Leading the Charge:
Renewable Energies, Climate Security, and the US Military

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I. Abstract

Climate security exists as one of the greatest challenges to humanity in the 21st century. Profound environmental shifts in the oceans, atmosphere and polar regions create hazards with a high potential to threaten long-term stability in the United States and the world at large. Developments in the field of renewable energy form a significant part of the possible solutions to mitigate and reverse these effects. New and improved technologies for harnessing renewable energy resources make up one aspect of this field, but other factors such as economic strength, geographical feasibility, and political decision making power comprise other salient elements. The United States military occupies a unique position in this context, having both significant economic resources and plentiful and diverse geographic locations. The military’s imperative task of resilience against security threats of all kinds also compels a response to issues of climate security. The research herein investigates the progress in development and methods of application of renewable energy technologies at US military bases in order to deliver greater understanding of best practices and procedures in the global fight for climate security solutions.
II. Introduction

Background: The evolution of human society brings continuous change to the earth’s present and future environment. In the era beginning with the Industrial Revolution, an ever-expanding demand for energy resources gave rise to vast consumption of fossil fuels. The use of these resources significantly impacts our land, sea, and air and plays a major role in the phenomenon of climate change. Neither the employment of fossil fuels nor the mounting threats and hazards of climate change lie evenly distributed across the globe; however, the problems and solutions to these issues require universal involvement and participation.

Scientists, politicians, businessmen and women, and other social innovators from various sectors of industry strive to make progress in mitigating, stabilizing, and reversing these planetary effects. The forces contributing to climate change, unfortunately, are complicated, multifaceted, and devoid of a simple solution. One of the primary methods of deterring anthropogenic climate change calls for the reduction and eventual elimination of fossil fuel consumption. This objective necessitates the development of replacement energy sources, preferably ones with high levels of sustainability and affordability. According to a Renewable and Sustainable Energy Reviews publication, “shifting to renewable energy can help meet the dual goals of reducing greenhouse gas emissions, thereby limiting future extreme weather and climate impacts, and ensuring reliable, timely, and cost-efficient delivery of energy.”

Problem: The path to sustainable energy remains besieged with hardships—alternative sources possess various advantages and disadvantages, and demand for power continues to increase.

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exponentially. Developing nations of the world not only possess rising populations but also expanding industrial and manufacturing capacities and an emerging middle class. This growth pattern will require adaptive strategies to resource management, and Rear Admiral David Titley, Director of the Center for Solutions to Weather and Climate Risk, states that “the National Intelligence Community predicts that by 2030 demand for food would increase by 35 percent, fresh water by 40 percent, and energy 50 percent.”

In previous years the US looked to nuclear power for clean alternatives to fossil fuels, and nuclear facilities still deliver the highest Energy Return on Investment (EROI) according to a 2016 comparison by Energy Policy. Environmental and security concerns, however, along with a risk of high-level catastrophe can discourage its implementation, as “the potential for high consequence accidents influences people more than do the arguments that probabilities of these are very low.” Renewable energies present perhaps the greatest earth-centric solution, but continue to struggle with consistency, reliability, and cost of implementation.

United States Energy Statistics: Figure 1.1 (below) depicts the 2016 US Energy Information Administration (EIA) percentage estimates for American consumption of energy by source. Figures 1.2 and 1.3 show statistics for consumption and production as well as electricity generation and CO₂ emissions, respectively.

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Figure 1.1
Total = 97.4 quadrillion
British thermal units (Btu)

- Petroleum: 37%
- Natural gas: 29%
- Coal: 15%
- Renewable energy: 10%
- Nuclear electric power: 9%
- Geothermal: 2%
- Solar: 6%
- Wind: 21%

Figure 1.2

<table>
<thead>
<tr>
<th>Total primary energy production</th>
<th>83.88 quadrillion British thermal units (Btu)</th>
</tr>
</thead>
<tbody>
<tr>
<td>By fuel/energy source and share of total</td>
<td></td>
</tr>
<tr>
<td>Natural gas</td>
<td>33%</td>
</tr>
<tr>
<td>Oil (includes crude oil and natural gas plant liquids)</td>
<td>28%</td>
</tr>
<tr>
<td>Coal</td>
<td>17%</td>
</tr>
<tr>
<td>Renewable</td>
<td>12%</td>
</tr>
<tr>
<td>Nuclear</td>
<td>10%</td>
</tr>
</tbody>
</table>

| Total energy consumption      | 97.39 quadrillion Btu                      |
| By fuel/energy source and share of total |                                          |
| Petroleum                     | 37%                                        |
| Natural gas                   | 29%                                        |
| Coal                          | 16%                                        |
| Renewable                     | 10%                                        |
| Nuclear                       | 9%                                         |

Figure 1.3

<table>
<thead>
<tr>
<th>Electricity generation</th>
<th>4.08 billion kilowatthours</th>
</tr>
</thead>
<tbody>
<tr>
<td>By major fuel/energy source and share of total</td>
<td></td>
</tr>
<tr>
<td>Natural gas</td>
<td>34%</td>
</tr>
<tr>
<td>Coal</td>
<td>30%</td>
</tr>
<tr>
<td>Nuclear</td>
<td>20%</td>
</tr>
<tr>
<td>Renewable</td>
<td>15%</td>
</tr>
<tr>
<td>Petroleum</td>
<td>&lt;1%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Carbon dioxide (CO2) emissions</th>
<th>5,171 million metric tons CO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>By energy end-use sector and share of total</td>
<td></td>
</tr>
<tr>
<td>Transportation</td>
<td>36%</td>
</tr>
<tr>
<td>Industrial</td>
<td>27%</td>
</tr>
<tr>
<td>Residential</td>
<td>20%</td>
</tr>
<tr>
<td>Commercial</td>
<td>17%</td>
</tr>
</tbody>
</table>
Greenhouse Gas Emissions: In the graphs below, Figure 2.1 shows the increase in atmospheric concentrations of the greenhouse gas (GHG) carbon dioxide, methane (orange), and nitrous oxide (red) from 1850-2010. Figure 2.2 illustrates anthropogenic carbon dioxide emissions from forestry and land use (brown) and those primarily from fossil fuels (grey) during the same span of years, given limited data collection information from 1850 to 1970.5

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The Industrial Revolution provided the momentum for the rise of fossil fuel usage beginning in the latter half of the 19th century. Independent and decentralized decisions by public and private sector individuals, corporations, organizations, and state governments to use

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fuels and other resources that create GHGs have severely impacted the planet’s environmental security. Given the heat-trapping nature of these gases, many members of the scientific community have gone to great efforts to warn national leaders about the dangers they present for the planet. NASA states that “there is no question that increased levels of greenhouse gases must cause the Earth to warm in response”\(^6\) and the Intergovernmental Panel on Climate Change (IPCC) agrees that “scientific evidence for warming of the climate system is unequivocal.”\(^7a\)

The resulting conditions from anthropogenic climate change—environmental impacts originating from human activity—have introduced measurable trends of global warming, oceanic acidification, glacial melt, and numerous other secondary and tertiary effects that impact the planetary environment. These changes, according to the IPCC, produce direct consequences such as an increasing frequency of severe storms, natural disasters, water scarcity, landslides, sea level rise, and flooding coupled with indirect impacts of varying severity on trade, migration levels, pandemics, wildfires, air pollution, transportation, energy and cyber systems, commerce and tourism, food and water security, and other areas strongly linked to climate change that imperil the health and welfare of US citizens and the critical infrastructure that supports the nation.\(^7b\)

*US Military and Climate Security*: The use of fossil fuels still constitutes the majority of energy consumption in the US in the 21st century. In order to bring renewable energies to the frontlines in the fight against climate change, the US military has emerged as a patron and pioneer of

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renewable energy technologies serving to help pivot away from dependence on fossil fuels. Ostensibly an unexpected candidate, devoid of a political agenda or impetus to preserve the flora, fauna, and natural environment of the planet, the military has nonetheless assumed a position of leadership in the movement for renewable energy development.

The US military has a decorated history in developing systems and technologies that can meet public needs and provide solutions for progress in various sectors of industry. Weather forecasting and the National Weather Service started out as relayed information about approaching storms by the Army Signal Corps. Modern commercial air travel uses jet engines and pressurized cabins originally made for combat aviation. Analysis of radio transmissions from the Russian satellite Sputnik led to the creation of Global Positioning Systems (GPS). Even the internet found its roots in the Cold War era computer networks of the Advanced Research Projects Agency. Solutions to the problems of humanity can trace a long line of precedents from military endeavors, and the present need for renewable energy technologies and implementation strategies welcomes all manners of ingenuity.

The factors driving the need for renewable energy initiatives involve cost savings and mandates from the Pentagon, but another critical element is the big-picture awareness of how the direct and indirect consequences of anthropogenic climate change will affect the military. Admiral Titley, in a brief to the Center for Naval Analyses (CNA)’s Military Advisory Board (MAB) stated, “climate change will be a catalyst for conflict in fragile areas and U.S. military involvement could be an option in response to the conflicts.” Threats appear both domestically

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and abroad, with installation vulnerabilities to sea level rise, extreme weather events, wildfires, and other hazards. “Our bases are where we generate readiness,” says Admiral Titley. “It is where we train, garrison, repair, maintain and prepare to deploy… It is not just the bases, but also the surrounding communities, which house and support the military.”

Outside the US, humanitarian response and disaster relief is projected to increase, with parts to play by the military as well. “Witness more than 13,000 military troops that responded to Typhoon Haiyan in the Philippines late last year,” cites Admiral Titley, who forecasts a continued rise in the “demand for active duty forces to provide defense support for civilian authority.”

While renewable energy initiatives extend to both operational and fixed occupation military environments, the more salient impacts for civilian sector energy progressions mostly stem from the systems that power permanent and semi-permanent military installations. This investigation will look at implementation and development of these technologies at Department of Defense (DoD) bases and installations in the US to illustrate some of the challenges and solutions they face and to show best practices and lessons learned that may translate to other government and civilian sectors. To frame this undertaking, the researcher primarily seeks to answer the question:

What operational ideals of the US military compel the expeditious development and implementation of renewable energy resources at DoD installations, and how can these qualities inform public and private sector renewable energy initiatives?

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III. Discussion Methodology

To address this question (above), the researcher proposes to investigate four aspects of the US military to determine which, if any, serve as the principal operational ideals driving the DoD’s proactivity regarding renewable energy. The dependent variable is recognized as the military’s determination to develop renewable energy capabilities at US installations, and the following four components represent the independent variables of this study:

Variables

2. Efficiency: conservation of resources—monetary and non monetary.

Hypothesis:

At the onset of the investigation, predictions for the outcome of the research question synthesized elements of all four variables, with greater relevance assigned to each respective to the listed order. Resilience prevailed as term of constant use under the Obama administration, and efforts towards greater readiness and resilience better enable military units to complete their given mission—a primary goal in the eyes of the armed services. Budget concerns also take top priority. The military is a proponent of lowest-bid procurements of contracts, services, and equipment as long as they meet the criteria for “lowest-price, technically acceptable” (LPTA) designation,\(^\text{11}\) and widening margins for potential savings from renewables would likely stand

out to installation controllers. The third and fourth variables seemed contributory but less plausible as determining ideals, since top-down directives are contingent upon political positioning and the scope of what lies within the operational environment (relevant to climate change) remains a subject of national debate. Before entering into the research phase of the investigation, the hypothesis of the researcher asserted that resilience and efficiency marked the principal drivers of the DoD’s renewable energy development.

Sample:

Research into renewable energy development for this project examines DoD installations in the continental US. While Army and Air Force initiatives contribute to the discussion, a narrower focus is granted to Navy and Marine installations because of the greater immediacy of their efforts. In 2009 the Senate’s mandate (U.S.C. §2911) that the DoD “produce or procure ≥25 percent of the total quantity of facility energy from renewable energy sources beginning in 2025” set the standard for all branches of the military; however, the DoN took measures a step further with five energy goals to meet and exceed this mandate.12a Figure 3 lists the DoN’s energy goals, issued in 2012.11b

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Marine Corps Air Station Miramar (MCAS Miramar) serves as a singular case study within the sample to allow for an example of greater depth of analysis at a specific installation. MCAS Miramar showcases effective renewable energy implementation, strategies for partnering and collaborating with civilian sector actors and agencies, and represents “one of the most forward-leaning military installations in the Marine Corps in terms of renewable energy fuel source diversity and versatility.”

*Research Methods:*

Conduct of research for this project collects data from multiple channels and numerous sources, including personal interviews with individuals working in the energy departments of military bases and civil-military contracting companies; publications from US government agencies and multilateral organizations on climate security, resiliency initiatives, and renewable

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energy projects at US military bases; policy memorandums, official documents, news reports, scholarly articles, and online databases, all of which served to support and craft the context, discussion, and analysis for the project. Additionally, attendance by the researcher of The Center for Climate and Security’s 2017 conference “Security & Climate Change: Issues and Perspectives for the Pacific Coast” in San Diego further developed leads through the information presented at the panels as well as with speakers and attendees at the event.

Information resources yielded both qualitative and quantitative data for the investigation of this project. Qualitative data from primary and secondary sources along with statements of individuals and written accounts of policy and position from US government and military offices offer insight on the context of the problem, specific cases of renewable energy implementation, current and planned renewable energy projects, and strategies and practices contributing to developments in the field. Quantitative data pertaining to the origins of climate change, energy and emissions statistics, DoD environmental resource programs, as well as cost and efficiency data expands the understanding of US military’s relationship to renewable energy. Sources of qualitative and quantitative data include agencies such as the Department of Defense (DoD), Department of Energy (DoE), US Energy Information Administration (EIA), National Resource Defense Council (NRDC), Department of the Navy (DoN), National Aeronautics and Space Administration (NASA), Strategic Environmental Research and Development Program (SERDP), United Nations Framework Convention on Climate Change (UFCCC), the Intergovernmental Panel on Climate Change (IPCC), US Congress, and the White House.
**Limitations:** Research and execution of this project comes with several limitations the researcher wishes to note. First, all data acquired during project research and all resulting findings are unclassified and open to the public. Adhering to unclassified material gives greater audience availability and possibilities for fact checking and follow-on research, but may not cover all present and planned development and strategies for the implementation of renewable energies at DoD installations. Access to military facilities and personnel along with restrictions in information release may have impeded the scope of research into the subject matter. In the same vein, the researcher did not visit in person any military installations to witness renewable energy development firsthand. Time considerations for the research phase of the project may deliver findings that do not represent the totality of information available for the investigation. A preponderance of data exists both online and in the physical world regarding the subject in question, and the researcher is but one man. Personal, political, or positional motivations may impact the wording, presentation, or inclusion of information given among collected sources of data, both in orally delivered information and in published works. At the onset of the project, the researcher took the dependent variable (military interest in renewable energy) as given based on available evidence prior to a more thorough investigation. No contradiction arose. Independent variables came similarly as trends manifested during preliminary research. Finally, the imagination of the researcher may not perceive every angle or interpretation of the information available, nor every limitation affecting the study. Caveat: the positions taken in this document do not necessarily reflect official policy or position of the US government or the DoD and is intended for discussion purposes only.
IV. Data & Analysis

“We’re doing it – not because it’s green, but because it increases our war fighting capability,” states Rear Admiral Yancy B. Lindsey, discussing projects involving renewable energy and sustainable resources. “We do it because it improves our ability to do our job.” 14a Admiral Lindsey serves as the Commander of Navy Region Southwest, one of the largest of the 11 regions of the Navy that encompasses 10 installations including Naval Station San Diego and Naval Base Coronado.15 His approach to climate security and adapting to renewable energy technologies matches his approach to most all of his decisions—a perspective that values “war fighting enhancement and operational capability and efficiency.” 14b

Admiral Lindsey’s comments relate strongly to how the military undertakes the transition to renewable energy—the DoD pursues the challenge as it would a military operation. The standard Operations Order (OPORD) used by all branches of the military within the DoD is formatted into five paragraphs: Situation, Mission, Execution, Sustainment (formerly Service and Support), and Command and Control (see Appendix A).16 OPORDs can apply to simple tasks at the most basic level of the military or reach levels of extreme complexity with pages numbering in the thousands and covering entire theaters of war. Each of the dependent variables under examination in this study connect and align with different sections of the OPORD, and employing the aid of this format can help to understand a military-style approach to the integration of renewable energy technology.

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Independent Variable 1: Resiliency

OPORD Paragraph: Mission. Resiliency lies at the heart of the military’s ability to Complete the Mission, no matter the task assigned. "Resilience," as defined by an executive memorandum from President Barack Obama, “refers to the ability to anticipate, prepare for, and adapt to changing conditions and to withstand, respond to, and recover rapidly from disruptions.”

The mission paragraph of an OPORD details the “Who What When Where Why” of an operation. In considering the task as the implementation of renewable energy technologies to enhance measures of resiliency, Who associates with the participating military installations, What refers to the energy systems, When derives from the Chain of Command (CoC)’s timeline, Where is respective to the installation’s location, and Why describes the importance of enhancing resiliency in order to remain mission capable. The Why is essential because it expresses the “Commander’s Intent”—a vital element in operational planning and execution that, with adequate comprehension, allows for decentralized decision making and expeditious actions by subordinate units to achieve the desired goals and end-state. The Command and Control Research Program (CCRP), charged by the Pentagon to help “DoD take full advantage of the opportunities afforded by emerging technologies,” published Planning Complex Endeavors in 2007, which states:

People and organizations who have explored the problem together understand command intent more thoroughly and see the role of their actions in carrying out

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that intent more clearly. This gives them a greater capacity for adaptation and innovation within those boundaries.19

Under the Obama administration, policies and statements from the top of the military’s CoC—the Commander-in-Chief himself—clearly establish climate security resiliency measures as a critical element of the Commander’s Intent with regard to the functions of the DoD. Issuance of the “Presidential Memorandum—Climate Change and National Security” in 2016 arrived as a culmination to nearly a decade’s worth of dedicated efforts to improve resiliency across a wide spectrum of governmental departments.20a The “Presidential Memorandum” reinforces previous policies set prior to the 2017 regime changeover, such as:

- The 2015 National Security Strategy, which “identified climate change as an urgent and growing threat to our national security” and highlighted the direct and indirect threats of climate change to the nation’s critical infrastructure.20b
- “Executive Order 13693” of March 2015, directing “federal actions to improve environmental performance and federal sustainability.”20c
- “Executive Order 13677” of September 2014, setting “requirements for systematically integrating climate-resilience considerations into US international development work.”20d
- The President's “Climate Action Plan” of June 2013, which “included actions to help prepare the United States for the impacts of climate change.”20e

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• “Executive Order 13653” of November 2013, directing “federal agency actions to incorporate climate-resilience considerations into agency operations and other mission objectives.”

After establishing the observed emphasis on actions towards improved resilience, the investigation looks to determine what measurable impacts this imperative has produced for renewable energy technologies at US military installations. Figure 4.1 (below) depicts a map of the continental US with red icons representing DoD installations. The DoD’s physical plant consists of “more than several hundred thousand individual buildings and structures located at more than 5,000 different locations or sites. When all sites are added together, the Department of Defense utilizes over 30 million acres of land.” Figure 4.2 provides a second map created by the DoD’s Strategic Environmental Research and Development Program (SERDP), showing completed and ongoing renewable energy projects at DoD installations. Locations are color-coded according to the branch of service funding each project. The database accounts for 189 total renewable energy projects at DoD installations as of 2017, as well as each project’s name, status, location, branch of service, and detailed description for public use.

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According to the Center for Climate and Security, “climate change will impact the US military’s readiness, operations and strategy...in a range of ways,” and its response for enhanced resiliency will cover a similarly broad expanse: “diversifying its energy portfolio, defending coastal installations from sea level rise, adapting training areas and improving water management, amongst other measures.”

The DoD primarily invests in biofuels, wind, and solar power for renewable energy initiatives, but the objective remains to exist as an “interoperable...

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force better prepared and more widely available to prevent and respond to crises.\textsuperscript{26} These renewable energy sources hold a significant advantage over conventional fuels, however, because they can be produced on-site at geographically permissible military installations. After building the requisite microgrid systems to generate and distribute the energy, biofuels, photovoltaic (PV) systems, and wind turbines can produce localized electricity when the appropriate conditions are met.\textsuperscript{27a} As energy storage technologies continue to improve, these microgrid systems become more attractive and affordable, but already they grant a small number of installations around the US an “islanding” capability whereby the base can produce its own power independent of an external grid system for a limited amount of time.\textsuperscript{27b} Coupled with power redundancies from traditional fossil fuel systems burning lean diesel, serving as a reserve should renewable sources prove insufficient to demand, microgrid islanding magnifies energy security measures and greatly improves an installation’s resiliency.\textsuperscript{27c}

\textit{Independent Variable 2: Efficiency}

\textbf{OPORD Paragraph: Sustainment.} The principal concern for the DoD in regards to efficiency lies in the fiscal realm. Like any complex organization, the military operates on a budget—one that must be approved each year by Congress, with expenses to the taxpayer justified to the satisfaction of an army of bureaucrats. Budget decisions find roots in tactics, strategy, and mission readiness, but must also contend with other priorities in federal funding allocations as well as the contemporary public and political will. While aspects of military


efficiency can take many forms, in this case “Economy of Force” brings relevance to the discussion. Finding origins in the “Principles of War” outlined by Carl von Clausewitz,28 Army Field Manual (FM) 100-5 defines economy of force as “the judicious employment and distribution of forces” with the intent to “employ all combat power available in the most effective way possible.”29 The Sustainment section of an OPORD pertains to logistics, administration, and service and support elements of an operation—to include accounting for resource management. With the deliberate substitution of military installation “resources” in the place of “forces” and “combat power,” the principle of economy of force dictates that renewable energies, if capable of effectively supplying installation power requirements and fulfilling end-state requirements of reduced fossil fuel usage, provide superior assets for completing Mission objectives.

The Navy and the Marines currently hold the most robust plan for energy efficiency measures, with goals to both produce more renewable energy internally (50% of shore-based energy by 2020) than required by the Presidential mandate and to reduce total energy consumption levels (achieved 50% lower commercial vehicular petroleum in 2015).30 With certain exceptions, DoD procurements adhere to the LPTA model by awarding contracts to the lowest bidder and purchasing equipment for the least acceptable cost. In their current state, however, renewable energy technologies do not match the LPTA model. In terms of raw Energy Returned on Investment (EROI), and disregarding GHG emissions, Figure 5 shows a 2015 graph of energy source rankings.

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Figure 5: Energy Returned on Investment by Source (2015)\textsuperscript{31}

The number assigned to each source corresponds to an input/output ratio expressed in joules—that is, the amount of work performed in order to obtain the energy output. An energy source has to achieve an EROI score of seven (1 joule expended, 7 joules gained) to pass a generalized criteria for fiscal viability (PVs and biofuels fail, as does wind used with battery storage).\textsuperscript{32a} These statistics, compiled by a team of German scientists and published in the scientific journal \textit{Energy}, cannot be fully relied upon as they do not account for numerous variables such as the higher cost-reward for renewables after recoupment of the initial technology investment. Nor do they itemize the elements attributing to work input, or assess any future value to reduced GHG emissions in the Earth’s atmosphere—a figure that cannot yet be accurately calculated. They do, however, convey a sense of the mountains that remain unsurmounted for renewable technologies attempting to compete in a capitalist economy. With the given conditions of the study, the EROI of fossil fuels, hydroelectric, and nuclear power rise above renewable energies by at least one order of magnitude.\textsuperscript{32b}


Independent Variable 3: Discipline

OPORD Paragraph: Command and Control. In President Obama’s “Address to Congress” in March of 2009 he stated, “to truly transform our economy, protect our security, and save our planet from the ravages of climate change, we need to ultimately make clean, renewable energy the profitable kind of energy.”³³a The military is, in essence, apolitical. Disciplined and trained to obey orders, it functions well as a war-fighting machine because it remains focused the mission and the directives sent from higher command. While not entirely rigid, with varying levels of authority through the echelons of commissioned and non-commissioned officers, a decision such as the one to systematically transition to renewable energy has to come from the top. President Obama set a vision and outlined courses of action from the beginning of his eight years leading the Executive Branch: he asked Congress to deliver “legislation that places a market-based cap on carbon pollution and drives the production of more renewable energy in America,” and followed through with a commitment to “invest fifteen billion dollars a year to develop technologies like wind power and solar power; advanced biofuels, clean coal, and more fuel-efficient cars and trucks.”³³b The “Command and Signal” paragraph of an OPORD tells the location of higher command, as well as adjustments to a unit’s Standard Operating Procedures (SOPs).³⁴

Although he never served in the Armed Forces, President Obama effectively communicated his Commander’s Intent—an essential component of the third paragraph: Execution. As his presidency unfolded, so did the “Concept of the Operation”—usually the most

developed section of an OPORD, detailing the specific tasks and actions to be performed along with a narrative of the plan.\textsuperscript{35} The disciplined and hierarchical structure of the military, built to perform tasks and accomplish objectives, could work with this sort of direction. By October of 2009 the Army had published its “Army Energy Security Implementation Strategy” and “Secretary of the Navy Ray Mabus promulgated five energy goals for the Department of the Navy” (see Figure 3 above). The Air Force, DoD, and the Marines followed in suit from 2010-12 with their respective policy publications, and in each case the standards the departments set for themselves exceeded the expectations issued by the President.\textsuperscript{36}

The discipline shown by the DoD’s rapid adoption of renewable energy technologies, resources critical to the accomplishment of the objectives designated by the President and those undertaken by the individual branches, again owes attribution to Clausewitz’s Principles of War. "Every unnecessary expenditure of time, every unnecessary detour,” claims Clausewitz,” is a waste of power, and therefore contrary to the principles of strategy.”\textsuperscript{37} Napoleon gains a modicum of credit as well for coining the Naval expression, “never lose a minute.”\textsuperscript{38} The nature of command is to issue an order, supervise its execution, and enforce measures of accountability. The expeditious development of renewable energy initiatives by DoD installations owe much of their success to the inherent qualities of the military that emphasize prompt and efficient action, but the command authority and strategies for accountability dually served to help maintain momentum. An example comes again from President Obama’s “Presidential Memorandum—


Climate Change and National Security,” with the instructions that within 90 days of the memorandum an Action Plan would be crafted to designate the manner of the memorandum’s execution, with “specific objectives, milestones, timelines, and identification of agencies responsible for completion of all actions described therein.”39a A working group charged with creating the Action Plan saw to its implementation, and was itself accountable to “the Assistant to the President for National Security Affairs and the Assistant to the President for Science and Technology.”39b

The effectiveness of the US military’s command structure has its disadvantages. The other side of the coin becomes apparent when the mission lacks clarity or commands find repeated contradiction. These instances can happen in battle, or they can arise in times of peace with situations such as a change in leadership. From 2009 to 2016 an articulated vision for renewable energies at DoD installations provided consistency and direction for the military. The new administration following President Obama, however, sends mixed signals. In June of 2017 the US withdrew from the Paris Climate Agreement, a single-minded decision to “abandon the agreement for environmental action signed by 195 nations” that the US had previously pledged to uphold.40 With the US as the second-largest consumer of fossil fuels on the planet, this step away from multilateral participation in climate security solutions countermanded international initiatives taken by the US for nearly a decade. Domestically, the Commander-in-Chief issued a permit previously denied under the Obama Administration for completion of the Keystone Pipeline (Dakota-Access Pipeline), and less than eight months later a 210,000 gallon oil spill

now threatens the water security of thousands of US citizens.\textsuperscript{41} Fear and unrest among government-funded scientists who support responsive actions to issues of climate security diminish levels of confidence for renewable energy initiatives already underway at DoD installations. A 2017 executive order on “Promoting Energy Independence and Economic Growth” revoked the Obama Administration executive order “Preparing the United States for the Impacts of Climate Change;” the memorandums for “Power Sector Carbon Pollution Standards” and “Climate Change and National Security;” and rescinded a memorandum to “Reduce Methane Emissions” as well as President Obama’s “Climate Action Plan.”\textsuperscript{42} While the military itself can strive to be objective and apolitical, the pinnacle of the command structure remains very much entrenched in the politics of the hour. This vulnerability holds a real potential to unravel much of the progress installations have achieved in their renewable technology ambitions.

\textit{Independent Variable 4: Situational Awareness}

\textbf{OPORD Paragraph: Situation}. A key element to overcoming issues of climate security, or approaching challenge or obstacle, comes with understanding the nature of the threat. Knowing the level of risk, the affected stakeholders, priorities for near and far targets, and a sense of what to expect relates directly to what a military leader does when assessing the situation for an operation. The Situation paragraph of an OPORD divides into three sections: Enemy Forces,
Friendly Forces, and Attachments/Detachments.\textsuperscript{43} Enemy Forces describes the elements of the situation that may hold threats or hazards for the operation’s participants and chances of success. Weather, terrain, and other natural conditions are included along with whatever information higher command possesses of a human threat (when applicable).\textsuperscript{44} Friendly Forces include the actions of other higher units or allies participating in the operation, and Attachments / Detachments refers to other assets assisting or separating from the effort. Situational awareness in regards to climate security comes with a responsibility for the DoD and its subordinates to gain information superiority on the strength, location, composition, and disposition of the threats imposed by climate change in accordance with actions taken during military operations. President Obama’s “Climate Change and National Security” memorandum gave orders to “identify the most current information on regional, country, and geographic areas most vulnerable to current and projected impacts of climate variability in the near- (current to 10 years), mid- (10 to 30 years), and long- (more than 30 years) term.”\textsuperscript{45}

Situational awareness for climate security requires attention to immediate threats but also (perhaps more importantly) to the increasing level of danger to civilizations presented by climate conditions unfolding over the coming generations. The mitigation of these risks benefits greatly from advanced planning, allowing humanity to adapt and respond to climate change as a military unit would shift tactics in accordance with an enemy’s actions on the battlefield. The DoD has particular advantage in this arena because of its inherent focus on various elements of security:

physical, informational, logistical, cyber, and now climate security. Additionally, the “lead from the front” attitude comes organically to military units, and leadership in the fight for climate security bears a monumental importance in the effort safeguard the nation.

Case Study: MCAS Miramar

OPORD Paragraph: Execution. “The things that the Marine Corps and Navy are doing in the Southwest are directly relevant to installations elsewhere,” states Commander David Slayton (USN-Ret.) of the Center for Climate and Security’s Advisory Board. “They provide a critical testbed for these technologies to be applied not just to US installations but to our friends and partners” outside the boundaries of the military and of the US.46 MCAS Miramar stands out as a place of action, and exemplifies an excellent case of how the military executes its mission to harness greater capacities in renewable energy. To demonstrate how the independent variables of this investigation can apply to a single military installation—as a representative of the sample, with the given conditions of the dependent variable—consider the case of MCAS Miramar’s developments in renewable energy technologies starting in 2010.

Overview: The Marine Corps selected MCAS Miramar as “the prototype installation by the DoD/DOE Net-Zero Analysis Task Force, focusing on its energy and greenhouse gas emissions baseline, energy efficiency measures, renewable energy potential, electrical system, and transportation fuel use.”47 Home of the 3rd Aircraft Wing in the Navy Region Southwest

(NRSW) command, it holds a community of approximately 15,000 service members, families, and civilian workers.\textsuperscript{48ab} Nearly 9,300 Marines occupy the air station along with roughly 200 fixed and rotary wing aircraft, a small installation relative to other US military stations in NRSW.\textsuperscript{48b} The unit maintains a regular deployment cycle and “prides itself in being ready” when the nation has need of it, along with the air station’s ability to train and “maintain the lethality of the Marine Air Ground Task Force's air combat power [which] must never be compromised.”\textsuperscript{48c}

The Installation Energy Manager (IEM), Mick Wasco, is a civilian contractor billeted in a Marine Corps officer position, has served in that capacity since 2013 after joining MCAS Miramar in 2011.\textsuperscript{49}

\textit{Renewable Energy Developments:} In September of 2017 MCAS Miramar broke ground on a new renewable energy project, a microgrid system to be completed in 2018 that will augment and integrate the installation’s existing renewable infrastructure.\textsuperscript{50a} Already in place at the air station are renewable technologies that “utilize power generated with biogas from a local landfill, solar hot water systems, and solar photovoltaic (PV) generation.”\textsuperscript{50b} Once complete, the microgrid will combine the station’s energy resources using a power distribution center and Supervisory Control and Data Acquisition (SCADA) system developed by the National

Renewable Energy Laboratory (NREL) to regulate electrical output efficiencies and maximize the installation’s use of its renewable energy assets. The combined systems will control:

- 1 MW Solar PV Carports
- 356 KW Solar PV Thin-film roof systems
- 3.2 MW landfill gas
- 6.45 MW diesel and natural gas power plant

The dark brown bar sections represent energy consumed from off-site power, the light brown shows the use of installation lean-diesel generators, and the green combines data from biofuel and PV systems.

Figure 6: MCAS Miramar Renewable Energy Production, by Year

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Islanding: In 2016 MCAS Miramar gave a demonstration of its “islanding” capabilities, meaning the off-grid operational capacity of the installation with mission-critical facilities maintaining power supply “using only solar and advanced energy storage technology, with no conventional diesel generation.”\(^{52a}\) Funding for the demonstration came from the California Energy Commission.\(^{53a}\) While “islanding,” the isolated grid system conserves energy “by remotely turning off non-essential functions in the building to extend islanding time.”\(^{52b}\) This capability primarily comes in use during an energy security incident, such as the 2011 blackout where a “tiny misstep shorted out the Southwest Powerlink — a major electrical artery for the region and a key part of the entire Western grid — and sparked one of the biggest blackouts ever to strike North America.”\(^{54}\)

Another set of assets MCAS Miramar can employ while “islanding,” during an energy security issue, or for field use are the 40 commercial-sized electric vans the air station acquired in 2016.\(^{53b}\) Capable of bi-directional charging with certain equipment and energy ports, the vans enhance the air station’s resiliency by delivering off-grid readily transportable power supplies for mission-critical tasks for designated use or in the event of an energy emergency.\(^{53c}\) Improving its “islanding” capacity allows MCAS Miramar to work further towards the end-state of achieving Net Zero Energy Installation (NZEI) status. The DoN and Marine Corps’ expressed goal of having 50% of the department’s installations operating at net-zero by 2020 requires on-site


energy production and consumption to neutralize or attain a positive production flow.\textsuperscript{55} MCAS Miramar plans to reach that objective no later than 2020.

\textit{Independent Variables:} The air station’s development of renewable technology owes attribution, with differentiated value, to each of the independent variables described in this investigation. Resiliency forms the principal impetus, not only because MCAS Miramar’s mission imperative requires uninterrupted capabilities from “more than 100 mission-critical facilities, including flight line operations” that provide short-notice “combat ready expeditionary aviation forces,” but also because the Marine Corps prides itself in preparedness against any manner of foe or hardship.\textsuperscript{56} Situational awareness factors into the calculations the installation’s leadership use to ensure resiliency and maintain a state of readiness. MCAS Miramar’s first inclusion of renewable technology derived from practices in efficiency—the installation recognized an advantage in granting landfill space for the City of San Diego and now harnesses 45% of its energy requirements from the methane byproducts.\textsuperscript{57}a Discipline and fulfilling the intent of higher command also plays a strong role, as IEM Wasco “runs the energy program at the base specifically for the greater purpose of following the same strategy” as the directives from the Marine Corps, DoN, and DoD.\textsuperscript{57}b

\textsuperscript{57}ab Wasco, Mick (November 9, 2017). Installation Energy Manager: Marine Corps Air Station Miramar. Personal Communication.
Constraints:

In order to maintain assuredness of its qualities of resiliency, MCAS Miramar cannot yet commit fully to renewable energy technology to power installation facilities. Even when it reaches NZEI status, IEM Mick Wasco has no plans to reduce the redundant energy from diesel generators on the base because the the renewable technologies have not yet proven to be 100% reliable.\textsuperscript{58a} Fluctuating levels of captured PV and burnable biofuel at the installation’s renewable assets do not produce a sufficiently consistent energy supply. “The landfill power has issues with intermittency,” says Wasco. “You can’t control the quality of the methane gas that comes out of the landfill. Our engines have issues dealing with the gap, and they can actually drop offline just solar would do with cloud cover. Energy storage is the missing piece of the puzzle to make renewables work.”\textsuperscript{58b} Electrical storage to mitigate these consistency variations is improving, but the acquisition of future generations of battery technology proves costly. Upkeep and maintenance on both renewable and fossil fuel electric generators remains necessary, further adding to the overall expense.

Summation:

MCAS Miramar’s developments in renewable energy technologies will soon mark it as a NZEI, however its need for energy redundancy and versatility will keep fossil fuels on the internal grid for the foreseeable future. Efforts to improve resiliency primarily drive renewable technology developments without official regard for the ideological aims of climate change mitigation. Energy projections for 2018 predict 20% consumption of non-renewable sources, and estimate a savings of over $1 million annually from microgrid generating capacities.\textsuperscript{57c}

\textsuperscript{58a} Wasco, Mick (November 9, 2017). Installation Energy Manager: Marine Corps Air Station Miramar. Personal Communication.
V. Conclusion

The DoD currently holds dual superlatives as “the single largest consumer of energy in the United States” and the largest government spender on renewable energy technologies. While petroleum-based liquid fuels comprise “approximately two-thirds of the DoD’s consumption,” its installations account for over 20% and offer opportunities for clean energy improvements through renewable technologies. These initiatives possess not only a policy directive, but an operational imperative by helping to “increase warfighter efficiency, enhance energy security and cut installation and operational energy costs.” The

After conducting this investigation into the military’s involvement with renewable energy and climate security, several themes relevant to the independent variables have emerged for the benefit of public and private sector actors intending to pursue renewable technology developments. These themes use terms that parallel the focuses outlined by Ray Mabus, who served as Secretary of the Navy under President Obama from 2009-2017. Honorable Mabus, charged to "conduct all the affairs of the Department of the Navy," supervised the greater part of the Navy’s transition to operations characterized by sustainability and energy security in the 21st century—including the sailing of the “Great Green Fleet” and the goals for alternative and renewable energies shown in Figure 3 above. People, Platforms, Power, and Partnerships represent the four focuses of his vision for the Navy while in office, and the following

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themes—based on the findings of this investigation—seek to enhance energy security efforts in the DoD, the US, and around the world.62

Four Themes: People:

Improving energy security in the near term and the far represents an imperative goal for preserving the health and welfare of the people of this planet. The military’s reduced consumption of fossil fuels adds to this effort, but the larger mission to aid all of humanity in this transition also stands to benefit. By taking responsibility for its own energy security and altering its impact on the environment of the earth, the military demonstrates leadership and sets a course that others may follow in gaining their own modicums of resilience. The global response to climate change depends on the actions of people around the world, but motivation and direction for these efforts requires the shaping force of entities with substantial resources and authority such as the US military.

Large populations of people worldwide face increasing degrees of peril as the threats and hazards of climate change are made manifest. With dense concentrations in cities and coastal regions, climate security in the coming years presents a host of unique challenges to nations on every continent. Meeting the goals for energy security set forth in documents such as the Paris Climate Agreement, the climate action plans of individual states, and organizational mandates such as those undertaken by the DoD and its subsequent departments provides critical benchmarks and methods to work towards the greater good of all of humanity. Near term

progress, like beginning and continuing the transition to renewable energy, works in accordance with long term strategies such as the eventual elimination of widespread fossil fuel consumption.

A key aspect of using people as a resource involves information sharing. With the majority of energy consumption in the US and in the DoD still coming from fossil fuel sources and those that produce GHGs, a scalable effort towards re-shaping energy systems becomes necessary to address concerns of climate change in a timely manner. Identifying causes and solutions to issues of climate security only helps through the broad and expeditious sharing of the obtained information. The networks, partnerships, business relationships, and political forums in which the military has significant participation and influence similarly becomes a shaping force for renewable energy developments through this proactive sharing process. The DoD “has a geographically extensive presence and involves rapidly changing military technology and research and development that may be impacted by renewable energy projects;” as one of the largest organizations in the world, it holds perhaps the strongest potential for addressing climate change concerns through the integration of efforts from all people—both military and civilian.\(^6^3\)

MCAS Miramar demonstrated an installation’s potential to send and receive benefits from information sharing during its 2016 microgrid demonstration. Having acquired one source of renewable energy through partnering with the City of San Diego to use a biofuel byproduct of the city’s landfill, the air station sought assistance from the California Energy Commission for the demonstration. The Commission agreed to fund the project and more than a dozen private

companies and state agencies contribute technology assets and information. The demonstration also served other local military installations by creating a clear implementation strategy along with a display of its efficiency and resiliency advantages. Employing people as a resource, through networking channels, information sharing, and the widespread adoption of climate response solutions by populations worldwide cultivates increasing levels of resilience and energy security and a decreasing threat potential from issues of climate security.

*Platforms:*

Platforms, in this context, refer to those that improve energy security—specifically platforms for harnessing renewable energy, for storage and distribution, and for aiding the transition away from fossil fuel sources. The DoD’s investments in PV and wind systems at its installations helps to develop new technologies, improve existing ones, and make the markets in which they are produced and sold profitable. As previously discussed, the task of making “clean, renewable energy the profitable kind of energy” stands paramount for facilitating a rapid reduction in global GHG emissions. As greater numbers of people across the earth gain awareness of the perils imposed by climate change, a corresponding need arises for practical and accessible platforms for countermanding these effects.

One practical solution exemplified in the DoD’s development of renewable energies centers around the use of available resources. To accommodate considerations of efficiency, taking advantage what is already available or readily accessible proves an expedient strategy. These resources can be naturally occurring (sunlight, wind), geographically preexistent (geothermal), anthropogenic (established infrastructure, repurposed material), or others. For

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example, MCAS Miramar harnesses 55% of the energy it produces from biofuel—the methane by products from the City of San Diego’s landfill, which the base offered to store in order to gain a renewable energy source. Each location’s requirements differ. In some cases, the available assets become more economically feasible after technology improves or the initial investment requirements sufficiently decrease. The environmental cost of using non-renewables also plays a factor, although this cost is often overlooked due to the difficulties in rendering accurate and consistent estimates.

A new PV storage platform in Australia helps illustrate this point. The country consumes an overwhelming majority fossil fuel energy in comparison to other sources and exists as “one of the world's worst per capita greenhouse gas polluters due to heavy use of coal-fired power.” Thus far coal has proven less immediately expensive than renewable sources across the nation, but heightened awareness to climate change shows future monetary and planetary costs of coal as potentially much greater. Through partnership with Tesla, a region near Adelaide has developed a PV system “three times more powerful than any system on Earth" according to Elon Musk. Sunlight and coal each proved to be readily available as resources in the area, but shifting to PV generation creates a long term advantage on both monetary and planetary costs.

The concept of developing platforms that harness energy using readily available resources applies unilaterally. While some regions of the world may have greater initial propensities than others, getting creative becomes easier as technological developments continue to hone an edge for economic advantage. Wind and solar power platforms compete for the

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greatest levels of progress—in 2016 “more than 14 GW of solar capacity was added” to the US energy mix, nearly doubling “the record-breaking new amount in 2015.67a America’s first offshore wind farm began operation on Block Island.67b Lying off the coast of New England, an area without the requisite sunlight consistency for effective PV systems, energy producers had to look in a different direction. By the end of 2016, wind “began the largest source of renewable capacity in the United States, beating out hydropower” to become number one in the field.67c Iceland, a pioneer in geothermal energy, built facilities that “currently generate 25% of the country’s total electricity production”—US military installations do not yet have anywhere near this geothermal capacity, but actively seek methods by which to increase net renewable energy gains.68

*Power:*

While the means of generating electric power forms a principal subject of this investigation, the DoD’s progress in developing renewable energy technology employs several other avenues of power that contribute to local, national, and international solutions for energy and climate security. In his vision for the Navy’s initiatives in resilience, Honorable Mabus states that the undertakings “make progress toward greater energy security, building on a record of alternative energy long term innovation from sail to coal to oil to nuclear to biofuels, wind, and solar power.”69 This process of adapting to a changing global environment (and the power relationships contained within) is not a novel concept. Whether making weapons from metal instead of stone, propelling ships by engines rather than sails, or generating electric power from


the sun and wind in lieu of burning fossil fuels, civilizations continue to evolve their practice of existence. As new technologies are created or become available, or as new challenges present themselves, shaping the response of humankind involves the interplay of various elements of power or influence.

Through its actions as a prime mover in the transition to renewable energy, the DoD executes maneuvers in fields of political power. The French and Raven interpretation of political power articulates six “Bases of Power:” legitimate, expert, reward, coercive, referent, and informational.70a Due to its size, national and international influence, and level of power consumption, the renewable energy efforts by the DoD (and subsequently the US) directly and indirectly exerts all six bases of power. Its recognition of energy and climate security issues brings heightened legitimacy to the cause on a global scale. Funding and research and development initiatives create opportunities to establish expert knowledge and further scientific and conceptual understanding of and response to climate change. Political, economic, and environmental rewards come to the DoD and its partners and stakeholders as the energy transition to renewables continues to progress; similarly, consequences in the same three categories serve as coercive forces for non-participants. Referent and informational powers arise bi-directionally through partnerships, associations, and information sharing as the joint efforts of civil and military actors provide greater degrees of energy and climate security.70b

An entirely separate investigation and analysis for applications of the French and Raven model to the DoD and renewable energy, however the salient aspect for purposes of this discussion is that power comes to those who embrace proactive change. The DoD and its

decision to lead the charge in energy transition creates a global impact, one that grants not only long term benefits for humanity but also (if its momentum continues) US leadership in this critical 21st century challenge. By extension, state and civilian sector actors and agents can grasp this opportunity to establish their own relative degrees of the bases of power. Military strategies of recruitment, resource mobilization, alliances, and treaties and accords find their parallels in the fight for planetary security, and the wise and judicious application of power equally holds sway.

**Partnerships:**

Partnerships enable improvements to resiliency. The military provides the intent, guidance, and funding for renewable technology development, but the actual work to accomplish these projects involves the coordination and cooperation of government and civilian sector entities. Whether simply procuring and installing equipment or conducting research and design for new technologies to meet a specific need, the partnerships necessary to meet each independent objective originate from the use of military and non-military resources to complete the mission. Commander David Slayton, an advisory board member for the Center for Climate and Security, discusses the collaborative efforts of the US military, stating “we’ve spent years developing joint ventures between DoD, DoE, places like Stanford, Google and other tech companies, to pull together the best and brightest minds in this area.”[71] These cooperative exchanges “strengthen the capacity of existing partnerships, while developing key alliances

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through initiatives, joint exercises, operations, and broad leadership engagement” and contribute to the nation’s progress towards renewable energy development.\(^{72}\)

In looking at the selected case study for this investigation, building the microgrid renewable energy system on MCAS Miramar involved using DoD and state budgets to fund contracts with private companies such as Raytheon, General Dynamics, Black & Veatch, and Advanced Energy, and other participants in the project.\(^{73}\) A non-governmental organization (NGO), the NREL, conducted data analyses and produced a plan to maximize the microgrid’s energy efficiency, and state-level coordination with the California Energy Commission provided funding for the demonstration of the installation’s capabilities in 2017.\(^{74}\) Through these partnerships, MCAS Miramar could not only reach its own energy objectives but also supply local business opportunities, share knowledge of its lessons learned for military installation renewable technology, spread productive competition for development at other installations, and bridge military-civilian governance gaps to in the struggle for climate security.

These four themes offer areas of consideration for how the DoD as well as civilian and state actors will move forward in addressing adversities relating to energy and climate security. Visions for a strategic response must have elements of both near and far targets, with objectives for achievement within the next 1-5 years and also goals reaching out 10, 30, 50, and even 100 or more years. Climate change has immediate impacts on humanity, yes, but its propensity for a

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complicated and perilous multi-generational struggle calls for extreme measures of transformation. Leadership in this struggle requires consistency and dedication, and while the DoD plays a strong role it cannot stand alone. Empowering the private sector along with local governance and civilian populations to find modicums of contribution alongside state actors will better facilitate a globally-integrated effort for climate security. After President Trump announced the US withdrawal from the Paris Climate Agreement in 2017, “more than 350 US mayors and governors representing more than 110 million Americans and half of all U.S. carbon emissions have recommitted to the goals of the Paris accord.”⁷⁵ Through a baseline of awareness, initiative, and a motivation to stay the course, agencies such as the DoD help to support persistent progress even through temporary setbacks.

Cal Lankton, Tesla's vice president of global infrastructure operations, asserts that “the consistently lowering cost of batteries, coupled with renewables, is going to fundamentally reshape the energy landscape much faster than anyone thinks it will.”⁷⁶ As technologies continue to improve, regions with widely-varying climate and geography conditions will gain progressive advantage in the renewable energy resources most efficiently available to them. Transitioning to renewable energy, reducing GHG emissions, and eventually eliminating the consumption fossil fuels may win a decisive battle for energy security, but it will not win the war. Incorporating consideration for the themes of this investigation—People, Platforms, Power, and Partnerships—into local and global actions and initiatives will greatly enhance the collaborative strength of civil society. The threats to climate security are omnipresent and non-discriminatory,

yet so too are the solutions to the considerable challenges presented by this epidemic.

Participation in the struggle need not be equal, but rather universal—just as momentum achieves victory in war, widespread collective action best serves the fight for climate security. As an organization built for the purpose of receiving a mission and dedicating all of its efforts to achieving operational success, the US military stands as a critical resource for protecting the national and international interests of humanity, exemplifying methods of addressing climate change, and leading the charge for energy and climate security.
Appendix A: FM 7-8 Operations Order Format

1. SITUATION
   - Area of Interest
   - Area of Operations
   - Enemy Forces
   - Attachments and Detachments

2. MISSION
   - Who
   - What
   - When
   - Where
   - Why

3. EXECUTION
   - Concept of Operations
   - Tasks to Subordinate Units
   - Coordinating Instructions

4. SUSTAINMENT
   - Logistics
   - Personnel Services Support
   - Army Health Systems Support

5. COMMAND AND SIGNAL
   - Command
   - Control
   - Signal

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VI. References


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