Multi Universities for Small Modular Reactor Simulators: NuScale

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ABSTRACT:

The goal of this proposed project is to build NuScale reactor simulators in multiple universities (Oregon State University, Texas A&M and the University of Idaho) for research, education, K-12 school kids' inspiration, and public advocation regarding nuclear power and Small Modular Reactor technology. Specifically, for Oregon State University, the objectives are: (1) Provide the a cross-comparison capability between the OSU NuScale Integral System Testing (NIST) facility and the NuScale Simulator such that research can be conducted for simulator improvement, parallel operation using the simulator as an artificial intelligent system to advise operators in accident transient, and using the NIST test signals for real-time event intervention to redirect accident transient simulations. (2) Serve as the only training/learning system that combines simulator and integral system testing facility, wherein scholars from around the world can learn and study SMRs on simulator and scaled-down test facility. (3) Provide undergraduate students of the associated universities an opportunity to amplify their understanding of basic nuclear engineering principles by observing the reactor response simulated transients. (4) Provide an opportunity for Graduate level research related to the use of the NuScale reactor system. (5) Provide outreach to the communities surrounding the simulator site through demonstrations, tours, and education to community leaders, K-12 students, junior college students, and interested citizens.

The NuScale's remote simulator to be installed is a virtual nuclear power plant control room that provides U.S. universities and national laboratories with the opportunity to experience nuclear plant behavior from the control room. The remote simulator, based on NuScale's simulator technology, will deploy a simulator interface that accepts input from operators in a virtual control room and reflects parameters simulating the plant response with the use of computer models. NuScale proprietary computer models used in the simulator include thermal-hydraulic systems models of the NuScale power module in NRELAP5, power train and shared systems thermal-hydraulics models in GSE, core physics models in S3K (Studsvik) along with models representing protection- and control systems for a twelve module NuScale power plant. NuScale will maintain control of the computer models underpinning the simulator and will provide remote access to the simulator interface through an academic license. NuScale will implement the simulator for each academic license on a cloud-based server. A cloud-based server provides superior security at a lower cost and higher availability than what NuScale can provide through a NuScale internal server.

The outcome/impacts of the installed SMR simulation system will provide opportunities for university research, education, training and public outreach. filling the gap due to the lack of SMR training and demonstration facilities in university and national lab, important to researchers and students who will be our future nuclear engineers. The impact of this proposed project to the DOE-NE missions will be preparing our national laboratories and universities to fully embrace the SMR technology with efficient education and research facilities, for the United State to take and maintain the leadership role in SMR research and development. In addition, the simulators can effectively support public education and K-12 kids' inspiration. Specific relevance to the DOE NE missions is reflected in multiple DOE R&D initiatives, including the special purpose reactor R&D, hybrid energy system design and modeling, and the mission support grand challenge.