TechNet

# Green Technologies:
## An Innovation Agenda for America

Recommendations of the TechNet Green Technologies Task Force

## Executive Summary

The United States today faces unprecedented concern over rising energy prices and their impact on our economic competitiveness and national security in an unstable world. Global climate change has the potential to dramatically alter the world environment. In addition, the relentless pressures of worldwide urbanization, manufacturing and population growth demand a renewed commitment to clean energy and environmental solutions.

The challenge of ensuring a sound energy future is tremendous, but so are the opportunities. Innovation, fostered by visionary entrepreneurship and private sector investment, can lead the way to addressing the world's energy and environmental challenges while spurring new technologies and the growth of entire new industries.

We are at a unique inflection point at which it is within our reach as a nation to make the shift from an economy fueled predominantly by oil to one that relies on a balanced mix of alternative energies and new technologies. Consumers are driving widescale commercialization of hybrid vehicles and alternative fuels, and demand for energy efficient products and clean energy solutions. U.S. venture capital investment in green technology has doubled in the past year, generating exciting new alternative and renewable energy technologies and solutions. Advances in solar, wind, biofuels, energy efficiency and fuel cell design create the potential for technology-driven energy and cost efficiencies that can revolutionize industries. U.S. corporations, manufacturers and energy companies are embracing solutions that drive efficiency and environmental improvement – and make economic sense.

Our nation's commitment to public policies that spur innovation will determine whether we are able to surmount the challenges and seize the tremendous opportunities of the 21st century. It is critical that the United States forge a national energy policy that boldly commits to new energy technologies and innovations, and creates new opportunities for economic growth and international competitiveness.

Recognizing the energy imperative and the enormous potential of innovation as a solution, the TechNet Green Technologies Task Force has developed the following recommendations to spur the development and adoption of new technologies to enhance energy efficiency, encourage use of renewable energy and protect the environment. The purpose of this report is to identify key public policy recommendations that will be most effective in spurring clean technologies.

### Our recommendations include:

- **A strengthened national commitment to energy research and innovation**
  - Double federal funding for basic energy research
  - Focus federal support on: basic research, technology demonstration and commercialization initiatives
  - Designate a lead federal agency to elevate and oversee the energy research and demonstration mission
  - Support a balanced portfolio of near and longer-term technologies
  - Enhance the federal government's role as purchaser of new energy technologies
  - Establish federally-sponsored Sustainable Design demonstration initiatives
  - Encourage long-term, declining incentives
  - Pursue university partnerships and research to generate a pipeline of innovation and talent
  - Support public/private partnerships to support energy efficiency initiatives and education

**Fundamental reform of federal tax policy to spur the development and adoption of new energy technologies**

- Increase the level of incentives to spur new energy technologies
- Restructure incentives to enable market signals that drive new technologies
- Establish a long-term consistent approach
- Increase consumer incentives to change patterns of demand
- Encourage technology neutrality enabling the marketplace to pick winners

- **Federal and state commitment to technology-neutral Renewable Portfolio Standards**
  - Establish a minimum national Renewable Portfolio Standard
  - Establish state energy strategies that include a base-level RPS that meets or exceeds the federal standard
  - Incorporate performance-based, technology neutral features
  - Promote standards based on energy demand to provide efficiency incentives
  - Establish an effective tradable Renewable Energy Certificate marketplace
  - Enable utilities to recover investments in renewable generation and transmission
  - Strengthen the Renewable Fuels Standard program to support innovative biofuels

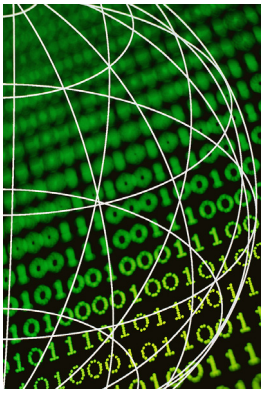
- **Design recommendations for a national program to reduce greenhouse gas emissions through a market-based system**
  - Consider design features that will drive the development and adoption of new energy innovations, including:
    - Market-based system
    - National marketplace
    - Credit for early reductions
    - Establishment of a robust opt-in program
    - Assignment of value to clean technology solutions
    - Allocation of allowances to support energy technology R&D
    - Technology neutrality

- **Development of industry best practices that promote and expand corporate commitments and contributions to clean energy**

Through new technologies, the United States has a historic opportunity to lead the world transition to cleaner energy sources that meet growing demand, reduce harmful emissions and mitigate environmental impacts. The result will be strengthened economic growth, job creation, national competitiveness and quality of life for our nation's future.

The TechNet Green Technologies Task Force is committed to working with Congress and the Administration to create a policy environment that supports these important goals.

## Defining the Challenge - and the Opportunity



The United States today faces unprecedented challenges to our economic competitiveness, national security and the global environment stemming from reliance on traditional sources of energy and conventional technologies.

The predicted energy needs of manufacturing centers and growing cities in emerging and developed economies are massive and will place tremendous demand on limited energy supplies. Demand for electricity in the United States alone is predicted to increase by approximately 50% in the next 25 years[1] while rapidly growing population centers in countries such as China and India, home to two-fifths of the world's population, will put substantial additional pressures on conventional world energy sources.[2]

The changed dynamics of a post- 9/11 world also demand that the United States pursue a strategy for reducing our reliance on foreign oil imported from the world's most unstable regions. Today, sixty percent of U.S. oil demand is met by imports from foreign sources.[3] The high costs of protecting a vulnerable energy supply and infrastructure clearly require a greater energy independence and reliance on new energy solutions.

The United States and all nations must take steps to reduce greenhouse gas emissions and the environmental impacts of our energy production, transportation and manufacturing in order to mitigate the risk of climate change and its impacts on the global environment.[4]

**How our nation responds to these challenges will shape the prosperity, security and quality of life of future American generations.**

Whether we surmount these challenges will depend largely on our nation's leadership in fostering innovations and new technologies that can fundamentally alter our energy future to a paradigm that is based on new sources of supply and new patterns of demand. Technology holds tremendous potential to meet our energy challenges – and to create new opportunities for the United States.

Today's innovation economy is already beginning to meet this challenge. Increased world demand is driving innovators and entrepreneurs to invest in and develop new energy solutions. As world demand spurs rapid growth in markets for new, cleaner energy technologies and nations commit to investment in energy innovation and increased efficiencies, innovators are responding with a range of green energy solutions.

**WHAT IS GREEN TECH?**

**Green energy technologies are technologies that enable environmentally friendly sources of power including renewable and ultra-clean energy sources. Green technologies include, but are not limited to:**

- Solar power
- Fuel cell technologies
- Tidal and wave power
- Geothermal power
- Wind power
- Small-scale hydropower
- Solar power
- Biofuels and biomass

Corporations, too, recognize that clean energy solutions are not only the right thing to do but make sound business sense. Energy efficiency, sustainable development and environmental awareness are means of driving competitive advantage, lowering costs and providing value to consumers in a marketplace that is increasingly valuing these investments. Programs that reduce power demand, waste and inefficiency are driving corporate cost savings across industries.

The technology industry has worked closely with policymakers to develop initiatives that support the manufacture, design and use of products in ways that preserve energy and protect the environment. The technology industry is developing energy efficient servers and new innovations that offer equal or improved computing and communications power with reduced power consumption. TechNet members consider energy efficiency a vitally important product specification, along with high performance and other key criteria, as they bring products into the marketplace. The industry is also pioneering voluntary industry initiatives and changing business practices to encourage telecommuting, video telephony and other innovations that promote energy savings and environmental stewardship.

Companies across industries are increasingly adopting engineering, design and manufacturing approaches to drive changes in products and processes that save energy as a means of improving the environment and the bottom line. Today's corporate world has given new meaning to eco-nomics.

We stand to benefit and to prosper as a nation from these advances. **Clean energy innovations are positioned to be the next great disruptive technologies with the potential to revolutionize the energy industry, spurring economic growth and creating new industries and jobs.** Just as innovation in information technologies drove productivity and economic growth in recent decades, so do energy technology innovations have the potential to fuel a new wave of growth. Federal policies that spur innovation are an investment in future economic growth and job creation. It is not just sound energy policy – but sound national policy – that demands that we seize the opportunity to foster a new era of clean technologies.

The private sector can and will lead the way in achieving innovation – in new green technologies, digitally-enabled efficiencies as well as research-driven advances in the conventional energy sectors.

Public policy, however, has a critical role to play in creating an environment in which new energy technologies can emerge and thrive. Supporting basic research, fostering a regulatory framework that spurs investment in new innovations, demonstrating promising advances and driving consumer demand are essential roles of federal and state policy, made even more vital in the energy context, in which patterns of supply and demand are longstanding and not easily changed.

**GREEN INNOVATION**

**Green innovations include products or technology-enabled engineering, design and manufacturing approaches that drive changes in products, business processes and systems to achieve energy efficiency and preserve the environment. Green innovations include, but are not limited to:**

- **Industrial process innovations that enable efficient manufacturing and product distribution**
- **Dynamic systems that rely on advanced sensors and networked communications to create highly efficient "smart" homes and offices**
- **"Intelligrid" systems that increase efficiency and reliability of electricity supply**
- **Time-of-day metering and energy valuation to drive energy efficiency**
- **Low-emittance coatings that enable energy efficient windows and skylights**
- **Energy efficient light-emitting diode (LED) lighting**

In short, our nation's energy policies will determine our nation's continued economic growth and our national security and will impact the future of the global environment. To maintain our nation's competitiveness in the 21st century, the United States will need to implement a bold strategy that overcomes the energy challenges of the coming decades by establishing public policies that transform our economy to one that is based on clean energy production, generation and use.

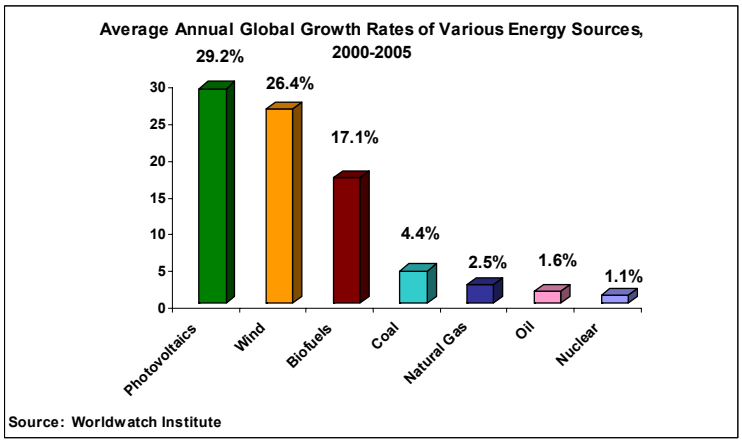
## Innovation as the Solution

Since its inception, TechNet's mission has been to promote innovation. Public policies and private sector initiatives that spur our nation's innovation-driven global competitiveness are our top priority. TechNet's Green Technologies Initiative embodies our longstanding commitment to new technologies and new ideas that together can resolve our nation's most pressing challenges.

The technology industries have powered the nation's economy, productivity growth and job creation for decades by creating new technologies and innovations that have transformed industries, fueled economic growth and fostered job creation. Technological progress driven by innovation has been responsible for up to one-half the growth of the U.S. economy in recent decades[5]. It is also a principal factor in increased job creation, improved standards of living and quality of life gains.

**We are seeing a Moore's Law dynamic today that is revolutionizing the energy sector just as advances in performance and cost-efficiency of silicon chips fueled the information technology revolution of recent decades.**[6] The convergence of computing, communications and data; digital technologies and broadband-enabled networking that has revolutionized industries from communications to e-commerce to manufacturing to finance is beginning to transform the energy sectors in the United States and abroad. Venture capitalists, entrepreneurs and innovators are investing in the development of clean energy technologies with the same commitment that fueled the growth of the Internet and information technology.

The development of clean energy technologies has a similar potential to revolutionize the energy industry and drive efficiencies across the economy. Advances in transportation technology have increased fuel efficiency and created alternative fuel vehicles. Radio frequency identification (RFID) tags, networked systems and e-commerce solutions have enabled manufacturers to improve efficiencies and conserve energy while achieving greater productivity. Advances in the building industry including energy efficient lighting, appliances and heating, ventilation and cooling systems are creating new models of sustainable development.




Technology is transforming the energy industry through new efficiencies, reduced emissions and better, cleaner products, in the same way technology has transformed industries across the economy.

Innovative and emerging technologies have the potential to shift the energy paradigm in numerous ways:

1. Empowering Alternative Energy: Solar manufacturing companies are developing next-generation technologies that address silicon supply shortages and costs. Processes that use less silicon or thin-film materials can generate solar electricity and enable building materials to be manufactured with integrated photovoltaic (PV) capabilities. Organic, light-activated power plastic is more flexible, versatile and less expensive than silicon,

creating the potential to convert everyday objects into clean power sources. Similarly, by leveraging breakthrough advances in materials science, fuel cell systems can now offer unprecedented electrical efficiencies and reliability, enabling significantly reduced operating costs and dramatically lower greenhouse gas emissions.

2. Spurring Efficiencies and Conservation: By using new materials, the semiconductor industry continues to introduce faster, more efficient, less-energy intensive chips, with the potential to create new advances in efficiency and conservation. Innovative engineering and design technologies are also enabling sustainable buildings to be constructed as energy efficient and "carbon neutral".

3. Developing New Biofuels and Biofuel Feedstocks: Technologies are enabling the agricultural and biofuels industries to create new alternative fuels from plant matter including grasses, wood chips or algae. New technologies are being developed that enable cellulosic biomass conversion, increase biomass crop yields and produce cleaner, higher performance biofuels. These innovations are enabling large-scale biofuel production with the potential to generate robust supplies of alternative fuels using plentiful, low-cost domestic resources.

4. Expanding Energy Storage: High-capacity, low-cost energy storage devices are being commercialized to improve energy generation systems and supplies. Advances in battery technologies are enabling hybrid vehicles to travel hundreds of miles on a single charge – reducing oil consumption and emissions in the process. Billions of dollars have been invested to develop hydrogen fuel cells that are durable, reliable and affordable and can power everyday products from automobiles to wireless phones. Nanotechnology creates tremendous potential for advances in next-generation energy storage. These improvements can play a critical role in transforming intermittent renewable energy supplies such as wind and solar power to baseload energy sources.

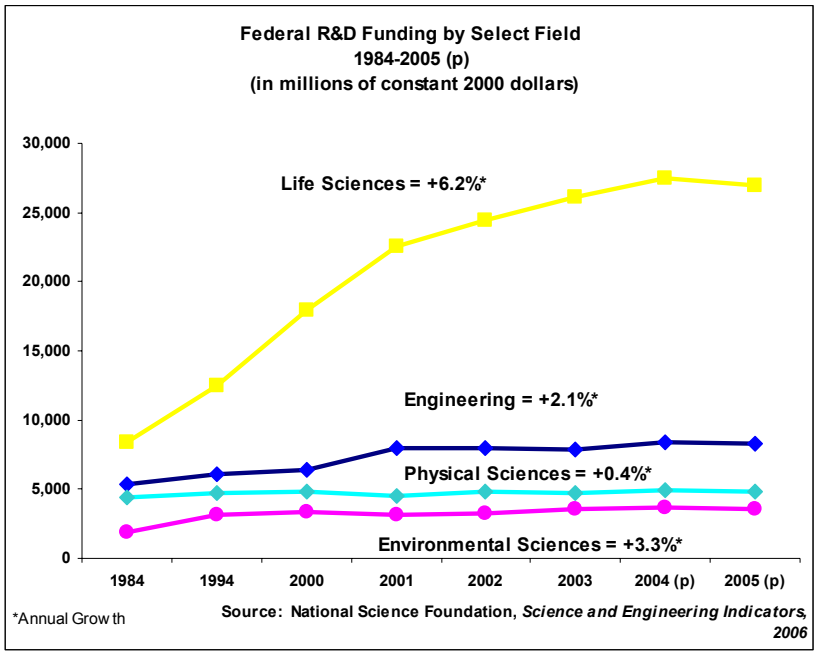
**Research and development initiatives by energy and manufacturing companies are also driving important advances in conventional energy supply and distribution.** Energy companies, for example, are deploying broadband over power line technologies to create a smart grid that ensures more efficient and effective distribution, monitoring and management capabilities. Utilities are also investing in smart meters that provide consumers with information on fluctuating time-of-use electricity rates, increasing conservation and reducing consumption, costs and emissions. Advanced clean coal technologies and carbon sequestration processes are essential innovations to enable continued reliance on domestic fossil fuels. Through greater efficiencies and clean distributed generation, utilities will reduce the need to build more power plants even as demand increases.

Technology is spurring economy-wide advances in energy efficiency and conservation as businesses change their activities to reduce energy consumption while maintaining economic output. Researchers have drawn a strong linkage between the use of digital products and reductions in energy consumption and harmful emissions. Examples include the growth of e-commerce transactions; greater reliance on sophisticated videoconferencing technologies to cut air and commuter travel; digital technologies that eliminate paperwork or drive efficiency in transportation, manufacturing and building design; and dynamic networked systems that control home or office lighting, temperature and ventilation systems to respond to individual preferences and needs, resulting in energy efficient "smart" homes, offices, enterprises or even entire industries.[7]

## Policy Recommendations

Congress and the President have committed to addressing our nation's energy challenges and have made clean energy a priority at the center of the national policy agenda. We commend this renewed national commitment to new energy solutions and we pledge to work with Congress and the Administration to craft policies and initiatives that respond to our nation's pressing energy challenges and opportunities.

We commit to working with our nation's leaders to address one of the most significant imperatives of the 21st century: forging a national policy that will power our nation's continued economic competitiveness, while strengthening our national security and preserving the future of the global environment through clean energy innovations.




We believe that significantly more can be done to create a policy environment in the United States that drives the development and adoption of new and innovative energy technologies. The following recommendations outline a targeted set of policy reforms that will do the most to achieve this important goal.

The TechNet Green Technologies Task Force supports the following:

### I. A Strengthened National Commitment to Energy Research and Innovation

We must forge a strong national commitment to new energy technologies through a doubling of federal funding for basic energy research and a strategy that drives the commercialization of new energy technologies and innovations through better coordinated and more effective federal spending.

While venture capital investment is funding the research and development of new clean energy technologies, the federal investment will best be spent by increasing allocations to the early stage energy research at our nation's universities, and funding later-stage demonstration of technologies that meet established performance criteria to prove their viability and to accelerate mass commercialization.

**We must make a bold commitment to new energy solutions through a doubling of federal funding for basic energy research conducted by the Department of Energy's Office of Science.**

Federal commitment to energy research lags in comparison to the government's support for other key areas of research. Federal funding of life sciences research and development grew by 6.2% annually from 1984 to 2005, compared to annual increases

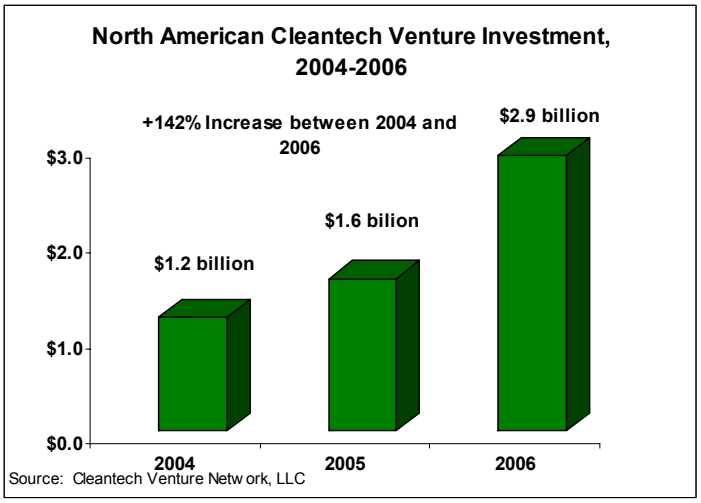
for engineering R&D (2.1%) and physical sciences R&D (0.4%), and relatively flat funding for energy efficiency and conservation programs in the past decade.[8] Overall federal funding for basic energy and applied energy research and development fell 60% in real dollars from 1978 to 2004.[9]

Current federal research funding for renewable energy (excluding nuclear power) and energy efficiency amounts to less than $2 billion per year. Energy consumption and transportation account for roughly 15% of U.S. gross domestic product, which is approximately the size of the U.S. health care system. But research and development funding for new and necessary technologies is not by any means commensurate. By comparison, the current NIH budget is approximately $28 billion.

**As important, the federal investment in energy research must be more effectively structured to have maximum impact as an impetus for the adoption of new technologies.** Increased funding alone will not be enough. It is critical that the government focus on areas that need federal support. We believe the primary federal role should be support for 1) basic energy research; 2) technology demonstration and 3) commercialization initiatives.

North American venture capital investment in the clean technology sector totaled $2.9 billion in 2006.[10] Recognizing the tremendous opportunity that exists by investing in companies that address the growing energy market, investors are aggressively identifying promising early-stage technologies and building them into privately funded enterprises.

Given the level of private investment in energy technologies, it is important that federal dollars not duplicate or compete with ongoing industry research and development efforts. It is our recommendation that the federal government work closely with industry to determine synergistic approaches that enable federal funding to leverage private sector investment so as to accelerate the rate or increase the impact of research initiatives.




The federal government should develop and implement a comprehensive strategy for driving market penetration and commercialization of promising new technologies including those developed by the private sector. Central to this mission is the federal government's role as an early adopter and leading consumer for viable innovative energy technologies.

**A strengthened national commitment to energy innovation will require the designation of a lead agency with a clear mandate** to (1) identify and fund a portfolio of basic energy research projects including breakthrough technologies and significant incremental advances in energy technologies; and (2) drive adoption and commercialization of promising energy technologies through a strategic approach.

We support the designation of a lead federal agency to implement this mission, based on structural features of both the National Institutes of Health (NIH) and the Defense Advanced Research Projects Agency (DARPA), as appropriate. We use the term National Institute of Energy (NIE) in this report, recognizing that other entities offer instructive lessons in how to best structure a lead energy research agency and that no one existing agency is a perfect model for a new energy lead agency.

Whether created through further consolidation of existing programs within the Department of Energy or as a separate entity, the NIE's mission would be to focus and coordinate a robust federal investment in energy research, development and demonstration, foster a pipeline of ideas and talent, ensure long-term continuity in energy planning and ensure a coordinated and comprehensive national energy strategy to expand and empower U.S. clean technology initiatives.

We recognize that other federal agencies, including the National Aeronautics and Space Administration (NASA) and the Department of Defense, will continue to manage energy-related programs related to their agency missions. An important role of the NIE would be to eliminate confusion and duplication in the management of federal energy research and development, eliminate diffusion of resources and establish a coordinated federal energy research mission. The result will be a strategic, focused and strong commitment to research, development and commercialization of energy technologies and innovations that complements but does not duplicate private sector investment.

Although the NIE will have unique structural characteristics that differentiate it from other existing organizations, the creation of an NIE is consistent with the establishment of the National Institutes of Health (NIH), the Defense Advanced Research Projects Agency (DARPA) and the Homeland Security Advanced Research Projects Agency (HSARPA) reflecting the national priorities of public health, defense and national security. Establishment of a NIE would similarly demonstrate the paramount importance we as a nation have placed on achieving a sound energy future.

We note that the policy debate has included thoughtful discussion of the appropriateness of the DARPA and NIH models – as well as key differences between the energy sector and the defense and health care contexts which should drive a unique focus and structure of a lead energy agency.

The size and characteristics of the global energy market, for example, are significant differentiating factors from the DARPA context in which the research and development of technologies is undertaken for effectively a single customer, the U.S. Department of Defense. As a result, new energy technologies generally face significant market penetration and consumer adoption barriers that merit a unique policy response.

In summary, we must pursue a national commitment to energy innovation through a strategy that ensures a pipeline of next generation innovations and talent, while bringing the most promising near-term new energy technologies to market. Doing so will increase American energy security, foster innovation and enhance American competitiveness.

Specifically, we recommend that a redirected federal research agenda include the following key features:

### 1. A balanced portfolio of near-term and longer-term technologies

As noted above, significant recent advances are making far-reaching energy innovations more and more viable. We recognize, however, that a sound energy policy must promote a balanced portfolio, in terms of a range of technology solutions as well as a balance between support for revolutionary technologies and those that are more evolutionary or commercially viable in the near-term. Redirecting the federal government's focus toward basic energy research and commercialization will support a balanced portfolio of technologies.

### 2. Federal government as a purchaser of new energy technologies

Among the most significant obstacles to the development of promising energy innovations into viable commercial technologies is the challenge of gaining commercial viability in the marketplace due to initial cost constraints, consumer perceptions and other barriers.

The federal government, as the single largest consumer of energy in the country, is well positioned to address this critical challenge. The federal government consumes almost 1 quadrillion BTUs of energy and spends nearly $15 billion annually on energy products and services.[11] As the single largest energy consumer, the federal government's power and influence over the energy sector cannot be overestimated.

By harnessing its spending power as an early adopter of promising energy technologies, the federal government can have an immediate impact in bringing companies to wide-scale commercial viability. Government adoption of new energy technologies will in turn drive down price and accelerate improved performance and reliability. Ultimately, government adoption will drive the growth of the commercial marketplace for new technologies.

By creating a market for new technologies, the government benefits by paying "pre-production" prices for emerging technologies, sharing the risk with innovators and entrepreneurs, reducing greenhouse gas emissions and supporting energy independence and security. By partnering with the private sector, the government can accelerate commercialization of viable new energy technologies.

The federal government should consider implementing its role as early adopter through an alternative energy consumption quota that directs a specified percentage of the annual federal energy budget toward alternative energy sources meeting specified performance-based criteria.

For transportation energy needs, for example, the federal government could establish a baseline of fuel efficiency (mileage standards), reduced emissions levels, and declining percentage of oil. For electricity, the baseline could reflect electrical efficiency, annual emissions and the use of clean energy resources.

To avoid complacency or abuse, such standards could be adjustable, based on changing market conditions. If annual evaluations determine that the quota is being met too handily or that technological advances can support a higher standard, standards could be raised. In this way the government will incentivize energy suppliers to continue to improve and innovate.

A further area where the government can and should lead by example is in establishing "green" procurement standards that can serve as an example for the private sector. Specifically, we recommend that federal government agency Chief Information Officers (CIOs) be required to consider energy efficiency as one of the criteria used in evaluation of contracts for government procurement. Currently, efficiency considerations are not typically incorporated in the analysis of government purchasing decisions and CIOs, who manage procurement, are not fully aware of or accountable for efficiency or sustainability results. Government agencies have an opportunity to lead in encouraging CIO awareness of and accountability for energy efficiency in federal purchasing.

### 3. Federal leadership in large-scale Sustainable Design demonstration initiatives

In addition to its purchasing power, the federal government can play a valuable role in driving consumer acceptance of and industry standards for clean energy solutions through demonstration initiatives. In this way, federal leadership in demonstrating the viability of new innovations can drive change throughout an industry.

We recommend the establishment of a federally-sponsored Sustainable Design initiative to develop and demonstrate innovative design, construction and operational approaches to integrated sustainable design. Key goals of the initiative would include:

- Use of digital models and technology to improve building design, performance and energy efficiency;
- Partnerships with universities, research organizations and the private sector to develop and test energy innovations;
- Design and installation of innovative energy-saving technologies (including alternative energy sources, monitoring systems, daylighting, etc.) in prototype buildings.

The federal government's General Services Administration (GSA) is the largest civilian landlord in the United States with over 8,900 buildings in its inventory.[12] Federal construction programs including development of federal buildings, federally-assisted home construction and rebuilding initiatives create a tremendous opportunity to drive large-scale installation of alternative energy technologies and adoption of innovative processes that create sustainable designs.

It has become increasingly clear that shortages of clean air and water, reliable energy, and materials pose threats to national competitiveness. In the construction industry, the price of steel rose 87% between 2003 and 2005 as China, India, and other developing nations embarked on an unprecedented building spree. Recognizing that the construction demands of the next 15 years will impose an enormous strain on the world's resources if current building techniques are used, the Chinese government has adopted sustainable development as a national strategy.[13]

The need for development and demonstration of green technology and design in the building industry is as critical to the United States. The American Institute of Architects (AIA) and the U.S. Council of Mayors have joined forces to promote integrated high-performance building design with a goal of achieving major reductions in baseline building energy use by 2010 and carbon-neutral buildings by

2030, yet processes to achieve this goal have yet to be established. Many buildings that will be completed in this timeframe have already begun design.[14]

As one of the world's largest owners, operators and constructors of buildings, the General Services Administration can affect standards and the adoption of green technologies in the building industry in a profound way. And since buildings comprise the largest part of energy consumption and environmental impact, innovative design to construction approaches developed by the GSA could rapidly be adopted by an industry that needs guidance and inspiration on this important issue. Creation of a Sustainable Design initiative in partnership with the private sector is an opportunity to build on GSA's existing leadership and programs in design excellence to spur green technologies and sustainable design.

***COST-SAVINGS FROM GREEN SCHOOLS & BUILDINGS***

**For an average school, building green would save enough money to pay for an additional full-time teacher. Financial savings to the community include reduced cost of public infrastructure and lower air and water pollution.**

**The total financial benefits of green buildings are over 10 times the average initial investment in design and construction. Energy savings alone exceed the average increased cost associated with building green. Additional benefits include cost savings from reduced energy, water, and waste; lower operations and maintenance costs; and enhanced occupant productivity and health.**

We applaud the leadership of Speaker Nancy Pelosi and other Members of the House of Representatives to address energy conservation, efficiency and cost savings for the U.S. Capitol and Congressional office buildings. The recently announced "Green the Capitol" initiative is an outstanding example of federal leadership to highlight the impact of buildings on the environment.

## 4. Long-term, declining incentives

New energy technologies face significant barriers to market entry and to achieving a level of consumer acceptance that enables them to compete with established technologies. Young companies and technologies face the challenge of driving down per unit costs to enable them to be price competitive. Consumer perceptions or realities regarding reliability, cost and convenience must also be overcome for new technologies to gain a foothold in the marketplace.

We support the establishment of long-term, declining incentives tied to the development of infrastructure and commercialization rates. The goal of federal policy should be to spur economic competitiveness for new technologies that are competing with incumbents advantaged by consumer acceptance, infrastructure development and market penetration. Once new technologies gain a foothold in the market and a level playing field in terms of production, distribution infrastructure, consumer awareness and resulting cost advantages, incentives should decline and be phased out over time.

## 5. University partnerships and university-based research to generate a pipeline of innovation and talent

The NIE should be structured to promote collaboration, flexibility and speed critical to accelerating technology development. A key feature must be an emphasis on partnerships or consortia among private industry, universities, and the national laboratories as much as possible. A strategic focus on project-based collaborative research that requires coordinated efforts from different fields of science as well as the commitment of leading scientists and innovators from universities, national labs and the private sector will most effectively drive transformational new technologies.

An important benefit of federally funded research centered at American institutions of higher education is the critical role it plays in the education and training of America's next generation of energy innovators. The shrinking U.S. science and engineering labor force is a critical problem for our nation. While approximately 31% of undergraduate degrees awarded are in the science and engineering fields, this number has declined or been static in the past several years. [15] A recent survey showed the United States ranked 17th among nations in the proportion of its 18-24-year-olds earning natural science and engineering degrees, compared to a third-place ranking in 1975.[16]

The growing shortage of U.S. talent in science, technology, engineering and math threatens to impact the fast-growing energy technology sector in the near term. Energy technology is a rapidly changing industry requiring skilled professionals from innovators to installers of energy technologies. The federal investment in basic research can and should play an important role in strengthening the next generation of talent through U.S. university-based programs and partnerships.

We believe that, consistent with DARPA and NIH, achieving this access to talent may require a relatively non-hierarchical reporting structure as well as an ability to function unconstrained by some of the hiring and government contracting rules that apply to federal agencies.

## 6. Public/Private partnerships to support energy efficiency initiatives and education

Technology-driven energy efficiency has a critical role to play in saving energy, reducing greenhouse gas emissions and protecting the environment. We support the ongoing pursuit of public/private partnerships to spur continued advances in energy efficiency.

California, for example, has relied largely on energy efficiency and conservation policies to maintain a constant level of per capita energy consumption for the past 30 years – a period during which U.S. per capita energy consumption has increased 50%. These efficiency gains were maintained even during periods of tremendous economic growth and job creation, due in part to the efficiency advantages of the state's Internet and technology-driven economy as well as to innovative policy leadership. California today has the lowest level of per capita energy consumption of any state in the nation.[17]

The technology industry has played a leadership role in crafting voluntary, market-based programs that spur continued advances in energy efficiency. We support continued public/private sector partnerships to support energy efficiency

initiatives and education. Specifically, we recommend consideration of voluntary government and industry programs to advance research and development for energy efficient computing technologies.

We further support voluntary partnerships between government and industry to increase awareness of energy efficient technologies and to develop incentives for businesses and consumers to adopt energy efficient technologies.

## II. Fundamental Reform of Federal Tax Policy to Spur the Development and Adoption of New Energy Technology Solutions

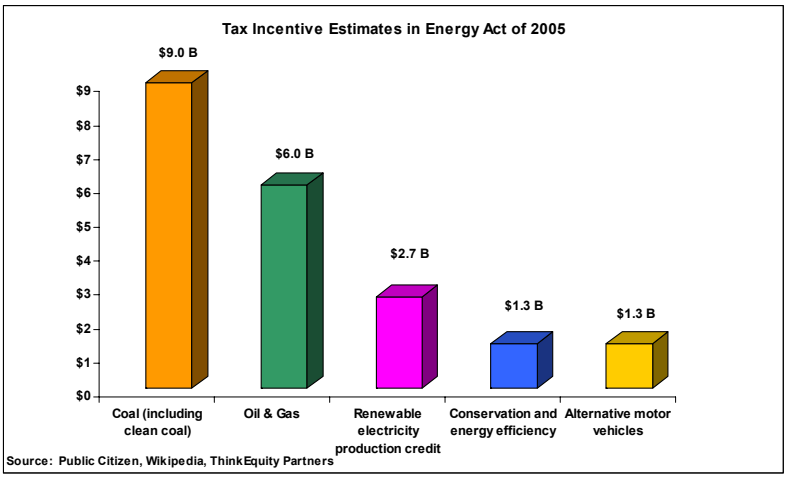
We support fundamental reform of federal tax policy with the goal of encouraging the development, commercialization and adoption of new energy technologies.

Several provisions of the current tax code provide incentives for investment in and deployment of renewable energy sources or alternative fuels.[18] These include:

- Production Tax Credit, providing a 1.5-cent/kWh credit for wind, solar, geothermal, and "closed-loop" bioenergy facilities (adjusted for inflation, the 1.5 cent/kWh tax credit is currently valued at 1.9 cents/kWh).[19]
- Investment Tax Credit, providing a federal income tax credit worth 10% of initial investment cost for certain solar, geothermal, or qualifying biomass facility and a 30% credit for some solar or fuel cell investments and residential projects, with various caps applying to different applications.
- Volumetric Ethanol Excise Tax Credit (VEETC), providing ethanol blenders and retailers with $.0051 per percentage point of ethanol in the blend on a volumetric basis (E10 is eligible for $.051/gal). VEETC also provides a credit of $.01 per percentage point to blenders of two types of biomass-derived diesel fuels (fatty-acid methyl esters derived from virgin oils/fat and diesel derived from biomass via a thermal depolymerization process), and $0.005 per percentage point to blenders of fatty-acid methyl esters derived from recycled oils/fats.

Federal incentives including tax credits, loan guarantees and other programs, are critical to the early success of energy technology projects which in many cases incur substantial up-front costs to generate electricity in lieu of high ongoing fuel costs. Investors or consumers face significant capital investments to develop or install such technologies, creating a need for creative financing solutions particularly for larger-scale commercial installations.

The federal tax code's existing incentive programs, however, are not optimally designed to spur the development of new technologies. We believe that they comprise a level of incentives that is not strong enough to drive substantial new investment or significantly change consumer behavior. As a



result, their impact on cutting edge innovations has been limited by constraints including the timeframe and structure of these incentives.

As a fundamental matter the current federal tax code has historically favored conventional fossil fuels, which have received billions of dollars in federal subsidies each year.[20] According to General Accountability Office data, the U.S. petroleum industry received between $134.9 and $149.6 billion in tax incentives between 1968 and 2000, as a result of various programs including expensing of exploration and development costs, alternative fuel production credits and other incentives.[21] Predicted benefits to the oil and gas industries resulting from just the incentives included in the Energy Policy Act of 2005 totaled $6 billion.[22]

Because current tax incentives are structured in a manner that continues to advantage traditional energy sources, we believe that federal tax policy will not significantly change patterns of energy production or consumption unless we commit to a fundamentally new approach.

**To be truly effective in addressing our nation's critical energy challenges, we must modernize our tax system so that it accelerates the rate of change for bringing energy technology solutions to market.** Significant reform is necessary even to achieve parity in terms of the support for new technologies relative to incumbent energy sources, but we should do more.

Similar efforts by other nations have yielded substantial results. Comprehensive and strategic policies to create sustainable markets for renewable energy technologies have had far-reaching success in Germany, Spain, Japan and other nations that now benefit from robust alternative energy industries.[23] In each case, an unwavering high-level commitment to a fundamental shift in strategy has led to sustained investment in and adoption of new energy technologies.

Achieving fundamental reform of our current tax system will be a complex undertaking that demands thoughtful and detailed policy change. We believe, however, that we can and must do more to expand markets for innovative technologies and to accelerate the development of new innovations through technology-neutral tax policies.

Piecemeal programs and incentives will not drive fundamental changes in behavior necessary to change patterns of energy supply and demand. Above all, we need a comprehensive, strategic and sustained approach to tax policy that drives supply and demand for new energy technologies so that they are developed and utilized at a scale that can make a significant impact.

We recommend the following reforms as a starting point for a new approach:

### 1. Restructuring incentives to ensure market signals drive new technologies

Structural issues significantly impact the effectiveness of existing tax programs in spurring new technologies. Our current tax code includes various alternative energy incentive programs, each of which applies to certain specified energy technologies but not to others.

Some of these incentives are subject to caps and other specified limitations. For example, federal law currently provides a 30% investment tax credit for solar installations, but residential systems are capped at $2,000 under the credit. As a

result, even modest residential solar installations receive relatively little incentive under the program.

Similarly, the investment tax credit includes a $1,000 per kilowatt cap for fuel cells for both commercial and residential installations. In addition, incentives for manufacture of fuel-efficient vehicles impose an annual cap on the number of eligible hybrid vehicles.

Tax incentives for alternative fuels are similarly structured to encourage specific technologies rather than technologies that meet performance goals. Tax incentives are available to companies (including oil companies, fuel distributors and others) that blend biofuels with conventional fuels for distribution. Existing credits apply to alcohols, fatty-acid methyl esters and diesel derived from biomass using a thermal depolymerization process.

Existing credits for biofuels are based on volumetric blend percentages (i.e. the percentage of biofuel in the finished fuel). Using a volumetric basis grants an advantage to relatively low energy content fuels despite the advantages of higher energy content fuels that include increased range and lower emissions. As a result, current tax incentives favor less energy dense fuels such as ethanol over fuels with higher energy content such as butanol and other high-alcohol content fuels.[24]

In addition, novel biofuels that do not fall within the chemistries or processes specified within the tax code are not eligible for the tax credits. These include such promising technologies as biomass derived and biochemically produced hydrocarbons. Furthermore, biofuels derived from feedstocks that result in significantly lower greenhouse gas emissions are not granted any additional incentive over those derived from conventional feedstocks.

In short, current tax policy picks winners and losers. The structure and value of existing incentives is not driven by an overarching strategy to impact energy security or reduce harmful emissions but is primarily a reflection of the political clout of various industry sectors or even individual companies.

Federal tax policy can be significantly more effective in addressing national energy and environmental priorities by driving new technologies if it is restructured in a manner that encourages a range of innovative technologies and enables the market to drive the growth of these technologies.

We recommend the establishment of robust, long-term incentives that are available to promising technologies that meet specified performance-based criteria. Such criteria may include, but are not limited to, minimum efficiency standards, reduced emissions of greenhouse gases or other pollutants, low-emissions or low-fossil fuel reliance in production processes, reduction in petroleum usage and similar factors consistent with energy and environmental policy goals.

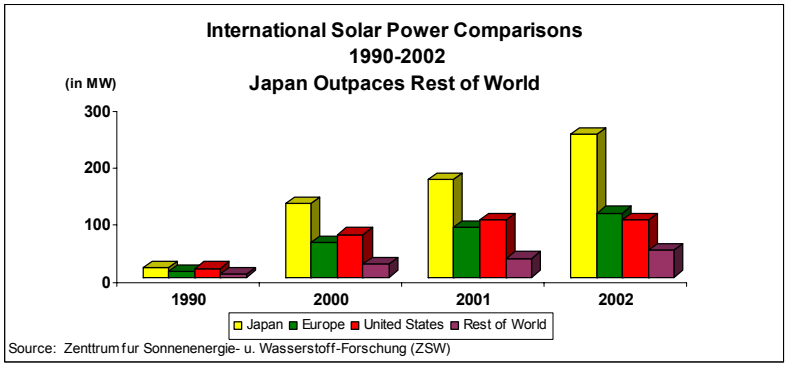
We believe that certain novel approaches to achieving market-driven incentives also merit consideration. Linking federal support for biofuels to changes in the price for oil, for example, will cause tax incentives for biofuels production to increase as oil prices decrease. This approach will enable alternative fuels to compete more effectively, while preserving federal support when it is not needed (i.e. when oil prices rise to a point at which biofuels are competitive).

## 2. Long-term, consistent approach

To drive substantial private sector investment, we need stable, long-term and predictable incentives. We support a minimum 5-year timeframe for clean energy tax credits.

We believe this is the minimum amount of time necessary to enable rational investment decisions and a reasonable period of time given budget constraints that impact tax policy. This minimum timeframe will allow for economies of scale in the development, deployment and cost of renewable energy sources.

The federal regulatory environment's support for energy technologies can be significantly improved by establishing consistency and predictability. The effectiveness of existing incentives is significantly limited in driving development of projects with long lead time, particularly given the pace of development and consumer adoption of energy technologies. In most cases, existing tax credits or incentives are short-term, piecemeal programs subject to the uncertainty of the Congressional reauthorization and/or appropriations processes. For example, the production tax credit for renewable energy, established in 1992, has been subject to three expirations and several short-term extensions (some retroactive), most recently through December 2008.[25]



Source: Zenttrum fur Sonnenenergie- u. Wasserstoff-Forschung (ZSW)

Energy policy and its urgency have fluctuated with changing energy prices. A sound national energy strategy must include long-term, stable policies that accelerate development and adoption of new technologies including next-generation technologies.

## 3. Consumer incentives that change patterns of demand

The federal tax code can do more to change consumer behavior consistent with the development and commercialization of new technologies. The tax code can significantly change consumer behavior, driving demand in pace with supply, by shortening the payback period for installation or adoption of new technologies.

Incentives currently exist for manufacturers and consumers of energy efficient appliances, including refrigerators and dishwashers. Industry has partnered successfully with the federal government for many years to establish effective market-based programs and initiatives, such as the Department of Energy-Environmental Protection Agency Energy Star program, which have been effective in informing consumers about energy usage and encouraging the development of energy efficient products.

Currently, some states offer generous incentives for consumer purchase and installation of energy technologies while others have no such incentives. Federal policy should establish greater consistency in consumer demand for energy technologies.

### 4. Technology neutrality and support for a balanced portfolio of technology solutions

Throughout this report, we emphasize the importance of technology neutrality as well as the need to develop a portfolio of technology solutions that is balanced. In particular, we note that more established energy technology solutions continue to make tremendous gains in cost reduction and effectiveness. These technologies, including solar, fuel cell and wind technologies, have not yet met their full potential. In the case of some established clean technologies, a lack of widespread consumer adoption has a counterintuitive effect of fueling consumer skepticism that should be addressed.

To the greatest extent possible, federal policy should establish a level playing field through performance-based criteria that enable all promising energy technologies to compete. Ultimately, the marketplace should pick technology winners and losers.

## III. Federal and State Commitment to Technology-Neutral Renewable Portfolio Standards

We call on the federal government to establish a national Renewable Portfolio Standard (RPS) to serve as a minimum standard for wholesale alternative energy usage throughout the United States. We call on every state in the nation to develop an energy regulatory strategy that includes a base-level renewable portfolio standard that meets or exceeds the federal standard and includes performance-based metrics that will drive investment in, and adoption of, viable, cost-effective clean energy technologies.

Renewable energy resources today provide approximately 6% of total U.S. energy, with the potential for significant growth.[26] Twenty-three states and the District of Columbia utilize RPS mechanisms to drive a greater reliance on renewable energy.[27]

A basic RPS requires that a certain percentage of a state's electricity load be served by renewable sources of generation. This is achieved by requiring the load-serving entities within a state (typically retail power companies that sell electricity to consumers) to obtain sufficient renewable energy certificates to cover the mandated percentage of their load. These certificates can be obtained from within the utility itself if it has a renewable power generator. Alternately, certificates can be purchased from other renewable generators that meet the state requirements. The market in certificates establishes a flow of funds for investment in renewable power generation.

Current state policies require varying percentages of renewables, with some specifying specific forms of renewable energy that can be utilized to meet the standard, most often wind or solar power. They typically target a goal of 1% to 5% in the first year, increasing each year to achieve a goal of 5% to 20% over approximately 10-15 years.[28]

In general, a utility can meet RPS requirements by incorporating renewable energy into its fuel mix in one of four ways: (1) building renewable energy facilities; (2) purchasing power directly from an existing renewable energy source; (3) buying Renewable Energy Certificates (RECs), which are certificates or credits representing the environmental attributes, benefits and other values of renewable energy; or (4) encouraging production of distributed renewable energy, efficiency, or conservation and the use of net metering. The specifics of existing state RPS programs vary widely in features, including goals, criteria and implementation. Many state programs favor one energy technology over others.

**Renewable Energy Credits (RECs) are tradable certificates denominated in megwatt-hours (mWh) that represent the attributes of clean energy, such as low emissions of carbon dioxide, nitrogen oxide, sulfur dioxide and other pollutants. RECs are created when a project begins producing renewable energy. Resulting green power (electricity) is sold into the electric grid, while the resulting RECs can be unbundled from the electricity and sold separately as a commodity in an established REC marketplace.**

**An RPS requires every electricity supplier to possess a number of RECs equivalent to a determined percentage of its total mWh load (or sales). If an RPS is set at 5%, and a load-serving entity sells 100 mWhs of electricity in a given year, it must possess 5 RECs at the end of the year.**

Renewable Portfolio Standards represent a powerful governmental policy tool with the ability to restructure wholesale energy markets toward a growing reliance on scalable renewable energy sources to meet growing load requirements. State RPS programs establish a foundation that will enable the United States to meet increasingly aggressive renewable energy goals over time while providing a catalyst for the development of new technologies that harness the power of the wind, sun, water and the earth. Aggressive standards provide a market opportunity to push technological developments by establishing economic incentives for investments in technology-driven solutions to meeting increased demand for renewable energy.

**A strong national commitment to clean energy implemented through a minimum federal standard and corresponding state RPS programs should be a central component to our energy strategy.** Absent the incentives, requirements and support of renewable portfolio standards, many utilities will continue to procure power to meet load requirements in a business-as-usual mode, which is least-risk, least-complicated, and least-cost in typical short run analyses.

Renewable portfolio standards create a powerful demand-side driver that can fundamentally restructure energy markets to rely increasingly on renewables within established cost constraints. By requiring a diversified portfolio but enabling utilities to identify least-cost approaches to meeting this goal, RPS policies provide a market-driven approach to spur increased reliance on clean technologies through deployment at a scale that matters. Conversely, by guaranteeing a market for renewable energy and technologies and enabling providers to compete on price to supply that market, the RPS has been an extremely effective policy for harnessing competitive market forces to drive down prices for renewable energy in a technology-neutral manner.

In so doing, effective state RPS programs that are consistent with a strong national minimum standard can significantly alter patterns of energy supply and drive investment in new technologies. Renewable portfolio standards will create markets that drive innovation and competition for least cost, best-fit renewable energy

resources. State economies and consumers ultimately benefit from a diversified energy supply that can withstand disruption and changes in global markets.

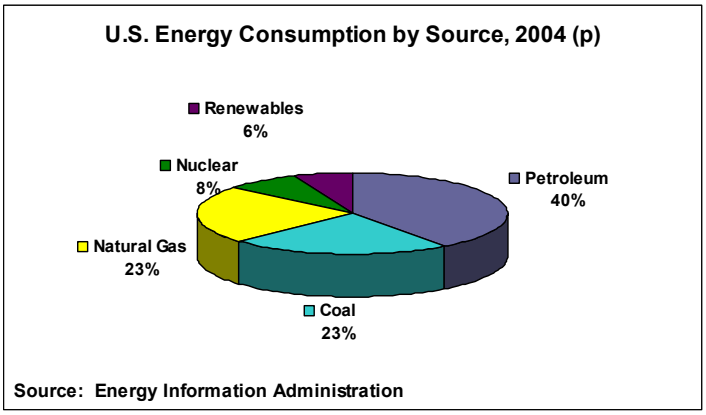
To accomplish these goals effectively, we recommend the following features of state and federal RPS policies.

## 1. Federal Leadership Through Establishment of a Minimum National RPS

Congress should establish a federal minimum Renewable Portfolio Standard that will serve as a floor for state programs, granting states ample flexibility to surpass federal minimum standards. We support additional federal efforts to provide incentives for states to exceed standards over time.

A national standard will require states that do not currently have a renewable portfolio standard to establish an RPS program that meets or exceeds the federal minimum standard. States with existing RPS programs may have to adjust their standards to conform to the federal floor. These states will have economic incentive to further invest in technology development and commercialization as a result of the tradable renewable energy certificate marketplace.

A federal minimum standard that is balanced with existing state RPS programs can be a market-based, demand-side solution for developing diverse, secure, cost-effective renewable energy sources and energy efficiency while encouraging technological advances throughout the energy supply chain. RPS programs will accelerate the attainment of diversified, sustainable and efficient energy production.




A national standard is necessary to foster regional markets for renewable energy, facilitating the ability of utilities to purchase renewable energy or RECs anywhere within their transmission system. The federal role thereby prevents geographic barriers that result in higher costs for renewables. Ultimately, the federal role will facilitate a national market in RECs, enabling further efficiencies. By setting aggressive goals for renewable energy production targets, the government will drive innovation and the creation of vibrant, efficient markets in renewables.

We believe the federal government has an important role providing oversight and guidance to support effective and efficient state RPS programs. In addition to establishing a national standard, the federal government should provide guidelines that assist states in developing performance-based criteria and other features of program compliance. Given the complexity and divergent paths already seen in the states that have enacted RPS programs, the federal government can encourage consistency with respect to fundamental program criteria as well as encouraging greater collaboration and uniformity among the states.

Federal policy should also play a valuable role in:

- Facilitating the development of a national market in renewable energy certificates (RECs)
- Disseminating best practices in state regulatory and utility renewable energy procurement
- Highlighting effective state approaches to energy technology development and consumer education about renewable energy and energy efficiency
- Rewarding energy efficiency improvements

## 2. State establishment of performance-based, technology-neutral renewable portfolio standards

We call on every state in the nation to develop an energy strategy that includes a meaningful renewable portfolio standard that meets or exceeds the federal standard and that uses performance-based metrics that drive investment in and adoption of viable, cost-effective energy technologies. We believe each state should establish a meaningful standard that increases over time to spur demand for and development of scalable renewable energy technologies at an efficient, market-driven pace.

We recognize that each state has a unique mix of potential renewable resources, creating unique challenges to fostering viable renewable resources – as well as unique opportunities to supply new clean energy alternatives. We believe that states are well-positioned to structure an effective RPS that enables utilities within a state to identify and use the optimal mix of renewables to meet state standards.

Because of the unique mix of renewable energy sources available to each state, states should establish a standard that reflects an effective but attainable percentage of renewables. We encourage states to increase this percentage over time, as new technologies and renewable resources become increasingly available. In so doing, an RPS will drive investment in development of longer-term renewable sources available to a state. Increased viability of resources such as ocean or wave energy, biofuels and other next-generation technologies, hold significant potential to meet domestic energy needs in the longer term, and will be encouraged by RPS programs.

The definition of qualifying renewable energy sources is also a key component to an effective RPS program. We support the establishment of performance-based criteria that are technology-neutral in order to enable a wide range of broadly-defined renewable resources and technologies to compete for market-share. In this way, state policy will create a market-based approach that enables the most viable and cost-effective renewables to succeed in gaining market share, rather than dictating which technologies will succeed.

We believe that technology should not be limited to traditional large-scale electricity generation, but should include clean energy from smaller facilities and distributed generation that, if deployed at scale, can make a meaningful contribution to meeting an RPS standard.

A performance-based, technology neutral approach is critical to the long-term success of RPS programs. Some state programs do not currently take this approach, but instead exclude certain technologies including technologies that can be among

the most efficient energy solutions. Effectively structured RPS programs should enable a wide range of viable technologies to compete in the marketplace.

We recognize that significant investments in updating the electric transmission and distribution grid will be necessary to enable greater integration of renewable energy supplies, monitoring of production from distributed sources of renewable electricity and security of supply. We believe that these investments should be a high priority, to enable greater reliance on renewables and new energy technologies.

### 3. Standards based on energy demand to provide efficiency incentives

We recognize that a national RPS program should not only create a greater demand for renewable energy production, but should also incorporate efforts to increase energy efficiency and reduce overall demand for energy. Therefore, a renewable portfolio standard that is tied only to production of energy will not incentivize efforts to reduce demand and encourage distributed energy generation efforts. Such incentives for efficiency initiatives are essential to counter an existing disincentive to invest in an approach which effectively reduces energy consumption – and utility profits. We believe a RPS system should be tied to energy demand to encourage energy efficiency and non-utility renewable energy generation.

By linking RPS goals to demand for energy and coupling these goals with net metering (enabling consumers to return excess energy generated at their homes or businesses to the grid), utilities will have a vested interest in renewable energy produced through distributed means not just through traditional utility-generated energy methods. And with the utility's goals linked to the fundamental demand for energy, utilities will be incentivized to monitor production and usage from distributed energy sources such as solar panels in end-users.

**NEW ENERGY = NEW JOBS**

**A large scale federal commitment to achieve a new diversified energy infrastructure will create millions of new American jobs.**

**Benefits of a $30 billion investment per year for 10 years:**

- **Add more than 3.3 million jobs to the U.S. Economy**
- **Stimulate $1.4 trillion in new Gross Domestic Project**
- **Stimulate the economy through adding $953 billion in personal income and $323.9 billion in retail sales**
- **Produce $284 billion in net energy cost savings**

***Source: Apollo Project***

Utilities will also be able to meet the RPS measures by reducing overall energy demand, which would increase renewable energy as a percentage of demand.

The secondary benefit of linking the RPS program to energy demand is that it will require a greater connectivity of the electricity grid to measure electricity demand. This information could be used in the development of better load management practices and efficiency of energy production. These tools coupled with an incentive to increase distributed power production by consumers and businesses, allows for more efficient operations in electricity production.

The systems integration and software industries are able to drive the same degree of cost saving innovation that has revolutionized the computing industry into the electric power grid, if electricity regulatory regimes are open to incorporating innovation and cost efficiency incentives. It is critical that electricity regulation evolve to enable utilities to achieve full efficiency potential.

### 4. Establishment of a tradable Renewable Energy Certificate marketplace

An effective national system of state RPS programs will require the development of an efficient renewable energy certificate (REC) marketplace. RECs are tradable units representing the environmental attributes of a single unit of renewable energy as distinct from the underlying electric power. Typically, each certificate equals the environmental attributes of one megawatt hour of electricity.

A national marketplace in RECs based on the development of regional markets will create a flexible tool for meeting renewable portfolio requirements and offer financial incentives for over-compliance. By enabling utilities to purchase credits in order to meet renewable standards when cost-effective, reliable sources of renewable power are not available, and allowing utilities to sell credits that result from compliance efforts that exceed state standards, a REC marketplace enables compliance with RPS standards in the least cost, most efficient manner.

The ability of utilities to purchase renewable energy certificates is an important factor in the financing of technology and new generation facilities because the certainty and stability of the market in renewables created by a properly designed RPS will enable long-term contracts and financing for renewable power projects, lowering renewable power costs. For many such projects, RECs represent approximately 70% of the revenue stream over a 30-year contract, while the sale of power may represent as little as 20% of revenue. As a result, the market value and contractual stability of tradable RECs is a critical component to driving investment in clean energy innovation.

Even in cases where RECs represent a smaller percentage of a project's revenue stream, they often contribute substantially toward a project's economic viability. Without them, many renewable power projects would be unprofitable and therefore not viable.

The certificate-based market approach can also be harnessed to create additional incentive for innovation. Connecticut provides a notable example of leadership in fostering energy efficiency innovation through a tiered portfolio standard. Connecticut's new Distributed Resources Portfolio Standard is based on the state's existing renewable portfolio standard but applies to energy efficiency and conservation. The standard increases over time, thereby encouraging increasingly aggressive programs in conservation, energy efficiency, demand management and efficiency in the state's cogeneration units.

The new standard is managed alongside the state's preexisting RPS utilizing the same infrastructure. Connecticut's energy efficiency portfolio standard is an innovative approach that could serve as a model for other states as well as other market-based approaches to driving increased investment in innovation. We believe such programs should be strongly encouraged.

Although significant progress toward consensus on key features of a REC market has been made by industry and environmental organizations, federal standards are necessary to fully eliminate economic inefficiencies and inconsistencies that are a

barrier to investment. A marketplace for transacting RECs on a regional scale (within commonly operated transmission systems) will promote development of the most efficient renewable energy production.

Establishing an efficient market in RECs is an important federal role. Currently, there are a wide variety of conflicting state and private definitions regarding what constitutes a renewable energy certificate and the terms by which they can be bought and sold. Differing criteria make transactions difficult, confusing, and more costly than necessary. It is critical that federal leadership encourage a more unified and standardized market such as exist for electric energy, capacity, ancillary services and all conventional fuel sources.

It is important to note that in many parts of the country, state and regional infrastructures to manage REC markets exist and are in use today. The earliest REC market system began operation in Texas in 2000, and active REC markets now exist in New England, the Mid-Atlantic states and will soon operate in California and Western states as well as in the Upper Midwest. Given the maturity of the existing infrastructure, we believe that extending it to enable a federal program could be accomplished relatively quickly, with modest cost and with high confidence in the success of a new program.

### 5. Enabling utilities to recover investments in renewable generation and transmission

We believe that the states and the federal government should put measures in place to enable utilities to recover investments made in renewable resources or RECs necessary to meet RPS standards. When a regulated utility purchases renewable energy (and its environmental attributes) or renewable energy certificates for the purpose of complying with renewable portfolio standards or green energy procurement programs, the utility should be able to recover the prudent costs of that investment. Provided that a regulated utility complies with requirements for an open and timely process for public review of proposed renewable resources and REC procurement plans, as well as established requirements that such decisions be found prudent, a utility should not bear the risk of less than full recovery of costs of the procurement.

Utilities should also be able to recover the necessary investments in the transmission facilities necessary to accommodate new renewable energy resources. Currently, such investments are subject to federal regulatory review despite the fact that they are undertaken to meet state retail energy renewable portfolio standards. Due to jurisdictional issues, the uncertainty of cost recovery is creating a significant bottleneck through which utilities will not build the transmission facilities necessary to get renewable resources to market.

Similarly, utilities should be allowed to recover necessary investments in the electricity grid to enhance net metering and connectivity. Substantial future investment will be required for monitoring, for efficiency of transmissions, and to support new technologies.

Technological improvements in the electricity grid will be crucial to achieve greater efficiency and integration of renewable energy sources yet there is currently little incentive for utilities to make these investments because of the risk that the costs will not be recoverable.

### 6. Strengthening the Renewable Fuels Standard program to support innovative biofuels

We support federal leadership through programs to promote innovative biofuels including ongoing efforts to strengthen the federal Renewable Fuels Standard, implemented under the Energy Policy Act of 2005.

We appreciate the President's recent commitment to strengthen the Renewable Fuels Standard by substantially increasing its targets for reliance on renewable and alternative fuels. It is critical that existing efforts by the Environmental Protection Agency to open the credit system to new fuels and differentiate these fuels on the basis of key criteria such as energy density and "renewable content" are seen through to completion.

We note the Renewable Portfolio Standard is an example of the policy leadership that state Governors, legislators and Public Utility Commissions have demonstrated in addressing our nation's energy challenges. In many cases, states have been important laboratories for forward-thinking approaches to energy conservation and efficiency initiatives. We commend this leadership and call for continued initiatives and greater collaboration among the states to design and promote best practices in energy policy including those that can be scaled to a national level.

We also believe, as noted, that RPS policy holds important potential for state and federal collaboration. State and federal collaboration in the development of approaches to spur nationwide markets in clean energy alternatives will be an important foundation for future efforts to establish national market-based programs to reduce emissions and spur clean technologies.

## IV. Design Recommendations for a National Program to Reduce Greenhouse Gas Emissions through a Market-Based System

The magnitude of the global environmental impacts of climate change demands that we implement thoughtful policies to substantially reduce greenhouse gas emissions. Climate change policies, to be effective, must internalize the environmental cost of emitting greenhouse gases, thereby reducing or eliminating the price differential between high carbon-emitting activities and more environmentally sound activities. Such policies can be undertaken at various levels of government and can take numerous forms.

Many states have already begun to take action to address climate change and many experts believe that near-term federal action is inevitable. TechNet is committed to working with Congress and the Administration to solve this challenge.

Policies to address climate change can alter the economics of energy supply options in a way that drives investment in energy efficiency and clean technologies. If the federal government enacts policies to address climate change, we believe the most effective, innovation-fostering approach is to design a broad-based cap-and-trade program that ensures an effective environmental result (through a cap on emissions) in the most flexible and cost-effective manner possible (through the trading mechanism).

States and regional initiatives are already developing programs that mitigate climate change by establishing a cap on total emissions of greenhouse gases at or below historical levels and providing allowances equal to the total amount of emissions

allowable under the cap. Emissions trading programs are designed to achieve overall reductions by enabling participants to reduce emissions or purchase sufficient allowances in a market-based system to offset emissions levels.

In September 2006, California undertook the most ambitious state program to date to address climate change. The Global Warming Solutions Act (AB 32) is the first state law to establish targets for the reduction of greenhouse gas emissions, with a goal of reducing carbon dioxide ($CO_2$) emissions by 25% by 2020.[29]

Leaders of the 110th Congress have proposed legislation to establish a national program to reduce $CO_2$ and other greenhouse gas emissions including Speaker of the House Nancy Pelosi, Senate Majority Leader Harry Reid, Chair of the Senate Committee on Environment and Public Works Barbara Boxer, and Senate Energy Committee Chair Jeff Bingaman.

We commend bipartisan efforts to address this pressing issue and are committed to supporting the development of thoughtful policies that reduce greenhouse gas emissions in an efficient and economically sound manner.

We believe that the structure of greenhouse gas emissions reduction initiatives is of fundamental importance to their effectiveness and to achieving maximum impact on the long-term demand for and development of new technologies and alternative energy sources. If structured effectively, policies to address climate change can be a significant driver of investment in new energy technologies by energy companies, manufacturers and other innovators.

Specifically, we believe that a national climate change program should have as its centerpiece a cap and trade system that utilizes market mechanisms to enable participants to achieve compliance in the cheapest, most efficient manner possible. A national emissions reduction program built around market mechanisms will be the most powerful driver of demand for new technologies, in turn spurring the development of new energy technology innovations.

By establishing a price for greenhouse gas emissions, market-based cap and trade policies create an explicit, tradable value for greenhouse gas emissions reductions. In so doing, such policies incentivize energy suppliers to invest in energy efficiency and clean energy options. They also incentivize consumers to purchase technologies that mitigate greenhouse gas emissions. This increased demand will in turn drive investment in new energy solutions that mitigate greenhouse gas emissions. In this way, a cap and trade approach minimizes the economic costs of mitigating climate change while maximizing incentives for adoption and development of new clean technologies.

Regulatory requirements, including appropriately structured incentives and mandates, play an important role in creating demand for energy efficiency initiatives and technologies. Cap and trade programs have been shown to spur energy efficiency improvements, followed by increased investment in new cleaner energy technologies.

Many experts believe that our ability to solve the global warming challenge by significantly mitigating greenhouse gas emissions will depend on the development of new technologies.[30] The development and global adoption of technological innovations in the areas of energy efficiency, renewable energy and carbon capture and sequestration beyond what is commercially or widely available today will play an important role in an effective response to climate change.

It is also well understood that government policies can play an important role in accelerating the rate of development and adoption of these new technologies.[31]

Because of the critical importance of new technologies and innovation to addressing global climate change, we believe that a goal of any cap and trade program should be to include structural incentives that encourage the development of new low-emissions technologies. We believe that additional structural features, beyond the cap and trade approach, should be incorporated into the design of an emissions trading system.

Structuring a national cap and trade program will be a complex task and many important considerations will drive its development, including environmental effectiveness, cost-effectiveness, administrative feasibility and other factors. We urge policymakers to consider incorporating design features that will drive the development and deployment of new energy innovations.

We believe that the following principles should be given careful consideration in the design of a national climate change program to determine the most effective approaches to fostering new technologies and innovation.

### 1. Design a market-based system

We believe the most effective approach to addressing the climate challenge will be through a market-based system that enables maximum flexibility to achieve reductions and includes trading provisions to allow for achieving emissions targets in the most economically efficient manner.

Because a market-based system enables participants to make emissions reductions in places and by methods that are the least expensive, it is an inherently efficient approach to achieving overall emissions reductions. Such an approach is uniquely suited to mitigating climate change because greenhouse gases are emitted from sources around the world and combine in the atmosphere, so that the specific location of emissions reductions is not important.

Participants in a market-based system are incentivized to develop new technologies to reduce emissions, in contrast to prescriptive policies that do not encourage companies to exceed a specified standard. Participants in a market-based system may be incentivized by the economic value of tradeable emissions allowances to over-comply with emissions reduction targets. As a result, they may be more likely to adopt ongoing improvements in energy efficiency and environmental controls, and to invest in the research and development of new energy technologies. A market-based system's incentives and flexibility combine to create an effective mechanism for driving new energy and environmental innovations.[32]

### 2. Ensure a national marketplace

We believe that establishment of a national market for greenhouse gas reductions will be most effective in driving new technologies. State-by-state or regional cap and trade policies impose compliance costs on a particular geographic region, while emitting sources outside of the region are not covered by the program and have no compliance obligations.

This approach thereby limits opportunities to achieve lower costs trading or emissions reductions from sources outside the region and also eliminates incentive for emitting sources outside of the program to invest in clean technology innovations.[33]

Given the global nature of climate change, we recognize that a national system may be most effective if integrated with emerging international markets in greenhouse gas emission reductions.

### 3. Provide credit for early reductions

Market-based systems to address climate change should recognize and provide credit for documented emissions reductions achieved by past voluntary actions. Investment decisions regarding clean technology installations or R&D efforts will depend in part on whether those making the investments can count on obtaining economic value under climate change policy. Incentives for early emissions reductions may accelerate the retirement of outdated facilities or investment in new capital equipment. The development of and support for policy proposals that provide credit for early emissions reductions may create incentive for early development and adoption of clean technologies.

### 4. Establish a robust opt-in program

We encourage consideration of a robust opt-in program whereby non-covered sources have an opportunity to enter the program on a voluntary basis and receive allowances for emissions reductions achieved. This approach broadens the reach of a cap and trade program's incentives for emissions reductions including those achieved through adoption of clean technologies.

This approach was implemented as part of the acid rain provisions of the Clean Air Act (Title IV), allowing electricity generating units and industrial emitters to voluntarily participate in the emissions reduction program.

### 5. Assign value to clean technology solutions

We support efforts to ensure the promotion of clean technologies by assigning value to clean technology distributed generation or energy efficiency solutions under a cap and trade program and assigning ownership of resulting carbon credits to the owner of the generating unit that utilizes clean energy technologies that result in carbon reduction. The approach applies market forces that assign value to clean technology investments, driving consumer adoption and investment.

### 6. Allocate allowances to support energy technology R&D

We support consideration of provisions that would allocate a specified amount of allowances for auction, sale or grant in order to generate revenue to fund advanced energy technology research and development or energy efficiency initiatives.

It may be appropriate to include provisions that set aside a specified number of emissions allowances to be sold or auctioned into the market for the purpose of raising revenue for technology deployment and dissemination, recognizing the importance of technology advances to mitigating climate change.

### 7. Ensure technology neutrality

Any approach to mitigating climate change should ensure technology neutrality critical to driving the deployment of a range of green technology options. Competing technologies will provide the fastest trajectory to a robust marketplace and reasonable prices for the consumer.

The implementation of a market-based program to mitigate greenhouse gas emissions will potentially involve thousands of stakeholders and the management of hundreds of millions of transactions. We urge policymakers to give careful consideration to implementation issues with the goal of achieving a system that is fair, transparent, efficient, reliable and able to handle the very large anticipated transaction volume and scope.

Existing environmental market programs, such as the regional Renewable Energy Certificate markets in New England, Texas, California and other regions and the $SO_2$ trading system established under the Clean Air Act Amendments of 1990 can provide a strong base of infrastructure experience upon which to build market-based systems for emissions reduction.

## V. Development of Industry Best Practices: Corporate Commitments and Contributions to Clean Energy

TechNet's members are committed to accelerating technologies that reduce emissions and achieve renewable energy, energy efficiency and conservation. TechNet's members will identify and share best practices that are making valuable contributions to clean energy and environmental improvement, through corporate commitments and the development of products and technology solutions that drive energy efficiency and environmental improvement across industries.

Industry best practices to promote clean energy include:

- Emissions reduction commitments through enhanced energy efficiencies and new innovations;
- Development of technologies to spur energy efficiency, environmental improvement and greater reliance on renewable energy;
- Innovations to increase efficiency and/or decrease emissions in products as well as IT-driven systems or industries, from e-commerce to manufacturing to business-to-business; and
- Purchasing Renewable Energy Certificates and $CO_2$ reduction credits to offset use of fossil energy.

The following are some of these commitments:

- **AMD**'s (www.amd.com) annual Global Climate Protection Plan, first published in 2001, addresses the company's commitment, goals, and strategies for reducing impacts on global warming. AMD has exceeded its EPA Climate Leaders goal to reduce greenhouse gas emissions, normalized for production, by 40 percent by 2007 relative to a 2002 baseline. In 2002, AMD received EPA's Green Power Leadership award, and in 2005 committed to powering its Austin operations with 100% renewable energy from Austin Energy's GreenChoiceTM program for the next ten years.

- **Applied Materials** (www.appliedmaterials.com) recently committed to purchasing 12% of the energy used in the company's Santa Clara facilities from wind and solar generation sources, which will reduce the company's greenhouse gas emissions by more than 5% and is equivalent to planting 1,107 acres of forest or removing 782 cars from the road for one year.

- **Google** (www.google.com) has committed to installing 1.6 MW of solar photovoltaic systems at its California campus headquarters, resulting in the largest solar installation on any U.S. business site. The result will offset 30% of the company's peak electricity consumption in the corporate complex.

- As a part of the Clinton Global Initiative, **Cisco** (www.cisco.com) developed the Carbon to Collaboration Initiative, a $20 million investment in collaborative technologies designed to achieve a minimum 10% reduction in the company's carbon emissions from air travel in 2007.

- In 2006, **Intel Corporation** (www.intel.com) completed dozens of energy improvement projects in its offices, facilities and factories, including the use of improved controls, heat recovery and other conservation techniques. These projects saved 61 million kWh of electricity and more than two million therms of natural gas. Since 2002, Intel has reduced the energy used per unit of product manufactured by almost 6% per year, well ahead of the publicly stated 4% reduction goal.

- **Intel Corporation**, **AMD** (www.amd.com) and other leading manufacturers comprising the **World Semiconductor Council** (www.semiconductorcouncil.org) created the first of its kind global voluntary agreement among the semiconductor industry and several national governments to reduce perfluorocarbons or PFCs – compounds used in small quantities in semiconductor manufacturing known to contribute to global warming. The WSC goal is to reduce PFC emissions to 10% below the baseline year (set at 1995 for U.S. participants) by 2010.

- **Autodesk** (www.autodesk.com) recently launched a Sustainability Center to serve as a Web-based resource for green design, building and construction which features profiles of "Green Dreamers," a diverse set of case studies, and links to other resources.

- **Sun Microsystems** (www.sun.com) has established an executive level position, Vice President of Eco Responsibility, to oversee internal initiatives to meet the company's commitment to a 20% reduction in greenhouse gas emissions over 2002 levels by 2012 as well as to improve existing products and develop new ones that are environmentally responsible.

- One of the first companies to sign on to the World Economic Forum's Global Greenhouse Gas Registry, **Hewlett-Packard** (www.hp.com) recently committed to increasing its purchases of renewable energy in the United States from 11 to 50 million kWh/year in 2007, an increase of more than 350%.

- As a part of its award-winning commute alternative program that helps reduce employees' carbon footprint, **Yahoo** (www.yahoo.com) has a full-time staff member dedicated to helping each employee find the best available commute mode, a monthly rewards program for staff who carpool to work, and WiFi-enabled shuttles that were recently converted to biodiesel.

- **EMC Corporation** (www.emc.com) built an on-site, self-distributed wastewater treatment and recycling plant at its headquarters in Hopkinton, Massachusetts that saves the municipality three million gallons of water annually. This state-of-the-art "sequential batch reactor" system reclaims 100% of building wastewaters, reuses a high percentage in building systems, and returns the remaining clean water to the local ecosystem.

- In 2006, **IBM** (www.ibm.com) purchased more than 5.5% of its electricity from renewable energy sources, including 96,000 million megawatt-hours (mWh) of wind Renewable Energy Certificates and approximately 208,000 mWh of direct purchases of wind, solar and biomass generated electrical energy. IBM procured renewable energy in the United States, United Kingdom, Germany, the Netherlands and Australia. IBM continues its commitment in supporting renewable energy development and using renewable energy.

## Conclusion

There is an unprecedented degree of consensus today that our nation faces significant energy challenges that threaten to impact our economic competitiveness, national security and the global environment. Ensuring a sound energy future is one of the most urgent policy challenges facing our nation and indeed the global community.

At the same time, technological progress and innovation are creating tremendous new opportunities for a sound energy future. Technology is revolutionizing the energy industries, and fundamental advances in a host of scientific disciplines related to the energy sector are beginning to solve problems that very recently seemed intractable.

We are at the beginning of an era of enormous promise. TechNet believes strongly that innovation, fostered by visionary entrepreneurship and visionary public policy, can lead the way to addressing our nation's energy and environmental challenges. We are committed to working with Congress and the Administration to achieve this important goal.

## The TechNet Green Technologies Task Force

Stu Aaron
Vice President of Marketing & Product Management
Bloom Energy Corporation

Phil Bernstein
Vice President, Industry Strategy & Relations
Autodesk, Inc.

John Denniston
Partner
Kleiner Perkins Caufield & Byers

Robert Farnsworth
CEO
Sonnet Technologies, Inc.

Todd Glass
Partner
Heller Ehrman, LLP

Laura Ipsen
Vice President
Cisco

Paul Lippe
CEO
Qulas

John Melby
Senior Vice President
APX Inc.

Diarmuid O'Connell
Director of Corporate Marketing
Tesla Motors

Steve Papermaster
Chairman of the Board
Powershift Ventures

David Pearce
President & CEO
Miasolé

Dr. Mark Pinto
Senior Vice President and Chief Technology Officer
Applied Materials, Inc.

Rahul Shendure
Vice President, Product Marketing
Amyris Biotechnologies, Inc.

Sue Snyder
Executive Legal Counsel and Vice President for International Policy and Relations
Advanced Micro Devices (AMD)

Donald M. Whiteside
Vice President, Corporate Technology Group
Director, Technology Policy and Standards
Intel Corporation

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The author of this report, Gretchen Beyer, Senior Vice President, TechNet, can be reached at gbeyer@technet.org

## About TechNet

TechNet was created in 1997 to shape public policy impacting U.S. innovation and technology leadership. TechNet has since become the preeminent organization representing chief executive officers of the nation's leading high technology companies. Through the power of its network, TechNet continues to have an extraordinary impact on public policy driving a stronger education system, investments in research and development, legal reform, broadband and Internet policy and other issues critical to U.S. innovation and global competitiveness.

Chaired by John Chambers of Cisco Systems and John Doerr of Kleiner Perkins Caufield & Byers, TechNet's CEO and Senior Executive members are the nation's leading innovators in the fields of information technology, Internet and e-commerce, biotechnology, venture capital and investment banking. TechNet companies represent more than one million employees. TechNet has offices in Washington, DC, Silicon Valley, Sacramento, Seattle, Boston, and Austin.

The TechNet Green Technologies Initiative represents TechNet's longstanding commitment to policies that strengthen the nation's innovation-driven global competitiveness. TechNet's top priority is to foster public policies and private sector initiatives that maintain U.S. competitiveness and economic growth through innovation.

**www.technet.org**

## Notes

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