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# Energy, Climate and National Security Challenges and Opportunities for America

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# Energy, Climate and National Security Challenges and Opportunities for America

## Introduction

The Patuxent Policy Group, a collaboration of The Patuxent Partnership and the Center for the Study of Democracy, hosted a group of experts at St. Mary's College of Maryland on August 4, 2011 to discuss the future of energy. The working group, facilitated by Vice Admiral Denny McGinn, (USN, ret.), Energy and National Security, brought together participants with unique talent and experience from academia, industry and government to present their ideas about the implications and future of energy on different sectors of society, including the U.S. military. This white paper organizes and summarizes the main themes that emerged from this policy discussion.

The views expressed in this paper reflect the output of a group discussion and are not intended to represent the views of any particular individual who participated in the working group. The paper was produced by Dr. Matthew Fehrs and Dr. Todd Eberly from St. Mary's College of Maryland.

## I. Main Findings

1. The effects of climate change are already being seen and the costs of inaction are significant. To highlight the cost of the status quo, the true cost of fossil fuel-based energy needs to be emphasized, as well as the problems that oil dependence creates for the U.S. economy and national security.
2. Thus far, technical innovation in the field of clean energy has not been matched by adequate governmental policies. Although the federal government will need to play a major role in clean energy policy for the foreseeable future, the lack of policy stability has not created a sufficient level of clean energy market certainty and thus has hampered private investment.
3. Despite this, there have been a number of policy successes, including the tax credits, grants, and loan guarantees in the 2009 federal stimulus bill. Overall, smaller, focused programs, such as the Electric Vehicle Deployment Act, are more likely to yield results than larger, encompassing initiatives.
4. The current debate over climate change and clean energy has often been incorrectly framed as environmental interests versus economic growth. Instead of discussing the issue in terms of costs and sacrifice, proponents of clean energy should emphasize the compatibility of these two issues as well as the significant economic benefits of large-scale deployment of clean energy technology and the lessening of American dependence on petroleum.
5. There is enormous potential in the “big three” renewable energy sources – wind, solar, and geothermal – but each also faces significant investment hurdles. Biofuels offer the advantage of working with existing technology, but can create economic imbalances and even ethical dilemmas when they compete with food for consumers. In addition to renewable energy sources, to fulfill growing electrical energy needs over the medium term, increased use of nuclear power and natural gas are likely.
6. The U.S. reliance on oil creates a high level of economic and national security risks and is most evident in the transportation sector. Even slight improvements in this area are likely to lead to positive compounding effects throughout the economy and in military operations. As in the past, future uncertainty and likely volatility of oil prices will create a significant drag on businesses, household budgets and the American economy overall.
7. The U.S. military, and the Navy in particular, are taking significant steps to reduce dependence on fossil fuels and increase the use of renewable energy. Moving forward, the Department of Defense can take a leading role in making the case for the benefits of clean energy as well as spurring development through its R&D and procurement policies.

## II. The Costs of Inaction

Climate change is occurring and the results are visible. The level of carbon dioxide in the atmosphere has risen steadily and the rate of future climate and severe weather changes depend on the steps taken to limit emissions. Evidence of trapped global energy is seen in the fact that there is less outgoing than incoming long-wave radiation in the earth's atmosphere.

Changes in the earth's bodies of water brought on by climate change are likely to have a dramatic impact on human life. On the one hand, sea levels rising one to two meters over the next several decades will pose significant challenges to coastal infrastructure and to the large portion of the earth's population living near oceans, particularly in the developing world. On the other hand, water scarcity resulting from higher temperatures and declining snow pack will pose both a direct problem for food production and several forms of energy production, including nuclear, biofuels and hydroelectric. Lower water flows make it more difficult to cool nuclear plants and will decrease the throughput, and therefore energy output of hydroelectric dams. Biofuel crops, requiring irrigation, would also suffer from water scarcity.

Two primary issues emerge with respect to educating the public about the need to transition away from a carbon energy-based economy. One is that the costs of maintaining the status quo of a fossil fuel intensive economy have to be more clearly demonstrated. That means showing the drag that U.S. petroleum imports create on national wealth, as well as educating consumers on the true cost of current energy sources. In 2008, U.S. expenditures on crude oil and petroleum products accounted for over 50% of the trade deficit. Citizens need to see that the price they pay at the pump for gasoline is only a fraction of the actual total cost they bear for oil, including the costs in dollars and lives in deploying U.S. military forces around the world to protect the free flow of oil. Finally, computer modeling can assist experts in showing the public the alternative futures that exist based on different energy and climate scenarios. Changing the discussion to reflect the notion of insuring against future risk is more effective than alarmist statements that may delegitimize the issue for some people.

Future discussions on energy and climate change need to emphasize the fact that U.S. dependence on petroleum imports has real and measurable national security implications. Although the repercussions are complex and far-reaching, the current war in Afghanistan provides a microcosm of the problems facing the U.S. To get oil to U.S. troops in Afghanistan, it must be transported by ocean and/or air, then travel overland by truck drivers who may have to pay bribes to get through Taliban checkpoints. This fuel, delivered to its final point of use and at a total transport cost of \$768 per gallon, is then used in part to fight the Taliban. Additionally, it has been documented that petro-dollars going to Iran have been secretly used to fund lethal weapons technology for extreme insurgents. Thus, the U.S., with its growing dependence on imported oil, is inadvertently funding both sides in the war on terror. Therefore, the Department of Defense has substantial motivation to become a leader in the drive to decrease reliance on fossil fuels.

### III. Energy and Public Policy

There is a growing gap between the technological successes in the field of clean energy and the public policy written to support it. While there is a great deal of interest in clean energy technologies, and investors waiting on the sidelines with large amounts of capital, a “visionary policy at the federal level” has been lacking. A myriad of state policies also has created a highly variable regulatory environment for existing resources. This creates a lot of market uncertainty and impedes the deployment of clean energy technology. Further, while U.S. energy policy efforts have languished, other countries, including China, are rapidly moving forward to develop green technologies.

The failure of leadership on clean energy at the national level creates a variety of problems. Most notably, investors need a predictable setting to create a degree of market certainty. This lack of predictability not only delays investment, but harms the United States’ international economic competitiveness. Policy inaction also reinforces the view that climate change problems are long-term and do not require immediate legislation. Additionally, the inability of the U.S. to take action domestically impedes its leadership in crafting international energy agreements.

Today’s policy choices are likely to have a significant impact on long-term climate trends, including land use. The impact of rising energy demand on land use depends significantly on how resources are valued. If terrestrial carbon is valued – as in a carbon trading system – over time, forest land will increase. However, if this carbon is not given a value, over time bio-energy crops will greatly expand – to cover more than 40% of all land - while forest area will decline. Already, the decrease in tropical forests is responsible for 20% of greenhouse gas emissions.

The reasons for policy failure are diverse. As noted below, the discussion over climate change in the United States has been narrowly framed for political expedience to emphasize costs and sacrifice over the benefits and opportunity of viable solutions. The fact that policymakers focus on short-term election cycles and climate scientists think in terms of decades and centuries makes it more difficult to argue for immediate action. Additionally, crises tend to focus the mind, and historically U.S. investment in clean energy has run up against access to cheap oil. Finally, regional differences in the United States, and the power sharing inherent in the federal system, highlight the fact that national solutions will need to allow for unique local conditions.

Despite these problems, there are a number of initiatives that have yielded success on a smaller scale. Generally, when creating programs to incentivize investment in renewable energy sources, smaller, focused programs are better than large, encompassing efforts.

The federal stimulus package enacted in February 2009 boosted investment in renewable energy sources, particularly wind and solar, but as these tax credits, grants, and loan guarantees run out, investment may stagnate. The role of the federal government in alternative energy investment will continue to be significant for the foreseeable future. The Electric Vehicle Deployment Act, part of the energy bill currently before the Senate, looks to pit U.S. cities against each other to create infrastructure for electric vehicles while also demonstrating best practices. A similar program is also underway in China, which has focused its efforts on electric engines, entirely bypassing the internal combustion model.

## IV. Energy and Public Policy

One particularly promising and perhaps surprising source of change (and funding for alternative fuels) is the Department of Defense (DoD). Specifically, the U.S. Navy has taken a number of steps to decrease its dependence on petroleum by increasing energy efficiency and using biofuels for ships and aircraft. The launching the “hybrid-powered” *USS Makin Island*, part of the “great green fleet” and biofuel powered flight of the F/A-18 “Green Hornet” are examples of the Navy’s investment and growing influence in this area. By 2020, the Navy hopes to increase the role of alternative energy sources to 50% of its total energy consumption, while simultaneously decreasing reliance on oil.

Considering the U.S. federal government is the largest single consumer of energy in the country (2%), and the DoD accounts for uses 93% of the government’s petroleum usage, the impact will be significant. A recent memorandum of understanding between the Departments of Energy and Defense, which will include embedding DoE advisors with DoD combat commands and assessments of forward operating bases in Iraq and Afghanistan, could serve as a catalyst for further changes and more rapid adoption of clean energy technology by the military.

## V. Framing the Issue of Climate Change

Popular perception and some media reports tend to frame the issue of environmental protection and economic growth as diametrically opposed forces that exist in a zero-sum environment. For example, public opinion polls showing a decline in support for environmental issues over the past decade tend to dichotomize the issue. This characterization is fundamentally flawed and, especially in difficult economic times, creates an obstacle to progress on energy issues. Just as investment in alternative energy sources moves counter-cyclically with oil prices, public opinion on environmental issues is strongly influenced by economic conditions.

While it is important to note the costs of inaction, too much of the rhetoric on climate change adaptation revolves around costs, while underplaying the benefits of action. Historically, the United States has passed environmental legislation, like the Clean Air Act, that has successfully addressed problems while having minimal negative consequences for the overall economy. These successes demonstrate that responsible policies for dealing with the effects of a changing climate are not at odds with economic growth and in many cases can enhance it.

The often politically charged language on this issue focuses too much on sacrifice, while ignoring the significant economic benefits that exist for alternative energy sources. Increasing the use of alternative energy sources will help decrease the volatility of energy markets, which has a significant detrimental impact on the overall economy. The previous four recessions in the U.S. have all come within six months of spikes in oil prices. At the same time, the clean energy sector is growing rapidly worldwide and is likely to be a key area of international competition for years to come. The question that Americans and our elected leaders must ask themselves is whether they want to lead in this ongoing energy revolution or to allow China and Europe to dominate future technologies in this huge potential market.

The Department of Defense can take a leadership role in demonstrating the benefits of addressing climate change and moving away from dependence on petroleum. From emphasizing its own efforts to reduce petroleum dependence to procurement practices emphasizing energy efficiency, the DoD can exert substantial influence on public opinion and private investment.

## VI. Alternatives

When it comes to alternative energy sources, there are a variety of choices that vary in their levels of current use, future investment potential, and limitations. These options also vary in terms of their “renewability” and environmental impact.

Of renewable energy sources, the most frequently cited are wind, solar, and geothermal. Wind power has undergone significant growth since 2002, but as the stimulus funds run out, investment is declining. Still, wind power remains the largest of these three sources. The problem remains that most wind energy is generated in the Great Plains and must be transported long distances to population centers. Solar power is currently undergoing its first investment boom and there are projects planned to produce more than 20,000 megawatts. A few years ago there were five U.S. manufacturers and none in China. Now China, primarily due to a lack of coherent U.S. energy policy, has far surpassed the United States in solar panel production, with 528 manufacturers while the U.S. still has but five. Concentrated solar power projects face two particular problems: their size and location often puts them at odds with environmental groups and they require massive initial investment. Finally, geothermal power, in perhaps as few as four decades, could replace coal, particularly in the western U.S. While its role is now relatively small in U.S. power production, it is likely to grow dramatically over the next century.

Two other renewables offer less promise for the future: hydroelectric and biomass. Hydroelectric power creates an even greater environmental footprint than concentrated solar power and also has limited potential for growth due to the large number of installations already online. Biomass power faces a different problem: proving that it has a steady and sustainable supply of fuel to convert to energy. The inability to prove reliable access to fuel makes it difficult for large biomass energy plants to get the necessary financing.

Biofuels for transportation offer promise to reduce oil use and greenhouse gases (by 60-80%), but could create new problems because they engender competition among food, feed, fiber and energy crops. For example, a farmer who chooses to grow corn for ethanol over food or animal feed crops impacts other parts of the economy with that choice. Without coherent legislation, the use of ethanol feed stocks derived primarily from food crops could drive up food prices and force other crops out of production. Energy feedstock crops need to be developed in a way that minimizes strains on the food supply, particularly in developing countries. With emerging non-food crop biofuel feed stocks like algae and increasingly using “cellulosic” technology, they offer significant cost and sustainability advantages. Further, in terms of biofuel end use, in many cases they can be used with existing technologies, preventing expensive equipment retrofitting. The Navy’s F/A-18 “Green Hornet” is one example of a successful use of biofuels that met the performance requirements of the military. The development of algae-based biofuels and cellulosic ethanol will help avoid the problems of “food versus fuel” that corn-based ethanol has encountered.

Two non-renewable energy sources are also likely to play a much larger role in future U.S. energy policy. Nuclear power is expected to become increasingly important, particularly in the southeastern U.S. Modular nuclear reactors, which are produced significantly more efficiently and at lower cost than traditional reactors, might also help the nuclear industry overcome the high initial cost investment necessary for a traditional-design plant. However, the reliance of old nuclear plants on large amounts of water could pose problems as water resources become scarcer.

## VI. Alternatives

Natural gas is another non-renewable that will receive increased attention in the future. The United States has significant domestic supplies of gas and the discovery of large shale deposits have greatly expanded supply projections. Natural gas is much less polluting than coal and petroleum and can also be usefully paired with renewables to provide a clean and reliable supply of energy. Natural gas does emit some carbon and prices have historically been volatile; however, shale production and natural gas electrical production, in conjunction with renewable energy, will likely lead to much greater price stability in the future.

One aspect of “clean energy technology” that requires more discussion is energy efficiency. Several future projections for energy use, both generally, and specifically for the Navy, assume substantial savings from energy efficiency in the future. The specific nature of these savings and how they will enable and interact with new energy sources needs further exploration. The diffuse nature of efficiency gains, in manufacturing, business, homes, and in the military need to be carefully factored with the large-scale projects required for many new sources of energy.

## VII. Transportation

Transportation is a particularly thorny issue for American dependence on petroleum. The U.S. uses more oil for transportation purposes than any other nation's total consumption. Nearly 70% of oil consumption is in transportation and 95% of transportation is powered by petroleum. This means that even relatively small improvements in transportation efficiency and a shift to non-oil sources of energy will have significant positive compounding effects.

The dependence of Americans on gasoline creates a variety of problems. As Americans spend an increasingly large portion of their income on gasoline, fluctuations in the market create significant difficulties for the larger economy, just as they do for the military. Thus, the increase in the cost of gasoline, 18.7 cents a gallon in 2008, had a greater financial impact on American families than did the effect of increases in the average adjustable-rate mortgage.

At the same time, most Americans have daily commutes that are within the capacity of electric cars. Unlike conventional combustion engines, as the power grid becomes cleaner, electric cars will consequently become less polluting. The primary challenge at this time is the lack of infrastructure to allow electric cars to recharge. The Electric Vehicle Deployment Act seeks to combat this inadequacy.

The U.S. military, which accounts for 93% of all government petroleum consumption, has particularly strong incentives to increase the use of alternative fuels. According to the Commandant of the Marine Corps, transporting fuel into Afghanistan and Iraq can raise the cost of a \$1.04 gallon of diesel fuel up to \$400 when it is delivered to a forward operating base. That price, which reflects the tremendous cost of transportation as well as the security and risks involved is referred to as the "Fully Burdened Cost of Fuel." That cost may be significantly higher if the fuel is transported via aircraft and not by land. Out of logistics security concerns and due to the problems of cost volatility, the DoD wants to decrease its dependence on oil. This is the primary motivation behind Navy initiatives to increase fuel efficiency and move to alternative fuel sources.

Moving forward, the buying power of the Navy will allow it to incentivize suppliers to offer more energy efficient vehicles. The total cost of ownership is becoming a major factor in the Navy procurement process, and energy use is a significant part of that cost. The Navy also faces the challenge that although 33% of its shore-based vehicles are fueled by alternative energy, the lack of alternative energy infrastructure prevents them from maximizing their potential.

The Navy is also constrained by its existing fleet and infrastructure. Retrofitting aircraft carriers and destroyers for alternative fuels is an expensive alternative, so any alternative fuel must be "drop in," meet performance requirements, and be able to mix with petroleum. Moreover, the Navy needs fuel sources that are compatible with the broad range of engines in its fleet, some dating from the 1950s.

## VIII. Conclusions

Climate change is occurring, the effects are already being witnessed, and the impact on human life is likely to be significant. While political responses to climate change often emphasize the costs of action, the American technology and economic initiatives in clean energy hold real opportunities. In this regard, the United States faces three challenges in dealing with climate and energy issues.

The first challenge surrounding discussions of climate change centers on shifting the debate from costs of action to costs of inaction. The status quo is not sustainable nor a stable basis for economic development and U.S. foreign policy. A true accounting of the costs of America's oil addiction would include the total cost for a gallon of gasoline, the problems of price volatility, and increasing drag of oil on the overall economy and the average household, and the problems energy insecurity creates for U.S. defense.

Moving from understanding the costs of the current U.S. fossil fuel dependence trajectory to a course of taking action presents the second challenge. A strong federal and state policy role will be necessary to create an environment for investment in alternative energy projects; however, especially at the federal level, past action has been inconsistent and crisis-driven. Despite the need for leadership from Washington, the federal nature of the U.S. system means both that regional conditions must be taken into account and that regulatory heterogeneity will persist. The diversity of U.S. state and regional interests and the variety of federal agencies involved, mean that coherent and focused legislation, and policy implementation, need to be developed in order to unleash the development and deployment of clean energy technology and the economic and security benefits that are achievable.

While renewable resources and biofuels present hope for a transition away from fossil fuels, their limitations present a third challenge. The lack of predictable federal financial support for renewable energy projects impedes investment and leads to boom and bust cycles. The ancillary energy needs of solar, (land mass), and nuclear, (water for cooling), projects may negatively interact with increasingly scarce water resources in the future. The surprising nexus of these three challenges is the U.S. defense establishment. By taking serious action regarding climate change, the military can take the leadership role on this issue. The Department of Defense also can make the most credible arguments about the costs and the national security implications of inaction. Further, due to the military's budget and role in U.S. energy consumption, the ripple effects of its actions are likely to be felt across the economy. Finally, the sheer size of the military's procurement decisions could help overcome some of the investment problems facing renewable energy sources and biofuels.

## IX. Suggested Readings

- CNA Military Advisory Board. *Powering America's Economy: Energy Innovation at the Crossroads of National Security Challenges*. July 27, 2010 - <http://www.cna.org/reports/climate>
- CNA Military Advisory Board. *National Security and the Threat of Climate Change*, Apr. 2007 - <http://www.cna.org/reports/climate>
- Defense Science Board. *More Fight, Less Fuel*. Feb. 2008 - <http://www.acq.osd.mil/dsb/reports/ADA477619.pdf>
- Naturalgas.org. *Natural Gas and the Environment* - <http://www.naturalgas.org/environment/naturalgas.asp>



## CENTER FOR THE STUDY OF DEMOCRACY

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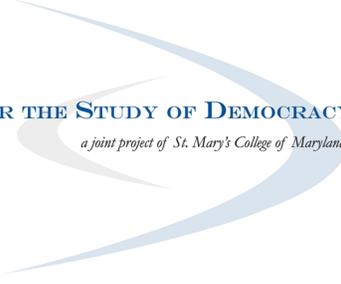
### **The Center for the Study of Democracy**

The Center for the Study of Democracy was founded as a joint initiative of St. Mary's College of Maryland and its partner institution, Historic St. Mary's City, the site of Maryland's first capital. The purpose of the Center is to explore contemporary and historical issues associated with democracy and liberty in national and international contexts. The Center provides a forum for presentations by government officials, journalists, and scholars; publishes scholarly writings on subjects of civil governance; encourages and supports public participation in political processes; and engages undergraduate students in study and research on related subjects.



### **The Patuxent Partnership**

The Patuxent Partnership works with government, industry and academia on initiatives in science and technology, hosts programs of interest to Naval Air Systems Command (NAVAIR) and the broader department of defense community, supports workforce development including education initiatives and professional development.



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