ENERGY Works For US

INSTITUTE FOR 21ST CENTURY ENERGY
U.S. CHAMBER OF COMMERCE

OUR MISSION

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

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Solutions for Securing America's Future

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Contents

3 Foreword

6 Introduction: Then and Now—Charting America's Changing Energy Future

9 Remove Barriers to Increased Domestic Oil & Natural Gas Exploration and Production and Fuel Manufacturing

21 Maintain Coal's Role as a Vital Part of a Diverse Energy Portfolio

27 Expand Nuclear Energy Use and Commit to a Nuclear Waste Solution

31 Enhance the Competitiveness of Renewable Sources of Energy

37 Promote 21st Century Energy Efficiency and Advanced Technologies

41 Modernize the Permitting Process for Our Nation's Energy Infrastructure

47 Protect Our Energy Infrastructure from Physical Disruptions and Cyber Attacks

51 Reform the Regulatory Process for Balance, Predictability, and Transparency

55 Ensure a Competitive Energy Workforce

59 Conclusion

60 Appendix 1: Recommendations

67 Acronyms

Foreword

America is poised to become a global energy powerhouse.

When the Institute for 21st Century Energy issued its Blueprint for Securing America's Energy Future in 2008, it is fair to say that the United States was suffering through an energy recession and just beginning to dive into a deep economic one. Five years later, the U.S. energy landscape is almost unrecognizable and is one of the few sources of optimism in an otherwise sluggish economy.

So swift and dramatic has been the change in U.S. energy fortunes that it has caught many analysts and policymakers unawares. The largely unexpected changes in the U.S. energy outlook documented in this report have been such that some credible experts now believe energy independence for North America, if not for the United States, actually may be within reach in the coming decade.

There are good reasons to be optimistic about growing U.S. energy production, but this optimism should be tempered by the realization that it has come about largely in spite of national policy rather than because of it. It does not have to be this way.

With few exceptions, energy policy in the United States over the past four decades has been predicated on energy scarcity—and not without some justification. Even though the United States is home to extremely large energy resources, getting access to them has proved difficult. The technology needed to develop some of these resources profitably also has been lacking. For example, for more than a hundred years we have known that there is an abundance of unconventional oil in the United States—more than 2 trillion barrels, greater than the total proved reserves globally—but there was no way to extract it profitably. The same applied to natural gas. But this is no longer the case.

Technological advancements—most notably the combination of hydraulic fracturing, horizontal drilling, and precise multidimensional geologic imaging—now allow producers to tap vast resources of oil and gas in geologic shale formations that previously were too costly and too difficult to reach. So deeply have these new techniques been integrated into oil and gas company operations that the distinction between "unconventional" and "conventional" is blurring rapidly.

What makes the "Shale Gale" in natural gas all the more impressive and instructive is that it occurred almost entirely on private or state lands, not on taxpayer-owned federal lands. The same applies to increased oil production from the Bakken and Eagle Ford formations, which have almost by themselves led to an increase in U.S. crude oil output after decades of nearly continuous declines. It is hard to imagine such a turnaround in oil and natural gas production occurring had these shale deposits been located on federal land.

But oil and gas are only part of the picture. The United States also has massive reserves of coal, the fuel that powered the Industrial Revolution and helped electrify the nation. The United States has been dubbed the "Saudi Arabia of Coal," and not without reason. Today, the United States has enough technically recoverable resources to last more than 450 years at current rates of consumption. Not only is coal abundant, it is affordable, and new clean coal technologies are dramatically reducing its environmental impact. With the International Energy Agency (IEA) predicting that by 2017 coal could exceed oil as the world's largest source of energy, large domestic reserves of this fuel confer to the United States a huge competitive advantage—if national policies do not eliminate it.

Nuclear power currently supplies about 20% of America's electricity supply. America's 100 operating nuclear power plants—soon to be 105—are, over the long term, an inexpensive source of emissions-free base load electricity. These plants represent tremendous

national assets that contribute to a diversified power-generating sector, but the federal government's inability to implement a workable waste solution has created uncertainty and needs to be solved.

A secure energy mix also must include renewable sources, and the United States is home to some of the world's best renewable resources of virtually all types. The Plains states offer exceptional areas for wind, the Southwest for sun, the West for geothermal, and the Southeast for biomass. While renewable technologies remain relatively high-cost options and some suffer from intermittency, they are becoming more competitive, and their use is growing. New wind and solar electricity-generating capacity, for example, has in recent years been growing at the fastest rate of any electricity-generating technologies.

Moreover, the United States has some of the world's largest reserves of rare earths minerals used in making key components of renewable technologies.

And it is not just on the supply side that the United States is making progress. The U.S. economy also continues to make progress in making more with less energy. It now takes less than half the energy to produce a dollar of gross domestic product (GDP) than it did in the 1970s, a trend that should continue to improve the U.S. energy outlook and its energy security.

So how is this document different from the Blueprint the Energy Institute issued in 2008? First, it recognizes—in fact, documents—just how different today's situation is by showing how expectations about our energy future have changed since then. We do this by comparing what the Energy Information Administration (EIA) was forecasting in 2008 against what it is forecasting in 2013. In many cases, the differences in outlook are startling, many for the better (e.g., unconventional oil and gas production) but some for the worse (e.g., offshore oil and gas production and coal production). These comparisons give insights into what we should be doing to make sure encouraging trends stay that way and discouraging trends reverse course.

If not for the ingenuity and enterprise of America's entrepreneurs, our energy present and future would not be as bright as they are. But a domestic energy renaissance is not a foregone conclusion. The positive changes to the U.S. energy picture documented in this report are not bound to happen; they can be derailed if the policy environment does not improve.

This leads to the second major difference between this report and the 2008 Blueprint: the recognition that the energy landscape is not the only thing that has altered since 2008. The policy landscape also has changed, and not for the better.

Poorly designed policies that limit access to resources, and regulatory overreach have created uncertainty that threatens to hold back U.S. energy production and the investment and jobs that go with it. A barrage of ill-conceived regulations coming out of the Environmental Protection Agency (EPA) aimed at strangling the coal industry; a leasing plan out of the Department of the Interior (DOI) that locks out about 80% of federal areas from oil and gas exploration and production; the threat of federal regulation of hydraulic fracturing drilling techniques now being regulated responsibly by the states; an increasingly broken and lengthy siting and permitting process; on again/off again incentives; a moribund nuclear waste disposal policy; assaults on free trade of energy; and an inability to get ahead of emerging issues like cyber-security threats to energy infrastructure—all of these have made the current energy policy landscape as inhospitable as it has been in a very long time.

We also have to be mindful of the huge deficits and debt the federal government has taken on that, when coupled with a deeply divided Congress, limit the realistic range of policy options. The time when some technologies could count on an endless stream of subsidies, for instance, is well and truly over.

With this in mind, taken as a whole the recommendations put forward in this report will reduce America's public debt. Greater domestic energy production could be and should be an even bigger source of economic growth and government revenue than it already is. One study found that unconventional oil and gas development alone can account for 3.5 million jobs, contribute $475 billion to GDP, and send

$124.4 billion annually to the U.S. Treasury by 2035. Another study finds that with a change in policy that increases access to America's oil and gas resources, the industry could create an additional 1.4 million jobs and raise more than $800 billion of additional government revenue by 2030.

The United States has a greater variety and quantity of energy resources than any other country in the world. When coupled with new exploration, production, and end-use technologies, there is no reason we cannot usher in a new and long-lasting era of energy abundance and enjoy its economic benefits.

Instead of throwing up roadblocks to domestic energy development or forcing existing sources to prematurely exit the system, we should be creating an environment that welcomes investment, risk-taking, and job creation.

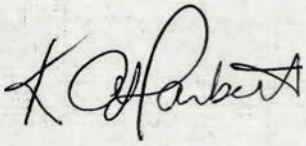
Plentiful, affordable energy provides a real stimulus and could initiate a U.S. manufacturing renaissance; create millions of good-paying jobs; and provide sorely-needed revenue to federal, state, and local coffers. We have the seeds of an economic boom right here at home; we need to plant them. Otherwise, the rest of the world will pass us by, and our industries will go where energy is cheap. How or whether we take advantage of these opportunities—or squander them—will influence profoundly the trajectory of the U.S. economy and its energy security for decades to come.

It is also prudent to consider the geopolitical dimensions of growing U.S. energy production. The global energy landscape is changing rapidly, and not always to the benefit of the United States. Take oil, for example. As a global commodity, oil is priced in a global market. The rise of China, India, Brazil, and other large emerging economies, including the Middle East, as major and growing oil consuming countries means that demand is growing. At the same time, supplies from other reliable and secure sources, such as Mexico, Norway, and the United Kingdom, are declining, and sanctions against Iran have removed oil from world markets. As a result, there is less spare oil production capacity, which puts upward pressure on oil prices.

In these circumstances, rapidly increasing production of unconventional oil in the United States takes on added significance and could not have come at a better time. For decades, U.S. oil production went down as global demand went up. That is no longer tenable. Indeed, U.S. oil production is not a luxury, but rather an increasingly important aspect of national security and a hedge against increasing demand and uncertainty in global markets. Having a large home-grown source of supply will help us weather whatever geopolitical storms may kick up in the future. And it is not just oil. Greater natural gas output, preserving a diverse electricity market and expanding markets for U.S. coal overseas also can make the U.S. more economically and energy secure.

Our policy proposals represent a sound and assertive strategy that will transition the United States from energy defense to offense. And they will not bust the budget, but actually increase economic growth and revenue.

In the United States, we have all the natural resources, technology, workforce, capital, and entrepreneurial spirit needed to usher in a new era of energy abundance. Business largely created the paradigm shift we are now experiencing, and it is ready to turn the opportunities it has created into a reality. Now is the time to adopt an agenda that will secure our nation's energy future and make energy work for US.



Karen A. Harbert
President & CEO
Institute for 21st Century Energy

Introduction: Then and Now—Charting America's Changing Energy Future

Since the rise in influence of the Organization of Petroleum Exporting Countries (OPEC) in the 1960s, energy has occupied the minds of policymakers. Energy is recognized as among the top challenges to our nation's future prosperity, national security, and quality of life.

Energy concerns have been consistently voiced by a number of administrations, both Democratic and Republican, since the Arab oil embargo in 1973. In the four decades since, the risks of supply disruptions, price spikes, blackouts, shortages, and environmental concerns solidified energy as a pressing national economic and security priority.

But that dynamic is changing. America has always been rich in unconventional energy resources. The problem has always been that they have been difficult and costly to tap, making them uncompetitive. That all has changed thanks largely to the application of two technologies, hydraulic fracturing and horizontal drilling (both of which have been used alone successfully for decades), to extract oil and natural gas from shale and other "tight" geologic formations. The transformation these technologies have produced has been astounding—and wholly unexpected just a few years ago.

The old aphorism that it is "tough to make an accurate prediction, especially about the future" certainly applies to something as complex as energy. Who could have predicted five years ago the profound turnaround in the energy fortunes in the United States? What seems obvious now was not at all obvious then.

To convey the magnitude of the changes between the time when the Energy Institute issued its original policy *Blueprint* in 2008 and 2013, the report that follows compares, where possible, projections from EIA's *Annual Energy Outlook* (AEO) 2008 reference case—the "then" forecast—and its AEO2013 reference case—the "now" forecast—for 2010 out to 2030.[1]

The results of the "then" and "now" analysis demonstrate that not all of the news is good. Progress over the past five years has been uneven, and some opportunities have been missed even as others have been seized. By comparing these different visions of the future, it is apparent where the opportunities are that we need to capitalize on and where the challenges are that we need to address to fulfill the nation's energy potential.

Each energy plank therefore includes a set of specific policy recommendations that, if put into practice, would ensure that we continue to take full advantage of opportunities and overcome obstacles that are preventing some opportunities from being realized.

The energy prospects now before America are unprecedented in their scale, scope, and importance to economic growth, but fulfilling these opportunities is not guaranteed. The energy policy plan that follows takes into account these new circumstances. It encompasses a bold, strategic, and actionable path forward toward a forceful, forward-looking energy policy that will serve our nation's vital interests, both foreign and domestic.

1 The comparative analysis ends at 2030 because, whereas the AEO2013 extends to 2040, the AEO2008 forecast extends only to 2030.

The report and recommendations are organized around nine key planks:

1. Remove Barriers to Increased Domestic Oil and Natural Gas Production and Fuel Manufacturing
2. Maintain Coal's Role as a Vital Part of a Diverse Energy Portfolio
3. Expand Nuclear Energy Use and Commit to a Nuclear Waste Solution
4. Enhance the Competitiveness of Renewable Sources of Energy
5. Promote 21st Century Energy Efficiency and Advanced Technologies
6. Modernize the Permitting Process for Our Nation's Energy Infrastructure
7. Protect Our Energy Infrastructure from Physical Disruptions and Cyber Attacks
8. Reform the Regulatory Process for Balance, Predictability, and Transparency
9. Ensure a Competitive Energy Workforce

CHAPTER 1

OIL AND NATURAL GAS

Technological advances have led to huge new opportunities to expand domestic oil and natural gas production, which will create jobs and generate revenue. These opportunities exist both onshore and offshore, and with unconventional sources like shale. However, the vast majority of federal lands are locked up for production. The administration and Congress should allow for much greater access to lands onshore and offshore, enact revenue sharing with the states and refrain from measures that will harm our economy such as punitive taxes and new EPA regulations.

1. Remove Barriers to Increased Domestic Oil & Natural Gas Exploration and Production and Fuel Manufacturing

Crude Oil

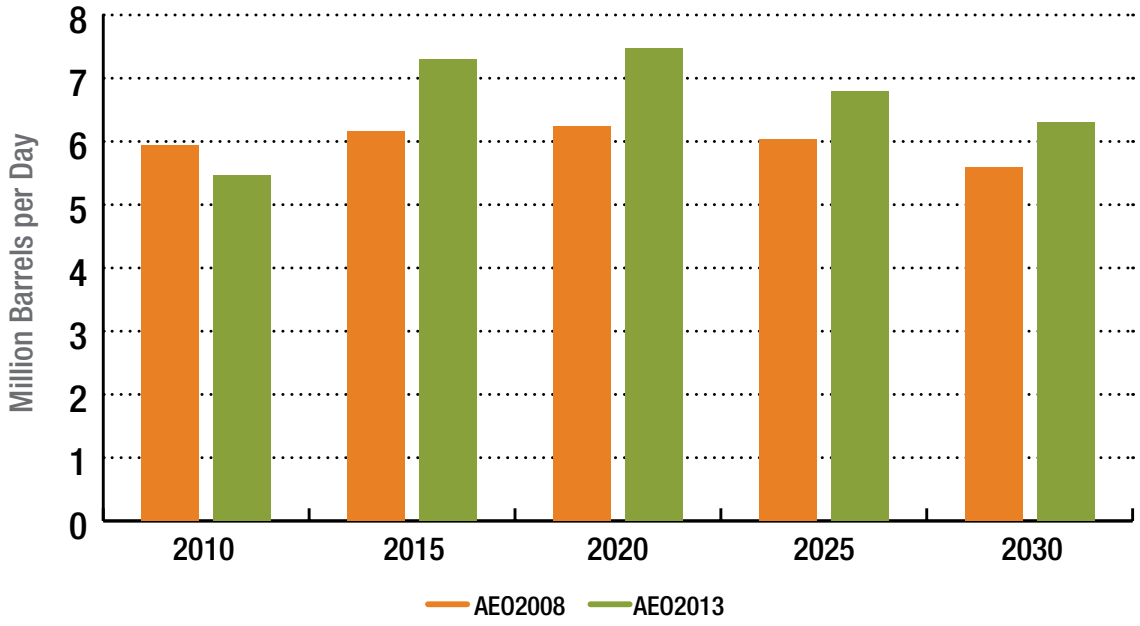
Every president since Richard Nixon has made reducing oil imports—or even achieving total oil independence—a top priority of U.S. energy policy. Nearly four decades after the 1973 Arab Oil Embargo, however, U.S. imports of crude oil account for a large share of the oil refined in the United States. In 2012, net imports of crude oil amounted to about 8.6 million barrels per day (MMbbl/d), representing about 58% of all the crude oil being processed at U.S. refineries.[2] Net imports are well off their peak of 10.1 MMbbl/d and 66% of refinery inputs in 2005 and 2006.

2 The United States also has been a net importer of refined petroleum products for many decades, but in 2011, it became a net exporter.

While much of this change is due to greater domestic production, other factors also are at play. A sharp economic contraction in 2008 and lingering economic weakness has reduced the demand for oil over the past few years, and it is possible that, should the economy begin to pick up, the demand for overseas oil will increase, too. Also, mandated vehicle fuel efficiency improvements has dampened demand.

Because of relatively recent improvements in technologies for producing oil from shale—including hydraulic fracturing—the decades-long trend in declining U.S. production leveled off and reversed sharply from 2008 to 2012, rising from 5.0 to 6.3 MMbbl/d. EIA's August 2013 Short Term Energy outlook projects U.S.

Figure 1a. U.S. Crude Oil Production

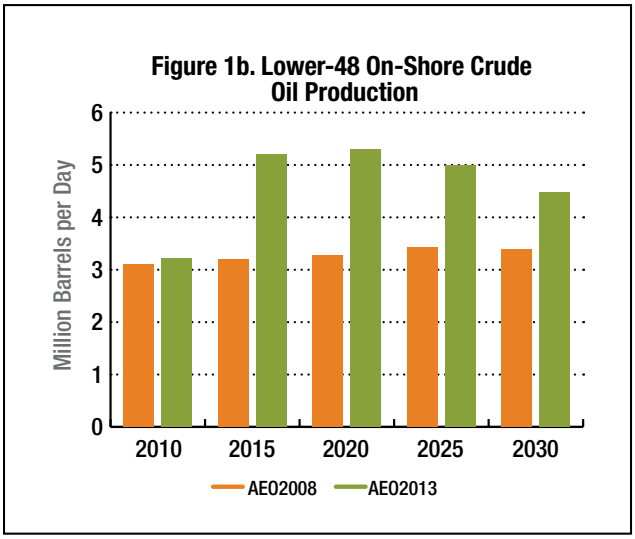


Sources: EIA, Annual Energy Outlook *2008 and 2013.*

crude production in 2013 will overage 7.4 MMBBl/d—a 48% increase since 2008. This momentum is expected to continue given the proper policy environment.

EIA's most recent projection of total U.S. crude oil production shows a higher level of domestic crude oil output than its 2008 projection, which showed essentially flat U.S. production out to 2030. EIA now expects total output in 2030 to be about 710,000 bbl/d greater than it was forecasting in 2008 (Figure 1a). But as the charts in Figures 1b–e show, the prospects for greater crude oil production are decidedly different in different parts of the country operating under different rules.

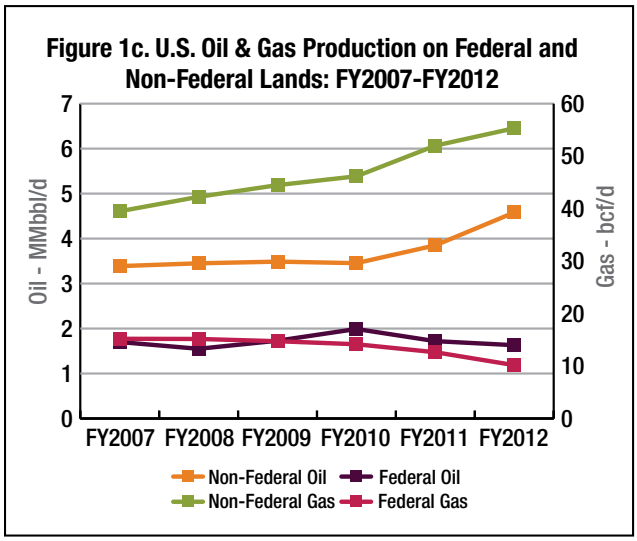
Take lower 48 onshore crude oil production, for example, shown in Figure 1b. EIA's AEO2013 forecast shows much greater output from these areas than its AEO2008, about 1.7 MMbbl/d. Continuing production of tight shale oil from the Bakken formation in North Dakota and Montana and the Eagle Ford formation in Texas are the largest drivers. EIA also anticipates output from the Austin Chalk and Spraberry formations in Texas, Avalon/Bone Springs formation in New Mexico, Monterey formation in California, Niobrara formation in Colorado, and Woodford formation in Oklahoma to contribute, as well.



Sources: EIA, Annual Energy Outlook *2008 and 2013.*

EIA's projections are consistent with a detailed analysis by the firm IHS, sponsored in part by the Energy Institute: *America's New Energy Future: The Unconventional Oil and Gas Revolution and the US Economy.*[3] In what it calls the "Great Revival," the group sees the production of "tight" oil rising from a not-insignificant 2.0 MMbbl/d in 2012 to about 4.5 MMbbl/d in 2020 and maintaining that level of output through 2035. By 2035, it expects tight oil to account for nearly two-thirds of total U.S. crude oil production.

Data compiled in a Congressional Research Service (CRS) report, however, show that all of the increase in domestic crude oil production (and natural gas, also) occurring from fiscal years 2007 to 2012 took place on non-federal lands (Figure 1c). While output on federal lands declined 4% over this period, output on non-federal lands jumped 35%, or nearly 1.2 MMbbl/d. As a result, the federal share of U.S. oil production fell 7%. Not only are fewer federal lands being opened up for production, but the time it takes to process permits to drill has risen from 218 days in 2006 to 307 days in 2011, largely because of the greater time it takes industry to comply with an increasingly complex process.[4]



Source: CRS, U.S. Crude Oil and Natural Gas Production in Federal and Non-Federal Areas.

There also are tremendous oil resources located on federal lands that could be brought on line with the right policies.

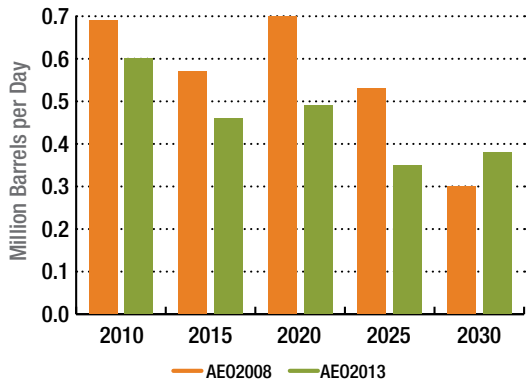
3 IHS Global Insight. 2012. *America's New Energy Future: The Unconventional Oil and Gas Revolution and the US Economy. Volume 1: National Economic Contributions.* Available at: http://www.energyxxi.org/sites/default/files/pdf/americas_new_energy_future-unconventional_oil_and_gas.pdf.

4 CRS. 2013. *U.S. Crude Oil and Natural Gas Production in Federal and Non-Federal Areas.* Available at: http://energycommerce.house.gov/sites/republicans.energycommerce.house.gov/files/20130228CRSreport.pdf.

The United States has massive unconventional crude oil reserves, for example. Government estimates suggest U.S. oil shale and oil sands resources exceed 2 *trillion* barrels.[5] The scale of this resource number is substantially larger than the total of all proven reserves globally. If just a modest amount of this resource meets geological, technological, and economic thresholds, it would increase U.S. production and lower oil supply risks greatly.

Developments in Alaska are much less promising (Figure 1d). Actual output in 2012 was about 60,000 bbl/d lower than EIA was forecasting in the AEO2008, and EIA expects it to remain below its 2008 forecast—240,000 bbl/d lower in some years—throughout most of the forecast period.

Figure 1d. Alaska Crude Oil Production



Sources: EIA, Annual Energy Outlook *2008 and 2013.*

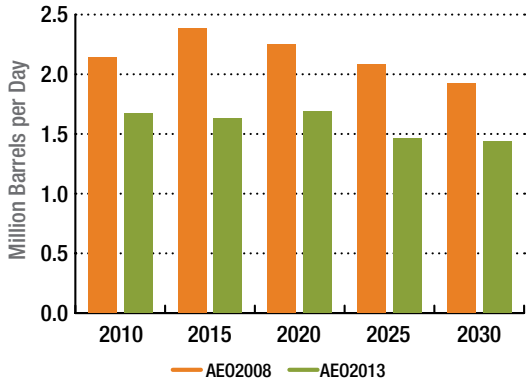
The Trans-Alaska Pipeline System (TAPS) was designed for a throughput of 2.1 MMbbl/d of crude oil from Alaska's North Slope to ports in the south of the state. EIA now projects pipeline flows will fall below 400,000 bbl/d by 2024. The pipeline's operator, Alyeska, has reported that throughput below 550,000 bbl/d makes pipeline operations much more difficult and complicated. If Alaskan output is allowed to decline much further, it could threaten the continued viability of TAPS, which, by law, must be dismantled if it cannot operate. This would be a tremendous loss, and with greater Alaskan production, this risk can be avoided for decades.

5 For more on U.S. oil shale potential, see: http://fossil.energy.gov/programs/reserves/npr/npr_oil_shale_program.html.

The problem in Alaska is not a lack of oil resources, the problem is a lack of access. The Arctic is a region potentially rich in crude oil resources. In 2008, the U.S. Geological Survey (USGS) published its assessment of undiscovered technically recoverable reserves of crude oil in the Arctic. Its mean estimate for crude oil reserves in the Arctic was 90 billion barrels, about one-third of which are thought to be in Arctic Alaska.[6] The Naval Petroleum Reserve-Alaska and the Arctic National Wildlife Refuge are two other areas with significant resources that could be tapped to keep Alaskan crude oil flowing in sufficient amounts to sustain TAPS.

Alaska also could hold a lot of oil in shale formation. In February 2012, USGS released a resource assessment of the North Slope's shale-rock resources and estimated that they could contain as much as 2 billion bbl of technically recoverable oil, with an average estimate of 940 MMbbl.[7]

Figure 1e. Lower-48 Off-Shore Crude Oil Production



Sources: EIA, Annual Energy Outlook *2008 and 2013.*

A similar situation is evident when looking at production from offshore areas in the lower 48 states (Figure 1e). In 2008, EIA was projecting offshore production in 2012—which is almost all in the Gulf of Mexico—to be higher

6 USGS. 2008. Circum-Arctic Resource Appraisal: Estimates of Undiscovered Oil and Gas North of the Arctic Circle. USGS Fact Sheet 2008-3049. Available at: http://pubs.usgs.gov/fs/2008/3049/fs2008-3049.pdf.

7 USGS. 2012. Assessment of Potential Oil and Gas Resources in Source Rocks of the Alaska North Slope, 2012. USGS Fact Sheet 2012–3013. Available at: http://pubs.usgs.gov/fs/2012/3013/pdf/fs2012-3013_2-28-2012.pdf.

than it turned out to be, largely due to the Deepwater Horizon oil spill in the Gulf in April 2010 and subsequent drilling moratorium. But instead of a recovery, EIA's 2013 forecast expects lower 48 offshore production from 2013 through 2030 to remain very weak, on average nearly 624,000 bbl/d lower than it predicted in 2008.

Again, the issue is not the availability of resources, but access to them. The exact size of U.S. offshore resources is unknown because companies are not allowed to do the necessary work to find out where the oil and natural gas are and how much there is. Preliminary work by government agencies, however, suggests that the resources could be quite large. The former Mineral Management Service estimated that the U.S. Outer Continental Shelf (OCS) contains 86 billion barrels of undiscovered, technically recoverable oil resources and 420 trillion cubic feet of natural gas.[8]

The imposition of a new burdensome and time-consuming permitting process has created a tremendous amount of delay and uncertainty for companies with deepwater rigs and other vital equipment in the Gulf. Some have sent them elsewhere. Moreover, the five-year offshore leasing plan released by DOI essentially blocks drilling activity on the East and West Coast and in large parts of the Eastern Gulf, the result of which is that more than 86% of offshore federal areas have an exploration moratorium or restriction.

The United States is blessed with vast oil resources, dynamic capital markets, and a culture of innovation that sustains our global leadership. As the EIA forecasts show, many of these assets are not being developed or used to their full potential. Just boosting Alaskan and lower 48 offshore production to the higher level EIA was forecasting in 2008 would raise annual output an average of three-quarters of a million bbl/d from 2013 through 2030.

If the overall trends projected in EIA's AEO2013 pan out, they will have a profound impact on U.S. crude oil markets and the economy as a whole. When combined with growing Canadian output and the potential for greater output from Mexico, North America could produce as much oil as it consumes in the coming years. Moreover, EIA now expects oil demand to be lower—18% lower in 2030—than it did in 2008. High oil prices, greater efficiency, new, sharply higher Corporate Average Fuel Economy Standards, slower economic growth and investment and other factors all play a role.

As a result of greater domestic production and these other factors, EIA is projecting net crude oil imports will be considerably lower than it was expecting in 2008 (Figure 1f). EIA's AEO2013 estimates that by 2030, U.S. oil imports will be about 7.4 MMbbl/d, nearly 3.7 MM bbl/d less than its AEO2008 estimate, and over the entire 2013 to 2030 period, imports will average 2.9 MMbbl/d less each year.

IHS shows a similar jump. By 2030, it estimates that natural gas output will climb above 33 tcf, with unconventional gas accounting for about 60% of the total.

The growth in development of Canadian oil sands also is reducing supply risks. Like with shale oil, new technologies such as in situ extraction are providing Canadian oil sands producers the ability to extract resources that were previously inaccessible or too expensive to develop. According to EIA, imports of conventional and unconventional crude oil from Canada, our most reliable trading partner, have increased from 1.3 MMbbl/d in 2002 to more than 2.2 MMbbl/d in 2012, and they are expected to rise further. Imports from Canada displace crude imports from other, more unstable regions of the world, thereby improving the reliability of U.S. supplies. U.S. companies selling goods and services to Canada also benefit by increased growth of oil sands development.

While the United States remains the only current market other than Canada for oil sands crude, Canadian producers are seeking new markets for their product, specifically China and India. This trend has hastened with the continued delays in approving the Keystone XL pipeline. If projects like the Keystone XL pipeline

8 DOI, Mineral Management Service. 2006. *Planning Area Resources Addendum to Assessment of Undiscovered Technically Recoverable Oil and Gas Resources of the Nation's Outer Continental Shelf, 2006.* MMS Fact Sheet RED-2006-02. Available at: http://www.boemre.gov/revaldiv/PDFs/NA2006BrochurePlanningAreaInsert.pdf.

continue to stall or are not completed, the full benefit of Canadian oil sands development to the United States could be slowed or never fully realized. Federal and state governments also must avoid passing legislation, like government procurement provisions or Low Carbon Fuel Standards, that hinders the use of crude oil from Canadian oil sands, and they should repeal existing discriminatory measures that prevent the use of Canadian oil sands–derived crude.

Natural Gas

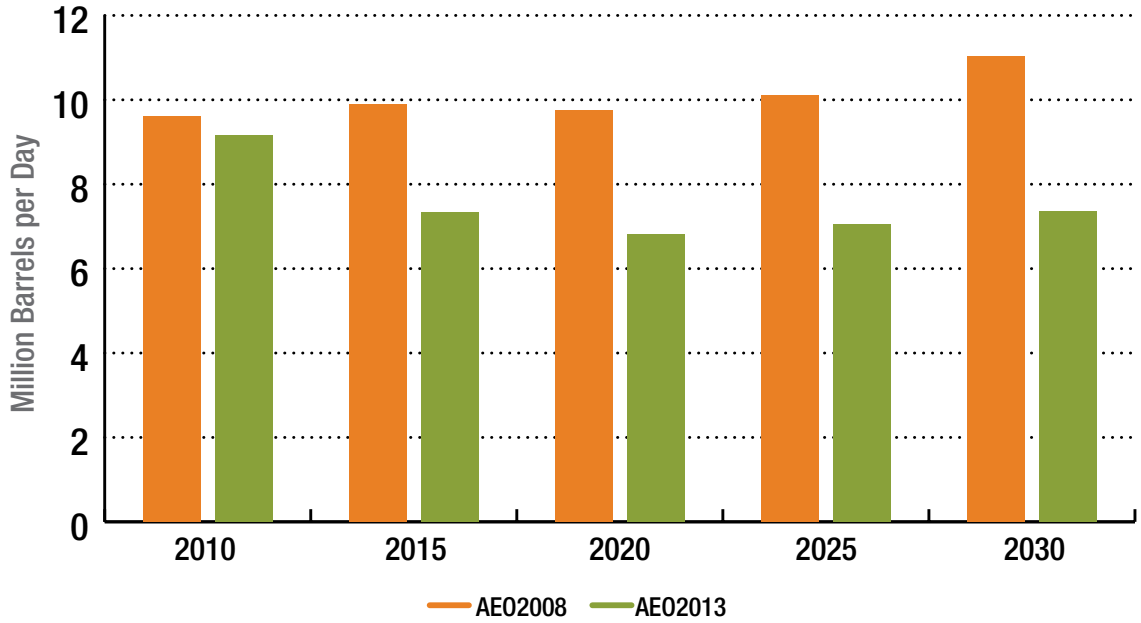
The turnaround in domestic natural gas production since the middle part of the past decade has been nothing short of astonishing. It was not all that long ago that the considered view was that declining natural gas production would see the United States traveling the same path as it had with crude oil and that, before too much longer, imports would be making up an ever-growing share of natural gas supplies. But that no longer is the case.

Figure 1g compares EIA's projections of domestic dry natural gas supply from the AEO2008 and AEO2013. Not only was actual 2012 production higher than expected in 2008, but production is expected to grow throughout the forecast period. In its AEO2008, EIA expected output to remain flat throughout the forecast period. In its AEO2013, supply grows continuously and in 2030 is expected to reach 29.8 trillion cubic feet (tcf), 10.4 tcf (53%) higher than the AEO2008 estimate for that same year of 19.4 tcf. Over the entire forecast period, natural gas output will average 7.5 tcf greater each year.

As Figure 1h shows, almost all of this expected growth is due to production from unconventional gas plays, shale formations in particular.[9] From about one-third today, shale gas will be the source of about 48% of U.S. production in 2030. The largest current sources of shale gas are the Marcellus formation in the Northeast (Maryland, New York, Ohio, Pennsylvania, and West

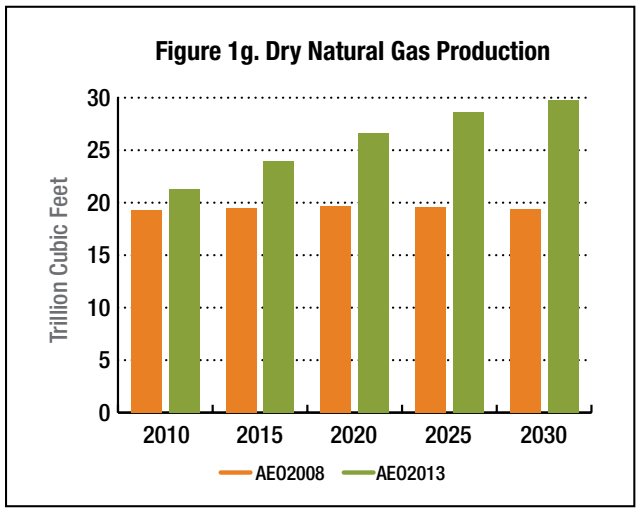
9 Unconventional gas here is defined as tight gas, shale gas, and coal-bed methane.

Figure 1f. Net Crude Oil Imports

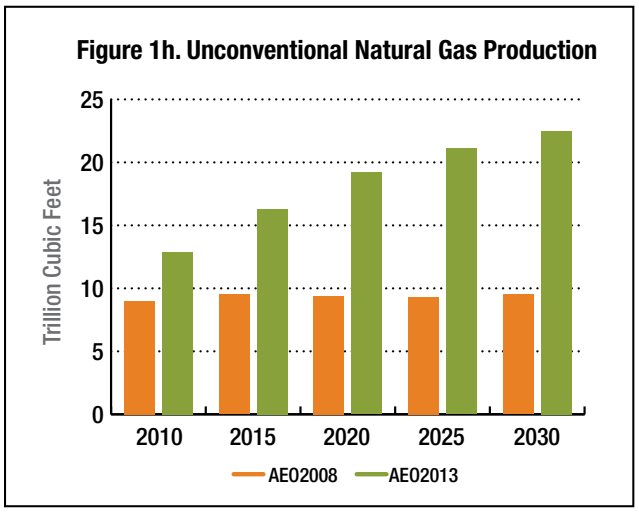


Sources: EIA, Annual Energy Outlook *2008 and 2013.*

Virginia) and the Haynesville/Bossier and Eagle Ford formations in the Gulf Coast region.



Sources: EIA, Annual Energy Outlook *2008 and 2013.*



Sources: EIA, Annual Energy Outlook *2008 and 2013 (Early Release).*

Like with oil, all of the increase in production from fiscal years 2007 to 2012 has been from production on private and state lands. CRS finds that while overall U.S. natural gas production from fiscal years 2007 to 2012 climbed 4 tcf to 24 tcf,[10] an increase of 20%, production on federal onshore and offshore lands combined fell 33% while production on non-federal lands soared 40% to 20.2 tcf[11] (Figure 1c).

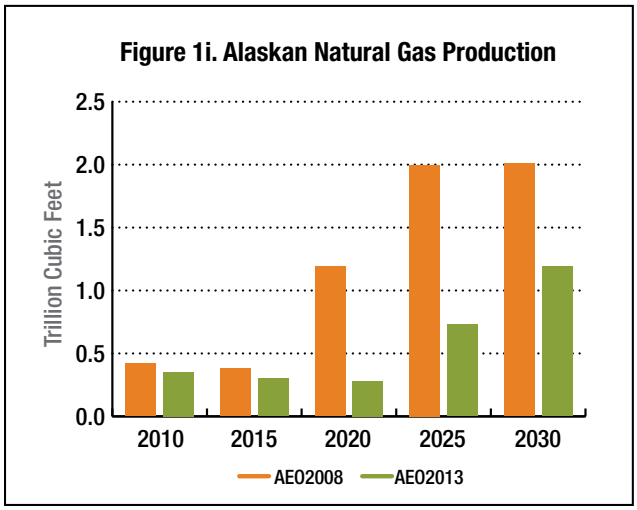
One result of the surge in natural gas production is that its use in electric power generation has grown sharply, from about 20% in 2005 to about 31% in 2012. Greater natural gas pipeline capacity will be needed to ensure that customers get the gas they need without interruption, a growing concern in places like New England, where pipeline capacity is limited and there are many competing gas users. In 2012, FERC began to take a closer look at the growing interdependence of natural gas and electricity supplies, especially in light of impending EPA regulations that favor combined-cycle natural gas generation over traditional coal-fired power plants. Greater coordination of electricity and natural gas markets and infrastructure is needed to ensure that adequate supplies of natural gas will be available as needed to meet seasonal peak electric generation loads.

Moving to the Figure 1i, the different forecasts of Alaskan natural gas production between the AEO2008 and AEO2013 boil down to changing expectations about the Alaska Pipeline Project, which would have moved gas from the North Slope to the United States through Alberta, Canada. In 2008, EIA expected the pipeline to begin moving North Slope natural gas to the lower 48 states by 2020, which would have raised Alaska's production from nearly 0.4 tcf in 2012 to 2.0 tcf in 2030.

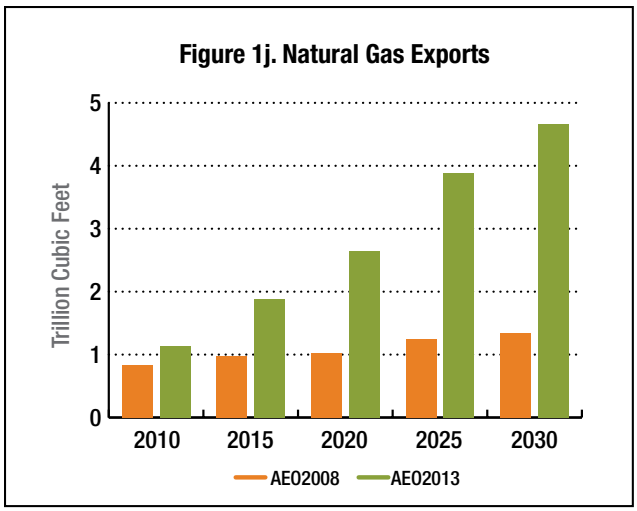
The business case for this trans-Canada natural gas pipeline collapsed because of the glut in gas created by shale production in the lower 48 states. In March 2012, however, TransCanada, ExxonMobil, ConocoPhillips, and BP agreed to evaluate options for a large-scale liquefied natural gas (LNG) export facility on the south-central Alaskan coast that would be fed by a pipeline from the North Slope. This project would make Alaskan gas available to its natural market in eastern Asia, provided the government approved these exports. EIA believes that by 2025, this project or another one like it will boost Alaskan production to 1.2 tcf by 2027.

10 Or 10.8 billion cubic feet per day and 65.5 billion cubic feet per day, respectively.

11 Or 55.3 billion cubic feet per day.



Sources: EIA, Annual Energy Outlook *2008 and 2013.*



Sources: EIA, Annual Energy Outlook *2008 and 2013.*

Increasing domestic production has caused a shift in the expectations for natural gas imports and exports (Figure 1j). In 2008, EIA expected foreign gas to account for 17% of supply in 2012 and 14% in 2030. In reality, foreign gas accounted for less than 7% of supply in 2012, and EIA now expects the United States to become a net exporter of natural gas by 2020 (perhaps earlier), even without the Alaska natural gas pipeline. To prepare for this transition, some liquefied natural gas import infrastructure is being converted to export facilities.

Shale gas presents a significant opportunity to lower the nation's energy security risk and increase the competitiveness of its manufacturing sector. The resulting reduction in costs for power generation from natural gas in many areas of the country has made U.S.-manufactured goods more cost-competitive internationally. Moreover, competitive edge honed from inexpensive natural gas has led chemical and fertilizer companies, some based overseas, to announce new investments into expanded or new U.S. production capacity. Abundant natural gas also has manufacturers and shippers looking into converting their existing diesel-powered truck fleets to natural gas, a transition that would require a great deal of new infrastructure.

Economic Benefits of Domestic Oil and Natural Gas Production

In the midst of an economy struggling to get moving and a dismal jobs outlook, the oil and natural gas industry has been a notable exception. The Independent Petroleum Association of America (IPAA) found that while the gain in total U.S. employment from 2001 to 2011 was just 3.4%, employment in upstream oil and natural gas activities[12] jumped by more than 60%, or nearly 194,000 jobs, a trend that appears to be continuing into 2012. These jobs also tend to be higher paying than average—nearly 50% above the national average wage. IPAA cites Bureau of Labor Statistics data showing that at $53 billion, total payroll for upstream oil and gas in 2011 was double the 2001 level.[13]

In a more recent study, IHS found that while unconventional oil and natural gas extraction already has revolutionized America's energy and economic fortunes, this is just the beginning.[14] As these activities expand over the next 23 years, they are expected to

12 Includes oil and gas extraction, drilling oil and gas wells, and support activities for oil and gas.

13 IPAA. 2012. "Petroleum Delivers on American Jobs." Available at: http://oilindependents.org/petroleum-delivers-on-american-jobs/.

14 IHS. 2012. *America's New Energy Future: The Unconventional Oil and Gas Revolution and the US Economy Volume 1: National Economic Contribution.* Available at: http://www.energyxxi.org/sites/default/files/pdf/americas_new_energy_future-unconventional_oil_and_gas.pdf.

bring enormous benefits to the economy, generating millions of jobs and billions of dollars in government receipts. Consider the following (all dollar figures in constant 2012 dollars):

- **Capital Expenditures:** From 2012 to 2035, capital expenditures are projected to grow from $87 billion to $172.5 billion, and cumulatively by $5.15 *trillion* over the period.
- **Employment:** In 2012, direct, indirect, and induced employment generated from this investment accounted for 1.75 million jobs in the lower 48 states. By 2035, this will grow to 3.5 million jobs. Over the forecast period, jobs in this area will account for between 1.5% and 2.0% of the total U.S. workforce.
- **GDP:** Unconventional energy activity will contribute about $237 billion to the U.S. economy in 2012. As the industry grows, the value added will climb to more than $416 billion in 2020 and $475 billion by the end of the forecast (in constant 2012 dollars).
- **Government Revenue:** Federal, state, and local tax receipts in 2012 alone will be on the order of $62 billion in 2012, rising to $124.4 billion by 2035. From 2012 to 2035, total receipts could reach $2.52 trillion (in constant 2012 dollars).

The report concludes that "Unconventional oil and natural gas activity is reshaping America's energy future and bringing very significant benefits to the economy—in terms of jobs, government revenues, and GDP."

A second IHS report took a look at state-level job impacts in the lower 48 states. It concluded that both producing and non-producing states were benefiting from the unconventional oil and natural gas revolution. Unconventional activity in producing states—including traditional producing states like Oklahoma and Texas and new producing states like North Dakota, Ohio, and Pennsylvania—contributed nearly 1.3 million jobs in 2012. Non-producing states benefit because many of their businesses are links in the long supply chains that provide goods and services supporting unconventional development. These supply chain activities support about 475,000 workers in 32 non-producing states, with Florida, Illinois, Michigan, Missouri, and New York each with more than 35,000 workers.[15]

Wood Mackenzie reported similar results, finding that "U.S. policies which encourage the development of new and existing resources could, by 2030, increase domestic oil and natural gas production by over 10 million boed [barrels of oil-equivalent per day], support an additional 1.4 million jobs, and raise over $800 billion of cumulative additional government revenue."[16]

So swift has been the turnaround in U.S. energy fortunes that the United States will shortly be in a position to export natural gas supplies, a wholly unanticipated scenario as recently as five years ago. Unlike crude oil, natural gas is priced regionally, not globally. In most parts of the world, the price of natural gas is linked to the price of crude oil and is much higher than it is in the United States. In Europe, for example, natural gas can sell for as much as $12, $13, or even $14 per million Btu, and in Asia, it can go higher still. Some have expressed concern that if the United States exports LNG to these places, natural gas prices would increase substantially and America would lose the competitive advantage low natural gas prices give manufacturing, petrochemicals, and other industries that use natural gas as a fuel or feedstock.

Exports of natural gas to nations that do not have free trade agreements with the United States, however, require a permit from the Department of Energy (DOE). In 2012, Cheniere Energy was granted the first permit to export LNG from its Sabine Pass terminal in Louisiana. But before DOE would issue further permits, it wanted an in-depth assessment of the economic impact of LNG exports. The study by NERA Economic Consultants released in December 2012 found that in all of the cases it examined, including those with relatively high levels of LNG exports, "the U.S. would experience net

15 IHS. 2012. *America's New Energy Future: The Unconventional Oil and Gas Revolution and the US Economy Volume 2: State Economic Contributions.* Available at: http://www.energyxxi.org/sites/default/files/Americas_New_Energy_Future_State_Main_Dec12.pdf.

16 Wood Mackenzie. 2011. *U.S. Supply Forecast and Potential Jobs and Economic Impacts (2012-2030).* Available at: http://www.api.org/~/media/Files/Policy/Jobs/API-US_Supply_Economic_Forecast.pdf.

economic benefits from increased LNG exports."[17] Moreover, export restriction also would be in violation of World Trade Organization (WTO) rules, which prohibits WTO members from discriminantly restraining exports to other WTO members.

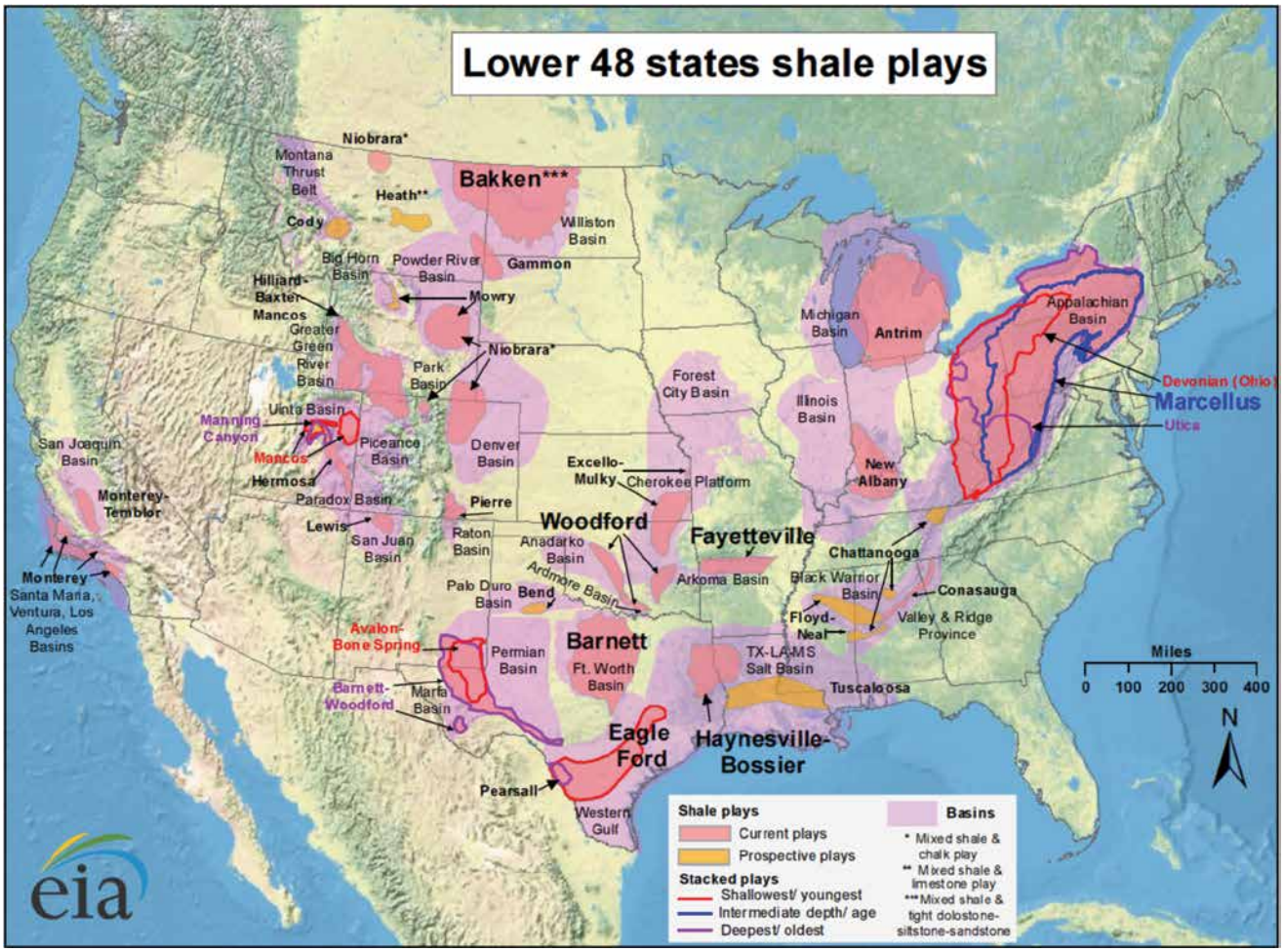
All the benefits of greater oil and natural gas production will be at risk, however, if these resources cannot be tapped further and delivered to where they are needed. With some 80% of federal onshore and offshore areas unavailable, access to resources on public lands remains a key concern. These restrictions amount to a huge lost economic opportunity. Wood Mackenzie found that "policies that increase access to currently undeveloped regions have the largest potential to create jobs in the U.S.," which the firm estimates could result in 690,000 new jobs by 2030.[18]

The benefits of the midstream, downstream, and energy-related chemicals links of the unconventional oil and natural gas value chain also are impressive. According to an IHS analysis, in 2012 these activities supported 324,000 jobs, generated nearly $46 billion in GDP, and added $11.4 billion to federal and state tax revenues. By 2020, IHS projects these economic contributions will grow to 351,000 jobs, nearly 52 billion in GDP, and $12.6 billion in federal and state tax revenues.

Infrastructure bottlenecks, labor shortages, inadequate storage facilities, stressed supply chains, and regulatory

17 NERA Economic Consulting. 2012. *Macroeconomic Impacts of LNG Exports from the United States*. Available at: http://www.fossil.energy.gov/programs/gasregulation/reports/nera_lng_report.pdf.

18 Wood Mackenzie. 2011. *U.S. Supply Forecast and Potential Jobs and Economic Impacts (2012-2030)*. Available at: http://www.api.org/~/media/Files/Policy/Jobs/API-US_Supply_Economic_Forecast.pdf.



delays and uncertainty can keep America from capitalizing on the potential of these resources. Bakken oil, for example, has traded at a discount because of inadequate pipeline capacity, and much of it has to be shipped by rail.

Regulation

Our ability to realize gains in domestic oil and natural gas production will depend on the ability of companies to explore and develop these resources and build the infrastructure necessary to move these new supplies to businesses, consumers, and overseas markets. That can be achieved only under a sound regulatory system, but right now it is uncertain whether the federal government will decide to regulate smart drilling technologies with a heavy hand or a light touch.

The single largest potential hindrance to expanding unconventional oil and natural gas production using hydraulic fracturing, horizontal drilling, and other production techniques is regulatory over-reach. Even though states already regulate these activities effectively, DOI and EPA have issued or are considering issuing a host of regulations governing activities already regulated under state laws.

And this may just be the tip of the iceberg. A executive order covering hydraulic fracturing lists 13 federal agencies with a responsibility for one aspect of fracking or another. Onerous federal oversight could imperil this revolution in natural gas and oil before it really gets going.

Different shale oil and gas plays in different states have very different characteristics, however, so a one-size-fits-all regulatory model may not be the best approach to ensuring the continued development of shale resources. State regulators have better knowledge of local conditions and geology and are better positioned to tailor regulations that meet state needs and address state concerns, and federal regulators must better collaborate and learn from their state counter-parts who have successful track records, some a century old. Unfortunately, access to resources on federal lands remains an issue.

Fuel Manufacturing

One crucial area within the oil and natural gas industry that gets much less attention than the upstream sector is the refining and fuel manufacturing sector. The downstream industry directly employs over 100,000 Americans manufacturing the gasoline, diesel, and jet fuels to fuel our vehicles as well as other petroleum products ranging from asphalt to lubricants.

Through efficiencies and technical acumen, this industry has harnessed the massive increase in domestic energy production to increase its production of these and other petroleum products. In 2011, the U.S. became a net exporter of refined petroleum products for the first time since 1949. Even while America's refining and fuel manufacturing sector increased its output by 21% from 1990 to 2010, it simultaneously decreased emissions of criteria air pollutants (sulfur dioxide, nitrogen oxides, volatile organic compounds, and particulate matter) by 80%.[19]

In 2000, EPA issued the Tier 2 rule limiting the amount of sulfur contained in gasoline. By 2006, the refining and fuel manufacturing industry made the investments needed to meet the rules requirements and reduced sulfur content by 90%. Compliance with the Tier 2 standard was expensive, but it yielded and continues to yielded significant environmental gains. Now just a few years later, EPA is proposing a new Tier 3 requirement that will yield very little additional sulfur emissions reductions yet cost the driving public nearly 10 cents per gallon of gasoline on top of $10 billion in initial compliance costs to fuel manufacturers.[20] Regulations that cost the American economy billions of dollars with scant environmental benefits should be a non-starter and should be withdrawn by EPA. (Note: Discussion of the Renewable Fuel Standard can be found in Chapter 4.)

19 Nelson, T. 2013. "An Examination of Historical Air Pollutant Emissions from US Petroleum Refineries." Environmental Progress & Sustainable Energy, Vol.32, No.2, 425-432. Available at: http://onlinelibrary.wiley.com/doi/10.1002/ep.11713/pdf.

20 Baker & Obrien, Inc. 2012. Addendum to Potential Supply Cost Impacts of Lower Sulfur, Lower RVP Gasoline. Available at: http://www.api.org/~/media/files/news/2012/12-march/addendum-potential-impacts-of-lower-sulfur-lower-rvp-gasoline-report.ashx.

Recommendations

- DOI must commit to harnessing the nation's oil and natural gas resources by enabling substantially greater access to the lands and waters owned by Americans.
    - Specifically, the department should propose a new Leasing and Exploration Plan for the OCS that provides the opportunities for leasing on the Atlantic and Pacific oceans and the Eastern Gulf of Mexico.
    - Additionally, the department must make significantly more onshore federal lands available for energy development, while also removing the bias on leasing federal lands for the production of advanced fuels like oil shale and oil sands.
- Congress should provide a 37.5% share of royalty revenues from all new production on the OCS to the state(s) adjacent to the development areas.
- The Bureau of Land Management should refrain from finalizing a new proposed rule regulating hydraulic fracturing on federal lands until it first seeks the input of and pursues collaboration with the states and with industry to ensure any future rules are addressing an existing regulatory gap, based in sound policy and not simply a rush to demonstrate the ability to regulate.
- EPA should cease its current effort to regulate hydraulic fracturing by circumventing the rule-making process and instead unlawfully issuing de facto regulations under the guise of guidance documents.
- Congress should refrain from leveling punitive taxes on the oil and natural gas industry.
- Congress should pass legislation that would ensure producers and users of commodities can continue to use over-the-counter swaps to hedge their business risk, without the burden of clearing and margin requirements.
- Congress must adequately fund and DOE must pursue research and development (R&D) focused on the production and utilization of advanced unconventional energy sources such as oil shale and oil sands.
- The Departments of Energy and Commerce should provide a non-discretionary license to any applicant proposing to export domestically produced natural gas or crude oil to any WTO member nation.
- There should be no discrimination against the use of Canadian oil sands crude, including §526 of the Energy Independence and Security Act of 2007 and Low Carbon Fuel Standards.
- EPA should withdraw its Tier 3 gasoline sulfur rule.

CHAPTER 2
COAL

Coal is an essential part of the U.S. energy mix, but it is being threatened by a rash of new regulations. As a result, newer and cleaner coal plants are not being built. EPA should be conscious of its statutorily-imposed boundaries and allow realistic compliance timelines for reasonable regulations. In addition, there should be a renewed effort to develop more efficient coal plants and carbon sequestration technology.

2. Maintain Coal's Role as a Vital Part of a Diverse Energy Portfolio

As dramatic as the changes in oil and natural gas industries have been over the past few years, the changes in the coal industry have been even greater, and not for the better.

The United States has by far the world's largest recoverable coal reserves—more than 259 billion short tons—enough to last more than 250 years. In addition to being extremely secure, coal is a large part of the U.S. energy economy. The National Mining Association estimates that coal mining employs 211,000 people directly (including mine workers, support activities, and transportation), and 766,000 people when indirect and induced jobs are included.[21]

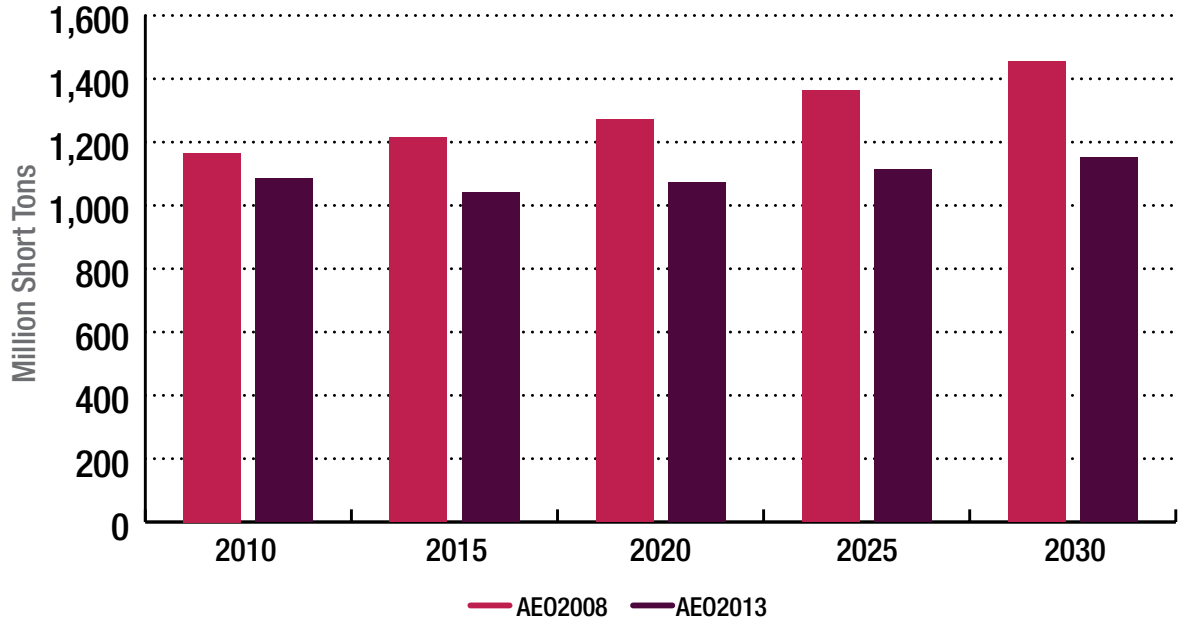
21 NMA. 2012. *The Economic Contributions of U.S. Mining in 2010.* Available at: http://www.nma.org/pdf/c_most_requested.pdf. EIA puts the number of coal mine workers at nearly 92,000 in 2011.

Coal has played an essential role in the U.S. economy, first powering steam engines and then in generating electricity. Today, there are more than 1,400 coal-fired electricity-generating units in operation across the country. Coal also is an extremely important fuel for industrial purposes, particularly steel production.

Coal has earned a place as an essential part of a diverse and reliable U.S. energy mix, and there is no getting around the fact that coal has been among our most affordable fuels. In fact, historically, the variation in the price of electricity from one state to another appears to have been inversely related to a large extent by the share of a state's electricity generated from coal.

For more than a century, coal has been a reliable and affordable source of fuel for power production. Coal has more recently provided a reliable hedge against historically

Figure 2a. Coal Production



Sources: EIA, Annual Energy Outlook *2008 and 2013.*

volatile natural gas prices. While the shale gas revolution, absent undue regulatory barriers, may mitigate future natural gas price volatility, a significant reduction in the installed capacity of coal-fired electric generation facilities would reduce the supply diversity that has supported an affordable electric energy supply.

Coal, however, faces significant and growing regulatory challenges. A flood of new air and greenhouse gas regulations combined with an abundance of relatively cheap natural gas are putting tremendous pressure on coal. Final and proposed regulations would have the effect of limiting coal's production and use, and even go so far as to effectively ban the construction of new coal-fired plants. New, proposed, and considered EPA regulations covering mercury and air toxics, cross-state air pollution, regional haze, particulate matter, coal ash as a hazardous substance, and greenhouse gases, among others, will curtail the use of one of our most secure and inexpensive fuels. On top of this, low natural gas prices have led to significant price competition between natural gas and coal-fired electric generation.

The three charts in Figure 2a–c show the impact of federal and state regulations and changing markets on coal production and coal consumption for electricity. Over the forecast period of 2013 to 2030, EIA's 2012 estimates for coal production and coal consumption at power-generating stations run an average of 18% and 26% lower, respectively, than they did in 2008 (Figure 2a). As a result, the share of electricity generated from coal plants over the next 17 years is expected to fall from an average of about 50% in the AEO2008 to about 40% in the AEO2013 (Figure 2b).

The economic losses of a distressed U.S. coal industry could be quite large. A NERA Economic Consulting assessment of seven major recent EPA regulations affecting power generation from 2013 to 2034 found:[22]

- **Compliance Costs:** Costs borne by the electricity sector would total $198 billion to $220 billion (in 2012 dollars).
- **Generating Capacity:** The power sector would lose between 54,000 megawatts (MW) to 69,000 MW of coal-fired capacity to premature retirement.
- **Employment:** Job losses would range from 544,000 per year to 887,000 per year.
- **GDP:** Economic losses would amount to between $36 billion to $63 billion each year (in 2012 dollars).
- **Disposable Income:** Average nationwide loss in disposable income would range from $200 per household to more than $500 per household.

It is important to note that these results do not include costs associated with EPA's proposed greenhouse gas (GHG) regulations for new and existing power plants, which would push these cost figures much higher.

Figure 2b. Coal Consumption for Electricity

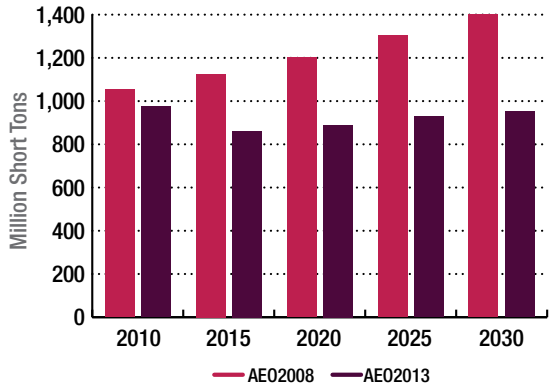
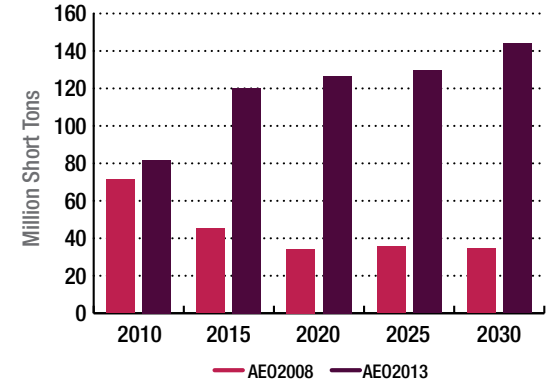


Figure 2c. Coal Exports



Sources: EIA, Annual Energy Outlook *2008 and 2013 (Early Release).*

Further, a literature review of the impacts of EPA regulations targeting coal-fired generating stations

22 NERA Economic Consulting. 2012. *Economic Implications of Recent and Anticipated EPA Regulations Affecting the Electricity Sector.* Available at: http://www.nera.com/nera-files/PUB_ACCCE_1012.pdf.

sponsored by the National Association of Manufacturers found that these regulations would lead to higher-priced electricity for consumers and businesses, with very little in the way of environmental or health benefits to show for it. "Retail electricity prices," the study noted, "are estimated to increase by around 6.5–6.6 percent per year, ranging from 13.6 percent per year in Kentucky and Tennessee and 0.1 percent per year in the Northwest."[23]

The regulations also would shutter a significant amount of coal-fired capacity. Coal-fired plants provide base-load power and are critical to the smooth functioning of the electric grid. There is a concern that a rapid shutdown of coal-fired generating capacity in many areas of the country could result in grid instability.

For example, EPA insists that power generators comply with its new Utility MACT rule by 2015, a completely unreasonable timeframe in which to shut down, significantly modify, or replace coal-fired power plants and build the necessary gas pipeline and electric transmission infrastructure. Making such sweeping changes is a long-term process that simply is not feasible within a limited, three-year window.

Utility companies and independent organizations like the North American Electric Reliability Corporation (NERC), with primary responsibility for the reliability of the electric grid, noted that these and other unbalanced rules could cause disruptions to the stability and reliability of the grid. In fact, in its 2011 reliability report,[24] NERC concluded that environmental regulations are the single greatest risk to the reliability of the grid over the next five years.

EIA's 2013 model run does not include recently proposed GHG regulations governing new power plants, which would have the effect of lowering future production and consumption estimates even more than shown in Figures 2a and 2b. Although this might reduce U.S. emissions of GHGs, any reductions would be swamped by increases elsewhere in the world, notably in Asia, as a recent analysis from IEA shows.[25] In fact, IEA predicts that global coal use by 2017 will come close to surpassing oil as the world's top energy source.

Moreover, EPA's proposed GHG rules for new coal plants would require new coal plants to install at some point carbon capture and sequestration (CCS) equipment that to date has not been demonstrated on a commercial scale. This is an untenable position, and the EPA should not be mandating technological solutions under the Clean Air Act that are neither cost-effective nor widely commercially available. Indeed, the entire panoply of regulatory activities EPA has proposed and implemented to control GHG emissions makes it clear that the Clean Air Act is not the proper vehicle for regulating GHGs.

Coal exports, however, are set to expand (Figure 2c). U.S. coal producers have willing buyers in Europe, Asia, and South America, and with domestic demand declining, EIA's 2013 forecast shows a significant shift in exports of U.S. coal compared to its 2008 forecast. From being a small net importer of coal, EIA now projects that the United States will remain a net exporter of coal, sending on average about 125 million short tons of coal overseas.

It is important that regulators ensure that port facilities are able to accommodate higher coal exports, which would be a boon to the U.S. balance of trade while also keeping U.S. coal miners employed. A report by the Energy Policy Research Foundation found that the economic value of only 50 to 100 million short tons per year of U.S. coal would be worth $2 to $6 billion dollars per year to the U.S. economy.[26]

Coal is a plentiful, affordable, and secure source of energy, and should continue to be an important part of a diversified energy portfolio, but draconian new and proposed rules—including those on mercury, cross-state air pollution, coal ash, GHGs, and more—threaten the viability of coal-fired power generation. Better designed and pragmatic and cost-effective regulations

23 NDP Consulting. 2012. *A Critical Review of the Benefits and Costs of EPA Regulations on the U.S. Economy*. Available at: http://www.nam.org/~/media/423A1826BF0747258F22BB9C68E31F8F.ashx.

24 NERC. 2011. *2011 Long Term Reliability Assessment*. Available at: http://www.nerc.com/files/2011LTRA_Final.pdf.

25 IEA. 2012. "Medium-Term Coal Market Report 2012 Factsheet." Available at: http://www.iea.org/newsroomandevents/news/2012/december/name,34467,en.html.

26 EPRFINC. 2012. *The Economic Value of American Coal Exports*. Available at: http://eprinc.org/?p=929.

could avoid the loss of an important domestic source of energy and economic activity.

Proposed GHG regulations that would require new coal-fired power plants to meet the GHG emissions profile of the most advanced natural gas-fired plants are simply unreasonable and would force unnecessary fuel switching. These strict standards require the use of a technology—CCS—that has not yet been proven to be commercially viable and will almost certainly not be ready to meet EPA's unreasonable effective date.

Efforts to support the development of CCS in the United States and other countries are important to maintain the use of affordable and abundant coal supplies while reducing emissions. Developing countries in particular will not adopt CCS until it is commercially viable and available at a reasonable cost. This will require a substantial and expedited research, development, and demonstration program focused on both pre- and post-combustion carbon dioxide capture technologies. In addition, such a program must include large-scale and scientifically intensive tests to study and understand the impacts of various methods of large-scale and permanent geological storage of carbon dioxide. These efforts should build upon the significant experience of the oil and gas industry with injecting carbon dioxide through enhanced oil recovery programs.

Coal can remain an economic and reliable source of fuel for the generation of electricity. It is important that we take advantage of the significant contributions it can play in our energy security and invest in the technology that will enable coal to continue to play an important role in America's energy mix. It is worthwhile noting that other countries have tried to eliminate coal from their energy mix but have come to appreciate its merits as a reliable, cheap source of energy. We should learn from this experience and adopt an approach that includes coal as a part of a diverse, domestic supply of energy.

Recommendations

- DOE's Office of Fossil Energy should direct its research portfolio to focus on the development, demonstration, and deployment of the full range of clean coal-generating technologies and improving and lowering the cost of CCS and carbon capture, use, and storage (CCUS) for coal and natural gas power-generating plants.
- EPA should ensure that its regulation of coal mining activities is consistent with its congressionally granted authority under the Clean Water Act, Clean Air Act, and any other applicable statutes, and it should cease to use guidelines in lieu of statutorily prescribed regulatory process.
- EPA should adopt realistic compliance timeframes for all regulations to reduce the adverse burden on consumers, jobs, and electric reliability.
- EPA's regulations covering GHG emissions from new and existing power plants must not arbitrarily mandate technology that is not commercially available to ensure that our fossil fuel resources are not eliminated from the energy mix.
- Environmental policies should focus on improving the efficiency of the existing fleet of fossil fuel-fired power plants and the commercial use of highly efficient coal-fired electric power-generation facilities.
- Policies, laws, regulations, and liability regimes that will govern geologic sequestration of carbon dioxide should be finalized. Long-term responsibility associated with the management and monitoring of such storage facilities must be apportioned and the appropriate level of public and private involvement in such facilities must be determined.
- The Surface Transportation Board and the Army Corps of Engineers should complete in a fair and expeditious manner any necessary National Environmental Policy Act (NEPA) reviews of enhanced rail capability and increased port capacity to facilitate coal exports. Such NEPA reviews should appropriately focus on the direct environmental impact of such facilities and not on theoretical upstream production growth that could be supported by enhanced U.S. export capabilities or the downstream use and impacts of coal use.

CHAPTER 3
NUCLEAR

While the expansion of nuclear energy has slowed, nuclear energy remains a major source of emissions-free electricity with an impeccable safety record. More effort should be made to advance public-private partnerships to demonstrate new nuclear technologies, and a permanent solution to store America's nuclear waste must be found.

3. Expand Nuclear Energy Use and Commit to a Nuclear Waste Solution

Generation

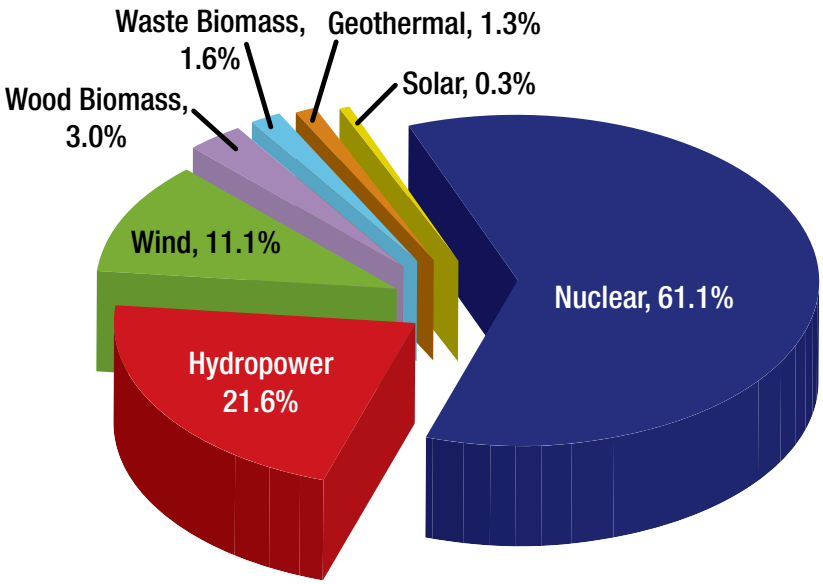
Nuclear power is and will continue to be one of America's greatest strategic energy assets. Our fleet of 100 nuclear reactors in 31 states produces about one-fifth of the electricity we consume and is our largest source of emissions-free power generation (Figure 3a). America's nuclear stations provide efficient, base-load electricity and operate at about a 90% capacity factor, higher than any other fuel type. Since 1990, efficiency gains alone have resulted in a 40% increase in electricity generated from nuclear units.

The benefits of nuclear power are being embraced globally, with more than 60 reactors under construction in 13 countries and another 130 in planning. U.S. business benefits from this global expansion by providing design and construction expertise and services.

Domestically, four new reactors are under construction—two in Georgia and two in South Carolina—with the first expected to start up in 2017. The prospects for builds beyond these four, however, are not particularly bright. The recent surge in natural gas output has pushed prices for that fuel to sustained lows and has clearly impacted utilities' decisions to invest in new reactors, especially in deregulated markets. Even though nuclear power remains one of the least cost sources of electricity over the life of the plant, merchant generators and many Public Utility Commissions either are unable or unwilling to shoulder the tremendous front-loaded cost of financing new construction when benefits are not realized for years or decades down the road.

Depressed demand for electricity, falling wholesale electricity prices, low natural gas prices, and new

Figure 3a. U.S. Sources of Emissions-Free Electricity: 2012



Source: EIA, Electric Power Monthly.

regulatory compliance costs are making it very difficult for many merchant companies already operating in competitive markets to continue to operate some nuclear reactors profitably. Owners have announced the shutdown of six reactors already and several Wall Street analysts and academics predict a growing wave of premature retirements. The loss of these units can have a significant impact on the cost of energy for American families and businesses and on the nation's clean energy generation. Natural gas prices are expected to rise gradually over the next decade, which will make nuclear power more competitive. Moreover, power generators have a long history of contending with volatile fuel and operating costs and retaining our nuclear fleet allows us to maintain reliable baseload capacity and a necessary degree of diversity within their generation portfolios.

In addition to these trends, federal and state subsidies and mandates for renewable electricity have distorted wholesale power markets, and in some areas of the country, renewable power generators pay grid operators to take their electricity in order to realize federal tax incentives during times of higher wind speeds and lower electricity demand. This not only makes it difficult for existing nuclear plants to operate, but discourages new plant construction. Nuclear power is the largest source of emissions-free power in the United Sates, and as a baseload source of energy, it is an important contributor to grid reliability. While nuclear power accounts for only about 39% of emissions-free capacity, it accounts for about 61% of emissions-free power generation because nuclear plants operate at about a 90% capacity factor. It remains the only method to produce emissions free energy baseload energy predictably and reliably.

To the extent that renewables force out nuclear power, grid stability could suffer and overall costs increase because of the intermittent nature of some renewable power sources. Whereas state renewable portfolio standards (RPS) exclude nuclear power, some states have used alternative energy standards that do not discriminate against nuclear power to the same degree.

Waste

The United States has grappled with the issue of nuclear waste disposal since 1957, the year the first commercial nuclear reactor began operations, and it appears no closer to a solution. In the 31 years since the Nuclear Waste Policy Act (NWPA) was signed into law in 1982, the nuclear industry has demonstrated an unrivaled record of safe, reliable, and economical electricity production.

Under NWPA, the government can levy nuclear waste fees on plants to offset the costs of the disposal program, and it has a legal responsibility to accept nuclear waste from nuclear plants—a responsibility it has shirked for decades because the permanent repository envisaged in the law has been blocked. The Yucca Mountain repository in Nevada was supposed to fill this role, but the Obama administration, with the support of parochial interests in Congress, has prevented it from going forward. None of this has stopped DOE from continuing to assess fees on the industry. In November 2013, the U.S. Court of Appeals for the District of Columbia ruled that DOE must stop collecting the fee because its "so-called" waste strategy "has no viable alternative to Yucca Mountain." Without the legally-mandated repository, nuclear waste continues to be held on site at nuclear plants.

The administration has said it wants to devise a new strategy toward nuclear waste disposal that does not involve Yucca Mountain. The administration and Congress have an obligation to establish a durable policy that ensures the federal government will meet its legal obligations and create the regulatory predictability needed to foster the expansion of commercial nuclear power in the United States.

Even though Yucca Mountain has been found to be the safest and best option for disposing of the country's used nuclear fuel and waste, it is also clear that Yucca Mountain is not the only solution, nor is its construction a necessary condition for allowing new reactors to be built. While on-site storage of used nuclear fuel is safe and secure, it should not be relied upon as a de facto waste policy merely because the federal government will not fulfill its legal obligations.

Recommendations

- In defining the technologies that are eligible to meet Renewable Portfolio Standards (RPS) or Clean Energy Standards, new and existing commercial nuclear energy should not be excluded. Any such generation mandates should treat all not-emitting resources equally without picking technology winners and losers.
- The Federal Energy Regulatory Commission and the various Regional Transmission Organizations need to examine the impacts of states' RPS' and the Production Tax Credits on the reliability of the electrical grid and the dispatch of baseload nuclear power.
- Nuclear energy should be treated no differently than other low-emission energy sources in any new energy legislation and policy-makers should ensure government policies do not distort competitive markets causing premature retirement of the country's essential nuclear fleet.
- The president and Congress must commit to a permanent solution to store America's nuclear waste. If the administration continues to elect to not implement the law, it has inherently accepted the responsibility to change the law, and must propose this change now.
- Until such time that the law has been changed, the administration must comply with the court's order to cease collection of Nuclear Waste Fund fees.
- Congress should pass legislation that creates an independent agency vested with the government's nuclear waste management responsibilities.
- The administration and Congress should continue to fund public-private programs that seek to demonstrate and license advanced nuclear technologies, including several different small modular reactor types.
- The administration should take advantage of America's tremendous commercial nuclear industry and more aggressively pursue civilian nuclear cooperation agreements with other nations and not predicate such agreements on other nations foreswearing enrichment or reprocessing technologies, while maintaining a policy of robust non-proliferation cooperation with other nuclear nations.
- DOE should propose a formal uranium inventory management plan. This plan should include the creation of a strategic reserve of low-enriched uranium from existing inventory to guard against supply disruptions.

Until 2012, the federal government's indecision over how and where to dispose of the nation's used nuclear fuel and waste had little practical impact on facility operations. For more than 40 years, the Nuclear Regulatory Commission (NRC) has been required to make a finding of "waste confidence" when licensing new reactors or extending the operating license of an existing reactor. Such a finding provides the NRC's reasonable assurance that a permanent waste solution would be available by the expiration of the operating license they were issuing. In June 2012, however, the U.S. Court of Appeals for the District of Columbia vacated the NRC's current waste confidence finding because the court said the NRC failed to conduct a sufficient environmental review.

The court's ruling has jeopardized the Commission's ability to issue new licenses and, more consequential in today's environment, extend existing licenses. The federal government's failure to implement a workable waste solution cannot be pushed off any further. While such a policy has been elusive, it remains achievable, and the administration and Congress owe it to the American people to reduce further taxpayer liability and provide the necessary leadership to achieve this goal.

CHAPTER 4
RENEWABLES

The U.S. is home to a large and diverse mix of renewable energy sources. However, challenges still exist because of their comparative cost and reliability. As more research and development occurs to bring costs down, subsidies must be phased out as these sources mature. In addition, public policy on renewable fuels has become out of sync with supply realities and must be addressed.

4. Enhance the Competitiveness of Renewable Sources of Energy

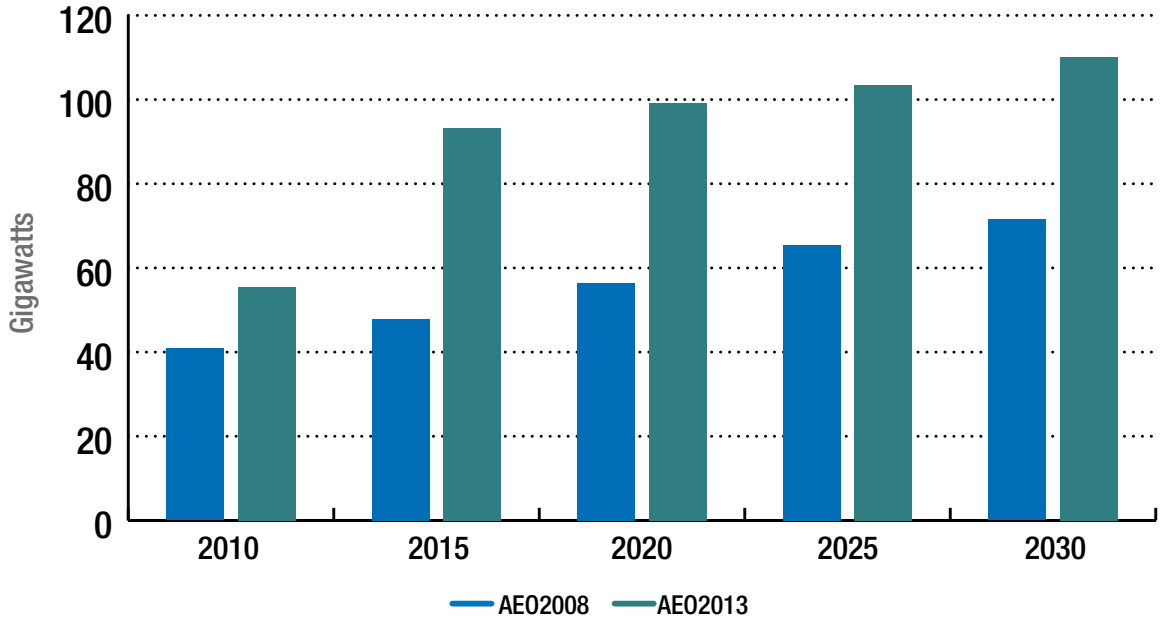
In addition to its significant reserves of fossil fuels, the United States is home also to a large and diverse mix of renewable energy sources, such as wind, solar, energy-from-waste, hydropower, geothermal, and biomass. These sources can play an increasingly important role in our nation's energy supply, providing lower emissions power and increasing the diversity of our energy portfolio.

Electric Power Sector

While the costs of emerging forms of renewable energy such as wind and photovoltaic solar continue to come down, in most markets they remain uncompetitive with traditional sources of energy and established renewable hydroelectric resources. As a result, more emergent renewable resources depend on mandates and subsidies to drive their deployment and use. Apart from cost, the inherent intermittency of many renewable generation technologies poses challenges. Sources like photovoltaic solar and wind are viable sources when the sun is shining or the wind is blowing and there is concurrent demand for their supply, but may be faced with negative prices when weather conditions are at their most favorable for these resources. Historically low natural gas prices further complicate the renewables picture. Another challenge facing many renewable projects is that they must be located far away from demand centers and are effectively stranded unless and until transmission capacity can link such resources to a market.

As electrification of the economy continues, and as intermittent renewable resources and load management grow in importance, the need for a more

Figure 4a. Renewable Generation Capacity



Sources: EIA, Annual Energy Outlook *2008 and 2013.*

robust transmission system will become increasingly evident. DOE and DOI now have in place a dedicated office and process to facilitate the siting of renewable energy resources on federal lands. These efforts are also beginning to facilitate the development of America's significant offshore wind resources. Breakthrough battery/storage technology also would allow cost-effective electricity storage—effectively time-shifting the output of renewable projects—and would help compensate for the currently uncontrollable intermittency of wind and solar sources by balancing their output with real-time loads on the grid.

In 2012, renewables provided roughly 13% of total electric power sector production. Non-hydro renewables, which generally are more intermittent and have lower capacity factors, accounted for approximately 6% of total electricity production. Looking ahead, EIA now projects significantly greater renewable generation capacity than it did in 2008, primarily because of state-level mandates. Non-hydro renewables will be the focus of this section because they account for most of the difference between EIA's AEO2008 and AEO2013. Figure 4a shows that the AEO2013 projections of non-hydro renewable capacity from 2013 to 2030 are, on average, about 42 gigawatts higher than in the AEO2008, a significantly more optimistic forecast. EIA now estimates that total renewable power generation in 2030 will account for about 15% of total generation (with non-hydro renewables accounting for between 8% and 9% of the total).

The cost of producing renewable power continues to fall, but renewables still remain more expensive than fossil fuels and nuclear, which are denser forms of energy. Policies promoting the commercial use of renewable electricity resources continue to be the key drivers of capacity expansions. Twenty-nine states and the District of Columbia have on the books an RPS or similar policies. Additionally, eight states have voluntary goals applicable to renewable generation. RPS policies have played a significant role in more than doubling the generation from non-hydropower renewables since 1990.

Federal tax credits also have been used to encourage the development and use of renewables, but their application has been very inconsistent. Tax credits have been instituted and then subsequently allowed to lapse. These short "boom and bust" cycles have resulted in tremendous inefficiencies in capital formation, investment, component production, project finance, and project management that have limited the impact of renewable energy in the U.S. market.

Aside from the unpredictable nature of the Production Tax Credit (PTC), which makes planning difficult, the incentive the PTC provides creates markets distortions by permitting generators to sell renewable power at a negative cost. Policies that promote the advancement of renewable technologies should not introduce or prolong competitive market distortions, either through subsidies or mandates, especially for technologies that already enjoy large-scale commercial penetration.

This can have the perverse consequence of shutting down base load generation capacity like nuclear and potentially jeopardizing grid reliability.

To create a more predictable investment environment, the Energy Institute has long advocated for a phasing out of incentives over time so that investors have a predictable environment in which to operate and plan. The American Taxpayer Relief Act of 2012 (ATRA) largely does this by extending through the end of 2013 the production tax credit at a rate of 2.2¢ per kilowatt hour of electricity produced at qualified generators for 10 years after the facility is placed in service. The ATRA also allows facilities that begin construction before the end of 2013 to qualify for the credit, rather than the usual "placed in service" standard for qualifying facilities. This new arrangement has the effect of extending and gradually phasing out the credit.

Further, making diverse tax structures, such as master limited partnerships, available to renewable project developers could ease the industry's transition away from a subsidized production tax credit environment by making it easier for developers to raise capital.

Recommendations

- DOE should focus its renewable and energy storage technology research and development programs on lowering the installed cost of renewable electricity resources and levelizing the real-time output of such renewable resources.

- Congress should not extend the PTC, thereby ensuring a multiyear phase-out of the credit.

- Congress should pass legislation that modifies the federal tax code to permit the formation of master limited partnerships by renewable energy investors and, as a matter of policy, this option should be available to all energy projects.

Transportation Sector

Renewables also are playing a more prominent role in the transportation sector. Much of the increase in biofuels use in recent years has been driven by federal incentives and mandates, including a blenders tax credit and a tariff on imported ethanol (both of which have expired). In addition, the Energy Policy Act of 2005 (EPAct 2005) set a new Renewable Fuel Standard (RFS) requiring the annual use of 7.5 billion gallons of ethanol and biodiesel in the nation's fuel supply by 2012.

The Energy Independence and Security Act of 2007 (EISA) built on the renewable fuel provisions of EPAct 2005 and ramped up the RFS to 36 billion gallons by 2022. It further mandated a ceiling for how much of the standard could be met with biofuels produced using conventional corn-based inputs and over time increased the amount of the standard that had to be met by biofuels produced using advanced and cellulosic methods. In 2022, the 36 billion gallon mandate would be apportioned as follows: 15 billion gallons of conventional biofuels; 16 billion gallons of cellulosic biofuels; 4 billion gallons of advanced biofuels; and 1 billion gallons of biodiesel.

Subsidies also became an issue in legislation to address the "fiscal cliff." In the end, cellulosic ethanol received a blender's credit of $1.01, which was extended through 2013 in ATRA, as was the $1.00 biodiesel credit.

These incentives and mandates and flatter-than-expected gasoline demand have created an oversupply of ethanol that would breach the 10% limit on ethanol allowed into the fuel supply by EPA. Concerned that the 10% "blend wall" placed an upper bound on the demand for their product, ethanol producers petitioned EPA to raise the allowable blend to 15%. Vehicle manufacturers and owners, however, argued that ethanol blends above 10% could potentially harm vehicle engines and fuel systems that were not designed to accommodate fuels with higher ethanol content.

Over two decisions, one in late 2011 and the other in early 2012, EPA agreed to waive the 10% ethanol cap, finding that blends of up to 15% can now be used in car and truck model years 2001 and later. EPA's decision

does not compel filling stations to sell 15% blends, however, and it is unclear how many fuel suppliers will offer the higher biofuel blend, or even if the rule will stand up to court challenges.

Refiners understandably are reticent to exceed the 10% blend wall because of the damage it might do to engines and because there is little demand for 15% blends, but they still have to meet the renewable standard. This means to keep blends at the 10%, refiners must purchase ethanol credits for the difference, or even export gasoline (which is not subject to the RFS). As a result, the demand for credits has soared, increasing the price of gasoline.

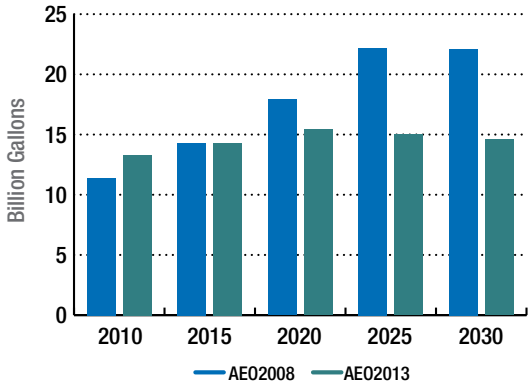
Fuel suppliers that purchase corn-derived ethanol also are in competition with other industries that use corn, such as for food production and animal feed. When corn yields are lower than expected because of drought, like the one experienced in the summer of 2012, the price of corn can rise sharply and ripple throughout the economy, raising the costs of food. This "fuel versus food" controversy is one that may be resolved partially with the advent of cellulosic ethanol.

At present, however, the production of cellulosic biofuels is quite small, so fuel suppliers have not been able to blend the amount of cellulosic biofuels required by EISA. This unavoidable state of affairs has not prevented EPA from fining refiners for not complying with the RFS and blending unavailable cellulosic ethanol into their fuel. In fact, technological hurdles remain the biggest challenge facing fuel providers as they struggle to achieve the RFS.

The view of technological progress in renewable fuels production has changed greatly since 2008. This can be seen in the different projections for ethanol production and for ethanol demand in the AEO2008 and the AEO2013 (Figures 4b).

Although ethanol production rises in both cases, EIA now expects the rate of increase to be much slower than it did previously (it also expects much lower levels of imported ethanol). As a result, EIA now estimates only 18.1 billion gallons of renewable fuel will be used in 2022, about 16.4 billion gallons of which will be ethanol.

Figure 4b. Ethanol Production



Sources: EIA, Annual Energy Outlook *2008 and 2013.*

Financial and technical challenges have delayed the start of many advanced and cellulosic biofuel projects for a number of years. EIA notes in its AEO2013 that cellulosic ethanol production "has been well under the targets set by the [Energy Security and Independence Act]." As a result, EIA expects cellulosic ethanol will not achieve EISA goals in 2022.

When EISA was enacted in 2007, expectations were for greater growth of gasoline demand and more rapid development of commercial-scale cellulosic. Neither has come to pass, creating significant market dislocations and piling unnecessary costs on refiners that will only grow if the program is not reconsidered.

The problems with the RFS have gotten to such a point that even EPA now recognizes that the program is impractical. In a final rule issued in August 2013, the agency said it anticipates that "adjustments to the 2014 volume requirements are likely to be necessary" because of a litany of issues that includes the "available supply of cellulosic biofuel, the availability of advanced biofuel, the E10 blendwall, and current infrastructure and market-based limitations to the consumption of ethanol in gasoline-ethanol blends above E10." Each of these issues by itself would pose a significant challenge and require waivers, but in combination, they render the program completely unworkable.

Recommendations

- DOE should focus its biofuels research and development programs on lowering the installed cost of cellulosic ethanol production.

- Congress should address the problematic structure of the Renewable Fuel standard, including requiring more flexibility to reflect market conditions, as well as potentially repealing the mandate.

- EPA should more aggressively exert its authority to waive and adjust annual Renewable Fuel Standard levels to accurately reflect market conditions, especially the availability of mandated fuels.

CHAPTER 5
EFFICIENCY

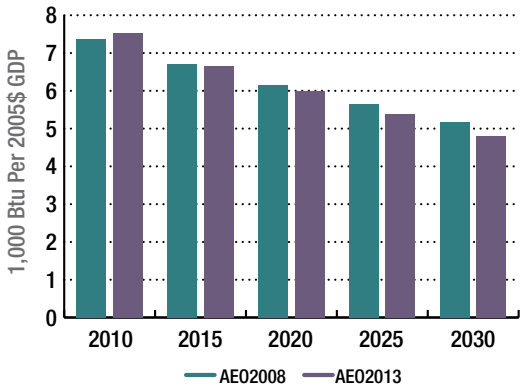
Energy efficiency remains an important component of a long term energy strategy. Policies should be pursued that will allow for more private-sector investment in efficiency upgrades, and a review should be undertaken of building codes. The U.S. can maintain its global leadership in technology by supporting a broad research and development portfolio, and considering a long term tax credit and other financial instruments.

5. Promote 21st Century Energy Efficiency and Advanced Technologies

Leveraging policies, markets, and technologies that promote energy efficiency can yield tremendous benefits. Energy efficiency generally has been the fastest, least expensive way to improving the supply picture.

The United States has steadily improved its energy intensity—energy use per unit of GDP—over the past four decades. High energy prices, new regulatory requirements, and advances in technology have continued to stimulate greater energy efficiency. It now takes a little less than half the amount of energy to produce a dollar of GDP than it did in 1970. As Figures 5 shows, EIA's latest projection indicates that it expects U.S. energy intensity to improve at a slightly faster rate than it was expecting four years ago.

Figure 5. Energy Intensity



Sources: EIA, Annual Energy Outlook *2008 and 2013.*

Although a useful measure, energy intensity is an imperfect proxy for the energy efficiency of the economy because it can be affected, for example, by changes in the manufacturing sector's share of the overall economy. As an economy shifts away from energy-intensive manufacturing toward service-based activity, energy intensity can be expected to fall. Though a measure of national energy efficiency is thereby difficult to come by, other measures within specific sectors provide indications as to how energy efficiency is improving.

Residential and commercial buildings account for roughly two-fifths of U.S. energy consumption. Most of this energy is used for space ventilation and air conditioning, water heating, lighting, refrigeration, cooking, and running a wide variety of appliances and equipment. Competitive pressures can lead to buildings that are not as energy efficient as they could be. For example, builders have a tremendous incentive to maximize investments in options that will visibly attract buyers and realize higher returns, but little incentive to invest in invisible energy efficiency systems that increase costs.

Residential energy efficiency keeps improving, but at a rate of less than 1% per year. Expectations about the penetration of electronic and chargeable devices in the home have grown appreciably, leading to greater electricity demand. The sluggish housing markets in recent years also has depressed demand for new, more efficient houses.

The outlook for the commercial sector has improved greatly in recent years. High energy prices and a tough economic climate have led to a greater focus on energy savings. Compared to its AEO2008 prediction for 2030, EIA's AEO2013 predicts that commercial buildings will use 19% less energy per square foot of space.

In both sectors, there is tremendous potential for improvement through the use of energy-efficient technologies and practices. An American Council for an Energy-Efficient Economy (ACEEE) white paper looking at the impact of energy efficient technologies found that accelerating their use could, when combined with new appliance standards, save consumers $23 billion (2009 dollars) and generate 185,000 jobs by 2030.[27]

Industrial energy use is another area where there is a great deal of potential for efficiency gains. The industrial sector

27 ACEEE. 2012. *Impacts of Energy Efficiency Provisions in Pending Senate Energy Efficiency Bills.* Available at: http://aceee.org/files/pdf/white-paper/shaheen-portman.pdf. The figure of $23 billion equates to about $21 billion in 2005 dollars.

accounts for approximately 31% of the energy consumed in the United States. About 80% of industrial energy use is related to the use of motors, steam, compressed air, pumps, fans, process heating, combustion, and combined heat and power.

Industries can take advantage of off-the-shelf technologies—many of which are common across a wide range of industries—and institute best practices and better energy management devices to save significant amounts of energy.

Electricity generation accounts for about 40% of total U.S. energy consumption. Generally speaking, utilities are more profitable the more electricity they sell. Because bulk electricity cannot easily be stored, the supply of electricity must be balanced continuously with demand. During peak demand periods, utilities may have to dispatch power from more expensive, less efficient generating facilities. Nevertheless, in most areas of the country, consumers pay flat rates for electricity, shielding them from market signals. New regulatory models could reward saving electricity through the implementation of energy efficiency programs and new approaches to the delivery and billing of energy services.

The federal government is the single largest user of energy in the nation. Under EISA, the federal government is required to reduce the energy intensity of its buildings by 30% by 2015. The Energy Savings Performance Contracts (ESPC) program is an important tool for realizing this goal, but for a variety of reasons—including the availability of stimulus funds to fund projects directly and a lack of familiarity with the ESPC program among federal government officials—it has not been used to the fullest extent possible.[28] ESPCs are a critical tool that will enable federal government agencies to meet their energy-intensity goals at no upfront cost to taxpayers and, if used to their full potential, could create tens of thousands of jobs.

Energy efficiency is a crucial component of the nation's energy portfolio, and it can realize almost immediate near-term benefits by harnessing the energy used inefficiently every day. The changes in outlook from 2008 to 2013 suggest that while we continue to make progress, efficiency improvements in our households and industries in particular may not be as great as we once expected. It is clear that the recession, housing crisis, and numerous pending and forthcoming regulations have altered expectations.

In addition to improving energy efficiency, the development and commercial use of advanced energy technologies should be an integral part of our energy policy. America's scientists and engineers must be challenged to accelerate breakthroughs in the cost-effectiveness and performance of renewable, nuclear, fusion, energy storage, smart-grid, and many other technologies that have the potential to alter the way energy is produced and consumed. The advent of hydraulic fracturing and horizontal drilling technologies has shown how breakthroughs can enhance energy security by diversifying supplies and producing more energy at home.

The United States should maintain a leadership role in advanced energy technologies by supporting a broad-based technology portfolio. It is also important to support a vibrant scientific enterprise more broadly. Advances in fields as varied as materials research, nanotechnology, supercomputing, and biotechnology, to name a few, may hold the keys to breakthroughs in fuel cells, batteries, biorefining, and other emerging energy technologies.

The establishment of DOE's Advanced Research Projects Agency for Energy (ARPA-E) program authorized under the America Competes Act has created a place where novel, high-risk, potentially high-payoff cross-cutting technology R&D is encouraged. The Energy Institute supported the creation of ARPA-E and sees tremendous value in continuing this program. A proper climate for R&D in our private-sector companies, where most of the R&D investment occurs, also needs to be maintained. In particular, the on-again, off-again nature of the R&D tax credit, which allows businesses to deduct part of those investments from their taxes, has made R&D planning for businesses

28 Kovacs, W. 2011. "Green Jobs and Red Tape: Assessing Federal Efforts to Encourage Employment." Testimony Before the Committee on Science, Space & Technology, Subcommittee on Investigations and Oversight, U.S. House of Representatives. Available at: http://www.uschamber.com/sites/default/files/040611-re-TESTIMONY-House%20Science%20Green%20Jobs%20Hearing%20REE%20Edits.pdf.

more difficult. About two-thirds of all R&D conducted in America (about $240 billion in total, including energy) is done by the private sector.

The development and deployment of new, affordable technology is not just the result of activities in a laboratory. Placing technologies on the shelf is one thing; moving them off the shelf is another. Both are important.

Adopting new technologies is not without risk. Public-private partnerships and supportive policies can be used to bridge the gap between the laboratory and the marketplace and overcome the "first movers' penalty" that early adopters face. If structured properly and issued with due diligence, loan guarantees can be used to encourage the first movers to bring these new technologies into the market. Criteria should be designed to stimulate competition and not pick winners and losers, so that markets can work to identify and adopt the best technologies.

In addition, when promising technologies are particularly complex and expensive, we must consider new methods of government/industry partnerships to demonstrate those technologies at a massive scale and on an ambitious schedule. Traditional federal programs, however, lack the capability and wherewithal to do this effectively. A new suite of financing instruments, like those available to the Export-Import Bank, Overseas Private Investment Corporation, and the Millennium Challenge Corporation, could be developed to lower capital costs, mitigate market risks impeding investment, and address market inefficiencies. These could include such things as risk management, debt, equity, and securitization products similar to those offered by venture capitalists.

Incentives almost certainly will be needed to overcome the risks associated with adopting many new technologies, but ultimately these technologies will need to be able to compete in the marketplace on an equal footing. Therefore, the real measure of our success in achieving energy security will be whether there is vigorous competition among different technologies and fuels within and among sectors.

Recommendations

- Congress and the president should enact legislation similar to the Energy Savings and Industrial Competitiveness Act of 2011 to boost private-sector investment in building efficiency upgrades, help manufacturers reduce energy use, update lighting and appliance standards, and strengthen building codes.
- DOE should update and set performance-based, easily implemented national model building energy codes.
- DOE should expeditiously promulgate appliance standards to meet statutory requirements.
- The president should direct federal agencies to use the ESPC program as the first energy efficiency option to meet the various government energy goals and to ensure that program managers are knowledgeable about ESPC contracting and management.
- More efficient use of energy and new approaches to the delivery of energy services should be rewarded.
- Congress and the president should allow more rapid depreciation of capital equipment by reducing the cost-recovery period for energy efficiency devices.
- The federal government should support a broad R&D portfolio on both the supply and demand sides, including energy efficiency, new energy sources, and advanced fuel and power delivery options.
- Congress should continue to fund the ARPA-E program's efforts to support high-risk, exploratory research on innovative energy technologies that have great potential for breakthroughs.
- Congress should establish a long-term R&D tax credit so companies can plan their R&D activities with greater certainty.
- Congress should create a portfolio of novel financial instruments to accelerate the market penetration of viable, more advanced, cleaner, and more efficient energy technologies. Public-private partnerships should continue to be the model to support demonstration projects.

CHAPTER 6

INFRASTRUCTURE

From BANANA ("Build Absolutely Nothing Anywhere Near Anyone") to NIMBY, it is no secret that the energy sector is suffering from an unacceptable permitting process for new energy infrastructure, creating alarming delays. To get things moving again, time limits and new streamlined guidelines should be put in place to ensure a more reasonable process.

6. Modernize the Permitting Process for Our Nation's Energy Infrastructure

Much of our energy infrastructure is increasingly inadequate to meet current and projected demand. Providing energy is a long and capital-intensive undertaking, and new energy infrastructure projects require long lead times and massive amounts—tens of trillions of dollars over the next few decades—of new investment. Some of that investment and the jobs that go with it will never happen or go elsewhere if the regulatory environment under which companies operate is unreliable and inefficient. Regulatory predictability allows business to plan and invest with greater confidence.

Unfortunately, our energy sector suffers from a lengthy, unpredictable, and needlessly complex regulatory maze that delays, and often halts, the construction of new energy infrastructure. Federal and state environmental statutes such as NEPA, state siting and permitting rules, and a "build absolutely nothing anywhere near anything"—BANANA—mentality, routinely are used to block the construction and expansion of everything from transmission lines to power plants to pipelines. And just because a project is "green" does not mean it fares any better. It has become too easy for energy projects of any hue to be wrapped up in "green tape."

Investments in expanding the capacity of the electricity transmission system, for example, have not kept pace with investments in new power generation. As a result, the system is not capable of meeting the demands placed on it, and almost daily transmission constraints or "bottlenecks" create congestion that increases electricity costs to consumers and the risk of blackouts (transmission will be discussed in more detail later in this section).

The failure of the federal government thus far to grant a construction permit for the Keystone XL pipeline exemplifies perhaps better than anything the challenges of building energy infrastructure in the United States. After years of environmental and other reviews, the portion of the northern section of the pipeline from the Canadian border to Steele City, Nebraska, is still awaiting presidential approval. This failure has tarnished America's image as a "can do" country open to foreign investment, a failure that can be difficult to shake from investors' minds.

TransCanada's Keystone XL pipeline is a $7 billion pipeline expansion project would increase the existing Keystone Pipeline system that connects Canada's 175 billion barrel oil sands resource to U.S. refining centers from a capacity of 591,000 bbl/d to more than 1.1 MMbbl/d. An economic analysis of the project by the Canadian Energy Research Institute (CERI) found that construction and operation of the pipeline could generate as many as 25,000 jobs within five years and more than 116,000 jobs after 25 years.[29]

In addition to its economic benefits, expansion of the Keystone XL pipeline would enhance U.S. energy security. Linkages to the pipeline system also could enable crude oil production from the Bakken formation and, if they are allowed to be developed, oil shale formations in Wyoming to be transported to refineries in the Gulf region more efficiently.

Keystone is not the only pipeline the country needs. Increasing North American oil and natural gas production in places such as the Bakken, Marcellus, and Eagle Ford formations, in Alaska, and in Alberta—some of which are not in traditional oil and gas producing areas—will require new pipeline infrastructure. Without it, new gas-fired power plants, manufacturing plants, and LNG exports facilities could all be delayed.

It is hard to imagine that the Hoover Dam was built in five years, the Empire State Building in a little over one year, and the New Jersey Turnpike in only four years. It now takes an average of over three years just to complete an Environmental Impact Statement (EIS), and the time

29 CERI. 2012. *Pacific Access: Part I – Linking oil Sands Supply to New and Existing Markets.* Study No. 129 – Part I. Available at: http://www.ceri.ca/images/stories/part_i_-_impacts_of_oil_sands_production_-_final_july_2012.pdf.

continues to increase. Real-world economic losses from regulatory delay can be quite substantial.

When the National Environmental Policy Act was enacted in 1970, it represented a compromise that allowed for environmental reviews of federal agency actions while setting limits on the time and scope of such reviews to prevent delays. The subsequent four decades have seen these constraints weakened significantly, adding years of delay and millions of dollars to the cost of many projects, with negligible environmental benefits. This favored tool of the NIMBY ("not in my backyard") movement needs a thorough re-evaluation to rehabilitate it back to the workable and beneficial law Congress intended.

A study of the length of time it takes to perform an EIS found that between 1998 and 2006, the average time for all federal entities was 3.4 years, with the time increasing by 37 days each year. Just three agencies—the U.S. Forest Service, Federal Highway Administration, and Army Corps of Engineers—were responsible for 51% of the EISs performed during the study period.[30]

New infrastructure is needed to expand and modernize aging systems and to take advantage of new sources of energy, particularly shale gas, shale oil, oil sands from Canada, and renewables, but an unpredictable regulation impedes investment in energy projects of all types. For all forms of energy, regulatory and fiscal policies need to be more predictable to accelerate capital investment. Policymakers should place high priority on those measures that are revenue-neutral given the current fiscal climate.

Transmission

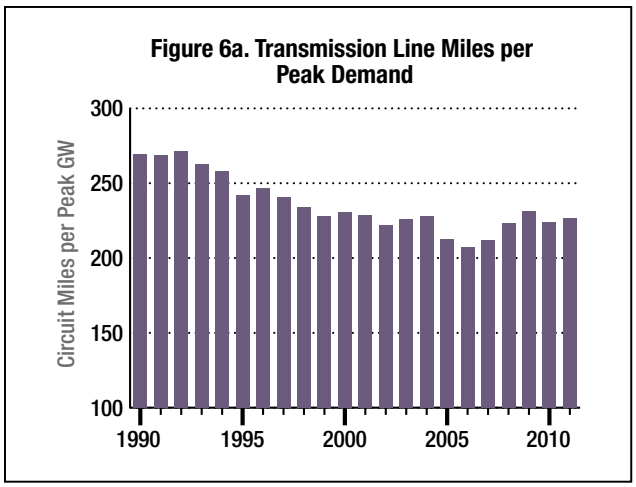
Perhaps nowhere are siting and permitting delays felt more keenly than in the building of needed electricity transmission infrastructure.

The transmission system is a key component of the nation's energy system. Nearly all aspects of modern life depend to one degree or another on electric power, and consumers expect that electricity will be available

30 deWitt, P and deWitt, C. 2008. "How Long Does It Take to Prepare an Environmental Impact Statement?" *Environmental Practice* 10 (4).

Recommendations

- Congress should limit to two years the State Department application review process for proposed projects that would cross an international border with the United States.
- Congress should pass legislation to streamline and enhance coordination of federal agency administration of the regulatory review, environmental decision-making, and permitting process for major construction activities undertaken, reviewed, or funded by federal agencies. It should prohibit requiring more than one EIS and one Environmental Assessment per project, except for supplemental environmental documents prepared under NEPA or environmental documents prepared pursuant to a court order.



Sources: North American Electric Reliability Corporation, Electric Supply and Demand Report*; EIA,* Annual Energy Review.

to them 24 hours a day, seven days a week, and 365 days a year at the flick of a switch.

An engineering marvel, the electric grid is an extensive system of interconnected, high-voltage networks, and its transmission lines provide the "highways" along which electrons flow from generating sources to demand centers. Providing reliable electricity is an extremely complicated undertaking, and while electrical outages are uncommon, they can and do occur, sometimes with significant local or regional economic impacts.

The importance of a reliable transmission system is apparent in the results of a NERC survey of reliability issues, which found that aging infrastructure and limited new construction, increased system congestion, and operating facilities closer to load limits were among the biggest risks facing the grid.[31]

A robust transmission system provides electric customers with the ability to draw from a diverse set of power plants in different locations and with different operating characteristics. If the transmission system has a certain amount of redundancy built in, it can withstand the failure of its most critical components. Moreover, as electrification of our economy continues, and as intermittent renewable resources achieve greater saturation, the critical nature of the transmission grid comes increasingly into focus.

While overall use of the transmission system has been growing, capacity additions through new construction or upgrades have struggled to keep pace. Planned additions in the short term do not change the picture appreciably. Figure 6a illustrates that from 1990 to 2012, transmission circuit-miles per gigawatt of peak demand have declined 16%. Further, an analysis by DOE, the *National Transmission Grid Study*,[32] asserted that without dramatic improvements and upgrades, the nation's transmission system will fall short of the reliability standards our economy requires, resulting in negative economic consequences and ultimately higher electricity costs to consumers.

Many transmission projects, however, are being held up due to broken permitting processes, excessive judicial challenges, and NIMBY activism. In addition to the impact on grid reliability, delays have a direct economic cost potentially in the tens of billions of dollars.

Rare Earth Minerals

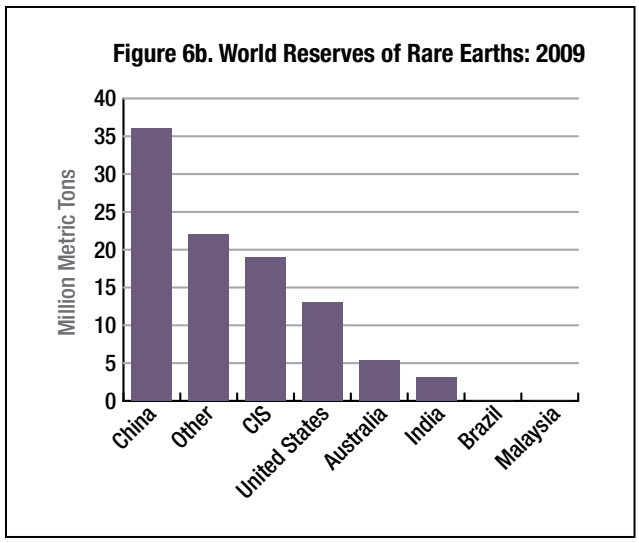
Siting and permitting delays also could affect the availability of key elements, such as rare earths, used in advanced technologies. The term "rare earths" is misleading in the sense that they are not all that rare, but they are not as concentrated as other types of metal ores, which makes them more difficult and expensive to mine.

New, advanced energy systems, especially renewable systems and batteries, require rare earth metals and materials. Electric vehicles, fluorescent lighting, photovoltaic cells, and wind turbines are all examples of technologies that use rare earths. DOE has identified five rare earth elements that were found to be critical in the short term (to 2015)—dysprosium, europium, neodymium, terbium, and yttrium—and four other elements that were found to be near critical—cerium, indium, lanthanum, and tellurium.[33]

31 NERC. 2002. *Reliability Assessment 2002–2011: The Reliability of Bulk Electric Power Systems in North America.* Available at: http://www.hks.harvard.edu/hepg/Papers/NERC_reliability.assessment_2002-2011.pdf.

32 DOE. 2002. *National Transmission Grid Study.* Available at: http://www.ferc.gov/industries/electric/gen-info/transmission-grid.pdf.

33 DOE. 2011. *Critical Materials Strategy.* Available at: http://energy.gov/pi/office-policy-and-international-affairs/downloads/2011-critical-materials-strategy.



Source: USGS, The Principal Rare Earth Elements Deposits of the United States—A Summary of Domestic Deposits and a Global Perspective.

Moreover, the U.S. Government Accountability Office recently reported that many U.S. defense and weapons systems are now totally dependent upon rare earth materials, almost all of which come from foreign sources.[34]

The rapid growth in the commercial use of renewable technologies has increased demand for rare earth metals and compounds. While the United States has large reserves scattered across more than a dozen states,[35] it is almost totally reliant on overseas providers, especially China, for supplies. A 2010 report by USGS found that although the United States held about 13% of the world total of rare earth oxides in 2009 (second only to China), its share of production was 0% (Figure 6b).[36] By itself, China accounted for 95% of total production in 2009, with India, Russia, Brazil, and Malaysia making up the other main producers (Figure 6c).

The dominance of China and its willingness to manipulate the markets for rare earths by withholding exports—leading to a challenge by the United

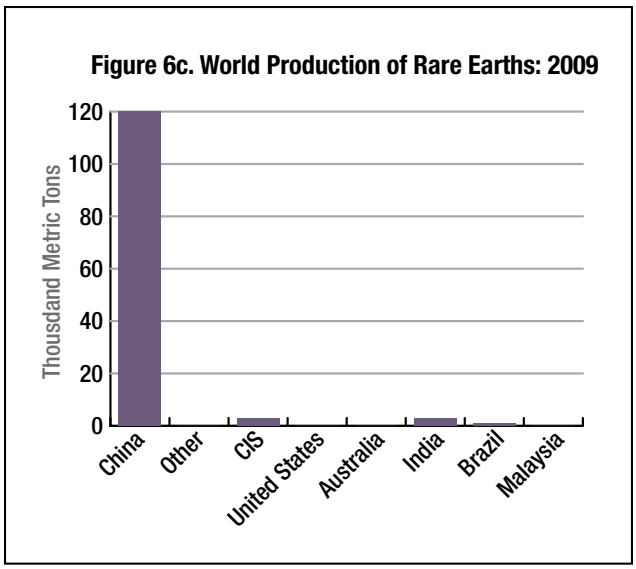
34 GAO. 2010. *Rare Earth Materials in the Defense Supply Chain.* GAO-10-617R. Available at: http://www.gao.gov/assets/100/96654.pdf.

35 They are: Alaska, California, Florida, Georgia, Idaho, Illinois, Missouri, Nebraska, New Mexico, New York, North Carolina, South Carolina, and Wyoming.

36 USGS. 2010. *The Principal Rare Earth Elements Deposits of the United States—A Summary of Domestic Deposits and a Global Perspective.* Available at: http://pubs.usgs.gov/sir/2010/5220/.

Recommendations

- Congress should pass legislation that enhances the Federal Energy Regulatory Commission's (FERC) authority to site electric transmission infrastructure. Such authority would be consistent with FERC's authority under the Natural Gas Act, which includes eminent domain power and an enhanced ability to work with states to site new energy infrastructure.
- Congress should pass legislation that modifies DOE's existing authority [granted under Section 216(h) of the Federal Power Act] as the "lead agency" to coordinate multiple federal agencies' permit reviews for an interstate transmission facility. Further, in no case shall the coordinated review process extend beyond two years.



Source: USGS, The Principal Rare Earth Elements Deposits of the United States—A Summary of Domestic Deposits and a Global Perspective.

States over export restraints—has highlighted the need for alternative sources of supplies. Despite an abundance of domestic reserves, however, U.S. policy has not adjusted to this new reality by making sure companies can get access to reserves and conduct mining operations. New mine development is a time-consuming task that involves meeting a variety of onerous regulations governing prospecting, exploration, process development, permitting, construction, and commissioning. The Behre Dolbear 2012 ranking of countries for mining investment found that permitting delays "are the most significant risk to mining projects in the United States," with waiting periods of seven to 10 years before mine development can begin. As a result, the United States is ranked last (tied with Papua New Guinea) in the time it takes to issue a mining permit.[37]

As a potentially large producer, it makes little sense either from an economic or an energy security perspective to continue to rely on often-unreliable supplies of increasingly important rare earths. U.S. policy must welcome the opportunity to produce more of these metals domestically and to come up with ways to recycle them to moderate demand.

Recommendation

- Congress and the president should enact legislation similar to the National Strategic and Critical Minerals Production Act of 2012, which was passed by the House of Representatives in 2012, to streamline the review and approval of exploration and mining permit applications.

37 Behre Dolbear. 2012. *2012 Ranking of Countries for Mining Investment.* Available at: http://www.dolbear.com/_literature_125436/2012_Ranking_of_Countries_for_Mining_Investment.

CHAPTER 7

CYBER

A reliable grid is essential to U.S. energy security. New threats have emerged to our energy infrastructure in the form of cyber attacks and geomagnetic storms. Computer networks that control infrastructure are constantly attacked. Efforts to facilitate information exchanges between government intelligence agencies and the private sector should be enhanced.

7. Protect Our Energy Infrastructure from Physical Disruptions and Cyber Attacks

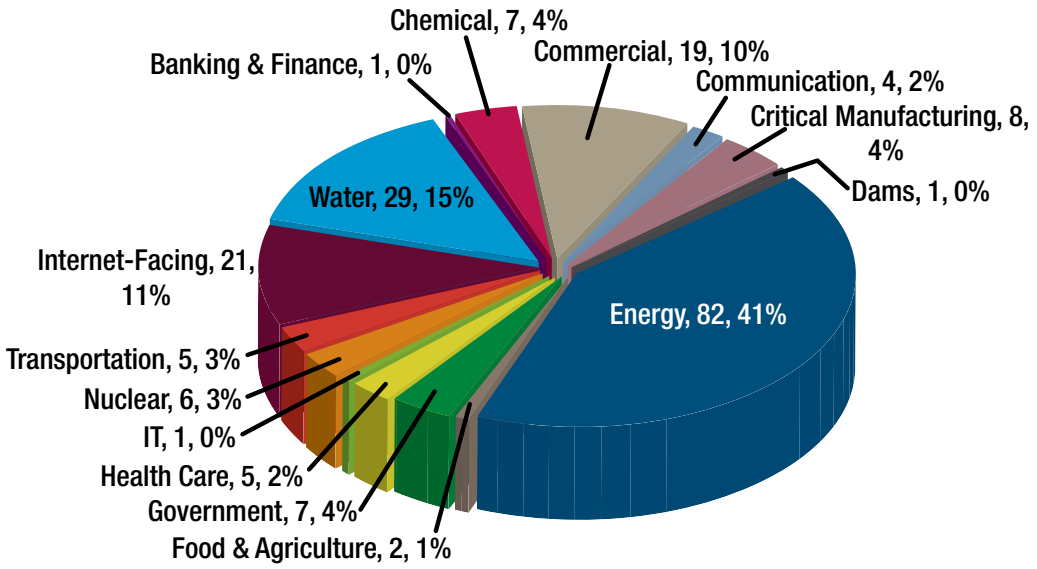
Threats to the viability and reliability of our energy infrastructure have many sources, including private actors, nation-states, and extraterrestrial disturbances (*e.g.*, geomagnetic storms and solar winds). Cyber threats are a particularly serious concern. Although the Internet has been a boon to global communications and commerce, it also can be used to perpetrate attacks on our energy infrastructure.

The Department of Homeland Security (DHS) recently reported that in fiscal years 2011 and 2012, there was an increasing trend in cyber attacks targeting energy and pipeline infrastructure around the world. According to the agency, cyber intrusions into pipeline and electric power infrastructure have been occurring at an "alarming rate," with attacks against energy-related systems comprising more than 40% of all reported incidents in fiscal year 2012[38] (Figure 7).

More than 80% of the nation's energy infrastructure is owned and operated by the private sector. Pursuant to the Energy Policy Act of 2005, the owners and operators of the bulk electric power system are subject to critical infrastructure protection (CIP) standards developed and enforced by NERC and approved by FERC. This regulatory regime is part of a broader suite of industry-driven protections designed to promote the resiliency of the electric grid in the face of a cyber or physical attack. Similar efforts also are being undertaken to study ways to protect the electric grid from geomagnetic impacts,

38 DHS Industrial Control Systems Cyber Emergency Response Team. 2012. "ICS-CERT Monitor," October/November/December 2012. Available at: http://www.us-cert.gov/control_systems/pdf/ICS-CERT_Monthly_Monitor_Oct-Dec2012.pdf.

Figure 7. Cyber Incidents by Sector: Fiscal Year 2012



Source: DHS Industrial Control Systems Cyber Emergency Response Team, "ICS-CERT Monitor.

such as solar flares and electromagnetic disturbances that could be caused by terrorists or nation-states.

The energy sector is one of the key infrastructure sectors identified in the National Infrastructure Protection Plan, now overseen by DHS. Through this framework, sector-specific plans are developed and implemented, providing cyber and physical infrastructure and supply-chain protections that are crafted to match the sector-specific characteristics and conditions.

Government and business efforts to protect energy infrastructure are constantly evolving to meet known and emerging cyber and physical threats. However, even as companies work diligently to protect their physical infrastructure and control systems from outside dangers, they often are not privy to critical threat information held by the U.S. intelligence community. Bridging this information gap so that timely and actionable government intelligence can be used by industry to protect critical assets is one of the greatest challenges in hardening our energy infrastructure.

Although proposals have been floated in Congress over the past several years to address this issue, to date none have been enacted. These proposals failed because it was clear they placed too much emphasis on the development and imposition of regulations that could easily be out of date by the time they were issued. Further, such regulations could be exploited by bad actors as indicators of the strengths and weaknesses of established cyber protection regimes. A more workable approach would implement an information-sharing framework that would allow the intelligence community and private industry to share intelligence and expertise.

Given the standoff in Congress, on February 12, 2013, the White House issued an executive order directed at improving critical infrastructure cybersecurity. The executive order rightly elevates the importance of bidirectional information sharing, and it also calls on government officials to produce timely classified and unclassified reports on cyber threats for specific targets, such as U.S. critical infrastructure.

A more workable approach would implement an information-sharing framework that would allow the intelligence community and private industry to share intelligence and expertise.

Given the inherent limitations to executive action on cybersecurity, legislation should codify and build upon these advances by providing legal certainty that businesses that voluntarily share threat information with the government will be provided safe harbor against the risk of frivolous lawsuits and will be exempt from public disclosure, and that cyber threat information will not be subject to use by government officials to regulate other activities. In addition, this necessary legislative supplement also needs to include a cybersecurity-focused exemption from antitrust laws, which would ordinarily limit exchanges of information between private entities that is intended to help prevent, investigate, and mitigate threats to critical infrastructure cybersecurity.

The implementation of a public-private partnership to address these and other concerns can be mutually beneficial. Private-sector expertise and experience could help the government improve the protection of its own infrastructure. The need is great. For example, from October 2009 to March 2012, DOE recorded 2,300 incidents of "unauthorized computer access, improper use of computing resources, and the installation of malicious software," according to a report from the department's own inspector general.[39] In particular, sophisticated cyber attacks hit computers at DOE's Pacific Oak Ridge National Laboratory in April 2011 and its Northwest National Laboratory in July 2011. Each of those attacks crippled the computer networks at those sites for days.

39 DOE Office of Inspector General, Office of Audits & Inspections. 2012. *Follow-up Audit of the Department's Cyber Security Incident Management Program.* Available at: http://energy.gov/sites/prod/files/IG-0878.pdf.

With respect to the protection of critical energy infrastructure from threats such as geomagnetic and electromagnetic disturbances, an established public-private partnership with active and largely uninhibited information sharing can also pay dividends. Of course, in the case of an electromagnetic attack, the Department of Defense plays an active role in prevention.

With respect to geomagnetic disturbances such as solar flares, additional investigation and analysis is necessary to determine the actual extent of the exposure to such threats faced by today's critical energy infrastructure. The information obtained through these efforts can then guide the implementation of cost-effective protections to relevant physical infrastructure.

A more terrestrial concern is adequate vegetation management around high-voltage transmission lines. Trees remain a major cause of power outages. Heavily loaded power lines coming into contact with trees was identified as the root cause of the August 2003 blackout that affected 50 million people across the northeastern United States and parts of southern Canada. Managing vegetation is, therefore, a high-profile focus of maintaining grid reliability that requires ongoing vigilance. The protection of energy infrastructure assets from physical sabotage also requires a renewed focus in conjunction with ongoing activities designed to safeguard our critical energy infrastructure from cyber, electromagnetic, and naturally occurring threats to reliable operations.

Instead of the top-down regulations previously proposed in Congress, the supplementation of the administration's February 2013 executive order with legislation that supports a true partnership will minimize the susceptibility of our nation's critical infrastructure—both privately and publicly owned and operated—from cyber attacks, geomagnetic disturbances, and physical intrusions in a cost-effective and flexible manner. The Energy Institute hopes to be able to support legislative proposals that would meet of these goals.

Recommendations

- Congress should enact legislation supporting the exchange of threat information between the government intelligence community and the private-sector owners and operators of critical energy infrastructure. Such legislation should include full liability protections and codify narrowly tailored measures to help business owners and operators harden critical infrastructure and adopt cutting-edge cybersecurity practices that serve to strengthen industry-specific efforts.
- Congress should direct DHS, in cooperation with DOE, to study the potential impacts of geomagnetic and electromagnetic disturbances on energy infrastructure and implement reasonable risk-based plans to insulate critical facilities from such threats in a cost-effective manner.

CHAPTER 8

REFORM THE REGULATORY PROCESS

Regulations can make Americans healthy and safer. But over the past several years, the administration has overstepped its bounds, particularly on energy, and begun using the regulatory process to accomplish policy objectives that could not be achieved through legislation. This subversion of the process has resulted in regulations that will crush consumers and harm job creation. Congressional approval should be required for new regulations, and regulatory agencies should be forced to consider the real economic impacts of their rules.

8. Reform the Regulatory Process for Balance, Predictability, and Transparency

As detailed earlier in this report, regulations have a significant impact on the construction of new energy projects and the operation of existing facilities and infrastructure. The impacts of regulation on existing infrastructure are no less important.

Regulations are an essential part of a complex economy. When designed well, regulations can make Americans healthier and safer. However, when designed poorly, regulations can cost jobs by inflicting significant compliance costs that divert resources away from more productive uses, harming and even destroying entire industries, and creating such complexity that they discourage business expansion and job creation.

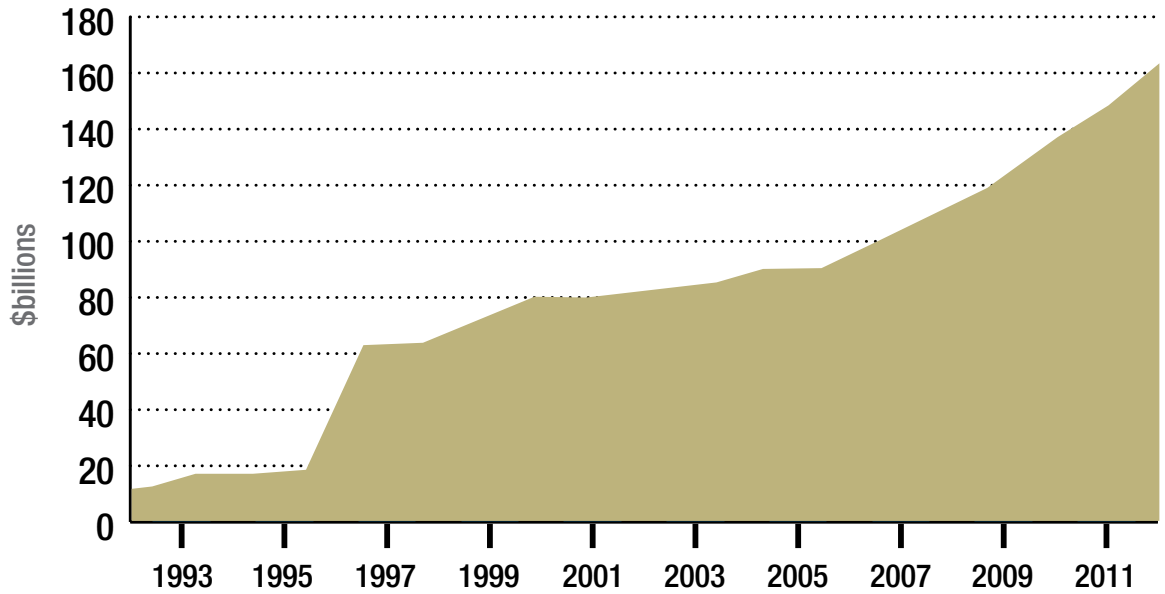
The scope and pace of federal rulemakings have increased dramatically in the past few years, including on energy.

According to an estimate study conducted for the Small Business Administration's Office of Advocacy, the total annual cost to comply with federal regulations was $1.82 trillion in 2011.[40] Since 2008, the number of new rules each year that impose compliance costs of a billion dollars or more has increased.

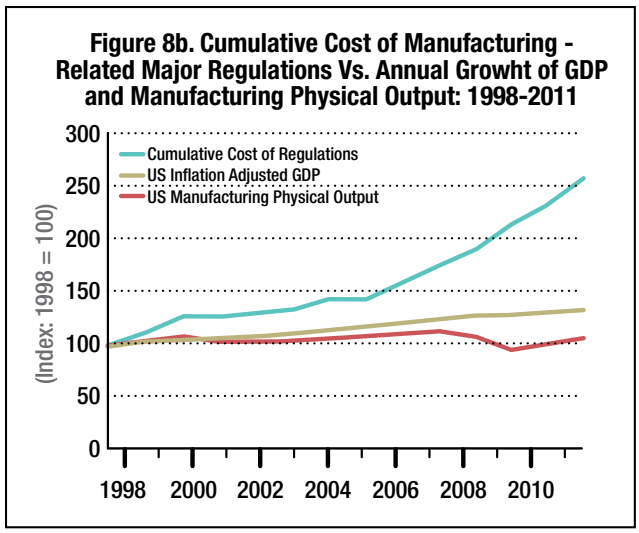
This represents a significant departure from past experience. NERA Economic Consulting took a look at trends in regulation and found that the average number

40 Crain, Nicole V. and Crain, W. Mark. 2010. *The Impact of Regulatory Costs to Small Firms.* Office of Advocacy, U.S. Small Business Administration. Available at: http://archive.sba.gov/advo/research/rs371tot.pdf. The 2011 estimate is benchmarked from the 2008 estimate of $1.75 trillion in the 2010 study. While the Crain and Crain study does not examine the detailed costs and benefits of each individual regulation, it remains the only comprehensive estimate of the cost impact of federal rules on the U.S. economy.

Figure 8a. Cumulative Cost of Manufacturing - Related Major Regulations Over Time: 1993-2011 (Billions of 2010$)



Source: NERA Economic Consulting. Macroeconomic Impacts of Federal Regulation of the Manufacturing Sector.



Source: NERA Economic Consulting. Macroeconomic Impacts of Federal Regulation of the Manufacturing Sector.

of major regulations issued each year grew from 36 from 1993 to 2000 to 45 from 2001 to 2008. Since 2008, the number has jumped to 72.[41]

The costs of this regulatory barrage have been quite large. The same NERA study found that from 1998 through the end of 2011, the cumulative inflation-adjusted cost of compliance with major regulations affecting the manufacturing sector grew by an annualized rate of 7.6% (Figure 8a), compared to a real GDP growth rate of just 2.2%.

These compliance costs and other effects of the growing regulatory burden are having a very real impact on economic activity, especially in energy-intensive industries. NERA estimates, for example, that output in the chemical and petroleum products sector could see declines averaging 9% to 10% per year over the next decade. Overall, the expected GDP loss in 2012 attributable to the cumulative burden of regulation under different scenarios ranges from $240 billion to $630 billion (Figure 8b).

Nowhere is this problem more endemic than at EPA, which in recent years has issued a series of controversial regulations covering everything from GHGs to Clean Water Act jurisdiction to chemical regulation. In many cases, regulations exceed what Congress would be willing to impose, while EPA ignores costs and exaggerates benefits. Indeed, EPA often ignores its legal requirement to consider job and economic impacts. The Clean Air Act, for example, requires EPA to conduct a cost-benefit analysis and economic impact assessment for most major air rules. Yet EPA either flat-out ignores these requirements or does a poor job of implementing them.

A recent study commissioned by the Chamber found that in its Regulatory Impact Assessments, which often indicate increased employment from new regulation, EPA uses obsolete practices that yield unreliable results with little credibility.[42] EPA also routinely flouts congressional direction to continuing evaluations of how its regulations affect employment through jobs losses and shifts.

Poorly designed regulation also can have the perverse consequences. For example, a company that wishes to undertake a large project to improve the energy efficiency of one of its regulated facilities may think twice if doing so would trigger a New Source Review that could potentially be very costly. As a result, many companies avoid these types of efficiency projects.

Challenging the findings of EPA and other regulatory agencies is extremely difficult because of the deference courts give these agencies. Using a substantial evidence test instead for major rulemakings would obligate courts to take a harder look at agency findings.

More than any other agency, EPA is "forced" to act, either by court order or statutory requirement. Most troubling is that EPA is the only agency that initiates rulemakings by what is commonly referred to as "Sue and Settle," which occurs when EPA initiates a rulemaking to settle a lawsuit by an environmental group rather than litigate it. All too often, the terms of these settlements give little consideration to the industries affected. In recent years, Sue and Settle Rulemaking has resulted in several of the most

41 NERA Economic Consulting. 2012. *Macroeconomic Impacts of Federal Regulation of the Manufacturing Sector.* Available at: http://www.mapi.net/system/files/NERA_MAPI_FinalReport_0.pdf.

42 NERA Economic Consulting. 2013. *Estimating Employment Impacts of Regulations: A Review of EPA's Methods for Its Air Rules.* Available at: http://www.uschamber.com/sites/default/files/reports/020360_ETRA_Briefing_NERA_Study_final.pdf.

controversial major rulemakings out of EPA in recent years, including New Source Performance Standards for GHG emissions from electric utilities and refineries.

Such an unbalanced regulatory process has been a factor in the unprecedented increase in major, economically significant regulations, some of which are harming the economy, inhibiting job creation, and eroding the nation's carefully calibrated constitutional system of checks and balances. Reforms are needed to make the regulatory process more effective and accountable to the American people.

A sensible balance should be restored to the rulemakings of regulatory agencies, especially EPA, to solve these issues. New rules should: (1) minimize costs and burdens to America's communities, businesses, and economy; (2) result in actual, appreciable, and measurable health and environmental benefits that outweigh actual costs and economic impacts of the rule; and (3) provide reasonable compliance options, including requirements of commercially attainable technology and realistic compliance timeframes.

Recommendations

- Congress should pass legislation like the REINS Act (HR 10) that would require congressional approval before any major regulation takes effect.
- Congress should pass legislation like the Regulatory Accountability Act (HR 3010) to require more transparent rules, sound cost-benefit and scientific data, and better judicial review, thus guaranteeing balanced, fair, and effective federal energy project regulation.
- Congress should pass legislation that requires regulatory agencies to consider economic impacts of proposed, new, or updated rules, including air quality standards.
- EPA should be required to analyze comprehensively the cumulative costs of interrelated rules and regulatory proposals.
- EPA should be required to eliminate its recent practice of comparing cumulative "co-benefits" likely to be realized outside of a rule to confined costs of that rule. Further, the agency should avoid issuing redundant rules when the desired outcomes are achieved through other regulatory programs.
- EPA must conform to the requirements of the Information Quality Act, which requires all disseminated information to meet "a basic standard of quality," defined in terms of objectivity, utility, and integrity.
- Congress should revise the New Source Review provisions of the Clean Air Act that have been misinterpreted by the EPA to thwart generation efficiency improvements at existing power generation and industrial facilities.
- Congress should pass legislation like the Regulatory Decrees and Settlements Act (S. 3382) to prevent regulatory abuse like Sue and Settle Rulemaking by special interests and their allies in government.
- Parties litigating against approved energy projects should be required to post a bond to compensate the developer for delay costs if the challenge fails.
- Congress should amend NEPA to provide appropriate energy project categorical exclusions and to ensure reviews are completed within one year or, under certain circumstances, within two years.

CHAPTER 9

COMPETITIVENESS

Thousands of new workers will be needed to design, build, and operate tomorrow's energy infrastructure, but not enough is being done today to ensure we have the workforce we will need. STEM education needs to be a higher priority for students and teachers, and established programs designed to boost competitiveness should be funded. Also, America's immigration policies should be adjusted to ensure that the best and brightest that come here to study stay.

9. Ensure a Competitive Energy Workforce

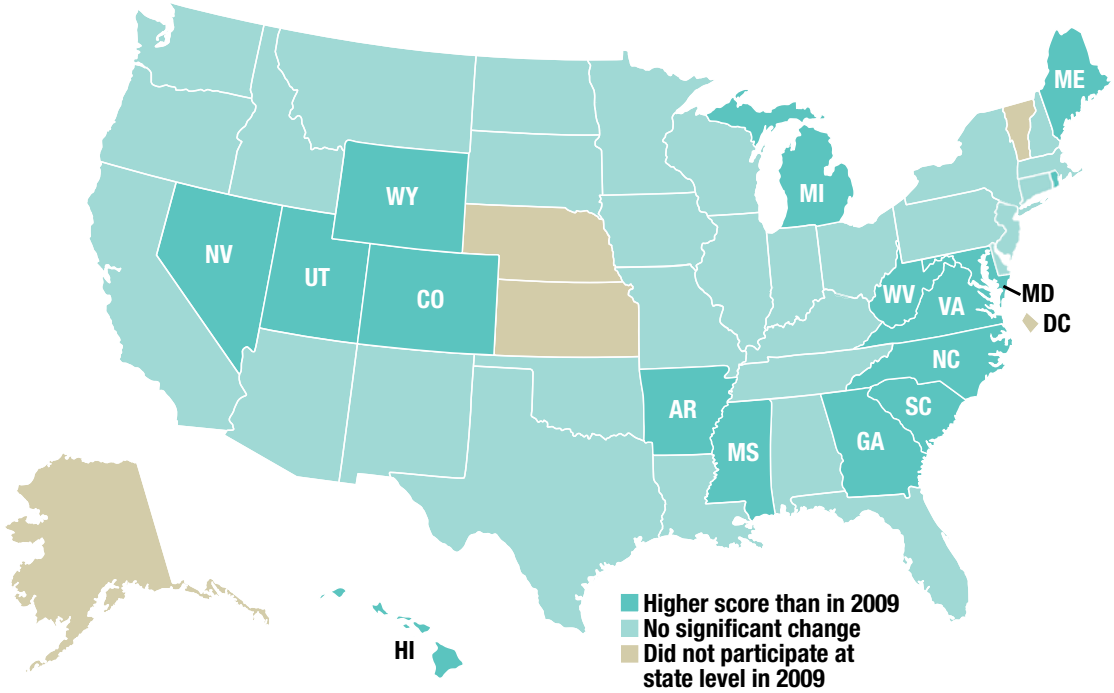
Given the importance of the energy sector to the well-being of the U.S. economy, ensuring a skilled workforce is a matter of national security. As the country's energy sector expands to meet expected demand, thousands of additional workers will be needed to design, build, operate, and service tomorrow's energy infrastructure. The demand for craftsmen (electricians, plumbers, welders, and machinists, for example), laborers, engineers, hydrologists, and other professionals is expected to grow rapidly.

The existing pipeline of new workers, however, may not be big enough to offset the expected retirement of existing workers, which could result in the loss of critical institutional knowledge and experience. Compounding this problem is the ever-growing skills gap between adults entering the workforce and the jobs available, a gap that is particularly glaring in science, technology, engineering, and math (STEM) fields.

Recent data show how acute the problem is. Nationally, only one-third of eighth grade students performed at the proficient level as reported in the Department of Education's Nation's Report Card. As seen in Figure 9, students in only 16 states scored slightly higher than they did in 2009,[43] a dismal record given all the recent attention to improving educational performance. Only 30% of U.S. high school graduates were ready for college work in science and only 45% were ready in math.

43 Department of Education National Center for Education Statistics. 2012. *Nation's Report Card. Science 2011: National Assessment of Educational Progress at Grade 8.* NCES 2012-465. Available at: http://nces.ed.gov/nationsreportcard/pdf/main2011/2012465.pdf.

Figure 9. Eighth-Grade Public School Student Science Scores 2009 vs 2011



Source: Department of Education National Center for Education Statistics, Nation's Report Card. Science 2011: National Assessment of Educational Progress at Grade 8.

American students do not fare any better when they are compared to their international peers. In a report from Harvard's Kennedy School of Government, U.S. students from 1995 to 2009 ranked 25th in math, 17th in science, and 14th in reading when compared to students from 48 other countries, and half of the countries in the group are improving their scores at a faster pace than the United States.[44] The numbers at university level are not reassuring, either. The National Science Foundation (NSF) estimates that in 2008, 31% of U.S. bachelor's degrees were awarded in science and engineering fields compared to 61% in Japan and 51% in China.[45]

Today, the number of students who never complete a secondary education or lack the skills necessary to enter the world of work or higher education is unacceptably high overall and even more so within certain demographic groups. For example, women comprise 48% of the U.S. workforce but just 24% of STEM workers.[46] African Americans and Hispanics are similarly underrepresented in the relevant areas of study. We must draw on the talents of all students at American academic institutions, from every background, to produce the engineers, scientists, and skilled workers necessary to design, build, and operate America's energy framework in the future.

These national trends are being felt acutely in the energy and mining industries, as detailed in a recent report by the National Academies.[47] The good news is that the demand for workers in the energy and mining sectors is expected to continue to grow. The challenge is that a large number of experienced energy and mining workers and university faculty experts are beginning to retire. Mine Safety and Health Administration data, for example, indicate that 46 percent of the coal-sector workforce will be eligible to retire within five years.

Today's educational system, however, is not producing enough individuals with the skills to fill these jobs to design, build, and maintain the energy systems of tomorrow.

Today's educational system, however, is not producing enough individuals with the skills to fill these jobs to design, build, and maintain the energy systems of tomorrow. The report found that community colleges are "proving to be the best vehicle for delivering the technician-level, skills-based education that the energy and mining industries need in a STEM technical workforce," and it cites the critical need for greater industry-education partnerships at these schools.

Fortunately, there is a growing recognition of the need for a long-term effort to raise the overall level of education in science and math, beginning in elementary school through high school and college. One such effort has been the Common Core State Standards Initiative, which has been adopted by 45 states and the District of Columbia. This is a state-led effort coordinated by the National Governors Association Center for Best Practices and the Council of Chief State School Officers. The standards were developed in collaboration with teachers, school administrators, business leaders, and experts to provide a clear and consistent framework to prepare our children for college and the workforce.

Similar to previous STEM curriculum and standards, a major challenge to the effective learning of these standards is ensuring teachers and instructors are properly prepared to teach the content. Study after study has shown that teacher quality has the biggest impact on student achievement.

44 Hanushek, E.A., Peterson, P.E. & Woessmann, L. 2012. *Achievement Growth: International and U.S. State Trends in Student Performance.* Harvard Kennedy School. PEPG Report No. 12-03. Available at: http://www.hks.harvard.edu/pepg/PDF/Papers/PEPG12-03_CatchingUp.pdf.

45 NSF. 2012. *Science and Engineering Indicators 2012.* Chapter 2. Higher Education in Science and Engineering. Available at: http://www.nsf.gov/statistics/seind12/pdf/c02.pdf.

46 U.S. Department of Commerce Economics and Statistics Administration. 2011. *Women in STEM: A Gender Gap to Innovation.* ESA Issue Brief #04-11. Available at: http://www.esa.doc.gov/sites/default/files/reports/documents/womeninstemagaptoinnovation8311.pdf.

47 National Academies, Board on Earth Sciences and Resources. 2013. *Emerging Workforce Trends in the U.S. Energy and Mining Industries: A Call to Action.* Available at: http://dels.nas.edu/Report/Emerging-Workforce-Trends/18250.

According to statistics compiled by the NSF, in 2007, about a third of public middle school science teachers either did not major in the subject in college or were not certified to teach it.[48] The lack of a teaching degree should not be a barrier to otherwise-qualified people with a background in math and science becoming teachers.

Also, the starting pay for teachers should align more closely with the impact the teacher has on his or her students. Treating all teachers the same in the traditional lock-step salary system should be avoided. Providing career advancement opportunities and financial rewards are proven methods of motivating employees in every profession, and the same is true for teaching. Ensuring an effective teacher is in every classroom is a key factor to elevating academic performance to world standards for all students.

48 NSF. 2012. *Science and Engineering Indicators 2012.* Appendix Table 1-19, "Preparation of public middle and high school mathematics and science teachers for teaching in their field, by minority enrollment and school poverty level: Academic years 2003–04 and 2007–08." Available at: http://www.nsf.gov/statistics/seind12/append/c1/at01-19.pdf.

Recommendations

- It should be a priority to align preparation, recruitment, induction, retention, and professional development of STEM teachers with the knowledge and skills needed to improve student performance.

- Pay and performance structures should reward STEM teachers whose performance contributes to substantial growth in student achievement; attract and retain effective instructors in subjects experiencing teacher shortages, notably math and science; draw effective educators to high-need schools; and remove ineffective educators.

- The America COMPETES Act should be fully funded by Congress in order to meet its objectives.

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

- Community colleges should seek private-sector input and develop curricula available to a broad range of students that address energy and mining industry demand for qualified workers with technical backgrounds.

Conclusion

America's energy policy is at a crossroads. Over the past five years, the United States has been leading a rapid and large geopolitical realignment of energy. This shift in the world's energy center of gravity is being driven by the private sector and free markets. Government policy has had very little to do with it—indeed, the greatest challenges tend to arise in those areas where government involvement is greatest.

As a nation, we have been blessed with abundant natural resources and a great capacity for technological innovation. Fulfilling America's energy potential requires strategic thinking underpinned by durable policy. For too long, our approach to energy has been conflicted, contradictory, and myopic. The extraordinary opportunities being created in U.S. energy today, such as the "Shale Gale," have come about despite government policy, not because of it. That has to change if we are to energize the economy and put people back to work.

If done right, energy can be a potent driver for our nation's economic recovery. We can choose to seize the new opportunities being created across America's energy landscape or simply cede these potential advantages to other countries.

The sweeping suite of recommendations offered here will get America's economy moving again. The Energy Institute believes that by instituting these bold policies, the president and Congress can unleash the power of free markets to create a competitive energy marketplace that stimulates economic activity and creates jobs. Our recommendations represent a comprehensive plan that, if adopted and accompanied by a favorable investment in technology advancements, will put America on a long-term path to a secure, strong, prosperous, and clean energy future.

Appendix I. Recommendations

Remove Barriers to Increased Domestic Oil and Natural Gas Exploration and Production and Fuel Manufacturing

- DOI must commit to harnessing the nation's oil and natural gas resources by enabling substantially greater access to the lands and waters owned by Americans.
    - Specifically, the department should propose a new Leasing and Exploration Plan for the OCS that provides the opportunities for leasing on the Atlantic and Pacific oceans and the Eastern Gulf of Mexico.
    - Additionally, the department must make significantly more onshore federal lands available for energy development, while also removing the bias on leasing federal lands for the production of advanced fuels like oil shale and oil sands.
- Congress should provide a 37.5% share of royalty revenues from all new production on the OCS to the state(s) adjacent to the development areas.
- The Bureau of Land Management should refrain from finalizing a new proposed rule regulating hydraulic fracturing on federal lands until it first seeks the input of and pursues collaboration with the states and with industry to ensure any future rules are addressing an existing regulatory gap, based in sound policy and not simply a rush to demonstrate the ability to regulate.
- EPA should cease its current effort to regulate hydraulic fracturing by circumventing the rule-making process and instead unlawfully issuing de facto regulations under the guise of guidance documents.
- Congress should refrain from leveling punitive taxes on the oil and natural gas industry.
- Congress should pass legislation that would ensure producers and users of commodities can continue to use over-the-counter swaps to hedge their business risk, without the burden of clearing and margin requirements.
- Congress must adequately fund and DOE must pursue research and development focused on the production and utilization of advanced unconventional energy sources such as oil shale and oil sands.
- The Departments of Energy and Commerce should provide a non-discretionary license to any applicant proposing to export domestically produced natural gas or crude oil to any WTO member nation.
- There should be no discrimination against the use of Canadian oil sands crude, including §526 of EISA and Low Carbon Fuel Standards.
- EPA should withdraw its Tier 3 gasoline sulfur rule.

Maintain Coal's Role as a Vital Part of a Diverse Energy Portfolio

- DOE's Office of Fossil Energy should direct its research portfolio to focus on the development, demonstration, and deployment of the full range of clean coal-generating technologies and improving and lowering the cost of CCS and CCUS for coal and natural gas power–generating plants.

- EPA should ensure that its regulation of coal mining activities is consistent with its congressionally granted authority under the Clean Water Act, Clean Air Act, and any other applicable statutes, and it should cease to use guidelines in lieu of statutorily prescribed regulatory process.

- EPA should adopt realistic compliance timeframes for all regulations to reduce the adverse burden on consumers, jobs, and electric reliability.

- EPA's regulations covering GHG emissions from new and existing power plants must not arbitrarily mandate technology that is not commercially available to ensure that our fossil fuel resources are not eliminated from the energy mix.

- Environmental policies should focus on improving the efficiency of the existing fleet of fossil fuel-fired power plants and the commercial use of highly efficient coal-fired electric power-generation facilities.

- Policies, laws, regulations, and liability regimes that will govern geologic sequestration of carbon dioxide should be finalized. Long-term responsibility associated with the management and monitoring of such storage facilities must be apportioned and the appropriate level of public and private involvement in such facilities must be determined.

- The Surface Transportation Board and the Army Corps of Engineers should complete in a fair and expeditious manner any necessary NEPA reviews of enhanced rail capability and increased port capacity to facilitate coal exports. Such NEPA reviews should appropriately focus on the direct environmental impact of such facilities and not on theoretical upstream production growth that could be supported by enhanced U.S. export capabilities or the downstream use and impacts of coal use.

Expand Nuclear Energy Use and Commit to a Nuclear Waste Solution

- In defining the technologies that are eligible to meet Renewable Portfolio Standards (RPS) or Clean Energy Standards, new and existing commercial nuclear energy should not be excluded. Any such generation mandates should treat all not-emitting resources equally without picking technology winners and losers.

- The Federal Energy Regulatory Commission and the various Regional Transmission Organizations need to examine the impacts of states' RPS' and the Production Tax Credits on the reliability of the electrical grid and the dispatch of baseload nuclear power.

- Nuclear energy should be treated no differently than other low-emission energy sources in any new energy legislation and policy-makers should ensure government policies do not distort competitive markets causing premature retirement of the country's essential nuclear fleet.

- The president and Congress must commit to a permanent solution to store America's nuclear waste. If the administration continues to elect to not implement the law, it has inherently accepted the responsibility to change the law, and must propose this change now.

- Until such time that the law has been changed, the administration must comply with the court's order to cease collection of Nuclear Waste Fund fees.

- Congress should pass legislation that creates an independent agency vested with the government's nuclear waste management responsibilities.

- The administration and Congress should continue to fund public-private programs that seek to demonstrate and license advanced nuclear technologies, including several different small modular reactor types.

- The administration should take advantage of America's tremendous commercial nuclear industry and more aggressively pursue civilian nuclear cooperation agreements with other nations and not predicate such agreements on other nations foreswearing enrichment or reprocessing technologies, while maintaining a policy of robust non-proliferation cooperation with other nuclear nations.

- DOE should propose a formal uranium inventory management plan. This plan should include the creation of a strategic reserve of low-enriched uranium from existing inventory to guard against supply disruptions.

Enhance the Competitiveness of Renewable Sources of Energy

- DOE should focus its renewable and energy storage technology research and development programs on lowering the installed cost of renewable electricity resources and levelizing the real-time output of such renewable resources.
- Congress should not extend the PTC, thereby ensuring a multiyear phase-out of the credit.
- Congress should pass legislation that modifies the federal tax code to permit the formation of master limited partnerships by renewable energy investors and, as a matter of policy, this option should be available to all energy projects.
- DOE should focus its biofuels research and development programs on lowering the installed cost of cellulosic ethanol production.
- Congress should address the problematic structure of the Renewable Fuel standard, including requiring more flexibility to reflect market conditions, as well as potentially repealing the mandate.
- EPA should more aggressively exert its authority to waive and adjust annual Renewable Fuel Standard levels to accurately reflect market conditions, especially the availability of mandated fuels.

Promote 21st Century Energy Efficiency and Advanced Technologies

- Congress and the president should enact legislation similar to the Energy Savings and Industrial Competitiveness Act of 2011 to boost private-sector investment in building efficiency upgrades, help manufacturers reduce energy use, update lighting and appliance standards, and strengthen building codes.
- DOE should update and set performance-based, easily implemented national model building energy codes.
- DOE should expeditiously promulgate appliance standards to meet statutory requirements.
- The president should direct federal agencies to use the Energy Savings Performance Contracts program as the first energy efficiency option to meet the various government energy goals and to ensure that program managers are knowledgeable about ESPC contracting and management.
- More efficient use of energy and new approaches to the delivery of energy services should be rewarded.
- Congress and the president should allow more rapid depreciation of capital equipment by reducing the cost-recovery period for energy efficiency devices.
- The federal government should support a broad R&D portfolio on both the supply and demand sides, including energy efficiency, new energy sources, and advanced fuel and power delivery options.
- Congress should continue to fund the ARPA-E program's efforts to support high-risk, exploratory research on innovative energy technologies that have great potential for breakthroughs.
- Congress should establish a long-term R&D tax credit so companies can plan their R&D activities with greater certainty.
- Congress should create a portfolio of novel financial instruments to accelerate the market penetration of viable, more advanced, cleaner, and more efficient energy technologies. Public-private partnerships should continue to be the model to support demonstration projects.

Modernize the Permitting Process for Our Nation's Energy Infrastructure

- Congress should limit to two years the State Department application review process for proposed projects that would cross an international border with the United States.

- Congress should pass legislation to streamline and enhance coordination of federal agency administration of the regulatory review, environmental decision-making, and permitting process for major construction activities undertaken, reviewed, or funded by federal agencies. It should prohibit requiring more than one EIS and one environmental assessment per project, except for supplemental environmental documents prepared under NEPA or environmental documents prepared pursuant to a court order.

- Congress should pass legislation that enhances FERC's authority to site electric transmission infrastructure. Such authority would be consistent with FERC's authority under the Natural Gas Act, which includes eminent domain power and an enhanced ability to work with states to site new energy infrastructure.

- Congress should pass legislation that modifies DOE's existing authority [granted under Section 216(h) of the Federal Power Act] as the "lead agency" to coordinate multiple federal agencies' permit reviews for an interstate transmission facility. Further, in no case shall the coordinated review process extend beyond two years.

- Congress and the president should enact legislation similar to the National Strategic and Critical Minerals Production Act of 2012, passed by the House of Representatives in 2012, to streamline the review and approval of exploration and mining permit applications.

Protect Our Energy Infrastructure from Physical Disruptions and Cyber Attacks

- Congress should enact legislation supporting the exchange of threat information between the government intelligence community and the private-sector owners and operators of critical energy infrastructure. Such legislation should include full liability protections and codify narrowly tailored measures to help business owners and operators harden critical infrastructure and adopt cutting-edge cybersecurity practices that serve to strengthen industry-specific efforts.

- Congress should direct DHS, in cooperation with DOE, to study the potential impacts of geomagnetic and electromagnetic disturbances on energy infrastructure and implement reasonable risk-based plans to insulate critical facilities from such threats in a cost-effective manner.

Reform the Regulatory Process for Balance, Certainty, and Transparency

- Congress should pass legislation like the REINS Act (HR 10) that would require congressional approval before any major regulation takes effect.

- Congress should pass legislation like the Regulatory Accountability Act (HR 3010) to require more transparent rules, sound cost-benefit and scientific data, and better judicial review, thus guaranteeing balanced, fair, and effective federal energy project regulation.

- Congress should pass legislation that requires regulatory agencies to consider economic impacts of proposed, new, or updated rules, including air quality standards.

- EPA should be required to analyze comprehensively the cumulative costs of interrelated rules and regulatory proposals.

- EPA should be required to eliminate its recent practice of comparing cumulative "co-benefits" likely to be realized outside of a rule to confined costs of that rule. Further, the agency should avoid issuing redundant rules when the desired outcomes are achieved through other regulatory programs.

- EPA must conform to the requirements of the Information Quality Act, which requires all disseminated information to meet "a basic standard of quality," defined in terms of objectivity, utility, and integrity.

- Congress should revise the New Source Review provisions of the Clean Air Act that have been misinterpreted by EPA to thwart generation efficiency improvements at existing power generation and industrial facilities.

- Congress should pass legislation like the Regulatory Decrees and Settlements Act (S. 3382) to prevent regulatory abuse like Sue and Settle Rulemaking by special interests and their allies in government.

- Parties litigating against approved energy projects should be required to post a bond to compensate the developer for delay costs if the challenge fails.

- Congress should amend NEPA to provide appropriate energy project categorical exclusions and to ensure reviews are completed within one year or, under certain circumstances, within two years.

Ensure a Competitive Energy Workforce

- It should be a priority to align preparation, recruitment, induction, retention, and professional development of STEM teachers with the knowledge and skills needed to improve student performance.

- Pay and performance structures should reward STEM teachers whose performance contributes to substantial growth in student achievement; attract and retain effective instructors in subjects experiencing teacher shortages, notably math and science; draw effective educators to high-need schools; and remove ineffective educators.

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- Community colleges should seek private-sector input and develop curricula available to a broad range of students that address energy and mining industry demand for qualified workers with technical backgrounds.

Acronyms

ACEEE	American Council for an Energy-Efficient Economy
AEO	Annual Energy Outlook
ARPA-E	Advanced Research Projects Agency for Energy
ATRA	American Taxpayer Relief Act of 2012
BANANA	"build absolutely nothing near anything"
CAFE	Corporate Average Fuel Economy
CCS	Carbon Capture and Storage
CCUS	Carbon Capture, Use and Storage
CERI	Canadian Energy Research Institute
CIP	critical infrastructure protection
CRS	Congressional Research Service
DHS	Department of Homeland Security
DOE	Department of Energy
DOI	Department of the Interior
EIA	Energy Information Administration
EIS	Environmental Impact Statement
EISA	Energy Independence and Security Act of 2007
EPCA	Energy Policy and Conservation Act
EPRFINC	Energy Policy Research Foundation
EPAct	Energy Policy Act of 2005
FERC	Federal Energy Regulatory Commission
GDP	gross domestic product
GHG	greenhouse gas
IEA	International Energy Agency
IPAA	Independent Petroleum Association of America
LNG	liquefied natural gas
MACT	Maximum Achievable Control Technology
MMbbl/d	million barrels per day
MMS	Mineral Management Service
MW	megawatt
NEPA	National Environmental Policy Act
NERC	North American Electric Reliability Corporation
NIMBY	"not in my backyard"
NMA	National Mining Association
NRC	Nuclear Regulatory Commission
NSF	National Science Foundation
NWPA	National Waste Policy Act
OCS	Outer Continental Shelf
OPEC	Organization of Petroleum Exporting Countries
R&D	research and development
RFS	Renewable Fuel Standard
STEM	science, technology, engineering, and math
TAPS	Trans-Alaska Pipeline System
tcf	trillion cubic feet
USGS	United States Geological Survey
WTO	World Trade Organization

Notes:

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