

The Gulf Nuclear Energy Infrastructure Institute (GNEII) After Three Years

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ABSTRACT

Established in 2011, the Gulf Nuclear Energy Infrastructure Institute (GNEII) recently completed its third year of operations, including the third offering of its signature GNEII Fundamentals Course. GNEII provides a regional mechanism for developing responsible nuclear energy infrastructure. GNEII's mission is to engender, through professional development and education of decision makers from Gulf-region nuclear-energy programs, a responsible nuclear-energy culture, including institutionalized safety, security and nonproliferation norms. GNEII is a strategic partnership among several UAE and USA entities, supported in part by the US Department of Energy's National Nuclear Security Administration Office of Nonproliferation and International Security and the US Department of State's Partnership for Nuclear Security. Sandia National Laboratories and Texas A&M University's Nuclear Security Science and Policy Institute (NSSPI) are the US implementers working with Khalifa University in the UAE, where GNEII is located. GNEII is predicated on three "pillars" that include an educational component, a research component and a technological component. With culmination of the 2013 GNEII Fundamentals Course, a total of 47 Fellows from UAE, Saudi Arabia, Qatar, Kuwait, and Jordan have completed the course. GNEII will continue to expand its educational, research and technological capabilities, as well as its reach throughout the region.

INTRODUCTION

Established in 2011, the Gulf Nuclear Energy Infrastructure Institute (GNEII) provides a regional mechanism for developing responsible nuclear energy infrastructure. Combining education and research, GNEII helps increase understanding about nuclear energy infrastructure, including safety, safeguards, and security (3S), among Gulf and Middle East professionals in regional nuclear-power programs. GNEII is affiliated with the Nuclear Engineering Department at Khalifa University of Science, Technology and Research in Abu Dhabi, United Arab Emirates (UAE).

BACKGROUND

GNEII's mission is to engender, through professional development and education of decision makers from Gulf-region nuclear-energy programs, a responsible nuclear-energy culture, including institutionalized safety, security and nonproliferation norms.[1] GNEII constitutes a strategic partnership among several UAE and USA entities. In the UAE, these are the Federal Authority for Nuclear Regulation (FANR), the Emirates Nuclear Energy Corporation (ENEC), the Critical Infrastructure and Coastal Protection Authority (CICPA), and Khalifa University. The partnership also includes support from the US Department of Energy's National Nuclear Security Administration Office of Nonproliferation and International Security and the US Department of State's Partnership for Nuclear Security. Sandia National Laboratories [2] and Texas A&M University's Nuclear Security Science and Policy Institute (NSSPI) are the US implementers working with Khalifa University. GNEII's UAE

partners will assume responsibility for GNEII operations by 2017, making it a fully indigenous regional institute.

FOUNDATIONAL PILLARS OF GNEII

GNEII is predicated on three “pillars” that include an educational component, a research component and a technological component (Fig. 1). At this early stage, development of the educational component is furthest along, with implementation of the Fundamentals Course; however, considerable progress is being made in all three components.

Education

GNEII Fundamentals Course

The GNEII Fundamentals Course introduces Fellows to critical thinking, systems thinking, and the scientific method, providing a framework in which Fellows learn about interrelated elements of a responsible nuclear-energy program (Fig. 2). The Fundamentals Course surveys technical and operational aspects of nuclear energy, including nuclear and radiological sciences, power-plant operations, nuclear-material controls, and the international nonproliferation regime. This is followed by focused instruction about nuclear safety, security, and safeguards, emphasizing how these three components interrelate and interact as a system (Fig. 3). This “3S” concept is integral to a responsible national nuclear-energy program.

The Fundamentals Course includes lectures, classroom exercises, and case studies. A crucial component is the Capstone project, independent research analyzing a regionally relevant nuclear-energy issue. Fellows present their Capstone projects as written papers and oral presentations to an open audience at the annual GNEII Symposium conducted at the course’s conclusion.

Potential GNEII Fellows are identified through outreach by the UAE and Khalifa University to FANR, ENEC, and CICPA, as well as to other Gulf Cooperation Council (GCC) member countries. Qualifications for enrollment in GNEII include a bachelor’s degree (or equivalent), proficiency in English, financial support of each fellow’s host institution, and strong recommendations from their employers or supervisors.

GNEII expects to continue its expansion to include all GCC countries plus select regional countries outside the GCC (e.g., Jordan, Morocco). The current aim is to keep class sizes relatively small, not more than about 20 or so, in order to maintain high-quality interaction time with the course instructors. If demand increases beyond this limit, the single-semester Fundamentals Course could be offered more than once per year. In addition,

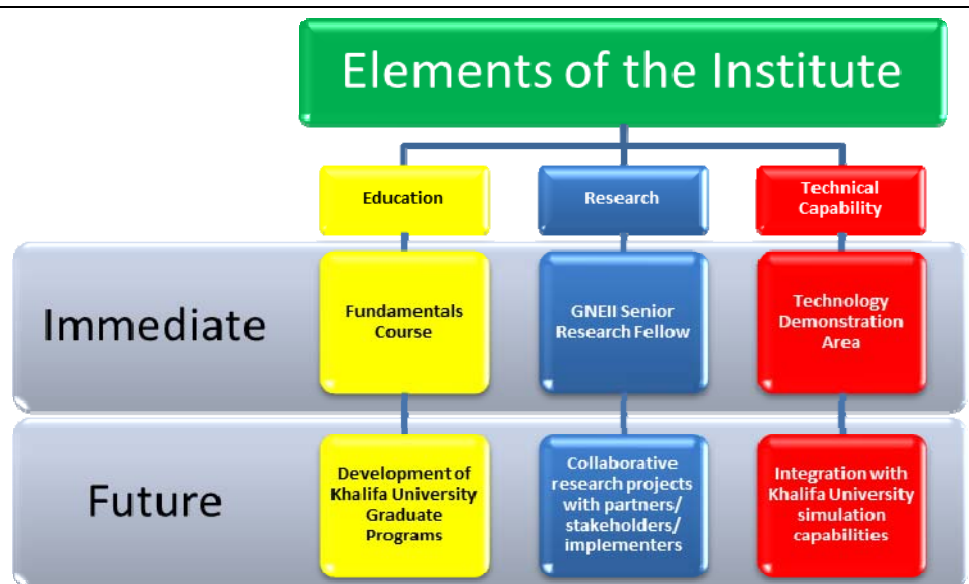


Figure 1: Primary functional elements of GNEII, current and planned.

| 2013 | Day 1 | Day 2 | Day 3 | Day 4 | Day 5 |
|--------|---|--|-------|-------|---------------------------|
| 17-Feb | Introduction to 3S, Critical Thinking, and Systems Thinking | | | | |
| 24-Feb | Introduction to Nuclear Physics, Radiation, & Nuclear Power | | | | |
| 3-Mar | Capstone Intro & 3S Interactions | Nuclear Power Plant Operations & Management | | | |
| 10-Mar | CAPSTONE & 3S Interactions | Nuclear Technologies & Nuclear Fuel Cycle | | | CAPSTONE |
| 17-Mar | CAPSTONE & 3S Interactions | Nuclear Materials Control, Nonproliferation History & Policy | | | CAPSTONE |
| 24-Mar | SAFEGUARDS | | | | Model NFC Exercise |
| 31-Mar | | | | | Model NFC Exercise |
| 7-Apr | ----- BREAK ----- | | | | |
| 14-Apr | SAFETY | | | | Model NFC Exercise |
| 21-Apr | | | | | CAPSTONE |
| 28-Apr | SECURITY | | | | CAPSTONE |
| 5-May | | | | | Review, Exam & Case Study |
| 12-May | Capstone Preparation | | | | |
| 19-May | SYMPOSIUM: Presentations & Certificates | | | | |

Figure 2: 2013 GNEII Fundamentals Course Single-Semester Format, illustrating technical foundations topics (green), followed by nuclear safeguards, security, and safeguards (light blue), integrated capstone research time (blue), and the Symposium (dark blue).

stakeholder requests for additional course offerings through GNEII could further expand GNEII's regional impact and its overall enrollment in the future. Such potential growth would have to be managed carefully in order to maintain GNEII's high standards and quality course offerings.

GNEII recently completed its third year, graduating 18 Fellows (of 20 enrolled) from three GCC countries (UAE, Saudi Arabia, Qatar). This brings the total number of Fellows that have completed the Fundamentals Course to 47. Annual enrollments have approximately doubled from the 11 UAE Fellows enrolled during the first year that the GNEII Fundamentals Course was offered in 2011. A class size of 20 or so Fellows is considered to be near the maximum, given current resources.

The Fundamentals Course is the first and most developed component of GNEII's education pillar; however, effort continues in developing additional course offerings and materials, with an expanded curriculum to become available as demand dictates. Initial effort will further integrate GNEII's curriculum with course offerings and expertise at Khalifa University, including potential involvement of Khalifa's Institute of International and Civil Security.

Accreditation

Graduating Fellows receive 21.6 Continuing Education Units from Texas A&M University, which can be applied towards Fellows' educational and professional-engineering credentials. Khalifa University is working with the Abu Dhabi Centre for Technical and Vocational Education and Training (ACTVET) for accreditation of GNEII's programs.

Research

GNEII aspires to be a regional center for collaborative research in 3S, including integrating 3S into national nuclear programs. Through GNEII's research component, GNEII Fellows and other collaborators, examine technical, sociological, and political aspects of nuclear energy safety, international safeguards, nuclear security, and nonproliferation. Collaborative research projects are coordinated among GNEII, Khalifa University's graduate programs in Nuclear Engineering and in International and Civil Security, as well as with regional and international institutions. Although in its earliest stages, research-oriented publications by GNEII Fellows and the Senior Research Fellows have been published in or submitted to several peer-reviewed journals and conference proceedings (e.g., [3]).

Technical Capability

Along with academic courses and research, GNEII includes practical exercises and hands-on instruction that provide Fellows familiarity with instruments, simulators, computer codes, and related technical tools used in the nuclear industry. In addition to access to laboratory facilities in Khalifa University's Nuclear Engineering Department, GNEII is developing a technology-demonstration area where nuclear safety, safeguards, and security equipment will be displayed and available for use.

GNEII OPERATIONS AND MANAGEMENT

Financial support for GNEII has come from the National Nuclear Security Administration's Office of Nonproliferation and International Security and the US Department of State's Partnership for Nuclear Security in the US and from Khalifa University in the UAE. United States' financial commitment will decrease as Khalifa University's commitment grows to encompass full responsibility for GNEII by 2017. This "indigenization" of GNEII, from a primarily US-supported initiative, to an indigenous UAE-supported institute, has been a goal since GNEII's inception. The fact that this is progressing as planned is an indicator of GNEII's success in achieving its mission.

Day-to-day management and oversight of GNEII is handled by the GNEII Manager, a permanent position at Khalifa University, and soon to be affiliated more closely with Khalifa University's Department of Nuclear Engineering. In addition to Khalifa's role in operations, a Steering Committee composed of representatives from GNEII's UAE stakeholders and its implementing partners meets once a year to review the previous year's progress and to set the following year's plans. The GNEII Steering Committee is responsible for setting goals, developing policy, and planning GNEII's overall direction in accordance with its mission. Members of the Steering Committee include the Executive Vice President

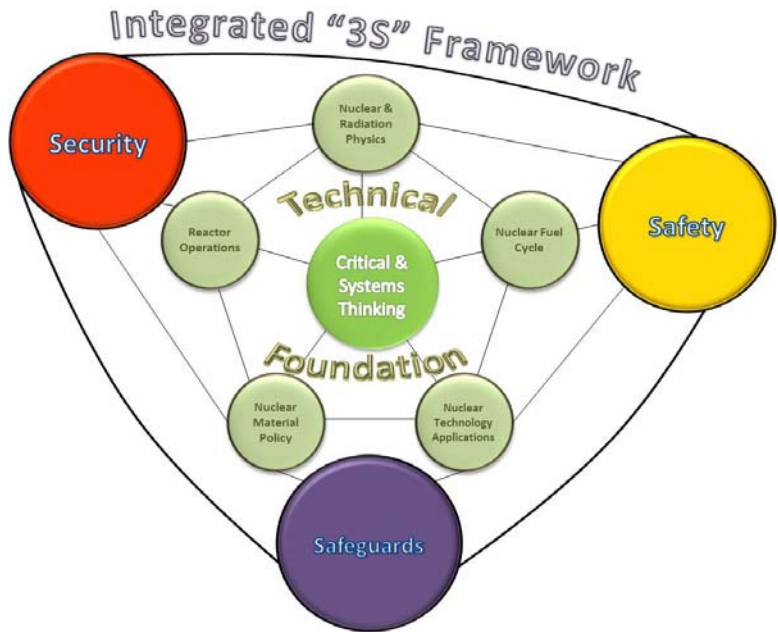


Figure 3: Schematic diagram illustrating some of the many possible 3S-related connections among the six Technical Foundations topics covered during the Fundamentals Course.

of Khalifa University (Committee Chair), the GNEII Manager, the Director of Training for FANR, a representative for the Licensing and Regulatory Affairs Manager of ENEC, the Head of Nuclear Power Plant Protection for CICPA, the Manager for Middle East and South Asia Programs at Sandia, and the Deputy Director for NSSPI. Steering Committee meetings may also include observers from US and UAE agencies with a financial stake in the Institute.

SUMMARY

Established nearly three years ago, GNEII has experienced considerable growth. GNEII's 2014 Fundamentals Course is expected to draw Fellows from additional regional countries while maintaining strong participation from the UAE's agencies responsible for nuclear energy safety, security and safeguards. Together with an expanding educational component, GNEII's research and technological components are also increasing in scope, further enhancing GNEII's mission as a regional institute. As the number of GNEII Fellows grows and the culture of an integrated 3S systems approach to responsible nuclear energy expands, it is expected that GNEII will become a world-class educational, training, and research hub with broad regional and international recognition.

REFERENCES

1. A.D. WILLIAMS et al., "Implementation and expansion of the Gulf Nuclear Energy Infrastructure Institute (GNEII)," Proceedings of the 56th INMM annual meeting, Orlando, Florida (2012)
2. Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.
3. W. AL HASHMI et al., "One Path to Integrating Nuclear Safety, Security and Safeguards Systems: Perspectives of GNEII Alumni," Proceedings of the 56th INMM annual meeting, Orlando, Florida (2012).