



Norwich University Applied Research Institutes

CONTRACT TITLE: DEVELOPMENT OF AN ENERGY TRACK WITHIN THE NORWICH UNIVERSITY CENTER FOR GLOBAL RESILIENCE AND SECURITY – DESIGN AND DEVELOPMENT PHASE

Final Technical Report

Development Report for Contract No. W9132T20C0005

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Final Technical Report

Reference

Solicited Proposal in Response to BAA #W912HZ-19-BAA-01, DEVELOPMENT OF AN ENERGY TRACK WITHIN THE NORWICH UNIVERSITY CENTER FOR GLOBAL RESILIENCE AND SECURITY – DESIGN PHASE, VOLUME I TECHNICAL PROPOSAL.

Executive Summary

The NUARI team worked on the challenge of designing energy resilience and security curricula across three lines of effort (LOE 1 - undergraduate students, LOE 2 - mid-level professionals, LOE 3 - senior leaders). In addition, a fourth line of effort looked at research and internship opportunities in this sector. The curriculum developed addresses the areas of energy fundamentals, policy, risk, and master planning—areas of interest identified in roundtables conducted during the analysis phase.

Major findings:

- 1) Curricular products: Academic and training programs should meet these two criteria.
 - a) Need and urgency: Modular curriculum across all lines of effort is needed now. It should be tailored to address current capability and knowledge gaps in existing DoD and civilian energy sector training.
 - b) Adaptable and dynamic: Modular curricular units that can be adapted to participants' backgrounds and academic disciplines will encourage participation.
- 2) Stakeholders: The human dimension is critical at solving energy resilience issues. Networking and information sharing, particularly across military and civilian communities, will be essential to the protection of critical infrastructure.
- 3) Platforms: Access to relevant and flexible material in a timely manner across multiple channels and modalities is required for everyone involved in critical infrastructure protection.

Recommended actions:

- 1) Conduct diagnostic needs assessment to tailor programs to meet mission requirements.
- 2) Optimize lessons with options to mix and match content that addresses limitations such as participants' time availability.
- 3) Integrate and formalize training programs, placing lessons and courses into existing professional development programs.
- 4) Create a one-stop resource for professionals to access web-based tools to effectively share energy resilience information.
- 5) Embed the often-overlooked human infrastructure component in all infrastructure resilience planning and assessment efforts.
- 6) Design experiences to maximize installation-community partnerships and collaboration emphasizing the potential benefits of such relationships.
- 7) Develop checklists to formalize newly developed procedures as program participants operationalize aspects of the energy resilience curriculum.

- 8) Disseminate, evaluate, and deliver the developed curricula through training programs, professional organizations, and networks (e.g., ADC, ICMA, or SAME).
- 9) Conduct distributed exercises to test current energy resilience capabilities.

Introduction

Phase 2 DESIGN/DEVELOPMENT of an Energy Track within Norwich University Center for Global Resilience & Security involved producing scalable, modular, and adaptive education and training programs to benefit four critical lines of effort (LOE) covering tactical, operational, and strategic roles within and in support of the DoD. At the undergraduate level (LOE 1), the goal of the curricular enhancements is to provide foundational energy resilience knowledge to future military officers and civilians to initiate generational change. For the mid-level officers (LOE 2), the programming was to bridge any knowledge gaps by providing them with tactical and operational energy resilience knowledge tools to use their authority to positively influence the energy resilience in a military organization. In the case of senior leaders (LOE 3), the premise was to rapidly and efficiently gather and leverage experts to provide strategic guidance in addressing energy resourcing, risk assessments, and engage in dynamic master planning with a goal to solve some of the most challenging national security risks in energy resilience facing our Nation. LOE 4 allowed all curriculum development to be tied with current research and a precursor to hands-on internship opportunities to promote experiential and immersive energy resilience education.

All activities undertaken in Phase 2 were framed using the ADDIE model (analysis, design, development, implementation and evaluation). The **analysis phase** involved multiple discussions within the team, the government, consultants, stakeholders, and experts to identify curriculum development approaches across all lines of effort. Congressional and research reports, peer reviewed journal articles, conferences, news stories, and defense community communications were used to guide these conversations. In addition, with approval from the Norwich University Institutional Review Board (IRB), multiple surveys were administered to identify knowledge gaps and to establish priorities for curricular module topics. In the case of LOE 1, an extensive conceptual plan on big ideas that undergraduates should be exposed to was

woven into a survey administered to all senior military colleges and military academies. Surveys administered to mid and senior level leaders were followed up with a roundtable virtual discussion to seek further clarification on survey responses prior to starting with curriculum development.

The curriculum **design efforts** involved multiple internal workshops with consultants to workshop the final list of modules, their content and prioritization schema using discussion prompts, survey responses, published documents as well as online collaboration tools. In addition, the NUARI team also engaged with multiple Norwich University units and platforms to determine the role that the existing curricula could play in design and development. For example, two graduate-level certificates are being created at the Norwich University College of Graduate and Continuing Studies, 1. “Energy Resilience and Emergency Response” and 2. “Energy Resilience Leadership,” from a combination of existing courses and a newly created course that will incorporate modules from the Senior Leader Seminar and independent study related to topics in energy resilience. The design process also included research on the ideal formats, modalities, contact times, professional credits, certification requirements, etc.

The curriculum **development activities** involved working with instructional designers to develop templates for all documentation related to curriculum. Consultants worked with the core team as well as instructional designers to build these templates for each module/course that was developed. Overall, many modules (as well as opportunities for future modules) organized into four themes were built for LOE 1 – Energy and You, Energy and Society, Energy and Resilience, and Energy Nexus. Two courses were built for mid-level personnel on Microgrid Architecture and Industrial Control Systems, and one seminar was developed for senior leaders on critical infrastructure. In addition, modules were pulled from existing Norwich resources, especially in areas of cybersecurity and financial management. The course development documents were further adapted to a learning management system. Platforms were also used to make the content more dynamic and interactive with audio-visual elements.

The implementation components in this phase involved pilot testing of some of the LOE 1 modules in undergraduate courses, as well as running pilots at the mid (LOE 2) and

senior career lines (LOE 3). The team also participated in conferences, and debriefed various on and off campus units throughout the contract period. In addition, the team worked on developing a decision wizard to help future participants determine the right mix and sequence of courses/modules they would need based on their background and knowledge gaps, an infographic to showcase the range of programming, and a comprehensive course catalog to be housed on a user-friendly website.

The **evaluation** elements involved multiple check points throughout the contract period. A series of regularly scheduled initial meetings with the government helped set the right course for all development activities. Discussions with all stakeholders (consultants, partners, colleagues, etc.) were always followed by an after-action review within the core team. Survey responses were solicited from participants in the pilot courses and helped inform the narrative evaluation that each instructor completed (included in Enclosure 8). Specifically, the evaluation of the April 2021 pilot courses reinforced the importance and urgent need for resilience. The evaluation also firmly established the connection between energy and other critical infrastructure as a key component of Energy Resilience education. Some specific observations included:

1. Given the challenges around participants' time availability, shorter modules or options to mix and match the modules will be important.
2. The Garrison Pre-command Course as well as the Civilian CP29 Professional development courses do not provide any content on this critical topic, so our curriculum is addressing a key need.
3. The human infrastructure component is a planning gap that should be integrated into future curriculum development and implementation.
4. The partnership and collaboration with the supporting community on mission resiliency was new to many pilot course participants.
5. The IMCOM Regional Director specifically noted that the Checklist type training format as in the Exercise Development module of the senior seminar would be valuable for Commander Conference training material.

6. Use of ADC, ICMA, and SAME Conferences as professional development opportunities that would be excellent venues for deployment of modules.

Importantly, as noted by the instructor of our senior seminar:

“As an Army and as a Nation, we are not articulating the command interest or resource investment needed to build the critical infrastructure resilience required if the Army and its supporting communities are going to be mission capable when the attack occurs. We have seen the impacts of such attacks and climate vulnerabilities in the short time this course was being developed and executed with the Solar Winds cyberattack, the ERCOT failure in Feb and the recent Colonial Pipeline ransomware attack. THIS CURRENT INVESTMENT BY CERL IS A VALUABLE FIRST STEP TOWARDS FILLING THE ARMY’S CURRENT CRITICAL INFRASTRUCTURE RESILIENCE KNOWLEDGE GAP!”

Overall, this DESIGN/DEVELOPMENT phase of the contract led to curricular modules in energy fundamentals, policy, risk, and master planning at LOEs 1 through 3. The team administered multiple surveys and shared survey results throughout the contract period. It hosted or participated in relevant debriefs, conferences, webinars, and meetings to emphasize the urgent need for energy resilience education across a large cross-section of communities and offer opportunities to address some of the existing gaps. The curricular efforts engaged over 100 participants in pilots that spanned undergraduate students through senior leader levels. With the help of consultants, the team evaluated all components of these efforts and practiced continual improvement. The team has also created tools such as the decision wizard to help future participants determine their educational needs in this sector and an infographic to offer a visual map of the offerings that were produced as well as a comprehensive catalog of modules and courses housed on a user-friendly website. This phase has started the process of creating generational change in the area of energy resilience and security by engaging multiple disciplines at the undergraduate level, mid-level, and senior leaders inside and outside the fence line. It is recommended that an IMPLEMENTATION phase that will put into action all components from this DESIGN/DEVELOPMENT contract phase. This effort will be essential to execute a sustainable multimodal educational platform that

delivers relevant energy resilience educational resources in support of the objectives of the DoD and Community customer.

As one of the pillars of the DoD Installation Energy Strategy, energy resilience is a complex objective that comes with broadly distributed and interrelated challenges. Recent climatic events and cyber-attacks demonstrate the extent to which energy resilience can be tested. Today, energy systems face a spectrum of natural and man-made stressors amidst a dynamic technological, political, cultural, and economic landscape. The Energy Track is being developed keeping in mind the interdisciplinary and dynamic complexity of energy resilience and the accompanying need for a broad scope of understanding and problem-solving capabilities within the energy community. Since energy is typically commercially supplied to installations, improving energy resilience will require the strengthening of military and civilian collaboration, incorporating the best practices at all levels of operation. As microgrids, distributed power generation, energy storage, and developing technologies penetrate the civilian sector, the DoD has developed a framework in which new and emerging technologies can be used at installations to enhance energy resilience. With the combination of new technologies, emerging threats, policies changes, and funding opportunities comes the increased need for tools to help people navigate the energy environment for improved effectiveness.

The Energy Track contributes to the improvement of installation energy resilience through education, exercises, seminars, networking opportunities, and information repositories. While the first LOE focus on the entry-level is promoting long-run generational change, the Energy Track's professional education and Senior Leader seminars offer solutions, including the sharing of expertise, strategic networking, and introduction to new technologies, that can address energy resilience challenges in the short-run.

Program Objectives

The stated objectives of the Phase 2 Design concept are as follows:

“In this Phase 2 (“DESIGN/DEVELOPMENT”), we will use the framework created in the planning phase to develop targeted education and training programs, pilot some of the training activities using new models, and promote research to help military and surrounding communities lead energy resilience efforts in a manner compatible with DoD approaches. We will leverage established public-private partnerships and create new ones to assist in documenting, educating, and implementing resilient community models and strategies for government and military operational resilience. The goal is to rapidly and efficiently gather and leverage experts to solve some of the most challenging national security risks in energy resilience facing our Nation. This collaborative approach to program design is one supremely focused on protection of the homeland against mounting strategic foreign threats of attacks, fortifying critical infrastructure, and hardening the operations that are required for community resilience, as well as power projection. Phase 2 efforts will result in tactical entry-level modules in energy resilience fundamentals, risk assessment, policy and master planning, and pilot programs to evaluate the effectiveness of the course implementation.”

Task Overview and Results

The tasks associated with the program followed the ADDIE (Analysis – Design – Development – Implementation – Evaluation – see Enclosure 19 for more detail) Curriculum Development model as stated in the Technical Proposal.

- a. Task Overview - Table 1 below outlines the tasks and deliverable descriptions for the Energy Resilience Education Track:

PROJECT SCHEDULE AND DELIVERABLES
Deliverable
Inventory/Creation of Certificates from existing courses
Research & Internship Program Set-up
Survey Mid-Career & Senior Leader Sample Populations
Review Survey Results and Define Requirements
Define Course Work Requirements; Identify Pilot Course Scope
Develop Courses
Pilot Courses/Seminars
Evaluate Pilot Courses
Draft and Final Technical Reports

Table 1 – Tasks and Descriptions

b. Results. This section of the Final Technical Report outlines the Deliverables for the contract. Each section below is a summary of the Deliverables described below and the actual Deliverable submitted to the Government is included as an Enclosure to this report. Due to the size of each Deliverable Document each will be uploaded to DTIC separately.

1) Inventory and creation of certificates from existing courses – Reference

Enclosure 1 for the Deliverable submitted to the Government on 4 August 2021. This task is part of the Analysis phase of the ADDIE process in that a baseline is established with the inventory. This inventory process is intended to be a starting point to develop an integrated and relevant curriculum. The purpose of the inventory and creation of certificates report in the field of energy resilience is to identify current courses, academic programs, professional development certificates, and energy exercises that can contribute to the Energy Resilience Track at Norwich University. Further, the Energy Track team initiated internal administrative procedures for the creation of the Master's-level certificate programs. The following is an inventory of existing courses that will be included in the Energy Track curriculum at Norwich:

- i. Undergraduate Main Campus programs involved a survey of Norwich University faculty in all majors in academic units and ROTC. Concurrently,

- energy and sustainability modules were piloted, meaning presented to students for demonstration, feedback, and analysis, for possible integration into current curriculum.
- ii. Undergraduate online with the College of Graduate and Continuing Studies – The online undergraduate program inventory included several standalone courses that have an impact in the field of energy resilience. They include, but are not limited to, the following academic concentrations:
- Supply Chain Management
 - Cyber Security Management academic certificate
 - Cyber Vulnerability Management
 - Project Management
 - National Security Studies and Strategic Studies and Defense Analysis courses
- iii. Graduate Certificate Programs – The following opportunities offer established programs that contribute to the interdisciplinary energy resilience field:
- MBA with a concentration in Energy Management
 - Graduate Certificates in:
 - Leadership
 - Public Sector/Government/Military Leadership
 - Cyber
 - Critical Infrastructure Protection and Cyber Crime
 - Vulnerability Management
 - Computer Forensic Investigation and Incident Response Team Management
 - Public Administration
 - Public Administration Leadership and Crisis Management
 - Procurement and Government Contract Management
 - Rural Municipal Governance
 - Urban Municipal Governance
 - International Development and Influence

- Energy Resilience specific certificates – these two proposed graduate certificates are adapted from existing courses to create an energy resilience specific program:
 - Energy Resilience and Emergency Response
 - Critical Infrastructure Protection
 - Computer Security Incident Response Team Management
 - Capstone Experience in Energy Resilience
 - Energy Resilience Leadership
 - Critical Infrastructure Protection
 - Public Leadership, Crisis Management, and Organizational Change
 - Capstone Experience in Energy Resilience
- iv. Norwich Pro – is a fully online learning organization created to bring world-class instruction in high-demand skillsets straight into the hands of busy working professionals and military personnel. Refer to the Norwich Pro web page for more information: <https://pro.norwich.edu/> Students in Norwich Pro courses earn Continuing Education Units known as CEUs based on the number of contact hours and programs can be tailored to meet an organization's requirements. Current courses that contribute to the Energy Resilience Education Track include the following:
 - Public Works Institute:
 - Public Works Management and Leadership Proficiencies
 - Public Works Strategy and Planning
 - Public Works Operations and Organizations
 - Public Works Long-Term Strategy Project
 - Project Management
 - Analytics Fundamentals
 - Analytics for Government, Industry and Business
 - Risk Assessments, Policies, and Internal Controls

- v. Norwich University Applied Research Institutes (NUARI) – NUARI is a 501(c)(3) non-profit that serves the national public interest through the interdisciplinary study of critical national security issues. NUARI is partially funded by the Department of Homeland Security and the Department of Defense, and federally chartered under the sponsorship of Sen. Patrick Leahy. We are co-located with Norwich University in Northfield, VT and share their ideals of academic excellence, innovation, and service to country.
- NUARI's Distributed Environment for Critical Infrastructure Decision-making Exercises (DECIDE® - a registered trademark of Norwich University Applied Research Institutes, 4 May 2021, registration 6339918) platform facilitates hands-on, web-based, distributed live exercises that engage human decision-making and crisis communications to drive scenario events and situational developments.
 - Security Situation Center Training 2020 is a four-week, online available as initial qualification training for an operator in an Emergency Operation Center. Follow-on training includes a “right seat ride” program to validate skill required to detect cyber intrusions.
 - Security Operations Center “in a box” is under development and will provide the tools and training needed to operate as Security Operations Center.

2) Research and Internship Program Set Up. Research and Internship

Opportunities were identified across the various public and private organizations that participated in the Development phase of the Energy Track. In addition to identifying Energy Resilience internships at NUARI, many of the participants in round table discussion and course development work expressed interest in hosting interns at their respective organizations. In order to implement the internship programs, the Energy Track project team developed an internship framework described below (See Enclosure 2 for full details and Sample Student Contract).

Student Internships in the NU Energy Resilience track provide all majors with the opportunity to apply and expand their knowledge within their discipline to applications related to Energy and Critical Infrastructure Resilience. The NU Energy Track has identified the 5 cross-disciplinary knowledge areas: Energy Fundamentals, Risk Assessment, Policy and Funding, Master Planning and Cyber Security. The Energy Fundamentals can also include Critical Infrastructure. Reinforcement of any of the knowledge areas through the experiential learning is supported by the Energy Track LOE's (LOE 4) and NU's founding principles. Norwich degree programs provide students with a unique leadership laboratory that distinguishes them from their peers. The Energy Track internship program will satisfy the following learning objectives:

- Develop the capacity to think critically about a given problem or question ideas related to Resilience of critical infrastructure systems.
- Build skills in conducting analyses in a variety of industries and develop an understanding of the challenges present in a global environment.
- Raise the awareness about the importance of Energy Resilience in the real world.
- Develop powers of managerial judgment, build skills in assessing business risk, and improve the ability to create results-oriented plans.
- Be able to operate effectively as a team in an unstructured environment under conditions of uncertainty and incomplete information.
- Build proficiency in making professional presentations.

A supervisor within the sponsoring organization must provide a written description of the internship beforehand and a final performance evaluation of the student. See Enclosure 2 for full program overview.

Faculty Research related to Energy Resilience will be coordinated through the Center for Global Resilience and Security. Supported research must align with the Energy Track's cross-disciplinary knowledge areas: Energy Fundamentals, Risk Assessment, Policy and Funding, Master Planning, and Cyber Security with

a focus on Norwich's strength in teaching and practical applications of academic topics (Reference Enclosure 2).

- 3) Survey Mid-Career and Senior Leader sample populations. The purpose of the survey exercise was to establish a baseline inventory of learning needs and areas of interest for the Energy Track education and training products from target populations. From August 7-21, 2020, the Norwich University Energy Track team conducted two surveys to gather views and opinions of the implementation of the Department of Defense's Energy and Security goals, one directed toward mid-career installation energy professionals and the other toward senior leaders. The mid-career survey focused on identifying the barriers to installation energy resilience and resources required including training and professional development opportunities. The senior leader survey focused on identifying the people and positions that drive energy resilience as well as some of the gaps that were indicated in the first phase of the Energy Track project that was completed earlier this year.

Using the Qualtrics platform, the survey was distributed across various networks including Energy Management Association, Association of Defense Communities, Society of Military Engineers, installation Energy Managers, and Norwich University contacts. An estimated 200 individuals received links to the two surveys and there were 38 responses to the mid-career survey and 41 responses to the senior leader survey. We did not restrict who took which survey, so it was possible for the same individual to respond to both surveys (Reference Enclosure 3).

- 4) Review survey results and define requirements. Approximately 95% of survey respondents agreed (of which 76% strongly agreed) that resilience is important for an installation's ability to achieve its mission. The top risks to installation energy resilience identified by survey respondents were modernization of infrastructure, vulnerability to climate and cyber threats, inclusion of energy resilience goals in the Installation Master Plan, and availability of training.

The survey respondents use a variety of channels to source information on best practices including colleagues, other energy managers, and online resources. Having an accessible and well-positioned online presence should be a key outcome of the Energy Track.

Though the surveys only focused on mid-career and senior leader populations, the responses regarding the importance of energy resilience, cyber security, and recovery from extreme weather events can be used to orient the training of the next generation in the primary undergraduate efforts. Funding availability was the most commonly mentioned answer to “What’s the biggest energy issue facing installations?”, Developing systems thinking, problem solving, risk management, and communication skills in the entry level population will help address some of the other issues described in the responses (Reference Enclosure 4).

- 5) Define Course Work Requirements; Identify Pilot Course Scope. The coursework requirements were framed in collaboration with the project consultants. For LOE 1, NUARI developed a concept plan with key learning objectives for an undergraduate curriculum (Big ideas). The conceptual plan evolved into a comprehensive survey that was shared with other senior military colleges and military academies. The responses allowed the team to finalize module development plans. The initial set of learning objectives were consolidated in some areas and expanded in other areas in response to the feedback from the multidisciplinary group of faculty and ROTC instructors who responded to the survey. The modified set of learning objectives is included in the LOE 1 Course Development Document (see Enclosure 9).

For LOE 2 focused on mid-career professionals, a 16-hour, hybrid delivery course was developed to introduce students to the principles of microgrid architecture, including development, design, and operations. This course introduced mid-level professionals on military installations to the basic components of microgrids, the role of telecommunications and automation in the operation of microgrids, and the risks of cyber threats to microgrids. The course

focused on the basic skills and knowledge needed to establish, operate, optimize, and disassemble microgrids.

For LOE 3 focused on senior military leaders, a 16-hour, hybrid delivery course was developed to prepare students to understand the role that critical infrastructure plays in the mission success of the installation as well as to the surrounding community. While the focus is on “energy infrastructure”, the analytical tools and exercises and much of the policy framework applies to other segments of mission critical infrastructure such as water, wastewater, communications, and transportation infrastructure (Reference Enclosure 5).

6) Design and Develop Pilot Courses - As proposed, modules at the undergraduate level (LOE 1) were piloted in two courses in Fall 2020.

- Freshmen level: EG 109 Introduction to engineering; 107 students registered (89 Fall + 18 Spring)
- Sophomore level: HN 101 Honors seminar course on Sustainability; 12 registered students in eight majors including Art and Architecture, Biology, Computer Security and Information Exchange, Criminal Justice, Mechanical Engineering, Nursing, Psychology, and Studies in War and Peace

We specifically targeted freshman and sophomore level courses to test curricular modules for the fall 2020 semester. This effort will be scaled up based on the assessment of the two courses and results from the survey (see item 4).

For the EG109 pilot of the Energy and Resilience module, the instructor commented that the student engagement in the exercise was high and that the students handled the portion of the activity related to defining energy very well. The audience (first-year engineering and construction management students) struggled to articulate a meaningful definition of resilience. The instructor reported that the lesson was completed in approximately half of the time for which it was designed. Completing the module in double time was less of an indicator of a need for more content and more of an indicator that the modules needed to have more instructor cues and more of a detailed support narrative to

emphasize the opportunities for discussion, reflection, and learning. This feedback informed a modification to the development of all the undergraduate learning modules.

For the HN 101 honors course on sustainability, separate module adaptation documents were developed. A pre-assessment and post-assessment survey was also administered in this course following approval by the Institutional Review Board with the following conclusions: “Overall, given that this was an honors class, students are above average in terms of academic and all-around accomplishments, more willing to engage in readings, discussions, and conversations than the average college student meant that as expected there wasn’t a large different between the pre and post responses. In a few cases, student understanding seemed to change, but mostly students were able to build on previous knowledge and use relevant vocabulary words to articulate ideas around resilience, sustainability and critical infrastructure.

One area where some confusion seemed to remain is in the articulation that building resilience can lead to long term sustainability. The areas for improvement would be to clarify some of the confusion around the links between the role that resilience qualities play in managing critical infrastructure and how resilient systems can help a community build long term sustainability.”

A detailed module assessment report for the module piloted in the honors course is available (Reference Enclosure 6).

At the LOE 2 level, two pilot courses were proposed. The first course was on Tactical Microgrid Standards (TMS). This title was changed to Microgrid Architecture on the recommendation of the course developer and in consensus with the project team and the government. The pilot for this course ran from April 12 through 30, 2020 on Norwich Pro. The second was on Industrial Control Systems (ICS), but was not piloted.

The September 15, 2020 roundtable discussions also showed the need for piloting a course for senior leaders. Therefore, an additional pilot course “Energy Resilience Senior Leader Seminar” was developed. This was also piloted using

the Norwich Pro platform between April 12 and 30, 2020. This course was specifically designed in a seminar style to engage senior leaders in discussions, share best practices, and create a network to learn from each other. An interactive tabletop exercise using NUARI's DECIDE platform was the culminating experience for participants who engaged in this pilot (Reference Enclosure 6).

- 7) Develop Courses. The development of modules and courses across all LOEs started in September and ran through most of the contract period. Each course developer prepared an extensive course development document based on a template provided to each consultant by the project team. The development document template included the course description, scope, target audience, prerequisites, required materials, testing/certification, reference list, evaluation strategy, and technical requirements. This was followed by a detailed course structure/outline that included a course progression flowchart, a course development matrix with weekly outlines, and an estimated contact time for each week. In addition, course developers were provided with templates for developing student slides. Modifications to the course development document format were made for modular content that was not necessarily sequential, but the key structural elements described were preserved.

Each course developer consulted with the core project team on a regular basis and used the team's feedback in modifications to the course development documents. The developers were also connected with instructional designers to experiment with various modalities and platforms to showcase the content developed for these courses (Reference Enclosure 7).

- 8) Pilot Course/Seminar. The objective of conducting the pilot course and pilot seminar was to prepare the instructional team for implementation and evaluating the suitability of the curricular materials. The Senior Leader Seminar and the Microgrid Architecture course were the two programs that were implemented between 12 and 30 April 2021. Attendees included a wide range of participants for both programs. The Senior Leader Seminar attendees included professionals

from Assistant Secretary of the Army, Installations & Environment, US Army Garrison Deputy Garrison Commanders, City Managers, Installation Energy Managers, and Emergency Managers. The Microgrid Architecture course included an Electrical Engineer, Professor of Engineering, Senior Cyber Security Specialist, and Installation Energy Managers (Reference Enclosure 8).

- 9) Evaluate Pilot Courses (Seminar). Both the Senior Leader Seminar and Microgrid Architecture course were piloted in April. Student feedback surveys, instructor feedback and reflection narratives, and observations by the project team were used to assess the pilot courses and to develop a robust list of strengths, opportunities, and recommendations for future implementation.

Strengths:

- **Strength 1.** The timeliness of the content and the linking of course content to current events in the energy and general infrastructure resilience spaces was highly valued by the course participants.
- **Strength 2.** The diversity of the participants in the courses, the networking that occurred in the synchronous sessions, and the student-to-student learning was invaluable. In the Senior Leader Seminar, the mix of professionals from multiple levels within the Department of the Army combined with the mix of individuals from multiple levels within the community sector was invaluable. After a key discussion session, one US Army Garrison energy manager commented that when he returned to his installation, he was going to revisit the way that he engaged with representatives in his community. In the Microgrid Architecture course, conversations between installation managers and practitioners with experience in the electric and telecommunications utility domains resulted in similar results—new-found motivation to create stronger community-installation relationships in the future.
- **Strength 3.** Students in both pilots felt that the course learning objectives were met. Similarly, the instructors were impressed by the students and their assessments of student learning over a few short weeks.

Observations from the project team reflected the instructors' appraisals—professionals immersed and engaged in the learning experience.

- **Strength 4.** The DECIDE® interactive, scenario-based, role-play exercise was well-received and useful as a capstone exercise to the Senior Leader Seminar.

Opportunities:

- **Opportunity 1.** For the Senior Leader Seminar, the content created for the course was exceptionally thorough—both broad and deep. It was created in a modular fashion and can exist as a stand-alone course or as supplemental modules integrated into other curricula. One participant commented that the module related to training exercises to support future preparedness was something they wished their entire team had completed. A rich bank of course content was created that is primed to serve many possible needs and audiences in the future. It will need to be attuned and modified for each need and audience.
- **Opportunity 2.** The Microgrid Architecture course focused on high-level principles related to the design and deployment of microgrids with special attention given to a tactical assessment of the associated operations, threats, and risks. One student commented that they wished the course covered more technical microgrid implementation details. Yet, the students in the course agreed that the course content was already intense; adding more content to the existing course is not realistic. There is an appetite for future course content development in the domain of tactical microgrids to support the rich content that was developed under this effort.
- **Opportunity 3.** In the pilot courses, students commented on the gaps between principle and practice—the chasm between recommended practices and the on-the ground realities. The student professionals commented on how nice it was to have access to others with practical knowledge and to talk with others who had similar experiences. In addition

to traditional professional development or continuing education courses, there is an opportunity to create a more consultative learning / training experience to support practitioners in this domain.

- **Opportunity 4.** Related to Strength 4 above, the interactive role-play exercise offered through the DECIDE® platform was an operational challenge to manage due to the support needs of the students who were geographically dispersed while also facing a wide variety of technologies, computer platforms, and computer networks. More homogeneity in terms of requirements for access combined with video tech support resources or a “try before the meeting” exercise would be helpful. An additional DECIDE® exercise could also be useful earlier on in the course as a diagnostic exercise.

Recommendations:

- To preserve Strength 1, a mechanism to continually refresh the courses and keep the content current needs to be designed into the operational and funding mechanisms for the courses. For future implementation of this program, funding should be included for updating course materials. The course content cannot remain static.
- To preserve Strength 2, all courses should include a component where the learning happens real time where the learners and instructors are together in time and space.
- Student access to the subject matter experts was key to student learning. Student access to other practitioners with varied experiences both inside and beyond the fence line, meaning inside a military installation’s boundaries and outside to the community, was also key to student learning. Networking opportunities and other opportunities for student-to-student learning should be preserved.
- The mixed audience with participants representing defense and community sector managers and practitioners enriched the learning experience. Multiple students commented on this aspect when

communicating with instructors. Delivery of the courses should be sought through an organization that can reach and provide service to both audiences.

- In any educational setting, student motivation and engagement are critical to student learning. Related to Strength 3, participants in both pilots removed themselves from the course experience when they realized that their other responsibilities would prevent them from engaging as professionals should. While this was fully understood and appreciated, it underscores the need to: a) clearly communicate time expectations in advance, b) repackage and rescale course delivery based on the student population and their individual and organizational needs, and c) to have partnerships with organizations where the recognition, opportunities for release, and opportunities for advancement are aligned with an installation and community “resilience objective,” recognizing and supporting participants in the program. Time and effort should be budgeted to develop these relationships and create this alignment.
- It is critical that the courses offered are attuned to the needs of the audience. Based on the intended audience, the learning objectives, selection of course content, timing of the course offering, course modality, and number of participants should be adjusted. All the content developed is appropriate and of value to members of the prospective audiences for the course, but it is not realistic for working professionals to complete a course that covers everything that was developed. Time and effort need to be allocated to allow for a down-selection to occur, modifying the developed courses to fit more specific audiences. For example, if the audience of “senior leaders” are experienced garrison commanders and community energy managers, much of the background content related to the motivations for the new policies should be removed and replaced with content that is more task-oriented (e.g., punch lists).

- A subset of the overall course content resonated with the students, but the subset was different for each student. It is likely that students gravitated to what was most relevant to them at the given moment based on their lived experience at work. It is likely that students could retake the same course multiple times and come away with something different each time based on their focus and the mix of the cohort. This is likely not the best use of one's time. Related to Opportunity 3, the development of an educational product and opportunity that is more consultative may be appealing to the audience (e.g. facilitated small group step-back sessions).

Conclusion

Need and Urgency of Energy Resilience Training

The Energy Resilience Education Track Design and Development program expanded the interdisciplinary team to include external consultants—experts on practical issues in military energy resilience and effectively working with community lifelines supporting military operations. Throughout the Development phase, events in the news, such as the power outages in Texas in February of 2021 and several cyber-attacks on critical infrastructure, made clear the current need for energy resilient systems. The SME's who collaborated with the Norwich Team in this phase reinforced not only the importance of energy resilience, but it's urgent need. Further, the connection between energy and other critical infrastructure was firmly established as a critical component of Energy Resilience education. The Energy Track educational platform provides one of the potential solutions whereby participants can develop the individual capacity, skills, and network to create and maintain resilient systems, both at installations and beyond.

Requirements and Relevance for DoD and Military-Civilian Cooperation

The parallel activities of taking inventory of Norwich programs and courses and the course development processes were valuable as they provided the NUARI research

team with a comprehensive understanding of the educational assets currently available while the new material was being developed. This allowed for the Team to develop clear assessments of quality and feasibility, which can ultimately accelerate the implementation of the Energy Track at all LOE's. What was clear from the inventory and course development processes is that there is a high-level of heterogeneity among all of the various options in terms of subject matter, quality, educational platform and prerequisites, which now necessitates an extensive market analysis or a clear and well-defined customer to focus the implementation efforts.

The Undergraduate modules were well received by the Norwich Faculty. Incorporating the material into courses into a broad range of subject matter areas will allow students to engage with energy resilience topics across the university. Pilot courses gave us an initial understanding of the challenges and opportunities of delivering classes to working civilian and military professionals, both mid-career and senior leaders.

Adaptable and Dynamic Process

In creating learning resources based on our previous design effort (Design to Develop in the ADDIE process), we encountered new issues and practical considerations that precipitated further work, additional work products, and outreach. For example, the Infographic and website evolved from the database concept and the requirement of effectively communicating our work to key current and future stakeholders—always keeping front-of-mind the overarching goal of “generational change.”

Another example of concept evolution and maturation in moving from the design to the development phase was a change to the operational plan where faculty from multiple disciplines would embed an LOE 1 module in their existing courses rather than focusing on the creation of new courses and the development of a minor in energy resilience housed in the school of engineering. This “re-thinking” helps further the goal of realizing broad, inclusive, “generational change.”

Finally, the Development phase along with the initial pilots occurred during a global pandemic where travel restrictions precluded in-person options. While Norwich

University regularly employs online learning platforms, we initially intended to deliver some portion of the Energy Track curriculum in an online course modality. The pandemic likely resulted in a bias toward online options. The in-person elements of the Energy Track such as seminars, round tables, internships, site visits, and other modalities are also very important to the goals of generational change and can be further developed as people begin to move more freely.

Recommendations/Next Steps

This section outlines a broad concept and general tasks to transition the Design/Development Phase into the Implementation Phase. Following the ADDIE (Analysis – Design – Development – Implementation – Evaluation – see Enclosure 19 for more detail) process, any transition from development to implementation would involve preparation of the course delivery mechanisms, developing an audience and engaging course participants, and instructor preparation. Specifically, the Implementation Phase of this project will primarily engage the implementation and evaluation modes of the ADDIE process and will require a detailed plan that covers the topics named below.

- a. Implementation Concept:
 - i. Purpose. The purpose of the Implementation phase is to launch the various energy resilience modules, courses, experiential learning activities, and other programming developed in the Development phase. Prior to deployment, formative evaluation will be conducted to ensure the appropriateness of the content and learning objectives for the selected audience. Throughout the implementation, summative evaluation will be utilized to assess how well the implementation is delivering on the stated objectives and desired learning outcomes. This evaluation informs iterative curricular refinement and planning for the sustained, future delivery of the Energy Track educational platform to improve the energy resilience capability of installations and operational units. The Implementation phase will provide energy resilience resources to Norwich

University students, other academic institutions, Department of the Army, other DoD entities, and local communities.

- ii. Method. The method to accomplish this “Generational Change” is a combination of academic and continuing professional education programs, consulting services, distributed exercise programs, security operations center training, internships, and research and development functions.
- iii. Endstate. The endstate of the Implementation phase is a sustainable multimodal educational platform that delivers relevant energy resilience educational resources in support of the objectives of the DoD and other customers.

b. Audience. Describe each LOE – include ICMA and ADC

- i. Undergraduate - The population for this effort is newly commissioned Lieutenants and civilian undergraduate degree students who will assume tactical level leadership or first line management roles in the US DoD or local communities with critical infrastructure oversight/responsibilities.
- ii. Mid-Career - Mid-career military and DoD civilians who have the authority to positively influence energy resilience in a military organization. Examples of personnel include but are not limited to Garrison Energy Managers, Cyber Security Professionals, Engineering Professionals (both in uniform and civilian), Operations Professionals, Housing Managers, and Logistics Professionals.
- iii. Senior Leader - The population for this effort includes: Garrison Commanders, City Managers, State and Federal Emergency Management leaders, senior staff at 1st US Army, Northern Command, Forces Command, US Army National Guard Command, State Adjutant Generals, and US continental-based US Army commands—including the Commander, Deputy Commander, or Chief of Staff, and the Senior Comptrollers, Cyber, Logistics, Special Operations, and Security Forces.

- c. ADDIE process – Continued application of the ADDIE model of instructional design will be employed throughout the Implementation phase. This model gives a focused approach in the development of course content and allows for continuous evaluation and improvement. The ADDIE model involves analysis, design, development, implementation and evaluation, iteratively applied in a continuous flowing process.
- d. Tasks:
 - i. Web resources – Videos, information graphics, and a decision wizard (a decision-making tool) are planned so that prospective students can easily find courses/modules/advice that suit their energy resilience mission needs.
 - ii. Partnership integration – Partners and consultants will be integrated to address key activities through webinars or other informational processes such as white papers, lessons-learned briefings, roundtable discussions, and the National Cybersecurity Preparedness Consortium (NCPC). These activities could be connected with an energy professional network for awareness and constant improvement.
 - iii. Consultant feedback sessions - During the implementation phase the instructors will provide a follow-on consulting session after the completion of the course to address student issues and support the energy resilience efforts at the installation level.
 - iv. Audience Definition – related to the broad audiences of professionals at the mid-career and senior leader levels, target cohorts of specific professionals from those groups will be identified and a formative evaluation will be conducted so that the modular curricular content developed can be repackaged and rescaled to meet the specific needs of the individual learners and their organizations. This customization will also address the likely time commitment that can be expected from learners in the different cohorts. Based on the specific, intended cohorts, the learning

objectives, course content, timing of the course offering, course modality, and number of participants will likely be adjusted.

v. Possible Course Content:

Integrated Course

- Senior Leader Seminar (this course integrates several modules into one seminar; integrated modules marked with *)

Fundamentals

- Energy and You Module
- Energy and Society Module
 - Sub-modules:
 - Energy Economics and Finance
 - Sustainability
 - National and Global Energy Trends
- Energy and Resilience Module
- Energy Nexus Module (Connected to SLS practical exercises)
- Microgrid Architecture
- Industrial Control Systems (ICS)

Risk Analysis

- Critical Infrastructure/Energy Resilience Overview Module*
- Identifying Mission Critical Infrastructure/Energy Systems Module*
- Critical Infrastructure Threat Analysis/Risk Management Module*
- Introduction to Compliance Investigations (CC310)
- Risk Assessments, Policies, and Internal Controls (CC320)
- Due Diligence and Internal Investigations (CC330)
- Organizational Culture and Continuous Compliance Improvement (CC340)

Policy, Partnerships, Cyber

- Security Situation Center Training 2020* (NUARI)
- Energy/Critical Infrastructure Resilience Policy and Partnerships Module*
- Exercise Development Process - Capstone Exercise Module
- Graduate Certificate in Computer Forensic Investigation/Incident Response Team Management
 - Computer Security Incident Response Team Management | GI554
 - Computer Forensic Investigation GI551
- Graduate certificate in Vulnerability Management
 - Vulnerability Management and Penetration Testing I GI562
 - Vulnerability Management and Penetration Testing II GI553
- Graduate Certificate in Critical Infrastructure Protection & Cyber Crime
 - Cyber Crime GI556
 - Critical Infrastructure Protection GI566

- Graduate Certificate in Public Administration Leadership & Crisis Management -
 - Foundations of Leadership and Ethical Decision-Making AD576
 - Public Leadership, Crisis Management, and Organizational Change AD586
- Graduate Certificate in Rural Municipal Governance
 - Municipal Governance AD543
 - Rural Municipal Governance AD553
- Graduate Certificate in Urban Municipal Governance
 - Municipal Governance AD543
 - Urban Municipal Governance AD563

Master Planning

- Energy Resources and Markets GB548 – in non-credit format
- Energy Savings and Efficiency Projects GB558 – in non-credit format
- Managing Corporate Energy Needs GB568 – in non-credit format
- Public Works PW310: Management and Leadership Proficiencies
- Public Works PW320: Strategy and Planning
- Public Works PW330: Operations and Organizations
- Public Works PW340: Long-Term Strategy Project
- Project Management PM310: Project Management Overview
- Public WorksPM320: Applied Psychology in Project Management

National Cybersecurity Preparedness Consortium – The NCPC develops and offers courses in five topic areas: See the courses at:

<https://nationalcpc.org/courses.html>

- Awareness
- Coordination and planning
- Cyber incident response and recovery
- Infrastructure technical training
- Cyber threat information sharing

The NCPC is the premier cybersecurity consortium in the nation. As early as 2004, in partnership with DHS/FEMA, the individual members of the NCPC have developed and delivered DHS/FEMA certified online and face-to-face training courses to an array of states, counties, local jurisdictions, and critical infrastructure components nationwide addressing cybersecurity and cyber-terrorism concerns.

The mission of the NCPD is to provide research-based, cybersecurity-related training, exercises, and technical assistance to local jurisdictions, counties, states, and the private sector.

The consortium is organized around the Community Cyber Security Maturity Model (CCSMM) that emphasizes cybersecurity as being the responsibility of the "whole community". The whole community includes the public and private sectors as well as any individual within the community who accesses the Internet or a computer network. The NCPD is based on the idea that cybersecurity response is better and more effective if collaborating to provide real solutions rather than individual training concepts.

- vi. UCC preparation/coordination – Modification of academic credit bearing courses requires approval by the University Curriculum Committee for implementation. Preparations for adjustments to courses such as graduate certificates that relate to energy resilience require coordination so that the processes and authorities are in place to offer the courses during Phase 3 – Implementation. The Cohort concept of conducting academic certificates is a model that supports both the professional development of the student and efficiency of academic programing and scheduling.
- vii. Certificate preparation – Modules and courses can either result in the award of academic credit or Continuing Education Units (or no credit if applicable). Some offerings could be combined to produce a certificate recognizing a specific skill set. Further, modules can be paired to create a seminar to meet a training requirement. The options to meet anticipated training and education needs are varied—flexibility and adaptability are key tenants of certificate options.
- viii. Energy Resilience Exercise concept –The concept of integrating distributed tabletop and multifunctional exercises as part of the education offerings has an enhancing effect on education and training programs.

- ix. Roundtables – Roundtable sessions with key influencers in the field of energy resilience can be both an awareness-building effort and a promotional effort for the Education Track.
- e. Risk – Subject: Target Audience Awareness of the NUARI courses – MEDIUM for audience awareness during the Implementation Phase. Recommend coordination with the Installation Management Command Garrison Pre-Command Course regarding Senior leader awareness, and attendance, at the courses being developed in this program. Finally, consider an interaction with ICMA and SAME on this subject. ICMA has a fellowship program with the Army G9 for Deputy Garrison Commanders to spend a week with a City Manager. The Association of Defense Communities (ADC) could also be a partner in exposure of the curriculum availability. We should also explore relationships with the National League of Cities, National Association of Counties, US Conference of Mayors, the National Governors Association, and National Association of State Legislators to further the policy and training partnership opportunities as each of them are currently addressing the issues of energy and other critical infrastructure resilience. Further, coordinate with AUSA and their professional development/hot topic day long seminars to expose the Army leadership to the essential components of energy assurance/resiliency and the installation's ability to project combat power. Finally, consider implementation with the USACOE Learning Center.

Enclosures:

- 1) Inventory & Creation of Certifications from Existing Courses
- 2) Research & Internship Program Setup
- 3) Survey Mid-Career and Senior Leader Surveys
- 4) NUARI Review of Baseline Survey Results
- 5) Define Course Work Requirements & Identify Pilot Course Scope
- 6) Develop Courses
- 7) Pilot Course – Seminar
- 8) Evaluate Pilot Course
- 9) Energy Resilience Fundamentals – Course Development Document

- 10) Microgrid Architecture – Course Development Document
- 11) Industrial Control Systems (ICS) – Course Development Documents
- 12) Critical Infrastructure
- 13) Identifying Critical Infrastructure
- 14) Critical Infrastructure Strategy and Resilience (Risk) Module
- 15) Energy/Critical Infrastructure Resilience Policy Strategy and Partnerships Module
- 16) Critical Infrastructure Energy Resilience Exercise Development Module
- 17) Critical Infrastructure/Energy Resilience Capstone Exercise Module
- 18) Course Catalog
- 19) References and Acronyms

Enclosure 1: Inventory & Creation of Certificates from Existing Courses

CONTRACT TITLE: DEVELOPMENT OF AN ENERGY TRACK WITHIN THE NORWICH UNIVERSITY CENTER FOR GLOBAL RESILIENCE AND SECURITY – DESIGN PHASE

Inventory and Creation of Certificates from Existing Courses - Report for Contract No. W9132T20C0005

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A. INTRODUCTION

The purpose of the inventory and creation of certificates report in the field of energy resilience is to identify current courses, academic programs, professional development certificates, and energy exercises that can contribute to the Energy Track at Norwich University. Further, courses will be identified and subsequently proposed to University Curriculum Board for academic recognition as an academic program or professional development program.

Reference: DEVELOPMENT OF AN ENERGY TRACK WITHIN THE NORWICH UNIVERSITY CENTER FOR GLOBAL RESILIENCE AND SECURITY – DESIGN PHASE VOLUME I TECHNICAL PROPOSAL outlines the following task which is extracted from the deliverables table in the NUARI proposal (and made a part of the contract).

Inventory and creation of certificates from existing courses	+15 days	+60 days 4 August, 2020	New NU Energy Track Certificates, Concentrations and Minors and other programs created

B. SCOPE

The scope of this inventory and certificate creation document includes the following:

1. Undergraduate Main campus – see Enclosure 1. The main campus energy resilience curriculum review includes freshman, sophomore, junior, and senior level courses in the field of energy and energy resilience. Further, the undergraduate survey will be administered to Norwich University faculty as well as several other Senior Military Colleges. The energy fundamentals survey and course design will focus on energy “Big Ideas” which will provide material for the modules to integrate into current curriculum.
2. Undergraduate – College of Graduate and Continuing Studies – see Enclosure 2. The online undergraduate program inventory includes several standalone courses that have an impact in the field of energy resilience. They include, but are not limited to Supply Chain Management, Cyber Security Management, Cyber Vulnerability Management, Project Management, Sustainability, and others. The new undergraduate certificate in Cyber Security Management in the Business Administration degree could, depending on the surveys and subsequent analysis, be modified to focus on energy resilience topics. Further, the Business Administration degree could, in coordination with the Main Campus energy resilience effort, develop either a concentration or an undergraduate certificate that supports energy resilience by combining Supply Chain Management, Program Management, Finance, Cyber Security and a “to be developed” energy resilience course or module.
3. Graduate programs – College of Graduate and Continuing Studies - see Enclosure 3. The primary offering in the field of energy resilience at the master’s degree level is the MBA with a concentration on Energy Management. Further, the Graduate Certificates in Leadership, Procurement and Contracting, Cyber, and Public Administration have a direct impact on the interdisciplinary subjects in the field of energy resilience. The Cyber and MPA Graduate Certificates can be tailored to specifically meet an energy resilience requirement (for example, the Leadership and Crisis Management course could be combined with the Computer Security Incident Response Team Management course to specifically address energy resilience organizational response).
4. Norwich Pro – see Enclosure 4. The current inventory of Norwich Pro Certificate programs has individual courses that can be combined to make either a micro-certificate or Professional Development certificate by awarding Continuing Education Units. Groupings of four interdisciplinary topics would form a certificate program. For example, Energy Resilience Managers certificate – Energy Fundamentals course (new); Energy Risk Assessment course (inject Resilience module with the Risk Assessments, Policies, Internal Controls course); Energy Partnerships (new); Project Management Overview; Due Diligence and Internal Investigations (with an energy resilience module).
 - a. NUARI – see Enclosure 5. NUARI manages the DECIDE® platform which is a remote exercise program sponsored by DHS that, in the current design, addresses energy resilience issues in the cyber realm. The scope of the DECIDE® platform can be adapted to instructional programs or seminars to address energy resilience. Further, NUARI participates in a cyber-security consortium that creates relevant federal emergency courses which, with permission, could be adapted to this energy resilience program.

Enclosure 1 - Undergraduate Main Campus, NUARI/Norwich University/Norwich Pro Energy Resilience Inventory of Courses, Certificate Inventory, and Creation of Certificates

1. Introduction: During Phase 1, CGRS developed an exhaustive inventory of interdisciplinary courses relevant to an energy curriculum from the undergraduate catalog. In addition, we also conducted a

survey of undergraduate faculty at Norwich University and learnt that the best way of introducing energy resilience and security ideas across majors at all levels of undergraduate education is to integrate energy resilience and security modules into existing courses. It was also noted that embedding research opportunities related to energy resilience and security within classes can be an effective strategy to increase student awareness and understanding of these areas. Development of concentrations and minors was also considered. Finally, we also had discussions on making internship opportunities available to students interested in pursuing advanced energy resilience and security related topics in their undergraduate experience.

2. In this Design Phase 2, we have accomplished the following tasks to date:
 - a. We have distilled the results of the phase 1 survey into “big ideas” related to energy and a series of student learning outcomes related to energy fundamentals education for undergraduate students. We have outlined a possible structure for undergraduate energy resilience and security curriculum (see attachment 1).
 - b. We have identified at least two courses at the undergraduate level to embed a new or expanded discussion or activity on energy resilience and security.
 - i. Freshmen level: EG 109 Introduction to engineering; 67 students registered
 - ii. Sophomore level: HN 101 Honors seminar course on Sustainability; 12 registered students in eight majors, including Art and Architecture, Biology, Computer Security and Information Exchange, Criminal Justice, Mechanical Engineering, Nursing, Psychology, and Studies in War and Peace
 - c. We specifically targeted freshman and sophomore level courses to pilot curricular modules for the fall 2020 semester. This effort will be scaled up based on the assessment of the two courses, and results from the survey (see item 4).
3. Each of these courses will add an activity to specifically introduce energy resilience and security concepts into the courses. Students’ understanding of these concepts will be assessed and reported at the end of the semester.
4. We have developed a survey to be administered to undergraduate faculty members at five Senior Military Colleges (SMCs) in the United States (see Attachment 2). These are Norwich University, West Point Military Academy, the Citadel, the US Coast Guard Academy, and Virginia Military Institute (VMI). Results from these surveys will allow us to develop more structured energy resilience and security curriculum at the undergraduate level.
5. We have approval from the Director of the David Crawford School of Engineering at Norwich University to develop a minor on energy resilience and security, to be housed at the engineering school. The survey results will help clarify the types of courses to be included in the minor. Our goal is to offer two paths of attaining the minor, making it accessible to technical and non-technical majors.

6. The development of the minor will begin after all survey results have been obtained and analyzed and will continue through the academic year.
 7. CGRS will develop all the paperwork necessary to present the minor to the University Curriculum committee for approval.
 8. Attachments - Key concepts from Phase 1 Survey – Attachment 1 (Big Ideas) and 2 (Survey) to Enclosure 1
Review of the NU faculty survey conducted during phase 1 of this project reveals the following broad themes or *big ideas*, herein referred to as BIs, related to energy fundamentals that are components of a variety of current undergraduate courses at NU. The coverage results predominantly from the architecture, environmental science / geology, and engineering disciplines, but it also includes courses from philosophy, cyber security, and nursing.
- BI 1. Energy resource deployment—generation capacity and loading
 - BI 2. Energy supply system—generation, transmission, distribution, conversion, or transfer of electrical or heat energy
 - BI 3. Energy analysis, modelling, and computation
 - BI 4. Technical, social, and ethical evaluation and analysis concepts:
 - a. Efficiency and high performance
 - b. Sustainability and product life-cycle
 - c. Environmental and ecological impacts

Through the same survey mechanism, the following broad themes or big ideas emerged as future energy-related content that faculty feel should be available in the catalog of offerings:

- BI 5. Energy infrastructure monitoring and security
- BI 6. Optimization techniques applied to energy generating and consuming systems
- BI 1. Strengthening content linking energy and transportation
- BI 4c Strengthening content linking energy to the environment

As a form of external comparison for the concept list uncovered in the NU faculty survey, the introductory text by Moaveni¹ includes content to meet the learning objectives listed below. A mapping of the learning objectives to those concepts resultant from the Norwich survey are included in Table 1.

Table 1 - Mapping of Moaveni Text Learning Objectives (LOs) to NU Survey Big Ideas (BIs).

Big Idea	Moaveni Learning Objective (Ch #, LO #)
BI 1	Understand that it takes energy to address basic human needs and be familiar with energy consumption rates and sources in your daily life (Ch 1, LO 2); Describe how much energy is consumed in the world (Ch 6, LO 1);

¹ *Energy, Environment, and Sustainability*, Saeed Moaveni, Cengage Learning, 1st edition, January 2017, ISBN: 978-1133105091.

	Describe how much energy is consumed in the United States in buildings, transportation, and industry (Ch 6, LO 2); Know about the production and consumption of gasoline, diesel, fuel oil, natural gas, propane, and coal (Ch 6, LO 3);
BI 2	Be familiar with how electricity is generated, transmitted, and distributed (Ch 4, LO 4) Understand how heat transfer occurs (Ch 5, LO 1)
BI 3	Describe how we quantify what it takes to move things (kinetic energy), to lift things (potential energy), and to heat or cool things (thermal energy) (Ch 3, LO 2); Explain the difference between energy and power (Ch 3, LO 3); Explain the meaning of degree-days and how this is used to estimate heating energy consumption (Ch 5, LO 4);
BI 4a	*Not phrased as a learning outcome, but the Ch 7 coverage of renewable systems is used for efficiency and performance discussions in comparison to the classical systems described in Ch 6;
BI 4b	define sustainability and its role in your everyday life (Ch 1, LO 3); explain the key sustainability concepts, assessments, and tools such as life-cycle analysis (Ch 12, LO 2);
BI 4c	describe different layers of the Earth, its structure, and its properties (Ch 10, LO 1); explain the phases of matter and the important properties of materials (Ch 10, LO 2); understand the importance of recycling and composting (Ch 11, LO 3)

In Phase 2 of this project, it is anticipated that course content will be developed in the broad areas of energy: fundamentals, risk analysis, policy + governance, and resilience master planning. For the energy fundamentals segment, the initial focus will be on students developing a conceptual understanding of technical energy concepts. It is important to note that, counter to the stereotypically “silo-ed” nature of many academic programs, the lessons developed and technical concepts explored in the energy fundamentals course should be presented within realistic contexts including consideration of ethical, social, geo-political, governmental, and environmental factors and implications. In order to truly meet the learning objectives for the course, students should develop *enduring understandings* that connect technical energy principles to other contexts, that are transferrable to many disciplines, and that are foundational for future study in the classroom and work beyond the classroom. The proposed list of desirable enduring understandings found in Table 2 were developed as extensions of the big ideas previously discussed. The draft list provided will be tested and validated through a survey of faculty at Norwich and other Senior Military Colleges, and revised accordingly. Further revisions will be conducted following an analysis of materials and results from David Ruzic’s “Energy, Environment, and Everyday

Life” MOOC course offering available through Coursera.² Over 8,000 students have enrolled in the aforementioned course and a related outline of learning objectives and YouTube playlist is publicly available. Those materials and other resources may be useful for a comparative analysis of the outcomes derived through the local faculty surveys.

Following the backward design principles laid out in the *Understanding by Design*^{3,4} framework (UBD), lists of essential questions and student content knowledge can be derived from the enduring understandings and BIs listed. The ADDIE design framework would then be incorporated to develop, deploy, and revise assessment and learning activities for the course.

Table 2 Student learning outcomes related to energy fundamentals phrased as enduring understandings stemming from the big ideas revealed in the NU faculty survey.

Big Idea	Enduring Understanding Reference (Outcome #)	Enduring Understanding Description Students will...
BI 1	U1-1 (O1)	explain that energy is conserved, that it can be transformed into various forms, and that the time scale on which it is “stored” and “released” is critically important.
	U1-2 (O2)	estimate the energy requirements of addressing basic human needs such as food, shelter, water, transportation, or waste management.
	U1-3 (O3)	discuss the scale and scope of energy consumption rates in the US and the world, as well as the sources and processes for transforming energy into forms useable for consumption.
BI 2	U2-1 (O4)	describe how electricity is typically generated, transmitted, and distributed, as well as the impact of renewable or local energy sources on those processes.
	U2-2 (O5)	provide examples of the three main processes by which heat transfer occurs and applications of those processes.
BI 3	U3-1 (O6)	quantify energy and power in its various forms (kinetic / mechanical, thermal, electric), connect those forms to the physical environment, and convert measures among those forms.
	U3-2 (O7)	differentiate between work/energy and power, connecting those quantities to time.

² *Energy, Environment, and Everyday Life*,” David Ruzic, University of Illinois, Coursera, Online, Accessed 6/27/2020, <https://www.coursera.org/learn/energy-environment-life>

³ *Understanding by Design*, G. Wiggins and J. McTighe, Association for Supervision and Curriculum Development, Alexandria, Va, 2005, 2nd edition.

⁴ “Big Ideas: Keeping the Expert at the Center,” iTeachU, University of Alaska Fairbanks, Online, Accessed: 6/28/2020, <https://iteachu.uaf.edu/big-ideas/>

	U3-3 (O8)	analyze and estimate the needs and impacts of energy producing or consuming systems using per unit quantities, and model behaviors to predict future needs.
BI 4 (a-c)	U4-1 (O9)	articulate that efficiency and performance must be viewed within particular contexts, and that standard efficiency and performance definitions for generating and consuming energy devices vary based on the particular context and materiality.
	U4-2 (O10)	apply key sustainability concepts, assessments, and tools to the analysis of existing systems and explore the impacts of the systems in multifarious societal contexts.
	U4-3 (O11)	connect the source and demand for energy to meet human needs to global, environmental contexts.

Example Survey Questions

** Use Likert scale 1 to 5: unimportant, slightly unimportant, neutral/no opinion, slightly important, important*

1. For each of the understandings listed above (U1-1...), please indicate their level of **importance** to the education of an informed global citizen who is conversant about energy topics.

** Use Likert scale 1 to 5: not covered, neutral/no opinion, slightly covered, moderately covered, well covered*

2. For each of the understandings listed above (U1-1...), please indicate the level of coverage of topics designed to help students develop that understanding in your program of study.

** Use Likert scale 1 to 5: no understanding, beginning understanding, developing understanding, conversant/proficient understanding, advanced/deep understanding*

3. For each of the understandings listed above (U1-1...), please indicate the success of your program at helping students develop the enduring understanding described.

** Free response*

4. Please list any understandings / learning outcomes related to energy fundamentals that you feel are important and absent from the list.
5. For each of the understandings listed, please succinctly describe any of your current course modules or units that you feel are successful at helping students develop that energy understanding

6. Please list the understandings above that you would be most interested in receiving supporting course modules for. (Select up to 3)

Ideas for Majors / Minors / Concentrations

Develop a six-course minor in energy resilience that is readily integrated into the following programs of study:

- Mechanical / Electrical / Civil Engineering
- Math / Physics
- Computer Security and Information Assurance
- Political Science / International Studies
- Geology / Environmental Science

Also, Environmental Science majors are required to select a concentration. There are two main concentration categories—technical-based and policy-based. Create both a technical- and policy-based concentration within environmental science.

Draft a plan of study for an energy resilience track within general engineering.

Enclosure 2 - Undergraduate – College of Graduate and Continuing Studies, NUARI/Norwich University/Norwich Pro Energy Resilience Inventory of Courses, Certificate Inventory, and Creation of Certificates

1. Bachelor's degree Energy Resilience Interdisciplinary Course Offerings summary:

Note: <https://online.norwich.edu/degree-programs/bachelors-degrees>

(A) BS in Business Administration - Currently has relevant concentrations in:

- a. Cyber Security Management (Academic certificate – 18 credits)
- b. Procurement and Contract Management
- c. Finance Services Management
- d. Supply Chain Management

Note: 4+1 with MBA in Energy Management (T) is a possibility depending on the survey and the design process.

(B) Possible Energy Resilience Concentration - A possible interdisciplinary concentration in Energy Resilience could include courses in Procurement and Contract Management, Finance, Cyber Management, and Energy Management (either from a main campus course or a portion of the MBA concentration in Energy Management).

(C) BS in Cyber Security - The Bachelor of Science in Cyber Security has two concentrations that are applicable to the field of Energy Resilience. Which are:

- a. Computer Forensics and Vulnerability Management
- b. Information Warfare and Security Management

(D) BS in Data Analytics - The Bachelor of Science in Data Analytics is a new course that has relevance to energy resilience in terms of data management.

(E) National Security Studies - Regional studies courses in the NSS program are beneficial to the Operational Energy Resilience program within ERDC.

(F) Undergraduate Certificates – Undergraduate academic certificate in Cyber Security Management.

2. Undergraduate certificate: Cyber Security Management (18 Credits) - The Cyber Security Management concentration is designed to help you to work collaboratively with cyber security professionals in an organization in order to achieve both effectiveness and efficiency in related projects and decision-making. To complete this concentration, students take the following courses:

- Project Management Fundamentals MNGT475 3 credit hours
- Project Management Advanced Techniques MNGT476 3 credit hours
- Cyber Law and Cybercrime CJ341 3 credit hours
- Management of Information Assurance IA342 3 credit hours
- Introduction to Information Assurance IA340 3 credit hours
- Systems Assurance CYBR410 3 credit hours Procurement and Contract Management

3. Undergraduate Courses: the following courses maybe relevant to the development of an energy resilience concentration at the bachelor's degree level with the inclusion of an energy resilience module:
- MATH 232 Elementary Statistics 3 Cr.- A course that covers the study of frequency distributions, averages and standard deviations, normal curve, probability, decision-making, sampling techniques, testing hypotheses, chi-square, students-t and F-distributions, correlation and linear regression. Prerequisite: A college level mathematics course or equivalent as determined by departmental placement testing.
 - SCIE 301 Environmental Science 3 Cr. - A study of the dynamic interaction between human and environment with emphasis on ecosystem structure and function; the study, analysis and identification of optimal solutions to local and regional environmental issues and problems; and short- and long-term strategies for natural disaster or post-conflict remedial measures. Prerequisites: none.
 - SCIE 310 Science Basis of Sustainability 3 Cr. - Students examine how Sustainability Science has emerged in the 21st Century. Students learn how evidence-based, quantitative data are collected and used to define and monitor sustainability-related issues and problems, and how critical thinking skills are applied to an interdisciplinary understanding of problems and solutions, as well as how information networks can both supply important data and serve as a medium for communicating with other interested parties on a global basis. The course concludes by examining how sustainability science relates to an ever-widening range of decisions, strategies and activities in the private, public and military worlds. Prerequisite: approval of the Division of Continuing Studies.
 - MNGT 311 Operations & Project Management 3 Cr. - This course is designed to introduce a broad overview of operations and project management, while exploring a number of important concepts critical to achieving operations and project management success. Operations management is broad in scope, encompassing products and services in a multitude of forms. These products and services range from the cars we drive, the computers we use, the Internet we access, to military operations that safeguard our county. In effect, operations management, as a field, encompasses the activities and tasks that create value for the goods and services all of us use in a variety of ways. In addition, this course will explore project management from the focus on the "nuts and bolts" or fundamentals of project management and practices, and how it supports operations management strategic goals and objectives. We'll also examine some of the key elements of project management from the project management life cycle, key processes and important tools, techniques and measurements of project. Prerequisites: None. Note: this course is under development and will be reviewed by the University Curriculum Committee.
 - SSDA 310 Emergency and Disaster Relief Operations 6 Cr. - This course examines the principles used by emergency managers to respond to local or regional disasters. Students examine the NIMS (National Incident Management System) and other standards governing emergency management. Prerequisites: None.

- INSC 311 Intro Homeland Security Intelligence 3 Cr. - This course addresses the functions of homeland security, critical infrastructure, and asset protection as they relate to government, industry, and the community. The key functions of threat prevention, crisis response, and operations recovery are addressed from a variety of perspectives given that homeland security is a responsibility that is shared by government agencies, the private sector, and individuals, encompassing a broad spectrum of professional career positions throughout our society. This course provides an overview of the elements involved in the homeland security function, as well as the challenges critical infrastructure managers in government and industry can/will face while maintaining mission operations and staff accountability in the midst of multiple overlapping roles and responsibilities in our rapidly changing world.
- MNGT 475 Project Management Fundamentals 3 Cr. - Focus is on the fundamentals of project management and practices and preparation for Project Management Institute (PMI) certification. Students explore the key elements of project management from the project management framework, the project life cycle, project process and key project management knowledge areas. Additionally, project integration, scope, time, cost, quality, resource and schedule management are studied. Other key areas of focus are project management procurement and overall project communications requirements. 3 cr.
- MNGT 476 Project Management Advanced Techniques 3 Cr. - Builds on and finalizes the foundational material on project management principles, practices, and processes covered in MNGT 475: Project Management Fundamentals. Students focus on the critical PM components of project management leadership, effective communications, and the management of project teams. 3 cr. Prerequisite: MNGT 475.
- CYBR 410 Systems Assurance 3 Cr. - This course focuses on the design considerations involved with the security of site design. The course will also provide and understanding of the Levels of Trust and system accreditation/certificate processes. Life cycle management of software, hardware, and physical plant, from planning through destruction will be examined and reinforced using case studies. Additionally, understanding of the variety of security systems involving computers and networks and an ability to evaluate vulnerabilities will be discussed. Note: This course is under development and will be reviewed by the University Curriculum Committee.
- CJ 341 Cyber Law and Cyber Crime 3 Cr. - This course includes extensive discussion of the legal constraints, both civil and criminal, that underlie acceptable behavior using computers and networks today. Cross-listed as IA241. Open to Freshmen 2 or higher or instructor permission. Offered in fall semester.
- IA 340 Introduction to Information Assurance 3 Cr. - This course introduces the foundations of information assurance, with focus on concepts and terminology used in describing, analyzing, and implementing information security. Topics include the history and mission of information assurance, history of computer crime, modern and historical cryptology, information warfare, penetrating computer systems and networks, malware, social engineering, spam, phishing, physical and facilities security, network security, identification and authentication, securing stored data, data backups and archives, patch management, and protecting digital rights. Classroom 3 hours. Prerequisite: CS 140 (with C or higher). Offered Fall.

- IA 342 Management of Information Assurance 3 Cr. - This course focuses on management of the information assurance process. Topics include human factors in reducing security breaches, security incident detection and response, remediation, management's role in information assurance, and other considerations in framing and implementing information assurance policies. The final section reviews current topics of particular interest and activity in the field of information assurance. Prerequisite: CS 140 (C) or higher. Offered Spring.
- MNGT 441 Public Procurement and Contracting 6 Cr. - The student examines the scope, methods, and processes of forming contracts between public and private parties for the purpose of accomplishing the missions of governmental agencies at the international, federal, state/provincial and local level. It is designed for individuals considering a career in public administration, persons employed in government agencies, public procurement personnel wishing to enhance their knowledge, and suppliers or citizens interested in learning more about the formulation of government contracts. Subject and foundational areas such as contract monitoring, contract administration ethics, and of the legal basis of the public procurement function will be examined and explored. Prerequisite: None.
- MNGT 442 Public Procurement and Strategic Planning 6 Cr. - Student examines the scope, methods and processes of forming contracts between public and private parties for the purpose of accomplishing the missions of governmental agencies at the international, federal, state/provincial and local level from a strategic planning vantage. It is designed for individuals considering a career in public administration, persons employed in government agencies, public procurement personnel wishing to enhance their knowledge, and suppliers or citizens interested in learning more about the formulation of government contracts. Subject and foundational areas such as procurement strategic planning, risk management and procurement ethics will be examined and explored as it relates to the public procurement function. Prerequisite: MNGT 441 (C or better).
- Computer Forensics and Vulnerability Management Concentration (18 credits)

The Computer Forensics and Vulnerability Management concentration allows you to develop a comprehensive understanding of forensic processes and cybersecurity protocols. Coursework will help strengthen your investigatory prowess through hands-on exercises in cyber investigation and vulnerability testing.

- Introduction to Computer Forensics CJ442 4 credit hours - This course provides the student with an ability to perform basic forensic techniques and use appropriate media analysis software. Knowledge of the security, structure and protocols of network operating systems and devices will be covered as students learn to gather evidence in a networked environment and to image and restore evidence properly without destroying its value. The student will learn and practice gaining evidence from a computer system while maintaining its integrity and a solid chain of custody. Within the laboratory, the student will gain hands-on experience in the use of current investigative tools.
- Network Forensics DF311 3 credit hours - This course is an introduction to network forensics. In this course the student will be introduced to digital forensic concepts and

practices on local area networks, wide area networks and large scale networks such as the Internet. Use of tools such as packet monitors, security information and event managers (SIEMs), network forensic tools, tracing tools and other tools useful for analyzing events on a network will make up a large part of the course. Material will be covered through lecture, demonstration and student hands-on labs. Many of the labs will involve analysis of pcaps of both actual attacks and theoretical malfeasance by offenders. Some of the lecture will involve investigative techniques, how to conduct an investigation, manage evidence and follow a cyber-trail.

- Malware Forensics DF312 3 credit hours - This predominantly laboratory-based course is an introduction to malware forensics including both static and dynamic analysis. Students will study profiling, malware behavior, behavior of malware on computer networks, anti-reversing and anti-debugging techniques, and packers.
- Cyber Investigation DF411 3 credit hours - This course is an introduction to cyber investigation. It includes elements of cyber crime, cyber warfare and cyber terrorism. The course will examine investigative techniques for cyber investigators, case studies of representative cyber crimes and cyber warfare incidents, some cyber investigation tools and expert witnessing. The course builds up to a mock trial where students act as a cyber investigation task force on an actual case of cyber crime. This is a course that incorporates extensive reading as well as hands-on lab exercises. No prerequisites.
- Vulnerability Testing I CYBR320 3 credit hours - This course presents the concepts, tools, and techniques used for penetration testing, vulnerability exploitation, assessment, reporting, and forensics; teaches multiple attack vectors as well as the defensive measures protecting against such attacks; focuses heavily on post- attack forensics allowing for a complete picture of the attack process. The seminar introduces several open- source tools such as the Metasploit framework. This seminar includes lab exercises using a virtual computer environment.
- Vulnerability Testing II CYBR420 3 credit hours - This course is the second of a two-part introduction to Penetration Testing and Vulnerability Assessment. This course presents the concepts, tools, and techniques used for penetration testing, vulnerability exploitation, assessment, reporting, and forensics; teaches multiple attack vectors as well as the defensive measures protecting against such attacks; focuses heavily on post-attack forensics allowing for a complete picture of the attack process. The course introduces several open- source tools such as the Metasploit framework, Nmap, Nessus, Wireshark, Vistumbler, BurpSuite, Nikto, Cain and Abel, Aircrack-ng Suite, John the Ripper, Social Engineer Toolkit and Kali Linux. This course includes lab exercises using a virtual computer environment. Prerequisite: CYBR320

- Information Warfare and Security Management Concentration (18 credits)

The Information Warfare and Security Management concentration introduces you to the international power dynamics of the Internet, and the ways in which professionals in cybersecurity analyze intelligence and assess threats in order to protect national sovereignty in cyberspace.

- Introduction to Information Warfare CYBR370 3 credit hours - This course introduces students to the overall concept of Information Warfare (IW) and Information Operations (IO), particularly with regard to the US Federal government and the Department of Defense. Introduction to IW / IO surveys the development of Information Warfare (IW) and Information Operations (IO) as these elements of power have become more important for the United States Department of Defense (DoD) and Federal Government as a whole. The course assumes only a rudimentary familiarity with the basic concepts and terminology of modern Internet usage and computing and is not a technology-focused course.
- Defense Information Warfare CYBR382 3 credit hours - This course introduces students to the overall concept of Defensive Information Operations (D-IO), which are conducted across the range of military operations at every level of war to achieve mission objectives. Combatant commanders and mission owners must carefully consider their defensive posture and strategy in order to deter and defeat adversary intrusion while providing mission assurance. Upon completion of this course, students will be able to develop a defensive strategy by analyzing risk, cyberspace terrain, mission priorities, and utilizing threat intelligence. Prerequisite CYBR 370 or Permission of Instructor.
- Offensive Information Warfare CYBR380 3 credit hours - Students learn how Offensive Information Warfare is executed at the technical level and the defensive measures cybersecurity professionals use to prevent them. The following principles from the National Security Agency and Department of Homeland Security Information Assurance/Cyber Defense Knowledge Units are examined: Cyber, Defense, Cyber Threats, IA Fundamentals, Policy, Legal, Ethics, and Compliance, Network Defense and Networking Technology and Protocols. Prerequisites: CYBR 370 or Program Manager permission.
- Politics of Cyberspace CS407 3 credit hours - This course explores the interrelations of modern computing and communications technology with politics, power, news, privacy, crime, and creativity. The course assumes only a rudimentary familiarity with the basic concepts and terminology of modern Internet usage and computing and is not a technology-focused course.
- National Security Policy POLS302 3 credit hours - This course introduces the issues and institutions of national security policy. Students gain an appreciation of strategic thought and strategy formulation, the ability to assess national security issues and threats, and an understanding of the political and military institutions involved in the making and execution of national security policy.
- Systems Assurance CYBR410 3 credit hours - This course focuses on the design considerations involved with the security of site design. The course will also provide and understanding of the Levels of Trust and system accreditation/certificate processes. Life cycle management of

software, hardware, and physical plant, from planning through destruction will be examined and reinforced using case studies. Additionally, understanding of the variety of security systems involving computers and networks and an ability to evaluate vulnerabilities will be discussed.

Enclosure 3 - Graduate Programs, NUARI/Norwich University/Norwich Pro Energy Resilience Inventory of Courses, Certificate Inventory, and Creation of Certificates

1. The NU CGCS Graduate Programs, both Master's degrees (six courses, six credits for each course = 36 credits total) and Graduate Certificates (two courses, six credits each = 12 credits), summary of offerings is as follows:

Note: <https://online.norwich.edu/degree-programs/masters>
and <https://online.norwich.edu/continuing-education>

- A. MBA – the Energy Management Concentration has the most applicability to the Energy Resilience program while the other concentrations listed contribute to the interdisciplinary approach required for successful Energy Resiliency programs.
 - B. Cyber – the Master's degree and the Graduate Certificates directly relate the interdisciplinary tasks of infrastructure protection, vulnerability management, and incident response.
 - C. Public Administration and Leadership – the Master's concentrations and the Graduate Certificates offer courses designed to address crisis management, procurement, fiscal management, governance and partnerships, and international development that are part of the Energy Resilience framework.
 - D. Civil Engineering – the water resources concentration has a direct relationship to Energy Resilience with specific emphasis protection of this resource for mission accomplishment. This program offers fundamentals courses for students that lack an engineering background.
 - E. International Relations – the IR and Diplomacy programs offer concentrations in international security, development, regional studies, and terrorism which are focus areas of operational energy resilience.
2. The Graduate Certificate offerings include two six credit courses that are 11 weeks long (each). The Cyber and Public Administration courses can be mixed to create a separate, energy resilience focused Graduate Certificate. The current energy resilience applicable programs include the following:

A. Cyber

- Critical Infrastructure Protection and Cyber Crime

- Cyber Law | GI557 | 6 credit hours

- This course explores a broad variety of federal statutory, common, and international laws that may impact the information technology professional as well as laws that affect the interaction between government and the private sector information technology industry.

- International Perspectives on Cyberspace | GI567 | 6 credit hours

- This course provides an overview of the issues surrounding transnational cyberspace policies, international investment strategies, and implementation of communication and information technologies that affect the global economy and transforms the flow of information across cultural and geographic boundaries.

- Vulnerability Management

- **Vulnerability Management and Penetration Testing I | GI562 | 6 credit hours**

This course introduces students to the penetration testing of computer networks. Students will utilize a virtual lab to gain experience through hands-on lab exercises, and learn to use the well-known open-source Metasploit computer security project to understand security vulnerabilities. Students will apply this tool for penetration testing, testing the control tools, and learn how to conduct monitoring of an enterprise. Topics explored in this course include system security and vulnerability analysis, the most common system exploits and vulnerabilities, along with system “pivoting” and client-side exploits. This course also introduces open-source tools, in particular, the Metasploit Framework (MSF). Students will learn how to assess enterprise security controls and system vulnerability, and learn to document their findings. The course is designed for penetration testers, system security, and network administrators.

Vulnerability Management and Penetration Testing II | GI563 | 6 credit hours

This course introduces students to advanced open-source tools used to conduct penetration testing of computer networks. Students will learn the rules of engagement, and how to conduct legal and ethical security tests and vulnerability assessments. Students will utilize a virtual lab to gain experience through hands-on lab exercises. Students will learn to use the well-known open-source tools (Metasploit, John the Ripper, Wireshark) to understand security vulnerabilities and how to use this tool for penetration testing, testing the control tools, and how to conduct monitoring of an enterprise.

- Computer Forensic Investigation and Incident Response Team Management

Computer Security Incident Response Team Management | GI554 | 6 credit hours

In this course, you will analyze and apply the key points in creating and managing a computer security incident response team (CSIRT), also known as a computer incident response team (CIRT) or a computer emergency response team (CERT). Topics include establishing CSIRTs; responding to computer emergencies; securing the CSIRT; managing the CSIRT with respect to professionalism, setting priorities for triage, and protecting personnel against burnout; and learning from emergencies using the incident postmortem and establishing continuous process improvement within the organization. Students will use their case study to apply their knowledge to real-world situations and will prepare recommendations for the establishment of a new CSIRT or improvement of their existing CSIRT.

Computer Forensic Investigation | GI551 | 6 credit hours

This course focuses on the spectrum of tools and techniques used to investigate digital incidents, whether in a civil or criminal environment. The course provides the broad understanding that information assurance professionals must have of the management, investigation, and analysis of digital incidents. It also places that understanding in the context of other information assurance domains. Discussions of digital investigation and forensics cover topics from both technical and management perspectives to increase the information assurance professional’s understanding and application of domain-specific knowledge.

B. Leadership

- Public Sector/Government/Military Leadership

- **Theories and Innovative Practices of Public Sector/Government/Military Leadership | OL543 | 6 credit hours**

This course addresses the dynamic economic, social, and cultural transformations faced by contemporary leaders in the public sector, government, and military organizations as they strengthen agencies for tomorrow's challenges. Part of these challenges comes from the need to cope with new forms of competition, market demands, technological innovations, and global economic and terrain shifts. The topics covered include: history and theories of successful public sector/government/military management, contemporary leadership strategies, and innovative responses to public sector challenges in a growing global marketplace.

- **Influence in the Public Sector/Government/Military: Collaborating Across Organizational Lines | OL553 | 6 credit hours**

As budget cuts and funding reductions continue for many public organizations, leadership is charged with finding economical ways to increase the value of services and products by streamlining processes and integrating efforts at macro and micro levels. Through understanding how to manage adaptation to changing environments and successfully dealing with multi-faceted variables using planning and control strategies, students will learn new approaches to leading people. Emphasis is placed on implementing fundamentals of strategic and performance management by leading effective change initiatives within an organization, and fostering teamwork by creating a work culture that values collaboration.

C. Public Administration

- Public Administration Leadership and Crisis Management

- **Foundations of Leadership and Ethical Decision-Making | AD576 | 6 credit hours**

The first course explores and examines the major models of leadership from a theoretical, ethical, and practical perspective. Outcomes of the first course are a thorough understanding of leadership concepts and being able to apply them in their own leadership situations.

- **Public Leadership, Crisis Management, and Organizational Change | AD586 | 6 credit hours**

In the second course, students will explore the role of leadership in public organizations by examining how leadership is intrinsically tied to the organization. The course also examines the role of leadership in crisis situations, including how decisions are made and implemented, how information is communicated in critical situations, how political leaders are held accountable for crisis situations, and how communities can be returned to a state of normalcy after a critical incident has occurred.

- Procurement and Government Contract Management

- **Public Procurement and Contracting | AD568 | 6 credit hours**

Effectively and efficiently engaging the overall procurement function is essential knowledge in public procurement and contracting realms. With this discussion and research-based course, you can learn how to analyze data and draft implementation plans to conduct the public procurement and contracting process. Throughout this course, you develop a public procurement strategic plan as a way to learn the essential elements and techniques of planning and sourcing successful contract formulation.
- **Government Contract Management | AD578 | 6 credit hours**

This course focuses on the concepts of contract management so that you can identify the mistakes, the cost estimation and legal and accounting implications within various contract types. You learn the current Federal Acquisition Regulations (FARs) and use the regulations to evaluate contractual issues. In addition, this course provides a foundation for you to take the [National Contract Management Association \(NCMA\) Certification Program](#), which is designed to distinguish your performance and knowledge of contract management from others in the practice. After the completion of this course, you can have the ability to actively engage in government contracting.
- Rural Municipal Governance
 - **Municipal Governance | AD543 | 6 credit hours**

The first course in this certificate introduces students to the work of local government managers in the United States. The core of the course is the study of best practices for municipal leadership, including the challenges of providing direction to a wide scope of departments and agencies necessary to serve the needs of communities. Students will also study how to create and maintain intergovernmental relationships and form partnerships.
 - **Rural Municipal Governance | AD553 | 6 credit hours**

The second course in this certificate explores the role of the public service leader, divisions and sectors within the rural municipality, organizing stakeholder collaborations and developing an action plan in support of accountability, good governance, and improvement of quality of life. Specifically, discussions will examine interdisciplinary and multidisciplinary cultural competence and effective leadership skills uniquely identified in rural communities.
- Urban Municipal Governance
 - **Municipal Governance | AD543 | 6 credit hours**

The first course in this certificate introduces students to the work of local government managers in the United States. The core of the course is the study of best practices for municipal leadership, including the challenges of providing direction to a wide scope of departments and agencies necessary to serve the needs of communities. Students will also study how to create and maintain intergovernmental relationships and form partnerships.

- **Urban Municipal Governance | AD563 | 6 credit hours**
Urban America is the focus of the final course in this certificate. Particular focus will be placed on the public administrator's multidisciplinary collaborations and action plan development, through discussions and reflections of key issues including the unique needs affecting public safety, emergency management, medical services, animal control, and public and mental health concerns.
 - **International Development and Influence**
 - **International Development and Influence I | AD564 | 6 credit hours**
This course introduces students to the political and historical background of U.S. efforts to foster development in developing countries, and the cultural, economic and legal factors involved in planning and engaging in economic and infrastructural development in these areas.
 - **International Development and Influence II | AD574 | 6 credit hours**
In this course, students will be introduced to the role of development as a means of furthering democratic principles and U.S. foreign policy. Particular focus will be placed on the problems and challenges, including conflicts, corruption and poor government, and how the developing organizations should integrate or coordinate their efforts with other actors in the area.
3. The following section includes Master's programs and concentrations contribute directly to the field of Energy Resilience.
- A. MBA - Energy Management Concentration - the curriculum is designed to help you develop strategic solutions that enable corporations or institutions to become more energy efficient by reducing their energy demands and usage. Besides the Energy Management concentration listed below, the following MBA concentrations are part of the interdisciplinary approach to energy resilience: Construction Management, Finance, Project Management, Supply Chain Management, and Technology Management.
- **Energy Resources and Markets GB548 6 credit hours** This seminar focuses on the energy resources and markets that include: introduction to the origins and the typology of the alternate ways to generate energy; price formation of energy and its markets; description of the existing markets and their most common negotiating instruments in relation to each type of energy: oil, natural gas, coal and electricity; development of energy markets and its regulations in U.S., EU and Latin America; environmental and climate change policies; and the feasible energy mix for the organization under the security of supply.
 - **Energy Savings and Efficiency Projects GB558 6 credit hours** Managing an organization's project to save and use energy in the most efficient way, including introductions to sustainability, energy intensity, energy efficiency and savings are topics of this seminar. These aspects are reviewed for electricity and heat generators energy systems. Students develop an efficiency solution project for a company, including financial aspects, auditing and energy strategies. Prerequisite: GB 548.

- Managing Corporate Energy Needs GB568 6 credit hours This seminar focuses on energy procurement optimization with security of supply, quality and low cost including how to value available and feasible energy sources of supply, manage energy procurement processes, contracts management, sector supply strategies, demand forecasting, quantitative risk assessment, the company flow of information and cooperative procurement techniques. A detailed behavior of each relevant energy market (oil, gas & electricity) from the demand point of view is discussed. Components of the energy markets and the available energy origins are reviewed, as well as internal analysis of the organization needs and processes, to optimize all aspects of a company's energy procurement. Students will acquire analytical and managerial capacity and skills to resolve the energy procurement of the organization. Prerequisites: GB 548 and GB 558.

- B. Cybersecurity - Norwich University's online Master of Science in Cybersecurity program can help you develop the business acumen and management skills needed to lead the field. Graduates of our program are armed with the skills they need to help ensure that information assets are understood, valued and protected within the complex business enterprise. There are five academic concentrations in this program and the concentrations are aligned with the Graduate Certificate programs listed above – the five programs include:
 - Computer Forensic Investigation and Incident Response Team Management
 - Critical Infrastructure Protection and Cyber Crime
 - Cyber Law and International Perspectives on Cyberspace
 - Project Management
 - Vulnerability Management

- C. Civil Engineering - The online Master of Civil Engineering program is uniquely designed to combine current engineering principles and leadership best practices. It can help you gain greater proficiency as an engineer and enable you to be an engineering leader in your organization, community, and the nation. There are four concentrations available that may have an impact on an organizations energy resilience program – they are:
 - Construction Management
 - Environmental/Water Resources Engineering
 - Geotechnical Engineering
 - Structural Engineering

- D. Master of Science in Information Systems - The MS in Information Systems requires the successful completion of 33 credits of study and strong quantitative background is recommended. If you don't have an undergraduate business or information systems degree, you can enter the master's program after completing appropriate prerequisite coursework that varies according to bachelor's degree discipline and workforce credentials. After completing or testing out of prerequisite coursework, you can move forward with foundational courses and concentration-specific coursework. Program concentrations include:
 - Business Intelligence
 - Data Analytics

- Master of Public Administration - The mission of the Master of Public Administration (MPA) program at Norwich University is to prepare and support diversified adult learners who are military and non-

military, to become knowledgeable, innovative public sector leaders. The MPA program develops leadership characteristics driven by fundamental public administration values, including those that are at the core of Norwich's history and tradition. Norwich MPA faculty members are academically and professionally prepared to advance the mission with practitioner-oriented educational experiences available through state-of-the art, on-line course delivery and external partnerships. Culminating experiences of a Capstone Project, portfolio development and Residency week complement the MPA online delivery method, providing the opportunity for problem solving, a retrospective on coursework, face-to-face collaboration and networking. The concentrations available are aligned with the graduate certificates listed and include the following: Criminal Justice and Public Safety

- Fiscal Management
- International Development and Influence
- Municipal Governance
- Nonprofit Management
- Public Administration Leadership and Crisis Management
- Public Works and Sustainability
- Policy Analysis and Analytics
- Procurement and Government Contract Management

Enclosure 4 – Norwich Pro Courses, NUARI/Norwich University/Norwich Pro Energy Resilience Inventory of Courses, Certificate Inventory, and Creation of Certificates

1. Background: Norwich Pro is a fully online learning organization created to bring world-class instruction in high-demand skillsets straight into the hands of busy working professionals and military personnel.
Refer to the Norwich Pro web page for more information: <https://pro.norwich.edu/>
2. Continuing Education Units: Students in Norwich Pro courses earn Continuing Education Units (also termed Professional Development Units – PDU), known as CEUs. Each CEU is equivalent to 10 contact hours and is accepted by professional organizations worldwide for the earning and maintaining of licenses and other credentials.
3. Tailored programs: Customized programs can be held onsite at an organization, offsite at another facility, online, or a hybrid seminar model all taught by experienced subject matter experts.
4. Course review: The following courses could either stand alone as an energy resilience core course or each could be modified with energy resilience modules (energy fundamentals, energy risk assessments, energy policy, industrial control systems, and energy master planning) to provide professional development CEUs.

Sustainability and Equity in Procurement - 2 CEUs, equivalent to 20 Contact Hours/PDUs

Every purchase has hidden social, environmental, and financial impact. This course discusses strategies that leading organizations throughout the world employ in their day-to-day procurement decisions. These include the use of products that minimize harm to the environment and human health, as well as purchasing decisions that support local communities and small businesses.

Procurement Methods and Strategies - 2 CEUs, equivalent to 20 Contact Hours/PDUs.

There are various ways to procure goods and services. Learn what your options are and how to determine when each method is most appropriate. Additionally, the principles of public procurement and the importance of work scopes will be covered.

Data Visualization - 2 CEUs, equivalent to 20 Contact Hours/PDUs

Professionals today face ever mounting pressure to analyze large quantities of information and to eloquently share their findings. This course is designed to lead a student through that process so that they can accurately make positive impressions on others and increase your influence to obtain a desired objective. Stand apart from your peers with visuals that are as powerful as they are elegant.

Crisis Communications - 2 CEUs, equivalent to 20 Contact Hours/PDUs

The world is more connected than ever, so messages travel fast—you need to prepare in advance. Protect your organization's reputation by assessing its vulnerability and then formulating a practical crisis communication plan, complete with social media campaigns and media talking points. We'll discuss the value of integrity, audience evaluation, acquiring support, and debriefing.

Public Works Institute Strategy and Planning - 2 CEUs, equivalent to 20 Contact Hours/PDUs

Strategic planning is an important factor in an organization's success. Planning includes finance, budgeting, purchasing, managing organizational communications, and administering contracts. To make sure you can do each of these tasks well, we provide participants with tools and strategies for each.

Public Works Long-Term Strategy Project - 2 CEUs, equivalent to 20 Contact Hours/PDUs

Students will synthesize their skills to create a long-term strategy plan appropriate for a public works organization. Students will use SWOT analysis, explore revenue generation and funding structures, and devise a media relations and social media strategy. Additionally, the course will cover outsourcing and open bidding, and determine the most suitable leadership approach.

Project Management Overview - 2 CEUs, equivalent to 20 Contact Hours/PDUs

Project management skills are in demand across a variety of industries, and the upward salary trends for the profession reflect that reality. This course aims to give you a bird's-eye-view of project management essentials, especially project planning.

Business Essentials for Project Managers - 2 CEUs, equivalent to 20 Contact Hours/PDUs

Business skills, or the lack thereof, can make or break projects and organizations, yet they are left out of many project management educational programs. At Norwich Pro, we take a different approach by making business a core element of our Project Management Certificate program. Whether you're learning these skills for the first time or refreshing your knowledge, join us to make sure you're equipped to thrive.

Analytics and Fundamentals (Artificial Intelligence) - 2 CEUs, equivalent to 20 Contact Hours/PDUs

Data analytics are critical in organizational decision-making. This course aims to provide a foundational level of understanding about what data analysis is, where data comes from, different types of data, and data measurement terminology.

Analytics for Government, Industry and Business - 2 CEUs, equivalent to 24 Contact Hours/PDUs

This course focuses on providing key skills in analytics from an applied perspective, emphasizing the development of competencies to analyze, predict, provide insights and prescribe actions to real-world problems in government and business.

Risk Assessments, Policies, and Internal Controls - 2 CEUs, equivalent to 20 Contact Hours/PDUs

Risk assessments are the foundation of any solid compliance management program. These appraisals can help protect your company from steep fines, sanctions, loss of licensure, reputation damage, and even employee incarceration. As such, you should carry out risk assessment frequently while using best practice processes.

Due Diligence and Internal Investigations - 2 CEUs, equivalent to 20 Contact Hours/PDUs

Due diligence is the evaluation of a third party's appetite for risk to determine whether they are a suitable business partner for your organization. This course is a practical guide to carrying out external and internal investigations. During this course, we'll discuss types of organizations that are riskier than others and best practices for weighing risk against

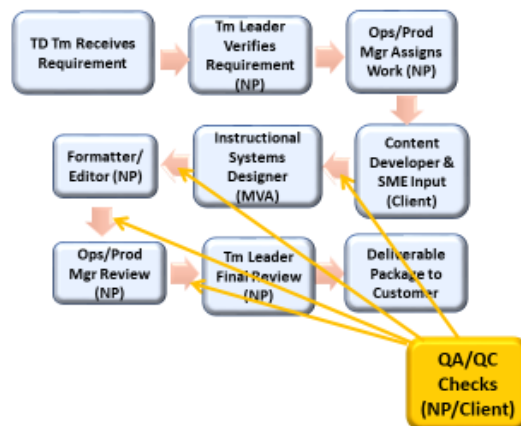
opportunity when conducting an assessment before turning our attention to the whys and hows of internal audits.

5. Certificate options (pending analysis and design processes):

- a. Energy Resilience Risk Management certificate – courses could include Analytics for Government, Industry and Business; Risk Assessments, Policies, and Internal Controls; Business Essentials for (Energy) Program Managers; a new Energy Fundamentals course or Energy Policy course
- b. Energy Resilience Managers certificate – Energy Fundamentals course (new); Energy Risk Assessment course (inject Resilience module with the Risk Assessments, Policies, Internal Controls course); Energy Partnerships (new); Project Management Overview; Due Diligence and Internal Investigations (with an energy resilience module)
- c. Industrial Control Systems – pending analysis and design (refer to the NUARI ICS FEMA course in Enclosure 5)
- d. Energy Resilience Senior Seminar – possible hybrid option including Energy Fundamentals (new); Risk Assessments, Policies, Internal Controls Course (with an energy resilience module); Strategic Communications; Energy Partnerships; and/or Long Term Strategy Project

6. Curriculum Development process

Norwich Pro Curriculum Development Process



Enclosure 5 – NUARI

1. NUARI's DECIDE® platform facilitates hands-on, web-based, distributed live exercises that engage human decision-making and crisis communications to drive scenario events and situational developments. Initially conceived and started independently by NUARI, and further developed with funding from DHS, the DECIDE® platform has been a trusted cybersecurity exercise solution for more than ten years. DECIDE® tests incident response plans in order to equip organizations, critical infrastructure sectors, the military, and the government with the situational awareness and strategic communications capabilities required to prevail against serious cyber threats. DECIDE® brings participants from across geographies and roles together into one distributed online gamespace.



Norwich University Applied Research Institutes Command and Control Cybersecurity Threat Exercises for the Energy Sector

The Norwich University Applied Research Institutes (NUARI) has been conducting command and control exercises using the DECIDE platform since the late 2000's. The DECIDE exercises simulate cyber-attacks for organizations and their partners to stress and test incident response plans, resulting in after action reports to improve strategic communications, compliance, business risk, and overall resilience to cyber-attacks. NUARI has executed DECIDE exercises with organizations of all sizes, from thousands of participants spread across hundreds of international locations, to fewer than 30 participants in a local initiative.

EVALUATE

Response and capability gaps to improve business survival and decrease risk.

CAPTURE

Custom after-action analyses that provide insight on how to counter emerging threats.

INTEGRATE

Your organization's response play-book to enhance strategic decisions.

- Over 100 exercises completed
- Over 1500 organizations served
- Raw exercise data available immediately for participating organizations
- Prescriptive recommendations available within two weeks
- Customized executive-level briefs available within three weeks

Contact Information

John A. Kunelius
Vice President
P: 507-384-1056
E: jkuneliu@norwich.edu



2. Industrial Control Systems course description under development for FEMA:

The *Cybersecurity Resiliency in Industrial Control Systems* course is designed to enhance understanding of the critical nature of Industrial Control System environments and the associated risks, threats, and defenses within an organization, business, or government entity. This course will introduce the convergence of physical security with cybersecurity, supervisory control and data acquisition (SCADA), and Industrial Control Systems security, increase awareness of the Internet of Things and Industrial Control Systems, and examine the threat landscape within Industrial Control Systems. Cyber threat mitigation techniques will be examined as well as methods of identifying cyber attacks and vulnerabilities. Tools to respond to and recover from cyber attacks on Industrial Control Systems will be addressed.

This course is intended to be delivered across the country to jurisdictions at all response levels: local, state, tribal, territorial, as well as private industry.

Enclosure 2: Research & Internship Program Setup

CONTRACT TITLE: DEVELOPMENT OF AN ENERGY TRACK WITHIN THE NORWICH UNIVERSITY CENTER FOR GLOBAL RESILIENCE AND SECURITY – DESIGN PHASE

Research and Internship Program Setup - Report for Contract No.

W9132T20C0005 Prepared for and Emailed to:

- Contracting Officer
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- Project Manager and Technical Point of
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Contractor Billing POC: Marsha Hopkins, Senior Accountant,
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1. **Reference:** DEVELOPMENT OF AN ENERGY TRACK WITHIN THE NORWICH UNIVERSITY CENTER FOR GLOBAL RESILIENCE AND SECURITY – DESIGN PHASE VOLUME I TECHNICAL PROPOSAL outlines the following task which is extracted from the deliverables table in the NUARI proposal (part of the contract).

Research and internship program set up	+15 days	+60 days 4 August, 2020	Identify internship and research opportunities for students/colleagues interested in energy resilience

2. **Purpose.** The purpose of the research and internship program set up is to meet the goal of LOE 4 on Research and Development as noted in the proposal.

3. **Scope.** The scope of this task is to ascertain opportunities available to students and colleagues interested in research on energy resilience, as well as support students interested in pursuing internships in the energy sector. This is an initial program set up, and will continue to evolve over the course of the contract period.

A. Internships for Undergraduate Students at Norwich University

Norwich University (NU) Internship Office is part of NU's Career and Internship office. For the 2019-2020 academic year, the internship office placed 120 students in internship positions in the summer 2019, 49 students in fall 2019, and 43 students in spring 2020. These numbers only reflect the students who obtained their internships through the internship office and does not include students who may have been placed through their own connections or through faculty and family networks, that work outside the internship office, especially when the internships are non-credit bearing.

These students represented the following majors:

1. Architecture
2. Civil Engineering
3. Communications
4. Construction Management
5. Criminal Justice
6. CSIA
7. Electrical and Computer engineering
8. English
9. Environmental Science
10. Exercise science
11. Health Science
12. History
13. International Business
14. International Studies
15. Management
16. Mechanical Engineering
17. Nursing
18. Political Science
19. Psychology
20. Spanish
21. Sports Management
22. Studies in War and Peace
23. Undeclared

The internship office has a breakdown of these internships by gender, civilian versus corps and the location of the internship. The number of interns placed through the university has seen a steady increase from 39 students in 2008 to 251 students placed in 2019. The university has created an "Expeditions" program, where students participate in internship opportunities in locations outside Norwich University, during the academic semester, while taking classes online or in a remote format. An example is the Washington DC Expedition Program.

In fall 2019 23 students lived, studied and interned in Washington DC. A breakdown of the students' majors is shown below.

Liberal Arts	Professional schools	Science and Mathematics
History (1), Psychology (1), Political Science (1), SWAP (1),	Architecture (1), Civil Engineering (1), Const. Management (1), CSIA (7), Management, Nursing (7)	Health Sciences (1), Biology (1)

The career and internship office is looking at staffing and logistical issues related to the expansion of expeditions into a coop type program in the future, as students look at flexible and affordable experiential education through Norwich University.

Energy Sector Internships:

The internship coordinator reported that over the past three years, the following 16 employers had advertised for internship opportunities in the energy sector:

1. Sun Common
2. Army Corps of Engineers
3. Mass. Bay Transportation Authority
4. L3 Technologies
5. Advance Testing Company
6. Vt. Agency of transportation
7. AECOM
8. DoD
9. Portland Water District
10. Vt. Agency of Natural Resources
11. Vt. Governor's Office
12. Peacekeeping and Stability Operations Center—Army War College
13. General Dynamics
14. Oswego Nuclear Power Plant
15. Entergy
16. Vt. Natural Resources Board

It was also noted that currently (as of July 6, 2020), the electronic platform used by the Internship Office, Handshake, revealed 62 employers that used the keyword "energy" in their searches.

Future Plans Through Design Phase 2:

Our goals are to expand the energy resilience and security internships at private companies, utilities, and DoD laboratories and affiliated centers to ensure plentiful opportunities for students to broaden their understanding of this sector. To do this, we will:

1. Reach out to CGRS Senior fellows, NU alumni in the energy sector and their networks to add to our offerings.
2. Work on developing Educational Partnership Agreements with interested parties.

To set up the research program, CERL has been provided with a copy of the Education Partnership Agreement signed with the Cold Regions Research and Engineering Laboratory (CRREL) in spring 2020. In addition, we have developed a schema to serve as a living document throughout the contract period that students and colleagues will be provided through the various curriculum development efforts under this contract. (Enclosure 6).

B. Research Program Schema

Energy Resilience and Security: Database Schema

The database will accommodate the broad scope of resources related to installation and operational energy resilience. It will include research, policy documents, current and future research funding opportunities, case studies and will be searchable. It should be built in a graph database, such as Neo4j and should be accessible via the CGRS and NUARI websites.

Energy Track Research Repository

Entry type—each entry in the database will be categorized by type and for each type, there will be a set of attributes relevant to that type. In addition to attributes, associated keywords will enable effective search.

TYPE	ATTRIBUTES
Policy document	Reference (APA, MLA, Chicago) Summary Date Agency
Peer reviewed article	Reference (APA, MLA, Chicago) Summary Date
Research funding	Title/Description Min-Max amount Deadline (date) Agency Eligibility criteria Contact information Energy Track Population

Training program	Course name Term (dates) Frequency Institution Location Website Contact information Energy Track Population
Case Study	Title/Reference (APA, MLA, Chicago) Summary Date

Descriptive Keywords

Policy

- Military/Defense
- National and sub-national
- International

al New

Technology

- Military
- Civilian
- Generation
- Transmission and distribution
- Storage
- Transportation
- Controls
- Cybersecurity
- IoT

Complex

systems

Energy Track Knowledge Categories

- Energy Fundamentals—understanding of energy basics and updated technologies
- Energy Risk Analysis—comparing the mission's energy requirements with the available energy assets and the development of an energy resilience culture.
- Energy Policy/Governance—policies, processes, procedures, partnerships, and funding.
- Energy Resilience Master Plan—leading, coordinating, and partnering to create a dynamic energy master plan.

Energy Track Populations

- Undergraduate/Officer level
- Mid-career

- Senior Leaders

Policy Document

Reference: Critical Infrastructure: Emerging Trends and Policy Considerations for Congress - R45809 July 8, 2019 Brian E. Humphreys Analyst in Science and Technology Policy ~~-redacted-~~ @crs.loc.gov

Summary:

Date:

Agency:

Keywords:

Policy Document

Reference: Selected Homeland Security Issues in the 116th Congress, R45701 June 21, 2019 William L. Painter, Coordinator Specialist in Homeland Security and Appropriations ~~-redacted-~~ @crs.loc.gov

Summary:

Date:

Agency:

Keywords:

Policy Document

Reference: Department of Defense Energy Management: Background and Issues for Congress, R45832 July 25, 2019 Heather L. Greenley Analyst in Energy Policy ~~-re-acte-~~ @crs.loc.gov Summary:

Date:

Agency:

Keyword

s:

Policy Document

Reference: Department of Defense, Annual Energy Management and Resilience Report (AEMRR), Fiscal Year 2017 – dated July 2018 - <https://www.acq.osd.mil/eie/Downloads/IE/FY%202017%20AEMR.pdf>

Summary:
Date:
Agency:
Keywords:

Policy Document

Reference: Improvement Needed in Energy Reporting and Security Funding at Installations with Limited Connectivity, January 2016 - <http://www.gao.gov/products/GAO-16-164>, View GAO-16- 164.

Summary:
Date:
Agency:
Contact information: For more information, contact Brian J. Lepore at (202) 512-4523 or leporeb@gao.gov or Frank Rusco at (202) 512-3841 or ruscof@gao.gov
Keywords: Defense Infrastructure

Policy Document

Reference: Improved Guidance Needed for Analyzing and Documenting Costs and Benefits - Highlights of GAO-16-487, a report to congressional committees, View GAO-16-487. For more information, contact Frank Rusco at (202) 512-3841 or ruscof@gao.gov or Brian J. Lepore at (202) 512-4523 or leporeb@gao.gov.

Summary:
Date:
Agency:
Keywords: Defense Renewable Energy Projects

Enclosure 3: Survey Mid-Career and Senior Leader Surveys

CONTRACT TITLE: DEVELOPMENT OF AN ENERGY TRACK WITHIN THE NORWICH UNIVERSITY CENTER FOR GLOBAL RESILIENCE AND SECURITY – DESIGN PHASE

NUARI Mid-Career and Senior Leader Surveys - Report for Contract No. W9132T20C0005

Prepared for and Emailed to:

- Contracting Officer
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Prepared by:

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Contractor Principal Investigator POC: Jeffrey S. Cairns, Program Manager, jcairns@norwich.edu, 802-485-2609

Contractor Billing POC: Marsha Hopkins, Senior Accountant, mhopkins@norwich.edu, 802- 485-2819

1. **Reference:** DEVELOPMENT OF AN ENERGY TRACK WITHIN THE NORWICH UNIVERSITY CENTER FOR GLOBAL RESILIENCE AND SECURITY – DESIGN PHASE VOLUME I TECHNICAL PROPOSAL outlines the following task which is extracted from the deliverables table in the NUARI proposal (part of the contract).

Survey mid-career and senior leader sample populations	+15 days	+60 days 4 August, 2020	Survey instrument approved and administered; identify marketing and outreach efforts

2. **Purpose.** The purpose of designing and administering surveys to mid-career and senior leaders in the Department of Defense meet the goal of LOE 3 on Course Work – Design and Development as noted in the proposal. Specifically, proposal item 3.2.2 refers to mid-career officers and proposal item 3.2.3 refers to senior leaders. The team will also work with government to coordinate the participants to be surveyed and develop the questions for the survey. Once the results are gathered, they will be analyzed, and a report developed to inform the design and development of the content.
3. **Scope.** The scope of this task is to design surveys to be administered to mid-career professionals and senior leaders in the Department of Defense, following approval of the final design by the Government.
 - a. Mid-Career Survey - see Enclosure 1 – The goal of this survey is to identify the relevant operational knowledge for mid-career military and DoD civilians who have the authority to positively influence energy resilience in a military organization.
 - b. Senior Leader Survey - see Enclosure 2 - The goal of this survey is to identify the relevant scope of senior leaders that have influence and responsibility for energy resilience activities in the DoD.

Enclosure 1 - Mid-Career Survey

Link to Mid-Career Survey for Distribution:

https://norwichuniversity.az1.qualtrics.com/jfe/form/SV_5uKplzvCFX_AiTTD

Content as follows:

Energy Manager Survey

Start of Block: Introduction

Welcome to the Norwich University – Center for Global Resilience and Security (CGRS) Survey of Installation Energy Managers and installation mid-career professionals views and opinions of the implementation of the DoD's Energy and Security goals.

This survey is voluntary and anonymous. The survey will provide insight into the views and opinions of Installation Energy Managers and installation mid-career professionals regarding meeting the DoD's Energy and Security goals. The data gathered by the survey will be available to DoD Leadership for insight into the progress and barriers that installations may be facing as they implement plans to meet the Energy Resilience and Security goals. Additionally, this survey will help CGRS prioritize the design-development-implementation of an Energy Track professional education and training programs for Installation Energy Managers and installation mid-career professionals.

The **CGRS Energy Track** is a program focused on building the educational foundation for energy resilience and security at military installations and more broadly in the municipal, state, national and global ecosystems within which they exist. The Energy Track promotes mission readiness of future military and civilian leaders.

Expected time to complete: 10 minutes. All survey responses will be anonymous. At the end of the survey, you will have the option to receive an invitation to future Energy Resilience related activities. The link provided will redirect you to another site and we will not be able to connect your survey responses to any contact information you provide. The survey will be open until August 10th, 2020.

End of Block: Introduction

Start of Block: Block 1

Improved energy resilience is important for installations' ability to accomplish their missions.

- ☐ Strongly agree
- ☐ Somewhat agree
- ☐ Neither agree nor disagree
- ☐ Somewhat disagree
- ☐ Strongly disagree

Do you agree or disagree with the following statements on risks to energy resilience at US Military installations:

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
Fuel for back-up generators is available for 14 days of continuous operations for mission critical functions.	☐	☐	☐	☐	☐
Energy infrastructure is modern and in good working order.	☐	☐	☐	☐	☐
The communication and control systems for energy infrastructure on both sides of the fence line are vulnerable to cyber threats.	☐	☐	☐	☐	☐
Existing processes support timely corrections of energy infrastructure deficiencies and vulnerabilities.	☐	☐	☐	☐	☐

Energy infrastructure requires recapitalization and modernization to meet the DoD's Energy Resilience goals.

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Installation leadership understands and has prioritized energy resilience.

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Procedures for defining and prioritizing critical load requirements are effective.

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DoD installations lack cooperation with local utilities to meet the DoD's Resilience goals.

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Energy infrastructure is vulnerable to disruptions from extreme weather.

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Training for personnel with energy related responsibilities is readily available.

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Installation
energy
resilience
projects must
be included on
a requirements
list and
Installation
Master Plan



What's the biggest energy issue facing installations?

Have you taken any professional development courses/workshops/trainings specifically addressing energy resilience?

☐ Yes

☐ No

Display This Question:

If Have you taken any professional development courses/workshops/trainings specifically addressing e... = Yes

Please elaborate, including who offered the training (your organization/external vendor). Select all that apply.



Energy Exchange

☐ Naval Post Graduate School

☐ Energy Management Association

☐ Other military-sponsored education or training classes (Please describe)

☐ Other non-military education or training classes (Please describe)

Display This Question:

If Have you taken any professional development courses/workshops/trainings specifically addressing e... = Yes

Please describe the effectiveness of the training.

How do you currently learn about best practices for your job as an energy manager?
Select all that apply.

☐ Colleagues

☐ Senior Leaders

☐ Other Energy Managers

☐ Online Resources

☐ Other (Please specify) _____

Display This Question:

If If How do you currently learn about best practices for your job as an energy manager? Select all that apply. q://QID17/SelectedChoicesCount Is Greater Than 1

Please rank the resources you selected in order of most valuable to least.

How do you currently learn about best practices for your job as an energy manager? Select all tha... = Colleagues

_____ Colleagues

How do you currently learn about best practices for your job as an energy manager? Select all tha... = Senior Leaders

_____ Senior Leaders

How do you currently learn about best practices for your job as an energy manager? Select all tha... = Other Energy Managers

_____ Other Energy Managers

How do you currently learn about best practices for your job as an energy manager? Select all tha... = Online Resources

_____ Online Resources

How do you currently learn about best practices for your job as an energy manager? Select all tha... = Other (Please specify)

_____ \${Q16/ChoiceTextEntryValue/5}

If training were offered related to energy resilience which of the following types of programs would interest you. Select all that apply.

- ☐ Professional development certificate courses
- ☐ Academic certificates and/or academic degrees
- ☐ Industry Certifications
- ☐ Seminars led by Subject Matter Experts
- ☐ Exercises

☐ Other _____

(Optional) What is your educational background? Please select all that apply and specify the field of study.

☐ Bachelors, Field _____

☐ Masters, Field _____

☐ PhD, Field _____

NU-CGRS Energy Track will sponsor a round table (date TBD, 2021) to discuss the results of this survey with other energy managers. Click [here](#) to request an invitation to the round table.

The link provided will redirect you to another site and we will not be able to connect your survey responses to any contact information you provide.

About NU-CGRS Energy Track

Norwich University (NU): Located in Northfield, VT, Norwich University is the oldest private military college in the United States, offering residential undergraduate degrees, online degree completion and graduate programs and continuing professional education.

Center for Global Resilience and Security (CGRS): Established in 2017 at NU, the Center for Global Resilience and Security (CGRS) recognizes the increasing interdependence of the energy infrastructure with clean and ready water, efficient waste disposal, and the vital agriculture sector and emphasizes NU founder Alden Partridge's vision of citizen-soldiers by prioritizing experiential educational activities.

Energy Track: A program focused on building the educational foundation for energy resilience at military installations and more broadly in the municipal, state, national and global ecosystems within which they exist. The Energy Track promotes mission readiness of future military and civilian leaders & currently deployed forces.

Enclosure 2 - Senior Leader Survey

Link to Senior Leader Survey for Distribution:

https://norwichuniversity.az1.qualtrics.com/jfe/form/SV_2t15yd1u4VRPmVT

Content as follows:

DoD Senior Leader Energy Resilience Survey

Start of Block: Introduction

Welcome to the Norwich University – Center for Global Resilience and Security (CGRS) Survey of Senior Leaders views and opinions of the implementation of the DoD's Energy Resilience goals.

This survey is voluntary and anonymous. The survey will provide insight into the views and opinions of Senior DoD leaders regarding meeting the DoD Energy Resilience goals. The data gathered by the survey will be available to DoD Leadership for insight into the progress and barriers that installations may be facing as they implement Energy Resilience

Plans. Additionally, this survey will help CGRS prioritize the design-development-implementation of an Energy Track professional education and training programs for DoD Senior leaders and installation personnel.

The **CGRS Energy Track** is a program focused on building the educational foundation for energy resilience and security at military installations and more broadly in the municipal, state, national and global ecosystems within which they exist. The Energy Track promotes mission readiness of future military and civilian leaders.

Expected time to complete: 10 minutes. All survey responses will be anonymous. At the end of the survey, you will have the option to receive an invitation to future Energy

Resilience related activities. The link provided will redirect you to another site and we will not be able to connect your survey responses to any contact information you provide. The survey will be open until August 10th, 2020.

End of Block: Introduction

Start of Block: Block 1

Based upon the DoD mission statement and services provided to Units/Tenant Organizations, how important is Energy Resilience in the following organizations:

	Extremely important	Neither important nor unimportant	Not at all important
Directorate of Emergency Services	☐	☐	☐
Directorate of Plans Training Mobilization and Security	☐	☐	☐
Directorate of Human Resources	☐	☐	☐
Director of Public Works	☐	☐	☐
Plans, Analysis & Integration (PAI)	☐	☐	☐
Public Affairs	☐	☐	☐
Safety Office	☐	☐	☐
Logistics Readiness Center	☐	☐	☐
Army Community Service	☐	☐	☐
Tenant Units – training and deployment support	☐	☐	☐
Medical Facilities	☐	☐	☐

Communications Units/Facilities	☐	☐	☐
Local Community	☐	☐	☐
Military Service Headquarters	☐	☐	☐
Department of Defense Headquarters	☐	☐	☐



Rank order each of the following functions that are important to the Military Installation, with the 1 being the most important and 12 the least. Drag and drop each function to change its position:

- _____ Cyber Security
- _____ Natural disaster management
- _____ Water services
- _____ Power distribution
- _____ Renewable energy
- _____ Physical Security
- _____ Commercial Utility provider
- _____ Local community energy agreements
- _____ Master planning
- _____ Department of the Army Energy Resilience policy
- _____ Energy resilience exercises
- _____ Funding for energy resilience

Page Break



Who is responsible for energy resilience in your Installation? Select all that apply.

- ☐ Commander
- ☐ Deputy Commander

- ☐ Installation Commander
- ☐ Director of Public Works
- ☐ Directorate of Plans Training Mobilization and Security
- ☐ Energy Manager, Director of Public Works
- ☐ Director of Information Management
- ☐ Commercial Utility provider
- ☐ Directorate of Contracting
- ☐ Corps of Engineers
- ☐ Industry Energy Service provider

Would training in the following subject areas support the energy resilience tasks of a Military Installation?

	Yes	Maybe	No
Energy Risk Analysis	☐	☐	☐
Cyber Security	☐	☐	☐
Energy resilience exercise planning	☐	☐	☐
Energy Policy	☐	☐	☐
Energy Partnerships	☐	☐	☐
Energy resilience master planning	☐	☐	☐

 Page Break


Which of the following certificates, training and/or education support services be helpful to maintain an energy resilient Military Installation Yes – now, Yes – sometime later, No, Undecided

	Yes, now	Yes, eventually	No	Undecided
Undergraduate academic certificate	☐	☐	☐	☐
Intern support	☐	☐	☐	☐
Energy Resilience Continuing Professional Education (CPE) certificates	☐	☐	☐	☐
Exercise support (for energy resilience)	☐	☐	☐	☐
Reference library	☐	☐	☐	☐
Subject Matter Expert on-call support	☐	☐	☐	☐
Graduate academic certificates	☐	☐	☐	☐
Energy Professional certificates	☐	☐	☐	☐
Graduate degree	☐	☐	☐	☐
Senior Leader Seminars	☐	☐	☐	☐

Please share any other comments you may have.

Page Break

About NU-CGRS Energy Track

Norwich University (NU): Located in Northfield, VT, Norwich University is the oldest private military college in the United States, offering residential undergraduate degrees, online degree completion and graduate programs and continuing professional education.

Center for Global Resilience and Security (CGRS): Established in 2017 at NU, the Center for Global Resilience and Security (CGRS) recognizes the increasing interdependence of the energy infrastructure with clean and ready water, efficient waste disposal, and the vital agriculture sector and emphasizes NU founder Alden Partridge's vision of citizen-soldiers by prioritizing experiential educational activities.

Energy Track: A program focused on building the educational foundation for energy resilience and security at military installations and more broadly in the municipal, state, national and global ecosystems within which they exist. The Energy Track promotes mission readiness of future military and civilian leaders.

End of Block: Block 1

Enclosure 4: NUARI Review of Baseline Survey Results

CONTRACT TITLE: DEVELOPMENT OF AN ENERGY TRACK WITHIN THE
NORWICH UNIVERSITY CENTER FOR GLOBAL RESILIENCE AND SECURITY –
DESIGN PHASE

**NUARI Energy Resilience Review of Baseline
Survey Results Report for Contract No.
W9132T20C0005**

Prepared for and Emailed to:

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Prepared by:

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1. Requirement:

Required Service	Paragraph Number	Standard
Review Survey Results and Define Requirements	Paragraph 5.1 of the Contractor's Proposal	Submitted within 90 days from the date of award and aligns survey results with Lines of Effort design and development

2. **What:** From August 7-21, 2020, the Norwich University Energy Track¹ team, led by Norwich University Applied Research Institutes (NUARI), conducted two surveys to gather views and opinions of the implementation of the Department of Defense's Energy and Security goals; one directed toward mid-career installation energy professionals, and the other toward senior leaders. The mid-career survey focused on identifying the barriers to installation energy resilience and resources required, including training and professional development opportunities; and the senior leader survey focused on identifying the people and positions that drive energy resilience, as well as some of the gaps that were indicated in the first phase of the Energy Track project completed earlier this year.
3. **Why:** The purpose of the survey exercise was to establish a baseline level and areas of interest from target populations for the Energy Track education and training products.
4. **How:** Using the Qualtrics platform, the survey was distributed across various networks, including Energy Management Association, Association of Defense Communities, Society of Military Engineers, installation Energy Managers, and Norwich University contacts.
5. **Who:** An estimated 200 individuals received links to the 2 surveys. There were 38 responses to the mid-career survey, and 41 responses to the senior leader survey as of August 24. The survey remains open and we continue to receive responses. We did not restrict who took which survey, so it was possible for the same individual to respond to both surveys.
6. **RESULTS:** *95% of survey respondents agreed (of which 76% strongly agreed) that resilience is important for an installation's ability to achieve its mission. The top risks to installation energy resilience as identified by survey respondents were: modernization of infrastructure; vulnerability to climate and cyber threats; inclusion of energy resilience goals in the Installation Master Plan; and availability of training.*
7. **ANALYSIS:** The survey respondents use a variety of channels to source information on best practices including colleagues, other energy managers and online

resources. With this in mind, having an accessible and well-positioned online presence should be a key outcome of the Energy Track.

¹ The Norwich University Energy Track is a program led by NUARI and focused on building the educational foundation for energy resilience and security at military installations and more broadly in the municipal, state, national and global ecosystems within which they exist. The Energy Track promotes mission readiness of future military and civilian leaders.

Though the surveys only focused on mid-career and senior leader populations, the responses regarding the importance of energy resilience – and the main concern, such as cyber and recovery from extreme weather events – can be used to orient the training of the next generation in the primary undergraduate efforts. Though funding was the most commonly mentioned answer to “What’s the biggest energy issue facing installations?” (in 5/13 of the qualitative responses), developing systems thinking, problem solving, risk management and communication skills in the entry level population will, in the long term, help address some of the other issues described in the responses. This directly correlates with LOE 1 and its relationship with LOEs 2-4.

8. **NEXT STEPS:** We used survey results and internal resource considerations to prioritize the specific areas in which we can develop the Energy Track:
- A. For the mid-career, training may be the most pressing need given that these are the individuals closest to delivering on the installation mission. However, for resilience, we need to have an education mindset so that an underlying understanding of the system where the skills acquired through training are applied and adapted as technology and the environment change. **LOE 2**
 - B. As for the delivery methods for energy resilience education and training, “If training were offered related to energy resilience which of the following types of programs would interest you,” professional development courses (23%) and Industry Certificates (21%), seminar series lead by senior leaders (25%) and exercises (16%) and academic degrees or certificates (13%) comprised the choices of respondents. At least 6 respondents had a master’s degree or higher, which can explain why the need for academic programs was of less interest than some of the other shorter and more targeted education and training platforms. **LOE 2+3**
 - C. The responses to the senior leader survey also highlighted the need for a variety of continuing professional education options and interdisciplinary teaching and learning that is relevant and not merely required. Respondents identified Exercises (76%), SME on-call support (73%), Energy Professional Certificates (50%), and Senior Leader Seminar (50%) as training and educational opportunities that are needed immediately. Less immediate, but still important in the medium and long terms as indicated by survey respondents are academic degrees, research and continuing professional education certificates. **LOE 2-4**
 - D. Finally, the following comment, made in response to the Senior Leader survey, highlights the complexity and interconnectedness of energy resilience issues and the need for systems approach and mentality into the development of policies and procedures:

“While our focus is on resilient and sustainable energy, energy is a subset of the much larger issue of critical infrastructure in general. Duties required in Public Works and

*City Manager - energy, water, waste collection and disposal, air quality, transportation, sewage collection and treatment are all infrastructure systems involving a wide range of other governmental, private sector and regulatory agencies. In today's environment, the Army installation is no longer able to "island" itself. The installation's ability to project combat power or realize mission success in any significant area is almost always dependent upon other local governments, utilities, and regulators understanding and positively reacting to the sometimes unique needs of the installation and the mission(s) it hosts and the military and civilian personnel that accomplish the mission(s)." August 31, 2020. **LOE 2-4***

9. This report includes the following Enclosures:

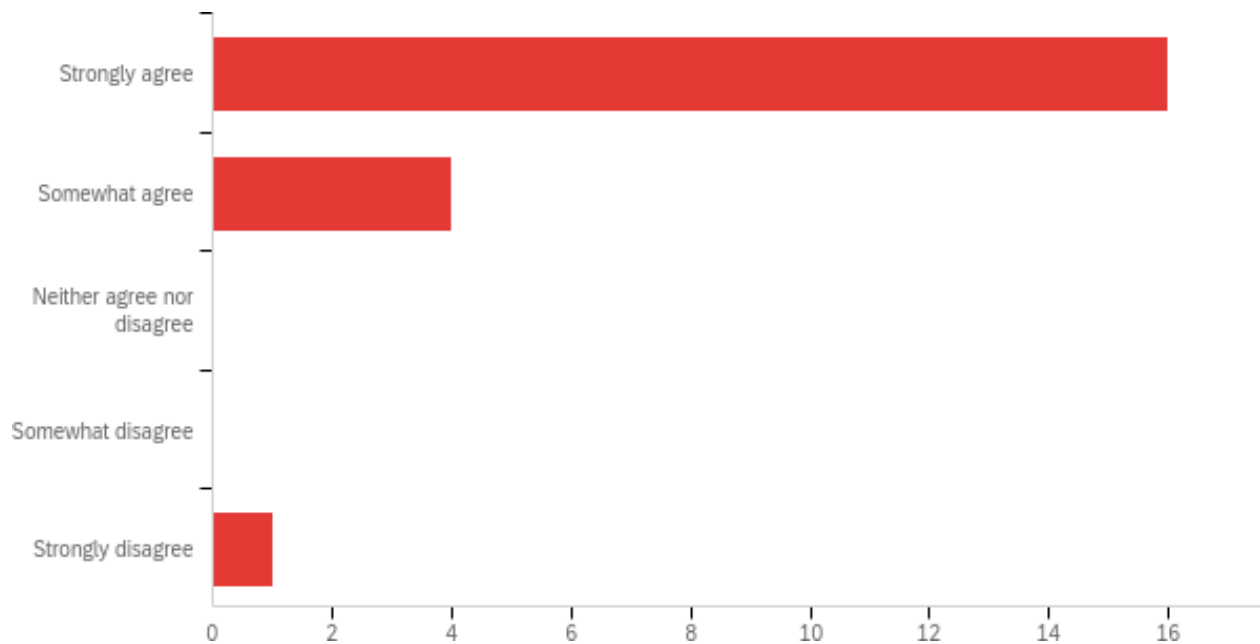
- Enclosure 1 – NUARI Energy Resilience Mid-Career and Senior Leader Raw survey data
- Enclosure 2 – Executive Summary – Energy Resilience Survey Report

**Enclosure 1 – NUARI Energy Resilience Mid-Career and Senior Leader Raw Survey Data,
Subject: Contract Deliverable - NUARI Energy Resilience Baseline Survey Results**

Survey Data Report
Energy Manager Survey

August 24th 2020, 3:44 pm EDT

Q: Improved energy resilience is important for installations' ability to accomplish their missions.



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Improved energy resilience is important for installations' ability to accomplish their missions.	1.00	5.00	1.38	0.90	0.81	21

#	Answer	%	Count
1	Strongly agree	76.19%	16
2	Somewhat agree	19.05%	4

3	Neither agree nor disagree	0.00%	0
4	Somewhat disagree	0.00%	0
5	Strongly disagree	4.76%	1
	Total	100%	21

Q: Do you agree or disagree with the following statements on risks to energy resilience at US Military installations (sorted by *Mean* response value—1=Strongly agree, 5=Strongly disagree):

Field	Minimum	Maximum	Mean	Std Deviation	Count
Energy infrastructure requires recapitalization and modernization to meet the DoD's Energy Resilience goals.	1.00	2.00	1.19	0.39	16
Energy infrastructure is vulnerable to disruptions from extreme weather.	1.00	3.00	1.44	0.79	16
Installation energy resilience projects must be included on a requirements list and Installation Master Plan	1.00	5.00	1.75	1.09	16
The communication and control systems for energy infrastructure on both sides of the fence line are vulnerable to cyber threats.	1.00	4.00	1.88	0.93	16
Installation leadership understands and has prioritized energy resilience.	1.00	5.00	2.50	1.06	16
Procedures for defining and prioritizing critical load requirements are effective.	1.00	5.00	2.69	1.26	16
Fuel for back-up generators is available for 14 days of continuous operations for mission critical functions.	1.00	5.00	2.75	1.48	16

DoD installations lack cooperation with local utilities to meet the DoD's Resilience goals.	1.00	4.00	2.94	0.90	16
Energy infrastructure is modern and in good working order.	1.00	5.00	3.00	1.22	16
Existing processes support timely corrections of energy infrastructure deficiencies and vulnerabilities.	1.00	5.00	3.31	1.40	16
Training for personnel with energy related responsibilities is readily available.	1.00	5.00	3.44	1.17	16

Q: Do you agree or disagree with the following statements on risks to energy resilience at US Military installations (same data as previous page):

#	Question	Strongly agree		Somewhat agree		Neither agree nor disagree		Somewhat disagree		Strongly disagree		Total
1	Fuel for back-up generators is available for 14 days of continuous operations for mission critical functions.	25.00 %	4	31.25 %	5	6.25 %	1	18.75 %	3	18.75 %	3	16

2	Energy infrastructure is modern and in good working order.	18.75 %	3	12.50%	2	25.00 %	4	37.50%	6	6.25%	1	16
3	The communication and control systems for energy infrastructure on both sides of the fence line are vulnerable to cyber threats.	43.75 %	7	31.25%	5	18.75 %	3	6.25%	1	0.00%	0	16
4	Existing processes support timely corrections of energy infrastructure	12.50 %	2	25.00%	4	6.25%	1	31.25%	5	25.00 %	4	16
	deficiencies and vulnerabilities.											

5	Energy infrastructure requires recapitalization and modernization to meet the DoD's Energy Resilience goals.	81.25 %	13	18.75%	3	0.00%	0	0.00%	0	0.00%	0	16
6	Installation leadership understands and has prioritized energy resilience.	12.50 %	2	50.00%	8	18.75 %	3	12.50%	2	6.25%	1	16
7	Procedures for defining and prioritizing critical load requirements are effective.	18.75 %	3	31.25%	5	25.00 %	4	12.50%	2	12.50 %	2	16
8	DoD installations lack cooperation with local utilities to meet the DoD's Resilience goals.	6.25%	1	25.00%	4	37.50 %	6	31.25%	5	0.00%	0	16

9	Energy infrastructure is vulnerable to disruptions	75.00%	12	6.25%	1	18.75%	3	0.00%	0	0.00%	0	16
	from extreme weather.											
10	Training for personnel with energy related responsibilities is readily available.	6.25%	1	12.50%	2	37.50%	6	18.75%	3	25.00%	4	16
11	Installation energy resilience projects must be included on a requirements list and Installation Master Plan	56.25%	9	25.00%	4	12.50%	2	0.00%	0	6.25%	1	16

Q: What's the biggest energy issue facing installations?

What's the biggest energy issue facing installations?

Timely and adequate funding for utility and energy infrastructure upgrades

Cyber security Robust automation and centralized energy management and control system(EMCS)

Lack of Communication between all the services energy managers is the biggest issue. If there was a easily accessible, CAC enabled web site for all of the energy community to communicate, there would be less reinvention of the wheel. The second biggest issue is lack of manpower to support most installations energy programs. For example my installation is authorized two energy managers, but only get funded for one. Which then leads to the discussion that it is up to the Garrison Commander to fund both slots and the GC needs to use the funding for a second person somewhere more urgent. Energy managers need their own hiring code and commands should receive funding for all authorized energy managers.

The third biggest issue is that each service seems to run its energy in similar ways, but calls every thing differently. Energy should be a DoD program. Energy managers for each service should have similar training except for specialty areas such as ships. Building Control Systems are another example where all the services should have a DoD energy program and not a services energy program. The building control systems for the navy should be similar to those in the army. How they are operated should also be similar, yet they are not.

Sufficient funding is not available to implement energy resilience projects to meet the established resilience goals (such as 14 day sustainable energy for all critical facilities during a grid outage).

Lack of dedicated funding. Congress needs to recognize and prioritize funding for resilience measures.

Any initiative dependent upon support from the NEC....

Aging and unconnected or 'last generation' connected infrastructure, single points of failure (because in DOD 'redundancy' connotes waste), and lack of prioritization of critical infrastructure, attributable to a lack of visibility on asset/infrastructure condition and mission dependence/criticality.

1. Senior leadership's understanding and vested interest, e.g. pay/bonus/performance directly linked to results of 3rd party assessments, e.g. availability for mission support/reliability, consumption, process automation, etc. 2. Oversight/Accountability (unmanaged and mismanaged, survey/assist/inspection program with direct impact on employee performance and pay; 3. Oversizing and underutilization (inefficient management) of facilities.

Lack of funding for upgrading system deficiencies and for capital improvement projects.

Microgrid implementation

Willingness play a participatory role in modern energy solutions, both DoD and Civilian parties.

Lack of ability to integrate the basic modern sensing and smart wire technology that would help with load shedding and microgrid integration.

Academic or professional development programs for Installation personnel.

Q: Have you taken any professional development courses/workshops/trainings specifically addressing energy resilience?

#	Answer	%	Count
1	Yes	58.82%	10
2	No	41.18%	7
	Total	100%	17

Q: Please elaborate, including who offered the training (your organization/external vendor). Select all that apply.

#	Answer	%	Count
1	Energy Exchange	28.57%	6
2	Naval Post Graduate School	9.52%	2
3	Energy Management Association	14.29%	3
4	Other military-sponsored education or training classes (Please describe)	19.05%	4
5	Other non-military education or training classes (Please describe)	28.57%	6
	Total	100%	21

Q15_4_TEXT - Other military-sponsored education or training classes (Please describe)

Other military-sponsored education or training classes (Please describe) - Text

SAME JETC/EMA

Army energy class

Army Energy & Water Reporting G-9 JACK

AFIT

Q15_5_TEXT - Other non-military education or training classes (Please describe)

Other non-military education or training classes (Please describe) - Text

FEMP

State sponsored lighting classes

DoE/FEMP

ASHRAE

Lean Construction Institute, LEED

Q: Please describe the effectiveness of the training.

Energy Exchange is the best place to meet with other energy professionals and all levels of leadership. NPS was an excellent program but left holes in cyber and other utility infrastructure training that could be expanded on with additional coursework. FEMP and DOW are excellent resources for energy information and training

Energy Management Association provided AIA-accredited 1 hour presentation on energy related resiliency issues. Excellent introductory course.

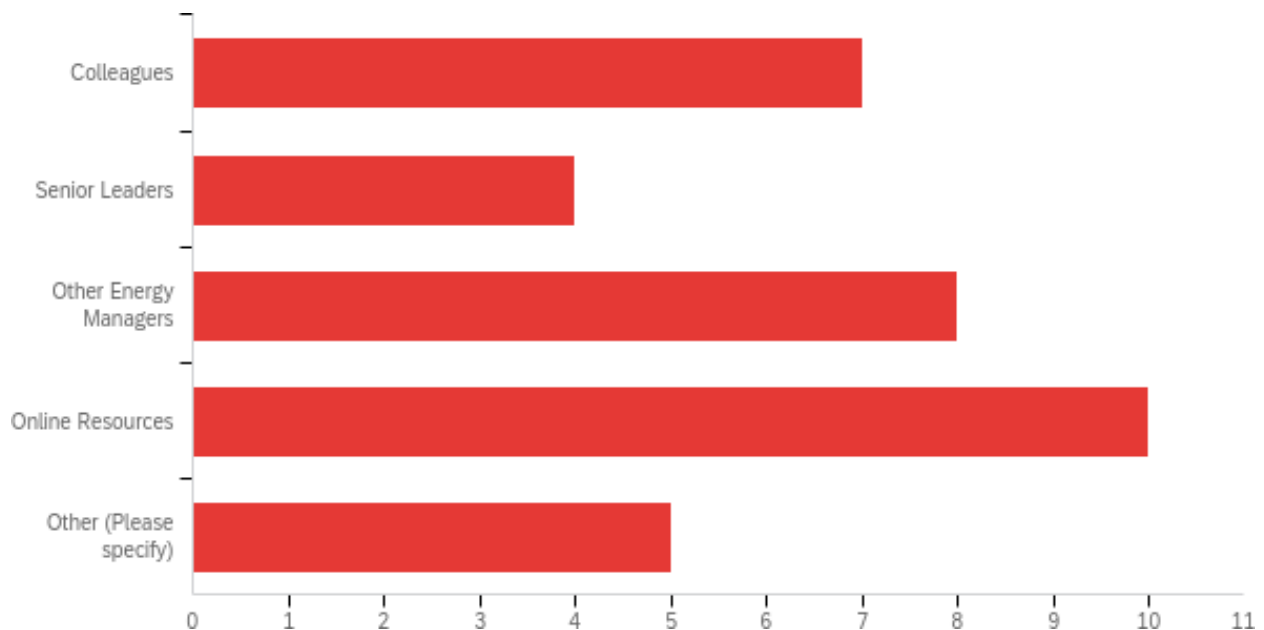
Not enough time or funding to implement most training and lack of a mentor to help get things going.

Excellent training, but not emphasized by the leadership.

Very informative, lots of great case studies and ideas

LCI provides a wealth of information to reduce waste of energy, materials, and time during construction projects. The LEED GA certification provided a lot of insight to energy and sustainable building solutions.

Q: How do you currently learn about best practices for your job as an energy manager? Select all that apply.



#	Answer	%	Count

1	Colleagues	20.59%	7
2	Senior Leaders	11.76%	4
3	Other Energy Managers	23.53%	8
4	Online Resources	29.41%	10
5	Other (Please specify)	14.71%	5
	Total	100%	34

Q16_5_TEXT - Other (Please specify)

Other (Please specify) - Text

Journal articles, technical manuals and regulations

Energy Management Association

DoE/FEMP

Conferences and professional societies

Conferences

Q: Please rank the resources you selected in order of most valuable to least. Data sorted by Mean response value.

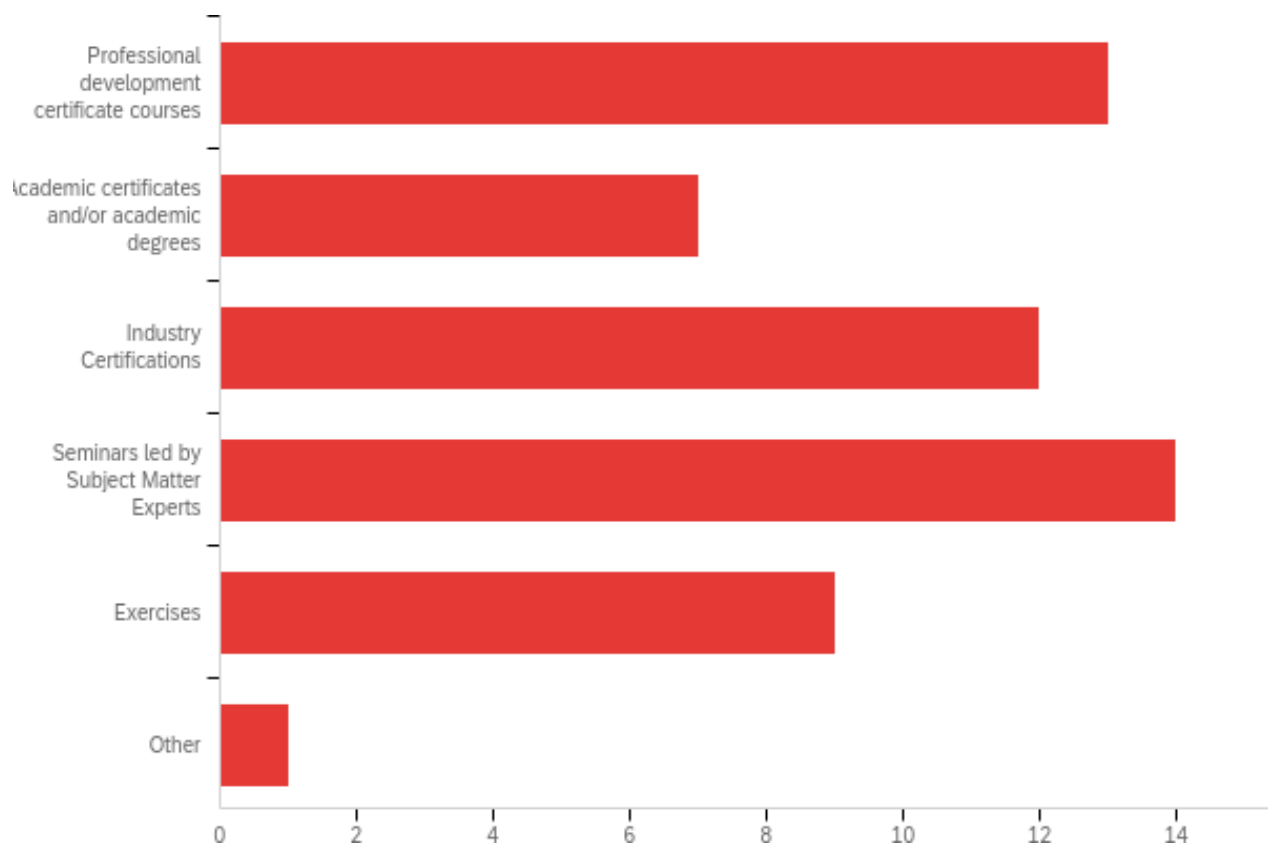
#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Colleagues	1.00	4.00	2.00	1.10	1.20	5
3	Other Energy Managers	1.00	4.00	2.20	1.17	1.36	5
4	Online Resources	1.00	5.00	2.33	1.37	1.89	6
5	[QID17-ChoiceTextEntryValue-5]	1.00	4.00	2.33	1.25	1.56	3
2	Senior Leaders	2.00	5.00	3.33	1.25	1.56	3

Response breakdown

#	Question	1	2	3	4	5	Total

1	Colleagues	40.00 %	2	40.00 %	2	0.00%	0	20.00 %	1	0.00%	0	5
2	Senior Leaders	0.00%	0	33.33 %	1	33.33 %	1	0.00%	0	33.33 %	1	3
3	Other Energy Managers	40.00 %	2	20.00 %	1	20.00 %	1	20.00 %	1	0.00%	0	5
4	Online Resources	33.33 %	2	33.33 %	2	16.67 %	1	0.00%	0	16.67 %	1	6
5	[QID17-ChoiceTextEntryVal ue-5]	33.33 %	1	33.33 %	1	0.00%	0	33.33 %	1	0.00%	0	3

Q: If training were offered related to energy resilience which of the following types of programs would interest you. Select all that apply.



#	Answer	%	Count

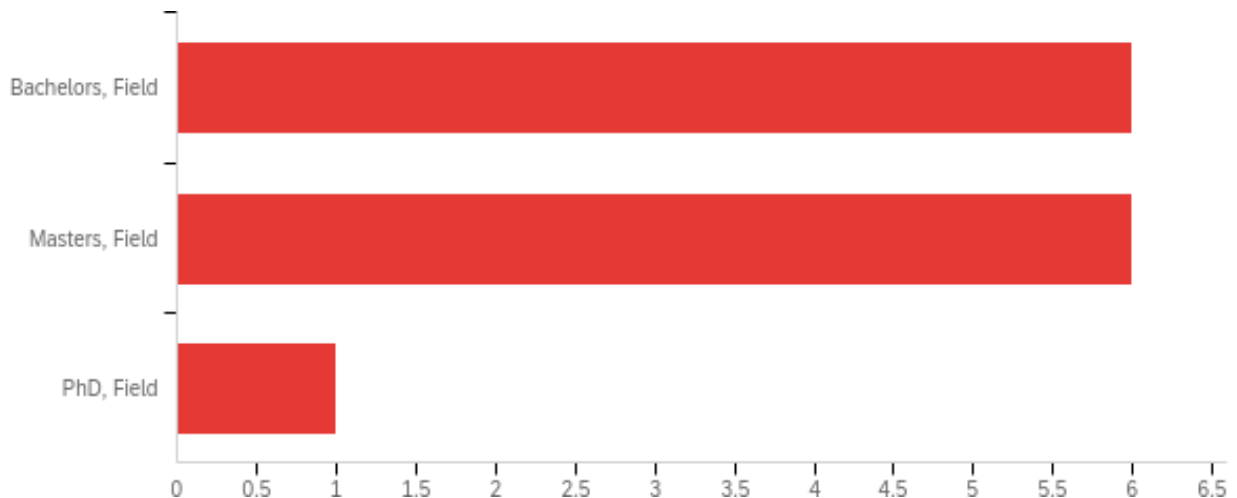
1	Professional development certificate courses	23.21%	13
2	Academic certificates and/or academic degrees	12.50%	7
3	Industry Certifications	21.43%	12
5	Seminars led by Subject Matter Experts	25.00%	14
8	Exercises	16.07%	9
9	Other	1.79%	1
	Total	100%	56

Q17_9_TEXT - Other

Other - Text

Few weeks 'shadow' TDY/intern or apprenticeship with best performing IEMs at most challenged installations.

Q: (Optional) What is your educational background? Please select all that apply and specify the field of study.



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count

1	(Optional) What is your educational background? Please select all that apply and specify the field of study. - Selected Choice	1.00	3.00	1.62	0.62	0.39	13

#	Answer	%	Count
1	Bachelors, Field	46.15%	6
2	Masters, Field	46.15%	6
3	PhD, Field	7.69%	1
	Total	100%	13

Q18_1_TEXT - Bachelors, Field

Bachelors, Field - Text

BS Communications

nuclear engineering

Civil Engineering

BSEE

Mechanical Engineering

Construction Management

Q18_2_TEXT - Masters, Field

Masters, Field - Text

NPS Energy Security Certificate

BS in Civil Engineering, MS in Engineering Management

Civil Engineering

Environmental Resource Management; 2 Bachelors: Mechanical Engineering &

Biology

Civil/Environmental Eng

Strategic Studies

Q18_3_TEXT - PhD, Field

PhD, Field - Text

Critical Infrastructure

Survey Data Report

DoD Senior Leader Energy Resilience Survey

August 24th 2020, 4:49 pm EDT

Q: Based upon the DoD mission statement and services provided to Units/Tenant Organizations, how important is Energy Resilience in the following organizations (sorted by *Mean* response value—30=Extremely Important, 31= Neither important nor unimportant, 32= Not at all important):

#	Field	Minimum	Maximum	Mean	Std Deviation	Count
4	Director of Public Works	30.00	30.00	30.00	0.00	23
1	Directorate of Emergency Services	30.00	31.00	30.09	0.28	23
12	Communications Units/Facilities	30.00	31.00	30.09	0.28	23
11	Medical Facilities	30.00	31.00	30.13	0.34	23
15	Department of Defense Headquarters	30.00	31.00	30.13	0.34	23
14	Military Service Headquarters	30.00	31.00	30.17	0.38	23
2	Directorate of Plans Training Mobilization and Security	30.00	32.00	30.22	0.51	23
8	Logistics Readiness Center	30.00	31.00	30.23	0.42	22

5	Plans, Analysis & Integration (PAI)	30.00	32.00	30.38	0.63	24
10	Tenant Units – training and deployment support	30.00	31.00	30.48	0.50	23
7	Safety Office	30.00	32.00	30.52	0.65	23
13	Local Community	30.00	32.00	30.70	0.69	23
6	Public Affairs	30.00	32.00	30.77	0.60	22
3	Directorate of Human Resources	30.00	32.00	31.00	0.59	23
9	Army Community Service	30.00	32.00	31.04	0.46	23

Q: Based upon the DoD mission statement and services provided to Units/Tenant Organizations, how important is Energy Resilience in the following organizations:

#	Question	Extremely important		Neither important nor unimportant		Not at all important		Total
1	Directorate of Emergency Services	91.30%	21	8.70%	2	0.00%	0	23
2	Directorate of Plans Training Mobilization and Security	82.61%	19	13.04%	3	4.35%	1	23
3	Directorate of Human Resources	17.39%	4	65.22%	15	17.39%	4	23
4	Director of Public Works	100.00%	23	0.00%	0	0.00%	0	23
5	Plans, Analysis & Integration (PAI)	70.83%	17	20.83%	5	8.33%	2	24
6	Public Affairs	31.82%	7	59.09%	13	9.09%	2	22

7	Safety Office	56.52%	13	34.78%	8	8.70%	2	23
8	Logistics Readiness Center	77.27%	17	22.73%	5	0.00%	0	22
9	Army Community Service	8.70%	2	78.26%	18	13.04%	3	23
10	Tenant Units – training and deployment support	52.17%	12	47.83%	11	0.00%	0	23
11	Medical Facilities	86.96%	20	13.04%	3	0.00%	0	23
12	Communications Units/Facilities	91.30%	21	8.70%	2	0.00%	0	23
13	Local Community	43.48%	10	43.48%	10	13.04%	3	23
14	Military Service Headquarters	82.61%	19	17.39%	4	0.00%	0	23
15	Department of Defense Headquarters	86.96%	20	13.04%	3	0.00%	0	23

Q: Rank order each of the following functions that are important to the Military Installation, with the 1 being the most important and 12 the least. Drag and drop each function to change its position:

Field	Minimum	Maximum	Mean	Std Deviation	Count
Power distribution	1.00	11.00	3.50	2.64	22
Physical Security	1.00	12.00	3.50	2.79	22
Water services	1.00	11.00	4.18	2.42	22
Cyber Security	1.00	12.00	4.64	2.59	22
Commercial Utility provider	1.00	12.00	5.32	3.35	22
Natural disaster management	1.00	12.00	6.36	2.51	22
Funding for energy resilience	1.00	10.00	6.68	2.77	22

Master planning	2.00	12.00	7.05	2.65	22
Energy resilience exercises	5.00	12.00	8.91	2.07	22
Department of the Army Energy Resilience policy	1.00	12.00	9.05	3.18	22
Renewable energy	4.00	12.00	9.27	2.43	22
Local community energy agreements	3.00	12.00	9.55	2.29	22

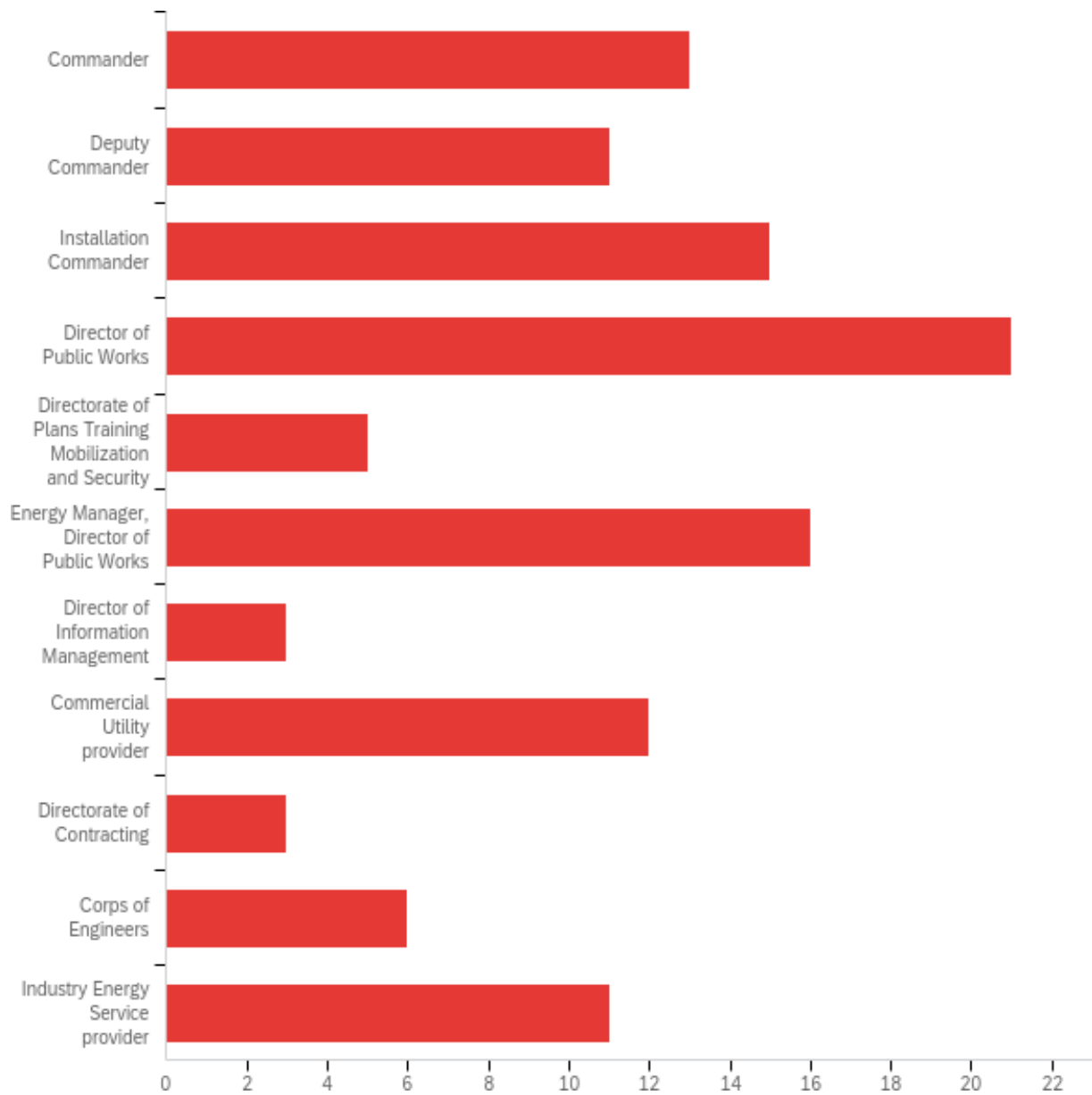
Question	1	2	3	4	5	6	7	8	9	10	11	12	Total
Cyber Security	9.09%	218%	413.64%	34.55%	19.09%	231.82%	74.55%	14.55%	10.00%	0.00%	0.00%	4.55%	122
Water services	4.55%	12.73%	518.18%	418.18%	418.18%	9.09%	20.00%	0.00%	0.00%	4.55%	4.55%	0.00%	22
Power distribution	22.73%	22.73%	13.64%	18.18%	9.09%	4.55%	0.00%	0.00%	0.00%	4.55%	4.55%	0.00%	22

Renewable energy	0.00%	0	0.00%	0	0.00%	0	4.55%	1	0.00%	0	18.18%	4	4.55%	1	9.09%	2	9.09%	2	4.55%	1	31.82%	7	18.18%	4	22
Physical Security	31.82%	7	18.18%	4	4.55%	1	22.73%	5	0.00%	0	9.09%	2	4.55%	1	4.55%	1	0.00%	0	0.00%	0	0.00%	0	4.55%	1	22
Natural disaster management	4.55%	1	0.00%	0	4.55%	1	9.09%	2	27.27%	6	4.55%	1	22.73%	5	13.64%	3	0.00%	0	4.55%	1	4.55%	1	4.55%	1	22
Local community energy agreements	0.00%	0	0.00%	0	4.55%	1	4.55%	1	0.00%	0	0.00%	0	4.55%	1	0.00%	0	27.27%	6	22.73%	5	18.18%	4	18.18%	4	22

Ma ste r pla nn i ng	0. 0	0	4. 5	1	9. 0	2	4. 5	1	4. 5	1	1 8. 1	4	2 2. 7	5	9. 0	2	4. 5	1	9. 0	2	9. 0	2	4. 5	1	2 2
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Co m m erci al Util i ty pro vid er	9. 0 9 %	2	9. 0 9 %	2	2 7. 2 7 %	6	4. 5 5 %	1	1 8. 1 8 %	4	0. 0 0 %	0	0. 0 0 %	0	4. 5 5 %	1	4. 5 5 %	1	1 8. 1 8 %	4	0. 0 0 %	0	4. 5 5 %	1	2 2

Q: Who is responsible for energy resilience in your Installation? Select all that apply.



Q: Who is responsible for energy resilience in your Installation? Select all that apply (same question as previous page).

Answer	%	Count
Director of Public Works	18.10%	21
Energy Manager, Director of Public Works	13.79%	16
Installation Commander	12.93%	15
Commander	11.21%	13
Commercial Utility provider	10.34%	12
Deputy Commander	9.48%	11
Industry Energy Service provider	9.48%	11
Corps of Engineers	5.17%	6
Directorate of Plans Training Mobilization and Security	4.31%	5
Director of Information Management	2.59%	3
Directorate of Contracting	2.59%	3
Total	100%	116

Q: Would training in the following subject areas support the energy resilience tasks of a Military Installation?

#	Question	Yes		Maybe		No		Total
1	Energy Risk Analysis	90.91%	20	4.55%	1	4.55%	1	22
6	Energy resilience master planning	90.91%	20	9.09%	2	0.00%	0	22
3	Energy resilience exercise planning	86.36%	19	13.64%	3	0.00%	0	22
2	Cyber Security	72.73%	16	18.18%	4	9.09%	2	22
4	Energy Policy	54.55%	12	40.91%	9	4.55%	1	22
5	Energy Partnerships	54.55%	12	36.36%	8	9.09%	2	22

Q: Which of the following certificates, training and/or education support services be helpful to maintain an energy resilient Military Installation Yes – now, Yes – sometime later, No, Undecided

Question	Yes, now		Yes, eventually		No		Undecided		Total
Exercise support (for energy resilience)	76.19 %	16	23.81%	5	0.00%	0	0.00%	0	21
Subject Matter Expert on-call support	72.73 %	16	18.18%	4	4.55%	1	4.55%	1	22
Energy Professional certificates	50.00 %	11	27.27%	6	18.18%	4	4.55%	1	22
Senior Leader Seminars	50.00 %	11	22.73%	5	13.64%	3	13.64%	3	22
Energy Resilience Continuing Professional Education (CPE) certificates	45.45 %	10	50.00%	11	0.00%	0	4.55%	1	22
Reference library	40.91 %	9	45.45%	10	13.64%	3	0.00%	0	22
Graduate degree	31.82 %	7	45.45%	10	22.73%	5	0.00%	0	22
Undergraduate academic certificate	23.81 %	5	47.62%	10	19.05%	4	9.52%	2	21
Graduate academic certificates	13.64 %	3	59.09%	13	13.64%	3	13.64%	3	22
Intern support	4.55 %	1	50.00%	11	13.64%	3	31.82%	7	22

Q: Please share any other comments you may have.

There is a need to create a succession plan and pipeline at installations that does not currently exist. A stepped approach, and a more robust structure for Energy Management would be a benefit to the installations, viewing them as more of an integrator for all PW services.

Energy resilience is as much a state of mind as it is a program

Continuing professional education opportunities and webinars with a focus on the national, state, and local efforts and organizations.

Content is key. If senior leaders had a greater understanding of resilience and how energy relates, they could be very effective at leading their installations to a more resilient posture.

Certificates and training are only meaningful if they are mandated and funded.

As a PhD in engineering and a PE, and a Masters in Strategic Studies from the Army War College, I'm not a big fan of certificates, certifications or degrees in the fad of the day.

Experience trumps all. I don't know how many PMPs I've thrown out of my office because they can't answer a simple question on a project because it's "off-template."

1. Accountability through funded/scheduled Assist Visit - Inspection Program 2. Best learning is by personally exercising and performing functions. 3. Recruit talent

Enclosure 2 – Executive Summary – Energy Resilience Survey Report,
Subject: Contract Deliverable - NUARI Energy Resilience
Baseline Survey Results

Subject: Energy Resilience Education and Training Survey and Program

Survey Objective: The objective of this study is to develop an educational curriculum that enhances the knowledge and expertise of DoD military and civilian personnel in understanding and implementing Energy Resilience in their areas of influence.

Survey Scope - Two surveys were conducted to gather views and opinions mid-career installation energy professionals and the other toward senior leaders. The mid-career survey focused on identifying the barriers to installation energy resilience and resources required, including training and professional development opportunities and the senior leader survey focused on identifying the people and positions that drive energy resilience, as well as some of the gaps in education and training opportunities.

Survey Population: An estimated 200 individuals received links to the 2 surveys and there were 38 responses to the mid-career survey and 41 responses to the senior leader survey as of August 24, 2020.

Survey RESULTS: 95% of survey respondents agreed (of which 76% strongly agreed) that “Resilience is important for an installation’s ability to achieve its mission.”

The top risks to installation energy resilience identified by survey respondents were:

- Modernization of infrastructure
- Vulnerability to climate and cyber threats
- Inclusion of energy resilience goals in the Installation Master Plan
- Availability of training.

Program Next Steps – the next steps in the Energy Resilience Education and Training Program include (timeframe September 2020 to May 2021):

- Design Energy Resilience courses, seminars, and exercises
- Develop the courses, seminars, and exercises
- Pilot the courses, seminars, and exercises
- Implement the courses, seminars, and exercises and continuously Assess and Improve the program

Enclosure 5: Define Course Work Requirements & Identify Pilot Course Scope

CONTRACT TITLE: DEVELOPMENT OF AN ENERGY TRACK WITHIN THE NORWICH UNIVERSITY CENTER FOR GLOBAL RESILIENCE AND SECURITY – DESIGN PHASE

**NUARI Program
Design Document
for Contract No.
W9132T20C0005**

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Subject: Contract Deliverable - NUARI Energy Resilience LOE Program Design Document

1. Reference: DEVELOPMENT OF AN ENERGY TRACK WITHIN THE NORWICH UNIVERSITY CENTER FOR GLOBAL RESILIENCE AND SECURITY – DESIGN PHASE and the Final ERDC Contract W9132T20C:0005, dated 5 June, 2020
2. Requirement:

Required Service	Paragraph Number	Standard
Define Course Work Requirements; Identify Pilot Course Scope	Paragraph 5.1 of the Contractor's Proposal	a) Submitted within 90 days from date of award and b) aligns survey results with Lines of Effort design and development requirements

3. General: During the month of September 2020, the NUARI Energy Track team conducted tasks associated with the broad design of the programs and courses for LOE 1 - Undergraduate, LOE 2 – Mid-Career, and LOE 3 – Senior Leader programs. The two surveys for LOE 2 and 3 were used as a baseline, while the tasks for LOE 1 included a review of energy resilience tasks already implemented in the current curriculum based on Phase 1 actions. Further, the NUARI team hosted a Round Table event (Enclosure 1 – Round Table Notes) to gather views of DoD Energy Managers, the Government team and other guests, such as the President of the Energy Management Association. The goal of the Round Table was to obtain more detailed information on the gaps that were identified in the surveys.
4. Purpose-Method-End State: The purpose of the design process is to define the objectives (the subject areas required in the LOE) and outcomes/competencies (skills and abilities of the learner) of the Energy Resilience Track as the foundation to begin the development process.

The method for the design is the ADDIE process (Assess – Design – Develop – Implement – Evaluate) in conjunction with subject matter experts and training developers which included the analysis of Phase 1 documents, the surveys, Round Table notes, and subject matter experts.

The end state of the design process is a design document that defines the learning objectives, learning outcomes/competencies, the course titles, and potential delivery platforms for LOE 1, 2, and 3 as a foundation for the development phase.

5. Design Framework: Each LOE will have a document that follows the format below:
 - Subject: Line of Effort: 1, 2, or 3
 - Population Description: Who will likely benefit from the Energy Track?

- Develop the Curriculum, Credential, Certificate Map: the task is to identify learning objectives and subsequent learning outcomes/competencies for LOE 1, 2, and 3. The learning outcomes/competencies are further defined from this map to the Curriculum Design noted below.
- Curriculum Design – the blanks below were filled in for each LOE to achieve the learning outcomes/competencies – the intent is to translate the learning outcomes/competencies that were identified in the survey, the Round Table, and future workshops (Converge) to create the curriculum Design Framework in each of the four following categories:
- Energy Fundamentals

Course Title	Learning Objectives	Learning Outcomes/Competencies	Delivery Options	Priority of Development	Competency Map link

- Energy Resilience Risk Management

Course Title	Learning Objectives	Learning Outcomes/Competencies	Delivery Options	Priority of Development	Competency Map link

- Energy Resilience Policy – Policy, Cyber, Partnerships

Course Title	Learning Objectives	Learning Outcomes/Competencies	Delivery Options	Priority of Development	Competency Map link

- Energy Resilience Master Planning

Course Title	Learning Objectives	Learning Outcomes/Competencies	Delivery Options	Priority of Development	Competency Map link

6. Results: the results of the design process are included in the following Enclosures to this document:

- Enclosure 1 – Survey Round Table meeting notes
- Enclosure 2 – LOE 1 – Undergraduate Program
- Enclosure 3 – LOE 2 – Mid-Career Program
- Enclosure 4 – LOE 3 – Senior Leader Program
- Enclosure 5 – Tactical Microgrid Standards and Industrial Control Systems
- Enclosure 6 – Energy Resilience Design Phase Executive Summary

7. Next Steps and Comments: the following are topics that impact the program and will be addressed throughout the program.

- Pilot Courses – the following are possible pilot courses and will be coordinated with the Government team regarding attendees and timing:
 - Tactical Microgrid Standards,
 - Senior Seminar – Critical Infrastructure Overview course and/or Energy resilience relationships, risks/vulnerabilities, policy framework and strategies course.
- Development and Evaluation – The NUARI team will conduct meetings to coordinate the development of the courses for each LOE. Evaluations will be conducted during the development process which may adjust the content of the courses and the LOE programs. The adjustments will be identified to the Government by email/meeting/Monthly Progress Reports (MPR).
- Course Composition – Modules, Modular, Tiered Programs and Certificates – the following definitions are provided as background for the design and development processes:
 - Modules - A series of learning modules will be developed to address a subset of the learning outcomes. The outcomes will be chosen such that learning experiences related to the broad areas of energy fundamentals, policy, risk analysis, and master planning. Once developed, those modules could be incorporated as lessons in existing courses or further developed in a future effort into full courses based on need.
 - Modular – A group of courses that meet a desired competency level. This concept is particular to LOE 2 and 3 in regards to Continuing Professional Education (CPE) and can be developed to meet emerging skill requirements.

- Tiered Programs and Certificates – The arrangement of courses based on competency or the achievement of a prescribed composition of work.
- Target Audience Awareness – Coordination with the Installation Management Command Garrison Pre-Command Course regarding Senior leader awareness of, and attendance at, the courses being developed in this program. A one-hour overview introduced as part of the IMCOM pre-command Academy by Norwich or a mentor could provide the introduction with a reference to the other modules or even a certificate available through one of the Norwich vehicles. For senior civilians, we need to coordinate with the CP29 coordinator, the Deputy Army G9 or his staff coordinator Tim Wethersbee at IMCOM HQ. Finally, we need to think about an interaction with ICMA and SAME on this subject. ICMA has a fellowship program with the Army G9 for Deputy Garrison Commanders to spend a week with a City Manager. One of the issues that they discuss in the orientation is critical infrastructure resilience. The Association of Defense Communities (ADC) could also be a partner in exposure of the curriculum availability. We should also explore relationships with the National League of Cities, National Association of Counties, US Conference of Mayors, the National Governors Association and National Association of State Legislators to further the policy and training partnership opportunities as each of them are currently addressing the issues of energy and other critical infrastructure resilience. Finally, we should coordinate with AUSA and their professional development/hot topic, day-long seminars to expose the Army leadership to the essential components of energy assurance/resiliency and the installation ability to project combat power.
- Energy Resilience Interdependency – Because the contract is specifically designed for energy resilience, there is a concern that if the curriculum could be restricted to just energy. The unintended consequence could be that the program loses sight of the critical relationships between energy and other critical infrastructure such as Water and wastewater. Many service policy documents are actually titled “energy and water” – this concern will be addressed in the next Monthly Progress Report and throughout the program.
- Rubric for Evaluation – the following provides the framework for evaluation of the design and development products as well a student and instructor course evaluations:
 - Interdisciplinary – modular and modules
 - Experiential & Collaborative
 - Training – Availability, “Doable” Delivery mode, Relevant

Enclosures to This Document (6):

- Enclosure 1 – Round Table Meeting Notes
- Enclosure 2 – LOE 1 – Undergraduate Program
- Enclosure 3 – LOE 2 – Mid-Career Program
- Enclosure 4 – LOE 3 – Senior Leader Program
- Enclosure 5 – Tactical Microgrid Standards and Industrial Control Systems
- Enclosure 6 – Energy Resilience Design Phase Executive Summary

Enclosure 1 – Energy Resilience Education Track Survey Round Table Meeting Notes - 10:00am, 15 September, 2020, NUARI Energy Resilience Design Document

GoToMeeting Set-up

Entry-Level Energy Fundamentals Video – David F –

<https://youtu.be/OTbm3L7x2Ew> Agenda:

- Welcome and Introductions
- Government perspective
- Entry Level plus R&D and Internships
- Mid-Career Survey discussion
- Senior Leader Survey discussion
- Standards discussion
- Summary and

discussion Attendees:

- Robert Knoedler - President Board of Directors – Energy Management Association
- Kevin Beal, Partnerships, NU CGCS Online Programs
- Shannon Bergt - USAG Detroit Arsenal, Energy
- Tom Bozada - ERDC-CERL, Government Project Manager for Energy Track
- William Chedister-Energy Mgr./Engr. Branch Chief Ft Wainwright AK
- Dan Daoust, Director, Norwich Pro
- Robert Davis, TETRATECH
- Kahwa Douoguih, Senior Fellow Norwich CGRS
- Andrew Hamblin - ERDC-CERL, Contracting Officer's Representative
- William Lyons, President & CEO, Fort Hill Companies LLC – NUARI Consultant
- Fred Meurer, President, Meurer Municipal Services – NUARI Consultant
- Kristen Pederson, Associate Vice President, NUARI
- Michael Wu, Principal and Co-Founder, Converge Strategies, LLC
- David Heap, Managing Director, Maxwell Faraday Consulting Inc. – NUARI Consultant (could not attend)
- Jeff Cairns, Program Manager, NUARI, Energy Resilience and Arctic Microgrid
- Brett Wobker, Energy Division Chief, Fort Leavenworth, Kansas

- Mark Parker, Director of Undergraduate Programs, NU CGCS

- *(Internal note: should we expand the Army team to include a Garrison Commander or a Deputy Garrison Commander?)*

Tentative:

- Robert Dyrdek
- James Ehrman

Notes

Government Perspective (Tom Bozada)

- The Energy environment is rapidly changing: more critical and more vulnerable
- DoD needs to establish training and education program for energy professionals
- Part of this effort is to influence policy when the opportunity presents itself
- Energy Track is a unique opportunity to “raise the bar”
- Should we reach out to the IMCOM Academy as they could/should be one of the venues that could use the LOE 3 curriculum we develop?

Main Objectives Today

- Deeper understanding of challenges and gaps in Energy Resilience for mission success at the installation
- Provide a good foundation for energy resilience and security training and education program

Statement: Energy resilience is becoming more important as society advances

- The purpose of Energy Resilience Education track is to establish a more formal education program that meets the mission needs of the US Army – at installations and within the Beltway
- This Round Table intends to dig deeper into the issues facing energy professionals and senior leaders to identify gaps in education in order to establish a firm foundation in energy education

Undergraduate

Energy fundamentals

- Coal to oil, how to change, how to handle different energy sources (Alaska)
- For undergrad mindset—establish the importance of **Maintenance** early - that is you don't just build something and leave it. It has to be maintained
- Good to have “across the fence” understanding, civilian-military

Risk Analysis

- The Mission is the primary focus at operational installations - Projection of the force at the installation level is part of every energy action/engagement
- We need to be giving tours to installation leadership (other directorates, operational units, tenants) to help understand the breadth and depth of installation energy
- A gap in the entry level, very installation-team oriented but not looking outside the military box
- There is a need to help entry-level installation energy professionals communicate their job functions to mission commanders and the importance of their function.
- Mission owners - how can we effectively communicate with guys in the field
- How to deal with legacy systems
- All levels need to understand the risks to their energy supply that reside off post and in other organizations infrastructure or operations. The energy manager and senior leader need to be sure that they have a relationship with the outside agencies and private sector that impact energy/mission resilience. This will often put Garrison Commanders in an environment in which they are not used to working.

Policy

- Public and Private partnerships outside the fence - at policy level it is an issue (for some senior leaders) to speak to public organizations people outside of the base because installation critical infrastructure always involves the municipality (for water systems and some energy systems, it could be the community, but most often energy supply and distribution policy formulation and decisions are made by regulated utilities, state and sometime regional agencies) – this has an impact at the entry and mid-career levels.

Master Planning

- Installation support personnel v. energy users and operators rift – how can these two groups come together so that requirements can be translated into actionable energy projects/policies.
- Converge found a lesson in energy exercise that caused disruptions — at the end the installation commander said “this didn’t go well, and it would have been worse if it really happened.” (As we are talking about exercises, we need to start including areas around the base and not just within the fence line. A great deal of

the infrastructure necessary to project combat power is dependent on people, organizations and capabilities outside the fence.)

- Converge runs exercises - black out exercises; there is a need for “train the trainer” exercises to speed up the evaluations an exercise provides.
- Lessons - take lessons learned from Black Start/Out? exercises and communicate it— HUMAN FACTOR

Mid-Career

Fundamentals

- Baseline training— do we need an Energy Manager Basic course, and then a targeted course for pressing issues?
- Shift to resilience has been helpful for getting things done, but Cyber fundamentals is a missing capability in coordination with control systems and communications units.
- Emerging technologies are a mystery sometimes when it comes to integration with legacy energy systems.

Risk Analysis

- Define the mission of the tenant units and how energy supports that mission.
- Vulnerabilities of new technologies, fundamental building blocks class, bidirectional controls, legacy issues, how to deal with workforce that accounts for people’s skills, energy experience, 5% dealing with cyber several years ago, now 30%.
- Critical asset list, installation threat protection working group.
- Have threat conversations on a regular basis is valuable to stay ahead.
- Energy Managers need to feel empowered and senior leadership needs to know how important the Energy Manager is to the installation mission (we need to somehow get energy resilience into the Installation mission commander and Garrison Commander lexicon thru their pre-command charm schools).
- Consider energy resilience as a spectrum of functions and how they interact and/or are synchronized – supply chain, cyber, contracting, the logistics of how things are done, vulnerability assessments, planning sessions etc.

Policy etc.

- Best practice - Creation of Military Energy Resilience Catalyst (MERC):

tremendous amount of talent and innovation, but no one knows each other, fractured bureaucracy, functional chain of command difficult to navigate, create a community of practice, bringing people together, address shared challenges, progress on energy resilience is too slow

- MERC—network, informal relationships, collaboration and training, human-centered design
- Having gone through NPS Master's program, utility infrastructure is covered but the understanding impact of cyber, Network Enterprise Center (NEC), from a communications standpoint is a challenge – CYBER is time critical - 10-20 hours a week beyond regular job. Proposal – develop a 1-week plus a weekend course, accelerated, painful, but practical.
- Cyber? ICS? Accelerated course: Example: what is the NEC dealing with, one day how do all of the different stakeholders look at cyber, inside, outside the fence line, how do you understand the threat from all of the different perspectives.
- Policy needs to be addressed—is this a required course? No comprehensive policy for cyber and energy. This is complex given different state regulations. How does the installation engage with the utility providers (this is very locality dependent. Energy providers are just one part of the energy resilience players)?
- Changing directive energy and water, 14 days or what installation commander designates - this policy is a start, but 14 days is way too optimistic. A good threat analysis will show that we need to rethink how to really become resilient thru distributed energy generation and microgrids to serve critical installation and off installation infrastructure.
- Policy issue: no path for promotion, at least not clear, installation losing staff to other organizations.
- Communication skills are important when planning and coordinating policy. The human factor in coordination is important when it comes to dealing with legacy systems.

Master Planning

- Do we need a piece at intermediate level; do we need solutions for long term outages? More than two weeks, fires as an example.
- Development of microgrids, fuel cells depending on the geography of where you are? Oil example in Alaska.

- “Someone” (a leader) needs to decide how important energy is in order to make these energy resilience improvements. Where would you see formal training being helpful? And where do you see gaps?

Additional Course Input

- Online is great, but in-person is better for relationship establishment, which is key, as people ascend in their careers.
- Some concepts need to be taught in-person, complex, need labs, need instruction from a professor/instructor, cyber as an example, hybrid options should be available.
- Topic: How important is energy? Why? Impact on installation and operational functions.
- Consider a tiered concept of training.
- Are lightning courses feasible (believe this means fast-paced but short courses)?
- LOE2 thoughts...partnerships, in that military leaders often only look at what happens inside their realm, but success can be determined by what happens to or with civilian partners. Case in point is how the wildfires out west are affecting bases, assuming the base depends on the utility for a significant percentage of their electricity. Need to think more about how we incorporate that policy aspect into the curriculum (for both undergrad and mid-career).
- Shannon brought up an issue related to boots on the ground engaging with decision makers, the former of which have legacy knowledge, and making sure everyone is on the same page (training levels, communication gaps, etc.). This is a well-known issue on the civilian side as well, and there are a lot of resources available in org and human behavior.
- Shannon – good point on the need to get all parties on board with a common language, especially with cyber. One-week courses on various subjects could be offered. The issue I see is that there are different levels of the depth of knowledge needed re: cyber.
- Face-to-face vs online delivery platforms – I think a hybrid strategy works well. Self- taught sessions online before a working group activity in person.
- Benefits and challenges of microgrids – I’ve got too much to say on this issue to cover it here. Let’s save it for another day, but in the meantime see attached for an article I co- authored on the subject for IEEE a few years ago.
- Lots of back and forth on energy cost vs reliability/resiliency. This is an industry-wide issue. Essentially, what is the cost of resiliency? It’s different for

various users, and always a moving target. However, we have to understand that all stakeholders operate under financial constraints, so money saved can be used somewhere else. I don't see budget and mission as mutually exclusive.

Senior Leader

Fundamentals

- Utility systems off base typically more modern - how does a modern system interact with a legacy system at installation "X"?
- Understand the energy systems and interoperability – i.e. what role does water play in energy resilience? Others...
- Most Garrison Commanders are not Engineers – what do they need to know about energy?
- How do the various energy systems outside the fence interface with those systems inside the fence?
- Who are the key players in the installation's energy resilience?
- What questions should the new commander ask about energy readiness and resilience of the installation and impact on mission
- Who are the entities and influencers that impact energy resilience on the installation and off the installation?
- What are the significant installation infrastructure and off installation infrastructure vulnerabilities that threaten the installation's capability to project combat power?
- What partnerships must be formed on and off base at the senior leadership level
- How do senior leaders interact with regional leadership to address cyber threats to mission capability?
- What entities at the local, regional and state levels should be included in exercise design?

Risk Assessment

- Define the installation mission and update this periodically - what are the energy requirements and energy risks?
- Military installation "islanding" is a short term scenario – long term operations require an understanding and coordination of utilities and local governments outside the installation.

- What is the threat assessment for an installation?
- What are the energy requirements of the tenant operational units?
- How do we help the senior leader understand the importance of maintaining critical infrastructure to the mission?
- How do we communicate vulnerabilities on and off installation?
- Identify key influencers, users, key actions that increase demand.
- Intelligence fusion center for energy?
- Frame energy in terms of risk in order for them (Garrison Commander) to address the issues.

Policy

- How do we get energy resilience information to Garrison Commanders and mission commanders?
- Help Garrison Commanders understand what they can and should do in terms of communicating with the key people outside the fence line
- Intergovernmental Support Agreement (IGSA) process, most are focused on saving money as opposed to mission assurance. Should look for partnerships under various authorities to improve mission assurance and resiliency
- Bringing MERC in, helps build awareness among senior leaders, P3 and P4, elevate energy to a different level
- Most Installation Commander's do not have Engineering experience – they are generally proven leaders in their original branch.

Master Planning

- Co-interest in mission accomplishment - How does the installation coordinate energy resilience efforts with the various local, regional, and national energy commissions?
- Consider Partnerships, agreements, and coordination meetings during master planning efforts.
- Can the Office of Economic Adjustment be an asset when planning? For instance, should Compatibility Use Plans (CUP) address critical infrastructure?
- Coordinate a "Vision" for the installation with a plan and sub-plans to address energy resilience.

- IGSA – can be a mutually supporting agreement as well as a way to share – how can this be integrated into planning?

Two resources for beyond the fence line partnerships:

- [Beyond the Fence Line Report](#)
- [RIGOR Report for JBER Process](#)

Importance of Standards

- Is a common framework important for a mobile workforce (military and government civilians)?
- Prioritize critical systems - can standards support effectiveness?
- Microgrid standardization - how can this concept work to streamline the workload at an installation?
- Some standards are helpful and some are onerous – what are helpful? Need to understand how they can help an installation energy resilience program.
- Maintenance, cyber hygiene would be fantastic; if the Army followed the Navy for standards would be great.
- Hard in practice to standardize at the installation level in the Army - why?
- Siting is an important conversation to have from a master planning perspective, especially for critical infrastructure - how can standards support proper site placement of new infrastructure/buildings etc.?
- Review how the MEVA list is generated. Are all appropriate parties participating in the process?

Enclosure 2 – LOE 1, Undergraduates/Entry Level, NUARI Energy Resilience Design Document

1. Line of Effort: 1 – Undergraduates/Entry Level

2. Population Description: The target population consists of undergraduate students who are pre-service officers and potential future civilian government employees working on matters that influence our energy resiliency.

It is anticipated the initial population will include students with majors in Engineering (all disciplines) and Computer Security and Information Assurance. Additionally, it will include students of all majors following the ROTC sequence of courses. Secondary populations will include students majoring in Business, Criminal Justice, Environmental Science, and Political Science.

3. Curriculum, Credential, Certificate Map: Identified below are learning objectives and subsequent learning outcomes/competencies for LOE 1. The learning objectives are categorized as relating to the areas of:

- Energy Fundamentals (F)
- Policy (P)
- Risk Analysis (R)
- Master Planning (MP)

Students will have a better understanding of:

- Energy resource deployment—generation capacity and loading (F, P)
- The energy supply system—generation, transmission, distribution, conversion, or transfer of electrical or heat energy (F, P)
- Energy analysis, modelling, and computation (F, R)
- Technical, social, and ethical evaluation and analysis concepts including: efficiency and high performance, sustainability and product life-cycle, environmental and ecological impacts (F, P, R)
- Energy infrastructure monitoring and security (F, P, R)
- The link between energy and other infrastructure and issues of societal import (P, R, MP)

The aforementioned objectives were developed into the learning outcomes below:

Objectives	Learning Outcome	Learning Outcome Description <i>Students will...</i>
1	O1	explain that energy is conserved, that it can be transformed into various forms, and that the time scale on which it is “stored” and “released” is critically important (F, P)
	O2	estimate the energy requirements of addressing basic human needs such as food, shelter, water, transportation, or waste management (F, P, R)
	O3	discuss the scale and scope of energy consumption rates in the US and the world, as well as the sources and processes for transforming energy into forms useable for consumption (F, P, R)
2	O4	describe how electricity is typically generated, transmitted, and distributed, as well as the impact of renewable or local energy sources on those processes (F, P)
	O5	provide examples of the three main processes by which heat transfer occurs and applications of those processes (F)
3	O6	quantify energy and power in its various forms (kinetic / mechanical, thermal, electric), connect those forms to the physical environment, and convert measures among those forms (F)
	O7	differentiate between work/energy and power, connecting those quantities to time (F)
	O8	analyze and estimate the needs and impacts of energy producing or consuming systems using per unit quantities, and model behaviors to predict future needs (F, P)
4	O9	articulate that efficiency and performance must be viewed within particular contexts, and that standard efficiency and performance definitions for generating and consuming energy devices vary based on the particular context and materiality (F, P)
	O10	apply key sustainability concepts, assessments, and tools to the analysis of existing systems and explore the impacts of the systems in multifarious societal contexts (F, P, R)

	O11	connect the source and demand for energy to meet human needs to global, environmental contexts (F, P, R)
5	O12	understand the evolving role that technology plays at all levels of society in all of society's systems, appreciate the risks and vulnerabilities that society is open to as a result of solutions that rely on massive data collection and interconnectivity, and recognize that the concepts of security and resilience should be designed into solutions from the start (P, R)
6	O13	demonstrate an understanding of the link between energy and issues of societal import by planning, synthesizing, and communicating an effort to answer a question or solve a problem, within the norms of their own discipline (F, P, R, MP)

The thirteen learning outcomes listed above are all-encompassing and beyond the scope of what can be achieved with an undergraduate student pursuing a foundational education in another content area. A survey is underway to help prioritize and reduce the outcome set above.

4. Curriculum Design: A series of learning modules will be developed to address a subset of the learning outcomes listed above. The outcomes will be chosen such that learning experiences related to the broad areas of energy fundamentals, policy, risk analysis, and master planning are present in the content created.

Once developed, those modules could be incorporated as multi-week lessons in existing courses or further developed in a future effort into full courses. Students could collect the requisite experience / exposure to the fundamentals of energy resilience by taking multiple courses that include the developed modules.

When a sufficient number of full courses related to the broad area of energy resilience are developed and offered, the possibility for credentialed minors or concentrations in the area exist.

To emphasize the possibility for the developed modules to be adopted and offered to students, a table of all of the majors at Norwich by each of the subject matter areas identified by the Energy Track is provided below. An "x" in each box indicates whether the courses in the major cover any of the topic areas identified by the analysis in Phase 1. The standard is very inclusive so as to show how the energy resilience modules (technical and non-technical) being developed by the Energy Track team can be incorporated into every major at Norwich and can eventually become a certificate, minor, major or program in the future, depending on interest from faculty and students.

Majors at Norwich	Fundamental s	Risk Analysi s	Polic y	Master Planning *
Accounting		x	x	x
Architectural Studies	x	x		x
Athletic Training				x
Biology	x	x		x
Biochemistry	x	x		x
Chemistry & Biochemistry	x	x		x
Communications				x
Computer Science	x	x		x
Computer Security & Information Assurance	x	x		x
Construction Management	x	x		x
Criminal Justice		x	x	x
Criminal Justice Criminology Concentration		x	x	x
Education			x	x
Engineering	x	x		x
Engineering, Civil	x	x		x
Engineering, Electrical & Computer	x	x		x
Engineering, Mechanical	x	x		x
English				x
Environmental Science	x	x		x
Green Design	x	x	x	x
Exercise Science	x			x
Geology	x			x
Health Sciences	x	x		x
History				x

International Business		x	x	x
International Studies		x	x	x
Management		x		x
Mathematics		x		x
Neuroscience	x	x		x
Nursing	x	x	x	x
Physical Education				x
Physics	x	x		x
Political Science			x	x
Psychology		x		x
Spanish				x
Studies in War & Peace		x	x	x

While all four key aspects of energy resilience (energy fundamentals, policy, risk analysis, and master planning) are represented in the learning outcomes, the connection of energy fundamentals and policy are the two most prevalent in the stated outcomes. Recognizing that it will be difficult to adequately create experiences and modules that are both limited in duration (one-three weeks so as to be desirable for adoption into existing courses) and extensive enough to excite all four modes or areas, special treatment in the creation of material to support the risk assessment and master planning themes is required.

Risk Assessment

One of the experiential learning methodologies endorsed by the senior leader military subject matter experts was exercises. Exercises or simulations that allow participants to test protocols, behaviors and strategies have been employed effectively by the military for learning purposes and, as a pedagogical technique, align well with Norwich University's focus on experiential learning.

The Energy Track will call for proposals from all NU professors to design a classroom exercise that achieves any of the learning objectives in the Energy Track subject matter areas, i.e.

Energy Fundamentals, Risk Assessment, Policy and Master Planning, but with a particular focus on Risk Assessment, as exercises provide an education delivery mechanism that was designed for understanding and decision making under risk and uncertainty.

NUARI's DECIDE® versatile Exercise/Simulation platform has been used by various business and government organizations to engage in training, stress-testing and other

applications.

DECIDE® can be configured to support an in-class (virtual or in-person) activity that could be used across disciplines.

Master Planning: Energy Resilience Capstone

An Energy Resilience Capstone that is open to all majors can be offered, by application, for any students with an interest in energy resilience and security. A capstone course is designed to integrate the students' undergraduate studies in their major. The course will be offered beginning in fall 2021.

In spring 2020, a pilot “Energy Resilience Capstone” was offered through the Management department and the following is a list of suggested improvements that can be incorporated into the next iteration of the class:

- Open the Energy Resilience Capstone to all majors
- Involve other faculty in the course as adjuncts (with compensation)
- Develop a comprehensive but succinct interdisciplinary reading list
- Begin the course with common foundational materials
- Schedule a final presentation open to the public and the Energy Track Network

Resilience and Energy Resilience are interdisciplinary topics with a broad scope of applications across the military and civilian sectors. The first section of the course will introduce the knowledge areas established in the Energy Track via an introductory Energy Resilience module and several readings, including Resilience Dividend: Being Strong in a World Where Things Go Wrong by Judith Rodin 2014.

In the second section of the course, under the supervision of a Center for Global Resilience and Security instructor and faculty advisors from each department, students will propose, develop, and deliver a final project that combines the general knowledge acquired in their core undergraduate courses with the specific knowledge related to energy resilience. The final project may be in the form of a technological innovation, a business or strategic plan, a formal proposal in response to an RFP, a research study of an energy resilience problem, or other type of substantive project. Students will need to identify two additional faculty advisors for their capstone project. While each student is required to research, write and hand in a project paper, students can collaborate substantively by co-authoring related work. Although the class will be an independent research exercise, the initial readings and discussion will focus on resilience and security topics. There will be opportunities to engage with senior military leaders and business executives.

By the end of this course, students will be able to:

- Synthesize the knowledge they have acquired in their major

discipline into a comprehensive, coherent qualitative and quantitative skill set;

- Analyze a problem or challenge and use their knowledge to create an effective solution. Course Materials

Students will use their own previous papers and projects from their studies as well as any materials, such as books, articles or other publications related to their research topic. Readings and case studies may be assigned by the professor to facilitate student research objectives.

Development Activities:

- Create introductory Energy Resilience module for the Capstone
- Select readings that cover Energy Track subject areas of Energy Fundamentals, Risk Assessment, Policy, Master Planning
- Create and compile a list of current Energy Resilience research topics suitable for undergraduate research
- Identify three to five guest speakers from the Energy Track SME network to speak on a current issue Energy Resilience
- Conduct faculty outreach to identify initial cohort of students

Master Planning: NU Capstone

The Capstone Project, which is required by all majors, provides students with an introductory exercise in Master Planning. Though not necessarily related to energy resilience, the educational foundation established by the capstone project can be built upon in any future energy resilience-related master planning applications they may encounter in their careers.

NU Capstone

Objectives Students

will:

1. Demonstrate an understanding of the field by undertaking the capstone project(s) to address one or more questions and/or problem(s) in the discipline.
2. Incorporate major scholarship of the field to synthesize a solution to question(s) and/or problem(s) as the capstone project(s) within the norms of

the discipline.

3. Write effectively in accordance with the standards of the discipline.
4. Successfully defend findings from the capstone project(s) in a presentation.

Enclosure 3 – LOE 2 – Mid-Career, NUARI Energy Resilience Design Document

1. Line of Effort: 2 - Mid Career2. Population Description

Installation management professionals (in priority of training):

- Installation Energy Manager (Public Works)
- Network Enterprise Center (NEC) Operations/Plans
- Public Works Operations/Master Planning
- Local community government and energy suppliers – Public Works/Operations
- Director of Plans, Training, Mobilization, and Security (DPTMS) Operations/Plans
- US Army Garrison (USAG) representative – Deputy/Plans
- Director of Logistics and Contracting – Operations/Plans
- Director of Public Safety

Organizational team – this group of deployable military members includes the unit Executive Officer, Operations Officer, Supply Officer, Communications Officer, Engineer Officer (if assigned) and associated senior Non-Commissioned Officers. Supporting personnel include generation mechanics, communications personnel, Civil Affairs specialists, Special Operations Forces (SOF) engineering personnel, and other personnel as designated.

3. Curriculum, Credential, Certificate Map

- Learning Objectives
 - Gain an understanding of energy sources and uses as well as resilience principles
 - Develop a mission focused risk analysis mind set based on available resources
 - Acquire an understanding of the national, regional, and local entities and policies that influence energy resilience
 - Develop the skills for effective energy resilience planning in a dynamic and complex environment
- Learning Outcomes/Competencies
 - Understand and analyze how energy is sourced and used on an Installation
 - Analyze risks to energy resilience when compared to the

requirements for Installation/town/community

- Explain how energy is provided to an Installation
- Evaluate Cyber risks (and NEC programs) to installation energy resilience
- Identify relationships inside and outside an installation that are part of the installation energy resilience program (could include the following: Cyber, Partnerships, Policy, Industry, Technology, and various levels of government)
- Evaluate the maintenance requirements of systems involved in energy resilience functions
- Explain the principles of organizational behavior and motivation
- Master Planning - Identify the coordination required in the relationship between legacy systems and new technology fielding

4. Curriculum Design

a. Energy Fundamentals

Course Title	Learning Objectives	Learning Outcomes/ Competencies	Delivery Options	Priority of Development	Competency Map link
Energy Fundamentals Course or Module	Understand how an Installation gets energy and how it is used	Identify how “your” Installation gets energy and how it is used to support the mission.	Online and/or In-person	1 st	Understand and analyze how energy is sourced and used on an installation
Energy resilience fundamentals Course or Module	Understand the multifunctional concepts of energy resilience	Compare and explain the interdisciplinary factors required for energy resilience on “your” installation	Online and/or In-person	2 nd	Analyze the risks to energy resilience when compared to the requirements

b. Energy Resilience Risk Management

Course Title	Learning Objectives	Learning Outcomes/ Competencies	Delivery Options	Priority of Development	Competency Map link

Energy Risk Management Module	Develop a mission focused risk analysis mind set based on available resources	Identify energy resilience risks to “your” Installation/town/community and possible mitigation strategies	Online and/or In-person ICW Norwich Pro Risk Analysis course	3 rd	Analyze risks to energy resilience when compared to the requirements for an Installation/town/community

c. Energy Resilience Policy – Policy, Econ, Partnerships, Cyber

Course Title	Learning Objectives	Learning Outcomes/Competencies	Delivery Options	Priority of Development	Competency Map link
Energy Policy and Partnerships Course or Module	Understand the DoD and DA policies and programs for energy coordination and partnerships	Describe how DoD and Service energy and energy resilience policies impact “your” Installation and how partnerships can contribute to the mission	Online and/or In-person as part of a Norwich Pro course “Risk Assessments, Policies, and Internal Controls”	2 nd	Identify relationships inside and outside of the Installation that are part of the energy resilience program
Leadership and Organizational Behavior module	Understand how to communicate the importance of energy resilience for an Installation	Effectively communicate and plan energy resilience actions to ensure the mission success of the Installation	Online and/or In-person as part of the Norwich Pro “Applied Psychology in Project Management”	3 rd	Explain the principles of organizational behavior and motivation
Cyber Security and Energy Resilience course	Understand the principles of Cyber Security related to energy resilience and Industrial Control Systems	Explain and produce plans that coordinates Cyber threats against energy resilience systems and programs.	Online and/or In person	1 st	Evaluate Cyber Risks

d. Energy Resilience Master Planning

Course Title	Learning Objectives	Learning Outcomes/Competencies	Delivery Options	Priority of Development	Competency Map link
Basics of Master Planning	Gain the skills required to effectively integrate energy resilience into the	Apply effective energy resilience master planning skills to meet the mission requirements at “your” Installation	Online and/or In-person possibly as part of the Norwich Pro “Strategy and	4 th	Master Planning – Identify the coordination required between legacy systems and
Course or Module	Installation master planning process		Planning” or Long-term Strategy Project” course		new technology systems
Applied Project in Master Planning	Apply energy resilience master planning principles	Produce an energy resilience master plan to “your” Installation.	1 st and Last weeks in person, monitored group engagement virtually	5 th - Capstone	Master Planning

5. Course Composition Definitions – Modules, Modular, Tiered Programs and Certificates

- a. Modules - A series of learning modules will be developed to address a subset of the learning outcomes. The outcomes will be chosen such that learning experiences related to the broad areas of energy fundamentals, policy, risk analysis, and master planning. Once developed, those modules could be incorporated as lessons in existing courses or further developed in a future effort into full courses based on need.
- b. Modular – Courses may be taken individually or grouped in various combinations that meet the requirements for a desired competency level and/or a designated credential, e.g. certificate, academic degree etc. This concept is particular to LOE 2 and 3 with regards to Continuing Professional Education (CPE) and can be developed to meet emerging skill requirements.
- c. Tiered Programs and Certificates – The arrangement of courses based on competency or the achievement of a prescribed composition of work.

6. Certificate Options (pending the Development analysis and planning processes)

- a. Energy Resilience Risk Management Certificate – courses could include

Analytics for Government, Industry and Business; Risk Assessments, Policies, and Internal Controls; Business Essentials for (Energy) Program Managers; a new Energy Fundamentals course or Energy Policy course

- b. Energy Resilience Managers Certificate – Energy Fundamentals course (new); Energy Risk Assessment course (inject Resilience module with the Risk Assessments, Policies, Internal Controls course); Energy Partnerships (new); Project Management Overview; Due Diligence and Internal Investigations (with an energy resilience module)
- c. Industrial Control Systems – pending analysis and design (refer to the NUARI ICS FEMA course in Enclosure 5)
- d. Energy Resilience Senior Seminar – possible hybrid option including Energy Fundamentals (new); Risk Assessments, Policies, Internal Controls Course (with an energy resilience module); Strategic Communications; Energy Partnerships; and/or Long-Term Strategy Project
- e. Energy Resilience Tiered Certificate Draft Concept
 - Level 1 (Basic) Energy Manager would have completed the Energy Fundamentals and Energy Resilience Risk assessment courses
 - Level 2 (Intermediate) Energy Manager would complete Policy and Cyber courses (and the Level 1 program)
 - Level 3 (Advanced) would complete the Master planning course and the Industrial Control Systems course or Applied planning course (and the Level 1 & 2 courses)
 - Non-Technical Certificate program – pick any four non-technical options from the following courses with energy resilience modules – Project Management, Risk Assessment, Organizational Behavior, Supply Chain, Procurement, Public Works planning
 - Micro-Certificate – for example, the Tactical Microgrid Course could be a stand-alone certificate

7. Norwich Pro Energy Resilience Inventory of Courses, Certificate Inventory, and Creation of Certificates

- a. Background: Norwich Pro is a fully online learning organization created to bring world- class instruction in high-demand skillsets straight into the hands of busy working professionals and military personnel. Refer to the Norwich Pro web page for more information: <https://pro.norwich.edu/>
- b. Continuing Education Units: Students in Norwich Pro courses earn Continuing Education Units (termed Professional Development Units – PDU), known as

CEUs. Each CEU is equivalent to ten contact hours and is accepted by professional organizations worldwide for the earning and maintaining of licenses and other credentials.

- c. Tailored Programs: Customized programs can be held onsite at an organization, offsite at another facility, online, or a hybrid model all taught by experienced subject matter experts.
- d. Course Review: The following courses could either stand alone as an energy resilience core course or each could be modified with energy resilience modules (energy fundamentals, energy risk assessments, energy policy, industrial control systems, and energy master planning) to provide professional development CEUs.
- e. From the inventory of current Norwich Pro courses that relate to the knowledge areas designated by the Energy Track (Fundamentals, Risk Assessment, Policy and Master Planning), there is significant coverage of Risk Assessment, Policy and Master Planning. For the development phase, the project team will need to develop courses or modules that provide Energy Fundamentals to those professionals with a less technical background.

Norwich Pro Course	Fundamentals	Risk Assessment	Policy	Master Planning
Sustainability and Equity in Procurement			x	
Procurement Methods and Strategies		x		x
Data Visualization		x		
Crisis Communications	x	x		
Public Works Institute Strategy and Planning				x
Public Works Long-Term Strategy Project				x
Project Management Overview		x		x
Business Essentials for Project Managers	x			x
Analytics and Fundamentals		x		
Analytics for Government, Industry and Business		x	x	
Risk Assessments, Policies, and Internal Controls		x	x	
Due Diligence and Internal Investigations		x	x	
Applied Psychology in Project Management		x	x	x

Detailed Norwich Pro Course Descriptions (subject to change)

Sustainability and Equity in Procurement - 2 CEUs, equivalent to 20 Contact Hours/PDUs

Every purchase has hidden social, environmental, and financial impact. This course discusses strategies that leading organizations throughout the world employ in their day-to-day procurement decisions. These include the use of products that minimize harm to the environment and human health, as well as purchasing decisions that support local communities and small businesses.

Procurement Methods and Strategies - 2 CEUs, equivalent to 20 Contact Hours/PDUs.

There are various ways to procure goods and services. Learn what your options are and how to determine when each method is most appropriate. Additionally, the principles of public procurement and the importance of work scopes will be covered.

Data Visualization - 2 CEUs, equivalent to 20 Contact Hours/PDUs

Professionals today face ever mounting pressure to analyze large quantities of information and to eloquently share their findings. This course is designed to lead a student through that process so that they can accurately make positive impressions on others and increase your influence to obtain a desired objective. Stand apart from your peers with visuals that are as powerful as they are elegant.

Crisis Communications - 2 CEUs, equivalent to 20 Contact Hours/PDUs

The world is more connected than ever, so messages travel fast—you need to prepare in advance. Protect your organization's reputation by assessing its vulnerability and then formulating a practical crisis communication plan, complete with social media campaigns and media talking points. We'll discuss the value of integrity, audience evaluation, acquiring support, and debriefing.

Public Works Institute Strategy and Planning - 2 CEUs, equivalent to 20 Contact Hours/PDUs

Strategic planning is an important factor in an organization's success. Planning includes finance, budgeting, purchasing, managing organizational communications, and administering contracts. To make sure you can do each of these tasks well, we provide participants with tools and strategies for each.

Public Works Long-Term Strategy Project - 2 CEUs, equivalent to 20 Contact Hours/PDUs

Students will synthesize their skills to create a long-term strategy plan appropriate for a public works organization. Students will use SWOT analysis, explore revenue generation and funding structures, and devise a media relations and social media strategy. Additionally, the course will cover outsourcing and open bidding, and determine the most suitable leadership approach.

Project Management Overview - 2 CEUs, equivalent to 20 Contact Hours/PDUs

Project management skills are in demand across a variety of industries, and the upward salary trends for the profession reflect that reality. This course aims to give

you a bird's-eye-view of project management essentials, especially project planning.

Business Essentials for Project Managers - 2 CEUs, equivalent to 20 Contact Hours/PDUs

Business skills, or the lack thereof, can make or break projects and organizations, yet they are left out of many project management educational programs. At Norwich Pro, we take a different approach by making business a core element of our Project Management Certificate program. Whether you're learning these skills for the first time or refreshing your knowledge, join us to make sure you're equipped to thrive.

Analytics and Fundamentals (Artificial Intelligence) - 2 CEUs, equivalent to 20 Contact Hours/PDUs

Data analytics are critical in organizational decision-making. This course aims to provide a foundational level of understanding about what data analysis is, where data comes from, different types of data, and data measurement terminology.

Analytics for Government, Industry and Business - 2 CEUs, equivalent to 24 Contact Hours/PDUs

This course focuses on providing key skills in analytics from an applied perspective, emphasizing the development of competencies to analyze, predict, provide insights and prescribe actions to real-world problems in government and business.

Risk Assessments, Policies, and Internal Controls - 2 CEUs, equivalent to 20 Contact Hours/PDUs

Risk assessments are the foundation of any solid compliance management program. These appraisals can help protect your company from steep fines, sanctions, loss of licensure, reputation damage, and even employee incarceration. As such, you should carry out risk assessment frequently while using best practice processes.

Due Diligence and Internal Investigations - 2 CEUs, equivalent to 20 Contact Hours/PDUs

Due diligence is the evaluation of a third party's appetite for risk to determine whether they are a suitable business partner for your organization. This course is a practical guide to carrying out external and internal investigations. During this course, we'll discuss types of organizations that are riskier than others and best practices for weighing risk against opportunity when conducting an assessment before turning our attention to the whys and hows of internal audits.

Applied Psychology in Project Management – 2 CEUs, equivalent to 20 Contact hours/PDUs

Humans often behave in predictable ways and understanding these tendencies can help managers accomplish more. Explore how these patterns and how they can be

used to motivate employees, resolve conflicts, guide groups through change, and communicate more effectively

– skills that are especially important for project managers who frequently are not in positions of power. Other topics include values-driven leadership, adapting messages for different personalities, and emotional intelligence.

Enclosure 4 – LOE 3, Senior Leader, NUARI Energy Resilience Design Document

Reference: NUARI Contract is the Energy Resilience Strategic Plan

1. Line of Effort: 3 – Senior Leader

2. Population Description

The Target population would primarily be Garrison Commanders, Deputy Garrison Commanders, Public Works Dir, Plans and appropriate IMCOM staff leads.

Secondary target population is Deputy G9, G9 SIG, Mission commanders, Corps District Commanders/Deputy Commanders with Milcon support, FORCES Command G3 and G4

Roles and responsibilities. The Target population's key roles are Garrison Commanders and Installation Commanders responsible for the Garrison's ability to project Combat power or otherwise perform its central mission. Secondary roles would deputies and senior staff members that need to have an understanding of the role resilient energy systems play in mission capability.

3. Curriculum, Credential, Certificate Map

Learning objectives and subsequent learning outcomes/competencies for LOE 3 are identified below. The learning outcomes/competencies are then further defined from this map to the Curriculum Design noted below in paragraph 4. These individual learning objectives could be structured as a formal certificate program for a senior leader that wants to gain in-depth knowledge of the subject.

LOE 3 – Senior Leader Curriculum Map

Learning Objectives

- *Imagine the unimaginable and understand the impact of critical infrastructure on installation's mission capability*
- *Gain an understanding of an installation's critical infrastructure/energy resilience relationships and principles*
- *Understand the current installation critical infrastructure/energy vulnerabilities and resilience strategies*
- *Develop and understanding of the non-kinetic threats such a cyber threat to the installation's energy and other critical infrastructure*
- *Develop a mission focused risk analysis mind set based on available resources and define strategic gaps in policy, infrastructure, and resource programing*

- *Develop an understanding of the national, regional, local government and non-government entities and policies that influence critical infrastructure/energy resilience on base and off base*
- *Develop an understanding of critical infrastructure resilience issues off base that can impact mission success*
- *Develop the skills for effective energy resilience planning and exercising in a dynamic and complex environment*
- *Understand the installation's authorities for participating in and partnering in national, state and local policy and resource discussions and exercises addressing critical infrastructure and its resilience*
- *Develop an understanding of the array of authorities available to improve on base and off base critical infrastructure/energy resilience*

Learning Outcomes/Competencies

- *Be able to understand and analyze the risk to installation mission capability associated with an interruption of energy supplies and other critical infrastructure.*
- *Be able to understand the scope of the cyber/non-kinetic threat to the installation energy and other critical infrastructure systems and develop defensive and resilience measures*
- *Be able to develop a strategic approach to address the critical infrastructure/energy resilience relationships of the installation, its critical infrastructure/energy vulnerabilities and create resilience enhancing strategies*
- *Be able to effectively participate in the national, regional, and local governmental and non-governmental entities policy discussions that influence critical infrastructure/energy resilience on base and off base*
- *Be able to effectively articulate the relative resource priority of investment in infrastructure capital investments, operations, maintenance and exercising of critical infrastructure resilience*
- *Be able to organize and lead regional exercises that address critical infrastructure vulnerabilities and resilience strategies that go beyond "installation Islanding"*
- *Develop partnerships with state and local governments and the private sector to finance and develop distributed generation and micro grid capabilities to improve installation and regional resilience.*
- *Be able to develop funding strategies to enhance energy/strategic*

infrastructure resilience

4. Curriculum Design – The following course descriptions will support the learning outcomes/competencies:

a. Energy Fundamentals

Course Title	Learning Objectives	Learning Outcomes/ Competencies	Delivery Options	Priority of Development	Competency Map link
Critical Infrastructure overview	Understand the impact of critical installation infrastructure on the installation mission capability	Be able to understand and analyze the risk to the installation's missions associated with energy and other critical infrastructure vulnerability	Seminar, self-paced non - resident, wargame, segment of pre-command course	High priority foundational material (Priority 1)	<i>Be able to understand and analyze the risk to installation mission capability associated with an interruption of energy supplies and other critical infrastructure.</i>

b. Energy Resilience Risk Management

Course Title	Learning Objectives	Learning Outcomes/ Competencies	Delivery Options	Priority of Development	Competency Map link

Energy resilience relationships, vulnerabilities, and strategies	Gain an understanding of an installation's energy and other critical on base and off base infrastructure resilience relationships, vulnerabilities/ risk analysis, and strategies for increasing resilience	Be able to develop a strategic understanding of how to address the interlinked nature of energy/critical infrastructure, its vulnerabilities to natural and man-made failures and how to increase the infrastructure resilience to attack Be able to effectively articulate the relative resource priority of investment in energy/critical infrastructure capital investments/modernization, operations, maintenance and	Seminar, self-paced non-resident, war game simulations, exercises, pre-command course	High priority foundational material (Priority 1)	<i>Be able to understand the scope of the cyber/non-kinetic threat to the installation energy and other critical infrastructure systems and develop defensive and resilience measures</i> <i>Be able to develop a strategic approach to address the critical infrastructure/energy resilience relationships of</i>

		exercising of resilience strategies			<i>the installation, its critical infrastructure/energy vulnerabilities and create resilience enhancing strategies</i>
Energy Resilience Exercise	Develop the skills for effective energy resilience planning and exercising in a dynamic and complex environment	Be able to organize and lead regional exercises that address energy/critical infrastructure vulnerabilities and resilience strategies that go beyond "installation islanding"	War game simulations, pre-command, CGSC	High priority foundational material (Priority 2) A Capstone Exercise should be developed to demonstrate competency in the basic foundational material at the base level, then regional and then large scale (Priority 3)	<i>Be able to effectively participate in the national, regional, and local governmental and non-governmental entities policy discussions that influence critical infrastructure/energy resilience on base and off base (mentors could be useful in exercise design and implementation)</i>

c. Energy Resilience Policy – Policy, Cyber, Partnerships

Course Title	Learning Objectives	Learning Outcomes/Competencies	Delivery Options	Priority of Development	Competency Map link

<i>Cyber and other threats to the energy supply and critical infrastructure</i>	<i>Develop and understanding of the non-kinetic threats such a cyber threat to the installation's energy and other critical infrastructure</i>	<i>Be able to understand the scope of the cyber/non-kinetic threat to the installation energy and other critical infrastructure systems and develop defensive and resilience measures</i> <i>Be able to develop a strategic approach to address the critical infrastructure/energy</i>	<i>Seminar, self-paced non-resident, war game simulations, exercises</i>	<i>High priority foundational material</i> <i>(Priority 1)</i>	<i>Be able to understand the scope of the cyber/non-kinetic threat to the installation energy and other critical infrastructure systems and develop defensive and</i>

		<i>resilience relationships of the installation, its critical infrastructure/energy vulnerabilities and create resilience enhancing strategies</i>			<i>resilience measures</i>
<i>Energy resilience policy and partnering</i>	<i>Understand the installation's authorities for participating in and partnering in national, state, and local policy and resource discussions and exercises addressing critical infrastructure and its resilience</i> <i>Develop an understanding of the array of authorities available to improve on base and off base critical infrastructure/energy resilience</i>	<i>Develop partnerships with state and local governments and the private sector to finance and develop distributed generation and micro grid capabilities to improve installation and regional resilience.</i> <i>Be able to develop funding strategies to enhance energy/strategic infrastructure resilience</i>	<i>Seminar, self-paced non-resident, war game simulations, exercises</i> <i>Seminar, self-paced non-resident, war game simulations, exercises</i>	<i>High priority foundational material</i> <i>(Priority2)</i>	<i>Develop partnerships with state and local governments and the private sector to finance and develop distributed generation and micro grid capabilities to improve installation and regional resilience.</i> <i>Be able to develop funding strategies to enhance energy/strategic infrastructure resilience</i> <i>(Mentors could be very useful here)</i>

Enclosure 5 – LOE 2 – Midlevel Professional Tactical Microgrid Standards and Industrial Control Systems, NUARI Energy Resilience Design Document

1. Line of Effort: 2 – Tactical Microgrids

2. Population Description

Installation management – The Deputy to the Garrison Commander, Director of Public Works, Energy Manager, Director of Plans, Training, Mobilization, and Security, Director of Public Safety, Director of Logistics, Director of Information Management, Director of Contracting, local energy suppliers, and local community government leadership (to include emergency management organizations).

Organizational team – this group of deployable military members includes the unit Executive Officer, Operations Officer, Supply Officer, Communications Officer, Engineer Officer (if assigned) and associated senior Non-Commissioned Officers. Supporting personnel include generation mechanics, communications personnel, Civil Affairs specialists, Special Operations Forces (SOF) engineering personnel, and other personnel as designated.

3. Curriculum, Credential, Certificate Map

a. *Learning Objectives*

- *Gain an understanding of tactical microgrids and their applications*
- *Gain an understanding of tactical microgrid objectives*
- *Describe the evolution of tactical microgrids from spot generation*
- *Describe the importance of standardization in microgrid design*
- *Describe the future of tactical microgrids*
- *Describe the components of a tactical microgrid*
- *Gain an understanding of the schematic design of a microgrid*
- *Describe the role of communications and automation in tactical microgrid design*
- *Describe the risk posed by cyber threats to tactical microgrids*
- *Describe design considerations in next generation tactical microgrids*

b. *Learning Outcomes/Competencies*

- *Understand the purpose of microgrids and their application*
- *Understand the objectives of microgrid implementation*
- *Explain the evolution of microgrids from spot generation and describe future*

innovations in microgrid design

- *Explain the rationale and criticality of microgrid design standardization Explain the components of a microgrid and the factors that must be considered in their design.*
- *Analyze the role of communications in the design of a tactical microgrid*
- *Analyze the role of automation in the design of a tactical microgrid*
- *Analyze the risk posed by cyber threats to tactical microgrids*
- *Analyze countermeasures to reduce the risk of cyber compromise*
- *Develop a schematic design of a tactical microgrid*
- *Analyze the next generation of tactical microgrids*

4. Curriculum Design**a. Tactical Microgrid Planning and Design**

Course Title	Learning Objectives	Learning Outcomes/Competencies	Delivery Options	Priority of Development	Competency Map link
Energy Master Planning and Microgrids	- Gain an understanding of tactical microgrids and their applications - Gain an understanding of tactical microgrid objectives - Describe the evolution of tactical microgrids from spot generation - Describe the future of tactical microgrids - Describe the importance of standardization in microgrid design	- Understand the purpose of microgrids and their application - Understand the objectives of microgrid implementation - Explain the evolution of microgrids from spot generation and describe future innovations in microgrid design - Explain the rationale and criticality of microgrid design standardization	Online and/or In-person	1 st	3.b.1-4 above

Microgrid Design	- Describe the components of a tactical microgrid - Describe the role of communications and automation in	- Explain the components of a microgrid and the factors that must be considered in their design. - Analyze the role of communications in the	Online and/or In-person	2 nd	3.b.5-10 above
	tactical microgrid design - Describe the risk posed by cyber threats to tactical microgrids	design of a tactical microgrid - Analyze the role of automation in the design of a tactical microgrid - Analyze the risk posed by cyber threats to tactical microgrids - Analyze countermeasures to reduce the risk of cyber compromise			
Advanced Topics in Microgrid Design	- Describe design considerations in next generation tactical microgrids	- Analyze the next generation of tactical microgrids	Online and/or In-person	3 rd	3.b.11 above

These courses could constitute a single Continuing Professional Education (Norwich Pro) certificate on microgrid standards and design, or could feed into a master's program in energy resilience.

1. Line of Effort: 2 – Industrial Control Systems

2. Population Description

Installation management – The Deputy to the Garrison Commander, Director of Public Works, Energy Manager, Director of Plans, Training, Mobilization, and Security, Director of Public Safety, Director of Logistics, Director of Information Management, Director of Contracting, local energy suppliers, and local community government leadership (to include emergency management organizations).

Organizational team – this group of deployable military members includes the unit Executive Officer, Operations Officer, Supply Officer, Communications Officer, Engineer Officer (if assigned) and associated senior Non-Commissioned Officers. Supporting personnel include generation mechanics, communications personnel, Civil Affairs specialists, Special Operations Forces (SOF) engineering personnel, and other personnel as designated.

3. Curriculum, Credential, Certificate Map

☐ *Learning Objectives*

- *Gain an understanding of the definition of industrial control systems*
- *Gain an understanding of the DoD definition of industrial control systems*
- *Describe the components of industrial control systems*
- *Describe the components of DoD industrial control systems*
Describe the importance of standardization in industrial control system design
- *Describe the process of conducting an inventory of DoD industrial control systems*
- *Describe critical documentation of ICS*
- *Describe the lifecycle management of ICS*

☐ *Learning Outcomes/Competencies*

- *Understand the definition of industrial control systems*
- *Understand the DoD definition of industrial control systems*
- *Analyze the components of DoD industrial control systems*
- *Explain the importance of standardization in industrial control system design*
- *Explain the process of conducting an inventory of DoD industrial control systems*
- *Explain the critical documentation of DoD ICS*
- *Explain the process of lifecycle management for ICS*

4. Curriculum Design

a. Industrial Control Systems Master Planning and Design

Course Title	Learning Objectives	Learning Outcomes/Competencies	Delivery Options	Priority of Development	Competency Map link

Energy Master Planning and ICS	- Gain an understanding of the definition of industrial control systems - Gain an understanding of the DoD definition of industrial control systems - Describe the components of industrial control systems - Describe the components of DoD industrial control systems - Describe the importance of	- Understand the definition of industrial control systems - Understand the DoD definition of industrial control systems - Analyze the components of DoD industrial control systems - Explain the importance of standardization in industrial control system design	Online and/or In-person	1 st	3. b. 1-4 above

	standardization in industrial control system design				
ICS Management	- Describe the process of conducting an inventory of DoD industrial control systems - Describe critical documentation of ICS - Describe the lifecycle management of ICS	- Explain the process of conducting an inventory of DoD industrial control systems - Explain the critical documentation of DoD ICS - Explain the process of lifecycle management for ICS	Online and/or In-person	2 nd	3. b. 5-7 above

These courses could be standalone classes (Norwich Pro), or could feed into a broader energy resilience certificate or master's program. I do not think there is enough content on this (in the context of energy resilience) to make this a certificate program.

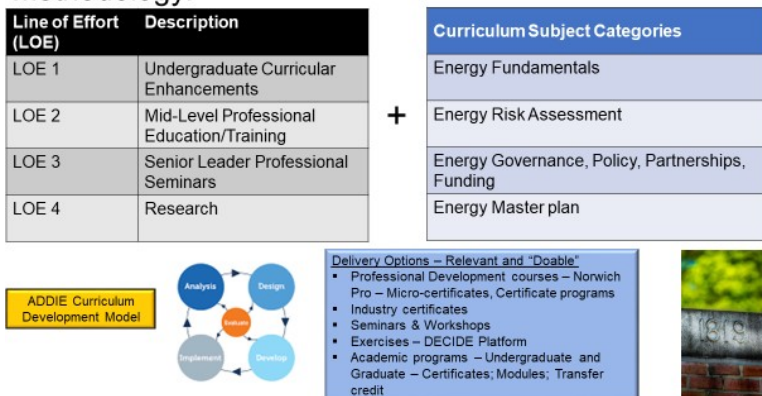
Enclosure 6 – Energy Resilience Design Phase Executive Summary, NUARI Energy Resilience Design Document

Subject: Energy Resilience Education Track Design Phase

Design Objective: The objective of the Design process is to create an educational framework that provides the foundation for energy resilience course development that enhances the knowledge and expertise of DoD military and civilian personnel in understanding and implementing Energy Resilience tasks in their areas of influence.

Design Scope: The Design process used the framework depicted below, analysis from Surveys, and a Round Table session to define the learning objectives and learning outcomes/ competencies for Undergraduate programs, Mid-Level and Senior Level programs in the four curriculum subject categories.

Methodology:



Design and Survey Results: 95% of survey respondents agreed that “Resilience is important for an Installation’s ability to achieve its mission.” The top risks to installation energy resilience identified by survey respondents were:

- ☐ Modernization of infrastructure
- ☐ Vulnerability to climate and cyber threats
- ☐ Inclusion of energy resilience goals in the Installation Master Plan
- ☐ Availability of training

The Design process resulted in program documents covering the topics above in the framework of Energy Fundamentals, Energy Resilience Risk Analysis, Policy and Cyber, and Energy Master Planning.

Program Next Steps: the next steps in the Energy Resilience Education and Training Program include (timeframe October 2020 to May 2021):

- Develop the courses, seminars, and exercises
- Pilot the courses, seminars, and exercises
- Implement the courses, seminars, and exercises and continuously Assess and Improve the program

Enclosure 6: Develop Courses

CONTRACT TITLE: DEVELOPMENT OF AN ENERGY TRACK WITHIN THE NORWICH UNIVERSITY CENTER FOR GLOBAL RESILIENCE AND SECURITY – DESIGN AND DEVELOPMENT PHASE

COURSE DEVELOPMENT DOCUMENT

Development Report for Contract No.

W9132T20C0005 Prepared for and Emailed

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Period Covered in this Report: 1 October 2020 to 2 March 2021

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1. Purpose: The primary purpose of this report is to document the status of the Energy Resilience Education Track curriculum development in the form of a course catalog. Further, this document will outline the tasks and concepts involved in completing the Final Technical Report and the preparation required for the Implementation Phase of the program.
2. Project Schedule and Deliverables Table: This report will serve as the framework for the Final Technical report and will address the scope of the curriculum development across LOE 1, 2, and 3, as well as the key tasks required to complete the pilot courses, evaluate the pilots, and tasks associated with Phase 3 - Implementation. The Project Schedule and Deliverables Table 1, with notes, defines the timeline to complete Phase 2, Design and Development.

Table 1. Project Schedule and Deliverables

Task	Start	Complete	Deliverable
Develop courses	+150	+270	Develop documents for LOE courses for: -Energy Fundamentals -Energy Risk Assessment -Energy Governance, Policy, Partnerships, Funding -Energy Master plan - Industrial Control Systems -Tactical Microgrid Design <u>Note</u> : See Enclosure 1, Course Development Format and Enclosure 2, Energy Resilience Education Track Course Catalog will cover this milestone task.
Pilot courses/seminars	+270	+330	Conduct Pilot courses/seminars for Mid- Career and Senior Level LOEs <u>Note</u> : This milestone task will be covered in paragraph 4 of this document.
Evaluate Pilot courses	+330	+350	Evaluate the effectiveness of the Pilot courses/seminars against the Design/Development standards; update the ADDIE process for each course <u>Note</u> : This milestone task will be

			covered in paragraph 4 of this document.
Submit Final Technical Report	+270	+360	Final Technical report for Phase 2 <u>Note:</u> This milestone task will be covered in paragraph 5 of this document.

3. Develop Courses – The curriculum development process, per the ADDIE model, is a progression of the previous deliverables in the Energy Resilience Education Track program. The analysis included the roadmap from Phase 1, the survey of mid-career and senior leaders, and the inventory of academic curriculum. The design deliverable included the synthesis of the findings in the form of learning outcomes for each LOE. Subsequently, the development process produced courses and modules that address energy fundamentals, risk analysis, policy and partnerships, and master planning.
 - a. Process & Review – Following the ADDIE process, the development documents are currently being reviewed for continuity of content, appropriateness for the LOEs, gaps, pedagogy, and feasibility. The review process is outlined in Enclosure 1 (see the Feedback Form). Feedback from the pilot courses will be incorporated in each development document as appropriate. In the case of modifying existing academic courses, the process at each LOE level includes the review by the University Curriculum Committee (UCC) and coordination with appropriate faculty.
 - b. Format – See Enclosure 1 which outlines the Development formats for the Course Development Document (CDD), Instructor slides, and Student slides. Critical to the process is the recurring evaluation of the format to insure simplicity and clarity from the student perspective are maintained. For example, in order to address the survey results issue of time availability for Mid-Career and Senior Leaders the course material will be transferred to an asynchronous format within the University's Continuing Education Units (CEU) format. This transition will reduce the instructor slide requirement and content will be integrated into the CDD and piloted to evaluate and improve curriculum delivery.
 - c. Course Catalog – See Enclosure 2 for the course catalog of Energy

Resilience related courses and modules. The catalog contains the following information about the courses that are part of the Energy Resilience Education Track:

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites

Course Description:

4. Pilot Courses/Seminars – The two pilot courses will be conducted during the month of April for the purpose of evaluating the relevance of the course material and the appropriateness of the delivery method. The plan is outlined in the sub-paragraphs below.
 - a. Course/Seminar Methodology – Following a peer review of the Senior Leader Seminar and the Microgrid Architecture courses, both will be integrated into the Norwich Pro Moodle format. Slide content will be transformed into the Articulate format and set up in an asynchronous format (this will accommodate the work schedules of the Mid-Career and Senior Leader students).
 - b. Course Timing – The two courses are planned to be conducted over a two-week period beginning in the middle of April 2021 (tentatively planned between 12 and 23 April, 2021).
 - c. Audience - The students for both pilot courses will be five to eight US Army Soldiers and/or Government Civilian employees. Initial coordination with the Converge MERC team indicates that they will be able to provide two to four students per course. Other students will be identified by the US Army.
 - d. Evaluate Pilot Courses/Seminars – During and after the completion of both courses, the instructors will seek feedback regarding the content of the course. The ADDIE process is the format for analyzing the comments, designing and developing improvements, and implementing the changes in the Moodle learning management program. As applicable, the NUARI team will apply lessons learned to other Energy Resilience Education Track courses. See Enclosure 1 for the Course Feedback Form.
5. Submit Final Technical Report – The main objective of the final technical report is to provide the finalized course/modules to the Government. Supporting efforts include the Research and Development and Internships plan (LOE 4), tasks associated with a Phase 3 Implementation effort, UCC tasks, and administrative functions such as a web presence and data base management. The following are tasks associated with the Final Technical Report:

- a. Course improvement process – The conduct of the pilot courses and the process to evaluate each course against the program standard will result in modified/improved course/module curriculum.
- b. Course Development Documents and Slides – The development formats in Enclosure 1 for each course/module will be provided to the Government per the contract. The courses/modules are large files that will be referenced in the Final Technical Report and submitted in a separate, but manageable, process prescribed by the Government. The course documents will also remain with the NUARI team for use in Phase 3 – Implementation and after the contract is closed out.
- c. LOE 4 Plan – The Research and Development and Internship Program will be part of the Final Technical Report.
- d. Implementation Planning – Phase 3 – Implementation requires the completion of tasks that are required by academic accrediting standards or needed in order to admit students and administer the courses/modules in the Energy Resilience Energy Track.
 - i. UCC preparation – Modification of academic credit courses requires approval by the University Curriculum Committee for implementation. Preparations for adjustments to courses such as graduate certificates that relate to energy resilience require coordination so that the processes and authorities are in place to offer the courses during Phase 3 – Implementation. The Cohort concept of conducting academic certificates will be addressed in the final report.
 - ii. Certificate preparation – Modules and courses can either result in the award of academic credit or Continuing Education Units credits (or no credit if applicable). Some offerings could be combined to produce a certificate in a specific skill set. Further, modules can be paired to create a seminar to meet a training requirement. The Final Technical Report will contain options to meet anticipated training and education needs.
 - iii. Partnership Integration – Partners and consultants will be integrated in order to address key activities through webinars or other informational processes such as White Papers, lessons learned, Roundtable discussions, and the National Cybersecurity Preparedness Consortium (NCPC). These activities could be integrated into an energy professional network for awareness and constant improvement.

- iv. Web presence and Decision Wizard – Preliminary research and development on the requirements to maintain a useful and relevant online resource is ongoing and will be explained in the Final Technical Report. Further, a decision-making tool is being researched so prospective students can easily find the courses/modules that suit their mission needs.
- v. Energy Resilience Exercise concept – The Final Technical Report will expand on the concept of integrating distributed tabletop and multifunctional exercises as part of the education offerings.
- vi. Consultant feedback sessions - During the implementation phase, the instructors will provide a follow-on consulting session after the completion of the course in order to address student issues and support the energy resilience efforts at the installation level.
- vii. Energy Behavior – Although not part of this program, the integration of Energy Behavior concepts, data, and recommendations could be part of the Final Technical Report.
- viii. Roundtable – A Roundtable session for the kick-off of Phase 3 is being planned in order to share information, obtain feedback, and support attendance in the Energy Track courses/program.

Enclosures:

Enclosure 1 – Development Formats - Course Development Document, Slide Format, and Course Feedback Form

Enclosure 2 – Energy Resilience Education Track Course Catalog

Enclosure 1 – Development Formats – Course Development Document (CDD), Slide Format, and Course Feedback Form

1. Course Development Document - The CDD will include:

a. Course Development Document contents:

- Description
- Target Audience
- Pre-requisites
- Required Materials
- Testing
- Reference List
- Evaluation Strategy
- Technical Requirements
- Course Structure/Content Outline

b. Slide format:

Instructor Slides format with notes and Evaluation plan are as follows:

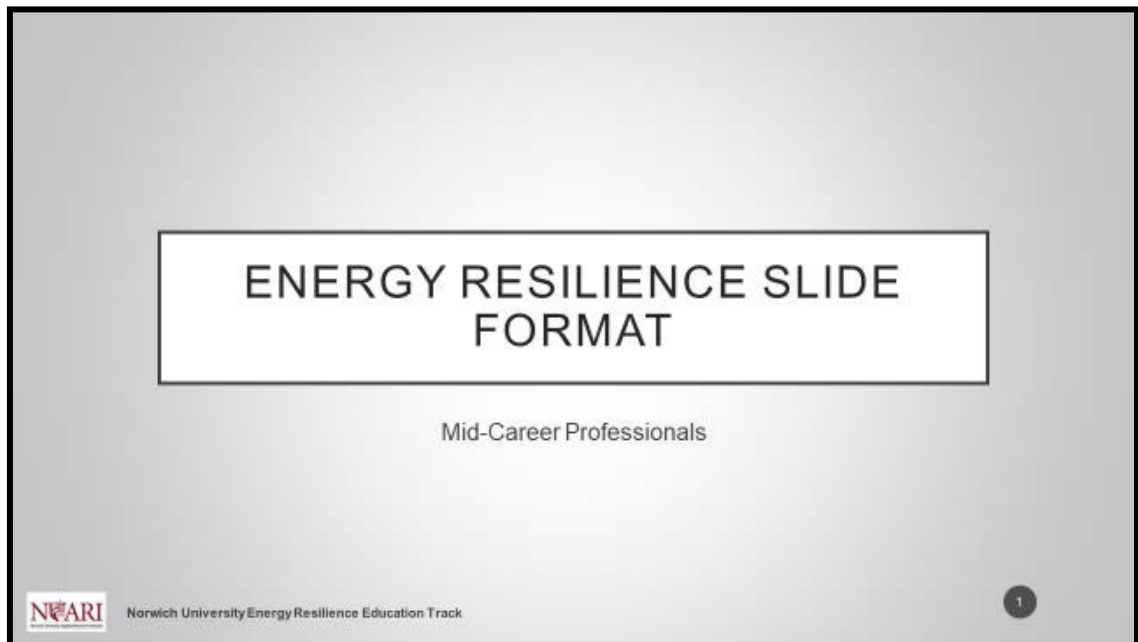


Figure 1: Instructor Slide Format

Student slides - same as the instructor slides without notes; include the class plan in the student slides (readings, lesson objectives, discussion questions)

STUDENT PLAN

1. Scope – This lesson is part of X Course for the Mid-Career Energy Resilience program.
2. Lesson objectives:
3. Readings and/or Case studies etc.:
4. Discussion questions:
 - a. Discuss the key elements of the “energy resilience risk analysis concept as it relates to your installation.
 - b. How should this “element of energy resilience be integrated with the Cyber program for your installation”?
5. Hands-on exercise instructions:

 Norwich University Energy Resilience Education Track

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Figure 2: Student Slide Format

2. **Course Feedback Form** – This form is used to evaluate the content and format of each module or course. Upon receipt of this form the course author will revise the course to meet the course standards. The Course Feedback Form content will be as follows:

Course Name:

Knowledge areas covered:

Primary LOE:

Please assess coverage of the course’s intended knowledge areas. Score only the course intended knowledge areas from 1-5, with 5 being the highest, N/A otherwise. Because the Energy Track is interdisciplinary, comments can be made for each of the knowledge areas in terms of integration with other course material or any prerequisites.

Knowledge Area	Score	Comments
Energy Fundamentals		
Risk Assessment		
Policy and Funding Mechanisms		

Master Planning		
Cyber		

Please assess the appropriateness for the LOE populations. Because course material may be used across LOE's, provide a score for each LOE 1, LOE 2 and LOE 3 where appropriate from 1-5, with 5 being the highest, N/A otherwise. Provide a score for at least the Primary LOE above. Comments may address, *inter alia*, level of difficulty, required prerequisites, hours of instruction and content delivery method.

LOE	Score	Comments
LOE 1: Undergraduate		
LOE 2: Mid-Career		
LOE 3: Senior Leader		

Please provide any other comments to facilitate the improvement of the course and the integration in the Energy Track curriculum.

Other Feedback	Comments
Assessment	
Gaps, missing content	
Pedagogical recommendations	
Implementation and feasibility from NU perspective	
Further questions and suggestions	

3. Articulate Option – The Articulate format is a curriculum format that is used as part of the academic and CEU format. The advantage of this format is the ability to use an asynchronous method in the learning management system. The NUARI team uses a proprietary version of Moodle to integrate the course/module content.

Enclosure 2 – Energy Resilience Education Track Course Catalog

This section of the Development Deliverable is the course catalog of both the modules and the courses that are part of the Energy Resilience Education Track. The course delivery options include online self-paced, online instructor-led, in person or online seminars, academic credit certificates, CEU micro certificates, or CEU certificate options based on the needs of the US Army. The Course Catalog is arranged in the following manner:

Integrated Course

- ☐ Senior Leader Seminar (this course integrates modules into one seminar)

Fundamentals

- ☐ Resilience for Sustainability (sub-module of Energy Fundamentals)
- ☐ Energy and You Module
- ☐ Energy and Society Module
- ☐ Energy and Resilience Module
- ☐ Energy Nexus Module
- ☐ Microgrid Architecture
- ☐ Industrial Control Systems (ICS)

Risk Analysis

- ☐ Critical Infrastructure/Energy Resilience Overview Module
- ☐ Identifying Mission Critical Infrastructure/Energy Systems Module
- ☐ Critical Infrastructure Threat Analysis/Risk Management Module
- ☐ Introduction to Compliance Investigations (CC310)
- ☐ Risk Assessments, Policies, and Internal Controls (CC320)
- ☐ Due Diligence and Internal Investigations (CC330)
- ☐ Organizational Culture and Continuous Compliance Improvement (CC340)

Policy, Partnerships, Cyber

- ☐ Security Situation Center Training 2020 (NUARI)
- ☐ Energy/Critical Infrastructure Resilience Policy and Partnerships Module
- ☐ Exercise Development Process - Capstone Exercise Module
- ☐ Graduate Certificate in Computer Forensic Investigation/Incident Response Team Management
 - Computer Security Incident Response Team Management | GI554
 - Computer Forensic Investigation GI551
- ☐ Graduate certificate in Vulnerability Management
 - Vulnerability Management and Penetration Testing I GI562
 - Vulnerability Management and Penetration Testing II GI553
- ☐ Graduate Certificate in Critical Infrastructure Protection & Cyber Crime
 - Cyber Crime GI556
 - Critical Infrastructure Protection GI566
- ☐ Graduate Certificate in Public Administration Leadership & Crisis Management -
 - Foundations of Leadership and Ethical Decision-Making AD576

- Public Leadership, Crisis Management, and Organizational Change AD586
- Graduate Certificate in Rural Municipal Governance
 - Municipal Governance AD543
 - Rural Municipal Governance AD553
- Graduate Certificate in Urban Municipal Governance
 - Municipal Governance AD543
 - Urban Municipal Governance

AD563 Master Planning

- Energy Resources and Markets GB548 – in non-credit format
- Energy Savings and Efficiency Projects GB558 – in non-credit format
- Managing Corporate Energy Needs GB568 – in non-credit format
- Public Works - PW310: Management and Leadership Proficiencies
- Public Works PW320: Strategy and Planning
- Public Works PW330: Operations and Organizations
- Public Works PW340: Long-Term Strategy Project
- Project Management PM310: Project Management Overview
- Public Works PM320: Applied Psychology in Project Management

Integrated Course – Senior Leader Seminar

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites
Senior Leader Seminar	Non-Credit (CEU)	12 hours	Senior Leaders(primary); Mid-Career (alternate)	Norwich Pro Asynchronous format	None

Course Description: This is a 12-hour, web-based seminar composed of 6 2-hour segments. These training segments will introduce senior army leaders to the subject of critical infrastructure resilience with an emphasis on energy. Learners will gain an overview of the critical infrastructure, whose overall resilience in the face of natural or manmade interruptions, is key to mission success of Army installations and their ability to project combat power. The training will assist Senior Leaders develop an understanding of the critical infrastructure both on and off base that must be operational for the installation and its tenant units to accomplish their assigned missions. The learner will also be exposed to the wide array of organizations beyond their normal control whose performance and capital investments will have great impact on the installation's mission success. The seminar participants will also become aware of the wide range of threats to critical infrastructure, some tools available for identifying these threats and potential partners in addressing the issue. Participants will become familiar with the Federal Agencies, local governments, non-profit and for-profit organizations that will play keystone roles in assuring the critical infrastructure resilience essential to installation mission success. The participants will also gain an understanding of how to manage the risk and enhance the resilience of their critical infrastructure and how to partner with other critical infrastructure owners. This will be accomplished by the participants developing an understanding of kinetic and non-kinetic threats by

participating in a critical infrastructure analysis and participating in a capstone resilience exercise using the DECIDE® exercise platform. Finally, students will gain an understanding of the policies controlling resilience standards, partnering with non-Army agencies, microgrids and funding opportunities for on base and off base infrastructure improvements.

Fundamentals

<u>Course Title</u>	<u>Credits</u>	<u>Duration</u>	<u>Audience</u>	<u>Delivery Method</u>	<u>Prerequisites</u>
Resilience for Sustainability - Part of the Energy Fundamentals offerings - Energy and You/Society / Resilience	None for Undergraduates – the course is integrated into existing courses .5 CEUs for Mid-Career and Senior Leaders	3 Hours	Undergraduate students in the following disciplines (not limited to this list): •Engineering •Biochemistry (or Biology or Chemistry/other sciences) •Psychology •Criminal Justice •Computer Security and Information Assurance •Studies of War and Peace •Nursing •Art and Architecture Mid-Career and Senior Leaders are eligible also	Web based, Online Synchronous	Undergraduate: Enrollment in a class that covers basic sustainability principles, elaborates on the components of sustainability and allows for dialogue and discussion on the interconnecting themes. None for Mid-Career and Senior Leaders

Course Description: This 3-hour, web-based unit comprises of two, seventy-five-minute-long classes, serving as the culminating activity to underscore the interconnectedness

of critical infrastructure in ensuring long term sustainability. Learners will build on their previous understanding of the environmental, social, and economic components of sustainability, and the intersections of environmental and social domains as bearable, intersection of environmental and economic domains as viable, and the intersection of economic and social domains as equitable in the context of critical infrastructure. The module uses the example of strategies being planned and implemented in the Global Resilient Cities Network, previously a Rockefeller Foundation initiative through 2019. Students will differentiate between sustainability and resilience across overlapping critical infrastructure sectors and learn the role of resilience in developing long-term sustainability and to accomplish sustainable development goals such as the ones laid out in the United Nations Sustainable Development Goals (SDGs). Learners will also be introduced to the core concepts of resilience, shocks and stresses in urban areas that challenge resilience, stakeholder engagement to develop resilience strategies that include a vision, goals, and actions, key partnerships and funding mechanisms that allow for implementation of actions, metrics that will track progress and success of implementation, including ways of disseminating information and results, and networking with regional and global groups with an eye toward continual improvement. This module is based on research and strategy documents published by cities in the Global Resilient Cities Network.

The key topics covered in the module include:

- ☐ Defining resilience and connections to sustainability
- ☐ Urban resilience challenges (shocks and stresses) across critical infrastructure sectors
- ☐ Vision, goals and actions set by resilient cities for infrastructure resilience
- ☐ Funding, partnerships and metrics to track progress of implementation actions
- ☐ Engagement and dissemination tools for communicating resilience work
- ☐ Role of networks in continual improvement

<u>Course Title</u>	<u>Credits</u>	<u>Duration</u>	<u>Audience</u>	<u>Delivery Method</u>	<u>Prerequisites</u>
Energy and You (module)	N/A	3 – 5 hrs live content + support resources	Undergraduate students	To be integrated into existing courses of any format (Live, Hybrid, Online)	None

Course Description: An introduction to the concept of the fundamental dimensions in the physical world and the derived dimensions of: Force, Work, Energy, and Power. Students will understand how energy is measured and develop a conceptual understanding of the dimensions of power and energy. Students will explore their personal energy footprint and will have the opportunity to practice dimensional analysis and unit conversions involving energy units.

<u>Course Title</u>	<u>Credits</u>	<u>Duration</u>	<u>Audience</u>	<u>Delivery</u>	<u>Prerequisites</u>

				<u>Method</u>	
Energy and Society (module)	N/A	3 – 6 hrs live content + support resources	Undergraduate students	To be integrated into existing courses of any format (Live, Hybrid, Online)	None

Course Description: An introduction to the connections among energy and key societal infrastructure systems. US and global energy footprints over time will be examined. Energy economics considerations and financial constraints of the energy system will be discussed. Students will explore sustainability concepts and frameworks, and will have the option to analyze societal systems and constructs through a sustainability lens.

<u>Course Title</u>	<u>Credits</u>	<u>Duration</u>	<u>Audience</u>	<u>Delivery Method</u>	<u>Prerequisites</u>
Energy and Resilience (module)	N/A	3 – 4 hrs live content + support resources	Undergraduate students	To be integrated into existing courses of any format (Live, Hybrid, Online)	None

Course Description: Students will explore definitions of resilience and emerging work at the intersection of resilience and our energy infrastructure. Case studies involving beyond-the-fence-line resilience initiatives will be explored as a means of understanding the complexities and stakeholders involved in planning and executing more resilient energy systems.

<u>Course Title</u>	<u>Credits</u>	<u>Duration</u>	<u>Audience</u>	<u>Delivery Method</u>	<u>Prerequisites</u>
Energy Nexus (module)	N/A	3 hrs live content + support resources	Undergraduate students	To be integrated into existing courses of any format (Live, Hybrid, Online)	Energy related undergraduate modules.

Course Description: Students will draw on what they have learned throughout the various energy modules to complete a suitable capstone exercise.

<u>Course Title</u>	<u>Credits</u>	<u>Duration</u>	<u>Audience</u>	<u>Delivery Method</u>	<u>Prerequisites</u>

Microgrid Architecture	Continuing Education Units	16 hours	Mid-Career (primary), Senior Leader and Undergraduates (alternate)	Online-Asynchronous	None

Course Description: This 16-hour, hybrid delivery course is comprised of 12 2-hour classes and introduces students to the principles of microgrid architecture, including development, design, and operations. This course will introduce mid-level professionals on military installations (deputy garrison commanders, directors of public works, energy managers), as well as military personnel in tactical formations (battalion and brigade executive officers, communications officers, engineer officers) to the basic components of microgrids, the role of telecommunications and automation in the operation of microgrids, and the risks of cyber threats to microgrids. Learners will have an increased knowledge and understanding about the operating fundamentals and design of microgrids on a tactical basis. The course focuses on the basic skills and knowledge needed to establish, operate, optimize, and disassemble microgrids.

<u>Course Title</u>	<u>Credits</u>	<u>Duration</u>	<u>Audience</u>	<u>Delivery Method</u>	<u>Prerequisites</u>
Industrial Control Systems (ICS)	4 CEU	6 hours	Mid-Career (primary, Senior Leaders and Undergraduates (alternate)	Online-Asynchronous	None. Participants should have a fundamental understanding of power generation and system controls.

Course Description: This course will introduce mid-level professionals on military installations (deputy garrison commanders, directors of public works, energy managers), as well as military personnel in tactical formations (battalion and brigade executive officers, communications officers, engineer officers) to the fundamentals of industrial control systems (ICS), the role of ICS in the operation of microgrids, the role of telecommunications and automation in ICS, the risks of cyber threats to ICS, and recovery concepts.

Risk Analysis

<u>Course Title</u>	<u>Credits</u>	<u>Duration</u>	<u>Audience</u>	<u>Delivery Method</u>	<u>Prerequisites</u>

Critical Infrastructure/Energy Resilience Overview Module	Non-Credit .5 CEU	2 hours	Senior Leaders(primary); Mid-Career (alternate)	Online-Asynchronous	None

Course Description: Identify types of mission critical installation infrastructure.

- ☐ energy and control systems
- ☐ water and wastewater systems
- ☐ Transportation systems
- ☐ Communication systems-military and civilian
- ☐ Fuel distribution systems
- ☐ Medical
- ☐ Public Safety dispatch
- ☐ Micro grids

Identify types of mission critical infrastructure off the installation or owned by others.

- ☐ Power generation systems
- ☐ Power distribution systems
- ☐ Water production and distribution systems
- ☐ Transportation systems
- ☐ Logistic systems

Identify potential infrastructure owners that must be partnered with to ensure mission success.

- ☐ Regulated Public Utilities
- ☐ Local government/Regional government Utility providers
- ☐ Local Government Critical services
- ☐ Local Non-Profit and for-profit critical services

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites
Identifying Mission Critical Infrastructure/Energy Systems Module	Non-Credit .5 CEU	2 hours	Senior Leaders(primary); Mid-Career (alternate)	Online-Asynchronous	None

Course Description: *Understanding the interlinked nature of critical infrastructure systems*

- ☐ *Understanding the resources and capacities of the installation's energy and critical infrastructure staff*
- ☐ *Understanding the Software and Network Vulnerabilities of Industrial controls*
- ☐ *Understanding the resource and modernization needs of Energy and other on installation critical systems.*
- ☐ *Understanding the role of critical infrastructure off the installation and owned by others.*
- ☐ *Understanding the mission capability impact of critical infrastructure/energy systems failure*
- ☐ *Understanding the consequences of past capital investment and reinvestment in on and off base critical energy and other infrastructure systems.*

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites
Critical Infrastructure Threat Analysis/Risk Management Module	Non-Credit .5 CEU	2 hours	Senior Leaders(primary); Mid-Career (alternate)	Online-Asynchronou s	None

Course Description: Identify most significant threats to critical infrastructure on and off the installation.

- ☐ Identify key partners in energy/critical infrastructure resilience.
- ☐ Understand the scope and duration of potential cyber/non-kinetic man-made threats and environmental threats to critical energy generation and distribution systems.
- ☐ Develop a strategic approach to address critical infrastructure and energy resilience relationships of the installation and its supporting region.
- ☐ How to develop a regional RIGOR type analysis of the mission critical infrastructure.
- ☐ Develop strategies to enhance regional resilience.

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites
CC310: Introduction to Compliance Investigations	Non-credit – taken separately or 4 courses equal Corporate Compliance and Investigations Certificate	Self-paced – 2+ weeks	Mid-Career	Online-Asynchronou s	None – can be part of a Corporate Compliance and Investigations Certificate

Course Description: This course covers foundational information, including the definition, purpose, history and development of compliance in the United States. You'll learn how to build a culture of compliance in your organization. Additionally, you'll walk through the steps of creating a sustainable compliance plan. Topics Include:

- ☐ Developing an effective compliance program
- ☐ Factors that contributed to the development of modern-day compliance programs
- ☐ Department of Justice requirements
- ☐ How to effectively hire and train a strong compliance team or choose a compliance committee

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites

CC320: Risk Assessments, Policies, and Internal Controls	Non-credit – taken separately or 4 courses equal Corporate Compliance and Investigations Certificate	Self-paced – 2+ weeks	Mid-Career	Online-Asynchronous	None – can be part of a Corporate Compliance and Investigations Certificate

Course Description: During this course, we'll discuss valuable internal and external resources to use when assessing risk, including public databases. Additionally, we'll cover the issues and policies associated with several specific types of risk. Join us to find out what processes should you use for writing policies, getting them approved, and implementing them. Topics Include:

- ☐ The steps involved in creating sound codes of conduct and policies
- ☐ Why risk assessment is so important, using real cases as examples
- ☐ How to carry out a risk assessment
- ☐ Fostering a culture of compliance

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites
CC330: Due Diligence and Internal Investigations	Non-credit – taken separately or 4 courses equal Corporate Compliance and Investigations Certificate	Self-paced – 2+ weeks	Mid-Career	Online-Asynchronous	None – can be part of a Corporate Compliance and Investigations Certificate

Course Description: You'll walk through the steps of an inquiry, including how to gather the information you need, to determine how much auditing is required, what to do with the data you collect, and how to report your findings to those who need it. You'll learn about the concerns associated with certain types of third parties, and the instructor will include recommendations for creating contracts once business is approved. Topics Include:

- ☐ Approaches to root cause analysis
- ☐ Understanding why internal and external investigations are necessary
- ☐ The best sources of information for each type of investigation
- ☐ When due diligence is most important
- ☐ How to handle the discovery of negative information

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites
CC340: Organizational Culture and Continuous Compliance Improvement	Non-credit – taken separately or 4 courses equal Corporate Compliance and Investigations Certificate	Self-paced – 2+ weeks	Mid-Career	Online-Asynchronous	None – can be part of a Corporate Compliance and Investigations Certificate

Course Description: After starting with a discussion of what we mean by a “culture of compliance,” we’ll go on to reflect on the role of strong leadership. Specifically, we focus on the importance of relationship building and leading by example. You’ll also learn about the importance of who sits on your Compliance Committee, as well as the duties of each member. Topics Include:

- ☐ Factors that make people most likely to comply with regulations
- ☐ What causes compliance programs to fail?
- ☐ Actions that motivate and demotivate people

Policy, Partnerships, Cyber

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites
Security Situation Center Training 2020	TBD - The SOC can be exported (SOC in a Box)	4 weeks self-paced	Security Situation Center Operators	Online for Initial Qualification Training and "Right Seat Ride" for Mission Qualification	Students take an assessment prior to the course

Course Description: Commonly known as a security operations center (SOC), the NUARI SSC shares and receives information from federal and state law enforcement partners/agencies for increased protection against threat actors. This mutual transparency enables us to take a more proactive approach to cyber threats on the networks we serve. The NUARI SSC is well-equipped to provide threat hunting, monitoring, detection, mitigation, and reporting to improve any organization's resilience against cyber-attacks. Students learn the Detect-Report-Mitigate and Share methodology:

- ☐ Detect anomalies in your environment via information gathered from Homeland Security, local authorities, and threat intelligence.
- ☐ Formal reporting provides the information you need to defend your organization from threats detected daily, in addition to briefing leadership.
- ☐ Information is shared with you to help prioritize actions, keep your environment secure, and continuously improve your incident response plans.

NUARI currently produces analysts in-house via our rigorous certification process as follows:

- ☐ Existing information-sharing relationship with Homeland Security and the local state police provides relevant information necessary to evaluate evolving Cyber Security threats.
- ☐ Threat-hunting crews have access to cutting edge research and data through Norwich University. This partnership enhances concept development and brings our performance to another level.
- ☐ Analysts lead with real-world experience while preparing for their next future in the information security field.

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites
Energy/Critical Infrastructure Resilience Policy and Partnerships	Non-Credit .5 CEU	2 hours	Senior Leaders(primary); Mid-Career (alternate)	Online-Asynchronous	None

Module					

Course Description: Understand Army, DOD, and Homeland Security policies regarding the resilience of critical infrastructure.

- ☐ Develop an understanding of the on and off installation investment priorities necessary to achieve energy resilience required to accomplish the installation's mission
- ☐ Develop an understanding of the authorities and structures available for managing manmade or natural disaster impacts of critical infrastructure failure.
- ☐ Develop an understanding of the various partnerships required to effectively impact the installation's energy resilience. Develop an understanding of the various funding sources and authorities to assist in achieving energy and other critical infrastructure resilience.
- ☐ Based on the outcome of the Installation Energy and Water Plan development process for your installation, develop an investment strategy to maximize mission success.
- ☐ Understand the functional requirements for micro grid systems to support critical operations both on and off the installation that are critical to the installation's mission capability.

<u>Course Title</u>	<u>Credits</u>	<u>Duration</u>	<u>Audience</u>	<u>Delivery Method</u>	<u>Prerequisites</u>
Exercise Development Process - Capstone Exercise Module	Non-Credit .5 CEU	3 hours	Senior Leaders(primary); Mid-Career (alternate)	Online-Asynchronous and DECIDE meeting	None

Course Description:

- ☐ Develop Understanding of the 4 Phase Exercise process
- ☐ Develop Exercise scenarios for home installation using the 4-phase process.
- ☐ Develop the skills for effective energy/critical infrastructure resilience planning and exercising in a dynamic and complex environment.
- ☐ Be able to lead regional exercise that address the full gamut of energy/critical infrastructure vulnerabilities and resilience strategies for the infrastructure critical to the installation's missions.
- ☐ Be able to effectively participate in the national, regional and local government and non- governmental discussions that influence critical infrastructure/energy

resilience on and off the installation.

- ☐ As a result of the course be able to outline specific strategies and funding priorities to address the energy resilience/critical infrastructure needs of the installation mission

<u>Course Title</u>	<u>Credits</u>	<u>Duration</u>	<u>Audience</u>	<u>Delivery Method</u>	<u>Prerequisites</u>
Graduate Certificate in Computer Forensic Investigation/Incident Response Team Management - Computer Security Incident Response Team Management GI554	6 graduate credits	11 weeks	Bachelor's degree holders	Online – taken with Computer Forensic Investigation GI551	Bachelor's degree, an understanding of the Microsoft Windows operating systems and a background in systems administration is helpful, but not required.

Course Description: In this course, you will analyze and apply the key points in creating and managing a computer security incident response team (CSIRT), also known as a computer incident response team (CIRT) or a computer emergency response team (CERT). Topics include establishing CSIRTs; responding to computer emergencies; securing the CSIRT; managing the CSIRT with respect to professionalism, setting priorities for triage, and protecting personnel against burnout; and learning from emergencies using the incident postmortem and establishing continuous process improvement within the organization. Students will use their case study to apply their knowledge to real-world situations and will prepare recommendations for the establishment of a new CSIRT or improvement of their existing CSIRT.

<u>Course Title</u>	<u>Credits</u>	<u>Duration</u>	<u>Audience</u>	<u>Delivery Method</u>	<u>Prerequisites</u>
Computer Forensic Investigation/ Incident Response Team Management - Computer Forensic Investigation GI551	6 graduate credit	11 weeks	Bachelor's degree holders	Online – taken with Computer Security Incident Response Team Management GI554	Bachelor's degree, an understanding of the Microsoft Windows operating systems and a background in systems administration is helpful, but not

					required.

Course Description: This course focuses on the spectrum of tools and techniques used to investigate digital incidents, whether in a civil or criminal environment. The course provides the broad understanding that information assurance professionals must have of the management, investigation, and analysis of digital incidents. It also places that understanding in the context of other information assurance domains. Discussions of digital investigation and forensics cover topics from both technical and management perspectives to increase the information assurance professional's understanding and application of domain-specific knowledge

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites
Graduate certificate in Vulnerability Management - Vulnerability Management and Penetration Testing GI562	6 graduate credits	11 weeks	Bachelor's degree holders	Online taken with Vulnerability Management and Penetration Testing II GI563	Bachelor's degree should be familiar with and comfortable using both Microsoft Windows and Linux command line and GUI based tools as well researching proper usage of the tools.

Course Description: This course introduces students to the penetration testing of computer networks. Students will utilize a virtual lab to gain experience through hands-on lab exercises and learn to use the well-known open-source Metasploit computer security project to understand security vulnerabilities. Students will apply this tool for penetration testing, testing the control tools, and learn how to conduct monitoring of an enterprise. Topics explored in this course include system security and vulnerability analysis, the most common system exploits and vulnerabilities, along with system "pivoting" and client-side exploits. This course also introduces open-source tools, in particular, the Metasploit Framework (MSF). Students will learn how to assess enterprise security controls and system vulnerability and learn to document their findings. The course is designed for penetration testers, system security, and network administrators.

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites
Graduate certificate in Vulnerability Management – Vulnerability Management and Penetration Testing II GI 563	6 graduate credits	11 weeks	Bachelor's degree holders	Online taken with Vulnerability Management and Penetration Testing I GI562	Bachelor's degree should be familiar with and comfortable using both Microsoft Windows and Linux command line and GUI based tools as well researching proper usage of the tools.

Course Description: This course introduces students to advanced open-source tools used to conduct penetration testing of computer networks. Students will learn the rules of engagement, and how to conduct legal and ethical security tests and vulnerability assessments. Students will utilize a virtual lab to gain experience through hands-on lab exercises. Students will learn to use the well-known open-source tools (Metasploit, John the Ripper, Wireshark) to understand security vulnerabilities and how to use this tool for penetration testing, testing the control tools, and how to conduct monitoring of an enterprise.

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites
Graduate certificate - Critical Infrastructure Protection & Cyber Crime, Title: Cyber Crime GI556	6 graduate credits	11 weeks	Bachelor's degree holders	Online with Critical Infrastructure Protection GI566	Bachelor's degree – taken with GI566

Course Description: This course explores the nature of the conflict in cyber space focusing on two major Internet-based threats to the U.S. national security: cyber terrorism and cybercrime. Students will address questions such as: who is undertaking these cyber activities, what techniques are used, and what countermeasures can be adopted to mitigate the impact.

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites

Graduate Certificate - Critical Infrastructure Protection & Cyber Crime, Title: Critical Infrastructure Protection GI566	6 graduate credits	11 weeks	Bachelor's degree holders	Online with Cyber Crime GI556	Bachelor's degree – taken with GI556

Course Description: Students will examine the network infrastructure sectors critical to national security. Special attention is paid to the risk management of information in critical infrastructure environments through an analysis and synthesis of assets, threats, vulnerabilities, impacts, and countermeasures. Critical consideration is paid to the role of Supervisory Control and Data Acquisition (SCADA) systems in the flow of resources. Note: Students taking this certificate will complete a case study.

<u>Course Title</u>	<u>Credits</u>	<u>Duration</u>	<u>Audience</u>	<u>Delivery Method</u>	<u>Prerequisites</u>
Graduate Certificate in Public Administration Leadership & Crisis Management - Foundations of Leadership and Ethical Decision-Making AD576	6 graduate credits	11 weeks, 4+ weeks if CEU	Senior Leaders and Mid-Career Professionals	Online in combination with Public Leadership, Crisis Management, and Organizational Change AD586	Bachelor's degree

Course Description: The first course explores and examines the major models of leadership from a theoretical, ethical, and practical perspective. Outcomes of the first course are a thorough understanding of leadership concepts and being able to apply them in their own leadership situations.

<u>Course Title</u>	<u>Credits</u>	<u>Duration</u>	<u>Audience</u>	<u>Delivery Method</u>	<u>Prerequisites</u>

Graduate Certificate in Public Administration Leadership & Crisis Management, Title: Public Leadership, Crisis Management, and Organizational Change AD586	6 graduate credits, can be converted to CEU	11 weeks, 4+ weeks if CEU	Senior Leaders and Mid- Career Professionals	Online in combination with Foundations of Leadership and Ethical Decision-Making AD576	Bachelor's degree

Course Description: In the second course, students will explore the role of leadership in public organizations by examining how leadership is intrinsically tied to the organization. The course also examines the role of leadership in crisis situations, including how decisions are made and implemented, how information is communicated in critical situations, how political leaders are held accountable for crisis situations, and how communities can be returned to a state of normalcy after a critical incident has occurred.

<u>Course Title</u>	<u>Credits</u>	<u>Duration</u>	<u>Audience</u>	<u>Delivery Method</u>	<u>Prerequisites</u>
Graduate Certificate in Rural Municipal Governance, Title: Municipal Governance AD543	6 graduate credits, can be converted to CEU	11 weeks, 4+ weeks if CEU	Senior Leaders and Mid-Career Professionals	Online coupled with Rural Municipal Governance AD 553	Bachelor's degree

Course Description: The first course in this certificate introduces students to the work of local government managers in the United States. The core of the course is the study of best practices for municipal leadership, including the challenges of providing direction to a wide scope of departments and agencies necessary to serve the needs of communities. Students will also study how to create and maintain intergovernmental relationships and form partnerships.

<u>Course Title</u>	<u>Credits</u>	<u>Duration</u>	<u>Audience</u>	<u>Delivery Method</u>	<u>Prerequisites</u>

Graduate Certificate in Rural Municipal Governance, Title: Rural Municipal Governance AD553	6 graduate credits, can be converted to CEU	11 weeks, 4+ weeks if CEU	Senior Leaders and Mid-Career Professionals	Online coupled with Municipal Governance AD543	Bachelor's degree

Course Description: The second course in this certificate explores the role of the public service leader, divisions and sectors within the rural municipality, organizing stakeholder collaborations and developing an action plan in support of accountability, good governance, and improvement of quality of life. Specifically, discussions will examine interdisciplinary and multidisciplinary cultural competence and effective leadership skills uniquely identified in rural communities.

<u>Course Title</u>	<u>Credits</u>	<u>Duration</u>	<u>Audience</u>	<u>Delivery Method</u>	<u>Prerequisites</u>
Graduate Certificate in Urban Municipal Governance, Title: Municipal Governance AD543	6 graduate credits, can be converted to CEU	11 weeks, 4+ weeks if CEU	Senior Leaders and Mid-Career Professionals	Online coupled with Urban Municipal Governance AD 563	Bachelor's degree

Course Description: The first course in this certificate introduces students to the work of local government managers in the United States. The core of the course is the study of best practices for municipal leadership, including the challenges of providing direction to a wide scope of departments and agencies necessary to serve the needs of communities. Students will also study how to create and maintain intergovernmental relationships and form partnerships.

<u>Course Title</u>	<u>Credits</u>	<u>Duration</u>	<u>Audience</u>	<u>Delivery Method</u>	<u>Prerequisites</u>
Graduate Certificate in Urban Municipal Governance, Title: Urban Municipal Governance AD563	6 graduate credits, can be converted to CEU	11 weeks, 4+ weeks if CEU	Senior Leaders and Mid- Career Professionals	Online coupled with Municipal Governance AD 543	Bachelor's degree

Course Description: Urban America is the focus of the final course in this certificate. Particular focus will be placed on the public administrator's multidisciplinary collaborations and action plan development, through discussions and reflections of key issues including the unique needs affecting public safety, emergency management, medical services, animal control, and public and mental health concerns.

Master Planning

<u>Course Title</u>	<u>Credits</u>	<u>Duration</u>	<u>Audience</u>	<u>Delivery Method</u>	<u>Prerequisites</u>
Energy Resources and Markets GB548	4 CEU in Norwich Pro or 6 credits in the MBA	4-6 weeks CEU or 11 weeks for graduate credit in the MBA	Energy Managers	Online via Norwich Pro or CGCS Moodle platform	None in Norwich Pro, Managerial Finance GB 560 and Core courses in MBA program

Course Description: This seminar focuses on the energy resources and markets that include: introduction to the origins and the typology of the alternate ways to generate energy; price formation of energy and its markets; description of the existing markets and their most common negotiating instruments in relation to each type of energy: oil, natural gas, coal and electricity; development of energy markets and its regulations in U.S., EU and Latin America; environmental and climate change policies; and the feasible energy mix for the organization under the security of supply.

<u>Course Title</u>	<u>Credits</u>	<u>Duration</u>	<u>Audience</u>	<u>Delivery Method</u>	<u>Prerequisites</u>

Energy Savings and Efficiency Projects GB558	4 CEU in Norwich Pro or 6 credits in the MBA	4-6 weeks CEU or 11 weeks for graduate credit in the MBA	Energy Managers	Online via Norwich Pro or CGCS Moodle platform	None in Norwich Pro, Bachelor's degree & Managerial Finance GB 548 and Core courses in MBA program

Course Description: Managing an organization's project to save and use energy in the most efficient way, including introductions to sustainability, energy intensity, energy efficiency and savings are topics of this seminar. These aspects are reviewed for electricity and heat generators energy systems. Students develop an efficiency solution project for a company, including financial aspects, auditing and energy strategies.

<u>Course Title</u>	<u>Credits</u>	<u>Duration</u>	<u>Audience</u>	<u>Delivery Method</u>	<u>Prerequisites</u>
Managing Corporate Energy Needs GB568	4 CEU in Norwich Pro or 6 credits in the MBA	4-6 weeks CEU or 11 weeks for graduate credit in the MBA	Energy Managers	Online via Norwich Pro or CGCS Moodle platform	None in Norwich Pro, Bachelor's degree & Managerial Finance GB 548 and 558 and Core courses in MBA program

Course Description: This seminar focuses on energy procurement optimization with security of supply, quality and low cost including how to value available and feasible energy sources of supply, manage energy procurement processes, contracts management, sector supply strategies, demand forecasting, quantitative risk assessment, the company flow of information

and cooperative procurement techniques. A detailed behavior of each relevant energy market (oil, gas & electricity) from the demand point of view is discussed. Components of the energy markets and the available energy origins are reviewed, as well as internal analysis of the organization needs and processes, to optimize all aspects of a company's energy procurement. Students will acquire analytical and managerial capacity and skills to resolve the energy procurement of the organization.

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites
Strategy and Planning PW320	CEU	4 weeks self- paced	Mid-Career	Online-Asynchronou s	None

Course Description: A leader's effectiveness is dependent on so many factors. For one, they need to have a vision and a plan for reaching that vision that functions like a roadmap so that when it comes time to make decisions, the answers will be clear. Also, they need financial resources to fuel the organization toward its objectives and effective communication. In this course we'll discuss important steps and tips for designing your plans, conveying information clearly, and successfully competing for limited resources. Topics Include:

- ☐ Navigating the complex nature of obtaining financial resources in public works organizations
- ☐ Project Management approaches to planning
- ☐ Identifying values and exploring how they impact communication choices and decisions

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites
PW340 Long-Term Strategy Project	CEU	4 weeks self- paced	Mid-Career	Online-Asynchronou s	Non e Pre- requisite s: PW310, PW320, PW330

Course Description: Long-Term Strategy Project - In this course you'll use a time-tested and holistic approach to combine all your new knowledge and put it to use to develop a strategic plan that you can apply to your work in real life. We'll walk you through each stage of the process, from the research and analysis phases to the drafting and final formatting.

Topics Include:

- ☐ Developing your voice so that you write your plan with authority and clarity
- ☐ Building peer collaboration into not only your plan, but also your

- day-to-day work for improved results
- ☐ Realistic expectations for plan integration

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites
PW310 Management and Leadership Proficiencies	CEU	4 weeks self-paced	Mid-Career	Online-Asynchronous	None

Course Description: Leaders and managers must stay on top of rapidly changing technological developments if they want their organizations and departments to thrive. In this course, we'll start with a look into the specific ways technology can make public works organizations more effective. Then we move on to tips for building relationships. We believe that a leader's success involves a sophisticated and personal approach that relies heavily on connecting well with employees and stakeholders.

Topics Include:

- ☐ The latest software for managing and leading others
- ☐ A systematic, conceptual approach to decision making
- ☐ The importance of intentional personal and professional growth for leaders and managers
- ☐ The difficult and continual nature of learning good leadership

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites
PW330 Operations and Organizations	Non-Credit 1 CEU	4 weeks self-paced	Mid-Career	Online-Asynchronous	None

Course Description: The quality of public works projects and operations significantly affects the well-being of the communities they serve—from the quality of roads, bridges, and water to effective and safe snow removal and waste storage. Although technology is always an important part of successful operations, good leadership and quality of the relationships play a significant role too. In this course, we challenge you to consider how to improve services and operations in various ways. Topics Include:

- ☐ Why public works professionals need strong, mutually beneficial relationships with the communities they serve.
- ☐ The scope and nature of public works operations and services
- ☐ The critical need for collaboration and innovation
- ☐ Organizational structure in the public works sector and its pros and cons
- ☐ Best practices for conducting online research
- ☐ Ethics in public works

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites
PM310: Project Management Overview	Non- Credit 1 CEU	4 weeks self- paced	Mid-Career	Online- Asynchronou s	None

Course Description: This course can help put you on the path to PMP certification if that's something you'd like to pursue—CEUs/hours from this course count toward PMI PDU/Contact Hours requirements for taking the PMP exam or annual certification renewal. We also offer intensive PMP, CAPM, and Agile exam prep courses. Topics Include:

- ☐ Creating and using Gantt charts and other widely used project tools
- ☐ Pinpointing the gaps in your project management skills so you can create future learning plans
- ☐ More confidently and accurately using the language of the profession in interviews and on the job
- ☐ Identifying PMBOK process areas and knowledge areas
- ☐ Understanding the benefits of employing project management techniques

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites
PM320: Applied Psychology in Project Management	Non- Credit 1 CEU	4 weeks self- paced	Mid-Career	Online- Asynchronou s	None

Course Description: Humans often behave in predictable ways and understanding these tendencies can help project managers accomplish more. Join us for an exploration of these patterns and how they can be used to motivate employees, resolve conflicts, guide groups through change, and communicate more effectively—skills that are especially important for project managers who frequently are not in positions of power. Other topics include values- driven leadership, adapting messages for different personalities, and emotional intelligence. Topics Include:

- ☐ Evaluating personality type using Myers-Briggs and Big Five assessments
- ☐ Using the preferences of various personality types to achieve goals
- ☐ Confidently and accurately using the language of the profession in interviews and on the job
- ☐ Identify your values and the values of others to better recognize motivation and more effectively influence others

Pending UCC approval:

Goal: Create specific certificates/concentrations by mixing courses and explore options to make Cohort opportunities available.

1. Create a custom ER graduate certificate – Energy Resilience and Emergency Response
 - Computer Security Incident Response Team Management | GI554 | 6 credit hours
 - Critical Infrastructure Protection | GI566 | 6 credit hours
2. Create a custom ER graduate certificate – Energy Resilience Leadership
 - Public Leadership, Crisis Management, and Organizational Change | AD586 | 6 credit hours
 - Critical Infrastructure Protection | GI566 | 6 credit hours

Graduate Certificate programs can use the two following courses to create an energy resilience capstone experience:

- ☐ EXL 595 – Residency Requirement – this requirement can be used to be a plenary session, out brief their concept, panel review, oral exam
- ☐ GU 590 Selected Topics 6 Cr – This seminar will require a student(s) to make an original, extended, and in-depth study of an approved topic within their field of study and as approved by an appropriate Program Director. This course is used most often in combination with other listed courses where the student has transferred less than six credits. Approval of the Program Director is required to take the course.

Enclosure 7: Pilot Course – Seminar

CONTRACT TITLE: DEVELOPMENT OF AN ENERGY TRACK WITHIN THE
NORWICH UNIVERSITY CENTER FOR GLOBAL RESILIENCE AND SECURITY –
DESIGN AND DEVELOPMENT PHASE

PILOT COURSE/SEMINAR DOCUMENT

Development Report for Contract No.

W9132T20C0005 Prepared for and Emailed to:

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Subject: Energy Resilience Energy Track Contract Deliverable – Pilot Course/Seminar

1. Reference: Contract Number: W9132T20C0005, PERFORMANCE WORK STATEMENT - Development of an Energy Track within the Norwich University Center for Global Resilience and Security – Design Phase

2. General. The NUARI Technical Proposal defines this task as: The pilots provide a platform for the Energy Track to assess the immediate energy resilience training and education needs as identified by the pilot participants (paragraph 5.3). Further the Deliverable Schedule outlines this task in the following table:

Required Service	Paragraph Number	Standard
Pilot Course/Seminar	Paragraph 5.1 of Contractor's Proposal	a. Submitted within 330 days from the date of award, and b. Conducts pilot course/seminar for Mid-career and Senior Leader LOEs

Table 1 – Deliverable Schedule.

3. Pilot Course Concept – The objective of conducting the pilot course and pilot seminar is to perform both the implementation and the evaluation phases of the ADDIE curriculum development model. The Senior Leader Seminar and the Microgrid Architecture course were the two programs that were implemented between 12 and 30 April, 2021.

- a. Platform – Norwich Pro (<https://mypro.norwich.edu/>) is the platform used to conduct both courses. The Instructors used the Course Development Document (part of the Develop Courses Deliverable submitted on 2 March, 2021) and the slides (student and instructor versions) to transfer the material into the Norwich Pro Moodle Learning Management System. The Norwich Pro Curriculum Development Specialist integrated the slides into the Articulate instructional delivery platform in order to provide a quality multimedia program.
- b. Attendees – Attendees included a wide range of participants for both programs. The Senior Leader Seminar attendees included professionals from Assistant Secretary of the Army, Installations & Environment, US Army Garrison Deputy Garrison Commanders, City Manager(s), Installation Energy Managers, and Emergency Managers. The Microgrid Architecture course included an Electrical Engineer, Professor of Engineering, Senior Cyber Security Specialist, and Installation Energy Managers. Enclosures 1 and 2 includes the list of the attendees.
- c. Timing –
 - i. Senior Leader Seminar – see Enclosure 1 for the scope of the pilot. The

pilot seminar was scheduled for the following dates in April- 14, 16, 20, 22, 23, 27, 29, 30. The group discussion was held from 1200-1400hrs. This was an asynchronous course with read-aheads prior to the discussions. The primary days were the Tues and Thurs of each week with other days for make up if necessary. The final 3-hour session will be a tabletop exercise on 4/30 that participants can consider for use at their home station.

- ii. Microgrid Architecture – see Enclosure 2 for the scope of the pilot. Students participated in a virtual classroom via Norwich Pro on 4/19, 4/21, 4/23, 4/26, and 4/28 (at 1800hrs Eastern). The course is synchronous with student led presentations for each of the six modules.
- d. Evaluation – The evaluation of the pilot courses is planned for the period of 1-21 May, 2021. The method of evaluation includes a survey, student comments, and instructor notes. The purpose of the evaluation process includes the following:
 - i. Learning outcomes - Identify the effectiveness of the seminar/course when compared to the learning outcomes defined in the Course Development Document per the 2 March, 2021 contract requirement.
 - ii. Delivery – Evaluate the timing, format, and platform of the two courses.

4. Conclusion: The conduct of the two pilot programs is in compliance with the contract and proved to be a benefit to the students. Further, the pilot programs provided a relevant forum to address energy resilience efforts within the Department of Defense. The next deliverable, Evaluate Pilot Courses, will include improvements to both pilot programs and other courses/modules.

2 Enclosures

Enclosure 1 - Senior Leader Seminar

Enclosure 2 - Microgrid Architecture

Enclosure 1 – Senior Leader Seminar

Subject: Senior Leader Seminar Welcome Email

Attendees

- Khan, Mir Fasahat CIV USARMY IMCOM ATLANTIC (USA)
mir.f.khan.civ@mail.mil
- Hopkins, Sabrina W CIV USN NAVFAC SE DET PNS FL (USA)
sabrina.williams1@navy.mil
- Chris L. Tucker ctucker@norwich.edu
- Guest) Joseph Minicucci (jminicu2@norwich.edu)
- (Guest) Kurt Blomquist kblomquist@ci.keene.nh.us
- (Guest) Tara S. Kulkarni (tkulkarn@norwich.edu)
- (Guest) Kahwa C. Douoguih (kdouogui@norwich.edu)
- (Guest for review) William Lyons wlyons@forthillcos.com
- Hugh H. Hardin, Deputy to the Garrison Commander, USAG Fort Gordon
- Lynn Phillips, Senior Program Manager, Veterans Programs, ICMA
- Francis B. Burns, Army Support Activity (ASA) Manager, ASA, JBSA, Fort Sam Houston
- Dianne Hamilton, Office of the Deputy Assistant Secretary of the Army (Installations, Housing, and Partnerships)
- Mitchell, Justin O CIV USARMY ID-READINESS (US)
- Mary Beth Saenz, Director, Public Works, USAG Fort Huachuca, AZ
- Allison M Long, Strategic Planner- Installation of the Future Office of the Assistant Secretary of the Army (IE&E) (Strategic Integration)

To all- thank you for volunteering to support this project. After the Solar Winds Cyber attack that went undetected for months in 2020 and the winter storm that hit the South in Feb of this year, there should be little doubt in anyone's mind as to how vulnerable our nation's critical infrastructure is to both manmade and natural events. We hope that this seminar will be very useful to new Army installation leaders. Many new garrison Leaders arrive in their new command with no background or experience in managing the critical infrastructure that our installations depend upon to achieve mission success. You each will play an important role in helping us ensure that we deliver a seminar product to the Army that will help fill some of the critical infrastructure knowledge gaps that currently exist.

Please register as soon as you can. The signup for the course is at this link- Senior Leader Seminar: <https://prostore.norwich.edu/product?catalog=NUARI-ER-001> . The Norwich Pro system should open the details of the class on the 12th of April. After it is open, we will be able to have all of our class communications inside the class area.

There may be some who have not had time to read Koppel's book before the class

starts. Please watch one of the several YouTube hour long interviews with Koppel. Any one of the 3 will provide a good synopsis.

(<https://www.youtube.com/watch?v=Ngkt6PVvc04> or <https://www.youtube.com/watch?v=1dcSyibsF2w> or <https://www.youtube.com/watch?v=3ZQouyl1qiA>).

If you haven't read the book, it is an excellent warm up for the subject of Grid Resilience and how the current condition of our critical infrastructure is a serious threat to our national security.

As a reminder the seminar discussion periods are scheduled from 1200-1400hrs Eastern time on each class day. We will keep the discussion period open an extra hour (until 1500 hrs) in case we need to run over. Please participate as much as your schedule will allow. Any feedback on any lesson(s) regarding how to make the seminar better will be greatly appreciated.

The class topics are scheduled as follows:

- 14 April-Topic 1- Introduction and Overview
- 16 April-Topic 2- Critical Infrastructure
- 20 April-Topic 3- Strategy and Resiliency
- 22 April-Topic 4- Metrics and Strategy
- 23 April-Make up available for Topics 1-4 Discussion
- 27 April-Topic 5- Exercise Development
- 29 April-Topic 6- DECIDE Tabletop Exercise
- 30 April-Make up available for Topic 1-5 Discussion

Each class Topic will have a number of lessons to read before we come together for the class discussion on the 14th. The lessons will be multimedia and will suggest questions to contemplate for later discussion. Please go through all of the Topic 1 material prior to the class meeting/discussion on the 14th. During the discussion, we can talk about how to adjust the material content, but also discuss the material in terms of what is going on regarding this subject in our current assignments.

After you register and go to the Course site, you will see more details about the course. We will gain entry into our discussion room through the Big Blue Button otherwise known as the BBB. I tested it yesterday and it works just like a zoom meeting. I will be posting this message on the class site, so those of you that are already registered, will see it twice.

Enclosure 2 – Microgrid Architecture Course

Subject: Microgrid Architecture Course Welcome

Email Attendees:

- (Guest) David Feinauer feinauer@norwich.edu
- (Guest for review) Fred Meurer (meurer@meurermuni.com)
- Stephen L. Fitzhugh (fitzhugh@norwich.edu)
- (Guest) Michael Bobinsky mbobinsky@somersworth.com
- (Guest) Tara S. Kulkarni (tkulkarn@norwich.edu)
- (Guest) Jeffrey S. Cairns '80 (jcairns@norwich.edu)
- LEOVICH, MARY E NH-03 USAF AFMC
AFNWC/NCS mary.leovich@us.af.mil;
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- Bjorn Olsen, CIV US Army USAG FHAZ, bjorn.r.olsen.civ@mail.mil
- Phil Sussman, President, NUARI

Hello and welcome to the Norwich Pro Microgrid Architecture Course!

Thank you so much for your participation in the pilot run of this course, which has been developed through NUARI as part of a larger contract with the US Army for an Infrastructure Resilience Curriculum. There is no fee involved for your participation and all required materials will be provided to you.

The link to register is here:

<https://prostore.norwich.edu/product?catalog=NUARI-ER-002>

Please sign up as soon as possible as it will allow us to trouble shoot any issues. The Norwich Pro system will not open to the details of the class until the 12th of April. Please email me if you have any trouble signing up or if you have any questions or suggestions.

I am mindful of the fact that we are all working professionals. Most of the content of this course will be delivered asynchronously, so you can participate mostly at a time that is convenient to you. However, I have scheduled some time for us to meet synchronously so we can all learn from one another and share our experience and knowledge widely.

Below is a roadmap of the course. The course is organized into six modules. The content is delivered through a learning management system called Moodle. Where I have referenced the Big Blue Button feature, which is time that we will meet for about an hour on a video call.

Forums Generally

Forum posts are intended to promote an exchange of ideas between students and ensure that students are benefitting from their interaction with peers. Each student brings their own experiences and knowledge to the course. Sharing those experiences and knowledge is essential to maximizing the benefits of the course. Students should not limit their responses to course materials. Students are encouraged to seek additional information and sources of data to augment course materials.

Prior to Start of Class

Forum – Please introduce yourself to the class, including your position and interest in microgrids. Complete by April 18, 2021 at 6 PM.

Module 1

Forum – Choose one of the seven objectives of microgrids and prepare a forum post on why you think that objective is important. Maximum post is 100 words. Respond to two other forum posts with a substantive response critically analyzing their post.

Supplement course materials with individual research, as necessary. Complete by April 20, 2021 at 6 PM.

Module 2

Forum – Choose one of the 5 components of a microgrid. Describe why that component is critical to achieving the benefits of a microgrid. Maximum post is 100 words. Respond to two other forum posts with a substantive response critically analyzing their post. Supplement course materials with individual research, as necessary. Complete by April 20, 2021 at 6 PM.

Forum - Choose one of the configurations and describe the advantages and disadvantages of that configuration. Maximum post is 100 words. Respond to two other forum posts with a substantive response critically analyzing their post.

Supplement course materials with individual research, as necessary. Complete by April 19, 2021 at 6 PM.

Activity – Big Blue Button. Prior to class, the students will be divided 2 teams and assigned multiple configurations. Each team must come to class prepared to make a presentation on their assigned configurations. Students are encouraged to conduct independent research to support their presentation. April 19, 2021 at 6 PM ET.

Module 3

Forum - Choose an advanced capability and describe its importance to maximizing the benefits of microgrids. Maximum post is 100 words. Respond to two other forum posts with a substantive response critically analyzing their post. Supplement course materials with individual research, as necessary. Complete by April 21, 2021 at 6 PM.

Activity – Big Blue Button. Prior to class, students will be assigned one of the 5 advanced capabilities. Each student must come to class prepared to make a presentation on their assigned capability. Students are encouraged to conduct independent research to support their presentation. April 21, 2021 at 6 PM ET.

Forum - Choose a topic related to advanced power architecture as described in the course materials. Prepare a 250 to 300-word description of your topic and relate it to the overall course objectives. Respond to two other forum posts with a substantive response critically analyzing their post. Supplement course materials with individual research, as necessary. Complete by April 23, 2021 at 6 PM.

Activity – Big Blue Button. Prior to class, students will be assigned one of the 9 advanced power architecture topics. Each student must come to class prepared to make a presentation on their assigned topic. Students are encouraged to conduct independent research to support their presentation. April 23, 2021 at 6 PM ET.

Forum - Choose a power generation platform. Explain how this power generation platform can relate to your own experience or interest in microgrids. How will this platform affect microgrids as you understand them? Maximum post is 100 words. Respond to two other forum posts with a substantive response critically analyzing their post. Supplement course materials with individual research, as necessary. Complete by April 26, 2021 at 6 PM.

Activity – Big Blue Button. Prior to class, students will be assigned one of the 5 power generation platforms. Each student must come to class prepared to make a presentation on their assigned platform. Students are encouraged to conduct independent research to support their presentation. April 26, 2021 at 6 PM ET.

Discussion - Introduce the student project presentation as an assessed activity.

Module 4

Forum - Reflecting on your personal experience or knowledge about responses to natural disasters or your experience on a campus or installation, how can microgrids provide benefits to civilian operations? Maximum post is 100 words.

Respond to two other forum posts with a substantive response critically analyzing their post.

Supplement course materials with individual research, as necessary.

Complete by April 27, 2021 at 6 PM.

Forum - Describe why cybersecurity is a critical aspect of microgrid communications and automation. Give examples of why cyber security is such a threat to microgrid infrastructure. Prepare a 250 to 300-word post analyzing cybersecurity and microgrids. Respond to two other forum posts with a substantive response critically analyzing their post. Supplement course materials with individual research, as necessary. Complete by April 27, 2021 at 6 PM.

Module 5

Forum - Review the cybersecurity life cycle. Select one phase of the cycle and explain why that phase is important for the protection of microgrid infrastructure.

Prepare a 100-word post with your answer. Respond to two other forum posts with a substantive response critically analyzing their post. Supplement course materials with individual research, as necessary. Complete by April 28, 2021 at 6 PM.

Activity – Big Blue Button. Prior to class, students will be assigned one of the types of control. Each student must come to class prepared to make a presentation on their assigned type of control. Students are encouraged to conduct independent research to support their presentation. April 28, 2021 at 6 PM ET.

Forum - Choose either system operator controls or process controls and analyze why they are important for microgrid cyber security. Prepare a 100-word post with your answer. Respond to two other forum posts with a substantive response critically analyzing their post. Supplement course materials with individual research, as necessary. Complete by April 29, 2021 at 6 PM.

Module 6

Activity - Student presentations via Big Blue Button. Students will conduct research on a topic of the student's choice relating to microgrids, subject to instructor approval. Case studies of existing or proposed installations of microgrids are encouraged. Students will present research to the class conveying key concepts relating to their topic. Each student should plan to present for 10 minutes and there will be questions and answers after all presentations are complete. April 30, 2021 at 6 PM ET.

Enclosure 8: Evaluate Pilot Course

CONTRACT TITLE: DEVELOPMENT OF AN ENERGY TRACK WITHIN THE NORWICH UNIVERSITY CENTER FOR GLOBAL RESILIENCE AND SECURITY – DESIGN AND DEVELOPMENT PHASE

PILOT COURSE EVALUATION

Development Report for Contract No.

W9132T20C0005 Prepared for and Emailed to:

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Period Covered in this Report: 5 June 2020 to 30 April 2021

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Subject: Evaluate Pilot Courses Deliverable – Due 21 May 2021

1. Reference. Energy Resilience Education Track BAA Contract, DEVELOPMENT OF AN ENERGY TRACK WITHIN THE NORWICH UNIVERSITY CENTER FOR GLOBAL RESILIENCE AND SECURITY – DESIGN PHASE, VOLUME I TECHNICAL PROPOSAL

2. General. Paragraph 5.3 of the Technical Proposal states the following: Pilots: The pilots provide a platform for the Energy Track to assess the immediate energy resilience training and education needs as identified by the pilot participants. The following Deliverables table refers to the Pilot course conduct and evaluation.

Task	Start	Complete	Deliverable
Pilot courses/seminar	+270	+330	Conduct Pilot courses/seminars for Mid-Career and Senior Level LOEs
Evaluate Pilot courses	+330	+350	Evaluate the effectiveness of the Pilot courses/seminars against the Design/Development standards; update the ADDIE process for each course.

Table 1: Deliverables

3. Evaluation Concept. The evaluation process is the final step in the ADDIE model of curriculum development. However, evaluation occurs at every step of the ADDIE process and in this Deliverable, the comments refer to the two pilot programs: The Senior Leader Seminar and the Microgrid Architecture course. This evaluation uses the following two categories to create this Deliverable:

- a. Student Survey: Both pilot programs used the Qualtrics program to gather feedback from students. The surveys were shared with the Instructor/Developer that were based on the learning outcomes in each Course Development Document.
- b. Instructor Notes from the Pilot: Both Instructor/Developers routinely polled students for feedback using the learning outcomes as the foundation for discussion. Other topics such audience size and composition, delivery method, content, expectation mismatches, redundancies, and the instructor narrative were incorporated in the evaluations located in the Enclosures to the Deliverable.

4. Conclusions. Both the Senior Leader Seminar and Microgrid Architecture courses were piloted in April 2021. Student feedback surveys, instructor feedback and reflection narratives, and observations by the project team were used to assess the

pilot courses and to develop a robust list of strengths, opportunities, and recommendations for future implementation.

a. Strengths

- The timeliness of the content and the linking of course content to current events in the energy and general infrastructure resilience spaces was highly valued by the course participants (Strength 1).
- The diversity of the participants in the courses, the networking that occurred in the synchronous sessions, and the student-to-student learning was a positive element of both programs. In the Senior Leader Seminar, the mix of professionals from multiple levels within the Department of the Army combined with the mix of individuals from multiple levels within the community sector was invaluable. After a key discussion session, one US Army Garrison energy manager commented that when he returned to his installation, he was going to revisit the way that he engaged with representatives in his community. In the Microgrid Architecture course, conversations between installation managers and practitioners with experience in the electric and telecommunications utility domains resulted in similar results—new-found motivation to create stronger community-installation relationships in the future (Strength 2).
- Students in both pilots felt that the course learning objectives were met. Similarly, the instructors were impressed by the students and their assessments of student learning over a few short weeks. Observations from the project team reflected the instructors' appraisals—professionals immersed and engaged in the learning experience (Strength 3).
- The DECIDE® interactive, scenario-based, role-play exercise was well-received and useful as a capstone exercise to the Senior Leader Seminar (Strength 4).

b. Opportunities

- For the Senior Leader Seminar, the content created for the course was exceptionally thorough—both broad and deep. It was created in a modular fashion and can exist as a stand-alone course or as supplemental modules integrated into other curricula. One participant commented that the module related to training exercises to support future preparedness was something they wished their entire team had completed. A rich bank of course content was created that is primed to serve many possible needs and audiences in the future. It will need to be attuned and modified for each need and audience (Opportunity 1).
- The Microgrid Architecture course focused on high-level principles related

to the design and deployment of microgrids, with special attention given to a tactical assessment of the associated operations, threats, and risks.

One student commented that they wished the course covered more technical microgrid implementation details. Yet, the students in the course agreed the course content was already intense; adding more content to the existing course is not realistic. There is an appetite for future course content development in the domain of tactical microgrids to support the rich content developed under this effort (Opportunity 2).

- In the pilot courses, students commented on the gaps between principle and practice—the chasm between recommended practices and the on-the-ground realities. The student professionals commented on how nice it was to have access to others with practical knowledge and to talk with others who had similar experiences. In addition to traditional professional development or continuing

education courses, there is an opportunity to create a more consultative learning/ training experiences to support practitioners in this domain (Opportunity 3).

- Related to Strength 4 above, the interactive role-play exercise offered through the DECIDE® platform was an operational challenge to pull off due to the support needs of the students who were geographically dispersed and using a wide variety of technologies, computer platforms, and computer networks. More homogeneity in terms of requirements for access combined with video tech support resources or a “try before the meeting” exercise would be helpful. An additional DECIDE® exercise could also be useful earlier on in the course as a diagnostic exercise (Opportunity 4).

c. Recommendations

- To preserve Strength 1, a mechanism to continually refresh the courses and keep the content current needs to be planned for and designed into the operational and funding mechanisms for the courses.
- To preserve Strength 2, the courses should not be delivered in a wholly asynchronous, online format. For online delivery, hybrid (synchronous mixed with asynchronous) or fully synchronous deliveries could be appropriate, depending on the audience. For in-person delivery, a fully synchronous or a hybrid (in- person supplemented by asynchronous online exercises) format could be appropriate.
- Student access to the subject matter experts was key to student learning. Student access to other practitioners with varied experiences both inside and beyond the fence line was also key to student learning. Networking

opportunities and other opportunities for student-to-student learning should be preserved with some level of synchronicity.

- The mixed audience with participants representing defense and community sector managers and practitioners enriched the learning experience; multiple students commented on this aspect when communicating with instructors. Delivery of the courses should be sought through an organization that can reach and provide service to both audiences.
- In any educational setting, student motivation and engagement are critical to student success and learning. Related to Strength 3, participants in both pilots removed themselves from the course experience when they realized their other responsibilities would prevent them from engaging as professionals should. While this was fully understood and appreciated, it underscores the need to: a) clearly communicate time expectations in advance, b) repackage and rescale course delivery based on the student population and their individual and organizational needs, and c) to have partnerships with organizations where the recognition, opportunities for release, and opportunities for advancement are aligned with an installation and community “resilience objective,” recognizing and supporting participants in the program. Time and effort should be budgeted to develop these relationships and create this alignment.
- Related to Opportunity 1, it is critical that the courses offered are attuned to the needs of the audience. Based on the intended audience, the learning objectives, selection of course content, timing of the course offering, course modality, and number of participants should be adjusted. All the content developed is appropriate and of value to members of the prospective audiences for the course, but it is not realistic for working professionals to complete a course that covers everything that was developed. Time and effort need to be allocated to allow for a down-selection to occur, modifying the developed courses to fit more specific audiences. For example, if the audience of “senior leaders” are experienced garrison commanders and community energy managers, much of the background content related to the motivations for the new policies should be removed and replaced with content that is more task-oriented (e.g., punch lists).
- It seemed like a subset of the overall course content really resonated with the students, but the subset was different for each student. It is likely that students gravitated to what was most relevant to them at this given moment based on their live experience at work. It is likely that students could retake the same course multiple times and come away with something different each time, based on their focus and the mix of the cohort. This is likely not the best use of one’s time. Related to Opportunity 3, the development of an educational product and opportunity that is more

consultative may be appealing to the audience
(e.g., facilitated small group step-back sessions).

Enclosures (2)

Enclosure 1: Senior Leader Seminar Pilot

Evaluation Enclosure 2: Microgrid Architecture

Pilot Evaluation

Enclosure 1: Senior Leader Seminar Pilot Evaluation

1. Course description: This was a 12-hour web-based asynchronous seminar composed of 6, 2- hour segments. These training segments were designed to introduce senior army leaders to the subject of critical infrastructure resilience with an emphasis on energy. Learners gained an overview of the critical infrastructure, whose overall resilience in the face of natural or manmade interruptions, is key to mission success of Army installations and their ability to project combat power.

The training was designed to assist Senior Leaders develop an understanding of the critical infrastructure both on and off the installation that must be operational for the installation and its tenant units to accomplish their assigned missions. The learner was also exposed to the wide array of organizations beyond their normal control whose performance and capital investments will have great impact on the installation's mission success.

The seminar participants also were made aware of the wide range of threats to critical infrastructure, some tools available for identifying these threats, and potential partners in addressing the issue. Participants also became familiar with the Federal Agencies, local governments, non-profit, and for-profit organizations that play keystone roles in assuring the critical infrastructure resilience essential to installation mission success.

Students gained an understanding of the policies controlling resilience standards, partnering with non-Army agencies, microgrids and funding opportunities for on-base and off-base infrastructure improvements. The participants also gained an understanding of how to manage the risk and enhance the resilience of their critical infrastructure and how to partner with other critical infrastructure owners. This was accomplished by the participants developing an understanding of kinetic and non-kinetic threats by participating in a critical infrastructure analysis and participating in a capstone resilience exercise using the DECIDE® exercise platform.

2. Audience: The target population will be focused on new Garrison Commanders, Deputy Garrison Commanders, Public Works Director, Plans Director and appropriate IMCOM staff leads. Secondary target population is Army G9, Deputy Army G9, G9 SIG, Mission commanders, Corps District Commanders/Deputy Commanders with MILCON support, FORCES Command G3 and G4. This would also be a useful seminar for senior community leaders of communities that host an Army Installation.

The Pilot students were composed of individuals with experience as IMCOM region staff, Garrison Commanders, Deputy Garrison Commanders, Installation Public Works Director, Installation DPTMS, Installation PAIO, Installation Non-appropriated Fund Activities, G-9 staff, ASA(Installations) staff, Installation energy manager, a Navy

installation energy manager, International City/County Managers Association (ICMA) senior staff member for Community- Installation collaboration, a City Manager, a City Public Works Director and a City/County Fire Chief/Emergency Operations Director. All the Pilot participants were experienced in the topic of emergency planning and operations. Some had considerable experience in the area of critical infrastructure planning and resilience.

All the participants in the Pilot seminar were fully employed in their regular jobs. Most were over committed in their regular positions due to the stresses and organizational upheaval caused by each individual organization's response to the covid pandemic. Even though all the participants were volunteers, their professional duties, responsibilities and schedules often interfered with the scheduled discussion periods for the asynchronous course. Further complicating scheduling was the fact that while most participants were in the eastern time zone, we had students in every time zone from Alaska to Europe.

Roles and responsibilities: The Target student population's key roles are Garrison Commanders and Installation's Directorate staff responsible for the Garrison's ability to project Combat power or otherwise perform its central mission. Secondary roles would be deputies and senior staff members that need to understand the role resilient energy systems play in mission capability.

This course is appropriate for non-military senior leaders (City Managers, Public Works, Public Safety, regional utilities districts and regulators) working for partner state, local, tribal, and territorial organizations, especially those at decision-making levels. It is also appropriate for senior leaders in partner organizations in the private sector such as senior representatives of regulated private utilities and non-profits such as community power organizations.

3. Course schedule: The seminar was schedule over a period of three weeks from 14 Apr to 30 April. Two-hour discussion periods were scheduled for each of the five class modules and three hours were scheduled for the Capstone Exercise on the 30th of April. Two discussion sessions were scheduled each week, with one, two-hour make session scheduled the second and third week. The discussion sessions were scheduled from 1200-1400 Eastern time to take advantage of lunch availability for most students.

4. After Action Comments:

- a) What happened: While there was a total of 15 individuals who signed up for the pilot seminar, there were only 7 who were able to participate in a majority of the seminar modules discussions. Even those seven would sometimes have to drop off to take care of an immediate issue at their office/agency. The other individuals would join as their individual schedules allowed. For senior people in full time, highly demanding jobs, the two-hour discussion block was a difficult

length of time to carve out of the middle of the day. If the seminar were to be conducted again, with such a senior, working student complement, I would lengthen the execution period slightly and reduce the discussion periods to one hour.

Because of their experience and background, many of the students did not read all the supporting class material. This was in part due to their time constraints, part due to their subject familiarity, and part due to their belief that some of the material was too in-depth to spend their time on. A general comment was that if the Garrison Commander was already in command, the course was too academic and not “check list” oriented enough. The basic comment often repeated was that the Garrison Commanders are generally so overwhelmed, that if the material is not something that can immediately be used to solve a “today” problem, they would not have time for it.

The fact that the Garrison Pre-Command Course has been reduced to only four+ days, often leaves the new Garrison Commander in the position of continual OJT driven by the current crises of the day. The Army does not appear to have a robust professional development program for future Garrison Commanders as it does for future Brigade and Regimental Commanders. The seminar could easily be completed in its entirety prior to a Garrison Commander assuming command. After discussions with the seminar participants, I would streamline the seminar to be more training oriented than educational oriented as it is now.

The civilian CP29 career (Installation Management) field similarly does not have a coherent civilian professional development program that would guide a GS 9/11/13 intern to a SES 2 position at IMCOM, G-9 or ASA (Installations). This seminar, spread over a longer period with smaller modules and shortened discussion periods, but more numerous contact periods, could be an important professional development building block for CP29 career track professionals.

The seminar was developed in modules that can be mixed and matched with other curricula to meet the academic or professional development needs of the student. Pieces of this seminar could be extracted for use as a block of instruction at the Garrison Commander Pre-Command Course, for training at an IMCOM Commanders annual Garrison Commanders conference or for use at an IMCOM Regional Directors training event. Modules could be mixed and matched to be part of a Dept of Homeland Security Local Government Training program. Individual modules could also be used as training curricula for the ICMA University program. The modules could also be incorporated into tailored professional development certificate programs or degree producing coursework.

- b) Positive comments: The formal end of course evaluations and the informal discussions during the course all indicated the modules addressing material on community partnerships and planning were especially important. Most students had not given much thought to the critical role community infrastructure played in the installation's mission capability.

Another module that was very well received was the module on the development of various types of exercises. This was the fifth and final module before the DECIDE®- based moot tabletop. The module was designed to be a course summary of current critical infrastructure resilience definitions, authorities and requirements, partnership opportunities, exercise types, exercise participants as a function of type and expected outcomes of each type of exercise. Several participants thought this module could be an excellent stand-alone instructional block for a new Garrison Commander.

Another recurring comment was that the various examples of successful resilience projects and funding partnership strategies were particularly useful and of high value. A constant comment from attendees was the lack of resources to apply to the resilience issue. These examples generated ideas on how the resiliency issues at their installation or community might be addressed.

Course evaluation comments and informal discussion comments indicated that the seminar participants generally felt the stated objectives and learning outcomes contained in the Course Development Document (CDD) had been achieved.

Having a mix of community leaders and installation leaders in the resilience discussion together was viewed as a strong positive. Several of the Garrison Leaders indicated they would be taking an amended approach to embracing their supporting communities in critical infrastructure discussions as a result of this seminar.

- c) Issues & Recommendations: While having a mix of community and installation leaders in the seminar provided some extraordinarily strong positives, as previously indicated, it also precluded using some RAND report material that was restricted to Army use only. This is a shortcoming that can be managed in future seminars.

Audiences: As described earlier, the pilot course student cohort was truly diverse. We had a mixture of local government students, former garrison commanders, senior garrison leaders, mid-management garrison technical staff and representatives from the G-9 and ASA (Installations) office.

For the pilot course, this diverse experience mixture worked extremely well. Because of the diversity, we were able to gain feedback from their various perspectives of what an Army senior leader should know about critical infrastructure resilience. The crosstalk and comparative perspectives shared during the discussion periods also stimulated thinking on the part of the students. Additionally, the discussions helped students identify potential gaps in their own organizational planning around critical infrastructure resilience.

For future courses, the modularity of the class materials will support tailoring the course content to the specific needs of the target audience. The desired learning outcomes could also be tailored to be responsive to the specific needs of the audience. For instance, the fifth module on exercise structure and planning could be a two-hour training block for an IMCOM Garrison Commanders Conference. The module on community resilience planning would lend itself to an IMCOM Regional Director's training effort for their Garrisons. The modules could also be used for joint Army- Community presentations at conferences such as the Association of Defense Community's Installation Innovation Conference. As the Army further develops its CP29 professional development track through the IMCOM Academy or other vehicle, the whole seminar or individual modules could be incorporated into the curriculum.

On the civilian side of critical infrastructure resilience planning, the modules could also be used by organizations such as the National Conference of Mayors or the International City/County Managers Association (ICMA) as part of their annual conference professional development programs. The modules could also be married to other complementing course material to develop certificate or degree producing courses in public policy, critical infrastructure planning, military-civilian emergency response collaboration to suggest a few.

The course delivery system used for the pilot was based on the NorwichPro system using the Articulate for the multimedia training materials. The seminar was done asynchronous for the convenience of the students' schedules. The Articulate system is proprietary, but is a highly effective presentation vehicle. The basic input for the Articulate system was a more traditional PowerPoint presentation. The course target audience and course content lend itself to the seminar or discussion format rather than a straight presentation. The content is somewhat agnostic as to which asynchronous educational technology system is used for delivery.

5. Summary: The pilot was highly successful in terms of providing feedback from the participants on how to improve course structure, content and delivery methods to better meet the educational/training needs, time and resource

constraints of the target audience of senior Army leaders.

The ability of the NorwichPro team and their supporting professionals to incorporate late breaking events such as the Solar Winds cyberattack, and the Texas ERCOT system shutdown demonstrated the value and timeliness of the material. The recent ransomware attack on the Colonial Pipeline generated several emails from pilot students on the timeliness of the material.

The seminar is easily restructured to respond to student feedback and to meet the needs of the Army in further promoting professional development and training on the topic of critical infrastructure resilience.

6. Major Conclusions:

- a. The seminar is very timely and consistent with the education and training of the uniformed and civilian workforce necessary to implement the recently adopted doctrine addressing the Army Installation Strategy, the Installation Energy and Water Strategic Plan, and the Army Climate Resilience Handbook.
- b. The seminar modules can be mixed and matched to meet the formal educational and training needs of future military and civilian target audiences that have an impact on installations' resilience and readiness to project combat power or its other national security missions. The modules also have the capability to be tailored to more informal training conferences such as Association of United States Army (AUSA), Association of Defense Communities (ADC) or the Society of American Military Engineers (SAME).
- c. This seminar information on national resilience and the priority Commanders give critical infrastructure resilience must be allocated more resources. Peer, near peer and "wannabe" peer nation and non-nation states are developing the capability to severely threaten the national security of the United States. As an Army and as a Nation, we are not articulating the command interest or resource investment needed to build the critical infrastructure resilience required if the Army and its supporting communities are going to be mission capable when the attack occurs. We have seen the impacts of such attacks and climate vulnerabilities in the short time this course was being developed and executed with the Solar Winds cyberattack, the ERCOT failure in Feb and the currently underway Colonial Pipeline ransomware attack. THIS CURRENT INVESTMENT BY CERL IS A VALUABLE FIRST STEP TOWARDS FILLING THE ARMY'S CURRENT CRITICAL INFRASTRUCTURE RESILIENCE KNOWLEDGE GAP!

Enclosure 2: Microgrid Architecture Pilot Evaluation

1. Course Description: This 16-hour, hybrid delivery course is comprised of 12, 2-hour classes and introduces students to the principles of microgrid architecture, including development, design, and operations. This course will introduce mid-level professionals on military installations (deputy garrison commanders, directors of public works, energy managers), as well as military personnel in tactical formations (battalion and brigade executive officers, communications officers, engineer officers) to the basic components of microgrids, the role of telecommunications and automation in the operation of microgrids, and the risks of cyber threats to microgrids. Learners will have an increased knowledge and understanding about the operating fundamentals and design of microgrids on a tactical basis. The course focuses on the basic skills and knowledge needed to establish, operate, optimize, and disassemble microgrids.

The key course topics include:

- Objectives of a microgrid
- Components of a microgrid
- Microgrid Configurations
- Advanced Capabilities of Microgrids
- Advanced Power Architecture for Microgrids
- Power Generation Platforms
- Civilian Applications of Microgrids
- Role of communications and automation in microgrids
- Risk posed by cyber threats to microgrids
- Countermeasures to reduce the risk of cyber compromise
- Role of communications in the design of a microgrid
- Role of automation in the design of a microgrid

2. Audience: The target audience for this course includes civilian and military personnel technically proficient mid-level management in the public sector. The audience will be comprised of individual participants, as well as organizational divisions or a combination of both. Participants include, but are not limited to power generation and information technology personnel from the following entities:

- Installation management – The Deputy to the Garrison Commander, Director of Public Works, Energy Manager, Director of Plans, Training, Mobilization, and Security, Director of Public Safety, Director of Logistics, Director of Information Management, Director of Contracting, local energy suppliers, and local community government leadership (to include emergency management organizations).
- Organizational team – Deployable uniformed personnel including the unit Executive Officer, Operations Officer, Supply Officer, Communications Officer, Engineer Officer (if assigned) and associated senior Non-Commissioned Officers. Supporting personnel include generation mechanics, communications personnel, Civil Affairs specialists, Special Operations Forces (SOF) engineering personnel, and other personnel as designated.

This course is appropriate for individuals working for federal, state, local, tribal, and territorial organizations, whose responsibilities include the generation of power for discreet periods of time in austere and/or emergency conditions to sustain essential services.

The actual audience included two civil servants, one from Fort Huachuca, AZ and one from Hanscom AFB, MA, both of whom have DoD energy portfolio experience. The class also included two academic administrators/instructors with extensive knowledge in the energy and cybersecurity domains. One of the academic participants has extensive experience with civilian microgrids in a real-world context.

3. Course Schedule: The course was delivered synchronously and asynchronously over a two- week period from 19 to 30 April using the Norwich Pro platform. Most of the content was delivered asynchronously using multimedia tools in an online environment, which were accessed at the convenience of the participants. The course included six synchronous meetings focused on student led learning and an open exchange of ideas and knowledge. The six synchronous meetings occurred Monday, Wednesday, and Friday for the duration of the course. The participants met for approximately one hour for each meeting, beginning at 6 PM eastern time.

4. After Action Comments:

- a) What Happened: The course was fully conducted on the dates specified. The course successfully utilized the Big Blue Button feature in Moodle to conduct synchronous discussion sessions, where students presented on course topics and interacted to discuss the subject matter.
- b) Positive Comments: The students found significant value in the on-

demand features of Moodle, such as multimedia lessons and the sharing of course documents. The students also liked the group discussions via synchronous delivery, including topical discussion with the instructor and classmates. Students liked the student-led teaching, including the topical student presentations. Students liked the do-no-harm quizzes at the end of each module.

c) Issues & Recommendations:

- Different Audiences: The participation suffered some due to limited enrollment. The course is designed for student-led learning, which relies on a diverse and experienced student base. With only two energy professionals and two faculty/administrative professionals, the discussions lacked the richness of discussion that would have otherwise been a part of the course. On the other hand, the discussions were very lively and were seen as a positive.
- Course materials: The course materials were viewed favorably by the students. The students would have preferred more substantive course documents (rather than PowerPoint slides), but the slides contained important doctrinal material from USACE that was key to the course.
- Modality: The modality of the course was a strong positive. I recommend maintaining the delivery method. There was at least one request for a different platform other than Moodle.
- Pace: The primary negative related by the students was the pace of the course. Two weeks is not enough time to deliver this course content. It was too much for working professionals and was designed to be a 16-hour course. With roughly 6 hours of synchronous instruction, that left 10 hours of material to be covered online. The students felt that more time was needed to deliver the content or the course content needed to be reduced.

Enclosure 9: Energy Resilience Fundamentals – Module Development Document



Energy Resilience Fundamentals

Module Development Document

May 25, 2021

Content Description

Overview

The energy resilience modules developed for this program will introduce students to the broad concept of energy and our world. Undergraduate students from all disciplines will be introduced to energy concepts and learn to evaluate our interactions with energy as individuals and a society through the lenses of technical and resilience fundamentals, risk analysis, policy, and master planning.

The modules are packaged as a series of presentations and interactive class sessions with support resources and reinforcement assignments that could be delivered in in-person, online, or hybrid modalities.

Identified below are learning objectives and subsequent learning outcomes/competencies for learners completing the modules. The learning objectives are categorized as relating to the areas of technical and resilience fundamentals (F), policy (P), risk analysis (R), and master planning (MP).

Learners will have a better understanding of:

1. energy resource deployment—generation and loading (F, P)
2. the energy supply system—generation, transmission, distribution, conversion, or transfer of energy (F, P)
3. energy analysis, modelling, and computation (F, R)
4. technical, social, financial, and ethical evaluation and analysis concepts (F, P, R)
5. energy infrastructure monitoring and security (F, P, R)
6. the link between energy and other infrastructure and issues of societal import (P, R, MP)

The modules will be organized into the key “units” or categories listed below in bold face. Key topics covered in each modular unit are also summarized below.

Energy and You

- Fundamental dimensions: Force, Work, Energy, and Power
- Conceptual understanding of power vs energy
- Measuring energy (units)
- Personal energy footprint

Energy and Society

- Energy economics
- US and Global energy footprints over time
- Energy—Connection to key systems and infrastructure
- Financial constraints of the energy system
- Sustainability

Energy and Resilience

- Defining resilience
- Case study: Navy Nuclear in Groton CT
- Case study: Seabees in MS

Energy Nexus

- Multi-session exercise derived from LOE2 or LOE3 exercises

A target sequence, with associated timings, for the modules is presented in the *Module Development Matrix* section. If all modules are adopted, it is estimated that the content would cover 6-7 weeks of a typical 3 credit hour, 15-week undergraduate course (3 hours of course meetings and 6 hours of outside activity per week for 6-7 weeks).

Scope

The collection of modules is intended to help learners develop a conceptual understanding of energy and its impact on our world in multifarious ways (personal lifestyle, society, the environment, national security). Learners following the modules will demonstrate progress towards the aforementioned learning objectives by demonstrating the following outcomes:

Objective	Learning Outcome	Learning Outcome Description
		<i>Students will...</i>
1	O1	estimate the energy requirements of addressing basic human needs such as food, shelter, water, transportation, or waste management (F, P, R)
	O2	discuss the scale and scope of energy consumption rates in the US and the world (F, P, R)
2	O3	describe how electricity is typically generated, transmitted, and distributed, as well as the impact of renewable or local energy sources on those processes (F, P)
3	O4	quantify energy and power in its various forms (kinetic / mechanical, thermal, electric), connect those forms to the physical environment (F)
	O5	differentiate between work / energy and power, connecting those quantities to time (F)
	O6	analyze and estimate the needs and impacts of energy producing or consuming systems (F, P)
4	O7	apply key sustainability concepts, assessments, and tools to the analysis of existing systems and explore the impacts of the systems in multifarious societal contexts (F, P, R)
	O8	connect the source and demand for energy to meet human needs to global societal, economic, and environmental contexts (F, P, R)
5	O9	understand the evolving role that technology plays at all levels of society in all of society's systems, appreciate the risks and vulnerabilities that society is open to as a result of solutions that rely on massive data collection and interconnectivity, and recognize that the concepts of security and resilience should be designed into solutions from the start (P, R)
6	O10	demonstrate an understanding of the link between energy and issues of societal import by planning, synthesizing, and communicating an effort to answer a question or solve a problem, within the norms of their own discipline (F, P, R, MP)

The ten learning outcomes listed above have been developed and revised based on: the research of the program PIs and SMEs, a series of roundtables and in-person meetings with stakeholders conducted throughout phase 1 and 2 of this program, and a

survey of faculty representing programs from among the: liberal arts; mathematical, natural and social sciences; pre-professional programs; and ROTC programs. Approximately 37 faculty members and ROTC instructors completed the survey.

Target Audience

The target population for the modules consists of undergraduate students who are pre-service officers or potential future civilian government employees working on matters that influence our energy resiliency.

It is believed that the best, first populations to adopt the course content will include students with majors in Engineering (all disciplines), Computer Security and Information Assurance, Environmental Science, and Business. Secondary populations will include students following the ROTC sequence of courses, as well as students majoring in Business, Criminal Justice, or Political Science.

To emphasize the possibility for the developed modules to be adopted and offered to students, a table of all majors at Norwich is provided below. The possibility for the intersection of that major curriculum to each of the subject matter areas identified by the Energy Track is shown. An “x” in each box indicates whether the courses in the major cover any of the topic areas identified by the analysis in Phase 1. The standard is very inclusive so as to show how the energy resilience modules (technical and non-technical) can be incorporated into every major at Norwich and can eventually become a certificate, minor, major or program in the future, depending on interest from faculty and students.

Majors at Norwich	Fundamentals	Risk Analysis	Policy	Master Planning*
Accounting		X	X	X
Architectural Studies	X	X		X
Athletic Training				X
Biology	X	X		X
Biochemistry	X	X		X
Chemistry & Biochemistry	X	X		X
Communications				X
Computer Science	X	X		X
Computer Security & Information Assurance	X	X		X
Construction Management	X	X		X
Criminal Justice		X	X	X
Criminal Justice Criminology Concentration		X	X	X

Majors at Norwich	Fundamentals	Risk Analysis	Policy	Master Planning*
Education			X	X
Engineering	X	X		X
Engineering, Civil	X	X		X
Engineering, Electrical & Computer	X	X		X
Engineering, Mechanical	X	X		X
English				X
Environmental Science	X	X		X
Green Design	X	X	X	X
Exercise Science	X			X
Geology	X			X
Health Sciences	X	X		X
History				X
International Business		X	X	X
International Studies		X	X	X
Management		X		X
Mathematics		X		X
Neuroscience	X	X		X
Nursing	X	X	X	X
Physical Education				X
Physics	X	X		X
Political Science			X	X
Psychology		X		X
Spanish				X
Studies in War & Peace		X	X	X

Prerequisites

None

Required Materials

Computer with an Internet connection, an up-to-date web browser, headphones or speakers, video viewing capability, word processing software, spreadsheet software.

Testing/Certification

See Evaluation Strategy. Instructors adopting the modules will need to decide how to integrate the material covered in the modules into their overall course testing and assessment strategy. If the content from the modules is adopted and used in the course, then mastery of that content should be assessed and evaluated using the same strategy as other material covered in the course. If the content is adopted without a clear connection to the overall execution and delivery of the course, students will see it as ancillary or less important, and their engagement and achievement of the learning outcomes will suffer.

Reference List

Smil, Vaclav. *Energy and Civilization: A History*. Boston: MIT Press, 2018.

Rodin, Judith. *Resilience Dividend: Being Strong in a World Where Things Go Wrong*. New York: PublicAffairs, 2014.

Theis, T. and Tomkin, J. *Sustainability: A Comprehensive Foundation*. OpenStax CNX, 2015.

Wickerson, W., Wu, M., and Pringle, M. *Beyond the Fence Line: Strengthening Military Capabilities Through Energy Resilience Partnerships*. Association of Defense Communities, Nov. 2018.

Other references including videos and reports included in individual lessons.

Evaluation Strategy

Assessments of student understanding can be made by evaluating student performance and engagement on the interactive discussions and exercises embedded in the module content. Lists of possible comprehensive projects or assignments are provided to serve as summative assessments. Surveys for instructors and students may be developed as a feedback evaluation mechanism to inform future revision and development.

Technical Requirements

Instructors will need access to a computer with an internet connection, PowerPoint, a projector, and in-room speakers to present the content. Students will need access to a computer with an internet connection, web browser, and speakers or headphones to access supplemental course materials. For some assignments, students will need access to a word processor and spreadsheet software packages.

Module Structure / Content Outline

Module: Energy and You (3-4 Class Periods; 1-1.33 weeks)

Class 1: Fundamental Dimensions + Conceptual Understanding of Power vs Energy

Class 2: Measuring Energy (Units)

Class 3*: Personal Energy Footprint

**Could span 2 class periods depending on level of interactivity and whether material is presented or elicited and discussed*

Module: Energy and Society (6-7 Class Periods; 2-2.33 weeks)

Class A1: Energy Economics

Class A2: Financial Constraints of the Energy System

Class B1: US and Global Energy Footprints Over Time

Class B2: Energy—Connections to Key Systems and Infrastructure

Class C1-2*: Sustainability

**Developed and piloted as 2 75 min sessions; This is equivalent to 3 50-min class periods. Could be modified down to 2 class periods if required.*

Module: Energy and Resilience (3-4 class periods; 1-1.33 weeks)

Class 1: Defining Resilience

Class 2: Case Study: Navy Nuclear in Groton CT

Class 3*: Case Study: Seabees in Gulfport, MS

**Intended to be conducted as an interactive, role-play or tabletop exercise. A debrief and conversation + reflection should follow the exercise. If that is conducted live (not offline), then 2 meetings will be necessary.*

Module: Energy Nexus (3 class periods; 1 week)

Class 1-3: Multi-session exercise derived from LOE2 or LOE3 exercises

Module Progression

The most desirable sequence for the modules is the order in which they are outlined: Energy and You -> Energy and Society -> Energy Resilience -> Energy Nexus. The most desirable sequence for the individual lessons within each module is the order in which the lessons are listed for the Energy and You and Energy and Resilience modules. The lessons within the Energy and Society module are listed in pairs. Within a pairing, the lessons should be completed sequentially, as listed. The pairings could be completed in any order.

The modules and lessons can be used independently—each can stand on their own. The sequences listed are recommendations to improve continuity and to allow for the reinforcement of key topics should all lessons in a module be adopted.

Module Development Matrix

Module: Energy and You (3 – 4 Class Periods)

Class 1: Fundamental Dimensions + Conceptual Understanding of Power vs Energy

- *Scope Statement:* Explain the way we interact with the world by observing physical quantities and measuring them. Connect all the fundamental physical characteristics related to power and energy. Lay the foundation for energy analyses, modelling, and computations. Set students up for calculations and unit conversions in the dimensional analysis and unit conversion lessons.
- *Related Learning Outcomes:*
 - O4, O5, O6
- *Lesson Topics:*
 - Define “Fundamental Dimensions” and the ways we “observe + measure” our world
 - Show how “Derived Dimensions” and measurements can be broken down into fundamental dimensions
 - Through example, show that tearing things down to the fundamental dimensions helps us compare and relate phenomena
 - Develop a visual map relating key dimensions involved in energy (time, mass, and length)
 - Define energy, define power, connect the concepts emphasizing power as a rate
 - Discuss colloquial uses of power and energy, discuss technical uses, discuss points of confusion
- *Pre-Session Student Work:*
 -
- *Post-Session Student Work:*
 - Find power and energy ratings for key appliances (e.g. clothes dryer, water heater, furnace + air conditioner, refrigerator, stove + oven)
 - Research power and energy ratings of key appliances and how they have changed over time (e.g. How has the energy used in a clothes dryer vs. a refrigerator changed over time?)
 - Obtain an electric utility bill from home and analyze it. How much electrical energy was used during the billing period? What was the average used per day? How did that compare to the previous month? What was the net price paid for 1 kWh of electrical energy?

Class 2: Measuring Energy (Units)

- ***Scope Statement:*** Define units related to power and energy and their common uses in different contexts (transportation, heat / thermal, electrical). Reinforce both the difference between power and energy and their connection. Highlight how the units may initially cause confusion. Practice converting power and energy units using conversion factors by hand or the google unit converter.
- ***Related Learning Outcomes:***
 - O4, O5, O6
- ***Lesson Topics:***
 - Define common metric and customary units of energy and their contexts
 - Define common metric and customary units of power and their contexts
 - Reinforce connections between energy and power
 - Discuss orders of magnitude, scale, and the common prefixes
 - Discuss the “math” of unit conversion
 - Practice calculations on an example system: a building elevator
 - Practice calculations on an example system: an electric microwave
 - Compare common energy utility units (electrical and thermal (gas))
 - Discuss Carbon emissions of electrical energy and equivalent amount of energy provided by fuel oil and natural gas
- ***Pre-Session Student Work:***
 - Read Ch1 – Energy and Society from Smil – *Energy and Civilization: A History*
 - Watch How Much Electricity Does it Take to Power the World?
https://www.ted.com/talks/ted_ed_how_much_electricity_does_it_take_to_power_the_world#t-281201
- ***Post-Session Student Work:***
 - Gym exercise
 - Go to the gym and find a treadmill or elliptical machine that displays the output of your exercise in Watts and Calories
 - Which is a measure of power and which is a measure of energy?
 - Some machines display Calories / hr, what is that a measure of?
 - Enter the lowest weight it will allow for yourself
 - Set the resistance and other relevant settings for your desired workout and fitness level
 - Start your exercise and work up to a steady consistent pace
 - While maintaining that pace, observe the wattage and calories
 - Speed up. Return to your baseline pace. Slow Down. Return to your baseline pace. Observe the change in values for all of these states.
 - While at your baseline pace, change your weight in the system to the maximum weight it will allow. Observe the values. Did they change? Why or Why not?
 - Estimate what you think the wattage will be for your baseline pace and your actual weight. Plug it in and see.

- Pave California and Put Up a Solar Parking Lot
 - US Annual Energy Consumption
 - 100.2 quadrillion BTUs
 - 29.4 trillion kWh (If all energy were electric)
 - Surface perpendicular to the sun on clear day, approx. 1000 W/m² of solar energy hit the surface, at its peak
 - Top of the line solar panels
 - Averaging 20% total efficiency at collecting the solar energy
 - 4.5 pk hrs / day
 - 1609m = 1mi
 - Area California: 163,696 mi²
 - What is the annual result of covering California w/ solar panels in kWh?
 - $155973 \text{ mi}^2 \times 1609^2 \text{ m}^2/\text{mi}^2 \times 1 \text{ kW}/\text{m}^2 \times 0.20 \times 4.5 \text{ h/day} \times 365 \text{ day/yr} = 132.6 \text{ Trillion kWh / yr}$
 - How many Californias would we need to cover to meet current demand?
 - $29.4 \text{ Trillion} / 132.6 \text{ Trillion} = 0.222 \sim 1/4 \text{ of California}$
 - Or ~ 1 Indiana Or ~ VT + NH + CT + MA + RI

Class 3: Personal Energy Footprint

- ***Scope Statement:*** Introduction to energy and its many forms in our personal, daily life. Discuss many forms in which we use energy. Explore estimates of energy footprint of a US household vs the “direct” electrical energy usage attributed to the household.
- ***Related Learning Outcomes:***
 - O1, O4, O5, O6, O8
- ***Lesson Topics:***
 - List / elicit common household uses of electricity
 - Discuss personal and household “budgets” for water and electricity
 - Discuss uses of oil for heat, transportation, and consumer goods
 - Connect volume of oil used in US to known physical landmarks to help students appreciate the scale of the use
 - Compute personal energy footprint based on water, electricity, and transportation needs
 - Compare estimates for “personal needs” to annual usage amounts
- ***Pre-Session Student Work:***
 - Watch Mini Zeus TEDx Talk
(https://www.ted.com/talks/jordan_wirfs_brock_the_four_things_you_need_to_know_about_the_energy_you_use)
- ***Post-Session Student Work:***
 - Compute energy required for 20-minute vs 5-minute hot shower. Compute Carbon emissions for each.
 - Brainstorm 20 ways to reduce one’s use of electricity in the school buildings and at home / in the dorm room. For each way developed, evaluate it based on the impact of the reduction versus the impact on one’s “quality of life.” Based on this analysis, list your top 5 ideas and craft an argument convincing someone to implement one of the ways / behaviors changes you came up with.
 - When you observe someone taking an action that saves energy on your campus, thank them.
 - Find a room on campus where the lights are left on frequently when not in use. Go into the room and count the number of light bulbs and note the types (fluorescent 4-ft tube, LED 4-ft tube, fluorescent 8-ft tube, recessed LED can, etc.). Research the bulb and use the power ratings of it or similar ones to estimate the cost of leaving the lights on for one year in terms of energy used, dollars \$, and CO2 emissions.

Module: Energy and Society (6-7 Class Periods)

Class A1: Energy Economics

- *Scope Statement:* Discuss societal reliance on energy and the economic factors that influence our access to and interaction with energy. Concepts of markets, commodities, monopolies, regulated utilities, and conflict over access to resources are explored.
- *Related Learning Outcomes:*
 - O1, O8
- *Lesson Topics:*
 - Electricity and commodities markets
 - Why energy is not typically provided by a pure market process (even if the fuels are commodities)
 - Regulation
 - Natural monopoly
 - Tease something about conflict, natural monopolies, and natural resources to get students thinking
 - Emergent energy technology economics
- *Pre-Session Student Work:*
 - Read Smil, V. "Energy in the Twentieth Century: Resources, Conversions, Costs, Uses and Consequences." *Annual Review of Energy and the Environment* 25 (2000): 21-51.
 - Borenstein, S. "The Trouble with Electricity Markets: Understanding California's Restructuring Disaster." *Journal of Economic Perspectives* 16, no. 1 (2002): 191-211.
- *Post-Session Student Work:*
 - Consider how renewable energy sources change the economics of energy markets. Post 1 question and 1 A-ha moment related to this lesson / topic to a discussion forum.

Class A2: Financial constraints of the energy system

- ***Scope Statement:*** Practice analyzing energy projects within multiple contexts, particularly financial.
- ***Related Learning Outcomes:***
 - O7, O8, O10
- ***Lesson Topics:***
 - Project Evaluation
 - Cost Benefit Analysis
 - Opportunity cost
 - Triple Bottom Line Analysis
 - Corporate Finance
 - Risk, Uncertainty and Real Options (Investment)
 - Stories, Scenarios, Models
- ***Pre-Session Student Work:***
 - Read Hassett, K. and G. Metcalf. "Energy Conservation Investment: Do Consumers Discount the Future Correctly?" *Energy Policy* (June 1993): 710-716. and Hausman, J., and P. Joskow. "Evaluating the Costs and Benefits of Appliance Efficiency Standards." *The American Economic Review* 72, no. 2 (1982): 220-225.
- ***Post-Session Student Work:***
 - Case study discussion "Sustainable Renewable Energy Financing: Case Study of Kenya," from book: *Sustainability Through Innovation in Product Life Cycle Design* (pp.167-179) Publisher: Springer Editors: Mitsutaka Matsumoto, Keiji Masui, Shinichi Fukushima, Shinsuke Kondoh
 - Read the LA Time Article: "Why Does California's Power Grid Keep Flirting with Disaster?"
 - <https://www.latimes.com/environment/story/2020-09-08/why-does-californias-power-grid-keep-flirting-with-disaster-here-are-some-answers>
 - Prepare a short presentation for your peers emphasizing 1 thing you learned and 1 "a-ha" moment you had while reading the article.
 - Analyze one of the issues raised in the article using a triple bottom line analysis approach.

Class B1: US and Global Energy Footprints Over Time

- ***Scope Statement:*** Discuss US and Global consumption of energy resources for transportation, manufacturing, agricultural, personal, and other uses. Explore the evolution of vehicle fuel efficiency and its inability to curb use. Connect energy to health in positive (health technology) and negative (air and water pollution) ways
- ***Related Learning Outcomes:***
 - O1, O2, O3, O8
- ***Lesson Topics:***
 - Electricity – Resource mix, consumption categories
 - Energy – US vs Western World vs Developing World – link to Quality of Life
 - Transportation – Fuel Efficiency improvements vs overall usage / demand
 - Impact on air and water quality
 - Connecting energy to health (air + water quality)
- ***Pre-Session Student Work:***
 - Read excerpts from Ch 6 – Fossil-Fueled Society from Smil: *Energy and Civilization: A History*
 - Watch video from David Ruzic, PhD, UIUC - <https://www.youtube.com/watch?v=31Bi2LpLoK8>
- ***Post-Session Student Work:***
 - Research and find the resource mix for your local electric utility

Class B2: Energy—Connection to Key Systems and Infrastructure

- ***Scope Statement:*** Explain the electrical energy system in this country, de-mystify “the grid.” Discuss changing paradigm and challenges with renewables—decentralized infrastructure.
- ***Related Learning Outcomes:***
 - O3, O9
- ***Lesson Topics:***
 - Electrical energy system defined
 - Generation
 - Transmission
 - Distribution
 - Use
 - Smart Grid Challenges and Opportunities
 - Recovery and reliability solutions
 - Consumer expectations
 - System vulnerabilities
 - Complications with renewables
 - ASCE Infrastructure report card, with comparison to other elements of infrastructure
- ***Pre-Session Student Work:***
 - Watch the following two short videos about “How the Grid works”
 - <https://www.youtube.com/watch?v=nbPmsBmo03Y>
 - <https://www.wsj.com/video/how-does-the-us-power-grid-work/1671AA83-D0D2-4C75-913C-B381341159F4.html>
 - *For more technical audiences, either of the following videos could be used as replacements for the videos above—they are a bit longer
 - Practical Engineering – Episode:
<https://www.youtube.com/watch?v=v1BMWczn7JM>
 - Savre Video: <https://www.youtube.com/watch?v=fUWRyhsutL8>
 - Watch this TED short on the land required to support electricity generation
 - https://www.ted.com/talks/ted_ed_how_much_land_does_it_take_to_power_the_world/transcript?language=en
- ***Post-Session Student Work:***
 - Post 3 things you’ve learned, 2 A-ha moments, and 1 question related to this lesson / topic to a discussion forum.

Class C1-2: Sustainability

- ***Scope Statement:*** Students will differentiate between sustainability and resilience across overlapping critical infrastructure sectors and learn the role of resilience in developing long-term sustainability and to accomplish sustainable development goals such as the ones laid out in the United Nations Sustainable Development Goals (SDGs). Learners will also be introduced to the core concepts of resilience, shocks and stresses in urban areas that challenge resilience, stakeholder engagement to develop resilience strategies that include a vision, goals, and actions, key partnerships and funding mechanisms that allow for implementation of actions, metrics that will track progress and success of implementation, including ways of disseminating information and results, and networking with regional and global groups with an eye toward continual improvement. This module is based on research and strategy documents published by cities in the Global Resilient Cities Network.
- ***Related Learning Outcomes:***
 - O7, O8, O9, O10
- ***Lesson Topics:***
 - Defining resilience and connections to sustainability
 - Urban resilience challenges (shocks and stresses) across critical infrastructure sectors
 - Vision, goals and actions set by resilient cities for infrastructure resilience
 - Funding, partnerships and metrics to track progress of implementation actions
 - Engagement and dissemination tools for communicating resilience work
 - Role of networks in continual improvement
- ***Pre-Session Student Work:***
 -
- ***Post-Session Student Work:***
 -

Module: Energy and Resilience (3-4 class periods)

Class 1: Defining resilience

- *Scope Statement:* Define energy and resilience in meaningful ways. Discuss threat vectors to the energy infrastructure. Discuss old “reliability” and “redundancy” constructs and how resilience is a higher standard
- *Related Learning Outcomes:*
 - O7, O8, O9
- *Lesson Topics:*
 - Define energy and resilience for community and technical audiences
 - Discuss energy infrastructure threats and vulnerabilities
 - Human
 - Natural
 - Cyber
 - Discuss techniques for integrating reliability and redundancy in energy systems
 - Grid Level
 - Local project level
 - Discuss resiliency as a concept and the higher standard it imposes
 - Resiliency discussion based on an example crisis
- *Pre-Session Student Work:*
 - Read Judith Rodin article: “New Orleans Tells the Story of Resilience After Disaster,” *Time*, Sept. 2, 2015. <https://time.com/4015089/new-orleans-resilience-after-disaster/>
 - Watch CNBC video on Cyber Attacks: <https://www.youtube.com/watch?v=1Fwh86X-G04>
- *Post-Session Student Work:*
 -

Class 2: Case study: Navy Nuclear in Groton, CT

- ***Scope Statement:*** Introduce students to the numerous factors, contexts, and stakeholders involved in energy infrastructure changes. Discuss ways in which the implemented changes affected resilience.
- ***Related Learning Outcomes:***
 - O7, O8, O9
- ***Lesson Topics:***
 - Presentation of the site in Connecticut as a case study
 - Discuss problem and challenge
 - Elicit list of likely stakeholders
 - Present list of parties / stakeholders
 - Present solution
 - Discuss impacts and challenges
- ***Pre-Session Student Work:***
 -
- ***Post-Session Student Work:***
 -

Class 3: Case study: Seabees in Gulfport, MS

- ***Scope Statement:*** Reinforce concepts related to the factors, contexts, and stakeholders involved in energy infrastructure changes. Discuss ways in which the implemented changes affected resilience.
- ***Related Learning Outcomes:***
 - O7, O8, O9
- ***Lesson Topics:***
 - Desktop exercise using data from “case study”
 - Students are assigned to teams or groups.
 - Each person in the group has a role from the list below:
 - Concerned community members
 - Local Mayor / city manager
 - Manager with the electric utility
 - Regulator / Commissioner with State Public Utilities Board/Commission
 - Installation energy manager
 - Students given limited information from within the purview / context of their assigned role.
 - Students discuss / negotiate solution to yield mutually beneficial improvements to base and community resilience
 - Report out solutions developed by teams / groups
 - Discuss actual solution.
 - Debrief on lessons learned from the experience
- ***Pre-Session Student Work:***
 - Complete Lesson on Groton, CT
- ***Post-Session Student Work:***
 -

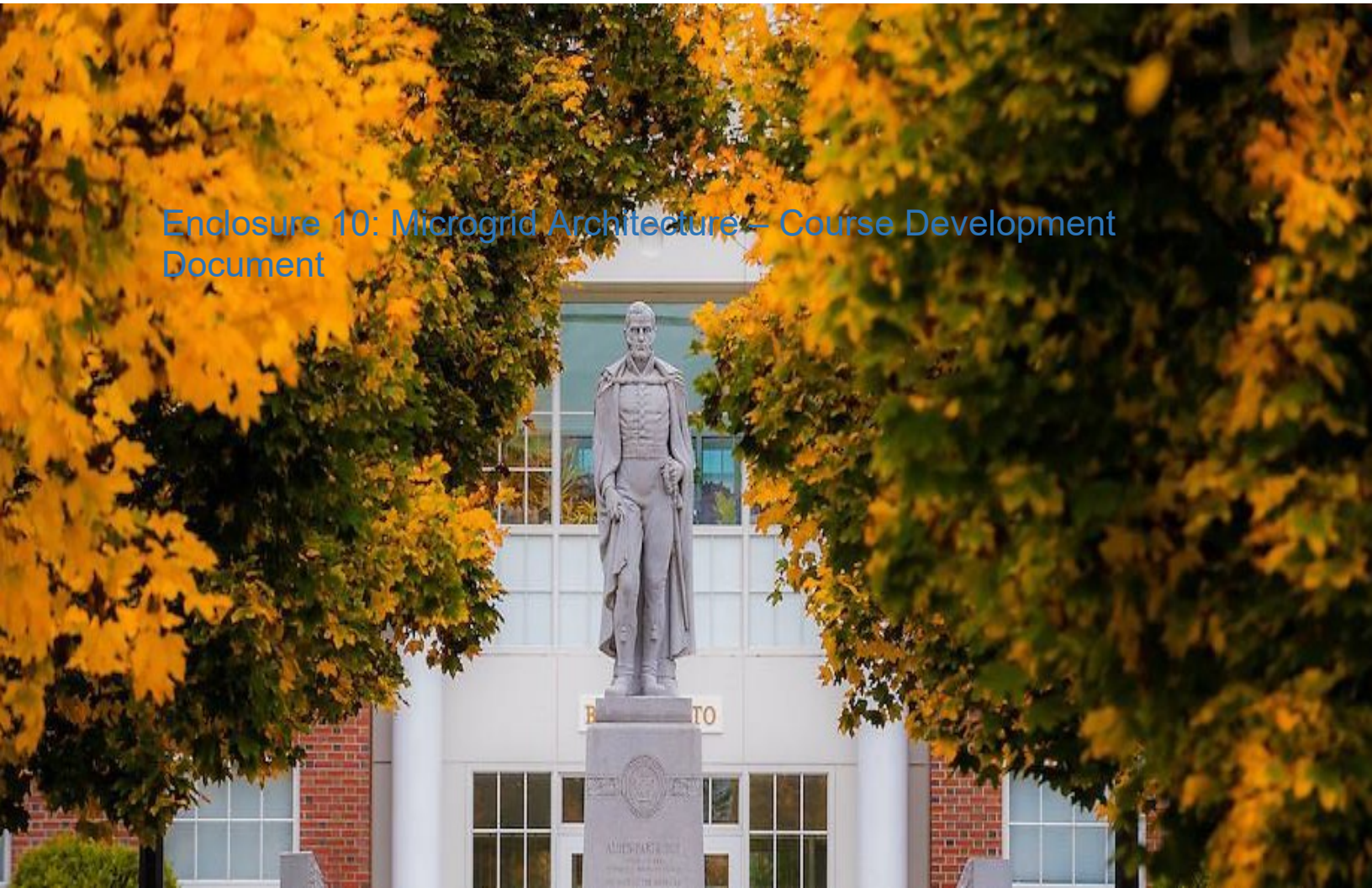
Module: Energy Nexus (3 class periods)

Class 1-3: DECIDE, Converge, or another suitable capstone exercise

Connect LOE 1 students to interactive or tabletop exercises developed for LOE2 or LOE3. LOE1 students either actively interface with other participants throughout the exercise, or they complete a lite version of the exercise.

- ***Related Learning Outcomes:***
 - O9, O10

Enclosure 10: Microgrid Architecture – Course Development Document



Course Description

Overview

This 16-hour, hybrid delivery course is comprised of twelve, two-hour classes and introduces students to the principles of microgrid architecture, including development, design, and operations. This course will introduce mid-level professionals on military installations (deputy garrison commanders, directors of public works, energy managers), as well as military personnel in tactical formations (battalion and brigade executive officers, communications officers, engineer officers) to the basic components of microgrids, the role of telecommunications and automation in the operation of microgrids, and the risks of cyber threats to microgrids. Learners will have an increased knowledge and understanding about the operating fundamentals and design of microgrids on a tactical basis. The course focuses on the basic skills and knowledge needed to establish, operate, optimize, and disassemble microgrids.

The key course topics include:

- Objectives of a microgrid
- Components of a microgrid
- Microgrid Configurations
- Advanced Capabilities of Microgrids
- Advanced Power Architecture for Microgrids
- Power Generation Platforms
- Civilian Applications of Microgrids
- Role of communications and automation in microgrids
- Risk posed by cyber threats to microgrids
- Countermeasures to reduce the risk of cyber compromise
- Role of communications in the design of a microgrid
- Role of automation in the design of a microgrid

Scope

This introductory course is intended to help prepare learners for the technical challenges associated with designing, implementing, operating, and protecting microgrids. This course introduces the basic skills learners will need to begin mastering the use of microgrids to improve energy resiliency and meet the demands of energy consumers, whether in a tactical or garrison environment. These skills range from the gaining an understanding of the fundamentals of microgrids to understanding and evaluating cyber threats to microgrids. The content covered in this course provides learners with the knowledge, skills and abilities needed to successfully learn how to design, implement, operate, and protect a microgrid system.

Target Audience

The target audience for this course includes civilian and military personnel technically proficient mid-level management in the public sector. The audience will be comprised of individual participants, as well as organizational divisions or a combination of both. Participants include, but are not limited to power generation and information technology

personnel from the following entities:

- Installation management – The Deputy to the Garrison Commander, Director of Public Works, Energy Manager, Director of Plans, Training, Mobilization, and Security, Director of Public Safety, Director of Logistics, Director of Information Management, Director of Contracting, local energy suppliers, and local community government leadership (to include emergency management organizations).
- Organizational team – Deployable uniformed personnel including the unit Executive Officer, Operations Officer, Supply Officer, Communications Officer, Engineer Officer (if assigned) and associated senior Non-Commissioned Officers. Supporting personnel include generation mechanics, communications personnel, Civil Affairs specialists, Special Operations Forces (SOF) engineering personnel, and other personnel as designated.

This course is appropriate for individuals working for federal, state, local, tribal, and territorial organizations, whose responsibilities include the generation of power for discreet periods of time in austere and/or emergency conditions to sustain essential services.

Prerequisites

Participants in this course should be currently serving in an installation support, energy management, or tactical military unit with responsibility for power generation and maintenance, as well as information technology personnel in a middle management position. Although there are no prerequisites for this course, it is expected that participants have a fundamental understanding of power generation and system controls.

Required Materials

Computer with an Internet connection and up-to-date web browser.

Testing and Assessment

A pre-assessment will be administered prior to starting the course. Each of the twelve modules will contain Knowledge Checks (Formative). A post-assessment (Summative) will be administered upon completion of all course classes. A passing score of 80% will be required for successful completion of the course.

Reference List

- Sandia National Laboratories, Microgrid Design Toolkit, N.p., Web. <https://ip.sandia.gov/techpdfs/Microgrid%20Design%20Toolkit%20v2.pdf>. DOI 11.8/2020
- The Next Generation Military Power Grid: Open Interoperability Standards Based Advanced Power Architectures, Tactical Microgrid Standards Consortium, US Army Engineer R&D Center (ERDC), US Army Communications-Electronics RD&E Center (CERDEC)/MIT Lincoln Laboratory
- Tactical Microgrid Standard: An Open Interoperability Standard for Advanced Power Architectures, Intro for IEEE 2030.4, 28 September 2020, US Army Engineer R&D Center (ERDC)/US Army C5ISR Center/MIT Lincoln Laboratory

Evaluation Strategy

Level 1 evaluation is assessed with the courseware evaluation form presented at the conclusion of the course. Level 2 evaluation is assessed through the comprehensive examination at the conclusion of the course. (Based on Kirkpatrick model)

Technical Requirements

Participants will require a computer with an Internet connection and a web browser that supports the delivery of multimedia content. Participants will require speakers or headphones for audio and video material.

Course Structure/Content Outline

Course Introduction and Objectives

- Course overview
- Course objectives
- Pre-assessment

Objectives of a Microgrid

- Improved Fuel Efficiency
- Improve Resiliency Through Redundancy
- Simplicity
- Conditioning of Power to Improve Performance
- Interoperability with Legacy Systems and Future Systems
- Seamless photovoltaic (PV) and battery integration.
- Use of Smart Technology to Improve Reliability and Efficiency
- Compliance to MIL-STD-TMS (Department of Defense Tactical Microgrid Standard).

Components of a Microgrid

- Power generation
 - Diesel Generators
 - Other Generators (Vehicles, Renewables)
 - Grid
- Microgrid Controllers
- Distribution
- Load
- Storage

Microgrid Configurations

- Spot Generation
- Consolidated Generation
- Central Plant
- Distributed Microgrid
- On-Grid v. Off-Grid (Island Mode)
- Advantages and Disadvantages

Advanced Capabilities

- Interoperability
 - Between Services
 - Between Partner Nations/Allies (NATO)
 - Between Military and Civilian Sources (Equipment and Generation)
 - Between Equipment Vendors
- Modularity

- Scalability
- Resiliency
- Cybersecurity

Advanced Power Architecture

- Must Be Capable of High Energy Power Generation
 - Weapon Systems
 - Sensors
 - Climate Control
 - Advanced Communications Systems
- Intelligent Management System
- Fueled Generation
- Renewables
- Inverter/Converter
- Energy Storage and Conditioning
- Distribution
- Loads

Power Generation Platforms

- Ground Based Platforms
 - Expeditionary
 - Installations/Garrison
 - Grid
- Vehicle Based Platforms
- Sea Based Platforms
- Air Based Platforms
- Space Based Platforms (Future)

Civilian Applications

- Civilian Sector Uses
 - Key in Remote and Isolated Areas
 - Humanitarian Relief and Disaster Assistance
- Scalable Capabilities
 - ☐ Diesel Generation
 - ☐ Augment with Storage
 - ☐ Augment with Renewables
 - ☐ Expansion with Additional Sources
 - ☐ Connection to Utility Grid

Role of Communications and Automation in Microgrids

- Microgrid Systems Manager
- Microgrid Controller
- Microgrid Control Loops
 - Command and Control Loop
 - Health and Status Loop
- Data Distribution Service
- Cybersecurity

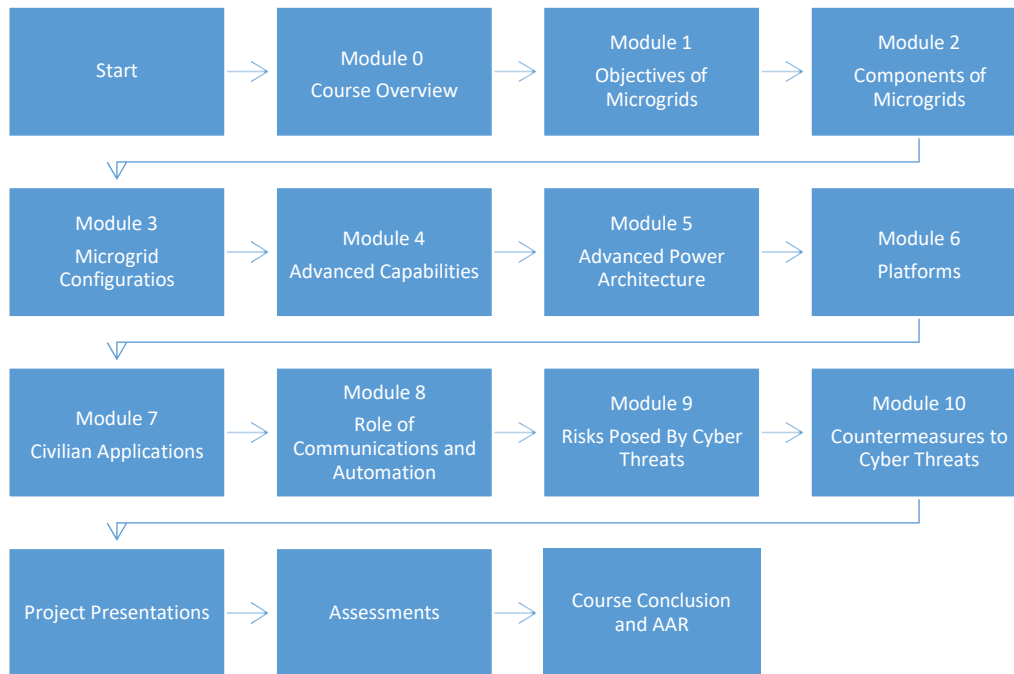
Describe the Risk Posed by Cyber Threats to Microgrids

- Cybersecurity System Lifecycle
- Process Control Points
- Types of Attacks
- Malware Injection Potential
- Consequences of Breach

Countermeasures to Reduce Cyber Risks to Microgrids

- System Operator Controls
- Process Controls
- Restoration of Control

Course Progression



Course Development Matrix

Module 0: Introduction, Course Objectives and Pre-Assessment

- **Scope Statement:** This lesson will prepare learners for course navigation and introduce course objectives. Learners will complete a pre-assessment prior to starting the course.
- **Terminal Learning Objective (TLO):**
 - None
- **Enabling Learning Objectives (ELO):**
 - None
- **Lesson Topics:**
 - Navigation
 - Pre-Assessment
- **Instructional Strategy:** Tutorial.
- **Assessment Strategy:** None

Module 1: Objectives of Microgrids

- **Scope Statement:** This Class will identify the objectives of a microgrid.
- **Terminal Learning Objective 1 (TLO1):**

Upon successful completion of the Class, learners will be able to describe the objectives of a microgrid.
- **Enabling Learning Objectives (ELO):**
 - Identify and describe seven different objectives of microgrids.
 - Identify and describe the Department of Defense Microgrid Standard.
- **Lesson Topics:**
 - Fuel Efficiency
 - Resilience/Redundancy
 - Simplicity
 - Power Conditioning
 - Interoperability
 - Seamless Renewables
 - Smart Technology
 - Military Standards
- **Instructional Strategy:** Tutorial, learning tasks and activities.
- **Assessment Strategy:** Knowledge review questions at the end of the class
- **Instructor Slide Notes:**
 - Slide 1
 - None
 - Slide 2

- Provide a detailed overview of the course, taking time to “connect the dots” between the modules and the course progression.
- Introduce Module 1.
- There are two assigned readings which should be completed prior to starting Module 1:
 - The Next Generation Military Power Grid: Bozada Powerpoint.
 - Portsmouth Naval, Shipyard, ME: AMERESCO
 - Add topical papers from current events as appropriate
- **Slide 3**
 - Use this time to have each student introduce themselves, with a brief explanation of their background, current employment, and the reason they are taking the course.
 - Student should be encouraged to discuss their level of interest in the field of microgrids, any previous experience with microgrids, and the role microgrids play in their current or future employment.
- **Slide 4**
 - Provide a brief overview of the modules.
 - Describe the learning assessment process for the course.
 - Pretest
 - Check on learning for each module
 - Student research and presentation
 - End of course assessment
- **Slide 5**
 - Administer the online pre-test prior to the beginning of the course to gauge student familiarity and knowledgeability on the course.
- **Slide 6**
 - Use the terminal and enabling learning objectives to guide the delivery of the course.
 - Use the Course Development Document (CDD) as a guide to delivery of the course.
- **Slide 7**
 - Instructor should elicit comments and observations from students to discuss the meaning and value of the assigned reading
- **Slide 8**
 - Use the link to play this YouTube video for the class as an introduction to the topic of microgrids.
- **Slide 9**
 - This is a student led curriculum. To the maximum extent possible, the instructor should elicit student participation to cover these topics and guide the learning process.

- Use this slide as an outline to explore each of the objectives. Provide a detailed description of the topics to be covered in this module.
- Describe each listed objective in sufficient detail.

- Use student experience and knowledge to explore each objective.
- Instructor should rely heavily on student participation to thoroughly explore each objective using experience examples from students.
- **Slide 10**
 - Provide an overview of why the Department of Defense needs military standards for microgrids.
 - Explain the ongoing standards development process.
- **Slide 11**
 - Instructor should use a student participation process to ask 5-10 questions assessing knowledge acquired during this module.
- **Slide 12**
 - As an introduction to Module 2, provide a brief overview of each TLO/ELO for the next module.
- **Slide 13**
 - As an introduction to Module 2, provide a brief overview of each TLO/ELO for the next module.
- **Slide 14**
 - Wrap up.
 - Solicit student feedback on Module 1.

Module 2: Components of a Microgrid

- **Scope Statement:** This class will identify the components of a microgrid.
- **Terminal Learning Objective 1 (TLO1):**
Upon successful completion of the Class, learners will be able to identify the components of a microgrid.
- **Enabling Learning Objectives (ELO):**
 - List the components of a microgrid.
 - List the various power generation options.
 - Describe the relationships between the components.
- **Lesson Topics:**
 - Power Generation
 - Microgrid Controllers
 - Distribution
 - Loads
 - Storage
- **Instructional Strategy:** Tutorial, learning tasks and activities.
- **Assessment Strategy:** Knowledge review questions at the end of the class.
- **Instructor Slide Notes**
 - **Slide 1**

- **None**
- **Slide 2**
 - Provide an overview where we are in the course, taking time to “connect the dots” between the modules and the course progression.
 - Review Module 1 lesson topics.
 - Introduce Module 2.
 - There is one assigned reading which should be completed prior to starting Module 2:
 - Tactical Microgrid Standard: An Open Interoperability Standard for Advanced Power Architectures. Bozada powerpoint
 - Add topical papers from current events as appropriate
- **Slide 3**
 - Use the terminal and enabling learning objectives to guide the delivery of the course.
 - Use the Course Development Document (CDD) as a guide to delivery of the course.
- **Slide 4**
 - Use the terminal and enabling learning objectives to guide the delivery of the course.
 - Use the Course Development Document (CDD) as a guide to delivery of the course.
- **Slide 5**
 - Instructor should elicit comments and observations from students to discuss the meaning and value of the assigned reading.
- **Slide 6**
 - Use YouTube to show this video.
- **Slide 7**
 - This is a student led curriculum. To the maximum extent possible, the instructor should elicit student participation to cover these topics and guide the learning process.
 - Use this slide as an outline to explore each of the components. Provide a detailed description of the topics to be covered in this module.
 - Describe each listed component in sufficient detail.
 - Use student experience and knowledge to explore each component.
 - Instructor should rely heavily on student participation to thoroughly explore each component using experience examples from students.
- **Slide 8**
 - Instructor should use a student participation process to ask 5-10 questions assessing knowledge acquired during this module.
- **Slide 9**

- As an introduction to Module 3, provide a brief overview of each TLO/ELO for the next module.
- **Slide 10**

- As an introduction to Module 3, provide a brief overview of each TLO/ELO for the next module.
- **Slide 11**
 - Wrap up.
 - Solicit student feedback on Module 2.

Module 3: Microgrid Configurations

- **Scope Statement:** This class will identify the various configurations used the deployment of microgrids.
- **Terminal Learning Objective 1 (TLO1):**

Upon successful completion of the Class, learners will be able to describe the various configurations in the deployment of power generation.
- **Enabling Learning Objectives (ELO):**
 - List the potential configurations of microgrids.
 - Describe the advantages and disadvantages of using each configuration.
 - Describe the relationship of each configuration to the grid
- **Lesson Topics:**
 - Spot Generation
 - Consolidated Generation
 - Central Plant
 - Distributed Microgrid
 - Role of the grid
- **Instructional Strategy:** Tutorial, learning tasks and activities.
- **Assessment Strategy:** Knowledge review questions at the end of the class.
- **Instructor Slide Notes**
 - **Slide 1**
 - None
 - **Slide 2**
 - Provide an overview where we are in the course, taking time to “connect the dots” between the modules and the course progression.
 - Review Module 2 lesson topics.
 - Introduce Module 3.
 - There is one assigned reading which should be completed prior to starting Module 3:
 - Tactical Microgrid Standard: An Open Interoperability Standard for Advanced Power Architectures. Bozada powerpoint
 - Add topical papers from current events as appropriate
 - **Slide 3**
 - Use the terminal and enabling learning objectives to guide the delivery of the

- course.
- Use the Course Development Document (CDD) as a guide to delivery of the course.

- **Slide 4**
 - Use the terminal and enabling learning objectives to guide the delivery of the course.
 - Use the Course Development Document (CDD) as a guide to delivery of the course.
- **Slide 5**
 - Instructor should elicit comments and observations from students to discuss the meaning and value of the assigned reading.
- **Slide 6**
 - This is a student led curriculum. To the maximum extent possible, the instructor should elicit student participation to cover these topics and guide the learning process.
 - Use this slide as an outline to explore each of the components. Provide a detailed description of the topics to be covered in this module.
 - Identify each listed configuration in general terms.
- **Slide 7**
 - This is a student led learning activity.
 - Prior to class, use LMS to divide the students into 5 teams.
 - Each team must come to class prepared to make a presentation on their assigned configuration.
 - This content should be delivered mostly by the students with facilitation and guidance from the instructor.
- **Slide 8**
 - Instructor should use a student participation process to ask 5-10 questions assessing knowledge acquired during this module.
- **Slide 9**
 - As an introduction to Module 4, provide a brief overview of each TLO/ELO for the next module.
- **Slide 10**
 - As an introduction to Module 4, provide a brief overview of each TLO/ELO for the next module.
- **Slide 11**
 - Wrap up.
 - Solicit student feedback on Module 3.

Module 4: Advanced Capabilities

- **Scope Statement:** This Class will describe the advanced capabilities of future microgrids.
- **Terminal Learning Objective 1 (TLO1):**
Upon successful completion of the Class, learners will be able to describe the

advanced capabilities required for future microgrids.

- **Enabling Learning Objectives (ELO):**
 - Describe the benefits and meaning of interoperability.

- Describe modularity in microgrid deployment
 - Describe scalability in microgrid deployment
 - Describe resiliency in in microgrid deployment
 - Describe the importance of cybersecurity in microgrid deployment
- **Lesson Topics:**
 - Interoperability Requirements
 - Modularity Requirements
 - Scalability Requirements
 - Resiliency Requirements
 - Cybersecurity Requirements
- **Instructional Strategy:** Tutorial, learning tasks and activities.
- **Assessment Strategy:** Knowledge review questions at the end of the class.
- **Instructor Slide Notes:**
 - **Slide 1**
 - None
 - **Slide 2**
 - Provide an overview where we are in the course, taking time to “connect the dots” between the modules and the course progression.
 - Review Module 3 lesson topics.
 - Introduce Module 4.
 - There is one assigned reading which should be completed prior to starting Module 4:
 - The Next Generation Military Power Grid:. Bozada powerpoint
 - Add topical papers from current events as appropriate
 - **Slide 3**
 - Use the terminal and enabling learning objectives to guide the delivery of the course.
 - Use the Course Development Document (CDD) as a guide to delivery of the course.
 - **Slide 4**
 - Use the terminal and enabling learning objectives to guide the delivery of the course.
 - Use the Course Development Document (CDD) as a guide to delivery of the course.
 - **Slide 5**
 - Instructor should elicit comments and observations from students to discuss the meaning and value of the assigned reading
 - **Slide 6**

- Introduce the 5 advanced capabilities to be discussed in this module.
- **Slide 7**
 - This is a student led learning activity.
 - Prior to class, use LMS to assign the students to one of the 5 advanced capabilities.

- Each student must come to class prepared to make a presentation on their assigned configuration.
- Students should be encouraged to conduct independent research to support their presentation.
- This content should be delivered mostly by the students with facilitation and guidance from the instructor.
- **Slide 8**
 - Instructor should use a student participation process to ask 5-10 questions assessing knowledge acquired during this module.
- **Slide 9**
 - As an introduction to Module 5, provide a brief overview of each TLO/ELO for the next module.
- **Slide 10**
 - As an introduction to Module 5, provide a brief overview of each TLO/ELO for the next module.
- **Slide 11**
 - As an introduction to Module 5, provide a brief overview of each TLO/ELO for the next module.
- **Slide 12**
 - As an introduction to Module 5, provide a brief overview of each TLO/ELO for the next module.
- **Slide 13**
 - Wrap up.
 - Solicit student feedback on Module 4.

Module 5: Advanced Power Architecture

- **Scope Statement:** This Class will describe advanced power architecture for modern microgrid deployment.
- **Terminal Learning Objective 1 (TLO1):**

Upon successful completion of the class, learners will be able to describe the requirements for advance power architecture of modern microgrid deployment
- **Enabling Learning Objectives (ELO):**
 - Describe High Energy Power Requirements.
 - Describe Intelligent Management Systems.
 - Describe Fueled Generation.
 - Describe Renewable Energy Sources
 - Describe the Use of an Inverter/Converter
 - Describe Energy Storage and Conditioning
 - Describe Energy Distribution

- Describe Energy Loads in a Power System

- **Lesson Topics:**
 - High energy power requirements
 - Intelligent management systems
 - Fueled generation
 - Renewable energy sources
 - Inverters/Converters
 - Energy Storage
 - Energy conditioning
 - Energy distribution
 - Energy loads
- **Instructional Strategy:** Tutorial, learning tasks and activities.
- **Assessment Strategy:** Knowledge review questions at the end of the class.
- **Instructor Slide Notes:**
 - **Slide 1**
 - None
 - **Slide 2**
 - Provide an overview where we are in the course, taking time to “connect the dots” between the modules and the course progression.
 - Review Module 4 lesson topics.
 - Introduce Module 5.
 - There is one assigned reading which should be completed prior to starting Module 5:
 - The Next Generation Military Power Grid:. Bozada powerpoint
 - Add topical papers from current events as appropriate
 - **Slide 3**
 - Use the terminal and enabling learning objectives to guide the delivery of the course.
 - Use the Course Development Document (CDD) as a guide to delivery of the course.
 - **Slide 4**
 - Use the terminal and enabling learning objectives to guide the delivery of the course.
 - Use the Course Development Document (CDD) as a guide to delivery of the course.
 - **Slide 5**
 - Use the terminal and enabling learning objectives to guide the delivery of the course.
 - Use the Course Development Document (CDD) as a guide to delivery of the course.

- **Slide 6**
 - Use the terminal and enabling learning objectives to guide the delivery of the course.
 - Use the Course Development Document (CDD) as a guide to delivery of the course.
- **Slide 7**
 - Instructor should elicit comments and observations from students to discuss the meaning and value of the assigned reading.

- **Slide 8**
 - Introduce the 9 elements of advanced power architecture.
- **Slide 9**
 - Play this video using YouTube.
- **Slide 10**
 - This is a student led learning activity.
 - Prior to class, use LMS to assign the students to one of the 9 advanced power architecture topics.
 - Each student must come to class prepared to make a presentation on their assigned configuration.
 - Students should be encouraged to conduct independent research to support their presentation.
 - This content should be delivered mostly by the students with facilitation and guidance from the instructor.
- **Slide 11**
 - Instructor should use a student participation process to ask 5-10 questions assessing knowledge acquired during this module.
- **Slide 12**
 - As an introduction to Module 6, provide a brief overview of each TLO/ELO for the next module.
- **Slide 13**
 - As an introduction to Module 6, provide a brief overview of each TLO/ELO for the next module.
- **Slide 14**
 - As an introduction to Module 6, provide a brief overview of each TLO/ELO for the next module.
- **Slide 15**
 - Wrap up.
 - Solicit student feedback on Module 5.

Module 6: Power Generation Platforms

- **Scope Statement:** This Class will describe the types of power generation platforms that could be used in the deployment of microgrids.
- **Terminal Learning Objective 1 (TLO1):**

Upon successful completion of the Class, learners will be able to describe the types of power generation platforms that could be used in the deployment of microgrids.
- **Enabling Learning Objectives (ELO):**
 - Describe ground based power generation platforms.
 - Describe vehicle based power generation platforms.

- Describe sea based power generation platforms.

- Describe air based power generation platforms
 - Describe space based power generation platforms
- **Lesson Topics:**
 - Ground based power generation platforms
 - Vehicle based power generation platforms
 - Sea based power generation platforms
 - Air based power generation platforms
 - Space based power generation platforms
- **Instructional Strategy:** Tutorial, learning tasks and activities.
- **Assessment Strategy:** Knowledge review questions at the end of the class.
- **Instructor Slide Notes:**
 - **Slide 1**
 - **None**
 - **Slide 2**
 - Provide an overview where we are in the course, taking time to “connect the dots” between the modules and the course progression.
 - Review Module 5 lesson topics.
 - Introduce Module 6.
 - There is one assigned reading which should be completed prior to starting Module 6:
 - The Next Generation Military Power Grid:. Bozada powerpoint
 - Add topical papers from current events as appropriate
 - **Slide 3**
 - Use the terminal and enabling learning objectives to guide the delivery of the course.
 - Use the Course Development Document (CDD) as a guide to delivery of the course.
 - **Slide 4**
 - Use the terminal and enabling learning objectives to guide the delivery of the course.
 - Use the Course Development Document (CDD) as a guide to delivery of the course.
 - **Slide 5**
 - Use the terminal and enabling learning objectives to guide the delivery of the course.
 - Use the Course Development Document (CDD) as a guide to delivery of the course.
 - **Slide 6**
 - Instructor should elicit comments and observations from students to

discuss the meaning and value of the assigned reading.

- **Slide 7**
 - Introduce the 5 power generation platforms to be discussed.
- **Slide 8**
 - This is a student led learning activity.

- Prior to class, use LMS to assign the students to one of the 5 power generation platforms.
- Each student must come to class prepared to make a presentation on their assigned configuration.
- Students should be encouraged to conduct independent research to support their presentation.
- This content should be delivered mostly by the students with facilitation and guidance from the instructor.
- **Slide 9**
 - Instructor should use a student participation process to ask 5-10 questions assessing knowledge acquired during this module.
- **Slide 10**
 - As an introduction to Module 7, provide a brief overview of each TLO/ELO for the next module.
- **Slide 11**
 - As an introduction to Module 7, provide a brief overview of each TLO/ELO for the next module.
- **Slide 12**
 - Wrap up.
 - Solicit student feedback on Module 6.

Module 7: Civilian Applications

- **Scope Statement:** This Class will describe the civilian applications of microgrids.
- **Terminal Learning Objective 1 (TLO1):**

Upon successful completion of the Class, learners will be able to describe civilian applications of microgrids.
- **Enabling Learning Objectives (ELO):**
 - Describe civilian sector uses of microgrids.
 - Describe the scalable capabilities of microgrids
- **Lesson Topics:**
 - Civilian sector uses of microgrids for remote/isolated areas, humanitarian relief, and disaster response
 - Scalable aspects of civilian applications
- **Instructional Strategy:** Tutorial, learning tasks and activities.
- **Assessment Strategy:** Knowledge review questions at the end of the class.
- **Instructor Slide Notes:**
 - **Slide 1**
 - None
 - **Slide 2**

- Provide an overview where we are in the course, taking time to “connect the dots” between the modules and the course progression.
- Review Module 6 lesson topics.
- Introduce Module 7.
- There are three assigned reading which should be completed prior to starting Module 7:
 - The Genius of Microgrids: Paper in Higher Education by Siemens
 - Tactical Microgrid Standard: An Open Interoperability Standard for Advanced Power Architectures. Bozada powerpoint
 - BEYOND THE FENCE LINE: Association of Defense Communities powerpoint
- Add topical papers from current events as appropriate
- **Slide 3**
 - Use the terminal and enabling learning objectives to guide the delivery of the course.
 - Use the Course Development Document (CDD) as a guide to delivery of the course.
- **Slide 4**
 - Use the terminal and enabling learning objectives to guide the delivery of the course.
 - Use the Course Development Document (CDD) as a guide to delivery of the course.
- **Slide 5**
 - Instructor should elicit comments and observations from students to discuss the meaning and value of the assigned reading.
- **Slide 6**
 - This is a student led curriculum. To the maximum extent possible, the instructor should elicit student participation to cover these topics and guide the learning process.
 - Use this slide as an outline to explore each of the components. Provide a detailed description of the topics to be covered in this module.
 - Describe each listed application in sufficient detail.
 - Use student experience and knowledge to explore each application.
 - Instructor should rely heavily on student participation to thoroughly explore each component using experience examples from students.
- **Slide 7**
 - Use YouTube to show these videos.
- **Slide 8**
 - Instructor should use a student participation process to ask 5-10 questions assessing knowledge acquired during this module.

- **Slide 9**
 - As an introduction to Module 8, provide a brief overview of each TLO/ELO for the next module.
- **Slide 10**

- As an introduction to Module 8, provide a brief overview of each TLO/ELO for the next module.
- **Slide 11**
 - As an introduction to Module 8, provide a brief overview of each TLO/ELO for the next module.
- **Slide 12**
 - Wrap up.
 - Solicit student feedback on Module 7.

Module 8: Role of Communications and Automation

- **Scope Statement:** This Class will describe the role of communications and automation in the deployment of microgrids.
- **Terminal Learning Objective 1 (TLO1):**

Upon successful completion of the Class, learners will be able to describe the role of communications and automation in the deployment of microgrids.
- **Enabling Learning Objectives (ELO):**
 - Describe the role of the microgrid systems manager.
 - Describe the role of the microgrid controller
 - Describe the role of the microgrid control loops
 - Describe the role data distribution service
 - Describe the importance of cybersecurity
- **Lesson Topics:**
 - Microgrid systems manager
 - Microgrid controller
 - Microgrid control loops
 - Data Distribution Services (DDS)
 - Cybersecurity
- **Instructional Strategy:** Tutorial, learning tasks and activities.
- **Assessment Strategy:** Knowledge review questions at the end of the class.
- **Instructor Slide Notes:**
 - **Slide 1**
 - None
 - **Slide 2**
 - Provide an overview where we are in the course, taking time to “connect the dots” between the modules and the course progression.
 - Review Module 7 lesson topics.
 - Introduce Module 8.
 - There is one assigned reading which should be completed prior to starting Module 8:

- Tactical Microgrid Standard: An Open Interoperability Standard for Advanced Power Architectures: Intro for IEEE 2030.4. Bozada Powerpoint
- Add topical papers from current events as appropriate
- **Slide 3**
 - Use the terminal and enabling learning objectives to guide the delivery of the course.
 - Use the Course Development Document (CDD) as a guide to delivery of the course.
- **Slide 4**
 - Use the terminal and enabling learning objectives to guide the delivery of the course.
 - Use the Course Development Document (CDD) as a guide to delivery of the course.
- **Slide 5**
 - Use the terminal and enabling learning objectives to guide the delivery of the course.
 - Use the Course Development Document (CDD) as a guide to delivery of the course.
- **Slide 6**
 - Instructor should elicit comments and observations from students to discuss the meaning and value of the assigned reading.
- **Slide 7**
 - This is a student led curriculum. To the maximum extent possible, the instructor should elicit student participation to cover these topics and guide the learning process.
 - Use this slide as an outline to explore each of the objectives. Provide a detailed description of the topics to be covered in this module.
 - Describe each listed topics in sufficient detail.
 - Use student experience and knowledge to explore each objective.
 - Use follow on slides as a discussion starter
 - Instructor should rely heavily on student participation to thoroughly explore each objective using experience examples from students.
- **Slide 8**
 - This is a student led curriculum. To the maximum extent possible, the instructor should elicit student participation to cover these topics and guide the learning process.
 - Use this slide as an outline to explore each of the objectives. Provide a detailed description of the topics to be covered in this module.
 - Describe each listed topics in sufficient detail.
 - Use student experience and knowledge to explore each objective.

- Use follow on slides as a discussion starter
- Instructor should rely heavily on student participation to thoroughly explore each objective using experience examples from students.
- **Slide 9**

- This is a student led curriculum. To the maximum extent possible, the instructor should elicit student participation to cover these topics and guide the learning process.
- Use this slide as an outline to explore each of the objectives. Provide a detailed description of the topics to be covered in this module.
- Describe each listed topics in sufficient detail.
- Use student experience and knowledge to explore each objective.
- Use follow on slides as a discussion starter
- Instructor should rely heavily on student participation to thoroughly explore each objective using experience examples from students.
- **Slide 10**
 - This is a student led curriculum. To the maximum extent possible, the instructor should elicit student participation to cover these topics and guide the learning process.
 - Use this slide as an outline to explore each of the objectives. Provide a detailed description of the topics to be covered in this module.
 - Describe each listed topics in sufficient detail.
 - Use student experience and knowledge to explore each objective.
 - Use follow on slides as a discussion starter
 - Instructor should rely heavily on student participation to thoroughly explore each objective using experience examples from students.
- **Slide 11**
 - This is a student led curriculum. To the maximum extent possible, the instructor should elicit student participation to cover these topics and guide the learning process.
 - Use this slide as an outline to explore each of the objectives. Provide a detailed description of the topics to be covered in this module.
 - Describe each listed topics in sufficient detail.
 - Use student experience and knowledge to explore each objective.
 - Use follow on slides as a discussion starter
 - Instructor should rely heavily on student participation to thoroughly explore each objective using experience examples from students.
- **Slide 12**
 - Instructor should use a student participation process to ask 5-10 questions assessing knowledge acquired during this module.
- **Slide 13**
 - As an introduction to Module 9, provide a brief overview of each TLO/ELO for the next module.
- **Slide 14**

- As an introduction to Module 9, provide a brief overview of each TLO/ELO for the next module.
- **Slide 15**
 - As an introduction to Module 9, provide a brief overview of each TLO/ELO for the next module.
- **Slide 16**
 - As an introduction to Module 11, provide a brief overview of each TLO/ELO for the student presentations module.
- **Slide 17**
 - Introduce the student project presentation as an assessed activity
 - Outline requirements for student success.
 - Each student conducts independent research on a topic of their choice related to microgrids.
 - Topic must be approved by the instructor.
 - Students should prepare a 5-10 page paper (single spaced) exploring the topic of their choice.
 - Students will give a ten-minute presentation on their paper.
 - Papers will be presented live (virtually) during Module 11.
- **Slide 18**
 - Wrap up.
 - Solicit student feedback on Module 8.

Module 9: Risk Posed by Cyber Threats

- **Scope Statement:** This Class will describe the risks posed by cyber threats to the deployment of microgrids.
- **Terminal Learning Objective 1 (TLO1):**

Upon successful completion of the Class, learners will be able to describe the risks posed by cyber threats to the deployment of microgrids.
- **Enabling Learning Objectives (ELO):**
 - Describe the cyber security life cycle.
 - Describe the types of cyber security attacks
 - Describe malware injection potential
 - Describe the consequences of a cyber-security breach
- **Lesson Topics:**
 - Cyber security life cycle
 - Cyber security attacks
 - Malware injection potential
 - Consequences of cybersecurity breach
- **Instructional Strategy:** Tutorial, learning tasks and activities.

- **Assessment Strategy:** Knowledge review questions at the end of the class.
- **Instructor Slide Notes:**
 - **Slide 1**
 - **None**
 - **Slide 2**
 - Provide an overview where we are in the course, taking time to “connect the dots” between the modules and the course progression.
 - Review Module 8 lesson topics.
 - Introduce Module 9.
 - There is one assigned reading which should be completed prior to starting Module 9:
 - Microgrid Cybersecurity: Protecting and Building the Grid of the Future: S&C Electric Paper
 - Add topical papers from current events as appropriate
 - **Slide 3**
 - Use the terminal and enabling learning objectives to guide the delivery of the course.
 - Use the Course Development Document (CDD) as a guide to delivery of the course.
 - **Slide 4**
 - Use the terminal and enabling learning objectives to guide the delivery of the course.
 - Use the Course Development Document (CDD) as a guide to delivery of the course.
 - **Slide 5**
 - Use the terminal and enabling learning objectives to guide the delivery of the course.
 - Use the Course Development Document (CDD) as a guide to delivery of the course.
 - **Slide 6**
 - Instructor should elicit comments and observations from students to discuss the meaning and value of the assigned reading.
 - **Slide 7**
 - This is a student led curriculum. To the maximum extent possible, the instructor should elicit student participation to cover these topics and guide the learning process.
 - Use this slide as an outline to explore each of the objectives. Provide a detailed description of the topics to be covered in this module.
 - Describe each listed risk in sufficient detail.

- Use student experience and knowledge to explore each objective.
- Instructor should rely heavily on student participation to thoroughly explore each objective using experience examples from students.
- **Slide 8**
 - This is a student led curriculum. To the maximum extent possible, the instructor should elicit student participation to cover these topics and guide the learning process.

- Use this slide as an outline to explore each of the objectives. Provide a detailed description of the topics to be covered in this module.
- Describe each listed objective in sufficient detail.
- Use student experience and knowledge to explore each objective.
- Instructor should rely heavily on student participation to thoroughly explore each objective using experience examples from students.
- **Slide 9**
 - This is a student led curriculum. To the maximum extent possible, the instructor should elicit student participation to cover these topics and guide the learning process.
 - Use this slide as an outline to explore each of the objectives. Provide a detailed description of the topics to be covered in this module.
 - Describe each listed risk in sufficient detail.
 - Use student experience and knowledge to explore each objective.
 - Instructor should rely heavily on student participation to thoroughly explore each objective using experience examples from students.
- **Slide 10**
 - This is a student led curriculum. To the maximum extent possible, the instructor should elicit student participation to cover these topics and guide the learning process.
 - Use this slide as an outline to explore each of the objectives. Provide a detailed description of the topics to be covered in this module.
 - Describe each listed risk in sufficient detail.
 - Use student experience and knowledge to explore each objective.
 - Instructor should rely heavily on student participation to thoroughly explore each objective using experience examples from students.
- **Slide 11**
 - This is a student led curriculum. To the maximum extent possible, the instructor should elicit student participation to cover these topics and guide the learning process.
 - Use this slide as an outline to explore each of the objectives. Provide a detailed description of the topics to be covered in this module.
 - Describe each listed risk in sufficient detail.
 - Use student experience and knowledge to explore each objective.
 - Instructor should rely heavily on student participation to thoroughly explore each objective using experience examples from students.
- **Slide 12**
 - Instructor should use a student participation process to ask 5-10 questions assessing knowledge acquired during this module.
- **Slide 13**

- As an introduction to Module 10, provide a brief overview of each TLO/ELO for the next module.
- **Slide 14**
 - As an introduction to Module 10, provide a brief overview of each TLO/ELO for the next module.
- **Slide 15**
 - Wrap up.
 - Solicit student feedback on Module 9.

Module 10: Countermeasures to Reduce Cyber Risks

- **Scope Statement:** This Class will describe countermeasures to reduce the risk of cyber- attacks on microgrids.
- **Terminal Learning Objective 1 (TLO1):**

Upon successful completion of the Class, learners will be able to describe countermeasures to reduce the risk of cyber-attacks on microgrids.
- **Enabling Learning Objectives (ELO):**
 - Describe system operator controls.
 - Describe process controls.
 - Describe the concept of restoration of control.
- **Lesson Topics:**
 - System operator controls
 - Process controls
 - Restoration of control
 - DECIDE Platform
- **Instructional Strategy:** Tutorial, learning tasks and activities.
- **Assessment Strategy:** Knowledge review questions at the end of the class.
- **Instructor Slide Notes:**
 - **Slide 1**
 - None
 - **Slide 2**
 - Provide an overview where we are in the course, taking time to “connect the dots” between the modules and the course progression.
 - Review Module 9 lesson topics.
 - Introduce Module 10.
 - There is one assigned reading which should be completed prior to starting Module 10:
 - Practical Cybersecurity for Protection and Control System Communications Networks. SEL paper
 - Add topical papers from current events as appropriate.

- **Slide 3**
 - Use the terminal and enabling learning objectives to guide the delivery of the course.
 - Use the Course Development Document (CDD) as a guide to delivery of the course.
- **Slide 4**
 - Use the terminal and enabling learning objectives to guide the delivery of the course.
 - Use the Course Development Document (CDD) as a guide to delivery of the course.
- **Slide 5**
 - Instructor should elicit comments and observations from students to discuss the meaning and value of the assigned reading.
- **Slide 6**
 - Introduce the three types of controls
- **Slide 7**
 - This is a student led learning activity.
 - Prior to class, use LMS to divide the students into 3 teams.
 - Each team must come to class prepared to make a presentation on their assigned control type.
 - This content should be delivered mostly by the students with facilitation and guidance from the instructor.
- **Slide 8**
 - Instructor should use a student participation process to ask 5-10 questions assessing knowledge acquired during this module.
- **Slide 9**
 - As an introduction to Module 11, provide a brief overview of each TLO/ELO for the next module.
 - This is the last opportunity to advise students on their papers and presentations
 - Papers and presentations are due at the beginning of Module 11.
- **Slide 10**
 - As an introduction to Module 11, provide a brief overview of each TLO/ELO for the next module.
 - This is the last opportunity to advise students on their papers and presentations
 - Papers and presentations are due at the beginning of Module 11.
- **Slide 11**
 - Wrap up.

- Solicit student feedback on Module 10.

Module 11: Project Presentations

- **Scope Statement:** This class will use student led instruction based on research to present course projects.
- **Terminal Learning Objective 1 (TLO1):**

Upon successful completion of the class, learners will be able to present independent research on a topic of their choice relating to microgrids.

- **Enabling Learning Objectives (ELO):**
 - Conduct research on a topic of the student's choice.
 - Present research to the class
 - Convey key concepts relating topic to microgrid topics
- **Lesson Topics:**
 - Independent research and presentation
- **Instructional Strategy:** Student presentations.
- **Assessment Strategy:** Questions from instructors and students at the conclusion of each presentation.
- **Instructor Slide Notes:**
 - **Slide 1**
 - None
 - **Slide 2**
 - Provide an overview where we are in the course, taking time to “connect the dots” between the modules and the course progression.
 - Review Module 10 lesson topics.
 - Introduce Module 11.
 - There are no assigned readings for this module.
 - **Slide 3**
 - Wrap up.
 - Solicit student feedback on Module 11.

Module 12: Course Review

- **Scope Statement:** This class will use student led reviews of course content in preparation for the final assessment.
- **Terminal Learning Objective 1 (TLO1):**

Upon successful completion of the class, learners will have a detailed understanding of the course content.
- **Enabling Learning Objectives (ELO):**
 - Students choose topics to review the final assessment content
- **Lesson Topics:**
 - Course review
- **Instructional Strategy:** Student led reviews of course content.
- **Assessment Strategy:** None.
- **Instructor Slide Notes:**
 - **Slide 1**
 - None

- **Slide 2**
 - This module can be used for overflow if not all students have completed their presentations.
 - Review the course material in student led discussions. Use questions from each module's knowledge review.
 - Administer final assessment.
- **Slide 3**
 - Student feedback on course content and delivery
 - Course complete.

Estimated Contact Time

Objectives of a Microgrid

- Objective Screens (min.): 1 (1 min)
- Content Screens (min.): 12 (11 min/screen)
- Knowledge Check (KC) Screens: 1 (10 min)
- Practical Exercises (PE) Screens (min.): 0 (1 min)
- Total Screens/Minutes: 14 (100 min)

Components of a Microgrid

- Objective Screens (min.): 2 (2 min)
- Content Screens (min.): 8 (11 min/screen)
- Knowledge Check (KC): 1 (10 min)
- Practical Exercises (PE) Screens (min.): 0 (1 min)
- Total Screens/Minutes: 11 (100 min)

Microgrid Configurations

- Objective Screens (min.): 2 (2 min)
- Content Screens (min.): 7 (5 min/screen)
- Knowledge Check (KC) Screens: 1 (10 min)
- Practical Exercises (PE) Screens (min.): 1 (50 min)
- Total Screens/Minutes: 11 (100 min)

Advanced Capabilities

- Objective Screens (min.): 2 (1 min)
- Content Screens (min.): 9 (4 min/screen)
- Knowledge Check (KC) Screens: 1 (10 min)
- Practical Exercises (PE) Screens (min.): 1 (50 min)
- Total Screens/Minutes: 13 (100 min)

Advanced Power Architecture

- Objective Screens (min.): 4 (4 min)
- Content Screens (min.): 9 (4 min/screen)
- Knowledge Check (KC) Screens: 1 (10 min)
- Practical Exercises (PE) Screens (min.): 1 (50 min)
- Total Screens/Minutes: 15 (100 min)

Power Generation Platforms

- Objective Screens (min.): 3 (3 min)
- Content Screens (min.): 7 (5 min/screen)

- Knowledge Check (KC) Screens: 1 (10 min)
- Practical Exercises (PE) Screens (min.): 1 (50 min)
- Total Screens/Minutes: 12 (100 min)

Civilian Applications

- Objective Screens (min.): 2 (2 min)
- Content Screens (min.): 9 (10 min/screen)
- Knowledge Check (KC) Screens: 1 (10 min)
- Practical Exercises (PE) Screens (min.): 0 (1 min)
- Total Screens/Minutes: 12 (100 min)

Role of Communications and Automation

- Objective Screens (min.): 3 (3 min)
- Content Screens (min.): 6 (1.75 min)
- Knowledge Check (KC) Screens: 1 (10 min)
- Practical Exercises (PE) Screens (min.): 0 (1 min)
- Total Screens/Minutes: 18 (100 min)

Risk Posed by Cyber Threats

- Objective Screens (min.): 3 (3 min)
- Content Screens (min.): 11 (8 min/screen)
- Knowledge Check (KC) Screens: 1 (10 min)
- Practical Exercises (PE) Screens (min.): 0 (1 min)
- Total Screens/Minutes: 15 (100 min)

Countermeasures to Reduce Cyber Risks

- Objective Screens (min.): 2 (2 min)
- Content Screens (min.): 7 (5 min/screen)
- Knowledge Check (KC) Screens: 1 (10 min)
- Practical Exercises (PE) Screens (min.): 1 (50 min)
- Total Screens/Minutes: 11 (100 min)

Project Presentations (assume 12-16 students)

- Objective Screens (min.): 1 (4 min)
- Content Screens (min.): 90 (1 min/screen)
- Class review of presentations (min.): N/A (10 mins)
- Total Screens/Minutes: 91 (100 min)

Final Assessment (1 Hour)

Enclosure 11: Industrial Control Systems (ICS) – Course Development Documents



CDRL - Final Technical Report May 2021
W9132T20C0005
Enclosure 11

Course Description

Overview

This 6-hour, hybrid delivery course is comprised of three, two-hour classes and introduces students to the fundamentals of industrial control systems (ICS) in smart grids and energy systems, including their function in a microgrid system, cybersecurity threats and risks, and cybersecurity resilience and recovery. This course will introduce mid-level professionals on military installations (deputy garrison commanders, directors of public works, energy managers), as well as military personnel in tactical formations (battalion and brigade executive officers, communications officers, engineer officers) to the fundamentals of industrial control systems, the role of telecommunications and automation in the operation of industrial control systems, the risks of cyber threats to industrial control systems, and cyber resilience and recovery as they pertain to industrial control systems. The course focuses on the basic skills and knowledge needed to understand industrial control systems and their role in energy generation and distribution systems.

The key course topics include:

- Fundamentals of industrial control systems.
- Cybersecurity threats and risks to industrial control systems.
- Cybersecurity resilience and recovery for industrial control systems.

Scope

This introductory course is intended to help prepare learners for the technical challenges associated with industrial control systems in a microgrid. This course introduces the basic skills learners will need to begin mastering the use of industrial control systems to improve energy resiliency and meet the demands of energy consumers, whether in a tactical or garrison environment. These skills range from the gaining an understanding of the fundamentals of industrial control systems to understanding and evaluating cyber threats to industrial control systems. The content covered in this course provides learners with the knowledge, skills and abilities needed to successfully learn how to design, implement, operate, and protect a microgrid system.

Target Audience

The target audience for this course includes civilian and military personnel technically proficient mid-level management in the public sector. The audience will be comprised of individual participants, as well as organizational divisions or a combination of both. Participants include, but are not limited to power generation and information technology personnel from the following entities:

- Installation management – The Deputy to the Garrison Commander, Director of Public Works, Energy Manager, Director of Plans, Training, Mobilization, and

Security, Director of Public Safety, Director of Logistics, Director of Information Management, Director of Contracting, local energy suppliers, and local community government leadership (to include emergency management organizations).

- Organizational team – Deployable uniformed personnel including the unit Executive Officer, Operations Officer, Supply Officer, Communications Officer, Engineer Officer (if assigned) and associated senior Non-Commissioned Officers. Supporting personnel include generation mechanics, communications personnel, Civil Affairs specialists, Special Operations Forces (SOF) engineering personnel, and other personnel as designated.

This course is appropriate for individuals working for federal, state, local, tribal, and territorial organizations, whose responsibilities include the generation of power for discreet periods of time in austere and/or emergency conditions to sustain essential services.

Prerequisites

Participants in this course should be currently serving in an installation support, energy management, or tactical military unit with responsibility for power generation and maintenance, as well as information technology personnel in a middle management position. Although there are no prerequisites for this course, it is expected that participants have a fundamental understanding of power generation and system controls.

Required Materials

Computer with an Internet connection and up-to-date web browser.

Testing and Assessment

A pre-assessment will be administered prior to starting the course. Each of the three modules will contain Knowledge Checks (Formative). A post-assessment (Summative) will be administered upon completion of all course classes. A passing score of 80% will be required for successful completion of the course.

Reference List

- Cybersecurity Resiliency in Industrial Control Systems, CTG18 Instructor Guide, FEMA, October 2020.
- Guide to Industrial Control Systems (ICS) Security, NIST Special Publication 800-82, Revision 2, U.S. Department of Commerce, National Institute of Standards and Technology, May 2015

- Energy Sector Asset Management for Electric Utilities, Oil & Gas Industry, NIST Special Publication 1800-23, U.S. Department of Commerce, National Institute of Standards and Technology, May 2020
- Roadmap to Secure Control Systems in the Energy Sector, Energetics, Incorporated, January 2006
- Recommended Cybersecurity Practices for Industrial Control Systems, 3rd Annual national Cybersecurity Conference, Cybersecurity & Infrastructure Security Agency, 2019

Evaluation Strategy

Level 1 evaluation is assessed with the courseware evaluation form presented at the conclusion of the course. Level 2 evaluation is assessed through the comprehensive examination at the conclusion of the course. (Based on Kirkpatrick model)

Technical Requirements

Participants will require a computer with an Internet connection and a web browser that supports the delivery of multimedia content. Participants will require speakers or headphones for audio and video material.

Course Structure/Content Outline

Course Introduction and Objectives

- Course overview
- Course objectives
- Pre-assessment

Fundamentals of Industrial Control Systems

- Promote Efficient Use of Energy Resources
- Improved Fuel Efficiency
- Improve Resiliency Through Redundancy
- Simplicity
- Conditioning of Power to Improve Performance
- Seamless photovoltaic (PV) and battery integration.
- Use of Smart Technology to Improve Reliability and Efficiency
- Internet of Things (IoT) and ICS

Cybersecurity Threats and Risks to Industrial Control Systems

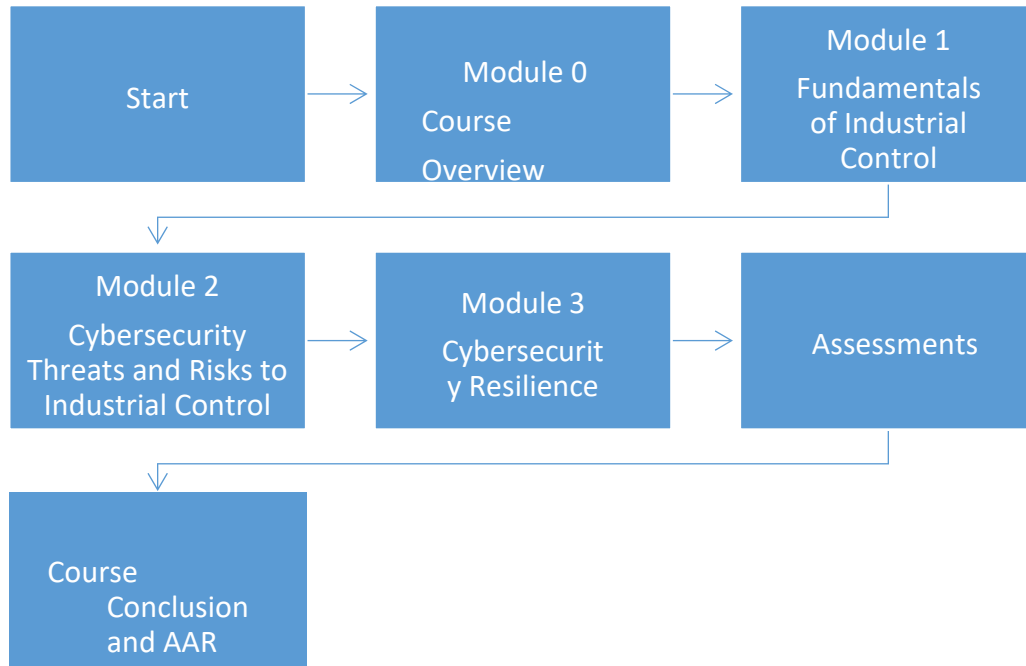
- Technical Vulnerabilities
 - Antiquated Hardware and Software
 - Patching
 - Backdoors
 - Smart Meters
 - Connectivity
 - Wireless
- Human Vulnerabilities
 - Nation State Actors
 - Remote Access
 - Vendors & Others Interacting with ICS
 - Insider Threats
 - Human Error, including Alarm Fatigue
 - Architecture
 - Cybercriminals
- Potential Impacts
 - Denial of Service
 - Financial Loss
 - Threats to Life & Safety
 - Litigation and Liability

- Damage to Equipment and Systems
- Loss of Customer Confidence/Base

Cybersecurity Resilience

- Mitigating Threats
 - Remote Access
 - Unique Logins and Passwords
 - Two-Factor Authentication
 - Local Administrators
 - Change Management
 - Backups
- Critical Infrastructure Assessments
 - Phishing Campaign Assessments (PCA)
 - Risk Vulnerability Assessments (RVA)
 - Validated Architecture Design Reviews (VADR)
 - Cyber Hygiene (CyHy)

Course Progression



Course Development Matrix

Module 0: Introduction, Course Objectives and Pre-Assessment

- **Scope Statement:** This lesson will prepare learners for course navigation and introduce course objectives. Learners will complete a pre-assessment prior to starting the course.
- **Terminal Learning Objective (TLO):**
 - None
- **Enabling Learning Objectives (ELO):**
 - None
- **Lesson Topics:**
 - Navigation
 - Pre-Assessment
- **Instructional Strategy:** Tutorial.
- **Assessment Strategy:** None

Module 1: Fundamentals of Industrial Control Systems in Smart Grids and Energy Systems

- **Scope Statement:** This class will describe the purpose and function of Industrial Control Systems in smart grids and energy systems.
- **Terminal Learning Objective 1 (TLO1):**

Upon successful completion of the class, learners will be able to describe the fundamentals of Industrial Control Systems.
- **Enabling Learning Objectives (ELO):**
 - Identify and describe eight different objectives of industrial control systems.
 - Identify and describe the role industrial control systems serve in the operation of microgrids and energy generation and distribution systems.
- **Lesson Topics:**
 - Promote Efficient Use of Energy Resources
 - Improved Fuel Efficiency
 - Improve Resiliency Through Redundancy
 - Simplicity
 - Conditioning of Power to Improve Performance
 - Seamless photovoltaic (PV) and battery integration.
 - Use of Smart Technology to Improve Reliability and Efficiency
 - Internet of Things (IoT) and ICS
- **Instructional Strategy:** Tutorial, learning tasks and activities.
- **Assessment Strategy:** Knowledge review questions at the end of the class

- **Instructor Slide Notes:**
 - **Slide 1**

- None
- **Slide 2**
 - Provide a detailed overview of the course, taking time to “connect the dots” between the modules and the course progression.
 - Introduce Module 1.
 - There is one assigned reading which should have been completed prior to starting Module 1.
 - NIST SPECIAL PUBLICATION 1800-23Energy Sector Asset Management For Electric Utilities, Oil & Gas Industry
 - Add topical papers from current events as appropriate
- **Slide 3**
 - Use this time to have each student introduce themselves, with a brief explanation of their background, current employment, and the reason they are taking the course.
 - Student should be encouraged to discuss their level of interest in the field of industrial control systems, any previous experience with industrial control systems, and the role industrial control systems play in their current or future employment.
- **Slide 4**
 - Provide a brief overview of the modules.
 - Describe the learning assessment process for the course.
 - Pretest
 - Check on learning for each module
 - Student research and presentation
 - End of course assessment.
- **Slide 5**
 - Administer the online pre-test prior to the beginning of the course to gauge student familiarity and knowledgeability on the course.
- **Slide 6**
 - Use the terminal and enabling learning objectives to guide the delivery of the course.
 - Use the Course Development Document (CDD) as a guide to delivery of the course.
- **Slide 7**
 - Instructor should elicit comments and observations from students to discuss the meaning and value of the assigned reading
- **Slide 8**
 - Use the link to play this YouTube video for the class as an introduction to the topic of industrial control systems.

- **Slide 9**

- This is a student led curriculum. To the maximum extent possible, the instructor should elicit student participation to cover these topics and guide the learning process.

- Use this slide as an outline to explore each of the objectives. Provide a detailed description of the topics to be covered in this module.
- Describe each listed objective in sufficient detail.
- Use student experience and knowledge to explore each objective.
- Instructor should rely heavily on student participation to thoroughly explore each objective using experience examples from students.
- **Slide 10**
 - This is a student led curriculum. To the maximum extent possible, the instructor should elicit student participation to cover these topics and guide the learning process.
 - Use this slide as an outline to explore each of the objectives. Provide a detailed description of the topics to be covered in this module.
 - Describe each listed objective in sufficient detail.
 - Use student experience and knowledge to explore each objective.
 - Instructor should rely heavily on student participation to thoroughly explore each objective using experience examples from students.
- **Slide 11**
 - Instructor should use a student participation process to ask four questions assessing knowledge acquired during this module.
- **Slide 12**
 - As an introduction to Module 2, provide a brief overview of each TLO/ELO for the next module.
- **Slide 13**
 - As an introduction to Module 2, provide a brief overview of each lesson topics and teaching strategy for the next module.
- **Slide 14**
 - Wrap up.
 - Solicit student feedback on Module 1.

Module 2: Cybersecurity Threats and Risks to Industrial Control Systems

- **Scope Statement:** This class will identify the components of a microgrid.
- **Terminal Learning Objective 1 (TLO1):**

Upon successful completion of the Class, learners will be able to identify the cybersecurity threats and risks to ICS.
- **Enabling Learning Objectives (ELO):**
 - List the technical vulnerabilities of ICS.
 - List the human vulnerabilities to ICS.
 - List the potential impacts of cybersecurity attacks on ICS.
- **Lesson Topics:**

- Technical Vulnerabilities
 - Antiquated Hardware and Software
 - Patching
 - Backdoors
 - Smart Meters
 - Connectivity
 - Wireless
- Human Vulnerabilities
 - Nation State Actors
 - Remote Access
 - Vendors & Others Interacting with ICS
 - Insider Threats
 - Human Error, including Alarm Fatigue
 - Architecture
 - Cybercriminals
- Potential Impacts
 - Denial of Service
 - Financial Loss
 - Threats to Life & Safety
 - Litigation and Liability
 - Damage to Equipment and Systems
 - Loss of Customer Confidence/Base
- **Instructional Strategy:** Tutorial, learning tasks and activities.
- **Assessment Strategy:** Knowledge review questions at the end of the class.
- **Instructor Slide Notes**
 - **Slide 1**
 - None
 - **Slide 2**
 - Provide an overview where we are in the course, taking time to “connect the dots” between the modules and the course progression.
 - Review Module 1 lesson topics.
 - Introduce Module 2.
 - There are four assigned reading which should be completed prior to starting Module 2:
 - CISA, Cybersecurity Practices for Industrial Control Systems
 - Department of Homeland Security, Recommended Practice: Improving Industrial Control System Cybersecurity with Defense-in-Depth Strategies, Industrial Control Systems Cyber Emergency Response

Team, September 2016

- NIST Special Publication 800-82, Revision 2, Guide to Industrial Control Systems (ICS) Security
- Roadmap to Secure Control Systems in the Energy Sector, US Department of Energy, 2006
- Add topical papers from current events as appropriate
- **Slide 3**
 - Use the terminal and enabling learning objectives to guide the delivery of the course.
 - Use the Course Development Document (CDD) as a guide to delivery of the course.
- **Slide 4**
 - Use the terminal and enabling learning objectives to guide the delivery of the course.
 - Use the Course Development Document (CDD) as a guide to delivery of the course.
- **Slide 5**
 - Instructor should elicit comments and observations from students to discuss the meaning and value of the assigned reading.
- **Slide 6**
 - Use YouTube to show this video.
- **Slide 7**
 - This is a student led curriculum. To the maximum extent possible, the instructor should elicit student participation to cover these topics and guide the learning process.
 - Use this slide as an outline to explore each of the components. Provide a detailed description of the topics to be covered in this module.
 - Describe each listed component in sufficient detail.
 - Use student experience and knowledge to explore each component.
 - Instructor should rely heavily on student participation to thoroughly explore each component using experience examples from students.
- **Slide 8**
 - This is a student led curriculum. To the maximum extent possible, the instructor should elicit student participation to cover these topics and guide the learning process.
 - Use this slide as an outline to explore each of the components. Provide a detailed description of the topics to be covered in this module.
 - Describe each listed component in sufficient detail.
 - Use student experience and knowledge to explore each component.
 - Instructor should rely heavily on student participation to thoroughly

- explore each component using experience examples from students.
- **Slide 9**
 - This is a student led curriculum. To the maximum extent possible, the instructor should elicit student participation to cover these topics and guide the learning process.

- Use this slide as an outline to explore each of the components. Provide a detailed description of the topics to be covered in this module.
- Describe each listed component in sufficient detail.
- Use student experience and knowledge to explore each component.
- Instructor should rely heavily on student participation to thoroughly explore each component using experience examples from students.
- **Slide 10**
 - Instructor should use a student participation process to ask three questions assessing knowledge acquired during this module.
- **Slide 11**
 - As an introduction to Module 3, provide a brief overview of each TLO/ELO for the next module.
- **Slide 12**
 - As an introduction to Module 3, provide a brief overview of the topics to be covered in the next module.
- **Slide 13**
 - Wrap up.
 - Solicit student feedback on Module 2.

Module 3: Cybersecurity Resilience

- **Scope Statement:** This class will identify the various configurations used the deployment of industrial control systems.
- **Terminal Learning Objective 1 (TLO1):**

Upon successful completion of the Class, learners will be able to describe the various configurations in the deployment of power generation.
- **Enabling Learning Objectives (ELO):**
 - List the ways to mitigate threats to ICS.
 - List the types of cybersecurity infrastructure assessments for ICS.
- **Lesson Topics:**
 - Mitigating Threats
 - Remote Access
 - Unique Logins and Passwords
 - Two-Factor Authentication
 - Local Administrators
 - Change Management
 - Backups
 - Critical Infrastructure Assessments
 - Phishing Campaign Assessments (PCA)
 - Risk Vulnerability Assessments (RVA)

- Validated Architecture Design Reviews (VADR)
 - Cyber Hygiene (CyHy)
- **Instructional Strategy:** Tutorial, learning tasks and activities.
- **Assessment Strategy:** Knowledge review questions at the end of the class.
- **Instructor Slide Notes**
 - **Slide 1**
 - None
 - **Slide 2**
 - Provide an overview where we are in the course, taking time to “connect the dots” between the modules and the course progression.
 - Review Module 2 lesson topics.
 - Introduce Module 3.
 - There is one assigned reading which should be completed prior to starting Module 3:
 - FEMA, Cybersecurity Resiliency in Industrial Control Systems, CTG18, Instructor Guide, October 2020
 - Add topical papers from current events as appropriate
 - **Slide 3**
 - Use the terminal and enabling learning objectives to guide the delivery of the course.
 - Use the Course Development Document (CDD) as a guide to delivery of the course.
 - **Slide 4**
 - Use the terminal and enabling learning objectives to guide the delivery of the course.
 - Use the Course Development Document (CDD) as a guide to delivery of the course.
 - **Slide 5**
 - Instructor should elicit comments and observations from students to discuss the meaning and value of the assigned reading.
 - **Slide 6**
 - Play the video using YouTube.
 - **Slide 7**
 - This is a student led curriculum. To the maximum extent possible, the instructor should elicit student participation to cover these topics and guide the learning process.
 - Use this slide as an outline to explore each of the components. Provide a detailed description of the topics to be covered in this module.
 - Describe each listed component in sufficient detail.

- Use student experience and knowledge to explore each component.
- Instructor should rely heavily on student participation to thoroughly explore each component using experience examples from students.
- **Slide 8**

- This is a student led curriculum. To the maximum extent possible, the instructor should elicit student participation to cover these topics and guide the learning process.
- Use this slide as an outline to explore each of the components. Provide a detailed description of the topics to be covered in this module.
- Describe each listed component in sufficient detail.
- Use student experience and knowledge to explore each component.
- Instructor should rely heavily on student participation to thoroughly explore each component using experience examples from students.
- **Slide 9**
 - Instructor should use a student participation process to ask 5-10 questions assessing knowledge acquired during this module.
- **Slide 10**
 - Wrap up.
 - Solicit student feedback on Module 3.
 - Administer Final Course Assessment

Estimated Contact Time

Fundamentals of Industrial Control Systems

- Objective Screens (min.): 2 (2 min)
- Content Screens (min.): 11 (10 min/screen)
- Knowledge Check (KC) Screens: 1 (10 min)
- Total Screens/Minutes: 14 (124 min)

Cybersecurity Threats and Risks to Industrial Control Systems

- Objective Screens (min.): 2 (2 min)
- Content Screens (min.): 10 (10 min/screen)
- Knowledge Check (KC): 1 (10 min)
- Total Screens/Minutes: 13 (114 min)

Cybersecurity Resilience

- Objective Screens (min.): 2 (2 min)
- Content Screens (min.): 7 (10 min/screen)
- Knowledge Check (KC) Screens: 1 (10 min)
- Total Screens/Minutes: 11 (84 min)

Final Assessment (1 Hour)

Enclosure 12: Critical Infrastructure



CRITICAL INFRASTRUCTURE/ENER GY RESILIENCE OVERVIEW MODULE

May 2021

Course Description

Overview

This is a 2-hour web-based seminar composed of 2-4 hour segment multimedia asynchronous lesson material followed by a 90-120 minute class discussion. These training segments will introduce senior army leaders to the subject of critical infrastructure resilience with an emphasis on energy. Learners will gain an overview of the critical infrastructure, whose overall resilience in the face of natural or manmade interruptions, is key to mission success of Army installations and their ability to project combat power. The training will assist Senior Leaders develop an understanding of the critical infrastructure both on and off base that must be operational for the installation and its tenant units to accomplish their assigned missions. The learner will also be exposed to the wide array of organizations beyond their normal control whose performance and capital investments will have great impact on the installation's mission success. The seminar participants will also become aware of the wide range of threats to critical infrastructure, some tools available for identifying these threats and potential partners in addressing the issue.

Participants will become familiar with the Federal Agencies, local governments, non-profit and for-profit organizations that will play keystone roles in assuring the critical infrastructure resilience essential to installation mission success. The participants will also gain an understanding of how to manage the risk and enhance the resilience of their critical infrastructure and how to partner with other critical infrastructure owners. This will be accomplished by the participants developing an understanding of kinetic and non-kinetic threats to critical infrastructure.

The key course topics include:

- Critical Infrastructure Overview and Resilience Evaluation
- Energy Resilience Relationships, vulnerabilities and strategies
- Cyber and other Threats to the Installation Energy Supply and other Critical Infrastructure

Scope

This senior seminar is designed to prepare students to understand the role that critical infrastructure both on and off the installation plays in the mission success of the installation. While the focus will be on "energy infrastructure", the analytical tools and exercises and much of the policy framework applies to other segments of mission critical infrastructure such as water, wastewater, communications and transportation infrastructure.

Target Audience

The target population will primarily be Garrison Commanders, Deputy Garrison

Commanders, Public Works Dir, Plans and appropriate IMCOM staff leads. Secondary target population is Army G9, Deputy Army G9, G9 SIG, Mission commanders, Corps District Commanders/Deputy Commanders with MILCON support, FORCES Command G3 and G4. This would also be a useful seminar for senior community leaders of communities that host an Army Installation.

Roles and responsibilities. The Target population's key roles are Garrison Commanders and Installation Commanders responsible for the Garrison's ability to project Combat power or otherwise perform its central mission. Secondary roles would deputies and senior staff members that need to understand the role resilient energy systems play in mission capability.

This course is appropriate for senior leaders (City Managers, Public Works, Public Safety, regional utilities districts and regulators) working for partner state, local, tribal, and territorial organizations, especially those at decision-making levels. It is also appropriate for senior leaders in partner organizations in the private sector such as senior representatives of regulated private utilities and non-profits such as community power organizations.

Prerequisites

While there are no prerequisites for the course, participants in this course should be senior installation leaders and installation staff managers. Nonmilitary participants should be senior leaders in local government or utility providers. It is assumed that all participants will have access to computers and internet and have competency in basic use of the computer.

Required Materials

None, other than computer access to the web.

Testing/Certification

There will be no testing or certification with this seminar.

Reference List

Lights Out-A Cyberattack, A Nation Unprepared, Surviving the aftermath-Ted

Koppel (2015) National Guidance Documents:

- ☐ Presidential Policy Directive 21-Critical Infrastructure Security and Resilience-(2013) <https://obamawhitehouse.archives.gov/the-press-office/2013/02/12/presidential-policy-directive-critical-infrastructure-security-and-resil->
- ☐ National Infrastructure Protection Plan (NIPP) 2013-Partnering for Critical Infrastructure Security and Resilience (2013) and selected supplements-Dept of Homeland Security-<https://www.dhs.gov/sites/default/files/publications/National-Infrastructure->

- Protection-Plan-2013-508.pdf
- ☐ NPPD Resources to Support Vulnerability Assessments-Dept. of Homeland Security-
<https://www.cisa.gov/sites/default/files/publications/NIPP-2013-Supplement-NPPD-Resources-to-Support-VAs-508.pdf>
 - ☐ Executing a Critical Infrastructure Risk Management Approach-Dept. of Homeland Security-
<https://www.cisa.gov/sites/default/files/publications/NIPP-2013-Supplement-Executing-a-CI-Risk-Mgmt-Approach-508.pdf>
 - ☐ Incorporating Resilience into Critical Infrastructure Projects-Dept of Homeland Security-
<https://www.cisa.gov/sites/default/files/publications/NIPP-2013-Supplement-Incorporating-Resilience-into-CI-Projects-508.pdf>
 - ☐ NIST Brief 13-Identifying and Prioritizing Closure of Resilience Gaps- National Institute of Standards and Technology (Dec 2017)-
<https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1190GB-13.pdf>
 - ☐ NIST Spec. Pub. 1190- Community Resilience Planning Guide-
<https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1190v1.pdf>
 - ☐ Executive Order 13834-Efficient Federal Operations-Presidential Order for Agencies to meet statutory requirements that increases efficiency, optimizes performance, eliminates unnecessary use of resources, and protects the Environment-Mar 2018-
<https://www.federalregister.gov/documents/2018/05/22/2018-11101/efficient-federal-operations>
 - ☐

DoD and Army Guidance Documents:

- ☐ Installation Energy Instruction DoDI 4170.11 Mar 2016 (Installation Energy Management)-
<https://www.acq.osd.mil/eie/Downloads/IE/DODI%204170.11%20-%20Change%201%20Effective%20March%2016%202016%20FINAL.pdf>
- ☐ The National Defense Strategy- Jan 2018-
<https://dod.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf>
- ☐ Memorandum-Installation Energy Plans-Energy Resilience and Cybersecurity Update requirement for ALL Installations- May 2018-
https://www.acq.osd.mil/eie/Downloads/IE/IEP%20Policy_May302018.pdf
- ☐ Memorandum-Metrics and Standards for Energy Resilience at Military Installations-
<https://www.acq.osd.mil/eie/Downloads/IE/Metrics%20and%20Standards%20for%20Energy%20Resilience%20at%20Military%20Installations.pdf>
- ☐ Memorandum- A Framework for Planning and Executing Black Start

Exercises-

https://www.acq.osd.mil/eie/Downloads/IE/Memo%20Framework%20for%20Planning%20and%20Executing%20Black%20Start%20Exercises_08062020.pdf

- Memorandum-Alternative Financing – Defense Energy Resilience Bank(DERB)Report_2020Feb-
[https://www.acq.osd.mil/eie/Downloads/IE/DefenseEnergyResilienceBank\(DERB\)Report_2020Feb.pdf](https://www.acq.osd.mil/eie/Downloads/IE/DefenseEnergyResilienceBank(DERB)Report_2020Feb.pdf)
- Army Directive 2020-03 Installation Energy and Water Security -Mar 2020- https://www.asaie.army.mil/Public/ES/doc/ARN21644_AD2020-03_Web_Final.pdf
- Army Directive 2020-08 Installation Policy to Address Threats Caused by Changing Climate and Extreme Weather- Sep 2020-
<https://api.army.mil/e2/c/downloads/2020/09/14/a6aa8a40/ad-2020-08-u-s-army-installation-policy-to-address-threats-caused-by-changing-climate-and-extreme-weather.pdf>
- Army Climate Resilience Handbook-Aug 2020-
https://www.g8.army.mil/digital_library/references/resources/20200900_Army_Climate_Resilience_Handbook.pdf
- Army Installations Strategy-Dec 2020-
[https://www.asaie.army.mil/Public/SI/doc/Army_Installations_Strategy_\(AIS\)_FINAL_Signed.pdf](https://www.asaie.army.mil/Public/SI/doc/Army_Installations_Strategy_(AIS)_FINAL_Signed.pdf)

Non-Governmental Resources:

- Beyond the Fence Line -Strengthening Military Capabilities Through Energy Resilience Partnerships-Association of Defense Communities -
<https://knowledge-online-defense-communities.knowledgeowl.com/help/installation-energy-water-beyond-the-fence-line-strengthening-military-capabilities-through-energy-resilience-partnerships>
- What Local Government Officials Should Know and Do about Cyber-Security-International City Managers Association (ICMA)-
https://www.nlc.org/wp-content/uploads/2019/10/CS-Cybersecurity-Report-Final_0.pdf
- Regional Identification of Gaps for Operational Resilience Process (RIGOR) for Joint Base Elmendorf Richardson (JBER)-Converge Strategies-
<https://static1.squarespace.com/static/58c0207d15d5db7d6b968444/t/5e96efcddcb3ec0fc5c8d613/1586950094234/RIGOR+Report.pdf>
- Report on Security in the North American Grid, A Nation at Risk - Fourth Update- George R. Cotter- Apr 2015-
<https://www.nrc.gov/docs/ML1511/ML15114A348.pdf>
- Cybersecurity and the North American Electric Grid; New Policy Approaches to address an evolving threat-Bipartisan Policy Center- Feb 2014- <https://bipartisanpolicy.org/wp-content/uploads/2019/03/Cybersecurity-Electric-Grid-BPC.pdf>
- Critical Infrastructure Resilience-A Regional and National Approach (Nov

- 2014)-MITRE Corporation Publication-
<https://www.mitre.org/sites/default/files/publications/14-4047-critical-infrastructure-resilience-a-regional-and-national-approach.pdf>
- ☐ Decide Platform-NUARI
 - ☐ Jack Voltaic Cyber Research Project 3.0 – Army Cyber Center-
<https://cyber.army.mil/Research/Jack-Voltaic/>

Evaluation Strategy

There will be no course evaluation.

Technical Requirements

Participants will require a computer with an Internet connection and a web browser that supports flash or HTML5. Participants will require speakers or headphones for supplemental audio and video material.

Course Structure/Content Outline

Course Introduction and Objectives

- ☐ *Course overview*
- ☐ *Course objectives*
- ☐ *Discussion of home installation vulnerabilities*

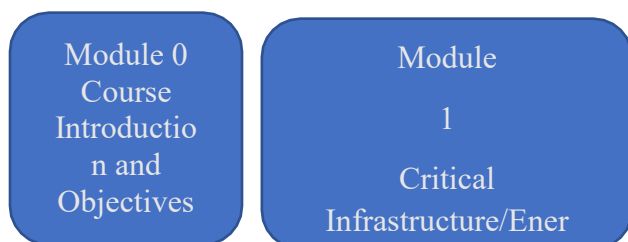
Critical Infrastructure/Energy Resilience Overview

- ☐ *Identify types of mission critical installation infrastructure.*
 - *energy and control systems*
 - *water and wastewater systems*
 - *Transportation systems*
 - *Communication systems-military and civilian*
 - *Fuel distribution systems*
 - *Medical*
 - *Public Safety dispatch*
 - *Micro grids*
- ☐ *Identify types of mission critical infrastructure off the installation or owned by others.*
 - *Power generation systems*
 - *Power distribution systems*
 - *Water production and distribution systems*
 - *Transportation systems*
 - *Logistic systems*
- ☐ *Identify potential infrastructure owners that must be partnered with to ensure*

mission success.

- *Regulated Public Utilities*
- *Local government/Regional government Utility providers*
- *Local Government Critical services*
- *Local Non-Profit and for-profit critical services*

Course Progression



Course Development Matrix

Class 0: Introduction, Course Objectives and Pre-Assessment

- **Scope Statement:** *This lesson will prepare participants for course navigation and introduce course objectives. Participants will complete a pre-assessment of their installation's energy resilience as part of the course introduction.*
- **Terminal Learning Objective (TLO):**
 - *None*
- **Enabling Learning Objectives (ELO):**
 - *None*
- **Lesson Topics:**
 - *Navigation*
 - *Discussion of current home installation's energy resilience*
- **Instructional Strategy:** *Read ahead assignment of "Lights Out", Videos of Ted talk on national resilience prioritization, review of 2003 grid outage in retrospect, Tutorial,*

group discussion, and practical exercise with students discussion their home installation and community resilience.

- **Assessment Strategy:** None

Class 1: Critical Infrastructure /Energy Resilience Overview

- **Scope Statement:** *This Class will identify types of critical infrastructure the installation is typically dependent upon for mission success.*

- **Terminal Learning Objective 1 (TLO1):**

Upon successful completion of the Class, participants will understand the nature and impact on mission of the critical infrastructure/Energy systems on the installation, critical infrastructure/Energy systems off the installation or owned by others and be able to identify essential partners in gaining desired energy resilience outcomes.

- **Enabling Learning Objectives (ELO):**

- *Identify Army owned and maintained energy and other critical infrastructure systems on the installation.*
- *Understand the interdependence of the systems.*
- *Understand the dependence of the Army owned/maintained systems on systems not under Army ownership/control.*

- **Terminal Learning Objective 2 (TLO2):**

Upon successful completion of the Class, participants will be able to identify infrastructure critical to the installation's energy resilience and mission capability that are off the installation or not under the direct control of the Installation Commander.

- **Enabling Learning Objectives (ELO):**

- *Identify off base and non-Installation controlled energy and other critical infrastructure that impacts the Installation's energy resilience and mission capability.*
- *Identify Non-Army critical infrastructure owners/operators that must be embraced as mission partners to ensure the Installation's energy resilience and mission capability.*

- **Terminal Learning Objective 3 (TLO3):**

Upon successful completion of the Class, participants will understand and can discuss the need to partner with non-Army infrastructure owners to gain installation energy resilience.

- **Enabling Learning Objectives (ELO):**

- *Discuss the reliance of the installation's critical infrastructure success dependence on entities outside Army control. staffing, resource needs and relative status of*

system currency/obsolescence and investment needs

- *Understand and discuss the role and impact of critical energy and other infrastructure off the installation or owned by others on installation resilience.*
- *Understand and discuss the impact on the installation mission capability if these interlinked energy or other critical piece of infrastructure failure.*

□ **Lesson Topics:**

- *Critical Infrastructure identification and definitions*
- *Impact of non-Army owned/controlled infrastructure on the Installation's energy resilience.*

□ *Partnership strategy considerations and impacts on energy resilience.* **Instructional Strategy:** Tutorial on resilience definitions, resilience policy framework, readings of key policy framework documents, orientation on major reference documents, videos on recent manmade and natural resilience failures.

□ **Assessment Strategy:** Knowledge review discussions at the end of this Class segment.

Estimated Contact Time

Course Introduction and objectives

- *Objective Screens (min.): 10*
- *Content Screens (min.): 90*
- *Knowledge Check (KC)/Practical Exercises (PE) Screens (min.): 20*
- *Total Screens/Minutes: 120 min*

Critical Infrastructure/Energy Resilience Overview

- *Objective Screens (min.): 10*
- *Content Screens (min.): 90*
- *Knowledge Check (KC)/Practical Exercises (PE) Screens (min.): 20*
- *Total Screens/Minutes: 120 min*

Enclosure 13: Identifying Critical Infrastructure



IDENTIFYING CRITICAL MISSION INFRASTRUCTURE/ENERG Y SYSTEMS MODULE

May 2021

Course Description

Overview

This is a 2-hour web-based seminar composed of 4-6 hours of multimedia material study asynchronously, followed by a 90–120-minute discussion period. These training segments will introduce senior army leaders to the subject of critical infrastructure resilience with an emphasis on energy. Learners will gain an overview of the critical infrastructure, whose overall resilience in the face of natural or manmade interruptions, is key to mission success of Army installations and their ability to project combat power. The training will assist Senior Leaders develop an understanding of the critical infrastructure both on and off base that must be operational for the installation and its tenant units to accomplish their assigned missions. The learner will also be exposed to the wide array of organizations beyond their normal control whose performance and capital investments will have great impact on the installation's mission success. The seminar participants will also become aware of the wide range of threats to critical infrastructure, some tools available for identifying these threats and potential partners in addressing the issue.

Participants will become familiar with the Federal Agencies, local governments, non-profit and for-profit organizations that will play keystone roles in assuring the critical infrastructure resilience essential to installation mission success. The participants will also gain an understanding of how to manage the risk and enhance the resilience of their critical infrastructure and how to partner with other critical infrastructure owners. This will be accomplished by the participants developing an understanding of kinetic and non-kinetic threats by participating in a critical infrastructure analysis and participating in a capstone resilience exercise using the DECIDE exercise platform. Finally, students will gain an understanding of the policies controlling resilience standards, partnering with non-Army agencies, microgrids and funding opportunities for on base and off base infrastructure improvements.

The key course topics include:

- Critical Infrastructure Overview and Resilience Evaluation
- Energy Resilience Relationships, vulnerabilities and strategies

Scope

This senior seminar is designed to prepare students to understand the role that critical infrastructure both on and off the installation plays in the mission success of the installation. While the focus will be on “energy infrastructure”, the analytical tools and exercises and much of the policy framework applies to other segments of mission critical infrastructure such as water, wastewater, communications and transportation infrastructure.

Target Audience

The target population will primarily be Garrison Commanders, Deputy Garrison Commanders, Public Works Dir, Plans and appropriate IMCOM staff leads. Secondary target population is Army G9, Deputy Army G9, G9 SIG, Mission commanders, Corps District Commanders/Deputy Commanders with MILCON support, FORCES Command G3 and G4. This would also be a useful seminar for senior community leaders of communities that host an Army Installation.

Roles and responsibilities. The Target population's key roles are Garrison Commanders and Installation Commanders responsible for the Garrison's ability to project Combat power or otherwise perform its central mission. Secondary roles would deputies and senior staff members that need to understand the role resilient energy systems play in mission capability.

This course is appropriate for senior leaders (City Managers, Public Works, Public Safety, regional utilities districts and regulators) working for partner state, local, tribal, and territorial organizations, especially those at decision-making levels. It is also appropriate for senior leaders in partner organizations in the private sector such as senior representatives of regulated private utilities and non-profits such as community power organizations.

Prerequisites

While there are no prerequisites for the course, participants in this course should be senior installation leaders and installation staff managers. Nonmilitary participants should be senior leaders in local government or utility providers. It is assumed that all participants will have access to computers and internet and have competency in basic use of the computer.

Required Materials

None, other than computer access to the web.

Testing/Certification

There will be no testing or certification with this seminar.

Reference List

Lights Out-A Cyberattack, A Nation Unprepared, Surviving the aftermath-Ted

Koppel (2015) National Guidance Documents:

- Presidential Policy Directive 21-Critical Infrastructure Security and Resilience-(2013) [https://obamawhitehouse.archives.gov/the-press-office/2013/02/12/presidential-policy-directive-critical-infrastructure-security-and-resil-](https://obamawhitehouse.archives.gov/the-press-office/2013/02/12/presidential-policy-directive-critical-infrastructure-security-and-resil)

- ☐ National Infrastructure Protection Plan (NIPP) 2013-Partnering for Critical Infrastructure Security and Resilience (2013) and selected supplements- Dept of Homeland Security-
<https://www.dhs.gov/sites/default/files/publications/National-Infrastructure-Protection-Plan-2013-508.pdf>
- ☐ NPPD Resources to Support Vulnerability Assessments-Dept. of Homeland Security-
<https://www.cisa.gov/sites/default/files/publications/NIPP-2013-Supplement-NPPD-Resources-to-Support-VAs-508.pdf>
- ☐ Executing a Critical Infrastructure Risk Management Approach-Dept. of Homeland Security-
<https://www.cisa.gov/sites/default/files/publications/NIPP-2013-Supplement-Executing-a-CI-Risk-Mgmt-Approach-508.pdf>
- ☐ Incorporating Resilience into Critical Infrastructure Projects-Dept of Homeland Security-
<https://www.cisa.gov/sites/default/files/publications/NIPP-2013-Supplement-Incorporating-Resilience-into-CI-Projects-508.pdf>
- ☐ NIST Brief 13-Identifying and Prioritizing Closure of Resilience Gaps- National Institute of Standards and Technology (Dec 2017)-
<https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1190GB-13.pdf>
- ☐ NIST Spec. Pub. 1190- Community Resilience Planning Guide-
<https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1190v1.pdf>
- ☐ Executive Order 13834-Efficient Federal Operations-Presidential Order for Agencies to meet statutory requirements that increases efficiency, optimizes performance, eliminates unnecessary use of resources, and protects the Environment-Mar 2018-
<https://www.federalregister.gov/documents/2018/05/22/2018-11101/efficient-federal-operations>
- ☐

DoD and Army Guidance Documents:

- ☐ Installation Energy Instruction DoDI 4170.11 Mar 2016 (Installation Energy Management)-
<https://www.acq.osd.mil/eie/Downloads/IE/DODI%204170.11%20-%20Change%201%20Effective%20March%2016%202016%20FINAL.pdf>
- ☐ The National Defense Strategy- Jan 2018-
<https://dod.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf>
- ☐ Memorandum-Installation Energy Plans-Energy Resilience and Cybersecurity Update requirement for ALL Installations- May 2018-
https://www.acq.osd.mil/eie/Downloads/IE/IEP%20Policy_May302018.pdf
- ☐ Memorandum-Metrics and Standards for Energy Resilience at Military

Installations-

<https://www.acq.osd.mil/eie/Downloads/IE/Metrics%20and%20Standards%20for%20Energy%20Resilience%20at%20Military%20Installations.pdf>

- Memorandum- A Framework for Planning and Executing Black Start Exercises-
https://www.acq.osd.mil/eie/Downloads/IE/Memo%20Framework%20for%20Planning%20and%20Executing%20Black%20Start%20Exercises_08062020.pdf
- Memorandum-Alternative Financing – Defense Energy Resilience Bank(DERB)Report_2020Feb-
[https://www.acq.osd.mil/eie/Downloads/IE/DefenseEnergyResilienceBank\(DERB\)Report_2020Feb.pdf](https://www.acq.osd.mil/eie/Downloads/IE/DefenseEnergyResilienceBank(DERB)Report_2020Feb.pdf)
- Army Directive 2020-03 Installation Energy and Water Security -Mar 2020- https://www.asaie.army.mil/Public/ES/doc/ARN21644_AD2020-03_Web_Final.pdf
- Army Directive 2020-08 Installation Policy to Address Threats Caused by Changing Climate and Extreme Weather- Sep 2020-
<https://api.army.mil/e2/c/downloads/2020/09/14/a6aa8a40/ad-2020-08-u-s-army-installation-policy-to-address-threats-caused-by-changing-climate-and-extreme-weather.pdf>
- Army Climate Resilience Handbook-Aug 2020-
https://www.g8.army.mil/digital_library/references/resources/20200900_Army_Climate_Resilience_Handbook.pdf
- Army Installations Strategy-Dec 2020-
[https://www.asaie.army.mil/Public/SI/doc/Army_Installations_Strategy_\(AIS\)_FINAL_Signed.pdf](https://www.asaie.army.mil/Public/SI/doc/Army_Installations_Strategy_(AIS)_FINAL_Signed.pdf)

Non-Governmental Resources:

- Beyond the Fence Line -Strengthening Military Capabilities Through Energy Resilience Partnerships-Association of Defense Communities -
<https://knowledge-online-defense-communities.knowledgeowl.com/help/installation-energy-water-beyond-the-fence-line-strengthening-military-capabilities-through-energy-resilience-partnerships>
- What Local Government Officials Should Know and Do about Cyber-Security-International City Managers Association (ICMA)-
https://www.nlc.org/wp-content/uploads/2019/10/CS-Cybersecurity-Report-Final_0.pdf
- Regional Identification of Gaps for Operational Resilience Process (RIGOR) for Joint Base Elmendorf Richardson (JBER)-Converge Strategies-
<https://static1.squarespace.com/static/58c0207d15d5db7d6b968444/t/5e96efcddcb3ec0fc5c8d613/1586950094234/RIGOR+Report.pdf>
- Report on Security in the North American Grid, A Nation at Risk - Fourth Update- George R. Cotter- Apr 2015-
<https://www.nrc.gov/docs/ML1511/ML15114A348.pdf>

- ☐ Cybersecurity and the North American Electric Grid; New Policy Approaches to address an evolving threat-Bipartisan Policy Center- Feb 2014- <https://bipartisanpolicy.org/wp-content/uploads/2019/03/Cybersecurity-Electric-Grid-BPC.pdf>
- ☐ Critical Infrastructure Resilience-A Regional and National Approach (Nov 2014)-MITRE Corporation Publication- <https://www.mitre.org/sites/default/files/publications/14-4047-critical-infrastructure-resilience-a-regional-and-national-approach.pdf>
- ☐ Decide Platform-NUARI
- ☐ Jack Voltaic Cyber Research Project 3.0 – Army Cyber Center- <https://cyber.army.mil/Research/Jack-Voltaic/>

Evaluation Strategy

None for this module.

Technical Requirements

Participants will require a computer with an Internet connection and a web browser that supports flash or HTML5. Participants will require speakers or headphones for supplemental audio and video material.

Course Structure/Content Outline

Course Introduction and Objectives

- ☐ *Course overview*
- ☐ *Course objectives*
- ☐ *Discussion of home installation vulnerabilities*

Identifying Mission Critical Infrastructure/Energy Systems

- ☐ *Understanding the interlinked nature of critical infrastructure systems*
- ☐ *Understanding the resources and capacities of the installation's energy and critical infrastructure staff*
- ☐ *Understanding the Software and Network Vulnerabilities of Industrial controls*
- ☐ *Understanding the resource and modernization needs of Energy and other on installation critical systems.*
- ☐ *Understanding the role of critical infrastructure off the installation and owned by others.*
- ☐ *Understanding the mission capability impact of critical infrastructure/energy systems failure*
- ☐ *Understanding the consequences of past capital investment and reinvestment in on and off base critical energy and other infrastructure systems.*

Course Progression

Module 1
Course
Introductio
n and
Objectives

Module 3
Identifying Mission
Critical
Infrastructure/Ener
gy Systems

Course Development Matrix

Class 0: Introduction, Course Objectives and Pre-Assessment

- **Scope Statement:** *This lesson will prepare participants for course navigation and introduce course objectives. Participants will complete a pre-assessment of their installation's energy resilience as part of the course introduction.*
- **Terminal Learning Objective (TLO):**
 - None
- **Enabling Learning Objectives (ELO):**
 - None
- **Lesson Topics:**
 - Navigation
 - Discussion of current home installation's energy resilience
- **Instructional Strategy:** *Read ahead assignment of "Lights Out", Videos of Ted talk on national resilience prioritization, review of 2003 grid outage in retrospect, Tutorial, group discussion, and practical exercise with students discussion their home installation and community resilience.*
- **Assessment Strategy:** None

Class 1: Identifying Mission Critical Infrastructure/Energy Systems

- **Scope Statement:** *This Class will focus on the interlinked nature of critical infrastructure and energy resilience systems and their accompanying resource requirements.*
- **Terminal Learning Objective 1 (TLO1):**
Upon successful completion of the Class, participants will have a deeper understanding of the complexity and interdependence of critical infrastructure and the resource requirements to attain energy resilience.
- **Enabling Learning Objectives (ELO):**
 - Understand the linkage of energy resilience to the resilience of other pieces of the installation's critical infrastructure.
 - Understand the software and network vulnerabilities of industrial controls.
- **Terminal Learning Objective 2 (TLO2):**
Upon successful completion of the Class, participants will understand the resources and capacities of the installation's energy and critical infrastructure staff.
- **Enabling Learning Objectives (ELO):**
 - Understand normal staff structure devoted to critical infrastructure on base.

- *Understand the array of off installation agencies that impact installation mission capability.*
- **Terminal Learning Objective 3 (TLO3):**
Upon successful completion of the Class, participants will understand the software and network vulnerabilities of their energy and industrial control systems.
- **Enabling Learning Objectives (ELO):**
 - *Understand the array of systems and controls on a typical installation.*
 - *Understand the non-Army controlled systems off the installation that impact the installation's energy resilience.*
- **Terminal Learning Objective 4 (TLO4):***Upon successful completion of the class, participants will understand the resource needs to obtain energy/critical infrastructure resilience.*
- **Enabling Learning Objectives (ELO):**
 - *Understand the consequences of past capital investment strategies in on base and off base systems critical to the installation's mission.*
 - *Understand installation's personnel and budget resource status for critical infrastructure/energy resilience investment.*
 - *Understanding the mission*
- **Lesson Topics:**
 - *Interlinked nature of critical infrastructure systems*
 - *Mission Impact of non-Army owned/controlled infrastructure on and off the installation*
 - *Mission impacts of energy resilience failure*
- **Instructional Strategy:** *Tutorial on identifying critical infrastructure, discussion of infrastructure posture at home installation, an introduction of the infrastructure resilience issue for the installation caused by non-Army infrastructure owners, creating partnerships with other infrastructure owners. Discussion of the appropriate involvement of the installation in discussions and deliberations of off base community resilience issues with introduction to OEA Pamphlets regard appropriate participation with local governments, utilities. Videos orienting students on recent infrastructure cyber-attacks and kinetic attacks on grid, with introduction to planning tools and resources such as Installation Energy Plans and the DCIP finding program.*
- **Assessment Strategy:** *Knowledge review discussion at the end of the Class segment.*

Estimated Contact Time

Course Introduction and objectives

- Objective Screens (min.): 10
- Content Screens (min.): 90
- Knowledge Check (KC)/Practical Exercises (PE) Screens (min.): 20
- Total Screens/Minutes: 120 min
- Total Screens/Minutes: 120 min

Identifying Mission Critical Infrastructure/Energy Systems

- Objective Screens (min.): 10 min
- Content Screens (min.): 90 min
- Knowledge Check (KC)/Practical Exercises (PE) Screens (min.): 20 min
- Total Screens/Minutes: 120 min

Enclosure 14: Critical Infrastructure Strategy and Resilience (Risk) Module



CRITICAL INFRASTRUCTURE

STRATEGY AND RESILIENCE (Risk) MODULE

May 2021

Course Description

Overview

This is a 2-hour web-based seminar composed of 4-6 hours of multimedia material study asynchronously, followed by a 90–120-minute discussion period. This training module will introduce senior army leaders to the subject of critical infrastructure resilience with an emphasis on energy. Learners will gain an overview of the critical civilian and installation infrastructure, whose overall resilience in the face of natural or manmade interruptions, is key to mission success of Army installations and their ability to project combat power. The training will assist Senior Leaders develop an understanding of the critical infrastructure both on and off base that must be operational for the installation and its tenant units to accomplish their assigned missions. The learner will also be exposed to the wide array of Federal and local government organizations beyond their normal control whose performance and capital investments will have great impact on the installation's mission success. The seminar participants will also become aware of the wide range of threats to critical infrastructure, some tools available for identifying these threats and potential partners in addressing the issue. Participants will become familiar with the Federal Agencies, local governments, non-profit and for-profit organizations that will play keystone roles in assuring the critical infrastructure resilience essential to installation mission success.

The key course topics include:

- Critical Infrastructure Overview and Resilience Evaluation
- Energy Resilience partners, relationships, vulnerabilities and strategies
- Regional analysis of critical infrastructure
- Cyber and other Threats to the Installation Energy Supply and other Critical Infrastructure

Scope

This senior leader seminar is designed to prepare students to understand the role that critical infrastructure both on and off the installation plays in the mission success of the installation. While the focus will be on “energy infrastructure”, the analytical tools and exercises and much of the policy framework applies to other segments of mission critical infrastructure such as water, wastewater, communications and transportation infrastructure.

Target Audience

The target population will primarily be Garrison Commanders, Deputy Garrison Commanders, Public Works Dir, Plans and appropriate IMCOM staff leads. Secondary

target population is Army G9, Deputy Army G9, G9 SIG, Mission commanders, Corps District Commanders/Deputy Commanders with MILCON support, FORCES Command G3 and G4. This would also be a useful seminar for senior community leaders of communities that host an Army Installation.

Roles and responsibilities. The Target population's key roles are Garrison Commanders and Installation Commanders responsible for the Garrison's ability to project Combat power or otherwise perform its central mission. Secondary roles would deputies and senior staff members that need to understand the role resilient energy systems play in mission capability.

This course is appropriate for senior leaders (City Managers, Public Works, Public Safety, regional utilities districts and regulators) working for partner state, local, tribal, and territorial organizations, especially those at decision-making levels. It is also appropriate for senior leaders in partner organizations in the private sector such as senior representatives of regulated private utilities and non-profits such as community power organizations.

Prerequisites

While there are no prerequisites for the course, participants in this course should be senior installation leaders and installation staff managers. Nonmilitary participants should be senior leaders in local government or utility providers. It is assumed that all participants will have access to computers and internet and have competency in basic use of the computer.

Required Materials

None, other than computer access to the web.

Testing/Certification

There will be no testing or certification with this seminar.

Reference List (A list of key readings and documents addressing resilience of critical infrastructure)

Lights Out-A Cyberattack, A Nation Unprepared, Surviving the aftermath-Ted

Koppel (2015) National Guidance Documents:

- ☐ Presidential Policy Directive 21-Critical Infrastructure Security and Resilience-(2013) <https://obamawhitehouse.archives.gov/the-press-office/2013/02/12/presidential-policy-directive-critical-infrastructure-security-and-resil->
- ☐ National Infrastructure Protection Plan (NIPP) 2013-Partnering for Critical Infrastructure Security and Resilience (2013) and selected supplements-Dept of Homeland Security-<https://www.dhs.gov/sites/default/files/publications/National-Infrastructure->

- Protection-Plan-2013-508.pdf
- ☐ NPPD Resources to Support Vulnerability Assessments-Dept. of Homeland Security-
<https://www.cisa.gov/sites/default/files/publications/NIPP-2013-Supplement-NPPD-Resources-to-Support-VAs-508.pdf>
 - ☐ Executing a Critical Infrastructure Risk Management Approach-Dept. of Homeland Security-
<https://www.cisa.gov/sites/default/files/publications/NIPP-2013-Supplement-Executing-a-CI-Risk-Mgmt-Approach-508.pdf>
 - ☐ Incorporating Resilience into Critical Infrastructure Projects-Dept of Homeland Security-
<https://www.cisa.gov/sites/default/files/publications/NIPP-2013-Supplement-Incorporating-Resilience-into-CI-Projects-508.pdf>
 - ☐ NIST Brief 13-Identifying and Prioritizing Closure of Resilience Gaps- National Institute of Standards and Technology (Dec 2017)-
<https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1190GB-13.pdf>
 - ☐ NIST Spec. Pub. 1190- Community Resilience Planning Guide-
<https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1190v1.pdf>
 - ☐ Executive Order 13834-Efficient Federal Operations-Presidential Order for Agencies to meet statutory requirements that increases efficiency, optimizes performance, eliminates unnecessary use of resources, and protects the Environment-Mar 2018-
<https://www.federalregister.gov/documents/2018/05/22/2018-11101/efficient-federal-operations>
 - ☐

DoD and Army Guidance Documents:

- ☐ Installation Energy Instruction DoDI 4170.11 Mar 2016 (Installation Energy Management)-
<https://www.acq.osd.mil/eie/Downloads/IE/DODI%204170.11%20-%20Change%201%20Effective%20March%2016%202016%20FINAL.pdf>
- ☐ The National Defense Strategy- Jan 2018-
<https://dod.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf>
- ☐ Memorandum-Installation Energy Plans-Energy Resilience and Cybersecurity Update requirement for ALL Installations- May 2018-
https://www.acq.osd.mil/eie/Downloads/IE/IEP%20Policy_May302018.pdf
- ☐ Memorandum-Metrics and Standards for Energy Resilience at Military Installations-
<https://www.acq.osd.mil/eie/Downloads/IE/Metrics%20and%20Standards%20for%20Energy%20Resilience%20at%20Military%20Installations.pdf>
- ☐ Memorandum- A Framework for Planning and Executing Black Start

Exercises-

https://www.acq.osd.mil/eie/Downloads/IE/Memo%20Framework%20for%20Planning%20a%20Executing%20Black%20Start%20Exercises_08062020.pdf

- Memorandum-Alternative Financing – Defense Energy Resilience Bank(DERB)Report_2020Feb-
[https://www.acq.osd.mil/eie/Downloads/IE/DefenseEnergyResilienceBank\(DERB\)Report_2020Feb.pdf](https://www.acq.osd.mil/eie/Downloads/IE/DefenseEnergyResilienceBank(DERB)Report_2020Feb.pdf)
- Army Directive 2020-03 Installation Energy and Water Security -Mar 2020- https://www.asaie.army.mil/Public/ES/doc/ARN21644_AD2020-03_Web_Final.pdf
- Army Directive 2020-08 Installation Policy to Address Threats Caused by Changing Climate and Extreme Weather- Sep 2020-
<https://api.army.mil/e2/c/downloads/2020/09/14/a6aa8a40/ad-2020-08-u-s-army-installation-policy-to-address-threats-caused-by-changing-climate-and-extreme-weather.pdf>
- Army Climate Resilience Handbook-Aug 2020-
https://www.g8.army.mil/digital_library/references/resources/20200900_Army_Climate_Resilience_Handbook.pdf
- Army Installations Strategy-Dec 2020-
[https://www.asaie.army.mil/Public/SI/doc/Army_Installations_Strategy_\(AIS\)_FINAL_Signed.pdf](https://www.asaie.army.mil/Public/SI/doc/Army_Installations_Strategy_(AIS)_FINAL_Signed.pdf)

Non-Governmental Resources:

- Beyond the Fence Line -Strengthening Military Capabilities Through Energy Resilience Partnerships-Association of Defense Communities -
<https://knowledge-online-defense-communities.knowledgeowl.com/help/installation-energy-water-beyond-the-fence-line-strengthening-military-capabilities-through-energy-resilience-partnerships>
- What Local Government Officials Should Know and Do about Cyber-Security-International City Managers Association (ICMA)-
https://www.nlc.org/wp-content/uploads/2019/10/CS- Cybersecurity-Report-Final_0.pdf
- Regional Identification of Gaps for Operational Resilience Process (RIGOR) for Joint Base Elmendorf Richardson (JBER)-Converge Strategies-
<https://static1.squarespace.com/static/58c0207d15d5db7d6b968444/t/5e96efcddcb3ec0fc5c8d613/1586950094234/RIGOR+Report.pdf>
- Report on Security in the North American Grid, A Nation at Risk - Fourth Update- George R. Cotter- Apr 2015-
<https://www.nrc.gov/docs/ML1511/ML15114A348.pdf>
- Cybersecurity and the North American Electric Grid; New Policy Approaches to address an evolving threat-Bipartisan Policy Center- Feb 2014- <https://bipartisanpolicy.org/wp-content/uploads/2019/03/Cybersecurity-Electric-Grid-BPC.pdf>
- Critical Infrastructure Resilience-A Regional and National Approach (Nov

- 2014)-MITRE Corporation Publication-
<https://www.mitre.org/sites/default/files/publications/14-4047-critical-infrastructure-resilience-a-regional-and-national-approach.pdf>
- ☐ Decide Platform-NUARI
 - ☐ Jack Voltaic Cyber Research Project 3.0 – Army
Cyber Center-
<https://cyber.army.mil/Research/Jack-Voltaic/>

Evaluation Strategy

Students will discuss their evaluation of their home installation critical Infrastructure resilience.

Technical Requirements

Participants will require a computer with an Internet connection and a web browser that supports flash or HTML5. Participants will require speakers or headphones for supplemental audio and video material.

Course Structure/Content Outline

Course Introduction and Objectives

- *Course overview*
- *Course objectives*
- *Discussion of home installation vulnerabilities*

Critical Infrastructure Threat Analysis/Risk Management

- *Identify most significant threats to critical infrastructure on and off the installation.*
- *Identify key partners in energy/critical infrastructure resilience.*
- *Understand the scope and duration of potential cyber/non-kinetic man-made threats and environmental threats to critical energy generation and distribution systems.*
- *Develop a strategic approach to address critical infrastructure and energy resilience relationships of the installation and its supporting region.*
- *How to develop a regional RIGOR type analysis of the mission critical infrastructure.*
- *Develop strategies to enhance regional resilience.*

Course Progression

Module -
Course
Introductio
n and
Objectives

Module - Critical
Infrastructure Threat
Analysis/Risk
Management

Course Development Matrix

Class 0: Introduction, Course Objectives and Pre-Assessment

- **Scope Statement:** *This lesson will prepare participants for course navigation and introduce course objectives. Participants will complete a pre-assessment of their installation's energy resilience as part of the course introduction.*
- **Terminal Learning Objective (TLO):**
 - None
- **Enabling Learning Objectives (ELO):**
 - None
- **Lesson Topics:**
 - Navigation
 - Discussion of current home installation's energy resilience
- **Instructional Strategy:** *Read ahead assignment of "Lights Out", Videos of Ted talk on national resilience prioritization, review of 2003 grid outage in retrospect, Tutorial, group discussion, and practical exercise with students discussion their home installation and community resilience.*
- **Assessment Strategy:** None

Class : Critical Infrastructure Threat Analysis/Risk Management

- **Scope Statement:** *This Class will address how to identify the most significant threats to an installation's energy/critical infrastructure systems and how to mitigate those threats impact on mission capability.*
- **Terminal Learning Objective 1 (TLO1):**
Upon successful completion of the Class, participants will have a familiarity with the most significant threats to the installation's energy resilience.
- **Enabling Learning Objectives (ELO):**
 - *Identify the range of threats to the installation's energy and other critical systems.*
 - *Understand the linkage of the installation's system vulnerabilities to off base systems not under the Army's control.*
- **Terminal Learning Objective 2 (TLO2):**
Upon successful completion of the Class, participants understand the need to partner with governmental and non-governmental agencies to improve the installation's energy resilience.
- **Enabling Learning Objectives (ELO):**
 - *Understand the need to develop regional strategies and alliances to enhance resilience of critical systems.*
 - *Understand the methodology of the RIGOR process for evaluating regional risks and potential risk mitigation measures.*
 - *Understand the scope and potential duration of potential cyber/non-kinetic man-made threats and environmental threats to critical energy*

generation and distribution systems.

- ***Terminal Learning Objective 3 (TLO3):***

Upon successful completion of the Class, the participants will understand strategies to fund and improve energy and other critical infrastructure resilience.

□ **Enabling Learning Objectives (ELO):**

- *Develop listing of potential governmental and non-governmental partners essential to address the threats and mitigation measures necessary to protect mission capability of the installation.*
- *Understand the array of authorities available to establish and fund the partnerships and the projects necessary to improve the installation's energy resilience.*
- *Develop a strategic approach to form necessary partnerships and alliances to improve energy and other critical infrastructure resilience.*

□ **Lesson Topics:**

- *Establishing the scope of the threat to the installation's energy resilience*
- *Developing the partnerships and organizational alliance beyond the fence line to develop a regional response capability to the threats against critical infrastructure.*
- *Technics, tools and authorities to define and address the threats to energy resilience of the installation.*

□ **Instructional Strategy:** *Tutorial regarding on-base and off-base critical infrastructure vulnerabilities, readings and introduction of the JBER RIGOR exercise as a case study and analysis process as a model for resilience analysis of the student's home installation/region, readings on National level policies and resilience programs starting with PPD21 and NIPP13, Introduction to Community resilience planning process and Army role in that process, Readings and discussion of major DoD and Army resilience policy documents and case studies..*

□ **Assessment Strategy:** *Knowledge review discussion at the end of this course segment.*

Estimated Contact Time

Course Introduction and objectives

- *Objective Screens (min.): 10*
- *Content Screens (min.): 90*
- *Knowledge Check (KC)/Practical Exercises (PE) Screens (min.): 20*
- *Total Screens/Minutes: 120 min*

Energy/Critical Infrastructure Strategy and Resiliency

- *Objective Screens (min.): 10 min*
- *Content Screens (min.): 90 min*
- *Knowledge Check (KC)/Practical Exercises (PE) Screens (min.): 20 min*

- *Total Screens/Minutes: 120 min*

Enclosure 15: Energy/Critical Infrastructure Resilience Policy Strategy and Partnerships Module



ENERGY/CRITICAL

INFRASTRUCTURE RESILIENCE POLICY STRATEGY AND PARTNERSHIPS MODULE

MAY 2021

Course Description

Overview

This is a 2-hour web-based seminar composed of 2-4 hours of asynchronous multimedia study material followed by a 90–120-minute discussion period. These training segments will introduce senior army leaders to the subject of critical infrastructure resilience Policy for the Army, DoD and Dept. of Homeland Security. Learners in this module will develop an understanding of on and off installation investments in resilience impacting the installation missions. The participants will also gain an appreciation of the requirements for various public-private and public-public partnerships that can impact mission readiness and mission resilience. The learners will also develop an understanding of the various funding sources and strategies that are available to implement projects identified in the Installation Energy and Water Plan. The participants will also be introduced to several military and civilian microgrid projects.

The key course topics include:

- Critical Infrastructure Overview and Resilience Evaluation
- Energy Resilience Relationships, vulnerabilities and strategies
- Cyber and other Threats to the Installation Energy Supply and other Critical Infrastructure
- Energy Resilience Policy and Partnering Authorities and Strategy

Scope

This senior seminar is designed to prepare students to understand the role that critical infrastructure both on and off the installation plays in the mission success of the installation. While the focus will be on “energy infrastructure”, the analytical tools and exercises and much of the policy framework applies to other segments of mission critical infrastructure such as water, wastewater, communications and transportation infrastructure.

Target Audience

The target population will primarily be Garrison Commanders, Deputy Garrison Commanders, Public Works Dir, Plans and appropriate IMCOM staff leads. Secondary target population is Army G9, Deputy Army G9, G9 SIG, Mission

commanders, Corps District Commanders/Deputy Commanders with MILCON support, FORCES Command G3 and G4. This would also be a useful seminar for senior community leaders of communities that host an Army Installation.

Roles and responsibilities. The Target population's key roles are Garrison Commanders and Installation Commanders responsible for the Garrison's ability to project Combat power or otherwise perform its central mission. Secondary roles would deputies and senior staff members that need to understand the role resilient energy systems play in mission capability.

This course is appropriate for senior leaders (City Managers, Public Works, Public Safety, regional utilities districts and regulators) working for partner state, local, tribal, and territorial organizations, especially those at decision-making levels. It is also appropriate for senior leaders in partner organizations in the private sector such as senior representatives of regulated private utilities and non-profits such as community power organizations.

Prerequisites

While there are no prerequisites for the course, participants in this course should be senior installation leaders and installation staff managers. Nonmilitary participants should be senior leaders in local government or utility providers. It is assumed that all participants will have access to computers and internet and have competency in basic use of the computer.

Required Materials

None, other than computer access to the web.

Testing/Certification

There will be no testing or certification with this seminar.

Reference List

Lights Out-A Cyberattack, A Nation Unprepared, Surviving the aftermath-Ted Koppel (2015) National Guidance Documents:

- Presidential Policy Directive 21-Critical Infrastructure Security and Resilience-(2013)
<https://obamawhitehouse.archives.gov/the-press-office/2013/02/12/presidential-policy-directive-critical-infrastructure-security-and-resil->
- National Infrastructure Protection Plan (NIPP) 2013-Partnering for Critical Infrastructure Security and Resilience (2013) and

- selected supplements-Dept of Homeland Security-
<https://www.dhs.gov/sites/default/files/publications/National-Infrastructure-Protection-Plan-2013-508.pdf>
- NPPD Resources to Support Vulnerability Assessments-Dept. of Homeland Security-
<https://www.cisa.gov/sites/default/files/publications/NIPP-2013-Supplement-NPPD-Resources-to-Support-VAs-508.pdf>
 - Executing a Critical Infrastructure Risk Management Approach- Dept. of Homeland Security-
<https://www.cisa.gov/sites/default/files/publications/NIPP-2013-Supplement-Executing-a-CI-Risk-Mgmt-Approach-508.pdf>
 - Incorporating Resilience into Critical Infrastructure Projects-Dept of Homeland Security-
<https://www.cisa.gov/sites/default/files/publications/NIPP-2013-Supplement-Incorporating-Resilience-into-CI-Projects-508.pdf>
 - NIST Brief 13-Identifying and Prioritizing Closure of Resilience Gaps-National Institute of Standards and Technology (Dec 2017)-
<https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1190GB-13.pdf> NIST Spec. Pub. 1190-Community Resilience Planning Guide-
<https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1190v1.pdf>
 - Executive Order 13834-Efficient Federal Operations-Presidential Order for Agencies to meet statutory requirements that increases efficiency, optimizes performance, eliminates unnecessary use of resources, and protects the Environment-Mar 2018-
<https://www.federalregister.gov/documents/2018/05/22/2018-11101/efficient-federal-operations>
 -

DoD and Army Guidance Documents:

- Installation Energy Instruction DoDI 4170.11 Mar 2016 (Installation Energy Management)-
<https://www.acq.osd.mil/eie/Downloads/IE/DODI%204170.11%20-%20Change%201%20Effective%20March%202016%202016%20FINAL.pdf>
- The National Defense Strategy- Jan 2018-
<https://dod.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf>
- Memorandum-Installation Energy Plans-Energy Resilience and Cybersecurity Update requirement for ALL Installations-May 2018-
https://www.acq.osd.mil/eie/Downloads/IE/IEP%20Policy_May302018.pdf

- Memorandum-Metrics and Standards for Energy Resilience at Military Installations-
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- Memorandum- A Framework for Planning and Executing Black Start Exercises-
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- Memorandum-Alternative Financing – Defense Energy Resilience Bank(DERB)Report_2020Feb-
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- Army Directive 2020-03 Installation Energy and Water Security -Mar 2020-
https://www.asaie.army.mil/Public/ES/doc/ARN21644_AD2020-03_Web_Final.pdf
- Army Directive 2020-08 Installation Policy to Address Threats Caused by Changing Climate and Extreme Weather- Sep 2020-
<https://api.army.mil/e2/c/downloads/2020/09/14/a6aa8a40/ad-2020-08-u-s-army-installation-policy-to-address-threats-caused-by-changing-climate-and-extreme-weather.pdf>
- Army Climate Resilience Handbook-Aug 2020-
https://www.g8.army.mil/digital_library/references/resources/20200900_Army_Climate_Resilience_Handbook.pdf
- Army Installations Strategy-Dec 2020-
[https://www.asaie.army.mil/Public/SI/doc/Army_Installations_Strategy_\(AIS\)_FINAL_Signed.pdf](https://www.asaie.army.mil/Public/SI/doc/Army_Installations_Strategy_(AIS)_FINAL_Signed.pdf)

Non-Governmental Resources:

- Beyond the Fence Line -Strengthening Military Capabilities Through Energy Resilience Partnerships-Association of Defense Communities - <https://knowledge-online-defense-communities.knowledgeowl.com/help/installation-energy-water-beyond-the-fence-line-strengthening-military-capabilities-through-energy-resilience-partnerships>
- What Local Government Officials Should Know and Do about Cyber-Security-International City Managers Association (ICMA)-
https://www.nlc.org/wp-content/uploads/2019/10/CS-Cybersecurity-Report-Final_0.pdf
- Regional Identification of Gaps for Operational Resilience Process (RIGOR) for Joint Base Elmendorf Richardson (JBER)-Converge Strategies-

<https://static1.squarespace.com/static/58c0207d15d5db7d6b968444/t/5e96efcddcb3ec0fc5c8d613/1586950094234/RIGOR+Report.pdf>

- Report on Security in the North American Grid, A Nation at Risk - Fourth Update- George R. Cotter- Apr 2015-
<https://www.nrc.gov/docs/ML1511/ML15114A348.pdf>
- Cybersecurity and the North American Electric Grid; New Policy Approaches to address an evolving threat-Bipartisan Policy Center- Feb 2014- <https://bipartisanpolicy.org/wp-content/uploads/2019/03/Cybersecurity-Electric-Grid-BPC.pdf>
- Critical Infrastructure Resilience-A Regional and National Approach (Nov 2014)-MITRE Corporation Publication-
<https://www.mitre.org/sites/default/files/publications/14-4047-critical-infrastructure-resilience-a-regional-and-national-approach.pdf>
- Decide Platform-NUARI
- Jack Voltaic Cyber Research Project 3.0 – Army Cyber Center-
<https://cyber.army.mil/Research/Jack-Voltaic/>

Evaluation Strategy

This module will not have a formal evaluation segment.

Technical Requirements

Participants will require a computer with an Internet connection and a web browser that supports flash or HTML5. Participants will require speakers or headphones for supplemental audio and video material.

Course Structure/Content Outline

Course Introduction and Objectives

- *Course overview*
- *Course objectives*
- *Discussion of home installation vulnerabilities*

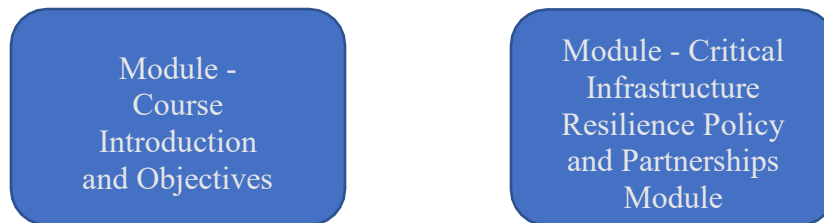
Energy/Critical Infrastructure Resilience Policy and Partnerships

- *Understand Army, DOD, and Homeland Security policies regarding the resilience of critical infrastructure.*
- *Develop an understanding of the on and off installation investment priorities necessary to achieve energy resilience required to accomplish the installation's mission*
- *Develop an understanding of the authorities and structures available for managing manmade or natural disaster impacts of*

critical infrastructure failure.

- *Develop an understanding of the various partnerships required to effectively impact the installation's energy resilience.*
- *Develop an understanding of the various funding sources and authorities to assist in achieving energy and other critical infrastructure resilience.*
- *Based on the outcome of the Installation Energy and Water Plan development process for your installation, develop an investment strategy to maximize mission success.*
- *Understand the functional requirements for micro grid systems to support critical operations both on and off the installation that are critical to the installation's mission capability.*

Course Progression



Course Development Matrix

Class 0: Introduction, Course Objectives and Pre-Assessment

- **Scope Statement:** *This lesson will prepare participants for course navigation and introduce course objectives. Participants will complete a pre-assessment of their installation's energy resilience as part of the course introduction.*
- **Terminal Learning Objective (TLO):**
 - None
- **Enabling Learning Objectives (ELO):**

- None
- **Lesson Topics:**
 - Navigation
 - Discussion of current home installation's energy resilience
 - **Instructional Strategy:** Read ahead assignment of "Lights Out", Videos of Ted talk on national resilience prioritization, review of 2003 grid outage in retrospect, Tutorial, group discussion, and practical exercise with students discussion their home installation and community resilience.
 - **Assessment Strategy:** None

Class: Energy/Critical Infrastructure Resilience Policy and Partnerships

- **Scope Statement:** This Class will describe the range of Army, DOD, Homeland Security and National Policies regarding the resilience of critical infrastructure and authorities for essential partnerships for meeting these policy demands.
- **Terminal Learning Objective 1 (TLO1):**
Upon successful completion of the Class, participants will understand the key energy/critical infrastructure policies impacting the installation.
- **Enabling Learning Objectives (ELO):**
 - Understanding the interconnectedness of on and off installation systems that mitigate against islanding the installation.
 - Understand the role microgrid(s) and distributed generation can play in the installation 's and the region's resilience and ability to execute the installation's mission.
 - Understanding the Army/DOD policies addressing energy and other critical infrastructure resilience
- **Terminal Learning Objective 2 (TLO2):**
Upon successful completion of the Class, participants will understand the authorities that are available to encourage and fund regional response to energy and other critical infrastructure resilience needs.
- **Enabling Learning Objectives (ELO):**
 - Understand the capabilities and limitations of the various energy investment authorities.
 - Understand the authorities available to allow collaboration and joint funding with key infrastructure partners.
- **Terminal Learning Objective 3 (TLO3):**
Upon successful completion of the Class, participants will understand the need for a regional partnerships and investment strategy to improve the installation and region's energy resilience.
- **Enabling Learning Objectives (ELO):**
 - Understand the RIGOR analysis process.

- *Techniques for mobilizing the region to address the outcomes of the RIGOR analysis.*
- *Understand how to develop a regional infrastructure investment strategy.*

□ **Lesson Topics:**

- *Partnership authorities*
- *Infrastructure investment strategies and authorities*
- *Regional Identification of Gaps for Operational Resilience (RIGOR) analysis process*

□ **Instructional Strategy:** *Readings and Tutorial on Army resilience policies, discussion of the application status of policies at the home station in various forms of critical infrastructure, the role of the Army Installation strategy and resilience partnerships case studies, integration of civilian and DoD resilience efforts, the risk of “islanding” philosophy, videos. Discussion of the evolution of resilience policies and practice in DoD, discussion of Ft Typical resilience issues, discussion of the role of IEWPs as energy resilience planning and execution tools, class discussion and tutorial on the various types of exercises and the value of each type, a discussion of the range of funding tools to help finance energy resilience, discussion of various Army and other Service resilience partnership projects and community role in funding strategies, and videos on the basics of grids and microgrids*

□ **Assessment Strategy:** *Knowledge discussion questions at the end of this Class segment.*

Estimated Contact Time

Course Introduction and objectives

- *Objective Screens (min.): 10*
- *Content Screens (min.): 90*
- *Knowledge Check (KC)/Practical Exercises (PE) Screens (min.): 20*
- *Total Screens/Minutes: 120 min*

Energy/Critical Infrastructure Resilience Policy and Partnerships

- *Objective Screens (min.): 10 min*
- *Content Screens (min.): 90 min*
- *Knowledge Check (KC)/Practical Exercises (PE) Screens (min.): 20 min*
- *Total Screens/Minutes: 120 min*

Enclosures 16: Critical Infrastructure/Energy Resilience Exercise Development Module



CRITICAL INFRASTRUCTURE/ENERG Y RESILIENCE EXERCISE DEVELOPMENT MODULE

May 2021

Course Description

Overview

This is a web-based seminar composed of 2-4 hrs. of asynchronous multimedia training material followed by a 2-hour discussion period. These training segments will introduce senior army leaders to the subject of critical infrastructure resilience with an emphasis on energy. Learners will gain an overview of the critical infrastructure, whose overall resilience in the face of natural or manmade interruptions, is key to mission success of Army installations and their ability to project combat power. The multimedia material will use the exercise development process to expose the student to the policy framework addressing critical infrastructure resilience. Through a discussion of the various types of resilience exercises, the learner will also be exposed to the wide array of organizations beyond their normal control whose performance and capital investments will have great impact on the installation's mission success. The seminar participants will also become aware of the wide range of threats to critical infrastructure, some tools available for identifying these threats and potential partners in addressing the issue.

Participants will become familiar with the Federal Agencies, local governments, non-profit and for-profit organizations that will play keystone roles in assuring the critical infrastructure resilience essential to installation mission success. Through the exercise development process and exercise execution, the participants will also gain an understanding of how to manage the risk and enhance the resilience of their critical infrastructure and how to partner with other critical infrastructure owners. This will be accomplished by the participants developing an understanding of kinetic and non-kinetic threats by participating in a critical infrastructure analysis necessary to develop various types of exercises from tabletops to black-start exercise. The reference list provides a listing of additional material the learner may refer to for more in- depth coverage of the multimedia material.

The key course topics include:

- Critical Infrastructure Resilience Policy and Exercise development process

Scope

This senior seminar is designed to prepare students to understand the role that critical infrastructure both on and off the installation plays in the mission success of the installation. While the focus will be on "energy infrastructure", the analytical tools and exercises and much of the policy framework applies to

other segments of mission critical infrastructure such as water, wastewater, communications and transportation infrastructure.

Target Audience

The target population will primarily be Garrison Commanders, Deputy Garrison Commanders, Public Works Dir, Plans and appropriate IMCOM staff leads. Secondary target population is Army G9, Deputy Army G9, G9 SIG, Mission commanders, Corps District Commanders/Deputy Commanders with MILCON support, FORCES Command G3 and G4. This would also be a useful seminar for senior community leaders of communities that host an Army Installation.

Roles and responsibilities. The Target population's key roles are Garrison Commanders and Installation Commanders responsible for the Garrison's ability to project Combat power or otherwise perform its central mission. Secondary roles would deputies and senior staff members that need to understand the role resilient energy systems play in mission capability.

This course is appropriate for senior leaders (City Managers, Public Works, Public Safety, regional utilities districts and regulators) working for partner state, local, tribal, and territorial organizations, especially those at decision-making levels. It is also appropriate for senior leaders in partner organizations in the private sector such as senior representatives of regulated private utilities and non-profits such as community power organizations.

Prerequisites

While there are no prerequisites for the course, participants in this course should be senior installation leaders and installation staff managers. Nonmilitary participants should be senior leaders in local government or utility providers. It is assumed that all participants will have access to computers and internet and have competency in basic use of the computer.

Required Materials

None, other than computer access to the web.

Testing/Certification

There will be no testing or certification with this seminar.

Reference List

Lights Out-A Cyberattack, A Nation Unprepared, Surviving the

aftermath-Ted Koppel (2015) National Guidance Documents:

- ☐ Presidential Policy Directive 21-Critical Infrastructure Security and Resilience-(2013)
[https://obamawhitehouse.archives.gov/the-press-office/2013/02/12/presidential-policy-directive-critical-infrastructure-security-and-resil-](https://obamawhitehouse.archives.gov/the-press-office/2013/02/12/presidential-policy-directive-critical-infrastructure-security-and-resil)
- ☐ National Infrastructure Protection Plan (NIPP) 2013-Partnering for Critical Infrastructure Security and Resilience (2013) and selected supplements-Dept of Homeland Security-
<https://www.dhs.gov/sites/default/files/publications/National-Infrastructure-Protection-Plan-2013-508.pdf>
- ☐ NPPD Resources to Support Vulnerability Assessments-Dept. of Homeland Security-
<https://www.cisa.gov/sites/default/files/publications/NIPP-2013-Supplement-NPPD-Resources-to-Support-VAs-508.pdf>
- ☐ Executing a Critical Infrastructure Risk Management Approach-Dept. of Homeland Security-
<https://www.cisa.gov/sites/default/files/publications/NIPP-2013-Supplement-Executing-a-CI-Risk-Mgmt-Approach-508.pdf>
- ☐ Incorporating Resilience into Critical Infrastructure Projects-Dept of Homeland Security-
<https://www.cisa.gov/sites/default/files/publications/NIPP-2013-Supplement-Incorporating-Resilience-into-CI-Projects-508.pdf>
- ☐ NIST Brief 13-Identifying and Prioritizing Closure of Resilience Gaps-National Institute of Standards and Technology (Dec 2017)-
<https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1190GB-13.pdf>
- ☐ NIST Spec. Pub. 1190- Community Resilience Planning Guide-
<https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1190v1.pdf>
- ☐ Executive Order 13834-Efficient Federal Operations-Presidential Order for Agencies to meet statutory requirements that increases efficiency, optimizes performance, eliminates unnecessary use of resources, and protects the Environment-Mar 2018-
<https://www.federalregister.gov/documents/2018/05/22/2018-11101/efficient-federal-operations>
- ☐

DoD and Army Guidance Documents:

- ☐ Installation Energy Instruction DoDI 4170.11 Mar 2016 (Installation Energy Management)-
[https://www.acq.osd.mil/eie/Downloads/IE/DODI%204170.11%20-](https://www.acq.osd.mil/eie/Downloads/IE/DODI%204170.11%20)

%20Change%201%20Effective%20March%2016%202016%20FINAL.pdf-

- ☐ The National Defense Strategy- Jan 2018-
[https://dod.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy- Summary.pdf](https://dod.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf)
- ☐ Memorandum-Installation Energy Plans-Energy Resilience and Cybersecurity Update requirement for ALL Installations- May 2018-
https://www.acq.osd.mil/eie/Downloads/IE/IEP%20Policy_May302018.pdf
- ☐ Memorandum-Metrics and Standards for Energy Resilience at Military Installations-
<https://www.acq.osd.mil/eie/Downloads/IE/Metrics%20and%20Standards%20for%20Energy%20Resilience%20at%20Military%20Installations.pdf>
- ☐ Memorandum- A Framework for Planning and Executing Black Start Exercises-
https://www.acq.osd.mil/eie/Downloads/IE/Memo%20Framework%20for%20Planning%20and%20Executing%20Black%20Start%20Exercises_08062020.pdf
- ☐ Memorandum-Alternative Financing – Defense Energy Resilience Bank (DERB)Report_2020Feb-
[https://www.acq.osd.mil/eie/Downloads/IE/DefenseEnergyResilience Bank\(DERB\)Report_2020Feb.pdf](https://www.acq.osd.mil/eie/Downloads/IE/DefenseEnergyResilienceBank(DERB)Report_2020Feb.pdf)
- ☐ Army Directive 2020-03 Installation Energy and Water Security -Mar 2020-
https://www.asaie.army.mil/Public/ES/doc/ARN21644_AD2020-03_Web_Final.pdf
- ☐ Army Directive 2020-08 Installation Policy to Address Threats Caused by Changing Climate and Extreme Weather- Sep 2020-
<https://api.army.mil/e2/c/downloads/2020/09/14/a6aa8a40/ad-2020-08-u-s-army-installation-policy-to-address-threats-caused-by-changing-climate-and-extreme-weather.pdf>
- ☐ Army Climate Resilience Handbook-Aug 2020-
https://www.g8.army.mil/digital_library/references/resources/20200900_Army_Climate_Resilience_Handbook.pdf
- ☐ Army Installations Strategy-Dec 2020-
[https://www.asaie.army.mil/Public/SI/doc/Army_Installations_Strategy_\(AIS\)_FINAL_Signed.pdf](https://www.asaie.army.mil/Public/SI/doc/Army_Installations_Strategy_(AIS)_FINAL_Signed.pdf)

Non-Governmental Resources:

- ☐ Beyond the Fence Line -Strengthening Military Capabilities Through Energy Resilience Partnerships-Association of Defense Communities - <https://knowledge-online-defense->

communities.knowledgeowl.com/help/installation-energy-water-beyond-the-fence-line- strengthening-military-capabilities-through-energy-resilience-partnerships

- What Local Government Officials Should Know and Do about Cyber-Security-International City Managers Association (ICMA)-
https://www.nlc.org/wp-content/uploads/2019/10/CS-Cybersecurity-Report-Final_0.pdf
- Regional Identification of Gaps for Operational Resilience Process (RIGOR) for Joint Base Elmendorf Richardson (JBER)-Converge Strategies-
<https://static1.squarespace.com/static/58c0207d15d5db7d6b968444/t/5e96efcddcb3ec0fc5c8d613/1586950094234/RIGOR+Report.pdf>
- Report on Security in the North American Grid, A Nation at Risk - Fourth Update- George R. Cotter- Apr 2015-
<https://www.nrc.gov/docs/ML1511/ML15114A348.pdf>
- Cybersecurity and the North American Electric Grid; New Policy Approaches to address an evolving threat-Bipartisan Policy Center- Feb 2014- <https://bipartisanpolicy.org/wp-content/uploads/2019/03/Cybersecurity-Electric-Grid-BPC.pdf>
- Critical Infrastructure Resilience-A Regional and National Approach (Nov 2014)-MITRE Corporation Publication-
<https://www.mitre.org/sites/default/files/publications/14-4047-critical-infrastructure-resilience-a-regional-and-national-approach.pdf>
- Decide Platform-NUARI
- Jack Voltaic Cyber Research Project 3.0 – Army Cyber Center-
<https://cyber.army.mil/Research/Jack-Voltaic/>

Evaluation Strategy

The students will be required to discuss their plans for implementing various types of exercises and their exercise objectives.

Technical Requirements

Participants will require a computer with an Internet connection and a web browser that supports flash or HTML5. Participants will require speakers or headphones for supplemental audio and video material.

Course Structure/Content Outline

Course Introduction and Objectives

- ☐ *Course overview*
- ☐ *Course objectives*
- ☐ *Discussion of home installation vulnerabilities*

Exercise Development Process

- ☐ *Develop Understanding of the 4 Phase Exercise process*
- ☐ *Develop Exercise scenarios for home installation using the 4-phase process.*

Course Progression



Course Development Matrix

Class: Introduction, Course Objectives and Pre-Assessment

- ☐ **Scope Statement:** *This lesson will prepare participants for course navigation and introduce course objectives. Participants will complete a pre-assessment of their installation's energy resilience as part of the course introduction.*
- ☐ **Terminal Learning Objective (TLO):**
 - ☐ *None*
- ☐ **Enabling Learning Objectives (ELO):**
 - ☐ *None*
- ☐ **Lesson Topics:**
 - ☐ *Navigation*
 - ☐ *Discussion of current home installation's energy resilience*
- ☐ **Instructional Strategy:** *Read ahead assignment of "Lights Out", Videos of Ted talk on national resilience prioritization, review of 2003 grid outage in retrospect, Tutorial, group discussion, and practical*

exercise with students discussion their home installation and community resilience.

- ☐ **Assessment Strategy:** None

Class: Energy Resilience Exercise Development

- ☐ *Scope Statement: This class will describe the four phases on understanding and developing an installation energy resilience exercise.*

- ☐ **Terminal Learning Objective 1 (TLO1):**

Upon completion of the Class, participants will understand the drivers of energy resilience and the basics of energy resilience exercise planning.

- ☐ **Enabling learning objectives (ELO)**

- ☐ *Define resiliency in DoD terms.*
- ☐ *Define the drivers of DoD resiliency.*
- ☐ *Define DoD Resilience Policies and Testing requirements*
- ☐ *Identify the types of energy resilience exercises and capabilities and benefits of each.*

- ☐ **Terminal Learning Objective 2 (TLO2):**

Upon completion of the class, participants will be able to identify the installation resilience champions; identify resilience requirements, capabilities and gaps; conduct necessary data calls; and identify and prioritize mission risks.

- ☐ **Enabling learning objectives (ELO)**

- ☐ *Obtaining leadership exercise buy in/support.*
- ☐ *Identifying key stakeholders*
- ☐ *Learning Techniques for identifying resilience gaps*
- ☐ *Facilitating Data calls and site visits*
- ☐ *Determining resilience gaps in critical infrastructure*
- ☐ *Prioritizing mission risks associated with identified gaps.*

- ☐ **Terminal Learning Objective 3 (TLO 3):**

Upon completion of the class, participants will be able to develop threat scenarios that provide "crucible" environment for players.

- ☐ **Enabling Learning Objectives (ELO)**

- ☐ *Developing a cascading scenario*
- ☐ *Tailoring scenario to exploit gaps.*
- ☐ *Tailoring threat selection to installation risk*
- ☐ *Identifying critical infrastructure beyond the fence line*
- ☐ *Tailoring injects to evoke player response.*
- ☐ *Developing white cell situation reports for maximum value.*

- ☐ **Terminal Learning Objective 4 (TLO 4):**

Upon completion of the class the participants will understand the requirements to execute an exercise to meet the desired objectives

- ☐ **Enabling learning Objectives (ELO)**

- ☐ *Establish and assign key roles and responsibilities.*
- ☐ *Identify Event's key stakeholders.*
- ☐ *Develop event logistics, agenda and timeline.*

- ☐ *Define event steps and execute.*
- ☐ *Develop exercise out brief and results.*
- ☐ *Capitalize on exercise results for identifying policy or training needs, project identification and acquisition, and initiate planning for next exercise.*
- ☐ **Instructional Strategy:** *Tutorial covering course content review, types of exercises and the planning process for exercise. Class will discuss the specifics of their installation mission resilience structure and preliminary planning for a tabletop exercise at home station.*
- ☐ **Assessment Strategy:** *Participants will use the information they gain in this class as foundation for the next seminar segment using the DECIDE platform for a capstone exercise that uses the information gained in the seminar.*

Estimated Contact Time

Course Introduction and objectives

- ☐ *Objective Screens (min.): 10*
- ☐ *Content Screens (min.): 90*
- ☐ *Knowledge Check (KC)/Practical Exercises (PE) Screens (min.): 20*
- ☐ *Total Screens/Minutes: 120 min*

Energy Resilience Exercise Development

- ☐ *Objective Screens (min.): TBD*
- ☐ *Content Screens (min.): 10 min*
- ☐ *Content Screens (min.): 90 min*
- ☐ *Knowledge Check (KC)/Practical Exercises (PE) Screens (min.): 20 min*
- ☐ *Total Screens/Minutes: 120 min*

Enclosure 17: Critical Infrastructure/Energy Resilience Capstone Exercise Module



CRITICAL INFRASTRUCTURE/ENER GY RESILIENCE CAPSTONE EXERCISE MODULE

MAY 2021

Course Description

Overview

This is a 2-3-hour web-based distributed tabletop exercise. Prior to the exercise there is a 2–3- hour multimedia instruction on the DECIDE platform and the exercise scenario. These training segments will introduce senior army leaders to the use of distributed tabletop exercise to develop skills in critical infrastructure resilience planning and exercising in a dynamic environment. Learners will gain an overview of the critical infrastructure, whose overall resilience in the face of natural or manmade interruptions, is key to mission success of Army installations and their ability to project combat power. The training will assist Senior Leaders develop an understanding of the critical infrastructure both on and off base that must be operational for the installation and its tenant units to accomplish their assigned missions. The learner will also be exposed to the wide array of organizations beyond their normal control whose performance and capital investments will have great impact on the installation's mission success. The seminar participants will also become aware of the wide range of threats to critical infrastructure, some tools available for identifying these threats and potential partners in addressing the issue. Participants will become familiar with the Federal Agencies, local governments, non-profit and for-profit organizations that will play keystone roles in assuring the critical infrastructure resilience essential to installation mission success. The participants will also gain an understanding of how to manage the risk and enhance the resilience of their critical infrastructure and how to partner with other critical infrastructure owners.

The key course topics include:

- Energy Resilience Relationships, vulnerabilities and strategies
- Cyber and other Threats to the Installation Energy Supply and other Critical Infrastructure
- Exercise development process
- Energy/Critical Infrastructure Resilience Exercise

Scope

This senior seminar is designed to prepare students to understand the role that critical infrastructure both on and off the installation plays in the mission success of the installation. While the focus will be on “energy infrastructure”, the analytical tools and exercises and much of the policy framework applies to other segments of mission critical infrastructure such as water, wastewater, communications and transportation infrastructure.

Target Audience

The target population will primarily be Garrison Commanders, Deputy Garrison Commanders, Public Works Dir, Plans and appropriate IMCOM staff leads. Secondary target population is Army G9, Deputy Army G9, G9 SIG, Mission commanders, Corps District Commanders/Deputy Commanders with MILCON support, FORCES Command G3 and G4. This would also be a useful seminar for senior community leaders of communities that host an Army Installation.

Roles and responsibilities. The Target population's key roles are Garrison Commanders and Installation Commanders responsible for the Garrison's ability to project Combat power or otherwise perform its central mission. Secondary roles would deputies and senior staff members that need to understand the role resilient energy systems play in mission capability.

This course is appropriate for senior leaders (City Managers, Public Works, Public Safety, regional utilities districts and regulators) working for partner state, local, tribal, and territorial organizations, especially those at decision-making levels. It is also appropriate for senior leaders in partner organizations in the private sector such as senior representatives of regulated private utilities and non-profits such as community power organizations.

Prerequisites

While there are no prerequisites for the course, participants in this course should be senior installation leaders and installation staff managers. Nonmilitary participants should be senior leaders in local government or utility providers. It is assumed that all participants will have access to computers and internet and have competency in basic use of the computer.

Required Materials

None, other than computer access to the web.

Testing/Certification

There will be no testing or certification with this tabletop exercise.

Reference List

Lights Out-A Cyberattack, A Nation Unprepared, Surviving the aftermath-Ted Koppel (2015) National Guidance Documents:

- ☐ Presidential Policy Directive 21-Critical Infrastructure Security and Resilience-(2013)

[https://obamawhitehouse.archives.gov/the-press-office/2013/02/12/presidential-policy-directive-critical-infrastructure-security-and-resil-](https://obamawhitehouse.archives.gov/the-press-office/2013/02/12/presidential-policy-directive-critical-infrastructure-security-and-resil)

- National Infrastructure Protection Plan (NIPP) 2013-Partnering for Critical Infrastructure Security and Resilience (2013) and selected supplements-Dept of Homeland Security-
<https://www.dhs.gov/sites/default/files/publications/National-Infrastructure-Protection-Plan-2013-508.pdf>
- NPPD Resources to Support Vulnerability Assessments-Dept. of Homeland Security-
<https://www.cisa.gov/sites/default/files/publications/NIPP-2013-Supplement-NPPD-Resources-to-Support-VAs-508.pdf>
- Executing a Critical Infrastructure Risk Management Approach-Dept. of Homeland Security-
<https://www.cisa.gov/sites/default/files/publications/NIPP-2013-Supplement-Executing-a-CI-Risk-Mgmt-Approach-508.pdf>
- Incorporating Resilience into Critical Infrastructure Projects-Dept of Homeland Security-
<https://www.cisa.gov/sites/default/files/publications/NIPP-2013-Supplement-Incorporating-Resilience-into-CI-Projects-508.pdf>
- NIST Brief 13-Identifying and Prioritizing Closure of Resilience Gaps-National Institute of Standards and Technology (Dec 2017)-
<https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1190GB-13.pdf>
- Executive Order 13834-Efficient Federal Operations-Presidential Order for Agencies to meet statutory requirements that increases efficiency, optimizes performance, eliminates unnecessary use of resources, and protects the Environment-Mar 2018-
<https://www.federalregister.gov/documents/2018/05/22/2018-11101/efficient-federal-operations>
-

DoD and Army Guidance Documents:

- Installation Energy Instruction DoDI 4170.11 Mar 2016 (Installation Energy Management)-
<https://www.acq.osd.mil/eie/Downloads/IE/DODI%204170.11%20-%20Change%201%20Effective%20March%2016%202016%20FINAL.pdf>
- The National Defense Strategy- Jan 2018-
<https://dod.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf>
- Memorandum-Installation Energy Plans-Energy Resilience and Cybersecurity Update requirement for ALL Installations-May 2018-

https://www.acq.osd.mil/eie/Downloads/IE/IEP%20Policy_May302018.pdf

- Army Directive 2020-03 Installation Energy and Water Security -Mar 2020-
https://www.asaie.army.mil/Public/ES/doc/ARN21644_AD2020-03_Web_Final.pdf
- Army Directive 2020-08 Installation Policy to Address Threats Caused by Changing Climate and Extreme Weather- Sep 2020-
<https://api.army.mil/e2/c/downloads/2020/09/14/a6aa8a40/ad-2020-08-u-s-army-installation-policy-to-address-threats-caused-by-changing-climate-and-extreme-weather.pdf>
- Army Climate Resilience Handbook-Aug 2020-
https://www.g8.army.mil/digital_library/references/resources/20200900_Army_Climate_Resilience_Handbook.pdf
- Army Installations Strategy-Dec 2020-
[https://www.asaie.army.mil/Public/SI/doc/Army_Installations_Strategy_\(AIS\)_FINAL_Signed.pdf](https://www.asaie.army.mil/Public/SI/doc/Army_Installations_Strategy_(AIS)_FINAL_Signed.pdf)

Non-Governmental Resources:

- Beyond the Fence Line -Strengthening Military Capabilities Through Energy Resilience Partnerships-Association of Defense Communities - <https://knowledge-online-defense-communities.knowledgeowl.com/help/installation-energy-water-beyond-the-fence-line-strengthening-military-capabilities-through-energy-resilience-partnerships>
- What Local Government Officials Should Know and Do about Cyber-Security-International City Managers Association (ICMA)-
https://www.nlc.org/wp-content/uploads/2019/10/CS-Cybersecurity-Report-Final_0.pdf
- Regional Identification of Gaps for Operational Resilience Process (RIGOR) for Joint Base Elmendorf Richardson (JBER)-Converge Strategies-
<https://static1.squarespace.com/static/58c0207d15d5db7d6b968444/t/5e96efcddeb3ec0fc5c8d613/1586950094234/RIGOR+Report.pdf>
- Report on Security in the North American Grid, A Nation at Risk - Fourth Update- George R. Cotter- Apr 2015-
<https://www.nrc.gov/docs/ML1511/ML15114A348.pdf>
- Cybersecurity and the North American Electric Grid; New Policy Approaches to address an evolving threat-Bipartisan Policy Center- Feb 2014- <https://bipartisanpolicy.org/wp-content/uploads/2019/03/Cybersecurity-Electric-Grid-BPC.pdf>
- Critical Infrastructure Resilience-A Regional and National Approach (Nov 2014)-MITRE Corporation Publication-
<https://www.mitre.org/sites/default/files/publications/14-4047->

critical-infrastructure-resilience-a-regional-and-national-approach.pdf

- ☐ Decide Platform-NUARI
- ☐ Jack Voltaic Cyber Research Project 3.0 – Army Cyber Center-
<https://cyber.army.mil/Research/Jack-Voltaic/>

Evaluation Strategy

A DECIDE based exercise will allow self-evaluation rather than a formal evaluation.

Technical Requirements

Participants will require a computer with an Internet connection and a web browser that supports flash or HTML5. Participants will require speakers or headphones for supplemental audio and video material.

Course Structure/Content Outline

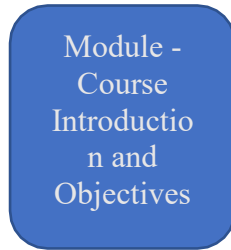
Course Introduction and Objectives

- ☐ *Course overview*
- ☐ *Course objectives*
- ☐ *Discussion of home installation vulnerabilities*

Capstone Exercise

- ☐ *Develop the skills for effective energy/critical infrastructure resilience planning and exercising in a dynamic and complex environment.*
- ☐ *Be able to lead regional exercise that address the full gamut of energy/critical infrastructure vulnerabilities and resilience strategies for the infrastructure critical to the installation's missions.*
- ☐ *Be able to effectively participate in the national, regional and local government and non-governmental discussions that influence critical infrastructure/energy resilience on and off the installation.*
- ☐ *As a result of the course be able to outline specific strategies and funding priorities to address the energy resilience/critical infrastructure needs of the installation mission*

Course Progression



Course Development Matrix

Class: Introduction, Course Objectives and Pre-Assessment

- **Scope Statement:** *This lesson will prepare participants for course navigation and introduce course objectives. Participants will complete a pre-assessment of their installation's energy resilience as part of the course introduction.*
- **Terminal Learning Objective (TLO):**
 - None
- **Enabling Learning Objectives (ELO):**
 - None
- **Lesson Topics:**
 - Navigation
 - Discussion of current home installation's energy resilience
- **Instructional Strategy:** *Tutorial, group discussion videos and practical exercise.*
- **Assessment Strategy:** *None*

Class: Capstone Exercise

- **Scope Statement:** *This Class will be a computer aided exercise to develop the participants understanding and skill set for addressing critical infrastructure/energy resilience issues in a dynamic and complex environment.*
- **Terminal Learning Objective 1 (TLO1):**
Upon successful completion of the exercise, participants will understand a typical installation energy infrastructure/critical infrastructure vulnerability and potential resilience strategies.
- **Enabling Learning Objectives (ELO):**
 - *Understand the DECIDE exercise system and how to participate in it.*

- *Be able to participate in region wide exercises and planning for critical infrastructure resilience.*
- *Be able to identify partnership opportunities with other governmental and non-governmental agencies to enhance energy resilience. Be able to outline specific strategies and funding priorities to address the energy resilience/critical infrastructure needs of the installation and their relationship with the region's needs.*

□ **Lesson Topics:**

- *DECIDE exercise platform.*
- *Use of RIGOR analysis process.*
- *Understanding the interdependency of the installation's mission capability with the Regional energy and other critical infrastructure systems*

□ **Instructional Strategy:** *Tutorial, exercise set up, learning tasks and exercise activities.*

□ **Assessment Strategy:** *Discussion of exercise learning elements at the end of the Class.*

□

Estimated Contact Time

Course Introduction and objectives

- *Objective Screens (min.): 10*
- *Content Screens (min.): 90*
- *Knowledge Check (KC)/Practical Exercises (PE) Screens (min.): 20*
- *Total Screens/Minutes: 120 min*

Capstone Exercise

- *Objective Screens (min.): 5 min*
- *Content Screens (min.): 10 min*
- *Knowledge Check (KC)/Practical Exercises (PE) Screens (min.): 105 min*
- *Total Screens/Minutes: 120+ min*

Enclosure 18: Course Catalog

Subject: Norwich University and NUARI Energy Resilience Education Track Course Catalog

This course catalog will reference modules created in Phase 2, Energy Resilience Education Track, and established courses and programs that meet the goals and objectives of the ERDC-CERL/NUARI Energy Resilience Education Track. The course delivery options include online self-paced, online instructor led, in person or online seminars, academic credit certificates, CEU micro certificates, or CEU certificate options based on the needs of the US Army. The Course Catalog is arranged in the following manner:

Note: “*” refers to modules/courses that are listed as Enclosures to the ERDC-CERL Energy Resilience Education Track Final Technical Report.

Integrated Course

- ☐ Senior Leader Seminar (this course integrates modules into one seminar)

Fundamentals –

- ☐ *Resilience for Sustainability (sub-module of Energy Fundamentals)
- ☐ *Energy and You Module
- ☐ *Energy and Society Module
- ☐ *Energy and Resilience Module
- ☐ *Energy Nexus Module
- ☐ *Microgrid Architecture
- ☐ *Industrial Control Systems (ICS)

Risk Analysis

- ☐ *Critical Infrastructure/Energy Resilience Overview Module
- ☐ *Identifying Mission Critical Infrastructure/Energy Systems Module
- ☐ *Critical Infrastructure Threat Analysis/Risk Management Module
- ☐ Introduction to Compliance Investigations (CC310)
- ☐ Risk Assessments, Policies, and Internal Controls (CC320)
- ☐ Due Diligence and Internal Investigations (CC330)
- ☐ Organizational Culture and Continuous Compliance Improvement (CC340)

Policy, Partnerships, Cyber

- ☐ Security Situation Center Training 2020 (NUARI)
- ☐ *Energy/Critical Infrastructure Resilience Policy and Partnerships Module
- ☐ *Exercise Development Process - Capstone Exercise Module
- ☐ Graduate Certificate in Computer Forensic Investigation/Incident Response Team Management
 - Computer Security Incident Response Team Management | GI554
 - Computer Forensic Investigation GI551
- ☐ Graduate certificate in Vulnerability Management
 - Vulnerability Management and Penetration Testing I GI562
 - Vulnerability Management and Penetration Testing II GI553

- ☐ Graduate Certificate in Critical Infrastructure Protection & Cyber Crime
 - Cyber Crime GI556
 - Critical Infrastructure Protection GI566
- ☐ Graduate Certificate in Public Administration Leadership & Crisis Management -
 - Foundations of Leadership and Ethical Decision-Making AD576
- ☐ Public Leadership, Crisis Management, and Organizational Change AD586
- ☐ Graduate Certificate in Rural Municipal Governance
 - Municipal Governance AD543
 - Rural Municipal Governance AD553
- ☐ Graduate Certificate in Urban Municipal Governance
 - Municipal Governance AD543
 - Urban Municipal Governance

AD563 Master Planning

- ☐ Energy Resources and Markets GB548 – in non-credit format
- ☐ Energy Savings and Efficiency Projects GB558 – in non-credit format
- ☐ Managing Corporate Energy Needs GB568 – in non-credit format
- ☐ Public Works - PW310: Management and Leadership Proficiencies
- ☐ Public Works PW320: Strategy and Planning
- ☐ Public Works PW330: Operations and Organizations
- ☐ Public Works PW340: Long-Term Strategy Project
- ☐ Project Management PM310: Project Management Overview
- ☐ Public WorksPM320: Applied Psychology in Project Management

National Cybersecurity Preparedness Consortium (NCPC): <https://nationalcpc.org/>

NUARI is a member of the NCPC that offers free courses in the area of awareness, coordination and planning, cyber incident response and recovery, infrastructure technical training, and cyber threat information training.

Integrated Course – Senior Leader Seminar

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites
*Senior Leader Seminar	Non-Credit (CEU)	12 hours	Senior Leaders(primary); Mid-Career (alternate)	Norwich Pro Asynchronous format	None

Course Description: This is a 12-hour web-based seminar composed of 6, 2-hour segments. These training segments will introduce senior army leaders to the subject of critical infrastructure resilience with an emphasis on energy. Learners will gain an overview of the critical infrastructure, whose overall resilience in the face of natural or manmade interruptions, is key to mission success of Army installations and their ability to project combat power. The training will assist Senior Leaders develop an understanding of the critical infrastructure both on and off base that must be operational for the installation and its tenant units to accomplish their assigned missions. The learner will also be exposed to the wide array of organizations beyond their normal control whose performance and capital investments will have great impact on the installation's mission success. The seminar participants will also become aware of the wide range of threats to critical infrastructure, some tools available for identifying these threats and potential partners in addressing the issue. Participants will become familiar with the Federal Agencies, local governments, non-profit and for-profit organizations that will play keystone roles in assuring the critical infrastructure resilience essential to installation mission success. The participants will also gain an understanding of how to manage the risk and enhance the resilience of their critical infrastructure and how to partner with other critical infrastructure owners. This will be accomplished by the participants developing an understanding of kinetic and non-kinetic threats by participating in a critical infrastructure analysis and participating in a capstone resilience exercise using the DECIDE exercise platform. Finally, students will gain an understanding of the policies controlling resilience standards, partnering with non-Army agencies, microgrids and funding opportunities for on base and off base infrastructure improvements.

Fundamentals

<u>Course Title</u>	<u>Credits</u>	<u>Duration</u>	<u>Audience</u>	<u>Delivery Method</u>	<u>Prerequisites</u>
*Resilience for Sustainability - Part of the Energy Fundamentals offerings - Energy and You/Society / Resilience	None for Undergraduates – the course is integrated into existing courses .5 CEUs for Mid-Career and Senior Leaders	3 Hours	Undergraduate students in the following disciplines (not limited to this list): •Engineering •Biochemistry (or Biology or Chemistry/other sciences) •Psychology •Criminal Justice •Computer Security and Information Assurance •Studies of War and Peace •Nursing •Art and Architecture Mid-Career and Senior Leaders are eligible also	Web based, Online Synchronous	Undergraduate: Enrollment in a class that covers basic sustainability principles, elaborates on the components of sustainability and allows for dialogue and discussion on the interconnecting themes. None for Mid-Career and Senior Leaders

Course Description: This 3-hour, web-based unit comprises of two, seventy-five minute long classes, serving as the culminating activity to underscore the interconnectedness of critical infrastructure in ensuring long term sustainability. Learners will build on their previous understanding of the environmental, social, and economic components of sustainability, and the intersections of environmental and social domains as bearable, intersection of environmental and economic domains as viable, and the intersection of economic and social domains as equitable in the context of critical infrastructure. The module uses the example of strategies being planned and implemented in the Global Resilient Cities Network, previously a Rockefeller Foundation initiative through 2019. Students will differentiate between sustainability and resilience across overlapping

critical infrastructure sectors and learn the role of resilience in developing long-term sustainability and to accomplish sustainable development goals such as the ones laid out in the United Nations Sustainable Development Goals (SDGs). Learners will also be introduced to the core concepts of resilience, shocks and stresses in urban areas that challenge resilience, stakeholder engagement to develop resilience strategies that include a vision, goals, and actions, key partnerships and funding mechanisms that allow for implementation of actions, metrics that will track progress and success of implementation, including ways of disseminating information and results, and networking with regional and global groups with an eye toward continual improvement. This module is based on research and strategy documents published by cities in the Global Resilient Cities Network.

The key topics covered in the module include:

- ☐ Defining resilience and connections to sustainability
- ☐ Urban resilience challenges (shocks and stresses) across critical infrastructure sectors
- ☐ Vision, goals and actions set by resilient cities for infrastructure resilience
- ☐ Funding, partnerships and metrics to track progress of implementation actions
- ☐ Engagement and dissemination tools for communicating resilience work
- ☐ Role of networks in continual improvement

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites
*Energy and You (module)	N/A	3 – 5 hrs live content + support resources	Undergraduate students	To be integrated into existing courses of any format (Live, Hybrid, Online)	None

Course Description: An introduction to the concept of the fundamental dimensions in the physical world and the derived dimensions of: Force, Work, Energy, and Power. Students will understand how energy is measured and develop a conceptual understanding of the dimensions of power and energy. Students will explore their personal energy footprint and will have the opportunity to practice dimensional analysis and unit conversions involving energy units.

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites
*Energy and Society (module)	N/A	3 – 6 hrs live content + support resources	Undergraduate students	To be integrated into existing courses of any format (Live, Hybrid, Online)	None

Course Description: An introduction to the connections among energy and key societal infrastructure systems. US and global energy footprints over time will be examined. Energy economics considerations and financial constraints of the energy system will be discussed. Students will explore sustainability concepts and frameworks, and will have the option to analyze societal systems and constructs through a sustainability lens.

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites
*Energy and Resilience (module)	N/A	3 – 4 hrs live content + support resources	Undergraduate students	To be integrated into existing courses of any format (Live, Hybrid, Online)	None

Course Description: Students will explore definitions of resilience and emerging work at the intersection of resilience and our energy infrastructure. Case studies involving beyond-the-fence-line resilience initiatives will be explored as a means of understanding the complexities and stakeholders involved in planning and executing more resilient energy systems.

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites
*Energy Nexus (module)	N/A	3 hrs live content + support resources	Undergraduate students	To be integrated into existing courses of any format (Live, Hybrid, Online)	Energy related undergraduate modules.

Course Description: Students will draw on what they have learned throughout the various energy modules to complete a suitable capstone exercise.

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites
*Microgrid Architecture	Continuing Education Units	16 hours	Mid-Career (primary), Senior Leader and Undergraduates (alternate)	Online-Asynchronous	None

Course Description: This 16-hour, hybrid delivery course is comprised of twelve, two-hour classes and introduces students to the principles of microgrid architecture, including development, design, and operations. This course will introduce mid-level professionals on military installations (deputy garrison commanders, directors of public works, energy managers), as well as military personnel in tactical formations (battalion and brigade executive officers, communications officers, engineer officers) to the basic components of microgrids, the role of telecommunications and automation in the operation of microgrids, and the risks of cyber threats to microgrids. Learners will have an increased knowledge and understanding about the operating fundamentals and design of microgrids on a tactical basis. The course focuses on the basic skills and knowledge needed to establish, operate, optimize, and disassemble microgrids.

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites

*Industrial Control Systems (ICS)	4 CEU	6 hours	Mid-Career (primary, Senior Leaders and Undergraduate s (alternate	Online-Asynchronou s	None. Participants should have a fundamental understanding of power generation and system controls.

Course Description: This course will introduce mid-level professionals on military installations (deputy garrison commanders, directors of public works, energy managers), as well as military personnel in tactical formations (battalion and brigade executive officers, communications officers, engineer officers) to the fundamentals of industrial control systems (ICS), the role of ICS in the operation of microgrids, the role of telecommunications and automation in ICS, the risks of cyber threats to ICS, and recovery concepts.

Risk Analysis

<u>Course Title</u>	<u>Credits</u>	<u>Duration</u>	<u>Audience</u>	<u>Deliver y Method</u>	<u>Prerequisites</u>
*Critical Infrastructure/Energy Resilience Overview Module	Non-Credit .5 CEU	2 hours	Senior Leaders(primary); Mid-Career (alternate)	Online-Asynchronou s	None

Course Description: Identify types of mission critical installation infrastructure.

- ☐ energy and control systems
- ☐ water and wastewater systems
- ☐ Transportation systems
- ☐ Communication systems-military and civilian
- ☐ Fuel distribution systems
- ☐ Medical
- ☐ Public Safety dispatch
- ☐ Micro grids

Identify types of mission critical infrastructure off the installation or owned by others.

- ☐ Power generation systems
- ☐ Power distribution systems
- ☐ Water production and distribution systems
- ☐ Transportation systems
- ☐ Logistic systems

Identify potential infrastructure owners that must be partnered with to ensure mission success.

- ☐ Regulated Public Utilities
- ☐ Local government/Regional government Utility providers
- ☐ Local Government Critical services
- ☐ Local Non-Profit and for-profit critical services

<u>Course Title</u>	<u>Credits</u>	<u>Duration</u>	<u>Audience</u>	<u>Delivery</u>	<u>Prerequisites</u>

				<u>Method</u>	
*Identifying Mission Critical Infrastructure/Energy Systems Module	Non-Credit .5 CEU	2 hours	Senior Leaders(primary); Mid-Career (alternate)	Online-Asynchronous	None

Course Description: *Understanding the interlinked nature of critical infrastructure systems*

- ☐ *Understanding the resources and capacities of the installation's energy and critical infrastructure staff*
- ☐ *Understanding the Software and Network Vulnerabilities of Industrial controls*
- ☐ *Understanding the resource and modernization needs of Energy and other on installation critical systems.*
- ☐ *Understanding the role of critical infrastructure off the installation and owned by others.*
- ☐ *Understanding the mission capability impact of critical infrastructure/energy systems failure*
- ☐ *Understanding the consequences of past capital investment and reinvestment in on and off base critical energy and other infrastructure systems.*

<u>Course Title</u>	<u>Credits</u>	<u>Duration</u>	<u>Audience</u>	<u>Delivery Method</u>	<u>Prerequisites</u>
*Critical Infrastructure Threat Analysis/Risk Management Module	Non-Credit .5 CEU	2 hours	Senior Leaders(primary); Mid-Career (alternate)	Online-Asynchronous	None

Course Description: Identify most significant threats to critical infrastructure on and off the installation.

- ☐ Identify key partners in energy/critical infrastructure resilience.
- ☐ Understand the scope and duration of potential cyber/non-kinetic man-made threats and environmental threats to critical energy generation and distribution systems.
- ☐ Develop a strategic approach to address critical infrastructure and energy resilience relationships of the installation and its supporting region.
- ☐ How to develop a regional RIGOR type analysis of the mission critical infrastructure.
- ☐ Develop strategies to enhance regional resilience.

<u>Course Title</u>	<u>Credits</u>	<u>Duration</u>	<u>Audience</u>	<u>Delivery Method</u>	<u>Prerequisites</u>
CC310: Introduction to Compliance Investigations	Non-credit – taken separately or 4 courses equal Corporate Compliance and Investigation	Self-paced – 2+ weeks	Mid-Career	Online-Asynchronous	None – can be part of a Corporate Compliance and Investigations Certificate

	s Certificate				

Course Description: This course covers foundational information, including the definition, purpose, history and development of compliance in the United States. You'll learn how to build a culture of compliance in your organization. Additionally, you'll walk through the steps of creating a sustainable compliance plan. Topics Include:

- ☐ Developing an effective compliance program
- ☐ Factors that contributed to the development of modern-day compliance programs
- ☐ Department of Justice requirements
- ☐ How to effectively hire and train a strong compliance team or choose a compliance committee

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites
CC320: Risk Assessments, Policies, and Internal Controls	Non-credit – taken separately or 4 courses equal Corporate Compliance and Investigations Certificate	Self-paced – 2+ weeks	Mid-Career	Online-Asynchronous	None – can be part of a Corporate Compliance and Investigations Certificate

Course Description: During this course, we'll discuss valuable internal and external resources to use when assessing risk, including public databases. Additionally, we'll cover the issues and policies associated with several specific types of risk. Join us to find out what processes should you use for writing policies, getting them approved, and implementing them. Topics Include:

- ☐ The steps involved in creating sound codes of conduct and policies
- ☐ Why risk assessment is so important, using real cases as examples
- ☐ How to carry out a risk assessment
- ☐ Fostering a culture of compliance

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites
CC330: Due Diligence and Internal Investigations	Non-credit – taken separately or 4 courses equal Corporate Compliance and Investigations Certificate	Self-paced – 2+ weeks	Mid-Career	Online-Asynchronous	None – can be part of a Corporate Compliance and Investigations Certificate

Course Description: You'll walk through the steps of an inquiry, including how to gather the information you need, to determine how much auditing is required, what to do with the data you collect, and how to report your findings to those who need it. You'll learn about the concerns associated with certain types of third parties, and the instructor will include recommendations for creating contracts once business is approved. Topics Include:

- ☐ Approaches to root cause analysis
- ☐ Understanding why internal and external investigations are necessary
- ☐ The best sources of information for each type of investigation
- ☐ When due diligence is most important
- ☐ How to handle the discovery of negative information

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites
CC340: Organizational Culture and Continuous Compliance Improvement	Non-credit – taken separately or 4 courses equal Corporate Compliance and Investigations Certificate	Self-paced – 2+ weeks	Mid-Career	Online-Asynchronous	None – can be part of a Corporate Compliance and Investigations Certificate

Course Description: After starting with a discussion of what we mean by a “culture of compliance,” we’ll go on to reflect on the role of strong leadership. Specifically, we focus on the importance of relationship building and leading by example. You’ll also learn about the importance of who sits on your Compliance Committee, as well as the duties of each member. Topics Include:

- ☐ Factors that make people most likely to comply with regulations
- ☐ What causes compliance programs to fail?
- ☐ Actions that motivate and demotivate people

Policy, Partnerships, Cyber

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites
Security Situation Center Training 2020	TBD - The SOC can be exported (SOC in a Box)	4 weeks self-paced	Security Situation Center Operators	Online for Initial Qualification Training and “Right Seat Ride” for Mission Qualification	Students take an assessment prior to the course

Course Description: Commonly known as a security operations center (SOC), the NUARI SSC shares and receives information from federal and state law enforcement partners/agencies for increased protection against threat actors. This mutual transparency enables us to take a more proactive approach to cyber threats on the networks we serve. The NUARI SSC is well-equipped to provide threat hunting, monitoring, detection, mitigation, and reporting to improve any organization’s resilience against cyber-attacks. Students learn the Detect-Report-Mitigate and Share methodology:

- ☐ Detect anomalies in your environment via information gathered from Homeland Security, local authorities, and threat intelligence.
- ☐ Formal reporting provides the information you need to defend your organization from threats detected daily, in addition to briefing leadership.
- ☐ Information is shared with you to help prioritize actions, keep your environment

secure, and continuously improve your incident response plans.

NUARI currently produces analysts in-house via our rigorous certification process as follows:

- ☐ Existing information-sharing relationship with Homeland Security and the local state police provides relevant information necessary to evaluate evolving Cyber Security threats.
- ☐ Threat-hunting crews have access to cutting edge research and data through Norwich University. This partnership enhances concept development and brings our performance to another level.
- ☐ Analysts lead with real-world experience while preparing for their next future in the information security field.

<u>Course Title</u>	<u>Credits</u>	<u>Duration</u>	<u>Audience</u>	<u>Delivery Method</u>	<u>Prerequisites</u>
*Energy/Critical Infrastructure Resilience Policy and Partnerships Module	Non-Credit .5 CEU	2 hours	Senior Leaders(primary); Mid-Career (alternate)	Online-Asynchronous	None

Course Description: Understand Army, DOD, and Homeland Security policies regarding the resilience of critical infrastructure.

- ☐ Develop an understanding of the on and off installation investment priorities necessary to achieve energy resilience required to accomplish the installation's mission
- ☐ Develop an understanding of the authorities and structures available for managing manmade or natural disaster impacts of critical infrastructure failure.
- ☐ Develop an understanding of the various partnerships required to effectively impact the installation's energy resilience.
- ☐ Develop an understanding of the various funding sources and authorities to assist in achieving energy and other critical infrastructure resilience.
- ☐ Based on the outcome of the Installation Energy and Water Plan development process for your installation, develop an investment strategy to maximize mission success.
- ☐ Understand the functional requirements for micro grid systems to support critical operations both on and off the installation that are critical to the installation's mission capability.

<u>Course Title</u>	<u>Credits</u>	<u>Duration</u>	<u>Audience</u>	<u>Delivery Method</u>	<u>Prerequisites</u>
*Exercise Development Process - Capstone Exercise Module	Non-Credit .5 CEU	3 hours	Senior Leaders(primary); Mid-Career (alternate)	Online-Asynchronous and DECIDE meeting	None

Course Description:

- ☐ Develop Understanding of the 4 Phase Exercise process
- ☐ Develop Exercise scenarios for home installation using the 4-phase process.
- ☐ Develop the skills for effective energy/critical infrastructure resilience planning and exercising in a dynamic and complex environment.
- ☐ Be able to lead regional exercise that address the full gamut of energy/critical infrastructure vulnerabilities and resilience strategies for the infrastructure critical to the installation's missions.
- ☐ Be able to effectively participate in the national, regional and local government and non- governmental discussions that influence critical infrastructure/energy resilience on and off the installation.
- ☐ As a result of the course be able to outline specific strategies and funding priorities to address the energy resilience/critical infrastructure needs of the installation mission

<u>Course Title</u>	<u>Credits</u>	<u>Duration</u>	<u>Audience</u>	<u>Deliver y Method</u>	<u>Prerequisites</u>
Graduate Certificate in Computer Forensic Investigation/Incident Response Team Management - Computer Security Incident Response Team Management GI554	6 graduate credits	11 weeks	Bachelor's degree holders	Online – taken with Computer Forensic Investigation GI551	Bachelor's degree, an understanding of the Microsoft Windows operating systems and a background in systems administration is helpful, but not required.

Course Description: In this course, you will analyze and apply the key points in creating and managing a computer security incident response team (CSIRT), also known as a computer incident response team (CIRT) or a computer emergency response team (CERT). Topics include establishing CSIRTs; responding to computer emergencies; securing the CSIRT; managing the CSIRT with respect to professionalism, setting priorities for triage, and protecting personnel against burnout; and learning from emergencies using the incident postmortem and establishing continuous process improvement within the organization. Students will use their case study to apply their knowledge to real-world situations and will prepare recommendations for the establishment of a new CSIRT or improvement of their existing CSIRT.

<u>Course Title</u>	<u>Credits</u>	<u>Duration</u>	<u>Audience</u>	<u>Delivery Method</u>	<u>Prerequisites</u>

Computer Forensic Investigation/ Incident Response Team Management - Computer Forensic Investigation GI551	6 graduate credit	11 weeks	Bachelor's degree holders	Online – taken with Computer Security Incident Response Team Management GI554	Bachelor's degree, an understanding of the Microsoft Windows operating systems and a background in systems administration is helpful, but not required.

Course Description: This course focuses on the spectrum of tools and techniques used to investigate digital incidents, whether in a civil or criminal environment. The course provides the broad understanding that information assurance professionals must have of the management, investigation, and analysis of digital incidents. It also places that understanding in the context of other information assurance domains. Discussions of digital investigation and forensics cover topics from both technical and management perspectives to increase the information assurance professional's understanding and application of domain-specific knowledge

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites
Graduate certificate in Vulnerability Management - Vulnerability Management and Penetration Testing GI562	6 graduate credits	11 weeks	Bachelor's degree holders	Online taken with Vulnerability Management and Penetration Testing II GI563	Bachelor's degree should be familiar with and comfortable using both Microsoft Windows and Linux command line and GUI based tools as well researching proper usage of the tools.

Course Description: This course introduces students to the penetration testing of computer networks. Students will utilize a virtual lab to gain experience through hands-on lab exercises and learn to use the well-known open-source Metasploit computer security project to understand security vulnerabilities. Students will apply this tool for penetration testing, testing the control tools, and learn how to conduct monitoring of an enterprise. Topics explored in this course include system security and vulnerability analysis, the most common system exploits and vulnerabilities, along with system "pivoting" and client-side exploits. This course also introduces open-source tools, in particular, the Metasploit Framework (MSF). Students will learn how to assess enterprise security controls and system vulnerability and learn to document their findings. The course is designed for penetration testers, system security, and network administrators.

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites
Graduate certificate in Vulnerability Management	6 graduate credits	11 weeks	Bachelor's degree holders	Online taken with Vulnerability Management and	Bachelor's degree should be familiar with and comfortable using both Microsoft Windows

– Vulnerability Management and Penetration Testing II GI 563				Penetration Testing I GI562	and Linux command line and GUI based tools as well researching proper usage of the tools.

Course Description: This course introduces students to advanced open-source tools used to conduct penetration testing of computer networks. Students will learn the rules of engagement, and how to conduct legal and ethical security tests and vulnerability assessments. Students will utilize a virtual lab to gain experience through hands-on lab exercises. Students will learn to use the well-known open-source tools (Metasploit, John the Ripper, Wireshark) to understand security vulnerabilities and how to use this tool for penetration testing, testing the control tools, and how to conduct monitoring of an enterprise.

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites
Graduate certificate - Critical Infrastructure Protection & Cyber Crime, Title: Cyber Crime GI556	6 graduate credits	11 weeks	Bachelor's degree holders	Online with Critical Infrastructure Protection GI566	Bachelor's degree – taken with GI566

Course Description: This course explores the nature of the conflict in cyber space focusing on two major Internet-based threats to the U.S. national security: cyber terrorism and cybercrime. Students will address questions such as: who is undertaking these cyber activities, what techniques are used, and what countermeasures can be adopted to mitigate the impact.

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites
Graduate Certificate - Critical Infrastructure Protection & Cyber Crime, Title: Critical Infrastructure Protection GI566	6 graduate credits	11 weeks	Bachelor's degree holders	Online with Cyber Crime GI556	Bachelor's degree – taken with GI556

Course Description: Students will examine the network infrastructure sectors critical to national security. Special attention is paid to the risk management of information in critical infrastructure environments through an analysis and synthesis of assets, threats, vulnerabilities, impacts, and countermeasures. Critical consideration is paid to the role of Supervisory Control and Data Acquisition (SCADA) systems in the flow of resources. Note: Students taking this certificate will complete a case study.

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites
Graduate Certificate in Public Administration Leadership & Crisis Management - Foundations of Leadership and Ethical Decision-Making AD576	6 graduate credits	11 weeks, 4+ weeks if CEU	Senior Leaders and Mid-Career Professionals	Online in combination with Public Leadership, Crisis Management, and Organizational Change AD586	Bachelor's degree

Course Description: The first course explores and examines the major models of leadership from a theoretical, ethical, and practical perspective. Outcomes of the first course are a thorough understanding of leadership concepts and being able to apply them in their own leadership situations.

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites
Graduate Certificate in Public Administration Leadership & Crisis Management, Title: Public Leadership, Crisis Management, and Organizational Change AD586	6 graduate credits, can be converted to CEU	11 weeks, 4+ weeks if CEU	Senior Leaders and Mid-Career Professionals	Online in combination with Foundations of Leadership and Ethical Decision-Making AD576	Bachelor's degree

Course Description: In the second course, students will explore the role of leadership in public organizations by examining how leadership is intrinsically tied to the organization. The course also examines the role of leadership in crisis situations, including how decisions are made and implemented, how information is

communicated in critical situations, how political leaders are held accountable for crisis situations, and how communities can be returned to a state of normalcy after a critical incident has occurred.

<u>Course Title</u>	<u>Credits</u>	<u>Duration</u>	<u>Audience</u>	<u>Delivery Method</u>	<u>Prerequisites</u>
Graduate Certificate in Rural Municipal Governance, Title: Municipal Governance AD543	6 graduate credits, can be converted to CEU	11 weeks, 4+ weeks if CEU	Senior Leaders and Mid-Career Professionals	Online coupled with Rural Municipal Governance AD 553	Bachelor's degree

Course Description: The first course in this certificate introduces students to the work of local government managers in the United States. The core of the course is the study of best practices for municipal leadership, including the challenges of providing direction to a wide scope of departments and agencies necessary to serve the needs of communities. Students will also study how to create and maintain intergovernmental relationships and form partnerships.

<u>Course Title</u>	<u>Credits</u>	<u>Duration</u>	<u>Audience</u>	<u>Delivery Method</u>	<u>Prerequisites</u>
Graduate Certificate in Rural Municipal Governance, Title: Rural Municipal Governance AD553	6 graduate credits, can be converted to CEU	11 weeks, 4+ weeks if CEU	Senior Leaders and Mid-Career Professionals	Online coupled with Municipal Governance AD543	Bachelor's degree

Course Description: The second course in this certificate explores the role of the public service leader, divisions and sectors within the rural municipality, organizing stakeholder collaborations and developing an action plan in support of accountability, good governance, and improvement of quality of life. Specifically, discussions will examine interdisciplinary and multidisciplinary cultural competence and effective leadership skills uniquely identified in rural communities.

<u>Course Title</u>	<u>Credits</u>	<u>Duration</u>	<u>Audience</u>	<u>Delivery Method</u>	<u>Prerequisites</u>
Graduate Certificate in Urban Municipal Governance, Title: Municipal Governance	6 graduate credits, can be converted to CEU	11 weeks, 4+ weeks if CEU	Senior Leaders and Mid-Career Professionals	Online coupled with Urban Municipal Governance AD 563	Bachelor's degree

AD543					

Course Description: The first course in this certificate introduces students to the work of local government managers in the United States. The core of the course is the study of best practices for municipal leadership, including the challenges of providing direction to a wide scope of departments and agencies necessary to serve the needs of communities. Students will also study how to create and maintain intergovernmental relationships and form partnerships.

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites
Graduate Certificate in Urban Municipal Governance, Title: Urban Municipal Governance AD563	6 graduate credits, can be converted to CEU	11 weeks, 4+ weeks if CEU	Senior Leaders and Mid- Career Professionals	Online coupled with Municipal Governance AD 543	Bachelor's degree

Course Description: Urban America is the focus of the final course in this certificate. Particular focus will be placed on the public administrator's multidisciplinary collaborations and action plan development, through discussions and reflections of key issues including the unique needs affecting public safety, emergency management, medical services, animal control, and public and mental health concerns.

Master Planning

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites
Energy Resources and Markets GB548	4 CEU in Norwich Pro or 6 credits in the MBA	4-6 weeks CEU or 11 weeks for graduate credit in the MBA	Energy Managers	Online via Norwich Pro or CGCS Moodle platform	None in Norwich Pro, Managerial Finance GB 560 and Core courses in MBA program – pending revision

Course Description: This seminar focuses on the energy resources and markets that include: introduction to the origins and the typology of the alternate ways to generate energy; price formation of energy and its markets; description of the existing markets

and their most common negotiating instruments in relation to each type of energy: oil, natural gas, coal and electricity; development of energy markets and its regulations in U.S., EU and Latin America; environmental and climate change policies; and the feasible energy mix for the organization under the security of supply.

<u>Course Title</u>	<u>Credits</u>	<u>Duration</u>	<u>Audience</u>	<u>Delivery Method</u>	<u>Prerequisites</u>
Energy Savings and Efficiency Projects GB558	4 CEU in Norwich Pro or 6 credits in the MBA	4-6 weeks CEU or 11 weeks for graduate credit in the MBA	Energy Managers	Online via Norwich Pro or CGCS Moodle platform	None in Norwich Pro, Bachelor's degree & Managerial Finance GB 548 and Core courses in MBA program – pending revision

Course Description: Managing an organization's project to save and use energy in the most efficient way, including introductions to sustainability, energy intensity, energy efficiency and savings are topics of this seminar. These aspects are reviewed for electricity and heat generators energy systems. Students develop an efficiency solution project for a company, including financial aspects, auditing and energy strategies.

<u>Course Title</u>	<u>Credits</u>	<u>Duration</u>	<u>Audience</u>	<u>Delivery Method</u>	<u>Prerequisites</u>
Managing Corporate Energy Needs GB568	4 CEU in Norwich Pro or 6 credits in the MBA	4-6 weeks CEU or 11 weeks for graduate credit in the MBA	Energy Managers	Online via Norwich Pro or CGCS Moodle platform	None in Norwich Pro, Bachelor's degree & Managerial Finance GB 548 and 558 and Core courses in MBA program – pending revision

Course Description: This seminar focuses on energy procurement optimization with security of supply, quality and low cost including how to value available and feasible energy sources of supply, manage energy procurement processes, contracts management, sector supply strategies, demand forecasting, quantitative risk assessment, the company flow of information and cooperative procurement techniques. A detailed behavior of each relevant energy market (oil, gas & electricity) from the demand point of view is discussed. Components of the energy markets and the available energy origins are reviewed, as well as internal analysis of the organization needs and processes, to optimize all aspects of a company's energy procurement. Students will acquire analytical and managerial capacity and skills to resolve the energy procurement of the organization.

<u>Course Title</u>	<u>Credits</u>	<u>Duration</u>	<u>Audience</u>	<u>Delivery Method</u>	<u>Prerequisites</u>
Strategy and Planning PW320	CEU	4 weeks self- paced	Mid-Career	Online-Asynchronous	None

Course Description: A leader's effectiveness is dependent on so many factors. For one, they need to have a vision and a plan for reaching that vision that functions like a roadmap so that when it comes time to make decisions, the answers will be clear. Also, they need financial resources to fuel the organization toward its objectives and effective communication. In this course we'll discuss important steps and tips for designing your plans, conveying information clearly, and successfully competing for limited resources. Topics Include:

- ☐ Navigating the complex nature of obtaining financial resources in public works organizations
- ☐ Project Management approaches to planning
- ☐ Identifying values and exploring how they impact communication choices and decisions

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites
PW340 Long-Term Strategy Project	CEU	4 weeks self- paced	Mid-Career	Online- Asynchronou s	Non e Pre- requisite s: PW310, PW320, PW330

Course Description: Long-Term Strategy Project - In this course you'll use a time-tested and holistic approach to combine all your new knowledge and put it to use to develop a strategic plan that you can apply to your work in real life. We'll walk you through each stage of the process, from the research and analysis phases to the drafting and final formatting. Topics Include:

- ☐ Developing your voice so that you write your plan with authority and clarity
- ☐ Building peer collaboration into not only your plan, but also your day-to-day work for improved results
- ☐ Realistic expectations for plan integration

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites
PW310 Managemen t and Leadership Proficiencies	CEU	4 weeks self- paced	Mid-Career	Online- Asynchronou s	None

Course Description: Leaders and managers must stay on top of rapidly changing technological developments if they want their organizations and departments to thrive. In this course, we'll start with a look into the specific ways technology can make public works organizations more effective. Then we move on to tips for building relationships. We believe that a leader's success involves a sophisticated and personal approach that relies heavily on connecting well with employees and stakeholders.

Topics Include:

- ☐ The latest software for managing and leading others
- ☐ A systematic, conceptual approach to decision making
- ☐ The importance of intentional personal and professional growth for leaders and managers
- ☐ The difficult and continual nature of learning good leadership

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites
PW330 Operations and Organization s	Non- Credit 1 CEU	4 weeks self- paced	Mid-Career	Online- Asynchronou s	None

Course Description: The quality of public works projects and operations significantly affects the well-being of the communities they serve—from the

quality of roads, bridges, and water to effective and safe snow removal and waste storage. Although technology is always an important part of successful operations, good leadership and quality of the relationships play a significant role too. In this course, we challenge you to consider how to improve services and operations in various ways. Topics Include:

- ☐ Why public works professionals need strong, mutually beneficial relationships with the communities they serve.
- ☐ The scope and nature of public works operations and services
- ☐ The critical need for collaboration and innovation
- ☐ Organizational structure in the public works sector and its pros and cons
- ☐ Best practices for conducting online research
- ☐ Ethics in public works

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites
PM310: Project Management Overview	Non-Credit 1 CEU	4 weeks self-paced	Mid-Career	Online-Asynchronous	None

Course Description: This course can help put you on the path to PMP certification if that's something you'd like to pursue—CEUs/hours from this course count toward PMI PDU/Contact Hours requirements for taking the PMP exam or annual certification renewal. We also offer intensive PMP, CAPM, and Agile exam prep courses. Topics Include:

- ☐ Creating and using Gantt charts and other widely used project tools
- ☐ Pinpointing the gaps in your project management skills so you can create future learning plans
- ☐ More confidently and accurately using the language of the profession in interviews and on the job
- ☐ Identifying PMBOK process areas and knowledge areas
- ☐ Understanding the benefits of employing project management techniques

Course Title	Credits	Duration	Audience	Delivery Method	Prerequisites
PM320: Applied Psychology in Project Management	Non-Credit 1 CEU	4 weeks self-paced	Mid-Career	Online-Asynchronous	None

Course Description: Humans often behave in predictable ways and understanding these tendencies can help project managers accomplish more. Join us for an exploration of these patterns and how they can be used to motivate employees, resolve conflicts, guide groups through change, and communicate more effectively—skills that are especially important for project managers who frequently are not in positions of power. Other topics include values-driven leadership, adapting messages for different personalities, and emotional intelligence. Topics Include:

- ☐ Evaluating personality type using Myers-Briggs and Big Five assessments
- ☐ Using the preferences of various personality types to achieve goals
- ☐ Confidently and accurately using the language of the profession in interviews and on the job
- ☐ Identify your values and the values of others to better recognize motivation and more effectively influence others

Pending UCC approval:

Goal: Create specific certificates/concentrations by mixing courses and explore options to make Cohort opportunities available.

1. Create a custom ER graduate certificate – Energy Resilience and Emergency Response
 - Computer Security Incident Response Team Management | GI554 | 6 credit hours
 - Critical Infrastructure Protection | GI566 | 6 credit hours
2. Create a custom ER graduate certificate – Energy Resilience Leadership
 - Public Leadership, Crisis Management, and Organizational Change | AD586 | 6 credit hours
 - Critical Infrastructure Protection | GI566 | 6 credit hours

Graduate Certificate programs can use the two following courses to create and energy resilience capstone experience:

- ☐ EXL 595 – Residency Requirement – this requirement can be used to be a plenary session, out brief their concept, panel review, oral exam
- ☐ GU 590 Selected Topics 6 Cr -. This seminar will require a student(s) to make an original, extended, and in-depth study of an approved topic within their field of study and as approved by an appropriate Program Director. This course is used most often in combination with other listed courses where the student has transferred less than six credits. Approval of the Program Director is required to take the course.

NCPC Courses: <https://nationalcpc.org/>

NCPC Training Course Catalog is located at: <https://nationalcpc.org/courses.html>

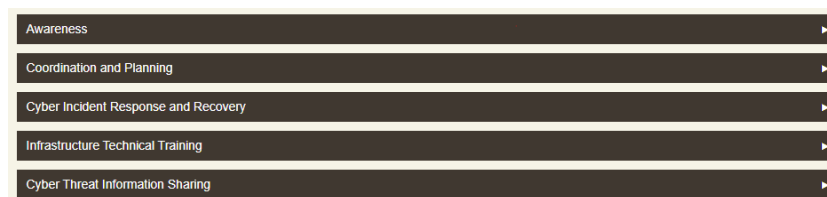
The NCPC develops and offers courses in five topic areas: awareness; coordination and planning; cyber incident response and recovery; infrastructure technical training; and cyber threat information sharing. To view the courses by topic, click on a brown bar to open that category.

The courses are developed by various partners of the NCPC with funding from

the Department of Homeland Security/FEMA and are offered at no cost to States, Locals, Territories and Tribes. When you "Click to Register" for a course, you will be redirected to the TEEX website. TEEX is one of the NCPC partner organizations and they manage course registrations.

Registering Through Your State's Homeland Security Training Office: To find out how to contact your State's Homeland Security Training Office, visit FirstResponderTraining.gov. Click on your state for contact information. States that need to register through their office include: AK, AZ, CA, CO, CT, FL, GA, HI, IA, ID, IN, KY, KS, LA, MA, MD, MI, MN, MO, MS, NC, ND, NE, NH, NJ, NM, NV, NY, OH, OK, OR, PA, PR, RI, SC, SD, TN, UT, VA, VI, VT, WA, WI, WV, WY. All other states may register through course specific contact numbers or email addresses listed in the course catalog below.

FEMA/SID Numbers: To take a FEMA course, whether online or in-person, participants must obtain a FEMA/SID number. To obtain a SID, register online at cdp.dhs.gov/femasid. There is no cost to register. The Training Courses are located at: <https://nationalcpc.org/courses.html> The courses are arranged in the following categories (screenshot of the web site):



Awareness

AWR-174-W Cyber Ethics

AWR-168-W Cyber Law and White

Collar Crime AWR-136 Essentials of

Community Cybersecurity AWR-175-

W Information Security for Everyone

AWR-376 - Understanding Targeted

Cyber Attacks

AWR-388-W - Cybersecurity Awareness for Municipal, Police, Fire and

EMS IT Personnel Coming Soon - AWR-383 Cyber Awareness for Senior

Officials

Coming Soon - Cybercrime Insight and Introduction to Digital

Evidence Identification Coming Soon - Mobile Device Security &

Privacy

Coming Soon - Observing a Cyber Incident

Coming Soon - Practical Internet of Things (IoT) SecurityAWR-367-W
Understanding Social Engineering Attacks

Coordination and Planning

MGT-384 Community Preparedness for

Cyber Incidents MGT-385 Community

Cyber Security Exercise Planning

AWR-353-W Developing a Community Cyber

Security Program MGT-452 Physical &

Cybersecurity for Critical Infrastructure

Cyber Incident Response and Recovery

AWR-169-W Cyber Incident Analysis and Response

PER-371 Cybersecurity Incident Response for IT Personnel

AWR-366-W Developing a Cybersecurity Annex for an Incident

Response Plan AWR-176 Disaster Recovery For Information

Systems

MGT-456 Integration of Cybersecurity Personnel into the Emergency
Operations Center for Cyber Incidents

MGT-465 Recovering from Cybersecurity Incidents

AWR-389-W Incident Response for Municipal, Police, Fire and EMS IT Personnel

Infrastructure Technical Training

PER-256 Comprehensive
Cybersecurity Defense PER-257
Cybersecurity First Responder
AWR-139-W Digital Forensics Basics
AWR-177-W Information Risk
Management AWR-173-W
Information Security Basics
AWR-368-W Introduction to Basic Vulnerability
Assessment Skills AWR-138-W Network Assurance
AWR-178-W Secure Software Cybersecurity Resiliency in Industrial
Control Systems AWR-384-W Cyber Identity and Authentication
Coming Soon - Cyber Security Fundamentals
Coming Soon - PER-377 Cybersecurity
Proactive Defense Coming Soon - Examining
Advanced Persistent Threats
Coming Soon - PER-382 Malware Prevention, Discovery, and Recovery

Cyber Threat Information Sharing

MGT-473 Organizational Cybersecurity
Information Sharing Coming Soon - Cyber
Threat Intelligence
AWR-381-W Establishing an Information Sharing and
Analysis Organization Coming Soon - Community
Cybersecurity Information Sharing Integration AWR-398-W -
Introduction to ISAOs

Enclosure 19: References, Acronyms and Definitions

1. Phase 1 Background. The Phase 1 contract provided the framework for the current, Phase 2, contract. The phase 1 contract is Named: Solicited Proposal in Response to BAA #W912HZ-18-BAA-01, DEVELOPMENT OF AN ENERGY TRACK WITHIN THE NORWICH UNIVERSITY CENTER FOR GLOBAL RESILIENCE AND SECURITY, VOLUME I TECHNICAL PROPOSAL Background and Objectives

Protecting the homeland against various strategic foreign attacks is a foundational focus of the National Security Strategy (NSS), the National Defense Strategy (NDS) and the Army Warfighting Challenge (AWFC). The National Security challenge concerning our critical infrastructure and the technical innovations which enable that security include hardening against various natural and man-made disasters including cyberattacks, electromagnetic pulse (EMP), high-altitude electromagnetic pulse (HEMP) and increasingly devastating climate extremes. These events limit access to energy availability and energy delivery systems limiting force capabilities.

Such a layered and interconnected problem set requires a holistic view of the challenge, and the ability to enable the collaboration needed with experts in targeted industries and organizations including infrastructure development, resilient cities, utilities, academia, and the financial community. Technology solutions are available to meet the energy resilience targets at the local, state, and global level. The challenge, however, is the integration, implementation, standardization and interoperability of various technology advancements. **This program intends to develop the framework to assess energy resilience technology systems in terms of life-cycle planning, policy implications, operational sustainment, cost-benefit framework, and logistics implications.**

These are not stand-alone energy systems. These systems exist within a larger network of highly interconnected nodes. Developing solutions require a multidisciplinary framework, to include stakeholder engagement and collaboration with civilian communities, utilities, and industry. This approach includes both testing and evaluation of the proposed research agenda:

1. Create a roadmap for necessary technology and innovation;
2. Enable technology transfer; and
3. Rapid prototyping, testing and evaluation of prototypes, as encouraged by the NSS and NDS to solve current National Security challenges.

A primary focus will be the inclusion of resiliency across all operating domains: air, land, sea, space, cyberspace, and the integration of vehicles, grids and renewables.

2. Curriculum Development Model - The ADDIE Model of Instructional Design - To build and offer the stated education and training goals, we will employ the ADDIE model of instructional design. This model gives a focused approach in the development of course content and allows for continuous evaluation and improvement. The ADDIE model includes analysis, design, development, implementation and evaluation. We refer to two styles of course delivery and learning: synchronous and asynchronous. Synchronous learning is learning in which learners and instructors are in the same place, at the same time, in order for learning to take place. Asynchronous learning is learning where students engage with material at their own pace and instructors set up a learning path.
- Analysis: Identify the Requirements - The analysis phase involves identifying the instructional problem or, from a training standpoint, identifying the performance gap and desired outcome subject areas. This phase includes identifying participant characteristics, learning resources, training methodologies, defining the learning environment, establishing instructional goals and objectives, and determining budget/time constraints.
 - Design: Identify the Learning Objectives - The design phase involves subject matter design broadly through storyboards or a prototype, including defining specific learning objectives and instructional strategies, structuring content, and assessments. Assessments will provide feedback on the learner's progress in achieving the learning objectives.
 - Development: Develop a Performance Solution - The development phase involves creating, curating, and assembling the content specified in the design phase. This phase includes stakeholder review and validation, as well as any required revisions. This phase will involve the integration of technology and related testing.
 - Pilot programs will be conducted in this phase to test the validity of the material and delivery methods. Pilot programs are intended to test the design and development of a course with an experienced student body. The instructor will present the course material and gather feedback on how to improve the course.
 - Implementation: Deliver the Performance Solution - Implementation is the construction of the course curriculum, learning outcomes, and the learning space. The process should also include confirming the availability of required materials and associated applications preparing learners to use any required tools or technology.
 - Evaluation: Evaluate the Results Relative to the Performance Objectives - In practice, the evaluation phase is included in every aspect of the ADDIE process. The overall design process is iterative with elements fine-tuned along the way. Quality assurance evaluations are conducted prior to implementation to confirm the course material meets the specifications established in the design phase. A summative evaluation would be conducted after implementation to determine training effectiveness on three bases: participant satisfaction, participant learning, and participant performance.

3. Energy Resilience Related References: The following references were developed during the Phase 2 process. Several documents were released as curriculum was in the final stages of Development which necessitated the revision of the course material in order to maintain relevancy. The references include, but are not limited to, the following:

National Guidance Documents:

- Presidential Policy Directive 21-Critical Infrastructure Security and Resilience - (2013) <https://obamawhitehouse.archives.gov/the-press-office/2013/02/12/presidential-policy-directive-critical-infrastructure-security-and-resil->
- National Infrastructure Protection Plan (NIPP) 2013-Partnering for Critical Infrastructure Security and Resilience (2013) and selected supplements - Dept of Homeland Security- <https://www.dhs.gov/sites/default/files/publications/National-Infrastructure-Protection-Plan-2013-508.pdf>
- NPPD Resources to Support Vulnerability Assessments-Dept. of Homeland Security- <https://www.cisa.gov/sites/default/files/publications/NIPP-2013-Supplement-NPPD-Resources-to-Support-VAs-508.pdf>
- Executing a Critical Infrastructure Risk Management Approach-Dept. of Homeland Security- <https://www.cisa.gov/sites/default/files/publications/NIPP-2013-Supplement-Executing-a-CI-Risk-Mgmt-Approach-508.pdf>
- Incorporating Resilience into Critical Infrastructure Projects-Dept of Homeland Security- <https://www.cisa.gov/sites/default/files/publications/NIPP-2013-Supplement-Incorporating-Resilience-into-CI-Projects-508.pdf>
- NIST Brief 13-Identifying and Prioritizing Closure of Resilience Gaps- National Institute of Standards and Technology (Dec 2017)- <https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1190GB-13.pdf>
- Executive Order 13834-Efficient Federal Operations-Presidential Order for Agencies to meet statutory requirements that increases efficiency, optimizes performance, eliminates unnecessary use of resources, and protects the Environment-Mar 2018- <https://www.federalregister.gov/documents/2018/05/22/2018-11101/efficient-federal-operations>

DoD and Army Guidance Documents:

- Installation Energy Instruction DoD I 4170.11 Mar 2016 (Installation Energy Management) - <https://www.acq.osd.mil/eie/Downloads/IE/DODI%204170.11%20-%20Change%201%20Effective%20March%2016%202016%20FINAL.pdf>
- The National Defense Strategy- Jan 2018- <https://dod.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf>
- Memorandum-Installation Energy Plans-Energy Resilience and Cybersecurity Update requirement for ALL Installations- May 2018- https://www.acq.osd.mil/eie/Downloads/IE/IEP%20Policy_May302018.pdf
- Army Directive 2020-03 Installation Energy and Water Security - Mar 2020- https://www.asaie.army.mil/Public/ES/doc/ARN21644_AD2020-03_Web_Final.pdf
- Army Directive 2020-08 Installation Policy to Address Threats Caused by Changing Climate and Extreme Weather- Sep 2020- <https://api.army.mil/e2/c/downloads/2020/09/14/a6aa8a40/ad-2020-08-u-s-army-installation-policy-to-address-threats-caused-by-changing-climate-and-extreme-weather.pdf>
- Army Climate Resilience Handbook-Aug 2020- https://www.g8.army.mil/digital_library/references/resources/20200900_Army_Climate_Resilience_Handbook.pdf
- Army Installations Strategy-Dec 2020- [https://www.asaie.army.mil/Public/SI/doc/Army_Installations_Strategy_\(AIS\)_FINAL_Signed.pdf](https://www.asaie.army.mil/Public/SI/doc/Army_Installations_Strategy_(AIS)_FINAL_Signed.pdf)

Non-Governmental Resources:

- Beyond the Fence Line -Strengthening Military Capabilities Through Energy Resilience Partnerships-Association of Defense Communities - <https://knowledge-online-defense-communities.knowledgeowl.com/help/installation-energy-water-beyond-the-fence-line-strengthening-military-capabilities-through-energy-resilience-partnerships>
- What Local Government Officials Should Know and Do about Cyber-Security- International City Managers Association (ICMA)-

https://www.nlc.org/wp-content/uploads/2019/10/CS-Cybersecurity-Report-Final_0.pdf

- Regional Identification of Gaps for Operational Resilience Process (RIGOR) for Joint Base Elmendorf Richardson (JBER)-Converge Strategies-
<https://static1.squarespace.com/static/58c0207d15d5db7d6b968444/t/5e96efcddcb3ec0fc5c8d613/1586950094234/RIGOR+Report.pdf>
- Report on Security in the North American Grid, A Nation at Risk - Fourth Update- George R. Cotter- Apr 2015-
<https://www.nrc.gov/docs/ML1511/ML15114A348.pdf>
- Cybersecurity and the North American Electric Grid; New Policy Approaches to address an evolving threat-Bipartisan Policy Center- Feb 2014- <https://bipartisanpolicy.org/wp-content/uploads/2019/03/Cybersecurity-Electric-Grid-BPC.pdf>
- Critical Infrastructure Resilience-A Regional and National Approach (Nov 2014)- MITRE Corporation Publication-
<https://www.mitre.org/sites/default/files/publications/14-4047-critical-infrastructure-resilience-a-regional-and-national-approach.pdf>
- DECIDE® Platform – NUARI - <https://nuari.net/decide/>
- Jack Voltaic Cyber Research Project 3.0 – Army Cyber Center - <https://cyber.army.mil/Research/Jack-Voltaic/>

4. Acronyms:

ADC – Association of Defense Communities
ASA I&E – Assistant Secretary of the Army: Installations and Environment
CDII – Cyber Dependent Infrastructure Identification
CDD – Course Development Document
CERL – Construction Engineering Research Laboratory
CII – Critical Infrastructure Information
CIPAC – Critical Infrastructure Partnership Advisory Council
DECIDE® – Distributed Environment for Critical Infrastructure Decision-Making Exercises
DHS - Department of Homeland Security
DoD – Department of Defense
DoE – Department of Energy
DHS – Department of Homeland Security
DPW – Department of Public Works
EO – Executive Order
ERCOT – Electric Reliability Council of Texas
ESF – Emergency Support Function
FACA – Federal Advisory Committee Act

FEMA – Department of Homeland Security/Federal Emergency Management Agency

GCC – Government Coordinating Council

ICMA – International City/County Management Association

ICS – Industrial Control System

IMCOM – Installation Management Command

ISAC – Information Sharing and Analysis Center

JTTF – Joint Terrorism Task Force

LOE – Line of Effort

MDMP – Military Decision Making Process

NCCIC – National Cybersecurity and Communications Integration Center

NCIJTF – National Cyber Investigative Joint Task Force

NCIPP – National Critical Infrastructure Prioritization Program

NICC – National Infrastructure Coordinating Center

NIPP – National Infrastructure Protection Plan

NOC – National Operations Center

NRF – National Response Framework

NU – Norwich University

NUARI – Norwich University Applied Research Institutes

NU CGRS – Norwich University Center for Global Resilience and Security

PCII – Protected Critical Infrastructure Information

PPD – Presidential Policy Directive

R&D – Research and Development

RC3 – Regional Consortium Coordinating Council

RSF – Recovery Support Function

SAME – Society of American Military Engineers

SCADA – Supervisory Control and Data Acquisition

SCC – Sector Coordinating Council

SLTT – State, Local, Tribal, and Territorial

SLTTGCC – State, Local, Tribal, and Territorial Government Coordinating Council

SNRA – Strategic National Risk Assessment

SOP – Standard Operating Procedure

SSA – Sector-Specific Agency

SSP – Sector-Specific Plan

THIRA - Threat and Hazard Identification and Risk Assessment

USAG – US Army Garrison

U.S.C. – United States Code