CENTER FOR THE NEW ENERGY ECONOMY

Colorado State University

Powering Forward:

Presidential and Executive Agency Actions to Drive Clean Energy in America

Even in the face of Congressional inaction, President Obama can leverage executive branch power, unleash enterprise and investment, and move America toward a clean energy future that curbs climate change. Featuring 200 specific recommendations developed by more than 100 industry experts and top energy thinkers, *Powering Forward* provides the Administration with options to move the nation closer to a clean energy economy.

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Presidential and Executive Agency Actions to Drive Clean Energy in America

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Foreword

100 CEOs, CFOs, academics, researchers, NGOs & government leaders pinpoint climate and energy security imperatives

In his 2013 State of the Union address, President Barack Obama told Congress that if it did not act to curb global climate change, he would.

And he did. Five months later, the President issued a comprehensive climate action plan that does not require congressional action. Many of the items already have been implemented or put in motion.

The President's plan adds to the long list of initiatives his administration has accomplished since 2009, ranging from historic vehicle efficiency standards to the regulation of greenhouse gas emissions from power plants.

Are there additional steps the President can take in the next three years to mitigate climate change and move America closer to a clean energy economy? The answer is yes. But they will require considerable work by the administration and support from the American people. They will also require steps by the President to unleash enterprise and investment across the country.

In March 2013 President Obama met with 14 energy thought leaders, representing a variety of stakeholder groups, to discuss how he could further pursue a clean energy agenda using his lawful authority. Following the meeting, the leaders asked the Center for the New Energy Economy (CNEE - the Center I founded in 2011 at Colorado State University) to undertake a deeper examination of the President's options in five discrete areas. In response, CNEE launched an eight-month initiative to gather ideas for additional presidential action on climate and clean energy. In dialogues, roundtables and peer reviews, CNEE engaged more than 100 participants, including chief executive officers, chief financial officers and other top executives from industry, academia, research institutions, NGOs and state and local governments. We asked them what new actions by the President and his executive agencies would help our nation be more effective in meeting our climate and our energy goals.

The five areas of focus are:

1. Doubling energy productivity
2. Financing renewable energy
3. Producing natural gas responsibly
4. Developing alternative fuels and vehicles, and
5. Enabling electric and gas utilities to adapt to the new realities of the 21st century

Two rules governed this process. First, we applied the Chatham House Rule, ensuring participants' anonymity to encourage open dialogue and free exchange of ideas. In accordance with that rule, we have not attributed ideas to specific individuals or organizations. Second, we encouraged but did not require consensus. Not all participants agreed with all of the recommendations in our final report, but everyone had a substantive voice in the process.

Four principal themes emerged during the CNEE exercise:

1. As CEO of the nation's largest energy customer—the Federal Government—and Commander–in–Chief of the armed forces, the President should use the full power of federal procurement to help create the large and stable markets that will attract more investment in clean energy goods and services. That will require changes in the procurement system.

2. Many of the most important legal responsibilities related to energy use and carbon emissions reside in states and localities. The Federal Government should help states and localities assert their leadership with increased research, technical assistance and carefully targeted financial assistance.

3. The Federal Government and its policies will have to be retooled to support a clean energy economy. For example, many industry leaders who are eager to participate in the energy transition say they are inhibited by government regulations that are not keeping up with today's rapid changes in energy technology and customer preferences.

4. The administration can make strategic changes in fiscal policy to help move private capital at every level of the economy off the sidelines and into clean energy.

This report offers President Obama and his administration more than 200 recommendations for America's transition to a clean energy economy – recommendations that CNEE believes can be implemented with the President's existing authority. Many of the recommendations can be implemented immediately; some will take several months; and others may not be completed until after President Obama leaves office.

President Obama deserves credit for his resolve to take action on climate change. This report is intended to help him. There simply is no more important issue and no time to waste.

Bill Ritter, Jr.
41st Governor of Colorado
Founder and Director, Center for the New Energy Economy

The Clean Energy Transition Has Begun But It Must Move Faster

The President has a wide variety of executive authorities to address climate change and shape energy policy without further action by Congress. The Constitution confers some; precedent establishes others; and most have been delegated to the Executive Branch by past Congresses.

America's historic transition to clean energy already is underway.

How actively a president uses these authorities, however, may depend on the breadth of support from the American people. The challenge for the President and his team is to rally the American people around the objective of creating a clean energy economy, to encourage their support and concrete action, and to unleash the economy's enormous reservoir of uncommitted private capital for investments in clean energy.

The reality is that America's transition to a clean energy economy is not just a job for the future; it's already underway. But, if we are to avoid the worst consequences of global warming and if we hope to capture the emerging global market for clean energy technologies, we must accelerate the pace of this transition. Indeed we must redouble our efforts for the sake of future generations.

Doubling the Nation's Energy Productivity

During his 2013 State of the Union address, the President announced a new goal: To double the energy productivity of the U.S. economy by 2030. That is both a challenge and an opportunity. According to the American Council for an Energy Efficient Economy, the national economy wastes 87% of the energy it consumes – a level of inefficiency that undermines our competitiveness, produces more greenhouse gas emissions, and costs every American family and business money.

The Alliance to Save Energy estimates that doubling our energy efficiency would save consumers $327 billion annually, including more than $1,000 each year for the average household. Businesses would save $169 billion annually, about as much as the entire corporate sector paid in federal income taxes in 2011.

President Obama already has taken several steps to improve the Federal Government's productivity and cut its energy bills. Shortly after taking office, the administration cleared up a longstanding bottleneck in appliance efficiency standards. In October 2009, the President issued Executive Order 13514 directing agencies to reduce the energy and carbon intensity of federal buildings. And in December 2011, he directed agencies to execute $2 billion in energy saving performance contracts (ESPCs), arrangements in which private companies make energy efficiency improvements to federal buildings with guaranteed results. There is no cost to taxpayers. The companies are repaid by sharing the government's savings on energy

bills. In addition, the Administration cleared up a longstanding bottleneck in appliance efficiency standards shortly after taking office.

However, there is greater potential for using ESPCs. Roadblocks remain in the contracting process. And the backlog in appliance efficiency standards has reappeared.

RECOMMENDATIONS TO THE PRESIDENT

- **Amend the December 2011 ESPC directive to require that agencies execute $1 billion in energy saving contracts in each of the next 5 years.**
- **Direct agencies to use ESPCs more widely to fund efficiency projects in public housing, demand-response programs, data center consolidations, combined heat and power systems, waste-to-energy projects and other energy-saving projects.**
- **Order the Office of Management and Budget (OMB) to complete its review of new appliance efficiency standards within 90 days, as its own rules require.**
- **Direct the U.S. Department of Energy (DOE) and the Federal Housing Finance Authority to analyze government mortgage data to find out whether residential energy efficiency investments reduce mortgage defaults. If they do, direct federal agencies that administer mortgage programs to reflect this benefit in their loan terms. Encourage private lenders to do the same.**
- **Allow electric utilities to earn credit for energy efficiency investments beyond the fence lines of their power plants as they comply with EPA's regulation of greenhouse gas emissions from generation plants.**
- **Work with the building industry to develop a model national code for net-zero energy buildings.**

We can cut the government's energy bills with guaranteed results at no cost to taxpayers.

Financing Renewable Energy

Renewable energy is an essential element of a clean energy economy, and renewables are ready now. The amount of electricity from solar and wind power in the United States has doubled over the past four years. Today, wind energy supplies enough electricity for 15 million homes. By mid-century, renewable energy technologies commercially available today could provide more than 80% of America's electricity, according to the Department of Energy's National Renewable Energy Laboratory.

The administration's goal is to make solar power cost competitive with traditional power generation by 2020. The President has nearly tripled his goal for renewable energy use in federal facilities, setting the target at 20% by 2020. He has proposed that the nation obtain 80% of its electricity from clean energy resources by 2035. And the Department of Defense is working to obtain 25% of its energy from renewable resources by 2025.

Renewable resources (including hydropower) provide 12% of America's electricity today. The Energy Information Administration projects that if we continue business as usual, the contribution of renewable energy will grow to only 16% by 2040. That is not enough.

RECOMMENDATIONS TO THE PRESIDENT

- **Develop methods for accurately counting the full costs of various energy choices, including pollution and health care costs that have been "externalized" in the past. Use these methods to establish priorities for federal support of energy resources and direct it to the "best of the above" rather than "all of the above".**
- **Clarify that federal agencies can enter into power purchase agreements for periods of up to 25 years.**
- **Expand the use of ESPCs to finance micro-grids, distributed generation projects and other proven but underutilized energy technologies that result in operational and maintenance savings.**
- **Design standards for greenhouse gas emissions from power plants under Section 111(d) of the Clean Air Act to promote the use of renewable technologies.**

- **Request that the IRS issue a revenue ruling that Real Estate Investment Trusts can invest in renewable energy. In addition, encourage the IRS to determine whether it has the authority to qualify renewable technologies for Master Limited Partnerships in the tax code.**
- **Request that the Comptroller of the Currency make clear that community banks will be credited under the Community Reinvestment Act for financing renewable energy and energy efficiency projects in low- and moderate-income neighborhoods.**
- **Direct the DOE to study federal, state and private data to determine the extent to which renewable energy investments raise the market value of homes and businesses. If the study verifies that benefit, direct federal mortgage agencies to factor it into the terms of their loans.**
- **Champion parity for renewable energy with fossil energy as part of tax reform. The objective is not to make the code more complex, but more fair. Direct the appropriate agencies to review other elements of federal fiscal policy to identify and reform policies that encourage greenhouse gas emissions.**
- **Work with states to reallocate $2 billion in unused Qualified Energy Conservation Bonds for investments in renewable energy projects.**
- **Work with trusted messengers in rural America to promote full use of the Department of Agriculture's new loan guarantee program for renewable energy projects by rural electric utilities and their customers.**
- **Convene state Treasurers and launch a state/federal partnership to align state and federal loan programs with the goal of maximizing private capital investment in renewable energy.**

Robust and Responsible Natural Gas Production

President Obama supports responsible natural gas production. Executives from the natural gas industry told CNEE they value reasonable government regulation. On one hand, regulation can weed out bad actors, provide certainty for business planning, and improve the industry's "social license to operate". On the other hand, ineffective, unnecessary or excessive regulations impede production and increase costs.

The regulation of natural gas production is largely a state responsibility, but the Federal Government can help in several ways.

RECOMMENDATIONS TO THE PRESIDENT

- **Direct the Bureau of Land Management to require that gas producers use and demonstrate the best available technologies and practices on federal lands, including full disclosure of hydraulic fracturing agents, zero tolerance for methane leaks, sound water management and minimal land disturbance.**

Natural gas companies must use the best available production methods on federal lands.

- **Direct the Council on Environmental Policy and the Office of Science and Technology Policy to work with states and the natural gas industry to improve the states' ability to inspect and enforce environmental rules.**
- **Work with states to develop a nationwide methane reduction strategy in the natural gas value chain, from wellhead to power plants, buildings and natural gas vehicles. Direct ARPA-E to research and develop more effective ways to monitor and prevent methane leaks.**
- **Create a presidential "George P. Mitchell Award" for gas producers who achieve excellence in environmental performance; innovate to minimize the environmental and social footprints of production; and build collaboration among producers, regulators and public interest organizations.**

21st Century Utilities

Most Americans don't fully appreciate the importance of their electric utilities until their lights go out. Yet the nation's utility sector does an admirable job of providing reliable electricity vital to the economy and to our quality of life.

Technology advancements are 10 years ahead of utilities and utilities are ahead of regulation. America needs a new utility revenue model and regulatory compact that can keep pace.

Today, electric utilities face enormous challenges adjusting to emerging trends—trends that raise questions about how renewable resources should be valued and incorporated into consumer rates; how distributed generation should be incorporated into the traditional electric grid; and how utilities should handle power dispatching when their energy mix includes resources that have no fuel costs. Utilities recognize their challenge, but they are without a working model or example. The Federal Government should pilot new revenue models for utilities to adapt to disruptive technology and environmental challenges.

Utility regulation is primarily a state responsibility, but the Federal Government can help policy makers and public utility regulators answer these questions and reshape their business models for the 21st century.

RECOMMENDATIONS TO THE PRESIDENT

- **Direct DOE's four Power Marketing Administrations and the Tennessee Valley Authority to develop and demonstrate the policies and practices necessary for electric utilities to incorporate renewable energy and distributed generation into their rates, infrastructure and management practices.**
- **Direct DOE's National Laboratories to provide research and expert testimony at public utility commission hearings to help identify and resolve issues related to the integration of renewable energy in rate structures, new utility revenue models, and true integrated resource planning.**
- **Ensure that Quadrennial Energy Reviews connect the dots between the systems integration work at the National Renewable Energy Laboratory and the Federal Energy Regulatory Commission's work on the transmission system.**

- **Direct DOE and the Department of Homeland Security (DHS) to work with industry to identify resilient pathways for transmission infrastructure.**
- **Direct DOE and DHS to develop model policies that help state utility commissions adapt to regional climate impacts.**

Alternative Fuels and Vehicles

A principal mission of national transportation policy should be to develop and deploy sustainable non-petroleum fuels, the infrastructure that moves them to market, and the vehicles that use them. This mission is not made less important by the prospect that the United States may soon produce enough oil to eliminate petroleum imports. The world oil market will still control prices. Whether oil comes from the Persian Gulf or the Intermountain West, the need to control carbon emissions will impact oil's overall use.

The President has already triggered a transformation in America's transportation sector. In his first term, his administration nearly doubled fuel economy standards, requiring that new cars and SUVs must average at least 54.5 MPG by 2025. By September 2013, the average fuel economy of new cars and trucks had already climbed to 24.9 MPG, up from 20.1 MPG in 2007, according to a study by the University of Michigan. The administration projects that the new efficiency standards will save families more than $1.7 trillion in fuel costs and result in significant reductions in carbon emissions. The new regulations have also pushed American auto manufacturers from the brink of bankruptcy to resurgence in innovation and global leadership. Other administration initiatives have included:

- A Clean Energy Grand Challenge – EV Everywhere program designed to make electric vehicles as affordable and convenient as gasoline powered vehicles for the average American family by 2022.
- Requirements that all federal government fleet purchases must be alternative fuel vehicles by 2015 and that federal agencies must cut their petroleum consumption by 30%.
- The first-ever efficiency and greenhouse gas emission standards for heavy-duty vehicles starting in 2014.
- The now-accomplished goal to break ground on four commercial-scale cellulosic or advanced bio-refineries to bring advanced biofuel production to commercial scale.

RECOMMENDATIONS TO THE PRESIDENT

We need a national roadmap for alternative fuels and vehicles.

- **Direct DOE, the Department of Agriculture and the Department of Transportation to develop a roadmap that clearly identifies the policies, milestones, performance measures and sequencing necessary to achieve the President's vehicle and fuel goals.**
- **Ensure that better vehicles and fuels do not result in less support for non-vehicular improvements in mobility, including transit-oriented urban design, public transportation, intermodal transportation systems and safe facilities for walking and biking.**
- **In assessing the benefits and costs of different alternative fuels, include the life-cycle costs of the infrastructure necessary to get them to the retail market.**
- **When considering federal support, determine where it will be most effective in the alternative fuel and vehicle value chains. For example, some stakeholders told CNEE that if a choice becomes necessary, natural gas resources would be better used in power plants where they displace coal and provide clean power for electric vehicles, rather than used in natural gas vehicles.**
- **Give preference to third-party transportation providers – for example, freight and delivery services – that use alternative fuels and alternative fuel vehicles.**
- **Create a "Golden Carrot" for advanced biomass fuels – a significant cash prize for the breakthrough that most contributes to the successful commercialization of cellulosic biofuels.**

Conclusion

Among the more than 200 specific recommendations submitted to President Obama as a result of the CNEE leadership dialogue, there are several underlying messages.

First, to ensure the nation's economic stability, environmental health, national security, and opportunity for generations to come, the transition to a clean energy economy must be accomplished more rapidly than any previous energy shift.

Second, the nation's energy policies and investments must be determined not by political pressures, but by objective full life-cycle analyses of each option's benefits and costs. Objective analysis will help resolve the inconsistencies between the President's climate goals and an energy policy that makes no distinction between carbon-rich and clean energy resources.

Finally, President Obama can build an enduring legacy by activating the American people's commitment to sustainable energy and by using the power of the Federal Government in partnership with states, utilities and industry, to open new opportunities for private investment in the clean energy economy.

CENTER FOR THE NEW ENERGY ECONOMY
Colorado State University

The Center for the New Energy Economy is a privately funded initiative to support the growth of a clean energy economy across the United States. It is led by former Colorado Governor Bill Ritter and is assisted by some of the nation's most important thought leaders in clean energy research, development and commercialization. Its mission is to incorporate best practices from around the nation and world to accelerate the development of a new energy economy.

The Center defines "clean energy" as technologies and resources whose life-cycle impacts are beneficial to national security, economic vitality, energy supply sustainability, environmental health, public health, the reduction of greenhouse gas emissions, the conservation and restoration of ecosystem services, social equity, high-quality jobs, and wise use of water and other critical natural resources.

The Center for the New Energy Economy provides policy makers, governors, planners and other decision makers with a roadmap that will accelerate the nationwide development of the new energy economy. That economy will create and keep jobs in the United States; encourage development and use of clean and affordable domestic energy; protect our environment and climate; and keep America on the leading edge of global competition. The Center helps to guide the country along the road to a more secure, stable, sustainable, and affordable energy future.

For the complete list of CNEE's recommendations to the President, go to www.poweringforwardplan.org.

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Introduction

If Congress won't act soon to protect future generations, I will. I will direct my cabinet to come up with executive actions we can take—now and in the future—to reduce pollution, prepare our communities for the consequences of climate change and speed the transition to more sustainable sources of energy. ~ President Barack Obama, 2013 State of the Union Address

Keeping that promise, President Obama issued a comprehensive climate action plan in June 2013, building upon a wide variety of executive actions he and his Administration have implemented over the last five years. Many of the Administration's previous actions involved the business practices of the Federal Government. Others such as the new fuel economy standards for vehicles were historic, with society-wide impacts.

However, as the CNEE confirmed during its dialogue with energy and climate leaders during 2013, there are many more things the Executive Branch can do to help the nation transition to clean energy and to reduce greenhouse gas emissions. A president's powers are limited by design in the American system of government, but they should not be underestimated. The president is CEO of America's biggest energy customer and Commander in Chief of the world's most powerful military. Each president's toolbox includes both soft powers such as the bully pulpit and hard powers such as the veto.

A president's most important power, however, comes from his or her special relationship with the American people. No other public official is elected by all of America's voters. Recognizing that their first responsibility was to protect the rights and interests of the public, including the resources the American people hold in common, several past presidents decided that when Congress failed to act, the Chief Executive had an obligation to do so. When they believed a national situation warranted action, some past presidents interpreted their authority broadly and exercised it aggressively. That is the practice of presidential authority America and the world need today.

In response to the increasing threat of climate change, many of the country's thought leaders have sought a "silver bullet" in recent years—a single act of Congress they hoped would change everything in regard to the nation's greenhouse gas emissions. Legislation to put a price on carbon remains essential, but much more can be done with a "silver buckshot" approach to retool the economy and the government that has been shaped to serve a carbon economy over the past 250 years.

In addition to identifying a great deal of silver buckshot, the CNEE initiative developed several high-level themes that should underpin President Obama's energy agenda as well as the priorities of his successors and of other elected officials.

First, the Federal Government should fully use its considerable potential to help build markets for clean energy technologies and services. As the manager of a $3.5 trillion annual budget, the steward of national assets including a third of America's land mass, and the owner or lessor of nearly 10,000 buildings and more than 200,000 vehicles, the Executive

Branch has procurement power to help build the large and sustained markets that will attract private capital to clean energy. The Administration also has opportunities to open new doors for private investment in clean energy at every level of society, from homeowners to community banks to the investment houses on Wall Street.

Second, the Federal Government should use every opportunity – including its management of buildings, fleets, public lands and the agencies that produce and distribute electricity – to demonstrate the business practices necessary in a clean energy economy.

Third, President Obama should require that empirical analyses replace political calculus in setting America's energy priorities. Objective analysis should quantify the full environmental, economic and social impacts of each resource including its direct and indirect impacts over its lifecycle. Costs that have traditionally been externalized should be internalized to produce more accurate market signals so the price of a resource reflects its true costs. President Obama's "all of the above" energy policy is the line of least political resistance, but it is not compatible with his stated objectives regarding global warming. The transition to clean energy involves difficult and politically challenging choices, but with an empirical basis for energy decisions, a president cannot be accused of waging a "war on coal", or "picking winners". The facts will speak for themselves.

Fourth, energy policy should be designed for problem solving rather than problem switching. Without full cost lifecycle accounting, public policies may promote resources that solve one problem but create many others. For example, liquid fuels from coal and petroleum from tar sands have been promoted to improve the nation's energy security by reducing our reliance on imported oil. But they are among the most carbon, energy and water intensive energy options. They trade greater energy security for greater global warming – a very bad bargain. Full cost lifecycle accounting will identify future tradeoffs like these so that public policy supports the energy options that provide greatest benefits with least costs and fewer unintended consequences.

Fifth, President Obama should use his bully pulpit to lead a national conversation about the new energy economy. During CNEE's dialogues, some of the nation's top executives from the utility, natural gas and renewable energy industries asked that President Obama help change the national conversation about their sectors. For example, leaders in the utility sector want the public to understand their essential role in providing the energy that sustains our high quality of life in America. As we point out elsewhere in this paper, utilities face formidable challenges as solar, wind and other renewable technologies are added to the nation's energy mix and as rooftops become power plants. Utility customers will not be exempt from the changes ahead. The industry's leaders feel the President can help establish a level of public trust and goodwill that will make those changes go more smoothly.

Sixth, President Obama, along with other thought leaders, should turn public support for clean energy into concrete action. Backing renewable energy in opinion polls is one thing; employing them in our lives is another; and so is supporting clean energy policies and electing leaders who are committed to the transition. With an informed, committed and active voting public, fewer elected officials would be comfortable sitting on the sidelines

while climate change progresses.

A committed public also is important to a president's legacy. Nearly all of the executive actions a president can take can be easily undone by his or her successors. The active and sustained support of the American people is the only way a president can ensure that the nation stays on course after he or she leaves office.

Seventh, a top Administration objective should be to provide states and communities with the information, tools, technical support and financial resources to remain on the cutting edge of the clean energy transition. States are the laboratories of change in the United States. They are in closer day-to-day touch with the American people. They have many of the key authorities to reduce the nation's greenhouse gas emissions, from creating and enforcing building codes, to guiding urban design and land use practices, to transportation system planning and utility regulation. Much of the progress the United States has made so far to reduce carbon emissions can be credited to states that have created renewable energy portfolio standards, energy efficiency standards and other enlightened policies. For example, 32 states now have mandatory or voluntary renewable energy standards. Despite 26 legislative attempts to roll back these standards during the 2013 legislative season, none were repealed or rolled back. With focused financial and technical assistance, the Administration can help state and local leaders continue to champion and implement clean energy policies.

Eighth, the President should communicate to the American people that the clean energy transition is not a distant goal. It already is underway, in part because of actions by homeowners, businesses, fleets and industry. Solar electric generation has doubled over the past four years; wind energy today generates enough electricity in the United States to power 15 million homes. Some technologies such as passive solar heating and solar thermal water heating have been cost-competitive for years.

However, the transition is not occurring deep enough or fast enough. Renewable energy technologies, including hydroelectric generation, provide only 12% of America's electricity today. With targeted policies and investments, 80% of America's electricity could come from wind power alone in less than four decades, according to the National Renewable Energy Laboratory (NREL).

In its early release of the Annual Energy Outlook for 2014, the Energy Information Administration (EIA) projects that if we continue business as usual and permit federal subsidies to expire as currently scheduled, renewables will supply only 16% of the nation's power by 2040. "Extensions of such subsidies could have a large impact on renewable generation," the EIA concludes. An analysis by the Union of Concerned Scientists shows that with a reliable production tax credit in place, it will be less expensive to replace existing coal-fired power plants with wind power than to equip the plants with modern pollution controls. And in a statement that could apply to renewable energy technologies in general, NREL has observed "it is disingenuous to expect wind energy to compete in the marketplace without the incentives enjoyed by established technologies."

This leads to the ninth and final thematic conclusion from the CNEE dialogue: A new energy economy will require new fiscal policies. To put it simply, the tax code and other fiscal instruments should not encourage things that hurt us, or stand in the way of things that make our nation healthier. Sustainable energy technologies must be given tax parity if not tax preference over fossil energy if we want them to become a substantial part of the nation's energy mix. Parity means not only the amount of taxpayer investment, but also the reliability of that investment. The on-again off-again tax incentives for renewable energy technologies in recent years have not only inhibited private investment, they've made some renewable technologies more expensive. [1] If Congress begins working on tax reform, the President should be a steadfast champion of eliminating tax support for carbon-rich energy resources – subsidies that are perverse in a low-carbon economy – and shifting them to sustainable energy. In the meantime, the Administration should make those fiscal policy changes that are within its discretion, not to make the tax code more complex but to make it fairer.

The question today is not whether the United States should make an expeditious transition to clean energy. The question is when it will do so and how much damage we will force ourselves and future generations to sustain for the sake of the status quo. The fact that human endeavors are now pushing up against planetary boundaries such as atmospheric warming should tell us the transition must be now.

Chapter 1: Doubling America's Energy Productivity

Key Themes and Recommendations

- Create larger and more stable markets for productivity investments by increasing goals and removing barriers to federal procurement of energy efficiency goods and services.
- Analyze the government's extensive mortgage data to determine whether residential energy efficiency improvements reduce the risk of defaults. If so, direct federal mortgage agencies to reflect that benefit in appraisal procedures and loan terms.
- Allow states and utilities the flexibility to use energy efficiency investments outside the power plant as creditable compliance measures under EPA's upcoming regulation of greenhouse gas emissions from existing power plants.
- Triple federal technical assistance on energy productivity to states, localities and utilities.
- Quantify and promote the value of energy efficiency measures to increase community resilience, to prevent business losses due to power outages and to reduce hazardous risks.
- Encourage the IRS to issue a revenue ruling on when and how publicly traded Real Estate Investment Trusts can invest in energy efficiency projects.

During his 2013 State of the Union address, President Obama announced a new goal: doubling the nation's energy productivity by 2030. The benefits would be enormous. According to the American Council for an Energy Efficiency Economy (ACEEE), the United States economy wastes 87% of the energy it consumes – an unacceptable level of resource mismanagement if the nation wants to remain competitive in the global economy. Because energy efficiency is the quickest, cheapest and among the most effective ways to achieve a clean energy economy, it is Job No 1 and the topic of the first chapter of this report.

The Potential of Productivity: The President's challenge to the country is mirrored in a report issued a week before his 2013 State of the Union address by the Alliance Commission on National Energy Efficiency Policy . Convened by the Alliance to Save Energy (ASE) in 2012, the commission found that:

> *Over the past 30 years, the U.S. has made large gains in energy productivity. More specifically, the U.S. has expanded its economic output by more than three times the 1970 level, while the demand for energy and power resources grew by only 50% during the same time period. According to the American Council for an Energy-Efficient Economy (ACEEE), three quarters of the energy required to fuel this economic growth did not stem from new energy supplies, but rather an assortment of efficiency measures.*

Despite these gains, the opportunities for greater energy productivity remain ubiquitous. They range from how we build our cities to how we get from place to place and how we design our vehicles, appliances and homes. The Alliance Commission reported that the building sector alone offers an investment opportunity in the hundreds of billions of dollars and savings as high as $1 trillion over the next 10 years – 30% of what we now spend annually on electricity. The U.S. Department of Energy (DOE) estimates that our manufacturing sector, which accounts for 11% of our GDP and 27% of our energy consumption, can improve its energy productivity by a third between now and 2035.

Presidential Initiatives

Throughout this report, CNEE has divided its recommendations into two broad categories: presidential actions and agency actions. Presidential action items for energy productivity are organized under three goals: 1) triggering more economy-wide investments in energy efficiency; 2) removing bureaucratic roadblocks; and 3) increasing collaboration between federal, state and local governments.

Goal 1: Trigger Economy-Wide Investments in Energy Productivity

President Obama can use his existing authorities to trigger new and sustained capital investments in energy productivity. His Administration can influence the allocation of capital to energy productivity in the residential mortgage market, in the commercial sector, in compliance with environmental regulations, and in the facilities and operations of the Federal Government.

Leveraging Energy Productivity Investments in the Mortgage Market: Energy and location efficiency[2] should become significant factors in mortgage underwriting, in real estate transactions, and in setting mortgage terms. The key is to verify that by reducing the operating costs of residential and commercial buildings, energy and location efficiency lower the risks of mortgage defaults.

Recent research has found that the risk of loan default is one-third lower in Energy Star-

rated homes and that energy efficiency improvements raise home values as much as 9%.[3] In addition, positive results from the few residential Property Assessed Clean Energy (PACE) programs launched during the President's first term are an indication of the opportunities missed in cities that halted development of PACE programs because of objections raised by the Federal Housing Finance Authority (FHFA).

The evidence suggests that lower operating and transportation costs should change the vector of risk for mortgage lenders. Yet federal agencies that administer mortgage programs use underwriting standards that don't take these factors into account when setting terms for homebuyers.

As the manager of a multi-trillion-dollar mortgage portfolio, the Federal Government is uniquely positioned to access, analyze, and publish data on the relationship between energy efficiency and mortgage risk, validating what has been found by the studies noted above.

Executive Actions:

1. **Determine if energy efficiency decreases defaults.** Conduct and publish an analysis that documents the relationship between energy efficiency and mortgage performance, drawing on large data sets uniquely available to the Federal Government. Start by directing federal agencies that administer mortgage programs to immediately provide relevant anonymous loan and default data to DOE and the Departments of Transportation (DOT) and Housing and Urban Development (HUD). Direct the three departments and the FHFA to use the data to study the relationship between mortgage performance and energy/location efficiency over as long a period as the data permit. The analysis should a) test the validity of FHFA's concern that senior liens for financing energy efficiency upgrades put mortgage lenders at greater risk, and b) determine whether financing energy efficiency upgrades with property assessments would increase or reduce risk for mortgage lenders.

2. **Modify mortgage terms to credit efficiency.** If the analysis confirms that energy and location efficiency are associated with lower mortgage default rates, implement policies that scale up financing for building efficiency improvements. For example, direct HUD to update its underwriting and appraisal guidelines to ensure that any home loan backed by a federal mortgage program reflects the home's energy and location efficiency.[4] Direct HUD and FHFA to assess the potential impact of making the attainment of energy efficiency standards—for example those contained in the most current International Energy Conservation Code (IECC)—a condition for new federally backed home mortgage loans.

3. **Solve the PACE problem.** Encourage FHFA to work with DOE to find administrative solutions to FHFA's concerns about PACE financing for residential energy performance upgrades authorized by state and local governments.[5] For example, order a review of all loan guarantee authorities within the Administration to determine the amount of funding available to create, within existing authorities through rulemaking, a private

residential building retrofit loan guarantee program with a loan loss reserve that backs up default risk. In addition, explore other mechanisms besides PACE that would be more acceptable to the mortgage industry.

4. **Allow REITS for clean energy.** Encourage the Internal Revenue Service (IRS) to issue a revenue ruling on when and how publicly traded Real Estate Investment Trusts (REITs) can invest in energy efficiency and renewable energy projects.[6]

5. **Encourage Energy Productivity in the Commercial Sector:** Private buildings such as office spaces and malls have huge potential for energy efficiency upgrades. However, commercial buildings have unique market barriers that complicate otherwise effective financing tools such as energy-saving performance contracts (ESPCs/UESCs)[7] and other financing mechanisms. For example, commercial lenders are concerned with who will take on repayment of debt if a building is sold in the middle of an efficiency upgrade. There is no standardization of building benchmarking for energy performance or contract documents for engineering, financing, measurement and verification. Lenders are also concerned about default on efficiency loans, even though default rates are very low.

Executive Actions:

1. **Create a loan loss reserve for commercial retrofits**. Order a review of all loan guarantee authorities within Treasury, DOE, USDA, and other agencies to determine the amount of funding available to create, within existing authorities through rule making, a private commercial building retrofit loan guarantee program with a loan loss reserve that will back up default risk but not technology risk.

2. **Streamline paperwork for commercial upgrades**. Direct DOE and other relevant agencies to create standard streamlined documentation for appraisers, engineering firms, and financiers to use for energy upgrade projects for commercial spaces.

3. **Use ESPCs in MUSH markets**. Direct DOE to work with states to launch ESPC programs for Municipal, University, State and Hospital markets (known as MUSH in the ESCO industry).[8]

4. **Champion international appliance efficiency measures**. To increase market opportunities for U.S. appliance manufacturers and to lower costs for U.S. consumers through economies of scale, provide global leadership by championing cost-effective and up-to-date appliance standards in other countries and promote the harmonization of standards across international markets.

Mobilizing Energy Productivity with the Clean Air Act. The Environmental Protection Agency's (EPA) regulation of greenhouse gas emissions from existing power plants can become a powerful driver in the energy productivity market. The key is to give states the flexibility to use a wide range of "outside the fence line" efficiency measures – i.e., efficiency

measures in different locations and sectors than the power plant – to comply with the regulations.

EPA already has issued a road map to states on how to include energy efficiency and renewable energy programs in State Implementation Plans (SIPs) under current applications of the Clean Air Act. The document lists a variety of state programs and policies that can be credited as compliance measures including energy efficiency resource standards, renewable energy portfolio standards, public benefits funds, and on-bill financing of energy efficiency improvements in new and existing homes.[9]

Executive Actions:

1. **Make power plant regulation a springboard for increasing the size of clean energy markets**. Direct EPA to do the following in developing greenhouse gas emission standards for existing power plants:

    a) Work with DOE to assess the potential for cost-effective energy efficiency programs and measures that reduce greenhouse gas emissions from sources other than the power plant. Cite DOE's findings in a Notice of Data Availability and use them in EPA's modeling.

    b) Allow states to get emission reductions by using less electricity and/or more clean energy across the system, rather than only by cleaning up individual power plants at the stack. For example, allow states to include transportation fuel efficiency improvements in their SIPs. Provide clear guidance in the regulatory dockets about the kinds of flexible, state-initiated approaches EPA is prepared to approve as equivalent to whatever default federal performance standard it establishes as a guideline. Be explicit about how it will quantify reductions from energy efficiency and renewable energy. Establish national guidelines (rather than guidelines at the regional level where state SIPs are approved) on the emission reduction approaches EPA will consider acceptable and give all stakeholders the opportunity to comment on those alternatives before the federal regulations are finalized.

2. Issue clear preliminary guidance to states as early as possible in the regulatory process to encourage early adoption of new energy efficiency and renewable energy measures with assurance that measures consistent with the guidance will be credited in SIPs. Encourage state Public Utility Commissions (PUCs) to open relevant state dockets ahead of EPA's guidance.[10]

    a) Instruct EPA Regional Offices to actively promote the use of energy efficiency and renewable energy in SIPs and to streamline the approval process for those measures.

    b) Develop information for states and PUCs on how energy efficiency measures can reduce the cost of compliance with Clean Air Act requirements and how states might count energy efficiency measures as avoided costs in utility regulation.

c) Collaborate with DOE to provide states with technical assistance and information to help them incorporate energy efficiency measures into their SIPs.

3. **Allow manufacturers to save jobs by using energy efficiency measures beyond the plant**. Prevent losses of manufacturing jobs and encourage energy productivity investments in heavy manufacturing facilities by directing EPA to consider energy efficiency improvements beyond new sources subject to the New Source Review[11] and Prevention of Significant Deterioration (PSD) permitting processes. [12]

Increasing the Energy Productivity of the Federal Government: As America's largest single energy consumer[13],the Federal Government, including the U.S. Department of Defense (DoD), has the potential to shape the market for designs, products and practices that significantly improve the nation's energy productivity.

The scale of federal energy productivity investments could be an important factor in market transformation to clean energy, leading to standardized contracts and useful data on project performance. In addition, by increasing the transparency and promotion of what the Administration is accomplishing, the President can position the Federal Government as leading rather than mandating the United States to a clean energy economy.

The President has already taken a number of steps to move his Administration into this leadership position, for example with the goals established by Executive Order 13514 and in his Climate Action Plan. He has directed agencies to reduce their energy intensity 30% by 2015 compared to 2003; to obtain 20% of their electricity from renewable resources by 2020; to reduce potable water use intensity 26% by 2020 compared to 2007; and to cut electricity-related greenhouse gas emissions 28% by 2020 compared to 2008. President Obama issued a memorandum in December 2011, directing agencies to execute $2 billion in ESPCs over two years. The President can build on these initiatives by expanding this goal even further.

Executive Actions:

1. **Broaden the category of energy productivity measures**. Amend EO 13514 to encourage agencies to go beyond traditional energy productivity measures to include distributed generation, combined heat and power (CHP), the development of micro-grids, careful consideration of the relationship between energy and water consumption, low-carbon mobility and creative ways to unleash private capital investments in clean energy.

2. **Improve the coordination of grant and finance programs**. Direct the Office of Management and Budget (OMB) to assess and recommend how to better coordinate federal grant and finance programs. An inventory of government loan and loan guarantee programs that could support clean energy projects show that the capital in these programs is 100 times larger than energy-related grants, on the order of $50 billion each year. At both the federal and state levels, these programs are scattered

across multiple agencies with no mechanism for coordination that could save both opportunity and operating costs.

3. **Increase the use of ESPCs**. Amend the President's December 2011 memorandum on ESPCs to:

   a) Set ESPC targets that more fully achieve the economic potential of government energy savings. At a minimum, adopt the recommendation that federal ESPC targets be set at $1 billion annually for 5 years.

   b) Clarify that agencies should use ESPCs to finance efficiency projects in public housing, demand response programs, multi-building efficiency projects beyond emergency demand response, data center consolidation and demand management in facilities. In addition, direct DOE, DoD and the General Services Administration (GSA) to expand the use of ESPCs to finance under-utilized but proven technologies such as enhancements to government energy security; micro-grids; distributed renewable energy projects that reduce line losses; CHP systems; waste-to-energy projects; water and wastewater treatment plants; energy from biomass; recycling centers; high-efficiency HVAC; hardened industrial control systems that protect against cyber attacks; high-efficiency, ultra-low emission and zero-emission fleet vehicles and charging infrastructure that lead to operational and maintenance savings; other efficiency improvements in the management of federal fleets; and faster progress on achieving net-zero energy and carbon buildings.

Additional Actions:

1. **Reward reductions in vehicle miles**. Direct agencies to make the reduction of Vehicle Miles Traveled (VMT) a key factor in awarding applicable discretionary federal grants and loans – for example grant programs such as TIGER (Transportation Investment Generating Economic Recovery) and loan awards under the Transportation Innovation Financing Act (TIFA). Broaden allowable uses of formula funds for VMT reduction efforts.

2. **Track progress on the energy-water program**. Direct DOE to report its progress on establishing a multi-agency program to address the energy-water nexus, as described in the Energy Policy Act of 2005 and recommended by the Government Accountability Office (GAO) in September 2012. Charge DOE with creating an interagency task force on the energy-water nexus that builds on EPA's Energy-Water Principles to produce a national action plan similar to the one the Climate Adaptation Task Force produced. Charge the task force with making recommendations in the following areas:

   a) Factoring water into energy policies and investments: Start with the premise that federal agencies should make water conservation and quality a key factor in assessing the life-cycle costs and benefits of energy supply and demand options.

b) Assisting states and localities: What type of information do states need to incorporate water factors into sub-national energy policies, particularly in areas subject to growing populations but declining or stressed water resources? Or are states ahead of the Federal Government and the Administration should become the "student"?

c) Conducting R&D on low-and zero-energy wastewater treatment facilities**:** What types of innovations are needed, and should the Federal Government support, regarding the reuse of degraded water, integrated water management, on-site treatment of hydraulic fracturing fluids, and the water efficiency of power plants?

d) Setting water-efficiency standards: Should the Federal Government create and periodically update voluntary standards for water fixtures, as it does now with energy efficiency standards for appliances? Is legislation necessary?

e) Getting tools and ideas into the hands of water decision-makers nationwide**:** The government supports the web portal www.watertoolbox.us, a multi-agency site that some people regard as a national strategic asset. Is the web portal sufficiently utilized by decision-makers for immediate operational decisions and long-term planning regarding water use?

f) Getting prices right: Strongly encourage the Federal Energy Regulatory Commission (FERC) to incorporate water intensity in wholesale avoided cost and other dockets.

Goal 2: Remove Administrative Roadblocks to Energy Productivity Improvements

Several of the stakeholders with whom CNEE has consulted cite roadblocks in the administrative processes for approving new appliance efficiency standards and executing ESPCs. Some delays have been excessive, resulting in unnecessary energy waste and greenhouse gas emissions.

While the use of ESPCs reportedly is brisk in many federal agencies, bottlenecks including shortages of trained staff are slowing down processing of the contracts. In addition, OMB, the Congressional Budget Office (CBO) and congressional budget committees "score" ESPCs as a cost without regard to savings.[14]

Executive Actions:

1. **Speed up action on clean energy rulemaking**. Direct OMB to:

   a) Adhere to its own policy to complete its review of rules within 90 days to ensure that the Administration complies with legal deadlines for finalizing appliance efficiency standards.

b) Move proposed rule makings on energy efficiency and renewable energy to the front of the clearance queue to prevent lost opportunities for energy savings and greenhouse gas emission reductions.[15]

c) Clear up the differences between the appliance efficiency statute that directs DOE to set standards at the "highest level that is cost effective," and the executive order that says regulations should be set at the "most cost effective" level.

d) Propose and work with the CBO and congressional budget committees to change the "scoring" of ESPCs.[16]

2. **Assign ESPC contracting to expert staff**. To address the problem of insufficient trained staff to process ESPCs within agencies, direct the Office of Personnel Management (OPM) to reassign agency contracting officers to DOE's Golden Field Office in sufficient numbers to create an efficient and highly skilled central ESPC processing center for the Federal Energy Management Program (FEMP).

3. **Appoint an energy productivity coordinator**. Assign the Office of the Federal Environmental Executive to serve as the Administration's energy productivity coordinator with secretariat support from DOE. Provide him or her with sufficient staff and authority to do the following:

   a) For budgeting purposes, estimate the staff capacity needed to arrange ESPC financing for all cost-effective energy efficiency improvements.

   b) Coordinate the Federal Government's energy efficiency and renewable energy grant, financing and technical assistance programs.

   c) Work with the EIA to track and publicly report progress on the President's energy productivity goal.

   d) Increase collaboration between federal agencies to maximize the effectiveness of technical and financial assistance programs related to energy productivity.

   e) Work with agencies to add energy productivity improvements as a rating factor in all federal grant programs where efficiency is relevant to the objective of the grant.

   f) Issue guidance to all agencies on using DOE's Energy Efficiency Savings Protocols to calculate the energy efficiency benefits of specific measures funded through federal grant and financial programs.

4. **Broaden the use of transportation funds**. Review administrative decisions that have been made to limit eligible expenditures of Surface Transportation Funds and Congestion Mitigation and Air Quality Funds, and modify them to allow cost effective approaches to reducing demand, alternative transportation and reductions in vehicle miles traveled.

5. **Anticipate the impacts and opportunities of reduced driving.** Direct DOT to analyze the implications for federal transportation investment of reduced car ownership and driving among younger age cohorts and to identify opportunities for alternative and active transportation investments to reinforce this trend.

Goal 3: Increase Collaboration with States, Localities and Utilities

In Executive Order 13514, among other statements and directives, President Obama has acknowledged the importance of collaboration between federal agencies, states, local governments and utilities. The order, issued in 2009, directs federal agencies to help their host communities achieve sustainable development goals, including clean energy. Analyses by numerous private sector organizations also recognize the importance of intergovernmental work. Both the Center for Climate Strategies and the World Resource Institute[17], among many other examples, have shown that energy efficiency and renewable energy policies at the state level are making a major contribution to progress on reaching the President's goal for a 17% reduction in greenhouse gas emissions by 2020.

Executive Actions:

1. **Make energy productivity progress visible**. Increase the visibility of economy-wide progress on the President's energy productivity goal by assigning the Federal Environmental Executive to work with DOE, the EIA, the National Association of State Energy Officers (NASEO) and others to do the following:

    a) Identify the "touch points" in the economy for significant energy productivity gains.

    b) Create a strategic plan that engages appropriate federal, state and local government agencies and organizations to promote and leverage energy productivity gains.

    c) Establish and implement a methodology to track and report progress both at the economy-wide level and by major energy-using sectors.

    d) Direct DOE, HUD, USDA, SBA, EPA and DOT to work with state and local authorities, including economic development officers, to identify and remove barriers to full utilization of federal financing programs for which clean energy is eligible.

    e) Direct Cabinet members to continue shaping the public dialogue about greenhouse gas regulations with early messaging about their economic, public health, safety, national security and other benefits. Schedule public events with Republican and Democratic governors to promote the state-by-state benefits of using energy efficiency to prevent pollution, particularly in regard to requirements under the Clean Air Act.

f) Establish clear leadership responsibility in the Executive Office of the President for engaging states and localities on policies and programs that serve the President's objectives on energy productivity and climate change.

g) Reaffirm the requirement in Executive Order 13514 that federal agencies help strengthen the "vitality and livability" of their host communities. Make clear that this requirement applies not only to line agencies, but also to military installations and PMAs. Specify that these potential collaborations can include federal-state-local power purchasing agreements and joint efforts between cities and military installations to improve local energy security with distributed generation, micro grids, and renewable energy technologies.

h) Direct the Federal Executive Boards in each region to actively market federal grant, financing and technical assistance programs related to energy efficiency and renewable energy and to serve as regional clearinghouses for states to access those programs.

i) Work with State Treasurers and other state and local authorities that want to establish public-private energy investment partnerships to capitalize them in part with existing federal grant funds.[18]

j) Direct DOE to earmark a portion of formula grants in the State Energy Program for states to identify how they will leverage the resources of other state and federal grant and financing programs.

Federal Agency Actions

Department of Energy

1. **Publish a schedule for appliance standards**. Expedite the updating and creation of new appliance efficiency standards. To make progress more transparent, publish a schedule for completing proposed and planned appliance standards over the remainder of the Administration's second term.[19]

2. **Plan for progress on the President's productivity goal**. Direct the Office of Energy Efficiency and Renewable Energy to a) encourage and facilitate public-private partnerships that extend the President's energy productivity goal beyond the current Administration, and b) engage in outcome-based strategic planning in support of the goal. Develop metrics that will measure and verify progress. Periodically and publicly report the results to help the private sector focus investment.

3. **Triple technical assistance** to states, localities and utilities by:

   a) Directing National Laboratories to give high priority to their state and local assistance programs as the labs allocate resources. Create more programs like

NREL's Technical Assistance Program, which taps experts from three national labs to help communities with short-term technical assistance. Use "tiger teams"—teams of experts who can be deployed to states, localities, utilities and industries—to help them design and implement energy productivity programs.

b) Reallocating resources to expand the Industrial Assessment Center (IAC) program beyond the two-dozen universities that participate now[20] thereby improving the energy productivity awareness and skills of tomorrow's engineers while identifying productivity improvements for small and medium manufacturers. Partner with the SBA to make loan guarantees available for companies to finance the measures recommended by the IAC program.

c) Exploring the effectiveness of providing states with technical assistance grants that allow them to select the expertise they need to supplement assistance from DOE's national laboratories and other federal sources.

d) Helping states quantify the greenhouse gas emission reductions, economic benefits[21] and contributions to state energy productivity and renewable energy goals that will result from their State Energy Plans.

e) Strengthening DOE's expertise in market penetration by assigning a senior specialist in technology deployment and technology deployment partnerships to each of the clean energy programs in DOE's Office of Energy Efficiency and Renewable Energy (EERE).[22]

4. **Increase the role of energy efficiency in risk management**. Evaluate and publicize the value of energy efficiency in managing the risks of climate change, energy price volatility and energy supply disruptions. Make greenhouse gas reductions and adaptation to climate change specific requirements in its State Energy Program program notice for 2014 and beyond. In addition, require states to keep their energy assurance plans current and to ensure that vulnerabilities related to climate change are addressed as they update the plans.[23]

5. **Improve the marketing of financial assistance programs**. Market the Federal Government's energy-related grant and financing programs more actively. The July 2013 Guide to Federal Finance Facilities for Clean Energy is a good start, but DOE can do more to raise the visibility of these opportunities and to link projects with financing for constituents across the country.

6. **Integrate energy productivity in planning and partnerships.** Work with Power Marketing Administrations (PMAs) and FERC to demonstrate and promote energy efficiency benefits in generation, transmission and distribution planning; to demonstrate the integration of renewable energy technologies with the nation's interstate transmission systems for oil, natural gas, and electricity[24]; and to use federal convening power to create strategic partnerships that increase the efficiency of the nation's electric grid.

7. **Create more market push and pull for net zero energy buildings:**

    a) Make net-zero energy and carbon buildings the accepted goal of the building industry by marketing the economic, environmental and national security benefits of these buildings.

    b) Ensure that NREL, the National Institute for Standards and Technology (NIST) and the several states active in the field of net-zero energy buildings collaborate on their research, development and deployment efforts.

    c) Develop three new model energy codes for residential and commercial buildings. The first would achieve 50% more energy efficiency than the current International Energy Conservation Code (IECC); the second would achieve 75% more efficiency; and the third would achieve net-zero energy performance. State and local adoption of the new codes would be voluntary.

    d) Assess the ultra-high-efficiency building standards developed by Architecture 2030, the U.S. Green Building Council and the Living Building Challenge, along with the work of leading cities and states, to incorporate tested cost-effective provisions into the National Model Building Code.

8. **Consider a Supply Star program:** Evaluate the cost and value of creating a "Supply Star" program along the lines of the proposed "Supply Star Act"[25] to improve the energy and water efficiency of the nation's supply chain.

9. **Elevate STEAB.** Strengthen the role of the State Energy Advisory Board (STEAB), the organization created by Congress to serve as a liaison between states and DOE on energy efficiency and renewable energy issues, and to "develop recommendations for DOE and Congress regarding initiation, design, implementation, and evaluation of federal energy efficiency and renewable energy programs."

10. **Update and improve the State Energy Program** by:

    a) Structuring its competitive grants to reward states that create and sustain progressive energy efficiency and renewable energy policies, including policies that encourage private capital investment in clean energy projects. Examples include performance incentives and decoupling policies that protect utilities from revenue losses due to energy efficiency; energy efficiency financing programs such as on-bill repayment and commercial PACE; and renewable energy and energy efficiency performance standards.

    b) Requiring that state energy plans under SEP reflect today's most cost-effective and emissions-effective policies, programs and technologies.

11. **Improve and extend the performance of FEMP** to:

    a) Comply with its requirement to post up-to-date reports of energy efficiency efforts from federal agencies on its website and catch up by posting past-due reports from 2008 to present.[26]

    b) Develop a uniform labeling system for all federal buildings that make energy efficiency and renewable energy improvements. Identify energy, greenhouse gas emission and taxpayer savings to help educate citizens about the benefits of specific energy efficiency measures.

    c) Work with GSA to collect current energy use data for federal buildings and vehicle fleets to establish benchmarks for energy efficiency improvements.

    d) Establish a collaborative state-federal program to retrofit all National Guard facilities using EPCS.

12. **Demonstrate battery storage.** Work with GSA and DoD to pilot the use of stationary battery storage to integrate higher levels of renewable energy into the power systems and as a demand response measure for base load electric savings in addition to peak shaving and energy emergency mitigation. Test this use of battery storage in clusters as well as individual federal buildings.

13. **Help low-income families adapt to climate change**. Instruct the Weatherization Assistance Program (WAP) to help low-income households adapt to the impacts of climate change[27] by allowing the program's crews to upgrade energy efficiency measures in those homes. For example, focus on energy efficiency improvements that protect low-income families from exposure to extreme heat waves, now the nation's No. 1 weather-related killer.

14. **Improve WAP's resource management**. Instruct WAP to propose ways to improve its management of resources. For example, WAP could partner with industry to design a regional dispatch system to manage procurement and distribution of inventory, saving millions of dollars. Similarly, a unified inventory system would allow weatherization agencies to better manage and track resources.

15. **Track productivity by state and sector**. Direct EIA to expand its energy end-use surveys to track energy productivity by state, by the most energy-intensive sectors and subsectors, and to compare U.S. energy productivity to that of other industrial nations. Direct EIA to add user-friendly visual indicators on its website so the public can track progress.

16. **Create a one-stop information resource**. Establish and maintain a one-stop web-based directory through which the public can easily learn about and access all federal energy efficiency programs. Organize the site by type of energy consumer – i.e. homeowners and renters, commercial building owners and tenants, industries,

farms and ranches, communities, etc. Include programmatic information as well as information on tax credits, grants, labeling and educational materials.

17. **Develop new standards for water efficiency**. Develop new recommended standards for all plumbing product water efficiency that are more stringent than current federal standards, promote their adoption by states, and recommend their adoption by Congress.[28]

18. **Renew work on HERS and EEMS**. Review lessons learned from the DOE/HUD program on Home Energy Rating Systems (HERS) and Energy Efficient Mortgages (EEMS) in the 1990s to determine whether sufficient data on loan performance now exist to revive the effort to reflect residential energy efficiency features in mortgage terms and to finance efficiency improvements by adding their costs in mortgage amounts.[29]

Environmental Protection Agency

1. **Coach the states**. Direct EPA's Regional Offices to serve as "coaches" to help states incorporate energy efficiency and renewable energy into SIPs and into NSR and PSD permitting. Equip the Regional Offices to help states calculate the economic as well as environmental benefits of energy efficiency measures in their SIPs.

Department of Housing and Urban Development

1. **Set energy standards for manufactured housing**. Work with DOE to create and implement an energy efficiency standard for manufactured housing at least as stringent as the latest IECC code for site-built residential buildings, as long as doing so is cost-effective on a lifecycle cost basis. Give DOE, HUD and OMB a deadline of 18 months or less to finalize the new standard.[30]

2. **Provide feedback to tenants**. To help achieve measurable reductions in HUD's energy costs, develop a data sharing agreement with local utilities and other appropriate third-party vendors to deliver detailed energy efficiency and consumption feedback to public housing tenants.[31]

3. **Improve energy standards for public housing**. Upgrade standards for public housing to the 2012 IECC Code, ASHRAE 90.1 or the host state's energy building code, whichever is more stringent.

4. **Educate tenants on reducing energy costs**. Develop a data sharing agreement with local utilities and other third-party vendors as appropriate to deliver detailed energy information to public housing tenants to promote energy literacy and to measurably and verifiably reduce HUD's energy bills.

Department of Health and Human Services

1. **Help low-income families control their energy costs**. Collaborate with HUD and state agencies that administer Low Income Home Energy Assistance Program (LIHEAP) funds to help lower income families to take control of their energy use and lower their bills.[32] in addition, coordinate with HUD to use LIHEAP funds to improve energy efficiency in public housing units.

Office of Management and Budget

Use full-cost accounting in all energy actions. Establish that it is the Administration's policy to use full-cost accounting (accounting that recognizes the full economic, environmental, health, and social costs of an action or decision) as well as life cycle accounting in all applicable federal actions involving energy.[33] Study the application of full-cost accounting in federal policies and programs and recommend how it should be incorporated into rule making, budget proposals, procurement and other federal actions. Engage in continuous improvement of full-cost accounting as research allows previously unaccounted for cost factors to be quantified.

Federal Emergency Management Agency

1. **Use energy efficiency and renewable energy as resilience tools**. Work with DOE and its National Laboratories to advance the use of energy efficiency and renewable energy technologies that strengthen the resilience of communities and infrastructure, prevent energy emergencies, and improve the energy productivity of communities as they rebuild after disasters. Incorporate energy productivity and renewable energy technologies into FEMA's guidelines, technical assistance, grant and financing programs.[34]

2. **Assess the role of clean energy in hazard mitigation.** Require that states and cities address the risk management benefits of energy efficiency and renewable energy in hazard mitigation plans. (For example, distributed power systems and micro-grids can reduce the risk of power disruptions from extreme weather events, while energy efficiency features in buildings can reduce heat-related illness and fatalities.)

3. **Equip emergency shelters with solar backup**. Equip all schools that are designated as emergency shelters with on-site backup power and up-to-date energy efficiency technologies, particularly those that strengthen the schools' ability to withstand extreme weather events. Help the schools become demonstration centers for energy technologies that increase resilience, providing them with assistance in interpreting the technologies for students, faculty and visitors.

4. **Use renewable energy technology to restore vital services**. Provide grants and technical assistance to other local facilities that deliver fuel, electricity, medical services and sanctuary from the impacts of climate change. Examples include backup renewable

power systems to operate emergency services, gasoline pumps at gas stations, medical facilities and vital communications services, as well as energy efficiency and renewable energy technologies that reduce losses to small businesses.

Small Business Administration

1. **Help small businesses reduce risks**. Incorporate risk-reducing energy efficiency and renewable energy technologies for disaster mitigation and recovery in SBA's emergency preparedness materials for small businesses.[35] Include training in performance-based energy efficiency programs such as ISO 50001 and ASHRAE bEQ labeling.

Veterans Administration

1. **Upgrade standards** for VA loans to the 2012 IECC Code.

Federal Housing Administration

1. **Upgrade standards** for direct FHA loans to the 2012 IECC Code.

Department of Transportation National Highway Traffic Safety Administration

1. **Prepare for CAFE review.** Lay the political groundwork for mid-course review of Model Year 2017-2025 fuel economy standards for passenger vehicles and light-duty trucks by publicizing ongoing data about energy savings, consumer savings and emission reductions.[36]

2. **Cover truck trailers.** In collaboration with EPA, develop post-2018 fuel-economy standards that cover both tractors and trailers for heavy-duty vehicles. Work with industry and stakeholders to incorporate other new technologies and designs into the post-2018 standards for heavy-duty vehicles, based in part on lessons learned in EPA's SmartWay partnership**.**

Federal Energy Regulatory Commission

1. **Protect private data**. Develop rules pertaining to consumer data privacy and access. Such rules should ensure consumers are protected when providing their data to third-party vendors, but should also enable innovation in consumer oriented energy applications that take full advantage of smart meter investments.

2. **Clear the path for CHP systems.** Reduce or eliminate barriers to wider use of combined heat and power systems by industry and other end-users.

Chapter 2: Developing Renewable Energy Markets

Key Themes and Recommendations

- Create larger and more stable markets for renewable energy technologies with several of the same actions CNEE recommended for energy efficiency. For example, design EPA's upcoming power plant regulations under Section 111(d) to allow renewable energy investments to be credible compliance measures.

- Direct the Tennessee Valley Authority and the government's four Power Marketing Administrations to lead the way in developing utility business models for the 21st century, including how to integrate distributed generation and renewable energy technologies into the grid, utility management practices and rates.

- Revitalize the administration's programs for the development of offshore wind energy projects.

- Work with rural leaders to ensure full utilization of USDA's loan guarantee program for energy efficiency and renewable energy projects by Rural Electric Cooperatives and their customers.

- Develop the information needed to consider fresh water resource demand as a factor in setting energy priorities.

- Use the bully pulpit to send the message that America's transition to a clean energy economy is already underway, that renewable energy is ready, but that the transition must proceed more quickly than any previous major shift in the nation's energy mix.

A widely held assumption is that financial capital will move from the sidelines to renewable energy when there is a substantial and sustained market. That sets up a classic chicken-egg problem: Investment will come when the markets arrive but the markets can't arrive without investment.

The cycle can be broken by government intervention. There is a longstanding disagreement in policy circles about whether government should "meddle in markets" or "pick winners." But the fact is, the government picks many winners among energy industries today and has

done so for at least a century. In the energy sector, the traditional winners have been coal, gas, oil and nuclear power, the longtime beneficiaries of taxpayer subsidies and other favorable policies.

CNEE's position, reinforced by its dialogue with industry leaders, is this: It is in the national interest for government to accelerate the development and market penetration of technologies that provide critical benefits or prevent irreparable harm to the American people. Today the American people need energy security and stable prices, clean air and a power system that does not trigger global climate disruption.

Still, government subsidies alone cannot unlock the potential of renewable energy. Governments at all levels in the United States are struggling with budget problems. Government's more important role is to encourage and create the conditions for capital investment and financing in the private sector. As states have been proving with policies such as renewable energy portfolio standards, governments have non-monetary as well as monetary tools to stimulate private investment. For the President of the United States, these include executive authorities already established by Congress or implied in congressional statements of intent.[1]

Presidential Initiatives

Goal 1: Open New RE Markets with the Clean Air Act

As noted in Chapter 1, the Clean Air Act is arguably the Administration's biggest power tool for stimulating renewable energy and energy efficiency markets. Congress has delegated the authority to enforce the act to the Administrator of the EPA. Within this authority, EPA can determine the degree of flexibility it gives to polluters.

In 2013, EPA issued a regulation on greenhouse gas emissions from new electric power plants. It is scheduled to issue a proposed rule in mid-2014 on greenhouse gas emissions from existing power plants and to finalize the rule a year later under Section 111(d) of the Act. If EPA gives states, state utility regulators and electric utilities sufficient flexibility, including credit for emission reduction measures beyond power plant fence lines, the regulation will be a market stimulus.[2]

Executive Actions:

Many of the recommendations in Chapter 1 apply also to designing Section 111(d) regulation to build markets for renewable energy technologies. The Administrator of EPA should:

1. **Look beyond the power plant**. Work with DOE to assess the potential for cost-effective renewable energy programs and policies to reduce greenhouse gas emissions from any generation stations in a utility's fleet and beyond the fleet to other carbon-cutting investments such as qualified distributed generation using clean energy

technologies. Cite DOE's findings in a Notice of Data Availability and use them in EPA's modeling.

2. **Provide clear guidance to states**. Provide clear guidance in the regulatory dockets about the kinds of flexible, state-initiated approaches EPA is prepared to approve as equivalent to whatever default federal performance standard it establishes as a guideline. Be explicit about how EPA will quantify emission reductions attributed to the use of clean energy resources. Establish national guidelines (rather than guidelines at the regional level where state SIPs are approved) on the emission reduction approaches EPA will consider acceptable and give all stakeholders the opportunity to comment on those alternatives before the federal regulations are finalized. Issue clear preliminary guidance to states as early as possible in the regulatory process to encourage early adoption of new energy efficiency and renewable energy measures with assurance that measures consistent with the guidance will be credited under Section 111(d). Encourage state PUCs to open relevant state dockets ahead of EPA's guidance.[3]

3. **Actively promote renewable energy technologies**. Instruct EPA Regional Offices to actively promote the use of renewable energy programs and policies in SIPs and to streamline the approval process for those measures.

4. **Quantify the value of renewable energy in Clean Air Act compliance**. Develop information for states and PUCs on how renewable energy technologies can reduce the cost of compliance with Clean Air Act requirements and how states might count renewable energy systems as avoided costs in utility regulation.

5. **Help states incorporate renewable energy in Section 111(d) plans**. Collaborate with DOE to provide states with technical assistance and information to help them incorporate renewable energy into compliance programs under Section 111(d).

6. **Streamline solar development in nonattainment areas**. Qualify solar energy projects as a LAER (lowest achievable emission rate) compliance tool under the Clean Air Act 1990 amendments, in order to streamline the development of solar projects in nonattainment areas.

Goal 2: Modernize and Mobilize Federal Electric System Assets

In a dialogue that CNEE facilitated with utility executives,[4] senior officers of several of the nation's largest electric utilities and transmission and distribution companies offered this situation analysis:

The nation's energy technologies and needs are advancing faster than rules, rate regimes and federal administrative processes. It's not only the utility and energy sectors that must be reinvented for the 21st century; it's the entire system of government regulation and private financing. Electric and gas utilities rely on private markets and private incentives to deliver reliable energy to the American people. The rules of investment and financing must be aligned

with advances in technology to expedite the transition to modern business models and energy resources.

The Federal Government has several assets that can lead the way to integrating renewable resources more deeply in the American economy. They include FERC, the PMAs, the TVA, the government's extensive land holdings, and the U.S. military.

Federal Energy Regulatory Commission (FERC):

FERC is an independent agency of five members appointed by the President. It regulates interstate transmission of electricity, natural gas, and oil as well as the licensing of hydroelectric projects. More specifically, FERC:

- Regulates transmission and wholesale sales of electricity in interstate commerce;
- Reviews certain mergers, acquisitions and business transactions by electricity companies;
- Regulates transmission and sale of natural gas for resale in interstate commerce;
- Reviews siting applications for electric transmission projects in limited circumstances;
- Licenses and inspects private, municipal and state hydroelectric projects;
- Establishes mandatory reliability standards for the high-voltage interstate transmission systems;
- Monitors and investigates energy markets; and
- Oversees environmental matters related to natural gas and hydroelectric projects.

FERC does not regulate retail electricity sales to customers; approve the construction, siting and routing of electric generation facilities; or regulate municipal power systems, federal PMAs or most rural electric cooperatives.

Because FERC is an independent agency, the President has no official authority over its decisions beyond his appointment of its members. Thus, the President should carefully exert his power of persuasion.

A consistent theme in CNEE's renewable energy financing roundtable was how power markets should evaluate the costs and benefits of renewable energy in a least-cost environment. Discussants observed that wholesale markets today do not correctly value a variety of emerging technologies and practices, including the benefits of distributed generation to system efficiency, the contributions of energy efficiency, protection from price volatility with renewable resources that carry no fuel costs, and reductions in capital intensity. At present, utilities and renewable energy companies involved in filings have shown they cannot even agree on categories of avoided costs. The results are market signals that undervalue renewable energy, energy efficiency and distributed generation in least-cost calculations.

Executive Actions:

Participants in the CNEE dialogue suggested an array of policy and communications initiatives involving FERC. The President can direct the Secretary of Energy to discuss the suggestions with FERC and to recommend that FERC consider implementing them. If necessary on important policy matters, DOE can generate FERC's response to the recommendations by petitioning it to do a rulemaking.

1**. Improve communication and outreach**.

a) Convene a discussion with academic, national laboratory and private sector experts on the issues listed above.

b) Offer suggestions to DOE's solar business models project on best practices regarding the impacts of solar systems on the wholesale market.

c) Develop a toolkit that gives state regulators examples of regulatory policies for incorporating renewable energy into the system. In addition, utilize FERC letters, white papers and technical reports to explain and promote these methodologies.

d) Offer to collaborate with states to correct inaccurate market signals in wholesale markets, including the value of distributed generation to system efficiency, the value of hydroelectric systems, the pairing of different renewable energy resources, and the benefits to the grid of distributed generation and energy efficiency. Explore incentives for distribution utilities to make least-cost investments that reduce capital intensity.

e) Work with PUCs to close the gap between PUC and FERC evaluations of grid-connected photovoltaic systems and other renewable energy technologies.

2. **Update policies and processes**.

a) Promote broad transmission cost allocation.

b) Advocate for recognition of the fact that distributed generation will look like a wholesale power resource if states don't treat solar as a Public Utility Regulatory Policies Act (PURPA) transaction. If distributed generation starts to have an impact on the wholesale market, increase transparency at the wholesale level.

c) Include the allocation of transmissions costs and the grid's operation efficiency in FERC priorities.

d) Identify costs that aren't currently priced, including the many services that now are not valued at the distribution level. Work with DOE to review how avoided costs are evaluated and distributed.[5]

e) Sustain the return on equity (ROE) for transmission projects at sufficient levels to ensure adequate and stable capital flows into new transmission investments.[6]

f) Implement performance standards, incentive rates, smart grid standards and other policies to ensure that new transmission projects incorporate advanced technologies for safer, smarter, more reliable and more efficient transmission systems.[7]

g) Require planning that incorporates all the benefits of building out the nation's electric grid system and reduces risks so that investment can flow into the system at least cost.

h) Develop a model for measuring the impact of various methodologies on avoided cost rates. The model should synthesize the varied ways that states implement avoided costs and provide an evaluation of those methodologies best suited to carrying out the goal of PURPA to promote the development of alternative power (Elefant, 2012).

i) Work with DOE on a common definition of the categories of avoided costs. Develop a more accurate methodology for avoided cost calculus that incorporates energy, capacity, pecuniary costs, and pecuniary benefits (Bradford & Hoskins, 2013) and more accurately reflects the value of distributed generation facilities during times of critical system peak. For example, include line-loss avoidance, the ability to make smaller capacity additions that follow incremental load changes, the deferral or avoidance of utility capital expenditures, and the environmental benefits of displacing fossil fuels (Keyes, Fox & Wiedman LLP).

j) Develop guidance that helps ensure that all markets (e.g., energy, ancillary services, capacity) and market-makers (utilities) consider both demand-and supply-side options. All options—central and distributed generation, transmission, efficiency, and demand-response—should compete with one another to provide electricity services (America's Power Plan, 4). To encourage innovation and to accommodate unique characteristics of markets, these rules should be oriented toward outcomes rather than prescribing specific technologies. They should also incorporate rigorous measurement standards to ensure that outcomes are met.

k) Begin considering the full life-cycle costs of renewable energy and fossil energy, including factors such as the social costs of carbon, to create a more level playing field for competition between these resources.

l) Consider creating guidance and taking regulatory action to enable effective combinations of policies to finance renewable energy technologies under the Federal Power Act.[8]

Power Marketing Administrations (PMAs):

The DOE oversees four PMAs—Bonneville (BPA), Southeastern (SEPA), Southwestern (SWPA) and Western Area Power (WAPA)—that operate electric systems, serve as balancing authorities and sell the output of federally owned and operated hydroelectric dams in 33 states (Figure 1). The PMAs are responsible for 7% of total electric generation in the United States. While their primary mission is to market wholesale power, three also have a role as transmission owners and operators in their territories.

By law, the PMAs sell wholesale power primarily to "preference customers" – mostly publicly owned and cooperative-owned utilities[9]–at the "lowest possible rates to consumers consistent with sound business principles." PMAs are allowed to borrow money from the U.S. Treasury at low interest rates. FERC regulates PMA rates to make sure they are sufficient to repay the Treasury.

The PMAs' preference customers are significant players in the nation's electric system. For example, rural electric cooperatives (RECs) provide power to 42 million people in 47 states. They own and maintain 42% of the nation's electric distribution lines. They are aggressive in defending business as usual in how the PMAs operate and set rates for electric power.

An example is the reaction to a memorandum that former Energy Secretary Steven Chu issued to the administrators of the PMAs in 2012, directing them to "take a leadership role in transforming our nation's electric sector." Among other things, Secretary Chu told the PMAs to develop new rate structures that offer incentives for integrating renewable energy technologies into their systems. The letter drew a rebuke from 166 members of Congress. It illustrated that although Congress established DOE as the administrative home of the PMAs in 1977, the preferred customers and their representatives in Congress exert considerable control.

As Secretary Chu noted in his memorandum, the nature and the needs of America's power sector are changing rapidly (Figure 2).[10] The President's opportunity is to mobilize federal power assets to lead the nation in integrating distributed energy generation and renewable energy resources into the traditional generation and distribution system, and to overcome the resistance of PMA customers and elected leaders who do not want changes in the status quo.

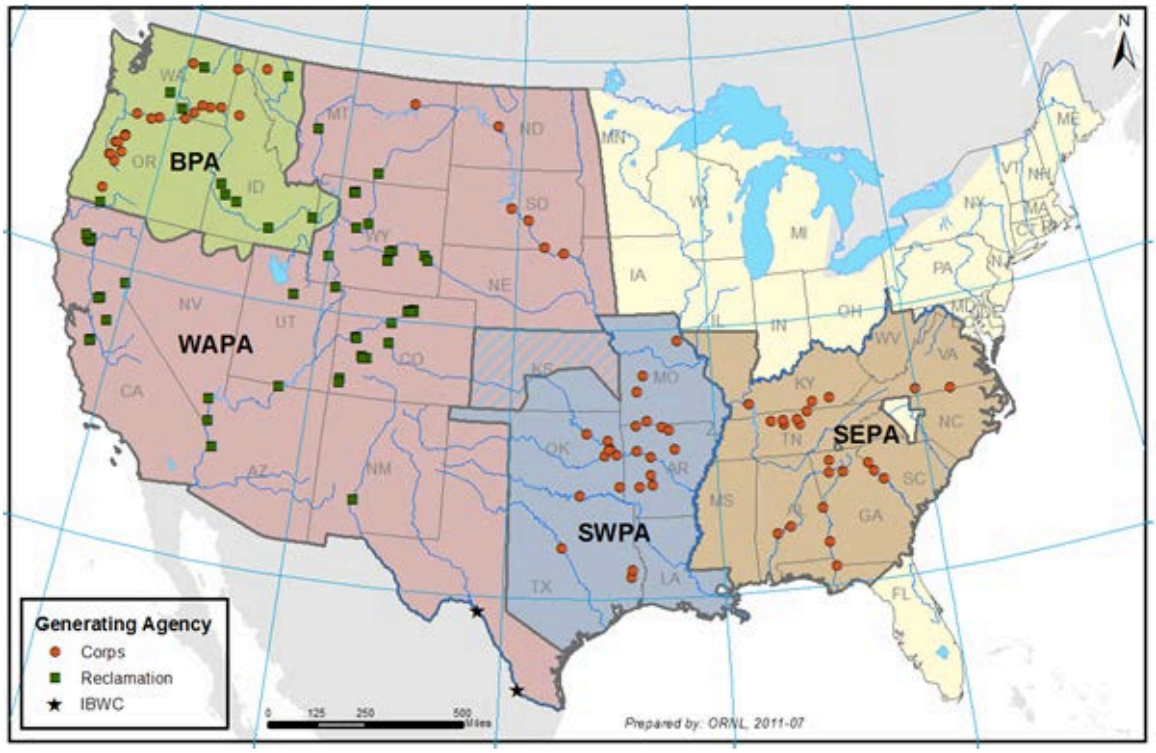


Figure 1: PMA territories and facilities

Executive Actions:

1. **Use borrowing authority for the grid**. Direct WAPA and BPA to use the borrowing authority they received in the Recovery Act ($3.25 billion) to expand and modernize the western electric grid.

2. **Accelerate energy system modernization**. Direct the Secretary of Energy, and reaffirm his authority, to work with PMA leadership to accelerate modernization of America's energy resources and power systems. For example, the DOE formed a Joint Outreach Team with the WAPA, which is now implementing recommendations to help ensure the U.S. has a modern, secure, and reliable electric transmission system. Each PMA can use this approach to better integrate renewable energy into its plans, finances, and management of grid assets.

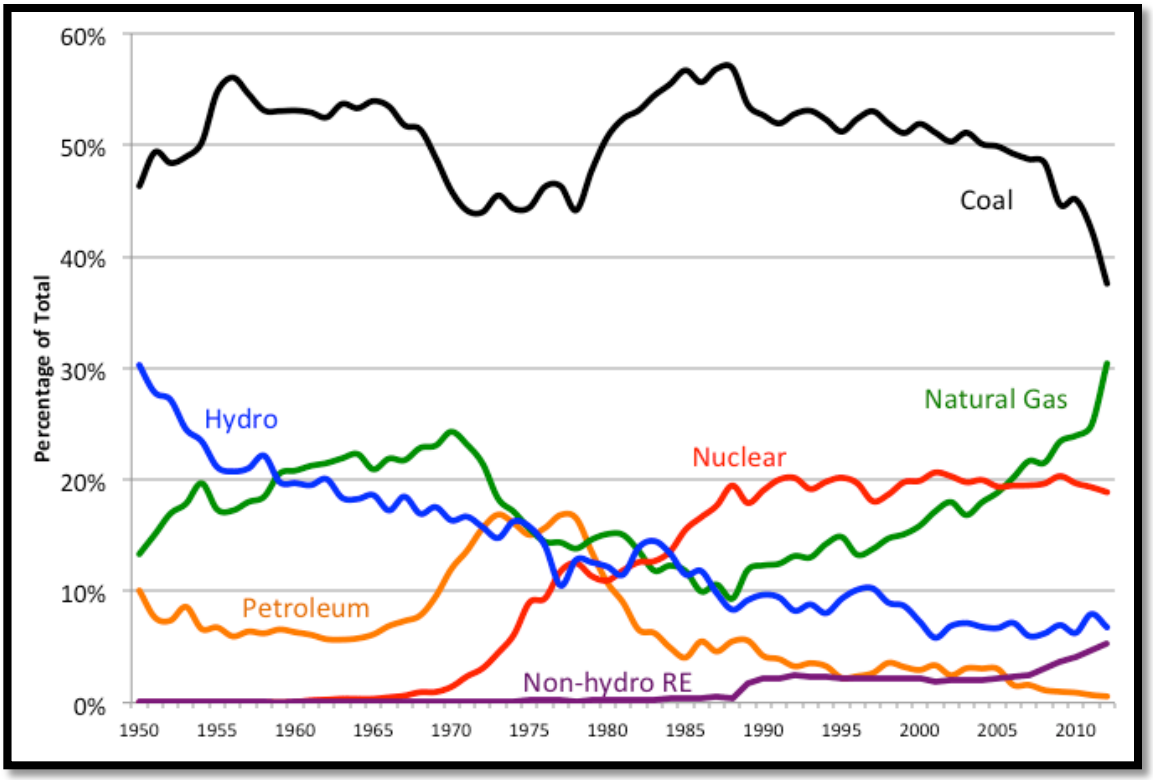


Figure 2: Changes in the Nation's Energy Mix – 1950 to 2010

3. **Develop strategic plans**. Direct the Secretary of Energy to require that the PMAs develop detailed strategic plans, with input from their customers, on how they will implement and communicate the policies and standards that constitute best practices for 21st century electric utilities, considering each region's unique characteristics. Among other things, the PMAs should describe how they will model:

   a) The costs, benefits and practices of increasing transmission capacity and system flexibility to integrate large amounts of renewable energy into the power system– amounts that contribute significantly to the President's goal of obtaining 25% of America's electricity from renewable resources by 2025[11], rising to 80% by 2050.[12]

   b) Better planning that fully considers the risks and benefits of issues ranging from electric utility resource selection to strengthening the power system's resilience against the impacts of global climate change.[13]

   c) Rules that target a portion of re-marketed or newly marketed hydropower to customers who plan to use their allocations for the direct replacement of conventional generation with high emission rates.

4. **Hire skilled managers**. Direct the OPM to ensure that the job requirements and performance criteria for general service federal employees in the PMAs emphasize knowledge, skills and abilities that build the PMAs' capacity to carry out the President's

goals and the Secretary of Energy's instructions related to building a 21st century electric power system. Encourage the federal Qualifications Review Board[14] to look for Senior Executive Service managers who have both executive management experience and technical skills relevant to the PMAs' new responsibilities.[15]

5. **Partner with private developers**. Direct the PMAs to take full advantage of their authority to partner with private transmission developers under EPAct Section 1222.

6. **Assess the benefits of allowing utilities to use excess capacity**. Direct the PMAs to evaluate the powerplant-to-plug benefits and costs of eliminating charges for utilities to move power through PMA transmission assets when the PMAs have excess transmission capacity. Report the results of this evaluation to the Secretary.

7. **Lay political groundwork**. To build political support[16] for these actions:

    a) Meet at the White House with thought leaders from the finance community, the Rural Utility Service (RUS) and the PMAs' preferred customer groups to explain the importance of their involvement in the evolution of America's power system, to challenge them to lead that evolution, and to enlist their support for making PMAs examples of how the nation's electric generation and distribution utilities can adapt successfully to emerging energy technologies and power system practices.

    b) Give a presidential address from a large rural renewable energy generation site to emphasize the role that rural America will play, and why, in the transition to clean energy and renewable resources.[17]

    c) Direct USDA to involve "boundary organizations" such as the Cooperative Extension Service[18] in building greater understanding in rural communities about the significant local financial and ecological benefits of rural renewable energy production.

Tennessee Valley Authority (TVA):

TVA is a corporation owned by the U.S. Government. It is similar to, but not, a PMA. It sells wholesale power to 155 utilities that serve 9 million people, 51 large industrial customers and six federal installations. It operates nearly 16,000 circuit miles of transmission lines connected directly to 14 other electric systems. More than 40% of its capacity comes from coal, nearly 24% from natural gas, 19% from nuclear power plants, and the rest from hydroelectric plants. TVA reports that in 2011, more than 40% of its energy came from clean or carbon-free sources.[19]

However, TVA has been the third-largest source of carbon dioxide emissions in the U.S. electric sector. In recent years, it has been charged with violations of the Clean Air Act at 11 of its coal-fired power plants. In April 2011, TVA reached a settlement with EPA, requiring it to spend $3-$5 billion on new and upgraded pollution controls and $350 million on clean

energy projects. TVA says its "renewed vision is to be one of the nation's leading providers of low-cost and cleaner energy by 2020."[20]

President Obama has directed OMB to conduct a strategic review of the Federal Government's relationship to TVA, including whether the government's role should be reduced or terminated. The President indicated the review is driven by the amount of debt TVA has accumulated and by the idea that TVA has achieved its original objectives and "no longer requires federal participation."[21]

TVA was established to meet the challenge of rural electrification. Although it has accomplished that goal, the 21st century has brought new challenges. The question is whether the Administration should privatize TVA or revise its mission to support the President's energy objectives.[22]

Executive Actions:

1. **Remission TVA as a pioneer of 21st century business practices**. Direct it to:

a) Collaborate with DOE, the Council on Environmental Quality (CEQ), EPA and other stakeholders to pioneer cost-effective strategies that help public utilities keep pace with emerging technologies. Such strategies could include competitive grants to distributors, pay-for-savings, and lost revenue recovery.

b) Open a docket on the implementation of an outcomes-based performance revenue model that rewards the accomplishment of certain policy objectives such as improvements in customer satisfaction, greater system reliability, emission reductions, energy productivity improvements and the integration of renewable resources and distributed energy generation.

c) Engage with merchant transmission developers seeking to bring low-cost renewable energy into the region by interconnecting wind power from Texas and Oklahoma with the TVA grid. *Cleanline*, the merchant transmission developer who proposed this, has applied to DOE to use the Section 1222 authority that would combine the company's private finance with the federal government's eminent domain authority. A commitment from TVA to buy clean, cheap wind power off the line would help address persistent uncertainty about the proposal.

Federal lands

The Federal Government owns nearly 650 million acres of land, nearly one-third of the land area of the United States. The Bureau of Land Management (BLM) has proposed a National Energy Policy Implementation Plan to identify the potentials for and barriers to renewable energy development—including solar, biomass, geothermal and wind energy—on public lands managed by it, the Bureau of Indian Affairs and the U.S. Forest Service.
As a first step, BLM partnered with NREL to assess this potential in the western United

States. In February 2013, BLM and DOE issued a report that 63 of BLM's planning units in 11 western states have high potential for power production from one or more renewable energy resources, while 20 planning units in 7 western states have high potential for power production from three or more renewable resources.

In June 2013, Interior Secretary Sally Jewell announced three large renewable energy projects with a combined generating capacity of 520 megawatts on 16,600 acres of federal land in Arizona and Nevada. The projects are expected to create nearly 1,000 construction jobs and 73 permanent jobs. In addition, Secretary Jewell announced that the government would lease nearly 165,000 acres on the Outer Continental Shelf off Rhode Island for commercial wind development. The Department of Interior (DOI) reportedly is considering permits for 23 additional renewable energy projects on public and Native American lands.

Executive Actions:

1. **Spotlight on renewable energy.** Hold high-visibility events involving the President in groundbreaking or dedication of these projects to draw public attention to the viability and current availability of solar, wind, geothermal and biomass energy production.

2. **Expedite development on public lands.** Continue encouraging and assisting DOI to expedite the development of renewable energy projects on suitable public lands.

Goal 3: Increase Collaboration with States, Localities and Utilities

As noted in Chapter 1, Executive Order 13514, directs federal agencies to help their host communities achieve sustainable development goals, including clean energy.
Analyses by numerous private sector organizations also recognize the importance of intergovernmental collaboration. Energy efficiency and renewable energy policies at the state level are making major contributions to progress on reaching the President's goal for a 17% reduction in greenhouse gas emissions by 2020.

Executive Actions:

1. **Work with State Treasurers** and other state and local authorities that want to establish public-private energy investment partnerships to capitalize them in part with existing federal grant funds.[23]

2. **Work with local governments to remove funding barriers.** Direct DOE, HUD, USDA, the Small Business Administration (SBA), EPA and the Department of Transportation (DOT) to work with state and local authorities, including economic development officers, to identify and remove barriers to full utilization of federal financing programs for which clean energy programs are eligible.

3. **Triple technical assistance to states**. Direct DOE to lead a multi-agency task force to plan how the Federal Government will triple technical assistance available to states for

using federal grants and financing programs to increase energy productivity, reduce greenhouse gas emissions, increase the use of renewable energy, and improve their ability to withstand the impacts of climate change.[24]

4. **Help host communities.** Reaffirm the requirement in Executive Order 13514 that federal agencies help strengthen the "vitality and livability" of their host communities. Make clear that this requirement applies not only to line agencies, but also to military installations and PMAs. Specify that these potential collaborations can include federal-state-local power purchasing agreements and joint efforts between cities and military installations to improve local energy security with distributed generation, micro grids and renewable energy technologies.

5. **Market federal funding.** Direct the Federal Executive Boards in each region to actively market federal grant, financing and technical assistance programs related to energy efficiency and renewable energy and to serve as regional clearinghouses for states to access those programs.

6. **Encourage states to leverage funds.** Direct DOE to earmark a portion of formula grants in the State Energy Program for states to identify how they will leverage the resources of other state and federal grant and financing programs, as well as private capital, for renewable energy development.

7. **Push for progress.** Formally establish the President's climate action goal of 40 gigawatts of new distributed solar capacity by 2020. Direct the Department of the Treasury (Treasury), the Department of Commerce (DOC), DOE, USDA and EPA to provide policy and technical assistance to states to promote investments in distributed solar energy. Direct the agencies to convene a national dialogue with ongoing regional workshops that encourage the adoption of best-practice policies such as net metering, interconnection standards, and third-party ownership of solar energy systems. Also cover how to overcome barriers to investment, the benefits of distributed solar energy, and existing federal financial incentives that support distributed energy projects.

8. **Help define the value of solar (VOS).** Direct the Secretary of Energy to have DOE's Office of Energy Efficiency and Renewable Energy (EERE) monitor and offer technical assistance to the state of Minnesota as it defines the "Value of Solar" (VOS) in compliance with recent state legislation. Minnesota's definition of VOS could become a model for PUCs and other legislatures. Encourage the state to define VOS to include the full life-cycle benefits of solar energy including not only economic development and new jobs, but also improvements in air quality, climate risk management, the ability of solar electric technologies to shave peak costs, and the potential to reduce the costs of building and maintaining transmission infrastructure when solar is used in distributed applications.

Goal 4: Maximize the Power of Federal Procurement

As America's largest energy consumer[25], the Federal Government can be an important force for market transformation to clean and renewable energy resources, leading to standardized contracts and useful data on project performance. In addition, by increasing the transparency and promotion of what the Administration is accomplishing, the President can position the Federal Government as leading rather than mandating the United States to a clean energy economy.

The President clearly appreciates the power of the purse and already has taken a number of steps to move his Administration into this leadership position, for example, with the goals established by Executive Order 13514 and his Climate Action Plan. He has directed agencies to reduce their energy intensity 30% by 2015 compared to 2003; to obtain 20% of their electricity from renewable resources by 2020; to reduce potable water use intensity 26% by 2020 compared to 2007; and to cut electricity-related greenhouse gas emissions 28% by 2020 compared to 2008. President Obama issued a memorandum in December 2011, directing agencies to execute $2 billion in Energy Saving Performance Contracts (ESPCs) over two years.

As the President knows, DoD presents an especially important opportunity for the Federal Government to increase its energy efficiency and use of distributed renewable energy. DoD is the Federal Government's biggest energy consumer and, by some estimates is the largest single institutional energy consumer in the world. It has the power to create and shape markets with its procurement practices.

Executive Actions:

1. **Go beyond the norm.** Amend EO 13514 to encourage agencies to go beyond traditional energy productivity measures to include distributed generation, CHP, the development of micro-grids, careful consideration of the relationship between energy and water consumption, and creative ways to unleash private capital investments in clean energy.

2. **Lay the groundwork for distributed energy in federal buildings.** EO 13514 requires federal agencies to align their policies "to increase the effectiveness of local planning for energy choices such as locally generated renewable energy" and beginning in 2020 to ensure that "all new federal buildings that enter the planning process are designed to achieve zero-net-energy by 2030." Amend the executive order to require that by 2020, all federal buildings will be evaluated for their distributed energy generation (DEG) potential and where cost effective and technically feasible, agencies will use third-party financing to equip existing federal buildings for DEG. Further amend the order to require that by 2020 all new federal buildings will be designed to utilize distributed renewable energy systems as well as to achieve zero-net-energy[26].

3. **Defend DoD's energy objectives.** To better defend congressional attacks against DoD's commitment to clean energy, issue an Executive Order clarifying that on military

facilities and in associated housing, the purchase of electricity from distributed, redundant, renewable energy systems requiring no delivery or stockpiling of fossil fuels, provides an "unusual standard for service reliability necessary for purposes of national defense" under Public Law 100 – 202.

4. **Clear away barriers to clean energy deployment in the military**. For example:

   a) Define and communicate best third-party financing practices at DoD: The energy productivity white paper CNEE submitted to the White House identified several problems in the Federal Government's use of ESPCs and UESCs. A report by the Government Accountability Office (GAO) in 2012 indicates that similar problems have limited the use of third party financing at DoD. Direct the Secretary of Defense to report on the status of its compliance with GAO's recommendation to "issue comprehensive guidance to ensure key analyses are completed and available financing approaches are fully considered," and that DoD "develop a formalized communications process to share best practices on financing renewable energy projects among installations."[27]

   b) Set ambitious goals for renewable energy ESPCs**.** Issue a presidential memorandum to the Secretary of Defense, setting aggressive goals for DoD's use of ESPCs and UESCs to finance renewable energy projects at no cost to taxpayers and without adding to the federal budget deficit.

   c) Clarify on-base/off-base power possibilities. Direct the Secretary of Defense to clarify and provide guidance on the electric power arrangements military bases can use to achieve their renewable energy targets, including purchasing power from nearby civilian renewable energy systems, selling power to nearby communities from on-base renewable energy systems and participating in aggregated civilian-military orders for renewable energy from other power producers.

Goal 5: Encourage Collaborations between the Natural Gas and Renewable Energy Industries

Abundant supplies of inexpensive natural gas are competing with renewable energy technologies and slowing their market penetration. However, NREL has studied potential synergies between the natural gas and renewable energy industries in the electric power and transportation sectors.[28] NREL concludes:

> *Partnerships between the natural gas and renewable energy industries have not historically been a source of significant dialogue, yet today there are many opportunities for the two industries and other energy stakeholders to jointly develop vibrant and robust hubs of integrated research and development, information exchange, planning, and policymaking. The first step in reaching this goal is laying the groundwork of open dialogue and engagement in all possible arenas in which further collaboration might grow.*

Among these opportunities, NREL says, are:

- Hybrid applications that capture the benefits and minimize the drawbacks of each industry. Examples include combinations of concentrating solar power systems and gas-fired power generation; natural gas and biogas co-firing of combined cycle gas turbines; and gas-powered compressed air energy storage.
- Collaboration on electricity market design and regulation including joint transmission planning.
- More dialogue on the role the two industries might play together on implementing the President's energy goals and policies.
- A portfolio approach to R&D and funding.
- Joint efforts to dispel myths about each other's industries and resources. "Natural gas and renewable energy both experience enduring misinformation and inaccurate portrayals" about their industries, NREL says.[29]

Executive Actions:

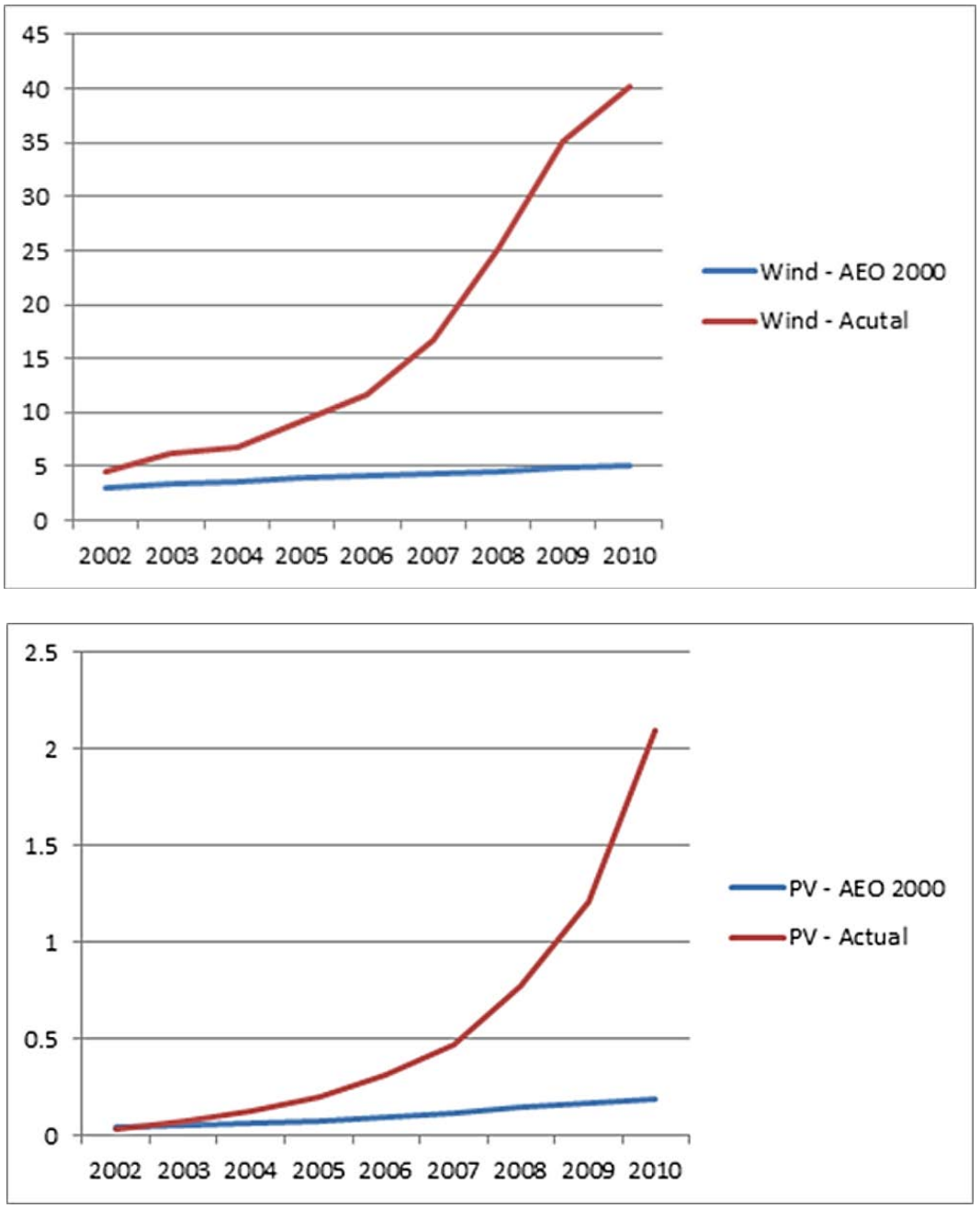
1. **Pass the peace pipe.** Convene leaders in the two industries at the White House, along with the governors of states with significant fossil and renewable energy resources, to convey the President's desire for inter-sector collaboration between the gas and renewable energy industries, where collaboration is mutually beneficial. Include an NREL briefing on opportunities it has identified.[30]

2. **Exemplify collaboration.** Push FERC, the PMAs and TVA to use their respective authorities and networks to encourage collaboration between the natural gas and renewable energy industries.

Goal 6: Improve Government Metrics on Market, Job and Economic Impacts

Two issues have caused controversy recently regarding Federal Government metrics associated with renewable energy. The first is the accuracy of the Energy Information Administration's predictions of renewable energy's contribution to the nation's energy mix in the years ahead – more specifically whether the EIA has consistently underestimated the market penetration of renewables (see Figures 3 & 4). The second is whether the Bureau of Labor Statistics (BLS), which has stopped reporting on "green jobs" after being criticized by Congress, should find another way to report on jobs related to renewable energy, energy efficiency and other occupations that contribute to environmental protection, as it does jobs in other industry sectors.[31]

These data have some influence in the financial community's perception of the renewable energy market. They also are likely to have some influence in the perceptions of the public, policy-makers and other stakeholders.



Figures 3 & 4: Wind and photovoltaic solar market penetration from 2002 to 2010 in gigawatts, comparing EIA's reference case projections in its Annual Energy Outlook 2000 to the technologies' actual performance based on data from the American Wind Energy Association and the Solar Energy Industries Association. (Adapted from Meister Consultants Group, 2013; REN21, 2013)

Executive Actions:

1. **Fix BLS Methodology.** Direct the CEQ, the SBA and the OMB to review how BLS has defined and calculated "green jobs" in the U.S. economy and to recommend a methodology that addresses real or perceived shortcomings raised by members of Congress and some private-sector research institutions.

2. **Report renewable energy jobs**. Based on these recommendations, direct BLS to resume reporting jobs attributed to the production, sale, installation and servicing of renewable energy and energy efficiency technologies.

3. **Obtain better crystal balls**. Direct DOE, through NREL, to evaluate the modeling methodology used by various expert organizations in academia and the private sector and to compare their projections of future renewable energy market penetration with those generated by the EIA. Determine whether any of the private sector methodologies have proved to be consistently more accurate. If so, recommend modifications in EIA's modeling.[32] Also determine whether EIA's projections would be likely to improve if it based them on the rapidly falling prices of a number of the technologies.[33]

Goal 7: Encourage Renewable Energy Use in the Commercial and Institutional Sectors

Private buildings such as office spaces and malls have huge potential for renewable energy upgrades. However, commercial buildings have unique market barriers that complicate otherwise effective financing tools such as energy-saving performance contracts (ESPCs/UESCs)[34] and other financing mechanisms. For example, commercial lenders are concerned with who will take on repayment of debt if a building can be sold in the middle of an upgrade.

Executive Actions:

1. **Create a commercial retrofit program.** Order OMB to review all loan guarantee authorities within Treasury, DOE, USDA and other agencies to determine the amount of funding available to create, within existing authorities through rulemaking, a private commercial building renewable energy retrofit loan guarantee program with a loan loss reserve fund that will back up credit risk but not performance risk.

2. **Help states with institutional ESPCs**. Direct DOE to work with states to launch ESPC programs that include renewable energy systems for municipal, university, state and hospital markets (known as MUSH in the ESCO industry).[35]

3. **Locate energy intensive facilities near renewable energy assets**. Direct DOE to launch a program that encourages energy-intensive industries and corporations to locate where there are substantial renewable energy resources and to maximize their

use of renewable power. Provide energy-intensive facilities with technical assistance on methods for improving their energy productivity, using combined heat and power, and using distributed generation.[36] Direct DOC and SBA to help DOE market the program among companies. Direct DOE to work with EPA, DOT and HUD to promote renewable energy resources as economic development assets through the Partnership for Sustainable Communities.

Goal 8: Educate the Public and Financial Markets

In 2010-2011, the International Economic Development Council surveyed economic development officials in 48 states to find out how many were actively recruiting renewable energy companies. The survey found that renewable energy was growing in its importance to economic development in the states, that most states were very active in targeting renewable energy development, that a lack of investment capital and financing were the leading challenge to renewable energy business growth, and that political leadership was seen as the leading asset in growing renewable energy businesses.

But is renewable energy a factor in where companies choose to locate? In 2012, a survey by Area Development Online found that energy availability and costs were among the top 10 factors corporations consider in deciding where to locate. Another factor was "green energy." The survey found that:

> *More companies are interested in developing a green footprint and using renewable, carbon-free energy for their facilities. Even though green energy can be an extra cost factor up front (for example, solar panels on warehouse roofs in the Southwest), it does eventually bring rates down and improves the company's image. "Sometimes the driver is not so much cost but growing the value of 'green' in a company's brand," says John Boyd, principal with the Boyd Company in Princeton, New Jersey. "Green brings coveted social and public relations value, which appeals to the company's executive suite and corporate/investor relations department, beyond the site selection/real estate team with whom we interact."*

In other words, states are not only trying to recruit renewable energy companies; companies are trying to find renewable energy communities. Federal agencies concerned with business creation and economic development can legitimately promote renewable energy—the technologies, resources and policies—as a business and jobs recruitment asset.

The transition to clean energy and diverse generation assets also requires a re-education of financiers and investors who are attracted to the growing renewable energy sectors. There are significant differences between power production from renewable vs. conventional energy resources. Many of these differences are important to successful investment and financing.

An obvious difference is that the capital requirements of most renewable energy

technologies are all on the front end. Fuel and operating costs during the life of the technologies are virtually nothing. These differences will move utilities further away from dispatching electric generation with fossil fuels and toward generation with renewable resources. If federal agencies, policy makers, regulators and investors assume they can proceed with business as usual, the results likely would include unsuccessful projects that undermine confidence in renewable power generation.

There is a great deal that government agencies, regulators and utilities need to clarify for themselves about the disruptive details of dealing with distributed generation and renewable fuels—details such as what constitutes avoided costs, and how to better internalize the relative benefits and costs of fossil fuels and renewables to accurately identify least-cost options for delivering power to customers.

Executive Actions:

1. **Promote renewable energy as an economic development asset.** Direct federal economic and business development agencies to gather additional evidence about the value of renewable energy systems and policies for state and local economic development and to communicate the evidence to state and city economic development officials.

2. **Help financiers understand renewable energy technologies**: Use the President's convening power to bring regulators, power producers and financiers together as often as necessary to educate one another about the differences between traditional and new ways of generating, dispatching, leveling, transmitting and distributing power from renewable resources.

3. **Be proactive in promoting DOE's loan programs for renewable energy business creation.** Recast and control the message about DOE's energy technology loan programs. After Solyndra, opponents of federal clean energy financing controlled the message, and the message was bad: The Obama Administration was trying to advance the President's clean energy agenda by "picking winners," critics said, and taxpayers were the losers. The real story is far different. DOE's 1703 and 1705 loan and loan guarantee programs were created by Congress to support companies engaged in developing new and innovative energy technologies. New and innovative technologies involve risk. Recognizing that, Congress set aside nearly $10 billion for a "loan loss reserve." As of July 2013, the programs had attracted more than $21 billion in private sector investment. Losses amounted to only about 2% of $35 billion closed and committed loans. In 2011, the programs constituted the nation's largest single public or private source of debt financing for clean energy.[37]

Goal 9: Stimulate the Development of Offshore Wind[38]

The Atlantic coast offshore wind resource represents the most significant developable renewable energy resource for East Coast states. DOI estimates that offshore Atlantic wind

contains 1,000 gigawatts of energy if fully developed, about equal to the United States' total generating capacity today.

Compared to land-based wind, Atlantic offshore wind has the capacity for more energy, is closer to load centers, and has a production pattern that better matches the load profile. Consequently, Atlantic offshore wind energy has the potential to reduce peak and congestion prices on the East Coast. Importantly, offshore wind is the only resource with which the Atlantic states can meet their renewable energy portfolio standards and significantly move the region toward a robust clean energy economy.

However, offshore wind has had a slow start in the United States, due in most part to the costs of 'first of its kind' projects and the nascent industry. Accelerating the development of offshore wind resource depends on reducing the delivered cost of its energy to ratepayers, increasing federal participation in reducing that cost, and in state-federal and state-state purchasing collaborations.

Accomplishing this will require high-level leadership from the Executive Branch. During its first term, the Obama Administration made a number of important contributions to accelerating offshore wind: DOE's *National Offshore Wind Strategy* identified broad deployment goals based on resource estimates and kick-started R&D efforts to reduce the cost of offshore wind. DOI empanelled Atlantic governors and entered into a Memorandum of Understanding with the states to address multiple siting and permitting issues. This resulted in *Smart from the Start*, an initiative that designated "wind energy areas" and made progress in reducing permitting timelines.

There is a continued need for leadership from the Federal Government on the most important issues facing offshore wind today: financing and cost. There is also a critical need for federal leadership to re-engage and support Atlantic governors in state-federal and state-state collaboration on these issues.

Executive Actions:

1. **Revitalize the Atlantic Offshore Wind Interagency Working Group**. Past participants tell CNEE that the group hasn't been active for some time.

2. **Continue *Smart from the Start*.** Direct Interior Secretary Sally Jewel to assess progress on the *Smart from the Start* initiative and revive the initiative if necessary.

3. **Quantify all benefits of offshore wind for use in federal procurement decisions.** Direct DoD and the GSA in concert with EPA to analyze the benefits of offshore wind power to the federal government, including social, environmental and economic benefits

4. **Review and improve procurement policies**. Direct DoD, GSA and DOE (FEMP) to evaluate their procurement authority and practices and to implement changes,

including quantified benefits, that allow long-term power purchasing agreements for offshore wind energy.

5. **Establish deployment goals**. DOE is currently revising deployment goals for offshore wind. While not yet published, the draft goals are reportedly 2GW - 4GW by 2020; 20GW - 40 GW by 2030; and 100GW- 150GW by 2050. Confirm that these goals are realistic and incorporate them into the President's Climate Action Plan.

6. **Increase the market with intergovernmental procurement**. Use federal-state and encourage state-state procurement of offshore wind to help create a larger market.[39]

7. **Help reduce the cost of capital**. Empanel an Offshore Wind Financing Task Force led by Secretaries of Energy and Treasury and assign it to recommend federal, state and private sector actions to remove financial barriers to offshore wind development. Include representation from OMB and DoD and instruct the Task Force to seek recommendations from Atlantic governors, financiers and investors.

8. **Emphasize offshore wind in financing and grant programs**. Direct the Secretary of Energy to give stronger emphasis to offshore wind technology in future rounds of DOE technology grants and applicable federal financing programs.

9. **Streamline dispute resolution**. Empower the Bureau of Ocean Energy Management (BOEM) to resolve competing use disputes quickly to streamline process for designating wind energy areas.

10. **Avoid excessive navigation claims**. Direct the Secretary of Homeland Security to ensure that the Coast Guard's Port Access Route Study (PARS) project guards against excessive claims to exclusive use of Outer Continental Shelf areas for navigation when those claims prohibit offshore wind development.

11. **Improve the auction process**. Direct the Secretary of Interior to resolve the disconnect between the cash-based bidding for federal lease rights and fact that some projects require significant federal and state government support. Resolve issues involving reserve prices, operating fee rates (they have been reduced to 2% but are still too high), and the formula for estimating the power revenues that are used to compute operating fees.

12. **Shorten permitting time**. Revive the inter-agency task force and add high-level representation to better coordinate permits and approvals at the federal level.

13. **Help expedite intergovernmental tasks**. Ensure high-level representation from the Federal Government to help expedite federal-state coordination on intergovernmental issues (e.g. BOEM working with state coastal planning and historic preservation officials and with state's lead environmental review agencies).

14. **Improve wildlife data**. Increase investment in federal and federal-state baseline data collection regarding avian and marine mammal activities in potential wind development areas.

15. **Communicate the Federal Government's support for offshore wind to the Regional Transmission Organization (RTO).** Direct the Secretary of Energy to **c**ommunicate to PJM—the RTO that coordinates the movement of wholesale electricity in all or parts of 13 states and the District of Columbia—the federal government's support for planning high-capacity offshore transmission systems that use advanced transmission technology to reduce the cost of delivering offshore wind energy.

Federal Agency Actions

Executive Office of the President/Office of the General Counsel

1. **Clarify executive authority to alter tax policy**. Direct the General Counsel to provide his or her opinion on the President's legal authorities to make or alter tax policy. (See recommendations under the Department of the Treasury, below.)

Department of Agriculture

1. **Continue developing USDA's effort to mobilize a number of federal rural development programs to promote financing for rural renewable energy development.** In June 2013, USDA announced that it would propose a rule to expand its renewable energy and project financing programs to help strengthen the rural economy "despite a time of significant budget uncertainty." The announcement was evidence of USDA's understanding of how renewable energy production can become a powerful driver of economic prosperity in rural America.

2. **Use the Energy Efficiency and Conservation Program to leverage RE policies.** USDA is working on a rule to provide up to $250 million annually in loans and loan guarantees to rural electric utilities and their customers for energy efficiency and renewable energy projects. Rural Electric Cooperatives using these loans and guarantees could be required to implement net energy metering and interconnection standards that meet the recommendations of the Interstate Renewable Energy Council's *Freeing the Grid* report and permit third-party ownership of solar energy systems. The Rural Utility Service, which will administer the new loan program, could designate a payback period that is related to the expected lifetime of the measure, reducing the monthly cost to the consumer. For example, its loans could be based on a minimum period of 80% of the expected life of the measure with incentives for early repayment. It should encourage on-bill repayment mechanisms to facilitate collection and repayment of the loan.

Department of Energy

1. **Analyze feed-in tariffs.** Direct NREL to study the performance of feed-in tariffs (FITs) in the TVA and to determine if and how FITs could be adopted by the PMAs' utility customers, given legal constraints in the Federal Power Act (FPA) and PURPA, as well as regulatory precedents.[40]

2. **Seek a FERC ruling on avoided costs.** Petition FERC, on behalf of the U.S. and the public interest, for a rulemaking on the avoided cost of residential customer-sited load (e.g., solar photovoltaics) for investor owned utilities (IOUs). This process would allow the best information from states and the Federal Government to be properly evaluated for the purposes of avoided cost. This process could reduce state-by-state conflicts over net energy metering.

3. **Inform state proceedings.** Fully study the value of distributed renewable energy on the grid, including CO_2 emission reductions; public health benefits; transmission and distribution savings and efficiencies; and savings from forgone fuel purchases. Affirmatively provide that data at state-level proceedings whenever the opportunity is presented.

4. **Equip PMA stakeholders to promote renewables.** Work with the American Public Power Association and the National Rural Electric Cooperative Association to provide their members with current information on financial incentives and the benefits of distributed renewable energy generation; solar market development; net energy metering; interconnection standards and permission for third-party ownership of solar energy systems.

5. **Use more third party financing for federal agencies.** Direct the FEMP to assess the use of ESPC, UESC and on-site power purchasing agreements by federal agencies for renewable energy systems. Direct the NREL to report on the use of its technical assistance services for federal agencies interested in implementing PPA projects. Direct FEMP and NREL to make recommendations on how to improve the use of these tools by federal agencies.

6. **Issue technology updates.** To better inform investors, policy makers and finance program managers, issue regular technology updates on the reliability and cost-effectiveness of new renewable energy technologies. For example, evaluate and recommend whether home storage for renewable energy systems is cost-effective and finance-ready.

7. **Increase geo-education.** Improve public awareness of and education about the costs, benefits and financing options for geothermal heating pump systems (GHP). Industry analysts report that real estate appraisers have difficulty determining the "contributory value" of renewable energy systems such as GHP if they are not in common use. In addition, homebuyers who are unfamiliar with a renewable energy technology are less

inclined to purchase homes that feature it. Although GHP is a good energy option in most areas of the United States, it has not achieved sufficient market penetration for realtors to determine comparable sales in nearby buildings. However, GHP, like solar electric technologies, significantly reduces a building's operating costs.[41] The Lawrence Berkeley National Laboratory (LBNL) study cited above indicates lower energy bills are a significant factor in increasing a building's value and market appeal.[42] In addition, educate communities and energy service companies about GHP, with the goal of producing more community-scale systems that lower costs through economies of scale[43] and more ESCOs willing to engage in shared-savings contracts.

8. **Use Power Purchasing Agreements.** Encourage collaborations and joint efforts including federal, state and local power purchasing agreements between cities and military installations to improve local energy security with distributed generation, micro grids, and other technologies (Bates, 13).

9. **Align utility rates of return with clean energy priorities.** Develop guidelines for the use of the federal PMAs and state PUCs on performance-based utility ratemaking that aligns utility compensation with changing societal priorities, as well as state and federal clean energy policies. Also, develop model legislation in consultation with the National Conference of State Legislatures (NCSL) and the National Association of Regulatory Utility Commissioners (NARUC) to allow utilities to rate-base resources that are consistent with state and federal clean energy policies, providing the costs are reasonable. Such performance-based regulation can draw on best practices established in California, Maryland and Oklahoma.

10. **Collaborate on risk management with the Department of Homeland Security (DHS) and FEMA**. As part of the National Mitigation Framework, conduct ongoing assessments of risks to the nation's power systems and advise FEMA of the risk-management benefits of distributed energy systems, at building and community scale, non-interruptible renewable electric technologies and renewable electric equipment for first responders, water purification, hospitals and other emergency services. Also advise FEMA on the cost and post-disaster reliability differences between diesel generators and solar photovoltaics.

11. **Work with DoD to increase coordination between military installations, other federal facilities and localities with similar clean energy goals.** Work with localities to establish micro-grids, accommodate electric vehicle fleets, and bundle power purchases. Work with the DOI and DoD to coordinate renewable energy power production and transmission on federal lands with nearby military bases and other federal installations.

12. **As recommended in Chapter 1 on energy efficiency, triple technical assistance to states, localities and utilities.**

    a) Direct National Laboratories to give high priority to their state and local assistance programs as the labs allocate resources. Create more programs like NREL's

Technical Assistance Program, which taps experts from three national labs to help communities with short-term technical assistance. Use "tiger teams" – teams of experts who can be deployed to states, localities, utilities and industries to help them design and implement renewable energy programs.

b) Help states quantify the greenhouse gas emission reductions, economic benefits and contributions to state energy productivity and renewable energy goals that will result from their State Energy Plans.

c) Strengthen DOE's expertise in market penetration by assigning a senior specialist in technology deployment and technology deployment partnerships to each of the clean energy programs in EERE.

13. **Emphasize Risk Management.** Evaluate and publicize the value of renewable energy and distributed energy technologies in managing the risks of climate change, energy price volatility and energy supply disruptions.

14. **Get the word out.** Market the Federal Government's energy-related grant and financing programs more actively. The July 2013 Guide to Federal Finance Facilities for Clean Energy is a good start[44], but DOE can do more to raise the visibility of these opportunities and to link projects with financing for constituents across the country.

15. **Make net-zero standard practice**. Create more market push and pull for net-zero energy buildings:

a) Promote net-zero energy and carbon buildings as the accepted goal of the building industry by marketing the economic, environmental and national security benefits of these buildings.

b) Ensure that NREL, NIST and the several states active in the field of net-zero energy buildings collaborate on their research, development and deployment efforts.

c) Conduct and publish a current inventory of existing net-zero buildings in the U.S., along with best practices and lessons learned.

d) Provide technical assistance to help net-zero energy programs succeed – for example, California's plan to develop net-zero standards.

e) Develop three new model energy codes for residential and commercial buildings. The first would achieve 50% more energy efficiency than the current International Energy Conservation Code (IECC); the second would achieve 75% more efficiency; and the third would achieve net-zero energy performance. Each model code should indicate the role of renewable energy technologies in approaching net-zero energy. State and local adoption of the new codes would be voluntary.

16. **Engage STEAB.** Strengthen the role of the State Energy Advisory Board (STEAB), the organization created by Congress to serve as a liaison between states and DOE on energy efficiency and renewable energy issues, and to develop recommendations for DOE and Congress on designing, implementing and evaluating federal energy efficiency and renewable energy programs.

17. **Improve SEP.** Update and improve the State Energy Program by:

    a) Structuring its competitive grants to reward states that create and sustain progressive renewable energy policies, including policies that encourage private capital investment in clean energy projects. Examples include performance incentives and decoupling policies that protect utilities from revenue losses due to distributed energy production; on-bill repayment and commercial PACE financing programs; and renewable energy performance standards.

    b) Requiring that state energy plans reflect today's most cost-effective and emissions-effective policies, programs and technologies.

    c) Making greenhouse gas reductions and adaptation to climate change specific requirements in the State Energy Program program notice for 2014 and beyond.

    d) Requiring states to keep their energy assurance plans current and to ensure that vulnerabilities related to climate change are addressed as they update the plans.

    e) Encouraging State Energy Offices to work with State Treasurers to identify renewable energy finance strategies that help meet state renewable portfolio standards and other similar policies.

18. **Encourage collaboration between the natural gas and renewable energy industries.**

    a) Direct NREL to produce a report that identifies, analyzes and offers lessons from past efforts at collaboration, both successful and unsuccessful.

    b) Encourage hybrid energy projects through its loan, grant and loan guarantee programs, where DOE has the discretion to do so.

    c) Instruct ARPA-E to conduct basic and applied research in hybrid applications of natural gas, biogas, wind and solar energy.

19. **Make building labels uniform and test battery storage.** Direct FEMP to:

    a) Develop a uniform labeling system for all federal buildings that make energy efficiency and renewable energy improvements. Identify energy, greenhouse gas emission and taxpayer savings to help educate citizens about the benefits of specific energy efficiency measures.

b) Work with GSA and DoD to pilot the use of stationary battery storage to integrate higher levels of renewable energy into the power systems and as a demand response measure for base load electric savings in addition to peak shaving and energy emergency mitigation. Test these uses of battery storage in clusters as well as individual federal buildings.

20. **Create user-friendly program access.** Establish and maintain a one-stop web-based directory through which the public can easily learn about and access all federal renewable energy programs. Organize the site by type of energy consumer – i.e. homeowners and renters, commercial building owners and tenants, industries, farms and ranches, communities, etc. Include programmatic information as well as information on tax credits, grants, labeling and educational materials.

21. **Provide Guidance on Emergency Power for Shelters**: Work with the Department of Education to provide communities with guidance on establishing on-site backup power and up-to-date energy efficiency technologies in all schools that are designated as emergency shelters. Help the schools become demonstration centers for energy technologies that increase their resilience against extreme weather events and provide them with assistance in interpreting the technologies for students, faculty and visitors.

22. **Streamline documentation.** Convene industry stakeholders to develop standard streamlined documentation for appraisers, engineering firms, and financiers to use for renewable energy investments in residential and commercial spaces.

23. **Make the social and environmental costs of electricity more transparent**. Conduct a detailed analysis of the full life-cycle costs of electricity from solar and wind systems compared to coal and natural gas, including the social costs of carbon. Include the impact of each energy resource on ecological services and potable water supplies.

24. **Address the energy-water nexus.**[45] To help government agencies and the private sector to make more fully informed financing and investment decisions, establish and support a multi-agency program to address the energy-water nexus, as required by the Energy Policy Act of 2005 and recommended by the Government Accountability Office (GAO) in September 2012.[46] Instruct DOE that the program should:

a) Build on EPA's Energy-Water Principles to produce a national action plan similar to the one the Climate Adaptation Task Force produced.

b) Develop procedures that factor water into energy policies and investments. Start with the premise that federal agencies should make water conservation and quality a key factor in assessing the life-cycle costs and benefits of energy supply and demand options.

c) Develop information for states and localities. Determine the type of information states need to incorporate water factors into sub-national energy policies,

particularly in areas subject to growing populations but declining or stressed water resources.

d) Advise agencies on new policies. Strongly encourage FERC to incorporate water intensity in wholesale avoided cost and other dockets.

e) Improve data and research. Develop and execute a plan to better understand the energy-water relationship. The GAO noted that "effective policy choices will continue to be challenging without more comprehensive data and research" to better understand hydrological processes, aquifer recharge rates and groundwater movement.

25. **Give investors economic assessment tools**: Direct DOE to inform the energy investment community about the availability of EPA tools that states use to estimate the economic benefits of energy efficiency and renewable energy programs.[47] These tools can be helpful to investors and financiers if EPA allows states to meet power plant emission targets with energy efficiency and renewable energy programs. Section 111(d) would be a market driver; the EPA's tools will help investors evaluate project benefits.

Department of Defense (DoD)

At last report, 44 military bases are operating, planning or demonstrating microgrids that allow them to generate and distribute energy independent of the civilian electric grid. DoD reportedly is investigating the use of small microgrids at some of its 600 forward operating bases. Pike Research (now renamed as Navigant) forecasts that the total capacity of U.S. military microgrids for stationary bases could reach nearly 55 megawatts by 2018.

1. **Share microgrid lessons.** Order military bases equipped with microgrids to report annually on their operation and on lessons learned, and to make the reports available to the managers of large civilian installations, other federal agencies[48] and municipalities in the United States.

2. **Share net-zero lessons.** Require similar annual reports from military bases involved in DoD's net-zero projects – i.e., U.S. Army installations that have been instructed to achieve net-zero energy use, water use and/or waste[49] – and make lessons learned available to municipalities, other federal agencies, and comparable civilian installations. The reports should be developed in collaboration with NREL, which has published a guide to assessing and planning net-zero military installations.

Environmental Protection Agency

1. **Coach the states.** Direct EPA's Regional Offices to serve as "coaches" to help states incorporate energy efficiency and renewable energy into SIPs and Section 111(d) plans, as well as New Source Review and Prevention of Significant Deterioration permitting.

Equip EPA's Regional Offices to help states calculate the economic as well as environmental benefits of energy efficiency measures in their SIPs.

Federal Emergency Management Administration

1. **Identify resilience through renewables.** Work with DOE and its National Laboratories to identify and promote renewable energy technologies that strengthen the resilience of communities and infrastructure, prevent or shorten energy emergencies, and improve the energy productivity of communities as they rebuild after disasters. Incorporate energy productivity and renewable energy technologies into FEMA's guidelines, technical assistance, grant and financing programs.

2. **Include renewable energy in hazard plans.** Require that states and cities address the risk management benefits of renewable energy in the Local Hazard Mitigation Plans required by FEMA.

3. **Explore the role of plug & play in disaster response and recovery.** Determine whether plug and play information and energy systems can help communities restore vital functions more quickly after disasters. Advise communities as part of their disaster response plans to prioritize the restoration of data systems, power connections and other functions – in other words, to identify which systems must be restored first.

Department of Transportation

1. **Fund EV charging stations.** Work with the Electric Power Research Institute to better understand the impact of an electric vehicle fleet and infrastructure on utilities and utility regulation. Direct the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA) to prioritize funding from the Congestion Mitigation Air Quality Improvement (CMAQ) Program for solar-powered electric vehicle charging stations in both nonattainment areas and states that have no nonattainment areas but are still eligible for funding under the MAP-21 (Moving Ahead for Progress in the 21st Century) Program. Incorporate insights into utility and regulatory impacts into this change.

Department of Homeland Security

1. **Find funding for renewable energy applications in emergency services and resilience programs.** Identify and market grants and technical assistance available from the Federal Government for organizations that deliver fuel, electricity, medical services and sanctuary from the impacts of climate change. Examples include backup renewable power systems to operate emergency services, gasoline pumps at gas stations, medical facilities and vital communications services, as well as energy efficiency and renewable energy technologies that reduce losses to small businesses.

2. **Identify energy system risks.** Collaborate with DOT and DOE to identify and prioritize risks to the nation's energy system and develop model policies and best practices to help PUCs and electric utilities prevent or adapt to these risks, including climate impacts.

Small Business Administration

1. **Employ renewable energy systems for preparedness.** Incorporate risk-reducing renewable energy technologies for disaster mitigation and recovery in SBA's emergency preparedness materials for small businesses. Include training in performance-based energy efficiency programs such as ISO 50001 and ASHRAE Building Energy Quotient (BEQ) labeling.

Department of Interior/Bureau of Land Management

1. **Check on "Smart from the Start".** The Interior Department issued a memorandum on Feb. 7, 2011, with new guidance on how BLM should review right-of-way applications for solar and wind projects on BLM lands. The guidance requires that BLM work with state, tribal and local governments to identify potential negative impacts of projects before the project developer submits its right of way application. BLM should check on how this guidance is being used and whether it is having the desired effect of saving time and avoiding conflicts.

2. **Coordinate renewable energy project siting.** Continue to coordinate with states and other federal agencies on siting and permitting utility-scale renewable energy facilities and transmission projects.

3. **Meet the President's objective for renewable energy production on public lands.** The President's goal is to permit 20,000 MW of renewable energy projects on public lands by 2020.

4. **Designate new solar and wind energy zones.** Identify and designate new solar and wind energy zones on public lands, building on the western solar plan and the Arizona Restoration Design Energy Project.

5. **Get the Bureau of Reclamation involved.** Leverage Bureau of Reclamation resources to promote renewable energy at scale– for example, by replacing coal with renewable energy in power plants and by covering water canals with photovoltaic arrays.

6. **Develop species-friendly permitting.** Develop a fully functional regulatory program at the Fish and Wildlife Service to permit wind projects while preserving migratory birds and other avian species. In addition complete the desert tortoise recovery plan chapter for solar energy and the California Desert Renewable Energy Conservation Plan.

7. **Complete the Dry Lake mitigation project.** Complete the Dry Lake mitigation pilot and related updates to BLM's mitigation manual to encourage landscape-level mitigation on public lands for the use of utility-scale projects on private lands.

Independent Agencies

Internal Revenue Service (IRS)

1. **Allow renewable energy investors to form Master Limited Partnerships.** Determine whether the IRS has the statutory authority to allow renewable energy investors to form Master Limited Partnerships. If so, issue a revenue ruling to that effect.[50]

2. **Monetize the PTC.** Encourage the Office of Tax Policy to determine if and how the Production Tax Credit (PTC) can be monetized.[51]

3. **Eliminate ambiguity and delays in tax laws**. Request that the IRS Oversight Board[52] review the IRS's interpretation and implementation of tax laws related to renewable energy resources, in response to complaints that ambiguity and delays in its implementation of renewable energy and energy efficiency tax provisions discourage investment in these technologies.

Securities and Exchange Commission (SEC)[53]

1. Increase corporate risk reporting. Direct the Chairman of the SEC to annually assess and publicize a list of publicly traded companies that fail to file yearly reports on their climate risks. A recent analysis found that 75% of publicly traded companies are failing to comply with SEC guidance on climate risk reporting. Further direct the Chairman to step up implementation of the guidance by returning substandard corporate reports to be rewritten and by sending letters to those who fail to report, informing them that the public will be notified of their failure to comply.[54]

Chapter 3: Financing Renewable Energy

Key Themes and Recommendations

- Replace the "all of the above" energy policy with a "best of the above" policy by determining the full life-cycle costs of energy options to reveal and give higher priority in federal policy to those that offer the greatest public benefit for least environmental, economic, social and security costs.

- Analyze federal mortgage data to determine whether renewable energy investments in homes increase their value, as one recent study suggestions.

- Ask the Comptroller of the Currency to clarify that renewable energy projects qualify as public welfare investments (PWI) by financial entities and fall under the Community Reinvestment Act (CRA).

- Work with states to reallocate the more than $2 billion in Qualified Energy Conservation Bonds that remain unissued.

- Find administrative solutions that allow residential PACE programs to go forward as well as other financing approaches that serve the same function but are more acceptable to investors .

The President has made renewable energy a central element in the transition to a clean energy economy. During the June 2013 speech in which he announced his Climate Action Plan, the President said:

> *Over the past four years, we've doubled the electricity that we generate from zero-carbon wind and solar power. And that means jobs–jobs manufacturing the wind turbines that now generate enough electricity to power nearly 15 million homes; jobs installing the solar panels that now generate more than four times the power at less cost than just a few years ago. So the plan I'm announcing today will help us double again our energy from wind and sun.*

Among his renewable energy directives and goals to date, the President has:

- Proposed that by 2035, the United States will generate 80% of its electricity from clean energy resources, including wind, solar, biomass and hydropower.[1]

- Committed the Department of Energy (DOE) to make solar power cost competitive with traditional sources of energy, driving down the price of utility scale solar to $1/Watt and residential scale solar to $1.50/Watt by 2020.[2]

- Directed the Interior Department to approve sufficient private renewable energy capacity on public lands to power more than 6 million homes by 2020.

- Set the goal that renewable resources will supply 20% of the Federal Government's electricity by 2020, either from on-site generation, renewable power purchases or renewable energy certificates. The previous goal, set by the Energy Policy Act of 2005, was 7.5%.

- Announced that the Department of Defense (DoD) will install 3 gigawatts of renewable power on its bases in the years ahead, generating the equivalent each year of the energy from 3 million tons of coal.

- Set the goal, in his June 2013 climate speech, to "double again our energy from wind and sun…to power more than 6 million homes by 2020."

- Supported DoD's statutory goal to obtain 25% of its energy from renewable resources by 2025, up from 9.6% in 2012.

Unleashing Private Sector Finance and Investment: The key question in this chapter is how in a time of government austerity can the Administration stimulate greater financing and investment in renewable energy resources? How can we make sufficient progress in the next 2-3 years to discourage if not prevent a regression to the carbon economy after the President leaves office.

In late 2011, international investment in the clean tech sector surpassed $1 trillion dollars[3] making clear the industry has taken root in the global economy. Yet a tremendous amount of investment capital remains on the sidelines waiting for a stable market for clean energy technologies and the public policies that will help create it. The amount of capital that will be required in 2020 for wind and solar installation consistent with DOE's goals will approach $70 billion, according to NREL, or roughly twice the level of investment in 2012. However, the current patchwork of state energy policies, financing programs, regulatory structures and on-again/off-gain federal tax expenditures combine to create a complex environment for investors.

There are a number of ways the Federal Government can stimulate investment in renewable energy. Among them are 1) working with the private sector to improve access to low-cost capital; 2) developing effective mechanisms to rapidly bring renewable energy technologies to scale; 3) investing in innovation; 4) demonstrating the use of these technologies at large enough scale to generate investor confidence in (or "de-risk") renewable projects; 5) providing technical assistance and encouragement to state regulators to redesign their regulatory regimes to integrate emerging resources and

technologies; and 6) creating large and stable market demand through government procurement. The recommendations in this chapter suggest what the Administration could do to affect these "tools".

Even the bully pulpit can play a role by helping to dispel common misinformation about renewable energy technologies, by solidifying the broad and bipartisan public support that opinion polls consistently show for renewable energy, and by creating a national constituency that will prevent a future rollback of the nation's progress toward clean and sustainable energy.

The Challenging New Realities of Renewable Energy: This is not to say that the transition to renewable energy will be easy. It will be disruptive. The rising popularity of small-scale solar electric generation (aka distributed generation) and the use of intermittent resources such as solar and wind have some electric utilities concerned about a "death spiral" of the traditional utility model. The boom in production of natural gas – the cleanest of the fossil fuels – is displacing coal in power plants and providing new competition for renewable energy technologies. While some leaders in the utility sector regard renewable energy as a threat and are actively resisting the integration of these technologies into the conventional electric system, CNEE has found that other utility leaders are eager to capitalize on the opportunities presented by greater diversity in energy resources and a more resilient architecture for the nation's electric transmission and distribution systems. Despite the tensions inherent in the traditional versus new business models, the ability of utilities to access low-cost capital combined with their control of access to transmission and distribution systems positions them well to partner with new market entrants in distributed power, electric vehicles and storage technologies. Whether distributed generation is owned or controlled by utilities or the end user is a separate issue not addressed in this paper, but its rapid growth is a matter of fact.

A common message that CNEE heard from the energy and utility experts is that our current regulations, infrastructure and market conventions are making it difficult, if not impossible, for the power sector to keep up with the challenges and opportunities being created by the rapid emergence of renewable resources and distributed generation. Reinventing the regulatory infrastructure and the marketplace will require that policy makers, regulators and investors all understand the President's energy objectives and the deep differences between renewable energy, conventional energy and the various renewable energy options.

Clarifying the President's objectives: There is a fundamental inconsistency between the President's "all of the above" energy policy, his efforts to move the nation closer to a clean economy and his climate action goals. Not all energy resources are clean. Nor is a non-discriminating approach to the nation's energy mix a policy in the usual meaning of the term – "a plan or course of action…intended to influence and determine decisions, actions and other matters." As one critic has pointed out, "all of the above" implies that anything goes in the U.S. energy mix; a better policy would be the "best of the above" in regard to economic stability, national security and environmental health.

A lack of clarity in national energy policy is a deterrent to public and private investment in clean energy. Instead, the Administration can help establish the foundation for investor confidence with a clear and consistent vision of what a clean energy economy would be; with a clear and consistent commitment to the energy resources and technologies necessary to get there; and by demonstrating the "new math" that corrects distorted market signals by making energy prices more accurately reflect true energy costs.

Understanding Today's Energy Options: Among policy makers and investors – if not in general public discourse – the Administration can help define the nation's contemporary and emerging energy choices. They require a new vocabulary. For example:

- The definition of "clean" has changed. The coal industry frequently uses the term "clean coal", a brand it adopted for coal-fired power generation that complies with EPA's regulations of criteria pollutants under the Clean Air Act. However, with today's constraints on greenhouse gas emissions, "clean" is a brand that should be reserved for energy resources that not only meet the law's limits on criteria pollutants but also emit little or no greenhouse gases.[4]

- Not all "clean energy" resources are renewable. Some are finite fuels still subject to price and supply volatility and ultimately to the disappearance of accessible and affordable supplies. For instance, natural gas and nuclear power often are categorized as clean because of their relatively low carbon emissions at the point of combustion or reaction. However, both are finite resources. Their market competitiveness is determined not only by variations in demand, but also increasingly on the recognition of externalized costs such as water consumption, methane leaks, impacts on public health and vulnerability to terrorist attack.

- While renewable energy resources generally are regarded as benign and major contributors to a clean energy economy, not all renewable resources are sustainable. Strictly speaking, the criteria for a "sustainable" resource is not only that it is renewable; it must also be free of significant negative impacts during its entire life cycle. The ongoing debate about the net energy and climate impacts of corn production for ethanol is one example.

- Not all renewable resources are the same. Each has different effects on the energy system. That means that not all investments have the same results, either for investors or for utilities and customers. The overriding difference between renewables like wind and solar on one hand and conventional resources on the other is that the vast majority of the cost of developing renewable energy occurs up front, as the actual "fuel" costs are free. This difference affects the financing, as well as the life cycle costs of energy, and needs to be reflected in regulations relating to new renewables development.

Clean Energy's New Math: The nation's transition to clean energy requires more than a new vocabulary; it also requires a new math – a different and more comprehensive way to weigh the benefits and costs of different energy choices. For example, as utilities and their

customers seek least-cost options for providing reliable energy, they must consider the important economic and social benefits that traditionally are uncounted by regulators, policy makers or the marketplace. Those benefits include reduced threats to public health, greater stability in energy prices, lower capital costs, a variety of avoided costs, and so on. Social and environmental benefits aside, the direct impact to utility customers from greater renewable energy deployment will be a stabilization of energy bills and less exposure to volatile short-term fossil fuel supply contracts which are the common driver of rate increases. Full-cost life-cycle accounting is necessary to establish a marketplace where the price of energy reflects its true costs to the economy, society and the environment.

The quantification of the direct and indirect benefits of renewable energy is an emerging science. The Obama Administration has developed and is using a "social cost of carbon" calculator to anticipate the climate impacts of energy policy. In Minnesota, new legislation to advance the use of solar energy requires the state's Department of Commerce to establish a method for calculating "VOS", or the Value of Solar. The VOS tariff concept is an area of significant debate between the renewable industry and utilities, particularly with regard to which internal and external costs should be factored into the value of the resource. The cost of oil and gas at the wellhead, or coal at the mine mouth, is no longer a useful indication of the true costs of these fuels. Regulators talk now about the "well to wheels" costs of fuels for transportation – a calculation that might soon evolve to "wells to weather" as we learn to better internalize the costs of carbon emissions and climate disruption. The new math recalibrates grid parity, corrects the market signals that influence consumer choices, and ensures that public and private energy investments provide the greatest benefit at lowest cost to the American people.

Recognizing the Depth of Disruption: It's widely appreciated that emerging trends such as distributed generation and intermittent power production from resources such as sunlight and wind present challenges to regulators and to the management of the grid. But those challenges are more deeply disruptive than is commonly understood. For example, because wind and solar energy have no fuel costs, their marginal costs are near zero. In the current transmission and distribution system, they will always be the first to be dispatched. This will have a negative impact on the return on investment for coal and gas–fired generation, and on how utilities maintain their reserve generation capacity. A medium term impact on utility profits may be a trend toward mitigating risk in generation fleets and incorporating life cycle costs in generation decisions. These factors will increasingly render fossil-fired generation - the traditional source of utility profits - inherently less price competitive.

The Importance of the National Narrative: Experts involved in the CNEE dialogues on renewable energy financing, 21st century utility business models and natural gas production all emphasized the need to change the national conversation about their sectors. In regard to renewable energy, roundtable participants identified two themes they hope the President will help emphasize to correct current misconceptions and misinformation in public discourse.

First, renewable energy is here. Its significant contribution to the nation's energy mix is not 10 years, or 30 years or 50 years away. It already has begun. Renewable energy companies are not destined to be a boutique industry; renewable resources are not destined to be a small niche in the nation's energy mix. NREL has concluded that currently available renewable energy technologies could provide 80% of America's electric power by mid-century.[5]

Second, the renewable energy market is dynamic and robust – in other words, a good investment opportunity. Long-term contracts for wind energy are being signed by utilities in several states in the range of 3¢/kWh over 20 years. The U.S. Energy Information Agency (EIA) predicts that for power plants entering service in 2018, the levelized cost of wind power will be $86.60 per megawatt hour, compared to $100 to $135 for even the most advanced coal plants. However, the American Wind Energy Association reports that the cost of wind power in power purchase agreements is as low as $30 per megawatt hour, and the costs of dropped an average of 43% in just four years (2008 to 2012. Because wind has historically comprised the bulk of new renewable generation to meet the 30 mandatory and 7 voluntary state Renewable Portfolio Standards (RPS), compliance with these policies is saving consumers a great deal of money.

Consistent with free-market assumptions, the growth of the solar market and increased competition within the sector has reduced cost by 70% over the past 10 years. In fact, solar power is already at cost parity (with the Federal Investment Tax Credit) or below utility cost in a handful of states, even by the standards of conventional cost-benefit considerations. And cost competitiveness is increasing every year through improvements in financing (such as securitization), installation, customer acquisition and soft cost management.

Much of the public understanding of America's renewable energy resources is rooted in misinformation from the industries' competitors, or in information that is outdated. With the objective of building a strong and active political constituency for renewable energy – a constituency that will prevent slip-back after the President leaves office – it's critical that the President and his top officials use their bully pulpits to correct the national narrative about these resources.

The Importance of the President's Convening Power: Another common message that emerged from the CNEE's roundtables was the striking lack of communication between key actors in the energy sector. It is clear that regulators, power generators, transmission and distribution utilities, and critical government agencies operate in stovepipes with insufficient exchanges of views and information. Given this, the President's convening power is an important tool in the transition to clean energy.

In fact, despite the good work of organizations such as the Electric Power Research Institute (EPRI) and the National Association of Regulatory Utility Commissioners (NARUC), participants in the CNEE dialogues said they rarely have the opportunity for the type of open dialogue they experienced at the CNEE roundtables, even with other members of their own sectors.[6] Their appetite for greater dialogue included discussions with federal

agencies – for example, a greater exchange of views, opportunities and concerns between FERC, PUCs and regulated utilities.

Another opportunity for the President to use his convening power lies in the Tennessee Valley Authority (TVA), which is seen by some as the "President's utility." The Administration should appoint Board members that reflect a strong commitment to climate action and renewable energy. TVA has the potential to drive market adoption of renewable energy in the Southeast where many renewable policies have been slow to deploy. Insodoing, TVA can demonstrate how electric utilities nationwide can integrate renewable energy technologies and resources into the grid and pricing structures.[7]

Laying the Groundwork for Legislation: While the President has resolved to act on energy and climate issues with or without Congress, congressional action remains essential to the long-term and lasting changes needed in national policy if we are to succeed in the clean energy transition. Among other things, Congress must align the nation's fiscal policies with the national interest in the transformation of the energy economy. Among the policies in need of reform are inequities in the tax structure and in access to capital markets for fossil fuels versus renewable resources.

It is widely accepted that the current Congress will not act with the urgency or the substance that the clean energy transition requires. Nevertheless, the President should continue championing and building public support for legislation to create more favorable market conditions –i.e., to "level the playing field"—for renewable energy. At a minimum, renewable resources should be afforded the same or comparable advantages in federal policy that traditional fuels receive. CNEE recommends that the Administration explore whether it can create greater parity between energy sectors through administrative steps, some of them suggested in this paper. Meantime, the President can continue advocating for legislation. For example, renewable energy developers should be allowed to use Master Limited Partnerships, the same corporate structure that has attracted hundreds of billions of dollars in investments in fossil fuel development.[8] The President can also support legislation that provides for continuation of and more flexible monetization of the Investment Tax Credit (ITC) and Production Tax Credit (PTC) to spur investment and deployment. In addition, he can begin laying the political groundwork to make clean energy parity part of tax reform.

As he changes the national narrative about renewable energy technologies and their enormous benefits for the health, welfare and future of the American people, we may see voters become more concerned about Congress's lack of action on these issues and more willing to reflect those concerns in future elections.

Recommendations for Presidential Action

Goal 1. Organize for Implementation

The way in which the President delegates implementation to agencies, the visibility of the delegations, and an effective system of accountability all are factors in how much more the Administration will achieve in clean energy and climate policy during the few years before the President leaves office.

Executive Actions:

1. **Imbed clean energy policies**. Use the tools of executive authority that will most influence the priorities of the President's Cabinet and federal agencies and that will be most difficult for future Administrations to undo. Few if any executive authorities can produce policies as permanent as legislation. However, there are advantages to the force and staying power of policies codified through rules and regulations, for example, directives and memoranda are less easily reversed than executive orders.

2. **Root policies in law**. In addition, the President can reduce the chance of challenges to his use of authorities by clearly rooting them in existing federal law and in line with congressional intent. There is an ample body of statutes and congressional language that require the Executive Branch to take actions consistent with a national transition to clean energy.[9]

3. **Appoint energy and climate leaders at high levels.** Elevate the coordination of the President's energy and climate agendas, including his Climate Action Plan, to a senior level position in the White House with full access to the President, full authority to do the job, and no other assignments that compete for his or her time and attention. The status of this position is more than a symbol of the President's commitment to clean energy and climate action. Rank, title and access to the President make a significant difference in how effective a leader can be in Washington D.C., from how seriously Administration officials take his or her direction down to what meetings he or she is allowed to attend. A prominent example and a potential model was the appointment of the Vice President to oversee implementation of the American Recovery and Reinvestment Act and the transparent system the Administration established to track progress.

4. **Link clean energy to high-ranking public values**. Establish a solid foundation of public support for these initiatives by helping to change the national narrative about renewable energy, as recommended earlier. Stress the practicality, affordability and substantial benefits of clean energy at every level of society. Put more visits to exemplary renewable energy installations on the President's schedule, particularly when they can be linked to pressing public concerns such as rising gasoline prices, unrest in oil-producing nations, power interruptions in the U.S., damaged infrastructure from weather-related disasters, etc. Whenever possible, partner in public events and

announcements with Republican governors and present or former members of Congress to demonstrate that renewable energy is not a partisan topic.

5. **Open new dialogues**. Convene meetings and conferences at the White House to create opportunities for dialogue between key stakeholders in the energy sector, including FERC, DOE, the Department of Treasury, Public Utility Commissioners, public utility executives, experts from universities and national laboratories, etc. Participants in the CNEE dialogues stressed that the simple opportunity for frank dialogue would help key agencies and stakeholders better collaborate toward the common objective of implementing the President's energy and climate policy objectives. In addition, these dialogues would help educate stakeholders about the very different characteristics of renewable resources and the disruptive challenges of integrating them into the power system.

6. **Explore collaboration between state and federal finance**. Convene the State Treasurers at the White House for a discussion with the President and Cabinet members on how the federal government can work with states in creating larger markets for renewable energy though standardization of state and federal financing programs.

Goal 2. Open New Investment Opportunities with the Clean Air Act

As noted earlier, EPA's administration of the Clean Air Act, including the regulation of greenhouse gas emissions from new and existing electric power plants, can open the door to new markets, and more intensive market penetration, for energy efficiency and renewable energy technologies. New markets resulting from government regulations offer a degree of stability that can attract private capital.

Build on existing markets. In addition to the early recommendations on the application of EPA's greenhouse gas standards for power plants, it should consider allowing states to participate in existing organized greenhouse gas markets as a compliance pathway, such as the Regional Greenhouse Gas Initiative (RGGI).

Goal 3. Encourage RE Investments Through Mortgage Lending

A 2011 study by researchers at Lawrence Berkeley National Laboratory (LBNL) found that on average, homes equipped with solar photovoltaic panels sold for $17,000 more than homes without solar.[10] The researchers noted that relatively little additional study had been done on the relationship between solar systems and home values, but:

> *A clearer understanding of these effects might influence the decisions of homeowners considering installing PV on their home or selling their home with PV already installed, of home buyers considering purchasing a home with PV already installed, and of new home builders considering installing PV on their production homes.*

In its policy recommendations on energy productivity, CNEE concluded that energy

performance and location efficiency[11] should become significant factors in mortgage underwriting, in real estate transactions and in setting mortgage terms, both in the private sector and in federal mortgage programs. The same is true for solar electric systems and may be true for other forms of building-scale renewable energy such as ground-source heating and cooling. The key is to verify that renewable energy systems raise the value of buildings in which they are installed.

Executive Actions:

As noted in Chapter 1, the Federal Government manages or influences a multi-trillion-dollar mortgage portfolio. It is uniquely positioned to access, analyze, and publish data on the relationship between renewable energy installations and home values. CNEE recommends the same actions listed in Chapter 1 for using these data to encourage the mortgage market to recognize the value of clean energy improvements to buildings. The "action items" include:

1. **Analyze federal data**. Direct DOE, the Department of Housing and Urban Development (HUD) and FHFA to determine whether the Federal Government's mortgage data verify that renewable energy investments increase building values.

2. **Fix residential PACE financing**. Direct DOE to work with FHFA to find administrative solutions to FHFA's concerns about Property Assessed Clean Energy (PACE) financing for renewable energy improvements to residential properties.

3. **Consider creating a loan loss reserve**. Direct DOE to review loan guarantee authorities within the Administration to determine whether there is an opportunity to create a private residential renewable energy retrofit loan guarantee program with loan loss reserve to insure against mortgage defaults.

4. **Allow REITs to invest.** Ask the IRS to clarify that publicly traded Real Estate Investment Trusts (REITs) can invest in energy efficiency and renewable energy projects.[12]

5. **Qualify renewable energy projects as public welfare investments.** Encourage the Comptroller of the Currency[13] to clarify that renewable energy projects qualify as public welfare investments (PWI) by financial entities and fall under the Community Reinvestment Act (CRA).

Goal 4. Remove Administrative Roadblocks to Financing for Federal Renewable Energy Projects

There are several ways federal agencies can finance on-site renewable energy projects. Among them are Energy Saving Performance Contracts (ESPCs), Utility Electric Service Contracts (UESCs) and Power Purchase Agreements (PPAs). In general, DOE's Federal

Energy Management Program (FEMP) and NREL help agencies understand and apply these tools.

However, several of the stakeholders CNEE consulted cite roadblocks in the administrative processes for executing ESPCs. Some delays have been excessive, resulting in unnecessary greenhouse gas emissions. While the use of ESPCs reportedly is brisk in many federal agencies, bottlenecks including shortages of trained staff are slowing down processing of the contracts. In addition, OMB, the Congressional Budget Office (CBO) and congressional budget committees score ESPCs as a cost without regard to the energy performance of a renewable energy system beyond the traditional 10-year assessment window.[14]

Today, there is a damaging gray area of administrative policy in which it is unclear whether or not renewable power purchase agreements can be used within the ESPC and similar models. Many renewable energy purchases have higher upfront costs that fall within the 10-year window, but nearly zero costs for O&M and no fuel costs. Some agencies are proceeding with them while others are not due to lack of clarity.

DOE's Electricity Advisory Committee has highlighted that Section 1222 allows the Department through two PMA's, including the Western Area Power Administration (WAPA) and the Southwest Power Administration (SWPA), to accept $100 million in third party funding for transmission projects. The Committee argued that the goal of this legislation was to foster partnerships with the private sector and that the agency should consider more projects to jumpstart transmission development. Former Energy Secretary Steven Chu made this authority a priority in his memo to the PMAs in 2012, when he called on WAPA and SWPA to more actively exercise their authority in this policy area. CNEE has heard from stakeholders that there is private interest in developing projects to bring renewables to market, though it would require WAPA and SWPA to issue RFPs for new transmission.

In addition, DOE could exercise its authority to enter into participation agreements for qualified transmission project proposals under the Energy Policy Act of 2005 in an effort to bring more renewable power to market. Under Section 1222(a) of the Act, DOE working through either the WAPA or SWPA, "may design, develop, construct, operate, maintain, or own, or participate with other entities in designing . . . an electric power transmission facility. . . needed to upgrade existing transmission facilities."

Executive Actions:

1. **Fund renewable energy projects with third-party contracts**. Encourage executive branch agencies to use renewable technologies in ESPCs, UESCs, and similar instruments. Direct OMB to provide agencies with permission to use renewable power purchase agreements beyond the current 10-year ceiling.[15]

2. **Get OMB on track**. In regard to ESPCs, direct OMB to:

    a) Adhere to its own policy to complete its review of rules within 90 days to ensure that the Administration complies with legal deadlines for finalizing regulations related to renewable energy investments by the Federal Government.

    b) Move proposed rulemakings on renewable energy to the front of the clearance queue to prevent lost opportunities for greenhouse gas emission reductions.

    c) Propose and work with the CBO and congressional budget committees to change the scoring of ESPCs to include consideration of guaranteed savings.[16]

3. **Centralize contract processing**. To address the problem of insufficient trained staff to process ESPCs within agencies, direct the Office of Personnel Management (OPM) to reassign professional agency contracting officers to DOE's Golden Field Office in sufficient numbers to create an efficient and highly skilled central ESPC processing center for federal agencies.

4. **Beef up leadership and staffing.** To provide high-level attention to the financing of renewable energy technologies in the public and private sectors, assign the Federal Environmental Executive (FEE) to serve as the Administration's clean energy coordinator with secretariat support from DOE. Provide him or her with sufficient permanent staff and authority to coordinate the Federal Government's energy efficiency and renewable energy grant, financing and technical assistance programs. Direct the FEE to report any significant and recurring administrative roadblocks or failures to the President and allow the FEE greater authority to carry out executive actions to achieve aims of the Climate Action Plan.

5. **Increase the ESPC goal for agencies**. Amend the President's December 2011 memorandum on ESPCs to:

    a) Clarify that power purchase agreements for solar and other applicable renewable energy technologies, both on-site as well as off site, may be used within the ESPC framework for a period not to exceed 25 years. Similar structures, such as UESCs, should receive similar direction.

    b) Set ESPC targets that more fully achieve the economic potential of renewable energy in government energy savings. At a minimum, adopt the recommendation that federal ESPC targets for energy efficiency and renewable energy be set at $1 billion annually for 5 years. [17]

    c) Clarify that agencies should use ESPCs to finance renewable energy projects in public housing, military housing and federal facilities nationwide.

    d) Direct DOE, DoD and the General Services Administration (GSA) to expand the use of ESPCs to finance under-utilized but proven technologies such as micro-grids;

distributed renewable energy projects that reduce line losses; combined heat and power (CHP) systems; waste-to-energy projects; water and wastewater treatment plants; energy from biomass; high-efficiency, ultra-low emission and zero-emission fleet vehicles and charging infrastructure, along with other clean energy projects that lead to operational and maintenance savings as well as faster progress on achieving net-zero energy and carbon buildings.[18]

6. **Push to eliminate the power purchase ceiling for renewable energy.** Work with Congress to eliminate the outdated, counterproductive 10-year power purchase contracting ceiling for renewable energy sources. DoD is exempt from this constraint and is demonstrating with its gigawatts of renewable energy goals how renewable energy resources are cost-competitive and help make our nation safer.

7. **Work with PMAs on new transmission**. Direct DOE to reassert Section 1222 authority by working with WAPA and SWPA to evaluate new transmission build out for renewable electricity within these two PMA regions and for export to other PMA regions.

Goal 5. Make Better Use of Federal Financial Incentives While Encouraging Less Reliance on Them

Federal policies including beneficial provisions of the tax code and government grants and loans have been an important part of national energy policy for at least a century. Some of the taxpayer subsidies for fossil energy that were created a century ago are still in existence today. For example, a recent inventory of government loan and loan guarantee programs that could support clean energy projects shows that the capital in these programs is 100 times larger than energy-related grants, on the order of $50 billion each year.[19] But these programs are scattered across multiple agencies with no mechanism for coordination that could save both opportunity and operating costs.

Federal assistance is particularly important – and most justified – for emerging energy technologies that are in the national interest, a category in which most renewable energy technologies clearly belong. However, public subsidies have shortcomings, among them their vulnerability to politics and to less-than-perfect knowledge in Congress about what is required to bring new technologies to market.

Notable examples in regard to renewable energy are the Investment Tax Credit (ITC), the Production Tax Credit (PTC) and the residential renewable energy tax credit. Since Congress created it in the Energy Policy Act of 1992, the PTC usually has been authorized for only a year or two at a time. Congress has extended the credit five times and has allowed it to expire four times. After each expiration, the number of new wind energy installations dropped between 73% and 93%, with associated job losses.[20] LBNL reported as far back as 2007 that…

…the frequent expiration/extension cycle that we have seen since 1999 has had several

negative consequences for the growth of the wind sector. Due to the series of 1- to 2-year PTC extensions, growing demand for wind power has been compressed into tight and frenzied windows of development. This has led to boom-and-bust cycles in renewable energy development, under-investment in wind turbine manufacturing capacity in the U.S., and variability in equipment and supply costs, making the PTC less effective in stimulating low-cost wind development than might be the case if a longer-term and more-stable policy were established.[21]

LBNL documented that the on-again/off-again application of the PTC slowed U.S. wind energy development, gave foreign competitors an advantage, raised the cost of wind turbines, made rational transmission planning difficult and reduced private investments in R&D.

In negotiations with Congress over tax reform, the White House should advocate tax policies that provide more stable incentives for clean energy development, while making sure that renewable energy industries are aware and take full advantage of other forms of federal financial assistance.

Executive Actions:

1. **Champion the eligibility of renewable energy projects for Master Limited Partnerships.** In tax reform negotiations and in his legislative agenda, the President should support the right of renewable energy developers to use Master Limited Partnerships (MLP), the same corporate structure that has attracted hundreds of billions of dollars in investments in fossil fuel development. It is important that support for MLPs not be seen or used as a substitute for the ITC or PTC.

2. **Create an agenda for fiscal policy reform**. Direct the White House Council of Economic Advisers to analyze current federal financial incentives and programs for renewable energy technologies and to recommend how fiscal policies can be improved to a) more cost-effectively stimulate private markets; b) leverage private investments in renewable energy without additional costs to taxpayers; and c) become monetized and "bankable."

3. **Improve the coordination of federal financial programs**. Direct OMB and the FEE to recommend how federal grant and loan programs can be better coordinated to capitalize renewable energy technologies and projects and to save administrative time and costs in getting this capital to market.

4. **"Market" the tax code**. Direct the Department of Treasury to create, distribute and periodically update a guide to all provisions of the federal tax code that can apply to renewable energy development and investment. Improve the implementation of ITC for distributed solar industry by catalyzing a more supportive role for Treasury and the IRS. In addition, direct DOE to annually update and distribute its new directory of federal financial assistance programs referenced above.

Goal 6. Re-allocate Remaining Qualified Energy Conservation Bonds

Qualified Energy Conservation Bonds (QECBs) were originally created in the 2008 Energy Improvement Extension Act at a funding allocation of $800 million. They were subsequently expanded significantly to $3.2 billion by the American Recovery and Reinvestment Act in 2009.

QECBs may be used for a wide range of qualifying projects including energy efficiency publicly owned buildings, research programs for biofuels and batteries, mass commuting infrastructure and demonstration projects for reducing peak electricity and carbon emissions mitigation.[22] In practice, however, the bonds are typically used to finance renewable energy projects and capital improvements on public buildings.

The U.S. Treasury allocated QECBs to states and tribes in 2009 by formulaic distribution according to population. From there, most sub-allocations were administered by State Energy Offices and granted to municipalities with populations of at least 100,000. The 2010 Hiring Incentives to Restore Employment Act of 2010 (HIRE) expanded the utility of QECBs beyond a tax credit as originally created to also include the option for a direct subsidy. This subsidy in lieu of tax credit option rendered QECBs one of the least expensive forms of public financing for efficiency and renewable projects because the U.S. Treasury could directly subsidize borrowing costs for bond issuers.

TABLE 1A: STATE AND LOCAL ISSUANCES OF QECBS (JUNE 2013)

State	Amount	Known Issued	Remaining
Alabama	$48,364,000	$5,750,000	$42,614,000
Alaska	$7,120,000	$0	$7,120,000
American Samoa	$673,000	$0	$673,000
Arizona	$67,436,000	$16,023,804	$51,412,196
Arkansas	$29,623,000	$0	$29,623,000
California	$381,329,000	$284,598,250	$96,730,750
Colorado	$51,244,000	$43,190,321	$8,053,679
Connecticut	$36,323,000	$10,700,000	$25,623,000
Delaware	$9,058,000	$0	$9,058,000
District of Columbia	$6,140,000	$0	$6,140,000
Florida	$190,146,000	$0	$190,146,000
Georgia	$100,484,000	$5,372,000	$95,112,000
Guam	$1,826,000	$0	$1,826,000
Hawaii	$13,364,000	$0	$13,364,000
Idaho	$15,809,000	$0	$15,809,000
Illinois	$133,846,000	$49,735,000	$84,111,000
Indiana	$66,155,000	$19,500,000	$46,655,000
Iowa	$31,150,000	$0	$31,150,000
Kansas	$29,070,000	$29,065,000	$5,000
Kentucky	$44,291,000	$41,297,000	$2,994,000
Louisiana	$45,759,000	$30,318,244	$15,440,756
Maine	$13,657,000	$0	$13,657,000
Maryland	$58,445,000	$6,500,000	$51,945,000
Massachusetts	$67,413,000	$26,232,237	$41,180,763
Michigan	$103,780,000	$0	$103,780,000
Minnesota	$54,159,000	$16,025,000	$38,134,000
Mississippi	$30,486,000	$0	$30,486,000
Missouri	$61,329,000	$11,435,000	$49,894,000
Montana	$10,037,000	$8,334,000	$1,703,000
Nebraska	$18,502,000	$0	$18,502,000
Nevada	$26,975,000	$8,135,950	$18,839,050
New Hampshire	$13,651,000	$1,129,348	$12,521,652
New Jersey	$90,078,000	$0	$90,078,000
New Mexico	$20,587,000	$0	$20,587,000
New York	$202,200,000	$5,169,870	$197,030,130
North Carolina	$95,677,000	$0	$95,677,000
North Dakota	$6,655,000	$3,780,000	$2,875,000
Northern Marianas	$899,000	$0	$899,000
Ohio	$119,160,000	$35,749,605	$83,410,395
Oklahoma	$37,787,000	$0	$37,787,000
Oregon	$39,320,000	$0	$39,320,000
Pennsylvania	$129,144,000	$35,135,000	$94,009,000
Puerto Rico	$41,021,000	$0	$41,021,000
Rhode Island	$10,901,000	$0	$10,901,000
South Carolina	$46,475,000	$0	$46,475,000
South Dakota	$8,343,000	$6,575,000	$1,768,000
Tennessee	$64,476,000	$6,440,000	$58,036,000
Texas	$252,378,000	$0	$252,378,000
US Virgin Islands	$1,140,000	$0	$1,140,000
Utah	$28,389,000	$6,918,774	$21,470,226
Vermont	$6,445,000	$0	$6,445,000
Virginia	$80,600,000	$1,240,000	$79,360,000
Washington	$67,944,000	$36,465,000	$31,479,000
West Virginia	$18,824,000	$0	$18,824,000
Wisconsin	$58,387,000	$24,302,883	$34,084,117
Wyoming	$5,526,000	$0	$5,526,000
Total	**$3,200,000,000**	**$775,117,286**	**$2,424,882,714**

1. The information attached hereto has been gathered from various sources, including IRS Notice 2009-29, Municipal Securities Rulemaking Board, Department of Energy (DOE), Wells Fargo, Muni OS, Bloomberg, state and local issuer websites, state and local government contacts. The amount issued figure may be rounded.

2. Chart compiled by Elizabeth Bellis, Director, QECB Program, and Sarah Sieting Alim, EPC, and was funded by the Energy Foundation, Surdna, and others. Chart includes all known QECB issuances through June, 2013, but may not include all QECB issuances.

For more information, please contact Elizabeth Bellis at ebellis@energyprograms.org or Sarah Sieting Alim at ssieting@energyprograms.org or 202-333-5915

The challenge to deployment of QECBs appears to be administrative. As of August 2013, only $813 million of the $3.2 billion authorized had been issued, leaving a remaining QECB allocation of more than $2 billion. The previous table from an Energy Programs Consortium report shows state issuances as of June 2013.[23]

Part of the reason for uneven uptake of QECBs may be that they have no expiration date and therefore no inherent use-or-lose incentive for states and municipalities. Economies of scale have also been difficult to achieve in some states due to the number of municipalities with more than 100,000 people, which results in small allocations to each local government.

The solution to leveraging QECBs as a finance mechanism for renewable energy lies in creating scale by reallocating the remaining $2 billion. There may be two approaches to this reallocation. First, ARRA specified that local governments may return unused allocations to their states, presumably for use at the state level or redistribution to other localities.[24] This re-pooling of allocations at the state level requires states to undergo a waiver process. States have employed three approaches by which large local governments return their allocations to the state: Affirmative waivers, Construction waivers and Letters of Intent.[25] Second, there may be a mechanism by which states can combine their unused portions into larger, regional funds, though this interstate trading concept will require more research to determine if congressional action is needed.

One clear trend in the QECB story is that deployment has suffered from a lack of clarity in the allocation and local government waiver process. A 2009 IRS guidance clarified that "large local governments" are those with 100,000 residents or more among other questions, yet the lack of clarity on the reallocation/waiver process was interpreted by many states to mean that it takes "an act of the full relevant governmental body to affect a waiver".

In 2012 the IRS issued another guidance reiterating that states have wide and broad discretion in the waiver and re-allocation process. The guidance also outlined a method for calculating the 20% minimum energy efficiency requirement, defined "capital expenditure" and "green community program" in addition to making clear that renewable energy projects that are eligible, like Clean Renewable Energy Bonds (CREBs), also qualify for QECBs.

Neither of these IRS notices appear to have gone far enough, however, to eliminate confusion on how large local governments can waive their allocations back to the state for pooling and reallocation.[26]

A uniform and accepted waiver process should be developed for the remaining states as NASEO reports that of the 20 remaining states 8 have an unknown waiver process, while 12 states have no waiver process in place. While the IRS has suggested that the QECB program was meant to give wide and broad discretion to states, there may be a need for more specificity on the waiver process in order to encourage the remaining states to take action.

In the past, QECBs have been substantially impacted by federal budget sequestrations. This fluctuation in subsidy has been difficult for bond issuers to manage. OMB has determined that payments to issuers from the budget accounts to QECB holders are subject to a reduction of as much as 8.7%.[27]

In summary, QECBs represent a $2 billion existing opportunity to advance renewable energy in nearly every state (Kansas is the only state that has used nearly all QECB allocations). There are a number of key steps the Administration can take to unlock this financing.

Executive Actions:

1. **Clear up ambiguities**. Direct the IRS to issue a third notice that clears up remaining questions about the QECBs, especially the IRS's preferred large local government waiver process (affirmative, construction, letter of intent, etc.).

2. **Organize states for reallocation**. Direct the Secretary of Energy to convene State Energy Office directors on this issue and encourage them to put a waiver, reallocation and project assignment plan in place.

3. **Provide technical help in the reallocation process**. In exchange for these plans, direct DOE to deploy technical assistance to states and municipalities for the waiver, reallocation, and project identification process.

4. **Explore QECB exemption from sequestration**. Direct the Secretary of Energy to investigate whether QECBs can be rendered exempt from future budget sequestration in order to bring greater certainty to this financing mechanism.

5. **Determine whether QECB's can be reallocated without Congress**. Direct the Secretary of Energy to investigate whether QECBs can be reallocated among states without congressional action. Work with the National Association of State Energy Officials (NASEO) on a uniform program structure that could qualify for a pooling of QECB funds for states if this is determined to be allowable.

Chapter 4: Robust and Responsible Natural Gas Production

Key Themes and Recommendations

The roundtable meeting CNEE convened in Washington, D.C., on natural gas production was attended by officers and senior staff from two natural gas operators, four industry organizations (national and state), two research institutions, three public interest and environmental NGOs, and one law firm. The key recommendations that resulted from the meeting were:

- Strengthen federal-state-stakeholder collaboration to address the issues involved in natural gas production
- Collaborate with state regulators, the gas industry and stakeholders to develop a national methane leak reduction plan
- Work with the gas industry on the steps necessary to sustain its "social license to operate" – i.e., public support for gas as America's transition fuel to a clean energy economy
- Demonstrate best available production practices on public lands
- Help states improve pipeline inspections
- Create a pubic/private research institute to develop more effective methods for controlling methane leaks and other technical advances in gas production, distribution and use
- Create a presidential George P. Mitchell Award for environmental excellence in natural gas production

The National Conversation

CNEE's dialogue with natural gas stakeholders identified several background issues that

provide context for the specific recommendations in this paper. Those issues include the quality of the national conversation about natural gas, the benefits of the resource, why industry values reasonable regulation, who should regulate, how communication can increase confidence in the industry and where natural gas fits in the President's national energy policy.

A key recommendation that emerged from the CNEE stakeholder consultation on natural gas production – perhaps THE key recommendation – had less to do with public policy and more to do with public discourse. It was the need to build greater trust and a sense of joint mission among government, the natural gas industry, the environmental community, other public-interest stakeholders, and the general public.

In one sense, the public conversation is trying to catch up with the technology. In just a few years, the United States has been transformed from a prospective natural gas importer to the world's biggest natural gas producer, with plans to export liquefied natural gas (LNG) in coming years.[1]

Leaders in the natural gas industry have the principal responsibility for building trust in the rapidly increasing role of natural gas production. The industry's willingness to be transparent in its practices, frank about its challenges and proactive in addressing the environmental and social impacts of the natural gas system are key factors.

However, President Obama also has an important role to play in a constructive and informed national conversation about the nation's energy mix and the contribution of natural gas. He can continue underscoring the many benefits of this resource to the American people (see the next section). He can make clear to the industry and the public what "responsible" production means. He can convene stakeholders for greater dialogue about resolving environmental and social impact issues.

CNEE's dialogue involved leaders in industry, environmental organizations and the public interest sector. They generally agree with some important fundamentals, including that a) natural gas can and should make a critical contribution to the nation's energy security and economy;[2] b) responsible natural gas production is a key element in the President's national energy policy; c) the rapid evolution of new extraction technology and industry practices requires reasonable regulatory oversight; and d) the need for "responsible" practices applies to government as well as to industry.

In a recent report on the potential of shale gas development, the Center for Strategic and International Studies (CSIS) summarized the situation this way:

> *Certain facts are uncontested. The resource base is enormous. Current government estimates put the U.S. recoverable shale gas resource base at close to 2,000 trillion cubic feet (representing nearly 100 years of supply at current consumption levels) while private and industry assessments run substantially higher…As a consequence of the location, scale and operational characteristics associated with shale gas development, public scrutiny has also increased, especially in relation to ground and*

surface water protection, air emissions, seismic activity, chemical disclosure and community impacts. As a result, government, industry and local communities are increasingly focused on finding ways to maximize the benefits of these abundant resources while effectively managing the associated risks.[3]

The Benefits of Natural Gas

The CSIS report points out several of the benefits of natural gas production to date:

> *The combination of reduced electricity demand and increased use of natural gas in the power sector has led to lower greenhouse gas emissions. New production opportunities (26 basins in 28 states) have contributed to tens of billions of dollars in new investment, economic development, and job creation, while lower relative natural gas prices have aided in the economic recovery both by lowering the basic cost of energy inputs for existing gas consumers and by attracting new investment in petrochemical and other gas-related industries in the United States.*

More specifically, the benefits include these:

- **Jobs and consumer savings.** The Energy Information Administration (EIA) reports that jobs in the gas sector rose 40% from 2007 through 2012 compared to 1% in the private sector overall. So long as the current lower price of natural gas for electric generation is sustained, it means savings for consumers, jobs, and greater international competitiveness for U.S. industries.

- **Less water conservation that other fossil fuels**. Research shows that over its life cycle, natural gas consumes less water than coal-fired and nuclear power generation, an important factor at a time when water supplies are a growing concern in the U.S.[4]

- **Possible collaboration between natural gas and renewable energy industries**. Although natural gas and renewable energy compete in the marketplace, they can also help one another. As the Center for Climate and Energy Solutions notes, natural gas plants can quickly scale their electricity production down to serve as effective hedge against the intermittency of renewables, while the fixed fuel price of renewables can act as a hedge against natural gas price volatility.[5]

- **Improved public health**. Insofar as it replaces energy from coal and petroleum, natural gas reduces air emissions that endanger public health.

- **Fewer greenhouse gas emissions**. So long as the industry adequately addresses methane leaks,[6] natural gas will result in far fewer greenhouse gas emissions per unit of energy than coal and petroleum. The substitution of natural gas for coal in electric generation has been a contributing factor in the reduction of U.S. greenhouse gas to their lowest levels in 20 years.[7] A study by the Massachusetts Institute of Technology's Energy Initiative concludes that while natural gas will "need to make way for other low-

or zero-carbon sources of energy in the future," domestic supplies are "likely to grow considerably and contribute to significant reductions in greenhouse gas emissions for decades to come."

Why Industry Values Reasonable Regulation

Several leaders in the natural gas industry told CNEE they generally support effective government regulations that enable production as well as continuous improvement in the sector's environmental and social performance. A recent report by the National Petroleum Council (NPC)[8] makes this point:

Achieving the economic, environmental and energy security benefits of North American natural gas and oil supplies requires responsible approaches to resource production and delivery…(I)n all locales and conditions, the critical path to sustained and expanded resource development in North America includes effective regulation and a commitment of industry and regulators to continuous improvement in practices to eliminate or minimize environmental risk.

Reasonable and effective regulation is important to natural gas producers because it creates business planning certainty; screens out the "bad actors"; reduces the chances that companies within the energy sector will obtain unfair advantage by engaging in irresponsible practices; and strengthens the industry's "social license to operate" – i.e., public trust that energy is being produced in ways that are consistent with public health, welfare and quality of life.

CNEE found that the positions of the leaders involved in its dialogue can be summarized with three points. First, excessive, ineffective, or unnecessary regulations constrain gas production, increase development costs, impede adoption of environmental improvements, and delay or reduce the benefits cited above. Second, regulation cannot be for regulation's sake; rather, regulations must be well matched to the legitimate risks associated with the gas value chain. Third, the challenge for government and the gas industry is to find the "sweet spot" between reasonable regulations and the responsible production and use of the nation's natural gas resources.

Who Should Regulate?

Participants in the CNEE dialogue discussed the role of federal versus state regulation of particular industry practices. Several issues surfaced.

First, industry representatives feel strongly that state regulation generally is more effective than federal regulation due to the unique geology, hydrogeology, topography and resources in different areas of the country, and due to the ability of states to respond more quickly than federal agencies to changes in technologies and conditions.[9] The diversity of state approaches also provides opportunities for learning and innovation regarding preferred production practices, substantive rules, and multi-stakeholder processes.[10]

Second, the industry's ability to control its environmental and social impacts is complicated by cross-boundary issues – i.e., the fact that air quality and water disposal issues associated with natural gas development can cross state lines.[11]

Third, while states play a leading role in regulating natural gas production, the Federal Government has very significant responsibilities. Federal agencies can help deal with cross-boundary issues. They have the authority to regulate oil and gas productions on federal lands and have exclusive authority on Indian Lands. The U.S. Environmental Protection Agency (EPA) has important, ongoing responsibilities associated with oil and gas production, particularly regarding air and water pollution.[12] The Federal Energy Regulatory Commission (FERC) has lead responsibility for the siting of interstate natural gas pipelines. The Department of Energy (DOE) oversees imports and exports of LNG and supports research and development of advanced oil and gas technologies. In fact, public-interest leaders told CNEE that the Administration has a number of executive authorities it is not using but could, in the interest of responsible gas production.

The Federal Government has an important role, too, in strengthening the foundation for smart state and local regulation of oil and gas development. President Obama's Climate Action Plan as well his Executive Order 13605, *Supporting Safe and Responsible Development of Unconventional Natural Gas Resources* [13], recognize this and provide a framework for ongoing executive actions in this area.

These responsibilities at the state and federal levels create a complex, dynamic and multi-layered legal and regulatory framework regarding natural gas production. That can create what one CNEE discussant called "dynamic tension" between the two levels of government. It is important that state and federal regulators coordinate to achieve the most effective, timely and transparent methods for environmental protection. But where states and the Federal Government have overlapping responsibilities, industry participants in the CNEE dialogue felt that in most cases, regulation is best carried out by states because of the advantages cited above. For that reason, representatives of industry told CNEE, federal agencies should consider whether existing state efforts already are doing an adequate job before promulgating new federal rules.

Increasing Confidence Through Communication

All stakeholders can improve the quality of the public dialogue about natural gas production by engaging more thoughtfully and frankly in the conversation. The industry can build public trust by acknowledging and addressing global, national and community concerns such as climate change and the challenges involved in responsible gas production; policy makers and public-interest groups can engage in fact-based, neutral communication that demonstrates they understand the industry and its role in ensuring the nation's energy and economic vitality. The public, and public policy, are best served by frank and honest discourse that leads to rational and thoughtful decision-making rather than emotional and polarized debate. Keys to thoughtful discourse include the following:

Getting the words right: The current conversation about natural gas development is complicated by inaccuracies. Many industry-related terms are misused and create confusion. For example, the term "hydraulic fracturing" is regularly misconstrued to include every aspect related to resource development, rather than a specific step in the extraction process. To identify and address people's real issues, it's far more useful for them to focus their concerns about gas production than to condemn the entire production process.

Also, although "oil and gas" are virtually conjoined industries, the two fuels have very different carbon profiles that must be recognized to make sound public policy on issues such as global climate change.

Another important distinction regards methane emissions in the oil and gas value chain. While most discussion is about "fugitive" emissions – a term whose negative connotation the industry does not like – intentional emissions (i.e., venting) also are a source of methane emissions.

Some of the issues associated with natural gas production arise from misunderstandings, some are the result of inadequate data, some are highly emotional, and some are legitimate. All of them must be addressed to build public confidence that natural gas is being produced and transported responsibly.

Defining "responsible production": As noted earlier, President Obama and members of his Administration can help the industry, state regulators and the public better understand what "responsible production" entails. There can be no reasonable argument against responsible production, but stakeholders may define "responsible" differently depending on their sensitivity to development timeframes, the government's role, consumer costs, community impacts and environmental concerns. What some consider responsible regulation, others may consider unnecessary constraints on the production of a critical national resource. The President can dispel confusion about his criteria for responsible production.

Highlighting progress as well as problems: Several industry leaders in the CNEE dialogue said that significant progress is being made in regard to disclosure of the chemicals used in fracturing fluids. While this remains an issue (during the 2013 legislative session, at least 16 bills were introduced on the subject), industry leaders say there is a clear trend today toward more disclosure.

In 2011, a subcommittee of the Secretary of Energy's Advisory Board (SEAB) issued a report that concluded, "There is no economic or technical reason to prevent public disclosure of all chemicals in fracturing fluids, with an exception for genuinely proprietary information." Today, a growing number of companies have voluntarily released information on the chemicals they use in their hydraulic fracturing operations. Many of these companies post their information on the non-governmental FracFocus website.[14]

States are engaged on the issue. Several require disclosure of chemicals used in hydraulic fracturing but allow operators to withhold information on chemicals judged to be trade secrets. Legislation on hydraulic fracturing in gas production was introduced in 50 states during the 2013 sessions, including 16 bills dealing specifically with the disclosures of fracturing agents.[15] California's new law on hydraulic fracturing includes a disclosure requirement[16]. Illinois's recently enacted law requires operators to "submit both redacted and un-redacted lists [of chemicals] to the Department of Natural Resources, regardless of any claim of trade secrets." [17]

Meanwhile, the American Gas Association has issued a position statement on *Responsible Natural Gas Resource Development*, which says in part that disclosure is "vital to securing broad-based support for the continued development of natural gas resources". [18]

Leaders in the gas industry expressed concern that the public's image of hydraulic fracturing does not reflect the improvements made in chemical disclosure. Industry participants believe that disclosure has been addressed in a significant way by state regulations. In fact, most states with oil and gas extraction have various disclosure requirements in place either through legislation or regulations. Environmental and public interest organizations, meanwhile, remain active in encouraging more complete disclosure requirements.[19]
The President can help draw attention to these positive developments while acknowledging the important role that regulators and public-interest organizations play in continued oversight, and while the Administration works with states and the gas industry on continuing improvements in transparency.

Industry's role in the conversation. For its part in the conversation, production companies and the industry as a whole should be frank in acknowledging problems where problems exist and in being responsive to legitimate public concerns. As one participant in the CNEE process suggested, the message from the gas industry should be: "I know you are worried. Here are the things to be concerned about. Here are the things we are doing to address those concerns, and here is the information that will enable you to see how well we are doing."

Another current concern of environmental leaders is methane emissions in the natural gas value chain – i.e., in production, storage and the pipeline system. Industry leaders told CNEE that reducing these emissions is a shared priority for the oil and gas sector and that oil and gas companies place high value on continuous improvement in emission reductions as a critical component of operational efficiency.

Evidence seems to bear this out. Estimates of methane leakage until recently have relied on a limited number of direct measurements, many of which were collected in a 1990s study by EPA and the Gas Research Institute (GRI). More recent estimates have varied significantly, a reflection primarily of different assumptions, research designs, and methods in different studies. In September 2013, the Proceedings of the National Academies of Science (PNAS) published a peer-reviewed study by the Environmental Defense Fund (EDF) and the University of Texas at Austin (UTA), based on direct field measurements

collected in 2012-13 at 150 wells and other production facilities across the country. The EDF-UTA study found, based on direct measurements that natural gas sites release 0.42 percent of methane produced per year. This is in line with EPA's current emission Inventory estimate for the production segment of the supply chain. The EPA Inventory estimated emissions from the value chain from wellhead to customer equate to 1.5% of produced gas annually.[20]

EPA estimates that methane emissions from natural gas systems decreased from 1990 to 2011 due in part to voluntary pollution control measures by the industry. UT results were heavily influenced by the widespread adoption of "reduced emissions" completion technology at the well sites sampled, some of which is attributable to industry anticipation of federal regulatory requirements to capture or flare gas that became effective in October 2012, during the time in which UT was in the field taking measurements. The management of methane emissions must continue to be a high priority for industry and regulators, particularly with the anticipated growth in gas production.
Industry leaders tell CNEE there are numerous nationwide studies underway that will help focus emission reduction efforts where they are most needed, using the best available methods. In addition, EPA's recent adoption of a VOC rule is a key step in reducing oil and natural gas emissions while also providing collateral cuts in methane emissions.

Tell how we'll get there from here: The national dialogue can be improved by greater frankness from government officials on the challenges and directions of current energy policy (see the next section). The President set an excellent example of communicating values, goals and specific actions during his climate-action speech in June 2013.[21]

Part of the Administration's message should be to acknowledge that there is no energy resource without some measure of environmental, energy and economic costs over its life cycle. Various fuels have different advantages based on their emissions profiles, production methods, the size and accessibility of supplies, location of the resources, transportability and social factors traditionally externalized in determining costs and benefits. The key to transparent and responsible energy policy is to recognize and quantify those factors for an informed evaluation of our energy choices.

Finally, the President can contribute to a more informed public dialogue about energy policy and his vision of a clean energy economy by addressing how we'll get there from here. What is the roadmap for the energy transition? What should the relative roles be of fossil energy, renewable energy and energy efficiency? As CSIS noted in its aforementioned report:

> *Perhaps the most important goal for the executive branch is to set an energy vision for the country that allows stakeholders to gauge how the government views various fuel sources and technologies and the role they play in reaching that long-term vision.*

The Role of National Energy Policy

Energy policy makers must grapple with an array of difficult domestic and international issues, among them job creation, a robust economy and national security. CNEE considers the most pressing of these to be global climate disruption and its antidote, the development of a clean energy economy. Climate change is an umbrella issue that casts its shadow on many other concerns that are important to the American people, ranging from the personal risks of extreme weather events to national security. Whether policy makers regard climate change as a virtual certainty or as a risk to be managed, the most important challenge they face today is how to close the gap between what climate scientists say is necessary and what political leaders believe is possible.

The gap is illustrated in the International Energy Agency's World Energy Outlook 2012. It predicts that the United States will become the world's No. 1 oil producer by 2020; at the same time, it warns that to avoid catastrophic climate change, the international community must leave two-thirds of the world's proven fossil energy reserves in the ground.[22] The President can help create more thoughtful public discussion about the nation's energy choices by clearly explaining how his policies reconciles his "all of the above" energy policy and his commitment to climate action.

Recommendations for Presidential Action

Goal 1: Improve the Conversation

The President and the Administration should strive to improve the quality and productivity of the national conversation about natural gas production so that policy makers, regulators, public interest organizations and the American people better understand its benefits and challenges.

Executive Actions:

1. **Conduct a holistic analysis of costs and benefits.** Direct the U.S. Department of Energy through its national laboratories to conduct an analysis that synthesizes the many studies now underway or recently completed on the life-cycle costs and benefits of natural gas production in regard to high-priority public concerns. Those concerns range from conserving freshwater resources to reducing greenhouse gas emissions, and from job creation to consumer prices.

2. **Give clear direction to federal agencies.** Issue a Presidential Memorandum to federal agencies clearly stating that the Administration's policy is to ensure the prudent production of natural gas in environmentally and socially responsible ways, and to make use of existing statutory authorities to achieve this objective. Emphasize that both parts of this policy – "responsible" and "production" – are equal in importance.

3. **Build more collaboration with state and local governments**. Make clear to federal agencies that the environmental and social issues related to gas production – among them air quality concerns in some states, flaring in others, and the proper balance between CBI and disclosure – should be addressed collaboratively among federal, state and local governments, along with public-interest organizations, energy companies and the public. Emphasize that many of the tools and much of the information we need to engage in environmentally and socially responsible energy production already exist and can be better used; where they don't exist, the Administration will work with the gas industry, public-interest organizations and the research community to obtain or create them.

Goal 2: Enhance Federal-State-Stakeholder Collaboration

As mentioned earlier, many of the principal responsibilities in working with the natural gas industry reside in the states. The Federal Government's responsibilities and authorities could be better coordinated with the states' roles. In addition, the President can use those convening powers to facilitate more open and frequent interaction among the gas industry, states and stakeholders.

Executive Actions:

1. **Ask states first.** A first step in further understanding how the Federal Government can help ensure the prudent development of natural gas is work closely with the states in understanding where gaps and deficiencies currently exist in federal or state regulations. A constructive step in this direction is to survey the states where production is occurring to ask them where they need federal assistance. This should be an ongoing dialogue and a precursor to the launch of any federal level initiative.

2. **Engage the National Governors Association (NGA).** Propose to the NGA that it be the key link between the Federal Government and gas-producing states, with the objective of improving coordination and information sharing among federal, state and local governments.

3. **Create a public-private research institute.** ARPA-E is an exemplary federal research program, but it doesn't focus on the applied research needed for continuous improvement of natural gas value chain. The President can spearhead the creation of a new public-private research institute[23] that:

    a) Brings key organizations together from the natural gas industry, national laboratories and educational institutions to set R&D agendas aimed at minimizing the industry's environmental and social footprint;[24]

    b) Provides a clearinghouse that tracks the evolution of the industry's most effective practices for responsible production and the states' most exemplary policies for responsible production on public and private lands;[25]

c) Helps the natural gas industry with the diffusion and consistent replication of proven mitigation technologies and preferred practices in the field.

4. **Clarify and streamline air emission standards.** Work with states to develop air emissions standards and regulations that protect public health and the environment while revising existing regulations to make them clearer, more effective, and more easily implemented and enforced (e.g., the recently finalized New Source Performance Standards that EPA issued in 2012 to limit emissions of volatile organic compounds and hazardous air pollutants from oil and gas operations). In addition to federal rulemaking, the EPA can lend research and technical capacity to states pursuing state-level regulation. Partnerships with other agencies such as DOE and the National Oceanic and Atmospheric Administration (NOAA) could enable access to more advanced technologies such as remote sensing to increase compliance rates.[26]

5. **Collaborate to improve inspections and enforcement.** In regard to the enforcement of environmental rules, the rapid expansion of natural gas production in some states has raised concerns they are not able to hire enough inspectors to keep up with the boom in natural gas production to ensure that regulations are enforced.[27] Public confidence will increase and enforcement of regulations will be strengthened by retaining qualified inspectors, by training new inspectors and by ensuring that states and the federal regulatory agencies are adequately staffed. Recommend that the Shale Gas Production Subcommittee of the SEAB work with the NGA to:

   a) Assess the adequacy of compliance inspections in the field – the number of inspectors, whether they are paid sufficient wages to keep them on the job, and whether their training is adequate to deal with rapid changes in production and distribution methods. Propose sustainable sources of funding for states with major increases in natural gas production to maintain adequate numbers of inspectors.

   b) Investigate the optimal scenario for inspecting and monitoring natural gas wells and distribution systems: i.e., the most cost-effective and enforcement-effective mix of monitoring technology and field inspectors, including the optimal ratio of inspectors to pipeline miles.

   c) In partnership with state universities, develop regional training centers for permit writers and inspectors and adopt worker training and certification programs to help ensure we have a trained, certified, qualified workforce to do the jobs required on both the regulatory and production sides of the fence.

6. **Make collaboration visible**. Announce the Memorandum proposed in 1(b) above at an event in which the President, industry leaders and the leaders of environmental and other public interest organizations stand side-by-side. Explain the critical role that America's gas resources have in the nation's transition to a clean and stable energy economy. Announce verifiable commitments by stakeholders to work together on responsible production. In addition, create a commission that represents the diverse array of stakeholders in natural gas production – producers, regulators, academics,

public-interest organizations, researchers, etc. – for an ongoing dialogue that increases interaction among the natural gas industry and its stakeholders.[28] Determine whether the NPC can fill this role if it's given greater public visibility.[29]

Goal 3: Advance Science, Technology, and Recommended Practices to Enhance Natural Gas Production in Ways that Minimize Environmental and Social Risks

Industry participants in the CNEE dialogue pointed out that while it's important to identify and communicate recommended production practices, the practices are constantly evolving. Developing and sharing them must be an ongoing process. Several industry stakeholders noted that recommended practices should be technically and economically feasible, and that the term "best practice" should be avoided because it seems to imply that "one size fits all" when responsible production practices often are unique to the company, community, and methods they employ. Industry also pointed out that recommended standards and practices are already in existence and are developed through the American National Standards Institute (ANSI) accredited standards development process at API. These API standards are regularly cited in government regulations.

Executive Actions:

1. **Broker more collaborative R&D.** Use the President's convening power to broker new R&D collaborations among government, environmental and energy organizations to improve our understanding of the opportunities and challenges in responsible natural gas production.[30]

2. **Incentivize continuous improvement.** Create a presidential "George P. Mitchell Award"[31] for organizations involved in natural gas production, modeled loosely on the Malcolm Baldrige National Quality Award.[32] Create three categories in the Award: 1) excellence in total environmental and operational performance; 2) exceptional innovation that minimizes the environmental and social footprint of the natural gas value chain without sacrificing production; and 3) a demonstrated commitment to advancing dialogue and collaboration among natural gas producers, regulators and public interest organizations.[33]

3. **Strengthen support for organizations and programs that assist states with research and regulatory responsibilities.** They include:

    a) **STRONGER:** Encourage more support including additional funds for the State Review of Oil and Natural Gas Environmental Regulations (STRONGER)[34] to serve as a mechanism for reviewing state regulatory programs, sharing recommended practices, and developing programs to promote continuous improvement. Encourage the NGA to work with STRONGER and other similar groups to develop a training program on natural gas regulation. Request that STRONGER identify gaps in

the federal/state regulatory framework (the so-called "seams" issues) and recommend how the gaps should be addressed.

b) **Natural Gas STAR**: Industry representatives told CNEE that the program has been problematic and that there are questions about whether Natural Gas STAR is still necessary given EPA's emissions reporting requirements under Subpart W.[35] Public-interest representatives said Natural Gas STAR would be more useful if it were expanded to more extensively inventory, track, and evaluate the use of best practices for the measurement and control of air emissions associated with all natural gas lifecycle stages, including production, processing, transmission storage and distribution.

c) **Research Partnership to Secure Energy for America (RPSEA):** RPSEA is a non-profit corporation consisting of U.S. energy research universities, industry and independent research organizations. Its mission is to "provide a stewardship role in ensuring the focused research, development and deployment of safe, environmentally sensitive technology that can effectively deliver hydrocarbons from domestic resources to the citizens of the United States."

d) **Take Stock of Executive Tools:** Direct agencies to inventory all statutory authorities pertaining to responsible production of natural gas, and to assess if and how those tools are being employed. Direct the Council on Environmental Quality (CEQ) and the Office of Science and Technology Policy (OSTP) to oversee this exercise and to recommend improvements in the use of the authorities, mindful of the need to ensure that regulations and rules must be necessary and administered with a minimum of red tape.

Goal 4: Build the Information and Knowledge Base

In the literature and in dialogue with stakeholders, data comes up often as an issue. Is there enough of it, where are the gaps, and why is not existing data better used? A common concern is that government will require data for data's sake. In some cases, the most important "data" are what federal and state agencies can learn from each other with better communication.

One recent case where public interest organizations advocated for more data involves the Emergency Planning and Community Right to Know Act's Toxics Release Inventory (TRI). Oil and gas operators currently are not required to report annual releases of toxic chemicals under TRI. In October 2012, 17 public interest organizations petitioned EPA to develop a rule that would require oil and gas operators to engage in TRI reporting.

Executive Actions:

1. **Map the nation's water resources**. Direct the United States Geological Service (USGS) to conduct a comprehensive study that characterizes, maps and estimates the long-term

stability of brackish and freshwater aquifers in the United States. The study would inform a national strategy on water use in energy production and consumption, including how water resources might be allocated to serve municipalities, businesses and agriculture as well as the energy industry. Follow this study with analyses by other qualified agencies of technology options to address water challenges, and of the types and techniques of energy production that offer the best opportunities for conserving and protecting water resources. [36]

2. **Expand the Quadrennial Energy Review (QER).** Expand the mission of the QER[37] to include the influence of energy policy on food, water, climate and other elements of the environment. Direct the QER to assess the interrelationship between these elements, for example providing a life-cycle assessment of water consumption/Btu for different energy options.[38]

Goal 5: Strengthen the Industry's Social License to Operate[39]

In response to the rapid expansion of domestic natural gas development, a number of local communities have expressed concerns about the potential health and land use impacts. Key concerns include ground and surface water protection, air quality impacts, and increased traffic, dust, and noise. Some county and municipal governments have responded to these concerns by enacting or considering bans or temporary moratoria on hydraulic fracturing and, in some cases, on oil and gas development altogether.

In some natural gas producing states, legislation has been proposed or enacted to limit the power of local governments to regulate unconventional natural gas development. Of the 50 bills related to hydraulic fracturing introduced in state legislatures during the 2013 session, 20 imposed some form of ban or moratorium.[40]

Executive Actions:

1. **Acknowledge challenges and spotlight solutions.** Both the Federal Government and the industry should frankly acknowledge the risks and issues of gas production and distribution about which the public is concerned, at both the community and national levels. The President and officials in his Administration should more clearly communicate how agencies charged with protecting the public interest are addressing environmental and public health issues associated with oil and gas production.

2. **Make better use of data.** Make federal GIS capabilities available to county and municipal officials to assist them in their planning. Direct DOE to task the NPC with assessing the role and sufficiency of current metrics, data and performance evaluation methods. The NPC should identify how existing data can be made more accessible and better used, where gaps exist in each area, and how best to fill the gaps to better inform the gas industry, government regulators, state legislatures, and the general public.[41]

3. **Facilitate the resolution of key issues.** Request that the NGA review how states are defining and handling Confidential Business Information (CBI) in regard to the disclosure of the contents of fracturing fluids. Request that the NGA recommend a criteria for identifying legitimate CBI while protecting the public's need to know and the industry's right to protect trade secrets.

Goal 6: Minimize Environmental Impacts in the Value Chain

As mentioned earlier, environmental concerns associated with gas production include intentional and unintentional emissions of methane. The responsible management of water used in hydraulic fracturing and produced in the extraction process also is an issue. Methane is a potent greenhouse gas, with more than 20 times the global warming impact of CO_2 when emitted directly to the atmosphere. Estimates of methane leakage until recently have relied on a limited number of direct measurements, many of which were collected in a 1990s study by EPA and the Gas Research Institute (GRI).

Several significant developments are emerging in regard to the industry's methane emissions. In February 2013, EPA's Greenhouse Gas Reporting Program published its first emissions data from petroleum and natural gas facilities. In June 2013, the President announced his climate action plan, which directs EPA, DOE, Agriculture, Interior, Labor and Transportation to develop a comprehensive Interagency Methane Strategy that assesses current emissions data and data gaps, identifies exemplary practices and technologies for emission reductions, and inventories existing authorities and incentives to reduce methane leaks. In September 2013, EPA published a proposed rule that would require oil and gas companies to publicly report the amount of greenhouse gases they release each year.

Executive Actions:

1. **Create a national methane leak-reduction strategy:** Direct the Council on Environmental Quality (CEQ) and the Office of Science and Technology Policy (OSTP) to work with state regulators and the natural gas industry to design a cost-effective national methane leak-reduction strategy; to align federal agencies to help implement it; and to coordinate on their ongoing efforts to measure, monitor, and reduce methane venting, flaring, and leakage. In addition, direct the agencies to:

   a) Reach agreement on guidelines that indicate a ceiling on the amount of methane that can be released from the natural gas value chain while retaining the resource's advantages over coal and oil in regard to greenhouse gas emissions.[42]

   b) Assess and quantify to the extent possible the economic and environmental benefits to the industry and the public of keeping methane emissions below that level.

2. **Employ new technologies to reduce monitoring costs.** Direct EPA to track and communicate emerging technologies that provide less expensive ways to detect methane leaks that increase the carbon footprint of the gas value chain.

3. **Accelerate research.** Direct ARPA-E to facilitate R&D on natural gas emissions hotspots and the most cost effective ways to monitor and prevent methane leakage.

Goal 7: Demonstrate Best Available Cost-Effective and Site-Appropriate Production Practices on Federal Lands[43]

Data compiled by the Congressional Research Service (CRS) show natural gas production on federal lands constituted nearly 18% of the U.S. total (down from a high of 26.4% in 2008). The CRS reports there were more than 49,200 oil and gas leases for production from onshore federal lands and more than 6,600 leases for production on offshore federal lands in 2012. Some 37 million acres of onshore and nearly 36 million acres of offshore federal lands were under lease last year.

BLM has drafted and recently extended the comment period on a proposed rule governing hydraulic fracturing on federal lands. The draft rule has been criticized by some states, by some in the oil and gas industry and by several environmental organizations. Officials in North Dakota, for example, criticized the rule's provisions on hydraulic fracturing and its requirement that exemptions to the new rule would be considered on an operator-by-operator basis rather than allowing blanket exemptions within state borders. Environmental groups have criticized provisions that would require producers to disclose the contents of their fracturing agents, but not until after drilling begins.

Executive Actions:

1. **Demonstrate responsible production methods.** Direct BLM, in its final rule and in guidance, to encourage natural gas producers to use regionally appropriate methods for environmentally responsible production on federal lands, while working with states and tribes to avoid duplication of efforts, to stimulate innovation, and to recognize states' and tribes' unique knowledge of the geology and other characteristics of their regions. Direct other federal offices and agencies to periodically consult with BLM to identify best available technologies and practices. Direct BLM to pay specific attention to exemplary practices by states on wellbore integrity, water management and methane capture.

2. **Demonstrate full disclosure of chemicals used in hydraulic fracturing, consistent with the protection of CBI**: Generally support the 2011 recommendations of the SEAB Shale Gas Production Subcommittee, including a requirement for full disclosure of fracturing agents in oil and gas production on federal lands. Use the BLM's upcoming rule on gas production on Federal and Indian Lands to demonstrate the appropriate balance between proprietary issues and the public's right to know. Ensure that the final rule clearly defines CBI to ensure that non-disclosure is allowed only when the need for confidentiality is justified.

Goal 8: Natural Gas Pipeline Issues

CNEE's principal focus in this white paper is natural gas production. However, the dialogue with industry and environmental leaders identified several issues and recommendations related to gas distribution.

Executive Actions:

1. **Adequate inspection.** Direct the DHS, including the Pipelines and Hazardous Materials Safety Administration (PHMSA)[44], to work with Interstate Natural Gas Association of America (INGAA), America's Natural Gas Alliance (ANGA), the American Gas Association (AGA) and other key industry organizations to identify sustainable alternative funding for states to adequately staff their pipeline inspection programs. Although there have been modest increases in the number of federal inspectors in recent years, the pipeline safety inspection programs are reported to be chronically understaffed (CRS 2013, p. 17). The inspection program relies heavily on states, many of which are dealing with budget shortfalls, and the prospect is uncertain for significant federal budget increases. This issue, raised in reference to production site inspectors in recommendation 2(e) applies to pipelines and to pipeline security as well as safety according to the Congressional Research Service programs (CRS 2013, p. 19).

2. **Pipeline safety and security.**[45]Ensure that the DHS has implemented the 2012 recommendations of the Government Accountability Office's *Critical Infrastructure Protection* report as it applies to natural gas infrastructure. In addition, ensure that the several agencies with responsibilities related to natural gas pipeline siting, security and safety – including the DOT, DHS and FERC – collaborate closely to protect the system not only from traditional risks, but also from emerging risks such as extreme weather events, flooding, fire and other climate impacts. Encourage FERC to consider anticipated climate impacts and related safety concerns in the siting of interstate pipelines.

3. **Faster permitting.** Direct the EO 13604 Steering Committee to work with all federal siting and natural resource agencies in the approval chain including FERC to identify additional ways to streamline interstate pipeline permitting and to ensure that new infrastructure is built and maintained to the highest safety and environmental standards. Direct the Steering Committee to identify how agencies can streamline the ad-hoc reviews, approvals and permits required for intrastate natural gas pipelines and distribution projects, including permits for important operations, maintenance, and pipeline safety work required to revitalize existing infrastructure.[46]

4. **Early coordination of multiple federal, state and local reviews.** Direct federal agencies that issue permits for natural gas projects, including intrastate natural gas transmission and distribution projects that might affect federal lands, waters, or protected species, to hold strategic engagement meetings with permit applicants to determine how the agencies can serve as effective liaisons with the other multiple state,

federal, tribal and local agencies that must provide permits and approvals for the same projects[47]

5. **IPaC software.** Prioritize and expedite the development of the U.S. Fish and Wildlife Service IPaC software program so project applicants can make informed decisions about whether certain federal permits and reviews are necessary, whether environmental impacts can be avoided altogether on a proposed project route and whether proven environmental mitigation practices already exist for specific habitats, species and areas.

6. **General permitting program for minor projects.** Increase the scope and applicability of general and state-wide permits under existing federal environmental regulatory programs to cover minor, temporary natural gas projects that require routine operations and maintenance, repairs, integrity testing and safety-related, or time-sensitive work (including wetlands permitting by the U.S. Army Corps of Engineers and storm water permits issued by states and localities under delegated authority from the EPA). Ensure that general permitting is not allowed for companies that have a record of poor environmental and operational performance.

7. **Consistent compliance requirements.** Form an interagency working group to develop consistent regulatory compliance requirements, guidelines and timelines across agencies that share responsibility for permitting programs. An example is coordination between the regional and national headquarters of the Army Corps of Engineers, and the Advisory Council on Historic Preservation, to ensure that cultural/historical/tribal resource permitting regulations are regionally and nationally consistent and to ensure regulatory timelines for project approvals are enforceable.

Chapter 5: Utility Business Models for the 21st Century

Key Themes and Recommendations

To review its recommendations for presidential action, CNEE conducted a roundtable in Aspen, CO, that involved representatives of the electric generation, distribution and regulatory sectors along with representatives of public interest and environmental organizations. These themes and messages emerged:

- Current regulatory models, practices and time-consuming processes are lagging behind emerging electric technologies and generation options. This inhibits progress by utilities that want to implement 21st century business models and want to help the nation achieve a clean energy economy at the pace envisioned by the President. The United States must find new models that demonstrate how the electric system can adapt to the nation's need to double its energy productivity, integrate distributed energy systems and accommodate large amounts of renewable energy in the power system. Federal assets such as the Power Marketing Administrations and Tennessee Valley Authority should demonstrate these new models.

- Removing regulatory barriers, updating policies, and streamlining processes should be a central focus of regulators at the state and federal levels so that utilities and other power sector businesses can evolve effectively as disruptive generation, bulk power solutions such as storage and demand response, and information technologies emerge.

- Utilities need to formulate and communicate a vision for their future—a compelling and coherent set of goals that motivate rapid incremental progress across a variety of markets, operations, and investments. The President should use his convening power to create an opportunity for participants in the many "utility of the future" exercises to synthesize their ideas.

- The President should encourage policies that lead to larger regional markets that support a 21st century grid that effectively integrates new clean resources in a reliable manner. Those policies can "start at home" in the PMAs, FERC and the government's own energy production and consumption.

While utility leaders in the CNEE dialogue identified the challenges summarized above, they also regard the revolutionary changes in their industry as an opportunity. They are eager to face the challenge – except for one critical problem that became a recurring theme:

The nation's energy technologies and needs are advancing faster than the rules, rates and administrative processes that govern how America's utilities operate. Rules and procedures need to be streamlined, modernized and reformed to help utilities respond to changes in technology and markets, and to achieve the President's policy objectives for a clean energy economy.

Although electric and gas utilities are operated under varying business models with various levels of state and federal regulation, most depend on private capital investment. Still, the Federal Government has the power to expedite the revolution and make it less disruptive. Industry participants stressed the importance of the President taking action at the "30,000-foot" level.

The Critical Role of the Utility Industry in the Path Forward: Electric and gas utility investments are changing rapidly. Deployment of energy efficiency and distributed generation is expanding (although inconsistently) across the country. In addition, record low natural gas prices and pending Clean Air Act rules are making the fleet shift from coal to cleaner resources more viable. Simultaneously, policy makers, utilities and regulators are giving greater attention to modernizing utility business models and regulation.

Utilities recognize the challenge before them and the increasing role of technology. At the heart of this challenge is the application of a 20th century regulatory model for a 21st century economy. Traditional, volume-based rate setting as a means of recovering embedded costs of depreciated assets is still common. When volume-based regulation was put in place, however, large-scale generation made sense and utility load was growing. Today, load is declining, utilities are required to achieve various energy efficiency and renewable energy mandates that they may or may not be compensated for, consumers are asking for new products and services, and a trend has taken hold toward distributed, intermittent power sources.

Utilities are not the barrier to the path forward. CNEE believes that they are the linchpins to implementing a low-carbon energy economy by using cleaner fuels to generate electricity, helping to electrify the transportation sector and providing the enhanced services that customers are increasingly demanding. Utilities provide more than just power and energy. They are fundamental to our economy. As one participant put it "Utilities make life happen." Yet, for millions of Americans, that value is only acknowledged when the power goes out.

The President's role in the national narrative: The President can be the voice above the fray in the national discussion of 21st century power systems. He can help create a new national narrative about the utility industry and its role in the life of virtually every American. In so doing, he can build public support for the changes ahead, some of which will have direct impact on utility customers.

First, he can issue a bold call to action for all elements of the utility industry, including its customers. He can convene industry leaders to achieve a unifying vision for how this fragmented industry and all its moving parts will generate, deliver and manage clean electric power for the American people. He can help communicate the vision. He can help frame the discussion by suggesting that the 21st century utility should:

- Provide reliable and affordable electricity to consumers throughout the country.
- Produce and support a dynamic economy and good jobs.
- Achieve reasonable returns on investments, offer customers reasonable rates and align utility profits with public interests.
- Become sufficiently resilient to provide reliable electric power, even with the increasing challenges of global climate change and system cyber security.
- Produce and distribute electricity while accommodating consumer side of the meter interaction with maximum resource efficiency and minimum environmental impact.
- Plan effectively to reduce risks to the power system and its services and to achieve lower investment costs.
- Foster innovation and new consumer value while maintaining the reliability of the grid and preserving integrity of existing markets.
- Find ways to store both its energy and its carbon economically.
- Prioritize its resources based on an assessment of all benefits and costs to society.
- Set high standards for transparency, performance and accountability.

Second, the President can help utilities prepare customers for their role by being frank about how modernization may affect them. He can explain that:

- The 21st century power system will deliver new value and services, both tangible and intangible, to the American people.

- The system's modernization will require significant public and private investment. While this may mean upward pressures on electric rates in the future[1], out of pocket costs in customer bills (as opposed to rates) can be reduced with intelligent policies that focus on what needs to be built, a reliance on competitive markets rather than state subsidies, energy efficiency measures and distributed generation.

- Utility customers have an active role to play in the changes ahead. By increasing the efficiency of their energy use, by becoming power generators in their own right, and by supporting the leaders and policies that move the nation to a clean energy economy, utility customers will be an intrinsic part of the 21st century power system.

- Extreme weather events such as floods, wildfires, drought, heavy snow and rainfalls and coastal storms are focusing our attention on the need for greater resilience in our electric infrastructure. Utilities must engage in continuous improvement of the system's resilience before as well as after these disasters to mitigate and adapt to the impacts of global climate change. At the same time we improve the system's resilience, we must improve its reliability.

Third, as mentioned above, the President can help increase the public's appreciation of how vital the utility sector is to our economy and quality of life. Industry leaders say that customers only appreciate electric power when the lights go out. The invisible reality is that America's electric and gas utilities provide value nearly every minute of every day in every household, business, factory and community. Utilities support large local workforces; their own workers are unsung heroes who are among the first responders after natural disasters, working in dangerous conditions to restore vital energy services. The President can help bring these underappreciated contributions to light.

Cautions About Federal Leadership

Industry advised against the Federal Government producing model business designs, regulations or legislation. They cautioned that regional and sub-regional factors are too diverse for "one size fits all" approaches. As one leader put it, "Identifying best practices is fine; prescribing them is a stretch." They also cautioned that the industry's transition should be led from the ground up. They are not looking for the government to take over leadership during this time of change; rather, government can help facilitate the process, share best practices, provide informed analysis and offer technical assistance.

Most importantly, the Federal Government can revise, reform and update its policies that are inhibiting the transition by making it slower and more difficult. Delays in administrative processes, uncertainties caused by regulators, and the time delay between ideas and investments discourage capital investments critical to modernizing the power system. A key federal role in utility reinvention is to help streamline regulatory decisions by improving the coordination of agencies involved, clearly identifying decision-makers, defining each agency's authority, reducing the time lost to duplicated, uncoordinated, and unnecessary analysis and requiring decision makers to stick to their rulings once they've made them.

Generally, participants said, federal agencies should focus on policy guidance that provides flexibility between regions. Others suggested that FERC improves the timelines of its decisions at the commissioner as well as the contested process levels.

Finally, to have credibility as a partner in the transition, the Federal Government must reinvent its own assets, policies and procedures. Participants identified six areas where they feel the Federal Government's influence is most important:

1. Regulating power plant emissions
2. Providing adequate returns and incentives for new transmission projects and more effective use of existing transmission assets
3. Providing guidance with appropriate flexibility for Independent System Operators while also paying attention to utilities not in ISOs[2]
4. Leading by example in federal facilities and operations
5. Demonstrating how to integrate and evaluate distributed energy resources

6. Recognizing the industry's need to serve diverse conditions and constituencies in different parts of the nation.

Recommendations for Presidential Action

Goal 1: Leadership by Power Marketing Administrations (PMAs)

DOE operates four PMAs – the Bonneville Power Administration (BPA), Southeastern Power Administration (SEPA), Southwestern Power Administration (SWPA) and Western Area Power Administration (WAPA). The PMAs market electric power in 34 states and operate electric transmission systems that integrate with the transmission and distribution networks of investor owned utilities in 20 states; with some of the transmission in critical locations for facilitating exchange between and among these utilities. They marketed 42% of the nation's hydroelectricity in 2012, comprising 7% of all electric generation in the United States[3].

Congress began creating the PMAs in 1937. In 1977, it transferred operation of the PMAs from the Department of Interior (DOI) to DOE. With the exception of SEPA, the PMAs play a large role in transmission both as owners and system operators and they maintain reciprocity tariffs with FERC. These tariffs allow the PMAs to recover costs associated with operating the federal system and providing open access to transmission customers.

The PMAs are accountable to several other agencies besides DOE, mostly due to their sourcing of electric power generation from hydropower dams. PMAs market power from dams operated by the U.S. Army Corps of Engineers and the Bureau of Reclamation, and work with the U.S. Fish and Wildlife Service on activities that impact habitat.

Importantly, the PMAs serve a special class of "preference customers" including publicly and cooperatively owned utilities, federal agencies including DoD, and Native American Tribes. These customers have developed and operate as key political constituencies that stand watch over Congress and the legal mandate that the PMAs provide them with electric services "at the lowest possible rates to consumers consistent with sound business practices."

Executive Actions:

1. **Enlist the PMAs in the clean energy transition**. Meet at the White House with the administrators of the four PMAs and key opinion leaders among their preferred customers to enlist their support for demonstrating 21st century business practices. Lay the groundwork that will prevent the kind of political pushback that former DOE Secretary Steven Chu experienced when he directed the PMAs to do this.

2. **Reissue guidance to the PMAs**. Direct the Secretary of Energy to issue a secretarial memorandum to PMA Administrators that:

a) Clearly explains the President's policy objectives and the critical leadership role PMAs must play in America's historic transition to clean energy.

b) Directs them to prepare strategic plans and investment roadmaps that help implement the President's policy priorities including climate change mitigation and adaptation, increased system resilience, major advances in energy productivity, and an efficient and innovative power system that accommodates large amounts of renewable energy. The plans should also include strategies for working with the PMA's distribution utilities to integrate distributed generation.

c) Emphasizes that Congress put PMAs under the DOE's administration.

d) Communicates that the President looks forward to active collaboration with the PMAs and their preference customers on achieving his policy goals, and to creating "win-win" initiatives that improve the outcomes for the PMAs, their customers and the nation.

e) Directs PMA Administrators to offer recommendations on the long-term role of PMAs in a clean energy economy including the new skill sets they will need, the role of preference customers in the transition, and the criteria that determines who qualifies as preference customers.

f) Directs them to report to the Secretary how they will increase the transparency, consistency, accountability and clarity of their procedures and actions including all procedures and actions related to the use of their transmission assets and the formulation and execution of their power marketing plans[4].

g) Directs them to adhere to federal public meeting requirements.

3. **Make DOE's responsibilities and authorities clear**. If the PMAs or the preference customers push back on the Secretary's directives – for example, by mobilizing members of Congress to object – issue an Executive Order to clarify that the PMAs are federal assets that Congress put under the jurisdiction of DOE; 2) the PMAs are owned by the American people, not by preference customers; and 3) preference customers should not confuse preferential rights with ownership.

Goal 2: Leadership by the Federal Energy Regulatory Commission (FERC)

FERC is an independent agency of five members appointed by the President. Its authorities and roles include:

- Regulating transmission and wholesale sales of electricity in interstate commerce;
- Reviewing certain mergers, acquisitions and business transactions by electricity companies;
- Regulating transmission and sale of natural gas for resale in interstate commerce;

- Reviewing siting applications for electric transmission projects in limited circumstances;
- Inspecting and licensing private, municipal and state hydroelectric projects;
- Establishing mandatory reliability standards for the high-voltage interstate transmission system;
- Monitoring, investigating, and enforcing standards for energy markets; and
- Overseeing environmental matters related to natural gas and hydroelectric projects. [5]

In addition to these formal roles, FERC's pronouncements and decisions influence investors, industry leaders say.

Because FERC is an independent agency, the President has no official authority over its decisions beyond his appointment of its members and the designation of the Chairman.[6] The President can affect change in FERC policies that are consistent with the FERC's governing statutes most directly by the selection of the Chairman. The President can also exert his "power of persuasion" to enlist FERC in reforms that establish its role in building a clean energy economy. Participants in the CNEE roundtable recommended that, before he implements the following recommendations, the President should meet with FERC commissioners to hear their views on the commission's role in power system reinvention.

Executive Actions:

1. **Enlist FERC in the clean energy transition**. In written and oral communications with FERC commissioners, the President can acknowledge their status as an independent agency, enlist them in the clean energy mission, and encourage them to use their authorities in the following ways:

    a) Leverage FERC's existing authority to provide incentives for transmission and related projects that advance critical policy goals. For example, link premiums on return on investment to the attainment of the President's energy and climate objectives.

    b) Carefully consider the costs that FERC decisions impose on states and the influence that FERC's decisions have on investors.

    c) Focus on high-level principles aligned with advancing the President's policy objectives and moving the electric infrastructure into the modern area. Choose to be less involved in jurisdictional issues.

    d) Encourage and support ISOs and RTOs under FERC's jurisdiction to implement policies and specific rules that advance the President's goals.

    e) Encourage collaboration between and among regions.

f) Provide incentives to utilities that are not in ISO's if they participate in RTO-like mechanisms with mutually beneficial resource exchange, such as an Energy Imbalance Market, etc.

g) Strive for greater predictability and alignment of policy pronouncements among commissioners.

h) Ensure that ISOs and RTOs under FERC's jurisdiction support sufficient assets to sustain system reliability for the long term.

i) Hold noticed meetings with leaders of the utility industry to discuss their needs and concerns in making the transition to clean and diverse energy.

j) Anticipate that the EPA will limit emissions of greenhouse gases beginning in the intermediate term. This would affect the financial analysis of most infrastructure projects overseen by the FERC, and might reasonably affect the agency's review of corporate transactions by electric companies, its investigations of energy markets, and its oversight of environmental issues related to natural gas and hydroelectric projects. Importantly, this action will be within the authority of the FERC. The agency is not determining unilaterally that GHG emissions should be limited; instead, it is taking the prudent step of incorporating the likelihood that an agency with direct authority will take such action.

k) Avoid "decision lag" by setting a maximum time for actions by commissioners and for the resolution of contested cases. Recommend that the time limit be 270 days, similar to that used by several state commissions.

2. **Use DOE's role as intervener**. Direct the Secretary of Energy, in his role as intervener, to counsel and assist FERC in the following actions:[7]

a) Define FERC's focus and authorities to create a level playing field for electric power resources in the United States

b) Thoroughly analyze issues that affect the just and reasonable allocation of interregional transmission costs that support reliability and clean energy deployment

c) Task the National Laboratories to provide research and expert testimony on proceedings of greatest policy significance.

d) Make sure the Quadrennial Energy Reviews connect the dots between the systems integration work at NREL, system resilience issues, and FERC's work on the transmission system.

Goal 3: Leadership by the Tennessee Valley Authority (TVA)

TVA is a corporation owned by the U.S. Government. It is not a PMA. It sells wholesale power to 155 distribution utilities that serve 9 million people, and it retails to 51 large industrial customers and 6 federal installations. It operates nearly 16,000 circuit miles of transmission lines connected directly to 14 other electric systems. More than 40% of its capacity comes from coal, nearly 24% from natural gas, 19% from nuclear power plants and the rest from hydroelectric plants. TVA reports that in 2011, more than 40% of its energy came from clean or carbon-free sources.

However, TVA is the third-largest source of CO_2 emissions in the U.S. electric sector – hardly an example of climate leadership in the Federal Government. In recent years, TVA has been charged with violations of the Clean Air Act at 11 of its coal-fired power plants. In April 2011, TVA reached a settlement with EPA that requires it to invest $3-$5 billion on new and upgraded pollution controls and $350 million on clean energy projects. TVA says it has "renewed its vision to help lead the Tennessee Valley region and the nation toward a cleaner and more secure energy future, relying more on nuclear power and energy efficiency and relying less on coal."

In 2011, the TVA says, it instituted an innovative risk analysis process in its integrated resource plan. It determined that the established plan (along with an alternative that included new nuclear construction) represented a higher risk portfolio for customers than a portfolio that emphasized renewed investment in energy efficiency and renewable energy technologies[8]. This process can be promoted and replicated among state regulatory authorities.

More recently, President Obama directed OMB to conduct a "strategic review" of the Federal Government's relationship to TVA, including whether the government's role should be reduced or terminated. In his 2014 budget, the President indicated the review is being driven by the amount of debt TVA has accumulated and by the idea that TVA has achieved its original objectives and "no longer requires federal participation."

TVA was established to meet the challenge of rural electrification. It has met that goal, but the 21st century has brought new challenges – the same or similar challenges as those faced by many public power providers, which supply upwards of one-quarter of the electricity used in the United States.

Executive Actions:

1. **Consider re-missioning rather than privatizing TVA**. Direct OMB to evaluate a third option in its strategic review of TVA: It should consider updating the mission of the TVA to become a model of adaptation to 21st century market and environmental realities.

2. **Assess TVA staffing**. Direct OMB to review whether the TVA is adequately staffed with sufficient skills.

3. **Help utilities become pioneers**. Direct TVA to collaborate with DOE, CEQ, EPA and other stakeholders, to pioneer cost-effective strategies that help public utilities keep pace with emerging technologies. Such strategies could include providing distributors with competitive grants, decoupling utility profits from electric or natural gas sales to encourage more utility-sponsored energy conservation programs with revenue recovery. In the process, the Tennessee Valley could once again become a living laboratory for energy innovation and a model for 21st century utilities.

4. **Pilot a new IRP process**. Direct TVA to work with DOE in piloting a new Integrated Resource Planning process for TVA that no less frequently than every six years evaluates all supply- and demand-side resources together in a single proceeding. This plan should build upon and go further than IRP best practices from other utilities[9].

5. **Confer with the TVA Board**. Call members of the TVA board to the White House to explain their role in meeting the President's energy and environmental policy objectives, to enlist their cooperation, and to exchange ideas on how to reinvent TVA's mission and practices to exemplify the utility practices of a clean energy economy.

6. **Appoint reformers to the Board**. Appoint forward thinking members who are eager to reform TVA into a utility of the future to the TVA Board of Directors.[10]

Goal 4: Federal, State and Local Collaboration

As the nation's largest energy consumer, the Federal Government can use the power of its purse and the example of its internal policies to help inform state regulation of electric utilities. With their state and local assistance programs, DOE's national laboratories can help localities meet emerging challenges such as the reduction of greenhouse gas emissions in transportation and utility systems. In addition, the Federal Government has a wide variety of technical assistance programs on the energy performance of buildings, fleets and industries; on community sustainability; on resilience to natural disasters; and more.

Executive Actions:

1. **Collaborate with NARUC**. Direct DOE to meet and arrange collaboration with the National Association of Regulatory Utility Commissioners (NARUC) to:

    a) Expand joint efforts into emerging priority areas such as the nexus between energy and water.

    b) Explore ways for regulators to increase flexibility for innovation by electric and gas utilities to bring more value to consumers, improve the Federal government's technical assistance to regulators and speed rates of innovation and change across the industry.

2. **Help modernize performance metrics**. Provide technical assistance to NARUC and state PUCs in developing performance metrics and policies that reflect customer needs and values; gather sufficient data to measure performance against those metrics; align utility compensation with the performance measures; and reward superior utility performance.

3. **Complete regional sustainability plans**. Direct the Federal Environmental Executive under Section 15 of Executive Order 13514 to complete a regional implementation plan that supports the President's sustainability objectives "taking into account energy and environmental priorities of particular regions of the United States." The plan should:

   a) Include collaboration among military installations, utilities and communities on energy efficiency, renewable energy, distributed generation and micro-grids.

   b) Define the role of the Federal Energy Management Program (FEMP) in working with the government's field installations and their local utilities on distributed energy and combined heat and power systems in buildings and facilities.

4. **Help utilities comply with greenhouse gas limits**. Direct DOE and its national laboratories to provide technical assistance, as requested, to utilities as they comply with greenhouse gas emission regulations under Section 111(d) of the Clean Air Act.

5. **Anticipate the impact of electric vehicles**. Direct federal installations to work with their electric utilities to anticipate, manage and develop best practices regarding the impact of electric vehicles on local utility services.[11]

6. **Participate actively in PUC dockets.** Direct DOE (including its national laboratories and FEMP) and DoD (often the biggest customer for their local electricity utilities) to take an active role in state PUC dockets and rate cases that have an impact on their electricity mix. Encourage them to intervene in specific proceedings before PUCs to advocate for levels of energy efficiency and renewable energy that meet federal agency goals.

7. **Promote bundled power purchasing.** Direct DOE to promote more bundled power purchases by federal agencies.[12] FEMP reports that "Federal agencies throughout the country are actively seeking opportunities to buy renewable power for their sites," in large part to fulfill presidential directives. Federal agency purchases of green power can help utilities meet the requirements of state renewable portfolio standards.

8. **Foster collaborations between military bases and communities**. In support of EO 13514 and statutory goals on the use of energy efficiency and renewable energy, direct the Secretary of Defense to have military installations collaborate with their local utilities to establish micro-grids and renewable energy generation systems, to integrate these systems with the civilian grid when it is consistent with installation security, and to share lessons learned by the military in its development of micro-grids, islanding and distributed energy systems.[13]

9. **Help public utility commissions on smart grids**. Direct NIST to work with PUCs in developing smart grid standards.[14]

Goal 5: Electric System Resilience, Security and Flexibility

In the 21st century, America's economic stability will depend increasingly on the ability of the electric generation and transmission system to adapt to the threats of extreme weather and other impacts of global climate change. Utility planners need to practice risk management against climate change and to anticipate, mitigate, and repair higher levels of damage.[15] Risk management measures should include investments in smart grid technologies that improve utilities' access to real time energy data and that allow them to deliver next generation outage management and customer engagement systems. The response to Hurricane Sandy in New York and New Jersey indicates that utilities will need to change how they do business in regard to climate risks and impacts. [16]

In a July 2013 report, the DOE warned that the nation's thermoelectric power plants are vulnerable to increasing air and water temperatures that could reduce available generation capacity. Rising temperatures are expected to increase transmission losses, reduce current carrying capacity and increase stresses on the distribution system. NREL researchers warn that power plants, which account for about half the water withdrawals [17] in the U.S., are vulnerable to water shortages caused by drought. Shortages of cooling water already have curtailed power production in parts of the United States, including the shutdown of some coal and nuclear plants in the Southeast in 2007, and nuclear plants in Illinois and Minnesota in 2006. The Millstone nuclear plant in Waterford, CT., shut down one of its reactors in 2012 because the water it drew from Long Island Sound was too warm to cool critical equipment. A twin unit nuclear plant in Braidwood, IL, had to get permission to keep operating because the temperature in its cooling water pond rose to 102 degrees.

In the final recommendations it issued in October 2010, the National Infrastructure Advisory Council observed:

> *Risk management, reliability, and recovery are so ingrained into the operation of the electric grid that the executives we interviewed don't often think of their practices as resilience. Electric utilities are very experienced in emergency response and recovery, and have evolved risk management models that help predict the impact of weather, unforeseen equipment failure, and natural disasters, enabling them to more effectively prepare… An evolving risk profile and new threats to grid resilience, however, are causing grid operators to prepare for risks outside of their traditional experience and responsibilities. Grid resilience is entering an area of joint responsibility where a coordinated industry and government approach is imperative.*

It is important to note that no matter how fortified a power system is with fences, guards, etc., its individual elements may remain vulnerable. The goal of grid resilience should be not to just make the system more guarded, but to make it less vulnerable to single points of failure. Reducing the importance of any one generator or power line is essential to grid resilience.

Cyberattacks also are emerging as a risk to power production. Cyberattacks on utility sector control systems reportedly increased more than 50% in 2012 and more than 780% from 2006 to 2012. The North American Energy Reliability Corp. (NERC) has established, and FERC enforces, a set of critical infrastructure protection standards. FERC initiated a rule in April 2013 to adopt Version 5 of the standards.[18]

Utility expert Ron Lehr, a former chairman of the Colorado Public Utilities Commission, predicts that the next conflicts in world affairs will likely be in response to cyberattacks on critical infrastructure including electric grids. A critical question, Lehr says, is how to source and invest in the information technology and communications software, equipment, and training required in conditions where expectations, trends, and the future are all unclear.

Other key issues being considered by Congress and the Administration are how to balance the security of the nation's critical infrastructure with privacy protections and whether cybersecurity standards should be mandatory or voluntary. President Obama issued an executive order in February 2013 that requires federal agencies to provide private sector organizations with better information on cyber-threats and to ensure that cybersecurity protections do not conflict with privacy and civil liberties. The order also directs NIST to develop a voluntary cybersecurity framework for critical infrastructure by February 2014. [19]

Executive Actions:

1. **Develop a cybersecurity strategy**. In compliance with a key recommendation from the Government Accountability Office (GAO), assign the White House Cybersecurity Coordinator to develop an overarching federal cybersecurity strategy that includes performance measures and milestones, specific roles and responsibilities of different federal organizations, guidance on how the strategy relates to other national objectives, and a roadmap for improving those areas where the GAO has identified deficiencies.[20] Instruct the Office of Personnel Management (OPM) to work with agencies that have cybersecurity roles to ensure that performance measures and milestones are well specified in the job descriptions and performance standards of cognizant program managers.

2. **Study how distributed generation affects reliability**. Direct DOE to identify synergies and potential collaborations between current cybersecurity programs and its work on energy efficiency and clean energy technologies, based on the premise that their goals may be mutually beneficial. Also direct DOE to study and report on the impact of distributed generation on electric system reliability, taking into account that energy flows will change from one-way to a two-way/multi-way flow pattern. This diversity of generation methods can in theory enhance reliability, but significant investments need to be made to enable best use of DG to support social goals (such as more rapid restoration of the grid in the event of a prolonged outage).

3. **Find the cybersecurity-privacy balance**. Direct DOE and its Cybersecurity for Energy Delivery Systems Program, in collaboration with NIST, to recommend how to balance cybersecurity in the nation's power system with citizens' right to privacy – an issue that has greater relevance in the wake of recent information about the activities of the National Security Agency.

4. **Identify a security and resilience leader**. Solve the confusion created by too many agencies involved in security and resilience issues by identifying a single point of contact in the federal system – a consistent person or agency that utilities can contact for guidance on security issues.

5. **Help develop resilient transmission pathways**. Direct the DOE to work with DHS and industry on the assessment of industry best practices for resilient pathways for transmission infrastructure. (Utility leaders told CNEE that DHS has said this is not in its mission.) Alternatively, identify another federal entity with the analytic capability to advise the industry on resilience pathways.

6. **Help utilities and regulators adapt to climate change**. Direct DHS to take the lead in identifying and prioritizing risks to the nation's electric power system and in suggesting model policies and practices to help Public Utility Commissions (PUCs) and electric utilities adapt to their regional climate impacts.

7. **Assess utility climate risks**. Ensure that the National Climate Assessment includes assessments of risks to utility infrastructure and addresses the resilient pathways issue.

Goal 6: Address the energy-water nexus in energy services

The energy-water interface is gaining considerable interest in the environmental and policy communities as extreme weather events and growing water stress affect water supplies and the nation's energy production options. Energy resource choices can increase stress on water supplies; conversely, water availability will influence our energy choices, including how we generate electricity. As noted in No. 5 above, thermoelectric generation accounts for nearly half of all freshwater withdrawals in the United States. In California, for example, an estimated 19% of electricity use, 32% of natural gas consumption, and 88 million gallons of diesel fuel consumption each year are related to water (CEC 2005). Energy production and water consumption are intimately related; the efficiency of one improves the efficiency and security of the other.[21]

The Administration increased its focus on this issue following the severe drought in 2012 that affected more than a third of the country. At DOE alone, some 20 different programs deal to some degree with this nexus. A Water and Energy Technology Team at DOE is working to coordinate these programs, but broader coordination is needed.

Other agencies have a key role in the energy-water relationship. EPA regulates the impacts of energy production on water quality; DOE studies the impacts of energy production on

water use; the U.S. Geological Survey (USGS) monitors the impacts of energy production on water availability. In addition, USDA, Interior, the Bureau of Reclamation, the Power Marketing Administrations and the U.S. Army Corps of Engineers all are involved in water projects that affect the cost, reliability and security of the nation's energy supplies and energy infrastructure.

Executive Actions:

1. **Develop an energy-water action plan**. Create an interagency task force on the energy-water nexus along the lines of the Interagency Climate Adaptation Task Force and charge it with building on the EPA Energy-Water Principles to produce a national action plan similar to the one the Climate Adaptation Task Force produced. Charge the task force with making recommendations in the following areas:
   a) Factoring water into energy policies and investments**.** EPA has undertaken a study of the value of water to the U.S. economy. Based on that study and other assessments of the value of ecosystem services, charge the interagency task force with recommending how water impacts should be factored into the decisions and operations of the PMAs, FERC, the TVA, regulators and utilities. Task it also with assessing the risk that the current electric generation portfolio will be threatened by projected limitations on water resources.

   b) Assisting states and localities**.** Assign the task force with identifying the information that PUCs, municipal utilities, cooperatives and other electric providers need to incorporate water factors into regulation and utility management.

   c) Conducting R&D on low- and zero-energy wastewater treatment facilities**:** What types of innovations are needed, and should the Federal Government support, regarding the reuse of degraded water, integrated water management, alternative cooling methods, and the water efficiency of power plants?[22] Have others done sufficient basic and applied research on these issues? If so, should the Administration help interpret and disseminate the findings to utility regulators and companies? If not, should these issues be factored into the research plans of the National Laboratories?

      Including an evaluation of water intensity of energy generation resources in the EPA's analysis of climate adaptation strategies to help regulatory authorities prioritize energy generation alternatives in water-restricted states.

Agency Actions

Power Marketing Administrations

1. **Suggestions for the strategic plans.** Address the following topics in the strategic plans the Secretary of Energy directs PMA administrators to prepare:

   a) A proposed plan for implementing and communicating to their customers the policies and standards which constitute best practices for 21st century electric utilities.

   b) An assessment of the costs, benefits and practices of increasing renewable energy capacity by 2025[23], rising to 80% by 2050.[24]

   c) Similar to the recent MISO ruling, a cost allocation formula for transmission infrastructure used to accommodate increasing renewable resources, considering the overall system improvements achieved by incorporating renewables in the portfolio.

   d) A planning process that fully considers the risks and benefits of issues ranging from electric utility resource selection to the impacts of global climate change.[25]

   e) Policies to target a portion of re-marketed or newly marketed hydropower to customers who can demonstrate plans to use their allocations for the direct replacement of fossil fueled electric generation.

   f) Economic modeling by local Land Grant Universities of the benefits and costs of transitioning from coal to natural gas and renewable energy in each PMA's service territory.

   g) Specific plans for water demand management.

   h) How the PMAs will make their planning and decision processes more transparent.

   i) Plans for establishing energy efficiency as a resource to meet power supply obligations, as currently practiced by BPA, and for facilitating energy efficiency improvements by customer utilities.

   j) How the PMAs will increase the public transparency of complying with FERC Order No. 746 on Integrating Variable Energy Resources and to implement sub-hourly scheduling and the use of power production forecasting to more efficiently integrated variable energy resources.

k) How the PMAs are participating in regional transmission planning procedures under FERC Order No. 1000.

Federal Energy Regulatory Commission

1. **Consult with stakeholders**. Increase the involvement of power system stakeholders in creating and updating FERC's strategic plans.

2. **Make ex parte uniform**. Apply ex parte uniformly and reinforce its "permit but disclose" requirements.

3. **Allow decoupling**. Show leadership to states by implementing a decoupling mechanism for FERC jurisdictional revenues. (The federal government supports decoupling in the states but it does not allow for a decoupling adjustment for transmission revenue impacts associated with utility energy efficiency efforts.)

4. **Ensure sustained reliability**. Ensure that ISOs and RTOs under FERC's jurisdiction improve existing market structures so they can support sufficient assets and financial strength to sustain system reliability for the long term.

5. **Create incentives for state-of-the-art transmission**. Implement performance standards, incentive rates, smart grid standards and other policies to ensure that new transmission projects incorporate advanced technologies and state of the art operating practices for safer, more reliable and more efficient transmission systems by 2014.

6. **Put all options on the table**. Develop guidance that helps ensure that all markets (e.g., energy, ancillary services, capacity) and market-makers (utilities) include both demand- and supply-side options. All options—central and distributed generation, transmission, efficiency, and demand-response—should compete with one another to provide electricity services.[26] Orient guidance and rules toward outcomes rather than prescribing specific technologies. Incorporate rigorous measurement standards to ensure that outcomes are met. Outcome-oriented rules will make it easier to bring new products and services into the market.[27]

7. **Identify 21st century rate structures**. Identify but do not prescribe best practices for performance-based utility rate making to help align utility compensation with changing societal priorities, including an increased demand for distributed resources and lower emissions. These emerging priorities threaten to undermine existing utility business models that rely on the growth in demand for traditional energy supplies. Such performance-based regulation should draw as appropriate to each region from the practices established in California, Maryland, and Oklahoma.[28]

8. **Create international and regional dialogues**. Utilize DOE's international engagement to host best practices conference on performance based regulatory models such as the UK's RIIO model involving the National Association of State Energy Officers (NASEO),

the National Governors Association (NGA), the National Association of Regulatory Utility Commissioners (NARUC) and the National Conference of State Legislatures (NCSL). Facilitate regional dialogues with key stakeholders to work through identified critical issues for locally appropriate solutions.

9. **Include mass-market demand in load forecasts.** Create and implement practices for incorporating more mass-market demand-side resources into load forecasting, organized wholesale markets, and resource procurement planning processes to ensure they are fully and accurately integrated into the system, thereby ensuring greater system reliability at lower system cost.

10. **Define "public good".** Lead a stakeholder dialogue on defining and quantifying "public good" and determine whether FERC should embody a quantification of public good in its rules.[29]

11. **Design rules and practices for emerging technologies**. Anticipate the changing needs of the power system with larger shares of the nation's energy coming from wind and solar technologies, driven by market forces and state policies. Guide complementary changes in market rules and operating practices to accommodate these changes in a timely way so as to maximize the value of wind and solar power and avoid inefficient dumping or curtailing of energy from wind and solar capacity.

12. **Provide opportunities for informal exchanges on issues.** Continue to host technical conferences that provide a forum for open conversation about future policy issues rather than relying only on evidence-based hearings and briefs.

Department of Energy

1. **Compare full life-cycle costs of energy options**. As a matter of practice, consider the full life-cycle costs of renewable energy and fossil energy, including factors such as the social costs of carbon, to create a more level playing field for competition between these resources in federal policies, budgets and goals.

2. **Encourage military-civilian collaborations**. Encourage collaborations and joint efforts including federal-state-local power purchasing agreements among cities and military installations to improve local energy security with distributed generation, micro grids, and other technologies (Bates, 13).

3. **Intervene for the President's goals**. Exercise the Secretary of Energy's intervener rights at FERC proceedings to represent positions that will achieve the President's Climate Action Plan and other stated goals.[30]

4. **Keep abreast of the climate/power system relationship**. Continue assessing the interrelationships of climate and the electric power system as additional data, climate science and climate impacts develop.

5. **Develop guidance for power continuity despite disasters**. Collaborate with the FEMA on guidance for PUCs, electric utilities and communities on how to maintain continuity of power for critical services during and after weather-related disasters. Among the options the two agencies should consider are the disaster-response and recovery attributes of renewable energy technologies, distributed generation, micro-grids and "islanding"—i.e., the ability to detach local power systems from electric grids during power disruptions.[31]

6. **Strive for greater transparency in energy decisions**. Improve transparency and stakeholder involvement in decisions that impact industries and the public. An example of where the utility industry felt there was inadequate transparency is DOE's inclusion of the social cost of carbon in recent appliance efficiency regulations.

7. **Find new ways to assist the reinvention of the power system**. Greatly expand the Department's capacity to provide technical assistance to stakeholders in the reinvention of the power system. For example:

    a) Replicate the model of DOE's Industrial Assessment Center program[32] to create expert teams that provide customized technical assistance to utilities as they deal with transition challenges. Include local universities, colleges and technical schools on the teams.

    b) Increase technical assistance to Native American Tribes in utility planning and their negotiations with PMAs and other utilities.

    c) Increase dissemination of technical assistance and information to NARUC, NCSL, NASEO, NGA, the National Association of State Utility Consumer Advocates (NASUCA) and National Conference of Environmental Legislatures (NCEL), and American Legislative Exchange Council (ALEC) on utility business model challenges and policy solutions.

8. **Increase the use of clean electricity at ports**. Work with utilities to identify and overcome barriers to the use of energy efficiency and renewable energy in electrifying the nation's ports.

9. **Calculate the benefits of energy storage**. Quantify the economic benefits for utilities of consumer-scale energy storage and utility-scale storage systems in reducing the need for constructing and operating peaking plants. In addition, quantify the economic benefits of distributed power generation in reducing the costs of building and maintaining transmission and distribution infrastructure.

10. **Help utilities invest in clean transportation**. Work with the Department of Transportation and NARUC to define and expand the roles that electric and gas utilities should play in providing alternative fuels for transportation. Recommend federal and state policies that will allow utilities to invest in the transportation sector, including

infrastructure that supports electric vehicles and the use of electric vehicles for storing electricity.

11. **Align NREL with other agency work on transmission issues**. Ensure that the systems integration and resilience work at NREL lines up with other federal work on the transmission system, as these state of the art system operations should help to justify and reduce the amount of risk in new system investments.

12. **Calculate the value of system resilience to businesses**. Quantify the economic value of increased system resilience and reliability, in regard to avoiding lost productivity in the business sector. Factor that value into benefit-cost analyses of energy efficiency and renewable energy investments and provide the methodology to states and private investors.

13. **Design "high reliability zones" for commercial enterprises**. Work with the Department of Commerce to conceptualize, define and propose "high reliability zones" that are micro-gridded to ensure resilience and reliability in meeting the energy needs of commercial enterprises. Although electric rates presumably would be higher, the zones would provide substantial value to commercial customers, allowing them to avoid costly investments in backup generation. The creation of the zones would provide economic development potential for local jurisdictions. In addition, the zones would demonstrate customer differentiation by service (i.e., reliability) in addition to traditional differentiation of customers as residential, commercial or industrial.

14. **Assess the resources needs of a re-missioned TVA.** Work with TVA's new leadership to assess its resource needs, including staffing levels, if the President decides to provide a new mission for the corporation to demonstrate how new utility business models can be implemented.

15. **Achieve sustainability at scale**. Through FEMP, work with DoD and other agencies to deploy sustainable energy at scale rather than facility by facility. Aggregate and lead toward larger scale and lower costs using the government's purchasing power. For example, focus on a 500-facility solar deployment rather than a single-building solar project. Add up total demand and compute the regional energy credit equivalents.[33]

16. **Support "utility of the future" demonstrations**. In conjunction with NARUC, conduct *Utility of the Future* conferences to engage in open dialogue on the topic of utility business models, similar to the conferences held 15 years ago when retail competition was emerging. In addition, support a "Utility of the Future" demonstration project that features high levels of distributed generation while sustaining reliable electric services for customers. Showcase microgrids, study how to improve customer adoption of advanced energy solutions, and demonstrate software that enables utilities to control behind the meter resources.

Office of Personnel Management

1. **Hire the appropriate skills for 21st century PMAs**. Ensure that the job requirements and performance criteria for general service federal employees in the PMAs emphasize knowledge, skills and abilities that build the PMAs' capacity to carry out the President's goals and the Secretary of Energy's instructions related to building a 21st century electric power system.

2. **Look for PMA managers with both management and technical skills**. Encourage the Qualifications Review Board[34] to look for Senior Executive Service managers in the PMA system who have both executive management experience and technical skills related to the PMAs' responsibilities.

Department of Education

1. **Educate for tomorrow's energy systems**. Invest in the human element of utility management, utility regulation, and the production and use of clean energy technologies by providing guidance to secondary schools, community colleges, technical institutes and universities on incorporating these topics into science, engineering and management curricula.

Department of Defense

1. **Improve communications with civilian utility leaders**. Encourage officials in charge of "greening" its installations to engage in better dialogue with their civilian utilities and state Public Utility Commissions. Industry leaders told CNEE that DoD sends mixed messages by wanting aggressive mission-related investments on the one hand, and low electric rates on the other.

2. **Expedite projects with pre-permitting**. Look for opportunities to pre-permit land for renewable energy projects at military installations, as has been done at Camp Pendleton.

3. **Assess clean energy investments at system-wide scales**. Prioritize renewable energy and energy efficiency investments on a system-wide rather than facility-by-facility basis, scaling investments at cost-efficient levels while also providing grid system benefits such as congestion relief.

4. **Increase use of UESCs**. Make more aggressive use of Utility Energy Service Contracts, which pay initial costs in clean energy investments while avoiding difficulties associated with Energy Savings Performance Contracts. [35]

Department of Homeland Security

1. **Give utilities a point of contact.** Provide utilities with a single point of contact to coordinate disaster resilience, response and recovery.

2. **Allow the military to help utilities after disasters**. Ensure that the military is authorized to transport utility equipment in post-disaster situations.

3. **Give utility crews timely access in post-disaster situations**. Ensure that utility crews are allowed timely access to disaster sites to ensure the safety of electric systems and to restore them as soon as possible.

4. **Link resilience organizations with state energy offices**. Sustain the Department's collaboration with private sector organizations working on the resilience of the power system and plans to restore power after natural disasters[36]; with the energy emergency plans states are required to submit to DOE to qualify for federal formula grants in the State Energy Program; and with the National Association of State Energy Officials (NASEO).[37]

Chapter 6: Alternative Fuels and Vehicles

Key Themes and Recommendations

- A principal mission of national transportation policy should be to develop and deploy *sustainable* non-petroleum fuels, the infrastructure that moves them to market, and the vehicles that use them.

- The President should clearly define his high-level goals for alternative fuels and vehicles, reflecting his energy, climate and security objectives.

- Develop a roadmap that identifies the policies, milestones, performance measures and sequencing necessary to achieve the President's vehicle and fuel goals.

- Establish fuel and vehicle priorities based on full-cost life-cycle analyses of options.

- Make policies and programs flexible enough to evolve with changes in technologies, economics, climate, national priorities and international obligations.

- Alternative fuels and vehicles should not be considered a substitute for other components of a fully developed 21st century transportation system that includes non-vehicular options.

- Federal investments in new fuels and vehicles should be contingent on cost sharing and co-investment by the private sector.

Every U.S. president since Ronald Reagan has promoted the use of alternative fuels (AFs) and alternative fuel vehicles (AFVs). Congress has supported these fuels in legislation going back decades. The objective of the Alternative Fuels Motor Act of 1988, for example, was to increase the development of non-petroleum transportation fuels. The 1992 Energy Policy Act sought to displace 30% of the nation's transportation petroleum use by 2010.[1] The Clinton Administration began raising the issue of carbon emissions from fossil fuels. The Bush Administration advocated the development of hydrogen-powered vehicles and supported Congress's passage of a Renewable Fuels Standard (RFS) to greatly increase the nation's use of biofuels.

The principal motivations for using AFs and AFVs include reductions in transportation

sector emissions of greenhouse gases and criteria air pollutants; public health benefits; and the security and market stability that comes from domestically produced fuels. Some alternative fuels also offer cost savings; others will, too, as work continues to lower the costs of producing and distributing them. For many years, however, the paramount objective has been to reduce the United States' "addiction" to imported oil[2].

Why ending oil addiction remains critical

The United States is expected to transition from an oil importer to world's leading oil producer[3]. That expectation can lead to the mistaken idea that we need not worry about finding alternatives to petroleum fuels. Alternative fuels and vehicles are as important as ever to the nation's economic, environmental and energy security, for several reasons.

First, the EIA projects that if we continue business as usual (BAU), the United States will rely on imported oil far into the future (Figure 1). In EIA's BAU scenario, imports would still provide 37% of the country's liquid fuels in 2040. The EIA estimates that the U.S. could end oil imports by 2040 only with a very aggressive scenario based on very optimistic assumptions.[4] Analysts at the International Energy Agency (IEA) project that in 2035, half of the world's oil supplies still will come from the Organization of Petroleum Exporting Countries (OPEC).[5]

Second, even if the United States used no OPEC oil and even if domestic production allowed us to end all oil imports, we would not be safe from the type of oil supply and price instability that has preceded nearly every U.S. economic recession since World War II. In today's global economy and world oil market, any nation's energy crisis becomes every nation's problem. As the EIA notes:

> *Regardless of how much the United States reduces its reliance on imported liquids, consumer prices will not be insulated from global oil prices if current policies and regulations remain in effect and world markets for delivery continue to be competitive.*

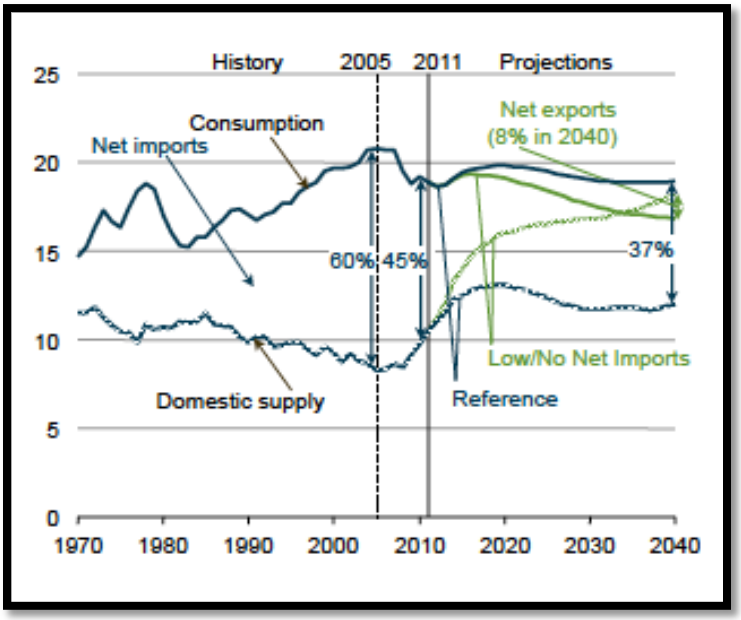


Figure 1: Net Import Share of US Liquids Supply in Two Cases 1970-2040 (million barrels per day) ***Credit: EIA***

Petroleum's Role in Climate Change

A third reason the United States must develop AFs is the world's "carbon budget" – the limit to how much carbon pollution the international community can put into the atmosphere without triggering catastrophic and irreversible climate change. Today, the transportation sector is responsible for about a third of the nation's greenhouse gas emissions; it was the source of more than half of all U.S. greenhouse gas (GHG) emissions from 1990 to 2011. The sector is also a major source of criteria air pollution emissions such as nitrogen oxide (NOx) and particulate matter (PM10).

IEA calculates that if the world continues on its present course, the carbon budget will be exhausted by 2017. Recent scientific research as well as the IEA have concluded that to avoid runaway climate change, roughly two-thirds of the world's proven fossil energy reserves must remain in the ground between now and 2050. In other words, the operative limit to using fossil energy is not how much we have in the ground; it's how much carbon we can put into the sky. By 2020, all nations are expected to agree to limits on their GHG emissions as a result of an international climate treaty. The ongoing negotiations over the treaty have made it clear that other countries expect the United States to make substantial contributions to reducing GHG emissions, since the U.S. economy is fully developed, remains one of the world's largest sources of ongoing emissions, and is responsible for most of the carbon in the atmosphere today.

Fourth, AFs are important to diversifying the nation's transportation energy mix and to making it more stable and sustainable. Fossil fuels are finite. As supplies become scarcer and as competition for them increases, prices will rise. At the same time, the cost of renewable fuels is likely to come down as we improve and produce more of them. Some energy analysts predict the world will never run out of oil; it will just become too expensive to use compared to its alternatives.

Fifth, transportation is a public health issue. According to the American Lung Association, motor vehicles create more dirty air than any other source – about a third of all air

pollution in the United States. Air pollution causes billions of dollars every year in illness and lost productivity. Insofar as vehicles and their fuels contribute to GHG emissions, they also result in a range of public health problems associated with climate change, including heat waves that are already the nation's No. 1 weather-related killer.

Sixth, this is the moment for the United States to clearly identify its vehicle, fuel and infrastructure priorities for the future. In its latest report card, the American Society of Civil Engineers calculated that the nation must invest $3.5 trillion by 2020 to repair and improve its infrastructure, including more than $1.7 trillion on surface transportation, $100 billion on rail, $134 billion on airports and $736 billion on the electric system. The objective should not be to repair the nation's infrastructure for transportation technologies of the past, but for the advanced technologies, fuels and mobility systems the United States will need for the rest of this century.

Finally, with world demand for passenger vehicles rapidly growing at the same time GHG emissions must come down, there is likely to be a massive global market for AFs and AFVs. Bloomberg New Energy Finance estimates that global venture capital and private equity investment in advanced transportation has totaled $4.5 billion since 2007. The United States could dominate this market if developed the technologies and energy resources for post-petroleum advanced transportation systems.

Automobiles are here to stay

Clean and equitable mobility in American society has many dimensions including how cities are planned and built; whether citizens of all ages, income levels and abilities have equal access to the necessities and amenities of modern life; the extent to which public transportation and non-vehicular mobility options will be needed to reduce traffic congestion and associated losses of productivity; whether the Internet and emerging communications technologies will reduce job-related travel; the introduction of innovative developments such as urban vehicle sharing; and the lifestyle preferences of adults and families.

In any planning scenario, however, public policy should be based on the assumption that wheels, rails and wings will remain a major part of the transportation sector worldwide. The United States' love affair with the passenger vehicle has become the world's love affair; we can assume that vehicular travel is here to stay, but with far more efficient vehicles powered by cleaner and more sustainable sources of energy.

In its Annual Energy Outlook for 2013, the EIA reference case scenario predicts that by 2040, biofuels' share of total U.S. liquid fuels consumption will grow from 3.5% in 2011 to 5.8%; efficiency will increase nearly 2% in new cars and 1.6% for new light trucks.[6]

But for all the reasons mentioned above, the United States must strive for vehicle efficiencies and non-petroleum fuels at much higher levels than that.

The President's Imprint

President Obama's leadership over the last five years already is triggering a transformation in America's transportation sector. In the President's first term, his Administration nearly doubled fuel economy standards to require that by 2025, new cars and SUVs must average at least 54.5 MPG. By September 2013, the average fuel economy of new cars and trucks had climbed to 24.9 MPG, up from 20.1 MPG in 2007, according to a study by the University of Michigan. The historic new standards are being met by changes in the weight of the vehicles and the engines that run them, along with an increase in the number of hybrid and electric vehicles sold in the United States. The Environmental Protection Agency (EPA) and the National Highway Traffic Safety Administration (NHTSA) project that the new efficiency standards will:

> *…save families more than $1.7 trillion in fuel costs and reduce America's dependence on oil by more than 2 million barrels per day in 2025, which is equivalent to one-half of the oil that we currently import from OPEC countries each day. In addition, the combined program will cut 6 billion metric tons of greenhouse gases over the lifetimes of the vehicles sold in (model years) 2012-2025 – more than the total amount of carbon dioxide emitted by the United States in 2010.*

Other Administration initiatives have included:

- A Clean Energy Grand Challenge-EV Everywhere program designed to make electric vehicles as affordable and convenient as gasoline powered vehicles for the average American family by 2022.

- Requirements that all federal government fleet purchases must be AFVs by 2015 and that federal agencies must cut their petroleum consumption by 30%.

- The first-ever efficiency and greenhouse gas emission standards for heavy-duty vehicles starting in 2014.

- The allocation of $19.5 million to help cities and towns expand the use of alternative transportation fuels and electric vehicles. The funds were designed to help 10-20 localities expand fueling infrastructure for alternative fuel vehicles by cutting red tape, streamlining permitting, and training mechanics, first responders and safety officials.

- A proposal to work with the private sector to develop up to five natural gas corridors along U.S. highways to support natural gas heavy-duty truck operations.

- The now-accomplished goal to break ground on four commercial-scale cellulosic or advanced bio-refineries to bring advanced biofuel production to commercial scale.

- A proposed Energy Security Trust (not yet created by Congress) that would divert $2 billion in revenue from federal oil and gas royalties over the next decade to fund research to "shift our vehicles off oil for good".

- Enforcement of the RFS with the result that ethanol accounted for about 9% of U.S. gasoline by volume in 2012.

- A proposed $1 billion National Community Deployment Challenge to catalyze 10-15 model communities to invest in, create incentives for and remove barriers to alternative fuel vehicles and infrastructure. If funded by Congress, the Challenge would support the development of five regional liquefied natural gas (LNG) corridors to make the fuel available to long-haul trucks.

President Obama's announced goals for transportation fuels include cutting oil imports in half by the end of this decade compared to 2008; putting 1 million electric vehicles on America's roads by 2015; continuing to increase the fuel economy of heavy-duty trucks; and making cellulosic biofuels a major contributor to transportation energy.

Partly as a result of President Obama's leadership and partly because of the legislative and executive actions that preceded him[7], alternative fuels and vehicles already are being integrated into the nation's transportation system. As the Energy Security Leadership Council[8] (ESLC) notes:

> *Federal government spending on advanced vehicle research, development, and deployment (RD&D) alone has totaled more than $2.4 billion since 2000. Economic stimulus programs designed to support manufacturing of AFVs and their components have contributed an additional $11 billion in grants and low-interest loans to the public sector total since 2009...Acquisitions contribute an additional $600 million to the private sector total.*

Federal Government purchases of AFs and AFVs creates larger markets, resulting in the production of more vehicles, which results in economies of manufacturing scale and lower prices. A key contributor to this positive chain of development is the Department of Defense (DoD) – the biggest institutional energy consumer in the world. Its goal is to obtain 25% of its energy from renewable resources by 2025. The Navy plans to have a "Great Green Fleet" powered by biofuels and nuclear energy by 2016. By 2020, the Navy plans to obtain 50% of its total energy from alternative resources. The Air Force plans to obtain 50% of its domestic aviation fuels from alternative energy, including blends of biofuels and jet fuels.

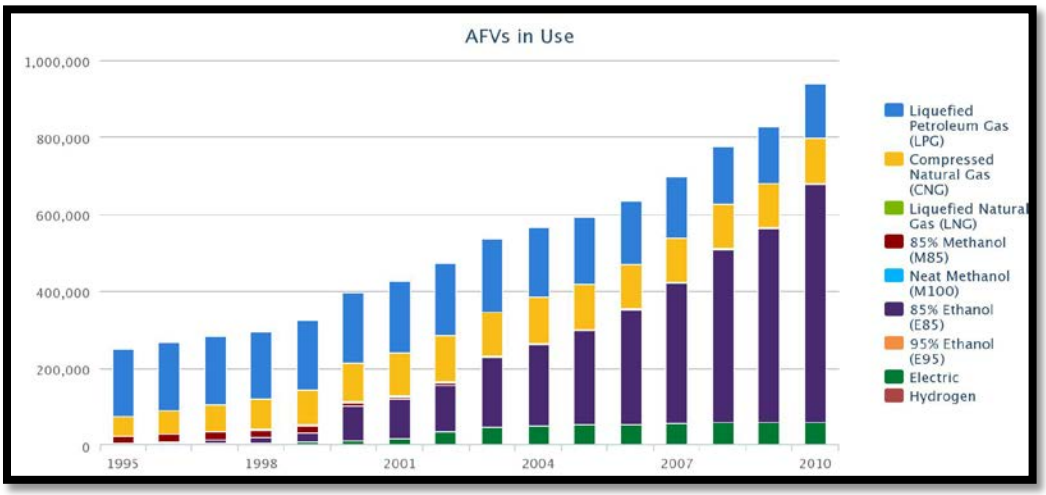


Figure 2: Alternative fuel vehicles in the U.S., 1995 to 2010. ***Credit AFDC***

Other Issues on the Radar

There are differing views on how and where federal resources are best applied to increase the sustainability of the U.S. transportation system. It is critical that policy makers look at the entire value chain of a new fuel or vehicle to ensure that investments to produce more problems than they solve. For example, the climate benefits of electric vehicles are undermined if the electricity is generated with carbon-rich fuels. The efficacy of biofuels depends the amount of fossil energy used in their production and the indirect effects of feedstock production, such as land use change. The carbon benefits of natural gas fuels depend on how much methane is emitted during their production, transportation and storage and by refueling equipment, as well as the efficiency of natural gas vehicles (NGVs). The prospects for all AFs are affected by the cost, practicality and environmental impacts of the infrastructure needed to bring them to consumers.

The investments of taxpayer funds should be informed by analyzing all benefits and costs over the life cycle of each fuel and vehicle. Time, talent and treasure will be most productive if they are applied to removing roadblocks in the way to an AF or AFV achieving a national objective, private investment and commercial competitiveness. And federal investments in these new fuels and vehicles should adhere to "good stage gating" – in other words, helping a fuel or vehicle technology graduate to its next level of scale only when it is ready.

Recommendations for Presidential Action

Crosscutting Recommendations

Among the experts CNEE engaged, there was no doubt that far more can be done to achieve the President's energy and climate goals with AFs and AFVs. Several potential executive actions cut across the variety of fuel and vehicle options.

1. **Identify clear national objectives.** Direct the White House Council on Environmental Quality (CEQ) to lead an exercise in which DOE, the Department of Transportation (DOT) and the EPA collaborate on developing clear national performance goals for alternative fuels and vehicles and identify where federal resources are best applied. Instruct CEQ to consider these performance criteria, among others:

   a) The overall life cycle carbon intensity of the AF or AFV must be substantially lower than petroleum;

   b) The AF or AFV must be able to scale to meaningful size to merit federal attention. The criteria would exclude niche solutions and measures, particularly where resource constraints are likely to limit the ultimate scale of the solution;

   c) The AF or AFV must not rely on extended subsidies to compete in the marketplace;

   d) The AF must be domestically produced with a strongly positive Energy Return on Investment (ERI) ratio; i.e., it must produce significantly more energy than it takes to make it and deliver it to consumers.

2. **Don't gamble on uncertainties.** Instruct agencies that in setting national priorities for energy resources generally and for transportation fuels in particular, the Administration will not rely on unproven or commercially unavailable technologies – for example, reducing the climate impact of a fuel with carbon capture and sequestration. One objective of setting performance-based goals rather than fuel-specific goals should be to avoid assumptions about unproven or insufficiently scaled technical fixes to GHG emissions.

3. **Frame the national conversation.** In the State of the Union address and in ongoing presidential communications, make the President's transportation objectives so clear and compelling that they become household concepts, including how they will benefit us as a nation, communities and families. Participants in CNEE's dialogue suggested these messages and themes:

   a) The resilience of the nation's economy and energy supplies depends on diversifying our fuel sources and vehicle technologies.

b) The overarching goal of transportation policy should be to help the American people achieve energy security, economic security and environmental security.

c) Petroleum has a place in the nation's foreseeable energy future, but we must become far less dependent on it. No matter how much we produce at home, we remain vulnerable to the world oil market and its volatility.

d) Alternative fuels and vehicles are another area of emerging technology in which the United States can lead the world. New jobs and industries are the prize when we capture a rapidly growing global market. If we don't lead, other nations will, with the new jobs and economic opportunities that leadership provides.

e) The United States has a history of bipartisanship on energy and environmental policy and it's a record we should continue. Every president of every party has aspired to increase the nation's energy security. Many of the most important environmental laws in force today were passed with bipartisan support in Congress and during Republican administrations. These are not partisan issues.

f) We need greater security not only from high gasoline prices, but also from air pollution that endangers the health of our children, from the oil conflicts that have forced so many American generations into war, and from global climate change that endangers our future. It is our obligation as leaders to get on with the job and not let partisanship keep us chained to the instability and insecurities that have been so much a part of our energy history.

g) This is not a matter of new industries versus old industries. All of our energy and vehicle industries should have skin in this game. Today, our traditional automakers are researching and producing vehicles that are achieving historic levels of efficiency. Companies are developing commercially competitive fuels made from what we once considered wastes. The future of transportation in this country will be invented not only by entrepreneurs and new businesses, but also by older companies willing to venture into new lines of business and new markets.

h) We already are seeing a new era of reliable, clean and secure transportation energy emerging in America. Natural gas vehicles. Biodiesel vehicles. Electric vehicles that can travel 200 miles or more on a single charge. Algae being turned into green petroleum. Materials and lands we used to consider wastes producing ethanol fuels. Wind and solar farms providing electricity for plug-in cars. New fuels, new industries, new jobs, new crops and markets for farmers, and new revenues for rural counties.

4. **Create an alternative fuel and vehicle roadmap and an action plan to achieve national objectives**. Researchers, investors and manufacturers need a clear national strategy—a roadmap—that identifies the paths to achieving the Administration's transportation objectives. The President can direct DOE to engage its National Laboratories along with EPA, DOT and the U.S. Department of Agriculture (USDA) to

develop such a roadmap based on empirical analysis of the most cost-effective investments to achieve the President's goals on climate, economic and energy security.[9] As one CNEE participant put it, this should not be an AFV 101 document; it should be strategic and specific, identifying challenges, goals and milestones. The roadmap should:

a) Identify systemic as well as policy-related barriers to full commercialization of these fuels and vehicles.

b) Include an action plan that assigns specific jobs and crosscutting responsibilities to each relevant federal agency.

c) Use BTU-equivalent rather than volumetric goals.

d) Focus on a broad set of clear high-level goals.

e) Move government policy from "an era of picking winners to an era of understanding what we need to achieve," in the words of one participant.

f) Make a compelling case for why we need changes in America's transportation system.

g) Identify inconsistencies in federal policies and how to resolve them. For example, how do federal goals for reducing GHG emissions from power plants relate to water rules that would inhibit nuclear power generation? Also address synergies, overlap or contradictions between federal and state policies – for example, federal incentives for purchasing plug-in electric vehicles at the same time some states tax the vehicles because the aren't subject to a fuel tax.

h) Include critical inputs from industry in a process modeled on DOE's Industries of the Future Program.[10]

i) Engage state and local agencies that have been in on the front line of promoting AFs and AFVs. The experiences and lessons of leading states can guide federal efforts to coordinate and facilitate AF and AFV promotion and demonstration programs at the state and local levels.

j) Define near-, mid-, and long-term goals that are properly stage-gated (see the section on this topic later in this paper). One participant recommended work on a few specific goals each year and getting them done before moving to a new set of goals.

4. **Lay groundwork for the roadmap**. To lay the groundwork for the roadmap, the Administration can take these steps:

a) Identify or create a protocol to quantify the full life-cycle benefits and costs of alternative fuel options to provide a framework for federal, state, local and private fleet policies. Analyze the full array of environmental, economic and social factors, including social equity; direct and indirect net job creation; the likelihood of consumer acceptance based on factors such as cost, convenience, quality, performance and practicality; net impacts of extracting or cultivating, processing and distributing each AF; environmental impacts associated with combustion and emissions; the long-term availability of fuel supplies and the natural resources necessary to produce fuels and vehicles at scale; the ability to reduce oil imports; each option's mid-term ability to compete economically with petroleum fuels; and the cost of developing the necessary infrastructure to move fuels to market.[11] Assess how these costs vary by region. Where possible, use or improve existing studies and tools such as Argonne National Laboratory's (ANL's) GREET model.[12]

b) Use this assessment to develop priorities and goals for the improvement of each fuel and vehicle option in areas where they fall short. Ensure that efforts are properly stage-gated.

5. **Conduct and publish scenario analyses of inter-sector fuel and vehicle alignments.** Develop and assess scenarios in which AFs, AFVs and their infrastructures are aligned with related national priorities such as distributed power generation, system resilience, climate change adaptation, air quality, water and soil conservation, forestation and reforestation, agriculture policy, and high-performance buildings.[13]

6. **Monitor the scientific debate** on and evaluate the benefits of using Technology Warming Potential (TWP) as well as Global Warming Potential (GWP) to reveal the radiative forcing of each fuel option and the time-dependent tradeoffs inherent in AFs.[14]

7. **Improve full life cycle cost analysis for AFV purchases.** In July 2013, the Government Accountability Office (GAO) reviewed the fleet management practices of several federal agencies and found that:

   Most of the selected agencies are not fully analyzing life-cycle costs to make decisions about when to replace vehicles. In addition, although most of the selected agencies use life-cycle cost analyses to decide whether to lease or purchase vehicles, some agencies' analyses do not consider a full set of costs.

8. **Redefine life cycle costing**. In federal fleet decisions, life-cycle calculations should go beyond determining when vehicles should be replaced. The General Services Administration (GSA) should direct agencies to apply **full-cost** life cycle analyses when choosing AF fleet vehicles.[15] GSA should define "full cost" as the benefits and costs related not only to the economics of each vehicle's operational life, but also to factors that traditionally have been externalized such as the social cost of carbon and the impacts on the "triple bottom line" of economic, environmental and energy security.

9. **Strengthen leadership on advanced transportation fuels and technologies.** If by the time this paper is issued, DOE has not selected a Deputy Assistant Secretary for Advanced Transportation within the Office of Energy Efficiency and Renewable Energy, it should expedite the hiring. The Deputy Assistant Secretary should be charged with overseeing and managing DOE's alternative fuel and vehicle programs including EV Everywhere; related research by the Advanced Research Projects Agency-Energy (ARPA-E)[16]; and the Fuel Cells Technology, Vehicle Technologies, Biomass and Clean Cities Programs.[17] The Deputy Assistant Secretary should align program priorities with the findings in Recommendations 1 and 4 above (setting objectives and developing a roadmap) to ensure that resources are being directed to where they will produce the most benefit.

10. **Champion tax parity** for the most beneficial non-petroleum fuels and vehicles as an essential element of tax code reform: In this context, tax parity should be defined as providing tax incentives for alternative fuels at least as substantial as those provided to petroleum fuels. Tax parity would not mean equal treatment for all alternative fuels; it would mean that all fuels are evaluated with the same benefit-cost analysis. Tax incentives, if any, would be based on the degree that each fuel would contribute to national goals such as greenhouse gas reductions.

11. **Recognize and reward leadership.** Create a President's Award presented annually at the White House to the companies, states or communities that most contribute to the nation's transition to sustainable transportation fuels and vehicles. Feature case studies of nominees on the White House website.

12. **Raise the visibility of the Clean Cities program.** DOE's Clean Cities program was launched during the Clinton Administration to solve the chicken-and-egg problem in deploying alternative fuels and vehicles. The problem is this: Fuel providers won't build fueling sites unless there are sufficient numbers of vehicles on the road and using the fuels; fleet owners and consumers won't buy AFVs if they can't conveniently refuel them; and vehicle manufacturers won't build AFVs unless there is consumer demand.

    Clean Cities uses the Federal Government's convening power to break the impasse. It helps communities get all the important stakeholders to the table at one time to make deals: Fuel providers agree to build fuel and service infrastructure; fleet managers agree to buy the vehicles that will use the fuels; and equipment manufactures agree to make the vehicles available. The program also provides technical assistance, information, networking and other services.

    Clean Cities has helped start nearly 100 coalitions. Its participating cities contain 74% of the nation's population. The President should raise the visibility of the program and encourage more communities to join, perhaps by visiting cities with the most successful coalitions.

13. **Set research and deployment priorities**. Direct the Secretary of Energy to prioritize additional research and deployment efforts for AFs and AFV technologies at DOE's National Laboratories. In regard to infrastructure, NREL has identified the following topics where additional research is needed:

    a) Improved decision-making for investments in fuel production and retail infrastructure, based on the evaluation of fuel-specific costs, technical challenges, market opportunities and barriers, policy and financing mechanisms, and environmental and social effects.

    b) The inclusion of infrastructure change intensity in the selection criteria for various energy options.

    c) How to assess fuel infrastructure expansion costs in the context of the total cost of driving including fuel costs, vehicle ownerships costs, and environmental and social impacts associated with fuel use and transportation services.

    d) A better understanding of consumer vehicle purchase decisions and the influence of spatial proximity and geographic coverage of different types of refueling infrastructure in different locations with different refueling times and vehicle ranges.

    e) The potential role of public-private partnerships (including involvement of utilities or current fuel providers) in supporting infrastructure planning and expansion, and in overcoming market barriers.

    f) Understanding markets for various vehicles and fuels at a geographically detailed level, to factor in region-specific effects on technology rollout and the potential for regionalized markets, including the influence of state and local policy incentives.

14. **Base Standards on "Whole Vehicle" Characteristics**: When establishing fuel-economy standards for heavy-duty trucks beyond 2018, apply them to the entire truck system – i.e., to trailers as well as cabs. Base the proposed post-2018 standards on lessons learned so far in DOE's Supertruck and the multi-agency 21st Century Truck Partnership programs.[18]

15. **Base Standards of "Whole Value Chain" Impacts**: When establishing GHG emission standards for vehicles, include methane emissions not only from the tailpipe but from the entire vehicle system – refueling, fuel tanks, and so on – to prevent fugitive methane releases.

Fuel-Specific Recommendations

Natural Gas:

1. **Promote near zero emissions strategies for natural gas engines to improve overall carbon and criteria air emissions performance.** The California Air Resources Board recently adopted new optional low oxide of nitrogen (NOx) standards[19] for on-road heavy-duty engines to incentivize the production of engines capable of reducing NOx emissions 50% to 90% below federal and California 2010 heavy-duty engine emissions standards. EPA could adopt a similar approach that would establish both carbon and criteria emissions incentive targets for natural gas engines, promoting more efficient engine designs and platforms that could produce zero emission-like performance. In line with the President's request that the Energy Secretary challenge our brightest engineers, scientists and entrepreneurs to produce new breakthroughs for NGVS, DOE should also consider supporting research, development and demonstration projects similar to the California Energy Commission's PIER Program's funding of flexible electro-hydraulic valvetrain ("camless" engine) designs that achieve breakthrough thermal efficiencies and ultra-low emission levels.[20]

2. **Promote and integrate Renewable Natural Gas use in the transportation sector.** The California Air Resources Board identifies Renewable Natural Gas (RNG), or biomethane, as an ultra low carbon fuel that can provide up to 88% less carbon emissions than petroleum-based fuels when powering a natural gas truck.[21] RNG is also the only commercially available cellulosic biofuel that can power an 18-wheeler while not being subject to a blend wall restriction that impairs an engine's warranty. Given that EPA has identified heavy-duty vehicles as the fastest-growing contributors to greenhouse gas emissions in its recent heavy-duty fuel economy standards[22], it is critical that federal policies help incentivize and advance RNG production from landfills, wastewater treatment facilities, and agricultural waste streams by removing barriers to private capital. Market mechanisms that would encourage private capitalization of RNG projects through the establishment of a national green bank, a national low carbon fuel standard and continued support of the Renewable Fuels Portfolio (RFS) program should be considered. It is also important that the proposed 2014 Renewable Fuel Volume Obligations (RVO) for Cellulosic Biofuels under the Renewable Fuels Standard (RFS-2) be amended to accurately reflect RNG volumes dedicated for transportation fuel in 2014.

3. **Encourage engine manufacturers to develop natural gas applications to power production equipment and other off-road applications.** Direct DOE and EPA to work with the oil and gas industry to identify the costs and benefits of using excess natural gas at well sites to power off-road vehicles and other equipment used in oil and gas production and transport. Examples include generators, drilling rigs, the pumps used in hydraulic fracturing, bulldozers and other excavation equipment, fork lifts, locomotives, and marine vessels.

4. **Study and find solutions for potential leaks in vehicle refueling infrastructure.** Direct EPA to investigate any potential methane leaks from natural gas vehicle refueling infrastructure and recommend improvements in the equipment; and to determine whether a rulemaking is needed to require closed-loop or industrial ecology designs for refueling infrastructure. Advise EPA that these actions should be completed as soon as possible so that RD&D projects can help address any potential methane leak issues as the Administration promotes the use of natural gas fuels.

5. **Support the President's call to work with private industry to develop five natural gas fueling station corridors.** Encourage the development of public-private partnerships that promote corridors that utilize best NGV infrastructure practices learned from proposed EPA methane leak studies.

Alternative Fuels from Renewable Resources:

1. **Continue supporting the accelerated development of advanced biofuels.**

   a) Promote the classification of algae cultivation as a form of agriculture.

   b) To establish RD&D priorities, direct DOE, USDA and EPA to develop more precise definitions of advanced biofuels, differentiating between those produced from biomass vs. non-biomass substances; to identify the relative net GHG emissions impacts of each type of biofuel; and to intensify their work to help the most beneficial fuels achieve commercialization and scale.

   c) Direct DoD and other federal agencies to expand the market for high-value advanced biofuels by using them wherever they are suitable and cost-effective.

   d) Direct the appropriate federal agencies to modify policies, permitting, and certification practices to enable a more level playing field for high-value advanced biofuels while avoiding fuel-specific policies that make it challenging for new fuels to evolve.

2. **Identify anticipated climate impacts on the nation's biomass potential.** Direct USDA, DOE, the U.S. Geological Service (USGS) and the National Oceanic and Atmospheric Administration (NOAA) to collaborate on identifying the impacts that global climate change are likely to have on the nation's ability to produce bioenergy at the levels identified in the 2011 "Billion Ton" study.[23]

3. **Address land use change issues.** Since 2008, significant efforts have been made in United States and Europe to use economic models to identify the impacts of land use changes. Recent studies have reached contradictory or inconsistent conclusions about emissions related to land use. Direct EPA, USDA, and DOE to conduct a scientific review of recent land use change studies and to suggest where additional research is needed to resolve the studies' differences.

4. **Address the food vs. fuel issue.** The United Nations Food and Agriculture Program has developed strategies and tools including a Climate-Smart Agriculture Sourcebook and a Bioenergy toolkit for the co-production of food and energy feed stocks on croplands. The program's specialists contend that with proper management, there need not be competition between food and fuel on these lands. Other experts emphasize that food vs. fuel conflicts cannot be avoided in monoculture corn ethanol production. Direct USDA to evaluate the UN's findings and materials, as well as the findings of other nations and international experts, and to distribute the most credible information to farmers and biofuel producers in the U.S. Also distribute information on low-risk energy feedstocks, sustainable land-use management and efficient biofuel processing methods.[24]

5. **Apply full-cost farm-to-vehicle accounting to biofuels.** Full-cost accounting for biofuels involves specialized analysis and analytic tools. Direct USDA to report to CEQ on its work to date on full-cost accounting for biofuels. Direct CEQ to evaluate USDA's work and methodology based on current science and technology and to assist with improvements if any are needed.[25]

6. **Align biofuel policies with related priorities.** Direct USDA, EPA, and DOE to report to CEQ on how they align bioenergy programs and policies with related policies in forestry, rural development, water conservation, climate change mitigation and sustainable energy. Direct CEQ to recommend improvements if necessary.

7. **Create a new category of biofuels that covers fuels produced from non-biomass resources.** Direct EPA to determine whether it has the administrative authority to create a specific category in the RFS to cover biofuels made from non-biomass resources, such as those produced from industrial emissions of carbon dioxide. If it does not have that authority, direct EPA to make the distinction for the purposes of its work and propose that Congress amend the RFS to create the new category.

Electric Vehicles:

1. **Support EV charging with CMAQ funds.** Through the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA), prioritize funding from the Congestion Mitigation Air Quality Improvement (CMAQ) Program for solar-powered electric vehicle charging stations in both nonattainment areas and states that have no nonattainment areas but are still eligible for funding under the MAP-21 (Moving Ahead for Progress in the 21st Century) Program. To make best use of federal resources, target funding for charging stations first at work places, followed by homes, commercial places and in-transit applications.

2. **Develop model charging regulations.** Direct DOE to work with the utility sector on model regulations to ensure that electric vehicle charging is efficient and delivers GHG emission savings.

3. **Draw on utility and state experience to effectively target PEV incentives.** One large utility participating in the CNEE dialogue has found that buying down the cost of electric vehicles, for example with rebates, is the most effective way to incentivize PEV adoption. Direct DOE to gather lessons from other states and utilities to more effectively target federal incentives.

4. **Conduct education on PEVs.** Direct DOE, DOT and EPA to conduct a public education program that corrects misinformation and addresses consumer concerns about hybrid and electric vehicles. Include information on the overall savings of money, energy and greenhouse gas emissions consumers can achieve by owning electric vehicles and charging them with distributed solar energy systems.

5. **Electrify heavy-duty vehicles.** By one estimate, a fifth of the transportation fuel consumed in the United States is used by medium- and heavy-duty trucks. The electrification of these vehicles should be an important component of the Administration's efforts to reduce air pollution and oil consumption, particularly for regions needing dramatic cuts in greenhouse gases and other air emissions. Direct DOE to redouble its work with truck manufacturers and the trucking industry on a range of electrification options, including hybrid-electric trucks that take advantage of regenerative breaking; battery-powered electric trucks for short-haul applications; fuel cell electric trucks; battery powered auxiliary power; and external electric power in which trucks run on systems similar to trolley cars and light rail.

6. **Produce a consolidated roadmap for PEVs.** The Crosscutting Recommendations earlier in this paper propose that the Administration develop an AF/AFV roadmap**.** In regard to PEVs, the Administration can build upon work that's already been done by several organizations. For example, the American National Standards Institute (ANSI) issued a *Standardization Roadmap for Electric Vehicles Version 1.0* in April 2012*.* It offers guidance on how to standardize energy storage systems, vehicle components, charging systems and several other components of vehicles and infrastructure. The ANSI document also lists 52 "gaps and recommendations" that need further attention. In addition, Congress has directed the National Academy of Sciences to study how to remove barriers to EV deployment[26] and DOE's Vehicle Technologies Office has produced a series of technical roadmaps for AFVs. Direct DOE to work with these organizations and other key stakeholders to produce a consolidated PEV roadmap that addresses how federal, state, public utility commissions (PUCs) and utility policies can advance the use of PEVs while keeping abreast of ongoing technical advances in these vehicles and their infrastructure.[27]

Hydrogen Fuels:

2. **Develop hydrogen infrastructure.** One of the key findings from the 2013 National Academy of Sciences Committee Report on Transitions to Alternative Vehicles and Fuels is that a failure to build a minimal hydrogen infrastructure would kill the fuel cell market. California is in the process of building 60 hydrogen stations to allow the fuel

cell market to develop there. Direct DOE to use California's plan as a template to work with other states on building hydrogen infrastructure.

3. **Correct safety perceptions.** Direct agencies involved in communicating with the public about AFs to correct misinformation about the safety of hydrogen fuels.

4. **Use renewable energy in hydrogen production.** Direct DOE to work with the hydrogen and renewable energy industries to promote the use of renewable energy to produce hydrogen. Publicize the relative greenhouse gas impacts of different hydrogen feedstocks to emphasize that the fuel's climate benefits depend on how it is produced.

Agency Actions

White House Council on Environmental Quality

1. **Protect habitat.** Develop guidance on minimizing negative impacts of biofuel feedstock production on land, water, wildlife and other natural resources. Direct that agencies with responsibilities to protect these resources incorporate CEQ's guidance into their plans and policies. For example, engage the U.S. Fish and Wildlife Service in developing habitat credit markets that encourage private transactions to protect areas that could be impacted by the production of biofuel feedstocks.

Department of Energy

1. **Develop a low-carbon fuel strategy.** In collaboration with CEQ and EPA, develop low-carbon fuel performance goals for the roadmap proposed in this paper's Crosscutting Recommendations. Annually rank the ability of current fuel and vehicle options to meet the performance goals. The purpose of this effort will be to encourage continuous carbon performance improvements for alternative fuels and to help guide federal, state, local and private investments in the highest-performing fuels and AF infrastructure.

2. **Expand second lives for batteries.** Direct the National Laboratories to proactively seek cooperative research and development agreements (CRADAs) with industries to develop second-life applications for batteries used in PEVs and in stand-alone solar energy systems.

3. **Target monetary and technical assistance to most effectively support the President's EV goals.** For example:

    a) Demonstrate "fast chargers" in DOE-funded PEV demonstration projects.[28] Require that the projects document the costs, benefits and effectiveness of the chargers.

    b) Work through State Energy Offices to help PUCs "harmonize technical standards, streamline the installation of household and commercial charging stations, and use

electricity rate structures to promote charging at off-peak hours."[29] Direct the Tennessee Valley Authority and Power Marketing Administrations to demonstrate and encourage these regulatory frameworks for their customers.

4. **Push for greater use of ESPCs.** Direct the Federal Energy Management Program (FEMP) to identify those AFs and AFVs that provide energy cost savings and promote greater use of ESPCs to purchase those vehicles.

5. **Change Erroneous Public Perceptions about AFVs.** In events, blog posts, op-eds and news releases involving the Secretary, conduct a communications campaign that:

   a) Recasts the value of PEVs and HEVs among policy makers. CNEE's research identified concerns about how policy makers perceive PEVs and HEVs. "PEVs are generally associated with environmental benefits and are thus not at the top of the agenda for every decision maker in every state," said one source.[30] "A small investment in broadening PEV advocacy programs could go a long way."

   b) Demonstrates that today's AFVs are robust**.** Show how AFVs and AFs being used by NASCAR, the military including Marines in Afghanistan, and heavy-duty trucks in well known fleets such as Federal Express. Schedule photo ops and visits by the Secretary to exemplary AF and AFV deployments, including visits to military bases with the Secretary of Defense. Propose that the President highlight military applications of renewable energy and fuels in his next State of the Union address.

   c) Spotlights successes. Publicize case studies of cities and regions that are achieving quantifiable benefits to their economy, energy security and environment because of AFs and AFVs.

6. **Continue aggressive research into vehicle efficiency features such as aerodynamics and the use of lightweight materials.** Direct the National Laboratories to be proactive in seeking CRADAs[31] on advanced vehicle designs and materials that reduce transportation energy demand.

7. **Provide intermodal assistance to more demonstration communities.** Direct the National Laboratories with relevant expertise to provide technical assistance to cities that are developing low-carbon intermodal transportation systems, including AFVs.[32] Give priority to cities enrolled in DOE's Clean Cities program.

8. **Provide states and localities with guidelines on right-sizing their mobility systems.**[33] Work with the interagency Partnership for Sustainable Communities to develop and distribute information on how cities can "right size" their multi-modal transportation systems.[34]

9. **Offer an X Prize for PEV charging.** Set aside a portion of State Energy Program grants in the next grant cycle to provide a cash award to the first city and utility that collaboratively achieve the large-scale integration of electric vehicle charging stations

in the electric grid. Require that the winning project include residential as well as commercial and municipal recharging facilities and that the utility demonstrate the use electric vehicles for power storage.

10. **Prepare for advanced biofuels**. Use the Section 1703 or Section 1705 loan program to finance one or more projects that demonstrate innovative processes to produce advanced biofuels from renewable feedstocks.

11. **Offer strategic support to clean fuel corridors.** One expert in the CNEE exercise observed that fuel providers cannot make good economic investments in clean fuel corridors without sufficient business from high-volume fleets such as long-haul trucking companies. Instruct the Clean Cities program to help the developers of clean fuel corridors assess high-value fleet traffic along the corridors and obtain refueling commitments from fleet operators. Encourage highway officials to provide incentives for AFs, for example toll exemptions for heavy-duty AFVs using the corridors.

12. **Inform EV infrastructure design.** Assign the National Laboratories to assess current research on the drawbacks and benefits for utilities of integrating distributed renewable electric EV charging stations into the grid. Based on the assessment, develop guidelines for the Clean Cities program to help communities plan EV charging infrastructure in ways that mitigate drawbacks for the utility power system.[35] Also develop guidance for GSA to use in advising agencies on how to properly install charging stations at federal facilities.

13. **Conduct a user survey on the AFDC.** One participant in the CNEE dialogue suggested the public needs a more user-friendly centralized information resource that consolidates AF and AFV incentives nationwide, offers brief overviews of those incentives, and provides ready access to the Federal Government's existing resources – for example, the information at: www.fueleconomy.gov. Instruct the AFDC to add a feature to its website that invites users to offer recommendations for the site's improvement.

14. **Promote AFs for freight.** Direct FEMP and GSA to help agencies integrate AFs and AFVs into the procurement of freight and package delivery services.

15. **Incorporate AFs in disaster preparedness.** In the next program year guidance for formula grants in the State Energy Program, encourage states to define the potential roles of AFs and AFVs in their energy emergency preparedness and energy assurance plans –for example, the contribution AFs can make to state and local energy security in the event that supplies of traditional fuels are interrupted by natural disasters or international conflicts.

16. **Address local code issues that inhibit the availability of hydrogen fuels.** Ensure that the Clean Cities program helps local officials identify and modify local codes that make it difficult to build hydrogen refueling stations due to misconceptions about safety.

Department of Transportation

1. **Build public support for additional fuel economy standards.** Have the NHTSA lay the political groundwork for mid-course review of Model Year 2017-2025 fuel economy standards for passenger vehicles and light-duty trucks by publicizing data and case studies about the significant benefits that consumers and the country have received from the standards so far.

2. **Support AF corridors on the Interstate Highway System.** In a collaboration between the Federal Highway Administration, DOE and the Clean Cities program, increase technical support and when possible financial support to organizations working to create successful alternative fuel corridors along the Interstate Highway System and other major transportation routes.[36]

Department of State

1. **Support reductions in aviation carbon.** Publicly support the latest version of the European Union's aviation carbon tax plan and advise the President whether the United States should create a similar plan for flights through U.S. air space. [37]

Environmental Protection Agency

1. **Create a "Golden Carrot" for advanced biomass fuels**. In collaboration with DOE and USDA, offer a significant cash prize for the breakthrough that most contributes to the successful commercialization of cellulosic biofuels.[38] Determine whether funds in the Section 1703 and 1705 loan programs at DOE can be used for this purpose.

2. **Focus on off-road vehicles**. CNEE participants said that off-road vehicles are a significant source of air pollution. However, recent regulations – for example requirements that tractors have diesel particulate filters and operate on low-sulfur fuel – are addressing the problem, at least in part. Continue evaluating the off-road vehicle sector for unresolved pollution problems that can be addressed with AFs and work with manufacturers to promote the use of clean alternative fuels.[39]

Department of Defense

1. **Charge ahead on ESPCs for AFVs**. Work with DOE to quantify the cost savings possible with greater use of AFs and AFVs on military bases, in military equipment and in the field, and use ESPCs to finance purchase of the fuels and vehicles. Explore whether third-party financing also can be used to fund AF refueling infrastructure.

2. **Test and transfer GHG reduction measures**. As the military gains experience in using AFs in on-road and off-road vehicles, in aircraft and in ships, work with EPA and DOE to transfer lessons learned to states, localities and industries. One example involves global shipping, which accounts for 1.5% of global greenhouse gas emissions from human

sources, an amount expected to double by 2050 if the maritime industry continues business as usual. The Navy is using 50/50 blends of biofuels and petroleum to power its "Great Green Fleet." The Navy should look for opportunities to transfer its biofuel lessons to commercial shipping, as well as information about improving the fuel efficiency and operational practices of ships.

3. **Set targets and clean fuel preferences in the next U.S. Transportation Command (USTRANSCOM) solicitation**. The USTRANSCOM solicitation for worldwide express deliveries is expected to be the largest package delivery contract ever awarded by the federal government, with a potential value of $2.5 billion over five years. The USTRANSCOM's Acquisition Directorate should establish a preference for vendor fuel efficiency and emission improvements, require annual reporting on environmental and fuel measures, and monetize the social costs of key environmental factors so they can be included in the agency's evaluation of best value from vendors.[40]

General Services Administration

1. **Build agency awareness of the costs of carbon**. In collaboration with EPA, conduct training for all federal agencies and procurement officers on the social of carbon in the energy consumption of buildings and vehicles, and the imbedded carbon in consumer products used by the Federal Government.

2. **Use full-cost accounting**. In line with the Crosscutting Recommendation at the beginning of this paper, review the guidance and policies GSA communicates to federal agencies regarding the procurement of vehicles and fuels. Improve the guidance to include full-cost as well as life-cycle accounting. Work with CEQ to ensure that GSA guidance and costing methodology includes the best available information for assessing environmental, energy security and economic costs. In addition, extend full-cost life cycle accounting to the evaluation of contracts for third-party transportation service providers and require that they use of AFs and AFVs.[41]

3. **Green the transportation supply chain**. Work with FEMP to assess the vehicle procurement practices of federal agencies to determine whether they are fully utilizing ESPCs and, if not, what the barriers are. In addition, evaluate whether agencies are using waivers to avoid requirements related to sustainability standards for procuring fuels and vehicles. Report the results of both assessments to the President.

4. **Incorporate fuel factors in procurements.** Include the following additional requirements in requests for proposals from and contracts with third-party transportation providers:

   a) Participation in EPA's SmartWay Transport Partnership.

   b) Providing information to GSA that will allow it to rate contractors on their practices for monitoring and improving environmental performance.

c) Providing information that will allow GSA to assess contractors on their ability to track and report metrics such as fleet-wide GHG intensity; renewable fuel use; criteria air emissions; fuel efficiency; and other factors GSA deems important to carrying out the government's energy efficiency, alternative fuel and greenhouse gas reduction goals. Strongly encourage contractors to provide recent benchmarks in each of the performance categories, along with annual targets for improvement.

d) More specifically, implement the recommendation of the American Clean Skies Foundation that GSA's contract for ground-shipping of small packages include a preference for cleaner transportation services, including targets for reducing emissions, cutting petroleum use and increasing the use of non-petroleum alternative fuels.[42]

Department of Agriculture

1. **Confront the food vs. fuel debate.** Even with the commercialization of cellulosic ethanol, it's likely that America's farmers will dedicate cropland to growing energy feedstocks. Consequently, cellulosic fuels may not end the "food vs. fuel" debate – a debate encouraged by organizations such as the American Petroleum Institute. In addition to monitoring the relationship between energy feedstocks, food grain production and food prices, USDA and the Agricultural Extension Service should continue providing research, demonstration and education to farmers on the following:

   a) How farmers can best allocate their lands for energy feedstock and food production on croplands.

   b) How to maximize farm income potential from feedstock production while reducing the use of petroleum fuels and fertilizers, protecting fresh water resources, improving soil fertility, and avoiding monoculture.

Implementation Sequence

The recommendations in this paper are based on the premise that the President is willing to use his leadership tools to define and very clearly communicate the nation's energy goals, to describe their benefits to the American people, and to periodically report progress.

The recommendations also are based on the premise that the President and his Administration support a holistic analysis of the nation's energy options – in this case for alternative fuels and vehicles – to give fair and objective consideration "all of the above" in order to identify the "best of the above."

Finally, the recommendations assume that the Administration is willing to reward the energy options that best meet the President's climate and energy goals and to sustain that support as clean technologies and resources achieve scale, and that it supports sufficient agility in federal resource allocations to shift incentives as we learn by doing.

Based on those assumptions, CNEE suggests that the Administration "sequence" federal support for individual AFs and AFVs to make most effective use of resources in the following ways:

Near Term (2013)

Establish clear performance-based goals and criteria and make clear that an objective review of lifecycle costs and benefits will determine which technologies and energy resources best meet the criteria and merit federal support. The criteria might include:

- Lifecycle emissions of greenhouse gases and criteria pollutants that are substantially lower than petroleum.
- Scalability—the ability to achieve meaningful market penetration and benefits to merit federal attention.
- Economic competitiveness so that energy resources and technologies do not require extended public subsides to compete in the marketplace.
- Domestic production that reduces U.S. dependence on imported energy.
- Positive energy return on investment in which a technology or resource provides significantly more energy than its production consumes.
- Long-term sustainability, where production of the fuel or vehicle does not depend on uncertain supplies of unsustainable or finite resources such as rare earth metals.
- Minimum or no collateral damage. The fuel or vehicle does not degrade or deplete other resources critical to the long-term health of the United States, such as soil fertility, water quality and supplies, healthy forests, air quality, and climate stability.

Mid Term (Early 2014)

- Announce the President's goals and criteria for alternative fuels and vehicles in his budget submission to Congress and the State of the Union address.
- Propose the resources necessary to achieve the President's objectives in the next budget cycle, justified by objective life-cycle analysis that identifies: a) the fuel and vehicle options that offer greatest return on investment and potential for successful commercialization, b) where they are on the scale-up ladder, and c) where gaps exist that can be meaningfully affected by Federal Government support. Include the cost of infrastructure in this analysis.

Longer Term (Late 2014)

- Track the pace of progress for AFs and AFVs and take progress into account in funding and program decisions. Allocate and shift resources as necessary to achieve greatest progress in meeting national objectives.

- When fuels or vehicles that showed initial promise plateau before making it to full scale and economic competitiveness, scale them back to R&D or discontinue public support.

- Continue assisting the fuels and vehicle technologies that make strong headway, and focus federal assistance on moving them to the next stage of scale-up. Take into account that scale-up is typically least expensive in the R&D phase, becomes more expensive as a technology scales. and is most expensive when it reaches deployment stage. Federal support should "stage gate" – in other words, focus on the appropriate stage of a technology's progress to ensure that public resources are spent most effectively.

Background Information on Alternative Fuels & Vehicles

What are alternative fuels?

The nuances in defining "alternative fuels" often are not recognized among policy makers or in public discourse. Yet, these nuances are critical for creating advantageous and intelligent public policy in regard to the transportation sector.

There are several classes of alternative transportation fuels, with very different characteristics, costs and benefits. For example, if the objective is to reduce America's dependence on petroleum, alternative fuels are any that are not derived from oil, even if they come from finite and carbon-intensive resources. Liquid fuels from coal are an example.

If the objective is to reduce the risks of global climate change, "alternative fuels" are those that produce fewer greenhouse gas emissions than conventional petroleum fuels. Natural gas is an example. Even though it is a finite resource and produced in close association with oil, natural gas is an alternative fuel because it emits fewer pollutants than other fossil fuels.

If the objective is to increase the long-term stability of America's fuel supplies, then we need "renewable fuels" -- those produced from self-replenishing and inexhaustible resources such as plants, sunlight, water and wind.

If our objective is transportation fuels that are not only inexhaustible but that also maximize economic, social and environmental impacts, then we want "sustainable fuels". Although biofuels are renewable, for example, they are only sustainable if they are

produced in ways that protect water resources, soil fertility and climate stability. Biofuels don't qualify if they are grown with lots of carbon-intensive and finite fuels, water consumption and monoculture farming. While electric and hydrogen powered vehicles produce no pollution as they operate, neither qualifies as a sustainable resource when it's produced with finite and carbon-rich resources -- for example, electricity from coal-fired power plants.

Throughout this white paper, CNEE emphasizes the importance of guiding national energy policy with full-cost life-cycle accounting to determine which resources offer the highest true value for national security, economic stability and environmental health, and therefore should be the nation's highest priorities for powering transportation. Full "cradle to grave" analysis reveals that "alternative", "renewable" and "sustainable" are not synonymous in the energy policy world. Not all alternative fuels are renewable, and not all alternative or renewable fuels are sustainable. While this CNEE white paper addresses a variety of non-petroleum fuels, the objective and comprehensive analyses beyond the scope of the paper would reveal that in the fuel hierarchy, public policy generally should put sustainable fuels first, followed by renewable fuels, then by the broader family of alternative fuels.

What are alternative fuel vehicles?

The CNEE dialogue focused on several types of alternatively fueled vehicles. They generally fall into one of three categories:

1. **Dedicated vehicles** run exclusively on an alternative fuel. Natural gas vehicles (NGVs), and plug-in electric vehicles (PEVs) are examples.

2. **Dual-fuel, flex-fuel and bi-fuel vehicles**: Flexible fuel (flex-fuel) vehicles generally are capable of using an alternative fuel and a traditional petroleum fuel. For example, ethanol flex-fuel vehicles are equipped with internal combustion engines capable of operating on gasoline, an E85 ethanol-gasoline blend or a mixture of the two. Bi-fuel vehicles typically have two separate fueling systems that enable them to run on either natural gas or gasoline. Dual fuel vehicles, traditionally used in heavy-duty vehicles, have fuel systems that run on natural gas but use diesel fuel to help with ignition.

3. **Hybrid vehicles** use both hydrocarbon and electric energy with onboard battery storage. They typically use batteries to power an electric motor and a traditional fuel to power an internal combustion engine. Hybrid electric vehicles (HEVs) recharge by capturing energy produced when the vehicle brakes or coasts. Plug-in hybrids (PHEVs) charge their batteries as HEVs do, but also by plugging the vehicle into an electric power source.

What's on the road today?

According to the Department of Energy's Alternative Fuels Data Center (AFDC), there are 16,082 public and private AF fueling locations in United States. They include 8,332 recharging sites for electric vehicles[43] (EVs); 2,639 fueling stations for E-85 vehicles; 1,263

for compressed natural gas (CNG); 757 for biodiesel; 81 for liquefied natural gas (LNG); and 53 for hydrogen.[44] Several areas of the country have proposed or are exploring alternative fuel corridors, also known as "clean vehicle corridors", to reduce range anxiety – an AFV driver's fear that he or she won't be able to find a refueling station.

The AFDC reports there were nearly 940,000 AFVs in use in the United State in 2010, the most recent year for which it has data. The number of AFVs increased steadily from 1995 to 2010 largely because of federal incentives for the manufacture, sale and use of the vehicles.[45] The total in 2010 included more than 618,000 flex-fuel vehicles, more than 143,000 propane vehicles, nearly 116,000 CNG vehicles, nearly 57,500 EVs, 3,350 LNG vehicles and 421 vehicles powered by hydrogen.[46]

What are the most prominent alternative fuels and vehicles?

Among the most prominent non-petroleum fuels and vehicles available or under development today are biofuels, biodiesel, renewable natural gas, renewable methanol, electricity and hydrogen, each described below.

Natural Gas Vehicles (NGVs)

NGVs have proven themselves to be reliable and natural gas supplies are expected to remain robust. Because natural gas has the lowest carbon content of the fossil fuels, many experts regard it as a transition fuel to more sustainable fuels and feedstocks. However, although its combustion produces relatively low carbon emissions compared to other fossil fuels, natural gas is composed mostly of methane, one of the most potent of the greenhouse gases. Much like other alternative fuel strategies that depend upon natural gas as a power source (i.e., EVs, fuel cells, biofuels), the climate benefits derived from NGVs depend upon preventing leaks in the natural gas system, from the point of production to the point of consumption.[47]

Natural gas fuels most often are used in the form of either compressed natural gas (CNG) or liquefied natural gas (LNG). Both can have significant fuel cost advantages over gasoline and diesel fuel. Assuming that methane leaks are controlled, they can have significant climate advantages, too. NGVs have been found to produce up to 29% fewer GHG emissions and fewer other pollutants than gasoline vehicles. When NGVs are powered by RNG in the form of CNG or LNG, these vehicles can potentially hit the nation's and California's 2050 carbon emission targets today at a competitive discount to petroleum fuels.

Other viable liquid fuels from natural gas are methanol and dimethyl ether (DME). Two members of the United States Energy Security Council – former Pennsylvania Gov. Tom Ridge and former Secretary of Transportation Mary Peters – are among those who believe that methanol should be another readily available fuel option in the United States. A study sponsored and published by the Massachusetts Institute of Technology (MIT) in 2011 concluded, "Conversion of natural gas to methanol, as widely practiced in the chemicals industry, could provide a cost-effective route to manufacturing an alternative, or

supplement, to gasoline, while keeping CO_2 emissions at roughly the same level." Gasoline engines can be modified to run on methanol. It can be blended with gasoline up to 85% (M-85), used as a low-blend gasoline oxygenate, used to produce hydrogen for fuel cells, or used in direct methanol fuel cells.

Interest in methanol as a transportation fuel was stimulated in California by its desire to reduce tailpipe emissions from automobiles. A limited network of vehicles and M-85 fueling stations were introduced there in the late 1980s or early 1990s. With the emergence of cleaner burning gasoline, however, methanol no longer had a big advantage in reducing emissions, and California did not expand its methanol network. Interest in moving away from oil combined with the abundance of natural gas has put methanol back on the menu of alternative fuels.

DME is a liquid fuel with a high octane number, giving it performance qualities and efficiencies similar to diesel. However, DME does not produce soot, eliminating the need for filters in vehicles. It is most suited for fueling heavy-duty trucks. It is stored and handled much like propane at much lower pressures than CNG and does not require the refrigeration that LNG does. To take advantage of the properties of DME, two major manufacturers of heavy-duty trucks – Mack and Volvo— have announced that they will produce a limited number of DME trucks in North America in 2015.

Overall, DOE calls NGVs a "good choice for high-mileage fleets" such as buses, refuse trucks and taxis that are centrally fueled or operated regionally. These vehicles can have short payback periods because of their high annual mileage and the price advantage of CNG and LNG over gasoline and diesel. This explains why roughly 60% of new refuse truck purchases in 2013 were powered by CNG.

While improvements in efficiency are reducing air emissions from conventional vehicles that burn conventional fuels, NGVs have several other advantages. Ample supplies are keeping the price of natural gas low; prices are set domestically rather than by a global market as is the case with petroleum; and the fuels reduce foreign oil imports. Compared to their diesel counterparts, NGVs reduce emissions of NOx and particulates. And when methane leaks are controlled, the natural gas production and supply chain generally produces fewer greenhouse gases than the petroleum supply chain.[48]

In regard to barriers, refueling sites for NGVs like most alternative fuels have limitations. However, since 2008, roughly 90 competitors in the NGV space have emerged and several of these firms have proposed national networks of LNG and CNG stations that are currently being built. Fleets wanting to use the fuel often have to construct their own infrastructure, but and there are firms that are willing to finance construction for customers who can commit to certain volume requirements. In addition, high vehicle acquisition costs and the high cost of quick-fill refueling equipment can present a barrier to more extensive deployment of this fuel but there are numerous programs across the country that offer vehicle incentive buy downs and private companies are also offering financing.[49]

There are some additional constraints on fueling light-duty vehicles with natural gas. Current refueling equipment typically allows methane to escape during the refueling process. According to the AFDC, although vehicles can be converted to run on natural gas, only two models of dedicated light-duty NGVs are currently available from major original equipment manufacturers. In addition, mainly because of CNG storage tanks, light-duty NGVs currently cost significantly more than conventional vehicles, although their cost reportedly is coming down.

Experts in the field have told CNEE that at current prices natural gas is a competitive choice for long-haul, local delivery, refuse, public transit, shuttle services, and taxi applications when adequate refueling sites are available, but are more challenged for consumer vehicle applications. NGVs are not necessarily more energy-efficient (although HEV or PEV platforms could help to change this); their current advantage is primarily cheaper operations due to the abundance of natural gas, energy security as natural gas is a domestic fuel, and lower criteria and carbon emissions as natural gas is a cleaner and lower carbon fuel. Some experts argue that in the long term and from a climate-change perspective, the best use of America's natural gas resource is to generate electricity. However, the NGV industry's willingness to invest in engine advancements and renewable forms of natural gas may make NGVs very competitive with electric and fuel cell strategies. Additionally, because of ample supplies and low prices, natural gas is a choice for both transportation and electric power production.

General Biofuels

Biofuels are derived from plant matter such as trees, grasses, agricultural residue, algae, and other biological materials. Demand in the United States is driven largely by the **Renewable Fuels Standard** (RFS), the nation's first renewable fuel volume mandate, established by the Energy Policy Act of 2005. The current RFS requires that by 2022, 36 billion gallons of renewable fuel must be used each year in the United States. It requires that a certain percentage of the renewable fuel blended into transportation fuels must be conventional biofuels, cellulosic biofuels, biomass-based diesel or advanced biofuels.[50]

The RFS defines each of these fuels as follows: conventional biofuels produced by plants built after 2007 must have 20% lower lifecycle carbon content than conventional fuels; biomass-based diesel fuels are those with 50% lower carbon content that conventional fuels; cellulosic biofuels have 60% lower carbon content; and other advanced biofuels produce 50% less carbon than conventional fuels.

Outside the RFS, biofuels are often assigned to two broad categories. First-generation biofuels such as conventional ethanol are produced mostly from corn in the United States. Second generation biofuels, including advanced biofuels and cellulosic biofuels, are typically produced from non-food feedstocks including switch-grass, crop wastes, wood, seed oils, and animal fats. Second generation fuels are the principal goal of biofuels research today, but only small amounts are commercially available. Advanced and cellulosic biofuels can be in the form of ethanol or other products such as butanol and oils

that can be refined directly into gasoline, diesel, or jet fuel.

The production and use of biofuels are supported by several federal and state government incentives. Federal incentives include the Second Generation Biofuel Producer tax credit; the Alternative Fuel Infrastructure tax credit; the Alternative Fuel and Alternative Fuel Mixture Tax Credits, and the Biodiesel and Renewable Diesel Fuel Credit. DOE and the USDA offer loans, grants and loan guarantees for activities ranging from R&D to biodiesel education for public and private fleet operators. State incentives include the California Low Carbon Fuel Standard.

First Generation Biofuels: "First generation" biofuels are those that can be produced from current feedstocks and processing methods. Biofuel feedstocks range from lipids (for example, soybeans and oil plants) to starches and sugars (for example, corn and sugarcane).

Corn ethanol blended with gasoline is the most common of biofuels used in U.S. vehicles today. According to the Energy Information Administration, 13.3 billion gallons of ethanol were produced in the United States in 2012, and 12.95 billion gallons were consumed. There are more than 10 million E-85 flex-fuel vehicles on U.S. roads today, although most owners don't realize they own them and continue using petroleum fuels.

Critics argue that producing corn as an ethanol feedstock competes with food production and can create upward pressure on global food costs, leading to indirect land use change; and that the intensive use of nitrogen fertilizers in agriculture results in emissions of nitrous oxide (N2O), a potent GHG, and causes water pollution problems. Petroleum and fertilizer inputs to corn production and processing and indirect land use change can reduce or reverse the GHG reduction benefit of corn ethanol and other food-based biofuels.

Supporters argue that farm corn yields have increased linearly at a rate equivalent to 1.5% annual growth over the past 20 years, a trend that continues today to help avoid a reduction in corn available for food. However, corn yields have increased linearly since the 1940s and the recent yield improvements cannot be clearly attributed to biofuel production. Nonetheless, it is clear that without biofuel production more corn would be available on the food market.

In regard to net energy, ethanol supporters say that corn ethanol plants have reduced unit energy use by three times over the past 30 years. Still, even with the improvements to date and further predicted efficiency gains to 2022, EPA finds that corn ethanol will only deliver modest carbon savings of 20% GHG by 2022.

Another issue involves the nation's ability to meet RFS targets for biofuels. Early in 2013, EPA acknowledged, "constraints in the market's ability to consume renewable fuels at the volumes specified" by the RFS. One factor is the "blend wall", which refers to a perceived maximum blend of ethanol in gasoline at 10%. Since gasoline consumption is expected to remain stable or slowly decline over the next decade due to increased vehicle efficiency, the blend wall could limit the demand for E-10 ethanol at the same time ethanol production

increases. As one solution, EPA has ruled that ethanol blends of E-15 can be used in cars newer than year 2000, but E-15 fueling stations are limited to a few Midwestern states.

Advanced Biofuels: As mentioned earlier, the RFS defines advanced biofuels as high-performing sustainable transportation fuels that reduce life cycle greenhouse gas emissions by at least 50% compared to conventional gasoline. With the advanced production pathways being explored today, some advanced biofuels could be engineered to go straight into existing pipelines, refineries and planes, trains and automobiles. These are called "drop-in" fuels because they can be "dropped in" the existing infrastructure without modifications.

For the purposes of this paper, advanced biofuels are defined as a suite of hydrocarbon, gasoline and oil substitutes created from bio-energy feedstocks using advanced technologies that need further research and support to achieve commercialization. Advanced biofuels are often called "second generation biofuels". [51] Advanced feedstocks from biomass materials include algae and lignocellulose (crop residues, forest waste, municipal waste and some energy crops). Numerous pathways exist to produce these materials, including chemical (transeterification, hydrotreating); biological (fermentation, enzymatic hydrolysis, synthetic biology); and thermochemical (pyrolysis, gasification) processes.

In addition to reducing GHGs, several advanced biofuels reduce emissions of other air pollutants such as sulfur, NOx, and carbon monoxide (CO). Industry leaders report that many advanced biofuel producers are looking to high value markets such as chemicals to help grow their businesses as they scale up. A barrel of oil produces a range of products including feedstocks for plastics, synthetic fibers, detergents, cosmetics, paints, pesticides, fertilizers, and electronics. Some drop-in biofuel pathways may be able to produce feedstocks for these products, too.

One issue raised by CNEE discussants involved the production of biofuels from non-biomass materials. Some companies are developing and deploying technologies to utilize industrial waste gases such as carbon dioxide (CO_2) and CO as the feedstocks to generate a wide range of transportation fuels. At present, some of these waste gases are not included as feedstocks under the RFS.

Cellulosic ethanol: Researchers at ANL have found that cellulosic fuels can reduce greenhouse gas emissions 85% compared to reformatted gasoline – much greater emission reductions that those produced by corn ethanol. Unfortunately, cost-effective production has not reached the stage where cellulosic fuels are commercially competitive or widely available. Researchers at George Washington University have concluded, "In the short term, [cellulosic] ethanol cannot meet the energy security and environmental goals of a gasoline alternative, because of scale up and cost difficulties of cellulosic ethanol plants."[52] EPA has announced that it anticipates adjusting the RFS volume requirements for 2014 to reflect current constraints on cellulosic biofuel production

Algae-based biofuels (ABB): These are a form of advanced biofuels that are emerging as a promising source of transportation energy. The fuel's trade group, the Algae Biomass Organization has set the goal of price parity with petroleum at 2017 or 2018.

In September 2013, the University of Virginia, the Scripps Institute of Oceanography at the University of San Diego, Embori Group LLC and Sapphire Energy issued a study assessing the lifecycle characteristics of algae grown in open ponds for use as a transportation fuel. The study found that algae biofuels have the potential for competitive energy returns on investment and a substantial reduction in GHG emissions.

ABB has been endorsed by the ESLC because the fuel "could offer aviation and trucking applications with many of the benefits of petroleum fuels – ease of transport, access to existing infrastructure and high energy density – while eliminating some of the critical drawbacks of oil combustion…"

Sapphire Energy – a San Diego based ABB company – describes algae-based fuel as "green crude," a renewable fuel in which sunlight, algae and carbon dioxide produce an oil that can be refined into gasoline, diesel fuel and jet fuel using the same process that produces traditional crude. Among algae's appeal is its short growing cycle; the fact that it does not require potable water; and the potential for some ABBs to be drop-in fuels. ABB nutrients can be recycled; its land requirement is relatively small because of its high per acre yield; and it can be grown on land and in locations unsuitable for agriculture. Because algae utilize CO_2 as they grow, production facilities can be co-located near fossil-fueled power plants in a symbiotic relationship. After examining various algae production pathways, ANL concluded that the fuel's GHG footprint is at least 50% smaller than conventional diesel – the minimum GHG reduction required for an advanced biofuel under current law. Other experts clarify that not all production pathways will necessarily achieve GHG emission reductions of that size.

ABB also can be scaled to energy industry proportions.[53] Pacific Northwest Laboratories (PNNL) recently published a study on the scalability of algae technology in the U.S. The lab found that for algae production using saline aquifers, it is possible to produce nearly two times the current law's target or ~52 billion gallons, enough to offset 70% of U.S. diesel consumption.

At present, the costs of some advanced biofuel technologies are too high to be competitive.[54] Among the barriers to commercialization: Because most advanced biofuel options are not springing from already well-established major industries, they depend primarily on venture funding. Scale-up from laboratory to demonstration to commercial plants is technically challenging and requires more time and funding than typical venture investors are accustomed to. Alternative financing for first-of-a-kind facilities is hard to come by.

In addition, advanced biofuel feedstocks and technologies require an intensive regulatory permitting process that is not established with totally new sources of fuel in mind. The

current policy structure of incentives such as tax credits is helpful but does not provide investors enough stability and certainty, in part because new energy concepts do not receive the favorable tax and regulatory treatments given to the oil, gas and conventional ethanol industries.

For a more detailed discussion of the benefits and costs of ABB, see the study issued in April 2013 by the Congressional Research Service.

Biodiesel

Some 128 million gallons of biodiesel fuel were produced in the United States in July 2013 alone. The 111 biodiesel plants in the United States – 64% of them in the Midwest—reportedly are capable of producing 2.1 billion gallons a year. Biodiesel can be used alone (B-100) with engine modifications or blended up to 20% with petroleum. The most common feedstocks are soybean oil, corn oil, yellow grease and tallow. Biodiesel from soybeans can yield significant GHG reductions on a life-cycle basis according to the latest RFS (RFS2), although other analyses have reported soybean biodiesel to have a higher lifecycle GHG intensity than petroleum largely due to high emissions attributed to indirect land use changes.

Researchers report that to avoid engine wear, deposit and clogging, vehicles must use high-quality biodiesel fuels. Other issues include its energy content, blending limitations, cold weather performance, energy return ratio, long term ability to compete without subsidies, food for fuel tradeoffs, and the fresh water demands of production. Land use change is a controversial issue regarding the climate benefits of biodiesel. In the United States, the RFS analysis shows that land use change carbon emissions from soybean-based biodiesel are small. However, the analysis behind California's low carbon fuel standard shows only slight GHG savings with soybean biodiesel.

Renewable Natural Gas (RNG)

Renewable Natural Gas, also known as RNG or biomethane, is an ultra-low carbon transportation fuel and renewable energy resource that is changing our nation's energy landscape. Biomethane advocates say that advances in anaerobic digestion technologies and considerable investment by energy and waste companies means that our nation's trash can power our 21st century economy. By converting organic waste into a non-fossil fuel, natural gas equivalent, RNG provides CNG and LNG options at a 90% greenhouse gas reduction compared to gasoline and diesel, according to the California Air Resources Board.[55]

RNG is a domestic resource. Feedstocks are abundant. Residential and commercial food waste, solid waste from farming, industry and at landfills throughout the country are being developed today at an historic pace. Still, only a small percentage of available resources have been developed into RNG.

According to the U.S. EPA's Landfill Methane Outreach Program (LMOP), there are 621 operational landfill-to-energy projects in the U.S. representing 1,978 MW and 331 mmscfd.[56] To date, only 38 of these projects (6.2%) have been developed to produce RNG. Additionally, there are 450 candidate landfills identified by LMOP, representing 850 MW, 470 mmscfd, and 36 MMT CO2e per year that have not been developed. According to the USDA, there are 58,000 milk cow operations.[57] In the United States, but EPA's AgStar program reports that only 167 anaerobic digester dairy projects were operating as of May 2013.[58] Yet, advocates of this fuel say that in 2014, available RNG resources are scheduled to produce more than 30 times the 2013 Renewable Fuel Standard Cellulosic Biofuel volumes.[59]

An ANL study issued in 2011 on RNG production pathways concluded that all of them show significantly fewer GHG emissions and less fossil fuel consumption than petroleum and natural gas. "Because it is chemically identical to fossil natural gas, yet produces far fewer GHG emissions," the AFDC says, "the blending of relatively small quantities of RNG with fossil natural gas can provide significant lifecycle GHG benefits."[60]

Advocates of RNG say that additional benefits include, but are not limited to:

Versatility: According to the Coalition For Renewable Natural Gas, a national non-profit advocating for increased utilization of biomethane, RNG may be used as a transportation fuel, for electricity generation and for heating purposes, in addition to being a natural gas additive or substitute in industrial and commercial applications.

A Complete Transportation Fuel Solution: RNG is the only fuel commercially available that can meet 100% of the fueling requirements of an 18-wheeler.

Cost Savings: RNG is currently selling at prices below fossil fuel alternatives, like gasoline and diesel.

Support for Other Alternatives: Because RNG can be easily stored, it helps balance electricity demand helping pave the way for increased utilization of intermittent renewable energy resources like wind and solar.

Increased Energy Security: Because of its wide domestic availability, RNG reduces our dependence on foreign oil.

Better Economics: RNG development and production creates U.S. jobs and benefits local economies.

Cleaner Environment: By utilizing, rather than discarding, our nation's waste, RNG contributes to better land use, protects water resources, reduces odors, and by replacing fossil fuels, helps clean the air and significantly reduces GHG emissions.

Methanol

Methanol is the principal component of natural gas and can be converted into a liquid fuel. In 2013, researchers reportedly discovered how to produce methanol directly from CO_2 at a "significantly lower cost" than gasoline. Carbon Recycling International, an organization that promotes methanol production from CO_2 sources such as industrial plants, calls the product "renewable methanol" when it is manufactured from carbon and hydrogen produced by electrolysis of water with renewable energy[61]. Proponents also contend that methanol can be considered a "carrier" fuel like hydrogen, because it "stores" the energy from the renewable resources used to produce it.

Like ethanol, methanol can be combined with gasoline to produce a high-octane fuel. Proponents say that methanol production in the United States has been prevented by federal ethanol subsidies and vehicle warranties that do not cover cars that burn methanol.

A study issued in 2011 by MIT researchers led by now-Energy Secretary Ernest Moniz concluded, "Conversion of natural gas to methanol, as widely practiced in the chemicals industry, could provide a cost effective route to manufacturing an alternative, or supplement, to gasoline, while keeping CO_2 emissions at roughly the same level." One liability of methanol fuels is that it is toxic to humans when it is inhaled or exposed to skin.

Electric Vehicles

Electric vehicles are being actively promoted at the federal, state and local levels. The American Recovery and Reinvestment Act allocated $400 million for a Transportation Electrification Initiative to deploy 13,000 plug-in electric vehicles and 22,000 charging stations by December 2013. DOE promotes PEV deployment in its Clean Cities and EV Everywhere programs. In 2011, DOE announced $8.5 million in funding for 16 projects to develop comprehensive PEV deployment strategies in 24 states.

Like several other alternative fuels, electricity's environmental advantage over petroleum depends on how it is produced. Emissions in the electric power sector have declined 12% since 2005, the result of several factors including the economic downturn, the low price of natural gas, and pending environmental regulations that will impact coal-fired generation. The EIA has reported that last year's carbon dioxide emissions from the U.S. energy sector were at their lowest levels since 1994. Further, the nation appears on track to reach President Obama's goal to reduce U.S. GHG 17% by 2020 relative to 2005 levels.

Looking ahead, the full implementation of the Mercury Air Toxics Standard (MATS) rule, the Greenhouse Gas New Source Performance Standard for New and Existing Sources, and efforts at the state level to increase the role that renewable energy technologies play in providing electricity are expected to continue to drive down the overall GHG profile of the electric power sector. If these assumptions change, then the overall GHG benefit of electrification of the transportation sector will be reduced except in those states with aggressive renewable portfolio standards and significant existing nuclear and natural gas

fired generation sources.

In addition to charging PEVs with electricity from central-station generating plants, there is an opportunity to capitalize on the proliferation of distributed energy systems that use photovoltaic (PV) technologies. Currently, distributed PV is growing most rapidly in California, New Jersey and Arizona. PEVs charged with distributed generation systems such as PV panels on garage roofs, at parking facilities and at business sites provide an opportunity to optimize these carbon-free resources. There is also a large opportunity to increase clean electricity production from wind power and geothermal sources. To fully capitalize on the pairing of these technologies, additional investments are needed in the local utility grid, in full deployment of smart meters, and in distributed energy storage. Time-of-use electricity pricing is critical to ensure that PEV deployment does not adversely affect the greenhouse gas intensity of the electric power sector. If all PEVs and PHEVs were charged at peak time, additional generators would have to be brought on line, causing inefficient cycling and higher average GHG intensity. Incentives, such as lower electricity rates at off-peak hours, are needed in order to ensure that electric vehicles deliver carbon savings.

Going forward, PEVs have the potential to serve as energy storage assets for utilities, selling power back to electric utilities to help them meet peak power demands. In that application, PEVs could also help reduce the problems of intermittency with solar and wind power. These benefits require full coordination between electric customers, utilities and grid operators, much of which would have to be done at the state level. Pilot projects are already underway between private companies and DoD to better understand the potential benefits of this model. However, the increased cycling of car batteries that would result from this practice would reduce the life of the batteries. In addition, drivers would sacrifice convenience with the risk of not having fully charged batteries when they wish to travel. These issues must be addressed before the interaction between electric vehicles and electric grids becomes widespread.

Improved battery storage is another area that would facilitate the use of PEVs. A perceived downside of PEVs has been the limited life and range of their batteries. Battery technology is improving due in part to federal investments in research, but PEV owners can still face a cost of several thousand dollars to replace their vehicles' batteries after several years of operation. However, scientists gathered at the 2003 meeting of the American Chemical Society reported that depending on where and how they're used, the batteries in electric and hybrid vehicles can last as long as 20 years. Scientists also are exploring "second life" uses of PEV and hybrid batteries to perform less demanding functions, such as backup power for computers and medical equipment. NREL began to examine this potential more closely in 2011, and private companies have already undertaken partnerships to further this new market.

An electric vehicle's range is affected by where and how the vehicle is driven. The most popular PEVs today are rated from about 60 miles to just over 100 miles, which falls well within the range of the average daily commute and aligns well with future energy production patterns in many regions of the country where the uptake of PEVs is most

expected. For example, in California, the current supply and demand profile is shifting as a result of the increased proliferation of rooftop PVs and central station storage, coupled with the increased use of home electronics and charging. A shift is occurring where the utilities expect an oversupply situation during the middle of the day when the sun is shining and cars are parked at the workplace. This offers a significant opportunity to optimize the use of both clean generation and PEV technologies as well as insights into where to best target resources and efforts.

The potential of PEVs to become major low-carbon passenger and light duty commercial vehicles of the future is significant. If the projected reduction in the GHG profile of the electric power sector is realized, these vehicles will offer benefits for the environment while helping to optimize and support the future electric grid and related technologies.

Hydrogen

Hydrogen can be used in pure form or in fuel cells to produce electricity. Hydrogen can offer substantial greenhouse gas reduction benefits, if it is produced with low-carbon energy from nuclear power or renewable resources such as solar, wind or biomass energy.

Many of the hydrogen fueling stations in the United States today were built to support demonstration projects. DOE is actively involved in research and development to make hydrogen fuel cells a cost-competitive alternative to conventional vehicles on a life-cycle basis. DOE envisions the near term use of hydrogen fuel cells in specialty vehicles and for emergency backup power, particularly in telecommunications.

Current federal incentives for hydrogen include the Alternative Fuel Tax Exemption, a Hydrogen Fuel Infrastructure Tax Credit, a Fuel Cell Motor Vehicle Tax Credit, a Hydrogen Fuel Mixture Excise Tax Credit, a Hydrogen Fuel Excise Tax Credit, and several other incentives.

Among the barriers to more widespread use of hydrogen as a transportation fuel are the costs of fuel cell vehicles, the lack of hydrogen distribution infrastructure, and local codes and ordinances that inhibit refueling infrastructure development based on perceived safety concerns. Safety concerns appear to go all the way back to the indelible Hindenburg disaster in 1937. In reality, hydrogen is a safer fuel than gasoline. In the event hydrogen is released outdoors, it disperses and rises very quickly and has less energy density per unit of volume than other vehicle fuels.[62] DOE is coordinating efforts to develop model codes and standards that ensure safe use.

DOE reports that, "in addition to the technical challenges being addressed through research and development, there are obstacles to successful implementation of hydrogen fueling infrastructure that can be addressed only by integrating the components into complete systems." DOE is, "developing and testing complete system solutions that validate integrated hydrogen and fuel cell technologies for transportation, infrastructure, and electric generation in a systems context under real-world operating conditions." However,

experts who participated in the CNEE dialogue noted that if NGV infrastructure became widespread, it could be converted to hydrogen refueling by using on-site reforming.

DOE cites storage as a problem because hydrogen requires high pressures, low temperatures or chemical processes if it is stored in small spaces such as a vehicle's fuel tank. And because hydrogen has low volumetric energy density compared with gasoline and natural gas (but higher energy density compared to batteries), it requires a larger fuel tank than most petroleum-fueled vehicles. Other challenges include the relatively high cost of on-board vehicle storage systems. DOE is conducting research in each of these areas.

Other Vehicle and Infrastructure Issues

A major factor in the cost and market success of AFs is the new or expanded infrastructure that will be required for full retail deployment. In addition to capital, operational and maintenance costs, infrastructure longevity is an issue, including whether public and private investments are at risk of being stranded in the future by limits on GHG emissions.[63] Infrastructure resilience also is important because of the anticipated impacts of global climate change that can affect pipelines, fuel storage facilities and the electric grid.

NREL's Transportation Energy Futures Project took up the infrastructure cost issue in a study released in 2013.[64] The lab analyzed four scenarios:

1. BAU with no significant changes in the transportation sector;

2. A "portfolio" future in which a variety of advanced vehicle and fuel technologies have been successfully deployed;

3. A "combustion" future fueled by advanced biofuels and natural gas; and

4. An "electrification" future dominated by electric and hydrogen powered vehicles.

NREL's conclusions were:

Lower fuel costs: Based upon long-term cost estimates, NREL found that each scenario results in total fuel costs lower than the low oil price case reported in the EIA Annual Energy Outlook for 2011 (AEO). Compared to total fuel expenditures in the BAU scenario, fuel cost estimates in the low-carbon scenarios suggested savings on the order of $200 billion to $1,000 billion per year by 2040–2050 when compared to the AEO low oil price case and the high oil price case, respectively.

While fuel prices in the marketplace would likely be higher than these estimates, particularly in the early growth years due to market barriers and high investment risk premiums, NREL said, the estimate of lower total fuel costs for the low-carbon scenarios highlights the opportunity for advanced fuel–vehicle systems to provide economic benefits and to mitigate the economic risks associated with high oil prices.

Adequate supply infrastructure: The low-carbon scenarios require significant investment in fuel supply infrastructure.

Adequate production infrastructure: Expansion of fuel production infrastructure in the low-carbon scenarios is about twice as large as in the BAU scenario.

Coverage challenges for retail infrastructure expansion: Expansion requirements for retail infrastructure components, such as the number of refueling or recharging stations needed to serve a particular urban market, depend upon assumptions about market growth, urban area population density trends, and retail sector market dynamics to 2050. NREL concluded that for some fuels that require new retail infrastructure, such as natural gas or hydrogen, it may prove challenging to provide sufficient geographic coverage while maintaining economically favorable station sizes. Sufficient retail infrastructure availability is a key market development issue for alternative fuels, NREL reported.

In addition to infrastructure issues, and even with the use of renewable fuels, vehicle efficiency remains an important objective. All fuels involve energy and material consumption during their life cycles. Even if fuels from renewable resources were ubiquitous, vehicle efficiency should remain a priority.

End Notes

Chapter 1 Endnotes

[1] Researchers at Lawrence Berkeley National Laboratory found as far back as 2007 that while the Production Tax Credit's impact on wind power development was beneficial, the short-term expirations and reauthorizations of the PTC caused demand for wind power to be "compressed into tight and frenzied windows of development". The results were slower wind development, higher than necessary costs, reduced R&D investments, difficulty in planning transmission expansions, and greater reliance on equipment produced in other countries.

[2] "Location efficiency" is defined here as energy savings that result when a home or commercial building is located in a place that reduces transportation costs. Examples include buildings near public transportation or in urban densities that allow people to access institutions and services without having to pay the financing, fuel, maintenance, insurance and parking costs of private passenger vehicles.

[3] "Home Energy Efficiency and Mortgage Risks," University of North Carolina at Chapel Hill, March 2013. The analysis concluded that the risk of default is one-third lower for Energy-Star-rated homes. A study by the University of California at Berkeley and UCLA found that energy efficiency upgrades increase home values by 5.5% to 9%. One of the authors of the UNC study, Roberto Quercia, concluded: "Consumer and industry acceptance of energy efficiency is high. But the lack of broad consideration of potential energy savings in the mortgage underwriting process still prevents many moderate-and middle-income homebuyers from fully enjoying the cost savings." In addition, new research utilizing data on multifamily homes from Fannie Mae found significantly lower risk of mortgage default when the properties were equipped with "sustainability features" – including walkability, access to mass transit, the presence of nearby parks, etc.

[4] This policy is part of the Sensible Accounting to Value Energy Act (SAVE Act) championed by bipartisan co-sponsors in the Senate. The Administration can implement it under existing authority while supporting the Act in Congress to make this practice a requirement in law. Energy-saving features should include renewable energy systems such as photovoltaic arrays and passive solar design, as well as energy efficiency measures.

[5] PACE financing is important also for capitalizing renewable energy projects. Several of the other recommendations in this paper are also applicable to renewable energy technologies.

[6] The IRS does not yet have a revenue ruling on energy efficiency or renewable energy. Real Estate Investment Trusts have to petition for a Private Letter Ruling individually because there is no guidance that would assure their investors that investing in efficiency and renewables via the REIT is legal. However, in April 2013, Hannon Armstrong Sustainable Infrastructure (NYSE:HASI) received confirmation from the IRS that it can finance

renewable energy projects in real estate if it maintains an acceptable balance between investments in energy efficiency and renewables. Hannon Armstrong is one of only two publicly traded REITs dedicated to sustainable infrastructure.

[7] From this point forward, for the purpose of this paper, ESPCs will also refer to UESCs as both are an active offering for federal facilities in many areas of the country.

[8] CNEE has found that several states have passed enabling legislation for ESPCs, but have no active program.

[9]In July 2012 EPA published a Roadmap for Incorporating Energy Efficiency/Renewable Energy Policies and Programs into State and Tribal Implementation Plans. The Roadmap clarifies guidance published by EPA in 2004 and 2005 regarding ways to credit energy efficiency and renewable energy measures in State Implementation Plans (SIPs). In addition, the National Renewable Energy Laboratory has developed a verification and measurement protocol for estimating energy savings from residential and commercial energy efficiency programs and measures. The protocol is intended to give electric utilities, regulators and other stakeholders more confidence in their energy-savings reports.

[10] This is a timing issue. If state Public Utility Commissions (PUCs) wait until after EPA issues its draft guidance next summer, it could be another year or more before PUCs approve energy efficiency and renewable energy programs and measurement and verification methodologies. PUC approval is crucial because they oversee all utility demand side management. If PUCs could anticipate EPA's ruling and have dockets opened to discuss the issue while EPA is completing its guidance, months and perhaps years of time could be saved. EPA and the White House would encourage this head start if it provided States and PUCs with cover by communicating that energy efficiency and renewable energy measures that reduce greenhouse gas emissions at or outside power plants will count in State implementation Plans.

[11] DOE's Office of Energy Efficiency and Renewable Energy and the State Energy Efficiency Action Network have produced resource documents on this issue.

[12] It has been widely reported that large amounts of private sector capital have for been parked on the sidelines several years and not invested in new plant and equipment. This reduced level of capital investment has been a drag on economic recovery and job growth, especially in manufacturing where skilled workers can still earn a middle-class wage. Although many reasons have been posited for this lack of investment activity, regulatory uncertainty is a factor. One area where greater regulatory certainty would likely spur investment in both new plant and equipment and in energy efficiency involves changes to the process for permitting new and modified sources under the Clean Air Act. There are two general types of new and modified source permitting under the Act. In "non-attainment" areas where the air quality is worse than that required to meet the national ambient air quality standards (NAAQS), new source review (NSR) permitting is required. In

"attainment" areas where air quality is equal to or better than the NAAQS, prevention of significant deterioration (PSD) permitting is required. EPA establishes minimum requirements for these permit programs but the states are in most instances authorized to administer them. End-use energy efficiency can reduce Clean Air Act permitting uncertainty in both of these programs and encourage investment in new plant and equipment. This can be accomplished by establishing an effective method to quantify the power plant emissions reductions attributable to investments in end-use energy efficiency. Under EPA's non-attainment NSR regulations and guidance, there can generally be no net increase in emissions. A company seeking to invest in expanded manufacturing equipment at an existing location must not only install advanced pollution abatement on the new or modified equipment, it must also find offsetting emissions reductions somewhere else. This is frequently done by curtailing operations on unmodified equipment at the existing plant with the unfortunate result that there is no net growth in either output or jobs. If a company were seeking to build a new plant in a non-attainment area, the company typically would need to find emissions reductions outside the fence line of the new plant. This is also frequently done by having another company curtail operations so that the new plant's emissions are offset and no net increase in emissions is achieved. In addition, NSR emissions offsets are sometimes achieved by purchasing existing Emissions Reduction Credits, frequently made available by a previously closed facility. These undesirable results could be reversed if EPA and the states changed their NSR programs to encourage the use of emissions offsets as well as the issuance of ERCs for emissions reductions achieved from investments in end-use energy efficiency outside the new plant's fence line. A similar pro-growth result could be achieved in PSD permitting if EPA and the states changed their PSD programs to encourage the use of such end-use energy efficiency investments to offset the anticipated missions of the new or modified source just to the extent necessary to net out of PSD. For both NSR and PSD it should be noted that investments in end-use energy efficiency will generate potentially greater offsets if the electricity in the area of those investments is supplied by coal, which tends to generate higher emissions per megawatt hour than other generation fuels or technologies. Currently, many areas that are served by coal-based generation are the same areas where manufacturing has been hardest hit and where jobs growth would be most welcome.

[13] The Federal Government is the nation's fourth largest source of greenhouse gas emissions and America's largest single energy consumer. In 2012, the government consumed 1.6 quads of energy, about 1.7% of the nation's energy consumption and approximately equal to the energy used by the city of Hong Kong or all of New Zealand. In 2012, the Federal Government's energy consumption cost taxpayers about $25 billion. In a typical year, planes, ships, and vehicles account for two-thirds of the government's energy consumption. The other third is used to operate more than 500,000 government facilities and buildings. These expenditures amounted to 0.7% of total federal expenditures last year.

[14] The same barrier exists in CBO's scoring of federal renewable energy investments.

[15] An example where delay is creating emission reduction opportunity costs is Section 433 of the Energy Independence and Security Act. The rule creates new energy efficiency standards for new federal buildings. DOE submitted it to OMB on Aug. 31, 2011.

[16] The CBO, congressional budget committees and OMB use the same method of counting, or "scoring", government expenses. Scoring guidelines are reviewed annually and revised as necessary, but they cannot be changed unless all of the "scorekeepers" agree (See Part 7 of Circular No. A-11 issued in July 2013 by OMB). The scoring system currently considers ESPCs to be long-term contracts that result in mandatory spending – in their words, obligations created in other than appropriations bills. The "scorekeepers" do not count the dollar savings federal agencies achieve by reducing their energy use, arguing that they fall into a different budget category. This reportedly inhibits the use of third party financing for energy efficiency projects. Similar problems have been reported in the past in regard to how renewable energy projects are scored. Among other issues, OMB should clarify whether agency ownership of energy efficiency upgrades affects scoring.

[17] See examples of WRI's analyses here, and CCS analysis here.

[18] 15 State Treasurers met with White House officials earlier this year expressing interest in this idea. DOE is preparing a "how to" guide for them, hopefully ready for release this fall. New York and Connecticut have already established energy investment partnerships at the state level. These funds are versatile and can provide low cost financing directly to high priority projects, such as improving energy assurance for hospitals, and they can also host loan loss reserve funds for state-backed financing programs for clean energy projects.

[19] In his Climate Action Plan, the President announced new goals for building and appliance efficiency. However, DOE's ability to expedite the development or updating of standards will depend largely on whether OMB accelerates its clearance process.

[20] IACs provide in-depth, no-cost energy assessments to eligible small and medium-sized manufactures, conducted by engineering faculty and graduate students.

[21] To comply with this requirement, states can use the Federal Government's methodology for measuring the social costs of carbon. In addition, the Center for Climate Strategies and several other organizations have developed credible modeling programs to quantify the jobs, economic and environmental benefits of energy-related greenhouse gas reduction measures.

[22] One example has been EERE's Clean Cities program in which the agency facilitated partnerships between the producers, fuel suppliers and fleet managers to deploy alternative fuel vehicles and to build the infrastructure to serve them. More than 100 cities now have coalitions to promote renewable fuels, idle-reduction measures, fuel economy and emerging transportation technologies. EERE reports that since the program began in 1993, it has reduced U.S. petroleum consumption by 4.5 billion gallons.

[23] DOE should instruct states to obtain information about anticipated regional climate impacts from EPA, the U.S. Global Change Research Program, the National Oceanic and Atmospheric Administration and other federal agencies.

[24] For example, solar cells already are used in parts of the natural gas pipeline system to power leak monitors; the UK National Grid collaborated with a company to install small turbines inside the natural gas network to produce clean energy from the high pressure in gas pipelines.

[25] Sponsored by Senators Jeff Bingaman (D-N.M.), Mark Pryor (D-Ark.), Scott Brown (R-Mass.) and Blanche Lincoln (D-Ark.). The bill proposed that DOE study supply chain energy resource efficiency; fund demonstration projects; support training programs; identify and promote practices, companies, and products that conserve energy, water, and other resources through highly efficient supply chains; collect and disseminate data on the energy consumption of supply chains; develop metrics, processes and tools for measuring supply chain energy use; develop guidance for improving supply chain efficiency; harmonize approaches to measuring supply chain efficiency among domestic and international organizations; and share best practices with industry, including small businesses, and provide them with opportunities to benchmark their supply chain efficiency.

[26] Agencies are required to report annually to DOE on their energy management efforts. DOE consolidates the agency reports into a report for Congress each year. However, the most recent report available on the FEMP website is from 2007.

[27] The Weatherization Assistance Program (WAP) will become increasingly important as the Administration implements the President's climate plan. Extreme heat is already the United States' No. 1 weather-related killer, with the elderly and those who live in homes without cooling systems the primary victims. In the event that prices increase for electricity or fossil energy due to carbon pricing or to the regulation of greenhouse gas emissions from power plants, low-income households will have to bear a higher energy burden both for cooling and heating, especially for those who heat with oil or gas.

[28] Congress adopted water flow limits on new showerheads, faucets and toilets as part of the Energy Policy Act of 1992. The federal standards have not been revised since then and are now outdated. Given this situation, DOE waived federal preemption of stronger state standards on these plumbing products in December 2010. Since then California, Georgia and Texas have adopted more restrictive water flow standards for new toilets.

[29] In the early 1990s, DOE and HUD conducted pilot projects in five states to link home energy ratings with energy efficient mortgages. Funding was discontinued in 1999. A post-program evaluation by NREL concluded that "Peer-reviewed analysis on the impact of EEMs on mortgage loan performance is still lacking. This critical question has been identified as the core issue by the mortgage community in its design and use of

EEMs products." An analysis of current federal mortgage data to address this "core issue" is proposed in Goal 1, No. 1 of this chapter.

[30] Nearly 7 million Americans, mostly low-income, live in manufactured homes. Energy efficiency standards for these homes lag behind the standards for site-built homes. A 2012 study by ACEEE concluded that the lag is caused by two factors. First, the HUD code that sets energy efficiency standards for manufactured homes is outdated. Second, HUD's emphasis on low initial cost while under-emphasizing operating costs results in homes with poor energy performance. ACEEE estimates that cost-effective energy efficiency measures in manufactured homes could save 40% of total projected electric consumption and 33% of total project natural gas consumption from 2011 through 2030.

[31] HUD spends $7 billion a year on energy bills for its public housing units. While it has data on what units qualify as public housing, it does not have detailed information on the energy usage of each of those individual units.

[32] Each year, HHS provides more than $3 billion to states to support the LIHEAP program to assist low-income households with their energy bills. Section 2605(b)(16) [Assurance 16] of the LIHEAP statute allows a state to "use up to 5% of such funds, at its option, to provide services that encourage and enable households to reduce their home energy needs and thereby the need for energy assistance, including needs assessments, counseling, and assistance with energy vendors." However, this 5% authority is not widely used by states and is not focused on delivering measurable energy savings that would save the government money, promote energy literacy, and reduce energy waste.

[33] At present, Section 8 of Executive Order 13514 requires agencies to develop sustainability performance plans that prioritize their actions based on "lifecycle return on investment". EPA and other federal agencies now consider the social cost of carbon to estimate the climate benefits of rulemaking. These calculations include net agricultural productivity, human health and property damages from flooding. However, these advances don't yet fully capture the value of full-cost accounting.

[34] Evan Mills and colleagues at Lawrence Berkeley National Laboratory have done extensive research into the risk-reduction benefits of energy efficiency and renewable energy.

[35] According to SBA, 25% of small businesses affected by natural disaster never re-open. Energy efficiency and distributed renewable energy systems can reduce this closure rate by preventing costly power disruptions, prolonging refrigeration during power outages, and sustaining business services in the aftermath of disasters.

[36] The mid-course review will consider whether fuel-economy standards should be adjusted for Model Years 2022-2025, based on consumer acceptance of fuel-efficient vehicles, energy prices and other factors. Performance of the standards may also determine whether they will be improved beyond Model Year 2025. A recent analysis published by Consumer

Reports found that "consumers are increasingly recognizing the benefits of fuel- efficient vehicles." A Consumer Reports survey found that lower fuel costs and being "environmentally friendly" were the principal motivations for consumer purchases of fuel-efficient vehicles.

Chapter 2 Endnotes

[1] As noted earlier, a president's use of power is on most solid ground when Congress explicitly delegates it. In critical times, however, some presidents have interpreted their authority to include anything Congress had not explicitly disallowed. Somewhere in the middle is congressional intent language in many statutes, which expresses the objectives Congress hopes to accomplish.

[2] In general, "beyond the fence line" emission reduction efforts can take two forms. First, EPA could allow an electric utility to bring one existing plant into compliance by reducing greenhouse gas emissions in one or more of its other power plants. Second, a utility might achieve compliance in part by sponsoring programs that reduce emissions outside the company's generation system—for example, demand-side management programs that reduce power consumption or distributed solar and wind energy systems that replace fossil-fired power with zero-carbon electric generation. As in other EPA regulations, compliance measures would have to be verifiable and enforceable.

[3] This is a timing issue. If state PUCs wait until after EPA issues its draft guidance next summer, it could be another year or more before PUCs approve energy efficiency and renewable energy programs and measurement and verification methodologies. PUC approval is crucial because they oversee all utility demand side management. If PUCs could anticipate EPA's ruling and have dockets opened to discuss the issue while EPA is completing its guidance, months and perhaps years of time could be saved. EPA and the White House would encourage this head start if it provided states and PUCs with cover by communicating that energy efficiency and renewable energy measures that reduce greenhouse gas emissions at or outside power plants will count in SIPs.

[4] For greater detail on each of the recommendations in this category, see Chapter 5.

[5] This is expected to be a big issue among the states, with a factor of five or more difference between PUC and FERC evaluations of PV systems going into the grid.

[6] Incentive rate treatment for transmission investments was directed under EPACT 2005 and FERC Order No. 679. FERC's five commissioners reportedly Incentive rate treatment for transmission investments was directed under EPAct 2005 and FERC Order No. 679. FERC's five commissioners reportedly have been hearing complaints that the ROE is too high and that ratepayers want lower rates. Bill White of the Energy Futures Coalition makes the case that investments in electric transmission infrastructure will lead to more

use of renewable energy, fewer carbon emissions and more stable energy prices for ratepayers.

[7] This is an objective in FERC's strategic plan, Infrastructure: *Promote Development of Safe, Reliable, and Efficient Infrastructure that Serves the Public Interest*.

[8] NREL has authored guidance for U.S. policy makers on how to design FITs, including how FERC could create pathways for states to adopt FIT programs. See *A Policymaker's Guide to Feed-in Tariff Policy Design*, particularly pages 14-18.

[9] PMAs also provide some electric power to Native American Tribes, federal agencies, investor-owned utilities and some industrial customers.

[10] The rapid rise in cheap domestic natural gas supplies is leading to a shift from coal to gas for electric power production. The reality of global climate change requires far greater levels of energy efficiency and low-carbon energy resources. A rapid reduction in greenhouse gas emissions is necessary both for the nation's physical security and public health and for United States credibility in international climate negotiations. The impacts of climate change already manifesting in the United States present risks to the nation's energy infrastructure.

[11] This recommendation is based on a proposal by the Western Governors Association in its June 2012 report, *Meeting Renewable Energy Targets in the West at Least Cost: The Integration Challenge*.

[12] A recent multi-lab, multi-organization study led by NREL concluded that with technologies available today and a more flexible electric system, renewable resources could supply 80% of the nation's electric power demand by mid-century. The NREL study shows the technical feasibility of achieving this target, but DOE's leadership is believed to be far from the political commitment needed to get there.

[13] See *Practicing Risk-Aware Utility Regulation*, Ceres, April 2012, and *The Benefits of Electric Transmission: Identifying and Analyzing the Value of Investments*, The Brattle Group, July 2013, on how transmission planning frequently omits analysis of major categories of benefits and how that can change.

[14] The federal Qualifications Review Board evaluates all potential Senior Executive Service employees in the government based on their ability to serve in executive roles. Technical qualifications typically are not part of the evaluations.

[15] DOE's Inspector General issued a highly critical report on Aug. 13, 2013, of hiring practices at the Bonneville Power Administration.

[16] The President also needs to build support for rural electric utilities and customers to fully utilize the new financing program the Rural Utilities Service is developing energy efficiency and renewable energy projects in rural America. The RUS has the authority to use $6.5 billion annually in lending authority for these projects at Treasury rates. The three actions in this section apply equally to rural support of these loans and of renewable energy leadership by the PMAs.

[17] Second-generation bioenergy generally refers to the production of fuels from non-food crops – for example, using corn stover or woody feed stocks to produce cellulosic ethanol.

[18] In a study titled *Finding a Place for Climate Science in the Rural West*, researchers at the University of Arizona concluded: "Cooperative Extension has been cited as an example of a boundary organization that has successfully linked agricultural science, policy, and producers (e.g. Cash, 2001; Lynch et al., 2008). There has been much debate about the future of Cooperative Extension and the role it should play in the 21st century. We suggest that Cooperative Extension is uniquely positioned to serve as a boundary organization for linking climate science, policy, and rural society."

[19] Tennessee Valley Authority website.

[20] Ibid. See TVA's report on its pollution control investments.

[21] President Obama's 2004 budget as quoted in the Tennessee Times News, "White House 'strategic review' of TVA may put agency up for sale".

[22] The challenge of re-missioning TVA to become an example of a 21st century utility was demonstrated earlier this year when two Republican senators from Tennessee blocked President Obama nomination of Marilyn Brown to serve a new term as chairman of TVA's Board of Directors. Dr. Brown is a noted expert in sustainable energy who worked at DOE's Oak Ridge National Laboratory in the past and shared the Nobel Prize awarded in 2007 to the Intergovernmental Panel on Climate Change. Corker and Alexander reportedly disagreed with Dr. Brown's views on energy conservation and fossil fuels. President Obama re-nominated her nine months later as a member of the TVA board. The Senate confirmed her for that lesser position in September 2013.

[23] Fifteen State Treasurers met with White House officials earlier this year expressing interest in this idea. DOE is preparing a "how to" guide for them, hopefully ready for release this fall. New York and Connecticut have already established energy investment partnerships at the state level. These funds are versatile and can provide low cost financing directly to high priority projects, such as improving energy assurance for hospitals. They can also host loan loss reserve funds for state-backed financing programs for clean energy projects.

[24] This recommendation and the two that follow deal with greenhouse gas emissions rather than with energy efficiency per se. The intention here is to help states recognize and quantify the link between clean energy technologies and the President's emphasis on climate action.

[25] As noted in Chapter 1, the Federal Government is also the nation's fourth largest source of greenhouse gas emissions.

[26] For further information, see the description of DEG from the National Institute of Building Sciences and FEMP's description of technical assistance available to federal agencies.

[27] The GAO found that "The military services have funded about 85% of nearly 600 projects that were in design, under construction, or operating in fiscal year 2011 with up-front appropriations, but financed 8 of the 9 large-scale projects and 19 of the 57 medium-scale projects with alternative financing. Several factors affect the military services' use of financing approaches, including perceived benefits and drawbacks such as how long it takes to obtain funding." GAO cited inadequate sharing of information across the armed services on best financing approaches. "As a result," it reported, "DOD cannot ensure that officials responsible for selecting a financing approach have timely access on an ongoing basis to information on approaches that their counterparts from other services have used and their experiences with those approaches. Such information could assist the officials in selecting a financing approach that maximizes the benefits and minimizes the drawbacks or risks of that approach."

[28] *Opportunities for Synergy Between Natural Gas and Renewable Energy in the Electric Power and Transportation Sectors*, NREL, December 2012.

[29] CNEE offers specific recommendations on changing the national narrative about natural gas in Chapter 4.

[30] The convening power of the President is most effective for problem solving when the problems are well framed. This meeting should be preceded by a conversation between the Secretary of Energy, NREL and renewable energy industry leaders on the most important contribution natural gas can make to the expansion and financing of renewable energy technologies.

[31] BLS received funding in 2010 to begin developing data on "green jobs." Since then, the BLS has been criticized both for over-counting and undercounting green jobs. BLS now has yielded to criticisms from Congress and has decided to stop counting and reporting jobs in this category. The Brookings Institution and the Pew Center on the States are among organizations that have attempted to develop methodologies to accurately count "green" jobs.

[32] In September 2013, several dozen clean energy advocacy groups complained that EIA's past estimates of electricity generation from renewables have been "unreasonably low and have not been borne out by actual experience." They suggested that EIA re-evaluate its predictions, saying that companies and policy makers rely on EIA's numbers. EIA Administrator Adam Sieminski responded with an explanation of the many variables the EIA considers in its projections.

[33] One of the difficulties EIA encounters is the time lag between the data it analyses and current market conditions for technologies whose prices are falling rapidly, as is the case with some renewable energy technologies.

[34] From this point forward, for the purpose of this paper, ESPCs will also refer to UESCs as both are an active offering for federal facilities in many areas of the country.

[35] CNEE has found that several states have passed enabling legislation for ESPCs, but have no active program.

[36] DOE has several existing programs that can assist with this initiative, including its Clean Energy Applications Centers, Industrial its Advanced Manufacturing Office its Data Center Energy Efficiency Program, and its Industrial Assessment Center program.

[37] These data come from congressional testimony by Peter Davidson, the executive director of DOE's Loan Program Office. Davidson's testimony includes several examples of program successes. They include the Tesla electric car (loan fully repaid); one of the world's largest wind farms; the world's largest photovoltaic and concentrating solar power plants; and one of the country's first commercial-scale cellulosic ethanol plants.

[38] Stephanie McClellan, Ph.D., the Project Director of strategic initiatives to advance offshore wind at the College of Earth, Ocean and Environment, University of Delaware, contributed the recommendations and narrative in this section.

[39] While legislation is outside the scope of this white paper, the Administration should support tax credits for a specific quantity of offshore wind development—for example, the first 2 GW—with no expiration date.

[40] The Energy Information Administration (EIA) reports that while FITs are relatively new in the United States, versions are being used by at least seven states and 15 electric power providers, including the Tennessee Valley Authority (TVA),[40] a federally owned corporation under the jurisdiction of the DOE. EIA also reports that a different model of FITs has emerged in the United States in which electric utilities independently establish a utility-level FIT, either voluntarily or to help them meet state or local renewable energy mandates. However, the Federal Government and the states should be cautious in how they design FITs, learning lessons from the experience in Europe and particularly in Spain, where poor design led to a boom-bust experience in the solar market.

[41] GHP systems serve a variety of energy needs. They are used for cooling as well as heating and can be used to pre-heat water, reducing the energy consumption of conventional water heaters.

[42] GHP requires relatively high costs on the front end for the equipment and its installation. This may make it a candidate for financing under third party shared-savings contracts.

[43] See the study sponsored by the American Council for an Energy Efficient Economy on the benefits of community-scale GHP.

[44] See *Federal Finance Facilities Available for Energy Efficiency Upgrades and Clean Energy Deployment*, a resource guide produced by DOE.

[45] The energy-water nexus recommendations also appear in Chapters 1 and 5, in the context of energy efficiency and utility operations respectively.

[46] According to the Congressional Research Service, the energy sector has been the fastest-growing water consumer in the nation in recent years; it's projected to account for 85% of the growth in domestic water consumption by 2030. The GAO recommended that federal agencies be cognizant of the impact of energy on water and water on energy in deciding which energy technologies to promote. It concluded that better coordination is needed among the various agencies with water-related responsibilities.

[47] EPA's tools include the Co-Benefits Risk Assessment Screening Model (COBRA), which assess the economic and health benefits of energy efficiency and renewable energy in public buildings and an energy impact calculator that estimates the annual energy savings that can be achieved by different state policies.

[48] For example, the Federal Government occupies a 623-acre "campus" in Denver, CO., with 28 different agencies in 44 buildings totaling 4 million square feet. Microgrids may also be attractive options for U.S. Embassies and other U.S. installations overseas, particularly in volatile areas of the world.

[49] Net-zero means that a facility produces as much or more energy than it consumes over the course of a year. The Army directed five installations to achieve net-zero energy by 2020, and plans to reach net-zero energy at 25 or more bases 2030. In 2011, the Base Camp Systems Integration Laboratory (SIL) opened at Fort Devens, MA to assess new systems and technology with the goal of increasing energy efficiency and reducing fuel usage in base camp operations.

[50] An MLP offers certain tax benefits now available only to fossil energy industries. See an explanation of how Master Limited Partnerships would apply to renewable energy

technologies in the legislation sponsored by Sen. Chris Coons. A revenue ruling by the IRS applies the law to certain factual situations and is considered precedent setting.

[51]It is our understanding that in interest of tax simplification, the White House has been reluctant to create or complicate tax benefits. However, selected tax provisions or revenue rulings, such as those proposed here to advance renewable energy technologies, have public benefits that are considerably more important than tax simplification. If Congress protests that the Administration is complicating the tax code, it can remedy the situation by repealing those parts of the code that subsidize mature renewable energy industries.

[52] The Board, created by Congress, oversees the IRS's application of tax law. It consists of 9 members, including seven appointed by the President of the United States and confirmed by the Senate for five-year terms. The Secretary of Treasury and the Commissioner of Internal Revenue are also members.

[53] The SEC is listed on the government's official website as an independent agency. However, recent court rulings indicate that the President has the authority to fire SEC commissioners, which gives the President leverage he doesn't have in other independent agencies.

[54] The SEC issued this guidance in 2010. The analysis of compliance cited here was done by a retired private-sector data expert who spent 5 months manually inspecting SEC documents and organizing them into a searchable database. He found that even among the companies that reported their climate risks, 70% only addressed what carbon regulations would do to their operating costs and did not address many other factors cited in the SEC guidance, including evolving climate science, emerging technologies and growing physical risks. As the New York Times reported in 2010: "The guidance doesn't carry the same force of law as a formal regulation, but public companies consider it binding. The issue revolves around the term 'material risk,' which is a regulatory guidepost used by companies to determine what information to disclose to investors. It builds on existing requirements that companies disclose environmental risks, including U.S. EPA rules." CNEE argues that climate risks have become so significant that they should be a key factor in the decisions of investors and financiers. An example is the International Energy Agency's conclusion in World Energy Outlook 2012 that to avoid catastrophic climate disruption, two-thirds of the world's proven oil, gas and coal reserves must remain in the ground. These reserves—or potentially stranded assets—account for much of these industries' value.

Chapter 3 Endnotes

[1] The President has included nuclear power and "clean coal" in his definition of clean energy, topics of some debate due to the lifecycle attributes of these fuels. In its *Renewable Electricity Futures Study*, the NREL concluded that with technologies available today, combined with a more flexible electric system, renewable resources are capable of

generating 80% of U.S. electricity by 2050, meeting demand in every region of the country. In addition, the Union of Concerned Scientists has devised a "climate blueprint" that shows the President's goal could be achieved or exceeded by 2030 with new investments in energy efficiency and renewable energy.

[2] This initiative, called "Sunshot", is a major R&D commitment. It is a key measure of management performance for DOE. Its objective is to reduce the price of solar electric systems by 75% between 2010 and 2020. NREL projects that this price reduction would allow solar technologies to provide 14% of the nation's electricity by 2030 and 27% by 2050.

[3] Bloomberg New Energy Finance, *Global Trends in Renewable Energy Investment (2011).*

[4] The Clean Air Act requires EPA to establish air quality standards for six common substances called "criteria pollutants". They include ozone, particulate matter, carbon monoxide, nitrogen oxides, sulfur dioxide and lead. They do not include carbon dioxide, methane, or the several man-made gases that contribute to global climate change.

[5] NREL's study involved 110 contributors from 35 organizations including national laboratories, industries, universities and non-government organizations. It was conducted over seven years.

[6] The CNEE roundtables used the Chatham House Rule to encourage open dialogue. Under the rule, participants are free to use the information they received during the roundtables, but without identifying one another or their affiliations. Compliance with the rule is the reason the CNEE white papers do not refer to specific individuals or organizations.

[7] TVA already has announced plans for more aggressive use of renewable energy technologies in its own operations and its service area. In response to President Obama's tripling of renewable energy targets for federal agencies, TVA reported it already has exceeded the Administration's previous target and it is expanding is purchases of solar and wind power. It currently has 128 megawatts of operating or committed solar projects under contract at more than 2,000 locations in its service area, plus 1,500 megawatts from wind and 60 megawatts from biomass. It is making 10 megawatts of capacity available for residential renewable energy projects of less than 50 kilowatts.

[8] NREL has conducted a study regarding the potential value of using Master Limited Partnerships here.

[9] For documentation on how executive actions on climate and energy are rooted in specific statutes, see the two-volume analysis of presidential authorities by the University of Colorado School of Law, archived at www.climateactionproject.com.

[10] The study was based sales of 72,000 homes sold in California between 2000 and 2009. According to the Appraisal Journal, appraisers typically assume that every $1 in annual utility bill savings from a solar electric system increases a home's value by $20. (*Evidence of Rational Market Valuations for Home Energy Efficiency*, the Appraisal Journal, October 1998 and 1999)

[11] "Location efficiency" is defined here as energy savings that result when a home or commercial building is located in a place that reduces transportation costs. Examples include buildings near public transportation stops or in urban densities that allow people to access institutions and services without having to pay the financing, fuel, maintenance, insurance and parking costs of private passenger vehicles.

[12] The IRS does not yet have a revenue ruling on energy efficiency or renewable energy. Real Estate Investment Trusts have to petition for a Private Letter Ruling individually because there is no guidance that would assure their investors that investing in efficiency and renewables via the REIT is legal. However, in April 2013, Hannon Armstrong Sustainable Infrastructure (NYSE:HASI) received confirmation from the IRS that it can finance renewable energy projects in real estate if it maintains an acceptable balance between investments in energy efficiency and renewables. Hannon Armstrong is one of only two publicly traded REITs dedicated to sustainable infrastructure.

[13] The Comptroller of the Currency is an independent bureau at the Treasury Department. The Comptrollers are appointed by the President and confirmed by the Senate for five-year terms.

[14] The same barrier exists in CBO's scoring of federal renewable energy investments.

[15] For more information on the issues of renewable energy procurement for federal facilities, see *Funding Solar Projects at Federal Agencies: Mechanisms and Selection Criteria* by NREL.

[16] The CBO, congressional budget committees and OMB use the same method of counting, or "scoring", government expenses. Scoring guidelines are reviewed annually and revised as necessary, but they cannot be changed unless all of the "scorekeepers" agree. (See Part 7 of Circular No. A-11 issued in July 2013 by OMB.) The scoring system currently considers ESPCs to be long-term contracts that result in mandatory spending, -- in other words, obligations created in other than appropriations bills. The "scorekeepers" do not count the dollar savings federal agencies achieve by reducing their energy use, arguing that they fall into a different budget category. This reportedly inhibits the use of third party financing for energy efficiency projects. Similar problems have been reported in the past in regard to how renewable energy projects are scored.

[17] The Administration's legal authority for third party financing of energy efficiency projects is not a limiting factor. Its authority totals $80 billion. A "multi-industry" letter

sent by the U.S. Chamber of Commerce to President Obama on June 14, 2013, encourages him to set a new goal of $1 billion in ESPCs in each of the next five years.

[18] In some applications – for example, renewable energy projects – ESPC financing will have to be bundled with federal appropriations.

[19] The *Guide to Federal Finance Facilities for Clean Energy* summarizes dozens of unique financing instruments for which clean energy is eligible. The Center for American Progress estimates there is more than $100 billion in federal loan and loan guarantee programs that could be applied "in support of clean energy" each year. The Center estimates that the cost to taxpayers would be less than 1% of that amount.

[20] *Production Tax Credit for Renewable Energy*, Union of Concerned Scientists, Jan. 4, 2013.

[21] *Using the Federal Production Tax Credit to Build a Durable Market for Wind Development in the United States*, Wiser et.al., Lawrence Berkeley National Laboratory, November 2007.

[22] 26 USC § 54D Qualified Energy Conservation Bonds.

[23] NASEO State by State breakdown of QECB issuances.

[24] ARRA language on reallocation: "The amount allocated under this subsection to a large local government may be reallocated by such local government to the State in which such local government is located." 26 USC §54D(e)(2)(B)a.

[25] In 26 states, municipalities have issued affirmative waivers by resolution of a county or city council stating that they do not intent to use bond allocations. Six states have gone the path of a construction waiver by requesting that by a certain date each municipality must commit funds or lose them. Failure to notify is considered a waiver. Three states have issued letters of intent for municipalities to clarify whether they intend to use the funds. Most states have administered the reallocation processes through State Energy Offices and many have implemented the municipal waiver legislatively. NASEO has documented the various approaches State Energy Offices have taken to deploy these bond allocations, their waiver processes, and future policy recommendations. For example, Colorado passed HB 09-1346, which specified that all un-allocated bonds expire on Nov. 10, 2009; at that time they reverted back to that State Energy Office for re-allocation in a competitive process. This competitive process was reiterated several times until funds were fully committed.

[26] Elizabeth Bellis, State and Local Energy Report, *Internal Revenue Service Issues Guidance on Qualified Energy Conservation Bonds*, Aug. 6th, 2012.

[27] Update on QECBs, Sequestration and Wheel (presentation by Elizabeth Bellis to NASEO). March 7th, 2013.

Chapter 4 Endnotes

[1] Today, shale gas accounts for some 34% of total U.S. natural gas production—up from only 4% in 2005— helping to make the United States the largest producer of natural gas in the world. The EIA projects that shale gas will make up 50% of the nation's natural gas production in 2035. (See EIA, Annual Energy Outlook 2013, Washington DC: Department of Energy (2013)). As INGAA reports, "Unconventional natural gas is expected to play an ever increasing role in U.S. gas production in the coming century. The consulting firm ICF International forecasts that production of unconventional gas, including coal bed methane, tight gas and shale gas, will grow from 42% of total U.S. natural gas production in 2007 to 64% in 2020."

[2] See *Leveraging Natural Gas to Reduce Greenhouse Gas Emissions*, June 2013, a report by the Center for Climate and Energy Solutions and the University of Texas, which concludes that while "natural gas is a fossil fuel and its combustion emits greenhouse gases", its expanded use as a replacement for coal and petroleum coupled with minimized releases of methane into the atmosphere "can help our efforts to reduce greenhouse gas emissions in the near- to mid-term, even as the economy grows."

[3] *Realizing the Potential of U.S. Unconventional Natural Gas: Executive Summary*, February 2013, Page v.

[4] The lifecycle water impacts of various energy resources are complex. One analysis (Meldrum et.al.2013) concludes that on the basis of best available evidence, total lifecycle water use is lowest for electricity generated by photovoltaic and wind and highest for thermoelectric generation. However, thermoelectric plants using natural gas combined-cycle (NGCC) turbines require much less water for cooling than traditional steam turbine technologies or than coal-fired and nuclear power plants. That makes "dry cooling" more economical for NGCC plants. On the extraction side, traditional production from deep vertical wells requires relatively small amounts of water, while hydrofracturing in shale gas deposits can require several million gallons of water per treatment (Chesapeake Energy 2013). A 2012 analysis of water consumption for gas produced by Nobel Energy Inc. in one Colorado formation found that vertical wells used 387,000 gallons of water on average for drilling and fracturing, while horizontal wells used 2,830 gallons. In addition to extraction, natural gas refining and by pipeline operations consume water – 400 million gallons of water per day in 2009, according to DOE. Another dimension of the gas-water nexus is the potential for competition with urban and agriculture uses of freshwater resources in some parts of the United States that are traditionally dry or that will experience increasingly dry conditions as a result of climate change. Energy company purchases of water rights in Colorado, for example, have become controversial. Oil and gas companies estimated they would use 6.5 million gallons of Colorado water last year, only 0.1 percent of total water consumption in the state. But the Colorado Oil and Gas Commission estimated the industry's water needs will grow by 16% over the next three years (New York Times

2012). Western Resource Advocates estimated in 2012 that the industry actually was using as much as 13 billion gallons annually of water in Colorado fracturing operations, enough to provide the needs of nearly 300,000 people.

[5]In regard to the competition between natural gas and renewables, the Natural Resources Defense Council explains, "Because power plants burning natural gas produce less air pollution than coal-burning plants, in the near term natural gas can actually serve to diminish a number of public health threats caused by generating electricity. To achieve this, though, sound policies must be in place to make certain that natural gas is used to replace coal and minimize methane emissions—a potent global warming pollutant—and does not displace investments in energy efficiency and renewable energy sources, such as wind and solar."

[6] The World Resources Institute has concluded that "Cutting methane leakage rates from natural gas systems to less than 1 percent of total production would ensure that the climate impacts of natural gas are lower than coal or diesel fuel over any time horizon. This goal can be achieved by reducing emissions by one-half to two-thirds below current levels through the widespread use of proven, cost-effective technologies."

[7] U.S. greenhouse gas emissions fell 4% in 2012 compared to 2011 and to their lowest level in 20 years. Natural gas production and consumption played a significant role, although there's disagreement about how much. Other significant factors included new federal policies including higher efficiency standards for light-duty vehicles, general energy efficiency improvements, and the economic slowdown. The CO2 Scorecard Group, a research organization, says that natural gas accounted for about 25% of this reduction, while energy efficiency measures accounted for 50%. The Group explains that natural gas replaced not only coal, but also lower-carbon energy resources such as hydroelectric generation, nuclear power and renewable energy technologies.

[8] The NPC consists of approximately 200 members who advise the Secretary of Energy on issues related to oil and gas production.

[9] As one participant noted, regional diversity also creates challenges including public health and environmental risks that sometimes turn up as lagging indicators of inadequate regulations.

[10] For an overview of current state regulations on various aspects of shale gas development, see RFF, *The State of State Shale Gas Regulation* (2013). See also Joint Institute for Strategic Energy Analysis (JISEA), *Natural Gas and the Transformation of the U.S. Energy Sector: Electricity*, Logan, J., Heath, G., Paranhos, E., Boyd, W., Carlson, & K., Macknick, J., NREL/TP-6A50-55538, Golden, CO, USA: National Renewable Energy Laboratory (2012), chap. 2.

[12] As noted in the text, the agency issued final NSPS and national emissions standards for hazardous air pollutants (NESHAPs) rules in 2012 regulating volatile organic compounds

(VOCs) and certain toxic air pollutants from unconventional natural gas production and has begun collecting information on methane emissions under its GHG reporting program. On water, the agency continues to regulate hydraulic fracturing that uses diesel fuel under the Safe Drinking Water Act's (SDWA's) Underground Injection Control (UIC) program and is considering the development of new pre-treatment standards for centralized waste treatment facilities (CWTs) and publicly owned treatment works (POTWs) that receive wastewater from hydraulic fracturing operations.

[13] Exec. Order No. 13605, 77 Fed. Reg. 23107 (Apr. 12, 2012).

[14] See *Chemical Disclosure Registry* at www.fracfocus.org. This online database, run by the Groundwater Protection Council, a nonprofit organization that consists of state ground water regulatory agencies, includes information from oil and gas wells in roughly 12 states and includes information from more than 500 companies. Nineteen states now require some form of disclosure of chemicals used in hydraulic fracturing. Of these States, 12 require or allow operators to register the hydraulic fracturing chemicals they use with FracFocus. The proposed May 2013 BLM rule regulating hydraulic fracturing on Federal and Indian Lands gives operators the option of registering the chemicals they use with FracFocus rather than submitting them only to the BLM. FracFocus has been criticized for limitations on the ability to search and aggregate data across individual wells, incomplete disclosure, inconsistent reporting, lack of quality control, and limited oversight. Its perceived limitations in the context of BLM rule at 92-93 are discussed by Kate Konschnik et al., in *Legal Fractures in Chemical Disclosure Laws: Why the Voluntary Chemical Disclosure Registry FracFocus Fails as a Regulatory Compliance Tool* (Harvard Law School, 2013) The authors conclude that "FracFocus is not an acceptable regulatory compliance method for chemical disclosures".

The most recent iteration, FracFocus 2.0, includes new and enhanced capabilities to respond to some of these criticisms. Nevertheless, one participant in the CNEE roundtable said "the public and many researchers are still largely unsatisfied that companies are reporting this information in a way that is sufficiently transparent to ensure accountability and adequate protections for the public interest." Participants reported that the debate and attempted fixes of the database have been going on for years and remain "highly contentious". Given the importance of achieving a degree of transparency that satisfies both industry and the public, the Administration may want to continue refereeing the debate to find further improvements in FracFocus or supplemental or alternative ways to disclose fracturing agents

[15] As of August 26, 2013, three states -- California, Illinois and Nevada -- had passed legislation this year on hydraulic fracturing. In addition to the 16 bills specifically addressing disclosure of fracturing agents, 10 contained multiple provisions related to hydraulic fracturing, including requirements related to disclosure. For a more detailed description of disclosure requirements in state law as of November 2012, see the report

from the National Renewable Energy Laboratory, *Natural Gas and the Transformation of the U.S. Energy Sector: Electricity*, Logan et.al., pp. 168-169.

[16] The bill says, "The public disclosure of chemical information required by this act ensures that potential public exposure to, and dose received from, well stimulation treatment fluid chemicals can be reasonably discerned." It requires oil and gas companies planning to engage in "well stimulation" to provide "A complete list of the names, Chemical Abstract Service (CAS) numbers, and estimated concentrations, in percent by mass, of each and every chemical constituent of the well stimulation fluids anticipated to be used in the treatment."

[17] See *Hydraulic Fracturing Regulatory Act*, Ill. Public Act 098-0022, § 1.77 (2013).

[18] The AGA's full statement on the disclosure issue is: "Public dialogue and disclosure—particularly as they apply to critical issues such as well completion chemicals, waste water treatment and air-quality—as well as fact-based education and stakeholder engagement, are vital to securing broad-based support for the continued development of natural gas resources."

[19] Issues include how Confidential Business Information (CBI) is defined when it is used to keep the composition of fracturing agents confidential, and when disclosure occurs. For example, BLM has been criticized for its draft rule regarding gas production on public lands because it requires producers to reveal their fracturing agents only after drilling has begun.

[20] The UTA report gave the initial findings of comprehensive multi-year research to measure where and how much methane is being released across the natural gas supply chain. Based on direct measurements at 150 production sites with 478 wells, it concluded that the majority of the sampled hydraulically fractured well completions had equipment in place that reduced methane emissions by 99%, or 97% lower than estimates issued by EPA in April 2013. The study found that methane emissions from certain types of pneumatic devices at production sites were 30% to several times higher than current EPA estimates. Total methane emissions from all sources measured in the study were comparable to EPA's most recent estimates. Ongoing research is scheduled to produce 16 reports by the end of 2014, each published in peer-reviewed science journals. More than 90 universities, scientists, research facilities and natural gas companies are involved.

[21] See the *President's Climate Action Plan* and speech, June 2013, which calls for strengthening America's position as the world leader in producing clean natural gas and continuing the progress achieved in reducing carbon emissions with responsible production and use of this resource.

[22] Some of the direct quotes from the IEA analysis are "the climate goal of limiting warming to 2°C is becoming more difficult and more costly with each year that passes"; "No more than one-third of proven reserves of fossil fuels can be consumed prior to 2050 if the world

is to achieve the 2°C goal, unless carbon capture and storage (CCS) is widely deployed"; and the "pace of (CCS) deployment remains highly uncertain". The IEA says natural gas constitutes 15% of the world's proven fossil energy reserves. It also concludes, "natural gas is the only fossil fuel for which global demand grows in all scenarios, showing that it fares well under different policy conditions".

[23] Membership in the institute could go well beyond the customary stakeholders in the national energy conversation. They might range from federal agencies with GIS and satellite capabilities to Engineering Extension Service offices that help state, city and county planners acquire information and tools to do a better job at land-use planning and other issues related to the local impacts of natural gas production.

[24] The Administration already is building research collaborations among federal agencies. DOE, EPA and the Department of the Interior signed a Memorandum of Agreement to develop multi-agency research on the highest-priority questions associated with "safely and prudently developing unconventional gas and tight oil reserves."

[25] An example of cutting edge state policy tracking is the Advanced Energy Legislation TRACKER developed by CNEE. An example of exemplary state policy: In late May 2013, the Illinois Legislature approved a hydraulic fracturing regulatory act that could become a model for other states. The bill was developed with input from industry, labor groups, environmentalists and agriculturists. Despite resistance from opponents concerned about pollution and water resources, it won overwhelming, bipartisan support in both houses, with 160 lawmakers voting "yes" and only 12 voting "no". Among other provisions, the bill requires public disclosure of chemicals used in fracturing and compulsory testing of water before and after a fracturing operation. Its approval followed the legislature's rejection of two bills that would have imposed moratoria on hydraulic fracturing.

[26] As the AFL-CIO explains, "when our energy infrastructure is allowed to decay, it becomes a threat—a public safety threat as shown by natural gas explosions in California and Kansas City, an environmental threat both in terms of toxic leaks and the release of methane and other powerful agents of global warming, and an economic threat as the efficiency of our domestic energy production is diminished. In Massachusetts alone, pipeline leakage is estimated to cost natural gas ratepayers $40 million per year. As a result of allowing our pipeline infrastructure to decay, leaks from pipelines have become a major source of greenhouse gas emissions, and a totally preventable one. The AFL-CIO supports the expansion of our pipeline infrastructure and a much more aggressive approach to the repair of our more than 2.5 million miles of existing pipelines. Repair and build out of the natural gas pipeline system alone has been estimated by the INGAA Foundation as likely to create, on average, 125,000 jobs a year between now and 2035."

[27] Last year, for example, Pew Charitable Trusts reported that the Ohio Department of Natural Resources tripled the size of its oil and gas team by hiring 70 new inspectors. Because of budget cuts, the state paid for the new inspectors with a "huge increase" in fees

collected from drilling applications. Shortages of inspectors also have been an issue for pipeline safety, as noted elsewhere in this report.

[28] The Federal Advisory Committee Act (5USC App.2) appears to allow the President to convene such a group if its purpose is to obtain information or viewpoints from individuals rather than from the group acting collectively.

[29] The President and Secretary of Energy should consider renaming the NPC to a) reflect that its mission is to advise the Secretary on issues related to natural gas as well as oil; b) that it is a Federal Advisory Committee rather than an oil industry trade association; and c) that its 200 members represent business, public interest organizations, Native Americans, the finance community and academia as well as the gas and oil industries.

[30] There currently are several excellent examples of this collaborative research, including a water quality study sponsored by a natural gas company in Colorado, and the industry-sponsored study of methane emissions by the Environmental Defense Fund.

[31] George Mitchell, who died in July 2013 at the age of 94, was the engineer who developed directional drilling – the technique that has revolutionized the natural gas industry by allowing drilling to branch out in several directions underground from a single wellhead. He also was a philanthropist who invested heavily in conservation.

[32] Congress established the Malcolm Baldrige National Quality Award in 1987 as "the highest level of national recognition for performance excellence that a U.S. organization can receive." Manufacturers, small businesses, health care and educational organizations, non-profits and government agencies are eligible. As many as 18 awards are given each year. The award is overseen by the Baldrige Performance Excellence Program at the Department of Commerce's National Institute of Standards and Technology (NIST).

[33] The award should be contingent on recipients remaining in compliance with all environmental regulations with no violations for at least five years. The award is intended to give public recognition to companies leading the way on responsible gas development and make that leadership more visible to the public.

[34] STRONGER is a non-profit, multi-stakeholder organization that assists states in developing environmental regulations for the exploration, development and production of oil and natural gas. STRONGER seeks to educate and provide services for continuous improvement of regulatory programs and industry practices. The review process benefits from the involvement of state regulators, industry participants, and NGOs.

[35] Subpart W is a greenhouse gas reporting rule for petroleum and natural gas Systems. EPA's position is that the rule "will complement efforts to reduce methane emissions through the Natural Gas STAR program."

[36] The amount of water used in hydraulic fracturing varies across and within shale producing regions. A recent study of water use in five shale-producing regions (cited in JISEA, *Natural Gas and the Transformation of the U.S. Energy Sector: Electricity*, at 71-72) found that average water use ranged from 1.1 million to 4.8 million gallons per well. However, the overall amount of water used in gas production including hydraulic fracturing is small compared to other water uses such as agriculture, manufacturing and municipal water supply. One study of the life-cycle water use of different fuels used in electricity generation found that while there are many variables including the method of gas extraction, the life-cycle water consumption for natural gas is considerably less than for coal, nuclear fuels and concentrating solar power, and significantly more than renewable technologies such as solar photovoltaics and wind turbines. In addition, water use becomes a big issue in dry areas of the country, despite the relatively small consumption of natural gas production. In Colorado, for example, energy company purchases of water rights have been controversial with Western Resource Advocates citing public records that show energy companies as of 2009 were entitled to divert more than 6.5 billion gallons of water a day during peak Western river flows, as well as rights to store enough water to supply metro Denver for six years. For more information about the Colorado experience, go here, here and here.

[37] The President's Council of Advisors and Science and Technology has recommended the development of a QER.

[38] An example of the energy-water-food nexus is occurring in Colorado, where natural gas producers are paying farmers to use irrigation ditches to transport water to well sites. For more detailed explorations of the relationship between energy production and water resources, see these reports by the Government Accountability Office. Water has become so crucial an issue in some parts of the United States that one participant in the CNEE dialogue suggested that the Administration launch a Quadrennial Water Review. Another suggested that the National Research Council could conduct a more frequent analysis of these issues.

[39] One organization explains the social license to operate in this way: "The resource sector is generally accepted by the public at large because of the role it plays: there can be no doubt as to the historic role the natural resource industry has played in the advancement of societies needs and well-being, and the economic growth and industrialization of specific countries. However, at the level of individual projects, this acceptance is neither automatic nor unconditional. Today, there is the need to gain and maintain the support of the people that live and work in the area of impact and influence of any given project – to have the Social License to Operate. There is ample evidence that a failure to gain and maintain this Social License can lead to conflict, delays or cost for the proponents of a project."

[40] See CNEE Advanced Energy Legislation Tracker.

[41] Stakeholders participating in the CNEE discussion disagreed on whether sufficient data exist on gas production and distribution. Some contended that there are ample data, but

scattered and generally not understood by the public. Others felt strongly that more data are needed on issues such as unintentional methane emissions. The Administration's position should incorporate both views: i.e., that existing data should be better utilized and that data gaps should be identified and filled. In addition, more user-friendly and intuitive ways of communicating metrics, data and performance evaluations are needed to increase public information and confidence in industry practices.

[42] The Alvarez and WRI studies cited in Endnote XVIII both concluded that a 1% leakage rate would ensure that life-cycle greenhouse gas emissions from natural gas have a lower carbon footprint than other fossil fuels.

[43] One expert in the CNEE roundtable recommended that this section of the paper be deleted, calling further constraints on energy development on federal lands a "veritable hornet's nest". He notes: "Many in industry believe that development on public lands today suffers from 'paralysis by analysis' and that the BLM regulations will provide little of new value while increasing the paperwork and analytical burden."

[44] Appropriations for PHMSA are offset almost entirely with user fees. Under the law, PHMSA may assess only natural gas transmission pipelines for user fees to fund the cost of its natural gas pipeline safety program, even though a steadily increasing portion of the PHMSA budget is dedicated to grants to the states to fund their regulation of natural gas distribution pipeline safety. This creates a tension that industry leaders feel must be addressed in creating a sustainable funding mechanism for PHMSA.

[45] As the Congressional Research Service (CRS) notes in its January 2013 report on pipeline safety and security, these are key considerations in building public support for new infrastructure. According to CRS, "One result of public concern about pipeline safety has been to prevent new pipeline siting in certain localities and to increase pipeline development time and costs in others." (p. 25) There are nearly half million miles of pipelines moving natural gas, oil and hazardous liquids across the United States. While pipeline releases have caused fewer fatalities than other methods of transporting products (p. 2) and there have been no terrorist attacks on the system so far, the Federal Government reports that Al Qaeda has specifically cited the pipeline infrastructure as a target for terrorists in the U.S. There is "widespread and vulnerable to accidents and terrorist" attacks, CRS concludes. And as mentioned elsewhere in this paper, unintended leaks in the gas pipeline system can undermine the advantage of natural gas over other fossil fuels as a resource that can help reduce U.S. greenhouse gas emissions.

[46] The Government Accountability Office (GAO) issued a report in February 2013 that details many of the complexities of the permitting process and reported that state and federal agencies, representatives of the gas industry and public interest organizations suggested that a) a lead agency coordinates the federal, state and local permitting process for intrastate pipelines; b) stakeholders are given an effective role in the permitting process; c) planning tools be provided to help companies route pipelines to avoid sensitive

environmental resources; d) industry is given the option to fund contractors or agency staff to expedite permitting; and e) opportunities are increased for public comments. GAO reported that the Departments of Agriculture and Defense generally agreed with its findings, while other agencies had no comment.

[47] AGA has submitted this and the following three recommendations to the Office of Management and Budget.

Chapter 5 Endnotes

[1] Participants in the CNEE roundtable had a variety of suggestions for presidential messaging on the changes ahead, perhaps through a presidential "call to action." One suggested the President say, "The transition to a 21st century power system is going to cost some, and we're going to pay for it over time. We can't get there tomorrow, but we're going to start making the transition today." Another suggested the President emphasize that repairing and modernizing America's power infrastructure will require significant public and private investment. Another suggested that the President emphasize how consumers have a critical role in increasing the nation's energy efficiency, utilizing clean energy technologies, etc. Another participant suggested that the President help consumers make a distinction between "cheap" and "affordable" energy, stating that "affordable" is the nation's goal. Finally, CNEE thinks there are opportunities for economic growth and good jobs in this area.

[2] FERC explains ISOs and Regional Transmission Organizations (RTOs) as follows: "Independent System Operators grew out of Orders No. 888/889 where the Commission suggested the concept of an Independent System Operator as one way for existing tight power pools to satisfy the requirement of providing non-discriminatory access to transmission. Subsequently, in Order No. 2000, the Commission encouraged the voluntary formation of Regional Transmission Organizations to administer the transmission grid on a regional basis throughout North America (including Canada). Order No. 2000 delineated twelve characteristics and functions that an entity must satisfy in order to become a Regional Transmission Organization."

[3] U.S. Energy Information Administration. Federal Power Marketing Administrations operate across much of the United States. June, 2013.

[4] "Marketing Plans" or "Power Marketing Proposals" is the common term used in the PMA community for the IRP and cost allocation like processes. In this process, the PMAs meet with its customers to evaluate the needs of customers (demand for federal power) and acts to meet those needs (current and incremental supply) by determining an allocation of federal power, an allocation of firm transmission rights, determining a cost allocation and any incremental investment requirements. Here is an example of a PMA power-marketing plan (from WAPA).

[5] FERC does not regulate retail electricity sales to customers; approve the construction, siting and routing of electric generation facilities; or regulate municipal power systems, federal PMAs or most rural electric cooperatives.

[6] FERC has 5 members, all of whom must be confirmed by the Senate. No more than 3 can be from the same political party.

[7] The Department of Energy Organization Act Section 405 (91Stat.586;42 U.S.C.7175) states:
"The Secretary may as a matter or right intervene or otherwise participate in any proceeding before the Commission. The Secretary shall comply with the rules of procedure of general applicability governing the timing of intervention or participation in such proceedings or activity and, upon intervening or participating therein shall comply with the rules of procedure of general applicability governing the conduct thereof. The intervention or participation of the Secretary in any proceedings or activity shall not affect the obligation of the commission to assure procedure fairness to all participants."

[8] Tennessee Valley Authority (TVA) (2011). Environmental and Energy Future (Knoxville, TN: Tennessee Valley Authority) p. 161.

[9] A best-practices resource is Using Integrated Resource Planning to Encourage Investment in Cost-Effective Energy Efficiency Measures, State & Local Energy Efficiency Action Network, September 2011.

[10] The terms of six of TVA's nine directors will expire during President Obama's second term. When their terms expire, directors are allowed to remain on the board until the end of the current congressional session or until their successors take office, whichever comes first.

[11] The government operates a fleet of more than 600,000 civilian and non-tactical military vehicles, most of them still powered by gasoline and diesel fuels. EO 13514 requires agencies to reduce their petroleum consumption 2% each year through fiscal year 2020. In addition, Executive Order 13424 requires agencies to purchase plug-in electric vehicles when they are available at reasonable cost. The deployment of electric and plug-in hybrid vehicles in the Federal Government could help shape the private vehicle market to meet President Obama's EV Everywhere Challenge goal to make the United States the first nation to produce plug-in electric vehicles as affordable as conventional gasoline-powered vehicles within 10 years. Plug-in and dedicated electric vehicles can increase demand on the nation's electric grid, but also hold promise of providing new utility services (electric charging stations) and decentralized storage of electric power.

[12] In one of the early examples, 30 federal agencies in the Denver region committed in 2009 to purchase 10 megawatts of wind power from their utility. It was the largest federal

procurement of renewable energy at the time. Today, federal agencies in Northern California are collaborating on combined purchases of rooftop photovoltaic panels to achieve better economies of scale.

[13] DoD spent $4 billion in 2011 for electricity to power its 300,000 buildings and fuel its 160,000 vehicles. As the largest energy consumer in the Federal Government, DoD is responsible for a disproportionate share of the government's greenhouse gas emissions. In 2008, the Defense Science Board warned that the military's critical missions were at risk because of their vulnerability to power disruptions. Now DoD is implementing aggressive energy efficiency and renewable energy requirements and goals in response to Congress, the White House and its own insights into how these technologies will improve military effectiveness. The Army launched a "net zero" program in 2011 in which five of its installations will become net-zero energy facilities by 2020. The Army's goal is to have 25 "net-zero" installations by 2030. DoD is building micro-grids, mini-grids and distributed energy systems at its field and domestic installations to insulate them from outages in the civilian grid, either by operating independently of the civilian grid or by islanding. Among other technical advances for distributed generation in the private sector, the Rocky Mountain Institute has developed an Electricity Distribution Evaluator (EDGE) model, a MATLAB-based simulation tool to comprehensively assess the distributed energy resource (DER) value proposition in different regulatory and utility business model environments based on a detailed assessment of the technical and operational implications. RMI says its model has the flexibility to be adapted for use by many different utilities and regions.

[14] NIST was charged by the Energy Independence and Security Act of 2007 with developing technical standards to coordinate the work of utilities, manufacturers, equipment testers and regulators on the development of a smart grid. It has issued a "Framework and Roadmap for Smart Grid Interoperability".

[15] For recommendations on risk management frameworks for climate and energy security, see *Degrees of Risk* released in 2011 by Third Generation Environmentalism. The report is highly regarded by the U.S. defense and intelligence establishments as a guide to responsible management of contemporary risks related to climate disruption.

[16] Climate scientists generally avoid attributing specific weather events such as Hurricane Sandy to climate change, but many of the extreme weather events the United States is experiencing today correspond closely with the predicted impacts of climate disruption. Drought, floods, sea-level rise and increasing storm intensity are current, not future, risks. For more information, see the Government Accountability Office's report on *Critical Infrastructure Protection*, the Congressional Research Service's January 2013 report, and the report DOE issued in July 2013. Also see the related discussion and recommendations in CNEE's white paper on natural gas production.

[17] The U.S. Geological Service reports that thermoelectric power accounted for nearly half of the nation's water use in 2005. Although significant amounts are returned to surface

waters and become available for other uses, water withdrawals and contamination are substantial in the life cycle of fossil energy production and use. The organization River Network has calculated that electricity production by coal, nuclear and natural gas power plants is the fastest-growing use of freshwater in the United States, accounting for about half of all freshwater withdrawals from rivers, more than any other economic sector.

[18] For a more detailed explanation of these developments, see *Industrywide Cybersecurity Standards Emerging Through Voluntary Framework,* June 12, 2013, by Ahren Tryon and Cozen O'Conner.

[19]For more information on cybersecurity initiatives at NIST, see http://www.nist.gov/el/smartgrid/cybersg.cfm. For information about cybersecurity work at DOE's Office of Electricity Delivery and Energy Reliability, see http://energy.gov/oe/services/cybersecurity/nesco. For an inventory of cybersecurity programs in the federal government and non-government organizations, see http://www.utilisec.com/resources.html.

[20] The GAO reported that in its response to the assessment, "the Executive Office of the President agreed that more needs to be done to develop a coherent and comprehensive strategy on cybersecurity but did not believe producing another strategy document would be beneficial." The GAO replied, "An overarching strategy document that includes milestones and performance measures, cost and resources, roles and responsibilities, and linkage with other key strategy documents would provide a more effective framework for implementing cybersecurity activities." Problems with federal cybersecurity policies appear to be persistent. Two years ago, the GAO conducted a similar study of cybersecurity programs and concluded that none of the 24 agencies it studied it studied had implemented full or effective security programs.

[21] For more information, see the Western Resource Advocates' report *Every Drop Counts*, which addresses water for power plant cooling.

[22] Communities expend considerable energy to move and treat water, with adverse impacts on their budgets and on air quality. One promising innovation involves zero-net-energy wastewater treatment. Gresham, Oregon, for example, has set the goal of making its treatment plant a net-zero-energy facility by next year.

[23] This recommendation is based on a proposal by the Western Governors Association in its June 2012 report, *Meeting Renewable Energy Targets in the West at Least Cost: The Integration Challenge*.

[24] A recent multi-lab, multi-organization study led by the National Renewable Energy Laboratory concluded that with technologies available today and a more flexible electric system, renewable resources could supply 80% of the nation's electric power demand by mid-century.

[25] See *Practicing Risk-Aware Utility Regulation*, Ceres, April 2012, and *The Benefits of Electric Transmission: Identifying and Analyzing the Value of Investments,* The Brattle Group, July 2013, on how transmission planning frequently omits analysis of major categories of benefits and how that can change.

[26] America's Power Plan, presents a comprehensive policy framework to support electric power sector transition to clean energy.

[27] Several of these ideas are drawn from Ron Lehr's chapter of America's Power Plan, *Utility and Regulatory Models for the Modern Era.*

[28] Ibid and RIIO.

[29] One participant in the CNEE dialogue recommended that FERC develop an algorithm on public good. Other approaches are discussed by researchers at Lawrence Berkeley National Laboratory in *Transmission Benefit Quantification, Cost Allocation and Cost Recovery*, LBNL, 2009.

[30] See End Note viii.

[31]In the past, DOE has collaborated with FEMA to stockpile portable photovoltaic systems to power communications, medical services, critical government operations and first responders during disaster response.

[32] The IAC program deploys teams of university engineering faculty and graduate students to provide no-cost on-site energy productivity and pollution prevention assessments for small and medium manufacturing facilities. The teams follow the assessments with detailed recommendations to the owners of the facilities. Twenty-four universities currently participate in the program.

[33] EPA has conducted training on aggregated purchasing as a way to capture significant energy, environmental and financial benefits. Ohio and Massachusetts have passed legislation that allows local governments to procure electricity on behalf of the residents of their communities. DOE encourages the practice and cites several other examples of where aggregated renewable energy purchases are being used in the United States.

[34] The federal Qualifications Review Board evaluates all potential Senior Executive Service employees in the government based on their ability to serve in executive roles. Technical qualifications typically are not part of the evaluations.

[35] Current issues involving federal use of ESPCs are detailed in CNEE's white paper on energy productivity.

[36] One example is the Edison Electric Institute's disaster planning program.

[37] NASEO works with State Energy Offices on power system resilience. It developed "State Energy Assurance Guidelines" in collaboration with NARUC and DOE's Office of Electricity Delivery and Energy Reliability.

Chapter 6 Endnotes

[1] EPAct also directed DOE to provide public information and data on the benefits of using alternative fuels in motor vehicles and to establish a voluntary program to coordinate efforts between local fleet managers, fuel providers, vehicle manufactures, and other stakeholders to deploy domestic replacement fuels in the transportation sector. This resulted in the DOE's "Clean Cities" program and the Alternative Fuels Data Center (AFDC), both of which are discussed in this paper.

[2] President Bush stated that "America is addicted to oil" in his 2006 State of the Union address.

[3] That projection is made by the International Energy Agency in its World Energy Outlook 2012 (WEO 2012): "By around 2020, the United States is projected to become the largest global oil producer (overtaking Saudi Arabia until the mid-2020s) and starts to see the impact of new fuel-efficiency measures in transport. The result is a continued fall in US oil imports to the extent that North America becomes a net oil exporter around 2030…The United States, which currently imports around 20% of its total energy needs, becomes all but self-sufficient in net terms – a dramatic reversal of the trend seen in most other energy importing counties" (WEO 2012, Executive Summary, pp. 1-2).

[4] Annual Energy Outlook 2013, US EIA, p. 37.

[5] Ibid, p. 4.

[6] Experts engaged by CNEE consider EIA's estimate to be conservative. They note that other sources project higher biofuel growth.

[7] Legislation and executive orders have required federal fleets to purchase AFVs since the Energy Policy Act of 1992. That law mandated that 75% of light-duty vehicles purchased by federal fleets must by AFVs. Executive Order 13423, issued in 2007, requires agencies with 20 or more vehicles in their fleets to cut their petroleum consumption by 2% each year and to increase their AF use by 10% annually. EO 13514, issued by President Obama in 2009, requires federal agencies to reduce the petroleum use of their fleets by at least 2% annually through 2020. The Energy Independence and Security Act of 2007 also included requirements related to AFVs. For details, see the "Laws and Regulations" section on the AFDC website.

[8] The ESLC is a function of Securing America's Future Energy, a nonpartisan private-sector organization that focuses on reducing the nation's oil imports. Members of the ESLC are high-level corporate officers and retired senior military leaders.

[9] An important benefit of this analysis would be to minimize apparent conflicts in federal policies that evolve from an "all of the above" energy strategy. While that strategy creates beneficial competition among AFs and AFVs, it also can produce policies that seem in conflict with one another. An example is EPA's proposed rule to tighten its limits on sulfur in gasoline starting in 2017. The rule would help improve air quality and public health while reducing smog by requiring passenger cars and trucks to capture more pollutants in their catalytic converters. While major environmental groups are on record in support of the rule, one New York Times analyst observed that increased petroleum production in the U.S. combined with improvements in traditional internal combustion engines "are likely to help the conventional automobile survive against competition from vehicles powered by electricity, natural gas and other cleaner alternatives." A former EPA official says the new rule "simply extends indefinitely the viability of traditional automobile engines."

[10] In its original form, the Industries of the Future program worked with the national trade associations of the country's most energy intensive industries to define a vision for each industry's future and the steps to achieve it. The results helped inform DOE's research. As applied here, stakeholders would help define the research, technical assistance, barrier removal and other steps needed to achieve the full potential of the selected fuels.

[11] Examples of analyses: *Alternative Fuel Infrastructure Expansion: Costs, Resources, Production Capacity, and Retail Availability for Low-Carbon Scenarios,* National Renewable Energy Laboratory for the U.S. DOE Office of Energy Efficiency and Renewable Energy Transportation Energy Future Series, April 2013. Society of Automotive Engineers, Joshi et.al., 2000; Air and Waste Management Association, MacLean et.al., 2000; Oregon Low Carbon Fuel Standards Report Oregon Department of Environmental Quality, 2011; US DOT bibliography at its Transportation and Climate Change Clearinghouse; US DOT methodology for analyzing GHG emissions from transportation; Societal lifecycle costs of cars with alternative fuels/engines, Ogden et.al, Princeton Environmental Institute, 2004.

[12] Other tools include EPA's social cost of carbon methodology; the Federal Highway Administration's method for assessing infrastructure investments; and protocols developed by other countries such as Victoria's method for identifying the external costs of transportation fuels.

[13] As proposed by the Energy Security Leadership Council, "This requires a pivot in focus from a structure aligned by technology to one aligned by functional end-uses such as transportation, power generation and delivery, and buildings. This will enable policymakers to compare fuels and technologies more directly based on their respective merits for a given use. These merits, in turn, can be assessed according to their capacity to

strengthen U.S. energy security." See *A National Strategy for Energy Security: Harnessing American Resources and Innovation*, Securing America's Future Energy and the Energy Security Leadership Council, 2013.

[14] As explained by the Natural Resources Defense Council: "TWPs have been proposed by Alvarez et al. as an alternative to conventional GWP analyses to better explain the time-dependent radiative forcing (or climate influence) of different fuel-technology options. While GWPs have been a valuable tool to compare the radiative forcing of individual gases over set time horizons, they are not sufficient when thinking about common fuel switching scenarios that involve multiple GHGs with distinct atmospheric lifetimes. For example, the methane lost during the production and delivery of natural gas diminishes the CO_2 benefits of using natural gas as a fuel. A second limitation of GWP-based comparisons is that they only consider the radiative forcing of single emission pulses, which do not reflect the climatic consequences of real-world investment and policy decisions: these are better simulated as emission streams over multiple years. For example, while an emission pulse can reasonably represent the effect of renting a natural gas car for one day, converting a corporate fleet of cars from gasoline to CNG is better represented by a multi-year stream of emissions. TWPs use the well-established science of radiative forcing used to calculate GWP, but they package the results in a more transparent way."

[15]Federal agencies (excluding the Postal Service) spend about $3 billion annually to acquire, operate and maintain some 450,000 civilian and non-tactical military vehicles.

[16] For example, DOE launched a research program last year – "Methane Opportunities for Vehicular Energy" (MOVE) – to develop innovative technologies that increase the use of natural gas fuels and vehicles. The program consists of 13 ARPA-E research projects totaling $30 million.

[17] ESLC, 2012

[18] The Administration says that EPA and DOT will continue a national program to boost fuel economy and reduce greenhouse gases from new light-duty and heavy-duty vehicles. It says the fuel economy and GHG standards for light duty vehicles alone will save some 12 billion barrels of oil and prevent six billion metric tons of greenhouse gas emissions over the lifetimes of the vehicles sold through model year 2025.

[19] See http://www.arb.ca.gov/msprog/onroad/optionnox/optionnox.htm, http://www.airclim.org/acidnews/california-adopt-new-ultra-low-nox-standards and http://www.arb.ca.gov/board/books/2013/121213/start.pdf

[20] See http://www.sturmanindustries.com/News/tabid/146/post/sturman-industries-demonstrates-breakthroughs-in-natural-gas-engine-efficiency-and-emissions-for-the-california-energy-commission-pier-program/Default.aspx

[21] See http://www.arb.ca.gov/fuels/lcfs/lu_tables_11282012.pdf

[22] http://www.epa.gov/otaq/climate/documents/420f11031.pdf, page 2

[23] The study detailed U.S. biomass feedstock potential nationwide, including the ability to produce one billion dry tons of biomass resources each year without negatively affecting the production of food, feed and fiber crops. The study concluded that the U.S. has the resources to produce about 85 billion gallon of biofuels, enough to replace 30% of the nation's petroleum consumption assuming that biorefinery capacity kept pace.

[24] See the UN's Climate-Smart Agriculture Sourcebook and its Bioenergy toolkit. The food vs. fuel debate is one of the arguments used by opponents of the RFS, part of a debate underway in Congress about whether the RFS should be repealed. Citing USDA reports of high corn stocks this year, the Renewable Fuels Association, which supports the RFS, calls USDA's corn report the "last nail in the coffin" of the argument that fuel production, particularly of corn for ethanol, raises food prices. However, a high yield year for corn in 2013 does not guarantee similar yields in the future.

[25]For example, "Several micro- and macro-level considerations need to be assessed. On a micro scale, the local impacts of the individual bio-refinery and its supply chain need to be considered. On the macro scale, the impacts of the biofuels industry as a whole on agricultural markets, arable land and high-quality water must be considered. Assessing the micro-scale impacts requires meticulous accounting and auditing, leading to additional cost for producing certified sustainable fuels. The macro-scale impacts are more difficult to determine and cannot be directly controlled by the individual producers of biofuels" (Parker, et al., 2011).

[26] The NAS study is "identifying the market barriers slowing the purchase of electric vehicles…and hindering the deployment of supporting infrastructure in the United States. The study will draw on input from state utility commissions, electric utilities, automotive manufacturers and suppliers, local and state governments, the Federal Energy Regulatory Commission, federal agencies, and others, including previous studies performed for DOE, to help identify barriers to the introduction of electric vehicles, particularly the barriers to the deployment of the necessary vehicle charging infrastructure, and recommend ways to mitigate these barriers. The study will focus on light-duty vehicles but also draw upon experiences with EVs in the medium- and heavy-duty vehicle market segment."

[27] Such a roadmap will be timely if EPA allows states to credit GHG-cutting electric vehicle programs in complying with Section 111(d) regulation of carbon emissions from power plants – a recommendation CNEE has offered in other papers in this series.

[28] Fast charging technologies use high-voltage DC current to charge a PEV in as little as 20 minutes, compared to hours for AC charging.

[29] Other research has concluded, "uniformly supportive utility policies and active utility engagement on a national scale will be critical to the expansion of the plug-in electric vehicle market." See Baumhefner, Max, Simon Mui, and Roland Hwang. 2012. "The Importance of Model Utility Policies for Vehicle Electrification." *Electricity Journal* 25 (5), June.

[30] Gordon, Deborah, Daniel Sperling, and David Livingston. 2012. *Policy Priorities for Advancing the U.S. Electric Vehicle Market. The Carnegie Papers.* Carnegie Endowment for International Peace.

[31] CRADAs are research partnerships between DOE's National Laboratories and industries in which they work together on R&D. No financial award is involved. Instead, the lab and industry partner each contribute labor, funding and facilities. CRADAs are one way that private industry can utilize the resources and talents of DOE's 10 labs.

[32] Several of DOE's National Laboratories offer technical assistance for states and localities. An example is the multi-lab Technical Assistance Project coordinated by NREL.

[33] CNEE will often refer to "mobility systems" rather than "transportation systems" to reflect that non-vehicular mobility—for example, safe pedestrian and bicycle infrastructure—should be a key part of community transportation planning. Non-vehicular options are an important to provide access to necessary goods and services for people who do not drive because of age, income, lifestyle choice or physical disability.

[34] A multi-modal system provides a variety of mobility options that link major destinations, for example light rail systems from airports to urban centers, followed by public transit systems, then car-loan, bicycle or safe pedestrian options in the city. Right sizing refers to selecting fuels and vehicles that deliver highest benefits and lowest total costs while being appropriate for the function they must perform. Car-sharing programs are an example. As 2013 began, nearly 900,000 people in the United States were participating in car-sharing programs, according to the University of California Berkeley Transportation Sustainability Research Center. In the City of Denver, where one of the most recent programs is underway, commuters can rent Smart cars by the minute and take advantage of parking spaces reserved throughout the downtown. This option allows commuters to reach the city by mass transit and have complete mobility once they arrive – a "right-size" alternative to private vehicles that add to congestion and air pollution. Bike-share programs are another popular option in a growing number of U.S. cities.

[35] Examples of research conduct so far include *Utilizing Electric Vehicles to Assist Integration of Large Penetrations of Districted Photovoltaic Generation* by Pacific Northwest Laboratory and MIT's *Study on the Future of the Electric Grid: Chapter 5 – The Impact of Distributed Generation and Electric Vehicles*.

[36] One example of federal support is the I-75 Green Corridor project in which 21 organizations, including Clean Cities coalitions, collaborated in an effort to establish the nation's longest biofuels corridor.

[37] The EU's aviation carbon tax, part of its carbon trading system, drew considerable controversy for proposing to impose a tax on airlines flying to the EU, based on 15% of their carbon emissions from their point of origin. On Oct. 17, 2013, the European Commission revised the plan to charge the tax only for the distance an airline flies inside EU air space. While a similar plan for the U.S. would undoubtedly be opposed by the airline industry, it could be designed to reduce the tax by the amount of carbon credits passengers purchase on each flight – a policy that would encourage U.S. airlines to promote the use of credits. In turn, the airlines could consider awarding passengers miles for the credits they purchase.

[38] While Golden Carrot Awards have become common across industries, DOE initiated the first such program in the United States in 1992 to encourage the development and successful commercialization of a "super efficient refrigerator." The program eventually involved about 20 partners including public and private utilities that put up $30 million for the winner-take-all competition. See the case study here.

[39] Polaris, for example, produces an all-electric Ranger utility-style all terrain vehicle. Arctic Cat produces a twin-cylinder all terrain vehicle that runs on biodiesel.

[40] The American Clean Skies Foundation (ACSF) was one of the organizations involved in CNEE's dialogue on AFs and AFVs. For more detail on this recommendation, see its Oct. 1, 2013, letter to the USTRANSCOM Acquisition Directorate.

[41] The ACSF recommends that agencies "develop and report annual targets, measures and initiatives for increasing the use of alternative fuels, reducing petroleum consumption, and lowering emissions associated with the transportation carrier services they procure." For more detail on the reasons and applications of that policy, and additional policy recommendations, see the Foundation's publication, *Oil Shift: The Case for Switching Federal Transportation Spending to Alternative Fuel Vehicles*, August 2012.

[42] The Foundation predicts that this contract will involve expenditures of between $100 million and $350 million each year during the 2014-2018 period. It proposed the AF preference in a June 24, 2013, letter to Acting GSA Administrator Daniel Tangherlini.

[43] The AFDC says 19,410 electric vehicles can be charged at one time in the United States if we count electric outlets rather than charging stations. That would bring the total number of AFV fueling/charging sites to 27,159.

[44] The AFDC website indicates that these numbers were current as of September 2013.

[45] See the AFDC for a list of AFV incentives at the federal level and by state. According to the Congressional Research Service (CRS), several AF and AFV issues are before Congress today, including potential modifications to the Renewable Fuels Standard, how much the Federal Government should support an increase in NGVs and NGV infrastructure, and the appropriate level of government support for plug-in electric vehicles (CRS 7-5700, April 4, 2013).

[46] Some experts do not believe that flex-fuel vehicles should be classified as AFVs since they use gasoline. Indeed, most of them in use today rely solely on gasoline. CNEE has included FFVs in the list of AFVs because they are an alternative to and provide benefits over vehicles powered solely by petroleum fuels and because, like other AFVs, their full potential relies on investments in refueling infrastructure.

[47] A significant amount of the greenhouse gas emissions associated with LNG and CNG are produced not from combustion but from the production, transportation and storage of the gases. Methane leaks in the supply chain can significantly reduce the fuel's carbon benefit. Recent research has concluded that for natural gas to achieve a net climate benefit over gasoline-powered light-duty vehicles, methane emissions in the fuel's value chain must be kept below 1.5% of total production; for heavy-duty vehicles, methane emissions must be kept below 1% of production. A study by the University of Texas at Austin, published in September 2013 in the Proceedings of the National Academy of Sciences, concluded "Compressed natural gas vehicles could produce climate benefits on all time frames if the well-to-wheels CH_4 (methane) leakage were capped at a level 45–70% below current estimates."

[48] Argonne National Laboratory's GREET model estimates the life cycle petroleum use and GHG emissions of light-duty vehicles running on CNG. The model shows that the two most important factors determining relative GHG emissions of CNG cars over gasoline cars are methane leakage of the NG supply chain and relative efficiency of CNG cars vs. gasoline cars.

[49] The New York Times reports that several major U.S. companies including Cummins and UPS are investing in LNG fuels. The Times gave this assessment of the prospects for LNG in the U.S.: "Though the network is growing rapidly, it has a long way to go. As of May 2012, only 53 LNG fueling stations were in the United States, more than two-thirds concentrated in California, along with 1,047 compressed natural gas stations around the country, according to the Energy Department. In comparison, there were 157,000 fueling stations selling gasoline…The federal Energy Information Administration last year projected that if enough LNG filling stations were built and economic conditions were right, sales of heavy-duty natural gas vehicles could increase to 275,000 in 2035, equivalent to 34% of new vehicle sales, from 860 in 2010. But estimates vary. Citigroup recently forecast that 30% of the heavy truck fleet would shift to natural gas by the end of the decade, but some in the transportation industry put that figure much lower. 'Natural gas will be a part of that play in commercial vehicles, but our view is, it is not going to replace diesel,' said Roe C. East,

general manager of the natural gas business at Cummins. He added that natural gas could capture as much as 10% of the heavy-duty truck market in North America in the next five years. One obstacle is cost. There are some tax incentives, and the Obama administration funneled stimulus money to various projects…But industry executives say that the incentives are not enough to get the system going and solve what Bill Logue, chief executive of the FedEx Freight Corporation, called the 'chicken-and-egg' dilemma, of which comes first, the trucks or the stations."

[50] Additional information about alternative fuels and vehicles as well as the RFS is available at the Department of Energy's (DOE) Alternative Fuels Data Center (AFDC).

[51] One participant in the CNEE dialogue observed, "There is a total lack of agreement in the sector and literature in general on what second generation means". The same participant points out that while "advanced biofuels" should be used to describe fuels whose production pathways are not yet ready for commercialization, the RFF definition includes and is dominated in volume by soy biodiesel and sugarcane ethanol, both of which are produced by well-developed methods. Coming to agreement on a clearer definition of second-generation and advanced biofuels could be an action item in its own right.

[52] Somma D, Lobkowicz H, Deason JP (2010). *Growing America's fuel: an analysis of corn and cellulosic ethanol feasibility in the United States.* Clean Technologies & Environmental Policy 12:373

[53] In 2011, the U.S. Navy and the USDA announced the $12 million purchase of 450,000 gallons of advanced drop-in biofuel, from a blend of non-food waste and algae, to be mixed with aviation gas or marine diesel fuel.

[54] One study (Ryan Davis, Andy Aden, and Philip T. Pienkos, *Techno-Economic Analysis of Autotrophic Microalgae for Fuel Production*, Applied Energy, vol. 88, no. 10 (October 2011), p. 3524-3531) reports that the production of algae biodiesel at its current stage of evolution could cost from $9.84 to $20.53 per gallon.

[55] California Air Resources Board: *Low Carbon Fuel Standard Report 2009*, see IV-15, ES-50 & ES-51.

[56] LMOP landfill and project database, U.S. Environmental Protection Agency.

[57] *Farms, Land in Farms and Livestock Operations 2012 Summary*, U.S. Department of Agriculture, February 2013, at 5.

[58] AgStar Projects Database, U.S. Environmental Protection Agency.

[59] Coalition for Renewable Natural Gas testimony to EPA.

[60] *Waste to Wheel Analysis of Anaerobic Digestion Based Renewable Natural Gas Pathways with GREET Model*, Argonne National Laboratory, Energy Systems Division.

[61] Methanol derived from a renewable CO_2 source and a renewable energy source for electrolysis – such as Iceland's use of renewable methanol generated from their geothermal plants – can be distinguished as clearly renewable. However, DOE and EPA should examine the extent to which this fuel source is renewable if the CO_2 is derived from fossil generation.

[62] These conclusions and specific language are drawn from a paper published by the International Consortium for Fire Safety, Health and the Environment.

[63] For example, if an oil pipeline's useful life is 35 years or more and the United States is committed by domestic policy or international treaty to cut its greenhouse gas emissions 80% by 2050, is the best infrastructure investment rail rather than pipelines, or infrastructure for AFVs and AFs rather than petroleum?

[64] *Alternative Fuel Infrastructure Expansion; Costs, Resources, Production Capacity, and Retail Availability for Low-Carbon Scenarios,* National Renewable Energy Laboratory, April 2013

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