Developing the User Experience for a Next Generation Nuclear Fuel Cycle Simulator

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Program: Fuel Cycle R&D

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ABSTRACT

With its recent roadmap for research, development and deployment (RD&D), the US Department of Energy's Office of Nuclear Energy (DOE-NE) seeks to ensure that nuclear energy continues to be a competitive energy option for decades to come. Development of sustainable fuel cycles has been identified as a primary challenge. Continued research in technologies that support such fuel cycles will be conducted in the coming decades in order to support an ultimate decision for the path forward. RD&D decisions for individual nuclear energy technologies must be informed by the technical, political and socio-economic impacts of those technologies on the whole nuclear energy system. Therefore, the Fuel Cycle Research & Development program is developing a next generation fuel cycle simulator (NGFCS) with sufficient modularity to accommodate a wide variety of audiences, use cases and developer needs.

The NGFCS is expected to be a useful evaluation tool for a variety of audiences. Non-technical audiences will interact with the NGFCS in a way that allows them to express critical high-level decisions and understand the outcomes of those decisions in a set of key metrics. Expert audiences may be interested in a quantitative technology assessment to help motivate design improvements. Developers of the NGFCS will need to visualize their results to ensure consistency and correctness. At the same time, it is important that the NGFCS allow experts to introduce new modules to capture specific physical models or market behavior, but rely on a common infrastructure that facilitates direct comparisons of results.

This university team will focus on the design and development of the user experience for a next generation nuclear fuel cycle simulator (NGFCS), based on the software requirements and design developed in conjunction with the Fuel Cycles Technologies Systems Analysis Campaign. In addition to ensuring an adequate user environment for developers, including input generation and detailed quantitative output visualization, particular attention will be paid to the policy- and decision-maker audience that may be interested in trends and trade-offs in a more qualitative manner. An interdisciplinary team will combine research in social science, computer science and nuclear engineering to support an innovative interface for nuclear fuel cycle systems analysis.

This project will have five thrusts, conducted in parallel and integrated into a unified effort:

- Identification of priority stakeholders, input parameters and output metrics
- User interface for model generation using input parameters
- Data translation to derive output metrics
- Visualization environment for analytic reasoning and data exploration
- Efficient Design of Client-Server Model