ENERGY ACADEMIC GROUP
NAVAL POSTGRADUATE SCHOOL

SURGE

ENERGY ACADEMIC GROUP QUARTERLY NEWSLETTER SUMMER 2021

Highlights

DoD Vulnerable to ICS Attacks

By Victor R. Garza, NPS Graduate School of Information and Operational Sciences

Colonial Pipeline, operator of the U.S.' largest fuel pipeline, was recently hit with a major ransomware attack. Colonial's CEO, Joseph Blount, confirmed he authorized a $4.4 million payout to the perpetrators.

Still unclear is whether the attack targeted the Industrial Control Systems (ICS) that operate critical fuel controls, or only the IT infrastructure. Because of the uncertainty, Blount shut down everything.

Had this attack been focused on the DoD, with over 250,000 buildings and an estimated three million ICS systems, a targeted attack could take out critical energy management, building automation, security systems, and increasingly, military weapons systems.

A great number of military weapons systems rely on ICS to manage and monitor essential functions. A March 2021 report from the U.S. Government Accountability Office (GAO) on weapons systems security found in three of five contracts "...examples of program contracts omitting cybersecurity requirements, acceptance criteria, or verification processes." Additionally, DoD officials state that "program offices may not know which industrial control systems are embedded in their weapons, or what the security implications of using them are."

Had this attack been focused on the DoD, with over 250,000 buildings and estimated three million Industrial Control Systems systems, a targeted attack could take out critical energy management, building automation, security systems, and increasingly, military weapons systems.

Although the U.S. stands at the forefront of cybersecurity, the GAO reports highlight how securing DoD systems lags behind the private sector, and as with Colonial, it is not a place of strength.

Americans must be assured that national defense, and every system that supports it, are not vulnerable to threats from cyber or other domains. The Naval Postgraduate School and its nascent Center on Combating Hybrid Threats (CCHT) will assist by focusing on cyber defense and energy security.

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Visit the CCHT website at **nps.edu/ccht**

FROM THE CHAIR

Dan Nussbaum, Chair of the Energy Academic Group

I know there is nothing new under the sun, and I know that to say the world is changing and that policies are in flux from one administration to another is really not saying anything new. Nonetheless, here are some things going on that accord with changes in the outside world: one in environmental security; another in hybrid threats; and a third in expanding the cadre of those who understand the centrality of operational energy (OE) in national security.

Environmental security and the robustness of national infrastructure are top priorities of the new administration. The recent proxy battles at EXXON/etc. and the recent IEA report "**Net Zero by 2050**" indicate that the issue has some traction in the marketplace too. NPS, and EAG, have responded by the formation of the **NPS Climate and Security Network**, which is focused on understanding the intersection of energy, climate and environmental security in order to understand the broader effects on military readiness, operations and strategy. Focus areas include: law and policy related to climate and national security; governance and policy related to the changing Arctic; adaptation needs of U.S. and other nation's military installations; and understanding the impacts of energy and environmental security in a changing climate. The EAG POC is **Kristen Fletcher**.

Events in Ukraine, Colonial Pipeline, and so forth highlight the importance of various aspects of hybrid warfare. **The Center on Combating Hybrid Threats** (CCHT) coordinates and conducts interdisciplinary research, education programs, and outreach. The Center focuses on both anti-hybrid threats measures and countering hybrid operations through the collaborative approach outlined in its vision. EAG POCs are **Larry Walzer** and **Tahmina Karimova**.

Energy is a *fundamental enabler of military capability*, as the 2016 DoD Operational Energy Strategy says. There is, therefore, an urgent requirement to ensure that knowledge about this fundamental enabler reaches the right people at the right time in their careers. The fundamental questions are: "What is the required information?", "Who needs to know it?", "When in their careers do they need to know it?", and "What is the right pedagogic delivery modality?" I am therefore delighted at two efforts along these lines. The first is the article included in this edition of Surge, an article entitled "Operation Energy—Essential Knowledge for Military Officers". This article adds to the growing effort to identify the essential knowledge military officers need to know about operational energy. In addition to addressing "what do they need to know", it also addresses "when do they need to know it?" Second is the effort by Navy OPNAV and SECNAV (*A Roadmap to Implementation of Navy and Marine Corps Operational Energy Training and Education*) to develop a roadmap to integrate OE into formal Navy and Marine Corps Training and Education programs. The roadmap will include a three-year plan that identifies relevant stakeholders, actions to advance the Training and Education plan at each institution/program, relevant policies, doctrine, and required revisions. The roadmap will also identify implementation actions that can and cannot be completed by the performer during the FY21 period of performance.

There is much going on, and I encourage you to reach out to me and to the POCs in this article. I would be happy to hear your ideas.

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or call 831-656-2387

Interested in Energy-related Thesis Research?

Since 2013, NPS and the EAG supported a plethora of student thesis research in the area of energy. Publicly viewable student theses can be searched from the Resources page of the EAG website at **nps.edu/web/eag/resources**. The EAG's extensive resources, intellectual capital, and connections with multi-disciplinary faculty and energy professionals provide students enhanced support for energy-related research. If interested in energy research, please reach out to the EAG team!

ENERGY RESEARCH

Operational Energy— Essential Knowledge for Military Officers

By Mason Carpenter
Paul Sullivan, PhD
Dan Nussbaum, PhD

The Department of Defense defines* operational energy *as "the energy required for training, moving, and sustaining military forces and weapons platforms for military operations."[1]

Operational energy (OE) can be thought of as a foundation of national defense and an *indispensable* attribute of military strength. It is essential for almost all forms of combat, and "commanding it" properly will be even more critical in the future. Over the past 100 years, energy has evolved to power literally every military capability of consequence. For example, OE 1) powers almost all forms of communication and sensing; 2) fuels all air, land, sea and space platforms; 3) energizes all electrical devices; and 4) is becoming a primary direct-fire weapon. Often considered a "vital national interest," the access to energy itself is often a *casus belli*—a reason to go to war. Moreover, since the beginning of World War I, OE has played a decisive role in all major conflicts.

It is therefore important to educate our officers early, often, and in job-relevant and functionally-relevant ways, throughout their careers and at all levels of the officer corps, if we are to effectively address the opportunities and threats presented by the ever-increasing importance of OE.

Sun Tzu noted, "In all fighting, the direct method may be used for joining battle, but indirect methods will be needed in order to secure victory. These two in combination give rise to 'an endless series of maneuvers'." Today, OE is an integral aspect of both the direct and indirect methods of warfare, and it is laced throughout all spectrums of conflict. Since the beginning of the 20th Century, the U.S. has had "energy superiority," but this is now being challenged. The U.S. must be first to lead in the OE domain. This should be a primary U.S. goal that America must attain and of which officer energy education is an essential aspect.

This paper emphasizes 1) why officers should be educated on OE, 2) what officers must know about OE, and 3) when officers need to be educated on OE as they progress through their careers.

LEARN MORE
Read the entire article on the Energy Academic Group's website at **nps.edu/web/eag/news**

Visit the CCHT website at **nps.edu/ccht**

Note:
1. Office of the Assistant Secretary of Defense for Sustainment website, https://www.acq.osd.mil/eie/OE/OE_index.html, accessed 22 January 2021.

Defense Energy Seminar Series

NPS' academic programs in Defense Energy are supplemented by a seminar series which provides a forum for leading voices within the field, practitioners, and other Defense Energy influencers. These professionals give presentations, engage in brown bag discussions, and facilitate informal gatherings that encourage Defense Energy faculty and students to discourse over current issues in Defense Energy, supplementing classroom teaching with practical, professional experiences. The Defense Energy Seminars Series is a permanent part of NPS' Defense Energy program, and a key to its real-world relevance.

LEARN MORE
Please see the Calendar of Events in this issue of ***Surge*** or visit **nps.edu/web/eag/seminars** for upcoming and archived seminars.

RESEARCH & SECURITY

NPS Launches Climate and Security Network

By Kristen Fletcher
Faculty Associate-Research, Energy Academic Group

Building on the momentum of the Executive Orders on Climate Change, especially Executive Order 14008 which places climate at the center of U.S. foreign policy and national security, NPS launched a Climate and Security Network in March. The Network supports climate and security research and curricular needs of the Navy and DoD. It coordinates research and other activities on climate and security across NPS to provide the optimum opportunity for understanding and analysis of these issues to NPS students, the Navy and DoD.

The goals of the Network are to:

- Connect faculty and researchers at NPS who are engaged in researching and teaching topics related to climate and security;
- Present NPS expertise on issues related to climate and security;
- Create opportunities for interdisciplinary collaboration, learning and problem-solving; and,
- Provide a forum for discussion, sharing of expertise and information, and welcome external colleagues.

NPS launched the Climate and Security Network in March 2021.

The Network hosts a Speaker Series including Joe Bryan, Senior Advisor on Climate to the Secretary of Defense, who spoke just days after the White House Leaders Summit on Climate, offering insight into how DoD can meet climate and security challenges moving forward. Also in April, John Conger, Director of the Center for Climate and Security, offered an overview of the Executive Orders and the mandates and vision laid out by the President and Secretary of Defense Austin. NPS faculty who research and teach in the climate and security area will be featured in future events.

The Network is open to NPS faculty, students and alumni and maintains a distribution list for external partners. Visit **nps.edu/climate** to join.

LEARN MORE

Joe Bryan Video Link:
youtu.be/Q9nNsB_h77k

John Conger Video Link:
nps.app.box.com/file/796683518547?s=ytkp1925dh2lj9r261pllywfd81h1d7d

Climate and Security Network:
nps.edu/climate

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OPERATIONAL ENERGY

Naval Enterprise Energy Education and Training Program

By Dan Temple, Faculty Associate – Research, Energy Academic Group

The Deputy Assistant Secretary of the Navy for Research, Development, Test and Evaluation (DASN (RDT&E)) has selected the Energy Academic Group to lead a multi-year effort to develop a roadmap for integrating Operational Energy (OE) education into undergraduate and graduate level education in the Department of the Navy. The project entitled "Naval Enterprise Energy Education and Training" or NE3T highlights the Navy's belief that OE is fundamental to the Navy's strategic, tactical, and operational mission execution. This effort seeks to create an energy-aware culture throughout the Navy and Marine Corps that regards OE as a force enabler and a valuable resource that demands consideration in all aspects of an effective military force from the acquisition process through combat operations. The target audience for this program includes Midshipmen at the undergraduate level and graduate students at the Naval Postgraduate School, Marine Corps Command and Staff College, and College of Naval Command and Staff. The first event scheduled for this effort will be an NE3T Workshop on 26 to 30 July at the Naval Postgraduate School to determine OE learning objectives, outline new curriculum, and identify insertion points in existing curriculum.

LEARN MORE

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Operational Energy Research Available on Calhoun

All NPS resident students write a thesis or capstone project report as part of their curricular requirements. Many theses are unclassified and accessible on Calhoun—the Naval Postgraduate School's digital repository for research materials and institutional publications created by the NPS community. To access theses which involve operational energy, please use the following link. New theses are added every quarter.

View operational energy theses available on Calhoun:
https://calhoun.nps.edu/

CLIMATE & ENERGY

Preparing Army Installations to Combat Climate Change and Extreme Weather Events

Schofield Generating Station (SGS) is a 50 MW multi-fuel power generation plant located at Schofield Barracks, Hawaii. SGS is the only baseload power generation facility on Oahu located above the tsunami inundation zone, which is critical for combatting the increasing threat of climate change & extreme weather events. The SGS is an example of how the Army is modernizing its installations with energy solutions that are resilient, efficient, and affordable.

By Mr. J.E. "Jack" Surash, P.E., Senior Official Performing the Duties of the Assistant Secretary of the Army for Installations, Energy and Environment

The Army recognizes climate change as a growing global security threat. In line with the President and the Secretary of Defense's direction, we are prioritizing climate change considerations in our threat picture, strategic plans, operations, and infrastructure design. The Army Installations Strategy states, "Army installations exist within a natural environment increasingly characterized by the effects of climate change, extreme weather events, pandemics, and environmental degradation." Therefore, installations must be resilient and prepared for energy disruptions caused by these threats.

Addressing climate change is an operational necessity and an opportunity for driving change. In recognition, the Army established the Army Climate Change Working Group (ACCWG) in March 2021 to support Executive Orders 14008 and 13990, and DoD's efforts to assess the impacts of climate on security strategies, operations and infrastructure. Subsequent implementation of Army Directive 2020-08, helps drive Army priorities to address climate change, gain efficiencies and reduce demand and climate harms.

The Army launched the Climate Assessment Tool (ACAT), developed by the U.S. Army Corps of Engineers, to help installations identify climate-related threats that could degrade mission readiness. The ACAT, used by the Army's U.S. installations, incorporates the latest actionable data and model results regarding climate change and extreme weather. The accompanying Army Climate Resilience Handbook serves as a guide for garrison planners to develop appropriate climate resilience measures.

The Army launched the Climate Assessment Tool (ACAT), developed by the U.S. Army Corps of Engineers, to help installations identify climate-related threats that could degrade mission readiness.

The time for installations to be resilient is now, and the Army is committed to preparing its installations to address climate change impacts and other natural, cyber and physical threats.

LEARN MORE

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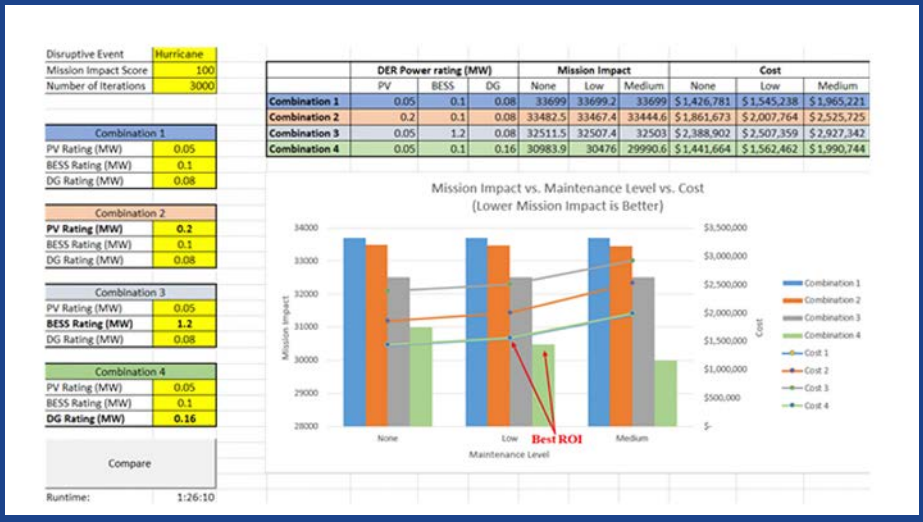
STUDENT ENERGY RESEARCH SPOTLIGHT

Distributed Energy-Resource Design Method to Improve Energy Security in Critical Facilities

Capstone Team Project

Existing design and analysis tools related to military microgrids lack an integrated system design and analysis process. This project integrates electrical engineering (EE) and systems engineering (SE) microgrid efforts into a single cohesive Microsoft Excel tool to provide base energy mangers an integrated system design methodology to quickly assess microgrid trade-offs between resilience, cost, and distributed energy resources (DER) and their energy needs. The report describes the development of a common streamlined tool and methodology to improve the ability to assess energy resilience for military microgrids using disruptive event scenarios including deliberate attacks and natural disasters. The resilience metric used in the MSET tool is the expected lifecycle mission impact (ELMI), which quantifies microgrid resilience in terms of the microgrid's ability to minimize mission impact against all potential threats to power disruption. The tool considers a realistic set of scenarios that could disrupt power allowing users to compare DER changes against a single microgrid architecture to determine the best balance between cost and resilience. Users are able to configure the tool to allow for changes in microgrid load or updates to equipment costs.



Sample trade-off analysis output

The MSET tool is intended to provide the end user the ability to compare and modify configurations based on user requirements and restrictions to meet each user's specific circumstance. A supplemental user's guide provides a thorough walkthrough of the tool, and a supplemental case study demonstrates the tool functionality by analyzing an existing naval installation microgrid.

Preliminary analysis conducted with the MSET tool indicates that, in general, increasing the diesel generator rating will provide the greatest increase in resilience versus return on investment. Generators are the most cost effective component, able to provide more power at a lower procurement and O&M cost than either solar array or battery. It may be possible to further improve the resilience of the generator by increasing the maintenance level, up to the supplier's recommended maintenance level; however, these gains are minimal and should be heavily examined in light of cost constraints. Increases to the battery capacity appear to provide the worst return on investment—minimal resilience impact at extremely high cost.

Research Authors

Vicki Chu, LT Curtis Bolen USN, Andy Dang, Paul T. Kim, Christian Proctor, Bridget Shideler. All authors are graduates of the Systems Engineering Department the Naval Postgraduate School. Contact Dr. Douglas Van Bossuyt **douglas.vanbossuyt@nps.edu** or Dr. Giovanna Oriti at **goriti@nps.edu** for more information about this research.

RESILIENCE CORNER

Rules for the Resilience Renaissance

By Dan Eisenberg, PhD, Department of Operations Research, NPS

I normally start the Resilience Corner stating that the term resilience is creeping into military directives, but recently the term feels less like it is creeping and more like it is having a renaissance. I started Resilience Corner to help make sense of a few energy and water resilience requirements for military installations. The term has since transitioned from niche requirements to a guiding principle across multiple DoD directorates. Given its increasing popularity and penchant for misinterpretation, I thought it would be helpful to summarize some "rules of thumb" on how to avoid traps when applying resilience concepts to military systems.

Rule 1: Focus on system function, not threats. The first step towards resilience is determining how military systems respond when faced with threats and adversaries. Associated analytic effort might overemphasize detailing the threat, rather than understanding what the systems do when stressed. Resilience engineering research recommends doing the opposite. Analytic effort should focus on understanding the function of the system we are trying to make resilient, rather than the threats we are trying to face. The goal is to identify all the different operational contexts that people will be faced with, even including those that are difficult to predict before they are experienced.

Rule 2: There is no such thing as a "resilience enabling" technology. Assuming we have a good understanding of how our systems work, the natural next step might be deploying new technologies expected to improve resilience, such as backup generators or microgrids. However, resilience is not necessarily gained by a backup generator, but by the ability to turn it on and use it when needed. This means there is no such thing as a "resilience enabling" technology, but rather a set of capacities to sense, anticipate, adapt to, and learn from past and future events. Resilience engineering research recommends focusing on improving these sociotechnical processes and matching improvements (which can still be new tech) to sociotechnical needs.

Rule 3: Fix what is broken and improve what works. Prioritizing limited resources in the DoD often means distributing funds to systems of the greatest need and mission-essential function. However, resilience is gained both by fixing known issues and by enhancing what is already working. For example, an installation might lack systems to monitor and manage energy use on base, but they might also have implemented an innovative work around using local capacity and expertise to assess energy needs. Making systems more complex with new monitoring systems might reduce adaptive capacity by taking resources away from practices that already work. Only funding the gaps overlooks an opportunity to learn from success stories and utilize them as a source of adaptive capacity. The goal should be maximizing adaptive capacity, rather than raising some minimum bar.

Resilience is gained both by fixing known issues and by enhancing what is already working.

LEARN MORE

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ENERGY SECURITY

Energy Security Through Distributed Energy Resources: Protecting Critical Facilities

By Petros Siritoglou (Hellenic Navy, NPS '20 Electrical Engineering Graduate), Giovanna Oriti PhD (Dept. of Electrical Engineering), and Douglas L. Van Bossuyt PhD (Dept. of Systems Engineering)

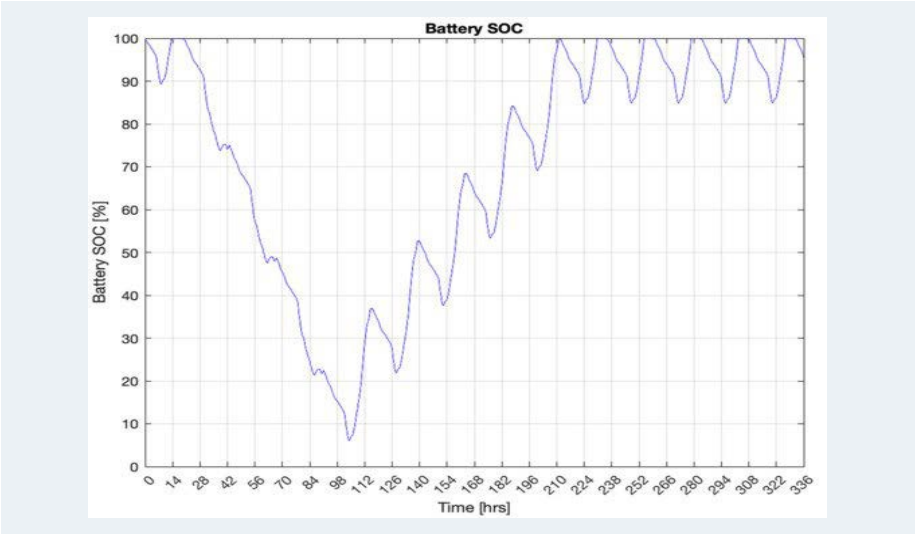

Figure 1: Battery state of charge over 14-day period with 50% PV disruption occurring on Day 1 and PV returning to full capacity occurring on Day 4. Battery regained full charge state at 4.6 days after PV returned to full capacity.

Energy security is of great strategic importance for facilities where critical loads are present. When the utility grid suddenly malfunctions, the energy security of a facility is threatened, and the use of microgrids with distributed energy resources (DERs) can improve the situation. Backup diesel generators are typically available in critical facilities and are generally turned on to power critical loads when the utility power grid is down. However, diesel generators are not sufficient to ensure the resilience of a critical facility because the diesel fuel supply may not be guaranteed, for instance, for the time during which critical loads must be powered. To further improve the resilience of a critical facility, we propose a back-up microgrid including at least one renewable energy source and energy storage.

In order to aid in implementing backup microgrids at military facilities, our recently published work proposes a design methodology that follows the guidelines in IEEE Standards 1562 and 1013 to size the combination of a renewable energy source, such as a photovoltaic (PV) array, and energy storage to develop a microgrid. The microgrid is explicitly a secondary or redundant microgrid that has the goals of (1) improving the resilience of a critical facility, and (2) boosting energy security to allow for full-time mission support when the utility grid is down and fuel delivery is interrupted.

This novel design method can assist energy managers in the early design stages of back-up microgrids to improve the energy resilience of their facilities, as it is a method based on worst-case analysis rather than an optimization method. Among other features, the design method allows for the designer to verify that the sizing of energy storage is sufficient based on potential PV failures in the context of improving the resilience of a microgrid to a variety of disruptions. Additionally, the design method was implemented on a MATLAB-based experimentally validated software platform featuring a user-friendly interface and less than 1 second processing time. The software could run in manual or automated mode, allowing for use with no knowledge of DER components' datasheets and performance.

Several microgrid-design examples are available that demonstrate how the proposed method can be used to achieve the user's resilience goals with a stand-alone microgrid. Specifically, using the software tool, a facility energy manager can simulate potential disruptions to verify that the design could allow for the microgrid to continue to operate through one or multiple disruptions and recover in an acceptable period of time. Examples include obtained simulations with a physics-based model that can run from the design software's output GUI. We ran two 24 h laboratory experiments on COTS microgrids to validate the design method and physics-based model.

The design software is fully editable and available to research groups for future optimization. A team of engineers is currently conducting research on optimizing different aspects of back-up microgrid design using this methodology, and is porting the design software to Python in order to better provide resilience to critical facilities. The availability of such a methodology and the open-source tool implementation offers a great advantage towards achieving energy security.

LEARN MORE

The full publication can be found at: **https://www.mdpi.com/1996-1073/14/10/2773**

For more informaiton, email Giovanna Oriti at **goriti@nps.edu** or Douglas Van Bossuyt at **douglas.vanbossuyt@nps.edu**

ENERGY RESEARCH

MCAS Miramar Microgrid Operators Conduct Islanding Operations

By Eric Hahn, Faculty Associate-Research, Energy Academic Group

MCAS Miramar recently conducted successful microgrid islanding operations. From left to right Dave Ross (Facility Related Control Systems Manager, MCAS Miramar); Mick Wasco (Utilities and Energy Manager, MCAS Miramar); and Matt Groom (Federal Account Manager, Schneider Electric) observe from the Energy and Water Operations Center (EWOC).

MCAS Miramar recently conducted successful microgrid islanding operations from the Energy and Water Operations Center (EWOC). During the operation, each day between April 20–22, Naval Facilities Engineering Command Southwest (NAVFAC SW) Metro Production Office (MPO) ramped up their power plant, and then seamlessly disconnected from shore power on the site creating a microgrid "island" on a portion of the base. They remained "islanded" for 4 hours each day, and then seamlessly connected back to the utility source at the end of the operation. The purpose of this "Test Mode" was to practice microgrid island operations without losing power to any base facilities. Upon conclusion of the test MPO worked with San Diego Gas and Electric (SDGE) to restore the base back to its normal configuration (a primary single feeder from utility). On Saturday, April 24 MPO conducted a full microgrid island test, which meant cutting power to the entire base starting at 1000. MPO then conducted a "black start" (no municipal power from SDGE) of the microgrid system/power plant to restore the base load. MPO then moved quickly to test functionality, successfully syncing with, and connecting back to their alternate "shore power" (municipal power feed from SDGE). MPO then tested a fully automated loss of utility power and automatic microgrid restoration. This was essentially the same sequence as the first test, but entirely automatic, simulating what would happen if the base lost power in the case of an unmanned system. At the conclusion of all testing MPO seamlessly restored the base to utility power again. Practice makes perfect, and this successful "Test Mode" practice demonstrates resiliency in the event of municipal power disruption.

LEARN MORE
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Postdoctoral Opportunity on Climate Resilience & Military Installations

The Naval Postgraduate School (NPS) Center for Infrastructure Defense (CID) and the Energy Academic Group (EAG) are leading efforts to assess and improve the resilience of U.S. military installations and surrounding communities to climate change related disasters. Currently, the CID and EAG are leading several projects in this area, such as conducting military installation resilience analysis, creating a climate resilience training platform, coordinating the Climate and Security Network (CSN), and delivering infrastructure resilience short courses to U.S. military and Allied partners. In support of these efforts, we are seeking one or more postdoctoral scholars to support research, publishing, and teaching activities. Applications are coordinated through the Oak Ridge Institute for Science and Education (ORISE) program. We are reviewing applicants, so please apply as soon as possible for full consideration.

LEARN MORE
Apply at: **https://www.zintellect.com/Opportunity/Details/NPS-2021-0002**
Visit the following websites to learn more about our work at **CID**, **EAG**, and **CSN**

Consumption Model Used to Identify Energy Security Concerns

By Brandon Naylor, Faculty Associate-Research, Energy Academic Group

This past fall, the Fuel Usage Study Extended Demonstration (FUSED) model was used to evaluate potential energy security concerns in naval operations overseas. The FUSED model is the product of over five years of development by Energy Academic Group interns and faculty. The model is able to predict how different policy and operational practices impact fuel consumption for battlegroups and the Combat Logistics Force fleet (CLF) that supplies them with fuel. FUSED was originally developed to support a Naval Postgraduate School student's thesis on different fuel conservation practices, but later additions to the program enabled it to model additional facets of naval operations such as tasking ships with delivering fuel to ground combat troops or comparing an operation's fuel requirements against the fuel delivery capabilities of a given number of CLF assets. In this way, FUSED can identify capability gaps and potential energy concerns. Future plans for the model include updating the interface to make it more user friendly so as to enable it to be used as a student educational tool.

LEARN MORE
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Enrollment Open for Defense Energy Certificate Program

The Naval Postgraduate School's (NPS) Energy Academic Group is pleased to announce the fifth offering of its Defense Energy Certificate program. This offering (cohort) will begin 28 March 2022. The certificate program is free to all students, but applications must be submitted, transcripts received, and a Participation Agreement signed before NPS can process the application.

Applications are due NLT 7 January 2022.

The DL Defense Energy Certificate program is a graduate-level and accredited certificate program. It consists of four courses, offered one course (on-line) per quarter for four consecutive quarters. The program is open to all federal civilian employees who are U.S. citizens and qualified uniformed enlisted and officers. The Energy Certificate is designed to support the Office of the Secretary of Defense and the Secretary of the Navy's energy goals. The DL Energy Certificate provides those working military and civilian employees of the Department of Defense the opportunity to understand the complex issues facing the Operational and Installation Energy segments of DoD and how they impact Operational Capability issues as well as military requirements. This certificate program is designed to expose students to the technical, operational, and security aspects of DoD's energy needs. Students who successfully complete the program will earn an accredited Certificate in Defense Energy. The Western Association of Schools and Colleges (WASC) confers accreditation.

FOR MORE INFORMATION OR TO APPLY
Email Kevin Maher at or call 831-656-2691. Detailed instructions are also posted on the EAG website at
https://nps.edu/web/eag

Calendar of Events

SEP

6 – 10 Sep
Advanced Regional Energy Security Symposium
Baku, Azerbaijan

13 – 17 Sep
Critical Energy Infrastructure Protection (CEIP) Analysis workshop
Baku, Azerbaijan

13 – 17 Sep
NATO Coherent Resilience Tabletop Exercise – Ukraine Black Sea
Odesa, Ukraine

20 – 24 Sep
NATO Coherent Resilience Tabletop Exercise – Baltic Region
Vilnius, Lithuania

OCT

10 – 14 Oct
Critical Energy Infrastructure Protection
Kuwait City, Kuwait

15 – 19 Nov
Energy Efficiency in Military Operations
Vilnius, Lithuania

DEC

29 Nov – 3 Dec
Energy Security Awareness
Ankara, Turkey

13 – 17 Dec
NSO Energy Security Course
Oberammergau, Germany

ENERGY ACADEMIC GROUP
NAVAL POSTGRADUATE SCHOOL

Connect with the Energy Academic Group

The Energy Academic Group is located in Room 101A, Spanagel Hall on the NPS campus in Monterey, California. A wide range of NPS faculty are affiliated with the energy program, actively participate in energy graduate education, energy executive education, and energy research. For questions, please contact one of the principal EAG faculty members:

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Contribute to an issue of *Surge*

If you would like to contribute an article or have your research/work published in the *Surge* newsletter, please contact Lois Hazard via email at lkhazard@nps.edu.

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