Project Title: SUSTAIN: SUpporting Strategic Training of Adaptable and Integrated Nuclear Workforce

PI:

Dr. Kenneth Czerwinski,
University of Nevada, Las Vegas

Program:
IRP-MS-1:
Nuclear Energy Workforce
Pipeline Gap Analysis

Collaborators:
University of Nevada, Las Vegas:
Drs. Jaewon Lim and Alexander Barzilov
University of Maryland, College Park:
Drs. Michelle Bensi, M. Modarres, K. Groth, A. Johnson
Morgan State University:
Drs. Jonathan Morgan, A. Kinyua and R. Damoah
NuScale, Power, LLC
Steven Mirsky, Technical Advisor
Impact Allies, Inc. – Research and Evaluation
Benjamin Reid, Principal

ABSTRACT:
Since the 1960s, nuclear energy generated by a fleet of large light-water reactors (LLWRs) has played an important role in the United States' energy generation portfolio. U.S. nuclear capacity peaked in 2012 at about 102,000 MW, generated by 104 LLWRs. However, market conditions, subsidies, and operating costs have since reduced the competitiveness of LLWRs relative to other energy-generating technologies. As a result, many plants shut down permanently over the past ten years while only one plant commenced operations. As of early 2022, only 93 commercial LLWRs remain in operation in the U.S. While existing economic conditions represent a challenge for the nuclear energy sector, ongoing innovations and advancements in reactor technology, manufacturing, and fuels have transformative potential for both the current fleet of LLWRs as well as new facilities. For example, the annual nuclear energy generation in the U.S. has remained steady in recent years despite the decrease in operating units due to plant updates and improvements in capacity factors. Strategic solutions-focused efforts (e.g., the LWR sustainability program) are expected to further improve economics, reduce operating costs, and extend the operating life of existing facilities. Moreover, small modular reactors and microreactors have the potential to further transform the industry by reducing upfront construction and ongoing operating costs and increasing flexibility. In turn, these nuclear technology changes will reshape the characteristics of the nuclear fuel cycle in the U.S. Unique opportunities also exist to leverage hybrid technologies such as using "waste heat" from reactors to generate hydrogen or perform desalination.

These transformative advancements can help ensure that nuclear power continues to be an energy source that protects air quality and meets the growing energy needs of a nation increasingly relying on electricity to power vehicles and other technologies. However, the ability of the nuclear energy sector to capitalize on these opportunities depends on the nation's ability to maintain a robust and diverse skilled nuclear workforce. This requires a proactive approach to recruiting, educating, training, and retaining current and future workers. The importance of this proactive approach is particularly notable when considering that "building" a skilled worker typically requires 2-10 years of education (depending on degree level). By comparison, the estimated construction timeline for the NuScale small modular reactor is estimated to be approximately three years.

Despite the transformative potential of technological, regulatory, and financial advancements, there remains uncertainty regarding the future of nuclear power in the U.S. and what this means for the potential workforce needs. This is exacerbated by uncertainties associated with other industries that may

compete for the same pool of skilled workers. As a result, strategic research is needed to provide a comprehensive understanding of the factors influencing the:

Demand for workers: There is a need for research on how the demand for workers will change with the overall evolution of the nuclear sector in the U.S. This understanding must be developed within the context of the (potentially substantial) uncertainties associated with electrical power demands, technological advancements, regulatory constraints, and financial conditions that may affect the demands of the industry, national labs, and governmental agencies.

Supply of workers: The supply of technicians, scientists, engineers, and other subject matter experts is shaped by factors as diverse as the economic prospects for individual workers, the demand for workers from competing sectors, and the societal perceptions on the value of nuclear power as a clean energy source. There is a need for research to understand and articulate these factors and how they influence worker decisions.

Educational institutions serve as the "link" to ensure the supply of workers meets the demands of the commercial nuclear sector. This includes educational activities from K-12 through post-graduate as well as efforts to re-train various skilled workers currently employed in other industries. Given the dynamic and uncertain nature of growth in the nuclear industry, efforts to train and re-train the nuclear workforce of the future must be strategically planned and executed.

The fundamental goal of this project is to develop a comprehensive and actionable plan for ensuring that a diverse pool of skilled workers is available to support the continued viability of nuclear power in the U.S. These goals will be achieved via strategic research activities under the following tasks:

- Task 1 (UNLV, NuScale) will integrate insights and lessons learned from existing workforce evaluations (in the nuclear and support sectors) and develop guidelines to inform subsequent research activities under the project.
- Task 2 (UNLV, IA) involves strategic engagement to identify: (1) the workforce needs and challenges across diverse organizations involved in the nuclear fuel cycle (e.g., industry, national labs, and government agencies), (2) the factors influencing the decisions of students and professionals to change-to or begin careers within the nuclear industry, and (3) the ways that educational institutions can serve as the "link" to ensure the right workers are available at the right time.
- Task 3 (UMD) performs an integrated assessment to understand: (1) the current state of the nuclear industry (including existing and new reactor technologies and all parts of the nuclear fuel cycle) and (2) the industry's prospects over the next 20 years and associated drivers of uncertainty. This task will integrate information about the current/future state of the industry with information collected in Tasks 1 and 2 to perform a gap analysis to understand the differences between projected demands for and supplies of workers. This task will assess the impact of potential uncertainties in workforce needs through analysis of a set of representative scenarios
- Task 4 (MSU, IA) translates insights from the gap analysis (and associated uncertainties) into actionable content for engaging a diverse pool of workers. Specifically, this task will develop representative and targeted educational content for K-12, the community college, trade school, undergraduate, and post-graduate programs. A focus will be on the training of new workers as well as re-training workers that may be displaced by other sectors. General educational content intended to increase community awareness of the benefits of nuclear power and the opportunities for employment in the nuclear sector will also be created. These tasks will be accomplished over a three-year period with a total project cost of $2,960,610.

  Costs are divided among partners as follows: UNLV $1,805,956; UMD $741,091; MSU $413,563.