



SURGE

ENERGY ACADEMIC GROUP QUARTERLY NEWSLETTER SPRING 2023

Highlights

- CLIMATE & SECURITY NETWORK
- UNDERGROUND GAS STORAGE
- HYBRID WARFARE FROM CHINA AND RUSSIA
- HYDROGEN-POWERED UAVS
- EUROPE'S ENERGY CRISIS



More than 100 participants, including diplomats and senior officials from nations bordering the Black Sea and Caspian regions, joined U.S. counterparts and energy experts for the Black Sea Security Symposium at the Naval Postgraduate School (NPS), Feb. 6-8. Hosted by the NPS Energy Academic Group (EAG), this was the second annual event which focused on "The Role of the Black Sea in Global Energy Security."

The symposium highlighted the region's importance in NATO and U.S. security, including energy among other missions of critical importance, and served as a catalyst for bringing together Department of Defense leaders, scholars, subject matter experts, and industry representatives to address the major issues affecting

energy security.

"The Black Sea region is an important arena affecting several critical issues of U.S. national security, including U.S.-Russian strategic competition, freedom of navigation at sea in the strategic waterways which transit the area, and European energy security," said the president of NPS, retired Vice Adm. Ann E. Rondeau. "We are very happy to see many U.S. allies and partners represented at the event to engage in important topics addressing energy and security of the region."

Considering current geopolitical developments, the NPS Energy Academic Group expanded the focus of this year's event and hosted Ambassadors and senior diplomatic representatives from Azerbaijan, Georgia, Turkey, as well as Moldova, Romania and Ukraine to participate in

this valuable exchange of information and collaboration.

"It was especially important to get information about the opportunities that allow the countries of the region not only to free themselves from Russia's energy and political influence finally, but also to play an essential role in the energy diversification of the European continent," said international student George Chkhikvadze, a civilian in the Georgia Ministry of Defense studying Defense Analysis at NPS.

The event consisted of four panels that centered on important issues pertaining to the Black Sea and adjoining Caspian region. Moderators and panelists represented highly qualified and diverse subject matter experts whose valuable insights were

Continued on page 3



From the Chair

Dan Nussbaum, Chair of the Energy Academic Group

Once again , there is much to talk about in the energy field, especially in today's "OMG-I-didn't-realize-how-important-energy-security-is" environment. Here are some highlights.

NPS-EAG had a very successful 2nd annual Black Sea Security Symposium, bringing diplomats and senior officials from nations bordering the Black Sea and Caspian regions, U.S. counterparts and energy security experts to discuss the most pressing security challenges facing this part of the globe. The symposium highlighted the region's importance in NATO and U.S. security, including energy security, and other missions of critical importance. Participants in attendance for this valuable exchange of information and collaboration included ambassadors and senior diplomatic representatives from Azerbaijan, Georgia, Turkey, as well as Moldova, Romania, and Ukraine. Other key participants included Ms. Erika Olson, Deputy Assistant Secretary of State for Southern Europe and the Caucasus; RADM (LH) Ruud Schoonen, ACOS Strategic Plans and Policy; Headquarters Supreme Allied Commander Transformation; and senior representatives from the NATO School Oberammergau; NATO Energy Security Centre of Excellence in Vilnius, Lithuania; and NATO SHAPE. Former Secretary of Defense Leon Panetta delivered the keynote address.

There are several activities within the Department of Navy (DoN) that indicate the importance being placed on operational energy (OE). In particular, the DoN is reestablishing the position of

the Deputy Assistant Secretary of Navy (energy). Additionally, Jim Caley, who has been the point person for OE within the DoN, and his SecNav OE team planned and hosted a very successful 2023 Naval Operational Energy Forum OE Summit at Naval Surface Weapons Center – Carderock, bringing together all the players in the naval services to gain a common understanding of the OE challenges and to share what they are doing on this critical topic. There were four full days of presentations, covering policies and an astonishing set of technologies that affect the Naval Operational Energy enterprise.

We are delighted to welcome three new EAG team members— Cayle Bradley, Michael Davis, and Bill Muras. They come to us from diverse backgrounds, and I anticipate that their skills and perspectives will make a significant contribution to EAG and the overall Energy enterprise. Welcome aboard!

"NPS and Stanford's Doerr School of Sustainability have signed an Educational Partnership Agreement (EPA), with the first collaboration being a design thinking event, the theme of which is resilience to support climate solutions. While the focus will be on Water Security, Ocean and Coastal Resilience, and Energy Security, the overarching goal of the event is to support future climate actions to inform the Navy's analytic agenda for climate. The event will take place at NPS on 27-28 April 2023.

ONR and EAG have teamed to create a Decarbonization Research Consortium, a public-private collaboration that advances interdisciplinary research to help the Navy meet the complex challenges of platform decarbonization, with a

focus on ships and aircraft. The Consortium will evaluate and identify technologies that show promise for adaptation on naval platforms and accelerate adoption as appropriate.

We are proud to highlight the release of Prof. Brenda Shaffer's new book, *Iran is More Than Persia: Ethnic Politics in Iran*, in which she explores the stability of the ruling regime and the evolving dynamics of global energy markets and their impact on international politics.

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 831-324-3228.

instrumental in addressing key themes of the symposium.

Dr. Dan Nussbaum, EAG chair, noted that the inaugural symposium in 2022 was held before the Russian invasion of Ukraine, and the current security environment further amplifies the Black Sea region and the security issues around it, compounding the need for greater dialogue with stakeholders and raising the critical importance of engagements like the symposium.

One of the highlights of the event was a keynote address by former Secretary of Defense Leon Panetta, chairman of The Panetta Institute for Public Policy at nearby California State University Monterey Bay. Panetta emphasized the centrality of the Black Sea and Caspian regions as a “geographic faultline.”

“The Black Sea and South Caucasus regions are the meeting grounds of Russia and NATO, Europe and the Middle East, and the Muslim and Christian worlds,” said Panetta. “The ongoing Russian aggression provided an opportunity for the U.S. to serve as a world leader again to ensure NATO unity and resolve.”

READ THE FULL ARTICLE

Visit <https://nps.edu/web/eag/nps-hosts-annual-black-sea-security-symposium-2023>

LEARN MORE

Contact Ms. Tahmina Karimova at ttkarimo@nps.edu for more information about this engagement at NPS.

CLIMATE

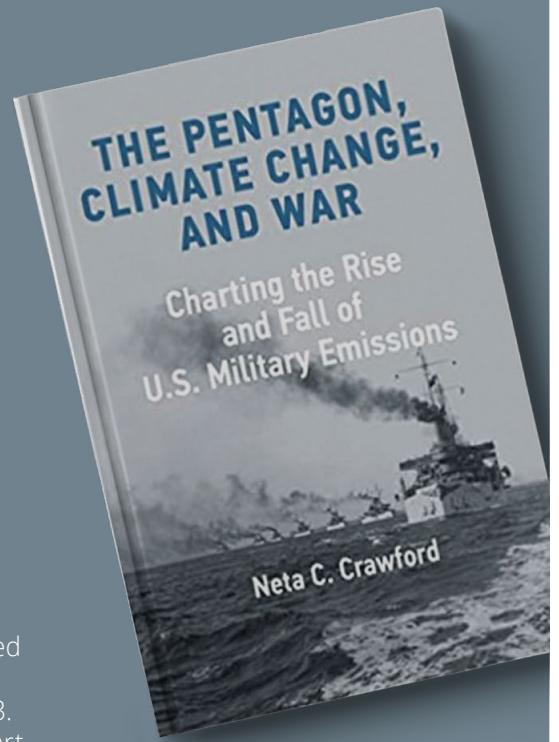
Combined Naval Address Features Author of *The Pentagon, Climate Change and War*

By Kristen Fletcher, Faculty Associate-Research, Energy Academic Group

The NPS Climate & Security Network hosted the 4th Combined Naval Address on Climate, Energy and Environment in February 2023. The Combined Naval Address is part of a partnership of the institutions in the Naval Education Enterprise – NPS, the U.S. Naval War College, U.S. Naval Academy, U.S. Naval Community College and the Marine Corps University. At the event, Dr. Neta Crawford addressed students, faculty and distinguished guests on the topic of Climate Change, Climate Security and the U.S. Military.

Dr. Crawford is the Montague Burton Professor of International Relations at University of Oxford and previously was professor and chair of the Department of Political Science at Boston University. She is the author of several books, and she spoke on findings included in the recently published *The Pentagon, Climate Change and War*.

For many years, DoD has recognized the relevance of climate change to national security, and recent Executive Orders require DoD to mitigate its emissions as it is the largest single energy consumer in the U.S. and the world’s largest institutional greenhouse gas emitter. Dr. Crawford traces the U.S. military’s growing consumption of energy and calls for a reconceptualization



of foreign policy and military doctrine to break the national security reliance on fossil fuels. Her analysis shows how a cycle of economic growth, fossil fuel use, and dependency has shaped U.S. military doctrine and how that can only be changed by rethinking U.S. grand strategy, enabling reduction in the size of the military and its operations.

Following her address, Dr. Crawford took questions from NPS and U.S. Naval Academy students and addressed faculty from the schools in a small-group Roundtable.

LEARN MORE

View Climate & Security Network events at <https://nps.edu/web/climate-and-security/events>.

Contact: Kristen Fletcher at kristen.fletcher@nps.edu

ENERGY RESEARCH Underground Gas Storage: A History of Energy Security

By Mr. Eric Hahn, Faculty Associate-Research, Energy Academic Group and Mr. Erik Limpacher, Senior Technical Staff, Energy Systems Group, Massachusetts Institute of Technology's Lincoln Laboratory

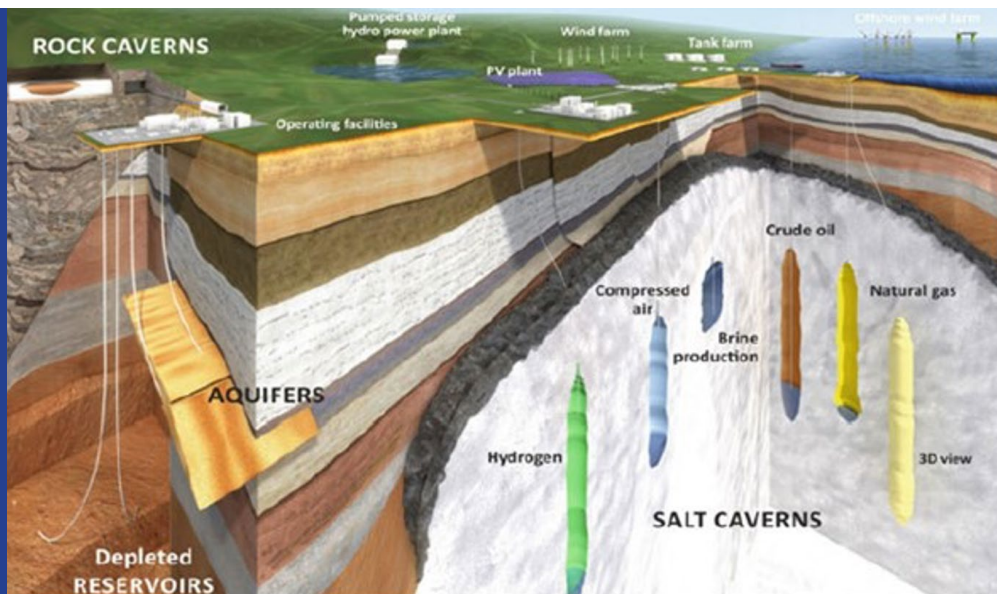


Image courtesy DEEP.KBB GmbH (<https://deep-kbb.de/>)

Underground Gas Storage (UGS) has a long history. Early examples dating back to the 19th century were used throughout Europe for “town gas”, a product of the partial combustion of fossil fuels. UGS has since been used for natural gas, crude oil (but not refined oil products), compressed air, and even hydrogen storage.

UGS allows for the efficient and safe storage of large quantities of gas, important for energy security, as stockpiled gas can be used during times of high demand. In addition, UGS is cost competitive with other forms of storage and environmentally sound. Hence, by the end of 2017, there were a total of 671 UGS facilities in operation world-wide.

Researchers at Massachusetts Institute of Technology's Lincoln Labs have been developing a new concept for sequestration and storing of H₂ and CO₂ feedstock in UGS wells. The main driver for this idea: Point-of-use production of this feedstock is a bottleneck for synthetic fuel production. It requires either a large chemical plant or a large quantity of power generation and electrolyzer equipment.

UGS wells at depths of about 2,000 ft. are well within the capability of the oil & gas industry and are incredibly robust to threats. These wells could be filled by local H₂ production or CO₂ capture systems, or filled with feedstock

purchased from the regional market. For example, production of hydrogen by Pacific partners and allies for industrial markets is projected to exceed nine million tons. Suitable UGS sites for H₂ or CO₂ storage, if identified as part of a comprehensive geologic evaluation, could potentially foster energy security for the U.S. as well as our partners and allies.

LEARN MORE

Email Eric Hahn at ehahn1@nps.edu for more information.



Interested in Energy-related Thesis Research?

Since 2013, NPS and the EAG have 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!



nps.edu/energy

⚡ STUDENT ENERGY RESEARCH SPOTLIGHT

Students Support NATO Project on Defending Against Hybrid Warfare from China and Russia

By William Gilfoil, Kyla Tiedemann, and Col. Ryan Bulger
Henry M. Jackson School, University of Washington



UW professor Dr. Sarah Lohmann with students Penelope Beagles, Ryan Bulger, Max Cheung, Erica Dahl, Vitoria Faustino, Jennifer C. Gile, William Gilfoil, Alina Renee Guyon, Aesha Hendricks, Yiqi Huang, Lily Anne Kinyon, Casper Pai-Sing Sun, Kimber Tanner, Kyla Elisa Tiedeman, Kristina Umanskiy, and Kelsey Zapf. The class contributed research to NATO SAS-183, an energy security project led by NPS faculty.

Students at the University of Washington (UW) have been providing research for NATO's Science and Technology project SAS-183 (tinyurl.com/ycx3nracs), focusing on energy security resilience, capability, and interoperability. Their research, under the supervision of professor Dr. Sarah Lohmann at UW, supports the project's cyber and regional working groups, and contributes to analysis and findings by the Energy Academic Group at the Naval Postgraduate School through a report (<https://tinyurl.com/nsjy9ehr>) for the ongoing NATO project.

The foremost threat to NATO's Critical Energy Infrastructure (CEI) in scale and impact is Russia's continued assault on NATO member cyber security. The report recommends promoting company standards on data pipeline vulnerabilities by implementing exercises and Cyber Early Warning Systems (CEW). It also encourages fostering EU NATO cooperation to strengthen malicious cyber intrusion reporting pertaining to critical infrastructure.

Another critical element of security is access to Rare Earth Elements (REEs), which are essential to construction of many sustainable technologies such as wind turbines, solar photovoltaics, and lithium-ion batteries. Chinese influence over the extraction and refinement of REEs is extensive, controlling 60% of mined REE production and 85% of processing capacity, as well as flooding the REE market to price out competitors. The report recommends establishing a sub-committee within NATO's Economics and Security Committee to review REE supply-chains and working closely with Norway and Sweden on diversification.

Disinformation also poses a significant threat to critical energy infrastructure (CEI). CEI workers are vital to the continued function of crucial frameworks such as nuclear power plants or coal mines. To avoid disinformation leading to protests and CEI shutdowns, the report recommends expanding worker access to affordable wire services to promote disinformation literacy, partnering with international and grassroots NGOs to research and report disinformation

campaigns, and intensifying cooperation with the European External Action Service (EEAS) to observe media platforms for disinformation. By addressing all aspects of hybrid warfare stemming from the Russia-China partnership, NATO will be able to take a unified approach to Alliance security.

ABOUT THE AUTHOR

William Gilfoil and Kyla Tiedemann are seniors in the Henry M. Jackson School at the University of Washington. Col. Ryan Bulger is a U.S. Army War College Fellow in the Jackson School.

LEARN MORE

Contact Dr. Sarah Lohmann at slohmann@uw.edu. Dr. Lohmann's bio can be viewed at <https://ssi.armywarcollege.edu/faculty-staff/sarah-lohmann/>

⚡ STUDENT ENERGY RESEARCH SPOTLIGHT

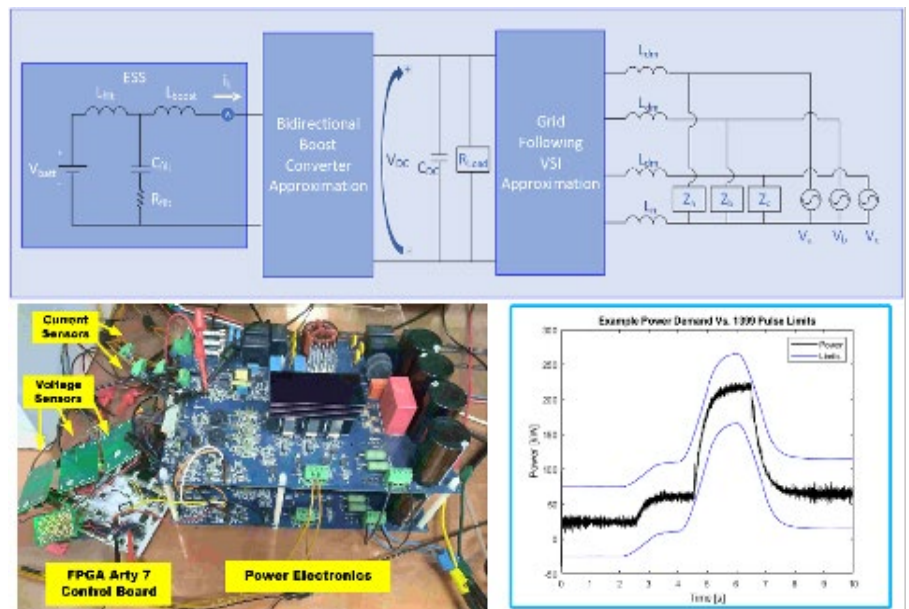
Novel Control Strategies for Shipboard Power Conversion Systems to meet the Pulsed Power Load Requirements in MIL-STD-1399

By LT Matt Storm, U.S. Navy

This thesis advances the state of the art in power converter technology to interface battery energy storage systems in microgrids and in shipboard power systems.

Pulsed power loads (PPLs) cause significant stress on power distribution systems because they require large amounts of current in short intervals of time. In islanded microgrids such as shipboard power systems the problem is accentuated because the synchronous generators used as sources respond to PPLs by slowing down or accelerating and causing voltage and frequency abnormalities. This thesis presents a solution to reduce the undesired effects of PPLs on shipboard power systems so the PPL requirements in the 2018 revision of MIL-STD-1399 can be met. Through the use of an Energy Storage System (ESS), switch-mode DC-DC power converter, and novel control schemes, the undesired effects of large PPLs are mitigated.

A physics-based model of the system was developed to provide a proof of concept via simulations of the system transient response to a PPL as detailed in MIL-STD-1399. The model includes a DC-DC converter interfacing the energy storage system and a three-phase voltage source inverter (VSI) interfacing the AC distribution bus. A novel control system for the DC-DC converter is proposed to regulate the DC bus to which the VSI is connected.



The model, implemented in Matlab/Simulink, was then converted to Verilog utilizing Matlab HDL (hardware description language) coder to program two field-programmable gate arrays (FPGAs) which controlled the two power converters in the laboratory prototype. Simulations and experimental measurements demonstrate that the PPL requirements in MIL-STD-1399 are met using the proposed power conversion system and novel control strategy.

This technology is applicable in shipboard power systems, where the continuous increase in energy demand requires increased energy density and efficiency, as well as microgrids on land.



ABOUT THE AUTHOR

LT Matthew Storm is a U.S. Navy Officer and is a MSEE candidate from the Graduate School of Engineering & Applied Sciences at NPS. For more information about this research contact Prof. Giovanna Oriti at goriti@nps.edu

⚡ STUDENT ENERGY RESEARCH SPOTLIGHT

Development of Operational Scenarios for Hydrogen-Powered UAVs

By LT Chase Smeeks, U.S. Navy

With the increasing cost of hydrocarbon fuels, their environmental impacts, and rising inflation the Department of Defense (DoD) has taken interest in finding alternative ways to power vehicles. One alternative that has been considered is batteries, but these can degrade quickly in harsh environments and are often heavy. Additionally, they do not address the primary logistical concerns of reducing storage requirements and eliminating the need to transport heavy fuels across the battle space. Hydrogen is an appealing alternative due to its ability to be produced in situ and its large gravimetric energy density, meaning it provides more energy from less mass compared to other fuels.

The intention of this work was to expand on previous alternative energy research into microgrids and hydrogen conducted at NPS by Dr. Anthony Gannon, Dr. Anthony Pollman, and Dr. Douglas Van Bossuyt. The purpose of this thesis research was to develop operational scenarios for hydrogen-powered unmanned aerial vehicles (UAVs) that demonstrate the plausibility, advantages, and implementation barriers of hydrogen as an alternative fuel source for a variety of naval operations. These operational scenarios are presented as a high-level operational concept graphic (OV-1), systems modeling language (SysML) sequence diagram, and written description.

The primary advantages of hydrogen-powered UAVs determined by this research were based on their increased flight endurance compared to battery-powered UAVs while maintaining a lower signature than hydrocarbon-fueled UAVs. These characteristics allow hydrogen-powered UAVs to stay on station much longer with a low detectability. The main barriers to implementation identified by this research include a scarcity of DoD policy on hydrogen fuel usage, no accepted single source of authority, and no established process for underway hydrogen usage mostly due to hydrogen safety misconceptions. Additionally, vessels lack the existing infrastructure to support the widespread usage of hydrogen, and crews are not sufficiently trained on hydrogen use and firefighting.

The operational scenarios presented in this thesis can help decision-makers better visualize the potential advantages of using hydrogen-powered UAVs and consequently hydrogen fuel for naval operations. This allows them to make better-informed decisions and improves on the justification for additional research and operational testing of alternative fuels for powering unmanned vehicles used during naval operations.

For additional information on this research please see the associated article "Reimagining Logistics to Enable Distributed Lethality," published in the innovation cell column of the January 2023 issue of *Naval Proceedings* at the following link: <https://www.usni.org/magazines/proceedings/2023/january/harvest-hydrogen-distributed-logistics>.



ABOUT THE AUTHOR

LT Chase Smeeks, USN, graduated from the Naval Postgraduate School in December 2022 with a Master of Science in Systems Engineering. Contact Dr. Douglas Van Bossuyt at douglas.vanbossuyt@nps.edu for more information about this research.

GLOBAL ENERGY

Lessons Learned from Europe's Energy Crisis

By Brenda Shaffer, PhD,
Faculty Associate-Research,
Energy Academic Group

On February 24, 2023, Prof. Brenda Shaffer delivered a lecture on "Lessons learned from Europe's energy crisis," hosted by Lawrence Livermore National Laboratory Center for Global Security Research.

During the lecture, Prof. Shaffer claimed that while U.S. and European policymakers frequently blame Russia's invasion of Ukraine in February 2022 for the current European energy crisis, in reality, the crisis emerged due to European policies. These policies include: the decision not to import sufficient natural gas volumes from a diverse set of suppliers, lack of attention to baseload needs, and limitations imposed on natural gas contract length. Despite the gravity of the energy crisis which is leading to the collapse of many energy-intensive industries in Europe, Brussels has not undertaken new policies that can fundamentally solve its energy crisis. She concluded that the United States can draw many lessons from the case of Europe's energy crisis in order to avoid a similar predicament and discussed those lessons.

READ THE FULL ARTICLE

Read the full article at the Lawrence Livermore National Laboratory Center for Global Security Research:

<https://cgsrc.llnl.gov/event-calendar/2023/2023-02-24>

Enrollment Open for Defense Energy Certificate Program

The Naval Postgraduate School's (NPS) Energy Academic Group is pleased to announce the sixth offering of its Defense Energy Certificate program. This offering (cohort) began 27 March 2023. 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.

FOR MORE INFORMATION OR TO APPLY

Email Kevin Maher at kjmaher@nps.edu or call 831-656-2691. Detailed instructions are also posted on the EAG website at nps.edu/web/eag/defense-energy-certificate-program

EAG Welcomes New Team Members

Cayle Bradley

joined the EAG in February 2023 as Faculty Associate-Research. Bradley's experience includes five years as Requirements Officer for Energy Programs at OPNAV and seven years as a Naval Architect at NSWC Carderock Division, primarily supporting energy technologies R&D. He also served eight years active duty enlisted and continues to serve as an Engineering Duty Officer in the Navy Reserves. Bradley will be contributing his experience to our Climate and Security Network. Contact Cayle at cayle.a.bradley@nps.edu



Bill Muras

joined the EAG in March 2023 as a part-time Faculty Associate-Research. Muras has over 20 years of experience in the defense, energy, small business and government contracting sectors, with a focus on energy, finance and climate change. With the EAG, Muras will focus on operational energy, climate adaptation and mitigation, and decarbonization strategies. Contact Bill at william.j.muras.ctr@navy.mil



Michael Davis

joined the EAG in January 2023 as Faculty Associate-Research. Davis has nearly thirty years of service in a variety of military assignments in the United States Army. Michael completed his military career in 2022, culminating as the Commandant of the NATO School Oberammergau. During his time in uniform, Michael focused on leadership, regional studies in Europe and Africa, and Energy Security. He developed and led the first-ever Energy Security Course for the U.S. Army's European Security Studies Seminar for Foreign Area Officers, and is the author of "Competition and Cooperation in Energy Security: Dilemmas for National Security and Influence" by Routledge Press. Michael's current efforts with the EAG are centered on Curriculum Development in support of Operational Energy for the Joint Force, allies, and partners. Contact Michael at michael.a.davis@nps.edu

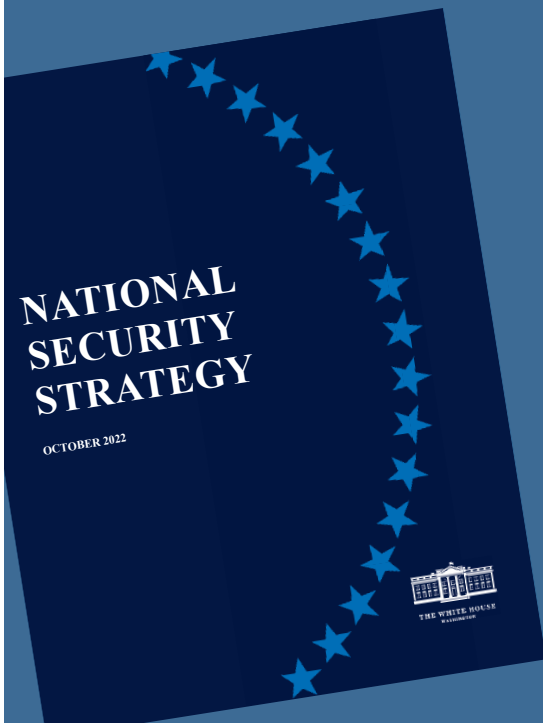


National Security Strategy Addresses Climate and Energy

The White House issued the 2022 National Security Strategy in October. Its core themes include strategic competition with China and Russia, investment at home, and climate change as a central challenge to the U.S.. While energy and climate are woven through the Strategy, it specifically includes a section on Climate and Energy Security, expressing that the "climate crisis is the existential challenge of our time" and "long-term energy security depends on clean energy." The Strategy further calls for working with allies and partners to secure energy security and affordability, access to critical mineral supply chains, and just transitions for affected workers.

LEARN MORE

The National Security Strategy is available at: <https://www.whitehouse.gov/wp-content/uploads/2022/10/Biden-Harris-Administrations-National-Security-Strategy-10.2022.pdf>



ENERGY RESEARCH

Marine Corps Air Station Miramar Microgrid – Island Mode Test – Automatic Black Start

By Alvaro Rodriguez, VTEC Intern, Energy Academic Group

Black start testing involves restarting the power system following the total loss of grid power. If a base, city, or organization does not have black start capability, they cannot operate until the utility operator has fully restored their power. The microgrid operated at Marine Corps Air Station (MCAS) Miramar is designed with black start capabilities, and frequent testing and evaluation of this capability ensures operators can restore functionality to base operations as quickly as possible.

In February of this year, MCAS Miramar conducted an island mode automatic black start exercise of its microgrid. The goal was to assess the system's response to an unexpected power outage during non-working hours. The island mode automatic black start operation is designed to automatically open all loaded breakers following loss of power, start all available engines, and close in all critical and essential loads following stabilization. At the beginning of the

test utility services were asked to secure power to the base feeds – removing power fed to the base from the external power grid and initiating the black start test.

Following engine start and grid stabilization, critical and essential loads were restored. The microgrid operator then took control of the plant. While monitoring spinning reserves, the operator closed in non-essential loads, restoring power to all buildings on base. Testing of a separate backup generation resource was also conducted. A standalone facility generator, separate from the central plant, was paralleled with the online islanded grid. This generator, in addition to the already proven landfill gas generation on the system, greatly increased the microgrid's redundancy, spinning reserve, and most notable increased island time with onsite fuel supply.

While the exercise was successful in demonstrating the capabilities of the microgrid, several minor software



MCAS Miramar's Microgrid Mechanical Room

and communication issues were discovered and quickly resolved during the exercise. Continuous testing and identification of resilience gaps gives MCAS Miramar a key advantage when facing the threat of a widespread power outage.

LEARN MORE

To learn more about EAG Intern Research visit: <https://nps.edu/web/eag/intern-research>

Contact Andrew Jennings at andrew.jennings@nps.edu for more information.

Energy Training Module Hosted on Navy e-Learning

After multiple stakeholder meetings, workshops, and countless hours of researching and collecting feedback, the EAG has successfully completed its effort in updating the energy training module titled *Energy – Enabling Combat Operations* (product number NPS-E-ECO-1.0). The General Military Training module is designed for both civilians and active-duty enlisted and officer members of the Department of the Navy (DoN), both sailors and Marines, and enables learners to harness a greater understanding of the DoN's operational energy focus. The learning objectives include how energy is critical to combat operations; DoN strategic energy objectives; energy challenges and best practices for different Naval Communities; and actions to take to become a more effective warrior. The GMT is a product of EAG's multi-year initiative: Naval Enterprise Energy Education and Training (NE3T).

To enroll and complete the updated GMT:

1. Log into your Navy e-Learning account at <https://learning.nel.navy.mil/ELIAASv2p/>
2. Click the 'Course Catalog' tab
3. Search 'Energy - Enabling Combat Operations'
4. Enroll, launch, and complete the course module

LEARN MORE Contact: Marina Lesse marina.lesse@nps.edu for more information.





Operational Energy Certificate Program

The Naval Postgraduate School's (NPS) Energy Academic Group is pleased to announce the establishment of NPS' Operational Energy (OE) Certificate Program. Three stackable certificates have been developed for this program and are designed to educate students to the technical, operational, and security aspects of DoD's energy needs.

The program is sponsored by OPNAV, and applications and transcripts must be received to enroll.

Directed Energy, Certificate 119, will be open for enrollment on October 15, 2023 for the Winter Quarter.

For more information or to apply:

For all program information and course requirements, please visit <https://nps.edu/web/eag/operational-energy-certificate> or email the Program Manager, Dr. Colleen McHenry, at colleen.mchenry@nps.edu.



CALENDAR OF EVENTS

APRIL

April 27–28, 2023

Joint Climate Event/TTX

Monterey, California

MAY

May 15–19, 2023

Energy Efficiency in Military Operations Course

Vilnius, Lithuania

May 15-19, 2023

Black Start Tabletop Exercise

Rota, Spain

AUGUST

August 13–24, 2023

Critical Infrastructure Protection Wargaming

Helsinki, Finland

UPCOMING

2023 Defense Energy Seminar Series

EAG is pleased to have resumed in-person presentations for its Defense Energy Seminar lecture series. Watch for upcoming dates and full event details as they become available on the EAG website at nps.edu/web/eag/seminars.



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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