UAE Experience in Nuclear Safety and Security Programmes

Case study: the Gulf Nuclear Energy Infrastructure Institute (GNEII)

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Outline

• Introduction & Background
• Foundational Pillars
• Sustainability & Transition
• New GNEII Modular Technical Degree
• Summary
Introduction & Background (1/3)

• Focus of this presentation is on the UAE experience in nuclear safety and security programmes (GNEII)

• GNEII is:
  – A Gulf/Middle East regional human resource development capability
    • Hosted at Khalifa University, Abu Dhabi, UAE
  – A strategic partnership between
    • UAE (KU, CICPA, ENEC, FANR, Nawah, NCEMA, AD Poly) & U.S. (DOE/NNSA, DOS/PNS, SNL, TAMU) stakeholders
  – An educational & research entity
    • Beyond traditional training courses
  – A leader in ‘3S’ & emergent nuclear energy infrastructure knowledge
• **GNEII’s Mission:**
  – develop a responsible nuclear energy culture and institutionalize safety, security, and safeguards norms in the future decision-makers of Gulf-region nuclear energy programs through professional development

• **GNEII’s Vision:**
  – provide the Gulf, and surrounding region, with a continual source of indigenous nuclear energy professionals with whom the global community can effectively collaborate to achieve broader nuclear energy security, safeguards and safety priorities

• **Established in 2011, 7 years of operation**
Introduction & Background (3/3)

• UAE Partners
  – Sponsorship & implementation
    • Khalifa University of Science & Technology
  – Support from
    • Federal Authority for Nuclear Regulation (FANR)
    • Emirates Nuclear Energy Corporation (ENEC)
    • Critical Infrastructure & Costal Protection Authority (CICPA)
    • National Emergency Crisis & Disasters Management Authority (NCEMA)
    • Abu Dhabi Polytechnic (AD Poly)

• US Partners
  – Sponsorship
    • DOE/NNSA – International Nuclear Security and Safeguards Engagement Programs (INS and INSEP)
    • DOS/CTR – Partnership for Nuclear Security (PNS)
  – Implementation
    • Sandia National Laboratories (SNL)
    • Nuclear Security Science & Policy Institute/Texas A&M University (NSSPI/TAMU)
Foundational Pillars (1/4)

- Education
- Research
- Technical Services
Foundational Pillars (2/4)

• Pillar #1: **Education**
  – GNEII integrated 3S educational paradigm for responsible nuclear energy programs
  – From 2011 to 2016, GNEII offered a semester long ‘Fundamentals Course’
    • Included experts from the UAE, U.S. and international collaborators across a range of nuclear energy infrastructure topics
  – GNEII is transitioning from its previous curriculum to a more structured degree-based program
• Pillar #II: **Technical Services**

  – Leverage Khalifa University Nuclear Engineering Department capabilities

  – Provides opportunities for:
    • Practical exercises
    • Hands-on instruction
    • Real-life scenario simulations
Foundational Pillars (4/4)

• Pillar #III: **Research**-New Opportunities

  – GNEII/KU-USG Stakeholders Collaboration
    • MOU 2.0 (Research emphasis)

  – Research projects and publications integral to GNEII ongoing success
    • To create a mechanism for GNEII to propose, initiate, conduct and publicize research in its core competency areas

  – Goal: provide a mechanism to ensure that regional research on nuclear matters are shared with global nuclear energy community
### GNEII Fellows

<table>
<thead>
<tr>
<th>Year</th>
<th># UAE Fellows</th>
<th># Non-UAE Fellows</th>
<th>Yearly Total</th>
<th>Countries Represented</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ENEC</td>
<td>FANR</td>
<td>CICPA</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>2012</td>
<td>3</td>
<td>9</td>
<td>2</td>
<td>18 (22)</td>
</tr>
<tr>
<td>2013</td>
<td>4</td>
<td>6</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>2014</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>2015</td>
<td>7</td>
<td>4</td>
<td>5</td>
<td>18</td>
</tr>
<tr>
<td>2016</td>
<td>2</td>
<td>16</td>
<td>3</td>
<td>21</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>26</strong></td>
<td><strong>43</strong></td>
<td><strong>17</strong></td>
<td><strong>99 (103)</strong></td>
</tr>
</tbody>
</table>

\(^{\text{i}}\) Due to modular structure of the course in 2012 not all international participants were able to finish all required modules because of the travel restrictions.

Total Fundamentals Course Alumni: 99 (103); UAE - 86
### GNEII 2016 Fundamentals Course Curriculum

<table>
<thead>
<tr>
<th>Date</th>
<th>Week</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>17-Jan</td>
<td>Week 1</td>
<td>Overview, Need for Nuclear, History, Components, Economics, Critical &amp; System Thinking, Scientific Method, 3S System</td>
</tr>
<tr>
<td>24-Jan</td>
<td>Week 2</td>
<td>Nuclear &amp; Radiation Physics, Neutron Interactions, Basic Reactor Theory, Radiation Effects, Nuclear Technology</td>
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<tr>
<td>31-Jan</td>
<td>Week 3</td>
<td>Reactor Operations, Power Plant Systems, Probabilistic Risk Assessment</td>
</tr>
<tr>
<td>7-Feb</td>
<td>Week 4</td>
<td>Nuclear Fuel Cycle, Nuclear Nonproliferation History &amp; Policy</td>
</tr>
<tr>
<td>14-Feb</td>
<td>Week 5</td>
<td>SAFEGUARDS (2 weeks) State System of Accountancy Controls, Non-Destructive and Destructive Analysis, Bulk and Item Facilities</td>
</tr>
<tr>
<td>21-Feb</td>
<td>Week 6</td>
<td>SAFETY (2 weeks) Safety Culture, Engineered Safety Features, Emergency Response Planning, Radiation Safety</td>
</tr>
<tr>
<td>28-Feb</td>
<td>Week 7</td>
<td>SECURITY (2 weeks) Security Culture, Physical Protection Systems, Detect, Delay, Respond, Evaluate</td>
</tr>
<tr>
<td>6-Mar</td>
<td>Week 8</td>
<td>Capstone Research &amp; Preparation (2 weeks)</td>
</tr>
<tr>
<td>13-Mar</td>
<td>Week 9</td>
<td>Capstone Preparation &amp; Dry Runs</td>
</tr>
<tr>
<td>20-Mar</td>
<td>Week 10</td>
<td>SYMPOSIUM: Capstone Presentations &amp; Certificates</td>
</tr>
</tbody>
</table>
Sustainability & Transition (1/2)

• Challenges going forward:

  – Sustainability
    • GNEII Operational Financial Plan
    • GNEII Human Capacity Development Plan

  – Transition
    • Formal GNEII handover at the 2016 Symposium
    • After the 2016 Fundamentals Course, decreasing USG support for GNEII management & operation functions
      ▪ Primarily geared toward successful knowledge transfer
    • Develop a more structured degree-based curriculum
Sustainability & Transition (2/2)

• The 2015 GSC meeting accepted the recommendations to have:
  – A financial plan fully supported by all local/regional stakeholders
  – A human capacity plan resourced from all local stakeholders

• The 2015 GSC meeting created the ‘Finance & Sustainability Subcommittee’:
  – Consists of representatives from all GNEII stakeholders
  – Meet more frequently than the GSC
  – Discussing & developing viable specific financial & human capacity plans for GNEII
GNEII MOU 2.0 with USG stakeholders

• **Goal:** provide framework for USG stakeholders continued engagement with GNEII
  – Between GNEII/KU, and SNL & NSSPI/TAMU

• **Emphasis:** collaborative research
  – Dual results:
    • Meet GNEII’s mission of developing a cadre of nuclear energy infrastructure professionals
    • Further bolster GNEII as a regional capability

• **Also includes language regarding:**
  – Limited USG education support
  – Mechanism for SNL & NSSPI to support GNEII’s technological development
Education/Training Pillar Sustainability

Foundation → Safeguards → Security → Safety → Capstone

GNEII → 2011 to 2016 → 14 Weeks

GNEII → 2017 and beyond → Modular Accreditation

Modular Accreditation

- Foundation
  - Existing content
  - IAEA content
- Safeguards
  - Existing content
  - IAEA review Update
- Security
  - Existing content
  - IAEA Review Update
- Safety
  - Existing content
  - IAEA Review Update
- Project
  - Thesis

Nuclear Security Forum 2018
Proposed New MA Degree Model for GNEII

**CERTIFICATE**
- IAEA NEM Course format
- Equivalent to 10 full working days
- Will operate under KU-IAEA Collaborating Centre

**DIPLOMA**
- Must complete Certificate or previous GNEII FMC
- 4 Courses (12 credits)
  - GNEI601: Critical Thinking &NE fundamentals
  - GNEI602: Principles of Nuclear Safety
  - GNEI603: Principles of Nuclear Security
  - GNEI604: Principles of Nuclear Safeguards

**DEGREE**
- Must complete Diploma
- Electives, 4 courses (12 credits)
  - GNEI-61X courses should be related to Nuclear Security
  - GNEI-62X courses should be related to Nuclear Safeguards
  - GNEI-63X courses should be related to Nuclear Safety
  - GNEI-64X courses should be related to Management and Leadership
- Thesis (12 credits)
Modalities and Resourcing

• IAEA Engagement
  – Regional Nuclear Infrastructure Projects
    • Khalifa University designated IAEA Collaborating Center

• UAE/KU Accredited Programs in Nuclear Education
  – Nuclear Minor in BSc in Mechanical and Electrical Engineering
  – MSc in Nuclear Engineering
  – MA Degree in International and Civil Security (Technical Elective in Nuclear Security)
  – PhD in Engineering (Nuclear Concentration)
Framework for IAEA Review and Modification

- Peer Review
- Restructuring
- Delivery ➔ Lecturers
- Support
- Member State Attendance
- Timelines
  - Spring 2019
Summary

- Current transition in the curriculum structure will support GNEII in providing the Gulf, and surrounding region, with a continual source of indigenous nuclear energy professionals with whom the global community can effectively collaborate to achieve broader nuclear energy security, safety and safeguards priorities.

- Signing of MOU 2 with the USG stakeholders established a framework for continuing collaboration & launched Phase II of GNEII operations
  - Emphasis on the evolution and expansion of peer-to-peer collaboration across the institute’s education, research and technical demonstration pillars.

- GNEII is actively marching toward its mission of becoming a leading entity through which Gulf and Middle East voices can be introduced into global nuclear discourse
Wrap-up Discussion

Questions?

Final thoughts?