

## ABSTRACT

Wright, Erik R. M.S.C.E., Purdue University, May 2012. Assessment of U.S. Construction Industry Capabilities for a Resurgence of Nuclear Power Construction. Major Professor: Makarand Hastak.

The Kyoto Protocol has prompted many nations to begin taking steps to reduce the total greenhouse gases they emit. Public opinion has also shifted with respect to nuclear energy. In recent decades, the U.S. government began encouraging and incentivizing the engineering, procurement, and construction of new nuclear power plants through several policy actions. The exorbitant cost of nuclear construction and the daunting regulatory process has slowed down bringing new projects on line; but there are now 12 projects currently under active review by the U.S. Nuclear Regulatory Commission (NRC) that will include up to 20 new nuclear power reactors.

The U.S. is at the dawn of a “Nuclear Renaissance” that will soon end a 30-year hiatus in the construction of nuclear power plants. The motivation for this resurgence includes environmental stewardship, energy security, and economics. The nuclear construction industry will play a key role in the success or failure in this next generation of nuclear projects. However, many professionals who possess the knowledge and experience of the last generation of nuclear construction projects have retired or will retire soon. Research is therefore crucial in order to retain this past body of knowledge and, most importantly, adapt it to construction techniques and technologies which have become available since the last generation of nuclear power plants were constructed.

A literature review was conducted in order to assess the overall readiness of the nuclear construction industry for this resurgence and provide recommendations to enhance that readiness in preparation for the next generation of nuclear construction projects. Our areas of focus included human capital readiness, advanced construction technologies, nuclear project lifecycles, past lessons learned, regulations, and safety. The available descriptive statistics provided the

relative importance of these various issues; and Importance-Satisfaction Analysis was utilized in order to delineate the potential impact of 70 advanced construction technologies on future nuclear construction projects. Factor analysis was ultimately conducted in order to summarize 76 activities associated with the nuclear project life-cycle into 12 aspects associated with the successful delivery of nuclear construction projects.

This research identified a shortage of available qualified nuclear construction professionals as well as the nuclear infrastructure to ensure the training and education of new and existing professionals. The findings of this research prompt the development of a nuclear construction body of knowledge (BOK) and the creation of a curriculum in the field of nuclear construction engineering and management. Development of this critical BOK will consider the lessons of past nuclear construction projects, technological developments, and industry evolutions during the 30-year hiatus, as well as provide an innovative vision of the future of nuclear construction. Although many advanced construction technologies are available for deployment on nuclear construction projects, many may not meet the needs of the industry or may be developed beyond the optimal point of return for the industry. Careful consideration of the possibilities through this recommended future research could provide greater efficiency of effort and yield a higher probability for significant positive impacts of this nuclear resurgence on the industry.