Open Architecture for Nuclear Cost Reduction

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Program: Reactor Concepts

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ABSTRACT:

A key contributor to high capital costs and schedule overruns for new nuclear power plants is lack of standardization, driven by site-specific customization and construction of multiple designs by competing vendors rather than commitment to a single standardized program. While advanced nuclear reactors (ARs) typically individually target repeat construction of standardized units, the many competing designs could ultimately exacerbate this problem. **Open architecture** has been identified as a potential strategy for reducing costs – in this context, through exploiting modular design and construction, with common, openly available interfaces between modules. In the ideal, this leads to standardization across ARs, with suppliers capable of constructing standardized modules that are incorporated into multiple designs, and enabling AR vendors to focus on supplying the heat source. This can be combined with a standardized approach to coal repowering, which has gained much recent interest.

However, the benefits of open architecture have yet to be established for the nuclear sector; there are technical, commercial, economic, and legal challenges; and there is as yet no consistent framework for its implementation. Therefore, the objectives of this project are:

(1) To develop a method for open architecture-enabled standardized design of modules and interfaces across the wide **variety of ARs of different temperatures, sizes, pressures and producing different energy products** and evaluate the extent to which this is possible.
(2) To develop a method for open architecture-enabled standardized design of modules and interfaces across the wide **variety of possible AR plant sites** and evaluate the extent to which this is possible.
(3) To identify how open architecture would facilitate **AR licensing and regulation**, and how to overcome the **commercial and legal challenges** to collaboration and info sharing among companies.
(4) To identify and evaluate through quantitative modelling how open architecture can simplify construction, shorten schedules and therefore **reduce costs.**

We will perform a specific pilot study on the application of this methodology to nuclear coal retrofit at Kemmerer, Wyoming.

Key outcomes/impacts are: (1) actionable recommendations that can be taken forward by the AR community (2) a proof-of-concept method that can be built upon by the industry. To maximize project impact, we build on existing high-impact work, and liaise closely with the AR community through the stakeholder group to develop a fit-for-purpose method and gain support for its real-world implementation. Our project is applicable to all ARs, with the goal of supporting a paradigm shift in nuclear construction and reducing costs and timelines within the Advanced Reactor Demonstration Program.