



SURGE

ENERGY ACADEMIC GROUP QUARTERLY NEWSLETTER SPRING 2022

Highlights

- OPTIMIZED FLYING
- BLACK SEA ENERGY AND SECURITY
- ENERGY EFFICIENCY IN MILITARY OPERATIONS
- NET ZERO BY 2050
- INFRASTRUCTURE RESILIENCE IN EMERGENCY SITUATIONS



The EAG has supported Exercise Coherent Resilience (CORE) since it began in 2017. CORE is a NATO-sponsored exercise in Kyiv, Ukraine, designed to enhance the resilience of Ukraine against hybrid warfare threats targeting their energy systems.

Before the Storm: How the Naval Postgraduate School Supports International Partners In Infrastructure, Energy, Cybersecurity

By Ms. Desiree Dellehay, Director of Communications,
NPS Foundation & Alumni Association

The Russian invasion of Ukraine rocked the critical infrastructure of Ukraine and has the potential to disrupt critical infrastructure globally.

The impacts have disrupted daily life in Ukraine and financial markets globally. Political leaders, national security experts, and consumers everywhere are keeping a close eye on impacts to infrastructure, energy security and environmental security as Russia expands its aggression and threats to international security.

Energy security is a critical enabler of military capability. The United States identified a national security interest in helping partners and allies to become

more resilient in the face of hybrid threats and attacks on the systems that undergird basic living conditions such as heating in the winter and the transportation of goods and services. The focus of the Department of Defense has been helping allies and partners develop innovative solutions to the complex challenges they face.

The Energy Academic Group at the Naval Postgraduate School plays an important role in enhancing global energy security by supporting security initiatives with NATO, partners and allies through education, research and outreach.

“As the U.S. has an interest in the protection and resilience of global energy

infrastructure and systems, it is fitting that DoD’s premiere Center of Excellence for energy security provides a focus on efforts to educate our forces, as well as our allies and partners, regarding the complexities of energy to include its challenges and opportunities,” said Dr. Daniel Nussbaum, Chair of the Energy Academic Group and an Operations Research professor at NPS.

READ THE FULL ARTICLE

Available at <https://www.npsfoundation.org/posts/nps-ukraine-infrastructure>



FROM THE CHAIR

Dan Nussbaum, Chair of the Energy Academic Group

I have previously said—and I am not the only one to have said it—that *Energy is a fundamental enabler of military capability*. An important aspect of the effort to get the appropriate knowledge about this fundamental enabler to the right people at the right time in their careers is the effort by NPS, sponsored by Navy OPNAV and SECNAV, entitled *A Roadmap to Implementation of Navy and Marine Corps Operational Energy Training and Education*. The main objective of this effort is to develop a roadmap to integrate Operational Energy (OE) into formal Navy and Marine Corps training and education programs. Phase 1 of this roadmap will be completed by the end of March 2022, and a recent in-progress review convinced all participants that the effort is on track. Dr. Arnold Dupuy is the Principal Investigator (PI) for this effort.

The U.S. Department of Labor defines stackable credentials as those that are “part of a sequence of credentials that can be accumulated over time and move an individual along a career pathway or up a career ladder.” NPS already has a successful Defense Energy Certificate, which is sponsored by Ms. RuthAnne Darling (OSD-OECIF). Our objective now is to build upon and enhance this program by creating a stackable certificate program. The PI for this effort is Dr. Colleen McHenry.

I was proud that NPS hosted a symposium on *Energy and Security in the Black Sea Region*, the focus of which was to analyze the major issues effecting energy and security in the greater Black Sea region. The symposium was conducted in a hybrid manner, with fewer than 50 attendees in person, and more than 145 people online. Key attendees included senior diplomatic personnel from the Embassies of

Azerbaijan, Georgia, and Turkey, as well as representatives from NATO School Oberammergau (NSO) and NATO Energy Security Center of Excellence (ENSEC COE), plus NPS leadership. Symposium speakers included the Hon. Leon Panetta, Ms. Erika Olson (Deputy Assistant Secretary of State), Mr. Andrew Winternitz (OSD Principal Director for Europe and NATO Policy), NPS President Ann E. Rondeau, Dr. Scott Gartner (NPS Provost), Mr. Dino Pick (NPS-IGPO Director), Dr. Dan Nussbaum (NPS-EAG Chair), Dr. Brenda Shaffer (NPS-EAG faculty), and Mr. Alan Howard (NPS-EAG Associate Chair). In his address, Secretary Panetta emphasized three points: the important role partner countries play in the Black Sea region and Caucasus in the realm of energy and security, energy corridors, military and security cooperation, as well as sea transit routes between the West and Central Asia; the criticality of alliance unity and stronger deterrence posture in the face of Russian aggression toward Ukraine and other danger points faced around the world through coercive and adversarial policies by China, North Korea, the Middle East, and others; and that history lessons teach us that the policy of “isolationism is dangerous”, and the “U.S. cannot withdraw from its responsibility to the world as our security and the security of the world is at stake.” While many people played a role in putting this symposium together, special kudos go to Ms. Tahmina Karimova and Dr. Brenda Shaffer.

To me, the Ukraine crisis is a perfect example of the nexus between Energy Security and Hybrid Warfare. There is a NATO Systems Analysis effort, SAS-163, entitled “*Energy Security in the Era of Hybrid Warfare*”. The effort addresses the broad range of relevant aspects within this nexus, including a conceptual framework approach, methodological developments, specific case studies, and stakeholder involvement through tabletop exercises. This effort is on



Dr. Brenda Shaffer moderates a panel during the Energy and Security in the Black Sea Region Symposium on January 25, 2022 at the Naval Postgraduate School.

schedule with frequent virtual meetings and drafts of final report sections written. A follow-on activity is also being planned that focuses on the unique challenges in the Baltics and Black Sea area as well as cyber warning technologies. Dr. Dupuy leads this effort.

Congratulations to Jim Caley and his team at SecNav-Operational Energy for this year’s very successful 2022 Naval Operational Energy Forum. There were four full days of presentations, covering policies and an astonishing set of technologies that affect the Naval Operational Energy enterprise.

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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OPERATIONAL ENERGY

Department of the Air Force Launches Pilot Program to Incentivize Optimized Flying

By Corrie Poland, Air Force Operational Energy (SAF/IEN)

Article originally published February 1, 2022. Provided by the U.S. Air Force and reprinted with permission.

As part of its effort to streamline operations and increase aircraft range and capability, the Department of the Air Force launched the pilot Mission Execution Excellence Program (MEEP) to incentivize optimized flying on aircraft that consume the most fuel across the enterprise.

MEEP will encourage Airmen to increase their use of efficient flying 'best practices,' which will not impact their mission and training requirements, through direct and indirect incentives. The pilot phase will focus primarily on C-17 Globemaster III aircraft, the largest Air Force fuel consumers, at Charleston Air Force Base, South Carolina, and Travis Air Force Base, California, and will be active now through December 2022. MEEP will mainly work with pilots and operations planners, as well as maintainers and logisticians, and will leverage Airman innovation to integrate improved techniques and best practices into their day-to-day operations.

The Air Force plans to incentivize Airmen to increase their use of six key efficiency techniques across the force that can be implemented to lower energy demand and improve readiness.

- Precision Fuel Planning – Decrease excess fuel carriage during planned flights when possible
- Reduced Engine Taxiing – Reduce the number of engines running during taxi to only what is required for safe operation when possible

- Reduced Use of Auxiliary Power Units (APU) – Limit the use of APUs during ground operations and utilize more efficient ground power equipment when possible
- Reduced or Simultaneous Engine Start – Minimize the time between engine start and takeoff by reducing engines running or starting the engine simultaneously when possible
- Descent Profile Technique – Employ continuous descent operations in a low-drag configuration, with minimal engine thrust when possible
- Cruise Altitude Selection – Fly at optimal cruise altitudes when possible

"We've met with a number of commercial airlines and freight and transport companies to see how they operate in the most efficient and effective way possible using 21st century tools," said Deputy Assistant Secretary of Air Force Operational Energy, Roberto Guerrero. "There are a lot of opportunities to support Airmen in flying more efficiently – like software that helps Airmen fuel plan more easily or flying techniques that pilots can implement, maintenance practices to improve engine performance and ways to improve load plans. Many of these are low-hanging fruit that we simply need to fund and incentivize."

Initial estimates show that employing the MEEP can improve energy intensity – or the mission effectiveness per gallon of fuel –

by 3%. This is expected to increase capability and readiness while generating as much as \$80 million per year in fuel cost savings that can be returned to the Air Force or participating wings.

The program is made up of three components: data and metric collection visibility, focused wing-level interaction, and direct and indirect incentives. Collaborating with the wings and in-house innovation cells, MEEP will collect and analyze flight and fuel data to gather feedback, track performance metrics, and address any challenges. Through various education and training programs, the teams will develop relevant dashboards for near-real-time operator feedback, connect with survey analytics, encourage operator reporting compliance, employ planning software to support operations, and conduct focus groups to collect qualitative data.

Incentives include direct transfer of operations and maintenance funds or funding of wing priority projects, funding or rebates in proportion to savings, and 'soft' incentives like awards and recognition to individual Airmen and wings that show increased energy-aware behavior.

Once the pilot phase is complete, Air Force Operational Energy plans to expand the program to other bases and aircraft.



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To learn more or to get involved, visit: <https://www.safie.hq.af.mil/Contact-Us/>

ENERGY SECURITY

NPS Hosts Black Sea Energy and Security Symposium

By Tahmina Karimova
Faculty Associate – Research,
Energy Academic Group
and LCDR Edward Early
Naval Postgraduate School,
Office of University
Communications

Diplomats from nations bordering the Black Sea and Caspian regions joined U.S. officials and energy security experts for a symposium at the Naval Postgraduate School (NPS) on January 24–25 to discuss a greater need for global energy security, especially in the vicinity of the Black Sea.

The event, titled “Energy and Security in the Black Sea,” was conducted under the auspices of the NPS Energy Academic Group (EAG), with participants



Symposium in-person attendees at the Naval Postgraduate School on January 25, 2022.

world leaders and building enduring relationships around the globe.”

As major sources of energy and energy transit, the Black Sea and adjoining Caspian regions have a significant impact on global energy security and particularly European energy security. These regions are also focal points of strategic competition

of the Secretary of Defense (OSD), as well as representatives from the NATO School Oberammergau and the NATO Energy Security Centre of Excellence in Vilnius, Lithuania.

Dr. Dan Nussbaum, EAG chair, described the event as one of the many successful collaborations involving NPS, partner organizations and regional

“The security of the world’s energy sources is important not just to the United States, but to energy producers and consumers everywhere. We are honored to be able to host this conference, and we hope that this gathering further underlines the important role NPS plays in educating world leaders and building enduring relationships around the globe.”

— Ann E. Rondeau, Ed.D., Vice Admiral, U.S. Navy (Ret.), President, Naval Postgraduate School

attending in person and via remote means. The focus of the symposium was to analyze the major issues affecting energy and security in the greater Black Sea region, as well as to discuss U.S. national security objectives and examine policies that can support U.S. and allied partner regional objectives.

“The security of the world’s energy sources is important not just to the United States, but to energy producers and consumers everywhere,” said the president of NPS, retired Vice Adm. Ann E. Rondeau. “We are honored to be able to host this conference, and we hope that this gathering further underlines the important role NPS plays in educating

involving the United States, Russia and other nations in the area. Developments in the Black Sea can affect freedom of navigation in the strategic waterways which transit the area.

Joining NPS leadership, faculty and students were three diplomatic representatives from the Black Sea region – Ambassador Khazar Ibrahim of Azerbaijan, Deputy Chief of Mission Sinan Ertay of Turkey and Deputy Chief of Mission Giorgi Tsikolia of Georgia. Other participants included Erika Olson, Deputy Assistant Secretary of State for Southern Europe and the Caucasus, and Andrew Winternitz, Principal Director for Europe and NATO Policy in the Office

stakeholders. Nussbaum noted that events such as the symposium could ultimately provide more opportunities for further collaboration between NPS and outside organizations, using interdisciplinary research, education programs and outreach efforts to bring together warfighters, scholars, subject matter experts, diplomats and partners, and industry leaders.

One of the highlights of the symposium was a keynote address by former Secretary of Defense Leon Panetta, chairman of The Panetta Institute for Public Policy at California State University Monterey Bay. Panetta emphasized the important role partners

and alliances play – not only in a general sense, but specifically in the Black Sea region and the Caucasus when it comes to energy and security, energy corridors, and military and security cooperation, as well as sea transit routes between the West and Central Asia.

Panetta also emphasized the criticality of alliance unity and stronger deterrence posture in the face of challenges from near-peer adversaries and other regional powers around the world. Furthermore, he underscored that history lessons teach us that the policy of “isolationism is dangerous” and that the U.S. “cannot withdraw from its responsibility to the world as our security and security of the world is at stake.”

“The current energy crisis in Europe is not a crisis due to energy shortages, but it is a crisis caused by policy,” said Dr. Brenda Shaffer, who moderated closed-door discussions at the symposium.

“Over the years, Washington has viewed the Black Sea region as an important security arena. Washington has also promoted European energy security through shepherding Caspian gas into Europe. This policy has benefitted from wide bipartisan support over the decades and has been a concrete success. Areas today in Europe, such as Italy, that benefit from these projects that the U.S. championed, are coping with the current energy crisis much better than those without access to pipeline supplies.”

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OUTREACH

EAG and NATO Return to In-Person Instruction as the Energy Efficiency in Military Operations Course takes Place in Vilnius, Lithuania

By Elle Hancock,
Faculty Associate – Research,
Energy Academic Group




Seventeen selected officers, NCOs, and civilians working in the energy sector attended the EEMOC held in Vilnius, Lithuania in November 2021.

The Naval Postgraduate School's Energy Academic Group (EAG) with the NATO Energy Security Center of Excellence came together in November 2021 to conduct NATO's annual Energy Efficiency in Military Operations Course (EEMOC). This year's course was a welcome return to in-person instruction in Vilnius, Lithuania, with seventeen selected officers, NCOs, and civilians working in the energy sector attending from seven different nations.

EEMOC serves to raise awareness and knowledge regarding the importance of seeking energy efficient solutions in the military domain, particularly during military operations. The course introduced students to topics such as climate change, battery storage, innovative and renewable technologies, hybrid power generation, energy management planning, case studies, behavior change, and more. Participants also had the opportunity to visit local camps in the region and were challenged by the SPARK simulator to create an energy efficient camp. There was also the opportunity to develop participants' understanding of energy efficiency via a wargame that

focuses on generator use, renewable technologies, and alternative energy solutions related to expeditionary base camp power. Participants shared that this wargaming group work and the syndicate work developing an energy management plan were highlights of the course, as well as the multinational instructor staff, including subject matter experts from ENSEC COE, EAG, NATO Headquarters, SHAPE, Natural Resources Canada, and the Fraunhofer Institute of Chemical Technology as well as some industry specialists.

EEMOC is slated to continue providing instruction to select participants annually and is constantly evolving in content, style, and delivery, adapting to feedback from former participants and to match the rapid emergence of new technologies and their integration into military operations. The next course is set to return to Vilnius May 23–27, 2022.

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ENERGY SECURITY

NATO Energy Center of Excellence in Vilnius publishes a Guide for Protecting Industrial Automation and Control Systems Against Cyber Incidents in Critical Energy Infrastructure

By Mr. Vytautas Butrimas
NATO Energy Security Centre Of Excellence



The NATO Energy Security Center of Excellence (NATO ENSEC COE) has published a “Guide for protecting industrial automation and control systems against cyber incidents in critical energy infrastructure” on its website, written by Mr. Vytautas Butrimas. The NATO ENSEC COE prepared this Guide in response to unsettling trends in cyberspace where a wide spectrum of threat actors have chosen to target critical energy and other infrastructures.

The Guide focuses on the technologies used to monitor and control physical processes found in the energy sector and is the result of 12 years of research and work at the policy-making level, which included site visits to operators

of liquid fuel pipelines, natural gas pipelines and electric power grids. It reviews new challenges and vulnerabilities put forward by the introduction of digital technologies to the energy sector and illustrates them with an analysis of notable cyber incidents like the Colonial Pipeline incident of May 2021. As a result of this analysis Mr. Butrimas proposes a way ahead which includes consideration of a comprehensive enterprise cybersecurity program together with the tools that can be used to improve the safety, reliability, performance and resilience of the technologies used in the energy sector vital to national economy, national security and the well-being of society.

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The full guide is available at:
https://enseccoe.org/data/public/uploads/2022/01/d2_guide-for-protecting-against-cyber-incidents-in-iacs-cei.pdf.

The Guide's author, Vytautas Butrimas, has for the past 5 years worked at the NATO ENSEC COE's Research and Lessons Learned Division in the area of industrial cybersecurity. Before that he worked for 22 years in various positions of IT security and defense policy at the Ministry of National Defence of the Republic of Lithuania.



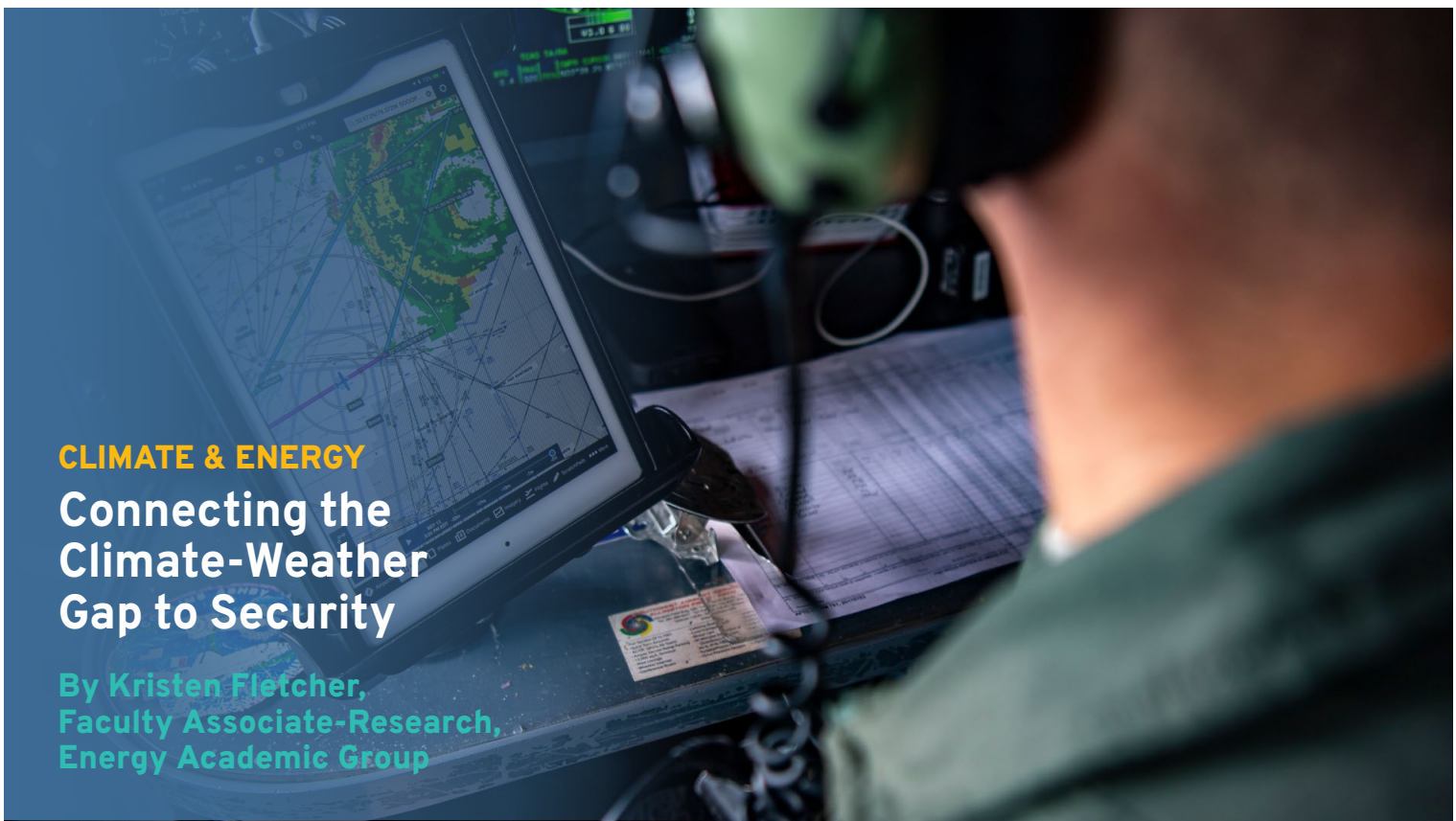
Hybrid Warfare and Energy Security

The Energy Academic Group and Center on Combating Hybrid Threats have collaborated with the Global ECCO team to publish a special issue of its journal, Combating Terrorism Exchange (CTX), that focuses on the nexus of energy security, hybrid warfare, and irregular warfare. Contributions from around the world include interdisciplinary content on operational energy, NATO tabletop exercises (Ukraine's case study), the role of energy in conflict, as well as integration of special forces in cyber operations. These are only a few of the topics that are covered in the special issue. To read the full issue of CTX, please go to <https://nps.edu/web/ecco/ctx-journal-home>



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CLIMATE & ENERGY

Connecting the Climate-Weather Gap to Security

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

A computer tablet is used to track a hurricane while in flight during a Hurricane Hunters mission out of Savannah Air National Guard Base, Savannah, GA Airport. (U.S. Air Force Photo by Technical Sgt. Chris Hibben)

For the second time, the Naval Postgraduate School, Naval War College, Naval Academy and Marine Corps University convened the Combined Naval Address on Climate, Energy and Environment to highlight different perspectives on climate and security issues. On February 2, the Combined Naval Address featured internationally renowned meteorologist and climate scientist Dr. J. Marshall Shepherd, Georgia Athletic Association Distinguished Professor of Geography and Atmospheric Sciences at the University of Georgia.

The impact of a changing climate on installations and servicemen and women has been a priority for DoD for many years. The issuance of multiple Executive Orders and key DoD strategies in 2021 shows the evolution of the U.S. approach to climate change. Entitled "*Extreme Weather-Climate Change Connections: Perspectives on science, vulnerability and communications*," Dr. Shepherd's presentation helped participants view climate change, extreme weather and

the Navy and DoD approach to climate security through a different lens.

After offering background on climate science, Dr. Shepherd explained the global impacts of climate change, especially the exacerbation of existing inequities around the world. This aligns with DoD's assessment that climate change contributes to conflict, especially in regions of the world that are already economically and environmentally vulnerable. Dr. Shepherd refers to the "Weather-Climate Gap" as a disproportionate sensitivity to extreme weather-climate events and a delay in the ability to bounce back. He concluded his presentation with suggestions for communicating about climate change and climate science, especially to non-scientists.

Students from NPS and the Naval Academy engaged Dr. Shepherd in discussion including how to integrate climate change into national security strategies, the impact of artificial intelligence in meteorology, and communicating with resource

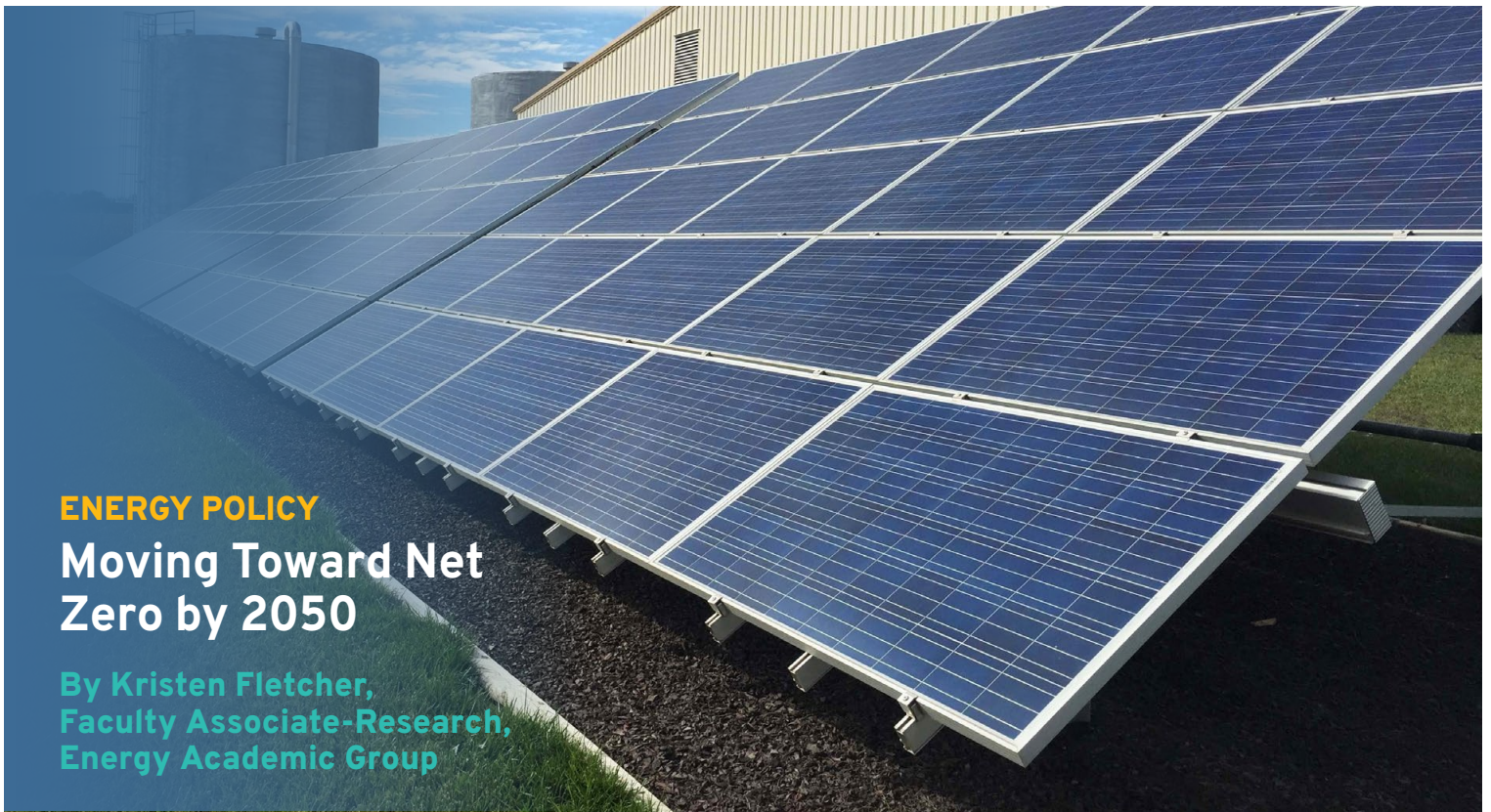
managers. Following the Address, invited faculty from each institution participated in a Roundtable with Dr. Shepherd to discuss these issues in more depth. Dr. Shepherd's perspectives inform the work of the Naval Education Enterprise and push us to advance solutions to these climate security challenges through research and undergraduate and graduate education.

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Video of the event is available at <https://nps.app.box.com/s/z6ox6ztp18xmz3s5mrhz7qfoslmt8n>

The event was organized through the Climate and Security Network. Join at nps.edu/climate

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ENERGY POLICY

Moving Toward Net Zero by 2050

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

Using natural energy from the sun is one of the many ways the U.S. Army Corps of Engineers fosters sustainability as a way of life. Remediation efforts at the former Nebraska Ordnance Plant, a Superfund site in Mead, Nebraska, incorporate sustainable solutions by using energy-saving technology to treat groundwater at the site and powering operations with renewable energy from the sun.

On December 8, 2021, President Biden signed Executive Order (EO) 14057 on Catalyzing Clean Energy Industries and Jobs through Federal Sustainability, calling for the federal government to achieve a carbon pollution-free electricity sector by 2035 and net-zero emissions economy-wide by no later than 2050.

The EO lays out five specific goals including 100% carbon pollution-free electricity by 2030, 100% zero-emission vehicle acquisitions by 2035, net zero emissions from federal procurement no later than 2050, a net zero emissions building portfolio by 2045 and net zero emissions from overall federal operations by 2050.

The Executive Order, together with the Federal Sustainability Plan that the White House released in December 2021, seeks to mainstream sustainability within the federal workforce, leverage partnerships to accelerate progress, and incentivize companies to develop recyclable, bio-based, and alternative options to

those products that utilize and contain PFAS. The EO also directs the federal government to orient its procurement and operations efforts to achieve climate resilient infrastructure and operations and build a climate- and sustainability-focused workforce.

This EO is driving multiple efforts within DoD and the Department of the Navy. Joseph Bryan, Special Assistant to the Secretary of Defense, was redesignated the DoD Chief Sustainability Officer in January in response to the EO. The Pentagon also recently issued a request for information on vendors who can provide carbon-free electricity generation services for the federal government. At NPS, EAG is leading a project entitled *Pathways to Net Zero Emissions for the Operation Navy*, funded by the Naval Research Program, which will be featured in a Net Zero Briefing Series by the NPS Climate and Security Network in the summer.

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The Executive Order is available at <https://www.whitehouse.gov/briefing-room/presidential-actions/2021/12/08/executive-order-on-catalyzing-clean-energy-industries-and-jobs-through-federal-sustainability/>

The Federal Sustainability Plan is available at <https://www.sustainability.gov/pdfs/federal-sustainability-plan.pdf>

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ENERGY RESEARCH

Energy Resilience Impact of Supply Chain Network Disruption to Military Microgrids

By Douglas L. Van Bossuyt,
PhD, Assistant Professor,
Systems Engineering
Department

An article titled “Energy Resilience Impact of Supply Chain Network Disruption to Military Microgrids” was recently published in the *MDPI Infrastructures Journal*, specifically in the Special Issue on Infrastructure Resilience in Emergency Situations that develops a method to analyze potential microgrid resilience issues for naval bases due to failures in energy supply chains. The work is part of LT Edward Anuat’s master’s thesis. LT Anuat graduated in December 2021 from the Naval Postgraduate School’s Systems Engineering master’s program and is now with Commander, Naval Air Force Atlantic to support the construction, maintenance, and modernization of the fleet’s aircraft carriers.

LT Anuat found that many bases credit diesel generators and on-site fossil power plants as integral parts of resilient microgrids. However, some bases may only have a few days of diesel and other fossil fuels on hand. Regular deliveries of fuel are expected during situations where on-site generation is required to support mission-critical loads. In many situations, this is an acceptable assumption. However, in the event of a significant supply chain disruption, fuel delivery could be jeopardized which in turn could reduce the ability of base microgrids to deliver mission-critical power where it’s needed and when it’s needed.

Regional disasters such as storms, earthquakes, tsunamis, and civil unrest



Solar microgrid project at Fort Hunter Liggett, California. (U.S. Army photo by John Prettyman)

can disrupt fuel supplies. Similarly, near-peer competitors can disrupt fuel delivery such as with the recent Colonial Pipeline cyber-attack. Even when multiple suppliers are contracted to deliver fuel to a base, there may be bottlenecks in the upstream supply network that are not fully understood and accounted for in base electrical energy resilience analyses.

To better understand the potential risk that over-reliance on fuel delivery during a grid outage or other scenario where on-site generation is needed, LT Anuat utilized an integrated discrete-time Markov chain and dynamic Bayesian network approach, where he investigated disruption propagation throughout a supply chain network and quantified its mission impact on an islanded microgrid. LT Anuat proposed a novel methodology and an associated metric termed “energy resilience impact” to identify and address supply chain disruption risks to energy security. The proposed methodology addresses a gap in the literature and practice where it is assumed supply chains will not be disrupted during

incidents involving microgrids.

LT Anuat worked with Dr. Douglas L. Van Bossuyt and Dr. Anthony Pollman, both with the NPS Systems Engineering Department, as part of his master’s research. His timely work has already seen interest in NAVFAC and elsewhere to better prepare naval bases for future disruptions so that bases can stay in the fight and assure critical mission success.

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Read the full article at
<https://doi.org/10.3390/infrastructures7010004>

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EAG Welcomes New Team Members

Andrew Jennings

joined the EAG in January 2022 as Faculty Associate-Research. Jennings is an electrical engineer with experience in the private sector in surge arrester applications and with the U.S. Government for mission data integration and military construction. With the EAG, Jennings will focus on engineering challenges in microgrids, renewable energy integration, and operational energy through education and research support. Contact Andrew at andrew.jennings@nps.edu.



Colleen McHenry

joined the EAG in February 2022 as Faculty Associate-Research. Dr. McHenry has spent the past five years working with



military schools in both undergraduate and graduate studies, preparing them for audits and the accreditation process. Prior to military education, Dr. McHenry contributed to civilian education in a variety of roles including teaching, curriculum development, program development, and research. Dr. McHenry will focus her efforts on curriculum development which supports the operational mission of the Navy and the Marine Corps. Contact Colleen at colleen.mchenry@nps.edu.

Nora O'Connor

joined the EAG in January 2022 as Faculty Associate-Research. Nora previously worked for EAG for six years as administrative support. Prior to EAG, Nora spent eight years in the United States Navy as a Surface Warfare Officer, completing tours on both a guided missile destroyer and guided missile cruiser. With the EAG, Nora will focus her effort on various research programs that support energy security and operational



energy, as well as financial management support for EAG's sponsored research programs. Contact Nora at naoconno@nps.edu.

Sheila Sklerov

joined the EAG team in February 2022 as Faculty Associate-Research. Sklerov brings with her 20 years of Naval Officer experience encompassing nuclear power engineering, host nation liaison duties, assault craft and amphibious construction battalion experience, science and technology research experience as well as NATO energy security and hybrid threat resilience evaluation experience. With the EAG, Sklerov will focus her efforts on ship power system design engineering curriculum development and the International Cooperative Engagement Program for Polar Research sub working group on Power and Energy. Contact Sheila at sheila.sklerov@nps.edu.



Defense Energy Certificate Awardees

Dr. Dan Nussbaum and the Energy Academic Group (EAG) congratulate Cohort V students for earning the Defense Energy Certificate, and also acknowledge the hard work and dedication of every student to the program. Upon conclusion of the winter quarter, we conferred certificates to 17 students. Feedback from these talented people indicates that the program is a worth-while and "eye-opening" experience, with a practical application to address DoD needs. EAG's Defense Energy Certificate program is a graduate-level accredited certificate program consisting of four courses, offered via Distributed Learning on a pace of one course per quarter for four consecutive quarters. The program is open to all federal civilian employees and active duty military. It provides those working military and civilian employees the opportunity to gain an understanding of the complex issues facing the Operational and Installation Energy segments of the DoD. We are pleased to report that Cohort V began the program on 29 March 2021. The next Cohort, Cohort VI, convenes in the spring quarter of 2022. For more information, email Kevin Maher at kjmaher@nps.edu.

Harold Anderson (CIV)

USAFRICOM • Stuttgart, Germany

Tamera Barr (CIV)

NAVSEA • Washington DC

Kenneth Campbell (CIV)

Marine Forces Special Operations Command
Camp Lejeune, NC

Christopher Cimento (CIV)

NAVSEA • Washington DC

Fatou Cisse (CIV)

NAVSEA • West Bethesda, MD

Capt. Shannon Daily, USAF

Kadena AB • Kadena, Japan

LT Jeffrey Deitel, USCG

USCG Cryptologic Group • Fort Mead, MD

LTC Alexi Franklin, USARNG

MD ARNG • Frederick, MD

1st Lt. Ioan Gaitan, USAF

AETC • Wright Patterson AFB - Dayton, OH

Capt David Lorio, USMC

MCCDC • Quantico, VA

Arch McCleskey (CIV)

NAVSEA • Washington DC

Aaron Ng (CIV)

Department of Energy • Washington DC

Lt. Col. Videt Norng, USAF

USEUCOM • Vilnius, Lithuania

LCDR Jeffrey Ross, USN

COMPACFLT • Kailua, HI

Jesse Shepard (CIV)

NAVSEA HQ • Washington DC

Eric Shields (CIV)

NSWC Carderock • Bethesda, MD

Capt. Yunior Soto, USAF

USAFE • Ramstein AB, Germany

ENERGY RESEARCH

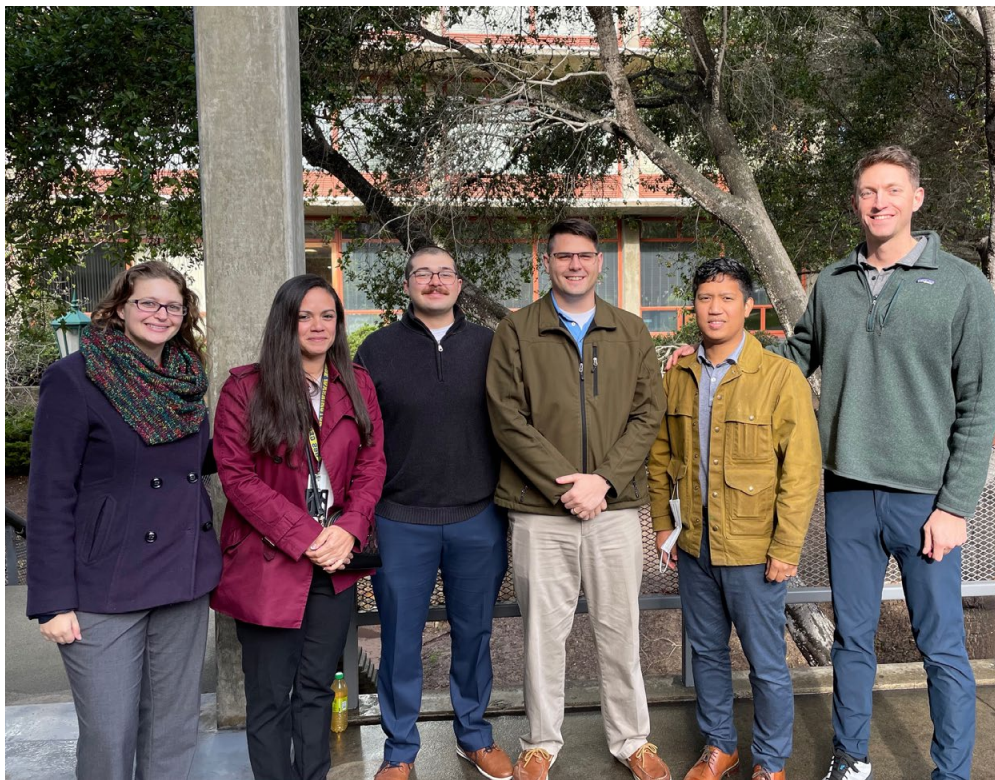
Defense Installation Energy Resilience for Changing Operational Requirements

By Douglas L. Van Bossuyt, PhD, Assistant Professor, Systems Engineering Department

An article titled “Defense Installation Energy Resilience for Changing Operational Requirements” was recently published in the *MDPI Designs Journal*. The work is part of LT Janice Mallery’s master’s thesis. LT Mallery graduated in December 2021 from the Naval Postgraduate School’s Systems Engineering master’s program. LT Mallery began her military career as a qualified Surface Warfare Officer onboard the USS Green Bay (LPD 20) and the USS Little Rock (LCS 9) blue crew. She has laterally transferred to the Engineering Duty Officer (EDO) community and is currently serving at Strategic Weapons Facility, Atlantic (SWFLANT).

LT Mallery found that missions which naval bases are expected to perform and support can rapidly and unpredictably change as the global threat environment changes. Many base microgrids already account for such potential future changes by being overbuilt. However, it is challenging to understand the resilience of base microgrids in different potential operational scenarios.

To address this, LT Mallery proposed a methodology to determine the impact of different potential mission scenarios upon energy resilience for mission-critical loads attached to a naval base’s microgrid infrastructure. The proposed methodology can be applied to almost any installation with changing operational states that has energy resilience requirements. The proposed methodology may be



LT Janice Mallery (left) pictured with colleagues at the Naval Postgraduate School.

used by energy managers to account for potential mission scenarios that a base may be part of, followed by assessing the microgrid energy resilience to supply the critical loads for said mission scenarios, especially where the external grid power may be unavailable and/or where damage to microgrid components may be present. In the event a microgrid design is unable to provide sufficient electrical energy, distributed energy resources and energy storage systems, including renewable energy resources, may be added to improve energy resilience.

To demonstrate the proposed methodology, LT Mallery developed an example of a fictitious representative military base, microgrid design, and changing mission demands. Her article contributes a methodology for energy managers to evaluate energy resilience using microgrids by accounting for potential mission scenarios, their energy requirements, resulting energy preparedness, and recommendations for improvement, as necessary.

LT Mallery worked with Dr. Douglas L. Van Bossuyt and Dr. Anthony

Pollman both with the NPS Systems Engineering Department as part of her master’s research. Her timely work has already seen interest in NAVFAC and elsewhere to better prepare naval bases for rapidly changing missions so that bases can be ready to take on new and unexpected missions, even when damage has occurred to the grid and/or microgrid.

LEARN MORE

Read the full article at <https://doi.org/10.3390/designs6020028>

Email Dr. Van Bossuyt at douglas.vanbossuyt@nps.edu



Calendar of Events

MAY

May 23–27, 2022
Energy Efficiency in Military Operations Course
Vilnius, Lithuania

JUNE

June 27–July 1, 2022
Critical Energy Infrastructure Protection Workshop
Baku, Azerbaijan

June 27–July 1, 2022
Coherent Resilience (CORE) 22-G Tabletop Exercise
Tbilisi, Georgia

SEPTEMBER

September 19–23, 2022
Regional Energy Security Symposium
Baku, Azerbaijan

UPCOMING

Spring 2022 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 <https://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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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 lkazard@nps.edu.

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