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Taking Action on Energy: A CEO Vision for America's Energy Future

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Business Roundtable℠

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A CEO Vision for America's Energy Future

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Dear Business Leaders, Policymakers and Other Stakeholders:

The CEOs of the Business Roundtable believe that we are at a pivotal time in our nation's history. America faces a number of serious economic and policy challenges, including unacceptably low economic growth, unacceptably high unemployment, unsustainable budget deficits, escalating health care costs, an uncompetitive tax code and an incoherent patchwork of regulation. Collectively, these challenges create a business climate that discourages the long-term investment that is needed to revitalize our economy and create jobs.

With these challenges in mind, the Business Roundtable released the March 2012 report *Taking Action for America* — a comprehensive plan to accelerate new business investment and remove barriers to economic growth. In that report, the CEOs of the Business Roundtable identified affordable, reliable energy as one of several critical strategies to revitalize economic growth and job creation.

Taking Action on Energy is designed to provide greater detail about the policies needed to make affordable, reliable energy a reality for U.S. consumers and businesses. To support this goal, the Business Roundtable Energy and Environment Committee embarked on an effort to re-evaluate U.S. energy policy and forge a long-term framework that has the potential to simultaneously advance the nation's economic, security and environmental interests.

In short, our assessment is that America's energy future is exceptionally bright. The nation's energy outlook has improved substantially in recent years due to a confluence of factors that are fundamentally reshaping the U.S. energy landscape, including the development of technologies to unlock vast new domestic oil and natural gas resources and the application of innovative technologies to economically extract and deliver these resources to market. In addition, the United States remains a global leader in the research, development and commercialization of energy efficiency, renewable energy, new nuclear and advanced coal technologies.

The Business Roundtable believes that America should capitalize on these advantages and accelerate efforts to develop a portfolio of affordable, diverse and efficient options for meeting our energy needs in the 21st century. As major domestic energy producers, energy consumers and technology suppliers, our companies are uniquely positioned to help the nation make the most of this opportunity. The business community is prepared to lead the way, but the government has an important role to play in establishing a coherent, forward-looking energy policy.

Accordingly, the CEOs of the Business Roundtable call on U.S. policymakers, business leaders and consumers to take action on energy. We can no longer afford to sustain our current patchwork of policies. Instead, we need a more purposeful approach that looks beyond today's headlines to forge a more enduring vision of how America will meet its energy needs in the coming decades.

Taking Action on Energy attempts to provide this vision. Our goal was to outline an energy policy framework that is both timely and durable — that is, one that is capable of addressing current issues as well as accommodating future developments. Accordingly, while many of our policy solutions speak specifically to the major issues of the day, we have also attempted to place them within a broader system of national energy policy goals, principles and strategies. We believe that the framework outlined in this paper represents a balanced approach to enhancing economic growth and energy security while also reducing the environmental risks associated with criteria pollutants, greenhouse gases and other emissions.

Despite our optimism, we remain realistic about the difficulty of replacing our ad hoc energy policy with a more purposeful approach. Making this change will require leaders who are willing to engage in an open and honest dialogue about our values and priorities as a nation, as well as the policy and regulatory approaches most likely to achieve them. This report is intended to contribute to that dialogue.

David M. Cote
Chairman & CEO
Honeywell International, Inc.
Chairman, Energy & Environment Committee
Business Roundtable

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Executive Summary

America is in the midst of an energy renaissance. Fueled by a combination of ingenuity and investment, recent developments have fundamentally altered the U.S. energy landscape. The implications of this energy renaissance are potentially profound and far-reaching. In fact, some energy experts believe that North American energy self-sufficiency is now within reach — a prospect that seemed unattainable as recently as five years ago.

In light of these developments, the CEOs of the Business Roundtable are optimistic about America's energy future. As major domestic energy producers, energy consumers and technology suppliers, our companies are uniquely positioned to help the nation make the most of this opportunity. Indeed, the unlocking of highly challenging resources, such as oil and natural gas from shale formations, is a textbook example of the private sector's ability to drive innovation, capitalize on new opportunities and put the United States back in the driver's seat toward a secure and sustainable energy future. The private sector must continue to lead the way if America is to sustain this energy renaissance and restore our status as an energy superpower.

But let us be clear: The business community cannot do this alone, and the federal government has an important role to play in facilitating private investment — namely, by establishing a coherent, forward-looking energy policy framework. Unfortunately, the nation's energy policy has evolved through decades of ad hoc measures, resulting in an incoherent patchwork of subsidies, mandates and regulations. The result is a policy labyrinth that, on balance, is more likely to inhibit than to unleash the private-sector investment needed to transform the energy sector. Accordingly, the CEOs of the Business Roundtable call on U.S. policymakers, business leaders and consumers to take action on energy.

With this goal in mind, *Taking Action on Energy* offers a comprehensive U.S. energy policy framework. The foundation of the framework is the CEO vision statement, which identifies three overarching policy goals (economic growth, energy security and environmental stewardship) and describes a virtuous cycle in which an expanding economy supports the investments needed to improve our energy security and safeguard our environment. The report then builds on this foundation by enumerating a set of guiding principles that advance these goals, including fostering innovation, encouraging competition and energy resource diversity, empowering consumers, engaging the international community, ensuring smarter regulation, and fortifying critical infrastructure. These guiding principles provide a yardstick by which policymakers should evaluate the merits of any policy proposal.

However, a successful energy policy framework cannot rest solely on visions and principles — it must apply those concepts toward actionable recommendations on the major issues of the day. Accordingly, *Taking Action on Energy* applies these principles to four critical areas: energy efficiency; traditional energy production; renewable energy production; and electric power generation, transmission and distribution. For each area, the document outlines current trends and barriers that are actively shaping investment decisions and presents a set of concrete, actionable policy recommendations. These recommendations, while directed at immediate issues in the short term, are also designed to transition the nation toward a more coherent, sustainable energy policy framework in the long term.

The CEOs of the Business Roundtable believe that restoring America's economic strengths remains our top priority, and sustaining America's energy renaissance is critical to realizing that goal. To do so, policymakers must:

- Foster innovation by sustaining public investments in a diverse portfolio of precommercial research and development activities;
- Encourage competition and energy resource diversity by ensuring that tax incentives are designed to address well-documented market inefficiencies, applied only to those fuels and technologies with a credible path to unsubsidized competitiveness, and finite in duration and eventually phased out in a predictable fashion;[1]
- Empower consumers by adopting transparent, cost-effective standards for energy efficiency and allowing efficiency investments to be reflected in consumers' utility rates;
- Engage internationally by approving infrastructure projects that provide access to world energy markets and expanding rules-based trade opportunities for coal and other materials;
- Ensure smarter regulation by requiring regulation to be grounded in sound science and cost-benefit analysis, streamlining the permitting process, and expediting critical infrastructure projects; and
- Fortify critical infrastructure by investing in upgrades and encouraging cooperation and information-sharing among government agencies, critical infrastructure owners and operators.

Three Overarching Goals of a Long-Term National Energy Policy

- **Boost economic growth** by ensuring access to affordable energy supplies and pursuing cost-effective energy efficiency measures;
- **Enhance energy security** by providing an adaptable, reliable and diverse portfolio of energy resources; and
- **Promote environmental stewardship** by improving energy efficiency and ensuring responsible management of natural resources.

I. Capitalizing on America's Energy Renaissance

America is in the midst of an energy renaissance. Fueled by a combination of ingenuity and investment, recent developments have fundamentally altered the U.S. energy landscape — upending long-held assumptions and turning conventional wisdom on its head. The facts speak for themselves. Despite decades of decline, U.S. crude oil production has increased in each of the past four years.[2] After decades of stagnation, U.S. natural gas production has surged to historic highs.[3] At the same time, coal-fired and nuclear power plants continue to provide affordable, reliable baseload electricity while renewable energy sources are becoming an increasingly important part of the nation's energy portfolio.[4] And on the demand side of the energy equation, improvements in energy efficiency and conservation are helping to ensure that energy is used more productively and, as a result, emissions are lower than they otherwise would be.[5]

"America's energy future is bright, but it is not certain. The only guarantee is that the energy landscape will continue to evolve as new technologies emerge, new resources are developed and markets respond accordingly. A diverse portfolio of energy efficiency and supply options is the best insurance policy against this uncertain future — enabling America to seize the opportunities and mitigate the risks associated with technological and economic change."

— David M. Cote
Chairman & CEO
Honeywell International, Inc.

The implications of this energy renaissance are potentially profound and far-reaching. After peaking at 60 percent in 2005, oil imports as a share of consumption have decreased to 47 percent — the lowest level since 1996.[6] Likewise, natural gas imports have fallen to their lowest level since 1992, and the Energy Information Administration (EIA) projects that the United States could be a net exporter of natural gas within a decade.[7] Enticed by the prospect of secure and affordable energy supplies, key manufacturing industries, including the chemical, steel and fertilizer industries, are returning to the United States after more than a decade of declining investment, bringing much-needed job growth.[8] Indeed, some energy experts believe that North American energy self-sufficiency may be on the horizon — a prospect that was considered unattainable five years ago.[9]

Given these developments, the CEOs of the Business Roundtable are optimistic about America's energy future. We believe that recent developments in the U.S. energy sector are overwhelmingly positive and potentially transformative. As major domestic energy producers, energy consumers and technology suppliers, our companies are uniquely positioned to help the nation make the most of this opportunity.

But let us be clear: The business community cannot do this alone, and the federal government has an important role to play. First and foremost, the federal government has a responsibility to forge a comprehensive, forward-looking energy policy framework that advances the nation's key interests. Unfortunately, no such policy framework exists. Evolving through decades of ad hoc measures, the nation's de facto energy policy is an incoherent patchwork of subsidies, mandates and regulations. The result is a policy labyrinth that, on balance, is more likely to inhibit than to enable the innovation and investment needed to sustain a diverse, affordable and efficient energy system.

With this challenge in mind, *Taking Action on Energy* provides an alternative to our ad hoc energy policy that capitalizes on America's energy renaissance. The foundation of this approach is the vision statement, which establishes economic growth, energy security and environmental stewardship as the three overarching goals of a sustainable energy policy and describes why the concepts of affordability, diversity and efficiency are central to advancing all three goals simultaneously. The report's guiding principles build on this foundation, providing a blueprint for designing and implementing policies that are likely to achieve this shared vision. A series of chapters then explores four key areas of energy policy in greater detail: (1) energy efficiency; (2) traditional energy production; (3) renewable energy production; and (4) electric power generation, transmission and distribution. Each chapter concludes with specific, actionable policy recommendations that are designed to address immediate issues in the short term while transitioning the nation toward a more coherent, sustainable energy policy framework in the long term.

The energy landscape has shifted dramatically in the past five years — infusing the U.S. energy outlook with new uncertainties, challenges and opportunities. Although these developments are, on balance, overwhelmingly positive for U.S. consumers and businesses, America's energy future is not certain. The only thing we know for sure is that the energy landscape will eventually shift again. America needs a comprehensive energy policy framework that is flexible enough to capitalize on known near-term opportunities while accommodating new long-term developments. The CEOs of the Business Roundtable believe this is that framework.

Energy Policy in the Context of Comprehensive Tax Reform

The tax code is a key tool by which policymakers encourage or discourage a wide range of behaviors in the private sector, including decisions regarding energy consumption, production and investment. As a result, some of the recommendations in this report necessarily touch on the issue of tax policy. At the same time, the Business Roundtable believes that comprehensive tax reform is a critical component of a long-term plan to restore U.S. economic growth and international competitiveness. To the extent that policymakers undertake comprehensive tax reform in the future, some recommendations in this report may need to be re-evaluated in the context of the proposed reforms.

II. Vision Statement

The Business Roundtable believes that a successful and sustainable long-term U.S. energy policy should simultaneously advance three national goals: economic growth, energy security and environmental stewardship.

Economic Growth

A long-term U.S. energy strategy should increase the nation's ability to compete in global markets, support private-sector job creation and improve the quality of life for all citizens. Access to affordable energy supplies and the pursuit of cost-effective energy efficiency measures are critical to attaining these goals. From a global and local perspective, affordable energy has been a primary driver of economic growth for decades, and it facilitates broad economic benefits that can generate increased spending on a variety of national priorities. Indeed, affordable energy can produce positive feedback loops in which increased economic prosperity leads to greater investment in new energy production and innovation, which in turn help keep energy costs competitive for businesses and consumers. As such, an effective long-term U.S. energy strategy must allow for flexibility to respond to changing economics in the energy sector as new technologies and resources emerge.

"Affordable energy supports the very foundation of American life."

— John S. Watson
Chairman & CEO
Chevron Corporation

Conversely, when energy costs rise, the impact is felt by consumers, businesses and governments, resulting in reduced consumer spending, job creation and government revenues. Rising energy costs also function as a regressive tax on consumers and hurt them in a variety of ways, including higher prices for electricity, gasoline and other basic necessities; an increased likelihood of unemployment or underemployment; and reduced economic vitality.

Energy Security

A long-term U.S. energy strategy should enhance the nation's capacity to prevent, mitigate, adapt to and recover from energy market disruptions resulting from political instability, military conflict, natural disasters, physical and cyber terrorist attacks, and disruptions of global energy supplies. To achieve this goal, U.S. energy supplies must be adaptable, reliable and diverse. Fortunately, the United States is endowed with a wide array of energy resources, including both traditional fuels and renewable resources, as well as access to global energy supplies. Coupled with sustained efforts to improve energy efficiency, this diversity affords U.S. energy producers and importers more flexibility in meeting our energy needs while also increasing the energy market's resilience against natural and man-made shocks.

The security of the energy supply is also affected by political developments. Policies that support open international markets and predictable regulatory and fiscal frameworks are critical to ensuring that U.S. businesses and consumers have access to the affordable energy they need, when they need it and where they need it. Energy security also requires a robust energy infrastructure, including sufficient processing capacity, and transmission and distribution systems that reliably deliver energy to consumers and businesses.

Environmental Stewardship

A long-term U.S. energy strategy should ensure that the nation produces and consumes energy in a manner that is consistent with protecting human health and preserving the environment through responsible and diligent management of natural resources. U.S. energy producers are responsible for meeting today's energy needs, and they should do so while safeguarding the environment for future generations. Energy producers should continuously strive for operational excellence to mitigate risks and minimize the overall environmental impact using proven and cost-effective practices and technologies. Likewise, energy users have an interest in consuming energy efficiently, reducing both their energy costs and their environmental impact.

Efforts to increase our understanding of the short- and long-term environmental risks of energy production are important and should be based on sound science. Regulations designed to ensure environmental stewardship should be based on a full lifecycle accounting of costs and benefits. The importance of this cannot be overstated. In addition to making energy less affordable and harming economic growth, excessive regulation and government intervention can drive production and energy-intensive manufacturing overseas, where environmental protection can be less of a priority. Successful environmental stewardship also requires a global commitment that levels the playing field and ensures that energy is produced in an environmentally responsible manner, regardless of location.

Energy Policy and Climate Change

As described in the Business Roundtable's 2007 Statement on Climate Change:

> *Because the consequences of global warming for society and ecosystems are potentially serious and far-reaching, steps to address the risks of such warming are prudent even now, while the science continues to evolve. The Business Roundtable supports collective actions that will lead to the reduction of [greenhouse gas (GHG)] emissions on a global basis with the goal of slowing increases in GHG concentrations in the atmosphere and ultimately stabilizing them at levels that will address the risks of climate change. These actions need to be coordinated with efforts to address other urgent world priorities, such as reducing poverty, improving public health, reducing environmental degradation and raising living standards. Reliable and affordable world supplies of energy are essential for meeting these challenges.*

Toward a Coherent, Balanced and Sustainable U.S. Energy Policy

Traditional policy paradigms frequently place the pursuit of our economic, security and environmental goals in competition with one another. The Business Roundtable believes, however, that America's economic, security and environmental futures can and should be mutually reinforcing in the long run. For example:

- Economic growth enables increased investment in new technologies, including energy efficiency and supply technologies, and the public and private gains generated by a strong economy can fund both environmental improvements and a more robust, secure energy infrastructure.
- A secure and reliable energy supply, especially when coupled with cost-effective improvements in energy efficiency, reduces the economy's exposure to market volatility and provides a more predictable climate for investing in cleaner technologies.
- Successful environmental stewardship improves human health and environmental quality while reducing pollution-related health care costs and increasing worker productivity. It can also reduce the likelihood of disruptions to energy supplies and highly dependent economic activities.

The CEOs of the Business Roundtable believe that economic growth is the primary driver of this virtuous cycle. Without economic growth, we cannot afford the investments required to improve our energy security and safeguard our environment. And without access to a diverse portfolio of affordable energy supplies and continuous improvements in energy efficiency, economic growth will suffer. For this reason, we believe that a long-term U.S. energy policy that places the concepts of affordability, diversity and efficiency at its core has the greatest potential to place the nation on a more sustainable pathway — that is, a pathway in which we simultaneously advance all three of our policy goals and maintain those improvements indefinitely.

III. Guiding Principles

To advance the goals of economic growth, energy security and environmental stewardship, U.S. policies and regulations should be aligned with the following principles.

Foster Innovation: A long-term U.S. energy policy should foster innovation by improving education at all levels, especially in science, technology, engineering and math; sustaining public investments in a diverse portfolio of precommercial energy technology research and development; and focusing public investments on research and development for scalable energy sources that are likely to be commercially viable in the absence of government support.

Encourage Competition and Energy Resource Diversity: A long-term U.S. energy policy should encourage competition and energy source diversity by ensuring that the private sector has access to all energy sources, both foreign and domestic; avoiding measures that discourage any energy source or any form of energy investment; ensuring that policies and regulations are technology and fuel-source neutral; and ensuring that any policies supporting the commercialization of fuels or technologies are designed to overcome well-documented market inefficiencies, are applied only to fuels and technologies that have a credible pathway to unsubsidized competitiveness, and are finite in duration and eventually phased out in a predictable fashion.

Empower Consumers: A long-term U.S. energy policy should empower consumers by improving the quality, transparency and flow of information to energy consumers and by leveraging market-based solutions that use price signals and consumer choice among competitive fuel and technology options.

Engage Internationally: A long-term U.S. energy policy should engage the international community by supporting open, unbiased and rules-based trade and investment systems and by providing leadership and encouraging collective action to address global energy and environmental challenges, including climate change.

Ensure Smarter Regulation: A long-term U.S. energy policy should ensure smarter regulation by establishing clear, predictable "rules of the road" that encourage investments in long-lived energy assets; improving the quality, transparency and flow of information to policymakers; minimizing administrative and regulatory burden; requiring regulations to undergo a rigorous, consistent and transparent analysis of their cumulative costs and benefits; supporting the historic role of states as the primary regulators of energy production; incentivizing investment in energy efficiency; and avoiding regulatory policies that discourage investments in energy efficiency.

Fortify Critical Infrastructure: A long-term U.S. energy policy should support the fortification of critical infrastructure by maintaining and enhancing the security of key domestic energy infrastructure and by removing impediments to the alignment of market-driven infrastructure investments with future energy production and demand.

IV. Energy Efficiency

"A successful energy strategy must capitalize on U.S. advantages to ensure reliable, affordable energy from a wide variety of sources while continuing to drive energy efficiency throughout the economy."

— David M. Cote
Chairman & CEO
Honeywell International, Inc.

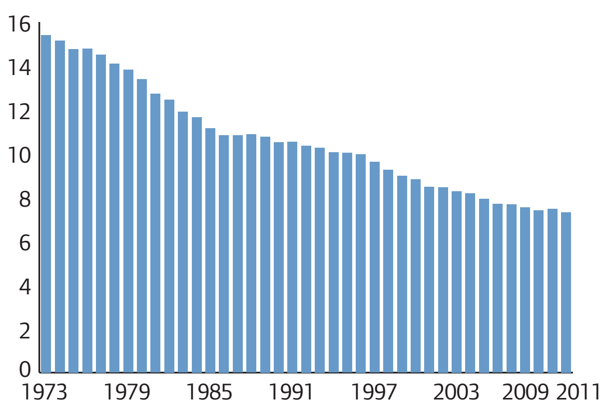
Energy efficiency is a cornerstone of a successful energy policy. Indeed, investments in energy efficiency have the potential to simultaneously advance all three pillars of a balanced, long-term energy strategy — resulting in a proverbial "win-win-win" for U.S. consumers and businesses. Cost-effective improvements in energy efficiency can boost economic growth by decreasing energy costs while increasing productivity and competitiveness; enhance energy security by reducing domestic energy consumption and lessening our exposure to disruptions in global energy markets; and protect human health and the environment by curtailing the release of criteria pollutants, GHGs and other emissions.

America has made significant investments in energy efficiency in recent decades. Since 1973, U.S. consumers and businesses have decreased their energy intensity (i.e., primary energy consumed per dollar of gross domestic product [GDP]) by more than 50 percent.[10] Although this decline is due to a variety of factors, including structural shifts in the economy from more energy-intensive manufacturing to less energy-intensive services, the increased deployment of energy-efficient technologies has been a key driver.[11]

Figure 1

U.S. Primary Energy Intensity

Thousand BTU Consumed per Real U.S. Dollar



Source: EIA (Nov 2012). Monthly Energy Review. *Table 1.7.*

Despite this progress, there is still significant room for improvement, and analysis suggests that the potential benefits of increased energy efficiency could be substantial.[12] For example, McKinsey & Company estimated that investing $520 billion in a diverse array of energy efficiency projects through 2020 would decrease energy demand by 23 percent and generate energy savings worth more than $1.2 trillion over the life of the investment.[13] Similarly, a 2012 analysis found that investing $279 billion in energy efficiency retrofits could yield more than $1 trillion in energy savings over 10 years, add 3.3 million cumulative job years of employment and reduce GHG emissions by nearly 10 percent.[14] Other studies have reached similar conclusions.[15]

To capture these benefits, however, America needs a coherent energy policy that prioritizes cost-effective energy efficiency. Technological advances, combined with innovative approaches to encourage the adoption of cost-effective efficiency measures, are driving further improvements in the way that we produce and consume energy. Nevertheless, smarter regulation and well-designed policies are needed to overcome key barriers and unlock the economic, security and environmental benefits associated with improved efficiency.

Trends in Energy Efficiency

Energy Efficiency Incentives

In recent years, policymakers have attempted to incentivize energy efficiency through a variety of measures. Funding for energy efficiency projects has been authorized in a number of federal legislative packages, including the Energy Policy Act of 2005, the Energy Independence and Security Act of 2007 (EISA), and the Energy Improvement and Extension Act of 2008. More recently, the American Recovery and Reinvestment Act (ARRA) provided more than $25 billion for core energy efficiency projects across the country.[16] These funds were disbursed through a variety of channels, including Energy Efficiency and Conservation Block Grants to states, the State Energy Program, and the Weatherization Assistance Program. Other funding was also provided through grants that were matched by the private sector (e.g., smart grid grants).

Tax incentives (e.g., personal, corporate, sales or property taxes) are also used to encourage energy efficiency. ARRA included substantial federal tax incentives for energy efficiency, while many states and localities offer their own tax incentives for energy efficiency measures.[17] Other incentives, such as utility rebates, grants and loans, have also been used as a means to encourage implementation of energy efficiency measures in the residential, commercial and industrial markets. Currently, utilities provide more than 1,000 programs across the country to incentivize a wide portfolio of efficiency measures in each sector.[18]

In addition, a variety of innovative financing arrangements have incentivized individuals and businesses to implement energy efficiency measures. These arrangements include:

- **Energy Savings Performance Contracts (ESPCs) —** Under an ESPC, an Energy Services Company (ESCO) arranges private financing to pay the costs associated with identifying and installing energy-efficient equipment. The ESCO also guarantees that the cost savings resulting from these energy efficiency improvements will cover the cost of the financing and service on the newly installed equipment. Any savings in excess of the guarantee accrue to the owner.
- **Energy Service Agreements (ESAs) —** Under an ESA, private lenders fund the cost of efficiency improvements and also assume responsibility for paying the property owner's energy bills. The property owner pays the lender an agreed-upon monthly amount that is based on the owner's historical energy consumption charge. As such, the lender captures the full value of the energy efficiency improvements and savings at no cost to the property owner.
- **Property Assessed Clean Energy (PACE) Financing —** Administered through municipalities, PACE funds are provided through public bonds or private lenders and provide up-front funding for efficiency improvements. This

funding is paid back through a special assessment on participants' property taxes. If the property is sold before the loan is repaid, the new owner assumes responsibility for the tax assessment. If the property owner defaults on the mortgage, the PACE lender has "first lien" rights and would recover funds before the mortgage lender.

- **On-Bill Financing —** On-bill financing is a financial agreement between a property owner and utility company in which the company provides funding for energy efficiency improvements. The utility provides the initial funding for the improvement and recoups its expense from the property owner through a surcharge on the owner's monthly utility bills until the loan is repaid. Utilities in at least 20 states have already implemented or will soon implement on-bill financing programs.[19]

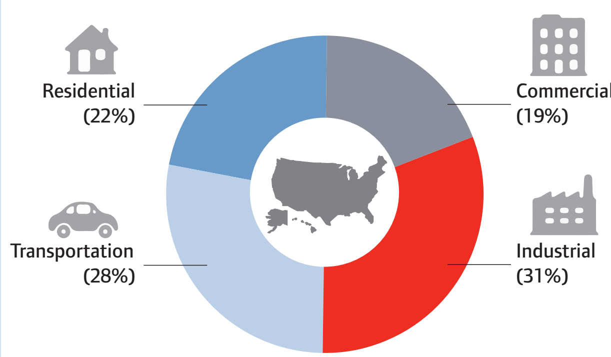
Voluntary Standards

In addition to financial incentives, voluntary energy standards for buildings, appliances and equipment can also play an important part in increasing energy efficiency. Buildings represent the largest energy consuming sector in the United States, and measures to increase their energy efficiency can have significant impacts.[20] For example, through the voluntary ENERGY STAR® program, the Department of Energy (DOE) and Environmental Protection Agency (EPA) have helped make consumers and businesses more aware of and informed about the energy efficiency of various products, which is estimated to have saved nearly $18 billion in utility bill expenses while reducing GHG emissions.[21] Through ENERGY AWARE — a voluntary program coordinated by private industry — thermostat manufacturers worked with the National Electrical Manufacturers Association to create and implement a certification and labeling standard for high-performance programmable residential thermostats. The program is intended to assist homeowners, distributors, contractors and installers in choosing programmable thermostat models that will best meet individual and family needs to manage and reduce energy.

Figure 2

Energy Consumption by End-Use Sector

Percentage of Total U.S. Energy Consumption, 2011



Source: EIA (2012). Annual Energy Review 2011. *Table 2.1a.*

Other voluntary programs, such as the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) program and the International Living Building Institute's Living Building Challenge program, use comprehensive rating systems to assess a building's energy and environmental performance. Another voluntary standard, known as ISO 50001, was developed by the International Organization for Standardization and establishes frameworks for industrial, commercial, institutional and governmental facilities.

Regulatory Requirements

State and federal governments are increasingly issuing regulatory requirements intended to improve energy efficiency. For example, Citi Global Perspectives & Solutions predicts that, by 2020, new federal vehicle standards could increase the weighted-average fuel economy of the national automobile fleet by 16 percent from 2010 levels.[22] EISA included a variety of energy efficiency provisions, including higher efficiency standards for lighting.[23] Presidents Bush and Obama each issued Executive Orders and other guidance calling on federal agencies to improve energy efficiency in their building operations and purchases, including a December 2011 order requiring agencies to enter into at least $2 billion in ESPCs and Utility Energy Service Contracts (UESCs) over two years.[24]

Although progress related to prior efforts to improve energy efficiency in federal facilities has been slower than some industry stakeholders had hoped, industry is currently working closely with the government to implement the recent memorandum. For instance, the Department of Defense (DOD), which is the nation's largest energy user, has established a variety of energy-related goals, including increasing efficiency across its platforms and facilities and reducing overall consumption.[25] Internationally, buildings ratings systems, such as Australia's government-implemented National Australian Built Environment Rating System (NABERS) program, are designed to help businesses and consumers improve their energy efficiency and reduce their environmental impact.[26]

States and municipalities have also developed requirements related to energy efficiency. Of the 30 states (including the District of Columbia) that have a mandatory Renewable Portfolio Standard or an Alternative Energy Portfolio Standard, 13 incorporate energy efficiency as an eligible resource for meeting the standard.[27] In addition, municipal building codes are widely acknowledged to improve the energy efficiency of buildings.[28]

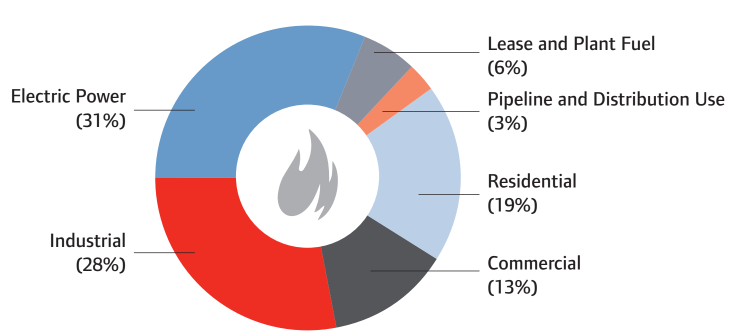
Declining Natural Gas Prices

Natural gas is a major source of energy for businesses and consumers, and the recent decline in natural gas prices could have an impact on energy efficiency investment decisions in some sectors. Current lower natural gas prices are due in part to a combination of increased shale gas production and decreased demand during the economic downturn. From 2004 to 2008, the average monthly price for natural gas rarely dropped below $5.50 per million British thermal units (BTU) and rose above $12 per million BTU in summer 2008. By April 2012, however, new extraction technologies and large supply increases briefly pushed

Figure 3

U.S. Natural Gas Consumption by Sector

Percentage of Total Consumption, 2011



Source: EIA (2012). "Natural Gas Consumption by End Use."

prices below $2 per million BTU,[29] and EIA expects them to remain below $5 per million BTU in real dollars through 2025.[30] Although low natural gas prices benefit the economy via lower energy costs for consumers and business, they may also diminish the economic incentive for some consumers to use energy more efficiently.

Increased Awareness

U.S. consumers are placing even more emphasis on managing their energy use due to the economic downturn, as well as their increasing awareness of environmental impact.[31] A recent survey found that 83 percent of consumers took steps to reduce their electricity bills in 2011, up 15 percentage points from the previous year.[32] Similarly, more than 90 percent of surveyed consumers indicated that they expect their future energy use would be equal to or less than their current energy use.[33]

U.S. businesses have demonstrated a similar willingness to embrace cost-effective energy efficiency measures. A survey of business executives across industries found that 90 percent of companies have set goals regarding electricity and energy management.[34] While cutting costs is the primary motivator (66 percent), internal motivations (56 percent) and “just the right thing to do” (49 percent) were also cited as reasons. Businesses are increasingly investing in building technologies that improve energy efficiency and elevate its importance in their corporate culture, embracing the energy savings potential of LEED, ENERGY STAR and similar programs. However, some businesses continue to require relatively short payback periods to justify making such investments.[35]

Utility Requirements and Resource Planning

Some public policies inadvertently discourage utilities’ investment in energy efficiency. For example, while demand reduction investments may be significantly cheaper than building new generating capacity or purchasing new supplies of electricity or natural gas, some state and utility resource planning processes do not consider efficiency or demand reduction as resources.[36]

While EISA requires that each state regulatory authority consider adopting federal standards relating to integrated resource planning; load management techniques; and rates that allow for utility investment in energy conservation, energy efficiency and other demand-side management measures, states are not required to implement such measures.[37] Additionally, as previously discussed, ARRA includes a provision requiring state governors to “seek to implement” electricity rate-making policies that align utilities’ financial incentives with more efficient energy use to receive State Energy Program funding. Some state utility regulators are increasingly integrating efficiency requirements into planning processes, and cost-effective energy efficiency is already a key component of the resource planning conducted in many states with vertically integrated utilities. Despite these efforts, progress remains uneven among investor owned, municipally owned and cooperatively owned utilities.

Barriers to Investment in Energy Efficiency

Regulatory Barriers

Regulations can play a role in bridging the gap between naturally occurring and socially optimal levels of energy use. However, poorly designed regulations can have unintended consequences that discourage investments in energy efficiency. For example, some industry and utility regulations require costly upgrades and lengthy permitting processes before energy efficiency projects can move forward.[38] These obstacles increase the effective cost of efficiency investments, which lengthens payback periods and may prevent investments from occurring. Regulation can also discourage investment in energy efficiency. Under some forms of traditional retail regulation, selling less electricity means a utility has fewer revenues to cover its costs, providing a disincentive to invest in energy efficiency.[39] Additionally, generators in restructured markets and wholesale electricity providers may undervalue energy efficiency if their revenues are based solely on electricity sales.[40] Finally, although recent trends suggest that some utility regulators have now begun to recognize the important role that energy efficiency can play in resource planning, they are sometimes less inclined to embrace relatively new technologies when compared to more traditional and established resource options, such as new generation.[41]

Local regulations can also be improved to ensure the adoption of cost-effective energy efficiency measures. For example, as local building codes become out of date they may fail to reflect advancements in building practices that provide cost-effective improvements in energy efficiency. Given that most new construction is typically built up to — but not in excess of — minimum building codes, it is critical that these codes are kept up to date to reflect current cost-effective technologies as identified through consultation with residential and commercial building industries. Residential and commercial building codes developed by the International Code Council and the American Society of Heating, Refrigerating and Air-Conditioning Engineers are good examples of existing codes that promote energy efficiency in new buildings. In addition to updating building codes, some communities require property owners to conduct a home energy audit on their structure prior to selling it, which can provide prospective buyers with valuable information on the structure's energy use and opportunities for cost-effective energy efficiency improvements.

Infrastructure Barriers

Many of the potential benefits of improved energy efficiency rely on investments in the electricity grid and transportation infrastructure — particularly in "smart grid" technologies that incorporate new communications, sensing and control systems throughout the electric grid.[42] For instance, a 2010 DOE study found that

Figure 4

Costs by Utilities to Fully Develop the Smart Grid

Billions of U.S. Dollars over 20 Years

Costs by Utilities to Fully Develop the Smart Grid	Low Estimate	High Estimate
Distribution Costs	235.2	339.4
Distribution Automation	163.1	231.1
Intelligent Universal Transformers	50.0	51.2
Advanced Metering Infrastructure	18.9	50.8
LEN Controllers	3.2	6.3
Transmission and Substation Costs	82.0	90.4
Total (Over 20 Years)	**317.2**	**429.8**

Source: Electric Power Research Institute (2011).

implementing smart grid technologies could reduce total U.S. energy consumption by 7 percent,[43] while the Electric Power Research Institute (EPRI) estimates the total benefits of smart grid to be between $1.3 and $2.0 trillion over the next two decades.[44] By facilitating efficiency improvements through automation and demand response, a modernized grid can play a significant role in a long-term U.S. energy policy.

Rapid and widespread adoption of smart grid technologies, however, can require substantial up-front investments. EPRI estimates that fully developing the smart grid — including installing smart devices and communication capabilities in buildings and throughout the transmission and distribution system — will cost utilities $317 to $430 billion over the next two decades.[45] While some individual smart grid investments are affordable and can be implemented incrementally, developing a fully modernized grid is a significant undertaking that must compete against other utility investments, such as transmission upgrades, new generation capacity and plant retrofits.

Split Incentives

A common barrier to improving energy efficiency in the residential and commercial sectors is the so-called split incentive or principal-agent problem. Split incentives tend to arise when the entity responsible for making decisions to improve energy efficiency does not receive the full economic benefits associated with those improvements. For instance, a homebuilder may be responsible for making a range of efficiency-related decisions (e.g., building materials, windows, heating and cooling systems, and appliances), while the homeowner will ultimately be responsible for paying the ongoing energy bills that are directly affected by these decisions. Likewise, a building tenant may be responsible for making energy consumption decisions (e.g., use of lighting and heating/cooling systems), while the building owner is responsible for paying the ongoing energy bills. It is estimated that the split incentives problem affects half or more of the energy use in many common residential and commercial end-use markets.[46]

Awareness and Understanding

Another barrier to improving energy efficiency can be a lack of consumer awareness and understanding. For example, some consumers may be unaware that cost-effective opportunities to improve energy efficiency exist, while others may be unaware that there are energy efficiency programs that can help finance those investments. Also, in some instances, there is a reluctance to deviate from regional norms based on climate, available materials and skills. Further, builders may view new energy efficient materials as risky until they gain more experience with them, as new materials require additional time to train workers and may also entail higher up-front costs.[47]

Transaction Costs

Transaction costs represent another significant barrier to improving energy efficiency. For instance, even if consumers and businesses are aware that certain efficiency-enhancing opportunities exist, they may be unwilling or unable to invest the time and effort needed to identify, research and assess their options. For many supply-side investments (e.g., the decision to build a new power plant), the transaction costs are often a relatively small portion of the overall costs of the project. For many demand-side investments (e.g., the decision to purchase a new dishwasher), however, the transaction costs can be a substantial portion of the overall costs of the project. Thus, although consumers and businesses may have numerous opportunities to improve energy efficiency, the potential benefits associated with each individual opportunity may be too small to justify the investments in time and effort needed to take advantage of it.[48] Measures that reduce transaction costs, such as disseminating accurate information and analysis to consumers about common opportunities, can help overcome this barrier and accelerate cost-effective investments in energy efficiency.

Policy Recommendations To Improve Energy Efficiency

Innovation

- Focus research and development on cost-effective technologies that have the potential to improve energy efficiency while diversifying energy sources.
- The federal government should provide resources, either by itself or in combination with industry, for precommercial aspects of priority technology areas, such as those identified in the National Petroleum Council's Future Transportation Fuels report.
- Direct DOE to establish collaborative research and development partnerships between the DOE Advanced Manufacturing Office and other DOE offices, with a focus on precommercial energy efficiency technology development for innovative manufacturing processes that improve efficiency, reduce emissions and waste, and improve industrial cost competitiveness.
- Establish an industry-government research and development partnership for new sustainable manufacturing and industrial processes, and ensure adequate funding for the Industries of the Future program, which provides industrial research and development of energy efficient technologies.

Incentives

- Congress should evaluate the cost-effectiveness of existing and proposed measures to improve energy efficiency, including but not limited to efficiency standard credits for appliances, accelerated depreciation of capital investments, financing mechanisms for residential building improvements and other financing innovations that facilitate the installation of cost-effective energy efficient technologies in buildings.
- To the extent that Congress adopts or extends tax incentives and other measures designed to improve energy efficiency, it should ensure that those measures are designed to overcome well-documented market inefficiencies, are applied only to technologies that have a credible pathway to unsubsidized competitiveness, and are finite in duration and eventually phased out in a predictable fashion.

Standards and Regulations

- States and localities should be encouraged to accelerate the adoption and implementation of energy efficient building codes on an ongoing basis, including the most recent nationally recognized energy efficiency standards for residential and commercial buildings.

- Adopt new cost-effective standards for home appliances, residential heating and cooling systems, and other products as jointly recommended by a group of key stakeholders, including energy consumers, technology suppliers, manufacturers and efficiency advocates.
- Support industry-led standards for energy efficiency, including ENERGY AWARE for residential and light commercial thermostats.
- Ensure that state legislatures and public utility commissions consider policies that promote investment in cost-effective energy efficiency measures, demand response measures and home energy management systems through a public and state regulatory approval process, and ensure that such investments are as profitable for utilities as generation and distribution assets.
- Congress should (1) direct the federal government to adopt a uniform buildings rating system; (2) ensure that all federal government buildings constructed, acquired or newly occupied after a certain date meet a minimum rating standard for energy efficiency; and (3) ensure that all government buildings currently owned or occupied meet a minimum rating standard for energy efficiency by 2020, provided that an ESCO or a similar entity is willing to finance the upgrades and guarantee the savings.

Information and Awareness

- Support technical assistance programs such as ENERGY STAR, the EPA Local Climate and Energy Program and the DOE Better Buildings Program.
- Establish a DOE "Supply Star" program to promote best practices and recognize companies and products that use highly efficient supply chains.
- Policymakers should support the deployment of cost-effective automated controls and energy management technologies and systems that make real-time energy consumption visible to industrial users, homeowners, building owners and tenants.
- Develop best practices for the advanced monitoring and management of energy use in federal facilities, buildings and equipment.

Other Recommendations

- Expand the use of ESPCs and UESCs in the federal government, as well as training and education for federal energy managers, policymakers and procurement/legal staff regarding the use and benefits of these contracts.
- Develop energy efficiency programs based on effective federal policy guidelines that can be cost-effectively implemented at the state level, and give states the flexibility to account for local differences in regulatory approaches.
- Establish an industry-government partnership to evaluate barriers to expanding electric vehicle charging and disposal infrastructure, such as installation costs, ownership and effective utility rate structures.
- Encourage government policies that promote energy efficiency and retrofit in residential and commercial buildings including proposals that (1) address mortgage lending regulators' concerns about PACE financing (PACE Assessment Protection Act of 2011); (2) encourage federal loan agencies to factor expected energy costs into the mortgage underwriting process for single family homes; and (3) encourage the use of ESPCs and other similar efforts for private commercial buildings.
- Congress and the Executive Branch should continue to support Corporate Average Fuel Economy (CAFE) rulemaking to improve motor vehicle fuel efficiency, subject to ongoing assessments of economic viability and public safety.
- Direct the National Institute of Standards and Technology (NIST) to develop model energy efficiency measurement, forecasting and accounting methodologies and planning protocols for consideration and possible use by load-serving entities, states and Regional Transmission Organization/Independent System Operators for resource adequacy planning activities.

V. Traditional Energy Production

For decades, traditional energy sources — including oil, coal and natural gas — have been the standard-bearer of the U.S. energy portfolio, and they will continue to play a crucial role in America's long-term energy strategy. Today, these energy sources supply more than 80 percent of U.S. energy demand.[49] Investment in traditional production promotes all three pillars of a successful energy strategy. Economically, sound investments in new technologies and processes such as horizontal drilling and hydraulic fracturing are unlocking new energy sources that create jobs, grow the economy, revitalize manufacturing and improve international competitiveness. From an energy security perspective, increased domestic production of oil, coal, natural gas and other traditional fuels is consistent with increased energy self-sufficiency and can help insulate U.S. consumers and businesses against global energy market disruptions. Finally, improvements in fossil fuel extraction and production methods are helping to reduce the environmental footprint of these fuels, and emerging carbon capture, utilization and storage (CCUS) technologies hold promise for further reducing the impact of traditional energy production on the environment.

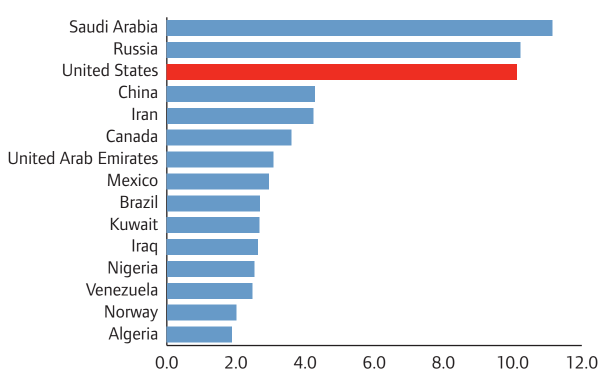
"Across the United States, from Pennsylvania to North Dakota, from West Virginia to North Texas, from Oklahoma to Ohio, affordable and reliable natural gas and domestically produced crude oil have helped strengthen and create jobs far beyond our industry."

— Rex W. Tillerson
Chairman & CEO
Exxon Mobil Corporation

Figure 5

Liquid Fuels Production by Country

Million Barrels per Day, 2011



Source: EIA (2012). International Energy Statistics.

America is experiencing a significant turnaround in domestic production of traditional fuels, led by crude oil and natural gas. Until recently, U.S. liquid fuels production had been declining — from its 1970 peak of 11.7 million barrels per day to 8.1 million barrels per day in 2005.[50] Yet since 2005, production has been rising[51] and has reached 10 million barrels per day due to increased supplies of offshore and "tight" oil extracted from shale resources.[52] Similarly, natural gas production has increased by 27 percent from 2005 levels due to new extraction technologies that have unlocked previously inaccessible gas reserves in shale formations.[53] The increased domestic production of traditional fuels has brought with it significant economic benefits. In 2009, the oil and natural gas industries added an estimated $1.1 trillion to the U.S. economy (representing almost 8 percent of GDP) and supported an estimated 9.2 million jobs.[54]

Even as increasing energy efficiency helps to reduce the growth in energy demand, and technological advances and economies of scale are reducing the cost of alternatives, the United States will continue to rely heavily on traditional energy resources to power our economy for many decades to come.[55] The EIA expects that oil, coal and natural gas will still supply 81 percent of the nation's energy needs in 2035.[56] According to the National Petroleum Council (NPC), under optimal conditions — including favorable regulations, technology improvements and access to key lands — the United States and Canada could maintain high levels of crude oil production through 2050.[57]

Future economic growth depends upon policies to encourage the development of new and existing oil, natural gas and coal resources. A study commissioned by the American Petroleum Institute estimates that, by 2030, such policies could generate an additional $800 billion in government revenue and produce 1.4 million jobs.[58] Likewise, a National Coal Council study estimates that advanced coal technologies, coupled with CCUS technologies for use in enhanced oil recovery could generate an additional $200 billion in economic activity and add 1 million jobs, while also reducing oil imports by more than 6 million barrels per day and substantially lowering carbon emissions.[59]

The energy renaissance has provided America with a tremendous opportunity. If harnessed correctly, increased development of the nation's traditional fuel resources can result in significant business investment and job growth and bring the nation closer to energy self-sufficiency, all while reducing GHG emissions and other pollutants. Realizing this long-term potential, however, will require a comprehensive, consistent and forward-looking national energy strategy that reflects current realities, addresses key barriers and capitalizes on future trends.

Trends in Traditional Energy Production

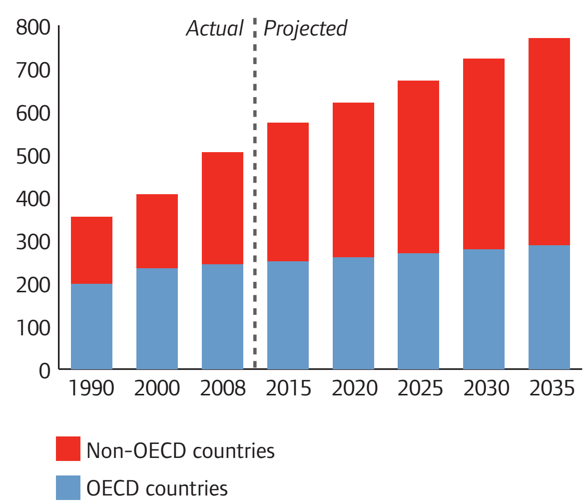
Global Energy Trends

According to EIA, worldwide energy consumption is expected to grow by 53 percent between 2008 and 2035, with the vast majority of growth expected to occur in countries that are not part of the Organisation for Economic Co-operation and Development (OECD).[60] Energy use in non-OECD nations is expected to rise from 52 percent of total world consumption in 2008 to 63 percent of world consumption in 2035.[61] Coal will continue to be the leading source of fuel for non-OECD energy consumption, with coal use expected to increase by 76 percent during this period in these countries.[62] Non-OECD demand for oil and natural gas is also projected to grow by 64 percent and 80 percent, respectively, from 2008 to 2035.[63]

Figure 6

World Energy Consumption by Region

Quadrillion BTU of Energy Consumed, 1990–2035



Source: EIA (2011). International Energy Outlook. *Figure 1.*

Meanwhile, EIA projects that energy demand in the OECD Americas will increase only modestly, by about 20 percent over this same time period (approximately

0.7 percent per year).[64] Yet even while demand is moderating, domestic production of key traditional energy resources is seeing significant gains, which are projected to continue. Recent oil and natural gas discoveries and the application of new recovery technologies — along with continuous improvement in reducing the costs of renewables — raise the possibility that North America could become energy self-sufficient and an important exporter of some fuels to the rest of the world in the coming decades.[65] These developments could fundamentally alter the foundation on which our energy policies have been based over the past 30 years.

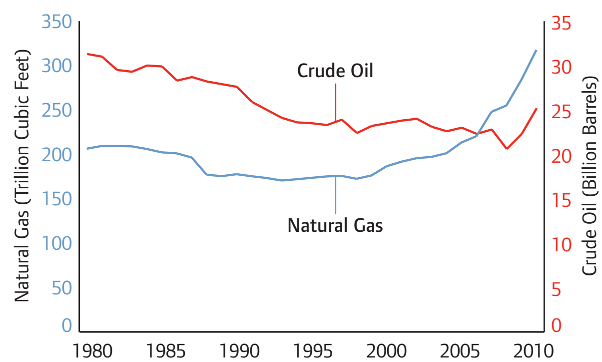
Oil and Natural Gas: Domestic Production and Import Dynamics

Beginning in the 1970s, conventional wisdom held that the United States was running out of oil and natural gas and faced the prospect of ever-growing oil and gas imports. Indeed, U.S. oil imports steadily increased until peaking in 2005,[66] and natural gas imports also grew steadily until reaching their peak in 2007.[67] Since that time, however, imports of both oil and natural gas have fallen sharply. Today, natural gas imports are lower than any time since 1992 and are expected to continue to decline,[68] while oil imports are at their lowest level since 1996.[69]

Figure 7

Total U.S. Proven Reserves

Trillion Cubic Feet of Wet Natural Gas and Billion Barrels of Crude Oil



Source: EIA (2012). "U.S. Crude Oil, Natural Gas, & Natural Gas Liquids Proved Reserves." Figure 1. (Crude oil includes lease condensate.)

Several factors have contributed to the reduction of oil and gas imports. Improvements in efficiency, a slow recovery from the 2008 financial crisis resulting in a reduction in demand, and increased use of domestic biofuels have all been contributing factors. However, dramatic gains in the domestic production of oil and natural gas have been the largest unanticipated factor in reducing U.S. fossil fuel imports.

The natural gas outlook has changed substantially since 2005. Vast new unconventional (shale and tight) resources have been unlocked as a result of advances in seismic imaging, horizontal drilling, hydraulic fracturing, well completion and other technologies. Increases in shale and tight gas have pushed natural gas production to an all-time high, surpassing levels last seen in the 1970s.[70] Moreover, shale gas production is expected to double from 2011 to 2035.[71] While production has increased substantially, significant new reserves have also been added. Today, the United States is estimated to have enough technically recoverable natural gas reserves to last more than 90 years at today's rate of consumption.[72] These new reserves have pushed natural gas prices to their lowest levels in more than a decade and have upended expectations that America will have to rely increasingly on imported liquefied natural gas (LNG) to satisfy its needs.[73] As noted by the NPC in 2011, "it is now understood that the natural gas resource base is enormous and that its development — if carried out in acceptable ways — is potentially transformative for the American economy, energy security and the environment, including reduction of air emissions."[74]

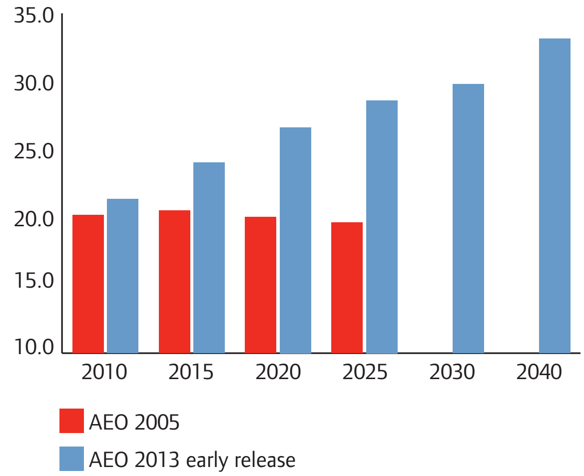
The advances in shale development technologies that have fundamentally transformed views regarding the natural gas resource base are also transforming the outlook for oil. Important discoveries like the Eagle Ford shale in Texas, the Niobrara shale in Colorado, the Utica shale in the Appalachian basin, and the Bakken shale in North Dakota and Montana are leading the way to increased domestic onshore oil production. According to EIA, oil production in the Bakken shale formation has increased more than four and a half times since 2005 (from slightly less than 100,000 barrels per day in 2005 to more than 460,000 barrels per day in September 2011) and is estimated to reach as much as 750,000 barrels per day by 2015.[75] In June 2012, EIA reported that U.S. crude oil production in the first quarter of 2012 topped 6 million barrels per day for the first time in 14 years.[76] In its latest long-term energy forecast, EIA projected that domestic crude oil production will increase from 5.7 million barrels per day in 2011 to 7.5 million barrels per day by 2020 — a level not seen since 1989.[77] According to the latest International Energy Agency World Energy Outlook, by 2017, the United States could rival Saudi Arabia as the world's top oil producer.[78]

In addition to realizing the potential of onshore oil and natural gas resources, advances in technology have extended our ability to drill and produce offshore oil and gas resources in ever-increasing water depths. U.S. jurisdictional waters hold an estimated 150 billion barrels of recoverable oil and natural gas resources,[79] the equivalent of more than 30 years of Saudi Arabia's oil and natural gas production.[80] Greater access to federal offshore areas currently unavailable for leasing, including the Eastern Gulf of Mexico, the Atlantic Coast, the Pacific Coast and Alaska, could provide opportunities for significant expansion of domestic energy development. The continuation of deepwater drilling activity in the Gulf of Mexico is vital to our nation's economic recovery and energy security as it accounts for more than 20 percent of U.S. domestic oil supply.[81] Working closely with the Department of the Interior, the offshore oil and gas industry has developed new containment and oil

Figure 8

Dry Natural Gas Production

Trillion Cubic Feet; Projections from AEOs 2005 and 2013 Early Release

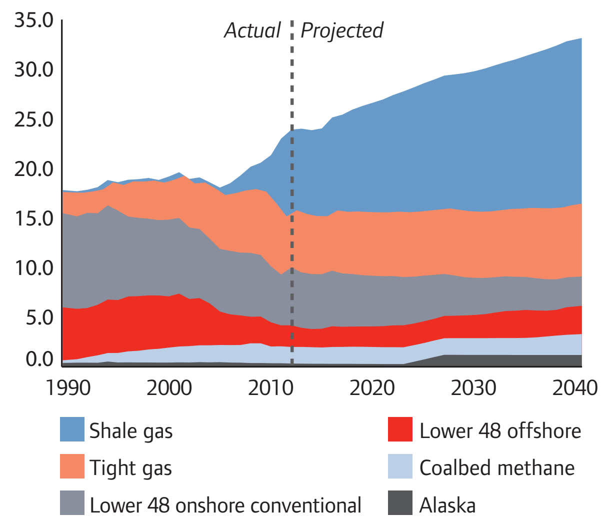


Sources: EIA (2005 and 2012). Annual Energy Outlooks 2005 *and* 2013 Early Release.

Figure 9

Natural Gas Production by Source

Trillion Cubic Feet, 1990–2040



Sources: EIA (2012). Annual Energy Outlook 2012. *Figure 107; and EIA (2012).* Annual Energy Outlook 2013 Early Release. *Table 14.*

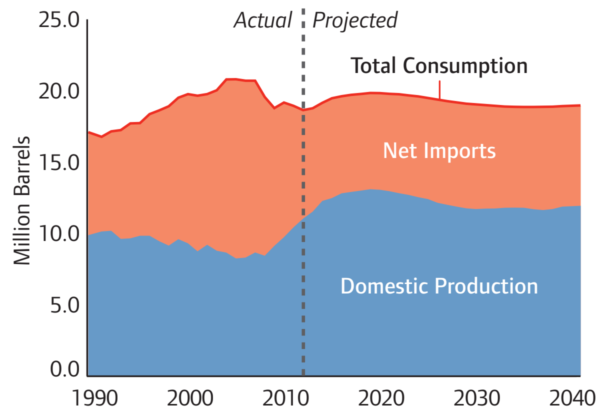
spill response equipment and procedures. With the advances in technology and the lessons learned from the 2010 Deepwater Horizon oil spill in the Gulf of Mexico, both industry and the Department of the Interior are confident that our offshore resources can be developed safely and help to ensure reliable, affordable U.S. energy supplies.[82]

While U.S. oil production is projected to increase, domestic demand is expected to remain relatively flat. According to a recent report by Citi, U.S. demand for petroleum products could fall by 2 million barrels per day over the next decade. This decline is on top of the 2 million barrels per day decline in oil demand that has already occurred since 2005, driven in part by the recession but also by increased fuel efficiency, demographic changes and an expanded biofuels market.[83]

Figure 10

U.S. Oil Production, Imports and Consumption

Million Barrels per Day, Oil and Other Liquid Fuels



Sources: EIA (2012). Annual Energy Review 2011. *Table 5.1a; and EIA (2012).* Annual Energy Outlook 2013 Early Release. *Table 11.*

These trends — modest economic growth, demographic changes, fuel economy improvements, increased use of biofuels and increased domestic production — are expected to reduce U.S. oil imports.[84] In its latest long-term energy outlook, EIA projects that U.S. net imports as a share of total U.S. liquid fuels consumed will drop from 45 percent in 2011 to 37 percent in 2035.[85] These Citi and EIA estimates are similar to published industry estimates that identify the same fundamental trends that are upending long-held assumptions about our energy security.[86] To the extent that projections regarding increased domestic oil production and reduced domestic oil consumption are realized, U.S. energy security is likely to improve during the next decade.

Natural Gas Supply and New Investment and Jobs in Domestic Manufacturing

The increased certainty regarding the size and accessibility of U.S. natural gas resources has changed the game for domestic manufacturing by creating a reasonable expectation of long-term natural gas supply at competitive prices. In the near term, expanding domestic natural gas production has pushed down natural gas prices, providing a large measure of relief to energy-intensive manufacturers. In a recent study, PricewaterhouseCoopers predicts that full-scale shale gas development through 2025 could lower feedstock and energy costs, reducing U.S. manufacturing expenses by as much as $11.6 billion per year.[87] The benefits of cost-competitive domestic energy supplies could add 1 million manufacturing jobs to the U.S. workforce by 2025.[88]

The U.S. chemical industry relies on hydrocarbon feedstocks for many products, and the prospects for long-term stable supplies and lower prices for natural gas are improving the industry's competitiveness. Ethane, a gas liquid associated with the production of certain liquids-rich natural gas, is one of the most important of these feedstocks. The American Chemistry Council (ACC) has projected that a 25 percent increase in ethane supply (a realistic assumption given dramatic natural gas production increases) would create 17,000 high-paying jobs in the U.S. chemical industry and 395,000 additional jobs outside the industry.[89] The ACC noted that these projected benefits have been corroborated by trends in the chemical industry, with Dow Chemical Company, ExxonMobil, Shell Chemical, LyondellBasell, Bayer MaterialScience and others announcing new investment in U.S. petrochemical capacity to take advantage of a more stable supply of resources.[90]

"Fueled by the prospect of competitively priced energy, U.S. manufacturers are reinvesting in America at record levels. Ensuring that manufacturing industries will continue to have access to reliable and affordable energy supplies is critical to maintaining competitiveness in the global marketplace."

— Stephen R. Wilson
Chairman, President & CEO
CF Industries

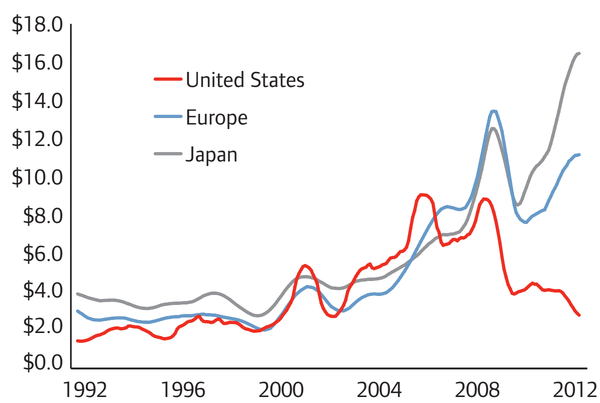
Lower natural gas prices are also ushering in a renaissance for the U.S. nitrogen fertilizer industry, which manufactures critical plant nutrients directly from natural gas. The availability of nitrogen fertilizers is essential to North American and global food security and will become even more so as the global population continues to rise. For the first time in decades, U.S. nitrogen fertilizer companies are bringing capacity back online and considering new domestic investments in world-scale production facilities.[91] Not only will these investments provide good jobs in construction and manufacturing, but they also will expand the availability of competitively priced nitrogen fertilizers for U.S. and world farmers and will play an essential role in helping to feed billions of people.

A recent report by Citi highlights the important role domestic shale gas resources could play in spurring future industrial job growth in the United States: "The shale gas production boom that propelled the fundamental change in the natural gas markets in the U.S. could begin to transform other sectors, including power generation and transportation. Other incremental gains could come from LNG exports with North America acting as the swing supplier to the world. But the most momentous change looks likely to be in the re-industrialization of America based on dramatically lower cost feedstock than is available anywhere in the world with the possible exception of Qatar. The economic consequences from this supply and demand revolution are potentially extraordinary."[92] Specifically, Citi estimates that, by 2020, the impact of increased output, reduced consumption and multiplier effects could range from $370 to $624 billion (in 2005$), boosting real GDP by 2.0 to 3.3 percent.[93]

Figure 11

United States vs. Global Natural Gas Prices

Nominal U.S. Dollars per Million BTU (12-Month Moving Average)



Source: World Bank (2012). "Prospects: Commodity Markets." Historical Data.

While increased domestic supplies of natural gas have the potential to improve the competitiveness of certain U.S. manufacturers, the extent of this improvement will depend on the future development of global natural gas markets. For some industries, the thermal-equivalent price differential between oil and natural gas (and their derivatives) represents a significant U.S. competitive advantage. As discussed below, increased shale gas production has raised the prospect that the United States could become a net natural gas exporter. Some stakeholders, particularly energy-intensive manufacturers, are concerned that exports of large volumes of LNG will place upward pressure on domestic natural gas prices and offset improvements in competitiveness.[94]

Lower natural gas prices occasioned by increased natural gas production are also having an unexpected effect on electricity prices. The Federal Energy Regulatory Commission's latest *State of the Markets* report found that despite an exceptionally warmer-than-normal summer, power prices were down in most areas of the United States in 2011, primarily due to lower natural gas prices.[95] While it is unclear whether these trends will continue, lower electricity costs will benefit homeowners as well as commercial and industrial users.

Potential for Increased Natural Gas and Petroleum Product Exports

Increasing natural gas and oil production has raised the prospect that the United States could become a net exporter of LNG and petroleum products. The Natural Gas Act requires a license to export LNG, which DOE is obligated to issue unless, after a public notice and opportunity to comment, it finds that the export is not in the public interest. With respect to petroleum products, the United States has one of the most modern, efficient and competitive refining industries in the world. Indeed, the United States recently became a net exporter of refined petroleum products for the first time in six decades.[96] In light of moderating domestic demand, increasing domestic supply and a highly competitive refining industry, the United States is likely to have additional opportunities to expand petroleum product exports in the coming years.

Coal

For decades, coal has served as the workhorse fuel of the electric power industry. According to EIA, approximately 93 percent of U.S. coal consumption is in the electric power sector, with the balance primarily used to produce cement and steel.[97] The existing coal generating fleet enables commerce, manufacturing and an electricity supply that is affordable, abundant and stable. Yet despite coal's relatively low cost, historically low natural gas prices and more stringent environmental regulations are, in some cases, creating cost advantages for natural gas as an electric generation fuel. As a result of these current conditions, combined cycle natural gas is displacing some coal-fired generation.[98] Between 2002 and 2011, coal's share of total electricity generation declined from 51 percent to 44 percent, while natural gas combined cycle generation increased from 10 percent to 20 percent.[99] However, despite the short-term pressures created by historically low natural gas prices, coal still maintains a fuel cost advantage for large baseload plants in certain locations and also provides key fuel diversity and reliability benefits.

EPA regulatory policies have profoundly affected the use of coal in the electric power industry. During the past year, EPA has either finalized or proposed a number of rules aimed at coal-fired power plants. For instance, EPA finalized the Cross-State Air Pollution Rule (though it was recently vacated by the U.S. Court of Appeals for the D.C. Circuit) and the Mercury and Air Toxics Standards (MATS, or utility MACT).[100] EPA has also proposed GHG new source performance standards (GHG NSPS) for electric generating units, coal combustion residuals regulation under the Resource

Conservation and Recovery Act, and cooling water intake regulations under section 316(b) of the Clean Water Act (which will affect all thermal plants). The net effect of these regulations will be to hasten the retirement of some older, smaller, less controlled and less efficient coal-fired electricity generating units.[101]

Furthermore, the proposed GHG NSPS regulation, as currently written, would require new coal generation facilities to use CCUS technology, which has not been economically demonstrated at scale. Significant legal and regulatory issues must also be resolved before CCUS technology is commercially deployed at scale. (Note: Additional information on CCUS technology is presented in "Chapter VII: Electric Power Generation, Transmission and Distribution.")

Although the combination of EPA regulations and competitive natural gas prices has placed pressure on domestic coal consumption, exports of both thermal and metallurgical coal have enjoyed robust growth. Between 2003 and 2008, world coal consumption increased by 30 percent, primarily as a result of coal demand in China, which increased 71 percent over the five-year period.[102] EIA expects these trends to continue, noting that coal will continue to be an important fuel source, especially in non-OECD Asia, where demand is likely to be supported by large domestic coal reserves and rapid economic growth.[103] EIA also forecasts that world net coal-fired generation will grow by 67 percent from 2008 to 2035.[104] As a result, U.S. coal exports are projected to increase by roughly 80 percent during the same period.[105]

A broad portfolio of traditional energy resources, including coal, will remain essential to U.S. economic success and job creation.

Barriers to Investment in Traditional Energy Production

Access to Federal Lands

Much of the recent increase in oil and natural gas production is occurring on privately owned lands, not lands controlled by the federal government. According to a recent study by the Congressional Research Service, approximately 96 percent of the increase in domestic oil production since 2007 took place on nonfederal lands.[106] Over the same time period, oil production on federal lands increased only slightly.[107] Federal offshore production declined in 2010 and 2011 as a consequence of the moratorium placed on new offshore drilling in the Gulf of Mexico in the wake of the Deepwater Horizon accident. While activity in the Gulf is returning to normal, it will take some time before production increases to the levels anticipated before the moratorium. EIA estimates that actual Gulf output in 2012 will be 29 percent lower than pre-moratorium projections.[108]

The development of traditional energy supplies is being hindered by limited access to promising onshore and offshore resources, as well as permitting delays. The entire Atlantic and Pacific Coasts, nearly all of the Eastern Gulf of Mexico, and the majority of offshore Alaska remain off-limits to leasing and exploration. In addition, federal permitting delays have prevented the development of the few promising Alaskan offshore leases that were auctioned in 2008.[109] Currently, 60 percent of federal onshore lands are either off-limits or subject to significant access restrictions.[110] According to the Bureau of Land Management (BLM), federal onshore lands hold an estimated 30.5 billion barrels of oil and 231.0 trillion cubic feet of natural gas,[111] which is equivalent to approximately 15 years of current U.S. crude oil production and 10 years of current U.S. natural gas production.[112] In addition, 87 percent of federal offshore lands are currently unavailable for oil and natural gas leasing and development.[113]

EPA Regulations

As noted previously, existing coal capacity will be adversely affected by EPA's recently finalized and proposed regulations. In addition, if EPA's proposed GHG NSPS regulations are finalized in their current form, new coal units will be required to have CCUS technology. Although EPA's proposed GHG NSPS regulations apply only to new electric generating units, EPA is required under the Clean Air Act to also regulate GHG emissions from existing power plants and those undergoing substantial modification. Depending on the stringency of these anticipated regulations, there could be additional impacts. At a minimum, additional investment and compliance costs will be incurred. Yet it is also possible that these regulations could, by reducing the diversity of available energy resources, cause the costs of other traditional energy resources to rise, resulting in negative impacts on manufacturing, transportation, agriculture and other energy-intensive economic sectors.

Additional EPA regulations are anticipated regarding other aspects of the energy sector, including the refining, exploration and production processes. New air quality standards for fine particles, tighter ozone standards, a new refinery GHG NSPS and rules pertaining to cooling water intake structures are anticipated in the next two years. Depending on their stringency, these regulations could increase compliance costs and make some existing capacity uneconomic.

Recently Finalized and Proposed EPA Regulations Affecting the Energy Industry

- Utility MACT/National Emissions Standards for Hazardous Air Pollutants (NESHAP) for mercury and air toxics
- Cement MACT/NESHAP for cement kilns
- Mandatory reporting of GHGs
- National Ambient Air Quality Standards (NAAQS) for SO_2
- Industrial boiler MACT/NESHAP for major source and area source
- Commercial/Industrial Solid Waste Incinerators Rule
- Cooling Water Intake Structures Rule
- Coal Combustion Product Regulation (i.e., Coal Ash Rule)
- New source performance standards for GHGs (utilities)
- New source performance standards for GHGs (refineries)
- National Ambient Air Quality Standard for fine particles (PM 2.5 NAAQS)
- Updates to Regional Haze Rule

New Federal Regulation of Hydraulic Fracturing

Oil and gas operations are subject to a combination of state and federal regulations, which are complemented by industry-recommended practices and standards. State agencies have the primary role in many regulation and enforcement activities, leveraging their experience and local knowledge necessary for effective implementation. The federal government also plays an important role in the regulatory framework for oil and gas through EPA regulation of air, water and waste and the Department of the Interior's BLM regulation and permitting of oil and gas development occurring on federal onshore lands.

In recent years, many states have updated and strengthened their regulation of hydraulic fracturing, including well integrity testing, fracturing fluid ingredient disclosure and fracturing liquids disposal. In addition, both EPA and BLM are considering new regulation of hydraulic fracturing. EPA recently finalized a suite of new regulations for the oil and natural gas industry, including the first federal air standard for wells that are hydraulically fractured. These regulations include a new source performance standard for volatile organic compounds, a new source performance standard for sulfur dioxide, an air toxics standard for oil and natural gas production, and an air toxics standard for natural gas transmission and storage.[114]

Further, EPA has announced that it intends to propose a rulemaking on disposal of fracturing water and fluids from shale gas extraction operations in 2014.[115] EPA also announced a rulemaking on fracturing fluid chemical reporting under the Toxic Substances Control Act and is in the midst of a long-term study on the impact of hydraulic fracturing on ground water and drinking water. A recently released progress report has outlined the framework of the study, but results are not expected to be released until 2014.[116]

BLM has proposed regulations for hydraulic fracturing on the federal lands it administers. These regulations require fracturing fluid ingredient disclosure and new well integrity measures.[117] Because of the sheer number of federal regulatory initiatives potentially affecting hydraulic fracturing, in early 2012 the Business Roundtable discussed with the President the notion of having a single point of contact within the White House to help ensure that Executive Branch regulatory activities regarding hydraulic fracturing are well coordinated, not overly burdensome and not duplicative. On April 13, 2012, the President issued an Executive Order establishing an interagency working group of relevant agencies that should help ensure better coordination of such regulatory activities.[118]

While this working group is a step in the right direction, it will be important to ensure that any future federal regulations applicable to hydraulic fracturing are consistent with industry best practices and not duplicative or inconsistent with state regulations.

Difficulty in Permitting Infrastructure

The federal government's permitting process is fraught with complexity, redundancy and uncertainty, creating a business environment that discourages large-scale capital investments and impairs job creation.[119] Large-scale energy projects, often requiring dozens of federal permits, are particularly susceptible to redundant, conflicting and unnecessary permitting delays. In addition, litigation over these permits adds another layer of delay and uncertainty that may threaten the viability of a project. As discussed in previous Business Roundtable documents, any comprehensive, long-term energy policy should address the regulatory, permitting and judicial review barriers that stand in the way of sensibly developing the nation's energy resources.[120] Such reforms can significantly accelerate beneficial energy development while maintaining the nation's commitments to public health and environmental quality.

Policy Recommendations To Enhance Traditional Energy Production

Access to Promising Resources

- Congress and the Executive Branch should increase access to onshore and offshore federal lands — focusing on the most promising areas, including oil and natural gas resources located in the Eastern Gulf of Mexico, the Atlantic Coast, the Pacific Coast and Alaska — to ensure reliable supplies of coal, oil and natural gas in the coming decades.

Permitting and Approval

- Congress and the Executive Branch should streamline permitting processes, including judicial review, to substantially lower the anticipated and unanticipated costs of investing in, producing, processing and transporting energy resources, while continuing to ensure public health, environmental quality and safety.
- The Executive Branch should ensure the expeditious approval of infrastructure projects, such as the Keystone XL pipeline and other privately funded infrastructure projects, pursuant to a predictable regulatory framework, to support increased domestic production and provide access to world energy markets.

Regulation of Onshore Oil and Natural Gas Exploration and Development

- Onshore oil and gas exploration and development is currently subject to a combination of federal and state regulations. Any proposal to promulgate new or expanded federal regulations should be weighed against the fact that the states traditionally have had the pre-eminent role in regulating oil and natural gas activity on nonfederal lands. The states have responded to the recent increased oil and natural gas development by updating their rules and the effectiveness of their regulatory programs. This regulatory approach has worked well and should continue to be the model applied for ongoing and future activity.
- BLM regulates oil and gas activities on federal lands but historically has worked closely with the relevant state authorities. New federal regulation of oil and natural gas activities on federal lands located within a state should be developed in consultation with states and be consistent with state regulations.
- Where regulatory authority overlaps, the Executive Branch should avoid promulgating conflicting or duplicative regulations and should work with the states and industry to ensure that the development of oil and natural gas occurs responsibly.

Regulation of Coal Development and Exports

- Federal regulation of coal production on federal lands located within a state should be deferential to and consistent with state regulations.
- Where regulatory authority overlaps, the Executive Branch should avoid promulgating conflicting or duplicative regulations and should work with the states and industry to ensure that coal production occurs responsibly, and states should continue to have the pre-eminent role in regulating coal production.
- The federal government and states should streamline the process for developing new and expanded port facilities to expand opportunities for coal and other materials exports. Permitting should include deadlines for completing study, and regulations should be promulgated that clearly define the parameters of any studies required for permitting and other approvals.

EPA Regulations

- EPA regulations should be based on sound science; undergo thorough net cost-benefit analysis; and take into consideration the net cumulative impact these regulations have on energy costs, economic growth and job creation, while being protective of human health and the environment. Adequate, affordable and reliable domestic energy supplies depend on rational EPA regulations and guidance.

Carbon Capture, Utilization and Storage (CCUS) Technology

- Congress and the Executive Branch should direct DOE and other appropriate agencies to pursue a comprehensive program that invests in research and development to focus on technologies and practices that lower the cost of CCUS technologies. This should include legal and regulatory reform and research and development investments in CCUS.
- Congress should fund projects to demonstrate the viability of CCUS technologies at commercial scale. Funding should be provided for a finite timeframe and limited to the minimum number of plants needed to determine whether the technology has a credible pathway to unsubsidized competitiveness.

VI. Renewable Energy Production

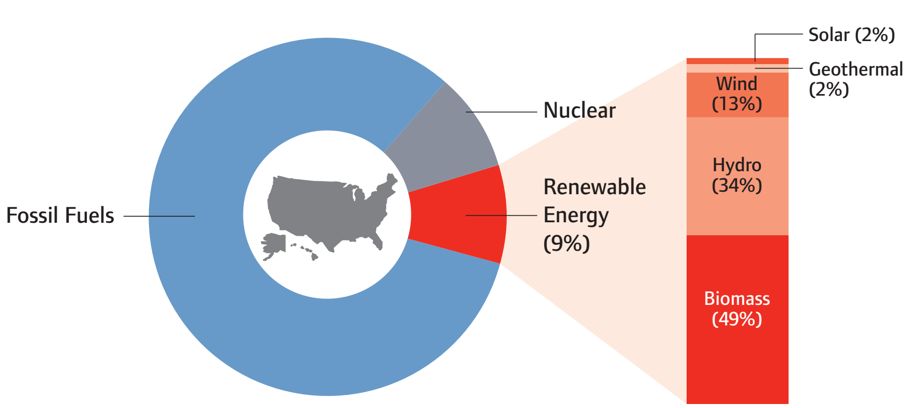
America is endowed with abundant renewable energy resources. Successfully harnessing and integrating these resources into the nation's energy portfolio is a key component of a successful long-term energy policy. In addition to serving as an important source of domestic economic activity and job creation, cost-effective investments in renewable energy have the potential to diversify the nation's energy portfolio and thereby reduce its exposure to disruptions in global energy markets. Furthermore, greater deployment of renewable energy sources is a key pathway for reducing criteria pollutants and GHG emissions.

"Overdependence on any one fuel will put our future economy at risk. America must keep clean coal, natural gas and nuclear fuel in the mix for electricity generation while supporting expanded renewable development and energy efficiency."

— Nicholas K. Akins
President & CEO
American Electric Power

Renewable energy makes up about 9 percent of total U.S. energy consumption, and it is used for both electricity generation and transportation fuels. Hydropower, wind, solar and geothermal power are used primarily for electricity generation and together account for just over half of U.S. renewable energy consumption. The remaining 49 percent comes from biomass, which is used for both electricity generation (in the case of wood and biomass waste) and transportation fuels (in the case of biofuels).[121] Worldwide, biomass accounts for more than 10 percent of the global primary energy supply and is the world's fourth-largest source of energy.[122]

Figure 12
Primary Energy Consumption by Source
Percentage of Total Energy Consumption, 2011



Source: EIA (Nov 2012). Monthly Energy Review. *Table 1.3.*

The United States has made great strides in the development of renewable energy sources over the last two decades. America has become a global leader in renewable electricity production, ranking first in electricity generation from non-hydroelectric renewable energy[123] and trailing only China in total renewable power capacity.[124] Hydroelectric generation currently accounts for about 8 percent of total electricity generation,[125] while electricity generated from non-hydroelectric renewable energy sources has more than doubled since 1990 and now constitutes almost 5 percent of net electricity supplied.[126]

America is also a global leader in renewable transportation fuels, including, but not limited to, ethanol and biodiesel. In 2011, the United States accounted for 63 percent of global ethanol production and surpassed Germany, Brazil, Argentina and France to become the world's top producer of biodiesel.[127] U.S. production of first-generation (i.e., corn-based) ethanol has more than tripled since 2005, while biodiesel production has grown tenfold.[128] The United States is also pursuing commercialization of advanced biofuels (e.g., cellulosic and algae-based fuels), which use agricultural waste, nonfood crops and less arable land, and thus have the potential to address the sustainability concerns associated with first-generation fuels.

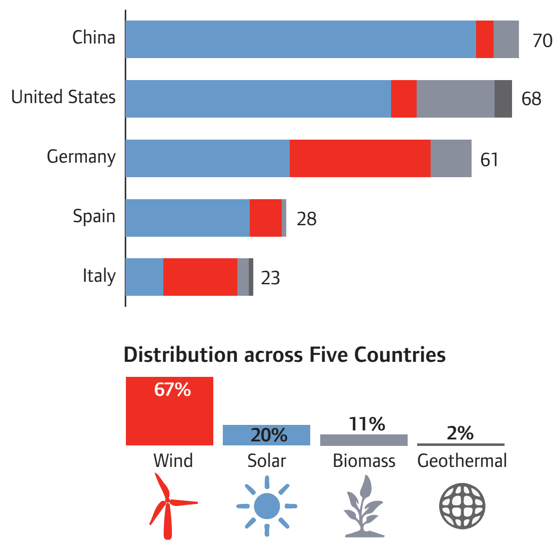
Looking forward, experts project that the domestic renewable energy industry will continue to experience solid growth in the next 20 years. For instance, EIA forecasts that non-hydroelectric renewable generation will grow by roughly 4 percent per year during the next two decades[129] and that domestic production of renewable transportation fuels will grow by 37 percent during this same period.[130]

Successfully developing and integrating these resources into the nation's energy portfolio will, however, require a long-term energy policy framework that recognizes emerging trends and addresses key barriers to investment in renewable energy production, distribution and use. Such a framework should include policies that support the precommercial development of renewable energy resources and provide investors with predictable regulatory and financial environments, with the objective of transitioning renewable energy to a state of unsubsidized competitiveness.

Figure 13

Renewable Power Capacity, Top Five Countries

Total Gigawatts of Nonhydro Renewable Power Capacity, 2011



Source: REN21 (2012). Renewables Global Status Report. *Table R2.*

Trends in Renewable Electricity Production

Production and Materials Costs

Production and materials costs for some renewable energy sources have declined significantly during the past decade. For instance, the price of photovoltaic (PV) solar panels fell roughly 75 percent from 2008 to 2012, in large part due to flattening cost curves for polysilicon and other key inputs, as well as increasing global production capacity.[131] Furthermore, the underlying costs of manufacturing PV solar panels are projected to drop by as much as 10 percent per year through 2020, in part due to increased standardization and industry consolidation.[132] Yet despite these cost reductions, the levelized cost of a new solar PV facility in the United States is still substantially higher than conventional electricity generation options — by a factor of 1.5 for coal and almost 2.5 for natural gas.[133]

The costs associated with wind power have also declined in recent years. Following a period of cost increases from 2003 to 2008, the average price of a wind turbine has declined by 20 to 30 percent due to lower labor costs and material prices, among other factors.[134] In addition, technological advancements have improved performance and increased energy production from wind resources. Bloomberg New Energy Finance estimates that every doubling of installed onshore wind turbine capacity results in economies of scale and supply chain efficiencies that can reduce turbine manufacturing costs by 7 percent. Operations and maintenance costs have declined nearly 80 percent since the 1980s as operators have become more experienced and the quality of wind turbines has improved.[135] Similarly, the cost of electricity from onshore wind turbines is projected to decrease by 12 percent over the next five years due to declining equipment costs, efficiency gains, technological advancements and increased competition (although the cost of offshore wind is still significantly higher than onshore wind).[136]

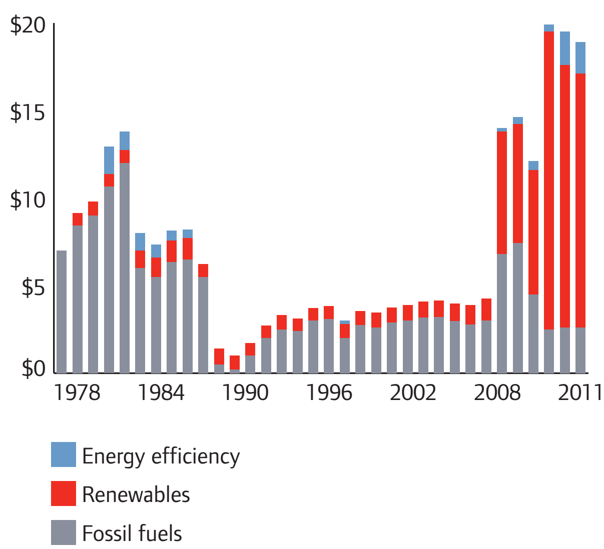
Hydroelectric Power

Hydroelectric power is the largest source of renewable electricity in the United States, accounting for 62 percent of renewable generation in 2011.[137] It often provides a more cost-effective option for generation, as it typically offers the lowest levelized cost among renewable electricity sources. Because it does not require back-up generation or energy storage, hydropower offers low operating and maintenance costs relative to other primary energy sources and can provide important ancillary services necessary to integrate intermittent renewables (e.g., wind and solar) into the electric grid. However, much like wind and solar power, hydropower requires higher capital costs than fossil fuel and other renewable sources.[138]

Figure 14

U.S. Energy-Related Tax Incentives

Billions of 2011 Dollars



Sources: CBO (Mar 2012); Joint Committee on Taxation (Jan 2012). JCS-1-12; and OMB (Feb 2012). Budget of the U.S. Government FY 2013.

Federal Incentives for Renewable Electricity Production

The 2008 financial crisis and ensuing economic downturn, and the subsequent influx of federal dollars intended to stimulate the economy, have had a significant effect on renewable electricity investment. Federal incentives for renewable electricity were more than seven times greater in 2010 than in 2007; approximately $8 billion in incentives was provided for renewable electricity in 2010, including $6 billion through the American Recovery and Reinvestment Act. The solar and biomass industries each received more than $1 billion in spending, while wind power received almost $5 billion — up from just $0.5 billion in 2007.[139] However, the ramp-up in federal spending on renewable energy following the financial crisis has been followed by a more constrained fiscal environment in which continued government support for renewable energy is uncertain.

Natural Gas Prices

Natural gas is a major source of energy for businesses and consumers, and the recent decline in natural gas prices has altered the relative competitiveness of renewable energy resources. Although low natural gas prices benefit the economy in many ways via lower energy costs, they also reduce the economic incentive to invest in renewable electricity generation and raise the bar for grid parity. Due to low natural gas prices, EIA projects that gas-fired power plants will maintain a cost advantage over many renewable electric power generation technologies for years to come and therefore will account for a significant share of new electricity production capacity.[140]

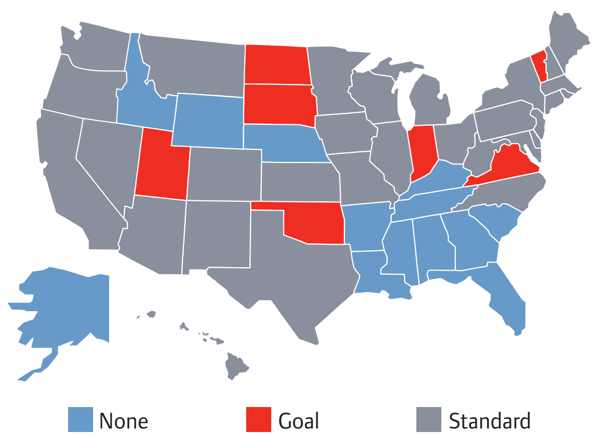
State Renewable Portfolio Standards

One of the key drivers of growth in renewable energy generation over the past decade has been the adoption of state Renewable Portfolio Standards (RPS), Clean Energy Standards and Alternative Energy Portfolio Standards, which require a certain portion of a state's electricity to be generated from renewable sources.[141] In total, 30 states and the District of Columbia have mandated an RPS or similar standard, and although the specific goal varies from state to state, most call for renewable energy sources to comprise between 10 and 30 percent of total electricity generation in the next 10 to 20 years.[142] In 2010, states with a mandatory standard produced nearly 13 percent of their electricity using renewables (including hydro), while states without a standard produced less than 7 percent from renewables.[143]

Figure 15

State Renewable Portfolio Standards and Goals

Mandatory Standards and Voluntary Goals



Source: EIA (Jan 2012).

Federal Environmental Regulation

In addition to state regulations, federal standards have affected renewable electricity use. Since 2009, EPA has issued a number of regulations that directly affect industries that use industrial and utility boilers for combustion-based electricity production, particularly coal-fired power generation. Proposed and finalized regulations covering mercury, ozone, sulfur dioxide, coal ash, particulate matter, GHG emissions, regional haze and cooling water intake structures are likely to increase the costs of producing energy from coal and other fossil-based fuels.[144] For some older coal-fired plants, the combined cost of complying with these rules will result in the retirement of some existing coal-fired generation.[145] Although the regulations also apply to power generation from biomass and waste-based renewable fuels (and will increase costs for those sources), the EIA forecasts that other renewable energy sources, along with combined cycle natural gas, will play increased roles in replacing this retired capacity.[146] Other industries (e.g., forest products, chemicals, primary metals and glass) will be similarly affected by EPA regulations, as many currently generate their own power using boilers or process heat production and are sensitive to retail electricity prices.

DOD's Green Initiative

As the nation's largest energy consumer, DOD has enormous purchasing power. Facing large fuel cost increases,[147] DOD has undertaken several initiatives to reduce its dependency on fossil fuels by shifting to renewable sources for a portion of its stationary energy demands and to second-generation renewable fuels for automotive, aviation and ship use. For example, DOD established a strategic goal of diversifying and developing new energy sources suitable for field use, including the testing, development and use of alternative energy sources, such as solar power, that can be generated near troop deployments.[148] In 2012, President Obama announced a DOD commitment to deploy 3 gigawatts of solar, wind, biomass and geothermal energy in Army, Navy and Air Force installations by 2025.[149] These efforts encourage renewable power development, and their ultimate success depends on the ability of new technologies to meet scalability, performance and economic expectations.

Barriers to Investment in Renewable Electricity Production

Policy Uncertainty

Significant policy uncertainty exists regarding the future of the renewable electricity production and investment tax credits. One federal incentive, the renewable electricity production tax credit (PTC) for wind energy, was enacted in 1992 and is scheduled to expire at the end of 2013.[150] According to EIA, the PTC has contributed significantly to the expansion of the wind industry over the past 10 years, and historical data show that new wind installations decrease during periods when the PTC has been allowed to lapse.[151]

Similar credits and incentive programs for biomass, geothermal, landfill gas, municipal solid waste and qualified hydroelectric generation are also scheduled to expire at the end of 2013. Another federal incentive that faces an uncertain future is the energy investment tax credit, which provides a 30 percent tax credit for solar, fuel cells and small wind projects and is set to expire in 2016. The uncertainty surrounding incentives for renewables discourages investment and complicates long-term planning, as many generation developers may choose to postpone decisions about expanding their renewable capacity until policymakers provide more clarity about the government's future level of support.

Cost Competitiveness

As is common with relatively new technologies, cost competitiveness remains a key barrier for many renewable electricity generation options. Some of these higher costs are related to intermittency and transmission barriers faced by wind and solar energy in some regions. For example, just as with traditional generation sources, wind and solar power investments can require additional investments in transmission infrastructure. Furthermore, wind and solar require back-up generating capacity or energy storage.[152] The competitiveness gap sometimes created by the additional back-up and energy storage costs has been exacerbated by increasing natural gas supplies, which have placed downward pressure on natural gas prices and improved the relative competitiveness of gas-fired generation.

In part due to these factors, the utility industry's optimism about the expanded role of renewables has somewhat diminished. In a survey of industry professionals, the proportion of respondents who believe that solar and wind will comprise more than 10 percent of their utility's generation by 2015 declined from 46 percent in 2011 to 38 percent in 2012.[153] Although technological advances and declining costs have narrowed the competitiveness gap for some technologies, additional improvements are needed to achieve unsubsidized grid parity for renewables in the long run.[154]

Transmission and Distribution Infrastructure

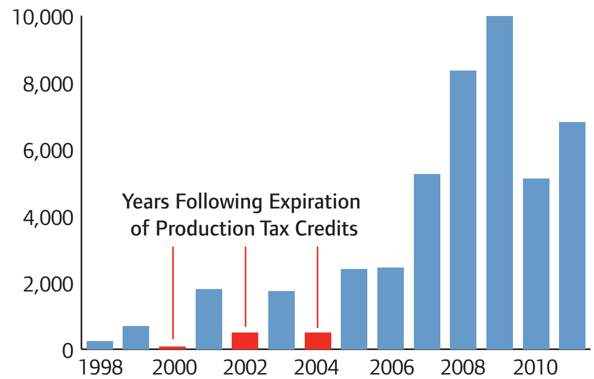
The current U.S. energy transmission and distribution infrastructure often poses a challenge to the delivery of renewable energy in the form of electricity. Optimal wind and solar resources are located far from load centers in certain western states, and as such the energy produced from these resources must be transmitted significant distances before it can be distributed to users. However, some of the nation's regions lack the transmission infrastructure necessary to efficiently and cost-effectively deliver wind and utility-scale solar resources to load centers, presenting significant challenges to integrating large-scale, centralized renewables with the grid.

Technologies such as high voltage direct current are being developed to help transmit renewable power more efficiently.[155] However, expanding the transmission system brings problems of its own, as using very long transmission lines tends to cause technical problems, and the construction of interstate transmission lines and facilities requires cooperation from multiple states and federal agencies.[156] (Note: Additional information on barriers to improving the U.S. energy transmission infrastructure is located in "Chapter VII: Electric Power Generation, Transmission and Distribution.")

Figure 16

U.S. Installed Wind Capacity by Year

Megawatts

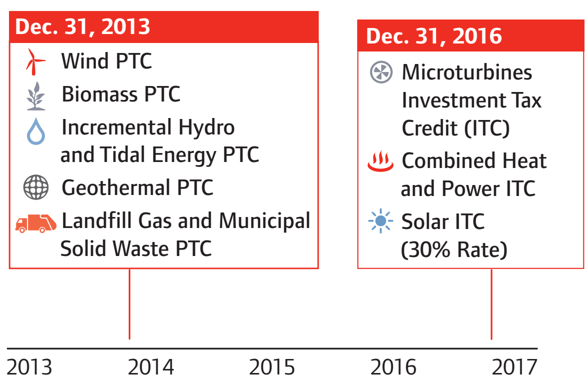


Sources: AWEA (2008). Annual Wind Power Outlook; *AWEA (2010).* Wind Technologies Report. *Table 4; and AWEA (2012).* Industry Market Report.

Figure 17

Expiration of Renewable Tax Credits

Date of Expiration



Source: Molly Sherlock (Apr 2012). "Impact of Tax Policies on the Commercial Application of Renewable Energy Technology." House Testimony.

Intermittency

Further compounding the electricity transmission capacity issue in some regions of the United States is the fact that wind and solar technologies are intermittent generators of electricity, which can complicate resource planning and contribute to grid instability. For instance, wind energy typically peaks at night, when electricity demand is lowest, though it may be available at various times throughout the day. In contrast, solar energy typically peaks in the middle of the day, when electricity demand is relatively high, but it is unavailable at night and varies depending on weather conditions. In addition, as system demands change and new technologies, such as electric vehicles, are deployed, utilities may experience multiple peaks throughout a day.

There are several ways to address the intermittency factor involved in wind and solar generation — including back-up generation capacity, automated demand response (ADR) technology and energy storage technologies. Back-up capacity involves bringing an alternate energy source (e.g., natural gas, coal or hydro power) online during periods of high demand. To plan for peak capacity, wind power typically needs to be backed up at a level of 90 percent of its installed capacity, which substantially adds to its total costs.[157] In addition, ADR can help mitigate intermittency challenges, as noted in a June 2012 DOE study.[158] Pilot programs are now under way to test the capabilities of ADR in integrating intermittent renewable energy sources into the electrical grid.[159] Lastly, energy storage technologies can help alleviate the intermittency barrier by reserving the energy produced in low demand periods and delivering it during high demand periods. These technologies include capacitors, batteries and superconducting magnetic devices for short discharge durations and hydro-pumped storage and compressed air energy storage for long discharge durations. These storage facilities may require long lead time for development, permitting and construction, which necessitates early action to ensure sufficient flexible storage resources.[160] Whether it be through more flexible backup resources, ADR or energy storage technologies, overcoming the intermittency barrier will be critical to efficiently integrating substantial additions of wind and solar resources into the grid.

Land Use Policies

Renewable electricity generation offers favorable environmental attributes and a lower overall environmental footprint, including fewer criteria pollutants and GHG emissions, than traditional energy sources. However, as the wind and solar industries have grown, some stakeholders have expressed land use concerns regarding large-scale solar arrays and wind farms.[161] For example, some solar projects have been delayed and costs have risen due to the need to study the potential impacts on wildlife habitats.[162] Onshore wind farms sometimes require large swaths of land and have been reported to cause damage to bird populations in some areas,[163] while offshore wind farms can generate resistance from local stakeholder groups due to environmental and aesthetic concerns.[164]

In addition, hydroelectricity faces land use and environmental restrictions that make it unlikely that new large capacity hydroelectric generating facilities will be built in the United States.[165] However, a study by Navigant Consulting has identified significant growth potential in hydropower through a variety of means that do not require the creation of new dams. For instance, efficiency measures, capacity upgrades at existing facilities, and efforts to increase pumped storage and generation at existing non-power dams could substantially boost installed capacity by 2025.[166] With the right policies in place, hydroelectric generation can continue to approach DOE's goal of water providing 15 percent of U.S. electricity needs by 2030.[167] Such policies include a streamlined licensing/relicensing process for low-impact projects and better coordination among federal agencies involved in the permitting and licensing/relicensing of hydroelectric facilities.

Trends in Renewable Transportation Fuels

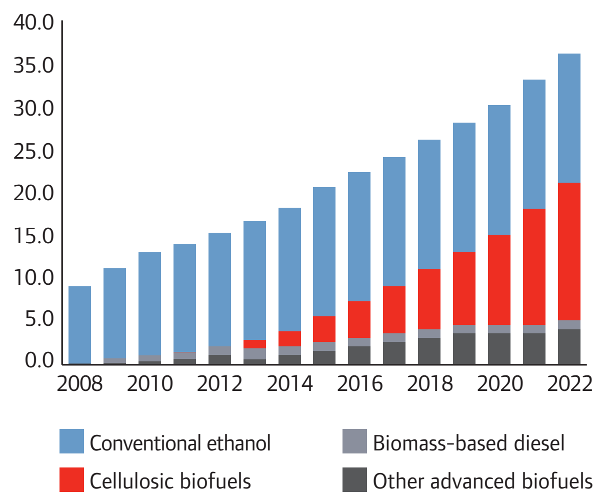
Federal Incentives for Renewable Transportation Fuels

Federal government support for renewable transportation fuels has changed dramatically in recent years. For decades, the domestic biofuels industry benefited from a tax credit for domestic ethanol blenders and a tariff on imported ethanol. In 2005, Congress established the Renewable Fuel Standard (RFS), which required 7.5 billion gallons of biofuels to be blended into gasoline by 2012. Congress expanded the RFS in 2007, which will ultimately require 36 billion gallons of biofuels to be blended in 2022.[168] More recently, both the blending tax credit and the tariff on imported ethanol were allowed to expire, leaving the RFS as the primary policy incentive for biofuels.

Figure 18

Renewable Fuel Standard Volumes by Year

Billion Gallons



Source: CRS (2012). "Renewable Fuel Standard: Overview and Issues." Table 1.

Demonstration and Commercialization of Second-Generation Renewable Fuels

The RFS sets individual annual volume requirements for first-generation (edible feedstock) and second-generation (non-edible feedstock) biofuels through 2022. For instance, by 2022 the RFS will require 15 billion gallons of first-generation ethanol, which primarily uses edible feedstocks (e.g., corn and seeds) and relies on relatively simple processing for fuel production. The RFS will also require 21 billion gallons of second-generation or advanced biofuels,[169] which primarily use non-edible biomass (e.g., crop residues, forestry byproducts, switchgrass, and vegetable oils from jatropha and microalgae) and other purpose-grown crops that do not compete with food crops for high-quality land.[170] In contrast to first-generation biofuels, second-generation biofuels have not yet reached large-scale production, and significant industry growth will be needed to meet the RFS requirements. However, several technologies have been successfully demonstrated in recent years, and many are transitioning into the commercialization phase. More than 165 companies are actively involved in advanced biofuel production in the United States and Canada,[171] and construction is now under way on the country's first six advanced biofuel refineries.[172]

DOD Initiatives

To protect against potential oil supply disruptions and reduce GHG emissions, DOD has taken steps to deploy alternative liquid fuels. One example of these efforts is the Department of Navy's "Great Green Fleet," comprising biofuel- and nuclear-powered vessels and scheduled to sail by 2016. Meanwhile, the Air Force is developing different blends of biofuels and jet fuels, with the goal of generating half of its domestic aviation fuel from biofuels by 2016.[173] DOD has also partnered with the Department of Agriculture and DOE to help fund private industry construction of several renewable fuel refineries in the United States.[174]

Barriers to Investment in Renewable Transportation Fuels

Policy Uncertainty

The RFS has received heightened scrutiny in the past year. Much of this attention comes in the aftermath of a severe drought, which reduced the country's corn supply and raised ethanol prices significantly. An additional source of concern is the RFS requirement for cellulosic biofuels, which has not yet been met due to lack of commercial availability. EPA has the authority to issue RFS waivers in special circumstances, and it has had to substantially reduce the cellulosic biofuels requirement for the past three years.[175] Despite progress, only 20,000 gallons of cellulosic biofuels were produced in 2012 — prompting a federal appeals court to reject EPA's 8.65 million gallon mandate.[176] Some members of Congress are now calling for the targets themselves to be reconsidered,[177] while others point to the numerous advanced biofuel refineries under construction that will soon produce commercial-scale quantities of second-generation fuels. The policy uncertainty surrounding these RFS requirements has significant implications for industry investment and growth.[178]

In addition, the future of many biofuels tax credits is uncertain. As previously mentioned, some were allowed to expire at the end of 2011.[179] Others, including the producer tax credits for cellulosic ethanol and biodiesel, have been extended through the end of 2013, but their future beyond then is uncertain.[180] This policy uncertainty, combined with the industry's sensitivity to fluctuations in feedstock and petroleum prices, makes it difficult for biofuel producers to anticipate future demand and make investment decisions.

"Affordable energy is now America's competitive advantage, and a secure energy future is within our grasp. We must continue to develop our conventional resources and use them wisely, while we apply our unparalleled innovative capacity to bring new energy sources to market."

— Andrew N. Liveris
Chairman & CEO
The Dow Chemical Company

Sustainability and Land Use Concerns

As domestic production of first-generation biofuels has increased, some stakeholders have expressed concerns about their sustainability and collateral impact on closely related markets.[181] Relying on agricultural crops (e.g., corn and soybeans) as feedstock, first-generation biofuels compete directly with other industries for food, land and other key resources — raising concerns about the impact of first-generation biofuel production on food prices and land use.[182] In the short term, a focused use of rotational or cover crops, which do not affect land or food production levels, could mitigate these concerns. Increased production efficiencies and higher crop and forest yields also have the potential to address this issue and ensure that first-generation biofuels are produced and consumed in the most efficient and sustainable manner possible. In the longer term, second-generation biofuels, which use non-edible feedstock and less arable land, have the potential to significantly augment domestic fuel supplies without exacerbating sustainability concerns.

Transmission and Distribution Infrastructure

First-generation biofuels (e.g., ethanol and biodiesel) face transmission and distribution infrastructure barriers. For example, there are significant logistical and technical challenges involved in shipping increased amounts of ethanol or biodiesel through existing pipelines. Ethanol tends to mix with traces of water in the pipeline system, raising the risk of corrosion and reducing fuel quality.[183] In addition, compatibility issues exist with respect to underground storage tanks (USTs) and fuel dispensing equipment. Most UST systems and fuel pumps at gas stations are designed to handle a blend of 10 percent ethanol and 90 percent gasoline (i.e., E10), and higher ethanol blends can increase the risk of equipment damage and malfunction. In its 2011 UST proposed rulemaking, EPA stated, "As the use of ethanol- and biodiesel-blended fuels increases, EPA is concerned that not all UST system components are compatible with these fuel blends."[184] In addition, the National Renewable Energy Laboratory and Underwriters Laboratories have found compatibility issues with both existing and new fuel dispensing equipment when tested with higher ethanol gasoline blends.[185]

While all ethanol-based fuels face compatibility issues, some second-generation biofuels have chemical properties that resemble traditional petroleum-based fuels and meet quality specifications for diesel, gasoline and jet fuel. These "drop-in" fuels can be used with existing tanks, pipelines and pumps without costly modifications, reducing compatibility concerns and enabling greater biofuel adoption upon commercialization.[186]

Vehicle Compatibility

The rapid growth of ethanol production in recent years has increased the demand for ethanol as a blendstock, putting pressure on the legal gasoline blending limit of 10 percent (E10) for gasoline-powered vehicles. In January 2011, EPA increased the limit to 15 percent (E15) for vehicles built since 2001. However, several issues stand in the way of E15's widespread adoption.

The vast majority of the existing vehicle fleet is designed to run on E10 blends, and recent studies have identified engine compatibility issues when those engines use higher ethanol blends.[187] Some gasoline retailers may be reluctant to sell E15 due to concerns about liability issues in the event of misfueling or storage equipment malfunctions.[188] Even if supply issues are addressed, the new blend will be subject to consumer demand. Some studies suggest consumer acceptance has been slow to take hold, as vehicle owners worry that the new blend could cause engine damage and void vehicle warranties.[189] As with the preceding infrastructure issue, drop-in biofuels have the potential to overcome the vehicle compatibility barrier due to their similarities to petroleum-based fuels. As drop-in replacements, they can be used in today's car, truck and other combustion engines without requiring costly modifications or risking mechanical damage.[190]

Cost Competitiveness

The widespread deployment of renewable transportation fuels will ultimately depend on their long-term cost competitiveness relative to traditional liquid fuels, such as gasoline and diesel. This is particularly true for second-generation biofuels. Indeed, the World Bank estimates that the current cost of second-generation ethanol can be two or three times as high as the price of gasoline. Similarly, the cost of biodiesel produced from microalgae is much higher than the price of diesel.[191] Capital costs are the primary determinant of overall production costs for second-generation fuels, though feedstock costs are also an important factor.[192] As with many new technologies, capital costs are likely to decline over time as second-generation fuels transition from demonstration projects to large-scale commercial production. Nevertheless, substantial investments in a first tranche of production capacity will be required to build a successful track record with the market, attract additional capital and achieve economies of scale.

Policy Recommendations To Enhance Renewable Energy Production

Innovation

- The federal government should continue to support research, development and demonstration projects for precommercial renewable electricity generation technologies, storage and related infrastructure, with an emphasis on performance, emissions reductions, technology neutrality and integration with existing infrastructure.
- The federal government should continue to support research, development and demonstration projects for precommercial renewable transportation fuels and related infrastructure, with an emphasis on performance, emissions reductions and technology neutrality.

Incentives

- Congress should provide wind-powered electricity generation with a smooth transition to an era of unsubsidized competitiveness by extending the wind production tax credit so that the benefit is gradually reduced and ultimately eliminated.
- In the event that Congress adopts or extends renewable tax incentives in future years, it should ensure that such measures are designed to address well-documented market inefficiencies, are applied only to those fuels and technologies with a credible path to unsubsidized competitiveness, and are finite in duration and eventually phased out in a predictable fashion.
- Congress should expand the availability of Master Limited Partnership tax treatment to all energy projects, including renewable energy and biofuels projects.
- Congress should authorize the U.S. DOD to engage in 15-year contracts for advanced biofuels, rather than the five-year contracts allowed under current law.

Regulations and Standards

- Congress and the Executive Branch should account for regional variations in renewable energy resource availability when developing legislation and regulation.
- With respect to the RFS mandate, policymakers should consider the limitations of the current vehicle fleet, fuel distribution infrastructure and actual production capacity and adopt targeted modifications as needed.

VII. Electric Power Generation, Transmission and Distribution

The electric power industry is critically important to the U.S. economic engine. Nearly all U.S. consumers and businesses rely on affordable electricity, and given the nature of electricity demand, high prices can have a significant impact on budgets and international competitiveness. Secure and reliable supplies of electricity are also a key driver of U.S. economic growth and associated job creation. The one-day blackout that engulfed the northeastern United States in 2003 is estimated to have cost $7–10 billion,[193] and the rolling blackouts in Japan in the wake of the Fukushima nuclear meltdown may have reduced nominal GDP by 0.29 percent in 2011.[194]

"To meet our electric power needs in the coming decades, America will need to utilize a full portfolio of energy resources. We need all the arrows in the quiver — nuclear, 21st century coal, natural gas, renewable and energy efficiency."

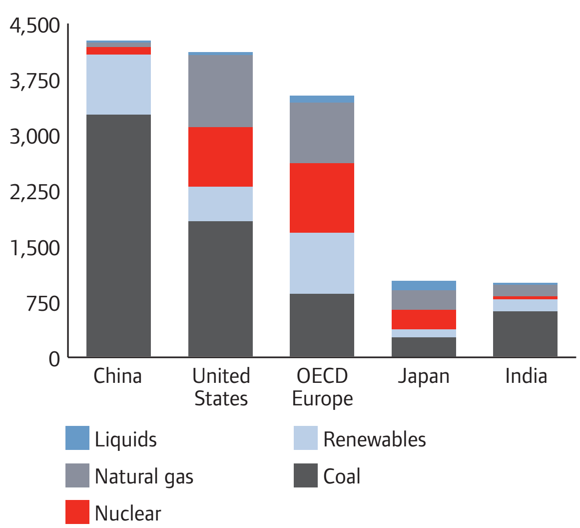
— Thomas A. Fanning
Chairman, President & CEO
Southern Company

The electric power industry also plays a key role in safeguarding the environment. Improved generation technology, such as more efficient power plants that incorporate scrubbers, selective catalytic reduction equipment and other pollutant-reducing devices, have reduced the environmental footprint of the electric power industry, and the prospect of commercial-scale carbon capture, utilization and storage (CCUS) technology has the potential to dramatically reduce the industry's GHG emissions in the future.

Figure 19

Electricity Generation, Top 5 Countries/ Regions

Billion Kilowatt-Hours Generated by Fuel Type, 2011



Source: EIA (2011). International Energy Outlook. *Tables F13–F17.*

The important role of the electric power industry in the U.S. economy is particularly relevant now, as the industry progresses through a major investment cycle. A variety of factors — including increased domestic production of oil and natural gas, more stringent environmental regulations, the need for additional generating capacity (including nuclear, gas-fired and modern coal-fired plants), increased integration of renewable generation, and needed upgrades to the transmission system that are long overdue in some regions — will collectively determine the type and size of industry investments that will occur in the next two decades. A report by the Brattle Group estimates that $2 trillion in investments through 2030 will be required to upgrade, replace and expand the nation's existing power production and delivery infrastructure.[195] The choices made during this investment cycle will shape the nation's electric power sector for decades to come.

However, achieving the best mix of long-term electric power investments that will put America on a path toward economic growth, energy security and environmental stewardship is not guaranteed. Indeed, the investments that are necessary to accomplish this goal are occurring against a backdrop of profound economic, regulatory and political uncertainty. The cumulative impact of this uncertainty intensifies the challenge of making sound planning and investment decisions. Reasonable, predictable and stable regulatory policies are needed to help ensure that necessary investments are made in a timely manner. Moreover, federal and state policies must encourage U.S. electricity generators to make full use of America's diverse portfolio of energy resources to meet current and future demand and achieve the positive economic, security and environmental outcomes that define a successful long-term energy strategy.

Trends in Electric Power Generation

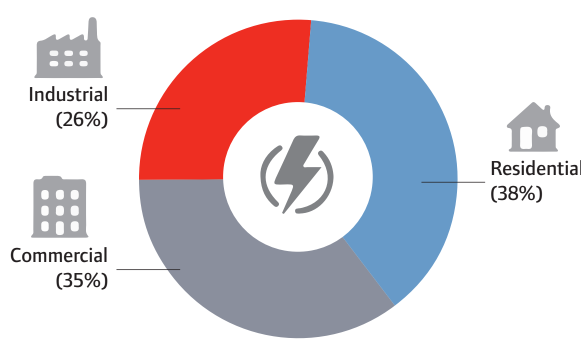
Slowing Demand Growth for Electricity

Through the 1970s, growth in electricity consumption in the United States outstripped GDP growth and population growth, as industrial processes were increasingly electrified, the population shifted toward warmer geographic areas and larger homes, and the use of consumer appliances and electronics proliferated.[196] Over the last several decades, however, growth in electricity demand has slowed dramatically in most regions of the country.[197] EIA, in its latest long-range energy forecast, predicts a further slowing of electricity demand growth to approximately 0.8 percent per year through 2035.[198] This reduction in the rate of demand growth is being driven, in part, by greater efficiency efforts (e.g., pumps, motors, HVAC systems, insulation and appliances). In addition, many state regulatory commissions require regulated utilities to consider demand reduction (including efficiency, as well as load-shifting and peak shaving programs) as part of their future resource plans.[199] Cost-effective efficiency efforts can help reduce demand, thus avoiding the need to build new generation. Despite the prospect for relatively modest future growth in electricity demand, a number of other factors are driving new investments in generation, as discussed in the next sections.

Figure 20

Electricity Consumption by Sector

Percentage of Total Electricity Consumption, 2011



Source: EIA (2012). Annual Energy Outlook 2013 Early Release. *Table 8. (Excludes utility direct use. Transportation sector not shown, equals less than 1/100.)*

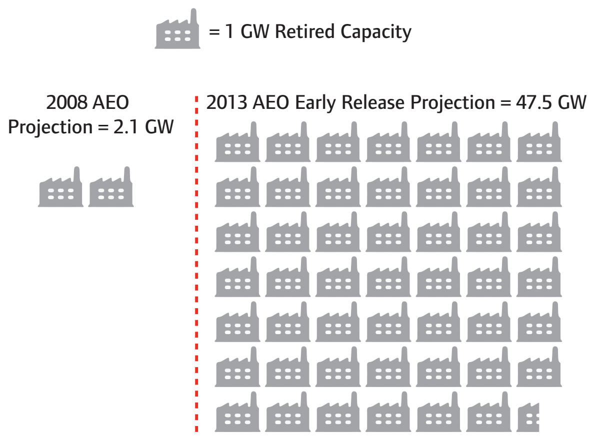
New Environmental Regulations

During the past year, EPA finalized the Cross-State Air Pollution Rule,[200] (though it was recently vacated by the U.S. Court of Appeals for the D.C. Circuit),[201] the Mercury and Air Toxics Standards (MATS, or utility MACT), and the National Ambient Air Quality Standard for fine particles (PM 2.5 NAAQS).[202] EPA has also proposed new regulations governing cooling water intake structures (pursuant to Section 316(b) of the Clean Water Act)[203] and the disposal of coal combustion residuals under the Resource Conservation and Recovery Act.[204] Finally, EPA has proposed GHG new source performance standards (GHG NSPS) for fossil-fueled electric generating units (discussed more fully in the "Uncertainty Regarding Climate Change Policy" section of this chapter) and may promulgate standards for existing units.

Figure 21

Projected Coal Plant Capacity Retirement

Gigawatts Retired between 2010 and 2018



Sources: EIA (2008 and 2012). Annual Energy Outlooks 2008 *and* 2013 Early Release.

The cumulative effect of these final, proposed and anticipated regulations would be to impose substantial new costs on coal-fired electric generating units, leading to retirements of older, less efficient coal-fired electric generating units over a three-year period (the time frame imposed by the Clean Air Act for utility MACT compliance). Today, the United States has approximately 300 gigawatts of coal capacity.[205] While estimates vary and are highly dependent on the final cooling water intake structure and coal combustion residuals rules, between 10 and 20 percent of existing coal capacity is expected to be retired over the next three to five years.[206] Although resources appear to be adequate in most regions of the country for the time being, tightening capacity margins may require replacing this lost capacity over the long term.[207] In the meantime, the timing and cumulative impact of EPA's rules are increasing pressures and creating reliability uncertainties due to the timelines associated with required retrofits, planned retirements and new construction.

Mixed Progress on Nuclear Power

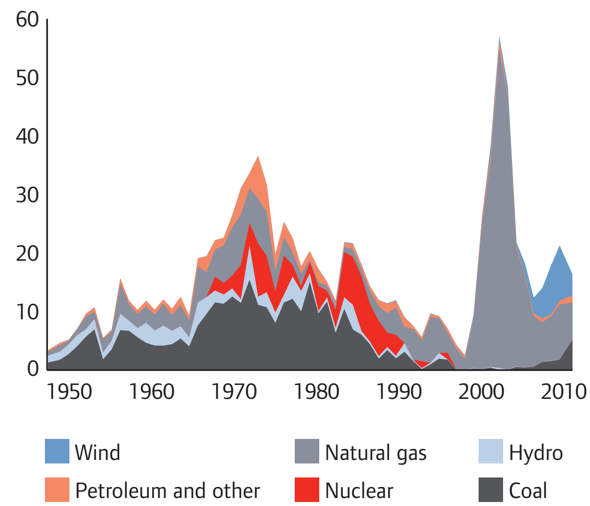
Nuclear energy generating units are the largest source of carbon-free electricity in the United States, have very competitive operating costs and operate at high capacity factors to provide baseload generation.[208] The United States has the largest nuclear fleet in the world, with 104 nuclear energy facilities in 31 states that generate approximately 20 percent of all U.S. electricity.[209] Nuclear energy generated 807 billion kilowatt-hours of electricity in 2010, nearly twice that of France, the country with the second largest nuclear fleet in the world.[210]

There have been several positive advances in the development of next-generation nuclear power plants, with the licensing and commencement of construction at plants in South Carolina and Georgia. The development of smaller, modular nuclear units may also prove to be an attractive generation technology in the future.

Figure 22

Electric Generating Capacity Additions by Fuel

Gigawatts, Current (2010) Capacity by Initial Year of Operation

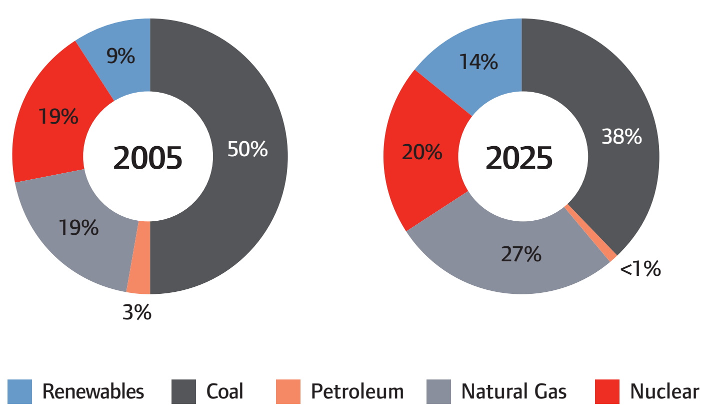


Source: EIA (2011). "Today in Energy." July 5, 2011.

Figure 23

Projected Shift in Electricity Generation Mix

Percentage of Total Electricity Generation



Sources: EIA (2012). Annual Energy Review 2011. *Table 8.2a; and EIA (2012).* Annual Energy Outlook 2013 Early Release. *Table 8.*

Nevertheless, nuclear power today faces a number of challenges. Modest projected electricity demand growth in most regions of the country, coupled with the high capital costs associated with new nuclear power plants and low natural gas prices, are dampening demand for new nuclear units. The Fukushima nuclear accident weakened public support for nuclear power and is likely to result in additional safety measures and associated costs for currently operating U.S. nuclear power plants. Thirty years after the enactment of the Nuclear Waste Policy Act, the nation still does not have a strategy in place to manage high level nuclear waste, the Yucca Mountain site is in limbo[211] and the D.C. Circuit has recently required DOE to justify the continued collection of fees from utilities for nuclear waste disposal.[212] Finally, EPA's proposed cooling water intake structures rule is also likely to increase costs for many existing nuclear generating units and could pose challenges for siting new generation.[213] All this combines to create extreme regulatory uncertainty that deters future investment.

Declining Natural Gas Prices

Decade-low natural gas prices have fundamentally altered the economics of electricity generation. In both independently managed and non-independently managed markets, available resources are typically dispatched in order of their marginal cost, which is determined mostly by fuel costs.[214] Coal and nuclear units, while having high capital costs, have historically had relatively low marginal costs and consequently have been good candidates for economic baseload operation. Conversely, natural gas units, which have historically had relatively high marginal costs but relatively low capital costs, were ordinarily dispatched after coal, nuclear, wind and other units with lower marginal costs and generally used to meet intermediate or peak demand.[215]

With natural gas prices at today's levels, however, the marginal cost of dispatching gas units is often cheaper than dispatching coal generators.[216] Consequently, existing natural gas capacity is being brought online more often while existing coal capacity is being idled. This shift to natural gas reached an historic peak in April 2012, when coal was used to generate only 32 percent of all electricity consumed, the lowest level since EIA began compiling data in 1973.[217] In addition, low natural gas prices have resulted in natural gas being the default fuel of choice for new electric generating units, a trend that is likely to continue if natural gas prices remain competitive.[218] With an anticipated abundance of natural gas to support such new construction comes added pressure to address the infrastructure requirements to move natural gas to generating units.

Barriers to Investment in Electric Power Generation

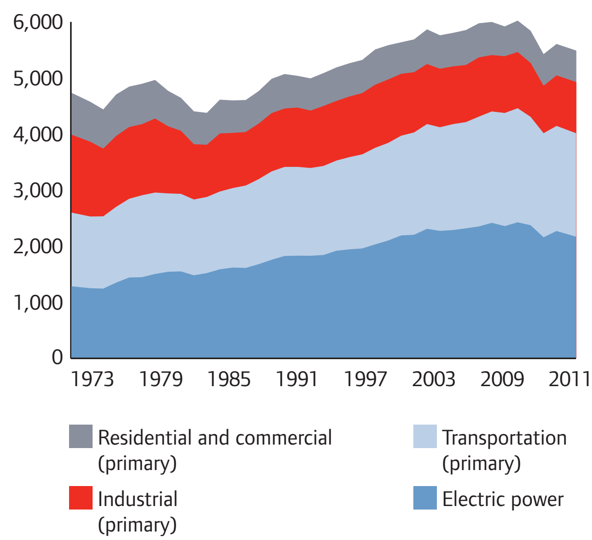
Uncertainty Regarding Climate Change Policy

One significant uncertainty looming over the electric industry concerns future U.S. policy regarding GHG emissions. The electric generation sector is responsible for approximately 40 percent of all U.S. carbon dioxide (CO_2) emissions and is the largest single category of carbon emissions.[219] Coal-burning electric generating units are the largest source of GHG emissions within the electric sector.[220] While legislative attempts at climate regulation in Congress have failed, EPA, pursuant to the Clean Air Act, has initiated a series of rulemakings to limit GHG emissions from the power sector. In March 2012, EPA proposed GHG NSPS for new fossil fuel-fired electric generating units larger than 25 megawatts.[221] This proposed rule would require all new fossil fuel-fired electric generating units, regardless of fuel source, to emit no more than 1,000 pounds of CO_2 per megawatt-hour generated. This emissions level is roughly equivalent to the emissions from combined cycle natural gas turbines and would thus effectively prohibit the construction of new coal-fired power plants unless those plants were equipped with CCUS technologies.[222]

Figure 24

Total U.S. GHG Emissions over Time

Million Metric Tons of CO_2



Source: EIA (Nov 2012). Monthly Energy Review. *Tables 12.2–12.6.*

However, EPA recognizes that CCUS technologies are not currently commercially viable. In the GHG NSPS proposed rule, EPA indicated that it has no current plans to extend the GHG NSPS to facilities undergoing major modifications to meet other pollution control requirements or to promulgate standards applicable to existing units.[223] However, the Clean Air Act ultimately will require EPA to promulgate GHG emissions limitations for the existing coal fleet.[224] Consistent with the EPA Endangerment Finding made following the Massachusetts v. EPA Supreme Court decision, all sectors of the economy will likely face GHG regulation, including coal- and gas-fired electricity generation plants, industrial facilities, and refineries.[225] In the absence of clear policy regarding GHG emissions, it is very difficult to assess the costs of various generation options and their long-term economic viability.

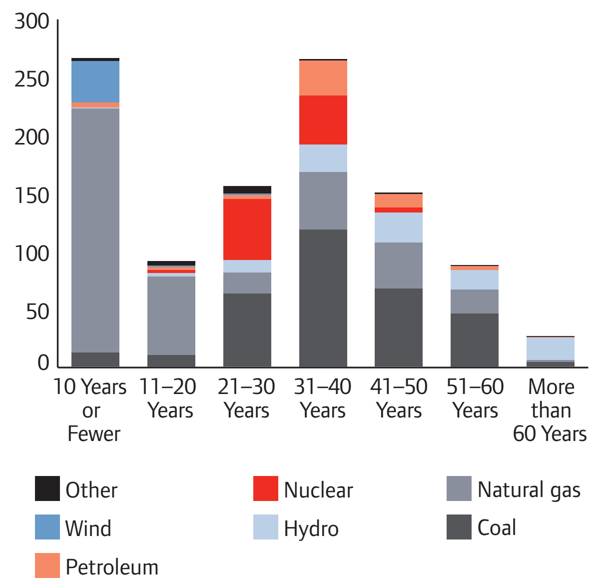
The Future of CCUS Technologies

Coal-fired power plants are a significant component of the nation's electric power system, generating approximately 40 percent of the nation's electricity today.[226] Coal accounts for more than half of power generation in 22 states, and it constitutes more than 80 percent of electricity generation in eight of those states.[227] Coal's abundance and widespread distribution in the United States make it a key fuel for producing electricity reliably and affordably.

Figure 25

Age and Capacity of Electric Generators by Fuel

Gigawatts, as of Year End 2010



Source: EIA (2011). "Today in Energy." June 16, 2011.

Coal's future as a key electric generation resource, however, is highly dependent on whether cost-effective technologies can be developed that will allow it to remain a viable electric generation resource in a GHG-constrained world. A recent Massachusetts Institute of Technology (MIT) study concluded that CCUS technology is "the critical enabling technology that would reduce CO_2 emissions significantly while also allowing coal to meet the world's pressing energy needs."[228] While CCUS technology has potential, many technical, economic, regulatory and legal issues will have to be resolved before this technology becomes viable and scalable. A recent study by the National Coal Council suggests that, rather than viewing CO_2 as a waste requiring permanent disposal, one should view CO_2 as a resource with economic value.[229] The United States has many declining oil fields that use CO_2 for enhanced oil recovery (EOR) techniques, which involve injecting CO_2 into oil reservoirs to recover remaining oil. This technique has been used for many years in areas that have access to CO_2 produced from naturally occurring reservoirs or recovered from natural gas processing plants.[230] While improved CCUS technology at electric power facilities could provide an additional source of CO_2 for expanded EOR activities, there are still technical challenges as well as significant economic, legal and regulatory barriers.

Distributed Generation

Distributed electricity generation technologies (e.g., industrial and commercial combined heat and power [CHP], rooftop solar, and micro-generators at customer sites) involve a number of complex regulatory issues, including rates and the assignment of costs, which discourage more widespread adoption. As noted in an MIT study on the future of the electric grid, "[i]ncreased penetration of distributed generation will pose challenges for the design and operation of distribution systems. New regulatory approaches may be required to encourage the adoption of innovative network technologies."[231] Ultimately, a new utility regulatory model may have to be devised if distributed generation becomes widespread. Policies regulating the treatment of distributed electricity generation technologies — including back-up power rates, rates for power sold to the grid and interconnection costs — should be crafted to encourage adoption of these technologies while avoiding negative impacts on reliability or consumer rates.

Fuel Price Variability

All fuel costs involve future price variability. A primary reason to have a diverse generation portfolio is to better cope with the price volatility of any particular fuel. For example, natural gas prices for electric generation peaked at $12.41 per thousand cubic feet (Mcf) in June 2008, before falling to $2.79/Mcf in April 2012.[232] Despite decades of low volatility, coal prices have also recently experienced significant variability; prices rose to a peak in 2008, before falling just as quickly as natural gas.[233] Operators in the electric generation sector seek to mitigate price risk through a variety of measures, such as hedging or entering into long-term fuel supply contracts. However, locking in or hedging fuel costs on a long-term basis is currently difficult, which can create a challenge to greater use of natural gas. In addition, with low prices spurring increased demand for natural gas from the transportation and manufacturing sectors and new proposals for the export of LNG, some stakeholders are concerned that future natural gas prices could be higher than they are today.[234] Finally, overly burdensome regulation of hydraulic fracturing technology could increase the costs of developing domestic natural gas resources and place some promising areas off-limits entirely. These concerns will need to be addressed by rigorous analyses of future technology, regulations, supply and demand so that hedging strategies and a reasonable range of future gas prices can be used to make informed investment decisions for generation assets that will be expected to operate for decades.

Inconsistent State Policies Regarding Competitive Generation Markets

Certain regions of the country that operate within independently managed competitive wholesale electricity markets are seeing an increase in state-sponsored efforts to promote the construction of new power plants, rather than rely on the market to provide the necessary resources.[235] In many of these cases, developers have been incentivized to build with customer guarantees or subsidies that are not available to other market participants. These state-sponsored efforts have been controversial because they could undermine independently managed competitive wholesale markets and chill future private investment.

Trends in Transmission and Distribution

Increased Investment in Transmission Infrastructure

After decades of underinvestment in the electric transmission infrastructure in some regions of the United States, transmission investment increased significantly over the past decade, rising from about $5 billion in 1995 to approximately $12 billion in 2009.[236] However, the Brattle Group projects that an additional $300 billion of transmission investments will be needed from 2010 through 2030 (in nominal dollars) to connect renewable resources with the grid to meet state Renewable Portfolio Standards (RPS), connect other generation resources to ensure resource adequacy and meet reliability needs.[237] Ultimately, investing in transmission infrastructure is a prerequisite to achieving a more secure, more reliable, more domestic, lower-carbon energy future.

Increased Integration and Collaboration in the Transmission Planning Process

Historically, transmission planning and investment have been primarily conducted by local and Regional Transmission Organizations and utilities, which in some cases has made it difficult to take into account the potential benefits associated with transmission projects that span jurisdictions. To address this issue, Federal Energy Regulatory Commission (FERC), which has jurisdiction over interstate transmission systems and wholesale power markets, has issued a series of orders. Most recently in 2011, FERC adopted Order No. 1000, which requires both regional and inter-regional transmission planning (and cost allocation, as discussed below).[238] In addition, the order requires that local and regional planning processes provide for consideration of transmission needs that are driven by public policy requirements under federal or state laws or regulations. This could include, for example, RPS or Clean Energy Standard requirements, although it is left to transmission providers and regional stakeholders to identify the public policy requirements to be considered. With respect to inter-regional planning, transmission providers are required to coordinate with transmission providers in neighboring planning regions within the same interconnection, though interconnectionwide planning is not required.[239]

Order No. 1000 also establishes new principles for cost allocation methods for both intraregional and inter-regional transmission facilities. Under the order, each transmission provider would be required to have a method or set of methods in place for allocating the costs of new transmission facilities included in regional transmission plans "in a manner that is at least roughly commensurate with estimated benefits" of the new facilities.[240] Different regions and transmission providers may propose specific cost allocation methodologies that are consistent with the general principles under the order.

Increased Deployment of Smart Grid Technologies

Smart grid technologies "can facilitate the integration of large volumes of renewable and distributed generation, provide greater visibility of the instantaneous state of the grid, and make possible the engagement of demand as a resource."[241] Smart grid investments have accelerated due to the Energy Independence and Security Act of 2007[242] and the American Recovery and Reinvestment Act, which provided $4.5 billion in smart grid-related funding,[243] including $3.4 billion for the Smart Grid Investment Grant program.[244] One promising smart grid technology is volt var optimization (VVO), a method of remotely monitoring and managing the voltage on the electric distribution grid through the deployment of capacitors, capacity monitors and associated control software. VVO allows for dynamic control of voltage on the distribution circuit, and preliminary results suggest that demand reductions of 2 to 4 percent could be achieved. Technologies like VVO can improve energy efficiency, reduce air emissions and avoid the need to build new generation.[245]

Increased Deployment of Load-Balancing Technologies

Due to the challenges of storing electricity efficiently and cost-effectively, demand for electricity and the amount of power generated must be in balance on a real-time basis. Given that the amount of power needed changes continuously throughout the day, resources must be brought on line or ramped up and down in real time. This complex balancing must occur almost instantaneously. Being able to accurately predict demand and smooth peak demand can increase grid reliability and reduce the need to dispatch more expensive resources — thereby reducing costs to consumers.

To meet this challenge, load-balancing technologies have advanced over recent years as a consequence of greater computer power, better data analytics capability, improved communications capability and a greater recognition by state regulators of the value of these programs. As technology continues to improve and the grid becomes "smarter," load-balancing technologies hold the promise of making the electric sector more efficient, reducing costs and the need for new generation capacity.

Barriers to Investment in Transmission and Distribution

Despite the progress that has been made in recent years in improving the nation's electric transmission infrastructure, regional and multistate transmission projects continue to confront a variety of major challenges.

Transmission Planning

In many areas, transmission planning is an incumbent utility-driven, bottom-up process that focuses on reliably meeting delivery service obligations. While in some regions transmission planning is handled through independent regional grid operators, utility-driven transmission planning does not ordinarily consider promoting national policy goals unless such goals involve providing firm transmission delivery services within the planning region. The planning process has been very good at what it is primarily designed to do: ensure the continued reliability of the bulk power system. However, it was not designed to facilitate, and is in fact ill equipped to address, projects providing widespread public benefits on a prospective basis absent specific delivery service needs.

As previously mentioned, FERC has recognized this long-standing challenge and through a series of orders (including Order No. 1000) has attempted to improve multijurisdictional transmission planning. Regional planning may improve as a result of FERC's efforts. However, the extent of the changes made will depend on the specific compliance plans developed by each Regional Transmission Organization/Independent System Operator/transmission provider and approved by FERC. In addition, numerous appeals of Order No. 1000 have been filed, and the outcome of the litigation is uncertain. Until these uncertainties are resolved, the new FERC transmission planning policies will not be fully recognized in regional transmission planning efforts.

Permitting and Siting

The states traditionally have been responsible for the permitting and siting of transmission facilities because historically, the electric industry was vertically integrated and transmission was more intrastate in nature. However, the necessity of additional interstate transmission capacity has increased with the partial deregulation of wholesale electric markets, the adoption of legislative and regulatory policies that provide for open and non-discriminatory access to interstate transmission, the development of organized wholesale electric markets, and the growth of generation located further from load centers.

Large, multistate transmission projects with widely dispersed benefits at times do not fit well within existing state permitting and siting procedures. An inclusive planning process that produces widespread stakeholder agreement on the need for a facility can help mitigate permitting and siting concerns, but difficulties remain when states have different processes governing permitting and siting decisions. Furthermore, siting and permitting difficulties can also reflect a lack of consensus regarding the need for facilities and disagreement over the broader benefits of a particular project and how costs should be allocated. However, even when there is consensus regarding the need for and benefits of a particular project, environmental concerns often result in rerouting, which can increase costs and delay construction.

Recognizing the need to upgrade and expand the transmission grid to support competitive electricity markets; provide access to new energy resources; and simplify the balkanized planning, siting and permitting processes, Congress gave FERC in the Energy Policy Act of 2005 limited "backstop" siting authority to permit transmission projects in National Interest Electric Transmission Corridors.[246] However, two federal appellate court decisions have, for the present, rendered FERC's authority to site transmission facilities ineffective.[247] Furthermore, any attempt to exercise this authority would likely be met with continued fierce opposition from state and local governments, environmental groups, and property owners.

Siting and permitting problems encountered by transmission developers do not rest solely at the state and local levels. If a project traverses federal public lands, federal land management agencies are responsible for the environmental review, permitting and siting of a transmission facility. Unfortunately, cumbersome statutory requirements and the inclusion of more than one federal agency can delay the siting of transmission even after a state has issued the necessary permits.

Cost Allocation

FERC has jurisdiction over the allocation of costs associated with interstate transmission. Cost allocation decisions are often straightforward for relatively small projects that are needed for reliability or economic dispatch and are located within a single state with clear benefits to the residents of that state. However, difficulties arise with respect to regional or super-regional, multistate projects that are intended to benefit more than one state or more than one region. Cost allocation — particularly the determination of who benefits from a project — has proven to be the most contentious of the transmission issues, although many believe that with improved transmission planning, cost allocation issues would be easier to resolve.

The cost allocation principle of FERC's Order No. 890 (adopted in 2007) requires that every transmission provider establish a methodology for the allocation of the costs of new transmission facilities, but it does not specify what that method should be.[248] As previously mentioned, FERC's Order No. 1000 goes a step further and establishes new principles for cost allocation methods for both intraregional and inter-regional transmission facilities.[249] However, petitions for review of the order have been filed, and it is inevitable that challenges to the cost allocation principles will be raised. Accordingly, while progress is being made, the uncertainty that surrounds cost allocation for transmission is likely to continue for some time.

Accommodating Intermittent Generation Resources

One of the key drivers of regional or multistate high voltage transmission projects is the need to interconnect location-constrained renewable resource projects to help utilities meet state renewable portfolio requirements. More than half of all states have adopted some form of RPS, most with escalating requirements.[250] These requirements will continue to drive investment in new generation, although many of the renewable resources most likely to be developed for generation (particularly wind and solar resources) are found in sparsely populated areas, located far from major load centers. The transmission infrastructure in these renewable resource-rich areas is often inadequate to allow for the development of these resources without additional infrastructure investments.

Another challenge posed by incorporating increasing amounts of renewable power into the nation's electricity generation portfolio is the intermittent nature of these resources, particularly wind and solar resources.[251] Given that widespread, cost-effective storage technologies are not yet available, intermittent resources require back-up, quick-start generation that can be brought online rapidly when it is needed and ramped down when it is not. Natural gas peaking units are uniquely suited for this role, but having such additional capacity on hand to back up unpredictable resources adds significant costs.

Increased transmission capacity can also help meet the challenge of integrating intermittent resources by increasing transfer capacity between load-balancing areas or regions, so that more generation resources can be called upon if needed. As state renewable portfolio requirements become increasingly stringent, integration of intermittent resources will become a more pressing concern. Better weather forecasting and predictive modeling capability, larger transmission balancing areas, blended supply products (e.g., renewable backed by gas generation), and better planning can improve intermittent generation integration.[252] The costs of additional transmission and back-up generation will be significant factors to consider in the overall economic evaluation of renewables.

Storage Challenges

Electricity demand can fluctuate widely during the day and varies between regions. Because peak load may be substantially above average load, cost-effective storage technologies would help reduce the need for high-cost generation capacity that is used intermittently as additional generation during peak demand.

A number of possible storage technologies are being explored, including molten salt, batteries, flywheel, compressed air and water pumped storage systems. One promising storage technology being deployed by concentrating solar generators involves heating a sodium solution to collect heat during periods of peak generation. In the evening, the molten solution is run through a heat exchanger to generate steam that runs a turbine.[253] Increased deployment of plug-in electric drive vehicles also offers potential storage capacity, as these vehicles could function as distributed electricity storage systems. While a number of storage technologies are being explored, no one technology has emerged as ready for widespread commercialization, primarily due to high costs.

Cybersecurity Concerns

Cyberspace has been defined as "the interdependent network of information technology infrastructures, and includes the Internet, telecommunications networks, computer systems, and embedded processors and controllers in critical industries."[254] The widespread reliance on digital information and communications technology has increased the extent and efficiency of our ability to do business in all sectors of our economy. However, because these networks were designed with interoperability rather than security in mind, the United States' critical infrastructure, economy and national security are exposed to growing cybersecurity threats and vulnerabilities from state and nonstate actors.[255]

While the electric grid was built primarily to transmit local generation to serve local load, the complex, interconnected grid of today now moves power across vast distances, relying on advanced control systems and equipment that communicate, store and act on data.[256] As with other sectors of the economy, the electric industry depends on digital technology to increase efficiency, reduce costs and maintain bulk power system reliability. According to the North American Electric Reliability Corporation (NERC), "[t]he networks and computer environments that make up this digital technology could be as vulnerable to malicious attacks and misuse as any other technology infrastructure."[257] NERC has developed and FERC has approved Critical Infrastructure Protection standards designed to reduce the transmission grid's vulnerability to a cyber attack.[258]

Because of the constantly changing nature of cyber threats, there is general agreement within the industry on the need for improved information sharing between government and the private sector regarding cyber threats and vulnerabilities and a defined role for the government in responding in real time to cyber emergencies that threaten the electric grid.

Sensitivity to Rate Increases

Large capital investments will be required to retrofit existing generation units to comply with new regulations, build the new generation capacity necessary to replace retirements over the next three years, and upgrade the transmission system to connect location-constrained renewable resources and maintain reliability. Ultimately, these costs will be passed on to consumers and businesses through higher electricity prices. Consumers and regulators in certain geographic areas facing particularly large investments have already expressed concerns about rates.[259] These concerns will only increase as the full costs of meeting the challenges facing the industry become more evident. For the first time in many years, key U.S. manufacturing sectors have begun to show signs of recovery driven largely by the new availability of affordable domestic energy resources like shale gas. Some U.S. manufacturing sectors are poised to make significant new capital investments that will create new jobs and drive supply chain growth.[260] To sustain this trend, policymakers need to be mindful of the cumulative impact that their decisions have on consumer rates and energy affordability.

Policy Recommendations To Enhance Generation, Transmission and Distribution

Generation

- The United States should seek to expand our broad portfolio of cost-effective generating options by continuing to provide precommercial funding for research and development for nuclear, clean coal, CCUS, renewable energy and other promising generation technologies in order to help drive down costs and preserve them as generating options.

(Also see “Chapter V: Traditional Energy Production” and “Chapter VI: Renewable Energy Production,” which discuss more specific recommendations regarding these technologies.)

- Congress and the Executive Branch should devise a long-term solution to remove and manage nuclear spent fuel. It is important to protect consumers’ investment in the Nuclear Waste Fund and ensure it serves its intended purpose of managing spent fuel. In particular, Congress and the Executive Branch should promptly resume the licensing and development of a spent nuclear fuel repository at Yucca Mountain, NV; develop one or more consolidated interim storage sites; provide access to the Nuclear Waste Fund for spent fuel storage and management without annual congressional appropriations; and develop a transportation plan to prepare for large-scale movement of spent nuclear fuel and high level waste to disposal facilities.
- The states should review and revise policies as necessary to regulate the treatment of distributed electricity generating technologies (such as CHP and rooftop solar PV) and facilitate the adoption of cost-effective technologies, while ensuring reliability and reasonable utility rates.
- FERC, DOE, NERC and private industry should collaborate and coordinate policies covering the electric and natural gas industries to ensure adequate integration of these industries as natural gas increasingly is used as an electricity generation fuel.
- Congress and the Executive Branch should carefully evaluate the timing and cumulative impact of EPA regulations under the Clean Air Act, Clean Water Act, Resource Conservation and Recovery Act, and other environmental statutes on the electric utility industry and its customers. Congress and the Executive Branch should modify these regulations, as appropriate, to ensure continued reliability; avoid unreasonable rate impacts; and maintain a diverse, market-driven portfolio of electricity generation fuel options.
- State and federal policymakers should recognize the need for stable and predictable regulatory environments in wholesale electricity markets and avoid interventions that threaten the benefits customers receive from these markets.

Efficiency

- States that do not already do so should allow cost-effective generation efficiency, distribution and customer-premise efficiency investments to be included in a utility’s rates in order to encourage utility investments in energy efficiency. (Also see “Chapter IV: Energy Efficiency” for more detailed recommendations regarding efficiency measures.) FERC should continue to provide rate treatment for efficiency investments in transmission where FERC has jurisdiction over such investments.

Infrastructure

- FERC and other agencies, such as the Corps of Engineers, should improve and streamline the permit application process for the construction of additional pipeline infrastructure and storage capacity, in order to accommodate the increasing amount of natural gas being used to generate electricity. (Also see “Chapter V: Traditional Energy Production.”)

- Upgrade the nation's railways, locks, ports and river transportation system to ensure continued access to reliable supplies of coal and other critical materials.

Transmission

- FERC should continue to provide transparent rate incentives for cost-effective upgrades to the nation's transmission infrastructure in order to facilitate grid modernization and support competitive wholesale electricity markets.
- Improve coordination among federal agencies, such as FERC and DOE; state commissions; and other stakeholders to address the complexity, unpredictability and inefficiency of transmission planning, siting and cost allocation decisions for interstate transmission projects, particularly those that cross federal lands.

Distribution

- Continue to support DOE and National Institute of Standards and Technology (NIST) efforts to accelerate and coordinate the development of "smart grid" standards in order to maintain continued U.S. leadership in smart grid technologies.

Cybersecurity

- Congress should continue to support existing FERC/NERC efforts regarding information sharing, education and development of industry best practices and avoid duplicative or preemptive legislation or standards.
- Federal legislation should cover all critical infrastructure while recognizing existing regulation and avoiding the creation of additional or duplicative burdens for highly regulated industries.
- Federal legislation also should require actionable and timely threat intelligence sharing from government to critical infrastructure owners and operators.

VIII. Conclusion

America's energy future is brighter than it has been in decades, and recent events have paved the way for the nation to reclaim our position as a global energy leader. Newly discovered oil and natural gas deposits in shale formations are at the heart of the energy renaissance and will undoubtedly play a major role in America's energy future, but the critical role of nuclear power and the abundance and affordability of coal must not be overlooked. Just as important, efforts to sustain the growth of renewable energy capacity and generation that has occurred over the last decade — particularly in the wind, solar and biomass markets — are important elements for diversifying our energy mix and safeguarding the environment. Regardless of the mix of traditional and renewable fuels in U.S. energy production, we must ensure that appropriate and sufficient private and public investments are made in our nation's energy infrastructure, as a robust electric power sector capable of generating, transmitting and distributing electricity securely and without interruption is a fundamental component of U.S. economic growth and associated job creation. Finally, businesses and consumers also have a key role to play in ensuring America's energy future by continuing to improve the efficiency with which they consume energy.

To fully capitalize on this rare opportunity, however, America must break the decades-long cycle of ad hoc energy policies and forge a coherent, forward-looking energy framework. To accomplish this, we must first engage in an open and honest dialogue about our nation's energy priorities and values, which the Business Roundtable believes to be economic growth, energy security and environmental stewardship. The policy framework that is produced from this dialogue must strike a balance between ensuring regulatory and financial predictability and providing the flexibility necessary to capitalize on new energy developments and opportunities that will undoubtedly occur in the future.

The decisions we make regarding energy policy in the coming months and years will shape our nation's future for decades to come. The CEOs of the Business Roundtable believe that this document provides the right path forward for these decisions. By following the framework and recommendations outlined in this report, policymakers can help reclaim the United States' position as a global energy leader and improve our nation's economic, security and environmental futures.

Appendix: Acronyms

ACC – American Chemistry Council

ADR – automated demand response

ARRA – American Recovery and Reinvestment Act

BLM – Bureau of Land Management

BTU – British thermal unit

CAFE – Corporate Average Fuel Economy

CCUS – carbon capture, utilization and storage

CHP – combined heat and power

CO_2 – carbon dioxide

DOD – Department of Defense

DOE – Department of Energy

E10 – blend of 10 percent ethanol with 90 percent gasoline

E15 – blend of 15 percent ethanol with 85 percent gasoline

EIA – Energy Information Administration

EISA – Energy Independence and Security Act of 2007

EOR – enhanced oil recovery

EPA – Environmental Protection Agency

EPRI – Electric Power Research Institute

ESAs – Energy Service Agreements

ESCO – Energy Services Company

ESPCs – Energy Savings Performance Contracts

FERC – Federal Energy Regulatory Commission

GDP – gross domestic product

GHGs – greenhouse gases

GHG NSPS – GHG new source performance standards

LEED – Leadership in Energy and Environmental Design

LNG – liquefied natural gas

MATS – Mercury Air and Toxics Standards

Mcf – thousand cubic feet

MIT – Massachusetts Institute of Technology

NAAQS – National Ambient Air Quality Standards

NABERS – National Australian Built Environment Rating System

NERC – North American Electric Reliability Corporation

NESHAP – National Emissions Standards for Hazardous Air Pollutants

NIST – National Institute of Standards and Technology

NPC – National Petroleum Council

OECD – Organisation for Economic Co-operation and Development

PACE – Property Assessed Clean Energy

PM 2.5 NAAQS – National Ambient Air Quality Standard for fine particles

PTC – production tax credit

PV – photovoltaic

RFS – Renewable Fuel Standard

RPS – Renewable Portfolio Standard

UESCs – Utility Energy Service Contracts

utility MACT – Mercury Air and Toxics Standards

USTs – underground storage tanks

VVO – volt var optimization

Endnotes

1 The term "market inefficiencies" refers to instances in which a freely functioning market fails to attain a socially optimal allocation of resources. This may result from the existence of imperfect competition, imperfect information, incomplete markets, externalities (e.g., pollution) and other so-called market failures.

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