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CLIMATE CHANGE AND THE DEFENSE DEPARTMENT:
ADAPTATION IS A BETTER STRATEGY THAN MITIGATION

by

David E. Feith, Major, USAF

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Instructor: Dr. Dennis Duffin

Maxwell Air Force Base, Alabama

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ABSTRACT

Addressing the impact of global climate change has become a priority item for the United States Department of Defense (DOD). This research report answers the question of what strategy DOD should adopt in response to climate change. An evaluation methodology was utilized in this research to examine the national security challenges projected to arise from climate change and how these challenges can be addressed by adaptation and mitigation strategies. The research thesis is that DOD can best prepare for the strategic impacts of climate change by adapting its operations and infrastructure to the changing environment, and not by trying to mitigate climate change.

The research supports a conclusion that adaptation is a necessary response to climate change, but DOD should not adopt a mitigation strategy. This conclusion supports the following three recommendations: First, DOD should adapt its infrastructure and planning in preparation for a changing global climate. Second, DOD should look for opportunities to save money or increase operational effectiveness by increasing energy efficiency. Finally, DOD should pursue opportunities to transition away from burning fossil fuels by producing energy through renewable resources, but only to the extent necessary to save money, increase operational effectiveness, or help bring DOD in compliance with federally mandated GHG emission targets or other federal requirements.

Section I: Introduction

Addressing the impact of global climate change has become a priority item for the United States Department of Defense (DOD). Unfortunately, DOD's climate change policy is constantly in flux due to ever changing directives from civilian leadership. This has led to confusion over the proper response to climate change. DOD policy has long recognized the need to adapt to a changing climate. Adaptation means adjusting to actual or expected future climate change. DOD is already adapting to projected climate change related infrastructure requirements by preparing low-lying installations for rising sea levels. DOD has also made strategic plans to prepare for worldwide geopolitical and security challenges projected to arise from or be exacerbated by climate change.

While DOD's overall strategy is based on adaptation, presidential directives and other political imperatives have led to actions taken to mitigate climate change. Mitigation means reducing the long-term severity of climate change by reducing the amount of greenhouse gases (GHGs) released into the atmosphere. DOD has engaged in expensive projects for the purpose of mitigating climate change. This research answers the following question: What strategy should DOD adopt in response to climate change? DOD policy favors adaptation, but DOD components frequently engage in mitigation.

DOD is not developing its response to climate change in a vacuum. It is constrained by presidential directives and federal law. Any discussion of possible DOD responses to climate change must include a basic understanding of these requirements. Further, all federal agencies are bound by similar constraints, so it is useful to examine how the DOD response fits within the overall U.S. government strategy. It is also useful to examine how DOD's climate change strategy compares with the strategies adopted by other nations with whom DOD could find itself

in competition. The United States could find itself at a military disadvantage if it directs its national security resources toward climate change mitigation while the military forces of the United States' enemies neglect climate change mitigation in favor of maximum investment in operational effectiveness. Thus, the research thesis is that DOD can best prepare for the strategic impacts of climate change by adapting its operations and infrastructure to the changing environment, and not by trying to mitigate climate change.

The evaluation methodology was utilized in this research to examine the national security challenges arising from climate change and how they can be addressed by adaptation and mitigation strategies. This research begins with a background section summarizing the causes of climate change and an analysis of how climate change affects the national security environment. Climate change will contribute to new tensions and conflicts across the earth, and specific vulnerable areas have been identified. Further, climate change will exacerbate tensions that already exist.

Most forms of air pollution cause local or regional problems, but atmospheric greenhouse gases affect the whole world. Climate change has become a major international political issue and the United States faces tremendous pressure to aggressively reduce its greenhouse gas emissions. Thus, this research addresses the international political climate as well as the domestic political climate. Domestically, this research identifies a high likelihood of changes in the United States' strategic approach to climate change under the new administration of President Donald Trump.

The final area addressed by this research is the range of reasonable alternatives available to DOD in responding to climate change. The primary options can be classified under the categories of adaptation or mitigation. The advantages and disadvantages of both approaches are evaluated. The conclusions and recommendations sections explain that this evaluation supports

the research hypothesis that DOD can best prepare for the strategic impacts of climate change by adapting its operations and infrastructure to the changing environment, and not by mitigating climate change.

Section II: Climate Change Background

This section of the report summarizes the leading scientific conclusions on climate change. It includes both the leading cause of climate change and its expected severity. This section also addresses the national security impacts from a changing climate that DOD must prepare for.

Climate Change Basics

Global temperatures show unambiguous warming trends, according to the temperature datasets developed by the National Oceanic and Atmospheric Administration (NOAA), National Aeronautics and Space Administration (NASA), and the Hadley Center.¹ All three sets of temperature records show warming trends over the past 100 years, with the greatest warming taking place over the last 30 years.² Most scientists attribute the bulk of the temperature increase to an increase in atmospheric concentration of heat-trapping gases known as greenhouse gases (GHGs), in addition to other human activities such as the clearing of forests. GHGs exist naturally in the earth's atmosphere, but they have increased dramatically since the Industrial Revolution.³ This increase in atmospheric GHGs causes the radiative effect known as global warming.

The primary source of anthropogenic (man-made) GHGs is the burning of fossil fuels.⁴ Energy consumption in the United States alone results in emissions of almost five and a half billion metric tons per year of the most important GHG, carbon dioxide.⁵ Carbon dioxide

emissions account for an estimated 71.6 percent of anthropogenic global warming.⁶ Carbon dioxide is especially problematic because it spends a long time in the atmosphere where it can have a long lasting impact on climate change.⁷ The bulk of carbon dioxide emissions that are not absorbed by vegetation or bodies of water remain in the atmosphere for 100 years, with a small portion remaining in the atmosphere for centuries.⁸ The GHG emissions caused by burning fossil fuels for energy production has changed the chemical composition of the earth's atmosphere, primarily due to the tendency of carbon dioxide and other GHGs to accumulate in the atmosphere. In 1900, Carbon dioxide and equivalent gases existed in the atmosphere at a concentration of 300 parts per million. In 2013, atmospheric carbon dioxide and equivalent gases increased to 400 parts per million.⁹

As the atmospheric concentration of GHGs unambiguously increases, most scientists predict the pace of global warming to increase. Average global temperatures are projected to rise somewhere between 2°F and 11.5°F by 2100.¹⁰ The lower end of this range represents temperature projections if worldwide GHG emissions are cut substantially, and the upper end of this range represents temperature projections if GHG emissions continue near the current rate.¹¹

Unfortunately, cutting GHG emissions is extremely difficult, because most GHG emissions come from burning fossil fuels, and fossil fuels provide most of the world's energy. As the world population grows, and as developing countries continue to industrialize, the demand for cheap energy will only increase.

Climate Change Impacts on National Security

Many consequences of climate change can already be seen and quantified. In addition to rising temperatures, the average sea level has risen eight inches since 1880, due primarily to melting of glaciers and arctic ice.¹² Rising sea levels are only one way in which climate change

directly impacts DOD infrastructure. DOD has identified five categories of climate change phenomena: rising temperatures, changes in precipitation patterns, increasing storm frequency and intensity, rising sea levels and storm surge, and changes in ocean temperature.¹³ The 2014 Quadrennial Defense Review noted that climate change could “undermine the capacity of our domestic installations to support training activities.”¹⁴

While it is impossible to link specific weather events to climate change, weather-related damage provides insight into climate change vulnerabilities of DOD infrastructure.¹⁵ Here are a few examples the military services reported to the Government Accountability Office. Air Force early warning radar stations in Alaska have suffered damaged roads, utility infrastructure, seawalls, and runways due to erosion caused by rising sea levels.¹⁶ The Army reports increased temperatures results in thawing of permafrost that made one installation halt training because the ground was too soft to traverse.¹⁷ A Pacific installation reported excess rain resulting in mudslides, while other installations reported impacts from insufficient rain, such as drought and wildfire risk.¹⁸

Threats to DOD infrastructure are only part of the climate change related challenges DOD faces. The same categories of climate change phenomena identified above will contribute to international instability and conflict. As noted in the 2014 Quadrennial Defense Review, climate change may increase water scarcity, increase food costs, and influence the competition for resources.¹⁹ War gaming and scenario planning suggests climate change could trigger a number of results impacting national security, including large-scale migration and displacement, increased nationalism and internalization, and friction caused by competition for resources.²⁰ Climate change effects are recognized as “threat multipliers that will aggravate stressors abroad such as poverty, environmental degradation, political instability, and social tensions.”²¹ These

are the kinds of conditions that tend to increase the likelihood of terrorist activity, violence, and instability.²²

Section III: Political Challenges

International political bodies such as the United Nations have struggled to reach consensus on how to respond to climate change. Climate change impacts are global, but not all geographic regions are affected equally. Reducing GHG emissions is expensive, so most countries are disinclined to reduce their emissions without assurances that their economic competitors are making the same reductions. Another international political challenge is determining the extent to which developing nations should be held to the same emission reduction standards as nations with developed economies.

Domestically, United States' leaders have been inconsistent in their approach to reducing GHG emissions. President Barack Obama made commitments to reduce the United States' GHG emissions and his administration made a number of regulatory changes aimed at reducing GHG emissions. However, President Donald Trump has denied that mitigating climate change is necessary, stating that "nobody really knows" if climate change is real, and calling climate change a "hoax" perpetuated by China.²³ President Trump promised to undo most of the Obama administration efforts to reduce GHG emissions and appointed a climate change doubter as head of the United States Environmental Protection Agency (EPA).²⁴

International Political Challenges

One of the political challenges in reaching international consensus on global climate change mitigation is reconciling differences between developed countries and developing countries. Developing countries point out that developed countries benefitted from having no

restrictions on GHG emissions for over 200 years during the industrial era. This access to cheap energy fueled industrial development. Developing countries argue that they must also be allowed the opportunity to develop their economies without being slowed by expensive GHG emission restrictions. Developing countries have offered to join international agreements requiring GHG emissions reductions only if developed countries make massive investments in foreign aid. On the other hand, developed countries are wary of making expensive commitments to reduce emissions when these commitments are not shared by all nations.

In spite of these challenges, the United States has been a party to several international agreements on climate change. In 1992, the United States joined the United Nations Framework Convention on Climate Change, which was a nonbinding agreement between 154 countries.²⁵ Emission reduction targets became binding in 1997 for 192 countries under the Kyoto Protocol.²⁶ The United States did not enter the Kyoto Protocol because the GHG emission requirements did not apply to developing nations such as China. The prevailing belief of the United States was that efforts to reduce GHG emissions would disadvantage the United States' economy relative to nations that did not agree to reduce GHG emissions, or to developing nations that were required to make less significant GHG emission reductions.²⁷ President Barack Obama announced a plan for the United States to cut GHG emissions 17 percent below 2005 levels if other major economies agreed to similarly limit their emissions, but an agreement was never reached.²⁸

The next significant international agreement on climate change was the Paris Agreement, which is part of the United Nations Framework Convention on Climate Change. It became effective in November 2016. Currently, 195 countries have agreed to be bound by this agreement, including the United States.²⁹ Governments agreed on the need for mitigation strategy so global GHG emissions will peak as soon as possible and then begin to decline. Governments also recognized that developing countries will take longer to reduce their emissions.³⁰ Countries such

as the United States agreed to undertake rapid reductions using the best available scientific technology.³¹

Domestic Political Challenges

A number of political leaders in the United States deny the existence of anthropogenic climate change, despite the fact that GHGs continue to rapidly accumulate in the earth's atmosphere in measurable quantities. These beliefs are dominant in the GOP, which currently controls both Houses of Congress and the Presidency. However, there is a small but growing green wing of the Republican Party that talks openly about strategies to mitigate climate change.³² President Donald Trump made campaign promises to withdraw the United States from the Paris Agreement.³³ The Trump administration's plan is to cut the budget of the Environmental Protection Agency (EPA) by approximately 25 percent.³⁴ President Trump's head of the EPA, Scott Pruitt, is a climate change denier who is currently the plaintiff in a lawsuit against the EPA.³⁵

The President and, to a lesser extent, Congress and the EPA will all have a profound impact on how DOD responds to climate change. President Trump is expected to issue an executive order that will change the way federal agencies, including DOD, factor climate change into decision making.³⁶ It is also expected to eliminate a requirement in an executive order issued by President Obama that instructs federal agencies to incorporate climate change into the National Environmental Policy Act process.³⁷ The removal of these requirements will give DOD more freedom to ignore climate change. However, DOD does not appear interested in ignoring climate change. Secretary of Defense James Mattis told the Senate Armed Services Committee he believes in climate change and considers it a threat.³⁸ Secretary Mattis wrote, "Climate change is impacting stability in areas of the world where our troops are operating today," in response to

questions from the committee.³⁹ This is consistent with longstanding DOD policy. DOD has identified and is preparing for specific national security challenges arising from climate change, as detailed in Section I above.

This is not to say that the domestic political situation has no impact on DOD's response to climate change. Certain mitigation strategies will be out of favor with civilian leadership. DOD could have a hard time obtaining funding for expensive mitigation strategies while the political leadership doubts the existence of the climate change that DOD is attempting to mitigate.

Section IV: Responses to Climate Change

DOD has long recognized the national security challenges caused by climate change, but influential elements of the political leadership, including the Commander-in-Chief and the Secretary of the EPA, believe climate change is a hoax. What is DOD to do? How can DOD reconcile the expectations of its political leadership with its need to effectively prepare for anticipated future challenges caused by climate change? This section of the report analyzes results of research on the primary climate change adaptation and mitigation strategies available to DOD.

Adaptation

Climate change adaptation means adjusting to actual or expected future climate change.⁴⁰ There are two major areas in which DOD must adapt its operations to a changing climate. First, DOD must ensure its built infrastructure is adapted to a changing climate. This is especially important in low-lying areas where rising sea levels are likely to have the most impact. The second area in which DOD must adapt is by preparing for the geopolitical upheavals that may be caused by or exacerbated by climate change. DOD's climate change adaptation strategy is well

defined. DOD Directive (DODD) 4715.21, *Climate Change Adaptation and Resilience*, establishes policy and assigns responsibility to provide the resources necessary for DOD to assess and manage climate change risks.⁴¹ DODD 4715.21 specifically requires that planning and execution must include three elements: 1) identification and assessment of climate change effects on the DOD mission, 2) taking those effects into account when developing plans, and 3) anticipating and managing climate change risks to build resilience.⁴² DOD Component heads are given responsibility integrating the full range of climate adaptation efforts into policy, guidance, plans, and operations.⁴³

Adaptation Option #1: Prepare DOD Infrastructure for Climate Change

The 2014 Quadrennial Defense Review recognizes the threat climate change poses to the capacity of domestic installations to handle mission requirements.⁴⁴ The Government Accountability Office has also noted that DOD infrastructure is vulnerable to climate change impacts.⁴⁵ These impacts include rising temperatures and sea levels, melting permafrost, and increases in frequency and severity of extreme weather events.⁴⁶ DODD 4715.21 was created to prepare for these challenges. It specifically charges DOD component heads with managing climate change related risks to infrastructure.⁴⁷ This includes installation master planning, resource management, and design and construction standards.⁴⁸ The Assistant Secretary of Defense for Energy, Installations, and the Environment (ASD(EI&E)) is required to consider climate change in installation planning and basing processes.⁴⁹ This is particularly important for installations located in low-lying areas that are most vulnerable to harmful effects of sea level rise.

In practice, this leads to common-sense solutions to increase the resilience of DOD infrastructure. For example, DOD service components must consider the impact of rising sea

levels when they consider whether to expand installations located in low-lying areas. Similarly, it only makes sense to consider projected climate change when developing construction standards. DOD has started collecting data on vulnerabilities from coastal locations and is developing scenarios for sea level rise for 704 coastal locations.⁵⁰ This data should shape DOD's long-term installation master planning.

Adaptation Option #2: Prepare for Geopolitical Instability

The 2014 Quadrennial Defense Review recognizes that climate change will significantly alter the geopolitical situation worldwide, creating new conflicts and intensifying old ones.⁵¹ One of the major problems projected to arise is water scarcity, which could increase food costs and intensify competition for basic resources.⁵² This could contribute to destabilization in certain regions. Because of this, climate change can be understood as a “threat multiplier,” due to its ability to aggravate poverty, social upheaval, and political instability.⁵³ DOD will have to adapt to these threats.

DODD 4715.21 also provides policy guidance on climate change adaptation in preparation for potential geopolitical instability. DOD policy is that “DOD must be able to adapt current and future operations to address the impacts of climate change in order to maintain an effective and efficient U.S. military.”⁵⁴ The Assistant Secretary of Defense for Energy, Installations, and the Environment is responsible for coordinating with the Under Secretary of Defense for Policy (USD(P)) and the Chairman of the Joint Chiefs of Staff “to account for climate change impact during planning processes across the spectrum of military operations.”⁵⁵ The USD(P) and Assistant Secretary of Defense for Strategy, Plans, and Capabilities, “develops policies, plans, programs, forces, and posture needed to implement the DOD strategy.”⁵⁶ This includes adapting

the full range of DOD operations in preparation for geopolitical changes precipitated by climate change.

Mitigation

Climate change mitigation means reducing the long-term severity of climate change by reducing the flow of heat-trapping GHGs into the atmosphere.⁵⁷ The United States current political climate does not favor new climate change mitigation initiatives by federal agencies, including DOD. However, a number of mandatory climate change mitigation requirements have been imposed on federal agencies by previous presidential administrations. Executive Order (EO) 13693, signed by President Obama on March 19, 2015, has a goal of maintaining federal leadership in sustainability.⁵⁸ It requires heads of federal agencies to “propose percentage reduction targets for agency-wide reductions of ...greenhouse gas emissions in absolute terms by the end of fiscal year 2025 relative to a fiscal year 2008 baseline.”⁵⁹ DOD guidance for executing EO 13693 provides DOD’s reduction target as being 42 percent by 2025 relative to its 2008 GHG emissions baseline for some categories of GHG emissions.⁶⁰ Other categories of GHG emissions have a 25 percent reduction target.⁶¹ This includes a 30 percent reduction target for petroleum fuel use.⁶²

These GHG emission reduction targets are a clear example of climate change mitigation. The argument in favor of DOD reductions in GHG emissions goes as follows: Reducing global GHG emissions will, in the long run, reduce the severity of climate change. Approximately 16 percent of GHG emissions come from the United States, so the United States should do its part to reduce GHG emissions.⁶³ Within the United States, the federal government should lead the way. Federal agencies use two percent of the nation’s energy.⁶⁴ DOD consumes more energy than any

other federal agency, consuming 75 percent of the total energy consumed by the federal government.⁶⁵

This does not suggest that DOD is inefficient or irresponsible in its high output of GHG emissions. DOD's high level of GHG emissions are a function of its mission and its size. DOD controls three million personnel, 36 million acres of land, 40,000 properties, over 250 major installations, 550 public utility systems, 22,000 aircraft, and hundreds of ocean-going vessels.⁶⁶ Nonetheless, it is difficult for the federal government to reduce its GHG emissions unless DOD, which makes up three-quarters of federal government GHG emissions, makes reductions in its GHG emissions.

There are three basic options for DOD to cut its GHG emissions to mitigate climate change. First, DOD can reduce its energy consumption by doing less or getting smaller. One method for this is for DOD to operate fewer buildings, aircraft, naval vessels, tanks, and other machinery. Second, DOD can increase fuel efficiency by implementing industry best practices and through modernization and the use of more advanced technology. Finally, DOD can reduce its GHG emissions by replacing some amount of its use of fossil fuels with renewable energy sources.

Mitigation Option #1: Do Less or Get Smaller

Reducing GHG emissions usually requires reducing energy usage, because most energy is produced by burning fossil fuels, which produces GHGs. The first option to reduce DOD's carbon footprint is to use less energy by doing less or getting smaller. Operating fewer facilities, aircraft, and other energy-consuming activities would reduce GHG emissions. This could be accomplished through a number of initiatives, including a new round of Base Realignment and Closure (BRAC), reductions in the number of DOD employees, flying fewer aircraft hours, and

reducing the use of tanks, heavy machinery, and automobiles. Certain military services are interested in closing unnecessary installations through another round of BRAC, but the rest of these initiatives are unlikely. President Trump has promised to increase the military budget in order to “rebuild our military” and pursue “the highest levels of military readiness.”⁶⁷ That does not sound like a call to close military installations, reduce the number of military personnel, or in any way reduce the amount of energy consumed by DOD.

Mitigation Option #2: Use Energy More Efficiently

The second option for DOD to mitigate climate change is to reduce its GHG emissions by becoming more efficient in its energy usage. This mitigates climate change, but it has another immediate benefit: cost savings. Fuel is expensive, and increases in fuel efficiency across DOD can have a significant cost savings impact.

Fuel efficiency can be improved by implementing industry best practices. The Air Force’s Air Mobility (AMC) Command leads the way in achieving fuel savings by implementing best practices. The Air Force is the largest user of fuel in DOD, due to its flying mission, and AMC uses 63 percent of all Air Force fuel.⁶⁸ The United States Department of Energy has recognized AMC for a “Fuel Savings Culture,” resulting in savings of tens of millions of gallons of fuel annually.⁶⁹ AMC focused on several fuel savings areas, such as removing excess supplies and equipment from aircraft to reduce its weight, carrying less excess fuel that weighs down aircraft, and maintenance activities such as engine washes that reduce fuel consumption.⁷⁰ Reducing aircraft speed can also dramatically increase fuel efficiency, in certain situations. It should be noted that AMC’s fuel savings were motivated primarily by cost savings, and not by a desire to mitigate climate change.

DOD can also become more efficient in its energy usage through modernization and the use of technology. For instance, when the Air Force replaced its C-5 Galaxy A and B models with M models its fuel efficiency increased by three percent due to the more efficient engine in the newer models.⁷¹ Newer cars, aircraft, tanks, and other machinery tend to be more fuel-efficient than older models.

DOD is making similar headway with fuel efficient buildings. Across the whole federal government, energy efficiency of its buildings has increased by 40 percent since 1975.⁷² This is due mostly to federal requirements. The Council on Environmental Quality publishes Guiding Principles for new federal buildings.⁷³ These green building standards apply to new buildings build by federal agencies. Further, at least 15 percent of federal buildings must comply with the new standards by 2025.⁷⁴ Federal agencies are certainly free to exceed these minimum standards. New federal buildings built according to these standards are more energy efficient and reduce GHG emissions.

Mitigation Option #3: Replace Fossil Fuels with Renewable Energy Sources

The third option for DOD to mitigate climate change by reducing its GHG emissions is to replace some of its use of fossil fuels with renewable energy. Renewable energy includes solar power, wind power, geothermal energy, and other energy sources collected from resources that are naturally replenished. Replacing energy produced by burning fossil fuels with energy produced from renewable sources mitigates climate change because renewable energy sources do not release GHGs into the atmosphere. Federal law requires DOD to transition to renewable energy. Title 10 U.S. Code Section 2911 mandates that at least 25 percent of DOD's facility energy use come from renewable sources by 2025. DOD has failed to meet similar requirements in the past. The Energy Policy Act of 2005 required federal agencies to obtain at least five

percent of their energy needs from renewable sources by 2012. DOD failed to meet that goal, as it only obtained four percent of its energy from renewable sources in 2012.⁷⁵

Renewable energy sources are often touted as cost savings measures, because the operators are not required to pay for fuel. In practice, however, renewable energy tends to be significantly more expensive than energy produced by burning fossil fuels. DOD has developed a number of renewable energy projects. The federal stimulus package in 2009 allocated \$335 million for renewable energy projects at DOD installations.⁷⁶ \$21 million funded the largest solar project in Virginia, providing power to Norfolk Naval Station. Unfortunately, this investment in green energy only provides two percent of the electricity required to power Norfolk Naval Station.⁷⁷ Similar projects have faced criticism due to their cost and minimal return on investment. One report identified a green energy project at Norfolk Naval Station that was expected to save money on electric bills, but the report concluded it would take 447 years for the Navy to make back its money.⁷⁸

Section V: Choosing a Climate Change Response

In order to answer the question of what strategy DOD should adopt in response to climate change, it is useful to compare the costs and benefits of the adaptation and mitigation strategies discussed above.

Costs and Benefits of an Adaptation Strategy

At its core, adaptation means preparation. If DOD leaders believe the climate is changing, then DOD must take steps to ensure its built infrastructure is adequate for the environment in which it will be used. Similarly, if DOD planners believe climate change will influence or precipitate conflict around the globe, then DOD plans must account for those possibilities.

Indeed, DOD holds both of those beliefs and has responded by adopting an adaptation strategy in DODD 4715.21.

Critics of this adaptation strategy may argue that DOD's military preparedness efforts should be focused on the world as it exists today, rather than on projections of possible future climate situations. It is true that climate change adaptation efforts could be in vain if the leading climate change assumptions turn out to be false. Nonetheless, failing to prepare for climate change scenarios poses a significant risk. Is it better to prepare for a climate change possibility that may never come to pass, or is it better to neglect preparations in the hope that generally accepted projections on climate change turn out to be overstated? The overwhelming evidence that worldwide temperatures are rising, and DOD's duty to prepare for various potential outcomes, requires some level of climate change adaptation, at a minimum.

Other critics of an adaptation strategy may argue that adaptation is a necessary, but insufficient response to climate change. These critics would argue that adaptation does not go far enough. Rather than accepting that DOD will have to navigate challenges caused by climate change, DOD could take steps to reduce the severity of climate change by reducing its own output of GHG emissions. In other words, some believe DOD should supplement its adaptation strategy by adopting a climate change mitigation strategy.

Costs and Benefits of a Mitigation Strategy

Regardless of which climate change response strategy DOD pursues, federal regulations compel DOD to take some mitigation actions. For example, as discussed above in Section IV, all new federal buildings must meet minimum efficiency standards by 2025. For purposes of this analysis, DOD efforts to meet these mandatory standards are not considered to be implementing a

DOD strategy of mitigation. Rather, these efforts simply represent DOD's obligations to comply with legal requirements.

DOD's climate change adaptation strategy in DODD 4715.21 makes it clear that DOD anticipates impacts from climate change, and DOD has a strategy to adapt to those impacts. But if DOD recognizes the challenges climate change will present, does this mean DOD should also work to mitigate those impacts by reducing its GHG emissions? After all, DOD is by far the largest emitter of GHGs in the federal government.

Analysis of Mitigation Option #1

The main challenge presented by a mitigation strategy is that the options for mitigation can run counter to other DOD goals. Mitigation option #1, discussed above in Section IV, is for DOD to reduce its GHG emissions by engaging in fewer activities that require energy, thus reducing the amount of GHGs released by burning fossil fuels for energy. The problem with this approach is that DOD's most essential operations require tremendous amounts of energy, and reducing the number or scope of those activities necessarily reduces DOD's effectiveness. DOD components could radically reduce GHG emissions by reducing aircraft flight hours, but this would result in fewer opportunities for training and other mission sets. The same logic applies to other vehicles and machinery operated by DOD components. Mitigation Option #1 also faces a political hurdle. President Trump's calls for bigger military budgets suggests he would not look favorably on a military strategy to mitigate climate change by shrinking military operations.

Analysis of Mitigation Option #2

Mitigation option #2 is for DOD to reduce its GHG emissions by becoming more efficient in its energy usage. The United States' current political leadership is likely to find this approach

more palatable than mitigation option #1, because it does not openly call for DOD to compromise its readiness or reduce its operational capability. The challenge presented by this option is that increasing energy efficiency can be expensive.

A common argument in support of mitigation option #2 is that energy efficiency should be pursued because increasing energy efficiency saves money by reducing the amount of fuel DOD must purchase. Indeed, even small increases in efficiency can result in substantial savings on fuel. However, the decision of whether to adopt fuel savings measures in order to save money can be separated from the decision of whether to adopt a strategy of climate change mitigation. If DOD determines it can save money by adopting best practices for fuel efficiency or by using more efficient technology, then it should unquestionably do so, whether it provides an environmental benefit or not, provided it does not result in diminished performance. It goes without saying that DOD should reduce its energy usage where practicable, when doing so will result in cost savings. The more important question is whether DOD should reduce its GHG emissions by becoming more efficient in its energy usage in cases where the energy reduction will be more expensive. This is relevant because transitioning to more energy efficient machinery tends to be very expensive.

Analysis of Mitigation Option #3

Mitigation option #3 is for DOD to mitigate climate change by reducing its GHG emissions through replacement of fossil fuels with renewable energy. Federal law requires federal agencies to obtain a certain percentage of their energy requirements through renewable energy sources. Compliance with the minimum standards these laws require should not be confused as a DOD mitigation strategy. Further, DOD has historically struggled to meet federally-imposed targets to replace fossil fuel use with renewable energy.⁷⁹ Adopting a

mitigation strategy that exceeds the federally-imposed renewable energy targets would require significantly more effort.

Advocates of renewable energy may tout renewables as cost savings measures. Indeed, operators of solar or wind farms do not have to pay for using the sun or the wind, while operators of fossil fuel fired power plants must continually pay for coal or natural gas. Unfortunately, however, renewable energy sources are generally much more expensive than traditional energy sources. Transitioning to renewable energy sources will rarely make sense for DOD if the only criteria is cost.

A strategy of mitigation is also harder to pursue in the current political climate. President Trump's says that "nobody really knows" if climate change is real, and he asserted that climate change is a "hoax"⁸⁰ He has promised to roll back many of the United States' climate change mitigation efforts. In light of these statements, DOD could have a hard time obtaining funding for a more robust climate change strategy.

Section VI: Conclusions and Recommendations

Conclusions

This research paper answers the question of what strategy DOD should adopt in response to climate change. The thesis for this research is that DOD can best prepare for the strategic impacts of climate change by adapting its operations and infrastructure to the changing environment, and not by trying to mitigate climate change. The research supports the thesis. Adaptation is the necessary strategy. DOD should not pursue a strategy to mitigate the effects of climate change.

Conclusion #1: DOD Recognizes a Need for Adaptation

DOD policy recognizes that the climate is changing, as evidenced by policy documents such as DODD 4715.21 and the Quadrennial Defense Review. The changing climate creates a need for DOD to prepare in two areas. First, DOD must adapt its built infrastructure to a changing climate. Second, DOD plans must account for the possibilities that climate change will influence or precipitate conflict around the world. These adaptation requirements are recognized and addressed in DODD 4715.21.

Conclusion #2: DOD's Mitigation Options are Impractical, Expensive, and Politically Unrealistic

DOD has three basic options for mitigation. The options tend to be impractical, expensive, and politically unrealistic. First, DOD can engage in fewer GHG generating activities by simply doing less or getting smaller. The military is growing, so engaging in fewer GHG generating activities is impractical. It is also politically unrealistic. President Donald Trump has expressed doubts whether manmade climate change exists, so the political leadership would be unlikely to accept this option.

The second mitigation option is for DOD to increase its energy efficiency. Increased energy efficiency means DOD would burn less fossil fuel to produce energy and therefore less GHG would be released into the atmosphere. These efforts make financial sense in some situations. DOD already has an economic incentive to increase energy efficiency in situations where it will save money. For instance, investing in a newer, more energy efficient building may cost less in the long term because utility costs are higher in older, less energy inefficient buildings. Unfortunately, instances where DOD can save money by increasing energy efficiency are often overstated. There are too many instances where a major construction project was billed

as a cost savings measure, and those savings never materialized. Further, if DOD can save money or increase operational effectiveness through energy efficiency improvements, then this should be pursued regardless of climate change considerations. It does not require a climate change mitigation strategy to realize these efficiency savings.

The final potential DOD mitigation strategy is replacing energy produced with fossil fuels with energy produced from renewable energy sources. DOD already struggles to meet federally-imposed targets to replace fossil fuels with renewables. The fact that DOD fails to achieve these federally mandated targets suggests that it would be very difficult for DOD to exceed these standards as part of a climate change mitigation strategy.

Conclusion #3: The Costs of a DOD Mitigation Strategy Outweigh the National Defense

Benefits

Global climate change is impacted by GHG emissions from around the world. When GHG emissions reach the atmosphere, it does not matter whether the GHG emission originated from the United States or from a country located on the far side of the world. Unlike other forms of air pollution that produce regional impacts on air quality, atmospheric GHGs impact the entire planet. Mitigation benefits are shared by all countries, whether that country participated in mitigation efforts or not. For this reason, there is little economic incentive for any country to lead the way in GHG reductions. Mitigation efforts are expensive, and countries are hesitant to take those steps without assurances that their economic competitors are making the same sacrifice.

The same analysis can be applied to a nation's military services. There is a disincentive to invest DOD funds in mitigation without assurances that the United States' military competitors are making a similar investment. No such assurances have been made, nor are they

likely to be made in the near future. Countries that are not engaging in climate change mitigation with their military, such as Russia, China, North Korea, and countries in the Middle East would have a relative advantage over the United States if the United States military diverted money to climate change mitigation at the expense of training, operations, more advanced weapons technology, etc.

More fundamentally, mitigating climate change is outside DOD's scope of responsibility. DOD certainly must comply with all legal mandates applicable to federal agencies, but DOD's responsibilities for the nation's defense do not extend to climate change mitigation over and above these legally mandated universal requirements. For this reason, it would be inconsistent with the DOD mission to expend DOD funds on climate change mitigation efforts. That does not mean DOD will irresponsibly pollute the air with GHGs without regard for the environmental impacts. Safeguards already exist to prevent unchecked GHG pollution. First, federal laws, regulations, and executive orders applicable to federal agencies already place a check on DOD's GHG emissions. Secondly, DOD is already incentivized to increase its energy efficiency and use of renewable energy in instances where DOD will realize a cost savings for doing so.

Even if DOD decided to adopt a climate change mitigation strategy and spend substantial sums of money to implement that strategy, the effort would ultimately be ineffective. Any reductions in GHG emissions achieved by DOD would be dwarfed by the amount of GHG emissions by the United States as a whole. All federal agencies, including DOD, combine to produce only two percent of the nation's energy. On a global level, any potential GHG emission reductions by DOD would barely register any impact at all. Meaningful climate change mitigation requires a coordinated effort by the entire nation and by groups of nations. DOD cannot make much impact going it alone, no matter how many resources it devotes to the effort.

For this reason, DOD should prepare for the strategic impacts of climate change by adapting its operations and infrastructure to the changing environment, and not by adopting a climate change mitigation strategy. Climate change mitigation in the United States should come from federal directives applicable across the country. DOD's compliance with nationally mandated GHG reduction standards is sufficient, and does not require pursuit of a climate change mitigation strategy.

Recommendations

DOD should take the following three steps.

1. DOD should adapt its infrastructure and planning in preparation for a changing global climate.

DOD leaders believe the climate is changing, as evidenced by DOD policy. Therefore, DOD should prepare for this change by ensuring its built infrastructure is adequate for the projected future environmental conditions in which it will exist. DOD should make necessary infrastructure improvements at installations that are most susceptible to climate change impacts, consider potential climate change impacts when choosing sites for new infrastructure, and ensure that new infrastructure is built to withstand climate change projections for the life of any new infrastructure projects. It is especially important to consider the effect of rising sea levels on installations in low-lying areas, as this is likely to be the most pressing climate change related infrastructure challenge. DOD planners should also account for the potential of climate change to influence or precipitate conflict and instability around the world.

2. DOD should look for opportunities to save money or increase operational effectiveness by increasing energy efficiency.

The results of this research do not support adoption of a DOD climate change mitigation strategy. DODs' current adaptation strategy is sufficient. However, there are opportunities to save money or increase operational effectiveness by increasing energy efficiency. These financial opportunities a secondary benefit of mitigating climate change, in limited circumstances. Examples identified include achieving fuel savings by implementing best practices, and transitioning to modern jet engines that are more energy efficient. These opportunities should only be pursued if the result will save money, increase operational effectiveness, or help bring DOD in compliance with federally mandated GHG emission targets or other federal requirements.

3. DOD should pursue opportunities to transition away from burning fossil fuels by producing energy through renewable resources, but only to the extent necessary to save money, increase operational effectiveness, or help bring DOD in compliance with federally mandated GHG emission targets or other federal requirements.

DOD should avoid investments in renewable resources for the purpose of climate change mitigation. That would likely result in increased cost or diminished operational effectiveness with minimal beneficial climate change impact. However, DOD should take advantage of opportunities to save money or increase operational effectiveness by transitioning toward renewable resources such as solar and wind power. These opportunities should only be pursued if the result will save money, increase operational effectiveness, or help bring DOD into compliance with federally mandated GHG emission targets or other federal requirements.

Bibliography

Colman, Zack, The Christian Science Monitor, *Spotted in Washington: conservatives supporting climate action*, February 3, 2017 (last accessed March 16, 2017).

The Council on Environmental Quality, Guiding Principles for Sustainable Federal Buildings and Associated Instructions, February 2016, https://sftool.gov/Content/attachments/guiding_principles_for_sustainable_federal_buildings_and_associated_instructions_february_2016.pdf, (last accessed March 23, 2017).

Danko, Pete, Greentech Media, US Military Faces Trio of Renewable Energy Goals, July 3, 2013, <https://www.greentechmedia.com/articles/read/us-military-faces-trio-of-renewable-energy-goals> (last accessed 23 March, 2017).

Davenport, Coral, New York Times, *Top Trump Advisors are Split on Paris Agreement on Climate Change*, March 2, 2017, (last accessed March 16, 2017).

Department of Defense, *Quadrennial Defense Review 2014*, VI.

DOD Directive 4715.21, *Climate Change Adaptation and Resilience*, January 14, 2016.

Eilperin, Juliet, The Washington Post, *Trump is poised to issue a sweeping order dismantling Obama's climate plan this week*, <https://www.google.com/amp/s/www.washingtonpost.com/amphtml/news/energy-environment/wp/2017/03/14/trump-is-poised-to-issue-a-sweeping-order-dismantling-obamas-climate-change-plan-tehis-week/>, March 14, 2017 (last accessed March 16, 2017).

Energy.Gov, Office of Energy Efficiency & Renewable Energy, Government Energy Management, <https://energy.gov/eere/efficiency/government-energy-management> (last accessed March 23, 2017).

Erickson, Edward J, *Climate Change and the Department of Defense: An Introduction*, MCU Journal, Climate Change and Policy Special Issue, Marine Corps University Press, 2016.

European Commission, Paris Agreement, https://ec.europa.eu/clima/policies/international/negotiations/paris_en (last accessed March 14, 2017).

Executive Order (EO) 13693, Planning for Federal Sustainability in the Next Decade, 19 March 2015, available at <https://obamawhitehouse.archives.gov/the-press-office/2015/03/19/executive-order-planning-federal-sustainability-next-decade> (last accessed 23 March 2017).

74 Federal Register 66,496, at 66,517, Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act; Final Rule, <http://www.gpo.gov/fdsys/pkg/FR-2009-12-15/pdf/E9-29537.pdf>.

Flesher, John, Matthew Daly, and Catherine Lucy, *The Washington Post*, *Climate, other programs get deep cuts in EPA budget proposal*, March 3, 2017.

Glicksman, Robert L., David L. Markell, William W. Buzbee, Daniel R. Mandelker & Daniel Bodansky, *Environmental Protection Law and Policy*, Sixth Edition, 1138, Aspen Casebook Series, 2011.

Harper, Scott, *The Virginian-Pilot*, Navy builds solar power farm near Norfolk base, December 4, 2012, http://pilotonline.com/news/military/navy-builds-solar-power-farm-near-norfolk-base/article_c92eab0-8d31-513b-b256-2b87edd49cfd.html (last accessed March 23, 2017).

Insinna, Valerie, and Yasmin Tadjeh, *National Defense Magazine*, Air Force Making Headway on Fuel Efficiency Goals, June 2013, <http://www.nationaldefensemagazine.org/archive/2013/June/Pages/AirForceMakingHeadwayonFuelEfficiencyGoals.aspx> (last accessed March 23, 2017).

International Energy Agency, Redrawing the Energy-Climate Map, *World Energy Outlook Special Report*, 14, June 10, 2013 <http://www.worldenergyoutlook.org/energyclimatemap/> (last visited March 9, 2017).

Kennedy, Caroline *CNN Politics*, *Trump: 'Nobody really knows' if climate change is real*, December 12, 2016, (last accessed March 16, 2017).

Masachusetts v. EPA, 549 U.S. 559 (2007).

NASA, Global Climate Change, Vital Signs of the Planet, *Climate Change: How do we Know?* <http://climate.nasa.gov/evidence/> (last accessed March 7, 2017).

NASA, Global Climate Change Vital Signs of the Planet, *Responding to Climate Change*, <https://climate.nasa.gov/solutions/adaptation-mitigation> (last accessed March 16, 2017).

Nash, Greg, *The Hill*, *Trump's Defense secretary calls climate change a national security risk*, <https://www.google.com/amp/thehill.com/policy/energy-environment/323959-trumps-defense-secretary-calls-climate-change-a-national-security%3Famp>, March 14, 2017 (last accessed March 16, 2017).

Office of the Assistant Secretary of Defense (Energy, Installations, and Environment), Department of Defense Guidance for Executive Order 13693: Planning for Federal Sustainability in the Next Decade, March 2016, <http://www.acq.osd.mil/eie/Downloads/IE/DOD%20Guidance%20on%20EO%2013693%20FINAL%2023Mar2016.pdf>, 14, (last accessed March 23, 2017).

The President's Climate Action Plan, June 2013, <https://obamawhitehouse.archives.gov/sites/default/files/image/president27sclimateactionplan.pdf> (last visited March 14, 2017).

Union of Concerned Scientists, Global Warming Impacts. *The Consequences of Climate Change are Already Here*, <http://www.ucsusa.org/our-work/global-warming/science-and-impacts/global-warming-impacts#.VRGSJxtFBjo> (last visited March 9, 2017).

United Nations Framework Convention on Climate Change, http://unfccc.int/kyoto_protocol/items/2830.php (last visited March 14, 2015).

U.S. Department of Energy, Energy Efficiency and Renewable Energy, Federal Energy Management Program, 1, https://www1.eere.energy.gov/femp/pdfs/af_fuelefficiency.pdf (last accessed March 23, 2017).

The United States Environmental Protection Agency, Global Greenhouse Gas Emissions data, <https://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data> (last accessed March 30, 2017).

United States Global Change Research Program, *Global Climate Change Impacts in the United States*, <http://downloads.globalchange.gov/usimpacts/pdfs/climate-impacts-report.pdf> 9 (last accessed March 9, 2017).

United States Government Accountability Office, *GAO 14-1446, Report to Congressional Requesters: Climate Change Adaptation. DOD Can Improve Infrastructure Planning and Processes to Better Account for Potential Impacts*, May 2014, 11.

U.S. Department of Defense: Climate Change, Energy Efficiency, and Ozone Protection, <http://infohouse.p2ric.org/ref/21/20958.htm> (last accessed March 23, 2017).

U.S. Energy Information Administration, International Energy Statistics, <http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=90&pid=44&aid=8> (last visited March 7, 2017).

The White House, Making Our Military Strong Again, <https://www.whitehouse.gov/making-our-military-strong-again> (last accessed March 16, 2017).

Notes

¹ 74 Fed. Reg. 66,496, at 66,517, Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act; Final Rule, <http://www.gpo.gov/fdsys/pkg/FR-2009-12-15/pdf/E9-29537.pdf> (last visited March 7, 2017).

² *Ibid.*

³ NASA, Global Climate Change, Vital Signs of the Planet, *Climate Change: How do we Know?* <http://climate.nasa.gov/evidence/> (last accessed March 7, 2017).

⁴ *Ibid.*

⁵ U.S. Energy Information Administration, International Energy Statistics, <http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=90&pid=44&aid=8> (last visited March 7, 2017).

⁶ 74 Fed. Reg. 66,496, at 66,517, Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act; Final Rule, <http://www.gpo.gov/fdsys/pkg/FR-2009-12-15/pdf/E9-29537.pdf> (last visited March 9, 2017).

⁷ 74 Fed. Reg. 66,496, at 66,517, Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act; Final Rule, <http://www.gpo.gov/fdsys/pkg/FR-2009-12-15/pdf/E9-29537.pdf> (last visited March 9, 2017)

⁸ *Ibid.*

⁹ International Energy Agency, Redrawing the Energy-Climate Map, World Energy Outlook Special Report, 14, June 10, 2013 <http://www.worldenergyoutlook.org/energyclimatemap/> (last visited March 9, 2017).

¹⁰ United States Global Change Research Program, *Global Climate Change Impacts in the United States*, <http://downloads.globalchange.gov/usimpacts/pdfs/climate-impacts-report.pdf> 9 (last accessed March 9, 2017).

¹¹ *Ibid.*

¹² Union of Concerned Scientists, Global Warming Impacts. *The Consequences of Climate Change are Already Here*, <http://www.ucsusa.org/our-work/global-warming/science-and-impacts/global-warming-impacts#.VRGSJxtFBjo> (last visited March 9, 2017).

¹³ United States Government Accountability Office, *GAO 14-1446, Report to Congressional Requesters: Climate Change Adaptation. DOD Can Improve Infrastructure Planning and Processes to Better Account for Potential Impacts*, May 2014, 11.

¹⁴ Department of Defense, *Quadrennial Defense Review 2014*, VI.

¹⁵ United States Government Accountability Office, *GAO 14-1446, Report to Congressional Requesters: Climate Change Adaptation. DOD Can Improve Infrastructure Planning and Processes to Better Account for Potential Impacts*, May 2014, 2.

¹⁶ *Ibid.*, 12.

¹⁷ *Ibid.*, 14.

¹⁸ *Ibid.*, 15.

¹⁹ Department of Defense, *Quadrennial Defense Review 2014*, 8.

²⁰ Erickson, Edward J, *Climate Change and the Department of Defense: An Introduction*, MCU Journal, Climate Change and Policy Special Issue, Marine Corps University Press, 2016.

²¹ Department of Defense, *Quadrennial Defense Review 2014*, 115.

²² *Ibid.*

Notes

- ²³ Kennedy, Caroline CNN Politics, *Trump: 'Nobody really knows' if climate change is real*, December 12, 2016, (last accessed March 16, 2017).
- ²⁴ Ibid.
- ²⁵ Massachusetts v. EPA, 549 U.S. 559 (2007).
- ²⁶ United Nations Framework Convention on Climate Change, http://unfccc.int/kyoto_protocol/items/2830.php (last visited March 14, 2015).
- ²⁷ See Glicksman, Robert L., David L. Markell, William W. Buzbee, Daniel R. Mandelker & Daniel Bodansky, *Environmental Protection Law and Policy*, Sixth Edition, 1138, Aspen Casebook Series, 2011.
- ²⁸ The President's Climate Action Plan, June 2013, <https://obamawhitehouse.archives.gov/sites/default/files/image/president27sclimateactionplan.pdf> (last visited March 14, 2017).
- ²⁹ European Commission, Paris Agreement, https://ec.europa.eu/clima/policies/international/negotiations/paris_en (last accessed March 14, 2017).
- ³⁰ Ibid.
- ³¹ Ibid.
- ³² Colman, Zack, The Christian Science Monitor, *Spotted in Washington: conservatives supporting climate action*, February 3, 2017 (last accessed March 16, 2017).
- ³³ Davenport, Coral, New York Times, *Top Trump Advisors are Split on Paris Agreement on Climate Change*, March 2, 2017, (last accessed March 16, 2017).
- ³⁴ Flesher, John, Matthew Daly, and Catherine Lucy, The Washington Post, *Climate, other programs get deep cuts in EPA budget proposal*, March 3, 2017.
- ³⁵ Kennedy, Caroline, CNN Politics, *Trump: 'Nobody really knows' if climate change is real*, December 12, 2016, (last accessed March 16, 2017).
- ³⁶ Eilperin, Juliet, The Washington Post, *Trump is poised to issue a sweeping order dismantling Obama's climate plan this week*, <https://www.google.com/amp/s/www.washingtonpost.com/amphtml/news/energy-environment/wp/2017/03/14/trump-is-poised-to-issue-a-sweeping-order-dismantling-obamas-climate-change-plan-tehis-week/>, March 14, 2017 (last accessed March 16, 2017).
- ³⁷ Ibid.
- ³⁸ Nash, Greg, The Hill, *Trump's Defense secretary calls climate change a national security risk*, <https://www.google.com/amp/thehill.com/policy/energy-environment/323959-trumps-defense-secretary-calls-climate-change-a-national-security%3Famp>, March 14, 2017 (last accessed March 16, 2017).
- ³⁹ Ibid.
- ⁴⁰ NASA, *Global Climate Change Vital Signs of the Planet, Responding to Climate Change*, <https://climate.nasa.gov/solutions/adaptation-mitigation> (last accessed March 16, 2017).
- ⁴¹ DOD Directive 4715.21, *Climate Change Adaptation and Resilience*, January 14, 2016, 1.
- ⁴² Ibid.
- ⁴³ Ibid, 8.
- ⁴⁴ Department of Defense, *Quadrennial Defense Review 2014*, VI.
- ⁴⁵ DOD Directive 4715.21, *Climate Change Adaptation and Resilience*, January 14, 2016, 5.
- ⁴⁶ Ibid.

Notes

⁴⁷ Ibid, 8.

⁴⁸ Ibid, 8.

⁴⁹ DOD Directive 4715.21, *Climate Change Adaptation and Resilience*, January 14, 2016, 5.

⁵⁰ United States Government Accountability Office, *GAO 14-1446, Report to Congressional Requesters: Climate Change Adaptation. DOD Can Improve Infrastructure Planning and Processes to Better Account for Potential Impacts*, May 2014, 2.

⁵¹ Department of Defense, *Quadrennial Defense Review 2014*, 8.

⁵² Ibid, 4.

⁵³ Ibid, 115.

⁵⁴ DOD Directive 4715.21, *Climate Change Adaptation and Resilience*, January 14, 2016, 3.

⁵⁵ Ibid.

⁵⁶ Ibid, at 6.

⁵⁷ NASA, *Global Climate Change Vital Signs of the Planet, Responding to Climate Change*, <https://climate.nasa.gov/solutions/adaptation-mitigation> (last accessed March 16, 2017).

⁵⁸ Executive Order (EO) 13693, *Planning for Federal Sustainability in the Next Decade*, 19 March 2015, available at <https://obamawhitehouse.archives.gov/the-press-office/2015/03/19/executive-order-planning-federal-sustainability-next-decade> (last accessed 23 March 2017).

⁵⁹ Ibid.

⁶⁰ Office of the Assistant Secretary of Defense (Energy, Installations, and Environment), *Department of Defense Guidance for Executive Order 13693: Planning for Federal Sustainability in the Next Decade*, March 2016, <http://www.acq.osd.mil/eie/Downloads/IE/DOD%20Guidance%20on%20EO%2013693%20FINAL%2023Mar2016.pdf>, 14, (last accessed March 23, 2017).

⁶¹ Ibid, 5.

⁶² Ibid, 5.

⁶³ The United States Environmental Protection Agency, *Global Greenhouse Gas Emissions data*, <https://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data> (last accessed March 30, 2017).

⁶⁴ U.S. Department of Defense: *Climate Change, Energy Efficiency, and Ozone Protection*, <http://infohouse.p2ric.org/ref/21/20958.htm> (last accessed March 23, 2017).

⁶⁵ Ibid.

⁶⁶ Ibid.

⁶⁷ The White House, *Making Our Military Strong Again*, <https://www.whitehouse.gov/making-our-military-strong-again> (last accessed March 16, 2017).

⁶⁸ U.S. Department of Energy, *Energy Efficiency and Renewable Energy, Federal Energy Management Program*, 1, https://www1.eere.energy.gov/femp/pdfs/af_fuefficiency.pdf (last accessed March 23, 2017).

⁶⁹ Ibid.

⁷⁰ Ibid, 1-2.

⁷¹ Insinna, Valerie, and Yasmin Tadjdeh, *National Defense Magazine, Air Force Making Headway on Fuel Efficiency Goals*, June 2013, <http://www.nationaldefensemagazine.org/archive/2013/June/Pages/AirForceMakingHeadwayonFuelEfficiencyGoals.aspx> (last accessed March 23, 2017).

Notes

⁷² Energy.Gov, Office of Energy Efficiency & Renewable Energy, Government Energy Management, <https://energy.gov/eere/efficiency/government-energy-management> (last accessed March 23, 2017).

⁷³ The Council on Environmental Quality, Guiding Principles for Sustainable Federal Buildings and Associated Instructions, February 2016, https://sftool.gov/Content/attachments/guiding_principles_for_sustainable_federal_buildings_and_associated_instructions_february_2016.pdf, (last accessed March 23, 2017).

⁷⁴ Ibid, 1.

⁷⁵ Danko, Pete, Greentech Media, US Military Faces Trio of Renewable Energy Goals, July 3, 2013, <https://www.greentechmedia.com/articles/read/us-military-faces-trio-of-renewable-energy-goals> (last accessed 23 March, 2017).

⁷⁶ Harper, Scott, The Virginian-Pilot, Navy builds solar power farm near Norfolk base, December 4, 2012, http://pilotonline.com/news/military/navy-builds-solar-power-farm-near-norfolk-base/article_c92eae0-8d31-513b-b256-2b87edd49cfd.html (last accessed March 23, 2017).

⁷⁷ Ibid.

⁷⁸ Ibid.

⁷⁹ Pete Danko, Greentech Media, US Military Faces Trio of Renewable Energy Goals, July 3, 2013, <https://www.greentechmedia.com/articles/read/us-military-faces-trio-of-renewable-energy-goals> (last accessed 23 March, 2017).

⁸⁰ Caroline Kennedy, CNN Politics, *Trump: 'Nobody really knows' if climate change is real*, December 12, 2016, (last accessed March 16, 2017).