The Gulf Nuclear Energy Infrastructure Institute: A Partnership for Human Resource Development

A.D. Williams[a†], A.H.Mohagheghi[a‡], D.R. Boyle[b], P. A. Beeley[c] , TBD[d], TBD[e]

[a]Sandia National Laboratories
Albuquerque, New Mexico, United States of America

[b]Nuclear Security Science and Policy Institute, Texas A&M University
College Station, Texas, United States of America

[c]Khalifa University for Science, Technology and Research
Abu Dhabi, United Arab Emirates

[d]Emirates Nuclear Energy Corporation
Abu Dhabi, United Arab Emirates

[e]Federal Authority for Nuclear Regulation
Abu Dhabi, United Arab Emirates

Abstract --

Sandia National Laboratories (SNL) and the Nuclear Security Science and Policy Institute (NSSPI) at Texas A&M University are working with Middle East regional partners to set up a nuclear energy safety, safeguards, and security educational institute in the Gulf region. SNL and NSSPI, partnered with the Khalifa University of Science, Technology, and Research (KUSTAR), the Emirates Nuclear Energy Corporation (ENEC), and the Federal Authority for Nuclear Regulation (FANR) in Abu Dhabi, the United Arab Emirates, plan to jointly establish the institute. The Gulf Nuclear Energy Infrastructure Institute (GNEII) will be a KUSTAR-associated, credit-granting regional education program providing both classroom instruction and hands-on experience. The ultimate objective is for GNEII to be autonomous – regionally funded and staffed with personnel capable of teaching all GNEII courses five years after its inauguration. GNEII also promotes international interests in developing a nuclear energy security and safety culture, increases collaboration between the nuclear energy security and safety communities, and helps to enhance global standards for nuclear energy technology in the Middle East.

[†]E-mail: adwilli@sandia.gov
[‡]E-mail: ahmohag@sandia.gov

Background

A growing interest in nuclear energy among an increasing number of Middle Eastern states has highlighted a regional need for educational, human, and technical resources necessary to develop an effective nuclear energy infrastructure and an indigenous nuclear security and safety culture. The recent International Atomic Energy Agency (IAEA) *Milestones in the Development of a National Infrastructure for Nuclear Power* document lays out the elements needed for the safe and secure development of a nuclear energy program.[i] An institutional capability to couple nuclear energy security, safeguards, and safety with nuclear energy infrastructure development and education can provide a positive model for regional nuclear energy development – one in concert with global nuclear norms.

Concept

Sandia National Laboratories (SNL) and the Nuclear Security Science and Policy Institute (NSSPI) at Texas A&M University are working with Middle East regional partners to set up a nuclear energy safety, safeguards, and security educational institute in the Gulf region. SNL and NSSPI, partnered with the Khalifa University of Science, Technology, and Research (KUSTAR), the Emirates Nuclear Energy Corporation (ENEC), and the Federal Authority for Nuclear Regulation (FANR) in Abu Dhabi, the United Arab Emirates, plan to jointly establish the institute. The Gulf Nuclear Energy Infrastructure Institute (GNEII) will be a KUSTAR-associated, credit-granting regional education program providing both classroom instruction and hands-on experience. As partners, SNL, NSSPI, and KUSTAR – with guidance and counsel from ENEC and FANR – propose to develop the curriculum, establish the facilities, provide guest lecturers, and prepare regional staff and GNEII program graduates to become the permanent GNEII faculty. The ultimate objective is for GNEII to be autonomous – regionally funded and staffed with personnel capable of teaching all GNEII courses five years after its inauguration.

GNEII is designed to assist participating states with the development and inculcation of nuclear safety and security culture norms into plans for developing peaceful nuclear power programs. GNEII seeks to be a "demand driven" initiative within the Middle East[ii] – with both indigenous public opinion and capital resources supporting this institute from its inception. Establishing GNEII on a firm foundation of regional "buy-in" will enable this institute to become a source of educational excellence and international collaboration on a wide variety of nuclear safety and security issues.

GNEII is intended to be a strategic effort to develop a responsible nuclear energy culture in individuals who will be making policy and managerial decisions within the regional nuclear energy programs. This institute is not designed to train these individuals as operators or technical experts on the details of running a nuclear power plant – instead, its purpose is to provide them a better understanding of their roles in a responsible nuclear energy program. The objective is to immerse future nuclear program decision makers in safety, safeguards, security, and nonproliferation concepts and to familiarize them with how these concepts apply in a regional and an international context.

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[i] For details, please see http://www-pub.iaea.org/MTCD/ publications/PDF/Pub1305_web.pdf.
[ii] GNEII defines the "Middle East" as the 22 nations that compose the League of Arab States.

Partnership

The UAE has an expressed mission to develop world-class leaders capable of addressing global challenges – including the introduction of a transparent, peaceful nuclear energy program. In the UAE and the surrounding region, however, there is an acknowledged shortage of indigenous capabilities in nuclear power-related fields. To help address this shortage, the UAE is making significant investments in targeted human resource development (e.g., KUSTAR's M.Sc in Nuclear Engineering Program). All these factors combine to make KUSTAR, ENEC, and FANR natural partners for GNEII. Additionally, in light of the recent UAE announcement regarding the purchase of four nuclear power plants from South Korea (to be operational by 2017), the UAE has a growing need for the skillset that GNEII graduates will obtain. Thus, in furtherance of the principles set forth in the *Memorandum of Understanding between the Government of the United States of America and the Government of the United Arab Emirates Concerning Cooperation in Peaceful Uses of Nuclear Energy of April 21, 2008*, a partnership involving SNL, TAMU, KUSTAR, ENEC and FANR will seek to attain GNEII's primary objectives: (1) to inculcate individuals working on developing peaceful nuclear power programs with nuclear safety, security and nonproliferation culture norms; (2) to gain and maintain regional relevance in the Middle East; and (3) to garner self-sustaining, regional automony.

Management, implementation, and oversight of GNEII also highlight how the partnership between US and UAE participants emphasizes the institute's main objectives. Daily operations of the institute will be managed by the GNEII local director and the supporting institute staff. Institute implementation will be directed by the GNEII Steering Committee – to consist of SNL, NSSPI, KUSTAR, ENEC, and FANR representatives – who will be responsible for overall business planning, setting strategic goals, and policy determination. A GNEII Advisory Council, whose members will come from selected partner organizations[iii] which have specialized knowledge in areas of importance to the GNEII mission, will provide external advice to the Steering Committee on strategic planning and policy matters. The breadth of knowledge provided by the GNEII partner organizations combined with the expertise of the Advisory Council will ensure the institute teaches the most current best practices regarding nuclear energy security and safety culture. These knowledgeable partners and advisors will also enable GNEII to achieve its broader nuclear energy security, safeguards and safety priorities as an education, training, and research institute.

Improving Regional Human Resource Development

The long-term objective of the institute is to populate the decision-making ranks of Gulf-region nuclear energy programs with GNEII graduates – a strategic effort to indigenize a responsible nuclear energy culture. GNEII will primarily recruit entry level to mid-career Middle Eastern government and government-affiliated corporate officials with either policy and/or technical backgrounds. These individuals should be capable of returning to their home countries and reconciling newly gained nuclear energy security, safeguards, and safety knowledge with their domestic laws, regulations, and politics. GNEII course material will be taught at the master's level of education. Accordingly, students must have at least a

[iii] Members of the GNEII Advisory Council may include, but are not limited to, the US Department of Energy (DOE)/National Nuclear Security Administration/Nonproliferation & International Security/Office of Global Security Engagement & Cooperation (DOE/NA242); US Department of State/Office of International Security & Nonproliferation/Cooperative Threat Reduction (DOS/ISN/CTR); DOE/Office of Nuclear Energy; KUSTAR; ENEC; FANR; International Atomic Energy Agency (IAEA); Landau Network Centro Volta (LNCV); World Institute for Nuclear Security (WINS); US Nuclear Regulatory Commission (NRC); and regional representatives.

bachelor's level of education or equivalent work experience. GNEII students must also hold a governmental/corporate commitment to be placed in their home state's nuclear energy infrastructure upon program completion. An additional short-term objective of GNEII will be to identify and train a subset of its high-achieving graduates who will be capable of teaching at the institute.

GNEII's curriculum, which is outlined below, will emphasize a systems approach to problem-solving and incorporate regional issues in order to establish Middle Eastern perspectives on nuclear energy safety and security cutlure. Instruction will be cumulative and emphasize the interconnectivity between nuclear energy safety, safeguards, and security.[iv] The *fundamentals module* will consist of month-long units that cover nuclear energy prerequisites and fundamentals, nuclear energy management and safety, and nuclear energy safeguards and security. Each month's topics of instruction will build upon previously gained information, with the focus being on emphasizing the interconnectivity between nuclear energy safety, safeguards, and security.

Unit 1, *nuclear energy prerequisites and fundamentals*, will be designed to develop a common understanding of basic principles that effect nuclear safety and security – to include courses on geopolitical and historical issues; basic nuclear reactor physics; the nuclear fuel cycle; laws, norms and regulations; technical tools and approaches to nuclear nonproliferation; and human resource development.

Unit 2, *nuclear energy management and safety*, will be designed to develop intellectual, technical, and operational capabilities in nuclear energy safety – to include courses on nuclear power plant management and operations; nuclear reactor safety systems; probabilistic risk assessment; radiological materials management, safety and health physics; nuclear reactor accident modeling; and emergency preparedness and response.

Unit 3, *nuclear energy safeguards and security*, will be designed to develop intellectual and technical capabilities in nuclear safeguards, security, and nonproliferation – to include courses on nuclear facility vulnerability assessment; nuclear terrorism, safeguards, inspections and monitoring regimes; physical protection system design and implementation; material control and accountability; and export control laws and norms.

The *capstone module*, which follows a two-month break, will give GNEII students an opportunity to apply the knowledge gained during the *fundamentals module* to real-world, regionally-focused projects. GNEII students will work with institute faculty to identify and research issues in the Middle East pertaining to nuclear energy development, management, safety, safeguards, or security. The *capstone module* will allow students to work in groups or individually to answer both policy and technical questions associated with each research topic. In addition, students from different regional states will gain familiarity with, and sensitivity to, multi-lateral collaboration on issues related to nuclear energy. Each student project will result in a report or paper to be presented at an annual GNEII Symposium. For example, GNEII students could address many of the intra-regional issues surrounding the development of a regional monitoring system for radiological materials. The students would not be expected to design the system, but rather to discuss difficulties and solutions associated

[iv] Organizing GNEII's curriculum according to an integrated "3S" methodology is a novel approach in nuclear energy safety, safeguards, and security education and training. SNL is pursuing a series of research projects aimed at developing a practical, comprehensive "3S" methodology that can be implemented in both emerging and established nuclear energy programs.

with intra-regional technology transfer, non-uniform capabilities between regional states, and interstate policy coordination.

Indigenization Plans & Future Development

Within five years of its inaugural class, GNEII will begin handing over responsibilities to KUSTAR faculty and select institute graduates. Through a combination of preparing select institute students, including other available experts, training KUSTAR faculty, and leveraging UAE representatives' capabilities, GNEII's goal of regional autonomy becomes multi-faceted and comprehensive.

In a phased approach, select GNEII graduates can be eligible to become instructors after completing several intermediate steps, including several years experience as teaching assistant and several additional years as a co-instructor. Once a GNEII graduate meets these requirements, the graduate is then eligible to become a primary course instructor. Additionally, employing the expertise of expatriates associated with the UAE's nuclear energy program – or other nuclear power-related expertise from within the region – will further GNEII's progress toward indigenization.

GNEII will also seek to leverage the faculty in KUSTAR's growing Nuclear Engineering Program and train an appropropriate subset as institute instructors. Targeting KUSTAR professors (with either technical or policy backgrounds) and involving them in the initial cycles of GNEII's full academic program will expedite the institute's handover. Similarly, as KUSTAR, ENEC, and FANR develop relationships within the international nuclear energy community, additional expertise and capabilities related to the UAE nuclear energy program (e.g., onsite educational trips to learn about South Korean nuclear power plants) will increasingly offer avenues to expedite indigenization.

As demand increases for nuclear energy infrastructure experience in the Middle East and GNEII matures into a self-sustaining entity, the institute will have the opportunity to expand its capabilities. Potential expansion could include additions to the core and elective curriculum, rotating regional workshops on nuclear safety/safeguards/security-related topics, teleconferencing services, or development of applied research capabilities. Any expansion of GNEII will be determined by the needs of the region, aim to leverage the capabilities of each partner organization, and utilize indigenous capabilities to further implant global nuclear safety, safeguards, and security standards in the Middle East.

Conclusions

In addition to benefits received by GNEII students, GNEII offers multi-faceted local, regional, and global benefits. Locally, GNEII would further the host country's quest to become an intellectual and academic hub in the region. Regionally, the institute will provide national energy programs with an enhanced understanding of the security, safeguards, and safety aspects of nuclear energy; thus enhancing their energy-related decision-making processes. Globally, GNEII will give the world community a model for an institute that addresses the policy/technology attributes of nuclear energy security, safeguards, and safety that is transportable to other fast-developing nuclear energy regions, such as Southeast Asia and South America. GNEII also promotes SNL, NSSPI, KUSTAR, ENEC, and FANR interests in developing an internationally shared nuclear energy security and safety culture, increasing collaboration between the nuclear energy security and safety communities, and implementing global standards for nuclear energy expansion.