BLUEPRINT FOR SECURING AMERICA'S ENERGY FUTURE

Institute for 21st Century Energy | U.S. Chamber of Commerce

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Institute for 21st Century Energy
U.S. Chamber of Commerce
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The mission of the U.S. Chamber of Commerce Institute for 21st Century Energy is to unify policymakers, regulators, business leaders, and the American public behind a common sense energy strategy to help keep America secure, prosperous, and clean. Through policy development, education, and advocacy, the Institute is building support for meaningful action at the local, state, national, and international levels.

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Introduction:

What This Energy Blueprint Is All About

The U.S. Chamber of Commerce's Institute for 21st Century Energy offers this Blueprint in the public interest to engage the presidential and congressional candidates, the business community, state policy leaders, and the American people in a productive dialogue on the major elements that we believe must be included in a bold new energy design for the United States.

In July 2008, the Institute unveiled 13 pillars for "Securing America's Energy Future" in an Open Letter to the next President and Congress, which was signed by 27 influential and experienced national leaders and supported by thousands of Americans. We committed to building specific recommendations behind each pillar. This Blueprint does just that by recommending dozens of concrete steps that the Institute believes must be taken to move our nation toward a more secure energy future.

This Blueprint is the bridge to an energy transition plan that we will provide to the next President and Congress. The transition plan will serve as a road map for a comprehensive and balanced energy strategy. This plan will have detailed programmatic recommendations for the country's forthcoming leadership to consider and adopt.

Why is it so essential that the next American government be fully prepared to act in a swift and comprehensive way? Simply put, it is because energy underpins every aspect of our lives. Without it, we cannot build and sustain a prosperous, globally competitive American economy or secure and protect our nation in a dangerous world. Concerns over our growing dependence on imported energy, an aging energy infrastructure, and the environmental impacts of energy production and use increase the complexity of addressing our energy challenges.

It is inexcusable that for so long our nation has failed to take the necessary actions to expand, transport, and secure an affordable, abundant, diverse, and clean supply of energy. Today, our economy and our families are paying the price. Left unattended, the situation will only get worse.

It is time to end an era of complacency and division—and begin a new era where every energy stakeholder starts pulling in the same direction for the good of the country.

It is the government itself that has taken energy options off the table by placing 85% of our oil and gas reserves off limits, giving short shrift to basic and advanced research needed to bring new clean energy sources into the marketplace, and erecting unpredictable and needlessly arcane regulatory processes that have prevented new infrastructure from being built. In short, the disincentives to invest in new energy sources currently outweigh the incentives; this must be reversed.

This Blueprint recognizes that government has an important role to play in securing our energy future, particularly in providing regulatory and legal certainty, military and homeland security, advanced research efforts for transformational discoveries, and select incentives and

a financial backstop for major energy developments and projects.

Yet, make no mistake, it must be the private sector, and not government, that leads us into the energy future. Whenever government tries to pick winners and losers through excessive regulation, centralized planning, and open-ended subsidies, it fails—and taxpayers and consumers lose.

New technology is the cornerstone of any sensible energy policy. Today, America's scientists, entrepreneurs, research institutions, companies, and investors are brimming with ideas and proposals to create more abundant supplies of both traditional and alternative energy. These innovations can only be successfully brought to market if an appropriate and stable legal, regulatory, and fiscal environment is maintained over the long term. When it comes to energy, we need it all. But ultimately, such ideas must stand on their own and meet the demanding tests of both consumers and the free marketplace.

Working together, we can transform our energy problem into an energy opportunity—an opportunity to unleash the power of free markets to develop new supplies, invest and apply new technologies, and create good new jobs for Americans. It can be an opportunity to lead the world to a new era of energy efficiency and truly enhance America's energy security.

The dozens of recommendations we have now put behind the 13 energy pillars in our Open Letter can be grouped under these four critical challenges:

- Promoting greater energy efficiency
- Increasing and diversifying our energy supplies
- Improving environmental stewardship
- Modernizing and protecting our nation's energy infrastructure

First, we must use our energy resources more wisely and produce and use our energy more efficiently.

We have cut our energy intensity in half since 1970, but there are still many areas that we can improve upon to ensure continued economic growth while using less energy. We must foster policies that address the inherent disincentives that exist for electric utilities, homebuilders, and others to use less electricity. Existing infrastructure constitutes a significant portion of U.S. energy consumption, and new building codes should incorporate energy efficiency measures and standards. Our vehicles will become more efficient as new Corporate Average Fuel Economy (CAFE) standards are put into practice. However, we must also increase efficiency throughout the energy delivery chain through the use of new technology and policies.

Electricity generation accounts for about 40% of total U.S. energy consumption. We should explore innovative new regulatory models that reward efficiency, especially for utilities—and, ultimately, their customers—through energy savings programs and new approaches to the delivery of electricity. Moreover, utility regulatory policies that reward more efficient use of generated electricity and natural gas must be encouraged. Consumers should have the ability to moderate their own consumption through transparent real-time pricing and smart metering, and grid technologies should become the norm. Our industries, too, should recognize the benefits of improving their efficiency, making themselves more productive and thus more competitive.

Second, we must not shy away from proven sources of energy while diversifying our energy mix.

The restrictions we have placed on the production of our own domestic oil and natural gas resources are a significant self-inflicted wound to our security and prosperity. The limitations and moratorium on exploration and production of domestic resources on our lands and on the Outer Continental Shelf must permanently end, and the states must be able to share in royalties collected from such production. Nuclear power is currently the least cost and largest source of zero-emissions baseload electricity. It must be significantly expanded. To do so, the federal government's partnership with the private sector must be enhanced to accelerate this revival. The existing federal Loan Guarantee Program, funded by fees levied on the applicants, should

be expanded to support more than just two or three plants. We must also provide a durable waste strategy once and for all. Our used fuel must be recycled before it is disposed. A new entity should be established to manage the entire back-end of the fuel cycle and be empowered with long-term contracting authority and direct access to the Nuclear Waste Fund.

We can and must use our vast domestic coal reserves in a clean and environmentally responsible manner. Much of the technology to further the advancement of clean coal is still in development or is not commercially viable. Specifically, we believe that an average of $20 billion over 10 years should be devoted to develop and demonstrate the full range of clean coal technologies, with half coming from the federal government and half from the private sector through a small fee on fossil-based utilities.

Renewable sources of energy are growing at a faster rate than traditional sources; however, they still only provide a fraction of generated electricity. We believe that the alternative and renewable tax credits provide a useful incentive to bring initially expensive technologies into the mainstream and allow these technologies to compete in the market. The tax credits should be extended for eight years and then phased out over the succeeding four years.

Technology is the cornerstone of our energy future. The billions of research and development dollars that the federal government has spent over the years have produced many of the technologies that we possess today to diversify our energy supply. However, our current funding levels are about half of what they were 30 years ago. We recommend that federal research and development funding be doubled within the next five years and concentrated in the areas that are most crucial to the nation and best suited for the size and scope of the governmental research and development enterprise.

We need to mobilize the capital that will be needed to deploy these clean energy technologies into the marketplace. Therefore, we make a very important recommendation: to create a United States Clean Energy Bank, a domestic entity modeled after the existing Overseas Private Investment Corporation (OPIC) and the Export-Import Bank. This will accelerate capital formation and provide an essential vehicle to mitigate the barriers to commercialization of innovative technologies that can truly change the world we live in.

Third, the United States must improve environmental stewardship at home and abroad without sacrificing jobs and growth.

We must address the impact of our growing energy consumption on the environment and climate. However, climate change should be addressed as part of an integrated agenda that enhances energy security, maintains economic prosperity, reduces pollution, and mitigates greenhouse gas emissions. Energy efficiency is central to our approach, and advanced technologies—for example, carbon capture and storage, advanced nuclear power, renewables, and smart grid—will be needed on a vast scale to eventually reduce emissions significantly.

In addition, we must continue to protect the air we breathe. As our understanding of the basic science related to air quality continues to progress, we must ensure that decisions about air quality keep

pace with science and that our standards remain protective. Accelerating air quality improvements will be made easier by many of the measures and strategies that address concerns about greenhouse gas emissions.

The United States should also work with developed and developing countries alike to tackle the interrelated challenges of energy security, economic development, environmental quality, and climate change. We should work to promote an approach to climate change that allows each nation to find its own best path for meeting strong environmental and economic development goals, while ensuring that all economies are included in addressing global environmental challenges. Innovative clean energy technologies and processes, developed by Americans with our intellectual property fully protected, can be an indispensable part of future environmental solutions.

Fourth, we must modernize, expand, and secure our energy infrastructure because no energy source—traditional or alternative—can reach the market without a modern and vibrant infrastructure.

Significant portions of our energy and transportation infrastructure are inadequate and, in some cases, in decline. Whether it is a new wind farm or transmission lines that carry generated electricity to homes and businesses, investments are needed to modernize, protect, and upgrade these critical assets. Transitioning to smart grid technology will help improve the resiliency and efficiency of our power supply and must be a priority for the next administration.

In addition, siting and permitting issues have slowed the construction and expansion of power plants, refineries, pipelines, and electricity transmission lines. Organized opposition has resulted in delayed and cancelled projects. As a consequence, the resiliency of our entire national energy infrastructure—really a collection of many complex interdependent infrastructure networks—is at risk.

We need clear and streamlined regulatory and licensing processes at the federal and state levels to allow industry to make large capital commitments with surety. In instances where additional transmission capacity across state lines is needed, the federal government should have authority to site needed electric transmission facilities. We also need to address our talent infrastructure. Nearly half of America's skilled energy workforce is expected to retire within the next decade. U.S. colleges and universities are attracting fewer graduates in chemical, mechanical, and nuclear engineering as well as in math and science. With expected increases in energy facility construction and operations through 2030 to meet projected energy demand, a highly skilled and technical workforce is necessary to ensure American competitiveness. New partnerships with community colleges and training programs, visa policies, and incentives must be implemented to attract young people to technical fields where they can develop and manage the energy systems of the future.

We encourage every citizen, policymaker, and office seeker to carefully review the many specific recommendations that are outlined in the ensuing chapters. Most importantly, we need strong, determined leadership. Global demand for energy will increase by more than 50% between now and 2030 and by as much as 30% here at home. Meeting this soaring demand requires swift and effective action.

It is time to unleash the real and unique power of America's innovation to solve our energy and environmental challenges. This is a monumental calling, but it is also a historic opportunity for America to demonstrate global leadership, create new American industries and jobs, and secure the American Dream for our children and grandchildren.

If the recommendations that are outlined in this report are undertaken with urgency and adhered to over time, our nation will have the near- and long-term options necessary to remain competitive, clean, and secure. The choice is ours to make, and the public must demand that the 44th President and 111th Congress provide the leadership required, in a nonpartisan manner, for the good of our national security and our economic welfare.

Aggressively Promote Energy Efficiency

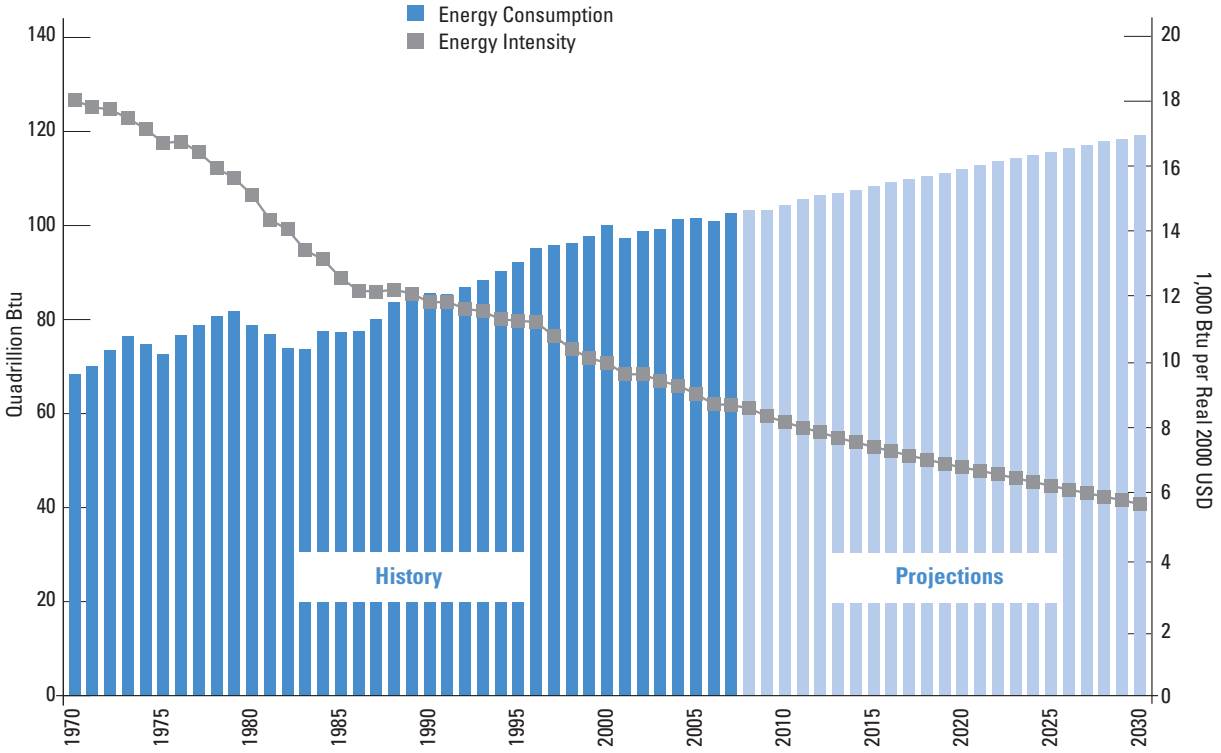
The next best source of new energy is the energy we can save every day. Immediate benefits can be realized by increasing building efficiency and appliance standards, two areas with high energy savings potential. We must explore new business models that reward energy savings, especially for utilities and ultimately the customers. We must expand the suite of voluntary programs, mandates, and fiscal incentives for greater benefits of energy efficiency.

While solving our energy challenges is a long-term proposition, we can realize almost immediate near-term benefits by better harnessing the energy we unintentionally waste every day and more robustly utilizing energy efficiency as a crucial component of our nation's energy portfolio. By doing so, we can liberate a tremendous amount of energy for more productive purposes and save consumers and businesses unnecessary expense.

The United States has steadily improved its energy intensity—that is, energy use per unit of gross domestic product (GDP)—since 1970, and high energy prices, new regulatory requirements, and advances in technology have stimulated greater efficiency since about 2000. In 1970 it took about 18,000 Btu to produce one dollar of GDP; it now takes a little less than half of that. By 2030, the Energy Information Administration (EIA) projects it will take 5,800 Btu for each dollar of GDP (Figure 1), which largely reflects a continuation of the historical rate of improved efficiency of about 1.8% a year since 1990. However, U.S. energy intensity continues to lag behind other developed countries. Japan and Europe, for example, use about 20% to 30% less energy to produce a dollar of GDP. Gains in energy efficiency over the past 30 years are offsetting the need for 50 quadrillion Btus today, or roughly one-half of United States' total consumption. While improvements in technologies and higher energy prices account for the majority of these gains, public policies such as appliance and vehicle efficiency standards and building codes are responsible for at least 20% of the improvement.

Given the projected growth in demand in the United States, achieving the historical rate of energy efficiency improvements projected by EIA is not enough; we need to do more. As it has been for the past three decades, public policy will be a key determinant in how quickly and widely we can improve the efficiency of our economy. How rapidly these reductions take place, however, will be determined by the turnover of capital stock, advances in technology, and capital investment. Allowing more rapid depreciation of capital equipment through the federal tax code

Figure 1. Historical and Projected U.S. Energy Consumption and Energy Intensity



Sources: EIA, Annual Energy Review 2007, Table 1.5 (http://www.eia.doe.gov/emeu/aer/txt/ptb0105.html); Department of Commerce, Bureau of Economic Affairs, Current-Dollar and "Real" Gross Domestic Product (http://www.bea.gov/national/xls/gdplev.xls); EIA, Annual Energy Outlook 2008, Tables 1 & 19 (http://www.eia.doe.gov/oiaf/aeo/aeoref_tab.html).

would provide incentives for new investment that would accelerate reductions in energy intensity and carbon intensity. Benefits from becoming more energy efficient are not solely in the domain of energy consumption. We can achieve lasting benefits through policies that promote greater energy efficiency from primary energy production all the way through to end use. It is not enough to make our buildings, appliances, lighting, and automobiles more efficient in their use of energy; we must also increase efficiency throughout the energy delivery chain through the use of new technology.[1] The processes that mine coal and uranium; produce oil and natural gas; enrich and convert uranium into nuclear fuel; refine crude oil into gasoline and diesel; convert coal, natural gas, nuclear-generated steam, wind, geothermal heat, hydropower, and solar power into electricity; and the methods we use to distribute electricity and fuels can all be made more efficient.

Generally, markets incentivize energy providers and users to maximize efficiency and thus lower cost to the consumer. But in some instances, the market does not deliver the most efficient products or services in the timeframe our strategic interests require.

1 Vehicle efficiency is discussed in Section X of this Blueprint.

It is also important to understand that decisions about energy efficiency are not made in a vacuum. Businesses, for example, typically look for investments that deliver the greatest return. Although investments in energy efficiency usually pay for themselves, they must compete and win against other investment opportunities, or they will not happen.

Competitive pressures also can lead to products that are not as energy efficient as they could be. For example, a builder that designs and constructs a new residential or commercial building has a tremendous incentive to maximize investments in options that will visibly attract buyers and realize higher returns, but little incentive to invest in heating, cooling, and lighting systems whose efficiency is invisible and that are initially more expensive. After all, the tenant or homeowner, not the builder, will be the beneficiary of lower energy bills. Residential and commercial buildings account for roughly 40% of U.S. energy consumption.[2] Most of this energy is used for space ventilation and air conditioning, water heating, lighting, refrigeration, cooking, and running a wide variety of appliances and equipment. In the near term, widespread adoption of advanced commercially available technologies can improve the efficiency of energy-using equipment in the primary functional areas of energy use. The success of the voluntary ENERGY STAR® program demonstrates that when properly informed, consumers do value energy efficiency. More than 60% of U.S. consumers recognize the ENERGY STAR® brand.

The Energy Policy Act of 2005 (EPAct2005) and the Energy Independence and Security Act of 2007 (EISA2007) require new efficiency standards for a range of appliances and equipment. The U.S. Department of Energy (DOE) should move expeditiously to meet these requirements.

Advances in building envelopes, equipment and appliances, and integrated systems may make it possible to achieve a 70% reduction in a building's energy use by 2025. With on-site energy technologies, such as solar photovoltaics, it is possible that many buildings could become self-sustaining and even net energy producers.

"Smart" building systems can integrate sensors, controls, and inputs from various building systems to inform an "energy management system" to optimize comfort and energy efficiency. Intelligent buildings can also communicate with the local utility to participate in peak shaving "demand-response" activities to substantially reduce the building owner's energy bills. Congress, as well as state legislatures, can catalyze the move to smarter and more efficient use of electricity though targeted tax credits and by requiring improvements in their own buildings and facilities.

The use of fully integrated smart building technologies is more often the exception than the rule, and most of our buildings, as a consequence, deliver less than the sum of their parts. Why? Generally, it is the result of the building developer or owner focusing on "first cost" rather than "life cycle" costs. This should be addressed with new business models and lease structures that make energy efficiency improvements profitable for building developers, owners, and tenants alike.

2 Includes purchased electricity. Total primary energy consumption in the building sector is about 10% of total U.S. consumption.

Stronger building codes that are performance-based and easy to implement—rather than proscriptive and difficult to modify to fit local conditions and circumstances—also can make a difference. Building codes are the responsibility of state and local governments; however, national model codes are developed by code-setting organizations and certified by DOE, and states are required to consider these certified codes. DOE's Building Energy Codes Program is working with national code organizations, the building industry, and state and local officials to develop and promote building codes that are 30% more energy efficient than the current national model. Legislation pending in the Congress would direct DOE to work with the code organizations to realize a 30% improvement in energy efficiency by 2010 and then a 50% improvement by 2020.

Industrial energy use is another area where there is huge potential for efficiency gains to reduce energy use. Industry accounts for about 32% of the energy consumed in the United States.[3] There are significant differences in the patterns of energy use in the industrial sector. Industries such as metals, petroleum refining, chemicals, fertilizers, glass, pulp and paper, and cement are very energy intensive, while others, such as automobile manufacturing, appliances, electronics, textiles, and food and beverages, are much less so. About 80% of industrial energy use is related to the use of motors, steam, compressed air, pumps, fans, process heating, combustion, and combined heat and power.

Industries can take advantage of off-the-shelf technologies—many of which are common across a wide range of industries—and institute best practices and better energy management to save significant amounts of energy. Plant energy audits sponsored by the DOE's Industrial Technology Program, for example, have been very successful in identifying ways to reduce energy use while improving productivity and recovering energy efficiency investments and saving money in an attractive timeframe. In the future, the industrial sector can adopt advanced technologies that could dramatically change basic manufacturing. These could include on-site energy generation, process efficiency improvements, advanced sensors and controls, and recovery and reuse of materials. The development and adoption of advanced industrial technologies can improve energy security while also helping to maintain the competitiveness of U.S. industry.

Electricity generation accounts for about 40% of total U.S. energy consumption and the power sector provides another example of an imperfect market. Because bulk electricity cannot easily be stored, the demand for electricity and the supply of electricity must be carefully balanced on a minute-to-minute, hour-by-hour basis. As utilities bring more-expensive, less-efficient generation on line to meet peaking demand, the cost of electricity generation can rise sharply. And yet, in most areas of the country, consumers pay flat rates for electricity. They are shielded from the true market signal and thus lack the incentive to curtail energy use during peak periods.

Consequently, we must explore innovative new regulatory models that reward efficiency, especially for utilities—and ultimately their customers—for saving electricity through energy efficiency programs and new approaches to the delivery of energy services. Moreover, utility regulatory policies that reward the more efficient use of generated electricity and natural gas must be encouraged.

Generally speaking, utilities are profitable when they sell electricity: if they sell less, they earn less. Electric companies are working with state regulators to transform the role of energy efficiency and to encourage them to treat investments in energy efficiency in essentially the same manner as investments for generation, transmission, and distribution. Many state legislatures and public utility commissions have recognized this reality and have implemented policies to remove this disincentive and to reward efficiency.

Such policies, which have had measurable success, include (1) cost recovery from the rate base for implementing efficiency programs or to compensate for lost marginal revenue that results, (2) separating fixed-cost revenue recovery from the volume of energy provided, and (3) creating financial incentives for

3 Includes purchased electricity. Total primary energy consumption in the industrial sector is about 21% of total U.S. consumption.

efficiency investment by utilities. All states, through their legislatures and public utility commissions, should seek to embrace these examples and create other mechanisms that make demand reduction as profitable for utilities as increasing supply. Today's twin challenges of reducing greenhouse gas (GHG) emissions while meeting the country's steadily rising demand for electricity make the shift in focus essential.

Needless to say, we must also promote new technologies that use energy even more efficiently and "smart grid" technologies that allow consumers (and their residences and vehicles) to interact with the power grid to seize energy savings. Plug-in hybrid cars and light trucks that operate on electricity for much of their driving cycle might not only reduce oil consumption and improve air quality; but they could also provide a reserve source of electricity for their owner's home, or provide power back to the grid during periods of exceptionally high demand, enhancing grid stability and reliability. Additionally, placing the generation source closer to end-users minimizes loss of electricity through the transmission process. However, the capacity of the current electricity grid must be expanded to support significant deployment of distributed generation systems.

There are still technological and economical barriers to overcome and standards to be established to leverage the most out of intelligent buildings, smart grids, and integrated plug-in hybrid cars and trucks. Perhaps the most daunting barriers, however, are the regulatory, institutional, and market barriers that exist at the local, state, regional, federal, and international levels. Therefore, the benefits and opportunities of energy efficiency must be broadly communicated and embraced at every level—from the White House and Congress, to Governors and state legislatures, to utility regulatory commissions, utilities, co-ops, and end users.

Leveraging policies, markets, and technology can yield tremendous benefits to promote energy efficiency, which is generally the fastest, least expensive method of helping to reconcile increasing demand for energy with increasingly constrained supplies, while reducing per capita emissions. This is the first priority.

Recommendations

- **The U.S. Department of Energy (DOE) should move expeditiously to promulgate the appliance standards as required by both the Energy Policy Act of 2005 (EPAct2005) and the Energy Independence and Security Act of 2007 (EISA2007).**

- **Allowing more rapid depreciation of capital equipment through the federal tax code would provide incentives for new investment that would accelerate reductions in energy intensity and carbon intensity. This can be accomplished by revising the tax code to:**

  - Reduce the recovery period for investment in electricity transmission lines and smart grid devices from 20 years to 10 years.
  - Reduce by half the cost-recovery period for the installation of best available energy efficiency devices by commercial facilities and small businesses.
  - Provide for immediate expensing for investments that meet the standard for breakthrough low carbon technologies.

- **Congress should increase annual funding for DOE's Buildings Program from the current level of about $110 million to $250 million and its Industrial Technologies Program from the current level of about $65 million to $175 million. (These funds are included as part of the increase of federal research and development (R&D) funding recommended in Section V of this report.)**

- **Congress should direct DOE to set energy-saving targets for national model building energy codes and encourage states to adopt such codes adapted for regional variances.**

- **Congress should require that federal energy efficiency grants to states be conditioned on the adoption of building codes that emphasize energy efficiency, consistent with model building codes certified by DOE.**

- **Congress should expand the tax deduction created in EPAct2005 for commercial buildings that reduce energy consumption by one-half to a value of at least $2.25 per square foot.**

- **States should establish appropriate regulatory mechanisms to treat utility investments in energy efficiency comparable to other investments.**

Reduce the Environmental Impact of Energy Consumption and Production

We must address the impact of our growing energy consumption on the environment and climate, while recognizing that any approach must be both economically viable and environmentally effective. We must not set targets for which technology does not yet exist or which threatens major economic displacement. We must give industry a predictable investment climate and incentives for innovation in clean energy. Costs and benefits must be transparent to consumers. We must commit to a course that promotes global participation while considering the priorities of the developing world.

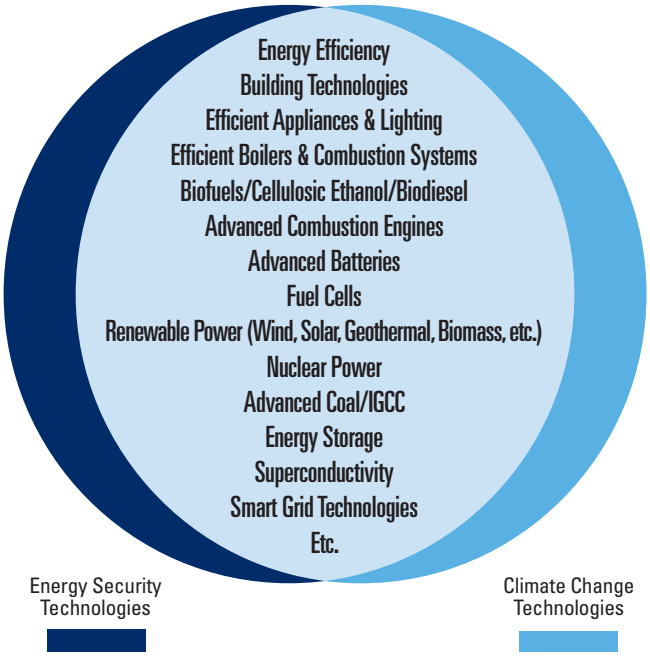
Climate change is a significant global environmental issue. Increasing global greenhouse gas (GHG) emissions are largely, but not exclusively, related to the production and use of fossils fuels. Carbon dioxide (CO_2) emitted from the burning of fossil fuels accounts for roughly 55% to 60% of global GHG emissions.[4]

Therefore, climate change should be addressed as part of an integrated agenda that enhances energy security, maintains economic prosperity, reduces pollution, and mitigates GHG emissions. In the climate change debate, energy is viewed as the problem. In reality, affordable energy provides a solution to climate change because it sustains the economic growth necessary to drive technology change and environmental protection. History has shown that poor economies do not have the resources to make protecting the environment a priority, but vibrant economies do. A smart energy policy can capitalize on this dynamic, providing clean energy to power economic growth and poverty eradication across the globe.

Achieving our energy security goals through greater efficiency and a highly competitive marketplace of energy options can reduce GHG emissions. Encouraging greater energy conservation and efficient use of all forms of energy (including fossil fuels) and diversifying energy supplies (through greater use of nuclear, wind, and solar power; biofuels; flex-fuel and plug-in hybrid vehicles; clean coal; smart grid; and other technologies) make sense from both an energy security and an environmental perspective (Figure 2). Our focus, therefore, should be on policies and technologies that produce more of these win-wins.

4 Includes emissions from land use.

Figure 2. Convergence of Energy Security and Climate Change Technologies



Source: Adapted from "Robert Marlay, Advancing Climate Change Technology—The Key to Multi-Goal Convergence," National Academies Summit on America's Energy Future, March 14, 2008 (http://sites.nationalacademies.org/energy/Energy_043332).

The pursuit of GHG emission reductions should not, therefore, occur in isolation from efforts to address energy security and economic growth. Meeting our energy security challenge—through greater energy efficiency and conservation, diversification of supply, and application of advanced technologies—can complement efforts to reduce GHG emissions. Nevertheless, we cannot ignore the tensions that do exist between energy security and climate change policies. Fuel switching from coal to natural gas in the power sector can lead to GHG reductions, for example, but it is appropriate to ask what the cost impact would be and what the implications would be for our long-term energy security.

Balancing these and other issues cannot take place through different, unrelated administrative processes using statutes and authorities, such as the Clean Air Act, Endangered Species Act, National Environmental Policy Act (NEPA), and Clean Water Act. These laws were not designed for and are ill suited to address the complexities of reducing GHG emissions. Rather than compound the present ambiguity, we need to increase the regulatory certainty businesses are seeking. Issues of such importance need to be debated and resolved legislatively by the Congress and the President and in a way that incorporates our desire for abundant and clean energy. Moreover, consumers and businesses need and expect a candid assessment of the costs and benefits of any legislative proposal.

We also need to take stock of existing trends in GHG emissions and existing climate policies and regulations. U.S. net total GHG emissions today stand at about 14% above their level in 1990. Over the 1990s, net emissions grew 17%; however, from 2000 to 2006, net emissions declined about 3%.

Energy-related CO_2 emissions—which account for about four-fifths of gross GHG emissions and are the more relevant metric for this energy policy Blueprint—have fared about as well. After rising 17% from 1990 to 2000, U.S. CO_2 emissions from energy grew just under 1% between 2000 and 2006 (Figure 3).

Energy-related CO_2 emissions intensity, a measure of emissions per unit of GDP, continues to improve. Throughout the 1990s, emissions intensity improved at a rate of about 1.7% annually; since 2000, intensity has improved by about 2.2% annually. We should look to accelerate these trends so that emissions growth slows even more rapidly, leading to a peak in emissions and absolute declines thereafter.

There are many policies already in place that will help us do this. With the enactment of EPAct2005 and EISA2007, the climate policy space has been populated with an array of different tools, programs, and mandates. These include more than $11 billion in tax incentives to stimulate efficiency and greater use of clean energy technologies over the next 10 years; a new loan guarantee program that has $42.5 billion in authority to support clean energy projects that reduce GHG emissions;

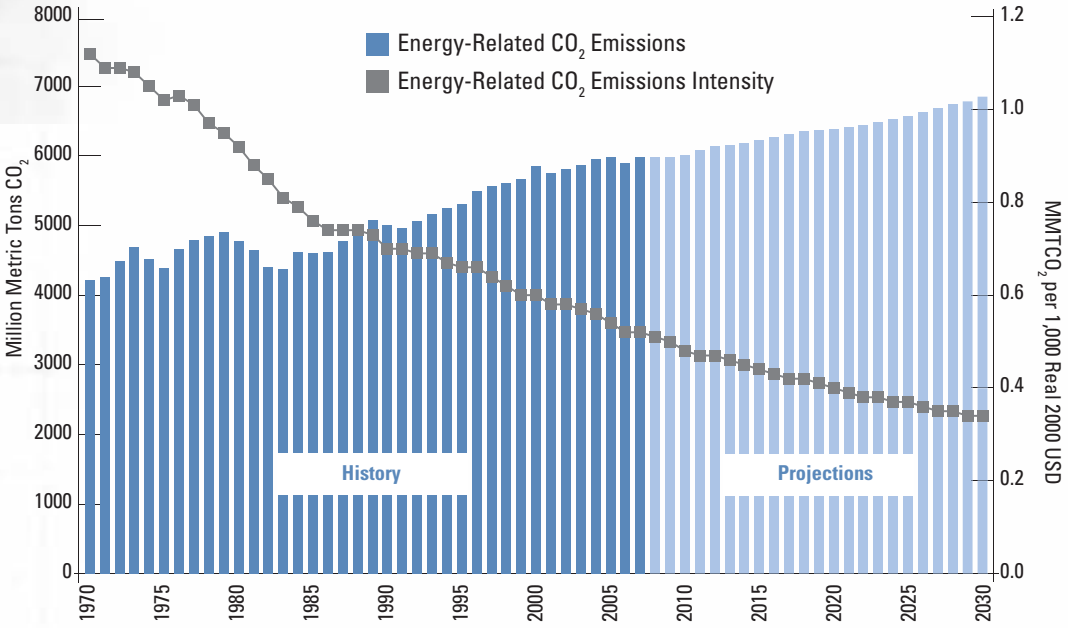
new renewable fuel mandates for cars and trucks that reach 36 billion gallons annually by 2022; increased fuel economy standards for vehicles to 2020; new appliance and equipment standards; new lighting standards; and new energy standards for federal facilities.

The impact of these laws in reducing emissions is seen in changes in DOE's Energy Information Administration (EIA) projections of CO_2 emissions from fossil fuel use just before and since EPAct2005 and EISA2007 were signed into law (Figure 4). The most recent projection shows CO_2 emissions in 2030 nearly 21% below the comparable level based on emissions growth rates in the *Annual Energy Outlook* (AEO) for 2005,[5] and cumulative emissions avoided from 2005 to 2030 of about 26 gigatons of CO_2. We have made, and should continue to make, considerable progress in limiting GHG emissions.

Additional policies, including those that attach an implicit or explicit value on certain air emissions, should give industry a more predictable and favorable investment climate, promote innovation in clean energy, and provide incentives to address the barriers and business risks

5 Based on the emissions growth rate in the *Annual Energy Outlook 2005*, energy-related CO_2 emissions in 2030 would be about 72% above 1990; in the *Annual Energy Outlook 2008* (revised), the comparable figure is 37%.

Figure 3. Historical and Projected U.S. Energy-Related CO_2 Emissions and Emissions Intensity



Sources: EIA, Historical Data Series, Energy-Related Carbon Dioxide Emissions by Fuel Type, 1949-2006, (http://www.eia.doe.gov/environment.html); EIA, Annual Energy Outlook 2008, Tables 18 (http://www.eia.doe.gov/oiaf/aeo/aeoref_tab.html); Department of Commerce, Bureau of Economic Affairs, Current-Dollar and "Real" Gross Domestic Product (http://www.bea.gov/national/xls/gdplev.xls).

associated with adopting advanced new technologies. Climate policies must not provide new windfall revenue to the government.

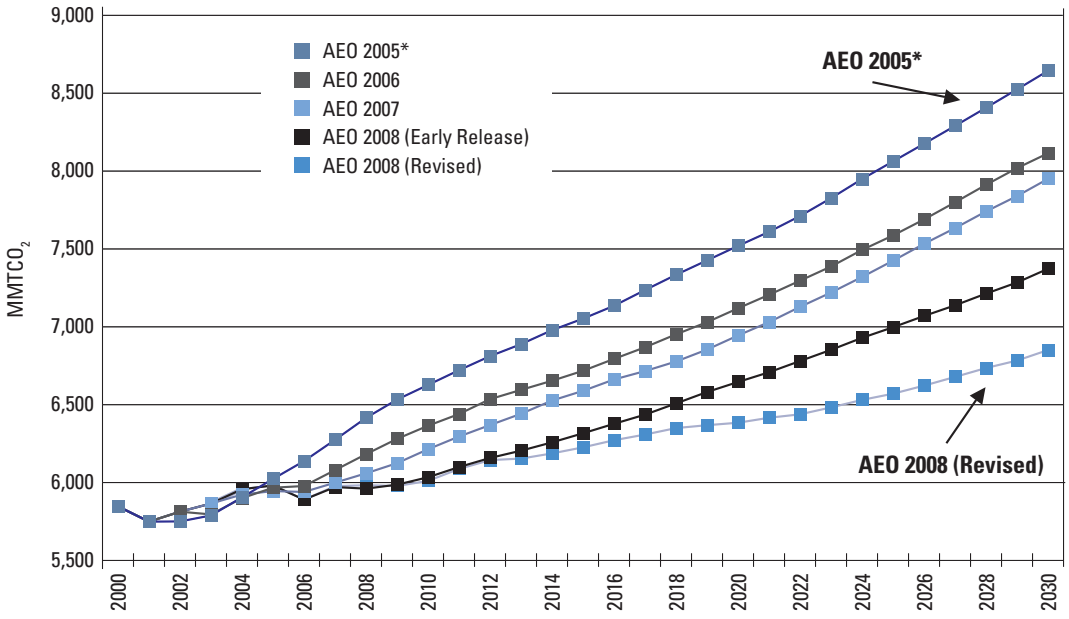
Energy efficiency and conservation provide the first and most cost-effective ways of reducing emissions and should feature prominently in climate change policy. Advanced technologies—such as carbon capture and storage, advanced nuclear power, renewables, smart grid, and others—will be needed on a vast scale to eventually reduce emissions significantly. Therefore, it is important that policies and goals not get ahead of the technologies needed to meet them. In other words, we cannot set targets for which technology options do not yet exist.

State policies also need to be reconciled with federal efforts. California's proposal for a low-carbon fuel standard for vehicles, which several other states could adopt, is an example. Federal policy should not be driven by any state or group of states. Congress should make it clear that any such state fuel requirements will be satisfied by meeting federal fuel requirements.

Additionally, we should learn from the experience of other countries, especially the European experience with the European Trading System, about what works and what does not. We must promote global participation and give appropriate consideration to the priority the developing world places on economic development. A new international arrangement that puts U.S. industry at a competitive disadvantage will simply shed industries and jobs, sending their related emissions overseas, which will do nothing to protect the environment.

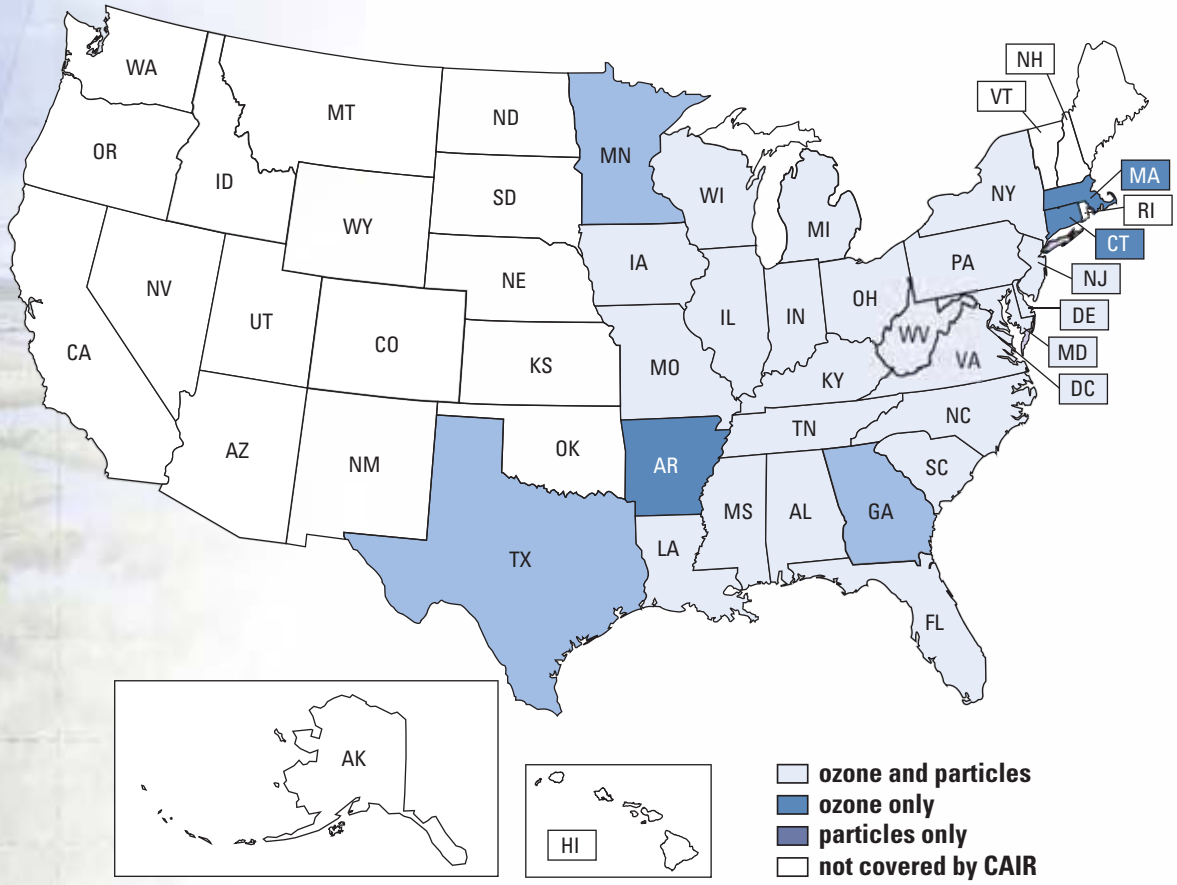
We also must continue to protect the air we breathe. As our understanding of the basic science related to air quality

Figure 4. Projections of CO_2 Emissions From Energy Over Time



*AEO 2005 projected emissions to 2025 only. This chart assumes the AEO 2005 emissions growth rate for 2020 to 2025 is maintained to 2030.
Sources: EIA, Annual Energy Outlook, 2005 – 2008, Table 18 (http://www.eia.doe.gov/oiaf/aeo/index.html).

Figure 5. States Participating in Clean Air Interstate Rule



Source: Environmental Protection Agency, Clean Air Interstate Rule website (http://www.epa.gov/cair/where.html)

continues to progress, we must ensure that decisions about air quality keep pace with science and our standards remain protective. Accelerating air quality improvements will be made easier by many of the measures and strategies to address concerns about GHG emissions. Regulators have an opportunity to reduce redundant, burdensome air pollution regulations without sacrificing air quality.

The 2005 Clean Air Interstate Rule (CAIR) was designed to bring eastern states into compliance with new federal air quality standards. CAIR would be implemented in two phases, and it would employ an innovative regulatory approach to cut sulfur dioxide (SO_2) and nitrogen oxide (NOx) emissions by 73% and 61%, respectively, from the power sector. The plan, which was adopted by 28 eastern states with the broad support of business, labor, and environmental groups, would reduce compliance costs through an interstate trading system and save energy consumers billions of dollars.

However, in July 2008, the U.S. Court of Appeals for the D.C. Circuit threw out the CAIR rule. If this decision stands, the Environmental Protection Agency (EPA) will have to start from scratch and rewrite the regulation. States in the meantime will have to develop and adopt new statewide plans for SO_2 and NOx emissions reductions, which may not be adequate after EPA finalizes the federal regulation. To achieve these emissions reductions in the absence of CAIR, states would have to cast a much wider regulatory net, including power plants and industries in neighboring states. Not only would this jeopardize economic growth and expansion, it would delay investment in and deployment of clean coal technologies. States and utilities need regulatory certainty. Congress could solve this by legislating a mechanism to address the issues and concerns that CAIR was originally intended to resolve, and Congress should do so now.

Recommendations

- The administration and Congress must approach climate change as part of, not apart from, a comprehensive energy plan and they must take into account the extent of existing mandates, provide regulatory certainty, and permit considerable flexibility in how goals are achieved.
- Climate change policies must initially focus on promoting win-win ways to achieve energy security and emissions reductions while protecting economic growth. Efforts should focus on accelerating energy efficiency gains; promoting the development, demonstration, and commercial use of low- or zero-emitting technologies; reducing or eliminating barriers to developing and using domestic climate-friendly fuel sources; and providing legal and regulatory certainty for implementing technologies to reduce emissions.
- Congress should remove the cloud of regulatory uncertainty by clarifying that greenhouse gas (GHG) emissions shall not be regulated under the Clean Air Act or the Endangered Species Act, and Congress should block legal "fishing expeditions" and lawsuits against particular entities for the effects of climate change. Federal standards should preempt state standards.
- Climate policies must not provide a revenue windfall to the government.
- To the extent that climate change policies reduce air pollution as a co-benefit, air pollution rules should be reevaluated and revised when it makes sense to do so.
- To ensure our competitiveness, any new national climate change policy should be conditional on an international agreement that requires full international participation.
- Congress should act expeditiously to legislate a mechanism to address the issues and concerns for which the Clean Air Interstate Rule (CAIR) was originally intended. Absent congressional action, the administration should appeal the D.C. Circuit Court's decision.

Invest in Climate Science to Guide Energy, Economic, and Environmental Policy

A deeper understanding of the issues and developing science associated with the environment and climate change will influence national and global energy, economic, and environmental policy choices. Balancing these priorities requires greater consideration of the complex processes driving climate change and increased attention to adaptation measures. We must increase our investment in climate science, which will enable us to adjust policies as scientific understanding advances. At the federal level, we need better coordination and collaboration across agencies for policy coherence and balance.

A significant reduction in GHG emissions implies a huge—and hugely expensive—transformation to low-carbon energy systems. Because climate policy will cut across and impact virtually the entire economy, it should be informed by the best science and observations available.

Our understanding of the climate system and the human impact on it has progressed significantly and supports efforts to mitigate GHG emissions. The recent reports of the Intergovernmental Panel on Climate Change (IPCC) and the U.S. Climate Change Science Program (CCSP) provide an overview of our current understanding of the scientific issues and the environmental and policy challenges that is both comprehensive and compelling. The United States should continue to be the world leader in climate change science and the major sponsor of the work upon which the IPCC reports rely. Our universities and research institutions house some of the finest minds, and our national labs house the world's fastest supercomputers. There is no reason we cannot remain the world leader in climate science.

To address climate issues and other environmental challenges, reduce uncertainty, and more properly identify and assess the risks and opportunities for mitigation of climate change, we ought to increase our investment in climate science to enable policymakers to set and adjust policies as scientific understanding advances. Although we have made considerable progress, we need an even deeper understanding of the complex processes that affect the environment and climate change to inform national and global energy, economic, and environmental policy choices. This is especially relevant now, as real world observations have

raised questions about the sensitivity of the climate and the ability of climate change models to reproduce natural variability and predict future temperatures. Models also perform poorly at a regional level, and, although they are improving, a growing body of evidence suggests that there is a much broader range of factors that impact climate, such as land use change, that deserve greater attention. More and better analysis of the costs and benefits of various climate change policies are necessary to make informed policy decisions.

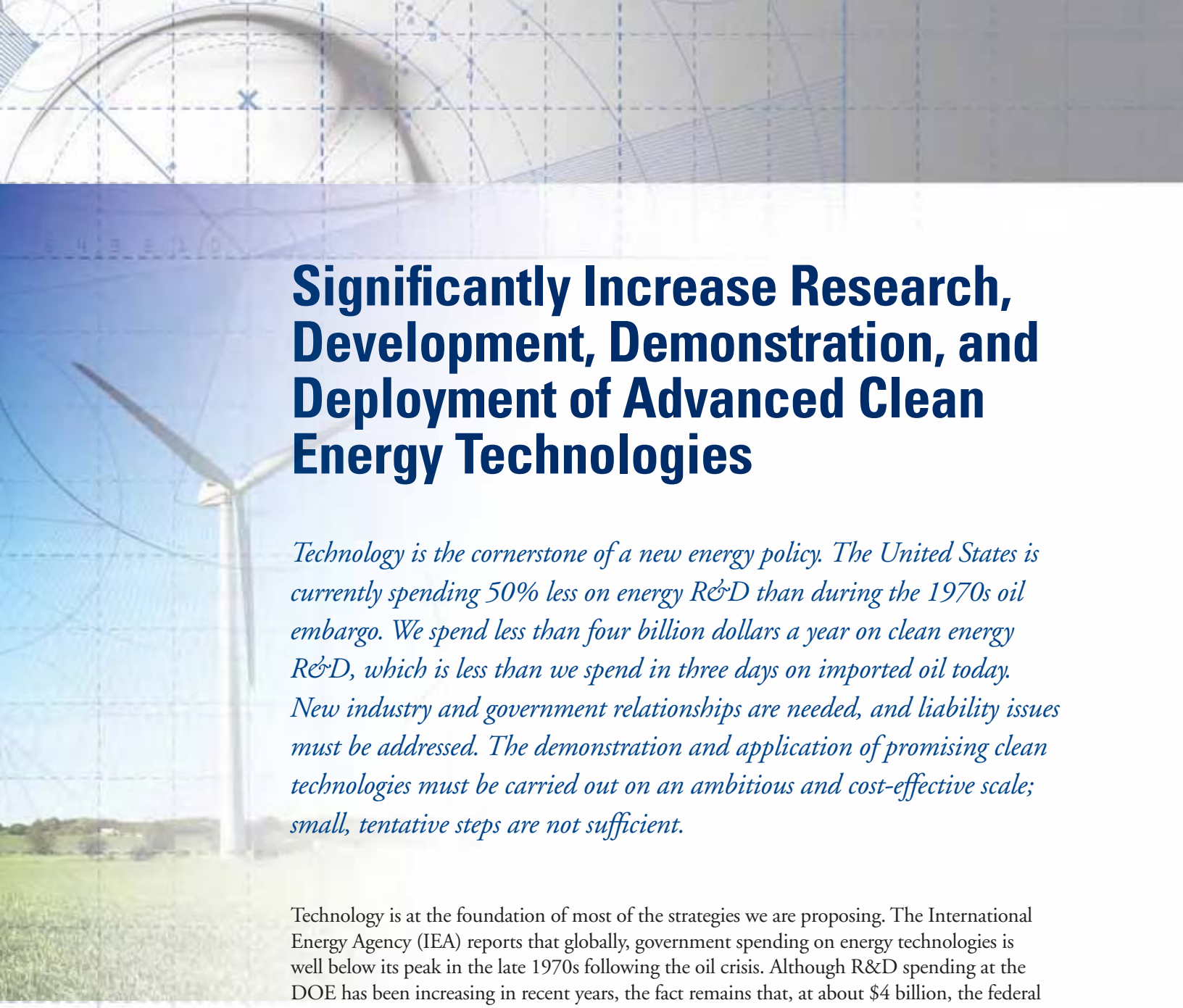
Accurate long-term observations of the earth and physical systems are indispensable to climate research, modeling, and prediction. Without such observations, progress in all areas of climate science will be held back. Many of our current systems were designed for weather prediction, not climate change research. The IPCC noted that trends derived from surface observations still contain significant errors, and the National Academies have expressed dismay over the state of the U.S. environmental satellite system. Developing and maintaining a robust and modern observational system integrating an array of surface, ocean, and space-based sensors— including the Global Earth Observation System of Systems (GEOSS)—should be a priority.

Moreover, there needs to be greater transparency, including public access to data and methods from research supported with federal funds, which would increase the public's confidence in research results.

The focus on the climate issue has been largely confined to climate science and mitigation—both of which are extremely important. But the issue of adaptation has not received the attention it deserves in our federally supported science programs, especially given its growing prominence in international negotiations. Increasing our resiliency to changes in the climate, whether due to natural variability or human-induced change, is an area where more research and coordination are needed. We also need to take a closer look at the potential cost, effectiveness, and risks of different geo-engineering strategies.

Recommendations

- **The federal government should make filling the gaps in climate science a research priority. Progress in climate science is apparent, but significant knowledge gaps remain, such as the predictive capability of climate models and the impact of land use on climate change.**
- **Congress should provide adequate funding to support an integrated surface, ocean, and space-based observation network, including the Global Earth Observation System of Systems (GEOSS). Greater coordination is needed to ensure that federal agencies properly collect, maintain, and share observational data.**
- **Federal research and development (R&D) agencies should develop a more comprehensive and concise policy on data disclosure, identifying what must be made publicly available. To maintain the public's trust and support and to ensure transparency, researchers who receive federal support should be required to disclose their data, models, and other relevant material, subject to protections for confidential business information, so that results can be assessed and reproduced.**
- **A federal multiagency Climate Change Adaptation Program, similar in organization and function to the Climate Change Science Program (CCSP) and the Climate Change Technology Program (CCTP), should be established to examine adaptation and geo-engineering issues and to coordinate R&D across the government.**



Significantly Increase Research, Development, Demonstration, and Deployment of Advanced Clean Energy Technologies

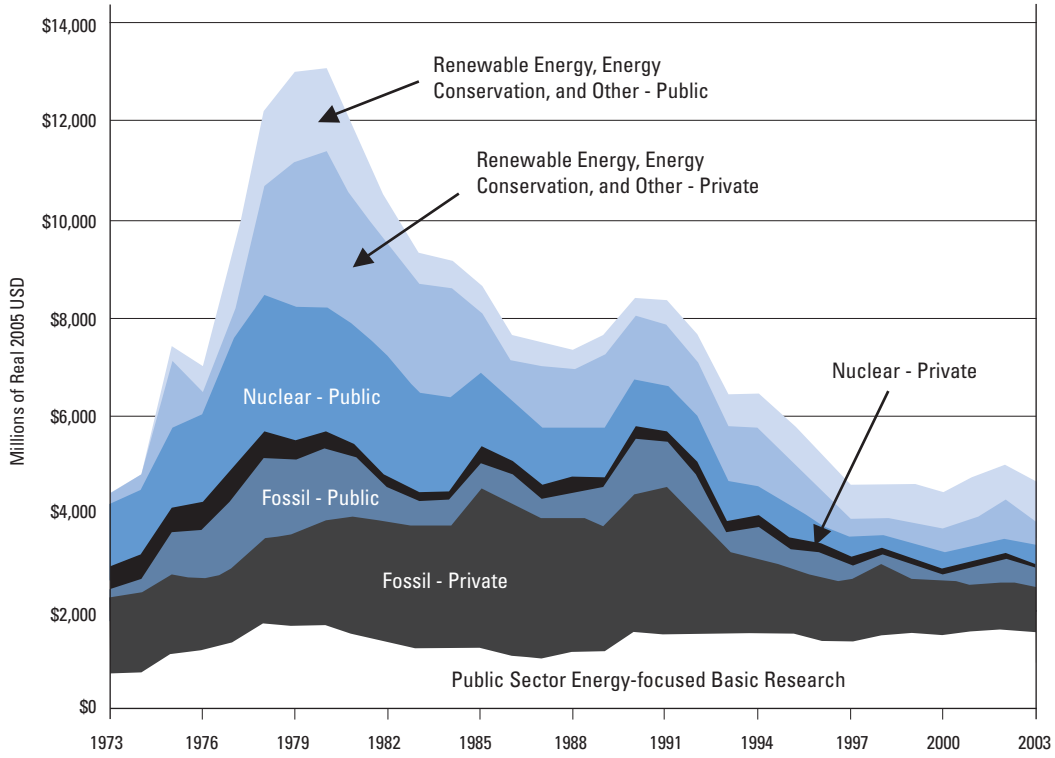
Technology is the cornerstone of a new energy policy. The United States is currently spending 50% less on energy R&D than during the 1970s oil embargo. We spend less than four billion dollars a year on clean energy R&D, which is less than we spend in three days on imported oil today. New industry and government relationships are needed, and liability issues must be addressed. The demonstration and application of promising clean technologies must be carried out on an ambitious and cost-effective scale; small, tentative steps are not sufficient.

Technology is at the foundation of most of the strategies we are proposing. The International Energy Agency (IEA) reports that globally, government spending on energy technologies is well below its peak in the late 1970s following the oil crisis. Although R&D spending at the DOE has been increasing in recent years, the fact remains that, at about $4 billion, the federal government now spends about 50% less on energy R&D than it did during the 1970s (Figure 6). To put this in perspective, global subsidies for biofuels in 2006 were about $5.5 billion to $7.3 billion, with U.S. subsidies on the order of $3 billion to $4 billion.

In addition to improving energy security, advanced new technologies can reduce the costs of meeting environmental requirements, especially GHG emissions goals. To eventually achieve significant cuts in GHG emissions at a cost that is acceptable, breakthroughs in technology are necessary. The *CCTP Strategic Plan* notes that, depending on the reduction target, advanced technologies can cut the global cost of reducing GHG emissions by 56% or more. Therefore, advanced technologies can expand the range of economically and politically acceptable policy options.

New technologies, then, are not a luxury, but they are a fundamental requirement, and technology development should be an integral part of any energy policy. We must challenge our scientists and engineers to accelerate breakthroughs in low-emission solar and wind energy, biofuels, hydrogen, advanced batteries, building efficiency, grid technologies, nuclear power,

Figure 6. U.S. Public and Private Energy R&D Since 1974



Source: Paul Runci and Jim Dooley. "Energy R&D Investments: Past and Future," Global Energy Technology Strategy Program, Pacific Northwest National Laboratory, May 24, 2007 (http://www.pnl.gov/gtsp/workshops/runci_%20dooley_gtsp_%20052407.pdf).

fusion energy, and other technologies that have the potential to fundamentally transform the way we produce and consume energy.

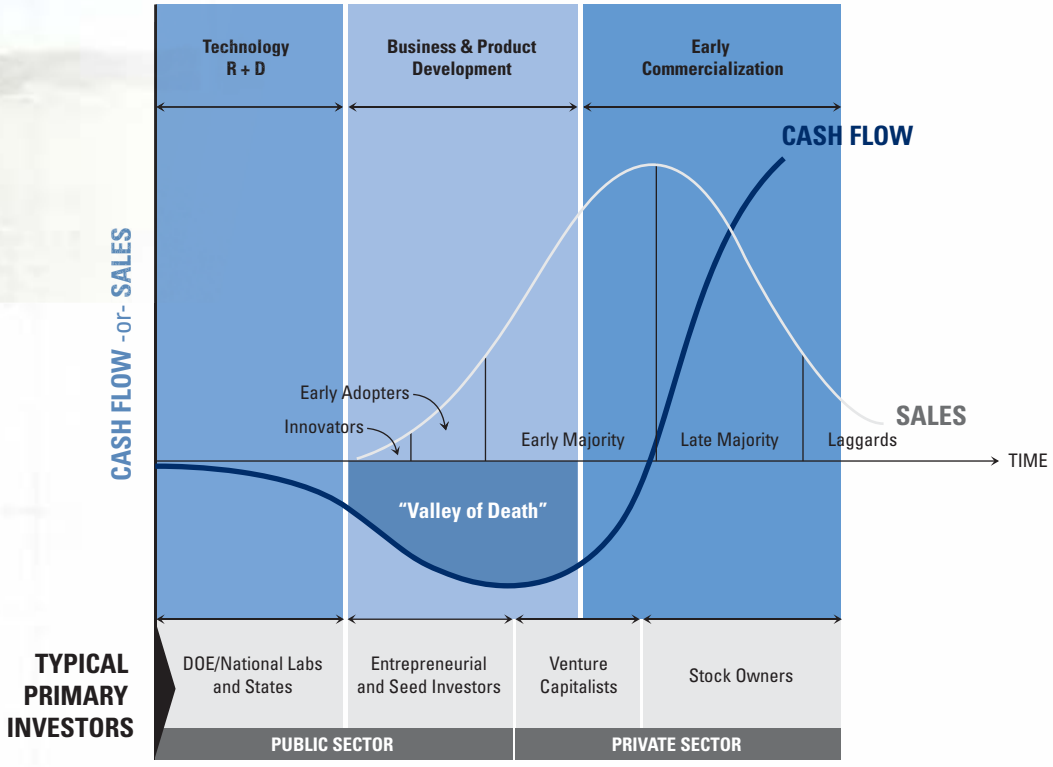
The U.S. should maintain its clear leadership role in technology development. To support and accelerate the development of a broad portfolio of clean energy and enabling technologies, the federal government should at least double the current federal energy R&D spending, in real terms, from $4 billion to $8 billion. We recognize the difficulty of ensuring responsible oversight and execution of a rapid and steep increase in funding; therefore, we recommend this increase scale up over the next five years. Recognizing that there is no "silver bullet" technology that will solve our energy challenges and that not all technologies will pan out, this funding should support a broad-based and hedged technology portfolio underpinned by a strong modeling and analytical capability. It is also important to support a vibrant scientific enterprise more broadly. Advances in fields as varied as materials research, nanotechnology, super computing, and biotechnology, to name a few, may hold the keys to breakthroughs in fuel cells, batteries, biorefining, and other emerging energy technologies.

There also needs to be a place where high-risk research with a potentially high payoff is not discouraged—indeed, is rewarded—but that will take a cultural change within

both the agencies and the Congress. Many R&D programs are adverse to risk, driven in part by fears of congressional oversight and the requirements of the Government Performance and Results Act.

The America COMPETES Act authorizes the establishment of an Advanced Research Projects Agency for Energy (ARPA-E) within DOE, similar to the U.S. Department of Defense's (DOD) successful Defense Advanced Research Projects Agency. The goal of ARPA-E is to support transformational energy technology research projects. To the extent that it could provide a home for novel, high-risk ideas and cross-cutting technology development, it should be welcomed. DOE, however, has not requested funding for ARPA-E, opting instead to subsume its function within existing programs. DOE should establish, and Congress should provide full funding for, ARPA-E or its equivalent to perform high-risk research. This funding should not, however, come at the expense of other more traditional R&D—robbing Peter to pay Paul does not contribute to a sound energy R&D strategy. Project funding decisions should be made on a merit-based competitive process, not legislated.

Figure 7. Bridging the Gap Between Innovation and Markets



Source: L.M. Murphy and P.L. Edwards, Bridging the Valley of Death: Transitioning from Public to Private Sector Financing, National Renewable Energy Laboratory, May 2003 (http://www.nrel.gov/docs/gen/fy03/34036.pdf).

We must also ensure that there is a proper climate for R&D for our private sector companies, where most of the R&D investment occurs. In particular, the on-again, off-again nature of the R&D tax credit, which allows businesses to deduct part of those investments from their taxes, has made R&D planning for businesses more difficult. About two-thirds of all R&D conducted in America (about $200,000 billion in total, including energy) is done by the private sector. The R&D tax credit should be made permanent so that companies have greater certainty as they plan and conduct R&D.

The development and deployment of new, affordable technology is not just the result of activities in a laboratory. Placing technologies on the shelf is one thing; moving them off the shelf is another. Both are important. Moving a new technology off the shelf requires that it be transferred out of the lab, capitalized, installed, and used in a marketplace of discerning consumers who are convinced that they will benefit from its use.

Adopting new technologies is not without risk. Between the laboratory and the marketplace lies a gap that is characterized by the inability of a project to secure sufficient funding or revenue to continue operations (Figure 7). In general, the public sector works in the early R&D phase to develop and validate the technology, and the private sector picks up the technology to commercialize and deploy it into the marketplace.

Public-private partnerships and supportive policies can be used to bridge the gap between the laboratory and the marketplace and overcome the "first movers' penalty," providing incentives for innovators to act. Not only must we be willing, therefore, to invest in basic and applied energy R&D, we must also be willing to expand loan guarantees and targeted incentives to encourage the first movers to bring these new technologies into the market.[6] These policies should be designed to stimulate competition and not pick winners and losers, so that markets can work to identify and adopt the best technologies.

When promising technologies are particularly complex and expensive, we must consider new methods of government-industry partnerships to demonstrate those technologies on a commercial scale and on an ambitious schedule.

Additionally, the firms and institutions that will ultimately deploy and utilize these advanced technologies need to be integrated into the technology development and engineering phases to ensure market acceptance and bridge the gap between lab and marketplace. The national laboratories are tremendous national assets, but all too often the technology innovations produced by them do not make it in the market place. One way to address this problem would be to bring into the labs successful businesses and venture capital firms to identify and develop business plans to take promising technologies and move them into the marketplace.

Indeed, securing our energy future is in large part tied to the degree we are able to accelerate the commercial adoption of new technologies, and that will necessitate an accelerated rate of capital formation. The federal government can help leverage private capital to attain these goals by reducing investment risk and lowering the cost of capital. However, traditional federal agencies lack the capability and wherewithal to do this effectively.

To meet this unmet need, we encourage the establishment of a new Clean Energy Bank of the United States (CEBUS), a quasi-governmental entity combining the functions and modeled after the Export-Import Bank, Overseas Private Investment Corporation (OPIC), and the Millennium Challenge Corporation. CEBUS would operate to lower capital costs and mitigate market risks impeding investment in new or advanced energy technologies and would be designed to address market inefficiencies rather than compete with existing market players.

As envisaged, the bank would offer risk management, debt, equity, and securitization products. These could include concessionary financing, direct loans, loan guarantees, lines of credit, and insurance products, and the bank could take equity positions, similar to a venture capitalist, in clean energy projects judged commercially

6 Further discussions of incentives, such as tax breaks, are found throughout this Blueprint.

viable. Moreover, to demonstrate the feasibility of precommercial technologies, CEBUS could help manage commercial-scale demonstration projects that require large amounts of public and private capital. After an initial capital infusion, which could include private investment, CEBUS could charge fees for its services to minimize or eliminate the need for appropriations.

Although incentives almost certainly will be needed to overcome the risks associated with adopting many new technologies, ultimately the new technologies will have to be able to compete in the marketplace on an equal footing. Therefore, the real measure of our success in achieving energy security will not be whether wind has achieved "X" percent of our generating capacity or biofuels have achieved a "Y" percent share of the transportation fuels market, but whether there is vigorous competition among different technologies and fuels within and among sectors. Right now there is not, but with new policies, we can drive technology innovation and create a competitive energy marketplace that is good for consumers, good for business, and good for the environment.

Recommendations

- **Congress should, at a minimum double, the funding for federal energy technology R&D programs in real terms within five years.**
- **The federal government should support a broad R&D portfolio on both the supply and demand sides, including energy efficiency, new energy sources, and advanced fuel and power delivery options. Above all, these efforts must be supported by a robust scientific enterprise within DOE and other public and private research institutions.**
- **DOE should establish, and Congress should fund, a new ARPA-E program or its equivalent to assess, prioritize, select, and support high-risk, exploratory research on innovative concepts and enabling technologies that have great potential for breakthroughs.**
- **Congress should establish a long-term R&D tax credit so that companies can plan their R&D activities with greater certainty.**
- **DOE should provide opportunities for businesses and venture capital firms to work within the national laboratories to identify and create business plans to commercialize new advanced energy technologies being developed by the laboratories.**
- **Congress should create a Clean Energy Bank of the United States (CEBUS), a quasi-governmental entity, with sufficient initial capitalization to invest in and accelerate the market penetration of advanced clean energy technologies. The bank should have the authority to issue loans, loan guarantees, lines of credit, insurance, and other financial products and help support demonstration projects. CEBUS should become self-financing through fees and interest.**

Immediately Expand Domestic Oil and Gas Production

Expanding domestic production will reduce our dependence on foreign oil and natural gas and significantly reduce the billions of dollars we send abroad each year. As our reliance on oil and natural gas will necessarily continue for the foreseeable future, we can no longer rule out the value of our own significant proven oil and gas reserves nor the value of a future significant discovery anywhere in or off the shores of the United States. Doing so will create new investment and new jobs here at home. New federal and state partnerships are needed, and new revenue-sharing models must be developed to build local support for environmentally sound energy exploration and production.

Our dependence on imported oil has risen from less than 40% in the 1970s to more than 60% today. Government policies have put the most promising domestic oil and gas prospects off limits to exploration and production.

High oil and gas prices, our growing reliance on imported oil (Figure 8), and price volatility clearly demonstrate the imperative to change course and expand domestic oil and gas production.

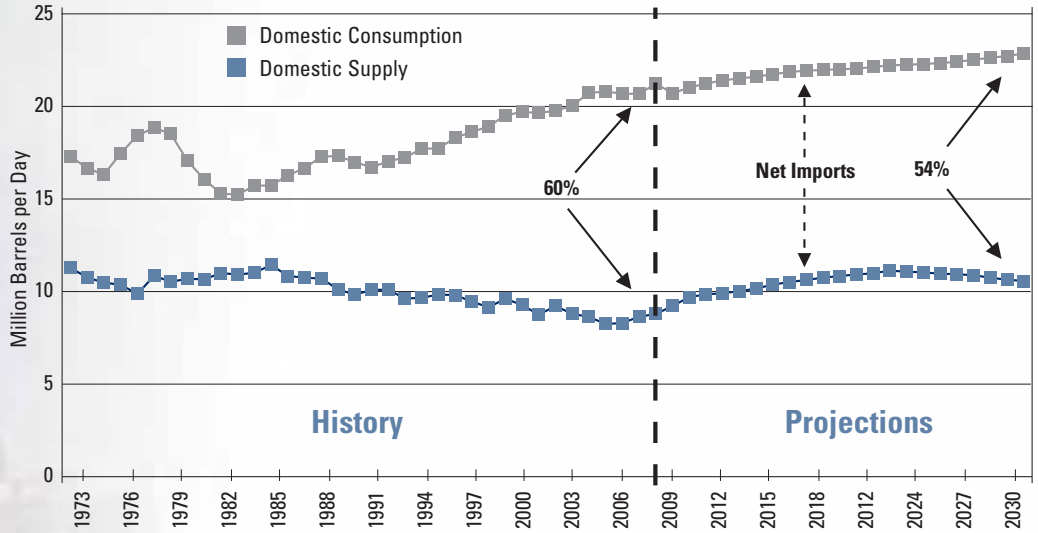
The Outer Continental Shelf (OCS) is an area of some 1.76 billion acres submerged off the United States' coasts controlled by the federal government. Approximately 97% of the OCS is under federal moratoria preventing any exploration or production of oil and natural gas. The U.S. Department of the Interior (DOI) estimates that the OCS contains 86 billion barrels of oil and 420 trillion cubic feet of natural gas. Because exploration is prohibited on the vast majority of the OCS, these estimates are primarily based on survey projections and are likely quite conservative. Additionally, about 83% of federal lands onshore containing some 28 billion barrels of oil and 207 trillion cubic feet of natural gas are under moratoria or severely restricted.

In the 26 years since the OCS moratoria were put into place, the technology utilized to extract oil and gas has evolved, significantly reducing the environmental impact of producing the resources. Advanced multidimensional seismic imaging allows a much higher degree of accuracy in locating oil and gas deposits, which reduces the amount of drilling necessary while increasing the amount of resources recovered. Pressure gauges and safety valves incorporated into offshore production facilities diminish the possibility of spills. These technologies have reduced the spillage rate to just 0.001%.

States have authority over oil and natural gas production within state coastal waters, which are generally those areas within three nautical miles of the coast. By law, Texas and Florida are treated differently; the seaward boundary for Texas is 9 nautical miles, and the seaward boundary for Florida in the Gulf of Mexico is also 9 nautical miles. States retain all rights to revenues generated from oil and gas production in state waters, including royalties. Some coastal states have resisted new exploration and production in offshore areas of the federal OCS in part because the states' share of revenues resulting from offshore production is generally far less than if the exploration and production were occurring on federal leases onshore.

Anything beyond the state boundary is by law federal land. Oil and natural gas production in offshore federal land is regulated under the Outer Continental Shelf Lands Act.

Figure 8. Historical and Projected U.S. Petroleum Consumption, Domestic Supply, and Net Imports: 1973-2030



Sources: EIA, U.S. Petroleum Product Supplied and U.S. Imports by Country of Origin ttp://www.eia.doe.gov/oil_gas/petroleum/info_glance/petroleum.html); EIA, Annual Energy Outlook 2008, Table 11 (http://www.eia.doe.gov/oiaf/aeo/aeoref_tab.html).

Under Section 8(g) of the Act, the federal government only shares 27% of revenues from oil and natural gas production occurring within 3 nautical miles of the state boundary. Under the Gulf of Mexico Energy Security Act, signed into law in 2006, selected Gulf of Mexico states are eligible to receive 37.5% of revenues collected from specified lease sales in the Gulf of Mexico.

New federal-state partnerships to expand upon already advanced and environmentally sound exploration and production, along with new revenue-sharing models to more equitably share the federal revenues derived from offshore development, should be pursued to assist in opening new domestic oil and gas fields to exploration and production. Specifically we are advocating for every state to be eligible to receive 37.5% of the revenue from all leases on the OCS off its coast.

It is important to recognize that the energy business is capital intensive. A new offshore production platform typically costs in excess of $500 million to construct and hundreds of millions of dollars per year to operate. Offshore drilling rigs are leasing for as much as $750,000 per day. Exploration and production investment decisions have always involved significant resource, technology, economic, and political risks. Such investments typically proceed without the certainty that future oil prices will allow recoupment of costs. Actually bringing an oil or natural gas prospect to production is tremendously time consuming and expensive, requiring millions, and in some cases billions, of dollars in investments and multiple licenses and permits for a single project. This is the primary reason calls for "use it or lose it" requirements are ill-founded

and do not recognize that awarding leases to industry for exploration is merely the first step in a lengthy and capital intensive process that often does not result in the production of oil or natural gas.

Historically, the primary advantages of the U.S. oil and natural gas regime in federal lands and waters have been lease-contract sanctity, stability of terms, and globally competitive government take. Without these, even favorable fiscal terms lose their power to promote exploration for and development of a nation's resources. For example, some have advocated for the imposition of a negative "windfall profits" tax on oil companies. This would be unwise and counterproductive, as it would curtail the amount of capital available for new exploration and production and ultimately curtail domestic production while increasing prices for the consumer.

Making available new areas for exploration will rationalize company investments in new technologies like multidirectional drilling that can recover more oil and gas from a field, or increase precision and efficiency and continue to reduce the environmental footprint of production. Additionally, efforts must be made to ensure the resources that are produced are more readily transported to market. To that end, the State of Alaska and industry should be encouraged to build and operate the Alaska Natural Gas Pipeline to transport natural gas from the North Slope of Alaska to the continental United States.

We must also utilize our significant reserves of liquid fuels derived from coal, oil sands, and oil shale as well as expand infrastructure to enable greater access to these resources located throughout North America. According to DOE, the United States has recoverable reserves of coal equivalent in energy value to nearly 6 trillion barrels of oil; oil shale amounting to more than 2 trillion barrels of oil equivalent; and heavy oil and oil sands equal to another 154 billion barrels of oil equivalent, some portion of which can be converted to liquid fuels such as gasoline and diesel. To understand the enormity of the remaining U.S. hydrocarbon endowment of nearly 8,300 billion barrels of oil equivalent, consider the fact that we have consumed just 197 billion barrels of U.S. oil since the first domestic oil well was drilled in Pennsylvania in 1859.

Unfortunately, much like the moratoria on energy development on the OCS, there is also a legal prohibition against the federal government leasing much of this land for exploration for oil shale. Keeping these lands off limits is stunting the investments necessary to improve the technology to extract these valuable resources in an environmentally responsible manner. It is also simply taking another domestic resource off the table for the American consumer.

Admittedly, only a portion of these resources are recoverable, and the potential environmental impact of production requires that care be exercised. However, the abundance and strategic value of these resources requires us to continue to improve methods to economically extract them with a minimum of adverse impacts to the environment.

Therefore, in addition to the recommendations related to carbon capture and sequestration outlined elsewhere in this Blueprint, we believe that a sustained and enduring federal R&D effort be undertaken—in partnership with private industry, universities, and national laboratories—to evaluate technologies and practices to minimize the impact of the development of these underutilized fuels on the land and water resources of the United States. We should also evaluate technologies and practices to reduce the energy intensity and carbon footprint of these fuel sources.

As a significant amount of these resources are located on federal lands, we recommend a clear and consistent regulatory framework to incentivize their safe and clean development.

Another potential source of significant amounts of domestic natural gas is methane hydrates, an icelike substance containing natural gas, found beneath the ocean floor and in the Arctic permafrost. The United States Geological Survey estimates there are some 317 quadrillion cubic feet of methane gas stored in hydrates in the United States. This represents more than 1,600 times the amount of conventional natural gas reserves estimated in the United States. More R&D is necessary to more accurately locate this resource and economically produce

it with minimal geologic impact or release of GHG emissions. However, the moratorium preventing exploration and production of traditional natural gas on the OCS also acts to thwart work to develop methane hydrates.

There is also a legal prohibition primarily aimed at preventing the U.S. military from being able to obtain transportation fuels from coal-to-liquids (CTL) technology due to concerns over resulting GHG emissions. Ensuring the military is able to fuel its vehicles from domestic energy sources should be a strategic imperative, and we recommend this prohibition be repealed. Moreover, this prohibition also serves to limit access for U.S. consumers to transportation fuels refined from the Canadian oil sands, which is estimated to be the second largest oil reserve in the world.

Recommendations

- **The President and Congress should increase domestic energy supply by permanently ending the moratorium on exploration and production of oil and natural gas in the Outer Continental Shelf and on federal lands onshore.**
- **Congress should provide a 37.5% share of royalty revenues from all new production on the OCS to the state(s) off the coast of which development occurs.**
- **The U.S. Department of the Interior should promptly conduct a comprehensive seismic inventory of areas of the OCS and the eastern Gulf of Mexico currently precluded from oil and natural gas exploration and production.**
- **The President and Congress should actively support construction of the Alaska natural gas pipeline.**
- **The President and Congress should expand the leasing program for increased access to and production of fuels from oil shale, oil sands, and other frontier hydrocarbons fuels in nonpark federal lands.**
- **Congress should repeal Section 526 of EISA2007, which prevents the federal government (including the military) from utilizing nontraditional transportation fuel sources, such as CTL or oil shale, for its vehicles and aircrafts.**

Commit to and Expand Nuclear Energy Use

Nuclear power is currently an emissions-free source of 20% of America's electricity supply, despite our not having licensed the construction of a nuclear power facility in nearly 30 years. Expansion of new nuclear power assets is essential to meet our projected growing demand while mitigating our emissions of CO_2. As required by law, the federal government must provide authorized fiscal incentives for new nuclear power plants. We must solve our long-term nuclear waste challenges and aggressively expand efforts to recycle used nuclear fuel.

Nuclear power is the nation's largest emissions-free source of electricity. From a life-cycle perspective—including the impacts of uranium mining, uranium enrichment, fuel fabrication, plant construction, and fuel disposal—nuclear power offers a huge emissions advantage over any other large-scale method of baseload power generation and is on par with renewable sources.

Nuclear power currently supplies about 20% of America's electricity supply. America's 104 operating nuclear power reactors are also the cheapest source of baseload electricity on a per-kilowatt-hour basis because operational and fuel costs are comparatively low.

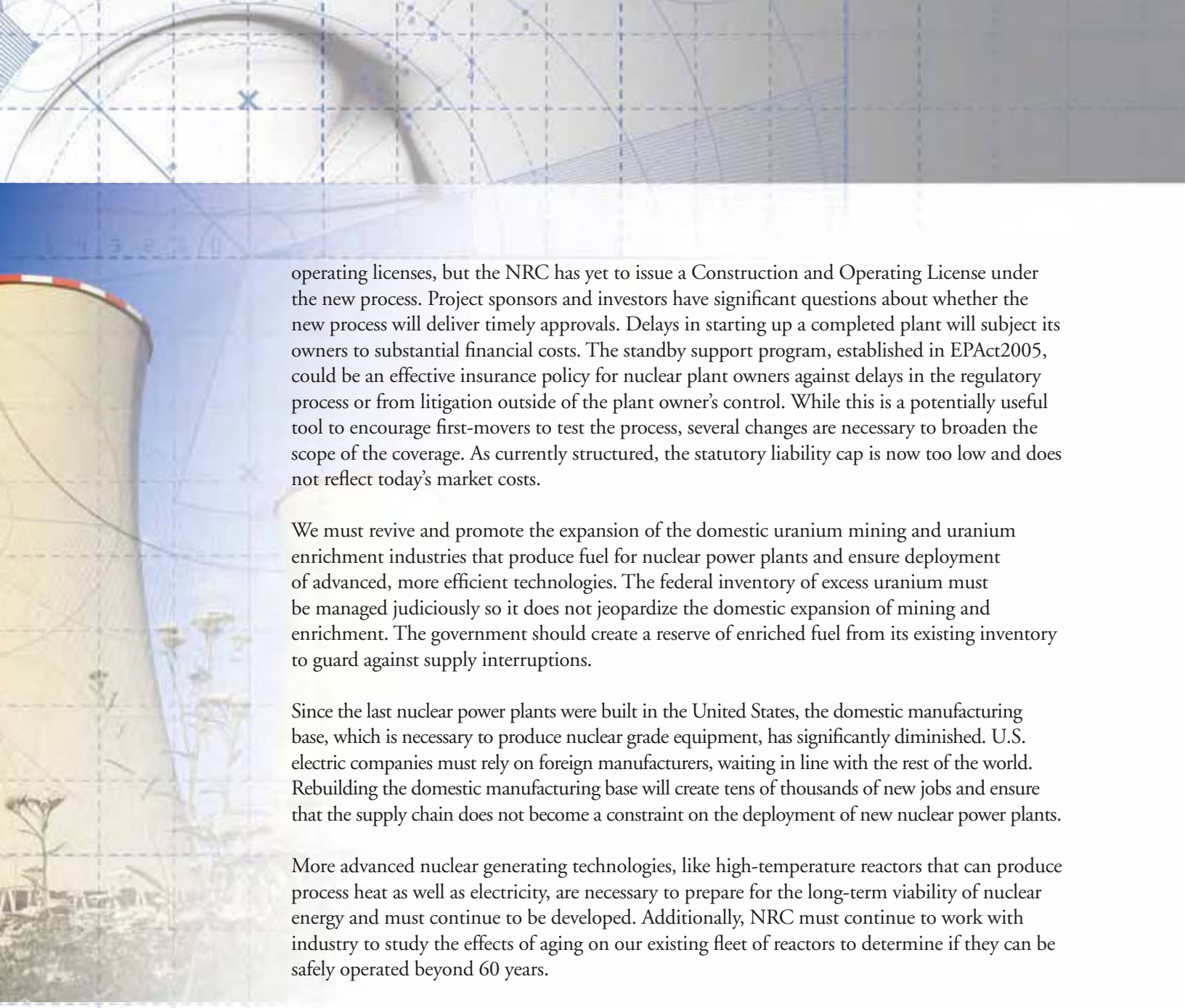
Although the existing nuclear units are successfully renewing their operating licenses for an additional 20 years, new nuclear power plants are essential to meet growing demand while avoiding GHG emissions.

New nuclear power plants are capital-intensive, requiring an estimated $6–8 billion (2008 dollars) per plant. The U.S. electric power sector consists of many relatively small companies that do not have the size, financing capability, or financial strength to fund power projects of this scale on their own, in the numbers required. Outside financial support is necessary.

The loan guarantee program authorized by EPAct2005 is a crucial tool to enable utilities to finance the construction of new reactors by increasing access to capital and enabling a higher share of leveraged debt. DOE estimates that by enabling a utility to rely more heavily on private debt than more expensive equity, a federal loan guarantee may save the ratepayers nearly 40% in the cost of power from a new nuclear plant.

A well-managed loan guarantee program will be funded by project applicants and not require any expenditure of government funds. Unfortunately, the loan guarantee program has not been implemented effectively by the DOE, and the $18.5 billion in loan volume authorized by Congress for nuclear power projects is inadequate, given the estimated cost of a new nuclear power plant. That loan volume will support, at best, two, or three new projects. The current program should be expanded, and at the appropriate time merged with the Clean Energy Bank of the United States discussed earlier.

The time it takes to license and build a nuclear power plant—now estimated at a minimum of eight years—is one reason the financing costs are high. The Nuclear Regulatory Commission (NRC) estimates it will take three and one-half years to review the first wave of new license applications for new designs. This period must be reduced for subsequent applications without compromising safety, and Congress must ensure the NRC has adequate resources to process license applications as expeditiously as possible. The regulatory and licensing framework has improved significantly since the 1980s, when we saw completed plants sit idle while awaiting issuance of



operating licenses, but the NRC has yet to issue a Construction and Operating License under the new process. Project sponsors and investors have significant questions about whether the new process will deliver timely approvals. Delays in starting up a completed plant will subject its owners to substantial financial costs. The standby support program, established in EPAct2005, could be an effective insurance policy for nuclear plant owners against delays in the regulatory process or from litigation outside of the plant owner's control. While this is a potentially useful tool to encourage first-movers to test the process, several changes are necessary to broaden the scope of the coverage. As currently structured, the statutory liability cap is now too low and does not reflect today's market costs.

We must revive and promote the expansion of the domestic uranium mining and uranium enrichment industries that produce fuel for nuclear power plants and ensure deployment of advanced, more efficient technologies. The federal inventory of excess uranium must be managed judiciously so it does not jeopardize the domestic expansion of mining and enrichment. The government should create a reserve of enriched fuel from its existing inventory to guard against supply interruptions.

Since the last nuclear power plants were built in the United States, the domestic manufacturing base, which is necessary to produce nuclear grade equipment, has significantly diminished. U.S. electric companies must rely on foreign manufacturers, waiting in line with the rest of the world. Rebuilding the domestic manufacturing base will create tens of thousands of new jobs and ensure that the supply chain does not become a constraint on the deployment of new nuclear power plants.

More advanced nuclear generating technologies, like high-temperature reactors that can produce process heat as well as electricity, are necessary to prepare for the long-term viability of nuclear energy and must continue to be developed. Additionally, NRC must continue to work with industry to study the effects of aging on our existing fleet of reactors to determine if they can be safely operated beyond 60 years.

Our nuclear waste policy was crafted at a time when we believed there would be no additions to our fleet of nuclear reactors, and the current fleet would be phased out, leaving us with a finite amount of used nuclear fuel to manage. However, if we are to ensure electricity supply keeps pace with demand, while avoiding hazardous air emissions and GHG emissions, nuclear power must be significantly expanded.

Our nuclear waste policy must be updated to foster this expansion, and we recommend establishing a government corporation to manage the entire back end of the nuclear fuel cycle. Such an entity would more efficiently meld used fuel recycling with ultimate disposal of nuclear waste, and more readily integrate industry into the recycling and disposal enterprise through long-term contracting authority.

Under any scenario, the country will require a high-level nuclear waste repository. In 2002, Congress authorized the construction and operation of a federal repository at Yucca Mountain in Nevada. This year, DOE submitted a license application, which the NRC has accepted for review; that approval could take three to four years, and perhaps longer. Even as the application is being

reviewed by the NRC, DOE needs to move ahead with site and transportation infrastructure development. However, Congress has consistently underfunded this effort, forcing schedule delays.

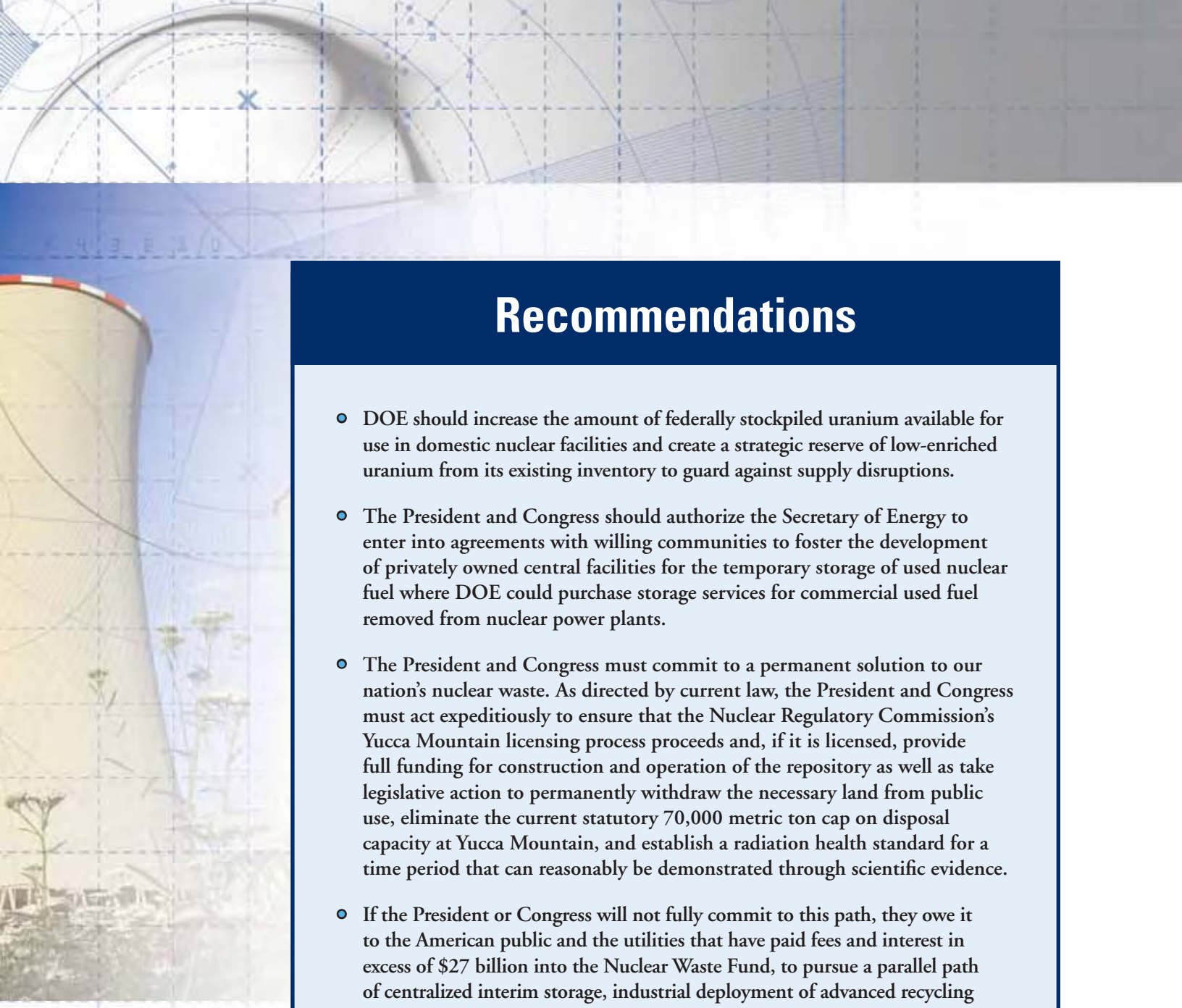
Our nation's leaders must commit to the creation and operation of a permanent waste repository. Yucca Mountain has been designated in law by both the executive and legislative branches as our nation's nuclear waste repository. The facility design is before the independent Nuclear Regulatory Commission for licensing. It follows, both the President and the Congress are required to do everything in their collective power to ensure the licensing, construction, and operation of Yucca Mountain. If the President or the Congress will not fully commit to this path, they owe it to the American public and the utilities that have paid fees and interest in excess of $27 billion into the Nuclear Waste Fund, to pursue a parallel path of centralized interim storage, industrial deployment of advanced recycling technology and continued governmental research and development to more quickly place the U.S. government in compliance with U.S. law. This is a high priority for our nation.

New used fuel recycling technologies and advanced reactors must be developed such that the volume, thermal load, and radiotoxicity of used fuel are reduced. These new technologies will help safely manage nuclear waste while utilizing our nuclear fuel resources more efficiently. We must move with urgency to establish a program to develop and demonstrate advanced fuel cycle technologies of tomorrow while empowering the government corporation to pursue the proper course for spent fuel management in the near term.

Interim spent fuel storage is a proven and safe method of storing used fuel, and we have the means to manage used fuel until the repository at Yucca Mountain is licensed by NRC or until acceptable new methods of used fuel treatment, waste disposal, or recycling technology are available. Additionally, interim storage must be a component utilized to manage the nation's used nuclear fuel, and the federal government must work with private industry, local communities, and states to foster private, central interim storage facilities. Perhaps most important, the Nuclear Waste Fund must be readily usable to finance any and all of these back-end options that will safely and effectively manage the country's civilian nuclear waste.

Recommendations

- **Congress should increase the loan guarantee authority of DOE's Loan Guarantee Program commensurate with the capital cost of new nuclear power facilities. Additionally, Congress should transition the function of the DOE Loan Guarantee Program to a more permanent, stable financing platform, like the Clean Energy Bank of the U.S. (CEBUS) discussed in Section V of this report.**
- **Congress should amend the Nuclear Standby Support Program to allow for recovery of increased project costs as a result of delays, rising equipment costs, escalation clauses, and costs of litigation, and it should provide for the recovery of 100% of covered costs and debt obligations.**
- **Congress should ensure that the Nuclear Regulatory Commisson (NRC) has the necessary resources to review and approve combined construction and operating licenses for new nuclear power plants in a timely manner.**



Recommendations

- DOE should increase the amount of federally stockpiled uranium available for use in domestic nuclear facilities and create a strategic reserve of low-enriched uranium from its existing inventory to guard against supply disruptions.
- The President and Congress should authorize the Secretary of Energy to enter into agreements with willing communities to foster the development of privately owned central facilities for the temporary storage of used nuclear fuel where DOE could purchase storage services for commercial used fuel removed from nuclear power plants.
- The President and Congress must commit to a permanent solution to our nation's nuclear waste. As directed by current law, the President and Congress must act expeditiously to ensure that the Nuclear Regulatory Commission's Yucca Mountain licensing process proceeds and, if it is licensed, provide full funding for construction and operation of the repository as well as take legislative action to permanently withdraw the necessary land from public use, eliminate the current statutory 70,000 metric ton cap on disposal capacity at Yucca Mountain, and establish a radiation health standard for a time period that can reasonably be demonstrated through scientific evidence.
- If the President or Congress will not fully commit to this path, they owe it to the American public and the utilities that have paid fees and interest in excess of $27 billion into the Nuclear Waste Fund, to pursue a parallel path of centralized interim storage, industrial deployment of advanced recycling technology, and continued governmental research and development to more quickly place the U.S. government in compliance with U.S. law.
- Congress should change budgeting rules to take the Nuclear Waste Fund "off budget" and codify use of this fund for interim used fuel storage through purchasing storage services from private central storage facilities as well as used fuel recycling.
- The President and Congress should expeditiously establish a program to begin the recycling of the nation's used nuclear fuel and establish a new corporation to coordinate the federal government's legal responsibility to safely and reliably dispose of the waste while not subsuming DOE's R&D mission. This entity should be provided long-term contracting authority and access to monies from the Nuclear Waste Fund.

Commit to the Use of Clean Coal

Currently, coal provides approximately 50% of our electricity supply, making it the largest source of domestic, reliable, and affordable energy. Coal will necessarily be a critical and expanding source for our future electricity and fuels needs. To use coal cleanly and to address CO_2 emissions, we need to greatly increase our research, development, and demonstration of clean coal and carbon capture and sequestration technologies. We also must establish a fair and predictable regulatory environment.

Coal is the largest source of energy produced domestically. Demonstrated reserves of U.S. coal stand at about 491 billion tons, about 264 billion tons of which are recoverable. At the current production rate of about 1.1 billion tons a year, this is enough coal to last for well over 200 years.

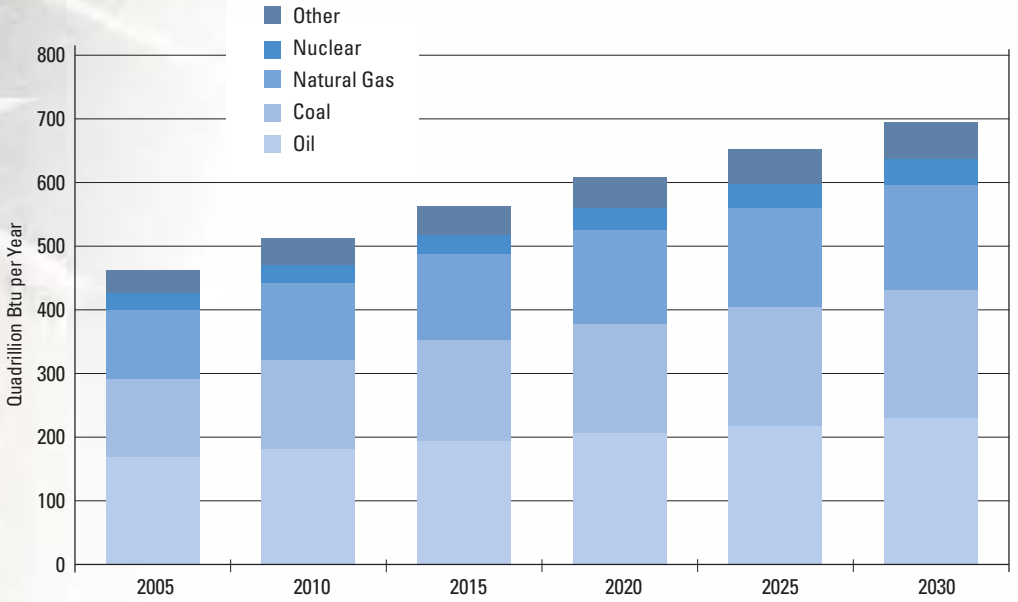
The United States has nearly 1,500 coal plants in operation. These plants make up about one-third of the nation's generating capacity, but they generate a much larger portion—more than half—of the nation's electricity. This is because coal plants, like nuclear power plants, are run constantly to meet baseload power needs while other types of plants, like natural gas plants, are generally run more intermittently to meet peak-load demand.

Not only must coal remain a viable source of energy in the United States, it is likely to play an increasingly important role globally in the generation of electricity and over time in the production of transportation fuels through coal-to-liquids (CTL) technology. The Department of Energy's Energy Information Administration (EIA) projects significantly greater global coal use, accounting for more than one-third of the total increase in energy consumption in 2030 compared to 2005, the highest amount for any single energy source (Figure 9). Coal is expected to supply about 29% of energy demand in 2030, up from 26% in 2005. Much of this growth is expected to come in the developing world, especially from large developing countries—such as China, India, Indonesia, and South Africa—that possess large reserves of coal.

Coal, however, poses significant environmental challenges, not least of which is that it emits the most CO_2 per unit of energy of any fuel source. Because coal will remain an important resource in the global energy portfolio, we must develop technologies such as carbon capture and storage (CCS) that allow us to use coal while minimizing the resulting air pollution and CO_2 emissions. For countries to adopt this technology, especially developing countries, the cost of a CCS-equipped coal plant will have to come down considerably. This will require a substantially expanded and expedited research, development, and demonstration program focused on both pre- and postcombustion CO_2 capture technologies as well as a scientifically-intensive program that includes large-scale tests to study and understand the impacts and methods of large-scale and permanent geologic storage or sequestration of CO_2.

However, for all of the promise of CCS, the technologies are very complex, expensive to build and operate (Figure 10), result in large "parasitic" energy losses, and require significant supporting infrastructure. Parasitic energy losses—that is, the energy lost to the grid because it is required to operate the CCS equipment of the plant—can run as high as 30%, which means that more or larger plants will be needed to supply the equivalent amount of energy to the grid compared to plants without CCS. These high costs could result in fuel switching from coal to natural gas, which could exacerbate, not improve, our energy security challenge.

Figure 9. Global Energy Consumption by Fuel: 2005-2030



Source: EIA, International Energy Outlook 2008, Table A2 (http://www.eia.doe.gov/oiaf/ieo/ieorefcase.html).

Bringing down the cost of CCS is therefore an important goal, and one that can be achieved only with some fundamental breakthroughs in technology. A recent report by the Massachusetts Institute of Technology on coal's future similarly concluded that to take advantage of the most widely available energy resource—coal—both the deployment time and cost of CCS need to be reduced.

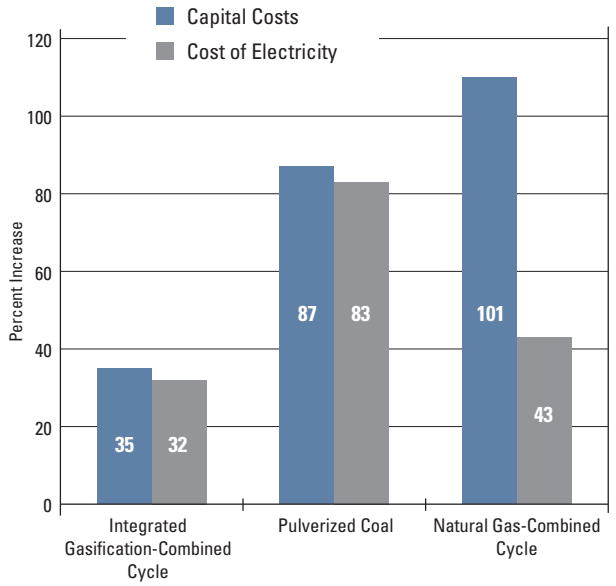
Given the prominence of coal as a fuel for power production, an accelerated program of CCS technology development and demonstration should be undertaken to determine the technical and economic practicability of the technology. If CCS technology proves too costly or research reveals adverse environmental impacts from storage, it is better to discover this earlier rather than later so that alternative technology paths can be pursued.

A number of CCS technologies are being pursued for different types of coal plants. CCS technologies for Integrated Gasification Combined Cycle (IGCC) plants rely on precombustion technologies that capture carbon before the fuel is combusted. However, there are only a couple of IGCC plants in operation today in the power sector (gasifiers are common in the petrochemical industry), and IGCC is more expensive, with a capital cost premium and parasitic energy loss of about 20% over a state-of-the-art pulverized coal (PC) plant. In addition to lowering the cost of capture technologies, improvements in IGCC plant efficiency, turbines, and other technologies will play an important role in making CCS more affordable. Maintaining a strong federal clean coal program overall is therefore extremely important.

PC plants of different types and vintages make up nearly all of the coal-fired power plants now operating in the United States. CO_2 from traditional coal plants can be captured from the flue gas using postcombustion technologies. Because CO_2 accounts for only 10–15% of the flue gas, a large amount of it must be processed per unit of CO_2 captured. Carbon capture technology using oxyfuel combustion is another technology being considered.

Concerning sequestration, estimates suggest that there are hundreds of years of geologic storage capacity in North America and thousands of years worldwide. Field tests sequestering at least a million tons of CO_2 per year are needed to test the environmental and technical feasibility of large-scale sequestration. The three largest sequestration projects in the world today—Sleipner in the North Sea, Weyburn in Canada, and In Salah in Algeria—together store approximately 3 million metric tons annually, which is the amount of CO_2 produced in one year by a single 500 megawatt coal-fired power plant. DOE is planning, through its Carbon Sequestration Regional Partnerships, at least seven such tests in different geologic formations. It is important that the partnerships receive the necessary funding to move ahead. The significant experience of the oil and gas industry with injecting CO_2 through enhanced oil recovery programs should be harnessed to supplement geologic storage R&D.

Figure 10. Effect of CO_2 Capture on Cost of Capital and Cost of Electricity

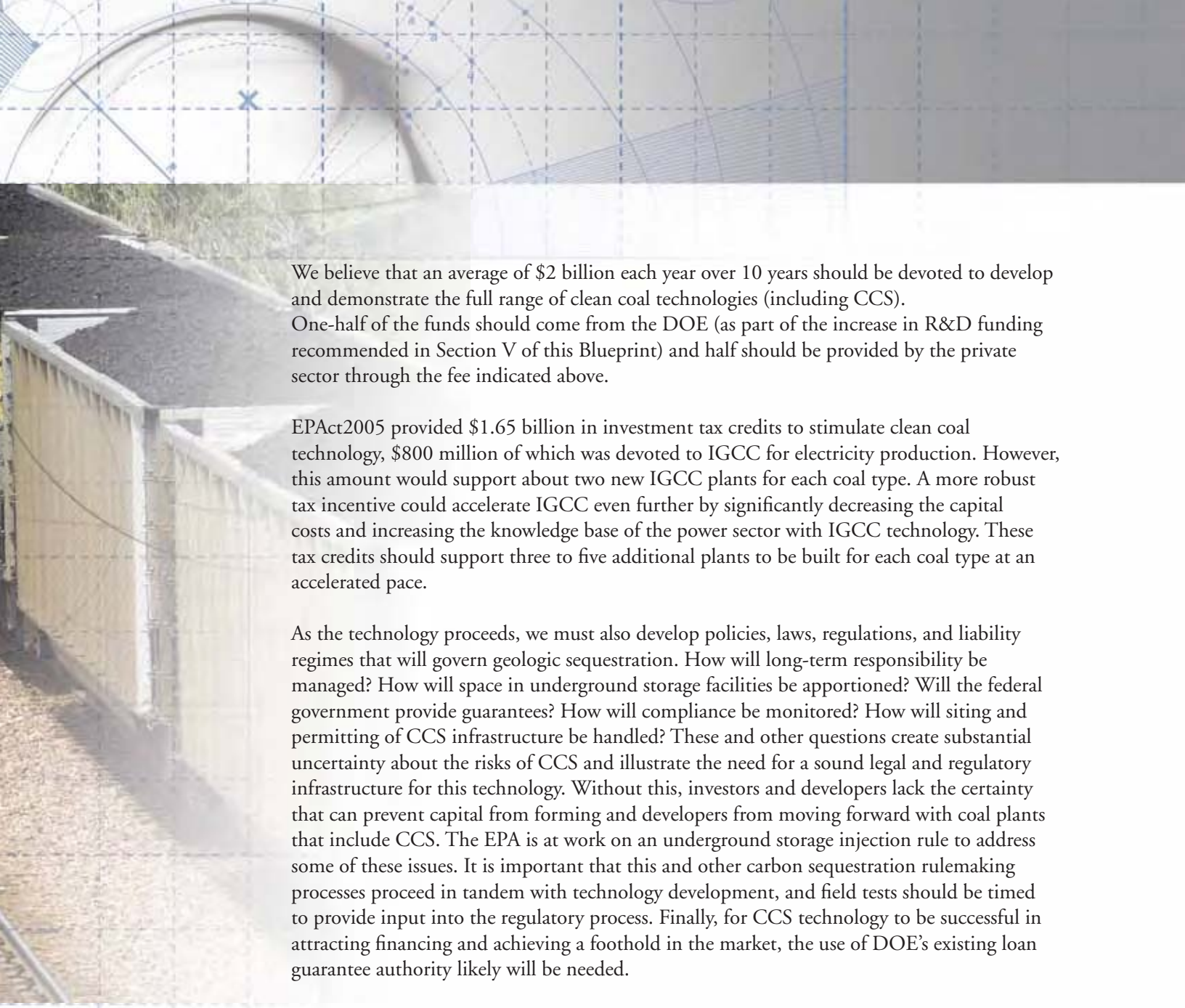


Note: Figures for bituminous coal. National Energy Technology Laboratory, Cost and Performance Baseline for Fossil Energy Plants, Volume 1. Bituminous Coal and Natural Gas to Electricity, August 2007 (http://www.netl.doe.gov/energy-analyses/pubs/Bituminous_Final%20Report.pdf)

The widespread use of CCS also would entail a considerable amount of infrastructure to move the captured and compressed CO_2 from the plant at which it was generated to the sequestration site. If the CO_2 from all existing coal-fired electricity generation in the United States were captured and compressed, its volume would be about 2.5 times the volume of oil handled each day. There is a great deal of uncertainty about how extensive this infrastructure would have to be—e.g., how much pipeline capacity would be needed—but it is safe to say that under almost any circumstances the infrastructure requirements would be quite large.

Advances in measurement and monitoring technologies for geologic storage also are needed to assess the integrity of subsurface reservoirs and transportation systems and the potential leakage from geologic storage.
CCS technology development and demonstration should be among our highest R&D priorities, and they will require more funding from both government and private sector sources. DOE and the private sector should continue to work together to support large-scale CCS on commercial plants to demonstrate and assess the performance of a range of capture, transport, storage, and monitoring technologies.

However, alternative methods to assemble the necessary level of funding should be considered for such an expanded program and new management regimes should be explored to allow private sector entities with the greatest stake in the outcome to participate in the management of such an expanded R&D effort. One way to accomplish this would be to administer a small fee on fossil-based utilities and match it with federal funds for a technology fund devoted to developing and demonstrating CCS on commercial plants.



We believe that an average of $2 billion each year over 10 years should be devoted to develop and demonstrate the full range of clean coal technologies (including CCS). One-half of the funds should come from the DOE (as part of the increase in R&D funding recommended in Section V of this Blueprint) and half should be provided by the private sector through the fee indicated above.

EPAct2005 provided $1.65 billion in investment tax credits to stimulate clean coal technology, $800 million of which was devoted to IGCC for electricity production. However, this amount would support about two new IGCC plants for each coal type. A more robust tax incentive could accelerate IGCC even further by significantly decreasing the capital costs and increasing the knowledge base of the power sector with IGCC technology. These tax credits should support three to five additional plants to be built for each coal type at an accelerated pace.

As the technology proceeds, we must also develop policies, laws, regulations, and liability regimes that will govern geologic sequestration. How will long-term responsibility be managed? How will space in underground storage facilities be apportioned? Will the federal government provide guarantees? How will compliance be monitored? How will siting and permitting of CCS infrastructure be handled? These and other questions create substantial uncertainty about the risks of CCS and illustrate the need for a sound legal and regulatory infrastructure for this technology. Without this, investors and developers lack the certainty that can prevent capital from forming and developers from moving forward with coal plants that include CCS. The EPA is at work on an underground storage injection rule to address some of these issues. It is important that this and other carbon sequestration rulemaking processes proceed in tandem with technology development, and field tests should be timed to provide input into the regulatory process. Finally, for CCS technology to be successful in attracting financing and achieving a foothold in the market, the use of DOE's existing loan guarantee authority likely will be needed.

Despite best efforts, it must be recognized that CCS technologies will not be ready for widespread commercial uptake until 2020 at the very earliest, and maybe closer to 2030. Climate change policies must take this timeframe into account. Until the technology is ready for deployment, policies should focus on improving the efficiency of the existing fleet of fossil fuel–fired power plants and the commercial use of highly efficient state-of-the-art coal plants.

Recommendations

- The President and Congress should accelerate clean coal technology development by increasing funding at DOE to $500 million per year to support R&D for advanced Integrated Gasification Combined Cycle (IGCC), carbon sequestration, advanced turbines, innovations for existing plants, fuels cells, and related technologies. (This is included in the increase in federal R&D as described in Section V.)

- The President and Congress should fund a clean coal power demonstration program on the order of $500 million per year to take advantage of R&D breakthroughs and more aggressively and rapidly undertake first-of-a-kind commercial-scale demonstration of advanced IGCC and other coal-fueled systems with carbon capture and storage (CCS). (This is included in the increase in federal R&D as described in Section V.)

- The President and Congress, working with the private sector, should establish a fund managed by fossil-based utilities to support research and demonstration of CCS technologies at private, academic, and government entities. Funding would be raised through a small fee on fossil-based utilities that could be passed onto consumers and treated as "off-budget" and not subject to appropriations. The fund's budget should not exceed $1 billion per year over 10 years.

- Congress should expand and structure the EPAct2005 clean coal investment tax credit program to reduce the effective cost of the first five or six advanced coal-fueled plants of each design and coal type so that they are market competitive with state-of-the-art supercritical coal-fired plants. Doubling the EPAct2005 tax credit would stimulate the construction of 12 more initial IGCC plants (four more plants for each major design type). Carbon capture "readiness" could be used as scoring criteria to encourage sequestration-amenable plants.

- The federal government and the private sector should capitalize on opportunities to partner with other governments and overseas businesses to advance CCS technology.

- The federal government should ensure a stable regulatory environment for carbon sequestration and ensure that regulations are ready when the technology is. These legislative and rulemaking processes should work in parallel with technology development and take advantage of knowledge developed during large-scale sequestration demonstrations.

Increase Renewable Sources of Electricity

Any effort to meet growing demand and address environmental concerns with continued economic growth requires zero and near-zero emissions power generation to be developed and deployed. This is true not only in our country, but around the world. We require a predictable and durable fiscal regime to stimulate new investments in solar, wind, energy-from-waste, and other renewable technologies. We must also invest in developing the required technologies needed to expand and transport new sources of commercially viable renewable energy.

Renewable sources of energy such as wind, solar, energy-from-waste, hydropower, geothermal, and biomass could play an increasingly important role in our nation's energy supply as they continue to become more cost competitive with traditional energy sources. This is especially true for sources that can provide reliable baseload electricity.

Renewable electricity is enjoying robust growth, but at about 8–9% of our overall electricity production, it remains a very small component. Conventional hydropower provided about 6.0% of generation in 2007, biomass 1.3%, wind 0.8%, geothermal 0.4%, and solar less than 0.01%.

Hydropower is a proven, long-standing renewable resource. Wind, geothermal, and biomass power are increasingly competitive economically. Energy-from-waste is also proven and used worldwide as a source of clean, baseload power. Solar (both photovoltaic and concentrating solar power) will play a larger role if costs can be further reduced. The fastest growing source of electricity in the United States is wind power. In 2007, wind accounted for about 35% of new generating capacity, and the United States is now the largest producer of wind power in the world.

EIA projects that in 2030 renewable power will account for a greater share of total electricity production, about 12–13%. By far the biggest increase is expected to come in wind production, which could rise nearly sixfold. However, even at such a pace, wind still will account for only about 2.4% of total electricity generation in 2030 (Figure 11). We can and should accelerate this pace.

Apart from cost, the assurance of adequate transmission capacity and the intermittency of generation must be addressed if renewable energy is to achieve its fullest potential. Sources like photovoltaic solar and wind are viable sources when the sun is shining or the wind is blowing and there is demand for their supply. A breakthrough in battery technology that would

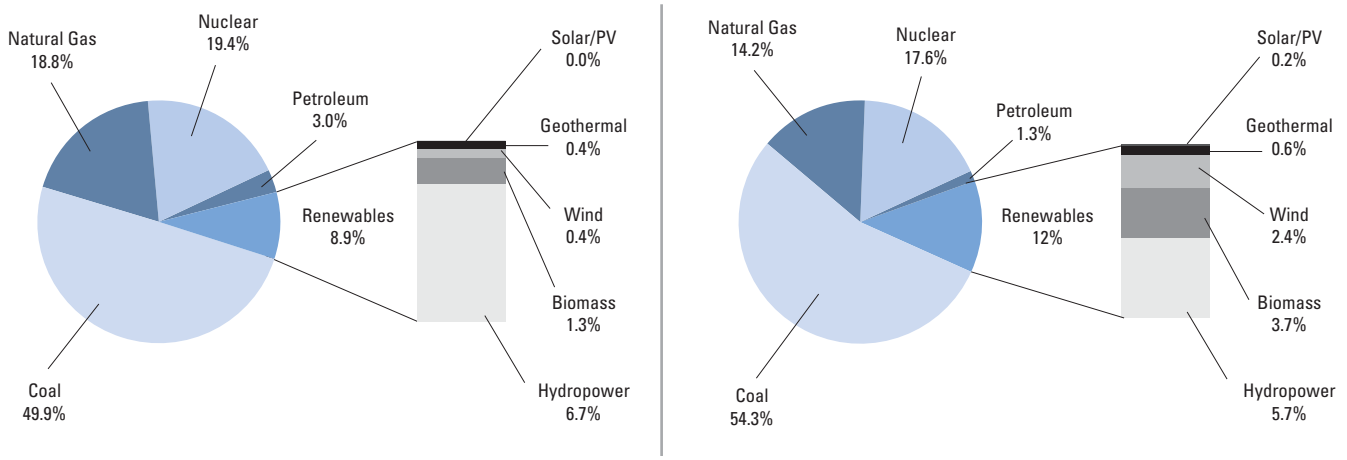
allow the affordable storage of electricity to balance the intermittent nature of most wind and solar sources could be transformative. At the same time, high voltage transmission lines are also needed to move the electricity produced from these sources beyond their service area to demand centers. Additionally, continuing advances in utilizing lower temperature geothermal resources would expand the scope and lower the cost of geothermal energy, potentially making it a baseload, nonintermittent producer of electricity. R&D to develop these technologies continues to be important in the effort to expand renewable energy.

Policies to promote the deployment of renewable energy continue to be important as well. Much of the growth of renewable energy has been inconsistent and intermittent because of uncertainties in the fiscal policy and regulatory environments. Tax credits have been instituted and then subsequently allowed to lapse. The renewable energy tax credits have expired in 2000, 2002, 2004, and are set to expire again at the end of 2008. These short "boom and bust" cycles have resulted in tremendous inefficiencies in capital formation, investment, component production, project finance, and project management that have limited the impact of renewable energy in the U.S. market, even as the costs for traditional energy sources have risen.

We need stability and predictability in the federal policies to promote renewable generation that has, to date, been absent. We should not however, subject the entire country to nationalized standards that penalize or favor some regions over others. We recommend that an eight-year renewable energy tax credit be enacted to allow long-term planning and investment to occur efficiently. Any such fiscal incentive benefiting one industry or sector must not come at the expense of raising taxes on another.

These credits must not exist in perpetuity; after eight years these credits should be phased out over the succeeding four years and then be eliminated entirely. After eight years, the eligible technologies must be able to survive commercially on their own economic and technological merit. If Congress judges the revenue impact of such an incentive to be too great, it should eliminate the inflation increases or otherwise reduce the amount of the tax credit rather than the duration of the window for eligible projects. The stability of the production tax credit is as important as its value—perhaps even more so.

Figure 11. Renewables as a Share of Total U.S. Electricity Production: 2005 and 2030 (Percent)



Source: EIA, Annual Energy Outlook 2008, Tables 8 and 16 (http://www.eia.doe.gov/oiaf/aeo/aeoref_tab.html)

Regulatory certainty is also imperative to ensure development of renewable energy projects in the United States. EPAct2005 directed the Department of the Interior's Minerals Management Service (MMS) to issue regulations for the development of renewable energy projects on the OCS by May 2006. MMS has yet to issue final regulations, and must do so expeditiously and continue its interim policy of processing permit applications.

Recommendations

- **Congress should increase annual funding for wind, solar, geothermal, and ocean programs at DOE from the current level of about $250 million to $450 million. (These funds are included as part of the increase of federal R&D funding recommended in Section V of this report.)**
- **Congress should extend for eight years the renewable energy tax credits and establish a phaseout period of four years.**
- **Congress should extend the existing Clean Renewable Energy Bond program to enable public power systems and electric cooperatives to seek alternative financing mechanisms for clean energy projects that are not eligible for production tax credits.**
- **As directed by EPAct2005, the Minerals Management Service should issue regulations for the development of renewable energy projects on the OCS and should continue to process permits for these projects in the interim.**

Transform our Transportation Sector

Transportation in the United States is currently 96% reliant on petroleum. New technologies, ready for application, must be affordable and become commonplace. Efforts to develop and promote alternative transportation options, including second generation biofuels, plug-in hybrids, and all-electric and hydrogen-powered vehicles, should be based on life cycle cost analysis and incorporate consideration of each technology's required infrastructure into policy planning. At the same time, we must focus on an improved surface and mass transportation infrastructure to generate efficiency and reduce emissions.

Energy consumption in the transportation sector is used to move people and goods via automobiles, trucks, buses, and motorcycles; trains, subways, and other rail vehicles; aircraft; and ships, barges, and other waterborne vehicles. Demand in this sector accounts for 28% of total U.S. energy demand.

The transportation sector is heavily dependent on petroleum, primarily in the form of gasoline and diesel, jet, and bunker fuels.[1] Transportation is responsible for about 70% of all the petroleum used in the United States, and petroleum now supplies 96% of the energy used in the transportation sector. Petroleum use in transportation also is a big source of CO_2 emissions from energy use, accounting for about one-third all U.S. CO_2 emissions from fossil fuels.

In the short-term, we will still have to purchase, refine, and use large amounts of oil to meet our transportation needs. EIA projects that between 2005 and 2030, energy use in the transportation sector will grow about 18%, while petroleum use will grow about 13%. This disparity in growth rates reflects to some degree greater adoption of alternative vehicles, which is expected to increase from about 4% of all new cars and light trucks in 2005 to 29% in 2030. As welcome as this is, in 2030 transportation still is projected to account for about 28% of total energy use, and petroleum still is projected to account for about 93% of the energy used in the transportation sector. We must do better.

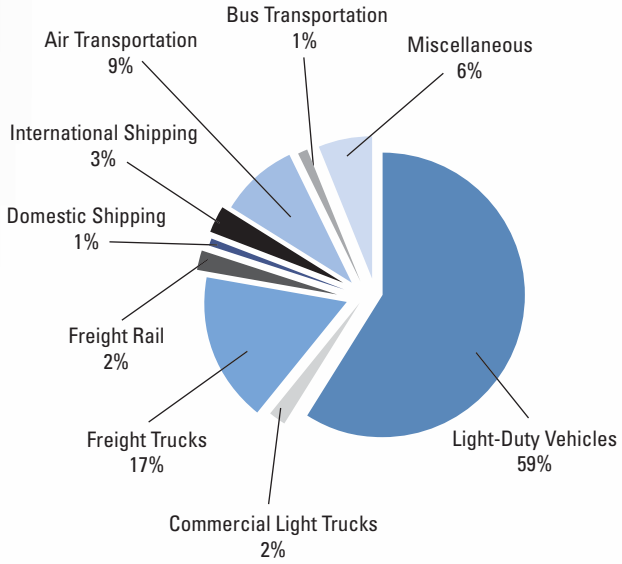
Most of the energy we use for transportation—about 59%—is used to power light-duty cars and trucks, primarily for personal transportation (Figure 12). For that reason, transforming the transportation sector largely means offering new technologies that will appeal to discriminating consumers with the power to choose and an expectation of both fuel availability and vehicle reliability. (A more extensive look at other transportation modes will be part of our forthcoming transition plan.)

Energy use in the transportation sector can be improved and diversified in two ways: (1) by improving the energy efficiency of the vehicles and the transportation system; and (2) by expanding the range of fuel and engine options available to motorists, including alternative fuels, fuel cells, and electricity/batteries. Some options can combine both.

These types of technologies can result in not only lower energy consumption, but in lower emissions of air pollutants and CO_2, as well. They can also avoid the safety problems that arise from simply reducing the size of the vehicle, and thus its safety in a collision, to save fuel.

1 Other transportation fuels include pipeline fuel natural gas, lubricants, aviation gasoline, electricity, compressed natural gas, liquefied petroleum gases, and ethanol.

Figure 12. Energy Use by Transportation Mode: 2005 (Percent)



Source: EIA, Annual Energy Outlook 2008, Supplemental Table 36 (http://www.eia.doe.gov/oiaf/aeo/supplement/suptab_36.xls).

With the passage of EISA2007, the Corporate Average Fuel Economy (CAFE) standards for new passenger cars were raised for the first time since the standards were established in the 1970s. EISA2007 mandates a 40% increase in the combined light-duty vehicle—car and light truck—fuel economy standards to 35 miles per gallon (mpg) by 2020. The form of the standard can be revised from a corporate average standard to one based on vehicle attributes, such as vehicle footprint, similar to the 2006 light truck CAFE rule, which established standards for 2008 to 2011. In April 2008, the U.S. Department of Transportation proposed a rule to implement new standards through 2015.[2]

To meet this ambitious goal, the marketplace must adopt advanced highway vehicle technologies, such as electric/fuel engine hybrids and clean diesel engines, at a greater pace. EIA projects that the share of alternative technology cars and light trucks will rise from about 4% in 2005 to 9% in 2020 and 35% in 2030.

Hybrid vehicles are more expensive than conventional vehicles. EPAct2005 provides tax credits of up to $3,400 per vehicle for hybrids.[3] These credits apply to vehicles purchased before the

2 The proposed rule would establish passenger car fuel economy at 31.2 mpg in model year 2011, increasing to 35.7 mpg in model year 2015. For light trucks, the comparable goals for compliance are 25.0 to 28.6 mpg.

3 Vehicles using fuel cell, lean burn, and alternate fuel technologies also qualify for tax credits under EPAct2005.

end of 2010, and the credit amounts begin to phase out for a given manufacturer once it has sold more than 60,000 eligible vehicles. If the cost of efficient vehicles remains high relative to conventional vehicles, it may be necessary to extend this tax credits for advanced vehicles.

In addition to reducing the amount of energy needed to travel each mile, we can reduce the number of vehicle miles traveled through technologies that improve surface and mass transportation infrastructure. A variety of policies, made possible by recent technology development—including time-of-use pricing, telecommuting incentives, intelligent transportation systems, and privately financed infrastructure expansions—could help address fuel-wasting congestion.

Urban and suburban planning that is well integrated with public transportation can reduce energy use, as can alleviating traffic congestion through intelligent transportation systems. Bicycle lanes and paths and pedestrian-friendly development planning can help reduce total vehicle-miles traveled, and new communications technologies may allow fewer commutes to the office.

In the longer term, we need to develop more fuel options for our transportation needs. Bio-based fuels, electricity, and perhaps even hydrogen show promise; however, to be successful in the market, an alternatively fueled vehicle needs to offer attributes that consumers will desire at an attractive price. Unacceptable tradeoffs in performance, drivability, durability, affordability, and safety forced by unrealistic policies or immature technology simply will not succeed in the marketplace—and consequently will have little impact.

The fuels for these vehicles, likewise, must be readily available and meet consumer expectations regarding affordability, reliability, and environmental impacts—a flex-fuel vehicle is of little value without E85, and vice versa. As stressed earlier, anything less than simultaneous attention on technologies, policies, and markets will likely fail.

In the near-term, we must pursue a portfolio of alternative technologies that can have a meaningful impact on reducing the demand for oil in the transportation sector, particularly if the alternatives can be used in combination with one another. Just as important, these alternative technologies can create vibrant and competitive markets for varying fuels and provide consumers with a broader range of fuel choices. These alternatives include biofuels, electricity, natural gas, and hydrogen.

Biofuels

Biofuels have traditionally been more expensive than gasoline, but with the increase in oil prices, the gap is closing. To stimulate the use of biofuels, blender's tax credits were created by Congress. The tax credit creates an incentive for oil companies to blend ethanol with gasoline or biodiesel with diesel fuel. The tax credit for ethanol, which is authorized through 2020, totals 51 cents per gallon (the 2008 Farm Bill reduces this to 45 cents the year after fuel ethanol demand reaches 7.5 billion gallons.) The biodiesel tax credit, which expires in 2008, is $1.00 per gallon for agri-biodiesel[4] and 50 cents per gallon for biodiesel from recycled oils and animal fats. These tax credits are disjointed and inconsistent, and in large part they are passed on to motorists. In addition, ethanol imports are subject to a tariff of 54 cents per gallon. This poses a significant obstacle to ethanol imports.

As a consequence of these incentives and the Renewable Fuels Standard first established in EPAct2005, ethanol production has increased from 1.77 billion gallons in 2001 to an estimated 6.5 billion gallons in 2007. The new Renewable Fuels Standard enacted in the 2007 energy legislation is designed to require as much as 36 billion gallons of renewable fuel produced each year by 2022, with different quotas for renewable, alternative, cellulosic, and biomass-based diesel. Currently, the largest source for biofuels is corn. Our ability to achieve the 36 billion gallon target depends on the development of next-generation biofuels, such as cellulosic ethanol from wood, forest residues, corn stalks, and everyday garbage, and the ability to produce and distribute such fuels efficiently to consumers.

4 Defined as first-use vegetable oils and animal fats, including palm and fish oil.

Progress toward broad commercialzation, particularly for cellulosic ethanol, has been slow, and we should not expect biofuels to replace our need for oil. Even if we are entirely successful in the effort to produce 36 billion gallons of renewable alternative fuels in 2022, that is a fraction of the 138 billion gallons of gasoline and 43 billion gallons of diesel that we currently use in the United States each year. Although biofuels can make an important and useful contribution, they alone cannot be expected to supply our need for liquid transportation fuels.

Moreover, biofuels also pose certain environmental challenges. There is a growing controversy over the sustainability of biofuels and their impact on food production and land use. Some analyses suggest that biofuels production, especially from corn starch, is responsible for a portion of the recent run up in global food prices, which is a legitimate concern. Concerns over the environmental and food impacts of first generation biofuels argue in favor of moving aggressively to develop cost-effective second generation technologies that can use a much broader array of feedstocks, thus reducing the upward pressure on energy and food prices and the need for additional arable land. Best practices and voluntary industry standards should also be developed to encourage sustainable biofuels production.

However, there is significant potential to use the approximately 1.3 billion dry tons of biomass that the United States might one day sustainably produce each year for other purposes as well. For example, it may make more sense to convert these feedstocks to synthetic gas that can be used in the existing refineries and pipelines. It may make sense to consider the prospects for synthetic bio-gasoline and biobutanol, an alcohol with higher energy content than ethanol that can, unlike ethanol, be transported and distributed in existing petroleum pipelines. Indeed, it may ultimately make more sense to convert this biomass resource into electricity for supply to electric vehicles.

While there has been plenty of discussion on what constitutes the highest and best use of the nation's biomass resource, it is now clear there are finite limits to corn-based ethanol, and while we do not wish to diminish its importance as a transition fuel, there is the need for new and comprehensive forward looking analysis, based on rigorous, "well to wheels" data, to gain a better understanding of the range of possibilities offered by renewable biofuels. Therefore, we believe the DOE, in collaboration with the appropriate national laboratories and universities, must undertake comprehensive analyses on the various uses and resulting effects on the nation's biomass resources, and how those resources can be best used with existing energy infrastructure while minimizing land use changes and impacts on food production.

As the biofuels market here in the United States grows and matures to meet the requirements of EPAct2005 and EISA2007, we should seek also to "commoditize" biofuels and help create an international market to increase their trade by harmonizing fuel standards. Eventually, free trade of biofuels should be the goal, and we should be prepared to reconsider the tariff on imported ethanol as global demand and markets progress.

Electricity as an Alternative Fuel

Electricity, used in a hybrid gasoline-electric, hybrid diesel-electric, hybrid biofuels-electric, or fully electric vehicles is a potentially important alternative fuel to decrease air emissions and increase supply and competition in the transportation sector. However, for electric and hybrid-electric vehicles to reach their potential, continued technology development on batteries to expand their capacity, lower their cost, improve their durability, and enhance their safety will be necessary.

For future vehicles to be in a position to meaningfully interact with the electricity grid, work remains to allow cars to become "intelligent" participants in peak-load reduction efforts, develop emergency power supply strategies, enhance grid resiliency, and arrange time-of-use pricing arrangements. We recommend that automakers and electricity providers accelerate necessary collaboration on the standards, power electronics, and interfaces that might allow electric drive vehicles to be more fully integrated with the electricity grid.

Natural Gas

There are approximately 120,000 natural gas–powered vehicles (NGV) in operation in the United States, well below 0.1% of all cars and light trucks. While the majority of these NGVs are used in fleets of municipal or commercial entities, they can potentially play a significant role in reducing our dependence on overseas sources of oil. We currently produce about 80% of the natural gas used in this country, and nearly all of our imported natural gas comes from Canada. Additionally, natural gas as a transportation fuel produces significantly less air emissions, including CO_2, than gasoline.

Vehicles account for 0.1% of all natural gas consumed in this country. Any effort to replace a significant portion of the 250 million passenger vehicles in the United States with NGVs must be accompanied by policies to significantly increase the supply of natural gas to avoid placing a strain on supply and increasing prices for current uses such as electricity generation, heating, and as an industrial feedstock. Moreover, a substantial expansion of infrastructure necessary to foster widespread market penetration of natural gas as a transportation fuel would be required.

Coal-to-liquids

Vehicle fuels from coal provide another option. Fuel from coal gasification and Fischer-Tropsch processes could be an assured source of transportation fuels. Coal-to-liquids (CTL) technology is a proven technology that meets about 30% of South Africa's transportation fuel needs and is being developed in some emerging economies with large coal reserves, including China. CTL technology could be a competitive and, given the extent of U.S. coal reserves, an assured source of transportation fuels. Coal gasification offers less costly capture and compression of CO_2, and with sequestration Fischer-Tropsch fuels can have a lower carbon footprint than traditional petroleum-based fuels. However, to move ahead with CTL with CCS, purchase agreements and incentives for the first few plants will probably be needed. The U.S. Air Force is considering purchase agreements for alternative fuels, including CTL fuels, but it needs multiyear procurement authority. Such purchasing authority is not without risk because of the volatility in fuels markets. Extension of the existing alternative fuels excise credit and loan guarantees are policies that can incentivize new CTL plants.

Hydrogen

Hydrogen is not an energy source, but rather an energy carrier in the manner that electricity is an energy carrier. Like electricity, hydrogen can be produced when processing a variety of primary energy resources (such as nuclear, biomass, fossil, and renewable). The conversion of hydrogen to electricity in a fuel cell results in no emissions other than pure water. When hydrogen is burned in an internal combustion engine, only trace amounts of NOx are produced. These characteristics offer the possibility of a fuel that can be produced from a variety of domestically available resources and that results in few if any emissions

at the point of use. However, hydrogen is difficult to transport and store in its gaseous state, fuel cells remain expensive and insufficiently durable for widespread consumer use, and hydrogen production currently requires significant amounts of electricity. Although hydrogen may be produced with high-temperature nuclear reactors without emissions in the future, current hydrogen production methods utilize large amounts of electricity, which largely comes from fossil fuel combustion.

There are a number of prototype and demonstration hydrogen fuel cell vehicles on the road today. Although progress has been made in recent years thanks to a well-organized effort by automakers, fuel providers, and U.S. and foreign governments, the pursuit of widely available, affordable, durable consumer hydrogen fuel cell vehicles remains a long-term proposition. The long-term federal R&D effort directed toward hydrogen fuel cell vehicles should continue, but we recommend that investments should correlate with the pace of progress made in plug-in hybrid and fully electric vehicle technology. We also recommend that U.S. government R&D efforts continue to advance cleaner, more efficient methods of producing hydrogen at scale, using novel techniques, and from zero-emission renewable and nuclear technologies.

Many of these alternative fuels cannot readily be utilized with our existing infrastructure. New transport and delivery infrastructure, including pipelines, storage, and fueling pumps, would be needed to ensure market penetration.

Recommendations

- The President and Congress should accelerate and increase funding from the current level of roughly $400 million to $600 million for transportation technologies and bio-based fuel technology R&D programs at DOE to support the transition to unconventional vehicles and alternative fuels, including hybrid electric systems, materials technology, advanced combustion engines, technology integration, and fuels technology.
- Congress should create a new tax credit for the production of plug-in hybrid vehicles over 10 years. The level should remain the same over the first five years and decline each year thereafter, phasing out entirely after 10 years.
- Congress should make the blenders' tax credit for biofuels variable by linking it to the price of gasoline or diesel fuel, as appropriate, so that as the price for these conventional fuels rises, the value of the tax credit falls proportionately. There should be a reasonable and rational floor price set.
- Second generation biofuels, like cellulosic ethanol, should be included in the blenders' tax credit; however, because these technologies are not as mature or economically competitive as other eligible fuels, Congress should increase the allowable credits for these fuels with a definite phaseout after 10 years.
- The President should direct the Secretary of Transportation, in consultation with the secretaries of Agriculture and Energy, and the administrator of the EPA, to commence a comprehensive review of the impacts of biofuels production on U.S. competitiveness, the environment, and global food supplies. The departments should enter into an agreement with the National Academies to produce an analysis of scientific findings relating to current and future biofuels production and the domestic effects of a dramatic increase in such production activity.
- The departments of State and Energy, the Office of the U.S. Trade Representative, and the private sector should work together internationally to develop harmonized standards for biofuels to increase international market opportunities.
- DOE and the Department of Defense should continue to work in partnership to develop and deploy technologies to ensure a domestic supply of alternative fuels for military use.

Modernize and Protect U.S. Energy Infrastructure

Our energy infrastructure is increasingly inadequate for our growing demand and economy. Blackouts, brownouts, service interruptions, and rationing could become commonplace without new and upgraded capacity. Critical energy infrastructure must also be adequately protected from both terrorist threats and natural disasters.

Stable energy supplies delivered to homes, businesses, and fueling stations across the country underpin a robust U.S. economy. More than 80% of our country's energy infrastructure is owned and managed by the private sector. U.S. transmission lines span more than 200,000 miles, U.S. oil pipelines could circle the equator eight times, and U.S. natural gas pipelines carry natural gas over 1.8 million miles each year. Robust investments are needed to modernize, protect, and upgrade these critical assets, which are essential to America's national security, economic security, and way of life. Federal, state, and local governments and the private sector must work together to enable needed expansions and upgrades to this aging infrastructure.

In August 2003, the power failure that affected 50 million people in the United States and Canada was not caused by a single extraordinary event on a single system, but rather a series of routine events that quickly became unmanageable because of an aging electricity distribution system lacking redundancy. National laboratories and others that have evaluated the weak points in our energy infrastructure have identified similar scenarios where a seemingly modest, routine occurrence can cascade into a debilitating energy supply disruption in very short order. The Energy Independence and Security Act of 2007 (EISA2007) supports the accelerated modernization of the nation's electricity distribution and transmission system. With the rapid deployment of smart power grid technology, our systems could self-diagnose and repair problems, accommodate new demand-response strategies, and promote greater efficiency through advanced metering and appliances that can interact with the grid using communications protocols that can be layered with electricity delivery. To improve security, efficiency, and reliability in our regional transmission grids, the next administration must place a high priority on transitioning to a sophisticated smart power grid.

In addition, most energy forecasts routinely assume that new power plants, oil refineries, pipelines, electricity distribution and transmission lines, liquefied natural gas (LNG) terminals, and tankers (as well as the roads, railroads, barges, and seaports that support energy production, conversion, and distribution) will be built or expanded whenever there is demand and a simple economic incentive to do so. Unfortunately, the reality is that

regulatory uncertainty, permitting challenges, and litigation, as well as organized opposition, have delayed or suspended new investment in needed infrastructure. Capital has flowed to other investments offering quicker returns. Meanwhile, demand for new infrastructure in China, India, and elsewhere in the developing world has driven up the cost of steel, concrete, and manufactured components that make up much of our infrastructure. Therefore, the next administration should direct the DOE, in cooperation with the Department of Transportation, to undertake a robust, systems analysis of energy and associated infrastructure dynamics and requirements from 2009 through the year 2030, and ask the Department of Energy's Energy Information Administration (EIA) to incorporate this analysis into its forecasting methods. In addition, the new administration will need to vigorously exercise, and Congress will need to strengthen, provisions in EPAct2005 that provide federal backstop authority for the establishment of new electricity transmission lines.

In Section 7 of the Natural Gas Act, Congress gave the Federal Energy Regulatory Commission (FERC) the authority to site natural gas pipelines, including eminent domain authority. EPAct2005 gave FERC authority to site transmission facilities, including eminent domain authority, but only under certain conditions - generally if state siting processes breakdown. Congress should simplify siting for electric transmission facilities and other energy facilities in interstate commerce (such as pipelines for carbon capture and storage) by giving FERC the same authority as it has to site natural gas pipelines under Section 7 of the Natural Gas Act.

Terrorist threats, cyber attacks, and natural disasters also have the potential to directly impact the reliability and security of our energy systems. It is incumbent upon the federal government to provide leadership and coordination with the private sector and international organizations to ensure protection of critical infrastructure. As outlined in the U.S. Department of Homeland Security's National Infrastructure Protection Plan published in 2006, nine federal agencies are designated responsible for coordinating critical infrastructure protection for key resources, including transportation systems; nuclear reactors, materials, and waste; energy (petroleum, natural gas, and electricity); hydroelectric dams; and chemical facilities. Because our economy is closely connected with the reliability of global infrastructure, the federal government must more closely coordinate with foreign governments and international organization for infrastructure protection needs.

In addition, the nation's four Strategic Petroleum Reserve (SPR) sites hold approximately 727 million barrels of crude oil for use in the case of a severe supply disruption. In an interconnected global energy environment, SPR must be expanded to 1 billion barrels as authorized in EPAct2005 to ensure availability of crude oil in the case of a significant domestic or international supply disruption.

Recommendations

- The Secretary of Energy should place high priority on the implementation of the smart power grid requirements of the Energy Independence and Security Act of 2007 (EISA2007). This may include specific recommendations for state and federal policies and other actions necessary to facilitate the transition to a smart power grid.
- The Department of Energy, in cooperation with the Department of Transportation, should undertake a robust, systems analysis of energy and associated infrastructure requirements from 2009 to 2030. The results should be applied to the Department of Energy's Energy Information Administration (EIA) forecasts as appropriate.
- Congress should simplify siting for electric transmission facilities and other energy facilities in interstate commerce (such as pipelines for carbon capture and storage) by giving the Federal Energy Regulatory Commission (FERC) the same authority as it has to site natural gas pipelines under Section 7 of the Natural Gas Act.
- Congress should modify DOE's existing authority (granted under Section 216(h) of the Federal Power Act) that designates DOE as the "lead agency" to coordinate the multiple federal agencies' permits required for an interstate transmission facility to ensure that in no case shall the process extend beyond two years. Two years is more than adequate to thoroughly consider and plan to mitigate environmental impacts.
- The President should require a federal task force led by the departments of Energy and State, in coordination with the departments of Homeland Security, Commerce, and Defense, to work with foreign governments and international organizations to strengthen domestic and international critical infrastructure protection efforts.
- Congress should fully fund the expansion of the Strategic Petroleum Reserve (SPR) from its current capacity of 727 million barrels to 1 billion barrels, as required by EPAct2005. To correspond with rising domestic demand, EPAct2005 authorizes the expansion of the nation's SPR as an insurance policy to provide the American people with protection against a significant oil disruption at home or abroad.
- The President should evaluate if the inclusion of refined products in the SPR is necessary.

Address Critical Shortages of Qualified Energy Professionals

Our energy industry employs well over one million people today, yet nearly half of this workforce is expected to retire in the next 10 years. Presently, American universities are graduating fewer and fewer students in science, engineering, and mathematics. We need additional education and training programs, incentives, and visa policies that enable the American energy sector to attract and retain a new generation of human capital in an increasingly technological and globally competitive industry. We must entice young people to enter technical fields to build, maintain, and manage our nation's energy systems.

Given the importance of the energy sector to the well-being of the U.S. economy, ensuring an adequate and adequately skilled workforce is a matter of national security. As the country's energy sector expands to meet expected demand, thousands of additional workers will be needed to design, build, operate, and service tomorrow's energy infrastructure. The drop in energy prices in the 1980s and 1990s, while welcome, had the perverse effect of leading to the closing of energy training and university education programs, many of which have not been resurrected or expanded. The demand for craftsmen (electricians, plumbers, welders, and machinists, for example), laborers, engineers, hydrologists, and other professionals is all expected to grow rapidly. However, the existing pipeline of new workers may not be big enough to offset the expected retirement of existing workers, which could result in the loss of critical institutional knowledge and experience.

The majority of graduate students in engineering and science fields at U.S. universities are not U.S. citizens. More than half of the doctorates awarded in engineering and computer sciences in the United States were to international students, according to the National Science Board. In the coming decades, the United States must be prepared to compete for talent. Restrictions on visa and immigration policies have deterred international graduate students, postdoctoral researchers, and visiting scholars, who were otherwise likely to study and work in science and engineering fields in the United States.

We need to do a better job of attracting U.S. students to these fields, especially as more and more foreign students—who historically stayed in the United States after school—are increasingly attracted to opportunities in their home countries. Until we do, we need to ensure that immigration policies allow U.S.-trained, foreign-born scientists to remain and immigrants with needed skills to work in the United States.

As we look to expand the number of graduates with science, engineering, and math degrees, we must also look to tap underrepresented demographic groups. For example, last year only 19% of students graduating with a bachelor of science degree in engineering were women, even though women accounted for more than 52% of all undergraduate degrees awarded. African Americans and Hispanic Americans are similarly underrepresented in the relevant areas of study. We must draw on the talents of all students at American academic institutions, from every background, to produce the daunting number of engineers, scientists, and skilled workers necessary to design, build, and operate America's energy framework in the future.

The next administration must pay particular attention to effective education and training programs, incentives, and visa policies that enable the American energy sector to attract and retain a new generation of human capital in an increasingly technological and globally competitive industry.

As critical as this is, we must make a determined long-term effort to educate U.S. students even more in science and math, beginning in elementary school right through high school and college. Test results have shown that U.S. elementary students do reasonably well in science and math compared to their peers in other countries, but between elementary school and high school, the performance of U.S. students gets progressively worse. Somewhere along the way, our students are losing their enthusiasm for science and math and the valuable skills that will be needed in a highly technical global marketplace.

Improving the math and science curricula is a must, especially in the middle and high school years, to capture and maintain the interest of students. Recruitment of and training for qualified math and science teachers could help and should be pursued with greater vigor. The lack of a teaching degree should not be a barrier to otherwise-qualified people with educational backgrounds in math and science. School districts also should consider paying competitive salaries to math and science teachers and awarding raises based on merit, to both attract and retain qualified individuals. There are many individuals with exceptional backgrounds and skills, many of them retired, who—with the right incentives—could help address the shortfall in math and science teachers.

The America COMPETES Act, which was signed into law in August 2007, addresses in particular the insufficient investment in science, technology, engineering, and mathematics (STEM) education. However, Congress has not fully funded the amounts authorized in the bill. Given the stakes, the next administration and Congress must fully and vigorously implement the STEM provisions to improve math and science in the America COMPETES Act.

Recommendations

- **Government at all levels should cooperate to provide incentives and motivate U.S. students and adults to enter science, technology, engineering, and mathematics careers.**

- **With state and local assistance, schools should offer competitive and performance-based salaries to recruit and retain highly qualified individuals into math and science teaching, even without a teaching certification, especially at the middle and high school levels, and provide flexibility so that qualified professionals can teach these subjects part time.**

- **The administration and Congress should reform visa and immigration policies to enable the United States to attract and retain science, technology, engineering, and mathematics students from around the world to study for advanced degrees and remain in the United States to work.**

- **The administration should request funding for and Congress should fully fund the America COMPETES Act to meet its objectives, including the following:**

  - Strengthening America's K–12 education system by recruiting and training highly qualified teachers and emphasizing science and mathematics in curricula.

  - Recognizing the importance of long-term basic research in science and engineering—particularly with regard to energy-related technologies and processes—and providing adequate financial and institutional support for researchers.

  - Revising and reforming policies to ensure that America remains the most attractive setting for the world's top talent to study and undertake research activities.

  - Cultivating America's role as the premier place in the world to innovate by investing in manufacturing and marketing, modernizing the patent system, realigning tax policy to encourage innovation, and ensuring widespread and affordable broadband Internet access.

Reduce Overly Burdensome Regulations and Opportunities for Frivolous Litigation

Energy infrastructure systems, including both generation and transmission, require massive amounts of new investment in the face of rising difficulty in locating, permitting, and building new infrastructure. Industry estimates that it will take 10 years to license and construct a new nuclear plant in the United States. Construction of numerous electricity transmission lines, natural gas terminals, and wind projects has been abandoned as a result of frustration and the inability to get siting approval. This may require us to address new federal eminent domain issues. Current regulatory uncertainty and liability issues discourage the development of clean energy alternatives and technologies. Failure to reverse this course will imperil our global economic competitiveness.

Siting and building energy infrastructure projects in the United States is a very complex process. Sponsors of such projects must navigate a myriad of regulatory structures to ensure state and local prerogatives are properly evaluated, environmental impacts are quantified and considered, and any interested party can make their opinion known. These public policy priorities are essential to ensure an informed, deliberate, and transparent process is followed. However, this process is inefficient, with multiple layers of overlapping jurisdictions and processes. Moreover, the current process too often allows opportunities for the will of a motivated few with parochial interests to override the best interest of the country, state, and community.

The imperative to move boldly to address our energy infrastructure challenges is clear. We are not suggesting that reasonable opportunities for citizens and groups to intercede in administrative and judicial proceedings be unduly constrained, but it is increasingly clear that it simply takes too long to make a decision to proceed, or not to proceed, with the siting and licensing of an energy or infrastructure project.

The energy business is a long lead-time, capital-intensive industry. Our nation's demand for more and more energy compels us to move forward immediately on projects that will take years to finance and complete. Lengthy, excessive, and unnecessary regulatory delays and roadblocks during a project will only increase costs, which are ultimately passed on to consumers, and

prolong the current imbalance of supply and demand, and imperil our economic progress.

While reasonable opportunities for citizens and groups to intercede in administrative and judicial proceedings rightly exist, abuse of these processes through endless interventions and appeals should not be permitted as the vehicle to stall or kill projects. Among these impediments is the "not in my backyard" (NIMBY) stance. It has become too easy to impede permitting of any energy facility—coal, nuclear, LNG, pipelines, transmission lines, even solar and wind—by exploiting the permit review and appeals process. NIMBY tactics have already stalled some LNG terminals such as the AES Sparrows Point LNG LLC in Baltimore, Maryland. In fact, of the 29 proposed LNG terminals approved by federal regulators, only eight have been built. In addition, local opposition has been able to use authority delegated under federal statutes such as the Clean Water Act and the Coastal Zone Management Act to kill projects on grounds not contemplated by such federal statutes. Streamlining permitting by placing hard deadlines on permit decisions and appeals of those decisions would thwart these ploys while preserving a transparent process with ample opportunity for public input.

With passage of EPAct2005, Congress recognized the urgent need to provide mechanisms to foster the siting and construction of crucial new electric transmission lines that have been stymied by inaction and regulatory delays at the state and local levels. Section 1221 of EPAct2005 created a new authority for DOE to designate corridors of high transmission congestion that adversely affect consumers. Sponsors of transmission projects located in these corridors can petition the Federal Energy Regulatory Commission (FERC) to authorize construction in certain circumstances where state consideration of the project has been delayed. This mechanism does not relieve the project's sponsor from obtaining necessary environmental permits. On October 2, 2007, DOE designated two such corridors as part of this process. Subsequently, several lawsuits have been filed against DOE attempting to overturn these designations even before FERC could consider any applications. These types of dilatory actions must be addressed if we are to see the expanded energy infrastructure this country needs to continue its economic growth.

An even more direct mechanism to ensure needed interstate energy facilities can be constructed when needed is FERC's authority in Section 7 of the Natural Gas Act, which gives the FERC authority to approve and site natural gas pipelines. Other energy facilities in interstate commerce - for example, electric transmission facilities and pipelines for CCS and other purposes - should be able to benefit from similar authority.

Another regulatory mechanism that is frequently used to impede energy projects is NEPA. The Act requires agencies to assess proposed actions that may cause significant environmental effects prior to making decisions on those actions. The NEPA process does allow for categorical exclusions for actions that the agency has determined do not individually or cumulatively have significant effects on the environment. Given the vital importance of energy to our country's national and economic security, and given that the NEPA process has been used as a delay tactic, a categorical exclusion for certain activities related to energy should be considered.

The regulatory process can also be manipulated to attain policy objectives that would otherwise be required to undergo a rigorous legislative process in Congress. The recent listing of the polar bear under the Endangered Species Act can be viewed not only as a backdoor way to limit our country's energy exploration and use, but also as a maneuver to achieve climate change policy restrictions under the guise of protecting the polar bear. Circumventing the appropriate policymaking apparatus will only lead to endless and frivolous litigation at the expense of our nation's energy security.

Moreover, it simply takes too long from a project's inception to its completion. Right now, the time needed to license and construct a new nuclear power plant in the United States is expected to take at least eight years and likely more. It is difficult to acquire the capital necessary to support such a capital-intensive project if the yield on investment is a decade or more in the future.
The next administration and Congress must redouble efforts to achieve fair administrative and judicial processes that yield decisions, whether affirmative or negative, in a timely manner that also preserves reasonable opportunities for public participation and input.

Recommendations

- Congress should provide for federal siting authority for energy infrastructure projects similar to that provided for natural gas pipelines in Section 7 of the Natural Gas Act to prevent lengthy delays in decisions at the state level.
- The President should establish an office for transportation fuel production facility permitting with responsibility to streamline the permitting process for refineries, similar to the Office for Electric Transmission Facilities codified in EPAct2005.
- Congress must reform the Clean Air Act's New Source Review program to allow routine maintenance on existing facilities to ensure efficiency, reliability, and safety without triggering costly environmental upgrades that do not significantly increase environmental protections but could lead to increases in the cost of gasoline and more plants being off-line for longer periods of time.

Demonstrate Global Leadership on Energy Security and Climate Change

We live in a global energy market that requires broad-based, global solutions. This is an opportunity for America to demonstrate our leadership in innovation and solve what is not solely an American challenge, but a global one. Open markets, expanded trade, and the elimination of tariff and nontariff barriers are necessary for a more resilient energy market and the worldwide availability of much-needed clean technologies, especially to aid developing nations.

To achieve immediate environmental benefits, we must find ways to share U.S. best practices and existing regulatory approaches to reduce air pollution wherever possible. We must exercise effective and consistent U.S. leadership to achieve a sound global framework to address the environment and issues associated with climate change. This framework must include all major-emitting economies and be compatible with the economic aspirations of the world's less developed nations, while looking after the well-being of the American people.

Recognizing that we live in a global energy market demanding global solutions presents a real opportunity for America to exhibit its innovation and provide global solutions. Energy security and climate change are by their very nature global issues. Energy is a fundamental driver of growth and development around the world, and the use of energy has been steadily expanding along with the world's economies.

Our policies must recognize—indeed, embrace—the aspirations of people everywhere for economic growth, abundant and affordable energy, an improved quality of life, and a clean environment. IEA estimates that more than 1.5 billion people lack access to modern energy services. Providing these energy services is a priority for many governments around the world to lift people out of poverty.

Greater wealth and prosperity may enhance national security by providing the underpinnings of more peaceful, democratic, and cooperative relations. But they also bring increasing pressure on world energy markets, particularly markets for oil, on which most of the world's transportation depends, and natural gas, on which a growing share of the world's electric power production depends.

Tight oil supplies in the face of rapidly growing demand have led to an historic rise of world oil prices that could in the long run curb economic growth and adversely affect the U.S. trade balance. At the same time, some longtime traditional oil suppliers are facing declining production, and new replacements of conventional oil supply are lagging. Investments are needed to unlock new supplies of oil and natural gas and to improve or prolong the lifespan of existing sources. Attractive trade and investment policies that promote the expansion of oil and gas production capacity around the world are necessary to match demand in developed and developing countries alike.

Because oil and gas production is projected to become more concentrated in the Middle East, North Africa, and Central Asia over time, the risks to our economy and security will become more pronounced unless supplies can be enhanced, new supply sources opened, alternative fuels found and fostered, and the efficiency of energy use improved—both at home and abroad. At the same time, the security concerns associated with tighter energy supplies can be adequately addressed if nations diversify energy supplies and supply routes and increase the use of environmentally sustainable sources.

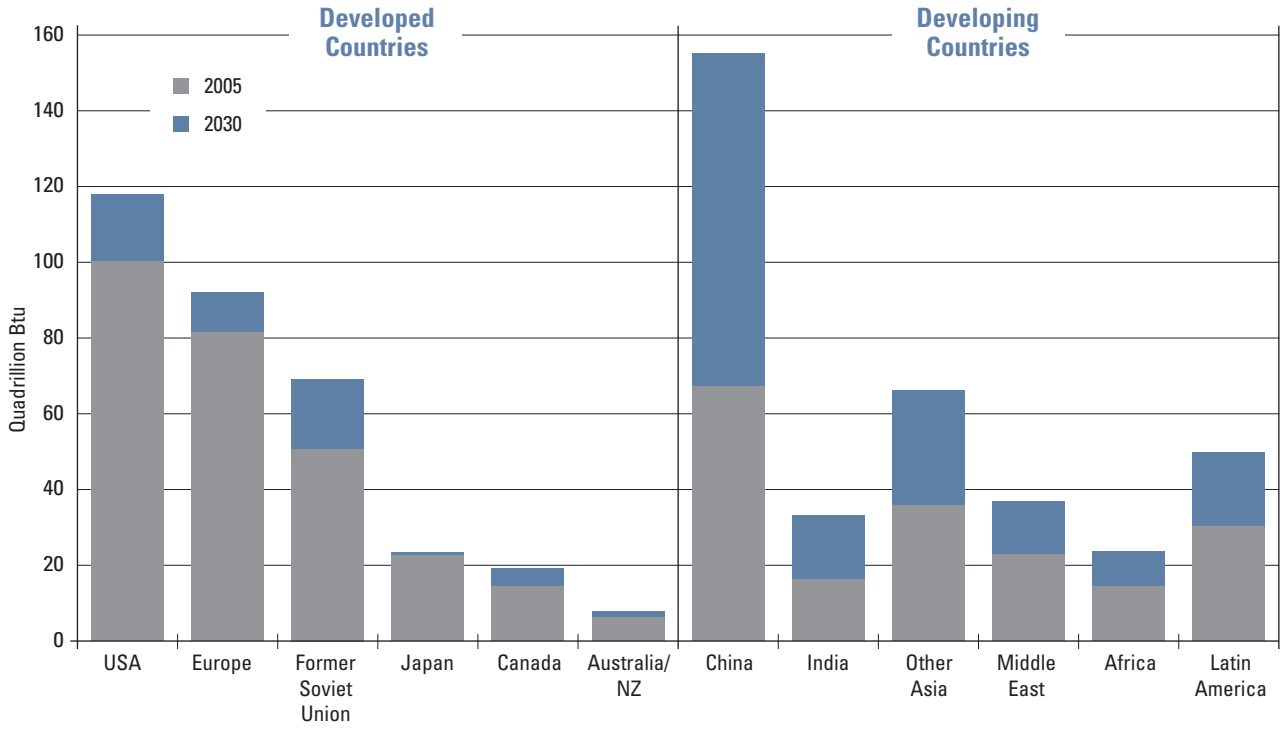
Tighter supplies also require greater protection of the infrastructure that ensures the transportation and delivery of energy around the world. The protection and enhancement of the global energy infrastructure has several major dimensions. It involves defending the free flow of oil and gas supplies around the world, over pipelines and sea lanes. It involves maintaining a robust emergency response posture to deal with oil supply disruptions, as both a deterrent to and a response to such disruptions. It involves strengthening and protecting the infrastructure of pipelines, terminals, and transmission lines over which oil, gas, and power are transported. This also means increasing nonproliferation efforts to significantly enhance national security.

The world has changed considerably since the establishment of many of the institutions that have a global focus on energy and environmental issues, including the IEA launched in 1973 and the United Nations Framework Convention on Climate Change (UNFCCC) launched in 1992. The old model of donor and recipient countries reflects neither the current state of affairs nor the future very well.

Indeed, significant transitions are occurring and will continue in world energy markets, especially in developing countries, that are changing the structure of energy markets dramatically. By 2030, global energy demand could be 50% higher than in 2005 (Figure 13), with the vast majority of this growth—roughly three quarters—coming from developing countries. The anticipated growth in energy demand from large developing countries is quite astonishing. For example, between 2005 and 2030, the increase in energy demand from China alone (88.1 quadrillion Btu) is expected to be nearly twice that from developed countries (45.0 quadrillion Btu).

This growth in energy usage is expected to increase global emissions of CO_2. In many developing countries, providing citizens with energy services is a much more pressing need than addressing climate change and even air pollution, although the latter is changing rapidly as countries recognize the almost immediate benefits of reducing air pollution levels. Developing countries make up the largest projected source of future global GHG emissions, especially the large emerging economies such as China and India (Figure 14). More than 80% of the increase in CO_2 emissions from energy between 2005 and 2030 is expected to come from developing countries. To be effective in reducing global emissions, therefore, any new international arrangement addressing climate change must include active participation from developing countries. In this regard, the Bali Roadmap that emerged from the UNFCCC talks in Indonesia in 2007 was a welcome development because developing countries agreed to consider actions that are measurable, reportable, and verifiable.

Figure 13. Global Energy Demand by Region: 2005 & 2030



Source: EIA, International Energy Outlook 2008, Table A1 (http://www.eia.doe.gov/oiaf/ieo/ieorefcase.html).

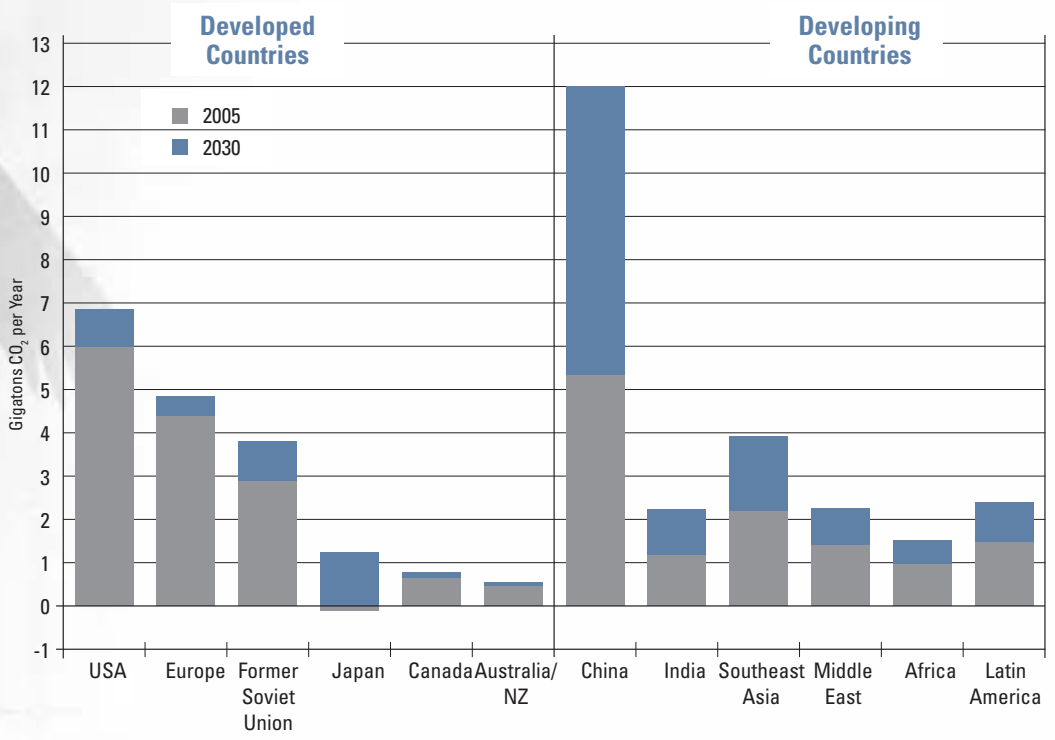
It is a simple fact that energy is needed to power economic growth and lift people from poverty, and much of that energy will likely be supplied by fossil fuels. Many developing countries have large resources of coal, natural gas, and oil, and it would be naive to believe that they will not use it. However, the increased use of existing and advanced new technologies can limit the environmental impact of using these fuels, reduce demand for them through efficiency, and provide alternate sources of energy. That is a goal all countries can share.

We have seen through the experiences of centrally planned economies and the Kyoto Protocol that top-down approaches do not work. The United States should work to promote a more bottom-up international approach to energy security and climate change that considers growing energy needs; sets realistic goals; ensures global participation, including major developing countries; promotes the development and commercialization of, and trade in, clean energy technologies and services; protects intellectual property; and maintain U.S. competitiveness.

The fact is that many countries—both developed and developing—find it difficult to reconcile addressing climate change and meeting increasing energy demand at an affordable price. Strategies that recognize these realities can raise the level of trust among developed and developing countries and win international support.

Energy security must be viewed as a set of complex interlocking challenges. Energy requires us to tap our technological, political, financial, and security strengths in a new, coordinated approach.

Figure 14. Global CO_2 Emissions from Fossil Fuels by Region: 2005 & 2030



Source: EIA, International Energy Outlook 2008, Table A10 (http://www.eia.doe.gov/oiaf/ieo/ieorefcase.html).

We should look to capitalize on significant opportunities to work together with developed and developing countries alike to tackle the common problems of energy security, economic growth, air pollution, and climate change. In particular, voluntary sectoral partnerships should be pursued to enhance the effectiveness of emissions reduction policies and to engage emerging economies on a lower emissions path. Innovative financing and free trade in clean energy technologies, goods, and services also should be pursued vigorously, as should joint R&D of promising clean energy technologies. We must be equally clear that international or domestic climate policy should not be used as an excuse to erect barriers to free and open trade or as a way to gain competitive advantage or redistribute wealth.

Recommendations

- The United States should strengthen support for the International Energy Agency (IEA) and support efforts to expand its membership to key consuming countries, particularly China and India.
- The U.S. government should engage the North Atlantic Treaty Organization (NATO) on energy security challenges and encourage member countries to support the expansion of its mandate to address energy security.
- Nations should improve transparency, reliability, and availability of oil and gas market data as well as their analysis of long- and short-term supply and demand trends to help make the world energy market less volatile.
- The United States should continue leadership efforts to expand the use of nuclear energy for peaceful purposes worldwide in a safe and secure manner through advanced technologies to foster economic growth, improve the environment, and reduce the risk of nuclear proliferation.
- The United States and other industrialized countries should support efforts to establish an International Clean Energy Fund, housed at the World Bank, to reduce capital costs for clean energy projects in the developing world.
- The United States should examine all of its tools through the Export-Import Bank, U.S. Trade and Development Agency, the Overseas Private Investment Corporation, and it should work closely with the multilateral development banks to ensure that attractive instruments are made available for clean energy projects.
- The U.S. government should elevate energy as a critical part of the U.S. trade agenda and lead a global effort to eliminate tariff and nontariff barriers to clean energy goods and services and utilize the World Trade Organization and bilateral free trade agreements to ensure a level playing field for energy projects, access, and trade.
- The United States should promote a global approach to energy security and climate change that does the following:
  - Allows each nation to develop its own path to meet strong environmental and economic development goals.
  - Considers growing energy needs, circumstances, and resource endowments
  - Sets achievable and realistic goals.
  - Ensures global participation, including major developing countries.
  - Ensures that mitigation actions by all parties are measurable, reportable, and verifiable.
  - Promotes the development and commercialization of, and trade in, clean energy technologies and services.
  - Protects intellectual property.

Summary of Blueprint Recommendations

Aggressively Promote Energy Efficiency

- The U.S. Department of Energy (DOE) should move expeditiously to promulgate the appliance standards as required by both the Energy Policy Act of 2005 (EPAct2005) and the Energy Independence and Security Act of 2007 (EISA2007).

- Allowing more rapid depreciation of capital equipment through the federal tax code would provide incentives for new investment that would accelerate reductions in energy intensity and carbon intensity. This can be accomplished by revising the tax code to:

    - Reduce the recovery period for investment in electricity transmission lines and smart grid devices from 20 years to 10 years.
    - Reduce by half the cost-recovery period for the installation of best available energy efficiency devices by commercial facilities and small businesses.
    - Provide for immediate expensing for investments that meet the standard for breakthrough low carbon technologies.

- Congress should increase annual funding for DOE's Buildings Program from the current level of about $110 million to $250 million and its Industrial Technologies Program from the current level of about $65 million to $175 million. (These funds are included as part of the increase of federal research and development (R&D) funding recommended in Section V of this report.)

- Congress should direct DOE to set energy-saving targets for national model building energy codes and encourage states to adopt such codes adapted for regional variances.

- Congress should require that federal energy efficiency grants to states be conditioned on the adoption of building codes that emphasize energy efficiency, consistent with model building codes certified by DOE.

- Congress should expand the tax deduction created in EPAct2005 for commercial buildings that reduce energy consumption by one-half to a value of at least $2.25 per square foot.

- States should establish appropriate regulatory mechanisms to treat utility investments in energy efficiency comparable to other investments.

Reduce The Environmental Impact of Energy Consumption And Production

- The administration and Congress must approach climate change as part of, not apart from, a comprehensive energy plan and they must take into account the extent of existing mandates, provide regulatory certainty, and permit considerable flexibility in how goals are achieved.

- Climate change policies must initially focus on promoting win-win ways to achieve energy security and emissions reductions while protecting economic growth. Efforts should focus on accelerating energy efficiency gains; promoting the development, demonstration, and commercial use of low- or zero-emitting technologies; reducing or eliminating barriers to developing and using domestic climate-friendly fuel sources; and providing legal and regulatory certainty for implementing technologies to reduce emissions.

- Congress should remove the cloud of regulatory uncertainty by clarifying that greenhouse gas (GHG) emissions shall not be regulated under the Clean Air Act or the Endangered Species Act, and Congress should block legal "fishing expeditions" and lawsuits against particular entities for the effects of climate change. Federal standards should preempt state standards.

- Climate policies must not provide a revenue windfall to the government.

- To the extent that climate change policies reduce air pollution as a co-benefit, air pollution rules should be reevaluated and revised when it makes sense to do so.

- To ensure our competitiveness, any new national climate change policy should be conditional on an international agreement that requires full international participation.

- Congress should act expeditiously to legislate a mechanism to address the issues and concerns for which the Clean Air Interstate Rule (CAIR) was originally intended. Absent congressional action, the administration should appeal the D.C. Circuit Court's decision.

Invest In Climate Science to Guide Energy, Economic, And Environmental Policy

- The federal government should make filling the gaps in climate science a research priority. Progress in climate science is apparent, but significant knowledge gaps remain, such as the predictive capability of climate models and the impact of land use on climate change.

- Congress should provide adequate funding to support an integrated surface, ocean, and space-based observation network, including the Global Earth Observation System of Systems (GEOSS). Greater coordination is needed to ensure that federal agencies properly collect, maintain, and share observational data.

- Federal research and development (R&D) agencies should develop a more comprehensive and concise policy on data disclosure, identifying what must be made publicly available. To maintain the public's trust and support and to ensure transparency, researchers who receive federal support should be required to disclose their data, models, and other relevant material, subject to protections for confidential business information, so that results can be assessed and reproduced.

- A federal multiagency Climate Change Adaptation Program, similar in organization and function to the Climate Change Science Program (CCSP) and the Climate Change Technology Program (CCTP), should be established to examine adaptation and geo-engineering issues and to coordinate R&D across government.

Significantly Increase Research, Development, Demonstration, And Deployment of Advanced Clean Energy Technologies

- Congress should, at a minimum, double the funding for federal energy technology R&D programs in real terms within five years.

- The federal government should support a broad R&D portfolio on both the supply and demand sides, including energy efficiency, new energy sources, and advanced fuel and power delivery options. Above all, these efforts must be supported by a robust scientific enterprise within DOE and other public and private research institutions.

- DOE should establish, and Congress should fund, a new ARPA-E program or its equivalent to assess, prioritize, select, and support high-risk, exploratory research on innovative concepts and enabling technologies that have great potential for breakthroughs.

- Congress should establish a long-term R&D tax credit so that companies can plan their R&D activities with greater certainty.

- DOE should provide opportunities for businesses and venture capital firms to work within the national laboratories to identify and create business plans to commercialize new advanced energy technologies being developed by the laboratories.

- Congress should create a Clean Energy Bank of the United States (CEBUS), a quasi-governmental entity, with sufficient initial capitalization to invest in and accelerate the market penetration of advanced clean energy technologies. The bank should have the authority to issue loans, loan guarantees, lines of credit, insurance, and other financial products and help support demonstration projects. CEBUS should become self-financing through fees and interest

Immediately Expand Domestic Oil And Natural Gas Exploration And Production

- The President and Congress should increase domestic energy supply by permanently ending the moratorium on exploration and production of oil and natural gas in the Outer Continental Shelf (OCS) and on federal lands onshore.

- Congress should provide a 37.5% share of royalty revenues from all new production on the OCS to the state(s) off the coast of which development occurs.

- The U.S. Department of the Interior should promptly conduct a comprehensive seismic inventory of areas of the OCS and the eastern Gulf of Mexico currently precluded from oil and natural gas exploration and production.

- The President and Congress should actively support construction of the Alaska natural gas pipeline.

- The President and Congress should expand the leasing program for increased access to and production of fuels from oil shale, oil sands, and other frontier hydrocarbons fuels in nonpark federal lands.

- Congress should repeal Section 526 of EISA2007, which prevents the federal government (including the military) from utilizing nontraditional transportation fuel sources, such as CTL or oil shale, for its vehicles and aircrafts.

Commit To And Expand Nuclear Energy Use

- Congress should increase the loan guarantee authority of DOE's Loan Guarantee Program commensurate with the capital cost of new nuclear power facilities. Additionally, Congress should transition the function of the DOE Loan Guarantee program to a more permanent, stable financing platform, like the Clean Energy Bank of the U.S. (CEBUS) discussed in Section V of this report.

- Congress should amend the Nuclear Standby Support Program to allow for recovery of increased project costs as a result of delays, rising equipment costs, escalation clauses, and costs of litigation, and it should provide for the recovery of 100% of covered costs and debt obligations.

- Congress should ensure that the Nuclear Regulatory Commission (NRC) has the necessary resources to review and approve combined construction and operating licenses for new nuclear power plants in a timely manner.

- DOE should increase the amount of federally stockpiled uranium available for use in domestic nuclear facilities and create a strategic reserve of low-enriched uranium from its existing inventory to guard against supply disruptions.

- The President and Congress should authorize the Secretary of Energy to enter into agreements with willing communities to foster the development of privately owned central facilities for the temporary storage of used nuclear fuel where DOE could purchase storage services for commercial used fuel removed from nuclear power plants.

- The President and Congress must commit to a permanent solution to our nation's nuclear waste. As directed by current law, the President and Congress must act expeditiously to ensure that the Nuclear Regulatory Commission's Yucca Mountain licensing process proceeds and, if it is licensed, provide full funding for construction and operation of the repository as well as take legislative action to permanently withdraw the necessary land from public use, eliminate the current statutory 70,000 metric ton cap on disposal capacity at Yucca Mountain, and establish a radiation health standard for a time period that can reasonably be demonstrated through scientific evidence.

- If the President or Congress will not fully commit to this path, they owe it to the American public and the utilities that have paid fees and interest in excess of $27 billion into the Nuclear Waste Fund, to pursue a parallel path of centralized interim storage, industrial deployment of advanced recycling technology, and continued governmental research and development to more quickly place the U.S. government in compliance with U.S. law.

- Congress should change budgeting rules to take the Nuclear Waste Fund "off budget" and codify use of this fund for interim used fuel storage through purchasing storage services from private central storage facilities as well as used fuel recycling.

- The President and Congress should expeditiously establish a program to begin the recycling of the nation's used nuclear fuel and establish a new corporation to coordinate the federal government's legal responsibility to safely and reliably dispose of the waste while not subsuming DOE's R&D mission. This entity should be provided long-term contracting authority and access to monies from the Nuclear Waste Fund.

Commit To The Use Of Clean Coal

- The President and Congress should accelerate clean coal technology development by increasing funding at DOE to $500 million per year to support R&D for advanced Integrated Gasification Combined Cycle (IGCC), carbon sequestration, advanced turbines, innovations for existing plants, fuels cells, and related technologies. (This is included in the increase in federal R&D as described in Section V of this report.)

- The President and Congress should fund a clean coal power demonstration program on the order of $500 million per year to take advantage of R&D breakthroughs and more aggressively and rapidly undertake first-of-a-kind commercial-scale demonstration of advanced IGCC and other coal-fueled systems with carbon capture and storage (CCS). (This is included in the increase in federal R&D as described in Section V of this report.)

- The President and Congress, working with the private sector, should establish a fund managed by fossil-based utilities to support research and demonstration of CCS technologies at private, academic, and government entities. Funding would be raised through a small fee on fossil-based utilities that could be passed onto consumers and treated as "off-budget" and not subject to appropriations. The fund's budget should not exceed $1 billion per year over 10 years.

- Congress should expand and structure the EPAct2005 clean coal investment tax credit program to reduce the effective cost of the first five or six advanced coal-fueled plants of each design and coal type so that they are market competitive with state-of-the-art supercritical coal-fired plants. Doubling the EPAct2005 tax credit would stimulate the construction of 12 more initial IGCC plants (four more plants for each major design type). Carbon capture "readiness" could be used as scoring criteria to encourage sequestration-amenable plants.

- The federal government and the private sector should capitalize on opportunities to partner with other governments and overseas businesses to advance CCS technology.

- The federal government should ensure a stable regulatory environment for carbon sequestration and ensure that regulations are ready when the technology is. These legislative and rulemaking processes should work in parallel with technology development and take advantage of knowledge developed during large-scale sequestration demonstrations.

Increase Renewable Sources Of Electricity

- Congress should increase annual funding for wind, solar, geothermal, and ocean programs at DOE from the current level of about $250 million to $450 million. (These funds are included as part of the increase of federal R&D funding recommended in Section V of this report.)

- Congress should extend for eight years the renewable energy tax credits and establish a phaseout period of four years.

- Congress should extend the existing Clean Renewable Energy Bond program to enable public power systems and electric cooperatives to seek alternative financing mechanisms for clean energy projects that are not eligible for production tax credits.

- As directed by EPAct2005, the Minerals Management Service (MMS) should issue regulations for the development of renewable energy projects on the OCS and should continue to process permits for these projects in the interim.

Transform Our Transportation Sector

- The President and Congress should accelerate and increase funding from the current level of roughly $400 million to $600 million for transportation technologies and bio-based fuel technology R&D programs at DOE to support the transition to unconventional vehicles and alternative fuels, including hybrid electric systems, materials technology, advanced combustion engines, technology integration, and fuels technology.

- Congress should create a new tax credit for the production of plug-in hybrid vehicles over 10 years. The level should remain the same over the first five years and decline each year thereafter, phasing out entirely after 10 years.

- Congress should make the blenders' tax credit for biofuels variable by linking it to the price of gasoline or diesel fuel, as appropriate, so that as the price for these conventional fuels rises, the value of the tax credit falls proportionately. There should be a reasonable and rational floor price set.

- Second generation biofuels, like cellulosic ethanol, should be included in the blenders' tax credit; however, because these technologies are not as mature or economically competitive as other eligible fuels, Congress should increase the allowable credits for these fuels with a definite phaseout after 10 years.

- The President should direct the Secretary of Transportation, in consultation with the secretaries of Agriculture and Energy, and the administrator of the EPA, to commence a comprehensive review of the impacts of biofuels production on U.S. competitiveness, the environment, and global food supplies. The departments should enter into an agreement with the National Academies to produce an analysis of scientific findings relating to current and future biofuels production and the domestic effects of a dramatic increase in such production activity.

- The departments of State and Energy, the Office of the U.S. Trade Representative, and the private sector should work together internationally to develop harmonized standards for biofuels to increase international market opportunities.

- DOE and the Department of Defense should continue to work in partnership to develop and deploy technologies to ensure a domestic supply of alternative fuels for military use.

Modernize and Protect U.S. Energy Infrastructure

- The Secretary of Energy should place high priority on the implementation of the smart power grid requirements of the Energy Independence and Security Act of 2007 (EISA2007). This may include specific recommendations for state and federal policies and other actions necessary to facilitate the transition to a smart power grid.

- The Department of Energy, in cooperation with the Department of Transportation, should undertake a robust, systems analysis of energy and associated infrastructure requirements from 2009 to 2030. The results should be applied to the Department of Energy's Energy Information Administration (EIA) forecasts as appropriate.

- Congress should simplify siting for electric transmission facilities and other energy facilities in interstate commerce (such as pipelines for carbon capture and storage) by giving the Federal Energy Regulatory Commission (FERC) the same authority as it has to site natural gas pipelines under Section 7 of the Natural Gas Act.

- Congress should modify DOE's existing authority (granted under Section 216(h) of the Federal Power Act) that designates DOE as the "lead agency" to coordinate the multiple federal agencies' permits required for an interstate transmission facility to ensure that in no case shall the process extend beyond two years. Two years is more than adequate to thoroughly consider and plan to mitigate environmental impacts.

- The President should require a federal task force led by the departments of Energy and State, in coordination with the departments of Homeland Security, Commerce, and Defense, to work with foreign governments and international organizations to strengthen domestic and international critical infrastructure protection efforts.

- Congress should fully fund the expansion of the Strategic Petroleum Reserve (SPR) from its current capacity of 727 million barrels to 1 billion barrels, as required by EPAct2005. To correspond with rising domestic demand, EPAct2005 authorizes the expansion of the nation's SPR as an insurance policy to provide the American people with protection against a significant oil disruption at home or abroad.

- The President should evaluate if the inclusion of refined products in the SPR is necessary.

- Congress should increase funding for R&D at DOE to accelerate the development of technologies for renewable and distributed systems integration, high-temperature superconductivity, visualization and controls, energy storage and power electronics, and permitting, siting, and analysis.

Address Critical Shortages of Qualified Energy Professionals

- Government at all levels should cooperate to provide incentives and motivate U.S. students and adults to enter science, technology, engineering, and mathematics careers.

- With state and local assistance, schools should offer competitive and performance-based salaries to recruit and retain highly qualified individuals into math and science teaching, even without a teaching certification, especially at the middle and high school levels, and provide flexibility so that qualified professionals can teach these subjects part time.

- The administration and Congress should reform visa and immigration policies to enable the United States to attract and retain science, technology, engineering, and mathematics students from around the world to study for advanced degrees and remain in the United States to work.

- The administration should request funding for and Congress should fully fund the America COMPETES Act to meet its objectives, including the following:

    - Strengthening America's K–12 education system by recruiting and training highly qualified teachers and emphasizing science and mathematics in curricula.
    - Recognizing the importance of long-term basic research in science and engineering—particularly with regard to energy-related technologies and processes—and providing adequate financial and institutional support for researchers.
    - Revising and reforming policies to ensure that America remains the most attractive setting for the world's top talent to study and undertake research activities.
    - Cultivating America's role as the premier place in the world to innovate by investing in manufacturing and marketing, modernizing the patent system, realigning tax policy to encourage innovation, and ensuring widespread and affordable broadband Internet access.

Reduce Overly Burdensome Regulations and Opportunities For Frivolous Litigation

- Congress should provide for federal siting authority for energy infrastructure projects similar to that provided for natural gas pipelines in Section 7 of the Natural Gas Act to prevent lengthy delays in decisions at the state level.

- The President should establish an office for transportation fuel production facility permitting with responsibility to streamline the permitting process for refineries, similar to the Office for Electric Transmission Facilities codified in EPAct2005.

- Congress must reform the Clean Air Act's New Source Review program to allow routine maintenance on existing facilities to ensure efficiency, reliability, and safety without triggering costly environmental upgrades that do not significantly increase environmental protections but could lead to increases in the cost of gasoline and more plants being off-line for longer periods of time.

Demonstrate Global Leadership on Energy Security and Climate Change

- The United States should strengthen support for the International Energy Agency (IEA) and support efforts to expand its membership to key consuming countries, particularly China and India.

- The U.S. government should engage the North Atlantic Treaty Organization (NATO) on energy security challenges and encourage member countries to support the expansion of its mandate to address energy security.

- Nations should improve transparency, reliability, and availability of oil and gas market data as well as their analysis of long- and short-term supply and demand trends to help make the world energy market less volatile.

- The United States should continue leadership efforts to expand the use of nuclear energy for peaceful purposes worldwide in a safe and secure manner through advanced technologies to foster economic growth, improve the environment, and reduce the risk of nuclear proliferation.

- The United States and other industrialized countries should support efforts to establish an International Clean Energy Fund, housed at the World Bank, to reduce capital costs for clean energy projects in the developing world. The United States should examine all of its tools through the Export-Import Bank, U.S. Trade and Development Agency, the Overseas Private Investment Corporation, and it should work closely with the multilateral development banks to ensure that attractive instruments are made available for this purpose.

- The U.S. government should elevate energy as a critical part of the U.S. trade agenda and lead a global effort to eliminate tariff and nontariff barriers to clean energy goods and services and utilize the World Trade Organization and bilateral free trade agreements to ensure a level playing field for energy projects, access, and trade.

- The United States should promote a global approach to energy security and climate change that does the following:
    - Allows each nation to develop its own path to meet strong environmental and economic development goals.
    - Considers growing energy needs, circumstances, and resource endowments.
    - Sets achievable and realistic goals.
    - Ensures global participation, including major developing countries.
    - Ensures that mitigation actions by all parties are measurable, reportable, and verifiable.
    - Promotes the development and commercialization of, and trade in, clean energy technologies and services.
    - Protects intellectual property.

Acronyms

AEO	*Annual Energy Outlook*
ARPA-E	Advanced Research Projects Agency for Energy
CAFE	Corporate Average Fuel Economy
CAIR	Clean Air Interstate Rule
CCS	carbon capture and storage
CCSP	U.S. Climate Change Science Program
CCTP	U.S. Climate Change Technology Program
CEBUS	Clean Energy Bank of the United States
CO_2	carbon dioxide
CREB	Clean Renewable Energy Bond
CTL	coal-to-liquids
DOD	Department of Defense
DOE	Department of Energy
DOI	Department of the Interior
DOT	Department of Transportation
EIA	Energy Information Administration
EISA2007	Energy Independence and Security Act of 2007
EPA	Environmental Protection Agency
EPAct2005	Energy Policy Act of 2005
FERC	Federal Energy Regulatory Commission
GDP	Gross Domestic Product
GEOSS	Global Earth Observation System of Systems
GHG	greenhouse gas
IEA	International Energy Agency
IGCC	Integrated Gasification-Combined Cycle
IPCC	Intergovernmental Panel on Climate Change
LNG	liquefied natural gas
mpg	miles per gallon
MMS	Minerals Management Service
NAS	National Academy of Science
NEPA	National Environmental Policy Act
NGV	natural gas–powered vehicle
NIMBY	not in my backyard
NOx	nitrogen oxide
NRC	Nuclear Regulatory Commission
OCS	Outer Continental Shelf
OECD	Organization of Economic Cooperation and Development
PC	pulverized coal
R&D	research and development
SO_2	sulfur dioxide
SPR	Strategic Petroleum Reserve
STEM	science, technology, engineering, and mathematics
UNFCCC	United Nations Framework Convention on Climate Change

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