Energy Security, Innovation & Sustainability Initiative
COMPETE: Energy

Drive.

Private Sector Demand for Sustainable Energy Solutions

A Comprehensive Roadmap to Achieve Energy Security, Sustainability and Competitiveness

Compete.

Council on Competitiveness

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Letter from the Council on Competitiveness Leadership

In July 2007, the Council on Competitiveness launched the Energy Security, Innovation & Sustainability (ESIS) Initiative in recognition of the critical linkages among these three issues and their profound impact on future U.S. productivity, standard of living and global market success. The genesis for the Initiative was the Council's 2004 groundbreaking National Innovation Initiative (NII). The NII recognized energy as a significant challenge on the horizon—one that if left unaddressed could undermine America's competitiveness in the years ahead.

Energy consumption is rising exponentially, driven by worldwide population growth, swiftly developing economies, improving global living standards and the burgeoning use of ever more energy-dependent technologies. Consumption of nearly every major energy source is up markedly. If current trends continue, humans will use more energy over the next 50 years than in all of previously recorded history.

In the United States, growing dependence on imports to meet our energy needs is a major factor in the trade deficit and results in the loss of precious capital from our economy. Increases in energy prices erode the competitive cost structure of energy-intensive industries, increasing the risk that these industries and the jobs they represent, will move offshore. Our growing dependence on foreign sources of natural gas and petroleum also poses a serious challenge to U.S. national and economic security. Moreover, we must lower the risk of climate change by reducing carbon dioxide (CO_2) emissions resulting from the combustion of fossil fuels.

Energy efficiency must be our first priority, but our goals will not be achieved through efficiency alone. Without a plentiful and affordable supply of energy in the future, the United States will lose current and future jobs, entire industries and see the further erosion of U.S. innovation capacity and our manufacturing base. Prices for goods and services will go up, our ability to create wealth will decline, and our very way of life may be threatened. If we allow this to happen, we will lose both the investment and the technological capacity we need for new energy solutions, goods and services. This is why we must establish an energy policy focused on expanding domestic production and making all energy sources more available, while employing efficiency and technology to protect the environment.

There is no one single solution to providing abundant, secure, clean and reasonably-priced energy. It will require legal, regulatory, policy and tax changes at both the federal and state levels that will support technological advances that improve the way energy is produced and used. If true change is going to occur, citizens and businesses will have to adapt to new circumstances, and it will require U.S. leadership to forge consensus and a commitment to global action to address climate change and economic development together.

While government policies can help enable the right conditions for progress, ultimately the private sector and the research community must come together to develop and deploy solutions. We must ensure that our best companies, experts, researchers, inventors and entrepreneurs have the freedom, the flexibility and the resources to develop cleaner, more secure energy—and more of it. We need to encourage innovation that leads to new sources of energy and improved use of existing, abundant resources. The way to accomplish this—the way to achieve game-

winning innovation, higher energy productivity, economic growth and stronger national security—is by driving demand for sustainable energy solutions in the private sector.

Drawing upon over a year's work of inquiry and real-time research and analysis, and in anticipation of the new administration, the Council issued *Prioritize: A 100-Day Energy Action Plan for the 44th President of the United States* in September 2008. The plan identified six "pillars" as integral to U.S. energy transformation and as top priorities for Presidential action upon taking office. At that time, the Council stressed that action plan recommended in *Prioritize* marked the beginning, not the end, of a concerted commitment to ensure the United States achieves energy security in a sustainable manner, while ensuring the competitiveness of its workers, industries and economy.

Drive: A Comprehensive Roadmap to Achieve Energy Security, Sustainability and Competitiveness, builds upon the energy action plan in *Prioritize* and sets forth the next set of integrated building blocks for America's energy transformation, sustainability and competitiveness in a low-carbon world. We believe that the recommendations presented in *Drive* will unleash a new era of American innovation, create new industries, revitalize and re-build manufacturing jobs across our nation, keep and grow high-skilled jobs for this generation and the next and accelerate economic prosperity for all Americans as we lead global growth, environmental stewardship and security.

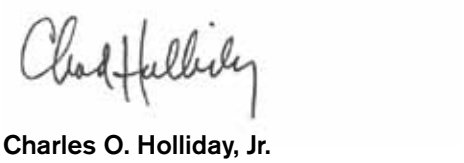
We are pleased to have the opportunity to present these recommendations at the National Energy Summit on September 23, 2009 in Washington, D.C. The recommendations set forth within *Drive* represent the voice of a very broad cross-section of America's preeminent business, academic and labor leaders, and citizens across the nation, committed to America's future prosperity and security. We urge policymakers to assign them the highest priority.

Moving forward, in the next phase of its work under the ESIS Initiative, the Council will delve deeper into the manufacturing, workforce and technology issues that will determine the success with which our nation converts today's energy and sustainability challenges into tomorrow's opportunity for economic growth and prosperity.

We would not have arrived at this point were it not for the contributions and dedicated commitment of so many individuals. We commend the reader to the Acknowledgements section of this report, as it reflects the breadth and stature of leading business, research, labor, academic, government and non-governmental leaders who gave so generously of their time and expertise to help us shape this roadmap. The ESIS Initiative Steering Committee has our gratitude for their leadership, with particular thanks to those members who generously hosted the Regional Energy Summit Series.

Reflecting the spirit and purpose of the Council, we declare, as leaders of industry, universities, national laboratories and labor, that we have come together to address this great challenge of our time—one that

will determine the future of our nation and shape the lives of our children. We are filled with hope and optimism, but grounded in reality. We stand at the crossroads of the 21st century energy and sustainability revolutions. We ask our nation's leaders and citizens to join us as we embark upon this great journey of discovery, opportunity and transformation.



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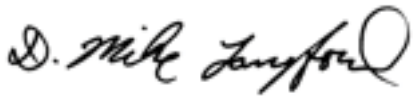

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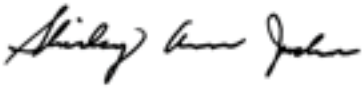

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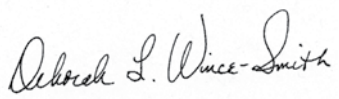

Deborah L. Wince-Smith
President
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Executive Summary

Energy is the lifeblood of our economy. America's competitiveness cannot be separated from energy issues. The efficiency with which we use energy affects our industrial and manufacturing cost competitiveness. Our dependence on foreign oil translates into an outflow of $439 billion dollars annually—accounting for over 45 percent of our trade deficit. Fully utilizing energy resources at home would direct precious capital to grow our domestic economy. In developing new industries to supply the sustainable energy and related services needed here and abroad, America can drive economic growth, create millions of new jobs and enhance the competitiveness and prosperity of the entire nation.

The United States must invest, create, commercialize and market the new products and services of the low-carbon energy future. We must actively engage in the intense global competition well underway in Asia, Europe, the Middle East and the Americas to capture the economic value, jobs and global market share for these new industries and infrastructure. As an example of what is at stake, within the past decade, the United States has fallen from first to fifth among top solar manufacturing countries and now imports solar cells from the European Union and Asia.

Revenue in just three clean energy sectors—wind, solar and biofuels—is projected to nearly triple over the next decade, from $116 billion in 2008 to $325 billion in 2018. Markets for clean technologies like carbon capture and sequestration for coal plants will expand exponentially as demand for this abundant energy resource continues to grow. These markets and the employment and economic growth they bring can be ours if we act now with the right set of policies and programs to catalyze research and development (R&D), investment, manufacturing and commercial deployment.

Our national security is challenged and will increasingly be compromised by our energy supply and usage—ranging from our dependence on oil imports and the vulnerability of our energy infrastructure to the impact on our armed forces on the land, sea and air. In 2008, we imported over 66 percent of our oil, much of it from areas of the world that are insecure and not always friendly to American interests.

Energy's impact on the environment is pervasive, particularly from the combustion of fossil fuel energy. If we are to mitigate climate change and keep changes in global temperatures to a safe level, we need to limit the concentrations of CO_2 in the atmosphere from using fossil fuels. Using old technologies to supply energy for the next few decades will lock in increases of emissions and make any needed reductions more expensive and harder in the future.

The Council identified six critical "pillars" as integral to U.S. energy system transformation in *Prioritize: A 100-Day Energy Action Plan for the 44th President of the United States* issued last September. These pillars are listed in Figure A. Recommendations for actions on each pillar were made.

Over the past year, Congress and the new Administration have made considerable efforts to reinforce and strengthen these pillars, and progress has been made and several of the Council's recommendations adopted. Nonetheless, the Council believes that additional critical actions in each of these six areas are necessary if true breakthroughs in U.S. performance are to be achieved. In many respects these pillars are interdependent. Progress in one area cannot be achieved without progress in one or more of the other areas.

Drive Recommendations

Create the Foundation for Success—at Home and Abroad

Expand trade, demonstrate leadership in Copenhagen and collaborate with the developing world. To have maximum impact we need to lay the foundation for success. This includes actions in both the international and domestic arenas. Internationally, we must act to expand trade, remove tariff and non-tariff barriers and protect intellectual property rights. The United States needs to demonstrate leadership at the United Nations (UN) conference in Copenhagen on climate change by committing to reduce greenhouse gases. We should seek an agreement that all major greenhouse gas-emitting countries agree to targets to limit emissions and confirm that the United States will provide technical and financial support to developing countries so they may achieve their aims of economic growth with cleaner technologies.

Clarify policies and inform the public. Here in America, we need to clarify and coordinate policies across federal agencies and take a systems approach to policy and funding decisions. The American public must be better educated on energy and environmental issues and technologies, and the consequences of policy choices.

Drive: Private Sector Demand for Sustainable Energy Solutions builds upon the six pillars of the energy system described in Prioritize (summarized in Figure A). This report details specific actions with assigned responsibilities under each overall recommendation.

Reward Efficiency. Efficiency is the cleanest, cheapest and most abundant energy "resource" available. Electric utilities are uniquely positioned to promote energy efficiency because they touch virtually every consumer and business in the United States. We must make sure that regulation gives utilities the right incentives to promote efficiency and that they can profit from helping their customers reduce their energy bills. Appliance standards should be set to match the best current appliance, and corporate average fuel economy (CAFE) standards for cars should be increased over time to 100 miles per gallon (mpg) by 2030. States which are most effective in reducing vehicle miles traveled per person should get additional funding from the federal government. And consumers of all types should be provided information and tax incentives to purchase the most efficient vehicles, equipment, appliances and homes.

Use it All and Price it Right. The future will likely include all the fuels we use now, although some in different forms. We must use coal-fired electricity generated with carbon capture and sequestration technologies, advanced nuclear power, natural gas and oil as well as renewables like biofuels, wind and solar power. A roadmap to rationalize state and federal siting, permitting and planning processes for critical energy infrastructure must be developed, as well as to expedite nuclear approvals and commissioning and resolving the disposal of nuclear waste must be developed. A low carbon standard, including requiring a percentage of electricity generation be from renewable sources coupled with assuring equal access to the grid for all renewables, must be adopted. A clear legal and regulatory structure for the storage of carbon emissions, including appropriate long term responsibilities and liability caps, must be established.

Figure A:

Prioritize Pillar	Drive Recommendation
1. Setting the Global Bar for Energy Efficiency	Reward Efficiency
2. Assuring Access to Clean and Competitive Energy	Use it All and Price it Right
3. Jumpstarting Energy Infrastructure and Manufacturing Investments	Capitalize Growth and Make it Here
4. National Transmission Superhighway and Smart Grid	Build it Fast and Smart
5. Spawning Technological Breakthroughs and Entrepreneurship	Discover the Future and Break the Technology Barriers
6. Mobilizing a World Class Energy Workforce	Bridge the Skills Gap and Train the Talent

Energy prices should include the costs that are not currently reflected in their prices such as the impact of oil imports to our national security and trade deficit and the impacts of carbon emissions on the climate. A gasoline price floor should be established with a gasoline tax indexed to CAFE standards and inflation, and a price on carbon emissions should be set as we seek an international agreement in which all major emitters, including developing countries, agree to emission targets.

Capitalize Growth and Make it Here. The magnitude of investment needed to achieve energy system transformation is immense. Access to patient capital is essential if investors are to move forward on large-scale, long-term infrastructure projects. The financial risks associated with capitalizing large scale, high risk projects need to be addressed through a comprehensive suite of polices including lowering corporate tax rates from 35 to 25 percent and limiting liability damages for clean energy technologies. Individual investors should be encouraged to invest in the clean energy future through tax-exempt CompeteAmerica savings bonds. To ensure that the technologies of tomorrow will be manufactured in the United States, a steady stream of financing support should be provided, including 40 percent of the revenues derived from any future carbon pricing program. Supported programs should include: federal, state or local clean manufacturing initiatives; the creation of clean energy development zones; financial assistance for the first two to three commercial manufacturing facilities for energy technologies; the expensing of the costs of retooling for production of qualified products, equipment or energy options; operating Regional Manufacturing Centers to promote advanced manufacturing technology; and dedicating a high performance computing (HPC) center for clean energy manufacturing.

Build it Fast and Smart. The transmission system is the backbone of the electric system. As we move to an energy system with more renewable and other advanced technologies such as plug-in hybrids, we

need to ensure that power may move easily and with minimum losses from where and when it is produced to where it is consumed. We need to set national criteria for transmission siting, have the costs for new transmission lines recovered regionally and set national standards so the devices that enable advanced energy management are secure and capable of being used on any smart grid.

Discover the Future and Break the Technology Barriers. America's technological leadership was built on a strong commitment to scientific discovery and collaboration across the triad of the nation's research community: universities, industry and national laboratories. That commitment waned in the last few decades of the 20th century as federal R&D investment experienced starts and stops. To ensure continued U.S. leadership we need to guarantee a long-term, stable source of funding. In the future, 30 percent of any revenue from carbon pricing should be allocated to R&D, including the demonstration of technologies. Three technologies—energy storage including batteries, carbon capture and storage and advanced nuclear reactors—are enabling technologies that are critical to develop if we are to fully exploit our renewable, coal and nuclear resources. Several demonstrations at commercial scale of each technology should be fast tracked with set dates for timely completion.

Bridge the Skills Gap and Train the Talent. Education is critical to develop the skilled workforce that will be required in the transformed energy system. DOE should establish a permanent early career research program. Twenty percent of any revenue from carbon pricing should be allocated to programs such as state and regional workforce training initiatives, funds to provide financial aid to American students pursuing education in career paths for energy disciplines and a national youth energy corps. Immigration laws should be modified so that foreign students graduating from U.S. higher education institutions with a specialty in sustainable energy-related disciplines may receive a United States Permanent Resident Card (i.e. green card). Tax incentives should be given to businesses which provide mentoring, internships and on the job training for new entrants into clean energy careers. The entire continuum of America's educational system—from community colleges and technical schools to our most preeminent research institutions—must be actively engaged in the mobilization of a world class energy workforce. Job and career training programs should be supported that position state entities, including Workforce Investment Boards, as the galvanizing force behind local coalitions including industry, educational institutions, government and labor.

Drive sets forth, in its comprehensive roadmap, specific recommendations that we believe if implemented will achieve the trifecta of simultaneously promoting America's economic competitiveness, enhancing our national security and improving the global environment. The payoff will be huge. Now is the time for action. Delay puts us at unacceptable risk to realizing these goals. Harnessing the power of America—its businesses of all sizes, its academic and laboratory excellence and its talented workforce—is the most effective way to seize this opportunity and achieve results.

Summary of Recommendations

Create the Foundation for Success

Global Prerequisites

Expand Trade and Global Growth

- *Remove tariffs and non-tariff barriers for sustainable energy products and services while not creating a dual track for preferential trade liberalization.* The World Trade Organization should re-launch the Doha Round of trade talks with the leadership of the Group of Twenty (G-20) Finance Ministers and Central Bank Governors and to ensure that tariff reductions and removal of non-tariff barriers are transparent, reciprocal and provide access to all national markets, where strong worker and consumer protections are provided.
- *Assure intellectual property rights (IPR) for all industrial products and services, copyrights and sustainable energy solutions.* The Secretary of State should coordinate with the U.S. Trade Representative to obtain strong IPR protection for all international R&D cooperative programs and technology transfer agreements for sustainable energy and carbon mitigation.

Take the Lead in Copenhagen

- *Commit to reduce U.S. emissions on a set timetable.* The President should demonstrate leadership by agreeing to reduce U.S. emissions on a set timetable in the process of creating an effective successor agreement to the Kyoto Protocol and the United Nations Framework Convention on Climate Change (UNFCCC).
- *Promote reduction targets for all major emitters.* The President should seek an agreement that all major greenhouse gas emitters, not just industrialized nations, are subject to emissions targets and that developing countries agree to actions to limit their emission growth.

Collaborate with Developing Nations in Reducing Emissions

- *Provide financial and technical support.* The President should agree to provide financial and technical support to those developing nations that agree to targets to limit their growth in emissions. This support should be provided to foster economic development, access to sustainable energy and carbon mitigation in the developing world.

American Prerequisites

Clarify Policies and Inform the Public

- *Clarify and coordinate energy and environmental policies across federal agencies.* The President should establish a sub-cabinet level joint task force of the National Security Council, National Economic Council and Council on Environmental Quality, to integrate energy security and sustainability-related policies and programs across the executive branch.
- *Take a "systems approach" to policy and funding decisions.* Congress and the Administration should assess the appropriate timeframe, sequence of and interdependence between energy-related policies and public investments.
- *Increase America's energy knowledge.* The Secretary of Education, in coordination with the Secretary of Energy, should issue guidelines for integrating energy-related curriculum at all education levels, from grade school through post-graduate education tracks—including vocational schools.
- *Disclose energy and carbon data for buildings and products.* Congress should require that by 2015 there is full disclosure of energy use and carbon impacts to consumers prior to their purchase of products, homes or buildings.

Setting the Global Bar for Energy Efficiency

Recommendation: Reward Efficiency

- *Provide tax credits and federal financing for home efficiency improvements.* Congress should expand and extend long-term tax credits for qualified energy-efficient home improvements and the availability and funding for federally-backed financing programs that lower the cost of energy efficiency upgrades to residential, commercial and industrial property.
- *Provide tax credits to accelerate the turnover to advanced technology vehicles.* Congress should extend tax credits for the purchase of hybrids or other advanced technology vehicles that represent significant advances over current CAFE or other regulatory requirements.
- *Make a step change in vehicle efficiency standards and vehicles miles traveled.* Congress should set the 2030 CAFE standard to 100 mpg and provide more federal transportation funding to states that are the most effective in reducing vehicles miles traveled per person.

- *Peg appliance standards to best-in-class.* Congress should require that future efficiency standards on appliances are set to current best-in-class products and are updated at regular intervals of at least every seven years.
- *Allow utilities to profit from energy efficiency so customers receive incentives.* All states should decouple utility rates from gross energy sales and focus on providing utilities with a reasonable rate of return on all their investments—including consumer energy-efficiency programs and emissions-reducing R&D investments.

Assuring Access to Clean and Competitive Energy

Recommendation: Use It All and Price It Right

- *Rationalize federal and state regulatory policies.* The National Governors Association (NGA) should develop by 2012—in conjunction with the U.S. Departments of Energy (DOE), the Interior (DOI) and Agriculture (USDA) and the Environmental Protection Agency (EPA)—a roadmap to rationalize state and federal siting, permitting and planning processes for critical energy infrastructure.
- *Drive diversification to low-carbon energy sources.* Congress should establish a national, low-carbon energy standard for electric utilities that encompass a minimum of 25 percent renewables by 2025 to promote the development of low-carbon energy from wind, solar geothermal, biomass and nuclear power, clean coal and natural gas, while ensuring the retention of U.S. manufacturing and jobs.
- *Assure renewables access to the grid.* DOE should ensure that utility-grade solar, wind, geothermal and biomass power generation facilities are provided access to the grid on a non-discriminatory basis, as has been the case with utility-scale hydropower.
- *Expedite nuclear power plant approvals and re-commissioning.* The Nuclear Regulatory Commission (NRC) should set appropriate review schedules for permitting of new nuclear construction.
- *Eliminate regulatory uncertainty for nuclear waste.* The President should create a commission to examine and make recommendations for new alternatives for dispensing of proliferation-resistant spent nuclear fuel from existing reactor sites, including potential storage alternatives.
- *Expedite construction of carbon capture and storage facilities.* Congress should designate the Federal Energy Regulatory Commission (FERC), as the agency responsible for the authority to approve, in consultation with DOE, applications for the long-term geological storage of carbon emissions and enact legislation that establishes a clear legal and regulatory structure for the storage of these emissions, including appropriate liability caps, long term responsibilities, short-term exemptions and safe harbor provisions.

- *Establish a price floor for gasoline.* Congress should establish a price floor for gasoline that is sufficient to accelerate demand for fuel-efficient vehicles and provide incentives for R&D and private sector investment in alternative fuels.
- *Link the gasoline tax to CAFE standards.* Congress should link any federal gasoline tax to the CAFE standard and direct its usage to transportation-related energy efficiency and R&D.
- *Price carbon emissions.* Congress should enact legislation that will result in the establishment of a consistent, predictable and transparent price on carbon emissions in conjunction with the President obtaining commitments from all developed and developing countries at international negotiations to limit their current and future emissions growth.

Jumpstarting Energy Infrastructure and Manufacturing Investments

Recommendation: Capitalize Growth and Make It Here

- *Reduce the corporate tax rate.* Congress should cap the federal corporate tax rate at 25 percent for all businesses regardless of size, make the R&D tax credit permanent and establish accelerated depreciation treatment for all capital investments.
- *Generate a revenue pool for infrastructure financing.* Congress should establish a CompeteAmerica savings bond to allow individual investors to purchase tax-exempt, federally guaranteed bonds, the proceeds of which would be invested in the building of America's next generation of clean energy infrastructure and manufacturing.
- *Enable high-risk, high-return energy projects.* Congress should authorize adequate funding to ensure a National Clean Energy Bank can provide insurance and other needed risk management or credit enhancements such as loan guarantees for the construction or utilization of sustainable energy resources or facilities, such as geological storage projects for carbon emissions and renewable purchase power agreements.
- *Invest in nuclear industry expansion.* Congress and the Administration should devote more resources to activities including long-term waste storage, R&D and deployment activities related to proliferation-resistant spent fuel re-cycling and interim storage technologies, improvements to reactor design and the financing of new nuclear power plants.
- *Provide a steady stream of manufacturing and job creation financing.* In addition to its current funding, Congress should allocate 40 percent of the annual revenue generated from carbon pricing, to federal, state and regional clean energy manufacturing initiatives.

- *Designate Clean Energy Technology Manufacturing Development Zones.* Congress should establish and fund a program to allow states to establish clean energy economic development zones by offering incentives such as waivers of corporate and employment taxes, worker training assistance, regulatory simplification and interest-free, long-term debt financing guarantees and liability insurance.
- *Establish Clean Energy Manufacturing Centers of Excellence.* Congress should expand the 21st Century Energy Leadership Initiative to encompass dedicated funding for the operation of fifteen federally-sponsored regional manufacturing centers to drive advanced manufacturing technology and best practices through the clean energy supply chain, leveraging the National Institute of Standards and Technology's (NIST) Manufacturing Extension Partnership program.
- *Provide federal financial investment in initial manufacturing facilities for clean energy technologies.* The U.S. government should coordinate and leverage all available instruments such as loan guarantees, grants or other financing vehicles available from any federal agency or state program, including the DOE, DOI, USDA and the U.S. Export-Import Bank, to facilitate construction of the first two to three manufacturing plants for any new or significantly improved sustainable energy technology.
- *Incentivize production retooling and efficiency for clean energy technology production.* Congress should allow manufacturers to fully expense the retooling of production lines to produce qualified energy-efficient products or qualified sustainable energy options.
- *Enhance industrial access to HPC resources.* Put the power of high performance computing (HPC) into the hands of American producers, innovators and entrepreneurs by expanding access to U.S. facilities and expertise in this critical field. Through the utilization of powerful HPC tools like modeling and simulation, the U.S. can lower the cost of innovation, develop high value products and services, impossible without HPC and jumpstart U.S. manufacturing.

Clearing Obstacles to a National Transmission Superhighway and Smart Grid

Recommendation: Build It Fast and Smart

- *Set national criteria for transmission siting.* Congress should create independent regional planning authorities overseen by FERC, with FERC issuing standards for transmission siting and having the final determination and approval for siting, while retaining and strengthening current consumer and worker protections.
- *Recover transmission costs on a regional basis.* FERC should require regional planning authorities to allocate costs to construct and upgrade transmission regionally, spreading costs across all jurisdictions served by the new lines.

- *Develop standards for device interoperability and security.* FERC should develop standards so that energy management devices can be operated on any smart grid and so that the grid architecture will be adaptive and secure.

Spawning Technological Breakthroughs and Entrepreneurship

Recommendation: Discover the Future and Break the Technology Barriers

- *Provide a steady, robust stream of R&D funding.* In addition to current funding, allocate 30 percent of the annual revenue generated from carbon pricing to turbo-charge R&D energy investment in technologies and to demonstrate new technological solutions within the national laboratories, research universities and industry.
- *Launch clean energy research consortia for enabling energy technologies.* The director of the White House Office of Science and Technology Policy (OSTP) should lead and coordinate across all government departments and agencies the establishment of cross-sector consortia with industry, academic and national laboratory partners to solve critical technical challenges in energy storage, including batteries and fuel cells; carbon capture and storage; and proliferation-resistant nuclear waste re-cycling and spent fuel disposal.
- *Fast-track technology demonstrations and pilots for CCS and energy storage.* Congress should support ten commercial-scale carbon capture demonstrations to be completed by 2020 by expanding the DOE regional partnership network and three to five at-scale demonstrations of energy storage technologies. Industry and universities should be strategic partners and investors in these pilots, with proper allocation of intellectual property rights (IPR).
- *Fast-track demonstrations of new nuclear reactors.* Congress should support the timely completion of three to five demonstrations of new designs of commercial-scale nuclear reactors that include passive safety features and other new design components, including consideration of closed loop fuel cycles and other means of proliferation-resistant nuclear waste re-cycling and spent fuel disposal.

Mobilizing a World-Class Energy Workforce

Recommendation: Bridge the Skills Gap and Build the Talent

- *Boost funding for workforce training in clean technology.* Congress should allocate 20 percent of the annual future revenue generated from carbon pricing to fund state and regional workforce training initiatives in clean technologies and related middle skills and direct the U.S. Department of Labor (DOL) and workforce boards to coordinate and accelerate their investments.

- *Develop and nurture world-class energy researchers and educators.* DOE should establish a permanent early career research program to support top emerging energy scientists and engineers at U.S. academic research institutions and DOE national laboratories.
- *Provide full scholarships for energy-related education.* The Departments of Energy and Defense and the National Science Foundation should allocate one percent of their R&D budgets to offer full scholarships to American students who successfully complete accredited undergraduate and graduate studies in energy-related disciplines and commit to a minimum period of service in an energy-related career.
- *Make worker training benefits portable.* Congress should establish a program that will allow eligible participants to secure a CompetePass through DOL's one-stop training centers that will be redeemable at certified employer, academic or labor-sponsored training programs that meet industry-driven skills requirements in current and future high growth job sectors, including clean energy.
- *Harness global talent by amending U.S. immigration laws.* To help fill the talent pipeline, the United States should grant green cards to foreign students receiving undergraduate and advanced degrees in scientific and engineering disciplines from U.S. institutions.
- *Cultivate youth interest in clean energy and environmentally-sound industry.* Government, industry and education coalitions should encourage and support high-school students to participate in sustainable energy projects; educate students on energy issues (i.e. use, production, conservation and impact on economy); and orient high school graduates towards work in energy related fields.
- *Give private industry a stake in creating a pipeline of workers.* Provide federal, state and local tax incentives to U.S. companies offering mentoring, internships and on the job training for new entrants into clean energy careers.
- *Bridge funding gaps for community colleges.* Maximize community college potential to create pathways for rewarding jobs and higher pay by financially supporting surging interest in their programs.
- *Galvanize local coalitions.* Fund job and career training programs that position state entities, including Workforce Investment Boards, as the galvanizing force behind local coalitions including industry, educational institutions, state and local government and labor.

Introduction

Energy is at the center of every issue that matters most to Americans—whether it is our long-term economic competitiveness, national security or the environ-ment. The leaders of the Energy Security, Innovation & Sustainability (ESIS) Initiative at the Council on Competitiveness believe that manufacturing and service companies of all sizes, academia, national laboratories and our national workforce will play the central role in meeting these challenges at scale.

As an organization comprised of business, academic and labor leaders, the Council is made up of the very people who will play the central role in meeting America's energy challenges—and that is how we know that if anyone can meet these challenges, it is us. That is why the government must set policies that unleash America's unique capacity to innovate, create and invest.

The goal of the ESIS Initiative is to create a roadmap for game-changing actions that enable American business to innovate and bring about energy systems transformation. The rewards for America and all our citizens will be great—the creation and global market success for new and existing industries, business innovation across all sectors and the growth of 21st century manufacturing and high value jobs all while improving our national security and the environment.

The ESIS Initiative has provided a remarkable journey of discovery, engagement and action. The members of the Steering Committee, supported by their advisors and Council staff, created a unique, new network of diverse and committed leaders to identify the critical challenges and create high-leverage solutions for America's energy and competitive future. With wisdom, insight, trust and creativity, these leaders asked the tough "what if?" questions and brought a complex systems-level approach to framing the problems and shaping the solutions. While there has not always been unanimity of views or policy consensus for all the issues explored, the ESIS Initiative members shared their business imperatives, experiences, successes and failures to create this roadmap and chart a new path forward.

> "While producing and using energy in a sustainable manner represents the seminal challenge of our generation, the transition to a new energy framework also represents tremendous economic prospects. The opportunities in our energy future present Americans the chance to do what we do best—lead. Leadership is essential in energy, and I am pleased the Council on Competitiveness is once again guiding the nation on a critical issue to our economic future. Given the serious complexities surrounding the path forward to achieve economic and energy security, we will not be able to forge consensus on every issue; however, the stakes are too high for our nation to not press ahead."
>
> **Charles O. Holliday, Jr.**
> Chairman, DuPont, and Chairman, Council on Competitiveness, at the ESIS Initiative Steering Committee meeting, November 2008.

The Initiative began with the launch of the Progressive Dialogue Series—three consecutive sessions engaging a diversity of high-level experts to examine the energy security and sustainability nexus from multiple angles. Dialogue I explored the energy-competitiveness relationship at the international, national, industry and workforce levels. Dialogue II documented the factors influencing energy-related decision

making and investments from the energy "users" perspective. Dialogue III examined these same issues from the perspective of energy suppliers. The Council is enormously grateful to the U.S. Department of Energy's (DOE) Office of Energy Efficiency & Renewable Energy (EERE) for not only supporting the dialogues, but for their active participation and manifold contributions.

The Progressive Dialogue Series laid the foundation for the release, on September 9, 2008, at the National Press Club, of the Council's recommendations to the next president. In a keynote speech, Council vice-chairman and co-chair of the ESIS Initiative, Shirley Ann Jackson presented *Prioritize: A 100-Day Energy Action Plan for the 44th President of the United States*. Well in advance of the 2008 election, Prioritize identified six pillars critical to energy system transformation and exhorted our next President to lead the way to our nation's energy future.

In the year that has followed, much has changed. The prices of oil, natural resources, industrial commodities and even some global food supplies have skyrocketed, crashed and risen again. Private investment for expansion in manufacturing capacity, inventory and sustainable energy technology has ebbed from historic highs as access to credit markets and risk capital shriveled in the face of a worldwide financial crisis. These stark economic realities have been further exacerbated by the collapse of global trade talks, growing protectionism and the rise of tariff and non-tariff barriers to U.S. industrial products and services. In short, robust economic growth has been replaced by a painful, global recession.

In the United States, we have witnessed some of the highest levels of unemployment, housing foreclosures and bank failures since the Great Depression of the 1930's. We have seen bankruptcies in the iconic American auto industry, contributing to growing economic distress of communities across the country. Tackling big national problems and needs from aging infrastructure and health care to clean energy and climate change have become focal points for the political agenda and economic recovery plans of both the President and the Congress.

> "It is clear that achieving a sustainable global and national energy framework capable of meeting the energy needs of our citizens without causing irreparable environmental damage, will require the right policy framework from a legal, regulatory and tax perspective at both the state and federal levels, but particularly coherence at the federal level. It will require continuing technological advances that can help modify current production and uses of energy. It is a given that at least in the long term, there will be no one single solution to providing abundant, clean and reasonably-priced energy. It will require a portfolio-based approach."
>
> **Shirley Ann Jackson**
> President, Rensselaer Polytechnic Institute, and Co-Chair, ESIS Initiative, at the inaugural ESIS Initiative Steering Committee meeting, July 2007.

The clean energy agenda has moved to center stage with funding for research and development (R&D), building domestic manufacturing and supply chain capacity, training a high skilled workforce and efforts to establish a price for carbon emissions all receiving attention. The U.S. House of Representatives has passed legislation to cap domestic greenhouse gas

(GHG) emissions, and hearings are being held in the Senate. The world community is meeting in Copenhagen this December to try to shape an international agreement to limit GHG emissions while ensuring economic growth, and the Council believes that enhancing energy security should also be part of the negotiation calculus at this pivotal forum.

Throughout this time of domestic and global turmoil and turbulence, a new duality has emerged. A rapidly growing global population is demanding more energy to improve their standard of living and develop. At the same time, this demand is coupled with the global imperative to mitigate climate change and ensure greater energy security for all nations.

Together these new realities are reshaping the global competitiveness landscape, and they will determine the future prosperity and security of nations and their citizens. The United States must enter the game with leadership from our government and the prowess of our private sector. We must field a high performing team to compete and collaborate as we play for skilled jobs, manufacturing, future industries and innovation leadership.

On the heels of the release of *Prioritize*, the leaders of the ESIS Initiative joined forces to carry their findings and recommendations across the nation and to learn first-hand the regional challenges and priorities driving energy-related investment and action across America. They tapped into the talent and expertise of an ever-expanding network of CEOs, university presidents, national laboratory directors and labor leaders who are forging new coalitions and partnerships across the nation. The Council consulted with our members and expert advisors and conducted a series of four regional energy summits designed to cull new perspectives and ideas from people with hands-on experience across the energy landscape.

> "We need to make sure that energy jobs are good jobs. We cannot cut corners when it comes to training the workforce that will tackle the challenges of the future. Encouraging innovation, investing in our workforce, providing consumers with broader choices, will give us the tools to help move America toward real energy security and economic competitiveness in the 21st century."
>
> **D. Michael Langford**
> National President, Utility Workers Union of America, AFL-CIO, and Co-Chair, ESIS Initiative, at the inaugural ESIS Initiative Steering Committee meeting in Washington, D.C., July 2007.

We launched this Regional Energy Summit Series in February with a Southern Energy Summit in Houston, Texas. This daylong event—hosted by Clarence P. Cazalot Jr., the CEO of Marathon Oil Corporation and held in collaboration with Daniel Yergin, Chairman of IHS CERA, during CERAWeek 2009—focused on the need for energy diversification and the future of the oil and natural gas industry in a carbon-constrained economy.

Our second summit took place at Rutgers University, The State University of New Jersey in April, with Rutgers' President Richard L. McCormick and the CEO of Public Service Enterprise Group (PSEG), Ralph Izzo, co-hosting the event, and New Jersey

Governor Jon Corzine keynoting. This Eastern Energy Summit explored the challenges and opportunities for scaling up energy efficiency efforts and the lessons that can be learned from the rollout of the Regional Greenhouse Gas Initiative (RGGI).

In May we convened our Midwestern Energy Summit at Argonne National Laboratory, which was co-hosted by Eric Isaacs, director of Argonne National Laboratory; James W. Owens, chairman and CEO of Caterpillar Inc.; and Robert J. Zimmer, president of the University of Chicago. This event focused on the economics of reducing carbon emissions in the electricity industry and the need for strategic investments in energy and transportation infrastructure.

In July we concluded the series with our Western Energy Summit at the NASA Ames Research Center in Silicon Valley, co-hosted by S. Pete Worden, director of NASA Ames Research Center; Mark Yudof, president of the University of California; George L. Miller, director of Lawrence Livermore National Laboratory; Paul Alivisatos, interim director of Lawrence Berkeley National Laboratory; and Thomas R. Baruch, founder and managing director of CMEA Capital. This event explored the lessons that could be gleaned from California's success as a front-runner in sustainable energy solutions and sought to discover ways to improve the energy technology innovation system all along the R&D and deployment continuum.

All these efforts have contributed to the development of the comprehensive energy action agenda presented in this document.

> "Without a plentiful and affordable supply of energy in the future, the United States will lose current and future jobs, entire industries and see the further erosion of U.S. innovation capacity and our manufacturing base. Prices for goods and services will go up, our ability to create wealth will decline, and our very way of life may be threatened. If we allow this to happen, we will lose both the investment and the technological capacity we need for new energy solutions, goods and services. This is why we must establish an energy policy focused on expanding domestic production and making all energy sources more available, while employing efficiency and technology to protect the environment."
>
> **James W. Owens**
> Chairman and CEO, Caterpillar Inc.; and Co-Chair, ESIS Initiative, at the ESIS Initiative Steering Committee meeting in Washington, D.C., July 2008.

The Council is honored to present this groundbreaking effort to address the grand challenge of generation. The issues are complex and difficult decisions must be made. Forward progress will not be easy and consensus will not be achieved easily—but it must done.

Create the Foundation for Success

There are several conditions or prerequisites that must be met to be successful in developing and deploying large-scale sustainable energy solutions worldwide. Meeting these conditions—on both the international and domestic fronts—lays the foundation for success in achieving a sustainable and secure energy future. Meeting the prerequisites is also necessary to achieve competitive success.

Global Prerequisites

All nations share a responsibility to promote sustainable economic growth and expand global prosperity and improve the quality of life, economic opportunity and security for their citizens. Energy is fundamental to the achievement of these objectives. All people of the world share a responsibility to serve as custodians of the planet; the challenges of energy security, sustainability and climate change cannot be met independently.

Global demand for energy is projected to increase with economic growth. Nations around the world are striving to enhance their energy security and manage their carbon emissions. The shift to a low-carbon economy has the potential to drive the next generation of technological innovation and sustainable development. Talent, capital and innovation are essential to the development and wide-scale deployment of sustainable technologies.

The major challenge for all nations is to achieve the optimal balance between the imperative for energy security and economic development, to provide food, health, education, jobs and prosperity for their citizens, while assuming shared responsibility for environmental stewardship and climate mitigation.

The big hurdle for developing nations is to what extent they will participate in global commitments to limit their GHG emissions, deforestation and non-sustainable agricultural production. The big hurdle for developed nations is to what extent they will agree to set GHG emission levels that could damage their domestic manufacturing, increase job loss and drive innovation and technology development to noncompliant, polluting nations. Residing between these two challenges is the extent to which technical and financial assistance will flow to developing economies, allowing them to meet their commitments.

While these challenges impact individual nations, their resolution is global in scope and impact and will require consensus and cooperation. It requires all nations to be at the table and to take measurable actions.

> "Energy consumption is rising exponentially—driven by population growth, swiftly developing economies, improving global living standards, and the burgeoning use of ever more energy-dependent technologies. It is not difficult to cite jaw-dropping illustrations of growth in energy consumption: e.g., each year, for the past few years, China has added 60,000 to 90,000 megawatts of electrical generating capacity—roughly the equivalent of the throughput of the entire electrical grid of England. Consumption of nearly every major energy source is up markedly. If current trends continue, humans will use more energy, over the next 50 years, than in all of previously recorded history.
>
> **Shirley Ann Jackson**
> President, Rensselaer Polytechnic Institute, and Co-Chair, ESIS Initiative, at the public release of Prioritize at the National Press Club, September 2008.

This dual challenge is particularly daunting for developing countries who must deliver growth to meet the needs of their growing populations, but who are constrained by limited financial resources, infrastructure, lack of skilled talent, research institutions and social, gender inequality issues. However, the economic development opportunity is great, for the technologies that will enable all nations to have a secure and sustainable energy system will also enable each to spur its own competitiveness.

Markets for technology development, production and deployment are increasingly worldwide. Reducing the barriers to trade and investment, protecting intellectual property and deploying new technologies and services is in all nations' interest as we transition to a sustainable, secure and competitive energy system. The following are enabling conditions that will accelerate this global transition and ensure that all nations share in its opportunities and economic and social benefits.

Expand Trade and Global Growth

- Remove tariffs and non-tariff barriers for sustainable energy products and services while not creating a dual track for preferential trade liberalization. The World Trade Organization should re-launch the Doha Round of trade talks with the leadership of the Group of Twenty (G-20) Finance Ministers and Central Bank Governors to ensure that tariff reductions and removal of non-tariff barriers are transparent, reciprocal and provide access to all national markets, where strong worker and consumer protections are provided.
- Assure intellectual property rights (IPR) for all industrial products and services, copyrights and sustainable energy solutions. The Secretary of State should coordinate with the U.S. Trade Representative to obtain strong IPR protection for all international R&D cooperative programs and technology transfer agreements for sustainable energy and carbon mitigation.

> "The first thing the United States should do is to stop being a bad example. As the richest country in the world, we ought to start addressing the problem in a moderate and constructive way. I do not believe we can be hypocritical in negotiating with China or India or with the Africa nations. I am not in favor of open-ended subsidies to any of those countries, but neither would I be smug. After all, what they are demanding is the right to do what we have already done."
>
> **John W. Rowe, Chairman**
> President and CEO, Exelon Corporation, at the Midwest Energy Summit at Argonne National Laboratory, May 2009.

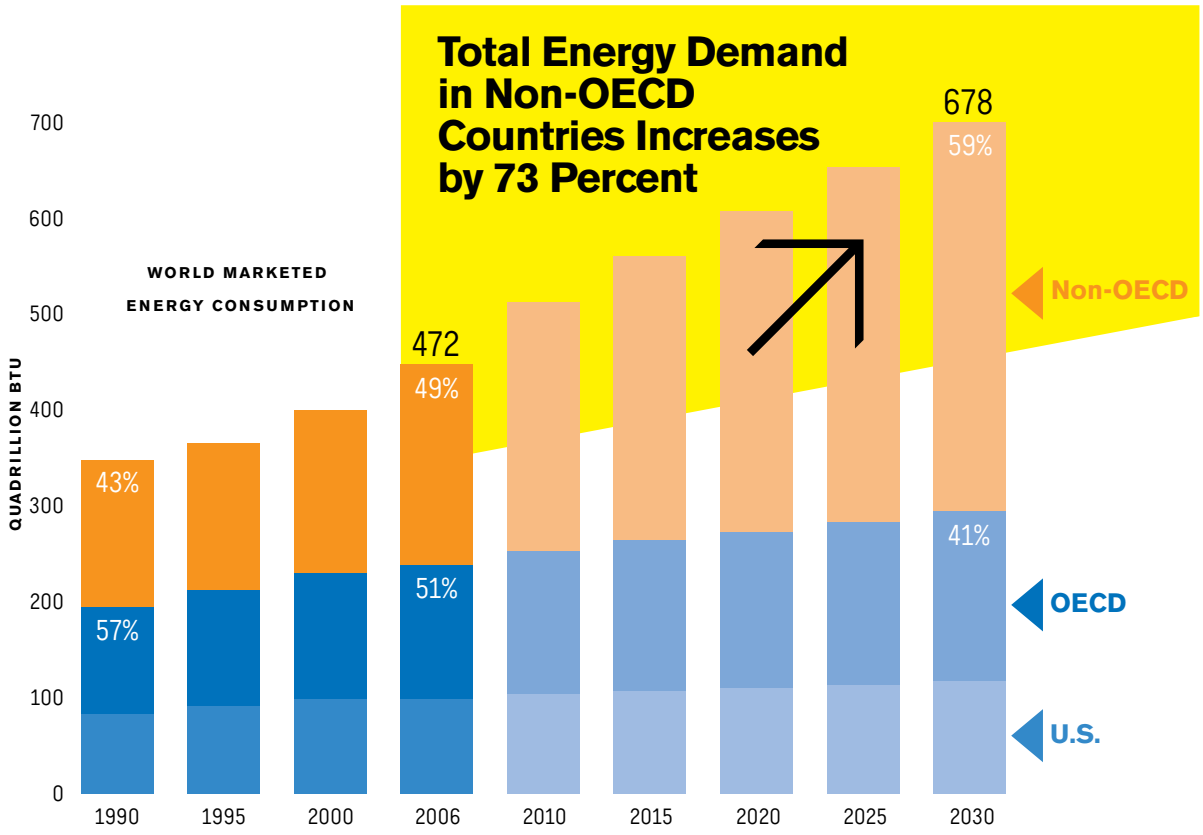
Take the Lead in Copenhagen

- Commit to reduce U.S. emissions on a set timetable. The President should demonstrate leadership by agreeing to reduce U.S. emissions on a set timetable in the process of creating an effective successor agreement to the Kyoto Protocol and the United Nations Framework Convention on Climate Change (UNFCCC).
- Promote reduction targets for all major emitters. The President should seek an agreement that all major greenhouse gas emitters, not just industrialized nations, are subject to emissions targets and that developing countries agree to actions to limit their emission growth.

Collaborate with Developing Nations in Reducing Emissions

- Provide financial and technical support. The President should agree to provide financial and technical support to those developing nations that agree to targets to limit their growth in emissions. This support should be provided to foster economic development, access to sustainable energy and carbon mitigation in the developing world.

Figure 1: Global Energy Demand is Projected to Increase by 44 Percent by 2030
Source: Energy Information Administration



Note: 2030 international energy consumption is projected to be 678 quadrillion BTU, a 44 percent increase over 2006 levels of 472 quadrillion BTU. Non-OECD countries are expected to contribute to 83 percent of this growth.

"We ought to make all the relevant goods and services—energy, pollution prevention, environmental clean-up, energy efficiency technologies—duty- and tariff- free to create really robust global trade. The G-20 economies have more than 90 percent of the world markets in all of these areas. We should open trade and let it flourish. That would probably be the best single thing we could do both for the environment and the economy."

Frederick W. Smith
Chairman and CEO, FedEx Corporation, and ESIS Initiative Steering Committee member, at the ESIS Initiative Steering Committee meeting in Washington, D.C., November 2008.

American Prerequisites

Because the energy system is so complex, and because energy sources are so diverse, responsibility and oversight for energy is often confusing and even inconsistent. Jurisdictional responsibility is often split among many federal agencies, and at times with state agencies as well. What's needed is a common-sense, clear system of jurisdictional responsibility. This will not only lead to a more affordable, predictable energy future, it will also help us achieve that future faster. By bypassing bureaucratic roadblocks, we can pave the way for smarter, faster solutions.

Transitioning to a low carbon, sustainable, secure, competitive energy economy will not happen overnight—which is why we must start immediately. However, we should recognize that policies and actions need to occur in the right order. Acting either too quickly or too slowly imposes needless costs on the economy. An understanding of the implications of policy options will allow us to avoid unintended consequences down the road.

Moreover, all tax and other financial incentives should be provided for a limited amount of time, taking into account market developments, the market share of the different products, and the costs entailed to the purchaser, manufacturer and the Treasury. There should be clear specifications as to which products are "eligible" for any financial incentive.

If the American public is informed, aware and educated about its energy choices and their relationship to climate change, we can reach solutions that Americans comprehend and wholeheartedly support.

"What is lacking is coordination [on energy] at the national level. You have every agency doing something very different – different models, different things – without a whole lot of coordination. This is certainly something that needs a lot of attention."

Dan E. Arvizu
Director, National Renewable Energy Laboratory, and ESIS Initiative Steering Committee member, at the ESIS Initiative Steering Committee meeting in Washington, D.C., July 2008.

Clarify Policies and Inform the Public

- Clarify and coordinate energy and environmental policies across federal agencies. The President should establish a sub-cabinet level joint task force of the National Security Council, National Economic Council and Council on Environmental Quality, to integrate energy security and sustainability-related policies and programs across the executive branch.
- Take a "systems approach" to policy and funding decisions. Congress and the Administration should assess the appropriate timeframe, sequence of and interdependence between energy-related policies and public investments.

"The energy challenge is an exceedingly complex one. It is not going to be solved by technology alone, by policy alone or by changes in the social and cultural environment. The solution will require the integration of all of these approaches."

Robert J. Zimmer
President, The University of Chicago, at the Midwest Energy Summit at Argonne National Laboratory, May 2009

- Increase America's energy knowledge. The Secretary of Education, in coordination with the Secretary of Energy, should issue guidelines for integrating energy-related curriculum at all education levels, from grade school through post-graduate education tracks—including vocational schools.
- Disclose energy and carbon data for buildings and products. Congress should require that by 2015 there is full disclosure of energy use and carbon impacts to consumers prior to their purchase of products, homes or buildings.

Reinforce the Six Pillars Critical to Energy System Transformation

The Council on Competitiveness identified six critical "pillars" as integral to U.S. energy system transformation in *Prioritize: A 100-Day Energy Action Plan for the 44th President of the United States*, issued in September 2008. In many respects, these pillars are interdependent. Progress in one area cannot be achieved without progress in one or more of the other areas.

Over the past year, Congress and the new Administration have made considerable efforts to reinforce and strengthen these pillars; progress has been made. Nonetheless, the Council believes that additional critical actions in each of these six areas are necessary if true breakthroughs in U.S. performance are to be achieved.

Pillar 1: Setting the Global Bar for Energy Efficiency

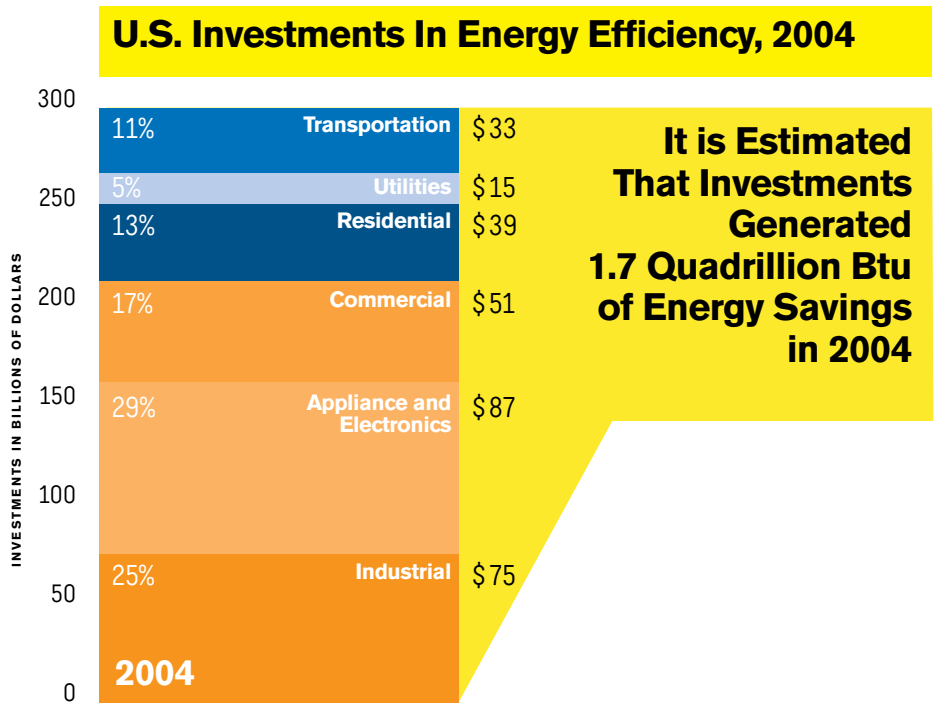
Energy efficiency is the cleanest, cheapest and most abundant energy resource available to the United States. Fully exploiting it will promote multiple objectives—from increasing our energy security to enhancing our competitiveness and promoting a cleaner environment.

- Investments in energy efficiency today can support an orderly energy system transition period over the next half-century. Accelerating broad deployment of existing energy-efficient technologies and practices—will buy time to develop and deploy the transformative energy technologies of the future, while helping reduce carbon emissions.[1]
- Investment in energy efficiency will also relieve pressure on production capacity, which is under increasing stress in the transportation fuel and power generation sectors.
- Improvements in energy efficiency lower or stabilize energy expenses, freeing up precious investment capital for other uses.[2]
- While efficiency investments require initial capital outlays, they will provide a very attractive return over the life of the investment. It is estimated that energy savings of $1.2 trillion dollars could be achieved through 2020 with the expenditure of $520 billion on efficiency in all sectors on efficiency. This would reduce end use energy consumption roughly 23 percent from projected demand.[3]
- Energy efficiency represents a very large and growing global market, and this market already supports numerous American jobs.[4] (See Figure 2.)

Despite the many benefits increased energy efficiency can offer, the United States has failed to fully realize them and ranks behind many of its economic competitors in terms of energy productivity, meaning the economic value produced for every input of energy consumed. (See Figure 3.)

Market failures inhibit energy efficiency. Energy efficiency opportunities have not been pursued for many reasons—ranging from a lack of upfront investment capital and/or technical information to classic market barriers like landlord-tenant situations where the purchaser of the equipment may not pay the energy bills. This is not insignificant as residential and commercial buildings in the United States account for almost 48 percent of U.S energy consumption and approximately 76 percent of electricity use.[5] There are some programs operating to provide incentives to consumers, such as mortgage programs which allow improvements to be financed as part of the mortgage when purchasing a home, but these

Figure 2: U.S. Energy Efficiency Investments Totaled an Estimated $300 Billion in 2004
Source: American Council for an Energy-Efficient Economy



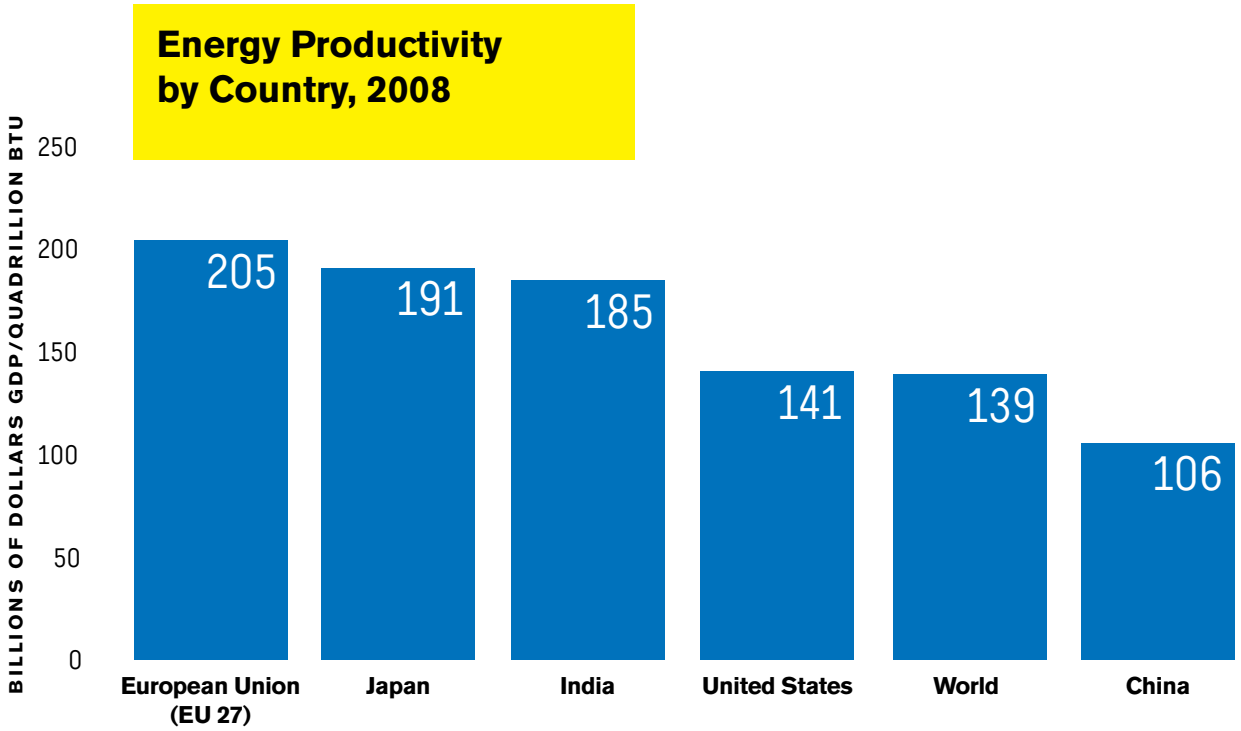
are not widely known or available.[6] Failure to pursue efficiency opportunities imposes needless costs on the economy significantly harming our competitiveness as well as our security.

Incentives and regulation can address market failures. Market demand for energy efficiency can be "pulled" by increasing the financial incentive to invest. Demand can also be "pushed," through the establishment of targets, standards and/or regulations that must be met as a pre-condition to participating in the marketplace or earning market share. For example, Japan uses a "top runner" approach to appliance standards and sets the new standard for an appliance to be at least that of the best domestic product available in the market.[7] Plug-in hybrids will enable a 100 mpg CAFE standard to be achieved.

"Increased energy efficiency creates a more cost-efficient and competitive economy with improved energy security and reduced emissions. The United States is five percent of the global population, consuming on the order of twenty-five percent of the world's energy. Closing this gap between our own energy supply capability and demand creates a big first step towards greater energy productivity—what we get from the energy we produce. There's too much waste in the system today."

James W. Owens
Chairman and CEO, Caterpillar Inc.; and Co-Chair, ESIS Initiative, at the ESIS Initiative Steering Committee meeting in Washington, D.C., July 2008

Figure 3: The United States Trails Developed Nations in Energy Productivity
Source: Central Intelligence Agency; Energy Information Administration



What is energy productivity?

According to the U.S. Bureau of Labor Statistics, productivity is a measure of economic efficiency which shows how effectively economic inputs are converted into output. Advances in productivity, that is the ability to produce more with the same or less input, are a significant source of increased potential national income. Energy productivity is the ratio of production (or service) output in dollars to energy input. Energy productivity of the United States is expressed as GDP ($)/ unit of energy.

Under draft EPA regulations to calculate how to rate a plug-in hybrid, the Chevy Volt scheduled for production next year would be rated 230 mpg city driving and received a combined city/highway rating of over 100 mpg.[8] By implementing transparent, coordinated and consistent measures, the government can drive market behavior and greater efficiency across the economy.

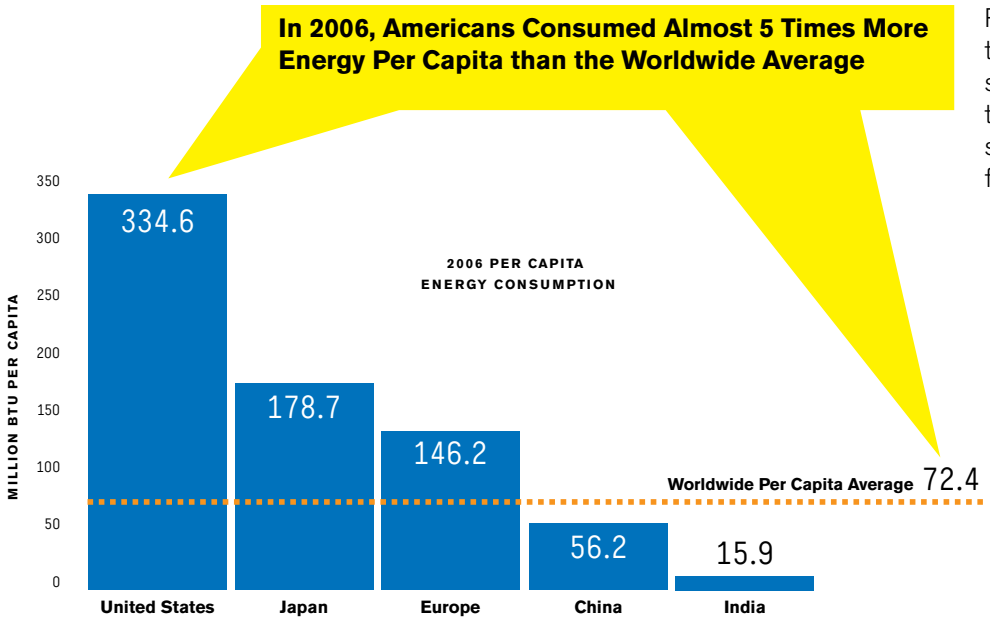
Utilities could be national change agents. Utilities are uniquely positioned to aid their customers in becoming more energy efficient, both by delivering energy efficiency services and technologies directly to customers and by helping customers acquire them through others. However, in many states, the regulation of utilities provides disincentives for the utility to do this because the utility's profits increase as they sell more energy to customers. Utilities that promote

efficiency in these states lose money. Many states have revised their regulations so that utilities have incentives to promote efficiency, but not all have done so. In states where well-crafted "decoupling" measures have been enacted, utility expenditures on energy efficiency programs have risen dramatically.

Recommendation: Reward Efficiency

- Provide tax credits and federal financing for home efficiency improvements. Congress should expand and extend long-term tax credits for qualified energy-efficient home improvements and the availability and funding for federally-backed financing programs that lower the cost of energy efficiency upgrades to residential, commercial and industrial property.
- Provide tax credits to accelerate the turnover to advanced technology vehicles. Congress should extend tax credits for the purchase of hybrids or other advanced technology vehicles that represent significant advances over current CAFE or other regulatory requirements.
- Make a step change in vehicle efficiency standards and vehicle miles traveled. Congress should set the 2030 CAFE standard to 100 miles per gallon (mpg) and provide more federal transportation funding to states that are the most effective in reducing vehicle miles traveled per person.
- Peg appliance standards to best-in-class. Congress should require that future efficiency standards on appliances are set to current best-in-class products and are updated at regular intervals of at least every seven years.
- Allow utilities to profit from energy efficiency so customers receive incentives. All states should decouple utility rates from gross energy sales and focus on providing utilities with a reasonable rate of return on all their investments—including consumer energy-efficiency programs and emissions-reducing R&D investments.

Figure 4: U.S. Per Capita Energy Consumption is Highest Among Developed Economies
Source: Energy Information Administration



Primary energy consumption refers to the direct use at the source, or energy supplied to users without transformation (i.e. energy that has not been subjected to any conversion or transformation process.)

"We are really missing the boat on efficiency. There is so much more we could do near-term without large investments in new technologies. The technologies are out there on the shelf. Their deployment simply needs to be encouraged and perhaps incentivized."

Clarence P. Cazalot Jr.
Chairman and CEO, Marathon Oil Corporation, at the Southern Energy Summit in Houston, TX, February 2009.

"Capital export is a daunting, seldom-discussed problem for the United States that is inherent in our conventional, petroleum-based economy. Capital export results in the loss of American jobs and greater foreign control of U.S. firms and real estate. Capital export must be considered in combination with other strategic factors, such as the instability of the Middle East and finite supplies of petroleum."

Lou Anna Simon
President, Michigan State University, at Progressive Dialogue I in Warrenton, VA, September 2007.

Pillar 2: Assuring Access to Clean and Competitive Energy

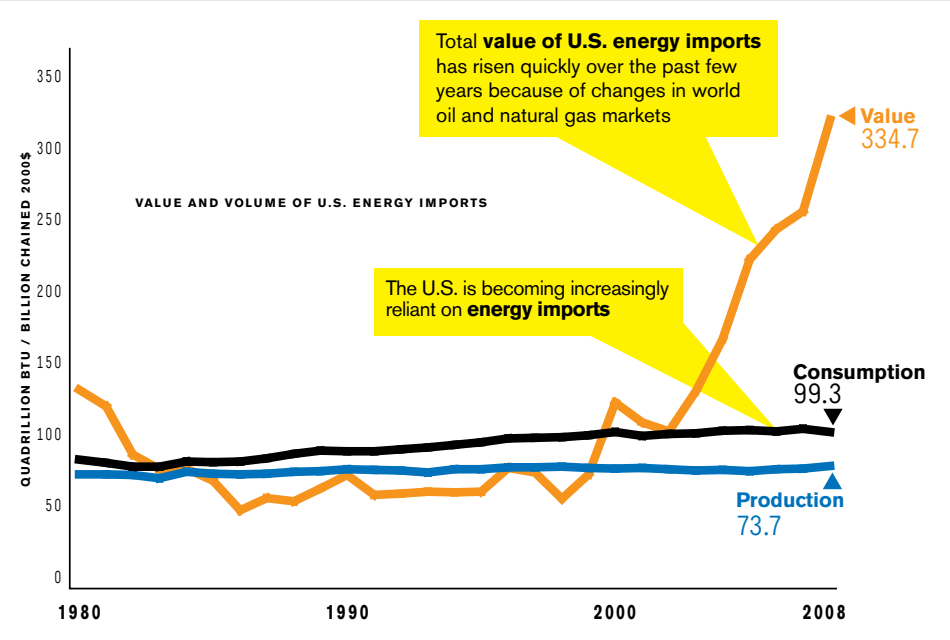
The basic proportions of U.S. energy supply have remained fairly stable for the last thirty years, with fossil fuels (coal, natural gas and petroleum) comprising more than 80 percent of total energy production and consumption and a combination of nuclear and renewables accounting for the remainder.[9] Currently, the transportation sector is 94 percent dependent upon petroleum-based liquid fuel to operate. The electric power sector utilizes primarily coal, followed by nuclear and then renewables to operate.

The United States will depend on hydrocarbon-based energy for years to come. The U.S. energy system has been designed around and operates principally on the basis of hydrocarbon, or fossil, based fuels. The Energy Information Administration projects that, in a BAU case, coal, natural gas and petroleum will continue to supply 81 percent of our nation's energy needs in 2030. With over 23 percent of the world's coal reserves and significant natural gas reserves, it is imperative that we develop the technologies that allow America to fully utilize these national resources.

Diversification is essential for energy security. The nation needs to move to a much more balanced and diversified portfolio of resources, including oil, gas, coal, nuclear, hydro, wind, solar, biofuels, geothermal, laser fusion-fission and other advanced energy sources. The energy security and sustainability challenges are far too pervasive and complex to be transformed by a single technology, fuel or practice. All options must remain on the table and be exercised. In exercising these options, consideration must be given to the full life-cycle impact of the technology—from development to deployment and through retirement and reuse. There is a carbon footprint in all methods and sources of energy production, whether fossil, nuclear or renewable.

There are many other advantages to a diversified energy portfolio. A diversity of sources promotes competition and can lower prices. Restrictions on access to any particular energy source or limits on the ability to build any particular power generation facility will raise the overall price of energy to all consumers as supply options are reduced. Diversification of sources will also help ameliorate price volatility. In addition, it promotes security, as over-reliance on

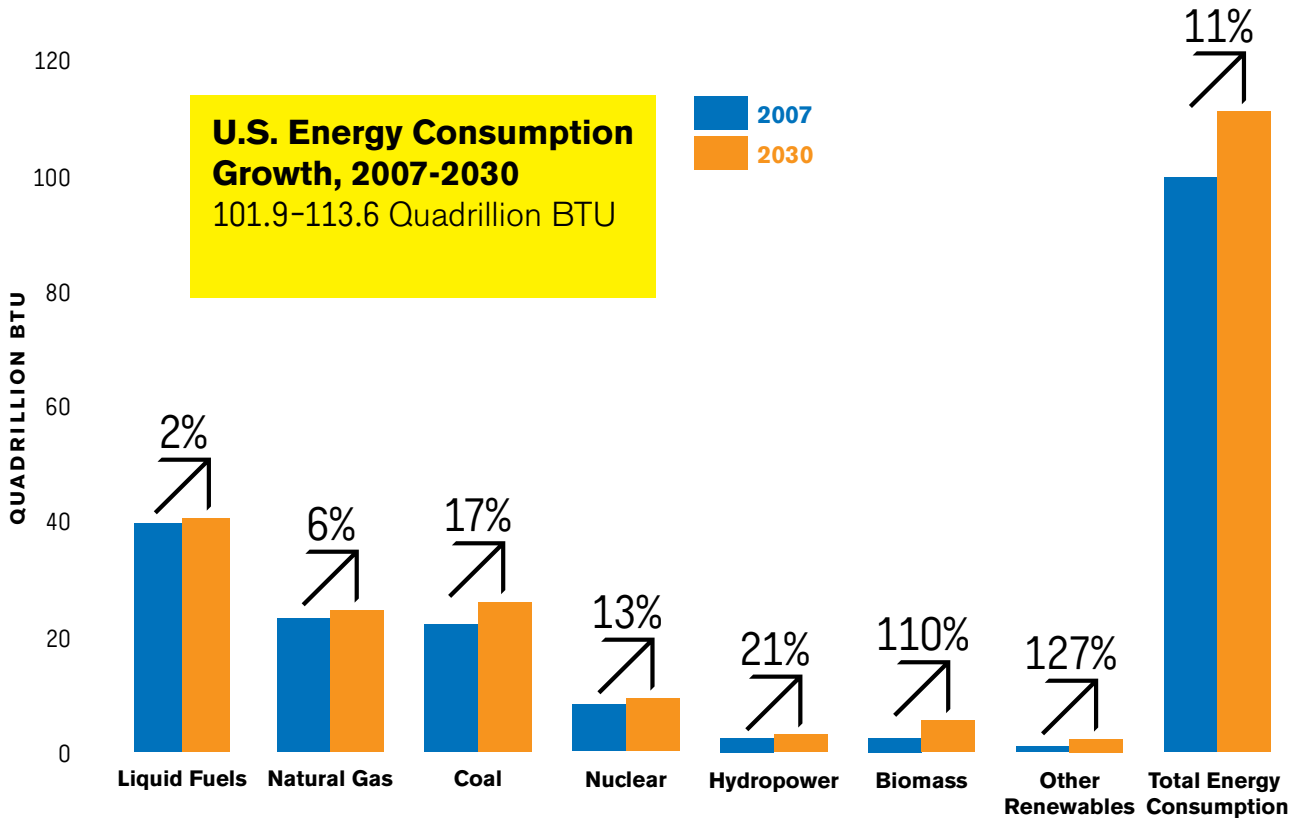
Figure 5: The United States' Current Energy Realty: Growing Import Dependence and Higher Costs
Source: Energy Information Administration



Fast Facts

- The United States relies almost entirely upon liquid fuel for transportation and on electric power for a large portion of the rest of its energy use.
- The U.S. transportation sector, including fuel for cars, trucks and jets, is 94 percent reliant on petroleum for primary fuel consumption.[10] The United States imports 56 percent of its petroleum.[11] Under a "business as usual" scenario, petroleum is projected to account for approximately 36 percent of the U.S. energy portfolio through 2030.[12]
- Coal currently accounts for 50 percent of the energy consumed in electric power production, and coal is projected to remain at 23 percent of total U.S. energy consumption in 2030, accounting for 49 percent of electric power.[13]
- Twenty-four percent of U.S. energy consumed in 2008 came from natural gas; this proportion is projected to be 22 percent of total energy in 2030.[14] The Energy Information Administration projects that the largest source of U.S. natural gas supply to 2030 will be from unconventional production, such as gas from tight sand formations.[15]
- Nuclear power supplied 21 percent of U.S. electricity in 2008. Under a business-as-usual (BAU) scenario, nuclear will supply 18 percent of electricity by 2030, constituting 8 percent of the total U.S. energy portfolio.[16]
- Already accounting for almost 10 percent of U.S. electricity consumed (and 7 percent of total U.S. energy consumption) in 2008, renewables are the fastest growing segment of the U.S. energy portfolio.[17] By 2030, under a BAU scenario, renewables are projected to account for 15 percent of U.S. electric power and 9 percent of the total U.S. energy portfolio.[18]
- Currently, the United States imports about 26 percent of its energy, which accounted for 45 percent of the U.S. merchandise trade deficit in 2008.[19]

Figure 6: U.S. Energy Demand is Projected to Grow 14 Percent by 2030, with Coal and Renewable Energy Consumption Experiencing the Fastest Growth
Source: Energy Information Administration



any one source is risky because its supply may be disrupted by many factors—from natural events such as earthquakes or hurricanes to terrorism.

Energy prices do not reflect their full costs. The price of oil does not reflect its harmful impacts on our national security or the effect on our economy of sending vast amounts of money overseas for imports. Energy prices today also do not reflect the costs inherent in the carbon emissions that result from the combustion of fossil fuels. While industries are concerned about the high costs of complying with carbon constraints, leading experts predict that the costs of non-action or delay will be far higher.[20] Scientists predict a range of severe impacts on water supplies, food production and sea levels and highly disruptive patterns of extreme weather, infectious disease and related immigration, all of which will carry a high economic toll.[21]

Price stability influences energy investments. The price volatility of oil inhibits both investments in current alternative sources of energy that would be more sustainable and secure, as well as funding for research, innovation and investment to develop and pursue new ones.

Low gasoline prices also reduce the incentive to purchase fuel-efficient cars. As cars become more efficient due to regulatory requirements, the effect of the gasoline tax is diminished in both real and absolute terms. Incentives for a driver to minimize vehicle miles traveled are decreased.

Figure 7: Power From Renewable Energy Sources Was the Fastest Growing Portion of U.S. Electricity Production in 2008, but Renewables Still Only Account for 9 Percent of Electricity Generaton
Source: Energy Information Administration

U.S. Electricity Net Production by Source

Electricity Net Production Per Billion Kilowatts	2007	2008	Percent
Nuclear Power	806.4	806.2	0.0%
Coal	2,016.5	1,994.4	-1.1%
Natural Gas	896.6	876.9	-2.2%
Petroleum	65.7	45.4	-31.0%
Other Gases	13.5	11.6	-14.0%
Fossil Fuels Subtotal	2,992.2	2,928.3	-2.1%
Conventional Hydropower	247.5	248.1	0.2%
Wood and Other Biomass	39.0	38.8	-0.6%
Wind	34.4	52.0	51.0%
Geothermal	14.6	14.9	1.5%
Biogenic Municipal Waste	16.5	17.1	3.4%
Solar	0.6	0.8	37.8%
Renewables Subtotal	352.7	371.7	5.4%
Total	4,156.7	4,110.3	-1.1%

FOSSIL FUELS

RENEWABLE ENERGY

Wind Electricity Production Grew the Fastest in the United States in 2008 at 51%, but Still Only Accounts for 1% of Electricity Generation

Note: Other Gases include blast furnace gas, propane gas and other manufactured waste gases derived from fossil fuels. Totals may not equal sum of components due to independent rounding.

"Price and taxation levels incentivize innovation and drive different behavior. The Europeans and Japanese are significantly more energy efficient than us, and that results, in large part, from the price at the pump and the price at home for electricity."

James W. Owens
Chairman and CEO, Caterpillar Inc.; and Co-Chair, ESIS Initiative, at the ESIS Initiative Steering Committee meeting in Washington, D.C., January 2008.

Similarly, inflation has significantly decreased the real impact of the tax. In real terms, the tax of 18.4 cents per gallon established in 1993 is the equivalent of 12 cents per gallon today—a reduction of approximately 33 percent. This both decreases incentives to drive less as well as affects the ability of the federal highway trust fund to have the needed money for road infrastructure improvements and public transit funding.

Failure to price carbon emissions in the United States perpetuates market uncertainty, which carries an economic toll, increases risk and undermines the private sector's ability to make long-term strategic investments at scale. The European Union, on the

other hand, has capped carbon emissions from their electrical generation and industrial sectors, and has an active emissions trading regime.

Absent a clear picture of the future, market actors are inhibited from making investment decisions. Investments not made today may incur larger costs due to later price increases; infrastructure not sited may cripple the economic competitiveness of entire regions; choosing conventional technology today may strand other investments, if clean technologies become the new standard.

Stable, long-term price signals are perhaps the most important pre-condition for driving increased levels of investment required to meet growing energy demands in a more sustainable manner.

"If we are going to drive policies that optimize the use of the most energy, we must have a clear understanding of the full costs. We need a positive, transparent, long-term and hopefully relatively predictable price on carbon emissions. This alone will be a huge factor in helping drive private sector investment in efficient and low-carbon technologies."

James W. Owens
Chairman and CEO, Caterpillar Inc., and Co-Chair, ESIS Initiative, at the ESIS Initiative Steering Committee meeting in Washington, D.C., July 2008.

Energy Permitting: The Regulatory Picture

Environmental impact statements for coal-fired power plants can be up to 1700 pages in length. One hundred planned coal power plants have been cancelled because of stalled permitting or financial unfeasibility.[22]

No streamlined regulations exist for small power projects. Small wind power projects in Massachusetts are subject to more than a dozen stakeholder permitting decisions. The Berkshire Wind Power project has been delayed for more than a decade because of permitting holdups.[23]

The Nuclear Energy Institute estimates that even with new licensing procedures, the permitting process for a new nuclear reactor could take eleven years, with four of those years devoted to the review of the license by the Nuclear Regulatory Commission. Even with tax credits in place, it is hard for a company to make an investment that takes eleven years to recoup.[24]

Energy Challenges: Spotlight on Nuclear Industry

Nuclear currently accounts for 21 percent of our electric generation but has not expanded for several reasons. We have not started construction on a new reactor in over 30 years. The workforce is nearing retirement age and new nuclear engineers have not gone into the profession. Qualified faculty is in short supply. There is intense global competition for the workforce and materials required to construct reactor domes and the associated structures. Public perceptions on nuclear safety inhibit the siting of new nuclear facilities, and the approval process for renewal and expansion of nuclear facilities is often quite lengthy, with delays increasing financing costs for nuclear projects. And yet nuclear energy currently provides the majority of low-carbon-emitting electricity produced in the United States.

30/30 Goal: The nation needs to maintain and expand the use of this low-carbon resource and raise the contribution of nuclear to our electricity supply by 30 percent by 2030, while ensuring all safety, security and emergency operations.

New energy production faces a multitude of barriers. Energy industry incumbents and market entrants both face challenges to deploying new energy production. Most of the nation's energy production facilities—such as power plants, refineries and oil and gas fields—are several decades old. Siting modern replacements for those facilities today is complex, time-consuming and expensive. Federal-state regulatory conflicts, environmental concerns, aesthetic preferences, highly localized planning processes, investment risks and preferences and regional policy differences have all played roles in driving current patterns of infrastructure development and make it difficult to permit and build major energy facilities in many parts of the United States.[25]

Recommendation: Use It All and Price It Right

- Rationalize federal and state regulatory policies. The National Governors Association (NGA) should develop by 2012—in conjunction with the Departments of Energy (DOE), the Interior (DOI), Agriculture (USDA) and the Environmental Protection Agency (EPA)—a roadmap to rationalize state and federal siting, permitting and planning processes for critical energy infrastructure.
- Drive diversification to low-carbon energy sources. Congress should establish a national, low-carbon energy standard for electric utilities that encompasses a minimum of 25 percent renewables by 2025 to promote the development of low-carbon energy from wind, solar, geothermal, biomass and nuclear power, clean coal and natural gas, while ensuring the retention of U.S. manufacturing and jobs.
- Assure renewables access to the grid. DOE should ensure that utility-grade solar, wind, geothermal and biomass power generation facilities are provided access to the grid on a non-discriminatory basis, as has been the case with utility-scale hydropower.
- Expedite nuclear power plant approvals and recommissioning. The Nuclear Regulatory Commission (NRC) should set appropriate review schedules for permitting of new nuclear construction.
- Eliminate regulatory uncertainty for nuclear waste. The President should create a commission to examine and make recommendations for new alternatives for dispensing of proliferation-resistant spent nuclear fuel from existing reaction sites, including potential storage alternatives.
- Expedite construction of carbon capture and storage facilities. Congress should designate the Federal Energy Regulatory Commission (FERC), as the agency responsible for the authority to approve, in consultation with DOE, applications for the long-term geological storage of carbon emissions and enact legislation that establishes a clear legal and regulatory structure for the storage of these emissions, including appropriate liability caps, long-term responsibilities, short-term exemptions and safe harbor provisions.
- Establish a price floor for gasoline. Congress should establish a price floor for gasoline that is sufficient to accelerate demand for fuel-efficient vehicles and provide incentives for R&D and private investment in alternative fuels.
- Link the gasoline tax to CAFE standards. Congress should link any federal gasoline tax to the CAFE standard and direct its usage to transportation-related energy efficiency and R&D.
- Price carbon emissions. Congress should enact legislation that will result in the establishment of a consistent, predictable and transparent price on carbon emissions in conjunction with the President obtaining commitments from all developed and developing countries at international negotiations to limit their current and future emissions growth.

Figure 8: As of 2007, Many Countries Had Set Targets to Diversify the Energy Consumed for Electricity Production with Cleaner, Renewable Sources
Source: New Energy Finance, International Energy Agency and Brazil National Energy Plan 2030.

	"Green Electricity" Target Proportions	Status
Spain	29.4% by 2010; 12%* of TPES by 2010	17.2%*
Italy	25% by 2010; no national target for 2020	16.5%*
France	21% by 2010; 20% by 2020	11%*
EU-25	20% TPES by 2020	20%*
Germany	12.5% by 2010; 20% by 2020	10.4%*
United Kingdom	10.4% by 2010; 20%** by 2020	4.1%*
Brazil	43.3%** by 2030, 25.4%** by 2030 excl. hydro	80%–90% hydro only; 37%* of TPES; 2% excl. hydro
China	15% of TPES by 2020	7.7%* of TPES
United States	15% by 2020 (investor-owned utilities only)	10%*, >5% excl. hydro
India	10% by 2012; 15% by 2032	5.9%* of TPES
Japan	3% by 2010 (excl. geo & hydro); 7% by 2010 (incl. geo & hydro)	3% incl. geo & hydro, 2% excl.
Russia	Absence of national renewable energy strategy	18.9%*; 3.6% of TPES, 1.2% excl. hydro

TPES: total primarty energy supply including transportation fuel
*** Including large hydro**
****Strategic goals, not binding targets**

Pillar 3: Jumpstarting Energy Infrastructure and Manufacturing Investments

Transformation of the U.S. energy system will require massive, steady investments over a period of several decades, but the nature, timeframes, dollar amounts and financing models of these investments will vary considerably. Innovative financial models and instruments, along with supportive public policies, are needed to move the energy industry forward, ensuring the global competitiveness of the U.S. manufacturing base and supply chains and domestic job retention and creation.

The U.S. energy system is vast. America's energy infrastructure is vast, complex and vital to virtually every facet of modern life and to the functioning of the U.S. economy. The scale is staggering: 20 million barrels per day of oil, 17 million barrels per day of refining capacity, 200,000 miles of oil pipeline—all aimed at fueling the more than 220 million cars and trucks now on U.S. roadways. The nation's infrastructure for extracting and transporting natural gas encompasses some 1,300 drilling rigs and over 300,000 miles of pipeline. Thousands of power plants, 200,000 miles of interconnected transmission lines and countless transformer substations operate in sync to power millions of homes and businesses.[26] The nation's existing energy infrastructure embodies an enormous capital investment, and simply maintaining and expanding it will require financial and institutional resources of comparable scale.

Upgrades and new infrastructure is needed across the board. Maintenance and expansion of our existing energy infrastructure is a very large, but relatively incremental undertaking. The need to upgrade facilities and turn over aging, obsolete and heavily polluting equipment is a continuous process, as more advanced technologies are always coming on line. Companies across the energy industry will need to invest heavily in new and more efficient production, generation, refining and other equipment to improve operating efficiencies and meet environmental requirements.

Capital requirements are immense. The capital required for the transition is very large both in the U.S. and worldwide. Estimates are that worldwide, over $45 trillion of new investment, on top of BAU spending, will be needed from 2010-2050 to decarbonize the energy sector by 50 percent.[27] The investments are along the whole energy delivery system including extraction, transport, distribution and power production from sustainable sources. Some new types of infrastructure will be also needed, such as facilities to sequester carbon.

A challenging operating environment for business. A fundamental disadvantage for U.S.-based manufacturing is the average combined federal and state corporate tax rate, which, at 39.3 percent, is the second highest among Organisation for Economic Co-operation and Development (OECD) nations.[28] There are long depreciation schedules, an impermanent R&D tax credit as well as a package of regulatory impediments, from liability risks and costs to complex and lengthy regulatory approvals for siting and permitting. No other advanced industrial nation has a comparable burden of risk and costs imposed on their manufacturing and service industries. Collectively these tax, fiscal and regulatory policies inhibit expansion, new technology investments and are contributing factors in driving American businesses offshore.

> "If we allowed the expensing of capital investment by business, there would be many projects that would be advanced by CEOs and boards of directors. Why? Because the ability to expense capital projects would reduce overall risk by creating a faster return on investment."
>
> **Frederick W. Smith**
> Chairman and CEO, FedEx Corporation, and ESIS Initiative Steering Committee member, at the ESIS Initiative Steering Committee meeting in Washington, D.C., November 2008.

To get American industry expanding here at the needed scale requires more than just energy specific incentives. The United States must establish the optimal tax, fiscal and regulatory environment that does not disadvantage U.S. producers and inadvertently create comparative advantage to other nations vying to attract and subsidize advanced technology development, manufacturing infrastructure and jobs.

Risk must be reduced along the whole energy value chain. To successfully develop and deploy sustainable energy technologies, the costs and regulatory uncertainty risks for investment should be reduced along the whole energy value chain. Investments in new energy technologies and associated enabling infrastructure are so massive and long term in nature that they will require financing assistance, including debt guarantees, product liability protection, and as transparent, predictable regulatory coherence to be successfully deployed in the United States. Without these policies and safeguards, the cost of capital and risk hurdles to private investors will simply be too great and capital will flow elsewhere. Investment capital will always seek out the optimal risk-reward ratio.

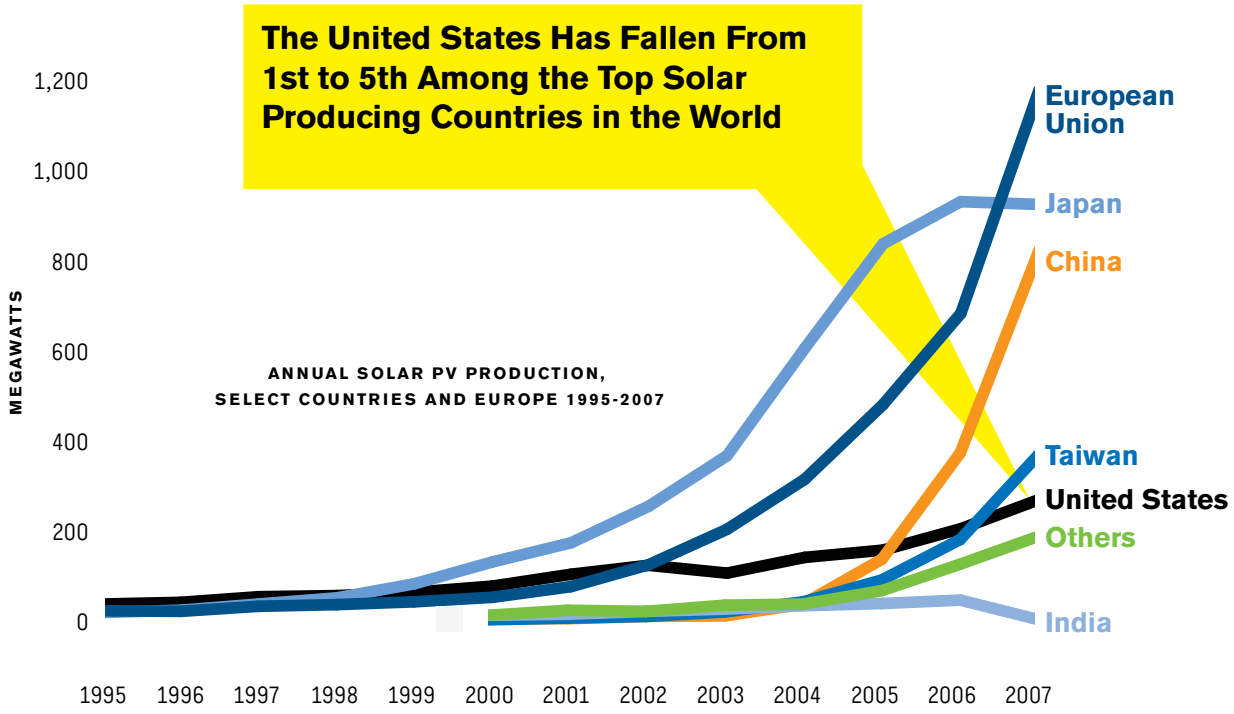
"We are not putting out enough incentives for markets to furnish the capital that's going to be required to do what we have to do. We absolutely need to have enlightened economic policies. We need to have tax policies, at both the state and federal level, which encourages, rather than discourages, innovation."

Thomas R. Baruch
Founder and Managing Director, CMEA Capital, at the Western Energy Summit at NASA Ames Research Center, July 2009.

Financing for projects and other financing tools in the federal toolkit must be mobilized to facilitate financing for sustainable energy projects. Moreover, until regulatory issues concerning the siting of infrastructure investments are simplified and facilitated, deployment is inhibited and the risks—and consequently costs—of constructing and maintaining the infrastructure will be higher than necessary.

Failure to finance means lost manufacturing and jobs. A more sustainable and secure national energy system will require a state-of-the-art manufacturing base and skilled workers if U.S. technological breakthroughs are to be transformed into U.S. manufactured equipment, components and services that can be deployed at scale here and around the world to create wealth, secure high paying jobs and grow the productivity and competitiveness of the nation's economy.

Figure 9: A Decade Ago, U.S. Solar Power Manufacturers Captured the Entire Domestic Market and 40 Percent of the World Market
Source: Renewable Energy World, Worldwatch Institute



We must bridge the "valley of death" between the first demonstration plant and prototype production for a technology. The inability to obtain financing for the first few commercial manufacturing plants or facilities is well known. It is a recognized research and technology problem in many areas, not just energy.

Failure to grow, retain and attract investment capital in the United States would result in large scale, long horizon debt financing, venture capital and private equity capital being deployed in competitive markets outside our economy, thereby financing clean energy infrastructure, building new industries and supporting next generation innovation offshore. This outcome would only further compound the loss of clean energy manufacturing and jobs in America.

Many financing options are required. Financing for all of these investments can be jumpstarted through a variety of means. The instruments could include loan guarantees, insurance or other means. A portfolio of techniques should be developed so that each infrastructure investment that is necessary can utilize the type of jumpstart that is most appropriate to its requirements. Regulators need to provide clear financial incentives for investments in energy infrastructure. Without such risk-reducing policies, essential private capital will not be available to build essential facilities.

The United States must shift to a low carbon energy-manufacturing base. Globalization has contributed to the erosion of the U.S. manufacturing base as companies have moved offshore to reduce costs, get closer to markets and other reasons. This has left the United States without a strong base of basic industries that may prove essential to building a 21st century energy system, such as steel for wind turbines, silicon and glass for solar panels, electric transformers for high-voltage transmission and advanced building materials. Many of these

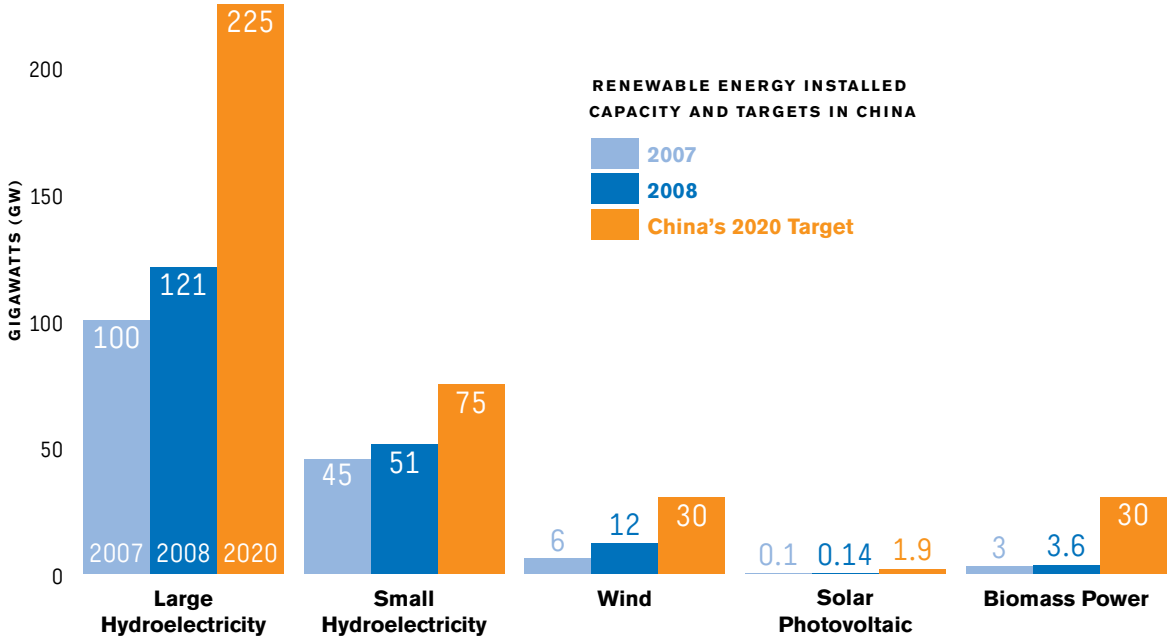
"Manufacturing executives across the country say that they would rather stay in the United States. But manufacturers are looking for leadership at the highest level to help coordinate the development of the next generation of capabilities and sustainable solutions, taking into account energy needs and constraints, so we [the United States] can be truly competitive for decades to come."

James H. Quigley
CEO, Deloitte Touche Tohmatsu, and ESIS Initiative Steering Committee member, at the ESIS Initiative Steering Committee meeting in Washington, D.C., November 2008.

Did You Know…?

China now constructs more of the most efficient coal fired-power plants than any other country, and is therefore driving down its costs of using these technologies. The energy-hungry nation is also building more nuclear power plants than the rest of the world combined.[29]

Figure 10: China Has Big Plans for Its Renewable Energy Industry
Source: New Energy Finance



technologies are simply too large and expensive to cost-effectively import, giving domestic production a strong competitive advantage.

In addition, the entire U.S. manufacturing base must reduce its carbon footprint, or risk reduced competitiveness in global markets. The enhanced energy management resulting from these efforts will also support U.S. manufacturing competitiveness as a key resource is optimized and financial savings result.[30]

Increase access to advanced manufacturing tools. The ability of the United States to model and simulate the complexity of the energy transformation can accelerate time to market and turbo-charge design of new energy efficient and sustainable products for competitive advantage. By increasing the capability of U.S. manufacturers to utilize high performance computing (HPC), we will leapfrog competitors and achieve advantage in time to market, complex design, safety and validation testing of complex materials and huge cost reductions.

Recommendation: Capitalize Growth and Make It Here

- Reduce the corporate tax rate. Congress should cap the federal corporate tax rate at 25 percent for all businesses regardless of size, make the R&D tax credit permanent and establish accelerated depreciation treatment for all capital investments.
- Generate a revenue pool for infrastructure financing. Congress should establish a CompeteAmerica savings bond to allow individual investors to purchase tax-exempt, federally-guaranteed bonds, the proceeds of which would be invested in the building of America's next generation of clean energy infrastructure and manufacturing.

- Enable high-risk, high return energy projects. Congress should authorize adequate funding to ensure a National Clean Energy Bank[31] can provide insurance and other needed risk management or credit enhancements such as loan guarantees for the construction or utilization of sustainable energy resources or facilities, such as geological storage projects for carbon emissions and renewable purchase power agreements.
- Invest in nuclear industry expansion. Congress and the Administration should devote more resources to activities including long-term waste storage, R&D and deployment activities related to spent fuel re-cycling and interim storage technologies, improvements to reactor design and the financing of new nuclear power plants.
- Provide a steady stream of manufacturing and job creation financing. In addition to its current funding, Congress should allocate 40 percent of the annual revenue generated from carbon pricing, to federal, state and regional clean energy manufacturing initiatives.
- Designate Clean Energy Technology Manufacturing Development Zones. Congress should establish and fund a program to allow states to establish clean energy economic development zones in offering incentives such as waivers of corporate and employment taxes, worker training assistance, regulatory simplification and interest-free, long-term debt financing guarantees and liability insurance.
- Establish Clean Energy Manufacturing Centers of Excellence. Congress should expand the 21st Century Energy Leadership Initiative[32] to encompass dedicated funding for the operation of fifteen federally-sponsored regional manufacturing centers to drive advanced manufacturing technology and best practices through the clean energy supply chain, leveraging the National Institute of Standards and Technology's (NIST) Manufacturing Extension Partnership program.
- Provide federal financial assistance for the initial manufacturing facilities for clean energy technologies. The U.S. government should coordinate and leverage all available instruments such as loan guarantees, grants, or other financing vehicles available from any federal agency or state program, including DOE, DOI, USDA and the U.S. Export-Import Bank, to facilitate construction of the first two or three manufacturing plants for any new or significantly improved sustainable energy technology.
- Incentivize production retooling and efficiency for clean energy technology production. Congress should allow manufacturers to fully expense the retooling of production lines to produce qualified energy-efficient products or qualified sustainable energy options.
- Enhance industrial access to HPC resources. Put the power of high performance computing (HPC) into the hands of American producers, innovators and entrepreneurs by expanding access to U.S. facilities and expertise in this critical field. Through the utilization of powerful HPC tools like modeling and simulation, the U.S. can lower the cost of innovation, develop high value products and services impossible without HPC and jumpstart U.S. manufacturing.

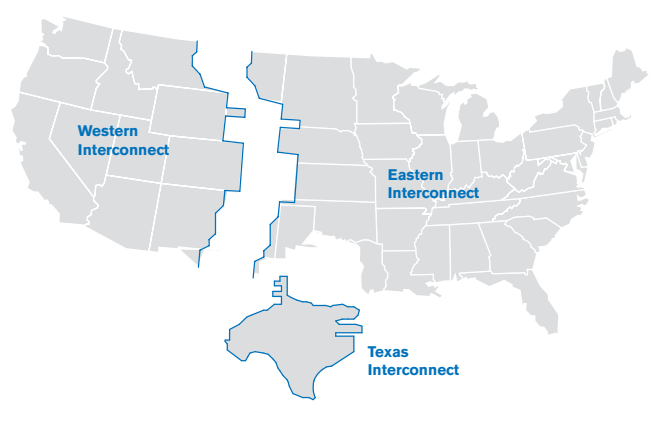
Pillar 4: Clearing Obstacles to a National Transmission Superhighway and Smart Grid

The transmission system is the backbone of the electric system. It is a fundamental component of our energy infrastructure. It has suffered from underinvestment for decades. The antiquated U.S. transmission and distribution systems are causing severe economic losses to the economy. For example, it is estimated that the cost of the power blackout in the Northeast in August of 2003 was $6-10 billion dollars.[33] Using new technologies, a transmission superhighway may also improve reliability and significantly reduce line losses. Especially as we move to an energy system with more renewable and other advanced technologies, we need to ensure that power may move easily and with minimum losses from where and when it is produced to where it is consumed.

Transmission enables deployment of renewables. A new transmission system is needed if we are to bring on line large amounts of new renewable resources, which are often best sited far from the demand centers. In addition, many renewable resources are intermittent. They may not produce power if the wind is not blowing or the sun not shining. Balancing the power produced by these intermittent resources with the other power supplies to meet the demand for energy will require more transmission.

Grid governance is balkanized and siting embroiled in controversy. Unlike the federal highway system, the U.S. electric power system was not designed from the top down. It is a mosaic that has been stitched together year over year, from one community to the next, and one transmission tower to another. It is a system comprised of large for-profit corporations with billion dollar revenues to small, non-profit rural electrical cooperatives serving a community of less than one hundred. The electric power system is disaggregated, balkanized and governed by a veritable patchwork of regulation and legislation. As such, the siting of transmission lines has been delayed by continuing disputes over jurisdictional authority, environmental impact and the allocation of construction costs.

Figure 11: Snapshot—The U.S. Energy Transmission System



The U.S. has three different electricity transmission interconnections with 273,564 miles of high voltage transmission lines. Electricity is distributed by 3,139 utilities, with 50 public utility commissions, either publicly elected or governor-appointed, providing regulatory oversight. A hundred and forty separate "balancing authorities" manage the electricity load, making inter-jurisdiction transport very difficult.

Sources: "The Changing Structure of the Electric Power Industry 2000; an Update," U.S. Energy Information Administration, 2000; Wood, P., Church, R., Building the 21st Century Transmission Super Grid; Technical and Political Challenges for Large Scale Renewable Electricity Production in the U.S., Washington, D.C.; American Council on Renewable Energy, April 2009.

"The U.S. electric power infrastructure is plagued by loose bolts and cables, rotten wood, overgrown vegetation, wind damage, rust, missing conductors, cracked footings, flooded stations, out-dated and inefficient equipment and collapsing towers. The current condition of the grid is contributing to a significant loss of energy efficiency and reliability. Further compounding the situation is the fragmented grid system that prohibits moving around electricity, creates congestion and causes huge penalties across regions."

Joseph L. Welch
President and CEO, ITC Holdings Corp., at Progressive Dialogue II in Chantilly, VA, March 2008.

Holistic approach to planning required. The development of a transmission superhighway should be done in parallel with the development and implementation of a smart grid so power dispatch and use can be managed with 21st century technology, empowering all types of consumers and providing more reliable and secure power. And the planning to evaluate the need and location of transmission lines should incorporate the capabilities of a smart grid to maximize energy efficiency and demand response.

Smart grid requirements. The market is beginning to demand tools and options to better manage energy at the point of consumption. Standards need to be developed so that devices are compatible and capable of being used by all consumers and any grid operator; security needs to be ensured so that hackers or others cannot access the devices or grid control points; and the design should incorporate an ability to be self-healing and adaptive so brownouts and blackouts are minimized.

Figure 12: Transmission Line Locations

Transmission lines are not sited in convenient locations to move abundant renewable energy to population centers. Investor owned utilities invest, on average, about 6.5 percent of their transmission budget on transmission to and from power sources. The American Wind Energy Association estimates that there are 300,000 MW of wind projects stalled because there is inadequate electric transmission capacity. That represents 20 percent of U.S. electricity consumption.

Sources: Wood, P., Church, R., Building the 21st Century Transmission Super Grid; Technical and Political Challenges for Large Scale Renewable Electricity Production in the U.S., Washington, D.C.; American Council on Renewable Energy, April 2009; American Wind Energy Association, 2009 Report Card, Washington, D.C.; American Wind Energy Association, July 2009.

Excitement has been building over the past several years about the prospects of plug-in hybrid electrical vehicles (PHEVs) as a means to reduce U.S. dependence on petroleum-based fuels, along with their CO_2 emissions. Numerous major car manufacturers are poised to introduce plug-in hybrids to the U.S. market over the next 2-3 years. A smart grid will be essential to help manage the power flow between

vehicles, charging stations and utilities. Experts believe that PHEVs represent an integral part of the nation's future power delivery system to help manage peak loads.[34]

Recommendation: Build It Fast and Smart

- Set national criteria for transmission siting. Congress should create independent regional planning authorities overseen by FERC, with FERC issuing standards for transmission siting and having the final determination and approval for siting, while retaining and strengthening current consumer and worker protections.
- Recover transmission costs on a regional basis. FERC should require regional planning authorities to allocate costs to construct and upgrade transmission regionally, spreading costs across all jurisdictions served by the new lines.
- Develop standards for device interoperability and security. FERC should develop standards so that energy management devices can be operated on any smart grid and so that the grid architecture will be adaptive and secure.

Did You Know…?

A pilot program of smart meters and thermostats among customers in New Jersey was conducted by the Public Services Enterprise Group, the state's largest utility. The utility recorded a 47 percent drop in peak electricity usage among the test group.

The Wall Street Journal, June 30, 2008.

"Transmission is so important because, whether you are talking about nuclear or clean coal, renewables or prioritizing efficiency, ultimately there has to be a shift in the country to greater electron liquidity—delivering clean electrons where and when we want them to fuel industry and homes, and even portions of our vehicle sector."

Alexander A. Karsner
Former Assistant Secretary for Energy and Energy Efficiency and Renewable Energy, U.S. Department of Energy, and Distinguished Fellow, Council on Competitiveness, at the ESIS Initiative Steering Committee meeting, July 2008.

Pillar 5: Spawning Technological Breakthroughs and Entrepreneurship

The need to meet growing U.S. demand for energy, assuring access to stable, affordable supply and achieving economic, environmental and national security needs present a set of unparalleled national and global grand challenges. The time scale, magnitude, complexity of the energy transformation will require investment and accomplishment at the frontiers of science and discovery. American businesses, academic institutions and our national laboratories are unrivaled in the world and have the capacity to tackle these grand, large-scale energy and sustainability challenges and in turn create new industries and grow them into global business opportunities.

Technology needs are great. The development of new technologies will require the fusion of multidisciplinary work from advanced materials, biotechnology, optics and biomimicry, to atomic and large-scale systems engineering, scalable software codes and

"The national laboratories have a unique set of capabilities. What they really need is the mandate to do it.The labs have many ideas about how we can apply technologies that already exist to the problems we face, whether it is the understanding of geothermal reservoirs or carbon capture or underground coal gasification. Those are all things that we have done. We're ready to apply those technologies."

George H. Miller
Director, Lawrence Livermore National Laboratory, at the Western Energy Summit at NASA Ames Research Center, July 2009.

"Regardless of the options—energy efficiency, renewables, a price on carbon —solving the primary challenges are extremely complex. To put this in perspective, even if electricity consumption remains flat for 40 years, and fossil fuels are not used, and the use of anything that requires an electric outlet is outlawed, the United States will still not make the target of 80 percent reduction in carbon emissions by 2050. Reaching that goal will take solutions on the scale of the complete electrification of our transportation system and the complete de-carbonization of our methods of producing electricity in the next 40 years. So as we stand here at 2009, thinking 41 years ahead, I hope no one in this room believes we have the luxury of time to achieve the kind of change I just described. The time is now."

Ralph Izzo
Chairman, President and CEO, Public Service Enterprise Group (PSEG), at the Eastern Energy Summit at Rutgers University, The State University of New Jersey, April 2009.

hardware to enable modeling and simulation at the edge of the exascale world,[35] and the understanding of human behavior and social systems.

There are a myriad of technologies that will drive and accelerate the solution pathways to a low-carbon energy future and U.S. economic competitiveness. These include: commercially-viable, low- or no-carbon fuels and conversion/production processes, advanced energy storage technologies for intermittent resources like wind and solar, light weight rechargeable batteries and fuel cells for electric vehicles, carbon capture and storage for coal and other fossil fuels, bio-based and other alternative fuels for jet aircraft, integrated real-time energy information and management systems, and practical and affordable alternative-fueled vehicles.

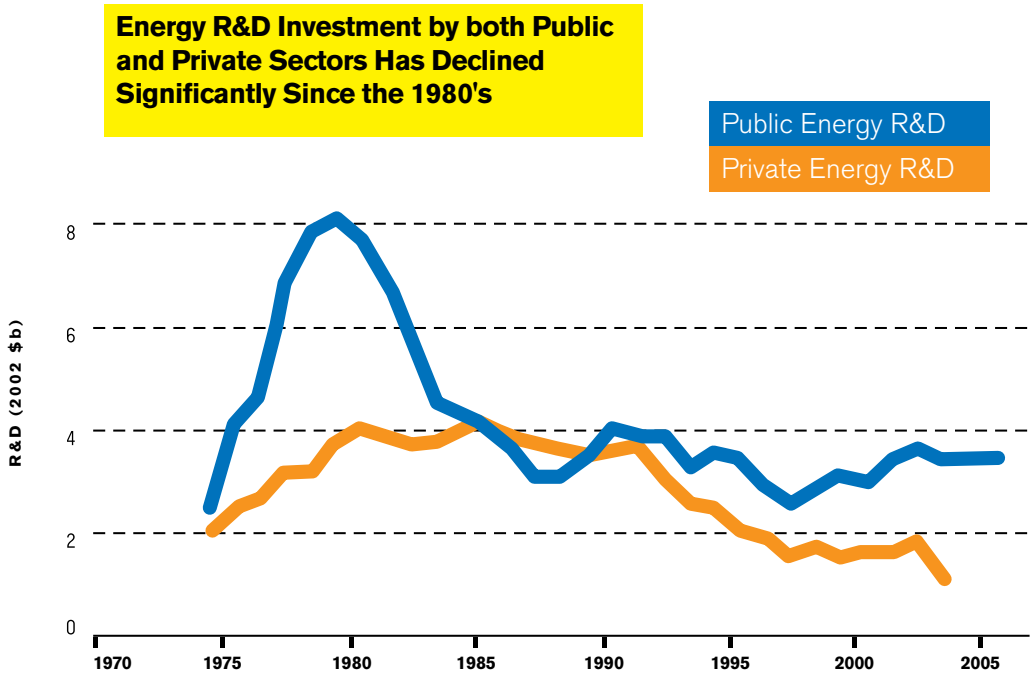
Time is short. Moving to a low-carbon future will require a much expanded research portfolio. Within the next ten years, we need to have cracked the codes to achieve transformative technological innovations across the entire energy system, encompassing the total earth, the seas and the atmosphere. Especially as we move closer to mid-century, new technological options are likely to be required to meet carbon constraints and the increased worldwide demand for energy resources. That research needs to begin now to develop technologies if they are to achieve significant deployment levels by mid-century. We need, however, to support efforts along the whole innovation chain—from basic and applied research to demonstration, commercialization and deployment—to achieve success. If we do not begin now, the environmental and economic consequences are likely to be catastrophic.

Priorities must be set. The are several "enabling" technologies that need to be focused on to address the technological and policy challenges that must be met for certain resources to achieve their potential. Each of these will unlock a vast energy resource. They also present great export opportunities in terms of technologies and services.

- Energy storage, including flywheels, pump water storage and batteries, is an enabling technology that will benefit intermittent renewable technologies like wind or solar.
- Carbon capture and storage (CCS) of carbon emissions from coal-fired power plants is an enabling technology for the United States to be able to fully exploit its vast coal reserves in a carbon-constrained world. American universities and national laboratories have made tremendous progress in CCS research and development, but industry has not yet invested in the scale up of research pilots to justify commercial deployment.
- Nuclear waste is a political and technical issue on which the United States, unlike other advanced nations and developing nations, has made little progress for decades. The future of the use and expansion of nuclear energy in the United States hinges on technological development, coupled to political will, to accomplish its resolution.

Federal R&D pays big dividends. Many of the energy technologies that we use today started with research—often begun several decades ago. This research has been both public and private as well as in universities. Often it has been done in partnership

Figure 13: Energy R&D Investment by Both Pubic and Private Sectors Has Declined Significantly Since the 1980s



- Between 1991 and 2003, U.S. private sector investments in energy R&D fell by 50 percent.
- Energy R&D as a percentage of total U.S. R&D fell from 10 percent to 2 percent between 1980 and 2005.
- Federal funding for energy R&D received just 2 percent of total federal R&D funds in 2009, compared with 21 percent dedicated to health R&D.

Sources: Kammen, Daniel M. and Gregory F. Nemet. "Reversing the Incredible Shrinking Energy R&D Budget," Real Numbers, 2005; "Major Functional Categories of R&D," American Association for the Advancement of Science, 21 March 2008.

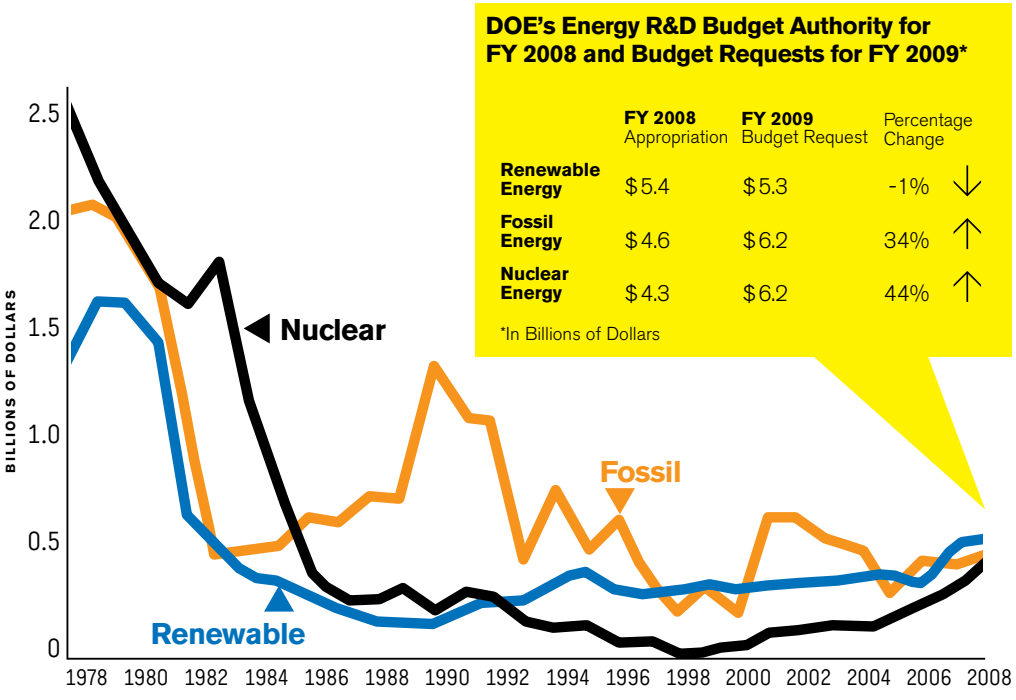
among the sectors. There are dramatic successes. The National Research Council estimated that just the energy efficiency program at DOE produced net economic benefits of $30 billion in 1999 dollars from an expenditure of $7 billion over the period of 1978-1999. Security and environmental benefits were in addition to those economic benefits, and technological options for future deployment were also developed that could enter the market as conditions changed.[36]

U.S. energy R&D has flagged. The flow of federal research dollars has fluctuated dramatically with changes in administrations. In real terms, not including the recently enacted stimulus legislation, it has declined dramatically. Federal energy R&D funding was 0.0067 percent of GDP in 2008 while forty years ago in the late 1970s it was around 0.111 percent.[37] And while the stimulus research funds are commendable, they are a one time boost. From the perspective of the private sector, universities and national laboratories, greater and more dependable short- and long-term research funding is needed. Research, some of which by its nature is longer term, cannot be effective with wild year to year gyrations in funding for individual projects. (See Figures 14 and 15.)

While recently there has been an increase in both energy companies and venture capital firms investing in clean technology, the R&D component must be increased and maintained at an appropriate level if we are to transform the energy system to a sustainable, secure competitive future.

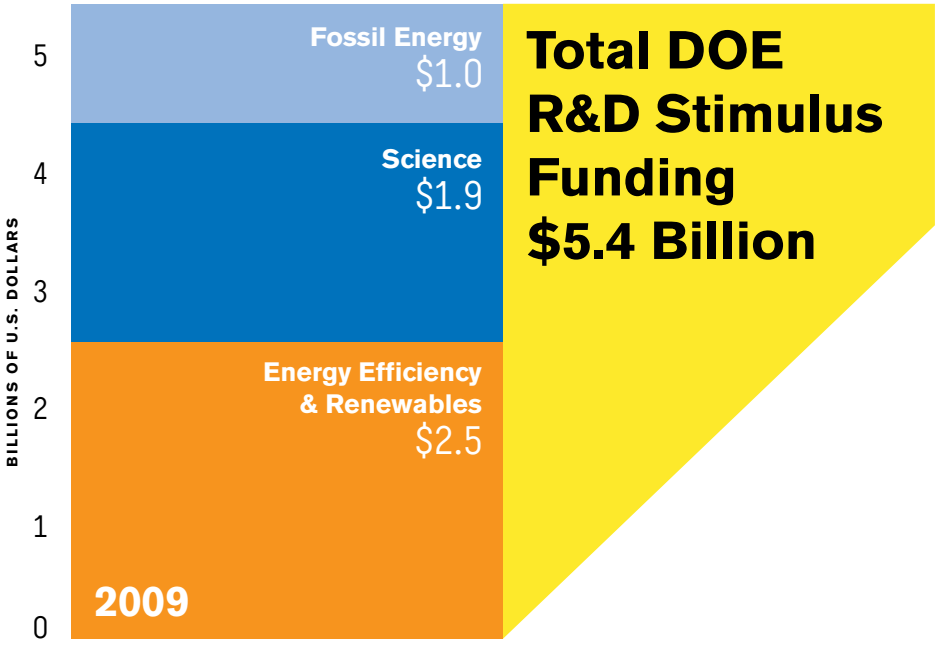
Figure 14: U.S. Department of Energy Funding for Applied R&D Fell Off Sharply Over the 1980s and 1990s but Has Since Rebounded Slightly

Source: Government Accountability Office analysis of Department of Energy data.



Note: Budget authority is in real terms, adjusted to fiscal year 2008 dollars to account for inflation. The budget data focuses on development of advanced energy technologies and excludes such R&D areas as Vehicle Technologies, because its focus is improving the energy efficience of vehicles.

Figure 15: Nearly Half of U.S. Stimulus Spending on Energy R&D Will Go Toward Energy Efficiency and Renewables
Sources: American Association for the Advancement of Science



"The reason the United States did so well after World War II is because of the foundation that was laid through massive federal investments in research and development. We invested massively up through the mid-sixties and then the R&D just trailed off."

Susan Hockfield
President, Massachusetts Institute of Technology, and ESIS Initiative Steering Committee member, at the ESIS Initiative Steering Committee meeting in Washington, D.C., November 2008.

Recommendation: Discover the Future and Break the Technology Barriers

- Provide a steady stream of R&D funding. In addition to current funding, allocate 30 percent of the annual revenue generated from carbon pricing to accelerate breakthroughs in technologies and to demonstrate the new technological solutions.
- Launch clean energy research consortia for enabling energy technologies. The director of the White House Office of Science and Technology Policy (OSTP) should lead and coordinate across all government departments and agencies the establishment of cross-sector consortia with industry, academic and national laboratory partners to solve critical technical challenges in energy storage, including batteries and fuel cells, carbon capture and storage and proliferation-resistant nuclear waste re-cycling and spent fuel disposal.
- Fast-track technology demonstrations and pilots for CCS and energy storage. Congress should support ten commercial-scale carbon capture demonstrations to be completed by 2020 by expanding the DOE regional partnership network and three to five at-scale demonstrations of energy storage technologies. Industry and universities should be strategic partners and investors in these pilots, with proper allocation of IPR.
- Fast-track demonstrations of new nuclear reactors. Congress should support the completion by 2018 of three to five demonstrations of new designs of commercial-scale nuclear reactors that include passive safety features and other new design components, including consideration of closed loop fuel cycles and other means of proliferation-resistant nuclear waste re-cycling and spent fuel disposal.

Pillar 6: Mobilizing a World-Class Energy Workforce

America currently lacks an energy workforce of sufficient size and capabilities to meet the needs of a sustainable, secure energy system.[38] With increasing demand come abundant job opportunities in both traditional and emerging energy industries. Unfortunately, U.S. workers are neither aware nor sufficiently prepared or aware to take them. Moreover, with an aging population and the retirement of the baby boomers well under way, there is an inadequate pipeline of replacement workers, technicians and managers to succeed them.

Traditional Energy Industry Needs. The United States stands to lose half of its electric power industry workforce within the next five to ten years due to retirement. America's oil and gas workforce averages 50 years in age. Half are likely to retire soon. Workers in these conventional energy sector jobs, from power plant operators to transmission line and pipeline workers, are retiring at a much faster rate than they are being replaced.[39] The introduction of any new energy technologies will not compensate for this workforce shortage.[40]

For example, in the nuclear industry, the fact that there has been no new construction of a nuclear facility in the United States in over 30 years, has led to the atrophy of skills, the loss of technicians, the dearth of American students in nuclear engineering and a national security risk for the primarily nuclear-powered U.S. Navy.

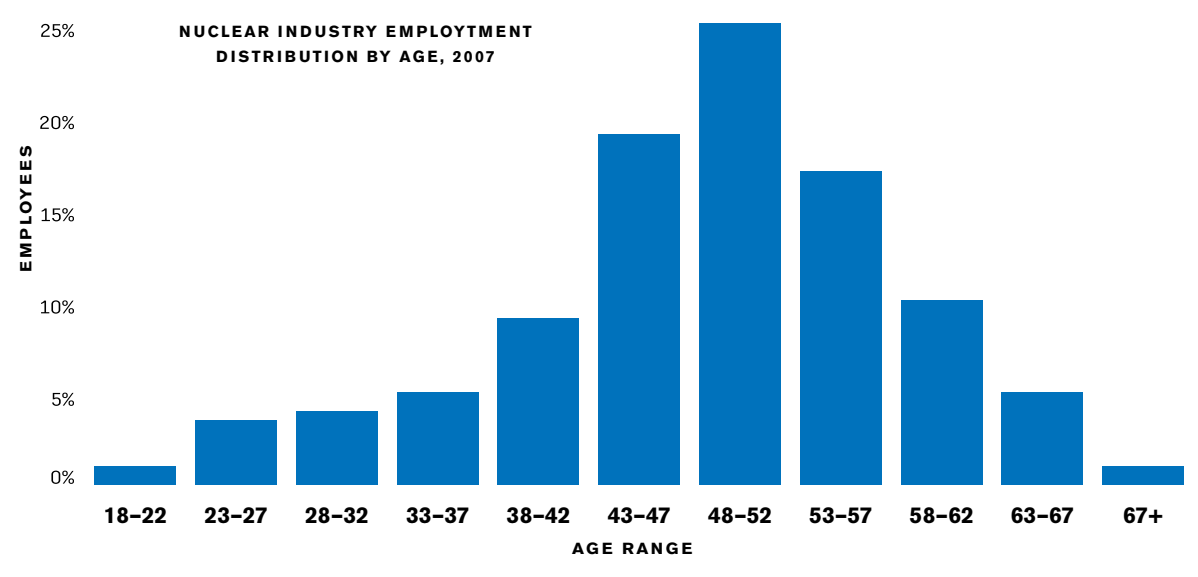
> "We do not have the workforce that is trained to build the next generation of nuclear plants at present, and that is going to cost us dearly."
>
> **Robert Rosner**
> Chairman Emeritus, Argonne National Laboratory, and former ESIS Initiative Steering Committee member, at the ESIS Initiative Steering Committee meeting in Washington, D.C., July 2008.

Emerging Energy Industry Needs. The development of new technologies, their installation and maintenance requires skills at all levels of educational training. The required skills will range from engineers to vocationally-trained personnel. Many of these jobs, such as building new power plants, making buildings more energy efficient and installing renewable energy technologies cannot be exported and will remain in the United States. So-called "green collar" jobs could fill this gap over time and provide for significant domestic employment growth. Capitalizing on the sustainable energy-related "green jobs opportunity" will require government being proactive in developing programs to provide the necessary skills. Government should provide a 21st century education to match the 21st century job opportunities, requirements and needs.

Advanced Energy Research and Engineering Needs. Industry executives cite the lack of scientific, engineering and skilled talent as among the most serious challenges facing their businesses today. There is growing global competition for scientific

Figure 16: Spotlight: Aging Nuclear Industry Workforce

The United States stands to lose half of the electric power industry workforce within the next 5-10 years due to retirement. America's oil and gas workforce averages 50 years in age. Half are likely to retire soon. Workers in these conventional energy sector jobs, from power plant operators to transmission line and pipeline workers, are retiring at a much faster rate than they are being replaced. The introduction of any new energy technologies will not compensate for this workforce shortage.



- By 2013, 35 percent of the nuclear industry workforce will be eligible to retire.
- Forty-six 2-year university and 4-year colleges in the United State offer nuclear engineering programs, out of the 4,314 total (i.e. just over 1 percent of all programs).
- In 2007-2008, 415 bachelors degrees in nuclear engineering were awarded out of a total of 74,170 bachelors degrees across all engineering disciplines (i.e. 0.56 percent of all engineering degrees.)

Sources: "Job Creation in the Nuclear Renaissance," CASEnergy Coalition, June 2008; "2007 Tables and Figures," National Center of Education Statistics, July 2007; "Engineering by the Numbers," American Society for Engineering Education, June 2009

and engineering talent today,[41] and the U.S. pipeline of students is slowing.[42] For example, universities in nations controlling vast hydrocarbon resources managed by state-owned energy companies produced more than 12,000 petroleum-engineering and geosciences graduates in 2008, double the roughly 6,000 in the United States, Canada and Europe—a striking change from 2000, when the United States, Canada and Europe produced 4,000 energy-related graduates compared with a total of about 6,000 in other nations.[43]

The private sector, where the overwhelming majority of careers will be, knows best the current opportunities that are not being met. It knows the future

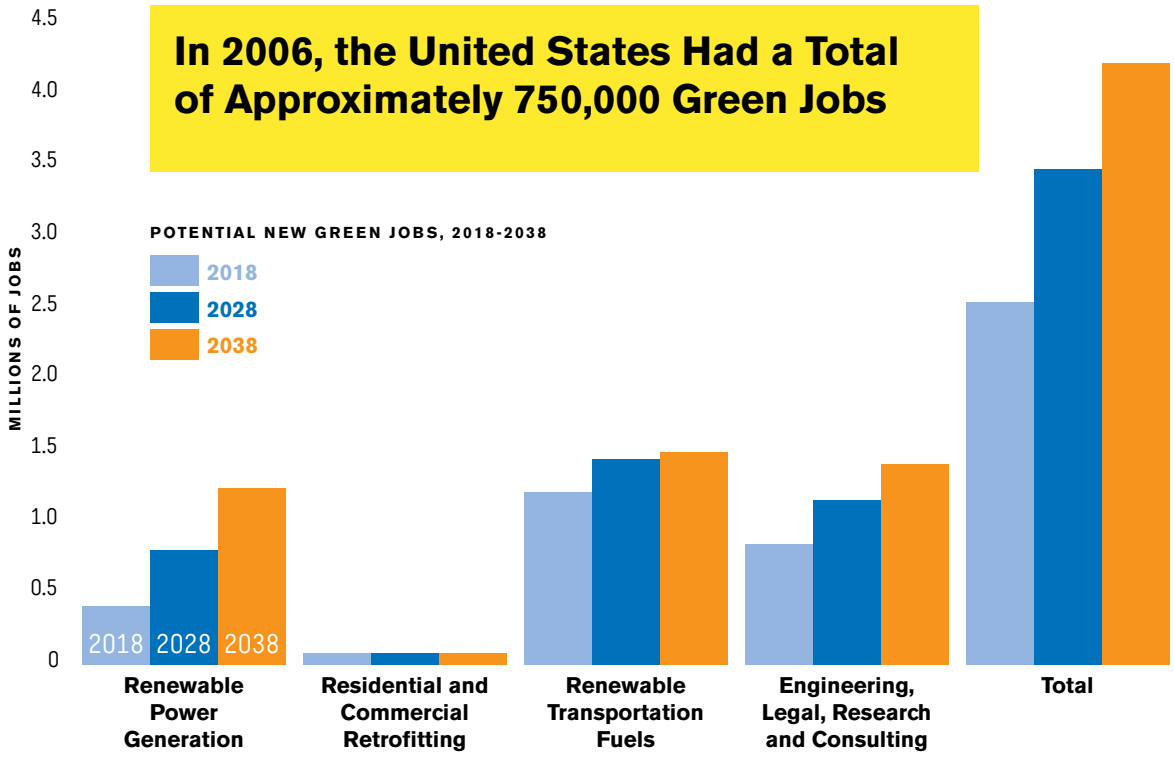
"The question of ensuring access to talent, developing talent, building talent is critical for this country. We have a domestic crisis in that we are simply not developing our own talent at multiple levels to meet our own expectations and needs."

John J. DeGioia
President, Georgetown University, and ESIS Initiative Steering Committee member, at the ESIS Initiative Steering Committee meeting in Washington, D.C., January 2008.

requirements in terms of skills that will be required. It can assist in developing the workforce of the future by working closely with universities and high schools as well as within their own organizations.

Opportunities for all energy portfolio and service jobs must be mapped and matched with current and future workforce needs along the entire continuum of need, from skilled tradesmen to advanced scientific researchers. There is an enormous opportunity and need for universities, national laboratories, energy companies, community colleges, state school systems and the federal government to join forces and develop the energy workforce of tomorrow, while investing in the energy workforce of today.

Figure 17: The Number of New Green Jobs in the United States May Reach 2.5 Million by 2018
Source: U.S. Conference of Mayors, 2008



Note: In 2006, there were an estimated 127,000 and 419,000 green jobs respectively in the areas of Renewable Power Generation and Engineering, Legal, Research and Consulting.

Community College Opportunities. Nearly half of the nation's undergraduate education students are enrolled in community colleges.[44] Community colleges are scrambling for more classrooms, instructors, and resources to meet the exploding demand as workforce preparedness puts a premium on just-in-time learning, industries push for skills credentials, and state cash-strapped universities push their current students and new applicants toward shorter certificate programs with faster delivery.

Galvanize Local Coalitions. Federal funds for jobs programs run through state agencies such as the Workforce Investment Boards (WIBs). WIBs must actively engage state and local business leaders, labor representatives, learning institutions (training institutes, community colleges and universities), and municipal and state leaders to ensure that trainers/educators are more targeted in their curricula, industry is better tuned into the job market, workers are better equipped with the portable skills they need, and local and state economic planners enable the drivers of economic growth.

"Over the past two decades we have experienced significant attrition in the U.S. population of scientific and engineering professionals who possess expertise in the fields critical to sustaining the nation's energy system. Our energy security and innovative capacity will be at risk if the nation's reservoir of brain power and experience is allowed to dwindle. More Americans need to be attracted into the energy industry, including skilled operators, linemen, energy engineers and geo-scientists. There is a growing global competition for scientific and engineering talent today, and the United States is producing fewer graduates with energy-related degrees and disciplines. The United States must take measures to ensure that it continues to attract the best and brightest from around the world."

D. Michael Langford
National President, Utility Workers Union of America, AFL-CIO, and Co-Chair, ESIS Initiative, at the ESIS Initiative Steering Committee meeting in Washington, D.C., July 2008.

Recommendation: Bridge the Skills Gap and Build the Talent

- Boost funding for workforce training in clean technology. Congress should allocate 20 percent of the annual future revenue generated from carbon pricing to fund state and regional workforce training initiatives in clean technologies and related middle skills and direct the U.S. Department of Labor (DOL) and workforce boards to coordinate and accelerate their investments.
- Develop and nurture world class energy researchers and educators. DOE should establish a permanent early career research program to support top emerging energy scientists and engineers at U.S. academic research institutions and DOE national laboratories.
- Provide full scholarships for energy-related education. DOE, the Department of Defense and the National Science Foundation should offer full scholarships to American students who successfully complete accredited undergraduate and graduate studies in energy-related disciplines and commit to a minimum period of service in an energy-related career in the governmental, academic or non-profit sectors.
- Make worker training benefits portable. Congress should establish a program that will allow eligible participants to secure a CompetePass through DOL's one-stop training centers that will be redeemable at certified employer, academic or labor-sponsored training programs that meet industry-driven skills requirements in current and future high growth job sectors, including clean energy.
- Harness global talent by amending U.S. immigration laws. To help fill the talent pipeline, the United States should grant green cards to foreign students receiving undergraduate and advanced degrees in scientific and engineering disciplines from U.S. institutions.
- Cultivate youth interest in clean energy and environmentally-sound industry. Government, industry and education coalitions should encourage and support high school students to participate in sustainable energy projects; educate students on energy issues (i.e. use, production, conservation and impact on economy); and orient high school graduates towards work in energy related fields.
- Give private industry a stake in creating a pipeline of workers. Provide federal, state and local tax incentives to U.S. companies offering mentoring, internships and on the job training for new entrants into clean energy careers.
- Bridge funding gaps for community colleges. Maximize community college potential to create pathways for rewarding jobs and higher pay by financially supporting surging interest in their programs.
- Galvanize local coalitions. Fund job and career training programs that position state entities, including Workforce Investment Boards, as the galvanizing force behind local coalitions including industry, educational institutions, state and local government and labor.

Conclusion

Drive sets forth, in its comprehensive roadmap, specific recommendations that we believe if implemented will achieve the trifecta of simultaneously promoting America's economic competitiveness, enhancing our national security and improving the global environment. The payoff will be huge. Now is the time for action. Delay puts us at unacceptable risk to realizing these goals. Harnessing the power of America—its businesses of all sizes, its academic and laboratory excellence and its talented workforce—is the most effective way to seize this opportunity and achieve results.

In the next phase of its work under the ESIS Initiative, the Council will delve deeper into the manufacturing, workforce and technology issues that will determine the success with which our nation converts today's energy and sustainability challenges into tomorrow's opportunity for economic growth and prosperity.

Acknowledgements

The Council on Competitiveness would like to extend its sincere appreciation to the many individuals who gave so generously of their time, wisdom and resources since the launch of the Energy Security, Innovation & Sustainability Initiative in July 2007.

ESIS Initiative Co-Chairs
Shirley Ann Jackson, Michael Langford and Jim Owens maintained an unflagging dedication to the success of the ESIS Initiative. Their leadership, vision and genuine commitment to the goal to the ESIS Initiative and the mission of the Council on Competitiveness have been vital to the success of this effort. We thank them and their key staff, Allison Newman, George Manoogian and Tim Elder for the tremendous support they have provided over the past two years.

ESIS Initiative Steering Committee
These distinguished leaders convened for extensive sessions on seven occasions to guide the Council's efforts and provide invaluable expertise on the many facets of the energy security, innovation and sustainability nexus. They offered the resources of their organizations, including dedicating senior executives to serve as advisors to the Council. We thank the members who committed time to attend the Progressive Dialogues and Regional Energy Summits.

ESIS Initiative Advisors
The Council benefited enormously from the contributions of the ESIS Initiative Advisors, who convened on multiple occasions in Washington, D.C. and around the country, served on task teams for specific issues, participated in the Progressive Dialogues and Regional Energy Summits and were always on hand to offer critical input and guidance when needed.

Regional Energy Summit Series Hosts
A number of the ESIS Initiative Steering Committee members served as hosts of the Regional Energy Summit Series, conducted over the first half of 2009 in the four regions of the nation. We thank them and their staff for the considerable contribution of resources that allowed the Council to tap the insights and ideas of a broad cross-section of the nation's business, academic, research, labor and state government leaders.

Progressive Dialogue Series and Regional Energy Summit Series Participants
We are very grateful to the many leaders who participated in these important ESIS Initiative forums. The process of inquiry and discovery was pivotal to the development of the findings and recommendations within Drive.

U.S. Department of Energy
Throughout the ESIS Initiative, the Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE) has been a stalwart and strategic partner, providing essential funding for the Progressive Dialogue Series and co-funding for the Regional Energy Summit Series and the National Energy Summit, as well as the direct involvement and contributions of the Office's leadership through the course of all ESIS Initiative program activities.

Council on Competitiveness Staff
The Council on Competitiveness would like to recognize the outstanding efforts of the ESIS Initiative team, Susan Rochford, Kara Jones, Steve Koerner Lars-Eric Rödén, Gourang Wakade and the many talented interns who demonstrated uncommon dedication and perseverance on the road to the National Energy Summit.

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Compete: Energy

Road to the National Energy Summit & International Dialogue

Since the launch of the ESIS Initiative in July 2007, the Council has drawn heavily upon the expertise and wisdom of the Initiative's CEO-level Steering Committee, a high-level advisory group, as well as the research and analysis of many expert organizations in the United States and abroad to inform the development of a comprehensive action agenda designed to enhance U.S. energy security, sustainability and competitiveness.

Progressive Dialogue Series

Through the generous support of the Department of Energy, and under the auspices of the ESIS Initiative, the Council conducted a progressive series of cross-cutting, high-level expert dialogues in 2007-2008 to examine the intersection of energy, sustainability and competitiveness.

Sept. 13–14, 2007
Warrenton, VA

Progressive Dialogue I examined the various ways in which energy has become a driver of competitiveness in the 21st century, looking at industry, workforce and international marketplace impacts.

March 6–7, 2008
Chantilly, VA

Progressive Dialogue II discovered factors influencing business decision-making and investments related to energy and identified the conditions that would enable enterprise-level **energy users** to move forward in adopting sustainable energy solutions.

June 3–4, 2008
Chantilly, VA

Progressive Dialogue III determined factors influencing business decision-making and investments in the energy industry and identified the conditions that would enable **energy suppliers** to move forward in deploying more sustainable energy solutions.

Release of *Prioritize*

September 9, 2008
Washington, D.C.

Drawing upon the findings from the Progressive Dialogues and the wisdom of the Initiative's Steering Committee and advisory group, the Council synthesized the new intellectual capital generated in 2007–2008 into a set of priority actions for government leadership. This plan, titled *Prioritize,* outlined action steps for the president to take within his first 100 days in office to move the nation forward toward a comprehensive energy security roadmap.

The National Energy Summit & International Dialogue

September 23–24, 2009
Washington, D.C.

The Council convenes a distinguished assembly of U.S. cabinet officials, international ministers and global business, labor, university and non-governmental organization leaders at an invitation-only event to address the interconnected challenges of energy security, innovation and sustainability. At the Summit, the Council presents this comprehensive action agenda designed to enhance U.S. energy security, sustainability and competitiveness.

Regional Energy Summit Series

February 13, 2009
Houston, TX

Clarence P. Cazalot Jr., president and CEO of Marathon Oil Corporation, hosted a regional summit on the path to achieving sustainable energy supplies and the impact of the economic stimulus package on U.S. energy security. This meeting was held in concert with CERAWeek 2009, the annual conference that brings executives from around the world together to discuss global energy issues.

April 15, 2009
New Brunswick, NJ

Ralph Izzo, chairman, president and CEO of Public Service Enterprise Group, and Richard L. McCormick, president of Rutgers, The State University of New Jersey, co-hosted a regional summit on ways to promote energy efficiency in the utility industry and lessons for the nation that can be learned from the rollout of the Regional Greenhouse Gas Initiative (RGGI).

May 13–14, 2009
Chicago, IL

James Owens, chairman and CEO of Caterpillar Inc.; Robert Zimmer, president of The University of Chicago; and Eric Isaacs, director of Argonne National Laboratory, co-hosted a regional summit focused on forward-looking energy investments and policy that will make possible a more successful and sustainable Midwest—and a more competitive United States of America.

July 30, 2009
Mountain View, CA

S. Pete Worden, director of NASA Ames Research Center; Mark Yudof, president of the University of California; George Miller, director of Lawrence Livermore National Laboratory; Paul Alivisatos, interim director of Lawrence Berkeley National Laboratory; and Thomas Baruch, founder and managing director of CMEA Capital, co-hosted a regional summit on lessons that can be learned from the successes of California and other western states as front-runners in the development and deployment of sustainable energy technologies.

Appendix A
Recommendations from *Prioritize: A 100-Day Energy Action Plan for the 44th President of the United States*

Setting the Global Bar for Energy Efficiency

Issue an executive order mandating that the Federal Government use the procurement process to lead the market toward efficient energy stand-ards for goods and services, as well as in the construction and retrofitting of facilities, while reducing the carbon load. Using its purchasing power, the government can move the marketplace.

- Direct the Secretaries of Energy and Commerce and the Administrators of the Environmental Protection Agency and General Services Administration, in coordination with the Secretaries of State and Defense and the U.S. Trade Representative, to work together with private sector standard-setting bodies to accelerate the development, rapid adoption and international recognition of the world's leading energy efficiency standards, together with a labeling, measurement and verification system.
- Direct all federal agencies and U.S. Government contractors to procure the most advanced and cost-competitive energy efficient equipment and vehicle fleets and to purchase low carbon fuel and electric power where available.
- Direct the Administrator of the General Services Administration, the Secretary of Defense and the Administrator of the National Aeronautics and Space Administration to amend the Federal Acquisition Regulation to require comprehensive energy efficiency compliance provisions in all U.S. Government contracts, without undue regulatory burden on small and medium-sized businesses.

Assuring Access to Clean and Competitive Energy

Immediately develop and utilize all sources of energy in America in sustainable ways—including oil, gas, coal, nuclear, hydro, wind, solar, biofuels, geothermal, laser fusion-fission and other advanced energy sources—and level the playing field on subsidies while creating incentives to discover and deploy new energy sources, consistent with environmental standards and safeguards.

- Direct the Secretary of Treasury to lead a Cabinet-level working group on "Clean Energy Incentives" to construct a transparent, non-discriminatory, long-term and consistent investment framework to promote affordable clean energy, taking into account full life-cycle costs and environmental impact, as well as regulatory compliance, legal liability, tax rates, incentives and depreciation schedules and market distortion from global trade subsidies and tariffs.
- Direct the Office of Management and Budget to create a cross-governmental task group to identify barriers to various sources of energy production and to issue a Presidential Executive Order, or propose legislation as necessary, to optimize federal agency regulatory regimes.

Jumpstarting Energy Infrastructure Investments

Throughout history, our government has set aside loans for Americans to afford homes, start small businesses and pursue higher education in order to strengthen and stabilize our nation. Today, our country requires a $200 billion National Clean Energy Bank to provide debt financing and drive private investment in the development of sustainable energy solutions and supporting infrastructure.

- Direct the Secretaries of Treasury and Energy to propose legislation to establish and capitalize a $200 billion National Clean Energy Bank, modeled on the U.S. Export-Import Bank and Overseas Private Investment Corporation, to provide long-term financing—including loan guarantees, lines of credit, equity investments and insurance—for the market deployment of breakthrough energy efficiency and clean energy products, technologies, services and projects that reduce, avoid or sequester carbon.

Spawning Technological Breakthroughs and Entrepreneurship

From the Great Depression to 9/11, Americans have come together to address threats to our nation's security and prosperity. Today, energy is the biggest national and economic security issue facing our country, and America needs to answer the call again. To ensure the American way of life is preserved, we need to drastically ramp up investment in R&D and market commercialization to deliver secure, sustainable and affordable clean energy while generating well paying domestic jobs.

Direct the Secretary of Energy to create the "21st Century Clean Energy Leadership Initiative," a public-private partnership funded at $250 million and matched by state and private sector investments, to create regionally-based R&D test-beds and large-scale commercial pilots, while leveraging the existing federal R&D infrastructure.

- Expand the Small Business Innovation and Research (SBIR) Program, which allocates 2.5 percent of eleven cabinet agencies' extramural R&D budgets, to provide critical "Phase III" mezzanine financing for clean energy start-up businesses.
- Create a Small Business Administration "Clean Energy Entrepreneurs Initiative" to support the job engines of America's economy—small- and medium-sized businesses—in the development and deployment of clean energy technologies.
- Allocate at least 10 percent of the existing funding for technology pre-commercialization programs across all federal agencies to accelerate development and deployment of mature clean energy technologies across the R&D portfolio.
- Triple the current federal investment in basic and applied energy R&D across all federal agencies and departments.
- Direct the Secretary of Energy to establish and operate a web-based "Clean Energy Resource Center" to serve as a one-stop clearinghouse for information on all federally-funded energy programs, pilots, test-beds, projects and RD&D and to track international energy initiatives and developments.

Mobilizing a World-Class Energy Workforce

Much as computer scientists and aerospace engineers were crucial to winning the space race in the 1960s, we will win the clean energy race by educating the next generation of science and technology researchers, game-changing innovators and professionally trained workers, thereby filling the workforce pipeline with a new generation of skilled talent.

- Direct the Secretary of Labor to create a $300 million "Clean Energy Workforce Readiness Program," augmented by state and private sector funding, to foster partnerships between the energy industry, universities, community colleges, workforce boards, technical schools, labor unions and the U.S. military to attract, train and retain the full range of skilled workers for America's clean energy industries.
- Require all federal agencies to commit 1 percent of their R&D budgets to competitive, portable undergraduate and graduate fellowships in energy-related disciplines for American students.
- Direct the Secretary of Labor to assess, classify and widely publicize the demand-driven needs for energy-related occupations and align federal workforce investment programs and state-directed resources to support skills training and career path development in energy fields for American citizens.

Clearing Obstacles to a National Transmission Superhighway

As with the interstate highway system and the information superhighway, our leaders must knit together the current patchwork of regulations and oversight into a seamlessly connected electrical power highway that is technologically capable of allowing both on and off ramps for all energy sources in the 21st century, while retaining and strengthening current consumer and worker protections.

- Direct the Federal Energy Regulatory Commission (FERC) to appoint a fully independent regional planning entity for the transmission superhighway, with FERC having final regulatory authority on determining the need for siting of transmission facilities.
- Direct the FERC to set national interconnection standards for a 21st century interoperable grid and transmission system capable of connecting multiple new energy sources and devices to the system.
- Direct the President's Science Advisor to establish the "High-Performance Computing Transmission Initiative," creating a consortium of national laboratories, universities, industry and organized labor to model and simulate the design, construction and operation of an intelligent, self-healing, electrical grid—integral to a national high-performance transmission system.

Appendix B
Council on Competitiveness Scorecard

Competitiveness Scorecard for Congress and the Administration

Key Council on Competitiveness recommendations included in the American Recovery and Reinvestment Act

	Compete	Prioritize	Rebound
• More than $22 billion for scientific research—including NASA, NIH, NSF, NIST, NOAA—and for energy efficiency and renewable energy research.	✓		
• $750 million for job training programs, including $500 million for "green" jobs.	✓		
• $6 billion to fund the Innovation Technology Guarantee program, including the Advanced Technology Vehicles Manufacturing Loan Program.	✓		
• Innovation Fund—$650 million in incentives awarded to schools who close the performance gap in low income schools.	✓		
• $3.4 billion for carbon capture and sequestration technology demonstration projects.		✓	
• $11 billion for research and development, pilot projects and federal matching funds for the Smart Grid Investment Program.		✓	
• $6 billion for loans for renewable energy power generation research.		✓	
• More than $4.8 billion to improve the energy efficiency of government buildings and fleets.		✓	
• Temporary increase in limitations on expensing of certain depreciable business assets.			✓
• $5 billion for low-income families to weatherize their homes.			✓
• $300 million to provide consumers with rebates for buying energy efficient Energy Star products to replace old appliances.			✓

Appendix C
Executive Summary: Highlights from the Southern Energy Summit

The path to true energy sustainability will not be fast or easy and will require unprecedented cooperation between government, the private sector and the American public.

More than a dozen energy experts convened in Houston, Texas, on February 13, 2009, for the first in a series of four regionally-based energy summits being held by the Council on Competitiveness. The Southern Energy Summit was hosted by Marathon Oil Corporation, and participants explored the public policy, business and technological challenges to increasing the diversity and sustainability of U.S. energy supplies.

There was strong consensus that no single form of energy can satisfy the projected doubling, if not tripling, of demand by the year 2050 while also meeting pressing environmental challenges, including climate change. Innovative technology such as carbon capture and storage, new mitigation techniques and alternative forms of energy must all be brought to bear.

However, unlike breakthroughs in information technology, advancing broad-based energy innovation requires an enormous scale that must be factored into any equation that represents an energy solution.

Further, the time frame for developing alternative forms of energy is much longer than many believe and is not understood by the general public, whose support for sustainability is critical. Some panelists estimated that it will take more than 50 years to achieve the vision of an energy system that is locally tailored and has tremendous diversity in generation. A long-term commitment to energy sustainability may also require some game-changing strategies that calm volatile energy markets and avoid political cycles. Taking a page from U.S. economic history, one panelist suggested the creation of an independent Federal Energy Reserve Board not unlike the Federal Reserve. The board would be independent and influence national decisions on energy supply, technology, infrastructure and the nation's carbon footprint to better calm the volatile energy market.

Public-private efforts are critical. Energy sustain-ability will require partnerships with the federal government, such as the U.S. Department of Energy's National Laboratories, that can provide real-world improvements in both the short- and long-term. Indeed, the roles of government and the private sector in energy sustainability were brought into sharper focus by the pending American Recovery and Reinvestment Act of 2009, also known as the economic stimulus bill. There was cautious optimism that the bill was moving the nation in the right direction by way of focusing on greater energy efficiency, alternative forms of energy and improved infrastructure. Nevertheless, there was concern over Congress picking energy winners and losers. Instead, Congress should challenge industry to produce solutions that will create a clear path forward to energy sustainability that the American people can support.

Appendix D
Executive Summary: Highlights from the Eastern Energy Summit

The Northern United States is aggressively seeking a lead in boosting energy efficiency and reducing carbon emissions.

More than a dozen policy makers, energy experts and corporate leaders met in New Brunswick, N.J., on April 15, 2009, for the second in a series of four regionally-based energy summits being held by the Council on Competitiveness under the auspices of the Energy Security, Innovation & Sustainability (ESIS) Initiative. The Eastern Energy Summit was co-hosted by Public Service Enterprise Group and Rutgers, The State University of New Jersey. Participants discussed initiatives aimed at boosting energy efficiency and reducing greenhouse gas (GHG) emissions, the progress of those initiatives and challenges and plans for the future.

A major focus of the Summit was the Regional Greenhouse Gas Initiative (RGGI), which is the first mandatory cap-and-trade program for carbon dioxide (CO_2) in the Western Hemisphere. Ten states in the Northeast and Mid-Atlantic regions, which collectively represent the eighth largest CO_2-emitting region in the world, are involved in RGGI. The program has created a market-driven auction system for electricity generators that allows the sale, purchase and trade of CO_2 allowances. This critical step of setting a price on carbon can eventually result in a market-driven reduction in carbon emissions. Though still in its infancy, RGGI is being viewed as a model for other regional and national approaches to reduce GHG emissions.

As the Summit was hosted in New Jersey, the state served as a reference for energy and climate initiatives in the region. In October 2008, New Jersey Governor Jon Corzine issued an Energy Master Plan, which is driving dozens of initiatives in the state. The plan calls for a 20 percent reduction in the state's energy use by 2020, a 30 percent increase in the use of alternative energy and a reduction of about 25 percent of GHG emissions, also by 2020.

The plan—combined with funding opportunities created by revenue raised by RGGI, federal stimulus funding and private investors—is transforming the state's energy landscape. New Jersey's approach is to create a market for green technologies, then provide funding and incentives to help keep manufacturing and jobs in the state. Summit participants described programs and private sector projects designed to reduce the need for fossil-fuel driven technologies, ranging from utility poles powered by attached solar panels and "smart" grid devices to supporting the use of hybrid electric vehicles.

There was overall agreement that energy efficiency requires not only the application of available technologies but also greater public awareness and understanding of the issues surrounding energy and its use. Many felt that if consumers better understood the true cost of energy and the value of energy sav-ings, they would alter their behavior to save energy.

Participants also agreed that energy education is critical and should not be limited to science and engineering subject matter. For example, social science curriculums should explore energy. Learning should begin in kindergarten and persist throughout high school, but it should not end in the classroom. Businesses can also learn how to use energy more efficiently in their operations.

Utilities can also play a major part in energy conservation. They are closest to the consumers and can provide ways to make homes and buildings more efficient, but incentives are needed for them to support alternative energy sources.

While all agreed that the states have an active role to play in increasing energy efficiency, all felt that there is a need for a national energy policy. In addition to federal standards, more research and development (R&D) can create transformational technologies with a clear path to market. The Advanced Research Projects Agency for Energy (ARPA-E)—a new organization within the U.S. Department of Energy that is modeled after DARPA, the defense agency responsible for the Internet and stealth defense—was cited as an exciting opportunity to bring forth game-changing energy solutions.

However, all agreed there is a fine line between quality regulation and red tape. While standardization and improved building codes are beneficial, they should be developed and applied in a manner that does not become a burden for business.

Appendix E
Executive Summary: Highlights from the Midwest Energy Summit

Participants discussed which energy technology and infrastructure investments would have the greatest impact on the region's—and the nation's—sustainability and competitiveness.

Energy experts, corporate leaders and academics met at Argonne National Laboratory outside Chicago on May 14, 2009 for the third in a series of four regionally-based energy Summits held by the Council on Competitiveness under the auspices of the Environmental Security, Innovation & Sustainability Initiative. This Midwest Summit was co-hosted by the University of Chicago, Argonne National Laboratory and Caterpillar Inc.

Robert J. Zimmer, president of the University of Chicago, opened the meeting with an explanation of why Argonne National Laboratory was such a fitting location for the deliberations. Argonne has long been a place where people have come together to address significant technological challenges, dating back to the development of the first atomic bomb. The intertwined challenges of energy security and sustainability, he noted, would require a similar degree of collaboration.

In a keynote speech, John W. Rowe, chairman and chief executive officer of Exelon Corporation, explained the stubborn facts associated with the economics of energy and carbon emissions. The challenge of reducing emissions is complex, and a price signal on carbon—while critically important does not solve all the problems. Well regulated competitive markets, he concluded, offer the best mechanism for encouraging economically sound solutions and innovation.

Participants in the Summit's plenary sessions agreed on the need for increased research and development activity, as the current menu of available technologies is inadequate to meet the nation's energy security, sustainability and competitiveness challenges. To that point, two of the Midwest's greatest energy resources—coal and shale gas—both require enabling technologies that have not yet been perfected. A third, wind, relies largely on technology that has matured but is limited in its capacity to meet future clean energy needs.

There was a general consensus among participants that more R&D funding is needed, but money is only part of the problem. One challenge is to use scarce resources to develop a diverse portfolio of energy technologies, rather than picking winners and losers. Another is to make sure that R&D projects have clear commercial application. With the latter point in mind, a number of participants recommended that technologies be developed in collaboration with private-sector partners.

Participants generally agreed that a cultural shift was taking place around energy issues, particularly among the young, but there was disagreement over its import. Some equated it to changing mores associated with smoking, which led to significant changes in behavior. Others questioned the depth of commitment behind the rhetoric, and suggested that behavior is more likely to change in response to clear price signals.

There was universal agreement that the United States is falling behind the rest of the world when it comes to the manufacturing of clean energy technologies—an issue of particular importance in the industrial Midwest. No consensus emerged as to how to address this problem, but a few participants advocated copying the aggressive industrial policies instituted by several other countries in their efforts to grab market share.

On the infrastructure side, the O'Hare Modernization Program was offered up as an example not only of how to build greener infrastructure, but also of how green infrastructure improvements can improve regional competitiveness. There was, however, general agreement that federal leadership is necessary to overcome financial and jurisdictional challenges to building the kind of large-scale infrastructure projects that would meaningfully advance the nation's energy security and sustainability goals. A number of participants also pointed out that meeting these goals will require that the nation's energy challenges be examined at the systems level, rather than simply considering the particulars.

Appendix F
Executive Summary: Highlights from the Western Energy Summit

Participants discussed the lessons that could be learned from California's experience as a front-runner in sustainable technology development and deployment, as well as the relative roles of the private and public sectors in addressing the conjoined challenges of energy security and sustainability.

A distinguished assembly of corporate chief executives, university presidents, national lab directors and energy experts met on July 30, 2009, at the NASA Ames Research Center in Silicon Valley for the last in a series of four regionally-based energy Summits held by the Council on Competitiveness under the auspices of the Environmental Security, Innovation & Sustainability Initiative. The Western Summit was co-hosted by the NASA Ames Research Center, CMEA Capital, the University of California, Lawrence Livermore National Laboratory and Lawrence Berkeley National Laboratory.

During his opening remarks, NASA Ames Research Center Director S. Pete Worden set the tone by framing the nation's space program as a catalyst for planetary environmental awareness, and by sharing some of NASA Ames' successes in developing clean energy technologies.Dr. Steven E. Koonin, Under Secretary for Science in the U.S. Department of Energy, gave the keynote address, emphasizing the unique scale of the energy security and sustainability challenge, and the importance of reinvigorating the nation's basic science and energy programs.

Apropos of the location, much of the Summit's plenary discussion focused on technology research and development. Participants generally agreed on the existence of a de facto division of labor among universities, national labs and the private sector, with the universities focused on basic research, national labs specializing in technology development and private sector firms engaged in applied research projects with relatively short-time horizons. All agreed that government funding was essential for long-term and high-risk projects, and there was a strong consensus in favor of creating institutions that would provide "connective tissue" for researchers working on similar projects at different institutions, such as the Bay Area's Joint BioEnergy Institute. Similarly, participants expressed support for increased public-private research partnerships and the need for greater international collaboration.

There was also considerable discussion of the underappreciated complexity of the joint energy security and sustainability challenge. A number of participants took issue with the "moon shot" and "Manhattan Project" metaphors commonly invoked when discussing the urgent need for solutions. As each pointed out in different ways, the Apollo Program and the Manhattan Project were well-financed government programs designed to produce a handful of technologies for non-commercial use, and for which there were no incumbent competitors. New energy technologies, on the other hand, must compete in the commercial marketplace on price and performance against mature incumbents that operate on a massive scale with an equally massive supportive infrastructure.

In line with this assessment, a number of participants sounded a call for realism when it came to the commercial development of sustainable technologies. Many – including top executives from a few local startups – emphasized the need for robust business models for new market entrants, such as a focus on technologies that are compatible with existing infrastructure or technologies that have multiple commercial applications. Many participants also acknowledged that most clean energy production technologies will require government support as technologies scale up and mature, or until externalities like carbon emissions are fully factored into energy prices. Accordingly, they recommend seeking a sound alignment of federal R&D spending, regulatory and other energy policies and the capital requirements of private sector investors.

Looking at California's experience, there was at least one clear example where technology, policy and capital successfully aligned:the state's effort to allow utilities to profit from energy-efficiency activities. But participants pointed out a number of missed opportunities as well, such as the failure to put stronger energy-efficiency codes into place prior to the state's recently completed construction boom.

With the issue of policy alignment clearly in mind, a number of participants also spoke to the importance of public education on energy issues – not simply to improve consumer behavior, but to build public support for otherwise politically unpalatable choices.

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About the Council on Competitiveness

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The Council's mission is to set an action agenda to drive U.S. competitiveness, productivity and leadership in world markets to raise the standard of living of all Americans.

The Council on Competitiveness is the only group of corporate CEOs, university presidents and labor leaders committed to ensuring the future prosperity of all Americans and enhanced U.S. competitiveness in the global economy through the creation of high-value economic activity in the United States.

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HOW WE OPERATE

The key to U.S. prosperity in a global economy is to develop the most innovative workforce, educational system, and businesses that will maintain the United States' position as the global economic leader.

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- Identifying and understanding emerging challenges to competitiveness
- Generating new policy ideas and concepts to shape the competitiveness debate
- Forging public and private partnerships to drive consensus
- Galvanizing stakeholders to translate policy into action and change

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Energy Security, Innovation and Sustainability Initiative Program Leadership

Deborah L. Wince-Smith is the president of the Council on Competitiveness, a group of CEOs, university presidents and labor leaders committed to driving U.S. competitiveness. She is a Senate confirmed member of the IRS Oversight Board and a member of the Board of Directors of the NASDAQ OMX Group, Inc. and the NASDAQ Stock Exchange. Ms. Wince-Smith also serves on the Secretary of State's Advisory Committee on International Economic Policy, the Board of Governors for the Argonne National Laboratory, and the boards of several private equity startup companies. She has more than 20 years of experience as a senior U.S. government official, including as Assistant Secretary for Technology Policy in the Department of Commerce during the George H.W. Bush administration. Ms. Wince-Smith earned a degree in classical archaeology and graduated Magna cum Laude and Phi Beta Kappa from Vassar College, and earned her master's degree from King's College, Cambridge University. In December 2006 she received an honorary Doctor of Humanities degree from Michigan State University.

Susan Rochford is vice president for energy and sustainability initiatives and joined the Council on Competitiveness in 2006 to launch and lead the Council's flagship project: the Energy Security, Innovation & Sustainability (ESIS) Initiative. Ms. Rochford spearheaded the development of this comprehensive action agenda designed to accelerate innovation and investment in sustainable energy solutions across the U.S. private sector. Prior to joining the Council, Rochford served as vice president of government, regulatory and industry affairs for Underwriters Laboratories Inc. (UL). Before UL, she served for more than 10 years as director of international affairs for Honeywell Inc. Ms. Rochford holds a Bachelor of Arts in political science from the University of Connecticut and a master's degree in international management from Thunderbird, The Garvin School of International Management.

Steve Koerner is the policy director for energy and sustainability initiatives, responsible for monitoring energy, environmental and economic issues efforts across all levels of government. He also evaluates academic, government and relevant think tank literature and participates in the drafting and execution of the project's publications. Prior to joining the Council, Mr. Koerner spent six years working on Capitol Hill as a legislative assistant, first to Rep. Rick Lazio of New York, and then to Sen. Richard Lugar of Indiana. He has also managed political campaigns at the state and federal levels, and has worked as a headhunter in the pharmaceutical industry. Koerner holds a doctorate in American history from the University of Virginia and a Bachelor of Arts from Georgetown University.

Kara Jones is the senior research associate for energy and sustainability initiatives. She conducts research across the spectrum of energy and climate issues and contributes to the data analysis and writing of the project's reports and white papers, including this action agenda. Ms. Jones also manages event management for initiative events and was instrumental in planning the National Energy Summit & International Dialogue. Prior to joining the Council, Jones spent two years teaching English as a second language, teaching classes at a private language school and managing her own private tutoring business. Ms. Jones holds a Bachelor of Arts in anthropology and philosophy-neuroscience-psychology from Washington University in St. Louis.

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