SURGE

ENERGY ACADEMIC GROUP QUARTERLY NEWSLETTER SPRING 2026

Highlights

ENERGY RESEARCH

A Half Century of Innovation: Sir Stan Whittingham Visits NPS and Illuminates the Future of U.S. Energy Leadership

By Mary J. Sims, Faculty Associate-Research, Energy Academic Group

Sir Stanley Whittingham, Nobel Laureate in Chemistry and pioneer of lithium-ion battery technology, meets with Dr. Frank Narducci in the NPS Physics Laboratory to discuss advances in energy research.

On February 23, 2026, the Naval Postgraduate School's Energy Academic Group (EAG), in coordination with the Physics Department, hosted Sir M. Stanley Whittingham, Nobel Laureate in Chemistry (2019), Distinguished Professor of Chemistry at Binghamton University, and one of the founding pioneers of the lithium-ion battery. His presentation, part of the NPS Defense Energy Seminar Series, offered an extraordinary journey through the scientific, industrial, and geopolitical forces shaping the world's energy future.

Sir Stan's talk, titled "The First Half Century of Lithium Batteries and the Challenges Faced in Building an American Industry," provided not only a historical narrative but also an urgent call to action for U.S. energy leadership. His opening slide's admonition, "Now, we need action!" was a theme that carried throughout the session.

Sir Stan grounded his audience in the interdisciplinary path that led to the modern lithium-ion battery. Highlighting his work across Stamford, Oxford, Stanford, Exxon, and Binghamton University, he described a career that blurred boundaries between chemistry, physics, materials science, and industrial engineering. This blend of disciplines became the bedrock for the revolutionary concept of intercalation chemistry, enabling ions to move in and out of layered materials—an entirely new way of storing energy that made rechargeable lithium batteries feasible. Some of the seminar's most compelling insights focused on next-generation battery materials. Discussing the drive toward ultra-high-energy lithium-metal batteries and stable high-nickel cathodes, Sir Stan highlighted promising solutions, including niobium-modified NMC cathode materials and single-crystal cathodes. These breakthroughs could revolutionize everything from electric vehicle (EV) ranges to the logistics chains that power U.S. military operations.

As the conversation turned toward industrial realities, Sir Stan shifted from scientific foundations to strategic national priorities. His assessment of current U.S. battery manufacturing was frank and cautionary: he argued forcefully that the United States must rethink its entire battery ecosystem—from mining to recycling to production methods—if it intends to reduce

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From the Chair

Alan Howard, Chair, Energy Academic Group

This issue of *SURGE* highlights a consistent and important theme: energy is not a supporting function to military operations—it is a determining factor in readiness, resilience, and strategic advantage.

Several contributions in this edition reinforce how the operational environment is evolving in ways that demand a more integrated approach to energy. Kristen Fletcher's work on environmental impacts to naval operations underscores a reality that has long been understood but insufficiently incorporated into planning: variability matters. Seasonal averages are not enough. Operational success depends on understanding and planning for extremes, not means.

At the installation level, the work by Emily Pesicka and Ella Nightengale-Luhan further reinforces that resilience is no longer a future concern—it is a present requirement. Over the past two decades, extreme weather has shifted from episodic disruption to a persistent stressor on military infrastructure, directly affecting readiness, training, and mission assurance. Treating resilience as a core readiness investment, rather than a recovery activity, is no longer optional.

At the strategic level, Brenda Shaffer's summary of Mark Pearson's lecture reminds us that global energy dynamics continue to shape geopolitical alignments. The notion that we are in an "energy transition" can be misleading; in practice, we are experiencing energy additions in most sectors with demand across all sources continuing to grow. This has direct implications for how the United States and its allies think about reliability, affordability, and security in energy systems.

At the same time, emerging technologies are creating new and often underappreciated pressures on those systems. The rapid growth of artificial intelligence, as highlighted in Tahmina Karimova's article, is not just a technological development—it is an energy challenge. The scale of electricity and water demand associated with AI infrastructure introduces new vulnerabilities and dependencies that must be incorporated into planning, exercises, and policy.

Finally, the visit of Sir Stan Whittingham serves as a reminder that technological innovation remains central to addressing these challenges, but that innovation alone is insufficient without deliberate action. His call for the United States to develop a resilient domestic battery ecosystem reflects a broader imperative: energy systems that underpin national security cannot rely on fragile or externally dependent supply chains.

Taken together, these perspectives point to a common conclusion. Energy must be treated as an operational variable across all levels of planning—from tactical execution to strategic policy. This requires integrating environmental realities, infrastructure resilience, technological change, and geopolitical context into a coherent approach to energy security.

This is the work we continue to advance within the Energy Academic Group, and we are grateful to our faculty, partners, and contributors for pushing this conversation forward.

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reliance on foreign manufacturing and ensure resilient defense energy systems.

For the Naval Postgraduate School, Sir Stan's visit was more than a scientific lecture; it was a strategic reflection on the intersection of energy technology, operational readiness, and national security. His statements reinforced ongoing EAG priorities in energy security, innovative technologies, supply chain resilience, and workforce development.

His overarching message was unmistakable: the United States cannot rely on imported technology to power its future—especially its defense energy future. His closing tone echoed his opening slide: "Now, we need action!"

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Event video is available at:
https://tinyurl.com/mw7n2an9

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OPERATIONAL READINESS

Enhancing Naval Operational Readiness Through Environmental Impact Analysis

By Kristen M. Fletcher, Associate Chair, Energy Academic Group

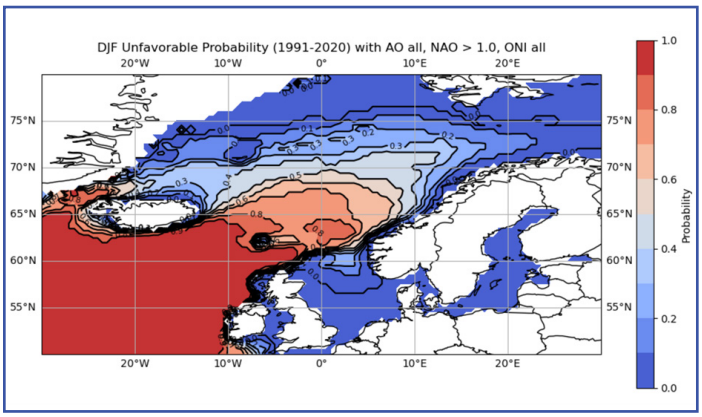
In January, the NPS Energy Academic Group and the Department of Meteorology released a technical report, titled *Enhancing Naval Operational Readiness Through Environmental Impact Analysis*, supported by the Naval Research Program.

Because weather and other impacts can present hazardous conditions to the U.S. Navy, researchers are striving to understand how the environment could impact naval operations. Historically, environmental conditions have not been considered in long-term applications when planning for maritime operations. The lack of integration of such hazards may negatively impact naval operations, such as Underway Replenishments and Replenishments at Sea (RAS). These essential operations sustain naval operations and enable naval forces to operate in the Arctic region. To understand the environmental impacts, the research team analyzed naval operations in the Greenland-Iceland-UK region. This report advances understanding of Arctic environmental impacts and their effects on current and future operations.

The GIUK area with regions of interest in the red boxes as the North Atlantic (1), Norwegian Sea (2), and the North Sea (3). Source: Google Earth.

Research shows that the North Atlantic Oscillation (NAO) drives significant subseasonal-to-seasonal variability in wave heights, wave periods, and mean wind speeds and gusts. Operational planners should consider uncertainty and variability in mean conditions by incorporating the full distribution of events, especially the extreme events. While monthly and seasonal mean wave height and wind conditions may be below unfavorable or marginal limits, there is enough variability in the data to warrant caution and attention to the NAO, as it is the primary driver of sub-seasonal to seasonal weather variability. Finally, operational limits are likely to be exceeded across the North Atlantic during the winter, especially during NAO positive events. Plans that are not informed by environmental variability are likely to be overly optimistic in the ability to conduct RAS operations year-round across the region.

These results suggest that when planning for sustainment operations, seasonality and climatological variability play a role in the expected number of days available across the region and in specific areas for RAS operations. Planners cannot assume that favorable or marginal conditions will exist year to year and support RAS operations year-round across the region.



Geospatial map of probability of exceeding operational thresholds during winter, NAO+.

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For a copy of the report, contact Kristen Fletcher at kristen.fletcher@nps.edu

ENERGY RESILIENCE

From Readiness to Resilience: Two Decades of Extreme Weather Impacts on US Military Infrastructure

Emily A. Pesicka, Faculty-Associate Research, Energy Academic Group, and Ella Nightengale-Luhan, ORISE Intern, Energy Academic Group

Offutt Air Force Base - One-third of the installation was flooded, and the containment boom was a precautionary measure for possible fuel leaks. (US Air Force photo by Delanie Stafford)

A recent publication in the *Small Wars Journal, From Readiness to Resilience: Two Decades of Extreme Weather Impacts on US Military Infrastructure* by Emily A. Pesicka and Ella Nightengale-Luhan, reveals that extreme weather events have intensified in frequency, severity, and geographic reach over the past two decades. This has also created systemic risks for US military installations and national security. From 2005 to 2025, hurricanes, flooding, wildfires, heat extremes, and other hazards have increasingly disrupted installations that serve as strategic platforms for force readiness, global power projection, and mission assurance. These impacts reflect broader shifts in the US military's operational environment, which is subsequently transforming risk and hazard mitigation related to these operational challenges.

Military installations are often located in high-risk environments—coastal zones, river basins, arid regions, and fire-prone landscapes—where exposure to extreme weather intersects with aging infrastructure and longstanding maintenance backlogs. Events such as Hurricane Michael's devastation of Tyndall Air Force Base, historic flooding at Offutt Air Force Base, and repeated wildfire encroachment at Camp Pendleton and Vandenberg Space Force Base demonstrate how extreme weather can destroy infrastructure, displace high-value assets, curtail training, and impose multibillion-dollar recovery costs. Even slow-onset hazards, including chronic flooding, heat waves, and drought, steadily erode readiness by constraining training availability, stressing energy and water systems, and increasing risks to personnel health and welfare. These disruptions generate cascading effects across physical infrastructure, operational readiness, mission assurance, finances, and human resilience.

While the Department of War has advanced resilience policies, implementation gaps persist, leaving installations vulnerable to accelerating hazards. This article argues that resilience must be treated as a core readiness investment rather than a reactive recovery effort. Proactive, risk-informed planning; infrastructure modernization and hardening; distributed investment; and institutionalized learning are essential to ensuring that US military installations remain reliable platforms for deterrence and operations in an increasingly unpredictable environmental context.

LEARN MORE

Visit Small Wars Journal to read the full article here: **https://smallwarsjournal.com/2026/02/20/extreme-weather/**.

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ENERGY SECURITY

U.S. Energy Dominance and Its Implications for National Security and Geopolitics

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

Dr. Mark Pearson, President and CEO of Liberty Resources, delivered the EAG Defense Energy Seminar on February 24, 2026, at the Naval Postgraduate School

Dr. Mark Pearson, President and CEO of Liberty Resources, delivered the EAG Defense Energy Seminar on February 24, 2026, at the Naval Postgraduate School on U.S. Energy Dominance. How did it Happen, Will it Continue, and Implications for National Security and Geopolitics. Dr. Pearson stated that "international energy needs are defining international alignments." He stressed that the U.S. is now an "energy powerhouse, producing more oil, natural gas, and natural gas liquids than any other country." He also stated that "the U.S. needs to lead the free world with firm and consistent energy growth policies to counter those authoritarian countries that have an easier path in planning/legislation energy growth and could use that to do us and our allies harm."

In his presentation, Dr. Pearson remarked that "there is no energy transition, there is energy addition," referring to the transition from hydrocarbons to renewable energy. He stated that there are "three elements of energy security: affordability, reliability, and being secure." Pearson also pointed out that a growing portion of California's energy supplies are imported. He stated that electrical power demand in the U.S. is growing after 20 years of no growth. That demand is now projected to grow by 2-3 percent per year over the next two decades. He stated that the only short-term solution to the growing demand for electricity is natural gas. After 2030, the first new nuclear projects will come online, according to the U.S. Pearson also noted that high energy prices primarily hurt the poor and that 7 billion people worldwide suffer from "energy poverty." His lecture ultimately reinforced that energy policy is not just an economic issue, but a strategic national security priority.

LEARN MORE

A video of Dr. Pearson's full lecture is found at: **https://nps.edu/web/eag/seminars**

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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

ENERGY SECURITY

Navigating the Rise of AI with Tabletop Exercises and Wargames

By Tahmina Karimova, Faculty Associate-Research, Energy Academic Group

The Skybox Prologis PowerCampus Austin, located in Hutto, TX, is a 160-acre hyperscale data center campus designed specifically for high-density AI and cloud computing workloads.

Faculty from the Energy Academic Group (EAG) joined experts and leaders at the Energy Resilience Simulation hosted by the Hoover Institution at Stanford University on March 4, 2026. The event brought together a diverse group of participants to examine how the rapid growth of artificial intelligence (AI) in the U.S. is creating new challenges and new opportunities for energy system resilience. As the momentum of the AI revolution accelerates nationally and globally, it is increasingly important to integrate these developments into tabletop exercises (TTX) and wargaming to develop actionable strategies, particularly through collaboration with allies and partners.

The rapid evolution of AI is placing increasing and often overlooked pressure on energy systems. Millions of people now rely on AI tools to support everyday tasks, including scheduling, content editing, and document summarization, as well as more advanced capabilities powered by large language models and generative AI. While each individual interaction may appear minor, the cumulative demand at scale places significant strain on energy infrastructure systems. When combined with the challenges posed by aging infrastructure and environmental stressors, this demand could intensify considerably in the coming years.

The surge in hyperscale data centers further amplifies these challenges. According to the International Energy Agency, a standard AI-focused hyperscale data center can use as much electricity in a year as roughly 100,000 homes, while the largest facilities under development could demand up to 20 times that amount. Beyond electricity demand, water consumption presents another critical concern. AI servers generate substantial heat and rely on advanced cooling systems that require significant quantities of water. Large data centers may use up to 5 million gallons of water daily, comparable to the consumption of a town of 10,000–50,000 people, and experts estimate that this demand could quadruple by 2030.

In the U.S., regions hosting major AI infrastructure clusters, such as Northern Virginia and Texas, have experienced rapid increases in electricity demand driven by these facilities. Recent disruptions, including power outages, extreme weather events like winter storms and hurricanes, and grid instability, have exposed vulnerabilities in existing energy systems and raised critical questions about preparedness. Globally, the expansion of hyperscale data centers and hubs across Asia and Europe presents similar pressures, demonstrating that the nexus of AI growth and energy resilience constraints is a worldwide challenge.

Addressing the energy and environmental pressures associated with AI requires a multifaceted approach, with TTXs and wargames serving as central tools for preparedness. The EAG conducts and supports TTXs and wargames with allied and partner nations focused on energy security, critical infrastructure protection, cybersecurity, information operations, resilience, and hybrid threats, including emerging AI considerations. These exercises allow stakeholders to rehearse plans, assess potential outcomes, and strengthen preparedness in a risk-free environment while generating actionable lessons for real-world applications. Incorporating AI-driven energy challenges into exercises and strategic planning, and expanding this approach across organizations, can help policymakers and industry leaders increase awareness, identify vulnerabilities, strengthen partnerships, and develop scalable solutions before future crises emerge.

LEARN MORE

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ENERGY RESEARCH

Energy Researcher Wins Tyler National Security Research Award

Maj. Chase Pedron, U.S. Army, MS Candidate in the Defense Analysis Department at the Naval Postgraduate School, was awarded the Tyler National Security Research Award, which recognizes outstanding student research demonstrating innovation and collaboration in support of national defense priorities. His thesis, *Bridging the Gap: Installation Energy Resilience in a Contested Homeland*, examined critical challenges related to installation energy resilience and its role in strengthening national security. Maj. Pedron's research identified four actionable, cost-effective, interim solutions to installation power needs. His focus on responding to the acute risks to the basic life support for both the military personnel and the families reliant on base infrastructure supports the Tyler award's focus on academic achievement, national security innovation, and collaboration.

Defense Energy Seminar Series

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

LEARN MORE
Please visit **nps.edu/web/eag/seminars** for upcoming and archived seminars.

Calendar of Events and Important Dates

MAY

6 May 2026
Network for Energy & Water Security Briefing: Energy Geopolitics after Venezuela & Iran, Virtual

*Contact **kristen.fletcher@nps.edu** for details.*

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
*The Seminar is held in the Winter and Summer quarters. 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
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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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If you would like to contribute an article or have your research/work published in the *Surge* newsletter, please contact Keyston Braxton via email at **keyston.braxton.ctr@nps.edu.**

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

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