2015

ENERGY

TOMORROW

the state of American Energy

energy API®

2015

The American Petroleum Institute

The American Petroleum Institute (API) is a national trade association that represents all segments of America's innovation-driven oil and natural gas industry. Its more than 600 members — including large integrated companies, exploration and production, refining, marketing, pipeline, marine shipping and support businesses, and service and supply firms — provide most of the nation's energy and are backed by a growing grassroots movement of more than 27 million Americans. The industry also supports 9.8 million U.S. jobs and 8 percent of the U.S. economy, delivers $85 million a day in revenue to our government[1] and, since 2000, has invested more than $3 trillion in U.S. capital projects to advance all forms of energy.[2]

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Our Energy Tomorrow

Jack Gerard, The American Petroleum Institute

Jack N. Gerard
President and CEO
API

America now occupies a position of energy leadership that was unthinkable a short time ago. Gone are the days of uncertainty and concern over having the supply of energy we need, when we need it. Today, the United States is the world's top producer of natural gas,[3] the world's leading refiner of petroleum products,[4] and very soon could be the leading producer of oil.[5] These developments are strengthening America's energy and economic security and benefiting tens of millions of individuals, from current and future workers in the industry to those who have pension plans or 401(k) retirement accounts that invest in oil and natural gas companies,[6] and for every American every day in maintaining a high quality of life.

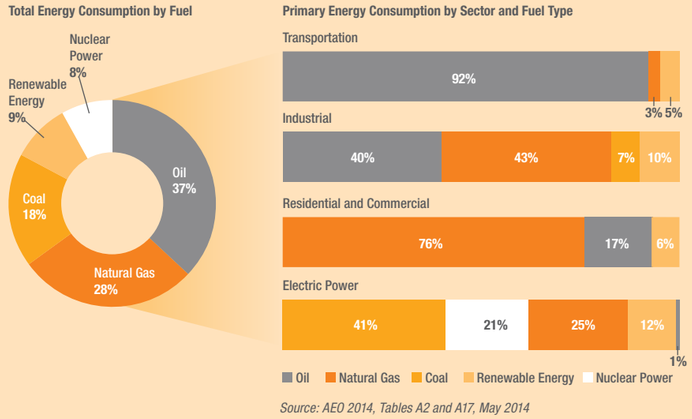
But this is only part of America's larger energy story. The United States is in the midst of a new era in domestic energy abundance characterized by rising use of renewable energy[7] and increased oil and natural gas production that is strengthening our economic outlook[8] and enabling America to emerge as a global energy superpower.[9] It is a remarkable transformation that has been made possible because America is uniquely rich in energy resources, a talented workforce and cutting-edge energy technologies. Nuclear energy, fossil fuels and renewable energy sources alike are vital components of the larger energy portfolio working to keep our economy moving.[10] And with both world and U.S. energy demand expected to increase in the future,[11] the continued availability of the full range of America's energy resources will grow in importance.

Today, different sectors of the economy rely on certain forms of energy. Transportation is largely fueled by oil, while electricity generation is powered by coal, nuclear, natural gas and renewables.[12] Looking ahead a quarter century from now, this is not expected to change,[13] which means each energy source — from oil and natural gas to solar and wind energy; from coal and nuclear to hydropower, geothermal and biomass — will remain essential to successfully meet America's future energy needs.

Such is the current State of American Energy, and hence, the emphasis of API's 2015 report. Rather than focus solely on the oil and natural gas industry, API this year is pleased to partner with organizations representing various energy sectors to highlight the contributions of each toward America's current and future economic well-being, and collectively stress the importance of adopting a lasting "all of the above" energy strategy.

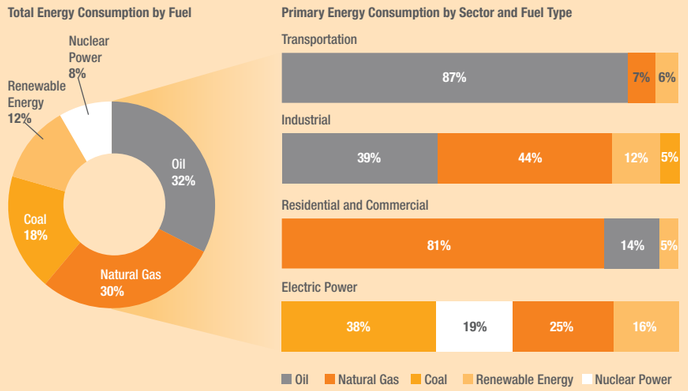
Energy is inseparable from America's economic growth and job creation, upon which rests a thriving quality of life and secure future for generations to come. The constant pursuit of innovation, driven by both robust competition and entrepreneurial spirit, has enabled the United States to safely develop a spectrum of energy resources. With smart public policy choices and a regulatory system that supports domestic energy opportunities, the United States can realize a prosperous energy tomorrow characterized by energy abundance and economic security.

U.S. Energy Consumption by Sector, 2012



Source: AEO 2014, Tables A2 and A17, May 2014

U.S. Energy Consumption by Sector, 2040



Source: AEO 2014, Tables A2 and A17, May 2014

Energy is inseparable from America's economic growth and job creation, upon which rests a thriving quality of life and secure future for generations to come.

America's Petroleum Renaissance

The American Petroleum Institute

Oil has been the foundation of the expansion and modernization of America's economy for more than a century. While the United States in recent history largely looked to foreign nations to satisfy its demand for oil, new cutting-edge technologies now enable America to capitalize on abundant domestic petroleum resources to increasingly meet its own current and future energy needs.

The results are striking. Since 2008, America's crude oil production has surged by 70 percent, rising from an average of 5 million barrels per day in 2008 to 8.6 million barrels per day in August 2014.[14] At its current production rate, the United States is anticipated to surpass both Saudi Arabia and Russia, historically two top energy producers, to become the world's largest producer of oil this year.[15]

Not surprisingly, America's new era in oil production has reverberated throughout the economy. The oil and natural gas industry contributed $1.2 trillion to U.S. Gross Domestic Product (GDP) in 2011, and at a time when other industries have been slow to add jobs in the wake of the recent recession, the oil industry supports 9.8 million jobs across the nation, up 600,000 from just two years earlier.[16]

Looking to tomorrow, petroleum will continue to be fundamental to America's economic growth and prosperity. Oil represents the lifeblood of the U.S. economy, providing for more than one-third of our current energy needs, and this is not expected to change significantly over the next quarter century.[17]

With smart policies that encourage the safe production, transport and refining of North America's abundant oil supplies, the United States can continue to be a global economic and energy leader well into the future.

A Foundation for America's Economic Recovery

The oil industry has been a steady source of growth and job creation in a still-struggling economy, and families and local communities are reaping the benefits. The industry supports 8 percent of the U.S. economy.[18] The refining industry alone, which plays a critical role in powering America's economic engine by producing fuels and petrochemicals, supports $289 billion in U.S. GDP and another 529,000 jobs.[19] At the height of the recession when the economy was losing jobs, direct employment in extraction grew by more than 300,000 jobs between 2009 and 2011, according to two reports from consulting firm PwC US.[20]

Jobs in the industry span a number of specialized fields, and workers earn higher-than-average wages — in fact, nearly double the national average wage across all industries.[21] Career opportunities will continue to grow with the industry, particularly among women and minorities. Of the nearly 1.3 million new job opportunities expected to be created by 2030, 408,000 of them are projected to be held by African-American and Hispanic workers, and women are expected to fill 185,000 of them.[22]

Looking to tomorrow, petroleum will continue to be fundamental to America's economic growth and prosperity.

America's Petroleum Renaissance

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As the industry expands, its strong commitment to safe operations remains unwavering. The API Standards Program has developed more than 600 industry standards, and more than 100 of them have been cited in existing federal regulations.[23] These standards, along with the creation of the Center for Offshore Safety and development of the API Process Safety Site Assessment Program to conduct safety systems assessments at refineries, help the industry continue its strong safety record.

An Essential Source of Energy Tomorrow

The rise in U.S. oil production has provided needed economic stimulus and been a valuable source of job creation, but petroleum's importance to the economy is much more profound. As America engages in important discussions about future energy use, oil's strong connection to our economic prosperity cannot be overstated.

Simply put, sustaining even modest economic growth in the years to come will require significantly more energy production. U.S. energy demand through 2040 is expected to increase by 12 percent, according to the U.S. Energy Information Administration.[24] Oil will play a fundamental role in meeting our future energy demand and fueling America's economic growth and prosperity in decades to come.

For consumers, U.S. refineries will continue to produce cleaner gasoline and diesel fuel for use in cars and trucks. As fuel requirements for vehicles have changed to make them more efficient and produce up to 99 percent fewer emissions, the refining industry has successfully met the need for these cleaner-burning fuels. In fact, meeting new vehicle emission requirements are largely possible through fuel advancements achieved at refineries.[25]

Just as important is oil's substantial contribution to specific industry sectors that factor significantly into U.S. economic growth. The transportation sector, which accounts for nearly 28 percent of energy demand today,[26] relies on oil to meet 92 percent of its energy needs.[27] The industrial sector uses oil for 40 percent of its primary energy requirements. In 25 years, this is projected to change very little. The transportation sector will still rely on oil for 87 percent of its energy needs in 2040, and the industrial sector will need oil for 39 percent of its primary energy requirements.[28]

Oil is an essential energy resource that plays a crucial role in the economy today, and it will be equally indispensable to our economic future. No other transportation fuel provides more energy by volume than gasoline and diesel or is more easily stored as an energy source in cars and trucks.[29] Like all of America's energy sources, it must be encouraged if the economy is to thrive.

Ensuring the Availability of Petroleum

Oil can continue to be an affordable, abundant and readily available energy source for consumers and businesses, and help fuel the economy well into the future, but public policies must keep pace with our energy revolution.

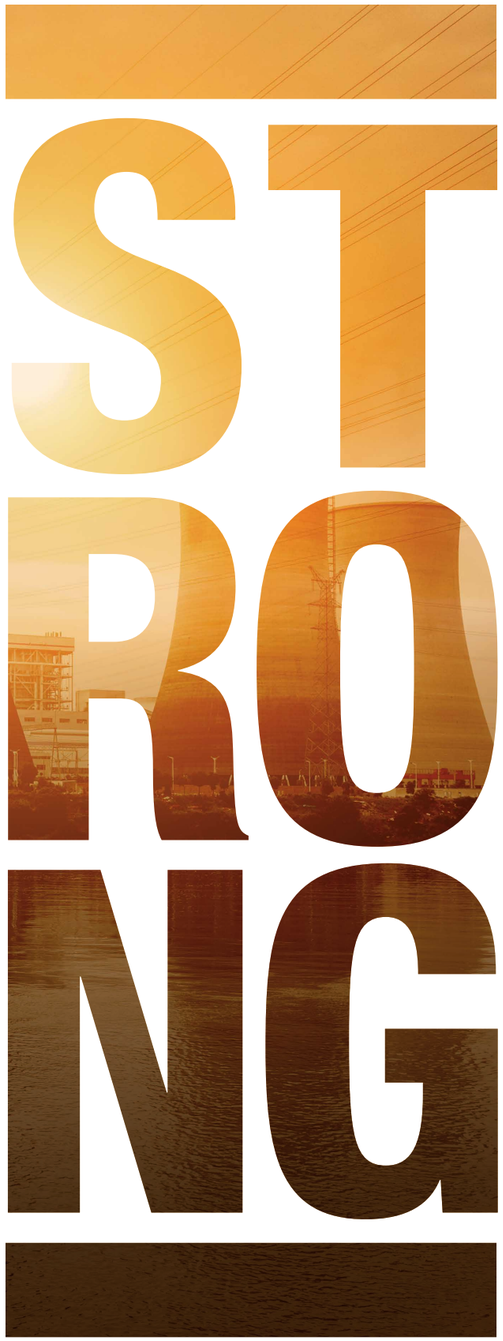
A strong domestic refining industry is essential to America's energy and economic security. Cleaner-burning gasoline and diesel, as well as biofuels, jet fuel and heating oil, fuel our homes and businesses and enable the movement of goods and people that is essential to a growing economy. Thanks to more efficient operations, U.S. refiners have increased capacity by roughly 16 percent over the past two decades[30] and today are refining near record amounts of crude oil.[31] America became a net exporter of petroleum products in 2011,[32] demonstrating the economic advantages of a robust domestic refining base that has access to overseas markets while meeting U.S. demand.

We must also support vital infrastructure projects, such as the Keystone XL pipeline. This much-needed addition to America's energy infrastructure would have the capacity to transport up to 830,000 barrels of oil a day.[33] Adding to the already operational southern leg, Keystone would bring both Canadian and U.S. oil to refineries for processing. Additionally, about 10 percent of the pipeline's capacity could also be used to bring oil produced in remote areas of North Dakota and Montana to market.[34] Approving Keystone will enable the U.S. to make significant strides toward meeting all of its liquid fuel needs from North American oil by 2024,[35] and create and enhance efficiencies between the production and refining sectors.

Also, federal lands and offshore resources must be opened for development. Developing oil and natural gas resources that have been kept off-limits by Congress could result in more than $1.85 trillion in government revenue over the life of the resource.[36] Recent studies by Quest Offshore estimated that opening up offshore regions in the Atlantic, Pacific and the eastern Gulf of Mexico for development could result in 839,000 new jobs and generate $38 billion per year for state and federal governments by 2035.[37]

Finally, with the United States on the verge of becoming the world's largest oil producer, eliminating trade restrictions dating back to the 1970s that prohibit crude oil exports would strengthen America's position as an energy resource to the world and its economic outlook. A recent study concluded that allowing crude oil exports could save consumers as much as $5.8 billion a year in lower fuel costs and add up to 300,000 jobs.[38] In fact, the 2014 U.S. trade deficit through August, all else equal, was nearly 18 percent lower due to petroleum product exports, according to data from the U.S. Census Bureau.[39]

Oil is vital to sustaining our economy now and in the decades to come. By making sound decisions today, America can continue to reap the benefits of this vast domestic resource and ensure a prosperous future.



Nuclear Energy Reliably Powers America

The Nuclear Energy Institute

Nuclear energy's contributions to the U.S. economy extend beyond being a dependable source of clean power generation. Construction of new facilities is driving job growth and economic development in numerous communities, providing valuable stimulus today and positioning nuclear energy to meet America's growing demand for power in the future.

Later this year, the Tennessee Valley Authority is expected to begin generating electricity at a new Watts Bar reactor in east Tennessee — the first nuclear energy project in America since the company started producing electricity at its first Watts Bar reactor nearly 20 years ago.

Five reactors are now under construction in the Southeast and all projects in this $30 billion expansion are more than halfway completed and tracking well relative to budget and schedule.

These are among the largest construction projects in the United States. Two advanced-design reactors being built at the Vogtle site near Augusta, Ga., represent the largest construction project in Georgia history — creating 5,000 jobs and driving vigorous economic development. A typical U.S. reactor contributes $470 million a year to the local economy[40] and typically is the most significant taxpayer in the region. Moreover, the construction of new reactors in the United States and globally has created thousands of new jobs throughout the American nuclear energy sector.

It's an enterprising time for the nuclear industry; lessons learned from these projects will help streamline the development of subsequent reactors that reinforce nuclear energy's prominent role in America's balanced energy portfolio.

A diversified portfolio of fuel and technology to supply power is fundamental to a reliable and affordable electricity system, and low-carbon sources will become ever-more valuable. One hundred nuclear energy facilities in 30 states produce nearly 790 billion kilowatt-hours of electricity each year[41] — more electricity than used by all but four countries from all power sources in the same period.[42]

As the energy industry and policymakers alike manage one of the most transformative periods in the electric sector, nuclear energy assets continue to provide a unique blend of valuable attributes: 24/7 large-scale electricity at sector-leading efficiency and reliability without producing greenhouse gases or other air pollution. In fact, this value proposition is why 72 new reactors are under construction worldwide[43] and another 174 nuclear projects are being planned.[44]

At the same time, some operating reactors are economically challenged in competitive markets due to price pressure from renewable portfolio standards and other market factors. In 2013, the Kewaunee nuclear plant in Wisconsin, a highly efficient reactor that produced affordable electricity, closed due to a confluence of market factors. Late in 2014, Vermont Yankee closed under similar circumstances.

Other nuclear facilities are at risk, including top-performing plants boasting 90-plus percent capacity factors and exceptional safety levels. As policymakers map the transition to a next-generation energy grid, they must systematically inventory the attributes of electricity sources that have value and then recognize that value in market designs, policies and operating practices. Absent this valuation, America runs the risk of losing valuable assets in its electricity grid and, in the process, reducing a central attribute of the American power delivery system: its diversity.

America's Leading Low-Carbon Power Source

Nuclear energy generates 63 percent of America's carbon-free electricity. It prevents carbon emissions and provides clean air compliance value, which the industry believes will have significant value as the U.S. Environmental Protection Agency develops a program to reduce CO_2 by 30 percent by 2030. Analyses by EPA,[45] the Energy Information Administration[46] and others clearly demonstrate that nuclear energy must play a significant role to meet national or regional carbon-reduction goals.

Nuclear plants provide large-scale electricity production, clean air, price stability and the highest reliability of any electricity-generating source. However, current market policies

and practices do not accord value to these attributes. The total value proposition of nuclear energy is, unfortunately, not fully recognized and realized.

The industry in 2014 launched a broad-based awareness campaign[47] — led by former Governors and Senators Evan Bayh and Judd Gregg — to ensure that opinion leaders and the public understand the strategic value of nuclear plants and the fact that some nuclear facilities are at risk of premature closure.

The aim is to begin a dialogue on the evolving energy landscape and potential policy solutions that will maintain these baseload assets, and create an environment that can lead to the necessary policy changes at the state and regional levels.

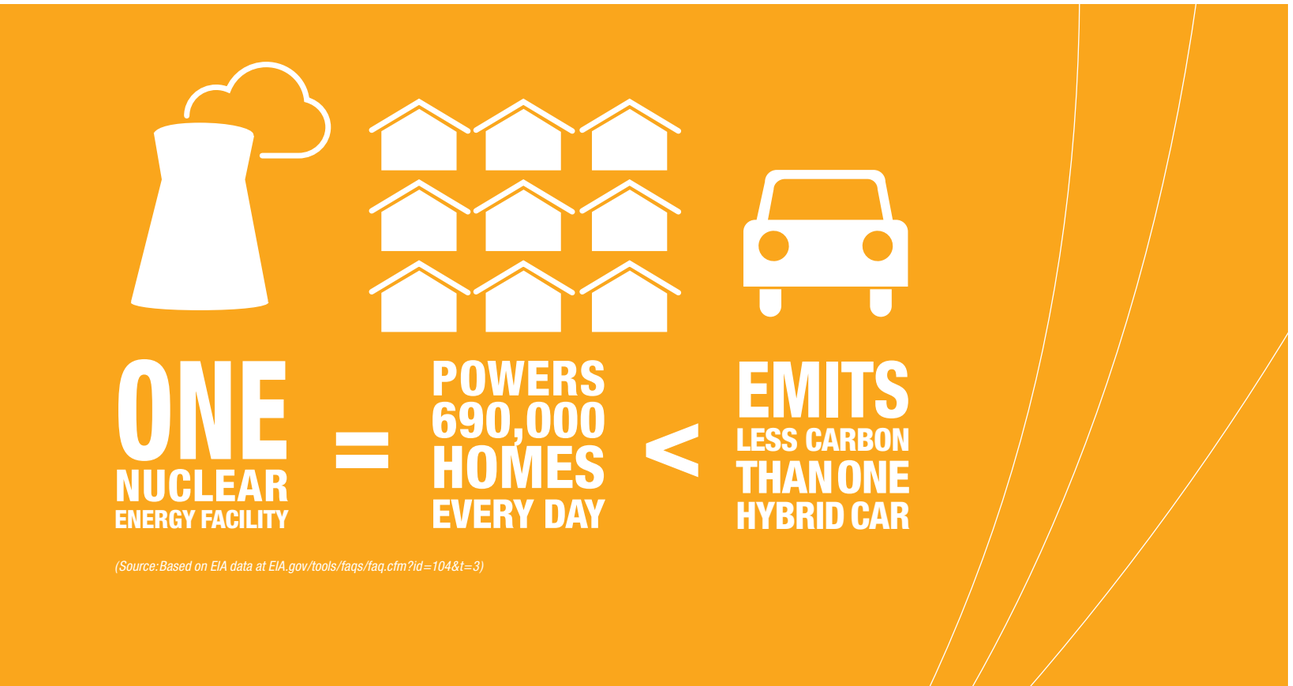
Global Leader in Safety

The U.S. nuclear industry is the global leader in nuclear energy safety, due to the combined efforts of the industry's workforce and the independent Nuclear Regulatory Commission (NRC). This commitment to safety is fundamental to the industry's future. The NRC is recognized as the global leader in safety regulation, and the agency is building on this record and evolving its priorities and practices along with the changing industry.

The NRC is in the formative stages of transitioning to a modern, disciplined and efficient regulatory system that maintains its commitment to safety, but with a greater focus on regulatory efficiency and discipline for prioritizing regulations and requirements that have a direct benefit to safety.[48] The challenge is to continually prioritize regulatory initiatives and, in some cases, eliminate those actions that have minimal or no safety benefit.

During the past three years, the industry has spent approximately $3 billion on nuclear plant upgrades as a result of lessons learned from the Fukushima accident in Japan[49] and NRC requirements for enhancing protective strategies against extreme natural events.[50] In response, the industry developed the FLEX strategy, an effective and tailored approach to providing layer upon layer of backup power and reactor cooling at each U.S. nuclear power plant.[51]

All U.S. companies are adding portable safety equipment at their nuclear energy sites and working together to manage additional portable safety equipment at two national response centers in Phoenix, Ariz. and Memphis, Tenn.



(Source: Based on EIA data at EIA.gov/tools/faqs/faq.cfm?id=104&t=3)

The emergency response centers are fully operational and capable of delivering equipment to any U.S. location within 24 hours.

Maximizing Today's Reactors, Building for the Future

The NRC last year finalized the process for companies to apply for a second renewal of nuclear power plant operating licenses under existing regulations. This was critically important to enable nuclear power to meet future energy demand as initial licenses allow plants to operate for 40 years; license renewals allow for additional 20-year periods of operation. More than 70 percent of existing reactors have been approved for license renewal,[52] and many are beginning to explore the feasibility of operating for up to 80 years, as long as they continue to meet stringent federal safety regulations.

Without a second license renewal period, more than 36,000 megawatts of nuclear energy will close by 2036. For electric system planning purposes, that's not far into the future. Maintaining nuclear energy at 20 percent of America's electricity supply will require 54,000 megawatts of new nuclear generation coming online in the next 25 years — or two large reactors each year.

To provide additional options for electric system planners, the industry is developing small modular reactor designs. Two designs are being advanced in a cost-share program with the U.S. Department of Energy.[53] Small, scalable nuclear energy facilities will be an important addition to the global nuclear energy market, particularly for emerging economies. Here at home, they will enhance energy security and expand nuclear energy's important role in reducing carbon emissions from the electric sector.

Small reactors, generally less than 300 megawatts in electric-generating capacity, are not a substitute for larger reactors. They give electric utilities more options for cleanly generating electricity at a lower capital outlay, including potential replacements for coal-fired plants that are closing. The industry expects the NRC to begin reviewing small reactor designs within two to three years.

The long-term prospects for nuclear energy remain strong. Even with modest economic growth over the next two decades, the Energy Information Administration forecasts a 28 percent increase in electricity demand by 2040.[54] That will require approximately 400 new, large power plants to meet increased 24/7 electricity demand and replace closed power plants.

Many mainstream, independent analyses of climate change conclude that nuclear energy must be expanded to meet rising electricity demand while reducing greenhouse gas emissions.[55] To succeed in this endeavor, the United States must establish a comprehensive and sustainable national policy that supports the development of technology-neutral, zero-carbon solutions like solar, nuclear energy, hydropower and wind. This policy must be implemented in the near term and be affordable for consumers. Therein lies the value of nuclear energy.

Hydropower | A Wave of Potential for a Renewable Energy Future

The National Hydropower Association

For well over a century, hydropower has been a reliable, low-cost, clean component of America's electricity portfolio. It powered the nation through the Great Depression and helped fuel our war effort during World War II, becoming a mainstay of economic growth and national security. Today, it continues to play an essential role in our energy mix and promises to expand that role with tens of thousands of untapped clean-energy megawatts.

Hydropower is the nation's largest source of renewable electricity. With 80 gigawatts of conventional and 20 gigawatts of pumped storage, hydropower provides numerous electrical, economic and environmental benefits. In 2013, it provided enough electricity for 25 million American homes to have access to clean, reliable, low-cost electricity.[56]

Hydropower provides baseload power critical to integrating greater amounts of intermittent renewable energy sources like wind and solar into the electricity grid. And "pumped storage" — energy that is stored by pumping water to a higher elevation reservoir that can be released when energy is needed — constitutes the vast majority of the nation's current energy storage capacity, which is critical in balancing other intermittent renewable resources and ensuring grid reliability.

Hydropower facilities can quickly go from zero power to maximum output, making them exceptionally good at meeting rapidly changing demands for electricity throughout the day. Long project life spans and zero fuel costs provide electricity at low-cost to tens of millions of Americans from coast to coast. Requiring nothing more than the flow of moving water, hydropower does not produce air pollution or toxic by-products.

Making an Economic Impact … with Room to Grow

Hydropower's positive economic impact is felt all over the country. Keeping the more than 2,000 hydropower facilities functioning optimally employs approximately 300,000[57] domestic workers and a supply chain of more than 2,500 companies from coast to coast. And every state in the country gets electricity from hydropower. While hydropower is certainly a critical resource in the Northwest, states such as Alabama, New York, North Carolina, Tennessee, and Arizona are among the top ten hydropower producing states in the nation.

Moreover, hydropower is a sustainable resource, which, in an era of concern over climate change and emissions, is an integral part of the solution to address climate issues and increase renewable energy generation. It was responsible for avoiding nearly 200 million metric tons of carbon pollution in 2013,[58] and new technologies and improved fish passage have helped reduce the industry's environmental footprint.

With its impressive remaining growth potential, there is an important place for hydropower in the nation's energy tomorrow. A 2010 study done by Navigant Consulting found that 60,000[59] megawatts (MW) of new hydropower capacity could be added in 15 years with the right policies

Hydropower is the nation's largest source of renewable electricity.

in place. Much of this development would not require the construction of new, large water infrastructure. In fact, as much as 10,000 MW could be achieved from capacity upgrades at existing plants.

Expanding hydropower would do more than just create new clean energy generation. It would create new job opportunities as well. Navigant estimated that pursuing the 60,000 MW identified in the report could support 1.7 million cumulative jobs.

Two recent reports from the U.S. Department of Energy confirmed that hydropower still has room to grow.

Though most people first think "dams" when they hear "hydropower," the two are not one in the same. Only 3 percent of the nation's 80,000 dams currently generate electricity. According to the U.S. Department of Energy, the United States could increase its generating capacity by over 12,000 MW through the addition of power generation to the nation's nonpowered dams[60] — enough to power 4 million American homes annually.[61]

Another U.S. Department of Energy study released in 2014 found extensive hydropower potential from new development still exists at the nation's stream reaches. The study estimated more than 65,000 MW of potential new hydropower development is available across more than 3 million U.S. rivers and streams — nearly equivalent to current U.S. hydropower capacity.[62] While not all of these resources will be developed for various reasons, it demonstrates that hydropower can continue to play an important role in the nation's clean-energy future.

Policies Can Enable Hydropower's Potential

America is entering an era where the value of hydropower in an all-of-the-above energy mix must be recognized in policy to ensure that its contributions are maintained and expanded.

Hydropower projects face a comprehensive regulatory approval process that involves many participants, including the Federal Energy Regulatory Commission, federal and state resource agencies, local governments, tribes, NGOs and the public. The system strives to promote development while protecting important environmental values. However, it can also contain redundancies and inefficiencies that unnecessarily slow the deployment of clean renewable hydropower and delay much-needed environmental enhancements and benefits. Currently, it takes more than five years to license even low-impact projects, such as adding hydropower to existing nonpowered dams. This delay adds costs and uncertainty that can make developers discontinue pursuing a hydropower project.

There have been some positive policy developments. Recent legislation passed unanimously by Congress and signed by the president has the Federal Energy Regulatory Commission examining how it can reduce licensing for low-impact projects to just two years. But, additional efficiencies in the regulatory process that get projects off the drawing board and put people to work are necessary at a time when we need all the renewable, affordable and reliable energy we can get.

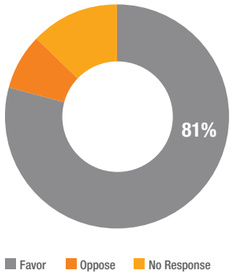
The uncertainty and inequality in tax incentives for hydropower development has also created a financial barrier for developers. Hydropower requires high capital investment up front. Currently, the production tax credit for hydropower is expired. Even when it was in place, hydropower developers received less than half the credit of other renewable resources. Reinstating this, and other renewable financing mechanisms, such as the Clean Renewable Energy Bonds for the tax-exempt sector, helps leverage additional private dollars to meet the costs of new development.

Finally, continued investment in research and development of conventional and emerging hydropower technologies is critical to the continued growth of the industry. Gains made over the past decade in developing more environmentally friendly turbines and bringing new technologies to market will be in vain if the Water Power Program at the U.S. Department of Energy is zeroed out again as it was under the previous administration.

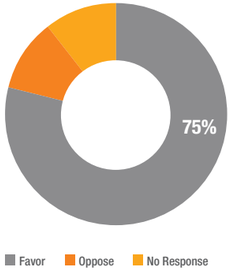
Hydropower brings tremendous electrical, environmental and economic benefits to the U.S. electricity grid and families and businesses. As America's largest renewable electricity resource, it provides for affordable electricity and a reliable power grid. These benefits will grow in importance as more and more renewable resources like wind and solar are brought online. With plenty of opportunity to unlock hydropower's untapped potential, hydropower will continue to play a large role in our diverse energy mix. Policies to support that growth are vital to reduce the financial and regulatory barriers that inhibit the development of this affordable, sustainable resource in the future.

The hydropower industry employs approx. 300,000 workers. Here, employees at Grant County PUD in Washington state oversee the installation of a new advanced turbine at their Wanapum facility. (Courtesy: Grant County PUD)

Support for Maintaining Existing U.S. Hydropower …

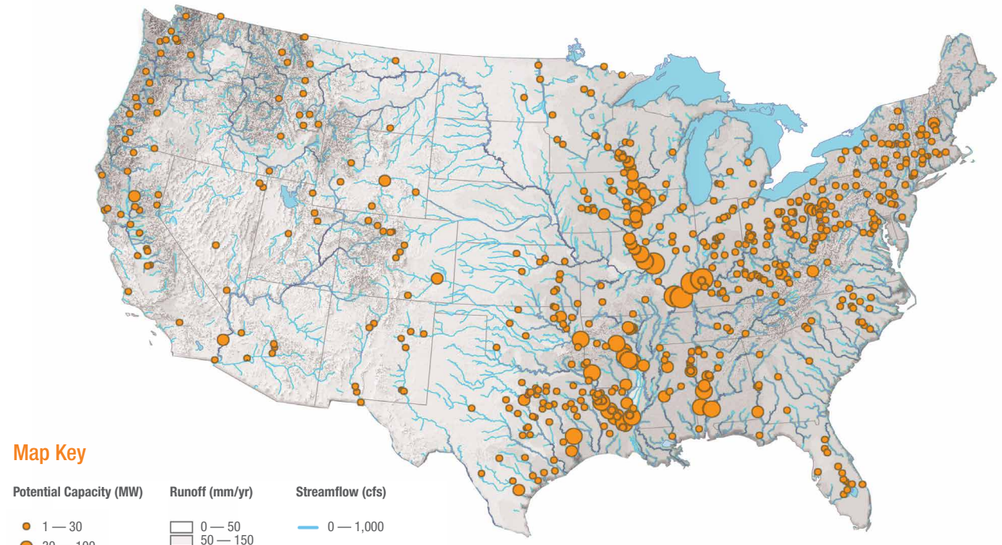


… and Expanding Hydropower in the United States



Maintaining existing hydropower and expanding its contributions enjoys broad public support.[63]

U.S. Nonpowered Dams with Potential Capacity Greater than 1 Megawatt



Note: This map has been generalized for cartographic purposes and some streams associated with nonpowered dams are not displayed.

Author: Brenna Elrod, November 7, 2013. This map was produced by Oak Ridge National Laboratory for the U.S. Department of Energy.

Solar Energy in America Shines Bright

The Solar Energy Industries Association

Few things threaten America's future prosperity more than climate change.

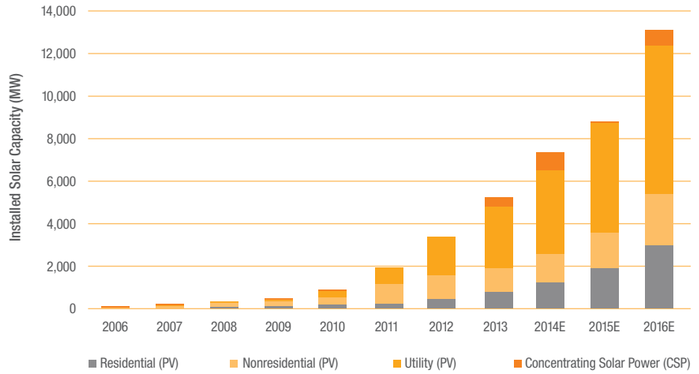
But there is growing hope. Every 2.5 minutes of every single day, the U.S. solar industry is helping to fight this battle by flipping the switch on another completed solar project.

According to GTM Research and the Solar Energy Industries Association (SEIA), the United States installed an estimated 7.4 gigawatts (GW) of solar last year — a 42 percent increase over 2013 — making it the best year ever for solar installations in America. What's more, solar accounted for a record 53 percent of all new electric generation capacity installed in the first half of 2014, pushing solar to the front as the fastest-growing source of renewable energy in America.[64]

Today, the U.S. has an estimated 20.2 GW of installed solar capacity, enough to effectively power nearly 4 million homes in the United States — or every single home in a state the size of Massachusetts or New Jersey — with another 20 GW in the pipeline for 2015-2016.[65]

Additionally, innovative solar heating and cooling systems (SHC) are offering American consumers cost-efficient, effective options for meeting their energy needs, while lowering their utility bills. In fact, a report prepared for SEIA outlines an aggressive plan to install 100 million SHC panels in the United States by 2050. This action alone would create 50,250 new American jobs and save more than $61 billion in future energy costs.[66]

Yearly U.S. Solar Installations and Forecast



A Growing Source of Environmentally Friendly Energy for Homes and Businesses

From an environmental perspective, solar helped offset an estimated 20 million metric tons of harmful CO_2 emissions in 2014, which is the equivalent of taking 4 million cars off U.S. highways or saving 2.1 billion gallons of gasoline.[67]

Simply put, when looking at America's energy future, solar can be a real game changer, providing more and more homes, businesses, schools and government entities across the United States with clean, reliable and affordable electricity while also helping states to meet proposed new obligations under Section 111(d) of the Clean Air Act.

Today, the U.S. solar market segments include utility scale photovoltaic or PV (48 percent); utility scale concentrating solar power, also known as CSP (9 percent); nonresidential PV (26 percent); and residential PV (17 percent). All totaled, there are an estimated 650,000 installed solar energy systems in the United States, including systems on more than half a million homes.[68]

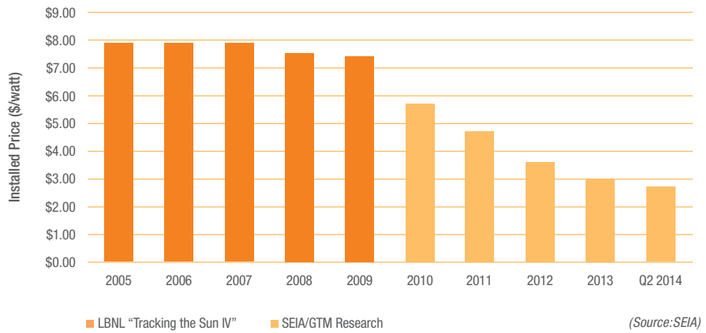
In fact, the residential sector grew an estimated 55 percent in 2014 — the largest among the market segments in terms of annual percentage growth. Last year's rapid growth in residential solar brings cumulative installed residential capacity to 3.5 GW, which is more than five times the amount of residential solar that existed in 2010. In fact, when all of the 2014 numbers are in, five states — California, Arizona, Hawaii, New Jersey and New York — are each projected to have installed more residential solar than the entire country did in 2006.[69]

The residential market has now grown by at least 50 percent in each of the past three years, largely due to continued decreases in the price of solar installation. Through the midway point of 2014, the price to install residential solar had fallen to $3.92/watt — more than 41 percent lower than 2010 and 6 percent lower than a year ago. When combined with increased

Solar Energy in America Shines Bright

The Solar Energy Industries Association

Average Solar Photovoltaic System Prices



(Source:SEIA)

market competition and new financing options, solar has never been more cost-effective for the residential consumer.[70]

U.S. businesses are also investing heavily in solar. According to SEIA's annual Solar Means Business report, which identifies major commercial solar projects and ranks top corporate solar users, Walmart remained America's commercial solar leader for the third year in a row with 105 megawatts (MW) installed at 255 locations.[71]

Other blue chip companies with large solar portfolios include Costco, Kohl's, Apple, IKEA, Macy's, Johnson & Johnson, McGraw Hill, Staples, Campbell's Soup, U.S. Foods, Bed Bath & Beyond, Kaiser Permanente, Volkswagen, Walgreens, Target, Safeway, FedEx, Intel, L'Oreal, General Motors, Toys "R" Us, Verizon, Toyota and AT&T.[72]

Combined, these companies have deployed 569 MW of solar capacity — a 28 percent increase over a year ago. Collectively, they're playing an increasingly important role in the development, expansion and promotion of solar nationwide, while also reducing their operating expenses, benefiting customers and shareholders alike.[73]

But the growth of solar in the United States isn't limited to commercial businesses — it's spread across all sectors. Today, there are nearly 15 GW of utility-scale, clean energy solar projects under contract in the United States — utilizing both PV and CSP technologies — which will put thousands of electricians, steelworkers and laborers to work, spurring the economy while helping reduce carbon emissions.[74]

Additionally, more than 15 major solar power plants (100 MW and above) have already come online, including Ivanpah (392 MW), Topaz (300 MW), Agua Caliente (290 MW), Solana (280 MW) and Desert Sunlight (278 MW). Solana also features six hours of thermal energy storage, enabling it to deliver electricity long after the sun has gone down.[75]

America's K–12 Schools Embracing Solar

Schools are investing heavily in solar, too. According to a new, first-of-its-kind study, America's K-12 schools have shown explosive growth in their use of solar energy over the last decade, soaring from 303 kilowatts (kW) of installed capacity to 457,000 kW, while reducing carbon emissions by 442,799 metric tons annually.[76]

Brighter Future: A Study on Solar in U.S. Schools was prepared by The Solar Foundation (TSF) — with data and analysis support from SEIA — and funded through a grant provided by the U.S. Department of Energy's SunShot program.

The report is the first nationwide assessment of how solar energy helps to power schools in communities across America. Most importantly, the report shows that thousands of schools are already cutting their utility bills by choosing solar, using the savings to pay for teacher salaries and textbooks.

Here are the report's key findings:

- There are 3,752 K-12 schools in the United States with solar installations, benefiting nearly 3 million students.
- Today, America's K-12 schools have a combined capacity of 490 MW, generating 642,000 megawatt-hours (MWh) of electricity each year.
- Of the 125,000 schools in the country, as many as 72,000 could "go solar" cost-effectively.

Additionally, an analysis performed for the report found that 450 individual school districts could each save more than $1 million over 30 years by installing a solar PV system. New York City, alone, could save $209 million. In a time of tight budgets and rising costs, solar can be the difference between hiring new teachers — or laying them off.

Effective Public Policies Paying Dividends

What's spurring this rapid growth? For one thing, solar energy is now more affordable than ever. According to SEIA/GTM Research, national blended average system prices have dropped 53 percent since 2010.[77]

Today, the solar industry employs 143,000 Americans and pumps more than $15 billion a year into the U.S. economy.[78] This remarkable growth is due, in large part, to smart and effective public policies, such as the Solar Investment Tax Credit (ITC), Net Energy Metering (NEM) and Renewable Energy Standards (RES). By any measurement, these policies are paying huge dividends for both the economy and environment.

The solar ITC is a 30 percent tax credit for solar systems on residential (under Section 25D) and commercial (under Section 48) properties. As a stable, multiyear incentive, the ITC encourages private-sector investment in solar manufacturing and solar project construction. As such, the solar ITC is the cornerstone of continued growth of solar energy in the United States. Under current law, the ITC will remain in effect through December 31, 2016.

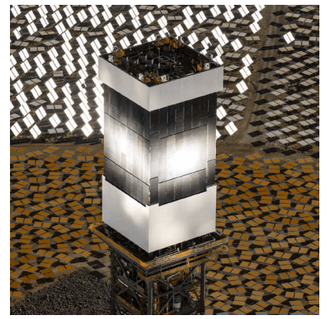
The ITC has fueled dramatic growth in solar installations. The market certainty provided by a multiple-year extension of the residential and commercial solar ITC has helped annual solar installations grow by more than 70-fold, rocketing from 106 MW to 7,400 MW since the ITC was implemented in 2006 — a compound annual growth rate of 53 percent.[79]

Net metering is a billing mechanism that credits solar energy system owners for the electricity they add to the grid. For example, if a residential customer has a PV system on the home's rooftop, it may generate more electricity than the home uses during daylight hours. If the home is net-metered, the electricity meter will run backward to provide a credit against what electricity is consumed at night or other periods where the home's electricity use exceeds the system's output. Customers are only billed for their "net" energy use. Exported solar electricity serves nearby customers' loads.

An RES requires utility companies to source a certain amount of the energy they generate or sell from renewable sources, such as wind and solar, while also establishing incremental targets that increase over time, helping reduce pollution and fight climate change. They are sometimes called renewable portfolio standards (RPS). These standards have proven to be one of the most effective policy mechanisms for driving demand of solar and other renewables. Currently, 29 states, plus the District of Columbia, have effective RPS policies.

The importance of establishing and maintaining effective public policies was highlighted in two reports issued last year by the International Energy Agency (IEA), which predicted solar could be the world's largest source of electricity by 2050 — so long as policymakers provide "clear, credible and consistent signals."[80]

Workers installing solar panels on the roof of the Deutsche Bank headquarters in New York City.



The Bright Source Energy solar facility at the Ivanpah Solar Electric Generating System in California's Mojave Desert.

Simply put, when looking at America's energy future, solar can be a real game changer … providing clean, reliable and affordable electricity.

Geothermal Power | Renewable Energy from the Earth's Warmth

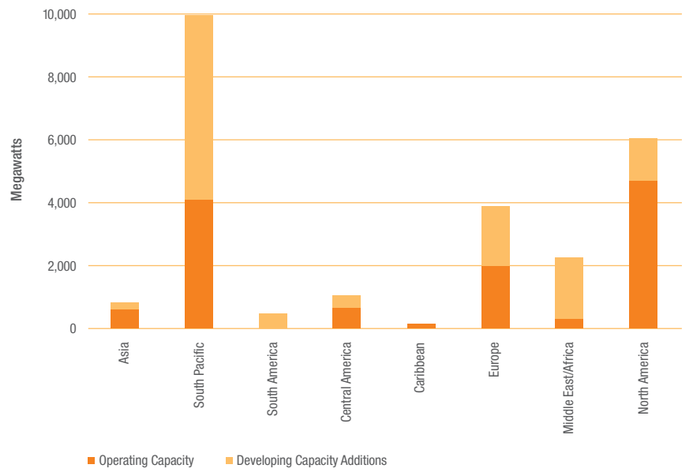
The Geothermal Energy Association

Electricity from geothermal energy was first generated in 1904 at Larderello geothermal field in the Tuscany region of northwestern Italy with a small 10-kilowatt generator. Since then, geothermal power has grown as a clean and reliable source of renewable electricity. Today, there are nearly 80 countries exploring for geothermal energy resources to power their economies and combat climate change.

Currently, the size of the global geothermal market is around 12.1 gigawatts (GW) and the U.S. market is roughly 3.6 GW of nameplate capacity.[81] Worldwide, geothermal power capacity has grown every year since the mid-1980s and is expected to increase by 4 to 5 percent each year for the rest of the decade as countries implement policies to avoid the consequences of climate change. The current 12.1 GW of global capacity represents only about 6 percent of total global potential resources, which the International Panel on Climate Change estimates at over 200 GW of identified geothermal resources.[82]

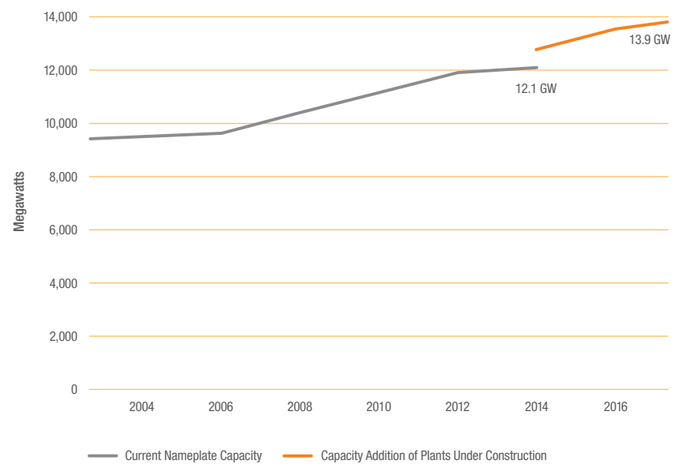
The fastest growth areas for geothermal power are presently East Africa, Indonesia and Central America. Motivated by the threat of climate change and demand for new electrical power, these regions are expected to bring a substantial amount of geothermal power online in the next decade. Around the world there is an additional 12.1 GW of geothermal power in some stage of exploration or development and about a tenth of that developing capacity is currently under construction. The Geothermal Energy

Operating and Developing Geothermal Capacity by Region



(Source: Geothermal Energy Association)

Geothermal Nameplate and Potential Capacity



(Source: Geothermal Energy Association)

Geothermal Power | Renewable Energy from the Earth's Warmth

The Geothermal Energy Association

Photo courtesy of Samuel Abraham, Baker Hughes of Puna Geothermal, Hawaii.

Photo courtesy of Samuel Abraham, Baker Hughes of Menengai Geothermal Resource Area, Kenya.

Geothermal power offers both firm and flexible solutions to the changing U.S. power system.

Association estimates conservatively the industry will reach at least 13.9 GW by 2017, just looking at projects in the pipeline already under construction.

Geothermal power offers both firm and flexible solutions to the changing U.S. power system by providing a range of services, including, but not limited to baseload, regulation, load following or energy imbalance, spinning reserve, nonspinning reserve, and replacement or supplemental reserve power. It is well known that geothermal plants can operate 24 hours a day with steady output, regardless of environmental conditions, and represent one of the only options for a renewable, baseload power source.

Additionally, geothermal power is environmentally friendly, producing very few emissions. Binary plants produce near-zero GHG emissions, while flash and dry steam plants represent a significant reduction compared to other technologies.[83] It also has a positive impact on local economies: For every 100 megawatts (MW) of geothermal built, an accompanying 170 operation and maintenance jobs and 640 temporary construction jobs are created.[84]

Finally, geothermal power is economical to produce. The U.S. Energy Information Administration (EIA) formulated the Levelized Cost (LCOE) and Levelized Avoided Cost per kilowatt-hour for various energy sources to be commissioned in 2019. In their latest forecast for geothermal power, EIA found the average LCOE to be 46.2 to 50.3 (2012 $/MWh) and Levelized Avoided Cost to be around 58.3 to 62.4 (2012 $/MWh), proving to be one of the most economical technologies EIA analyzed. According to EIA, "Geothermal cost data is site-specific, and the relatively large positive value for that technology results because there may be individual sites that are very cost competitive."[85]

Geothermal Power's Opportunities with the Oil and Natural Gas Industry

Tremendous opportunities exist for geothermal energy to capitalize on the staggering growth in oil and natural gas production and meet the economy's growing demand for power.

Beyond traditional hydrothermal resources that generate power today, there is a substantial amount of geothermal power potential in old oil fields across the western states and throughout the world. Oil and natural gas fields produce an average of 25 billion barrels of hot water annually, which could translate into over 3 GW of electricity.[86] The number of old oil and natural gas wells identified to have geothermal potential amounted to over 80,000 in 2012.

Historically, this hot water has required costly disposal; however, it is now being considered as a potential resource that can be used to produce electricity for field operations or sold to the grid. Many oil and natural gas fields have transmission infrastructure already in place, which could be inexpensively upgraded. These co-produced geothermal resources can deliver near-term energy savings, diminish greenhouse gas emissions, extend the economic life of oil and natural gas fields, and profitably utilize abandoned oil and natural gas field infrastructure.

In some cases, co-produced fluid (brine) is trapped under an impermeable layer of caprock. In many instances, various geological processes result in compressing these fluids to moderate pressures. These fields are called geopressured resources where temperatures typically range from 90°C to 200+°C. Additionally, the reservoirs that hold this fluid often contain dissolved natural gas that may not be economical to produce alone, but can be developed in combination with geothermal energy production from the hot brine. Geopressured brine reservoirs are located along the Pacific coast, in Appalachia, beneath the Gulf of Mexico and in other deep sedimentary basins in the United States. Development of these natural gas and geopressured geothermal resources is proven commercial through case studies, and used globally.

One recent example of a co-produced fluid system is ElectraTherm's Florida Canyon mine project in Nevada. Heat from geothermal fluids at the mine — once an unused by-product of gold mining — generates up to 70 kW of electric power for $0.06 to $0.08/kWh ($60 to $80/MWh) thanks to a small co-produced fluids generator, which was manufactured and installed for $982,000 with funds from a U.S. Department of Energy grant.[87]

In general, these small co-produced fluid units are mobile and unmanned. They can be set up in days or weeks, and moved as new wells are drilled. They are fully packaged, commercial units that have varying outputs depending on flows and temperatures of each well, and can be a cleaner and affordable alternative to diesel generators.

Policy Roadblocks to Geothermal Power's Expansion

With the right policies, geothermal energy can continue to grow as a share of America's energy portfolio and be a future source of clean energy for consumers and businesses.

One of the riskiest and most expensive steps during any geothermal power project occurs at the beginning when initially searching for geothermal resources. Before a developer can even begin construction, they will usually spend 50 to 60 percent of the project's total costs on exploration and drilling activities.

An effective way to encourage geothermal power's growth is for government to share this initial risk with the private sector through some kind of cost sharing, insurance, low-cost loan or other financial instrument. In many countries around the world, governments often share the risk of initial exploration because few private investors will assume it alone. Even the United States had policies supporting this assistance in the 1970s and 1980s. These mechanisms encourage the private sector to search for resources in new areas.

Legislation to address this obstacle has previously been introduced in Congress. It directed the creation of a loan program for high-risk geothermal exploration wells in the United States by establishing a Geothermal Investment Fund, which would help explore and confirm new geothermal resources as well as invest in new geothermal research projects. Further, the bill authorized a geothermal heat-pump research program at the U.S. Department of Energy, and federal oil and natural gas leases to co-produce geothermal energy, which is currently prohibited by the Mineral Leasing Act and Geothermal Steam Act of 1970.

Another barrier that raises costs for geothermal projects is long lead times for permit approvals. Bureaucracy can be particularly troublesome while geothermal developers wait for permits to explore resources they have recently found. In general, a current geothermal project takes 5-7 years to work its way through the federal government's approval process. This long delay raises costs for developers and projects that already require significant upfront capital.

ENERGY

Special Section | Infrastructure — The Essential Link to a Secure Energy Future

Equally important to promoting development of all of America's diverse energy sources is ensuring a robust national energy infrastructure that can reliably deliver it to consumers and businesses. Whether over land, underground or via waterways, the many modes responsible for moving energy from coast to coast work in concert with each other to make energy available when and where it is needed. Sustaining and expanding America's energy infrastructure is vital to a dependable supply chain that provides uninterrupted energy, which is central to our economic growth and national security.

Redundancy in the energy infrastructure is critical to its resilience and helps minimize any disruptions that occur. On the instance when there is an interruption of service, this same redundancy enables the system to recover as quickly as possible.

Often, the most significant barrier to maintaining existing and constructing new infrastructure is local opposition. Siting and permitting of projects often face delays that not only deny benefits in the local community, but also in towns far away that could see economic gains by virtue of the energy that is transported. In the oil and natural gas industry alone, investments in building, maintaining and updating transportation and storage infrastructure could contribute up to $120 billion to the economy each year and support as many as 1.15 million jobs annually over the next 12 years.[88]

Supporting those efforts that keep America's energy infrastructure — pipelines, surface transportation, ports and inland waterways, and the electricity grid — working effectively to meet current and future energy requirements will be the responsibility of elected leaders and citizens alike.

Pipelines

America's pipeline system — the most extensive in the world[89] — covers roughly 2.6 million miles[90] transporting oil and natural gas to refining and processing facilities and then to markets in the United States and around the world. The U.S. natural gas pipeline system consists of 305,000 miles of interstate and intrastate pipelines,[91] moving natural gas to processing facilities and then to homes and factories throughout the country. Keeping pace with rising production occurring throughout North America requires not only increasing capacity, but completely restructuring the system, which was designed to carry imported oil from coastal refineries to customers inland, but now must move significant quantities of oil and natural gas from often remote production areas to facilities for processing. In fact, movements of crude oil by pipeline from the Midwest to the Gulf region grew from 50,000 barrels per day in 2008 to more than 380,000 barrels per day in 2013.[92]

Pipelines remain the principal mode for transporting crude oil, refined products and natural gas. In 2013, pipelines carried nearly 15 billion barrels of crude oil, petroleum products and natural gas liquids to their destinations reliably and safely more than 99.999 percent of the time.[93] Though nearly 12,000 miles of new crude oil and 11,000 miles of new natural gas liquids pipelines have been constructed during the last 10 years,[94] much more is needed to transport the high volumes of crude oil, natural gas and natural gas liquids being produced to refineries and chemicals plants where they can be made into the fuels and raw materials consumers rely on each day.

Sustaining and expanding America's energy infrastructure is vital to a dependable supply chain that provides uninterrupted energy, which is central to our economic growth and national security.

Surface Transportation

Various modes of surface shipment also play an indispensable role in America's energy transportation network. Whether truck or train, surface transportation moves energy resources from locations where they are produced to facilities where energy is refined or generated, and then on to consumers and businesses.

Special Section | Infrastructure — The Essential Link to a Secure Energy Future

In the petroleum industry, rail has played an increasingly important role in the transportation of crude oil, serving as a flexible and readily available mode for moving oil from new fields that have led to the surge in domestic production. There are approximately 49,000 rail tank cars in service for the safe transport of crude oil,[95] with another 30,000 expected by the end of 2015.[96] The volume of crude oil shipped by rail tank cars increased from nearly 66,000 carloads in 2011 to over 407,000 carloads in 2013.[97]

Surface transportation also plays an important role in the movement of other energy sources, including coal and biomass used for electricity generation. Rail is a primary method for transporting coal used by power generation facilities,[98] particularly coal that is produced in Appalachia and other inland regions of the U.S. Woody biomass feedstock used for energy generation is transported to forest products manufacturing facilities by either truck or rail, but truck provides the most flexibility for transporting this material from remote areas, accounting for roughly 90 percent of all pulpwood delivered to U.S. mills in 2005.[99]

Ports and Waterways

Often, maritime methods are the most ideal for transporting large volumes of energy resources within the U.S. and they are the only means to export crude, natural gas and their products overseas. America's system of more than 25,000 miles of inland waterways provides important arteries for efficiently moving various resources to domestic processing and distribution areas, and ports serve as critical hubs for energy coming into and leaving the U.S. By effectively maintaining both, and expanding port facilities where needed, they can continue to anchor America's economic growth and energy security.

Maritime transportation is a method for moving large quantities of oil and natural gas from areas where it is produced, refined or processed to market. In the U.S., 42 percent of all waterborne trade comprises crude oil or petroleum products.[100] Globally, more than 46 trillion barrels of oil are carried worldwide via waterway[101] and safely delivered to port. Over the last decade, 99.99954 percent of oil shipped to the U.S. reached its destination without incident.[102]

Today, demand for natural gas in Asian countries has skyrocketed and, as the leading producer of natural gas in the world, the U.S. stands on the edge of becoming one of the world's largest exporters of the product. LNG ships are the only mechanism to move natural gas to markets overseas. It is imperative that export terminals be approved and the maritime infrastructure is sound to support this opportunity.

Maritime is also emerging as an option for reliably transporting coal for electricity generation. Power generation facilities located along coastal areas of the U.S. are increasingly using imported coal transported via ships, some of which can carry more than 50,000 tons of coal at a time,[103] to meet electricity demand. While such coal imports only account for roughly 1 percent of total U.S. coal consumption,[104] maritime transportation of coal shows how a diverse energy infrastructure is important to meet America's energy needs.

As public infrastructure, the responsibility for maintaining inland waterways, as well as ports and harbors, falls to the federal government. Absent proper resourcing, locks and dams that manage the movement of ships on the inland waterway system suffer from age and disrepair. Additionally, many of the inland waterways themselves, as well as harbors, get shallower and narrower as they fill with silt over time. Proper maintenance maximizes the efficiency of waterways for the movement of energy while minimizing the chance of an incident.

The Electricity Grid

While the U.S. will continue to rely upon many diverse methods of electricity generation to meet energy demand, including coal, solar, biomass, geothermal, nuclear, wind, hydropower and natural gas, it is the electricity grid that connects all these energy sources to consumers and businesses. The grid's interconnected system of power generation facilities, transmission lines and distribution facilities provide electricity to more than 145 million customers.[105] As new natural gas and renewable electricity generation plants join traditional coal-fired facilities, more up-to-date capacity must be added to today's roughly 450,000 miles of high-voltage transmission lines[106] to adequately carry electricity to consumers.

Today's aging electricity grid is especially vulnerable to severe weather. About 70 percent of the U.S. electricity grid's transmission lines and power transformers are more than 25 years old.[107] Improving the electricity grid with newer transmission lines is as essential as adding new capacity to provide more resiliency and redundancy across the grid that can prevent power outages during severe weather, which, according to a 2013 report from the Executive Office of the President, were estimated to have cost the economy an inflation-adjusted annual average of $18 billion to $33 billion between 2003-2012.[108]

Additionally, cyberattacks are a growing threat to the electricity grid. Such attacks are increasing in both frequency and sophistication[109] and, unlike severe weather, are more difficult to predict. A successful large-scale cyberattack could lead to extended power outages over large portions of the electricity grid and have a cascading effect that impacts many other services, from communications to food and water supply.[110] The U.S. Department of Homeland Security reported responding to 198 cyber incidents in fiscal year 2012, and 41 percent of them involved the energy sector.[111] Adequately protecting the electricity grid from cyber threats must be a joint effort by federal, state and local governments as well as relevant energy sectors.

Natural Gas | America's Abundant, Clean Energy

The American Petroleum Institute

Today, America has an opportunity to embrace natural gas as a fuel of our future. The United States has vaulted past Russia to become the world's largest natural gas producer and is projected to become a net exporter within the next decade.[112]

This development is attributable to technological innovation in the areas of horizontal drilling and hydraulic fracturing that turned previously inaccessible natural gas resources into producing wells — a 100-year, secure and safe supply of clean-burning natural gas. It has also paved the way for significant economic growth and opportunity. Today, the natural gas industry supports nearly 3 million jobs and adds about $385 billion to the national economy each year.[113]

Natural gas is projected to be an even more significant part of the country's energy mix in years to come. According to the Energy Information Administration (EIA), natural gas represented 28 percent of U.S. energy consumption in 2012 and is expected to grow to 30 percent by 2040.[114] However, as important as natural gas is to today's economy and our future energy needs, more must be done to capitalize on this resource and drive greater economic prosperity, including expediting the approval of U.S. liquefied natural gas (LNG) facilities and exports.

Creating New Jobs and Strengthening the Economy

Development of unconventional energy resources is a substantial driver of job growth and a more prosperous economic environment. A report by IHS Global Insight showed that the development of shale resources through hydraulic fracturing supported 2.1 million jobs in 2012.[115] This helped drive a 40 percent increase in job growth in the industry between 2007 and 2012, well outpacing overall private-sector job growth of only 1 percent.[116] Continued development is expected to boost that number to 3.9 million jobs by 2025, including more than 500,000 manufacturing jobs and 319,000 chemicals sector jobs.[117]

Hydraulic fracturing is also driving greater personal income, government revenue and domestic economic growth. The average U.S. household enjoyed an additional $1,200 in disposable income in 2012 from lower energy costs thanks to hydraulic fracturing — a total expected to grow to $3,500 in 2025.[118] And development of shale resources added $284 billion to U.S. GDP in 2012, a figure expected to grow to $533 billion by 2025.[119]

Furthermore, the incredible success of shale gas development has sharply reduced electricity and natural gas costs for local communities across the country.

Today's natural gas industry is already a significant contributor to job and economic growth, and these benefits are only expected to increase in the decades ahead. The critical question is whether or not the United States will take the necessary steps to maximize the opportunities.

Natural Gas | America's Abundant, Clean Energy

The American Petroleum Institute

U.S. public school districts saved $1.2 billion on electricity and natural gas in the 2012/2013 fiscal year, enough money to employ an additional 14,200 teachers, according to IHS.[120] State and local taxpayers saved $720 million on public electricity and natural gas expenditures, the approximate cost of an additional 11,000 public-service employees.[121]

The rapid development of America's natural gas resources delivers benefits that go well beyond economic growth. As a clean-burning energy source, natural gas is making a positive contribution to the nation's environmental and energy sustainability goals. U.S. carbon dioxide (CO_2) emissions are near 20-year lows, and a major reason for that progress is the development and use of America's abundant natural gas resources.[122] EIA projects energy-related CO_2 emissions to be substantially below 2005 levels by 2040[123] thanks, in large measure, to a continued shift to less carbon-intensive fuels, such as natural gas. Between 2006 and 2012, EPA data show methane emissions fell 40 percent while production of natural gas surged 37 percent. Finally, EPA estimates that technology and improvements led to a 73 percent decrease in methane released by natural gas development since 2011.[124]

These benefits — economic and environmental — are made possible by extraction methods that are safe and proven. Hydraulic fracturing has been in practice for more than 65 years and has been used in more than 1 million wells in the United States alone.[125] State regulation of hydraulic fracturing has been in place since its inception and, together with federal oversight and well-established industry standards, effectively protects the environment and workers.

Vital to our Economic Future

Today's energy debates are often dominated by the need for enhanced energy efficiency and the promise of nonfossil fuel sources. While it is true that renewable sources of energy are growing rapidly and other technology improvements will deliver greater energy efficiency, expected global population and economic growth mean demand is growing even faster.

In fact, EIA's most recent projections show U.S. energy demand increasing by 12 percent between 2012 and 2040, and that oil and natural gas, which together supplied 65 percent of the energy we used in 2012, will still provide 64 percent by 2040.[126] EIA goes on to project that natural gas will meet roughly the same share of industrial and electric power demand and an increasing share of the demand in the transportation and commercial sectors.[127]

Furthermore, America's abundant domestic supply has enabled energy-intensive manufacturing companies that had been moving overseas to stay and, in some cases, return to the United States to take advantage of our domestic energy renaissance.

Today's natural gas industry is already a significant contributor to job and economic growth, and these benefits are only expected to increase in the decades ahead. The critical question is whether or not the United States will take the necessary steps to maximize the opportunities.

Capitalizing on America's Abundant Natural Gas

Natural gas is recognized as being critical to meeting America's surging energy needs now and for the foreseeable future. However, in order for the United States to make the most of the opportunities that its abundant natural gas resources represent, we must develop appropriate policies that encourage continued use of safe, effective and environmentally responsible techniques, including hydraulic fracturing, horizontal drilling and offshore operations.

Freeing America's energy resources for development is essential to growing the economy, enhancing security, spurring job creation, increasing federal, state and local revenue, and improving the U.S. balance of trade. Sixty-six percent of voters say they are more likely to support a candidate in 2016 who supports producing more oil and natural gas, according to a survey by Harris Poll.[128]

Once produced, we need to enable the necessary expansion and extension of the pipeline infrastructure in the United States to get natural gas to customers. Much of the nation's electric generation and heating is becoming more dependent on natural gas, and the United States must have forward-thinking policies in place that ensure the successful build-out of natural gas infrastructure.

The United States also needs to seize the opportunity to become an exporter of LNG, which would reduce the nation's trade deficit, increase government revenue, grow the economy and support millions of U.S. jobs in engineering, manufacturing, construction and facility operations — with no significant price impact projected for domestic consumers.[129]

LNG exports could contribute up to $31 billion to the economy of Texas alone,[130] and other states will experience ripple effects due to the demands for steel, cement, equipment and other goods. Job gains as high as 155,000 are expected in gas-producing states with additional, indirect gains elsewhere.[131]

The opportunity that LNG exporting poses will not materialize on its own. There is a global race to build the infrastructure necessary to secure a sustainable leadership position. Today, there are more than 60 LNG export projects planned or under construction around the world.[132] The United States must act quickly to cement its place in this emerging market and secure the economic benefits — otherwise, we will cede the opportunity to other regions and lose a valuable tool for gas and petroleum production as well as global diplomacy.

The United States is blessed with a bountiful supply of clean-burning natural gas. This resource is helping cement the country's position as an energy superpower — bringing more and better jobs, supporting a cleaner environment and driving greater levels of economic prosperity. Now is the time for policymakers to continue to embrace natural gas and the opportunities it provides.

The Attributes of Wind Energy are Adding Up

The American Wind Energy Association

Wind energy has emerged as an attractive source of clean power that is delivering numerous economic benefits today and is poised to play a key role in meeting America's future needs for clean, affordable energy. Mainstream in the United States for many years and still on a steep growth curve, wind energy has a new source of appeal: Over the past five years, its cost has dropped an impressive 58 percent.[133]

As a result of continued technological improvement and domestic manufacturing, wind energy has become one of the most affordable sources of electricity today and one of utilities' leading choices for new generation.

It has also become a major economic contributor. The U.S. wind industry has attracted up to $25 billion a year in private investment and generated up to 85,000 jobs, roughly one-third of them in a rapidly growing new U.S. manufacturing sector.

Wind turbines offer zero emissions and use no water in operation, which offers an appealing energy option to policymakers seeking affordable pollution solutions that can be rapidly scaled up, including to meet pending EPA regulations on carbon emissions from power plants.

Affordably Positioned for Growth

Technological improvements leading to capacity gains are responsible for much of wind energy's impressive cost decline. Bolstering America's domestic wind manufacturing supply chain has helped, too, as it avoids the transportation costs involved with importing such large components from overseas.

Utilities are signing power purchase agreements (PPAs) for wind energy at a record pace, entering into 60 such contracts totaling over 8,000 megawatts (MW) in 2013.[134] When announcing these agreements, utilities typically highlight the cost savings for their customers.

"Wind prices are extremely competitive right now, offering lower costs than other possible resources," said David Sparby, president and CEO of Xcel Energy's Northern States Power, announcing 600 MW of new wind power contracts. "These projects offer a great hedge against rising and often volatile fuel prices."[135]

When MidAmerican Energy, the investor-owned utility controlled by investment icon Warren Buffett, received state approval for a major 1,050 MW wind farm in Iowa, the utility stated: "The expansion is planned to be built at no net cost to the company's customers and will help stabilize electric rates over the long term by providing a rate reduction totaling $10 million per year by 2017, commencing with a $3.3 million reduction in 2015."[136]

Industrywide numbers bear out such statements. The U.S. Department of Energy's annual Wind Technologies Market Report of August 2014 confirmed that wind power prices have reached historically low levels.[137]

As a result of continued technological improvement and domestic manufacturing, wind energy has become one of the most affordable sources of electricity today and one of utilities' leading choices for new generation.

The Attributes of Wind Energy are Adding Up

The American Wind Energy Association

In addition to cost-competitiveness today, wind energy has another quality that utilities value: price stability. Comments from electricity generators praising wind energy's ability to stabilize rates have become almost commonplace in utility news releases announcing wind energy agreements. Since a wind farm uses no fuel, PPAs can lock in prices for the long term, with contracts typically lasting 20 to 25 years.

As a result, wind energy has increasingly become the primary choice for new power in such regions as the Pacific Northwest, Plains states, and Midwest, providing 60 percent or more of all new electric generating capacity between 2011 and 2013, and delivering over 80 percent in the upper Midwest.[138]

Looking to the future, the U.S. Department of Energy's Wind Vision report, in peer review since it was previewed at the American Wind Energy Association's annual conference in 2014, states that wind energy capacity could double by 2020 and provide 10 percent of America's electricity, and then double again by 2030 to 20 percent of the grid. It projects that by 2050, wind can provide as much as 35 percent of the nation's electricity.[139] At that point, wind would be one of the leading sources of electric generation in the U.S.

The Wind Vision report becomes all the more compelling when considering that the U.S. industry is on pace to meet the 2030 goal, as outlined in an initial report produced by the George W. Bush administration in 2008.[140] The vision is already becoming reality.

Poised to Meet America's Future Clean Energy Challenges

While its price may make wind power irresistible to cost-conscious utilities, its other benefits are also important to America today, and will only become more so.

In June 2014, the U.S. Environmental Protection Agency proposed the first rule to limit CO_2 emissions from existing power plants under Section 111(d) of the Clean Air Act. States are expected to have substantial flexibility to meet the rule with low-carbon options "outside-the-fence." Wind energy can be a particularly attractive option to quickly and affordably comply with the rule, as state implementation plans are prepared in the coming years.

As shown by the 2014 Lazard report on the levelized cost of energy, wind is the most cost-effective generation option for reducing emissions.[141] With more than 62,000 MW now producing zero-emission electricity, today's installed wind fleet is already making a difference. The 167.7 million megawatt-hours generated by wind energy in 2013 avoided an estimated 127 million short tons of CO_2, equal to reducing power-sector carbon emissions by 4.4 percent, or taking 16.9 million cars off the road.[142] Moreover, a recent study found that a wind turbine designed to produce electricity for at least 20 years will pay back the energy cost of its production and installation in just five to eight months.[143]

One benefit that often goes unnoticed is the water that is saved by using wind energy, and the associated enhancement to reliability during heat waves. The 2008 U.S. Department of Energy Wind Vision report found reaching 20 percent of U.S. electricity generation by 2030 would save 4 trillion gallons of water, more than the annual consumption of 9 million Americans.[144] Wind energy generation led to water consumption savings of 36.5 billion gallons of water in 2013 — roughly 116 gallons per person in the U.S.[145] When heat waves threaten, wind energy can help keep the lights on.[146]

Offshore wind energy is an exciting segment of the industry that is anticipated to begin construction in 2015, bringing an energy source familiar in Europe to the U.S. for the first time. Such projects have been proposed in both state and federal waters off the Atlantic and Pacific Coasts, as well as in the Great Lakes and the Gulf of Mexico. Developers of two projects off Massachusetts and Rhode Island are expected to put steel in the water by the end of 2015.

Stable Policies Enable Wind to Thrive

Wind energy's rapid advance is remarkable when considering the unstable policy environment in which it has been forced to operate. The federal Production Tax Credit (PTC), wind energy's primary policy driver (as well as the alternative Investment Tax Credit relied on by offshore and community wind developers), has operated under short-term extensions of usually one and two years.

It has been allowed to expire several times before being renewed. This has created a boom-bust cycle for the industry.

Perhaps the best indication of what the industry is capable of doing in a stable policy environment was witnessed in the dramatic growth seen between 2005 and 2012, the longest stretch to date during which Congress did not allow the PTC to expire. American wind power saw 800 percent growth over the period, and average annual growth of 31 percent.

Total investment in new wind farms reached $105 billion and, during this time, a vast majority of all wind power capacity in the U.S. today was installed. In the record year of 2012 alone, the industry installed over 13,000 MW of capacity.[147]

In today's rapidly shifting environmental and energy policy landscape, an important goal of the wind industry is a policy framework that appropriately values its attributes, including zero-emissions power with no water use.

Failing to properly value a product's public benefits can be deemed a market failure. An appropriate policy environment will correct that failure, freeing the industry to realize the Wind Vision outlined by the U.S. Department of Energy — doubling its contribution by 2020, reaching 20 percent by 2030, and providing over one-third of the nation's electricity by 2050 while saving consumers money.

Electricity from Coal is a Vital, but Threatened, Energy Source

The American Coalition for Clean Coal Electricity

Coal-fueled electricity generation has powered the American way of life for decades and remains the backbone of the U.S. electrical grid. In 2013, coal-fueled generation accounted for nearly 40 percent of all electricity produced in the United States. This affordable and reliable energy source is critically important to America's economic present and future. Today, electricity from coal supports more than 880,000 U.S. jobs and contributes more than $106 billion to the national economy.[148]

Ninety-three percent of the coal consumed in the United States is used to generate electricity in 48 states, providing at least half of the electricity in 17 states and at least one-quarter of the electricity in 31 states. Coal is also used in the steel, paper, cement and plastics industries. It is used to produce activated carbon for water purification and carbon fibers for fuel cells and electronics. Coal is critical to keeping electricity costs low. Thirty-one states that, on average, generate more than 55 percent of their electricity from coal pay 11 percent less than the national average for electricity.[149]

America's future economic growth and energy security will require the continued and increasing use of fossil fuels, like coal, as part of a sensible, diverse energy portfolio. According to the Energy Information Administration, the United States has the largest recoverable coal reserves in the world, and is capable of meeting domestic demand for coal for roughly 290 years.[150]

Regrettably, the cumulative actions of the U.S. Environmental Protection Agency (EPA) since 2008 put in jeopardy the continued availability of affordable and reliable electricity from coal.

Numerous Policies Threaten Coal-Based Electricity

As of July 2014, EPA policies — primarily the Mercury Air Toxic Standards (MATS) rule finalized in 2013 — have led to the announced retirement or conversion of more than 350 coal-fueled generating units throughout the country.[151] In August 2014, the Government Accountability Office (GAO) released a report estimating 13 percent (roughly 238 units and 42,192 megawatts) of the nation's 2012 coal capacity will be retired by 2025, which is considerably higher than estimates made by GAO just two years earlier. GAO reported that three-quarters of these retirements will occur before the end of 2015 because of MATS and that "this level of retirements is significantly more retirements than have occurred in the past." GAO also warned that "some regions may face reliability challenges." EPA projected only 4,700 megawatts of coal-fueled generation would retire because of the MATS, a gross underestimation.[152]

EPA's proposed carbon emission standards will only exacerbate an already tenuous energy situation. EPA's proposed standard for new generating units under section 111(b) of the Clean Air Act effectively bans the construction of new, highly efficient clean coal plants. In order to meet the proposed standard, new coal plants would require Carbon Capture and Storage technology, which is not yet commercially viable. This proposal essentially ignores the technological advancements made as utilities and ratepayers have invested approximately $118 billion[153] to achieve a nearly 90 percent reduction per kilowatt-hour of sulfur dioxide (SO_2), nitrogen oxides (NOX) and particulate matter (PM) from coal-fueled power plants.[154]

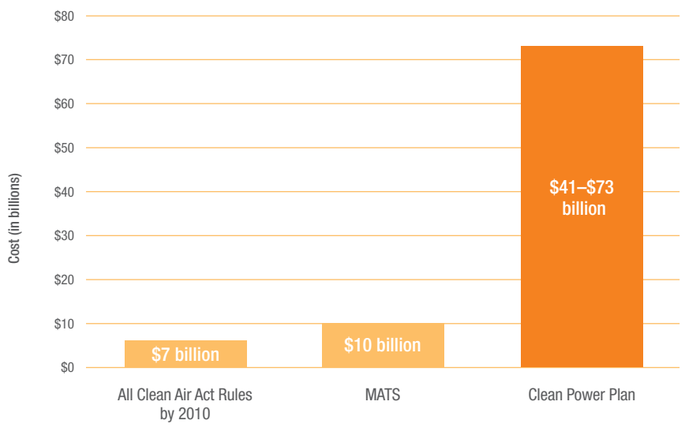
Regulations Would Result in Higher Electricity Prices

In June 2014, EPA proposed regulations to reduce carbon emissions from existing generating units under section 111(d) of the Clean Air Act. While there are serious technical and legal flaws associated with EPA's Clean Power Plan (CPP), which will continue to be challenged by a number of states in the court of law, it is clear the agency's proposal will inflict significant harm on the U.S. economy if finalized. By EPA's own estimates, the CPP will increase nationwide electricity

Electricity from Coal is a Vital, but Threatened, Energy Source

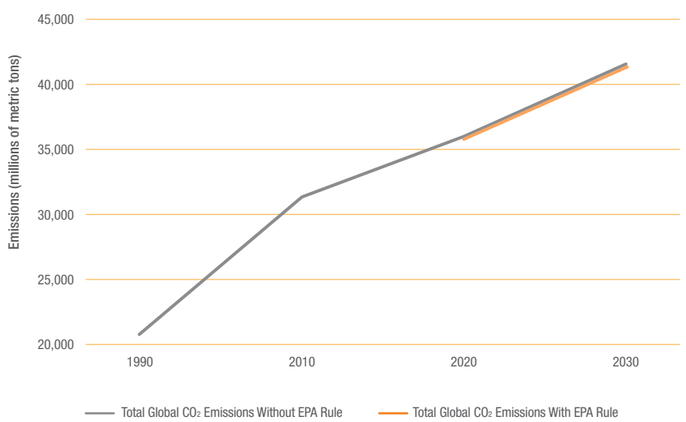
The American Coalition for Clean Coal Electricity

Annual Cost of Clean Air Act Rules for the Power Sector



Annual cost of all Clean Air Act rules for the electric power sector promulgated by 2010 from U.S. EPA, The Benefits and Costs of the Clean Air Act from 1990 to 2020 (2011) at Table 3-2 (electric utility direct annual compliance costs were $6.6 billion (2006$) in 2010; this converts to $7.1 billion in 2010$). MATS annual cost from U.S. EPA, Regulatory Impact Analysis for the Final Mercury and Air Toxics Standards, December 2011 ($9.6 billion compliance cost in 2006$ converted to 2010$.) Cost of proposed Clean Power Plan from NERA analysis (2013$).

EPA's Proposal Achieves Meaningless Emission Reductions



Source: EPA Carbon Regulation Proposal, p. 547-548 and www.eia.gov/forecasts/ieo/table2.1.cfm.

prices by 6 to 7 percent and up to 12 percent in many regions.[155]

An independent analysis using EPA's own data, however, found the cost consequences for consumers and businesses to be much worse. Forty-three states will experience double-digit electricity price increases, even when states choose the least expensive ways to comply, and 14 states could have peak-year electricity price increases exceeding 20 percent. Compliance costs will total $366 billion or more in today's dollars over 2017 to 2031, and consumers will spend more than $500 billion out of their pockets on ways to reduce electricity use.

According to the analysis,[156] annual compliance costs would average $41 billion to $73 billion, which is almost 10 times EPA's estimated cost. The CPP also far exceeds the cost of the previously most expensive rule for the power sector, MATS, which cost $10 billion per year and caused a large fraction of the coal fleet to retire. In addition to the 51,000 megawatts already retiring, mostly due to current EPA policies, the CPP would force another 45,000 to 168,000 megawatts to shut down. In total, EPA regulations could result in the loss of as much as 70 percent of the U.S. coal-fueled electric generating fleet.

EPA's carbon proposals will increase electricity costs for residential and industrial consumers alike, impacting most severely those families that can least afford it and rendering domestic manufacturers less competitive in a global market. Despite claims that the CPP demonstrates global leadership on tackling climate change, no other nations are following. Countries like China, Japan, Germany and India continue to use low-cost, reliable coal-fueled generation to power their respective economies.[157]

Further, EPA's carbon proposal for existing units will have no meaningful effect on the global climate, reaffirming that the agency's CPP is indeed an all-pain, no-gain proposition. The proposal will reduce atmospheric CO_2 concentrations by less than one-half of 1 percent and sea level rise by 1/100th of an inch — equal to the thickness of three sheets of paper. The entire U.S. coal fleet represents a mere 3 percent of global anthropogenic greenhouse gas emissions.[158]

Policies Put Reliable Electricity at Risk

The "polar vortex" of 2014 offered Americans a glimpse into the new reality that EPA's regulatory policies will yield for decades to come: a strained energy infrastructure and significantly higher energy prices. As extreme cold gripped much of the nation, utilities struggled to meet increasingly high energy demand at a reasonable cost. In some circumstances, power generators were forced to turn to nontraditional sources like jet fuel just to keep the lights on.

Meanwhile, coal plants slated for retirement in 2015 because of EPA regulations were relied upon to avoid cascading power outages. American Electric Power (AEP), a major investor-owned utility with more than 5 million customers in 11 states, was forced to run 89 percent of its soon-to-be-retired capacity just to meet demand. AEP's chief executive officer, Nicholas Akins, aptly told Congress in April 2014, "This country did not just dodge a bullet [last winter] — we dodged a cannonball."[159] Beyond 2015, many of those units will not be available as a failsafe.

Understandably, other federal and state regulators remain very concerned about grid reliability in the face of EPA's regulations and proposals. Delivering testimony before the Senate Committee on Energy and Natural Resources in April 2014, Commissioner of the Federal Energy Regulatory Commission Phillip Moeller stated, "I was, and remain concerned that EPA's analysis greatly underestimated the amount of power production that would be retired due to these rules." Moeller continued, "The experience of this winter strongly suggests that parts of the nation's bulk power system are in a more precarious situation than I had feared in the past."[160]

Federal and state elected officials and regulators agree that EPA's regulatory actions toward coal-fueled electricity generation show little regard for future or even near-term energy and economic needs, as many states might have to choose between compliance with EPA regulations and grid reliability. Such policies put in jeopardy a domestically abundant resource that has been the foundation of economic progress in the United States — a resource that must continue to reliably power our nation for years to come as part of a sensible, diverse energy portfolio.

America's future economic growth and energy security will require the continued and increasing use of fossil fuels, like coal, as part of a sensible, diverse energy portfolio.

Biomass Power | Ready, Proven and Cost-Effective Energy

The Biomass Power Association

For decades, biomass power has served as an important energy resource in the generation of electricity and heat for industrial, commercial and residential purposes. In addition to contributing to an "all of the above" energy policy, biomass provides significant environmental and economic benefits to rural America.

Biomass power is generated from the combustion of organic materials — principally forestry debris and agricultural materials. There are more than 100 biomass facilities across America located in more than 20 states. These facilities range in size from small-scale combined heat and power systems to large, grid-connected facilities, averaging in capacity from 20 to 100 megawatts (MW).

Bioenergy produces about 2.5 percent of the nation's total energy, and for every one MW of capacity, the industry generates four jobs. Today, the sector employs approximately 18,000 workers across 20 states.[161] Biomass is clean, renewable energy made from materials that would often otherwise be discarded. Bioenergy creates new markets for low-value wood fiber, which incents sustainable forest management, while supporting vibrant rural economies.

History of Biomass

The history of the biomass power sector is based largely on federal and state policies designed to encourage the use of alternative fuels. Most biomass facilities were developed immediately following enactment of the federal Public Utility Regulatory Policy Act of 1978 (PURPA). PURPA encouraged state utility commissions to approve long-term power purchase agreements between independent power producers and regulated utilities. For states and regions that aggressively implemented PURPA — New England, New York, the Midwest, California and the Pacific Northwest — biomass plants were financed and ultimately constructed.

Wood chips from pine beetle kill in front of the Gypsum, Colorado, Eagle Valley Clean Energy.

Beginning in the 1990s, many of these contracts expired or were renegotiated as part of utility deregulation. While some biomass plants were shut down, most flourished as a result of so-called state renewable portfolios (RPS) programs.

The industry has experienced a significant increase in investment since 2008 as a result of various federal incentives, including a refundable investment tax credit made available in 2009 (the so-called 1603 Treasury Grant Program). Between 2010 and 2013, approximately $4.1 billion was invested in the sector.[162] As a result of state RPS programs and federal support, biomass leads all forms of renewable generation, except wind, in the capacity of nonhydropower resources.

A Carbon-Mitigation Energy Resource Benefiting Rural Communities

Most Americans are familiar with other forms of renewable energy, such as wind and solar. However, in 2013 approximately 23 percent of all renewable energy consumed was from wood.[163] Biomass energy complements wind and solar by providing a baseload renewable energy source that is always available.

Woody biomass is a sustainable energy resource that plays a key role in maintaining forest health, utilizing low-value residues that have little other use. Using these materials to generate electricity creates a market that otherwise would likely not exist, helping sustain local communities where it is produced.

The organic materials that are the basis for biomass energy often have few or no other productive uses and do not introduce new carbon into the atmosphere when used to generate energy. If these forest by-products were not used to produce heat or electricity, the materials would either be open or pile burned, or they might be left on the forest floor to decompose — a process that releases CO_2 and methane, potent greenhouse gases, into the atmosphere. Also, when these residues are left on the ground, they contribute to the accumulation of hazardous fuels, which leads to a greater risk of catastrophic wildfire.

Biomass Power | Ready, Proven and Cost-Effective Energy

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Not surprisingly, biomass energy is a key part of sustainably managed forests and farms. The removal of lower-value wood from forests is a practice that can enhance the health, productivity and value of these lands. Wood energy is often generated using the by-products of forest restoration activities, making restoration more economically feasible. Biomass energy also provides a beneficial, productive use for the lower-value wood removed during forest thinning operations, and is diversifying the forest products industry by providing new markets for lower-value wood fiber, in addition to traditional timber markets.

America's forests are a sustainable and strategic natural resource that can help enhance our energy security, economic opportunity, environmental quality and global competitiveness. Public-private partnerships have emerged across the country to maintain federal forestlands while fueling clean energy projects.

In 2013, U.S. Department of Agriculture (USDA) Secretary Tom Vilsack announced a plan to promote the growth of bioenergy for this purpose, and recently reiterated his support, saying, "USDA's support for bio-based technologies is good for the climate, and enhances rural economic development while it decreases our dependence on foreign sources of oil."[164]

In September 2014, nine scientists from USDA Forest Service as well as prominent universities and think tanks published a peer-reviewed study in the *Journal of Forestry*[165] arguing, in no uncertain terms, for policies that recognize the long-term benefits of biomass power. They warned that not doing so could result in the loss of a valuable carbon mitigation tool, stating:

"The current debate about biomass energy often narrows the discussion to short-term and direct effects of increased use of forest biomass, understating the benefits of using sustainably produced forest-based fuels and materials … Carbon accounting frameworks often misrepresent the CO_2 impacts of using biomass fuels and put at risk many of the mitigation benefits and opportunities provided by sustainably managed forests and the products that flow from them."

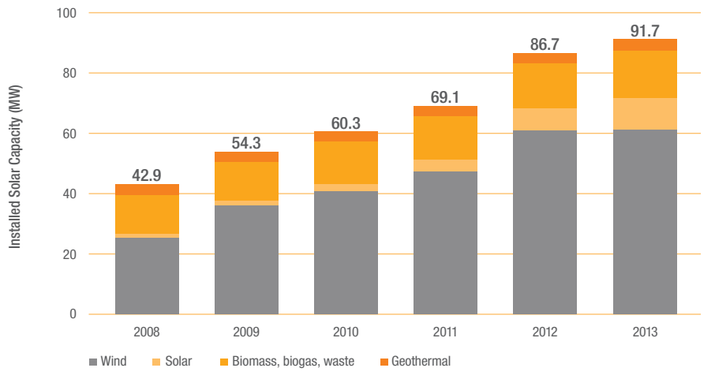
The authors of the study presented four key findings they recommended be reflected in any biomass policy framework. First, that substantial long-term carbon mitigation benefits are derived from sustainably managed working forests that provide an ongoing output of biomass to produce materials and fuels to displace more greenhouse gas-intensive alternatives. While the timing of benefits is debated, the fact that these benefits exist is not.

Next, the threats to maintaining long-term forest carbon stocks come primarily from pressures to convert land to nonforest uses and from natural disturbances. Research clearly shows that demand for wood results in investments in forestry that help prevent deforestation and incentivize afforestation.

Third, the most effective mitigation measures are those that provide the lowest long-term net cumulative emissions. The benefits of forest-based mitigation activities are sometimes delayed, but any increased emissions are reversible and temporary and are incurred in the interest of limiting cumulative emissions.

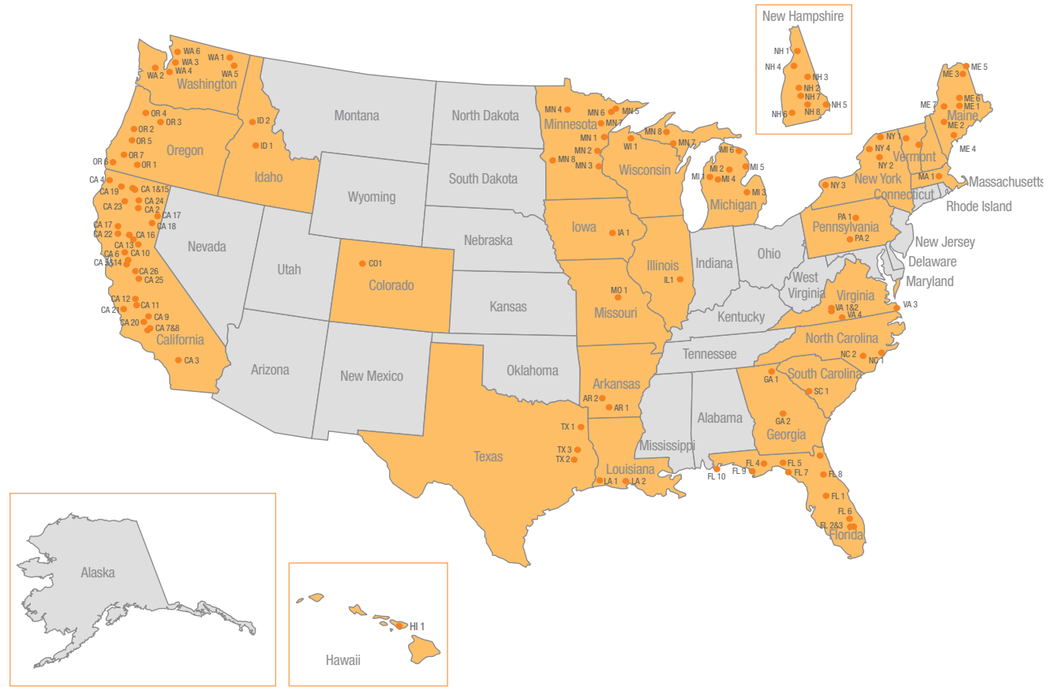
Finally, proper characterization of the global warming impacts of the mix of forest biomass sources likely to be used for energy shows net emissions of biogenic carbon to be low when including the effects of market-induced investments.

U.S. Cumulative Nonhydropower Renewable Capacity by Technology, 2008–2013 (GW)



(BCSE Bloomberg, Sustainable Energy in America, Figure 9 on p. 12)[166]

U.S. Biomass Facilities



Ensuring the Promise of Biomass

The biomass industry has significant potential as an energy source. In 2012, the Union of Concerned Scientists identified 680 million tons of biomass that could be used for energy and fuels, resulting in 54 billion gallons of nonfood ethanol and biofuels, and enough electricity to meet 20 percent of U.S. energy demand by 2030.[167] Bioenergy can help create a more stable energy future, improve environmental quality, and increase economic opportunities.

Yet, the industry faces challenges both to the continued success of current facilities and the ability to grow. State policies often do not value the baseload capacity provided by existing facilities. Also, state renewable policies are an uneven patchwork of incentives that have different rules and widely varying values from state to state.

New biomass development is also significantly hampered by federal tax policy that needs significant reform, as current law creates energy production tax credits of varying amounts, resulting in an uneven playing field for biomass. Moreover, the stop-start nature of renewable energy tax credits does not offer predictable, long-term incentives necessary for capital intensive, baseload energy projects like biomass.

Finally, national and state agencies involved in the regulation of carbon emissions must resolve policy uncertainties regarding how biogenic emissions from biomass plants will be regulated. The science overwhelmingly supports the carbon benefits of taking waste materials and converting them to energy. Many state agencies embrace the benefits of biomass, and the industry sees positive signs from the administration that the Environmental Protection Agency will soon also recognize the benefits of biomass on a federal level.

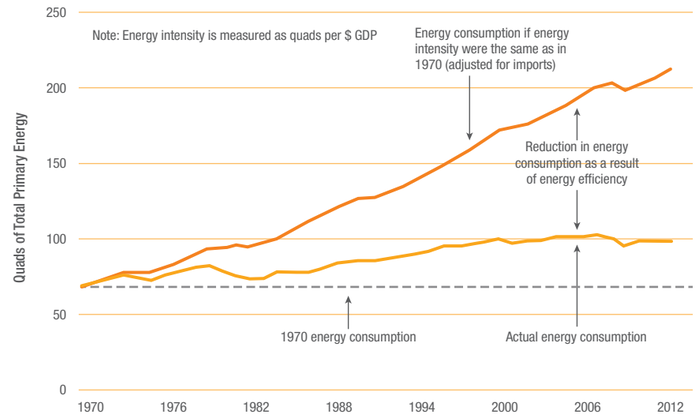
Energy Efficiency | A Great American Success Story

The American Council for an Energy-Efficient Economy

For the last 40 years, energy efficiency has been a quiet success story in America's energy industry. Modern energy efficiency in the United States began to emerge in the 1970s as changes in patterns of energy consumption and events, such as the oil crisis, began to put pressure on the U.S. energy infrastructure. In response, a diverse group of scientists and analysts from many fields and industries began to develop strategies and technologies for using less energy to deliver the same or better services to consumers and businesses. These strategies have grown to affect almost every activity that uses energy, and have greatly influenced utilities, building designers, industrial planners and manufacturers of everything from household appliances to heavy-duty vehicles.

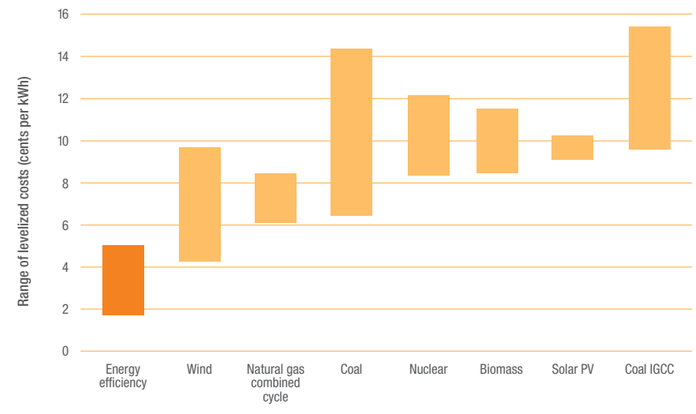
The result has been an unqualified success story, both economically and environmentally, although one often overlooked by the public at large. Since the oil crisis of 1974, the U.S. economy has continued to grow while the rate of increase in energy use has slowed significantly. If we were using energy today at the rate we were in 1974, we would be consuming more than twice the amount that we actually are using. Despite the recent recession and the period of sluggish growth that has followed, in the past 15 years, the economy has grown tremendously and we have seen total energy use remain constant.

Energy Intensity Declines Due to Efficiency Gains



Source: ACEEE using data from U.S. EIA & U.S. Census data[168]

Energy Efficiency Costs Compared to Electricity Generation Resources



Source: Energy efficiency costs Molina 2014;[169] *other energy sources Lazard 2013*[170]

Energy Efficiency | A Great American Success Story

The American Council for an Energy-Efficient Economy

That is due in no small part to advances in energy-efficient technologies, policies and practices.

Improving the Economy and Creating Jobs

Because of its proven track record in saving consumers money, energy efficiency should be the cornerstone of any energy policy. Efficiency is generally our least-expensive energy resource, meaning that it typically costs less to save a unit of energy and provide the same service than it costs to produce that same unit of energy. As a result, large cost-effective savings are achievable across the country, regardless of local conditions and geography. Energy efficiency programs cost utilities only about 3 cents per kilowatt hour, while generating the same amount of electricity from other sources can cost two to three times more.

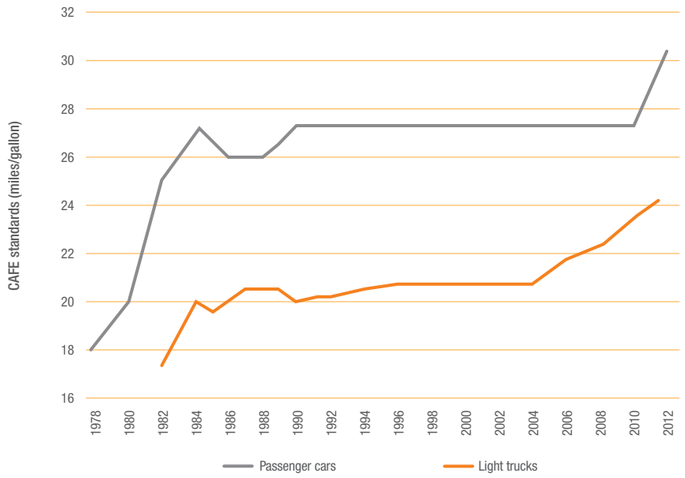
Energy policies directly impact the economy, and many studies have shown that energy efficiency promotes economic growth and well-being by saving consumers money while creating jobs. Since energy efficiency isn't tangible, it may be difficult to appreciate; however, the savings that result have had a very real impact on people's lives. A more energy-efficient economy makes more money available to consumers and businesses to both save and spend. Businesses' bottom lines are improved and consumers are free to spend money in whichever area of the economy they choose. A recent American Council for an Energy-Efficient Economy (ACEEE) analysis of the proposed EPA Clean Power Plan[173] found that energy efficiency efforts could drive more than $625 billion in investment and create an average of 400,000 net jobs per year through 2030.

Some of the most significant energy-efficiency improvements to the economy have occurred in transportation fleets and the appliances and equipment used in homes and workplaces. Since model year 1975, the energy required to drive a car or light truck each mile has declined 45 percent, an improvement made possible by technological progress and government fuel-economy standards. And these improvements are expected to continue as 2025 fuel economy standards call for the average automobile to improve fuel economy by an additional 35 percent relative to the average new 2013 vehicle.

Similarly, efficiency improvements for appliances and many other types of equipment have also accelerated, driven by many of the same forces. For example, the average 2014 refrigerator uses only about 30 percent of the energy of a 1973 unit, even though the 2014 unit is larger, has more features, and its inflation-adjusted price is lower.

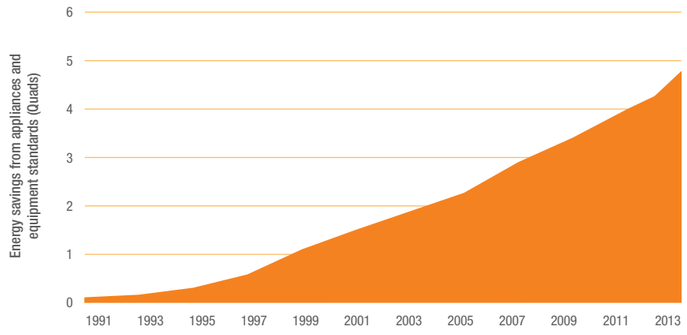
Similar efficiency improvements have been achieved in buildings, farms and factories across the country, due to better building practices, improved farming methods and advances in process technologies and materials.

Rising Fuel Economy Standards for Cars and Trucks



Source: U.S. Department of Transportation 2011[171]

Energy Savings Achieved through Appliance Efficiency Standards



Source: ACEEE analysis 2014 [172]

Not only is energy efficiency a critical resource for economic growth and productivity, it is also an important source of employment. In the manufacturing sector, energy efficiency plays an important role in developing new, affordable and more efficient products, and in improving industrial processes that allow us to make products with less energy than ever. Investing resources in making homes and offices more energy-efficient creates jobs in construction and in related equipment and materials manufacturing.

The positive effect of savings accrued from energy efficiency continue to ripple through the economy as well, creating even more jobs as consumers and businesses are free to spend their money from energy savings in all other sectors of the economy. In 2010 alone, homeowners and businesses spent less than half as much on energy as they would have without efficiency gains, saving over $1.3 trillion, enough to directly employ almost 9 million workers.[174]

The Potential for Energy Efficiency

A study by ACEEE found that energy efficiency could further reduce energy requirements in our economy by about half by 2050.[175] There are always opportunities to increase the nation's energy efficiency as technologies evolve, and information and communications technology innovations are enabling revolutionary advances in energy efficiency. For much of the past four decades, we have improved the efficiency of individual products that use energy, such as cars, lightbulbs and refrigerators. Experts have been aware for years that even greater energy savings are available from optimizing entire energy-using systems such as buildings, factories, freight transportation or even cities.

The challenge has been to collect data on operations and process the data quickly enough to be able to make decisions to eliminate energy waste. The information, communications and computing revolution of the past 15 years has given rise to the tools needed to accomplish this goal. We have seen the cost of sensors and controls fall while advances in communication and computing allow us to manage energy use in near-real time, anticipating demands for energy and optimizing the performance of these energy-using systems. ACEEE, working with industry thought leaders, has labeled this new approach "intelligent efficiency."[176]

Manifestations of intelligent efficiency are already appearing in the marketplace, ranging from intelligent buildings, such as the rehabilitated Empire State Building, to smart manufacturing plants, to the intelligent freight systems operated by major carriers such as UPS and FedEx. The energy savings potential is huge, with intelligent efficiency projects already saving more than 20 percent. Ultimately, we could see buildings networked with transportation systems to create intelligent cities that can meet businesses' and families' needs while saving energy.

Energy efficiency will also inevitably play a leading role in the fight against climate change. In a recent report, ACEEE found that a combination of the energy efficiency actions already undertaken by the government along with the future actions that could be employed, including appliance, vehicle and power plant standards, could cut cumulative carbon dioxide emissions by 34 billion metric tons, more than the total emissions produced by the U.S. in six years.[177] This would translate into $2.6 trillion in savings for the American people, proving that smart policies can protect our environment while strengthening tomorrow's economy.

Challenges to an Energy-Efficient Future

While energy efficiency has proven highly cost effective over the past four decades, it continues to face challenges. Perhaps the greatest challenge is that saving energy can be invisible to most consumers and policymakers. Hence, the need to increase awareness of the untapped potential for savings through energy efficiency and of the steps needed to realize that potential, such as incentivizing energy-saving programs by utilities.

Additionally, energy efficiency represents a challenge to many established energy supply markets whose financial viability relies on growing demand for energy. So working with traditional energy supply industries to identify alternative business models that will allow them to decouple their financial viability from increasing energy use will be critical. Electric and natural gas utilities are already focused on exploring new models.

Much as we are seeing a shift from efficiency improvements on discrete components, the U.S. needs to consider an integrated energy approach that optimizes the use of available resources. This would allow for continued economic growth while addressing the environmental challenges facing America and the world that result from energy use.

Energy efficiency has been a great, but unheralded, American energy success story for the past four decades. The future looks bright for efficiency, with intelligent technologies and systems enabling greater future efficiency savings while delivering even greater consumer benefits. Efficiency alone cannot meet all of the economy's energy needs, but with more intelligent use of all energy resources, we can ensure continued economic health while addressing the environmental challenges that face our world.

Because of its proven track record in saving consumers money, energy efficiency should be the cornerstone of any energy policy. Efficiency is generally our least-expensive energy resource.

Conclusion

Jack Gerard, The American Petroleum Institute

America's energy future is bright. With our abundant array of resources, technological expertise and skilled workforce, the United States stands on the threshold of energy self-sufficiency at a level unthinkable just a few years ago. Given the right policies, we can create jobs, reduce emissions and enhance energy security all at the same time. Bipartisan majorities of American voters support pro-growth energy policies, demonstrating that energy is not a partisan issue; energy is about jobs, the economy and national security. With a true all-of-the-above energy strategy, the United States can achieve its full potential as a global energy superpower.

Thank you to all the organizations that participated in this year's State of American Energy. With America's diverse and plentiful range of resources, our energy renaissance is only beginning.

2015

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