Atlantic Council

VETERANS ADVANCED ENERGY PROJECT

Veterans Advanced Energy Fellowship Policy Papers

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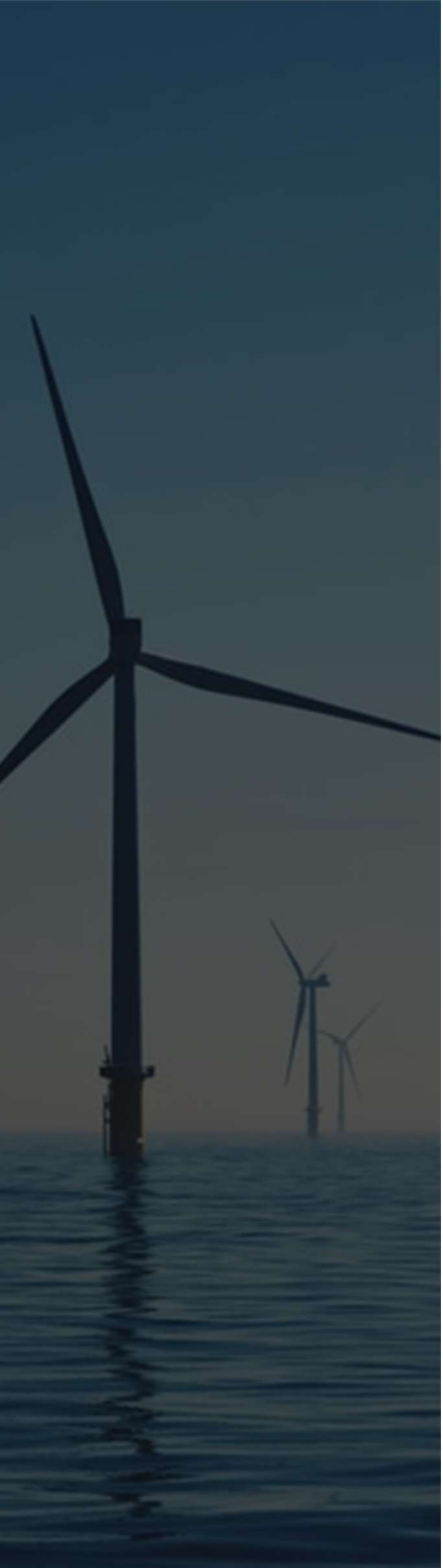


Atlantic Council

VETERANS ADVANCED ENERGY PROJECT

The Veterans Advanced Energy Project is designed to drive US leadership in advanced energy by recruiting, equipping, and empowering military veterans who understand the importance of the evolving energy landscape to our future security and prosperity.

Advanced energy is defined by leading edge energy technologies including solar, wind, batteries, microgrids, advanced nuclear, electric vehicles, and end-user energy efficiency.

The Veterans Advanced Energy Project mission applies to veterans of the US armed services and national guard, reservists, active-duty service members, and their spouses.

The Veterans Advanced Energy Project is housed within the Atlantic Council Global Energy Center, which promotes energy security by working alongside government, industry, civil society, and public stakeholders to devise pragmatic solutions to the geopolitical, sustainability, and economic challenges of the changing global energy landscape.

For more information, please visit www.AtlanticCouncil.org

Veterans Advanced Energy Fellowship 2022 Policy Proposals

As part of the 2021-2022 Veterans Advanced Energy Fellowship, each fellow prepared a policy memo and a persuasive five-minute flash talk on a topic related to national security, advanced energy, and/or military veterans. Both the written and oral presentations of the policy proposal were developed with the assistance of an advisor from the Atlantic Council network.

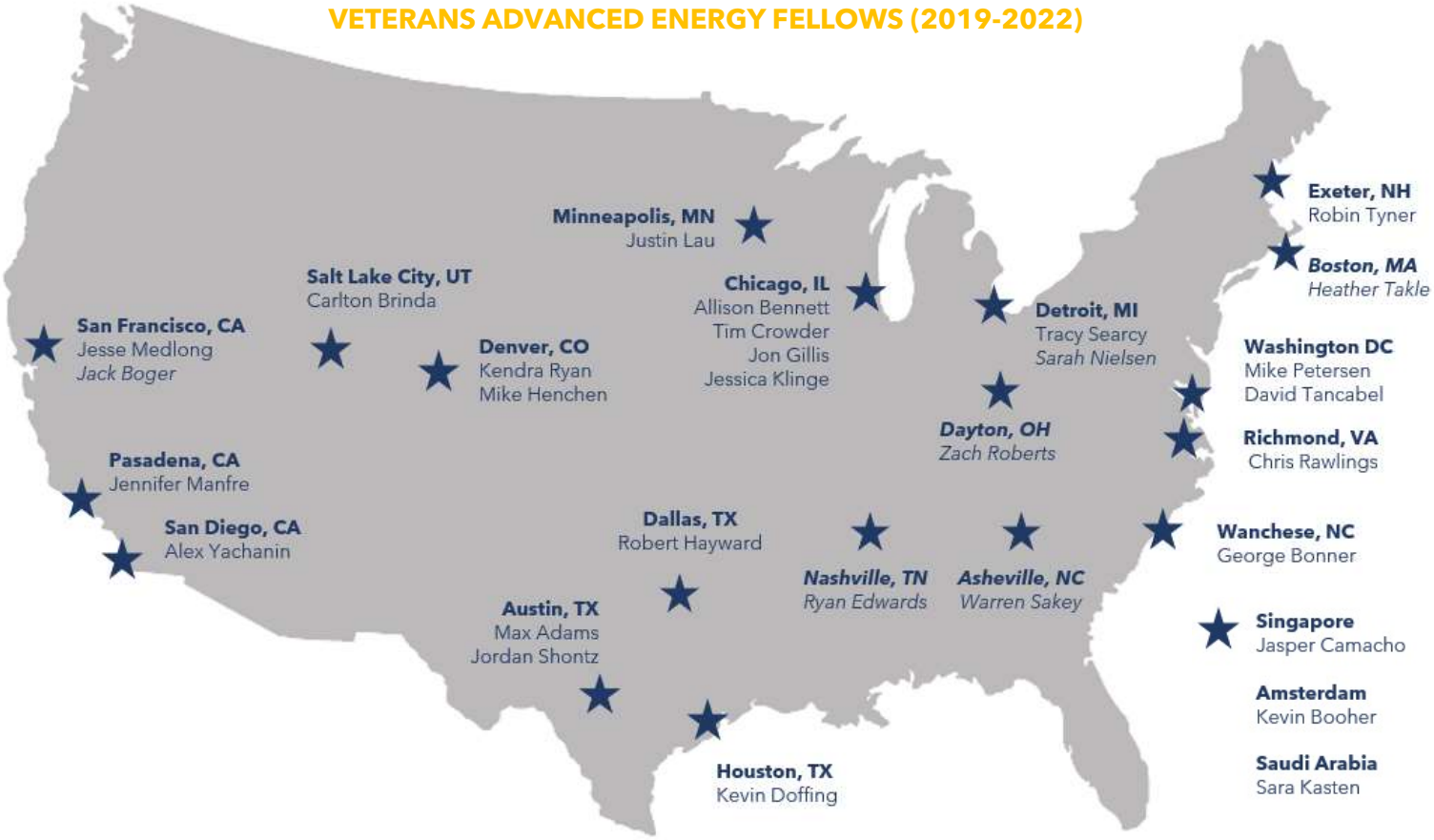
Each policy proposal diagnoses a problem and proposes a solution to a specific actor or actors. The papers include an executive summary, background on the topic, an analysis of the problem, and a proposed course of action. Fellows also consider the counterarguments of the policy prescription to strengthen the proposed pathway. Fellows were strongly encouraged to select a topic that they have a professional or personal connection.

The five-minute persuasive flash talks were presented to the Atlantic Council Global Energy Center and Veterans Advanced Energy Project network in June 2022 and during the Veterans Advanced Energy Summit on August 9, 2022.

ABOUT VAEF

The Veterans Advanced Energy Fellowship seeks to create a cadre of future leaders within the advanced energy industry. A successful fellow will become a peer mentor, advocate, and spokesperson for other veterans, reservists, and military spouses, helping to solidify the advanced energy connection to national security and the mission-driven advancement of veterans' employment in advanced energy. As fellows rise within advanced energy organizations, they can more closely tie national security to energy security, as well as move the advanced energy economy forward. Learn more at www.vetsenergyproject.org/fellowship

VETERANS ADVANCED ENERGY FELLOWS (2019-2022)



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Increasing DIU Energy Department Funding and Support to Strengthen Advanced Energy Technology Acquisitions

By Max Adams

Background

In recent years, there has been a significant pivot by military strategists and policy experts from a focus on counterterrorism operations in the Middle East to energy and energy resilience. This pivot is placing a greater degree of emphasis on the need for advanced technologies for both operational and installation energy. Improvements in operational energy are needed to enhance the range, duration, and efficiency of military platforms to optimize performance in contested environments and extreme conditions. Improvements in installation energy are needed to optimize energy generation, storage, and delivery to ensure installation infrastructure is smart, secure, and efficient ("Fiscal Year 2020 Operational Energy Annual Report"). The energy needs of the Department of Defense (DoD) are complicated by a complex relationship with utility companies providing energy to US military installations. Energy technology challenges also continue to increase as warfighting environment evolves, from powering military platforms at the Soldier level to cyber threats on critical grid infrastructure. In order to address this myriad of energy threats to the DoD and US national security, the DoD acquisition apparatus for advanced energy technologies needs to be streamlined and bolstered.

The current acquisition process within the DoD renders it difficult for nascent and emerging advanced energy technologies to be developed and sold to the government to deliver solutions to the warfighter. This is because it is confusing and difficult for small businesses to navigate the ecosystem of Partner Intermediary Agencies (PIAs), Program Executive Offices (PEOs), innovation hubs, research labs such as the National Energy Renewal Laboratory (NREL), and the Small Business Innovation Research (SBIR) programs among others. In addition, other government agencies also get involved, such as the Department of Energy (DOE) which funds significant research endeavors including the Operational Energy Capability Improvement Fund (OECIF)("Fiscal Year 2020 Operational Energy Annual Report").

In spite of the convoluted ecosystem, small businesses and the DoD have experienced some degree of success in developing and scaling nascent technologies with commercialization potential to meet the demands of the warfighter in technology domains outside of advanced energy. Arguably the most successful technology acquisition effort put in place by the DoD was the establishment of the Defense Innovation Unit (DIU). The DIU "strengthens our national security by accelerating the adoption of commercial technology...and partnering with organizations across the DoD, from the services and components to combatant commands and defense agencies, to rapidly prototype and field advanced" ("DIU 2021 Annual Report"). In 2020, the DIU stood up an internal department focused on Energy and Advanced Materials which has now been consolidated to "Energy". The DIU's Energy department is focused on developing critical and strategic energy capabilities and bringing them to the warfighter by facilitating the acquisition process for commercial technologies.

Analysis

The DIU continues to prove itself as the most efficient means of rapidly prototyping a solution that can be both commercialized as well as transitioned into a program of record. A program of record is an acquisition program leveraged by the Department of Defense to fund the development and innovation of technology that drives military operations. In 2021, the DIU has published 26 open solicitations, received 1,116 commercial proposals, awarded 72 new Prototype OT contracts, successfully transitioned 8 solutions to DoD end-users, and since 2016 they've awarded over $892.7M in DIU and DoD partner contracts. These statistics represent the businesses that intend to build and deploy a prototype for DoD users with a strong commercialization plan for potential dual-use applications. However, to date, the overwhelming majority of this funding has not been allocated to Energy projects. The DIU is projected to take on funding of over $81 million for fiscal year 2023 coming up soon, and the distribution among the programs is unclear (Williams 2022). As the United States seeks to responsibly and securely navigate the energy transition, a significant increase in funding for the DIU's Energy department is needed to connect the breadth and scope of DoD energy problems to the commercial industry. Instead of creating a new advanced energy-oriented technology acquisition program, the DoD should increase funding earmarked for the DIU's Energy department to ramp up Commercial Solution Offerings.

Deploying Clean, Advanced, US Nuclear Energy Technologies Globally

By: Allison Bennett Irion

Nuclear energy is the largest source of zero-carbon power, producing 20% of US and 10% of global electricity, accounting for over 50% of US and 20% of global clean energy. Few pathways achieve net-zero emission goals by 2050 without increasing nuclear power generation, which requires advances to the aging domestic and global nuclear fleet. The nations that lead new nuclear sales and deployment globally will shape the next generation of peaceful uses technologies, international nonproliferation standards, and energy security. This places the United States at a critical inflection point, where government and industry must actualize the potential of domestic nuclear innovation, including a domestic nuclear supply chain, to meet both carbon-free energy demands and to emerge as a global leader in advanced civil nuclear power.

Historically, the robustness, diversity, and volume of designs and deployments of US civil nuclear reactors have served as the cornerstone for the US government's global leadership position in nuclear nonproliferation. However, fifty-five nuclear reactors are currently under construction in nineteen countries, with China and Russia emerging as leaders in exporting civil nuclear technology. Attractive financing, coupled with fuel supply and spent nuclear fuel take-back assistance drive many state-backed economic incentive packages. These bilateral projects will establish century-long supply chain and workforce ties to nuclear newcomers and nuclear expansion states, while potentially moving away from the United States' unparalleled safety, security, and nonproliferation standards.

The United States continues to lead advancements in nuclear technology, with the Department of Energy (DOE) national laboratories and private industry often collaborating to pioneer cutting-edge research and development. The next generation of nuclear power will be compact and scalable, with new approaches to reduce construction, component and operating costs, and commissioning timelines. Advanced nuclear will offer increased diversity of applications ranging from desalination for water production to electrolysis to produce carbon-free hydrogen. US designs can be further strengthened by leveraging decades of experience through timely connections with DOE's National Nuclear Security Administration (DOE/NNSA) to apply safeguards by design, security by design, and proliferation resistance in nuclear systems to optimize nonproliferation features that uphold the global nonproliferation regime and meet global market demands.

Public-private partnerships are key to domestic and global deployment of advanced US civil nuclear technologies. The $1.2 trillion Infrastructure Investment and Jobs Act contains important provisions to support nuclear energy, with over $62 billion allocated to the DOE, including domestic demonstration, commercialization, and deployment. The Natrium Project, one of DOE's large-scale cost-sharing demonstrations with TerraPower and GE-Hitachi through DOE's Advanced Reactor Demonstration Program (ARDP) will site a 345 MWe sodium-cooled fast reactor at a retiring PacifiCorp coal and gas-fired power plant in Kemmerer, Wyoming. Prior to Russia's invasion of Ukraine, this project planned to receive its supply of high-assay, low-enriched uranium (HALEU) fuel (enriched between 5% and 19.75%) from a vendor that is a

Russian state-owned entity. Russia is a global leader in the nuclear value chain, accounting for 40% of global uranium conversion services. As countries assess their current and future energy relationship with China, this is one example where demonstration projects are drawing attention to the need to build out domestic and allied nuclear supply chains.

In addition to the 40 metric tons of HALEU needed by 2030 for DOE demonstrations, DOE national laboratories estimate that 5,350 metric tons of HALEU are needed to reach a domestic net-zero emissions economy by 2050, through a diversified mixture of conventional and advanced reactors.[1] A key priority for the DOE's Office of Nuclear Energy as it stands up the Advanced Fuel/HALEU Availability Program, established by The Energy Act of 2020, is to increase production capacity and to create a systematic process for US vendors to access advanced nuclear fuels, including addressing international acquisition in conjunction with relevant agencies. To be successful, fuel suppliers need the assurance of demand to spur US enrichment and deconversion facilities, while addressing that advanced reactor orders require the assurance of fuel supply. Innovative domestic fuel fabrication, component manufacturing, as well as assuring material supply, such as graphite, will also be key to reestablishing a strong US nuclear supply chain to meet the needs of both domestic and global markets.

The United States has the vision, innovation, and ability to close the current nuclear deployment gap by following near-term demonstrations with the deployment of clean, secure next generation nuclear to both domestic and global markets. Meeting US clean energy and global nonproliferation goals requires continued diligence at RD&D efforts, coupled with aggressively building out the domestic nuclear energy supply chain.

[1] Dixon, Brent W, Kim, Son H., Feng, Bo, Kim, Taek, Richards, Scott, and Bae, Jin Whan. Estimated HALEU Requirements for Advanced Reactors to Support a Net-Zero Emissions Economy by 2050. United States: N. p., 2022. Web. doi:10.2172/1838156.

US Maritime Decarbonization Center of Excellence

By: George Bonner

Recommendation

To reduce international maritime shipping industry greenhouse gas emissions 50% by 2050 (International Maritime Organization, 2018) and achieve ambitious US Administration net zero emissions goals by 2050, the United States needs to implement a sound, integrated strategy to accelerate necessary technology, infrastructure, and workforce development investments. Recent disruptions in supply chains highlight the importance of maritime transportation to national security as well as the complexities of related policies, resources, and stakeholders at all levels of community and government. A swift and integrated approach presents an opportunity to show global leadership in climate action and technology revolutions to spur economic development. Additionally, policies need to drive zero carbon solutions while sustaining critical shipping activity across the complex supply chain during transitions. As a cornerstone to a US Maritime Decarbonization Strategy, the establishment of a US Maritime Transportation Decarbonization Center of Excellence networked to green shipping clusters and green shipping corridors will accelerate this transformation that is critical to energy security, sustainability, and maritime safety.

Background

Reliable, affordable, and safe international and domestic shipping of goods is critical to trade and economic development. Current international maritime shipping contributes to 3% of global greenhouse gas emissions which is greater than the world's eighth largest greenhouse gas emitting country. Based on the International Maritime Organization (IMO) international shipping projected demand growth, these emissions could grow 90% to 130% by 2050 without major transitions to decarbonize the industry.

Recognizing the need for change, the IMO adopted an IMO Strategy to address this challenge and establish levels of ambition. The UN Climate Change Conference (COP26) has brought increased visibility to the need for decisive action to support maritime transportation decarbonization. Leading up to COP26, over two hundred industry leaders signed the Getting to Zero Coalition's "Call to Action for Shipping Decarbonization" calling for global commitment and IMO policies to support decarbonization. Across the globe, there are innovative approaches to promote collaboration and integration of new technologies. The Clydebank Declaration and the Declaration of Zero Emission by 2050 promote establishment of green shipping corridors. In 2021, Denmark, Norway, and the United States formed the "Zero-Mission Shipping Mission" to accelerate decarbonization initiatives including an "Industry Roadmap for Zero-Emission Shipping" released in April 2022. In May 2022, the "Silk Alliance" was launched to develop a Green Corridor Cluster to advance decarbonization with a focus on intra-Asia container trade. The Biden administration has taken steps to promote innovation and transportation decarbonization including the 17 June 2022 announcement of the scheduled launch of the "Green Shipping Challenge" at the U.N. Climate Change Conference in November 2022. This will help support goals of 100% decarbonization by 2050.

Within the United States, new blue economy clusters are emerging to support domestic sustainable ocean economies. In the Pacific Northwest, Washington Maritime Blue is a leader in promoting maritime decarbonization and bringing together various government, industry, and community stakeholders. At the federal level, cooperation across a complex regulatory landscape will be required for decarbonization transformation including coordination with the US Coast Guard and the Maritime Administration (MARAD), National Oceanic and Atmospheric Administration, the Environmental Protection Agency, and the Department of Energy.

Proposal

With no consensus on which technologies will emerge in this rapidly changing landscape, a Center of Excellence could serve as a convenor to establish US leadership in specific areas vital to this transformation:

- **Integrate and streamline Federal coordination –** Empowered representation from all federal agencies with regulatory authority; establish common metrics to provide transparency on emissions and progress.
- **Accelerate multi-disciplinary research –** R&D programs with focus on safety, efficiency, and integration with other energy transitions.
- Integration with regional, national, and global partner Blue Economy Hubs, Green Shipping clusters, and Green Ports. Collaboration to support workforce and supply chain developments for transformation.
- **Identify regulatory changes and incentives to reduce barriers to accelerate transitions while staying focused on safety -** Implementation of tax credits and corporate accountability will incentivize early adopters to lead infrastructure and shipping transformations.
- Promote Social Justice across the transformation.
- **Demonstration pilot projects –** Advance domestic and international pilot projects.

Conclusion

A holistic strategy is critical for development of clean energy solutions that complement existing renewable energy developments and energy transitions supporting storage, grid distribution, and transportation sectors. Establishment of a US Center of Excellence will serve as a convenor for national and global stakeholders; enhance research and development collaboration across National Labs, Academia, and Industry; and development of standards and regulations for public safety and compatibility across the blue economy and global ports. With many unanswered questions and lack of international standards, the United States needs to lead with a cohesive policy to drive action and smart investments for timely decarbonization and new levels of stewardship, safety, and international cooperation in maritime transportation.

Why the US Needs a Tiered Production Tax Credit for Low Carbon Hydrogen

By: Kevin Booher

Hydrogen policy via a tiered production tax credit should be used to support a broad but accurate low carbon hydrogen definition to meet both the decarbonization intent and the volume/capacity needed to address hard to decarbonize sectors.

The necessary decarbonization of our economy is currently taking place. The high-level approach is to electrify as much as possible, decarbonize the electric grid, and decarbonize the remaining sectors which are hard to abate using low carbon electricity alone. A low carbon hydrogen economy is needed to address certain areas of these hard to decarbonize aspects. Reducing emissions of current hydrogen production has significance alone (900 Mt CO2 in 2020, IEA Roadmap to NZE 2050) while additional low carbon hydrogen production can be used in areas of remaining emissions that do not have a clear path at this time.

The needed change to a low carbon economy is too great and the timeline too short for this development to meet decarbonization timelines without government support and a broad production approach. The bipartisan infrastructure bill directs the creation of a US clean hydrogen strategy and roadmap, and supports hydrogen with funding for research, development and demonstration via regional hubs with varying focus. Part of the strategy and roadmap should be a production tax credit (PTC) policy to support a broad but accurate low carbon definition to meet both the intent and the volume/capacity needed for future decarbonization of the economy. The PTC should focus on life cycle emissions reduction from current baseline and be tiered to provide additional support as CO2 emissions are further reduced.

Low carbon hydrogen production has been classed by color in an attempt to simplify the approach with green hydrogen from renewables powered electrolysis being the focus. Promoting only green hydrogen limits the ability to scale the low carbon hydrogen economy to meet demand. Renewables alone cannot meet projected demand while also supporting large scale grid decarbonization. An Atlantic Council Brief demonstrates how current US hydrogen demand would require 50% to 100% of US 2019 renewable capacity depending on capacity factor and electrolyzer efficiency. Net zero 2050 scenarios project 5 to 6 times current hydrogen demand (IRENA & IEA). The result would be 280% to 630% of 2019 renewables production to meet this with green hydrogen alone. Renewables capacity will obviously continue to increase but grid wide demand would compete with this green hydrogen requirement. Additional pathways should be considered when paired with methods of carbon reduction.

This low carbon hydrogen production tiered PTC will require clear emissions tracking guidelines and established boundary conditions to consider what upstream and downstream emissions are included. These decisions are significant to clearly understand the impact of production methods on emissions and properly incentivize emissions reduction. One example is the production of hydrogen from fossil gas using steam methane reforming (SMR) or pyrolysis. SMR production may be able to meet reduced carbon targets with carbon capture and storage (CCS) and pyrolysis may meet targets as solid waste carbon is easier to manage than gas emissions. Upstream considerations such as fugitive methane emissions must be considered

for both and downstream considerations such as carbon dioxide sequestration efficiency over time for SMR with CCS. Existing government agencies such as the EPA, FERC and NREL could create and maintain assumed emissions guidelines per production method along with requirements for third party review of LCAs. NREL already has both a US Life Cycle Inventory Database and a Life Cycle Assessment Harmonization project. Hydrogen producers could use the regional and production method specific guidelines or develop specific case LCAs and have them reviewed via third parties to qualify for a higher PTC tier.

PTC policies have already demonstrated their effectiveness in the renewables space and are a known quantity in the financing space. A tiered PTC model could be used to provide additional levels of support as greater levels of carbon reduction are achieved. Emissions for each method of production and region should be assumed at a most likely or worst-case scenario with the ability to demonstrate lower emissions levels. The production tax credit would then be tiered in value at the percentage of reduction from existing base case. This would be an incentive for hydrogen producers to prove reduced emissions via life cycle assessments (LCA) while investing in or creating a price signal for lower emissions feed stock. The proposed SEC Rules to Enhance and Standardize Climate-Related Disclosures may lead to an environment where this data is more readily available. The tiered PTC could also factor in additionality for renewables used in generation or curtailment of renewables in the local grid in the case of electrolysis via grid electricity. Hydrogen producers would report their assumed or proved emissions data via the existing EPA Greenhouse Gas Reporting Program (GHGRP) with the PTC claimed and monitored via the IRS.

Utah Investment in Nuclear Power Generation

By: Carlton Brinda

The Utah general assembly should approve $15 million in tax incentives for investment in nuclear power generation, specifically small modular reactors (SMR), to speed up the transition from fossil fuel energy to clean energy technology.

In 2015, the Utah Associated Municipal Power Systems (UAMPS) developed the Carbon Free Power Project (CFPP) to support Nuscale in the development of its first SMR in Idaho Falls, Idaho with the goal of utilizing the electricity generated in communities in Utah. In 2020, the Department of Energy (DOE) approved a $1.355 billion multi-year cost share award to UAMPS for the development and funding of the CFPP. Because SMRs are new, we need to ensure adequate funding is available for construction to ensure the successful commercialization of this new technology. This investment in tax incentives would ensure Utah's sustainable, reliable access to energy and improve air quality, especially in the Salt Lake valley.

According to the US Energy Information Administration, Utah generates over 87% of electricity from coal and natural gas power plants. While Utah ranks as the cheapest state for electricity bills, it is 43rd for carbon and pollutants produced by electrical generation. This continued reliance on fossil fuels wreaks havoc on the environment and worsens the air quality in Utah and the Salt Lake Valley.

SMRs are the next generation of nuclear energy innovation that brings a potential to address the climate crisis, clean up our environment, and provide economic growth to our region. One 462 MWe SMR is proposed to generate 4TWh per year which would supply almost 10% of Utah's annual electrical demand. This would directly replace fossil fuel generation.

The Idaho Policy Institute at Boise State University conducted an economic analysis showing that over 650 jobs will be created in the region for the entire 40 to 60 year lifetime of the facility. Operating the plant is also expected to raise the income level of local residents by nearly $48 million as well as increase the region's economy and tax base.

SMRs already have the Department of Energy (DOE) support in the form of funding provided to Nuscale Power. Nuscale was the first ever SMR to receive Nuclear Regulatory Commission (NRC) design approval. This was the final phase before moving forward with plans to develop power plants. The NRC has approved the SMR as a safe nuclear power plant.

Nuclear power provides for a safer working environment than fossil fuels. According to recent studies, for every TWh of electrical generation there is 0.07 deaths from nuclear power. Comparatively, coal plants cause 57.34 deaths and oil plants cause 18.43 deaths.

SMR technology can be paired with other applications to bring other advantages along with clean reliable power. They can be used in conjunction with desalination, green hydrogen production and can support mission critical facilities. They can also provide industrial facilities with clean, affordable, and reliable power and heat for their process applications. Place an SMR

near the facilities that most need the power generation, and it reduces the energy lost due to long transmission lines.

SMRs are already more economically competitive than conventional nuclear power plants and have the potential to be built in a fraction of the time and cost. This is the result of less fuel needed because it will last longer, 3 to 7 years for an SMR versus 1 to 2 years for conventional nuclear. While the levelized cost of energy for SMRs is still higher than other clean technologies like wind or solar, nuclear provides 24/7 power—not just when the sun is shining, or wind is blowing. Nuclear power plants are more stabilizing for the grid, better at responding to demand, and have twice the expected lifespan. Building at sites of retired fossil fuel power generation would reduce or eliminate the need for electrical distribution infrastructure and keep jobs in those areas.

Utah's neighbor Idaho is already home to extensive nuclear power resources and research experience. It is home to Idaho National Laboratory (INL) where the Navy has done and continues to perform testing and long-term experiments and storage. Nuscale has permitting rights to build their first SMR on the INL grounds. This SMR would provide power to Utah and other UAMPS customers across the western states. A tax incentive to bring SMRs to Utah would bring new jobs to the state, bolster the economy, and help replace aging and polluting fossil fuel plants with clean and reliable energy.

If we are to meet our carbon reduction goals and provide a healthy future for our children, then we must make big energy changes now. Utah needs to provide further funding into nuclear power generation to improve the future of the state's economy, environment, and energy access.

An Apollo Program for Fusion Energy

By: Jasper Camacho

Recommendation

The potential of fusion energy offers a near limitless, widely available source of reliable energy which does not contribute to greenhouse gas emissions and does not have the safety issues associated with nuclear fission such as meltdowns or large management of radioactive material wastes (Iter.org, 2022). The science and engineering executed by both the public and private sectors has advanced fusion energy to a place where there is debate on the timing of commercial viability of fusion energy within the next ten years. It is important that the public vis-a-vis the Federal Government embrace fusion energy as contender for the future of America's energy. The first iterations of commercial fusion energy projects will be the most financial and technical risky and will need Federal Government support. Similar to the Apollo Space Program, the US Federal Government has the ability to significantly accelerate cutting edge science and technology into reality. The Federal Government should implement a program to make fusion energy a reality to becoming the main source of energy from this decade and on.

Promise of Fusion Energy

Fusion Energy will have the ability to provide the world's need for reliable, clean energy. The process of forcing together atomic nuclei rather then splitting the nuclei could lead to near limitless source of energy for the world. While there are a number of methods that are being pursued to achieve a positive net energy balance to come from the fusion energy (getting more energy out then what you put into the process), a common mechanism for this process would be to fuse two different hydrogen isotopes together. The simplest isotopes are deuterium (hydrogen atom with one neutron) and tritium (hydrogen atom with two neutrons). Deuterium is found in abundance in the Earth's oceans. Tritium is rarely found naturally but the process of producing tritium is well known. Most fusion energy systems consider producing or breed tritium within the fusion energy process. Other than these two fuels, there are no other inputs or continuous raw material needs. Geopolitically, the fuel for fusion energy is widely accessible and will reduce the dependencies amongst nations for a specific fuel or material.

Fusion energy does not release any greenhouse gas (GHG) emissions. This makes the technology compelling as a major source of energy for the future. The major emission that fusion energy process would produce is helium which is an inert gas. Unlike other sources of non-GHG emissions energy, fusion energy power plants will not have a large land footprint such as solar and wind farms or for "Green Hydrogen" where a large reliance of solar and wind farm production is needed.

Compared to nuclear fission reactors, fusion energy has a lower risk profile. It's widely accepted that the risk of a meltdown, or the severe uncontrollable overheating of a reactor's core, is non-existent. Fusion energy process is extremely difficult to produce and maintain and an instability would extinguish the fusion process. Compared to nuclear fission, fusion energy does not create long-lived radioactive wastes nor create a large amount of radioactive waste. Fusion energy

would likely employ a holding capsule, or blanket, which would be exposed radioactive energy. This material would likely be a truck container worth of material per year and would employ the same handling techniques of radioactive material in our everyday lives such as medical x-ray machines.

For all of these reasons, fusion energy is sometimes called the silver bullet for energy production.

Commercialization of Fusion Energy is around the corner

The science around fusion energy has made large leaps over the last ten years. This was supported largely by multinational projects such as the European ITER project and other government sponsored projects throughout the world.

The research including fusion and plasma physics and ancillary areas of research such as material sciences, high temperature super-conductors, robotics, AI/machine learning, quantum computing, and advance 3D printing has helped bring fusion energy to reality in which hasn't been seen in our world since our Sun was formed.

The private sector has seen the promise of fusion energy's proximity to being reality. A number of large investments into the sector has ballooned over the last 12 months including a from venture capital firms such as USD $375 million into Helion Energy and USD $1.86 billion investment into Commonwealth Fusion Systems.

Finally a number of countries outside of the ITER projects are pursuing their own fusion energy R&D program such as China, Korea, Japan, Taiwan, Germany, and the United Kingdom.

Risks of First of a Kind Technology

While the science and engineering of fusion energy is promising, there will be a significant problem to commercializing the first iterations of of fusion power plants.

Fusion energy is a First of a Kind (FOAK) technology that is going to be significantly investment heavy in the near term. FOAK technologies have an issue in that any company that will develop the first iterations of fusion plants will be inventing and pioneering new technologies and processes. While the FOAK risk of the technology can be reduced by pilot projects and utilizing known technologies and processes, there is still a large technological leap in terms of building and commissioning the first commercial scale project.

The other feature that makes commercializing fusion energy is the large investment needed to design, build and commission the first fusion power plants. This first wave of fusion plants will likely be the most expensive as improvements in costs and execution will take a number of iterations. Its going to be challenging for the private sector energy purchasing model to be applied to help finance the new fusion energy fleet.

A Call for Fusion Energy's Apollo Program

A national call to action will be needed to accelerate the investment and execution for the first-generation fusion energy power plant. This would be important for the nation as it will bring the benefits of fusion energy to address the contemporary issues related to resources and climate change. China, EU, UK, Japan, and Korea all have heavy government involvement to help fusion energy leapfrog current energy technologies. Fusion energy technology science and research will bring several ancillary technologies and scientific advancements in the United States that can help advance our economy.

While there are programs such as the US Department of Energy Loan Guarantee Program and a number of grants and federal funds, America needs to consider a powerful, bold program to launch fusion energy into a commercialization.

Features of this author's coined *Theia Program* (named after the Greek Goddess sight):

1. A program large in nature like the Apollo Space Program and focused mission with the objective to have a 200 MW fusion energy plant consistently producing power in the United States by 2030.
2. The Federal Government would be the principal purchase of power from fusion energy. The Federal Government would provide a site in one of its federal lands to reduce siting risk for theses first generation plants.
3. Theia would mandate a number (three separate, competing programs) of initial approaches to fusion energy to build a net 200 MW of fusion energy power. The companies participating in Theia would put in a sizable financial security to compete the mandate. This would help ensure a filter of technologies, teams, and commitment.
4. Theia would de-risk the commercialization by providing milestone stipends to the companies that participate. There would be performance payouts to the companies based on achieving a net positive energy production and for providing continuous energy similar to how a traditional utility would procure power from a generator.
5. The program would also have provisions for the company to provide demonstration of operations and maintenance for at least three years.
6. It is suggested that Theia would have a Phase 2 program to allow a quick second generation fusion power plant to be developed based on learnings form Theia 1.
7. Committee of oversight, but not overly bureaucratic and over-reaching, in Theia to ensure that program objectives were being met.

An early calculation for the cost of Theia for the three projects would be about USD $15 billion plus indirect costs for running the program which would likely come to about USD $20 billion. Compared to several Federal programs, the investment would help propel the world into a new era of energy technology and secure America's leadership in the new energy world.

At first glance the budget for Theia seems to be aggressive, however the Apollo project was running at a budget of USD $25 billion in nominal terms (~USD $194 billion in present terms). Theia's budget size would likely be comparable to projects such as the F-22 Raptor Program and much less than NASA's Artemis Program.

Both Theia and Apollo have similarities in terms they are applying known science research to accelerate engineering solutions for both project objectives. Theia diverts in its ambition as the activities are meant to be a catalyst for the private sector to eventually take over investment and commercialization of fusion energy. Apollo's mandate in terms of putting humans on the Moon is straight forward relative to Theia's success. Theia's engineering objective to achieve a fusion reaction that is stable and producing more energy than it consumes is also measurable. Where Theia diverts from Apollo is that the point of Theia would be to catalyze commercial development and investment in fusion energy. The difference in the two projects should be accepted in order to design the best outcomes for the Theia project.

The world is currently at a crossroads in terms of societies' response to energy access, economic development, and advancement in energy technology. The world needs to embrace fusion energy as the energy source so that we can continue to advance the world's living standards and reduce the externalities and challenges with today's energy solutions. America can again be the leader and providing this solution through fusion energy and the Theia Program is the type of program that will solve the world's energy problem.

Deregulation and Incentives for Improved Geothermal Development and Deployment in Texas

By: Kevin Doffing

Summary

In order to meet the needs of Texans for increased economic and workforce development, the State of Texas should enact common sense policy changes to foster the geothermal industry. Only two reforms are necessary for this to occur. First, deregulate the permitting process to accelerate project development from years to months. Second, create an investment fund to match project finance dollars raised for geothermal projects that exceed $10 million in capital expenses invested in new or repurposing existing wells. Funds invested will have a return expectation for project developers. The investment fund should also be allowed, through an amendment to the natural resources code, to allow it to receive federal funding where available. These are common sense, bipartisan proposals in line with Texas business values supporting the oil and gas workforce of Texas, leverages our natural resources, and secures reliable base load power for our energy grid.

Background

As our civilization undergoes a rapid energy transition from fossil fuels to renewable energy the primary focus has been on wind and solar. This deployment led innovation has been driven by financial incentives for financial backers to underwrite the financing of these projects. This is in our society's best interests as the return horizon for the government is different than private capital markets. By incentivizing initial funding of new industries, the government is derisking project finance to sustain and grow employment, investment, and the resulting tax base from this growth and stability. Texas, more so than any other state, has led the United States in the investment, construction, and deployment of large scale capital projects around energy. This has been stimulated by the consolidation of energy resources including oil, gas, wind, and solar. The next market opportunity for the energy transition is geothermal, which again, Texas is rich in opportunities.

Geothermal technologies have been deployed at scale in the easiest to develop locations like California's Geysers. There the heat of the water temperature is such that it is close to ground level at a high temperature that project development is relatively simple compared to project development in other geographic locations. As closed loop and advanced geothermal technologies have been developed, they have lagged behind the technical progression and downward cost curves that wind and solar have experienced for the simple fact that they have not enjoyed the same rapid deployment. This lack of deployment is largely due to the financing these projects is not incentivized by the government. If geothermal can have the two major roadblocks to development removed, it is poised for meteoric growth.

Policy Proposal

First, expedited permitting is necessary which requires the deregulation of cumbersome bureaucratic processes that should require months but instead take years to overcome. This long lead time places geothermal immediately outside the investment timeline of private investment project finance. By accelerating the permitting process, which in Texas is overseen by the Rail Road Commission, projects become much more attractive to developers. According to 2019 data, review for a geothermal drilling permit could take up to 200% longer than its equivalent in the oil and gas sector, despite that both are similar subsurface operations.

The second is a government supported investment system. In the case of Texas, which would not be open to tax credit like wind and solar benefitted from with the Procurement Tax Credit (PTC) and Investment Tax Credit (ITC), respectively. What would be tenable and successful in Texas would be a mixed private public partnership for project financing. In 2021, HB 3576 was introduced to the Texas State House that would have established a Geothermal Investment Fund. The requirements to qualify for investment would have been a minimum of $10 million of financing secured, with a dollar-for-dollar potential match from the fund. This would be hugely beneficial given the fact that initial wells being drilled in Texas by geothermal startup Sage Geosystems are projected at $35 million.

Unfortunately, the bill was watered down when sent to the Energy Resources Committee of the Texas House, with only the recommendation to study geothermal opportunities in Texas. The bill also lacked bipartisan support, basically split down party lines then died in the Calendars Committee. In the Texas Legislature, this is a common mechanism for defeating bills by the majority party. If bills aren’t scheduled for vote by the Calendars Committee, which they are not required to do, then it is defeated without any debate on the House floor.

In order to coordinate and consolidate these two policy changes, a geothermal-specific Renewable Energy Coordination Office should be formed under the Rail Road Commission, similar to those for solar and wind. Whereas existing Rail Road Commission employees have oil and gas backgrounds, but they may not have the necessary geothermal expertise, resulting in higher administrative costs and duplication of assessments and skillsets across the agency. Doing so would increase efficiency by committing full-time, geothermal-focused staff to the review process.

Plastics Are a Critical Enabler to the Warfighter, But Not Without Problems

By: Sara Kasten-Lechtenberg

Background

Humans face an unsustainable relationship with plastics. Global demand grows 5.4% a year, with single-use plastics accounting for 40% of plastic waste. Plastics do not decompose land; instead, they break into microplastics which enter the food chain. Scientists contend we consume five grams of plastic a week—the equivalent of the weight of a credit card. Community recycling programs over the last half-century have failed: 98% of plastics go to landfills, incinerators, or leak into the natural environment. Incineration of plastics in open burn pits has been particularly problematic for the Department of Defense (DoD).

The topic of plastics is complex, and many audiences have not looked at the role of this commodity in our modern lives. Here are some important considerations:

Military Considerations

Plastics allow military gear to be lightweight, cost-effective, and mass-produced. Plastics are a vital part of wrapping consumables to ensure sanitary food, water, and health provisions in austere environments. While plastics have helped create a modern fighting force, waste management of plastics is a concern. The use of "burn pits" to incinerate plastics and other waste has led to health problems for service members and is linked to increased cancer rates for servicemembers. An April 2019 Department of Defense report to Congress highlighted the problems associated with toxins from burning plastics and specifically identified packaging, plastics, and tires as a part of solid waste burnt in open pits. According to the PACT Act, both DoD and the Veterans Administration acknowledge service members exposed to airborne hazards from open burn pit smoke. The bipartisan legislation notes that open-air combustion of trash and other waste in burn pits was a common practice and while the DoD closed out most burn pits and is planning to close the remainder, the practice of burning garbage left a lasting impact on the service members who were exposed to them

Economic Considerations

Hydrocarbons such as oil and gas are the feedstocks for polymer production. It is estimated that by 2050, the plastics industry will place a heavy demand on global oil supplies, consuming approximately 20 percent of global oil production to create polymers. A recent United Nations report indicates that global trade in plastic is valued at 1 billion dollars annually. It is not just the production of new plastics: trade in recycled plastics is a big business, with global trade in waste plastics valued at $5 billion in 2007 and growing to $9 billion by 2017. Creating efficiencies in the international exchange of plastic waste, pairings, and scrap can lead to circularity and prevent leakage. Circularity for plastics can also create jobs due to the labor-intensive nature of the recycling process.

Political Considerations

Plastic waste leakage has created political tensions around the globe. Wealthy nations have shipped plastic waste to developing countries for recycling, but often the shipments contain contaminated plastics and household waste or low-quality polymers. Recipient countries lack adequate infrastructure to process domestic waste, let alone imports. Starting in 2019, several countries refused entry of plastic waste, with demands to "return to shipper." China was the first to refuse entry, and later the Philippines, Malaysia, and Indonesia cracked down on imports of waste plastic.

Infrastructure Considerations

Burning plastic is not an acceptable form of waste management in the United States, but in many parts of the developed world, waste management includes incineration. In a Department of Defense context, waste management is a challenge in austere operations, leading to incineration as a leading choice for disposal of waste until 2019. Lack of waste management infrastructure in developing countries leads to leakage into waterways and causes many communities to incinerate the plastic refuse, leading to toxic fumes and health consequences. These problems are not contained within territorial boundaries. Creating circularity for plastics requires a commitment from many stakeholders and alignment of goals across multiple industries, municipal waste management, and consumers.

Information Considerations

Information gaps lead to inefficient recycling and a skewed perspective on plastics. Consumers need more information on how polymers can help our carbon footprint since plastics are lighter than glass packaging and often take less energy to produce when considering a Life Cycle Analysis. Additionally, plastics play a huge part in the transition from hydrocarbons to renewable energy sources and are an element of wind turbines, electric vehicles, and solar projects. Communities need to understand better the impact of single use plastics and the lack of recycling options for specific polymers. Many corporations virtue signal that they are "anti-plastic," but this narrative does little to reduce plastic leakage. It is greenwashing and blame-shifting. "Reduce, Reuse, and CONFUSE" is the current information environment.

Policy Recommendations

The House should pass the bipartisan Honoring Our Promise to Address Comprehensive Toxins (PACT) Act and send onto President Biden. This legislation has received support from veterans' organizations across the United States and focuses on the need to address service members' health impacts from toxic exposure from burn pits.

Industries should not be able to "greenwash" their products with misleading symbols when there is no recycling infrastructure available locally, or hard to recycle polymers make it economically impossible to process. Industries should be required to implement a supply chain certification program and comply with an external audit when using recycling logos and other environmental

claims. The Federal Trade Commission should take an active role in ensuring "truth in advertising" for industries that use recyclable symbols in their packaging.

The Department of Defense Needs a Supply-Chain Imperative for Rare Earth Minerals and EV Batteries

By: Jennifer Manfre

The United States is taking initial policy steps to reverse its dependence on foreign—and often hostile—sources of rare earth minerals (REMs) needed for manufacturing of electric vehicle (EV) and energy storage batteries. The Biden Administration's increased funding of National Labs for EV battery research and ordering the Department of Defense (DOD) to prioritize certain US borne minerals as essential to national security are positive steps to secure these critical resources domestically rather than being dependent on foreign sources. However, to face the increasing risk and urgent need for national security and climate resilience, the full scope of the DOD's research, procurement, and contracting apparatus should be used to aggressively secure a safe and sustainable supply chain for rare earth minerals.

Rare earth minerals are the building blocks for future energy security and global competitiveness. Included in this category are lithium, cobalt, graphite, nickel, and manganese—key components to make the batteries used in zero-emission and clean energy technologies for transportation and energy storage. Currently, the United States relies on other nations for mining and processing of these materials. According to the USGS Mineral Commodity Summaries, the United States was 100 percent reliant on importing 17 mineral commodities and at least 50 percent reliant on importing an additional 30 mineral commodities in 2021.

The United States is also lagging in manufacturing capabilities of the batteries and components that use these minerals. As noted by the Department of Energy's (DOE) battery supply chain assessment in 2021, the United States had less than ten percent of the global market share for manufacturing capacity across all major battery components and cell fabrication. Analysts optimistically forecast that the US global battery capacity will reach 15% by 2030, while China has already cornered of 75% of battery cell capacity.

Recent sanctions resulting from the Ukraine-Russia conflict are restricting the trade of nickel and other critical elements needed for EV battery manufacturing, increasing costs as the supply contracts and the demand for EVs increases. Russia was the third-largest nickel producer in 2021 and is also a relevant source of EV battery minerals such as cobalt and palladium. Other countries are acting aggressively to secure their competitiveness in this market. China recently announced the formation of a new state-owned entity, Rare Earth Group, that will control at least 60% of Chinese rare earth production, which is a third of the world's supply.

Political alignment between Russia and China due to the geo-political consequences of Russia's war on Ukraine could exacerbate future REM resource constraints for the United States through bilateral trade agreements for these commodities amongst themselves and impact the industry due to tariffs as seen in the solar panel industry.

To develop a truly sustainable and reliable supply chain, the United States must marry its full-market potential with climate and national security as the long-term drivers. The DOD is poised

to do just that. In October 2021, the DOD published its Climate Adaptation Plan. The Plan, recognizing the strategic imperatives of force readiness and the threats of climate change impacts, mandates the integration of climate-informed decision making into all department processes. It also states that the DOD will include climate change considerations into its supply chain management to leverage the DOD's renowned purchasing power to support the transformation to clean energy technologies. A safe and sustainable rare earth materials supply chain is a clear part of those essential technologies.

There are small steps being made to address parts of the issue, but a piecemeal approach cannot create the necessary shift in the supply chain the same way that the DOD's apparatus can. The mining industry is waiting on the investment implied in the Defense Production Act. Manufacturers such as Panasonic, LG Chem and Sila are eager for the DOE's $3 billion Battery Material Processing Grant Program. The National Labs and other US research facilities are also looking to apply that program to demonstration projects. It is time to move past this piecemeal approach.

Leveraging the DOD's research, procurement, and contracting mechanisms and applying them to the full spectrum of the REM industry can secure these strategic resources domestically or from friendly sources. This requires policymakers to prioritize funding and approve procurement and research initiatives that are focused on rare earth mineral supply, refinement, and the battery manufacturing supply chains that they support. This effort should not be derailed by a cost-containment focus, as seen in the USPS procurement process. This is an investment in US competitiveness. As a bonus, the DOD can apply standardized requirements through its procurement process that will ensure the supply chain operations and related industries are built with safety and sustainability as a core element.

The United States is at risk of losing out on the economic growth and domestic security associated with a growing technology—a situation reminiscent of solar panels, semiconductors, and wind-power constructions materials lost to China. Today's economic and geopolitical environment will not allow for the commercial market to grow domestic capacity in its own time. It is time to use the power and might of the US DOD to build and defend the rare earth mineral supply chain industry here at home. It is time to align national and energy security with our nation's climate strategy, while ensuring global competitiveness for the future.

Planning Renewable Energy Solutions on Department of Defense Property

By: Kendra Ryan

Recommendation

The Office of the Deputy Assistant Secretary of Defense for Environment and Energy Resilience (ODASD(E&ER)) should ensure that each military branch systematically identify opportunities for renewable energy development on Department of Defense (DoD) administered lands. Resource, sustainability, economic, and mission-compatibility assessments should proactively determine suitable sites. DoD installation energy and facilities managers should then use these assessments to develop public-private partnerships to provide energy security, energy resilience, and financial benefits.

Context

To meet the US goal of a carbon-free grid by 2035, renewable energy development, such as solar, wind, and geothermal, must rapidly accelerate. The amount of space required to produce this energy by renewable sources is much larger than the space needed by non-renewables; therefore, replacing non-renewable with renewable sources will increase demand on valuable space. Siting of these projects must consider resource availability, environmental interactions, conflicting uses, and stakeholder concerns such as impacts on viewsheds. Stakeholder objections would be easier to avoid on military lands.

DoD administers 8.8 million acres of land, making it the fifth largest land management agency in the US.[2] In addition, DoD has a memorandum of agreement with the Department of Interior for use of outer continental shelf submerged lands. Siting renewable energy projects on lands under the administrative jurisdiction of DoD could accelerate development and contribute to a "whole-of-government approach" towards the US national goal of a carbon-free grid. Furthermore, development of distributed renewable energy projects on DoD lands would help DoD meet its own goal that "no less than 25% of total facility electricity produced or procured will be renewable energy by 2025." In FY20, DoD progress was only at 15.1%. Renewable projects on DoD lands may also provide a cheaper form of energy to meet DoD demand.

Using DoD land for renewable projects is not a new concept. Photovoltaic systems, wind farms, and a geothermal facility are already operational on DoD lands. In FY 2020, DoD had in operation 2,091 renewable energy projects, with annual generation of 3,753 GWh. A framework for these projects, including land management and energy production, sale, and purchases is already codified.[3]

Investing in renewable energy is vital to mitigating the impacts of climate change. According to the US National Security Strategy, "Climate change is an urgent and growing threat to our

[2] Excludes land managed by the US Army Corps of Engineers and land managed overseas.

[3] 10 U.S.C. §§ 2911, 2916, 2922a, and 2662

national security, contributing to increased natural disasters, refugee flows, and conflicts over basic resources like food and water." More than 30 US military installations are facing elevated levels of risk from rising sea levels and many more installations have already been affected by natural disasters with increased intensity attributed to climate change. DoD and the services recognize that increasing threats, both natural and adversarial, threaten critical energy infrastructure and mission success. Transitioning to advanced energy solutions will thus ensure energy security[4] and energy resilience[5], the main drivers in the DoD Energy Policy.

ODASD(E&ER) provides energy-related policy and governance for programs and activities that enable resilient, efficient, and cyber-secure energy for joint forces, weapon systems and installations. They are, in many cases, the approver of renewable energy projects on DoD administered lands. Military services may be approvers due to funding vehicles; however, the services are still required to coordinate project specifications such as terms and type of contracts and land use, National Environmental Policy Act status, and economic forecasts with ODASD (E&ER). To meet renewable energy goals, DoD must proactively open-up its lands for renewable energy projects instead of waiting for industry proposals. ODASD (E&ER) should create policy and guidelines for the services to systematically conduct resource, sustainability, and mission-compatibility assessments to identify opportunities for development. Assessments would provide a list of pre-selected sites that would reduce uncertainty for developers.

The Army's Office of Energy Initiatives (OEI) provides a service model for this style of planning. OEI serves as the Army's central program management office for the development, implementation, and oversight of privately financed, large-scale, energy projects on Army installations. They seek to develop "islandable" projects with the ability to maintain operations when the electric grid goes down. They utilize a five-phase project development model that begins with project assessment. This master planning approach could be adapted to address the more ambitions renewable energy goals of DoD.

Conclusion

Proactive, systematic resource, economic, sustainability, and mission-compatibility assessments of potential renewable energy projects on DoD lands will facilitate meeting the national renewable energy goals and DoD's needs for energy security and resilience.

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[4] The term "energy security" means having assured access to reliable supplies of energy and the ability to protect and deliver sufficient energy to meet mission essential requirements.

[5] The term "energy resilience" means the ability to avoid, prepare for, minimize, adapt to, and recover from anticipated and unanticipated energy disruptions in order to ensure energy availability and reliability sufficient to provide for mission assurance and readiness, including mission essential operations related to readiness, and to execute or rapidly reestablish mission essential requirements.

Incentivizing Multiuse Utility Scale Solar Facilities

By: Jordan Shontz

Recommendation

The US Department of Agriculture (USDA) and the Department of Energy (DOE) should incentivize developers of solar facilities to keep land within agricultural production once a plant is operational. Through engaging with both USDA and DOE, a joint policy where solar and agricultural production are complementary toward each other instead of competitive can emerge in an effective manner. Embracing multiuse utility scale solar facilities will ease food shortages, enhance biodiversity, and keep land in agricultural production.

Background

With a nearly fifty-fold increase in utility scale solar plants from 2011 to present day, and a projected 100-fold increase estimated by 2023, utility scale solar installations are utilizing a rapidly growing land mass within the United States. By 2030, an estimated 3,600,000 acres will be used for utility scale solar production, which is roughly the size of Connecticut. This number is expected to rise to 10,300,000 acres by 2050, which is between the size of Maryland and West Virginia.

The lands that are most cost effective and in greatest abundance for solar development are generally agricultural production when they are identified and developed. Once the solar site has completed construction, it is usually not utilized for its previous agricultural use, but the soil below the panels could still yield valuable crops and agricultural attributes that would not negatively affect solar energy capture by the photovoltaic (PV) panel arrays. The decrease in available agricultural land presents a future problem to food security, biodiversity, and loss of jobs by farmers and ranchers.

Currently, most PV plants manage the vegetation on their sites by using a mix of herbicides and mechanical mowing techniques. Managing PV plants in this way creates multiple drawbacks such as:

- Increased amounts of herbicide and invasive plant species
- Reduction in soil stability and increased erosion
- Increased operational costs to prevent and remediate erosion
- Increased operational costs associated when only mechanically mowing
- Waste of potentially agriculturally productive land

The land below PV arrays could be used for a multitude of agricultural activities. This would include livestock grazing, pollinator habitats, crop production, grassland carbon sequestration and storage, and habitat restoration. These activities would provide steady revenues and jobs for farmers and ranchers, reduce erosion and sediment in surface waters, reduce irrigation needs by symbiotically cooling crops and PV panels, be tailored to varied ecoregions, and make a more productive use out of underutilized land. Using a solar site for these activities requires

an initial increase in capital contribution to ensure the correct functioning of the site and agricultural co-use; however, lifecycle costs will be lower than without multiuse methods.

The initial costs depend on the type of agricultural activity under the PV panels and range between $0.07 to $0.80 per watt of direct current capacity, roughly 4% of total cost depending on technology, and these costs are dropping. Much of these costs would be offset across the life of the project by decreasing civil work caused by erosion, reducing or eliminating need for mechanical mowing, and value capture of the agricultural products they yield.

The issue remains that in a competitive environment, solar developers will be reluctant to spend the additional upfront costs of multiuse facilities. To address this, the USDA and DOE should partner to offer incentives to developers to adopt multiuse solar plants so that they may grow at a larger scale and pace.

Proposal

There remains within the United States a dearth of leadership and direction for multiuse solar facilities at any meaningful scale. The USDA and DOE have an opportunity to lead the solar industry to a more productive use of the land resources that they manage while simultaneously promoting clean solar energy and responsible agricultural production. They should create a joint office to oversee and investigate best multiuse practices, identify incentives that promote its adoption, and signal to the industry that multiuse utility scale solar sites are a logical and profitable activity to include in a solar developer's portfolio. Potential incentives would be to create an Investment Tax Credit percentage adder, tax reductions on agricultural products produced, or retention of agricultural land tax exemptions for sites that participate in these multiuse solar facilities.

Incentivizing the West Coast Offshore Wind Pipeline

By: Alex Yachanin

In order for California to cost-effectively reach its goal of achieving 100% clean electricity generation by 2045, the state government must commit to the development of offshore wind energy by passing legislation that requires utilities to procure a minimum of 10 GW of offshore wind energy by 2040.

With the passage of SB100 in 2018, California set the ambitious yet necessary goal to generate 100% of its electricity from carbon-free sources by 2045. For decades, the state has been a leader in renewable energy deployment, with the most solar power of any state in the country and the second highest capacity of all renewable sources, yet there is one critical clean energy technology in which California lags far behind: offshore wind. In Europe, the first commercial offshore wind farm was constructed in 1991, and as of 2020 there were over 5,000 turbines installed for a total capacity of over 25 gigawatts (GW). On the East Coast, there are already two operating offshore wind projects, a growing pipeline of over a dozen projects that will have a capacity of more than 30 GW, and a number of state-led offshore wind commitments. On the West Coast, however, there are zero turbines in the water and only a handful of projects in the early planning phase.

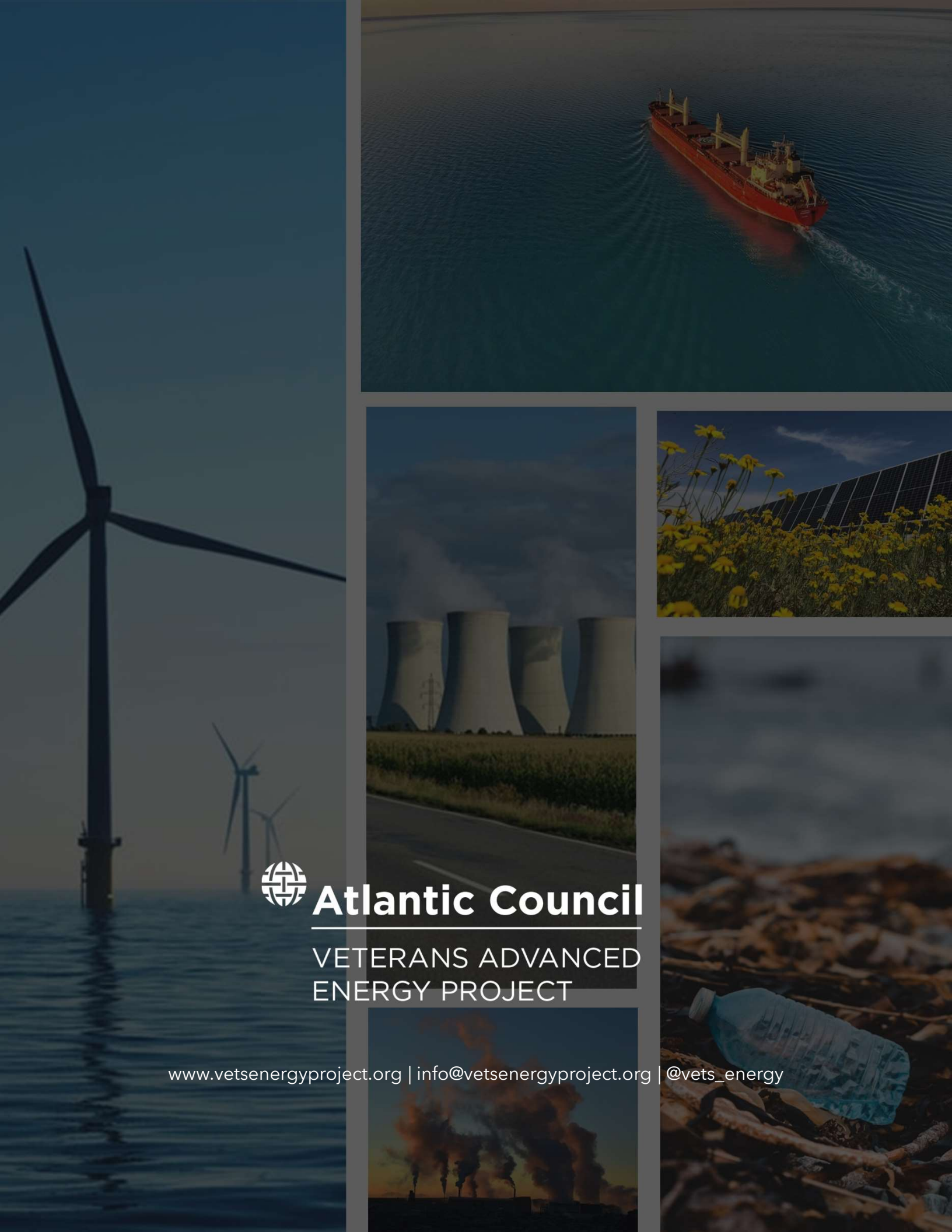
There are many reasons why California lags behind both Europe and the Eastern U.S. in offshore wind development. The main technical challenge is that the deep waters of the Pacific Ocean require wind turbines to be installed on floating foundations, a nascent but quickly developing technology with several pilot projects around the world. Other obstacles include a lack of transmission infrastructure, limited ports that could service and supply a new offshore wind industry, an undeveloped domestic wind energy supply chain, and potential conflicts with the fishing industry, the Department of Defense, Native American Tribes, and sensitive marine ecosystems.

Despite these challenges, offshore wind is an ideal energy resource for California. According to the National Renewable Energy Laboratory, there is enough technical resource potential to generate about 1.5 times the state's total existing electricity consumption. Because the wind offshore tends to blow much faster and more steadily than it does over land, offshore wind farms have higher capacity factors (a measure of how many hours per year that a power plant is generating at peak capacity) than both solar and onshore wind resources. Just as importantly, because offshore wind speeds tend to peak in the late afternoon and evening, the generation profile would be complementary to California's abundant solar energy, which peaks during the day but then drops rapidly as the sun sets. Connecting offshore wind farms to load centers via subsea cables can also mitigate the ever-growing risk of wildfires disabling onshore transmission and of that same transmission being the cause of more wildfires. For all of these reasons, a joint state agency report highlights that offshore wind would enhance the state's diversity in energy resources and technologies, while also lowering overall system electricity costs and bringing other economic and environmental benefits.

The most effective way to address all of these issues and to take advantage of the benefits that offshore wind could bring to California is for the state legislature to pass a law that sets a clear

and achievable procurement target for offshore wind energy. Many states on the East Coast have already passed these types of laws, such as New Jersey's Offshore Wind Economic Development Act, Massachusetts's Act to Promote Energy Diversity, and Virginia's Clean Energy Economy Act. In total, eight states (all on the East Coast) have set offshore wind energy procurement goals for a total of over 39 GW to come online between 2030 and 2040. A similar law for California could be structured to direct the California Public Utilities Commission (CPUC) to incorporate a minimum amount of offshore wind capacity in its Integrated Resource Planning (IRP) process, which would then compel the state's utilities and other load serving entities to procure offshore wind energy. As other states have done, this type of procurement target mechanism could also require a competitive bidding process that ensures that developers meet standards for economic investment, job creation, ratepayer impacts, and environmental stewardship, among other criteria.

For California, the procurement target should be no less than 10 GW by 2040. While this is only a small fraction of the total technical resource potential, 10 GW is significant enough to show that the state is committed to the expansion of this new industry. This amount of offshore wind capacity has already been analyzed in modeling studies of the state's future energy needs, and it's of the size necessary to bring about greater competition and economies of scale from multiple large-scale projects. For project developers, this law would provide the regulatory certainty and de-risked revenue stream to obtain the necessary long-term financing to build these projects. It also would incentivize them to work with the state and local governments to begin the much-needed investment in transmission expansion, port infrastructure upgrades, and workforce development training. By making this clear commitment to the implementation of offshore wind, California can diversify its renewable energy generation portfolio, cost-effectively transition to a carbon-free electricity sector, and become a global leader in the burgeoning floating wind industry.



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