced Reactors  
for Data Centers