

SURGE



ENERGY ACADEMIC GROUP QUARTERLY NEWSLETTER FALL 2025

Highlights

POWERBUOY TEST

US MARITIME COMPETITIVENESS

ISRAEL-IRAN 12 DAY WAR

GOVERNMENT INVESTMENT
POLICIES IN THE BATTERY SECTOR

HYBRID THREATS & ENERGY



ENERGY RESEARCH

NPS Harnesses Solar and Wind Energy to Power Advanced Ocean Buoy Testbed

By Dan Linehan, NPS Public Affairs Office

NPS deployed an Ocean Power Technologies self-powered buoy for oceanographic and meteorological studies and 24/7 maritime domain awareness applications. The buoy employs AT&T "5G at Sea" communication technologies to relay data real-time to NPS. The buoy was deployed by Westar Marine Services with support from the Stanford Doerr School of Sustainability's Hopkins Marine Station and its electrically-powered vessel to carry NPS observers. (U.S. Navy photo by Dan Linehan)

Floating in the Monterey Bay, 29 feet above the water's surface and 5 miles north of the Naval Postgraduate School (NPS), a newly deployed PowerBuoy provides a renewably powered, experimental testbed for a wide array of maritime observations, investigations, and communications by the Navy and local scientific community.

Beginning operation on 8 July 2025, the buoy was built and designed by Ocean Power Technologies (OPT). NPS installed additional instruments, and AT&T provided a "5G at Sea" base station for around-the-clock, high-speed data communications between the buoy and shore.

"This ocean buoy project is part

of an overall effort to increase our maritime sensing and experimentation capabilities right here in Monterey," said Kevin Smith, the principal investigator who is an acoustics researcher and chair of the physics department at NPS. "And it provides an opportunity for collaborative ocean research throughout the Monterey Bay community."

Encircled by solar panels and weighing 16 tons, the buoy looks more like a space satellite afloat than a maritime buoy bobbing in the waves. Even when the Sun goes down, two wind turbines continue to collect energy as breezes roll across the Bay.

With power generation optimized for Monterey Bay's location, the buoy's

solar panels and wind turbines charge high-capacity marine batteries that store enough electrical energy to make its operations completely self-sufficient. The buoy's tubular structure extends 30 feet below the waterline. Its batteries are contained in a 4.3-foot diameter section that runs most of this length.

Made of lithium iron phosphate, the battery composition is more chemically and thermally stable than what's found inside the common lithium-based batteries powering personal electronics. As a result, they are safer for long-duration use in corrosive environments, such as in seawater.

"The buoy provides a new persistent capability for real-time sensing and

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From the Chair

Alan Howard, Chair, Energy Academic Group

As we close out 2025, our work across the Energy Academic Group (EAG) reflects not only the steady expansion of our portfolio, but also the growing trust placed in Naval Postgraduate School (NPS) to address some of the most complex operational energy challenges facing our nation and our allies. This quarter's SURGE highlights that momentum.

You'll see it in the analysis our faculty produced on the evolving links between energy and conflict. You'll see it in our continued engagement with federal and maritime partners whether supporting the Maritime Administration's Center for Maritime Innovation or advancing deployed energy technologies like the PowerBuoy. And you'll see it in the recognition earned by members of our community, whose work in Science,

Technology, Engineering, and Mathematics outreach and student mentorship strengthens NPS well beyond our internal research lines.

Looking ahead, the strategic environment remains defined by the Navy's urgent need to strengthen warfighting readiness, accelerate shipbuilding capacity, and ensure forces can operate with resilience across every domain. Much of EAG's current project work, some of which will be featured in future issues, directly supports these priorities. From contested logistics and energy assurance to maritime resilience and advanced modeling, our contributions tie directly to the readiness and survivability of the fleet.

Equally important is our growing collaboration with partners and allies. The United States is stronger when we operate alongside others who share our commitment to stability and security. Our engagements across the United

States European Command and United States Indo-Pacific Command Area of Responsibility, and with key international institutions continue to build that collective resilience, ensuring that our forces and those of our allies are better prepared, more integrated, and more capable together.

Thank you for your continued professionalism and dedication. The demand signal from the Department of Defense will only intensify in 2026, and I am confident that our team and our partners throughout the wider energy community are ready to respond with purpose and professionalism.

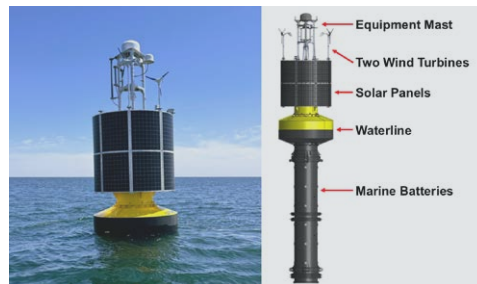


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networking with the shore and with autonomous systems above, on, and below the water's surface," Smith added. "So, it supports science as well as applied research in naval operations and maritime domain awareness needs of the U.S. Navy."



On the water, the buoy's solar panels and wind turbines provide the electricity to power all its operations and recharge its batteries. Attached to the equipment mast at the top of the buoy are AT&T's "5G at Sea" base station and a directional antenna that links to a similar transceiver at NPS. (U.S. Navy diagram by Dan Linehan, images courtesy of Ocean Power Technologies)

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Read the full article online at <https://nps.edu/-/self-powered-ocean-buoy-to-enhance-nps-research-and-5g-maritime-communication-applications>

Visit the buoy project's webpage: <https://nps.edu/web/physics/ocean-sensing-buoy>

Watch video of buoy's deployment and operation <https://youtu.be/-y3FeM5nRgY>

For more information about this article, contact pao@nps.edu

ENERGY SECURITY

U.S. Center for Maritime Innovation (USCMI) Environmental and Energy Security Efforts

By Kirk Waltz, Faculty Associate-Research, Energy Academic Group

The U.S. Maritime Administration's (MARAD's) U.S. Center for Maritime Innovation (USCMI), with the American Bureau of Shipping (ABS) acting as Secretariat, has outlined a broad set of research priorities designed to advance the technological, operational competitiveness, and workforce readiness of the U.S. maritime sector. The USCMI launched formally in late 2024 to serve as a national hub for maritime innovation and collaboration, engaging stakeholders from across government, industry, and academia to address the complex challenges

currently facing the domestic maritime domain. More information can be found on the USCMI's website here: [U.S. Center for Maritime Innovation](https://www.uscmi.org/).

One of the USCMI's foremost goals is to accelerate U.S. maritime competitiveness through targeted research and innovation in four key pillars: Maritime energy, maritime operations, U.S. maritime competitiveness, and maritime resilience (Figure 1).

This work will be underpinned by rigorous innovation development and demonstration projects, independent verification and validation work, and publications of best practices to ensure that promising innovations can be safely and effectively deployed. In addition, the USCMI will have nationwide research partnerships with regional working groups in addition to technical working groups in the areas identified in Figure 1.

Maritime Energy Scope

Collaboration on targeted research in adapting to emerging energy trends, ensuring greater operational energy security, and building resilience in an increasingly complex global maritime

environment is foundational to restoring America's energy and maritime dominance. The USCMI's work related to commercial maritime energy and fuels signals a potentially transformative shift in the global energy landscape that the DON will need to be prepared for. With the USCMI's utilization of whole-of-government and industry/academia stakeholder engagements, consultative and territorial panels, and continuous monitoring of emerging technologies gaps unique to the U.S. maritime sector, the defense sector can capitalize on industry tailwinds to establish future strategic flexibility while preserving warfighting capabilities amidst this changing landscape.

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For information about the Center and its working groups, visit <https://www.uscmi.org/>.

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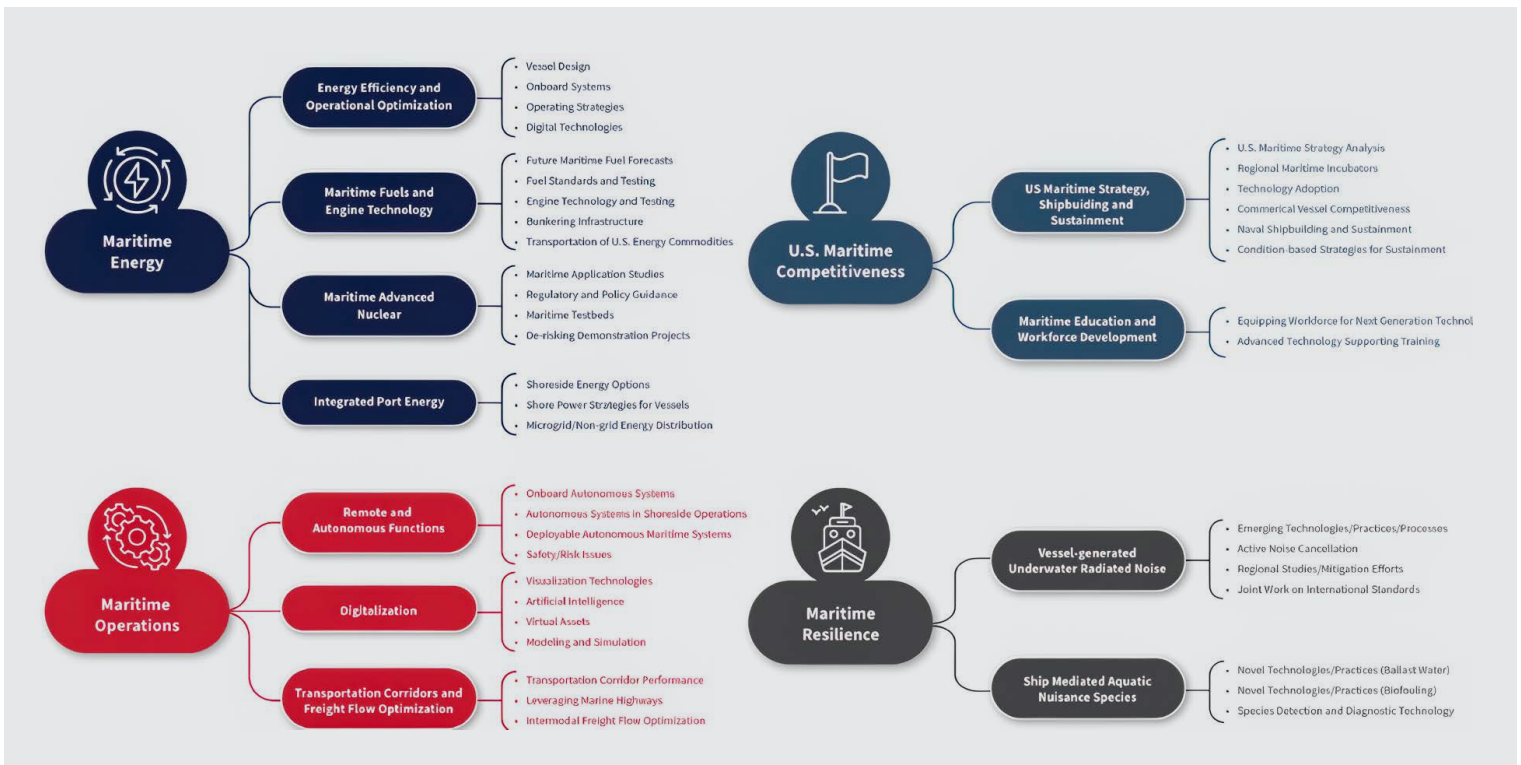


Figure 1 - CMI Four Key Pillars, from U.S. Center for Maritime Innovation



ENERGY SECURITY

Energy and Conflict: Quick Look at Israel-Iran 12 Day War

By Lawrence Walzer,
Faculty Associate-Research,
Energy Academic Group

The Middle East, a region prone to conflict and crises, again garnered the world's attention in June when Israel conducted strikes against Iran with the aim to degrade its nuclear weapons program. This article assesses some of the lessons from this abbreviated conflict as it relates to energy.

It Wasn't About the Oil. Often, conflict in the region is attributed to being all about the oil. Many experts highlight energy as often being a factor rather than a root cause of conflict. While this can be debated with some past conflicts in the region, the 12 Day War was not about the oil. Thucydides summed it up well a couple millennia back that conflict generally falls into three categories: honor, fear, and interest. While Israel may fear an Iranian nuclear weapon, it is in Israel's security interest to ensure Iran does not get one. It was this security interest—associated with longtime grievances between the two parties, which is also a primary factor in conflict—that led to war.

Middle East Oil and Gas Remains Significant, But Less So Today. The Organization of the Petroleum Exporting Countries (OPEC) produced roughly half of global oil production in the 1970s when prices more than quadrupled in the aftermath of the oil embargo and ahead of follow-on spike from the 1979 revolution. Today, Middle East oil hovers at around a third of global production. While global markets are affected by crises, supply disruptions stemming from Middle East conflict would hurt Asia nations the most and especially China.

Iran Unlikely to Try and Close the Strait of Hormuz. Iran is heavily dependent on the revenues of its daily output of 1.5 million b/d that flow through the Straits of Hormuz with some 90% of it headed to China. Iran neither wants to lose these revenues, nor antagonize its biggest customer. Any significant moves to shut down Strait transit would likely only come should the regime see its demise as inevitable, where it may then strike out in a last ditch effort to cause most amount of global strife it can.

No Taboo Against Energy Targets. Despite the hopes of many, critical infrastructure and energy will remain on targeting lists during conflict. However, it is clear from this episode that Israel did not see it in its interests to disrupt Iranian oil flows likely due to not wanting significant backlash should there be a real reduction in oil and gas supply risking a period of prolonged higher

prices. While Israel did strike Iranian energy targets, these were largely confined to targets that effect Iranian domestic supply and not exports.

Diversification is Imperative. Energy supply disruptions can happen due to a number of crises, with armed conflict just being one. Still, diversification of supply by consumers remains imperative. The 12 Day War was likely another reminder to China that it is vulnerable. Producers too need diversification... route diversification. Indeed, Saudi Arabia and Oman now have pipelines that do not require maritime shipping passage through the Straits of Hormuz. Expect efforts to diversify energy to continue.

Energy and security are often connected, especially during conflict; however, the recent 12 Day War was not about energy but Israel's need for security from a nuclear Iran. Critical energy infrastructure is vulnerable and often a target not just during conventional conflict but during hybrid, gray zone campaigns as well. This realization has propelled the quest for energy security and resilience around the world leading to much progress but as we have seen, challenges remain.

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ENERGY SECURITY

Report Released: 2025 Executive Orders on Energy

By Ella Nightengale-Luhan,
ORISE Intern, Energy
Academic Group

This report summarizes thirteen executive orders (EOs) issued between January and August 2025 addressing energy topics including nuclear energy, critical minerals, maritime dominance, energy security, and state and federal energy roles. An EO is a directive issued by the U.S. President directing administration officials and federal agencies to take or refrain from taking certain actions. EOs have the force of law but do not require congressional approval.

In this administration's first 10 months, from January 20 – November 20, 2025, President Trump issued 213 executive orders. This significantly outpaces other administrations in the



U.S. Department of Energy photo

use of EOs, including his own first term during which he issued 220 over four years from 2017 - 2021. If the current pace continues, this administration will issue over 1,000 executive orders by January 2029. The EOs are being executed by federal agencies and have led to litigation, both with the U.S. as prosecutor and as defendant.

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The report is available at:
<https://tinyurl.com/46cznz54>

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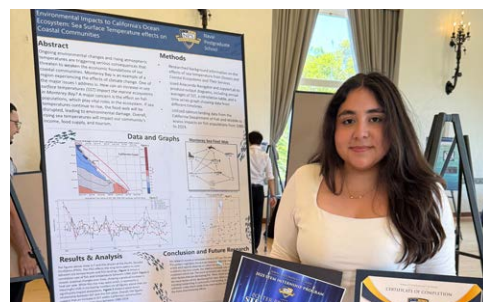
ENERGY EDUCATION

STEM Excellence Award from NPS

By Kristen Fletcher,
Associate Chair, Energy
Academic Group

Victoria Nava, an Energy Academic Group (EAG) summer intern who worked on a project focused on impacts to operations, received the Science, Technology, Engineering, and Mathematics (STEM) Excellence Award in the NPS Summer STEM Internship Program. A Computer Science major at Hartnell College, Victoria was awarded this honor for her poster presentation entitled Environmental Impacts to California's Ocean Ecosystem: Sea Surface

temperature effects on Coastal Communities. Her research builds onto NPS research aimed at understanding how future environmental impacts will impact naval operations around the world. During her summer internship, Victoria helped to code various weather models and contributed to analysis on navy refueling operational risk assessments in the North Atlantic Ocean region. Her analysis included complex mapping that visually represents environmental parameters over time in areas important to national security. The robust code utilized in her impact assessment on sea surface temperature effects shows the importance of interdisciplinary applications of meteorological and environmental research that is conducted at the NPS.



Victoria Nava, an Energy Academic Group (EAG) summer intern pictured with the Excellence Award in the NPS Summer STEM Internship Program.

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ENERGY POLICY

Government Investment Policies in the Battery Sector: An Analysis

By Aaron Wong, Intern,
Energy Academic Group

The United States ranks a distant fourth in global battery production, far behind China, Japan, and South Korea (Reinsch et al., 2024). As global demand for electric vehicles (EVs) and energy storage accelerates, governments are deploying tools such as subsidies, grants, and tax incentives to promote domestic battery industries. To remain competitive, the United States aims to adopt and surpass its rival's strategies by strengthening the battery supply chain, accelerating innovation, and enhancing energy security. This analysis reviews government investment policies in China, Japan, South Korea, and the United States to determine how the United States could gain market share, secure battery supply chains, and surpass economic competitors.

China has adopted a comprehensive, state-driven approach to battery development. The policy emphasizes large-scale subsidies and tax incentives that have helped firms like Contemporary Amperex Technology Co., Limited (CATL) and Build Your Dreams (BYD) expand rapidly (Xu et al., 2023). However, such state support has distorted market competition. With over 100 battery manufacturers competing on subsidized margins, the sector has seen a race to the bottom in pricing. Although efficiency and affordability have improved, many firms would likely be unprofitable without continued government support (Lombardo, 2025).

Japan's industrial policy is explicitly forward-looking, especially in its development of batteries and electric vehicles. Under the direction of the Ministry of Economy, Trade and Industry (METI), Japan sustains long-term support for its battery supply chain, while funding advanced research into all-solid-state battery (ASSB) technologies. METI also prioritizes the diversification of critical mineral sourcing to lessen dependency on Chinese supplies and supports the enhancement of battery-management-system (BMS) capabilities as a response to Tesla's competitive edge. This long-view investment approach emphasizes research and future-oriented supply networks, with returns on investment realized over time, all to bring Japan's domestic battery sector into alignment with its 2050 decarbonization goals (METI, 2022).

South Korea has ramped up public investment in response to growing global competition. The Ministry of Environment (MOE) increased subsidies and EV infrastructure investment steadily between 2019 and 2023, growing its budget share from 10.4% to 25.3% (Kim, 2023). In late 2023, amid weakened demand, the government temporarily raised EV purchase subsidies by one million Won (about \$730), showcasing policy agility (Kim, 2023). South Korea also supports battery recycling and localization of critical components to reduce external dependencies. Though less centralized than China's model, South Korea's approach reflects an adaptive, market-responsive strategy.

The United States, lagging behind, has launched major investment efforts. U.S. policy centers on the Inflation Reduction Act of 2022 (IRA) and Infrastructure Investment and Jobs Act (IIJA), which offer production tax credits, investment grants, and consumer subsidies (Reinsch et al., 2024). These programs are part of a broader energy independence strategy designed to exclude foreign supply chains while investing in domestic capacity to reduce reliance on China. The financial incentives have supported both emerging and established firms in developing new technologies and achieving economies of scale, thereby helping to lower the cost

of battery technologies despite higher labor and infrastructure expenses in the U.S. compared to Asian manufacturers. However, many provisions of the IRA and IIJA were subsequently frozen in 2025 following the passage of the *One Big Beautiful Bill Act (Public Law 119-21)* and related executive orders. Several of these freezes are currently under legal challenge. In parallel, the Trump administration has advanced a domestic manufacturing agenda under a "Bring Manufacturing Back to the U.S." initiative, which includes imposing tariffs on foreign goods, including batteries, in an effort to protect and bolster American manufacturers and further decouple American supply chains from foreign suppliers. More recently, the United States has directed defense institutes such as the Naval Postgraduate School to aid in the battery transition by advising on policy and providing public service resources (Sims & Dupuy, 2024; Sims & Douros, 2025).

China's vertically integrated subsidies have produced scale and market control. Japan and South Korea have deployed more targeted, industry-driven support. The United States, while a late mover, is now employing aggressive fiscal tools. Adopting demand-driven policies similar to those in Japan and South Korea may prove most effective, as they align more closely with United States market principles and friendshoring strategies.

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ENERGY RESILIENCE

NATO Explores Hybrid Threats to Energy Infrastructures

By Michael Davis, Associate Chair, Energy Academic Group

In September, faculty from the Energy Academic Group along with NPS students and US Naval Reservists from the Office of Naval Research supported the NATO Science and Technology Organization's (STO) **NORDIC PINE Exercise**. Initiated in 2022, NORDIC PINE (NP) is a Tabletop Exercise (TTX) focused on hybrid threats to renewable energy infrastructure. The unique nature of renewable energy infrastructure as an attack vector for hybrid warfare is of keen interest to the NATO Alliance, as evidenced by the participation of 150 participants from 20 NATO nations. The exercise was conducted from 23-25 September at three sites: the VTT Technical Research Centre of Finland; IABG in Munich, Germany; and Luleå University of Technology in Sweden.

The NP TTX aims to strengthen the resilience of renewable energy systems against hybrid threats via



realistic problems that simulate military aggression, trade conflicts, resource shortages, and cyberattacks. The annual exercise also aims to deepen US-EU-Nordic collaboration to enhance Alliance awareness and ensure security of energy supply.

NP25, as in years past, exemplified the importance of synchronization and understanding between military and civil authorities, as well as private businesses. Consistently, the training audience (TA) identified critical areas for further consideration to include EU policy and communication, as well as NATO's Article 4 and Article 5 processes. TA conversations focused on attribution as well as the adequacy of existing legal and regulatory frameworks for insider threats and cyber incidents.

The exercise was based on a full-spectrum scenario designed to assess the various aspects of NATO's assessment and response to hybrid warfare as a pre-cursor to a full-scale Russian attack against NATO's northeastern flank, with analysis specifically focused on the capabilities needed to successfully deter and defend northern Europe. The analysis highlighted conditions, structures, and military/civilian needs and requirements in the future battlefield, at different levels of conflict, and in different domains.

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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



Calendar of Events and Important Dates

KEY ACADEMIC DATES FOR STACKABLE CERTIFICATES AND THE MASTER'S IN OPERATIONAL ENERGY

Fall Quarter

- Begins: Monday, 29 September
- Last Day of Classes: Friday, 12 December
- Graduation: Friday, 19 December

Winter Break

- Monday, 22 December 2025 – Friday, 2 January 2026

Winter Quarter

- Begins: Monday, 5 January
- Last Day of Classes: Wednesday, 18 March
- Graduation: Friday, 27 March

MARCH

09 – 13 March 2026

BALTDEFCOL Operational Level Energy Security Course, Baltic Defence College
 Learn more at <https://www.baltdefcol.org/education/operational-level-energy-security-course>

MAY

18 – 22 May 2026

Energy Efficiency in Military Operations Course, Hosted by the NATO Energy Security Centre of Excellence, Vilnius, Lithuania

Learn more at <https://www.enseccoe.org/courses/energy-efficiency-in-military-operations-course-eemoc/>

UPCOMING

Defense Energy Seminar Series

Watch for upcoming dates and full event details as they become available on the EAG website at nps.edu/web/eag/seminars

EVENT UPDATES

For updates to our calendar, please visit the EAG website and Events tab at nps.edu/web/eag/events



ENERGY ACADEMIC GROUP
 NAVAL POSTGRADUATE SCHOOL



Connect with the Energy Academic Group

The Energy Academic Group is located in Suite 537, 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

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Surge is published quarterly by the Energy Academic Group at the Naval Postgraduate School.

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