

Oklahoma First Energy Plan

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The nation is undergoing an energy revolution. Unprecedented new supplies of natural gas, a renaissance in oil production, and a newfound ability to economically capture energy from the wind are here today. Promising new supply technologies in CO₂ enhanced oil recovery (EOR) and biofuels are close to commercial demonstration. New power generation, electricity distribution, and smart grid technologies are rapidly developing and penetrating the market. In each of these areas, Oklahoma is leading the way. Despite four decades of federal efforts to reduce America's dependence on foreign oil, imports have continued to rise—until now. The ideological ambitions of those seeking to eliminate traditional energy struggle to provide economically meaningful results at scale. In the meantime, pragmatic efforts to improve rather than replace traditional energy are yielding extraordinary results without massive federal subsidies or mandates. The twin national objectives to reduce oil imports and improve the environment are actually happening, but in ways many never expected.



Governor Mary Fallin

American Innovation Produces Results

A suite of new supplies and new technologies, rather than the proverbial silver bullet, is creating new options for power generation, radically improving overall system efficiency, and enabling scalable alternatives for traditional transportation fuels.

While energy has historically been viewed as discrete fuels, in reality, energy is a system where the components must be optimized. New supplies and technologies provide the tools to optimize the system to produce clean, affordable, abundant, reliable, and sustainable energy. Improving, instead of replacing, the system enhances national security, grows the economy, and creates jobs, all while protecting the environment. Oklahoma is an energy state and an energy leader. With virtually all of the pieces in place, the state's opportunity to seize the moment and lead the nation is here. In a globally competitive economy, especially with the growing economies in Asia, keeping Oklahoma competitive and business friendly is critical. Leveraging our unique human and natural resources to create wealth at home instead of exporting our commodities for final manufacture elsewhere should be a primary objective. In other words, think globally but act locally with Oklahoma resources.

The Oklahoma Contribution

Oklahoma's rich heritage has been built on traditional energy. For more than a century, natural gas and oil have advanced and sustained the state through good times and bad. Oklahoma's indigenous natural resource endowment, unmatched human resources, and cutting-edge companies have led the nation in practical and affordable energy innovation. America's energy history has evolved from wood to coal to oil, with nuclear and hydropower subsequently joining the mix. Along the way, natural gas, much of which came from Oklahoma, began assuming an increasingly important role due to its diversity, cleanliness, flexibility, and efficiency. But with supply and decline concerns in the late 1970s and again in the late 1990s, natural gas as a fuel of the future suffered from a confidence crisis. Fortunately, beginning in the early 1980s, a few innovative and persistent visionaries knew that, with the right combination, much more natural gas could be unlocked. Finding the combination, however, took almost 20 years.

In the meantime, the nation sought to diversify by developing other transformational sources of energy, especially renewable resources such as wind, biofuels, and solar power. Oklahoma's tremendous renewable resource potential made it a natural location for those looking to develop these new and emerging industries. It was the start of a national push to rely more fully on renewable resources, and Oklahoma was quickly becoming a national leader in realizing the potential of this resource development. But almost simultaneous to this aggressive pursuit of renewables, the oil and gas industry, with extraordinary technological innovation, discovered the combination to unlock unprecedented new supplies of natural gas. The presumed death of traditional energy was premature.



Creating a New and Better Future

This time the story is different. Emerging technology provides economical options to use this newly enabled natural gas endowment in innovative and more efficient ways than before. Natural gas can do more than just heat homes and power industry. The opportunity to use natural gas to efficiently generate electricity and fuel vehicles is becoming a foreseeable reality. Natural gas and oil production are significantly increasing for the first time in decades. Production from unconventional reservoirs is surging, and the technologies unlocking this tremendous natural gas resource base are proving equally effective at increasing oil production. Oklahoma companies are once again leading this renaissance. The innovation making so much of this new resource base technically recoverable is now reshaping the understanding of future reserves as an economic concept replacing the past physical certainty that existed regarding availability of resources.

With such a large resource base, natural gas will be the nucleus of the optimized energy system of the future. Its unique attributes allow it to work in conjunction with improved energy efficiencies, renewable wind power, smart grids, and increasing oil production to provide the opportunity to achieve the long-pursued objective of energy independence. Natural gas vehicles and new natural gas combined cycle power generation technologies that effectively and efficiently integrate Oklahoma's renewable resources into traditional energy grids can redefine domestic energy usage. Natural gas today accounts for more than 80% of the state's energy production, making it the centerpiece, although not the only piece, of our energy future, all while growing the economy and creating jobs right here at home.

The Government's Role

The role of government is to provide a fair and equitable environment for the free market to work while protecting the public interest. Government does not create wealth or jobs; companies and the free market do. Allowing the free market to create wealth, and meet the needs of the public good through good policy, is the objective. For example, inefficient energy use based on poor building construction or a poor choice of fuel options disproportionately hurt the elderly and low-income groups that do not have the resources or capabilities to rectify the situation. Those two groups not only end up paying an unacceptable percentage of their income on energy, but they are also oftentimes, without any choice on their part, stuck with the most expensive life-cycle energy cost option. Only those who have greater resources and knowledge can afford higher up-front costs to ultimately save more energy over a product's useful life. But the life-cycle benefits can and should be more available. Energy affordability and efficiency should not be a zero-sum game; everyone should be able to win.

Maintaining and growing competitive advantage requires continued technology development and innovation. This necessitates robust educational preparation from an early age and uncompromising commitment to research and development (R&D). Similar assurances are what enabled production from natural gas and oil resources once thought to be unproduceable, and they will be the same commitments that continually improve environmental performance to meet strict public demands. Educational excellence, technical workforce development, and world-class research initiatives are critical to keeping Oklahoma competitive and mandatory for the state to reach its full potential. Such a commitment would enhance Oklahoma's position as the natural gas capital of the world.

Health and the Environment

The recommendations in this energy plan also address human health and the full cost accounting of externalities, which historically have not been factored into energy cost analyses. Again, many times these burdens fall on those least able to help themselves. The combination of natural gas, renewable energy, and efficiency can dramatically improve the air we breathe and the water we drink, improving Oklahomans' health and the health of the economy at the same time. In the process, this can provide an affordable and practical method to use to comply with a host of existing federal environmental regulations regarding air and water. Energy efficiency itself may be the cheapest and quickest method to reduce energy costs and emissions. Energy efficiency leverages all energy resources, and as a resource state, Oklahoma is well-positioned to benefit greatly from this leverage.



Oklahoma First

We are at the beginning of an energy revolution that will fundamentally change the way we produce and use energy. New markets will develop as capital flows to the most efficient uses, and consumers, opting for maximum utility and value, will vote with their purchases. Oklahoma, and its demonstrated track record in energy innovation, is leading the way as a model for other states and the nation in practical and affordable energy policy for a new energy future—an Oklahoma First energy future. Leveraging and improving the traditional while also embracing the transformational is the key.



Fostering economic development, transitioning transportation fuels, optimizing the existing energy system, and positioning Oklahoma for the future by pragmatically leveraging Oklahoma resources are the key components of the Oklahoma First Energy Plan. Natural gas, renewable energy, and energy efficiency form the cornerstone of a new energy economy to address these objectives, and Oklahoma's natural resource base of natural gas, oil, and wind, along with technology and policy to make them work better and more efficiently together, position Oklahoma well as a national model for pragmatic energy policy.

Oklahoma First Energy Plan

Creating the Oklahoma First Energy Plan to make such a future possible began with the development of set criteria. A wide spectrum of groups representing Oklahoma's energy economy, including both producers and consumers of energy, was asked to provide input as to what an ideal energy plan for Oklahoma would look like, keeping the following questions in mind:

- ◇ Does the plan grow Oklahoma's economy?
- ◇ Does it create Oklahoma jobs?
- ◇ Does it protect and improve Oklahoma's environment?
- ◇ Does it protect and improve the health of Oklahoma's citizens?
- ◇ Factoring in questions 3 and 4, does it provide reliable and affordable energy for Oklahomans?
- ◇ Does it focus on Oklahoma's unique human and natural resources?
- ◇ Where are the opportunities to create leverage and synergy from our resource base?

In considering the input from participants, which resulted from a multitude of meetings, key concepts began to emerge. For one, it became clear that the ideological goal in Washington, D.C., of replacing traditional energy with an undeveloped silver bullet, has not materialized. Further, it could be seen that the challenges of cost and scale have not been appropriately acknowledged while abundant domestic resources of all types have been marginalized and suboptimized. Therefore, it became apparent that a more pragmatic approach was needed, one that embraces and leverages traditional energy by making it better and more efficient instead of trying to replace it at any cost. In the process, the value and extent of Oklahoma's resource base became obvious. Oklahomans have always relied upon themselves rather than others to solve their challenges, and this time proved no different.

A popular book asks, "Who moved my cheese?" In many ways that question addresses the issue of jobs and the economy. Technology and global economic competition have moved the cheese. Oklahoma's unemployment rate, although well below the national average, is still higher than normal and economic growth is inadequate. Educating a new generation of students to meet the challenges, training a new workforce of energy technologists, and using Oklahoma human and natural energy resources to maintain existing industry and develop new industry therefore emerged as top priorities because job creation, workforce development, and economic development are key to Oklahoma's prosperous future.

Oklahoma's energy policy goals—affordable, reliable, secure, domestic, and clean—mirror those of the nation as a whole. Transportation is clearly an area of great national security risk. With almost total reliance on oil to fuel our mobility and an unacceptably high level of oil imports in a world where the energy needs of developing countries are expanding, repowering vehicles and refocusing the fueling infrastructure also become top priorities. With almost one-fourth of total national energy requirements met by energy imports, subject to geopolitical forces beyond our control, it is clearly time to take destiny back into our hands. Therefore, new vehicles and transportation fuels are additional priorities. Oklahoma's resources squarely address this critical need.

It also became apparent that energy supply isn't always necessarily the constraint; rather, how energy is used and produced can be the restricting factors. For example, energy efficiency leverages all forms of supply by stretching the value a given unit of energy supplies. Using energy more wisely and more efficiently, and making the system smarter, is the first step in optimizing the energy system. Oklahoma has been a national leader in making the system smarter, and much potential exists to wring significant additional efficiency from the system. Most importantly, the potential to create synergy in the energy system, where the whole is greater than the sum of the parts, is especially high for Oklahoma's



resource base in, for example, the combination of natural gas and wind for new base-load electric power generation. Identifying opportunities and potential policies for synergy are thus also top priorities.

In addition, finding ways to increase all forms of Oklahoma energy production and building new markets that utilize the increase are imperative. By using the new production better than has been done in the past, the new production becomes more valuable than in the past. New and unprecedented supplies of natural gas are revolutionizing U.S. energy markets, and finding ways to efficiently utilize that energy is critical. Oklahoma also has extraordinary opportunities for increased oil production, some of which is occurring today through the application of technologies developed for unconventional natural gas. CO₂ EOR, for example, offers the potential to recover more oil than has previously been recovered in the state's history.

Finally, while making traditional energy better, embracing transformative energy where practical should remain a priority. This requires continued improvement, innovation, and a robust R&D commitment. Such efforts not only enhance environmental performance in all sectors, but also lead to new breakthroughs that can further leverage traditional supplies and importantly attract capital investment, including critical venture capital, into the state.

Developing the Objectives, Strategies, and Recommendations

With these priorities in place, a set of overarching principles could be developed, as seen below:

- ◇ Enhance all Oklahoma energy production to create jobs and grow the economy
- ◇ Lead the transition in transportation fuels to reduce dependence on foreign oil
- ◇ Leverage Oklahoma's energy resources to make the energy system smarter and more efficient and to protect the environment and human health
- ◇ Build new markets for Oklahoma natural gas
- ◇ Support local industry and attract new industry
- ◇ Make Oklahoma an energy research leader through the creation of the Oklahoma Energy Initiative to leverage Oklahoma's traditional and renewable resources with its world-class knowledge base

With these principles as guidelines, a specific set of objectives could then be developed. Breaking these objectives down into more precise strategies and detailed recommendations led to what is presented here as the Oklahoma First Energy Plan. Serving as a quick reference guide, a summary of these objectives and strategies is presented on the following page.

To start, the plan sets the stage for the content to follow by offering a general overview of the energy landscape. It then delves into these detailed objectives, strategies, and recommendations, organizing them by the appropriate energy sector and presenting them in individual sections along with the relevant background information, available opportunities, and existing challenges. Taken as a whole, the information in this plan will enable an Oklahoma energy system that is abundant, affordable, reliable, secure, domestic, and environmentally protective, all while growing the economy and creating jobs. The recommendations are designed to be used by legislators in statutes, employed by regulators in rule making, or promoted through executive order or bully-pulpit advocacy. Although the recommendations are specific and tangible by sector and fuel, most importantly they include opportunities to create synergy among the energy system components. Mandates and subsidies are not necessary in order to implement these recommendations, and with a continuing tight budgetary situation, leadership in many cases will be the key factor for implementing the recommendations of this Oklahoma First Energy Plan.



Natural Gas and Oil

- ◇ **Objective: Encourage the continued responsible development of natural gas and oil and promote new and existing market opportunities that enhance reliance on Oklahoma resources for economic growth.**
 - Promote Oklahoma's flagship fuel, natural gas
 - Maintain the ability to develop Oklahoma oil and gas resources with hydraulic fracturing
 - Address the price differential between Oklahoma crude prices and global crude prices to correct marketplace distortions
 - Ensure the Oklahoma Corporation Commission has the capacity to carry out its statutory purpose
 - Increase the recovery of Oklahoma oil resources through CO₂ enhanced oil recovery
 - Ensure refining regulations in Oklahoma remain effective while not impairing business development in the state
 - Ensure equitable assessment of ad valorem taxes across the state
 - Attempt to reduce litigation between oil and gas operators, producers, mineral owners, and surface estate owners

Renewables

- ◇ **Objective: Encourage the robust build out of Oklahoma's wind industry by strategically connecting Oklahoma wind resources to primary load centers across the state and to export markets, as well as encourage the naturally complementary partnership of wind and natural gas.**
 - Endeavor to realize the potential of Oklahoma's wind resources to the fullest extent
 - Enhance the integration of renewables into the power generation system by leveraging the complementary partnership potential of wind and natural gas
 - Encourage increased use of renewables for power generation through the use of flexible, next-generation natural gas combined cycle equipment
 - Endeavor to make Oklahoma an attractive place to locate additional wind turbine tower, blade, and component manufacturing as well as maintenance facilities and other support businesses
 - Promote the large-scale build out of residential and commercial geothermal systems to preclude the need for new power generation where practical
 - Solidify Oklahoma's position as a national leader in the development of biofuels
 - Explore opportunities to enhance Oklahoma hydroelectric power generation and create new opportunities for the state's solar and biomass resources

Coal

- ◇ **Objective: Promote opportunities to enhance Oklahoma coal production and streamline state processes to create effective regulation.**
 - Ensure the continued vitality of Oklahoma's coal industry with a special emphasis on metallurgic coal
 - Assist industry in overcoming federal obstacles that stymie new mining permit evaluation processes

Power Generation and Transmission

- ◇ **Objective: Harness the potential of all Oklahoma resources to promote diverse, reliable, and affordable power generation that makes the system smarter, more efficient, and more environmentally sound.**
 - Promote energy efficiency to preclude the need for new power generation and manage consumers' energy bills
 - Address the issue of electric power dispatch preferences as it relates to Oklahoma resources
 - Emphasize the importance of system reliability and fuel diversity
 - Preserve Oklahoma's relative low cost of energy advantage to maintain a healthy business environment
 - Encourage the build out of electric transmission to optimize power generation assets in the grid



Residential, Commercial, and State Buildings

- ◇ **Objective:** Empower consumers with the tools and information necessary to make informed energy decisions, taking advantage of efficiency opportunities that are economically feasible, in order to minimize life-cycle energy costs, maintain comfort and services, and help minimize the need for new power generation.
 - Benchmark all state buildings, conduct energy audits, and set target efficiency gains (what gets measured gets managed)
 - Ensure the effectiveness of legislative and municipal efforts designed to promote energy efficiency planning and reporting
 - Encourage public outreach efforts to communicate the benefits of efficiency for commercial and residential applications

Industrial

- ◇ **Objective:** Establish efficiency targets that work to preserve energy affordability while precluding the need for new generation capacity.
 - Capture the benefits of energy efficiency and combined heat and power opportunities in industrial processes
 - Provide training, expertise, and services to industrial consumers looking to implement energy efficiency opportunities

Transportation, Distribution, and Infrastructure

- ◇ **Objective:** Drive a coordinated effort between states to reach a tipping point for the production of functional and affordable original equipment manufacturer alternative vehicles.
 - Make new compressed natural gas vehicle purchases and conversions a viable and economic option for both the state and individual consumers
 - Strategically expand compressed natural gas and electric vehicle fueling and charging infrastructure
 - Clear transportation impediments in the marketing and distribution of new, increasing supplies of crude oil

Education and Workforce Development

- ◇ **Objective:** Provide the foundation for a competitive, trained world-class energy workforce.
 - Equip educational institutions with the resources necessary to enable successful energy training
 - Address the need and promote the promising opportunity for employment in Oklahoma's energy industry

Environment

- ◇ **Objective:** Leverage all Oklahoma resources to provide a clean environment and spur economic growth.
 - Increase utilization of natural gas and renewable energy sources for electric power generation
 - Utilize demand-side management and energy efficiency to control emissions levels and ensure air quality
 - Promote increased awareness of air quality issues
 - Endeavor to communicate better understanding of the safe and important use of water in energy processes
 - Reduce ozone levels through a decrease in transportation-related emissions

Research and Development

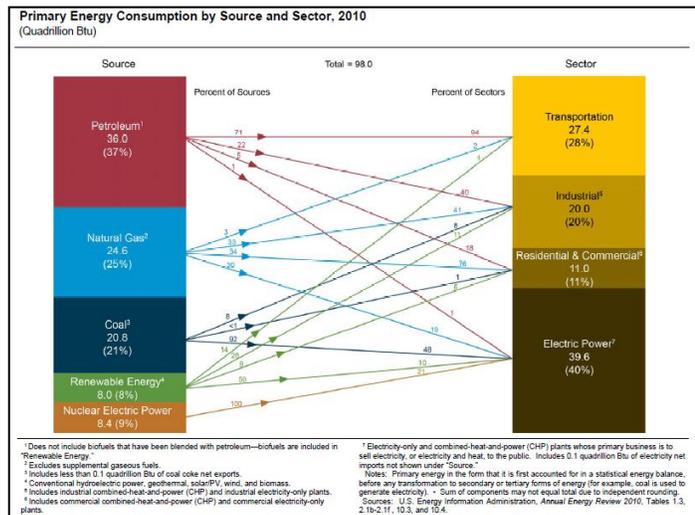
- ◇ **Objective:** Establish Oklahoma as the nation's capital for unconventional and renewable biofuel resource development.
 - Promote efforts to support existing Oklahoma R&D efforts
 - Advance new R&D efforts through the creation of the Oklahoma Energy Initiative
 - Brand Oklahoma as a traditional energy and renewable resource R&D state

Defining the Energy Landscape



Energy resource supplies are commonly thought of in discrete categories, such as fossil fuels, renewables, and nuclear. Demand sectors are understood in a like fashion, for example, transportation, industrial, residential/commercial, and electric power. But energy is really a system. Collectively, these sources and sectors, and especially how they interact, define the components of the larger energy system that each day provides Americans with the utility they enjoy to light and to heat or cool their homes, to drive their cars, and to cook their food and, in turn, to create jobs and wealth and to power the economy.

In 2010, the United States produced 75 quadrillion British thermal units (Btu), or “quads,” of energy between primary energy sources, approximately 83% of which was produced from fossil fuels, 9% from nuclear, and 8% from renewables. Yet, the United States consumed an estimated 98 quads of energy among primary demand sectors, with 40% consumed for electric power generation, 28% consumed for transportation, 20% consumed for industrial use, and 11% consumed for residential/commercial use. In other words, despite the policy of every U.S. administration since that of President Richard Nixon, America still relies heavily on international markets to provide almost one-quarter of its energy needs.



U.S. Energy Information Administration, Annual Energy Review 2010

While the United States is the world’s third-largest producer of oil, U.S. imports of crude oil and products averaged nearly 12 million barrels (bbls) per day throughout 2010. These imports represent the vast majority of the oil consumed by the transportation sector alone. Natural gas, the most diverse of the fuel sources, was consumed in near equal thirds by the residential/commercial, industrial, and electric power generation sectors, with only a small portion dedicated to transportation, primarily for facilitating pipeline distribution. As for coal, the United States is a net exporter, sending almost 82 million short tons to international markets in 2010, with primary U.S. consumption dominated by the electric power generation sector, which accounts for an estimated 92% of coal consumption. Primarily located along the East Coast and throughout regions of the Midwest, the United States has 104 commercial nuclear reactors in 31 states that

A National Point of Reference

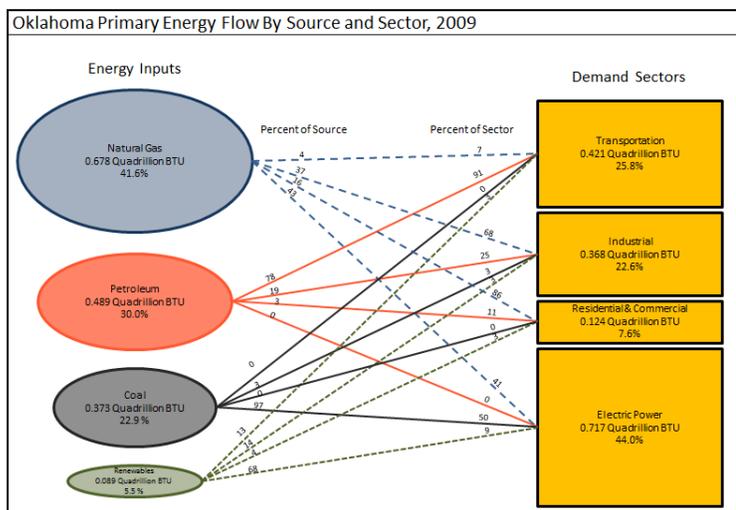
Perceptions of supply scarcity historically impacted the consistent utilization and development of natural gas. In 1977, President Jimmy Carter addressed the nation and asked Americans to begin making sacrifices regarding their energy consumption. The Powerplant and Industrial Fuel Use Act (FUA), which precluded the use of natural gas for power generation, followed shortly thereafter. From 1977 to 1987 (with 1987 being the year the FUA was repealed), Oklahoma added more than 5,000 megawatts (MWs) of nameplate power generation capacity, almost all of which was coal-fired, or approximately 94% of the state’s current coal-fired fleet. Over the next 21 years, power generators in Oklahoma redirected their focus, adding 7,348 MWs of gas-fired capacity. But during this time, fears of diminishing gas supplies began resurfacing, and policy makers once again were looking for solutions. The result was a massive infrastructure build out for liquefied natural gas (LNG) across the nation. But parallel to this effort, industry innovation began unlocking tremendous reserves of unconventional natural gas that are now reshaping America’s path toward energy security and leaving LNG import facilities idle. As exemplified, policy decisions have long-lasting consequences and can significantly impact the efficient deployment of market capital. President Carter’s concern with resource shortages turned out to be more of a shortaee of innovation than one of resources.

Defining the Energy Landscape



collectively account for 21% of the U.S. electricity supply. Renewables continue experiencing strong upward growth, led primarily by additions in wind generation capacity and increased integration of biofuels, but the resource category is consistently anchored by hydroelectric power, which accounted for more than 2.5 quads during 2010.

In Oklahoma, energy supplies vary slightly from the U.S. average primarily due to the absence of nuclear generation but also as a result of Oklahoma's abundant supply of natural gas. In 2009, Oklahoma produced almost 2.6 quads of energy, ranking the state eighth in terms of total energy production. Meanwhile, Oklahoma consumed approximately 1.5 quads among primary energy sources, placing Oklahoma thirteenth in terms of per capita energy consumption. Oklahoma's high per capita ranking is largely due to Oklahoma's energy-intensive nature as a producing state.



U.S. Energy Information Administration, State Energy Data System, 2009 (excluding retail electricity sales and electrical system energy losses)

Although natural gas production was down slightly from prior years, largely due to sagging commodity prices, it was still far and away the state's leading energy resource in 2010. Oklahoma produced more than 1.8 trillion cubic feet (Tcf), which accounted for more than 80% of the state's overall energy production. Of this, Oklahomans consumed only one-third, leaving about two-thirds of this production for export to other states. Without a dramatic shift in consumption, this trend is likely to continue, if not increase. Oklahoma currently boasts nearly 23 Tcf in reserves, much of which is due to rapid advancements in technology that have enabled the extraction of unconventional and formerly marginal gas resources throughout the state.

Similar technology has proved effective for oil development as well. The year 2007 marked the first time in more than 20 years that Oklahoma saw a notable increase in oil production. By 2010, oil production reached nearly 70 million bbls, and producers began experiencing new, increasingly significant production, particularly in the western regions of the state. Unfortunately, due to a lack of takeaway capacity in distribution and marketing channels, the marketplace began discounting light-sweet crude, leaving companies, mineral owners, and the state unable to fully realize the benefit of oil production in the state.

Mining activity resulted in the production of just less than 1 million tons of coal in 2010. While 97% of the coal consumed in Oklahoma is used for power generation, very little of this coal is actually mined within the state. Most is imported from Wyoming, resulting in Oklahoma's position among the top importers of Wyoming coal. Rather, the cement and lime industries serve as the primary consumers of Oklahoma coal with increasing volumes of metallurgic-grade coal being exported to international markets via the McClellan-Kerr Arkansas River Navigation System.

In 2009, renewables collectively provided about 5.5% of Oklahoma energy, about 99% of which was produced with wind, hydroelectric, and biomass resources. In 2010, Oklahoma provided 1.6% of total U.S. renewable generation (excluding hydroelectric generation), which ranks Oklahoma twelfth in the nation. Renewables continue to account for the largest addition of new electric generation capacity built in Oklahoma.



Background

In 2009, Oklahoma ranked eighth in the United States in terms of total energy production. More than 95% of that energy came in the form of gas (81%) and oil (15%). In 2010, Oklahoma produced nearly 70 million bbls of oil and 1.8 Tcf of natural gas, respectively supplying 3.5% and 8.1% of total U.S. consumption. Meanwhile, Oklahoma consumes an estimated 91.2 million bbls of oil and .657 Tcf of natural gas. This means that Oklahoma produces about three-fourths of the oil it consumes and exports about two-thirds of the gas it produces.

In 2009, production and drilling activities supported approximately one-third of Oklahoma's gross state product, and in fiscal year 2011, gross production tax collections accounted for nearly \$1 billion. The industry directly supports more than 71,000 jobs, representing almost 3.5% of the state's workforce, and industry activity combines to support nearly 300,000 Oklahoma jobs or almost 15% of the workforce. Impressively, the industry generates more than \$7.6 billion in labor income, or just over \$107,000 per worker. While it is Oklahoma's business-friendly policies that pave the way for these types of contributions to the state's economy, creating a climate that embraces innovation and adapts to technology is also critical to this objective.

Opportunities

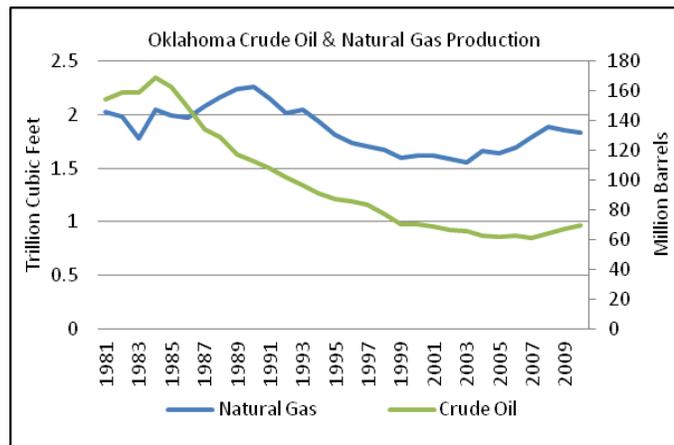
- ◇ In 2009, Oklahoma proved gas reserves totaled nearly 23 Tcf, accounting for 8.4% of total U.S. gas reserves. Horizontal drilling and hydraulic fracturing have unlocked tremendous new resource potential in shale resources plays throughout the United States, dramatically changing the future of energy in America. In Oklahoma, shale gas alone accounts for more than 6 Tcf of proved reserves, contributing substantially to Oklahoma's more than 66% growth in proved natural gas reserves over the past 10 years. At gas prices of \$4 .00per million Btu (MMBtu), developing this newly uncovered shale gas resource base alone has the potential of contributing more than \$1.6 billion over time to the state in the form of gross production taxes.
- ◇ Studies suggest national incremental market opportunities of approximately 4 Tcf/year in electric power generation and 3.3 Tcf/year in transportation (just with fleets and trucks). In addition, each 2 Tcf/year of domestic natural gas would displace 1 million barrels of imported oil per day. Taking advantage of this resource base with only a modest shift to natural gas in Oklahoma's electric power generation sector would have significant impacts for the state. Based on 2009 production and economic characteristics, displacing 15% of electric power generation with natural gas could generate nearly \$1.7 billion in economic activity in the oil and gas industries. Additionally, the increase in production could support nearly 10,000 full-time jobs and generate more than \$800 million in value add, largely in the form of employee compensation, self-employment income, and royalty payments. Beyond the economic impacts made available by this resource base, Oklahoma's environment and air quality would benefit greatly, thereby improving the health of Oklahoma citizens for years to come.

Building Oklahoma First

H.B. 1909, the Shale Reservoir Development Act (2011), takes more than 100 years of Oklahoma vertical well case law and adapts it to advancements in horizontal drilling. The act puts new tools in the shale development toolbox by allowing the drilling of multiunit horizontal wells. This is an example of state policy helping to ensure Oklahoma remains competitive, that drilling dollars stay in Oklahoma, and that Oklahoma resource development is maximized.



- Northwestern Oklahoma's Anadarko basin—for example, the Granite Wash and the Cleveland and Tonkawa tight sand formations, where only marginal production could be achieved with traditional vertical wells—now exhibits enormous potential due to the transformational impact that exists with horizontal well technology. Policies that help enable the development of these resources would help revitalize development in mature areas of western Oklahoma, which many considered economically played out. The application of new technology to traditional reservoirs has contributed to a more than 400% increase in Oklahoma gross production taxes since 1999.



Keeping development streamlined in Oklahoma ensures that industry is equipped with what it needs to create jobs, wealth, and economic stability for the state. But this is not possible without an adequate infrastructure to gather and transport products to market.

- Collectively, primary and secondary oil recovery operations generally produce about 30% of a reservoir's original oil in place. Tertiary, or enhanced oil recovery, has the potential of enabling the recovery of an additional 5% to 15% (or more) from these reservoirs. But this requires large-scale sources and distribution of CO₂. EOR is achieved by injecting CO₂ into the reservoir where the gas interacts with the oil in ways that increase oil recovery. Approximately three-quarters of U.S. domestic oil reservoirs (accounting for 345 billion bbls of oil in place) offer promising potential for CO₂ EOR. Technically recoverable oil using CO₂ EOR practices in these reservoirs could increase U.S. reserves anywhere from 81 to 126 billion bbls. In Oklahoma, potentially recoverable reserves from CO₂ EOR are estimated at more than 20 billion bbls, nearly 150% more oil than has been produced in Oklahoma since 1900. If exploited, this could mean, for one thing, injecting significant volumes of CO₂ into the ground that would otherwise be vented into the atmosphere and, for another, greatly increasing domestic oil production. This would provide as much as \$1.7 trillion in oil sales and \$121.2 billion in gross production taxes to Oklahoma, assuming an \$85/bbl oil price.
- Much of the natural gas produced in Oklahoma contains associated natural gas liquids (NGLs). NGLs are critical to the chemical industry and are the building blocks of the plastics industry. Ethane, which usually constitutes a significant portion of typical NGL yields, could play a significant role in job creation and economic growth, as studies suggest that a realistic 25% increase in U.S. ethane supplies could generate more than 400,000 new jobs, more than \$4 billion in federal, state, and local tax revenue, and a more than \$132-billion increase in U.S. economic output. Given Oklahoma's role as a leading gas-producing state, Oklahoma's opportunity to capture this potential is significant.

Challenges

- Despite the economic benefits and utility of fossil fuels, polling data suggests that only one-third of the public perceives the oil and gas sector as doing a good job of serving its customers.
- The uncertainty of federal intervention in regulating hydraulic fracturing creates tremendous uncertainty for industry.
- A lack of excess outgoing pipeline capacity from the oil hub at Cushing in the face of rising crude supplies in the Mid-Continent Region is lowering the value of crude in the Mid-Continent relative to the global crude price and is also adversely affecting production revenues to industry, royalty owners, and the state.
- Significant new crude supplies coupled with an inadequate and aging gathering infrastructure impact the ability for producers to bring new production to market.
- The difficulty of economically capturing and transporting CO₂ at scale impairs advantageous EOR opportunities.
- While the State Review of Oil & Natural Gas Environmental Regulations (STRONGER) report gave the Oklahoma Corporation Commission (OCC) high marks for effective regulation, future OCC budgetary constraints could potentially provide challenges in the future.



- ◇ Federal tax policies that seek to retire intangible drilling cost deductions would translate to decreased drilling budgets and decreases in gross state product.
- ◇ Taxes assessed at the local levels are not collected uniformly across the state, resulting in multiple reporting and payment processes.
- ◇ Compromising industry access to water supplies would have a devastating impact on drilling and completion processes.
- ◇ Industry has never had as many places to drill as it does today, and because capital flows to where it is most productive, Oklahoma competes with other states for industry investment.
- ◇ Oklahoma's experienced workforce is being pulled to other areas of the country that have significant new oil and gas development.
- ◇ The energy industry uses more steel than the auto industry, but availability to steel supplies is limited in Oklahoma creating a competitive disadvantage compared to states with easy access to such materials.
- ◇ There is an urgent need for the jobs that industry is ready and willing to create, but environmental pushback is making these jobs difficult to realize.

Oklahoma Leadership

The Oklahoma City-based Ground Water Protection Council (GWPC), working in conjunction with the Oklahoma City-based Interstate Oil and Gas Compact Commission (IOGCC), developed the nationally acclaimed FracFocus (www.fracfocus.org) voluntary disclosure database for chemicals used in hydraulic fracturing.

Strategy

- ◇ **Promote Oklahoma's flagship fuel, natural gas**
 - Recommendations:
 - Educate consumers and policy makers regarding the price stability and positive outlook forecasts of natural gas
 - Enable the use of long-term natural gas contracts for power generation to stabilize prices and reduce price volatility
 - Reduce net domestic state energy imports through increased reliance on Oklahoma resources for power generation
 - Increase market opportunities for compressed natural gas (CNG) through state-led efforts to transition fleets to run on natural gas
 - Promote industrial development in Oklahoma that utilizes Oklahoma resources
 - Provide utilities with multiple options to meet environmental compliance, such as regulatory mechanisms that allow the optimization of the clean Oklahoma resources of natural gas, wind, and efficiency
 - Promote the development of NGL plants in the state for manufacturing feedstocks
 - Leverage the acceptance and familiarity Oklahomans have with the industry to attract new development and business to the state
 - Promote the oil and gas industry as a high-tech industry
 - Preserve tax credits, such as the horizontal and deep well tax exemptions, which promote the investment of drilling capital in Oklahoma
- ◇ **Maintain the ability to develop Oklahoma oil and gas resources with hydraulic fracturing**
 - Recommendations:
 - Resist federal intervention and maintain state primacy in regulatory jurisdiction
 - Promote disclosure of hydraulic fracturing chemicals to the OCC in a manner easy to comply with for both small and large operators in order to address public concerns of transparency through the Ground Water Protection Council and Interstate Oil & Gas Compact Commission's FracFocus (fracfocus.org)
 - Promote continuous improvement in practices and technology through R&D
 - Encourage recycling, reuse, and reduction of treatment and flowback waters, including sensible regulation that encourages the efficient use of water and that does not allow bureaucratic impediments to stymie innovation
 - Promote the use of non-potable water for oil and gas operational requirements



- Articulate oil and gas and water requirements in Oklahoma water planning, emphasizing the industry's needs relative to the scale of other uses
- Encourage better communication and understanding between industry and surface owners regarding the use of landowner water
- ◇ **Address the price differential between Oklahoma crude prices and global crude prices to correct marketplace distortions**
 - Recommendations:
 - Enhance pipeline takeaway capacity from Cushing by supporting projects such as the Keystone XL oil pipeline
 - Encourage federal efforts to approve proposed projects that add additional outgoing pipeline capacity
 - Encourage cooperative efforts between independent producers to aggregate production to provide throughput commitments for pipeline project developers
 - Explore expanding rail capacity to assist transporting oil to market
- ◇ **Ensure the OCC has the capacity to carry out its statutory purpose**
 - Recommendation:
 - Consider at some point restoring the petroleum excise tax to the OCC as was originally intended by the legislature in order to adequately fund permitting and inspection responsibilities
- ◇ **Increase the recovery of Oklahoma oil resources through CO₂ EOR**
 - Recommendations:
 - Promote research into economic capture of CO₂ from regional CO₂ sources
 - Promote the development of a statewide CO₂ pipeline distribution system
- ◇ **Ensure refining regulations in Oklahoma remain effective while not impairing business development in the state**
 - Recommendation:
 - Facilitate continued communication efforts between the Oklahoma Department of Environmental Quality and Oklahoma refiners to ensure compliance with environmental regulations is effective and appropriate
- ◇ **Ensure equitable assessment of ad valorem taxes across the state**
 - Recommendation:
 - Prepare and utilize consistent assessment methodology across all 77 counties
- ◇ **Attempt to reduce litigation between oil and gas operators, producers, mineral owners, and surface estate owners**
 - Recommendations:
 - Foster better relationships and understanding with regard to the rights and obligations among various stakeholders
 - Assemble working groups of the stakeholders to examine Oklahoma's statutory and regulatory framework to determine areas of conflict and consider potential solutions

Objective: Encourage the continued responsible development of natural gas and oil and promote new and existing market opportunities that enhance reliance on Oklahoma resources for economic growth.



Background

In 2010, Oklahoma enacted the Oklahoma Energy Security Act, establishing a 15% renewable energy target by 2015. As of 2011, renewables, energy efficiency, and demand-side management already account for about 13% of power generation capacity in the state. Much of this progress is owed to the development of Oklahoma's wind resources over the past decade in addition to hydroelectric power generation and efficiency efforts.



In terms of overall power generation capacity, wind is Oklahoma's largest renewable resource. In 2010, Oklahoma had 1,482 megawatts (MWs) of installed power generation capacity, ranking Oklahoma eighth in the United States. Oklahoma's wind resources are among the best in the nation and presently deliver enough energy to power approximately 450,000 homes. In 2010, Oklahoma ranked sixth in the United States in terms of newly built wind capacity, adding 352 MWs, and the state anticipates that a total of nearly 2,000 MWs of capacity will become available with the completion of projects under construction during 2011. Oklahoma's wind industry contributes more than \$13 million annually in property tax and land lease payments and supports nearly 3,000 jobs throughout the state. Oklahoma's wind industry is poised to continue growing in part because of the high capacity factor of Oklahoma wind, which allows investment to go further in Oklahoma than in other states.

The Oklahoma solar industry is young but also shows promising potential, particularly in the panhandle of the state. Because solar output is strongest during periods of the day when wind output is at its lowest point, the two resources are capable of working well together.

Oklahoma is uniquely positioned to provide leadership in the energy systems of the future. For example, the natural complementary partnership of wind and natural gas is ideally suited to Oklahoma's resources. This partnership is critical to effectively integrating intermittent renewables into the grid at a larger scale and positions Oklahoma well to become a national resource for renewable development.

Oklahoma is also the nation's leading geothermal, or ground source, heat pump state with its expertise in drilling, equipment manufacturing, and system engineering and design. Although relatively small when compared to Oklahoma's other renewable sources on a capacity basis, the geothermal industry in Oklahoma employs more than 4,200 Oklahomans and boasts annual revenues in excess of \$550 million per year.

The state is continually making strides in developing its advanced biofuels potential, with its world-class institutions at the University of Oklahoma (OU), Oklahoma State University (OSU), and the Samuel Roberts Noble Foundation (Noble Foundation) collaborating at the Oklahoma Bioenergy Center. This unique endeavor is researching solutions in feedstock production, processing, and genetic engineering to address our nation's almost sole dependence on petroleum transportation fuels.

Hydroelectric resources make up the balance of renewables in the state and, in 2009, accounted for about 5% of Oklahoma generation capacity, when including both conventional resources and pumped storage.

Opportunities

- ◇ The opportunity in Oklahoma for wind energy is tremendous, with current development being only a fraction of its estimated potential. The Oak Ridge National Laboratory estimates that Oklahoma has 10 times the wind potential necessary to satisfy all electric energy demand in the Southwest Power Pool. In Oklahoma's panhandle alone, the state could develop more than 8,400 MWs of wind generation

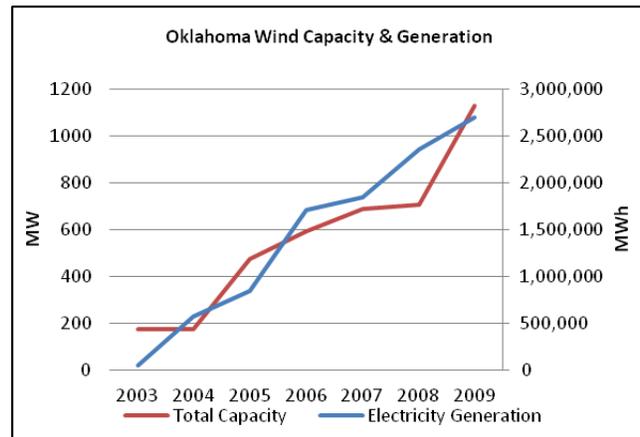
Building Oklahoma First

In May 2011, Gov. Mary Fallin joined executives from Siemens in announcing the opening of a wind service distribution center in Woodward, Oklahoma. The center will provide up to 40 "green collar" jobs and will be Siemens's largest wind power distribution center to date in the United States.



capacity. Assuming an average cost of \$1.5 million for each turbine installed, this equates to more than \$12 billion in capital investments, as much as \$38 million per year in royalty payments to landowners and approximately \$1.2 billion per year in wind electricity generation.

- ◇ More than 70% of the energy consumed by a typical single-family home is used to meet thermal loads. Geothermal heat pumps are 20% to 40% more efficient than available air conditioners and 50% to 70% more efficient than available heating systems. Large-scale installations of geothermal units would lower peak demand from electric power plants and postpone or eliminate the need for new power generation. In the Oklahoma residential sector alone, large-scale application could realistically result in a summer peak reduction of 375 MWs to 550 MWs. Reducing peak load and avoiding the need for new generation reduces costs, lowers emissions, enhances reliability, and lowers ratepayer monthly bills.



Challenges

- ◇ Insufficient transmission infrastructure exists throughout regions of the state with the highest wind densities.
- ◇ The cost-competitiveness of wind is reliant upon the availability of tax incentives.
- ◇ Wind energy is variable and requires rampable firming generation to ensure reliability to the grid.
- ◇ While improvements have been made in wind forecasting, wind can still be unpredictable at times.
- ◇ Oklahoma competes with surrounding states to attract investment for developing renewable resources.
- ◇ Geothermal systems require high up-front capital investment.
- ◇ Consumers and policy makers require education regarding geothermal system benefits.
- ◇ The average time a typical resident stays in a given home is far less than the life of a geothermal system, which deters homeowners from making long-term investments, even if those investments have very favorable life-cycle costing.
- ◇ Integrating renewables into the grid becomes more challenging at certain thresholds.

Strategy

◇ Endeavor to realize the potential of Oklahoma’s wind resources to the fullest extent

- Recommendations:
 - Encourage the development and expansion of existing and proposed transmission projects throughout Oklahoma and Southwest Power Pool region
 - Support transmission projects that export excess wind energy to other states to ensure the vitality of continued wind development in Oklahoma past local demand to the extent it results in job creation in the state
 - Promote projects that focus on Oklahoma’s highest wind production capacity regions to support the build out of infrastructure to these areas and improve economics for subsequent generation projects
 - Foster coordination between multiple uses of the surface estate, including agricultural, oil and gas, and wind development
 - Ensure that incentives for wind development remain competitive with those of neighboring states

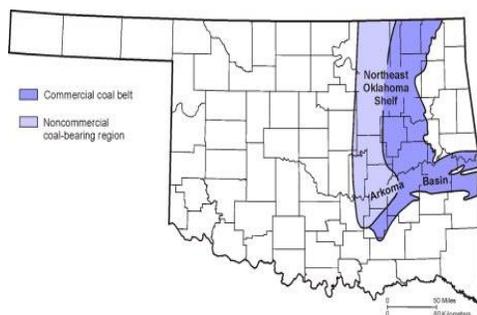
◇ Enhance the integration of renewables into the power generation system by leveraging the complementary partnership potential of wind and natural gas

- Recommendations:
 - Coordinate and promote a partnership between Oklahoma’s wind and natural gas industries to address the integration challenge



- Support study and research efforts to enable and enhance the large-scale integration of renewables into the power grid
- ◇ **Encourage increased use of renewables for power generation through the use of flexible, next-generation natural gas combined cycle equipment**
 - Recommendations:
 - Pursue, exceed, and raise Oklahoma's 15% renewable energy target
 - Support the creation of a Midwestern governor's compact focused on developing wind resources
 - Encourage the evaluation and realization of solar energy potential throughout the state
- ◇ **Endeavor to make Oklahoma an attractive place to locate additional wind turbine tower, blade, and component manufacturing as well as maintenance facilities and other support businesses**
 - Recommendations:
 - Preserve existing industry tax credits and ad valorem exemption and address clawback policies regarding county and school funding
 - Attract private and public investments for renewable energy R&D opportunities
 - Strengthen and continue to encourage Oklahoma Department of Commerce efforts to attract new renewable businesses to the state
 - Avoid regulatory siting approval that could become a barrier to development
 - Support educational programs that train Oklahoma's base of skilled workers in renewable operation and maintenance and encourage hiring Oklahoma staff for such positions
 - Ensure the governor's Quick Action Closing Fund is fully funded
- ◇ **Promote the large-scale build out of residential and commercial geothermal systems to preclude the need for new power generation where practical**
 - Recommendations
 - Encourage continued federal, state, and utility provider incentives, where appropriate, for the installation of geothermal heat pumps when economically practical, being careful to provide a level playing field and avoid unintended consequences of picking winners and losers
 - Support utility provider proposals to finance geothermal heat loops and allow cost recovery and a reasonable rate of return on investment
- ◇ **Solidify Oklahoma's position as a national leader in the development of biofuels**
 - Recommendations
 - Support continued collaborative efforts in the state for bioenergy research
 - Support public-private efforts to build a bioenergy refinery in the state for advanced generation biofuels
- ◇ **Explore opportunities to enhance Oklahoma hydroelectric power generation and create new opportunities for the state's solar and biomass resources**
 - Recommendations
 - Endeavor to maximize hydropower through state of the art turbines and full utilization of existing dams
 - Investigate solar opportunities where applicable
 - Work with the Secretary of Agriculture regarding red cedar management

Objective: Encourage the robust build out of Oklahoma's wind industry by strategically connecting Oklahoma wind resources to primary load centers across the state and to export markets, as well as encourage the naturally complementary partnership of wind and natural gas.



Background

Like the natural gas and oil industries, the coal industry has experienced production cycles. Since 1969, the Oklahoma coal industry has had as few as eight active mines and as many as 60. Oklahoma coal production declined from its peak of 5.73 million tons in 1981 to a low of 0.98 million tons in 2010. As of 2010, cumulative coal production in the state exceeded 293 million tons. Oklahoma has approximately 94 million tons of recoverable coal reserves at producing mines, positioning Oklahoma nineteenth in the United States. Approximately 8,000 square miles of coal resources extend through 20 counties across

Oklahoma.

Despite the relatively small size of Oklahoma’s coal industry, its impact on the economy in eastern Oklahoma is important. The Oklahoma coal industry accounts for an estimated \$146 million in economic activity, generates \$42 million in Oklahoma income, and supports 1,153 full-time equivalent jobs.

Opportunities

- ◇ Oklahoma boasts world-class metallurgic coal deposits. Globally, 70% of the steel and iron produced today relies on this particular grade of coal. Surging demand from developing economies such as China and India is driving the need for this resource. Each ton of Oklahoma metallurgic coal shipped to these international markets supports jobs in the state and brings foreign dollars to Oklahoma—counterbalancing the import trend in the transportation sector. The McClellan-Kerr water navigation system provides direct water access to the oceans and, therefore, the markets of the world.
- ◇ Fly ash, a by-product of coal combustion, can have valuable applications to a variety of industries. For example, natural gas and oil field operators use fly ash as a cement volume extender in drilling operations, and in the construction industry, fly ash is used for the commercial manufacturing of drywall and other building materials. Fly ash is also an important road-building material. These types of commercial applications play an important role in allowing the marketplace to absorb such by-products in an environmentally conscious manner, preventing potential problems associated with waste disposal.

Building Oklahoma First

Metallurgic coal is a necessary ingredient in the steelmaking process. In 2010, global steel demand rose by more than 13% and was projected to increase by roughly 6% per year through both 2011 and 2012. To meet this demand, Oklahoma’s mining companies are doing their part by providing coal supplies to growing markets around the world.

Challenges

- ◇ Piecemeal federal legislation creates uncertainty for coal mining companies.
- ◇ New mining permits can take more than one year to be approved.
- ◇ Fly ash disposal and waste handling implicate important environmental quality concerns.

Strategy

- ◇ **Ensure the continued vitality of Oklahoma’s coal industry with a special emphasis on metallurgic coal**
 - Recommendations:
 - Communicate the story of Oklahoma’s history in the coal industry
 - Encourage international mining export opportunities for metallurgical coal
 - Streamline state permitting processes and support efforts to reduce federal administrative delays
 - Work to improve and develop fly ash disposal options



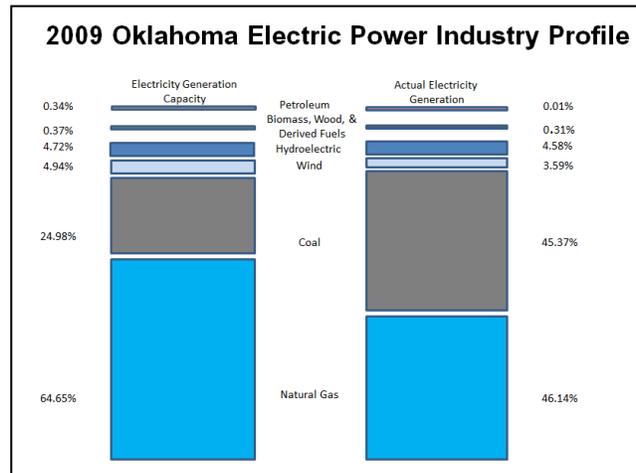
- ◇ **Assist industry in overcoming federal obstacles that stymie new mining permit evaluation processes**
 - Recommendations:
 - Encourage the Oklahoma Department of Mines to use its mediums of communications with the U.S. Office of Surface Mining to provide coal producers with an additional voice at the federal level
 - Ensure the Oklahoma Department of Mines has the resources available to continue effectively regulating mining operations in the state

Objective: Promote opportunities to enhance Oklahoma coal production and streamline state processes to create effective regulation.



Background

In 2009, Oklahoma had nearly 21,000 MWs of net summer generating capacity, ranking Oklahoma nineteenth in the United States. Oklahoma's electric utility providers accounted for just over 16,000 MWs of this capacity, while independent power producers and combined heat and power (CHP) made up the balance. About two-thirds of Oklahoma's generating capacity is gas-fired, while about one-quarter is coal-fired, with the top 10 largest power plants providing about 60% of the state's overall capacity. Approximately 90% of the state's actual electric energy production is split evenly between gas and coal, due to the higher percentage of coal that is run as base load. Renewables, primarily wind and hydroelectric, provide the balance of both capacity and generation.



Opportunities

- ◆ Efficiencies and demand-side management (DSM) can help offset the need for new generation. For example, refrigerators built today use only about 25% of the energy compared to models built in the 1970s, while still increasing in size by about 20%. Replacing a unit from the 1970s with a new Energy Star-qualified model can reduce annual operating costs by more than \$150 per year per unit for the average Oklahoman. Not only do these types of decisions pay out quickly, but they can have tremendous multiplier effects. If every home in Oklahoma replaced one 1970s' era refrigerator (1,726 kilowatt-hour kWh per year average) with a new Energy Star unit (441 kWh/year average), this would help avoid the need for almost 200 MWs of power generation capacity.
- ◆ In the U.S. power generation sector, approximately 70% of energy consumed is lost in the form of waste heat. Although it is impossible to be 100% efficient, incremental efficiencies go a long way toward reducing the need to add generation as the world increasingly electrifies.
- ◆ Newly developed, high-efficiency combined cycle natural gas turbines have the capability to significantly reduce emissions and load follow (ramp) variable renewable resources, such as Oklahoma wind, without emissions penalties.
- ◆ A significant amount of power generating capacity is used for meeting peak demand. By shifting daily peak energy consumption, Oklahoma could avoid running less-efficient peak power generation sources, which would translate into significant ratepayer savings in avoided fuel costs. Smart metering provides customers with information and incentives to manage their power use and adjust their consumption timing to accommodate peak load periods.

Challenges

- ◆ New and pending Environmental Protection Agency (EPA) rules and regulations under the Clean Air and Clean Water Acts will present significant cost and reliability challenges for existing and future power generation.
- ◆ An abrupt shift in energy feedstocks risks burdening power generators with stranded costs associated with fleets not fully depreciated.
- ◆ Prudent generation and transmission planning requires long-term decision making and involves large capital commitments.
- ◆ Integrating variable energy sources and preserving system reliability involves complex, technical designs and processes.
- ◆ Oklahoma relies on a traditional power distribution system utilizing primarily large, centralized power plants.



- ◇ Despite the need for sufficient generation and transmission, “not in my backyard” and other environmental viewpoints, in addition to Clean Air Act and Clean Water Act concerns, complicate infrastructure and power generation planning.
- ◇ Affordable and reliable power generation enables the prosperity of Oklahoma’s economy, but it must be balanced against environmental concerns that affect the health and well-being of Oklahoma’s citizens, including health care costs.
- ◇ Oklahoma will face increasing challenges in maintaining attainment status under the Clean Air Act, and high air quality is an important attraction for Oklahoma.

Building Oklahoma First

In 2009, Oklahoma residents were among the nation’s first to experience the benefit of smart metering. More than 3,000 customers participating in the utility-based program were able to make real-time decisions regarding their energy use. Armed with this information, customers could modify their consumption habits and reduce their monthly electric bills between 11 and 33 percent—just by changing their time of use.

Strategy

- ◇ **Promote energy efficiency to preclude the need for new power generation and to manage consumers’ energy bills**
 - Recommendations:
 - Allow the free market to drive decision making
 - Pursue decoupling mechanisms that incentivize utilities to promote reduced usage through energy efficiency without penalizing them financially or impairing their profitability for selling less electricity
 - Educate consumers about how they can modify their behavior to do their part in shifting peak loads without sacrificing comfort or services
 - Promote policies that lower consumers’ bills and not necessarily only policies that focus on lowering electricity rates
- ◇ **Address the issue of electric power dispatch preferences as it relates to Oklahoma resources**
 - Recommendation:
 - Work through the Southwest Power Pool to ensure dispatch order is based on all-in cost, including emissions
- ◇ **Emphasize the importance of system reliability and fuel diversity**
 - Recommendations:
 - Aspire to a statewide clean energy portfolio for electric generation where economically practical and efficient, with clean energy being defined as energy generated with air emissions not exceeding those from a comparable natural gas-fired plant
 - Synergistically incorporate energy efficiency and renewable energy with existing power generation assets
 - Strive to make the power grid smarter, more efficient, and more decentralized, flexible, and responsive
 - Standardize distributed power generation interconnection and zoning, make permitting easy, and encourage price predictability
 - Utilize demand-side management, smart-grid technology, and time-of-use pricing mechanisms to level or shift demand peaks and value opportunities to integrate time-of-use pricing mechanisms
 - Incorporate policies where practical to allow and integrate net metering
 - Educate consumers on energy consumption habits and peak loads through mechanisms such as smart meters
- ◇ **Preserve Oklahoma’s relative low cost of energy advantage to maintain a healthy business environment**
 - Recommendations:
 - Standardize the format of utilities’ integrated resource planning (IRP) process to provide consistent data related to more fully addressing the inclusion of renewable energy, energy efficiency, demand-side management, and environmental constraints
 - Enable an adequate transition period for utilities to comply with EPA regulations



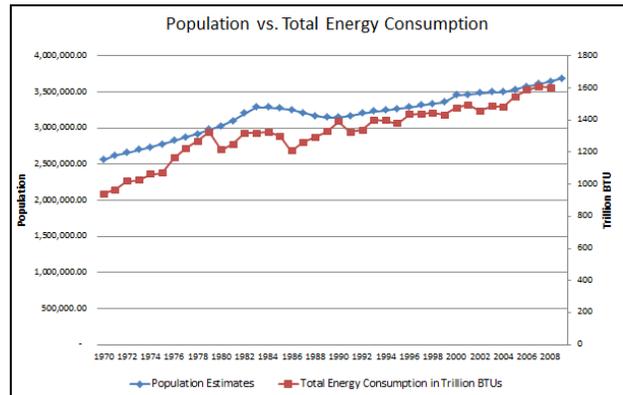
- ◇ **Encourage the build out of electric transmission to optimize power generation assets in the grid**
 - Recommendations:
 - Work with the Southwest Power Pool to streamline the transmission planning processes to more fully realize the benefits of Oklahoma’s wind resources
 - Support development of energy resources for export done in conjunction with prudent build out of state energy needs

Objective: Harness the potential of all Oklahoma resources to promote diverse, reliable, and affordable power generation that makes the system smarter, more efficient, and more environmentally sound.

Residential, Commercial, and State Buildings



- ◇ Harsh winters and hot summers can create excessive demand to heat and cool homes and businesses. Because such demand typically occurs during times of peak load, this taxes the distribution system to reliably deliver energy. More efficient buildings, HVAC equipment, and water heaters can provide greater comfort at lower cost while managing peak loads on the utility system.
- ◇ State buildings offer tremendous opportunity to save energy, reduce taxpayer costs, and lead by example when it comes to energy efficiency. Benchmarking state buildings identifies the best candidates for retrofit and updates and creates a frame of reference for identifying progress. The Oklahoma Department of Central Services (DCS) used the U.S. Department of Energy's (DOE) Energy Star program in its benchmarking efforts. Implementing this program has allowed DCS to capture significant energy savings across its building portfolio. Implementing similar programs in all state buildings would translate into significant taxpayer savings.
- ◇ Energy efficiency offers the most potential when considered in a total systems approach. For example, from production to end use, one of the most efficient uses of natural gas is in direct combustion for space and water heating. While high-efficiency condensing natural gas furnaces and water heaters are one example of how consumers can maximize efficiency and reduce cost, it is also important to not overlook the importance of investing in a building's airtightness and thermal performance. Collectively, all these components can work together to help minimize costly conversion losses.
- ◇ Geothermal heat pumps are up to 60% more efficient than standard HVAC units. For example, if, in a 1,750-square-foot home, a 25-year-old electric furnace was replaced with a geothermal heat pump, the difference in monthly electric bills would pay for the unit in approximately six years (after applying tax credits), and the geothermal heat pump could heat and cool a home for about \$1 a day.



Challenges

- ◇ The state lacks centralized planning processes and codes for implementing energy efficiency in state facilities.
- ◇ Building decisions are oftentimes driven by market forces that prefer the lowest up-front cost instead of the lowest life-cycle cost.
- ◇ Outdated, inadequate, or poorly enforced building codes affect the impact of demand-side management and the energy efficiency potential.
- ◇ Little or no building code inspection mechanisms exist in 35% to 40% of unincorporated areas of Oklahoma.
- ◇ Split incentives between landlords and tenants hinder investments in rental property efficiencies.

Strategy

- ◇ **Benchmark all state buildings, conduct energy audits, and set target efficiency gains (what gets measured gets managed)**
 - Recommendations:
 - Promote a centralized effort to gather information pertaining to agency energy use and designate knowledgeable personnel to prioritize projects and make recommendations for efficiency implementation
 - Benchmark state facilities utilizing the Home Energy Rating System Index, the U.S. DOE's Energy Star program, or other metrics for

Building Oklahoma First

In 2009, Oklahoma created the Oklahoma Uniform Building Code Commission and adopted a modified version of the 2009 International Residential Code (IRC). The IRC is the minimum building code for all one- and two-family townhouse and residential construction throughout the state. Effective building codes are an important foundation to capturing the potential of energy efficiency.



- o determining baseline energy performance
 - o Establish an efficiency improvement target between .5% and 2% per year across all agencies through 2020 to capitalize on new technologies that offer the same comforts and conveniences
 - o Base state capital investments, equipment installations, and operation and maintenance programs on life-cycle cost analysis instead of simple payback time
 - o Evaluate in-house expertise to capture energy efficiency potential or consider employing performance-based contracting where appropriate
- ◇ **Ensure the effectiveness of legislative and municipal efforts designed to promote energy efficiency planning and reporting**
- Recommendations:
 - o Evaluate incentives for both electricity and the direct use of natural gas with respect to overall process efficiency, ensuring competition on an equal playing field
 - o Promote the adoption of municipal codes and construction requirements for developers of multifamily dwellings and single-family tract homes to utilize life-cycle cost decisions, considering energy efficiency, with regard to appliance and building material installations in order to take advantage of applicable building tax credits and incentives, and leverage current programs through the Oklahoma Department of Commerce
 - o Preserve tax incentives for energy efficiency in new construction in order to assist the elderly and low-to-moderate income families
 - o Consider utilizing councils of government as the consolidation entity for training inspectors in enforcing newly adopted building codes
 - o Promote disclosure of building energy costs and performance when selling buildings or renting multifamily dwellings and encourage pricing efficiency investments into appraised values
 - o Encourage cost-effective consumer efficiency incentives for application in both the new and existing built environments
 - o Investigate better energy improvement financing options for homeowners and commercial customers for projects whose life may exceed the ownership period of the original investor
- ◇ **Encourage public outreach efforts to communicate the benefits of efficiency for commercial and residential application**
- Recommendations:
 - o Promote K-12 energy and efficiency educational programs to encourage informed consumer decision making
 - o Promote the Energy Star certification of Oklahoma state facilities
 - o Support the Oklahoma State Homebuilders Association and other industry organizations in their ongoing efforts to educate and train on energy efficiency building practices
 - o Endeavor to bolster consumer support for efficient consumer appliances
 - o Promote the benefits of smart metering and time-of-use pricing plans to empower consumers with the information needed to make cost-effective decisions regarding their energy use
 - o Encourage a state public relations program to raise consumer awareness about building codes and energy efficient building practices
 - o Ensure adequate funding is in place for existing efficiency programs and consider expansion of system benefit charges to allow the incorporation of all cost-effective efficiency programs

Objective: Empower consumers with the tools and information necessary to make informed energy decisions, taking advantage of efficiency opportunities that are economically feasible, in order to minimize life-cycle energy costs, maintain comfort and services, and help minimize the need for new power generation.



Background

In 2009, the Oklahoma industrial sector consumed more than a third of a quad in energy equivalents, or approximately 20% of all state energy consumption. Natural gas accounted for more than two-thirds of the primary fuels consumed (aside from energy inputs for electricity consumed), or 22.6% of total energy consumption across demand sectors. The level of energy intensity required for the industrial sector brings about tremendous opportunity for efficiencies, particularly in capturing waste heat for CHP, process heat, mechanical processes, lighting, and HVAC efficiencies. It is critical that while pursuing these types of opportunities the state recognizes the importance of preserving affordable energy to the industrial sector, which provides valuable jobs to so many Oklahomans.



Opportunities

- ◇ Improving Oklahoma industrial energy efficiency by 2.5% per year by 2016 could result in savings of more than \$890 million dollars, precluding the need for new generation, improving environmental emissions, keeping electric rates affordable, and improving profitability.
- ◇ Oklahoma manufacturers support more than 130,000 jobs and help contribute more than \$41 billion each year to Oklahoma's economy. For every 100 new manufacturing jobs, 240 additional jobs are created. With Oklahoma's low cost of electricity, the state's manufacturing industry is poised to grow—creating new jobs and bolstering Oklahoma's economy.
- ◇ Industrial efficiency applications, such as process heating improvements, can not only enhance energy performance but also improve the performance of underlying systems. For example, food processors that install oven draft controls might not only save natural gas but could also improve product quality. Similarly, waste heat recovery from operations processes might be used for distributed hot water supply systems. These are great examples of capitalizing on untapped potential to improve industrial processes and reduce overall energy demand.

Building Oklahoma First

In September 2011, OSU was named one of 24 universities across the United States to be apportioned part of a \$30 million grant designed to train undergraduate and graduate-level engineering students in manufacturing sector efficiency. The DOE Industrial Assessment Center Program is an effort designed to help train the next generation of industrial energy efficiency experts—progress occurring right here in Oklahoma.

- ◇ The average pre-1985 boiler is between 65% and 70% efficient. Modern boilers, however, can often boast efficiencies of 80% to 85%, with some "super" efficient boilers even reaching 95%. Technology that enables the more efficient capture of waste heat has been the key. Not only do such technology improvements consistently offer new opportunities for efficiency gains, but the payback period justifying investment is increasingly compelling. Replacing a pre-1985 boiler with a newer option usually pays for itself in 1.8 to 3.6 years, depending in part on fuel prices.

Challenges

- ◇ Industrial users are among the largest consumers and while they have exploited many of the easy-to-capture efficiency opportunities, many more opportunities still remain.
- ◇ Due to industrial energy intensity, price fluctuations and rate uncertainty can have an amplified impact on industrial processes.
- ◇ Efficiency investments can require diverting limited capital and personnel away from business-as-usual projects in order to focus on energy practices, which are often not at the core of a company's business model.
- ◇ Organizational personnel are often inadequately trained to implement efficiency programs.
- ◇ Industrial efficiency programs often fail to focus on smaller-sized industrial



firms, notwithstanding the fact that many medium- and large-sized industrial users purchase their natural gas through wholesale suppliers, preventing their participation in utility-provided efficiency programs.

- ◇ Utility standby charges, barriers to interconnection, and conflicting environmental regulations present obstacles to CHP opportunities.

Strategy

- ◇ **Capture the benefits of energy efficiency and CHP opportunities in industrial processes**

- Recommendations:
 - Encourage coordination between industry and utilities or firms specializing in recognizing and implementing efficiency potential
 - Explore programs and policies that encourage upgrading boilers and process heat applications with modern efficient equipment
 - Encourage load-leveling and peak-shaving practices through demand-side management opportunities and through favorable structured rates
 - Encourage utilities to allow reduced back-up capacity requirements or reduced fees associated with standby charges to encourage more robust investments in CHP applications
 - Employ emissions standards that account for efficiencies and evaluate industrial emissions based on the total useful energy actually produced, not simply the fuel put into the system
 - Evaluate the feasibility of providing feed-in tariffs or net metering that allow compensation (based on the time of generation) for companies that put power back into the grid

- ◇ **Provide training, expertise, and services to industrial consumers looking to implement energy efficiency opportunities**

- Recommendations:
 - Encourage increased communication between utilities and industrial consumers to evaluate and realize efficiency opportunities
 - Leverage efforts such as the DOE Industrial Assessment Center Program to help foster a new base of Oklahoma industrial efficiency

Objective: Establish efficiency targets that work to preserve energy affordability while precluding the need for new generation capacity.



Background

More than 39,000 miles of pipeline form an intrastate gathering and distribution network for oil and natural gas transport throughout the state. These pipelines carry energy supplies to refineries and processors and ultimately to the Oklahomans relying on them to fuel their transportation needs.

Petroleum-based fuels dominate Oklahoma's transportation sector. In 2009, Oklahoma consumed more than 90 million barrels of petroleum, about half of which was motor gasoline put into Oklahoma vehicles. The transportation sector alone accounts for more than 28% of Oklahoma's total energy consumption.

Alternative fuel vehicles are increasingly gaining support, but their market share remains very low. In 2011, there were roughly 3,000 natural gas vehicles (NGV) on the state's roads, which puts Oklahoma sixth in the nation in terms of total NGVs in use. This is in part attributable to a simultaneous build out of CNG fueling stations, expected to reach nearly 60 in Oklahoma by the end of 2011.



Opportunities

- ◇ The vast majority of U.S. energy imports is oil used for transportation fuels. CNG and liquefied natural gas (LNG) offer an opportunity today to grow natural gas market share and keep dollars in the United States and in Oklahoma, while long-term gas to liquids research opportunities exist for the liquefaction of natural gas as a component "drop-in" fuel to augment current gasoline distribution networks.
- ◇ In 2011, Oklahoma had 11,092 state vehicles in its fleet, but less than 1% of these vehicles run on CNG. If a comparably priced original equipment manufacturer (OEM) NGV was available, transitioning 500 of these new purchases could save the state as much as \$500,000 per year in fuel costs, in addition to reduced operations and maintenance costs, assuming gasoline costs \$3.39 per gallon and CNG costs \$1.39 per gasoline gallon equivalent, 10,000 miles per year, and average fuel economy of 20 miles per gallon. State leadership could lead the way for increased market penetration of affordable and functional general passenger NGVs.
 - ◇ In 2011, the hot summer weather led to areas of the state approaching EPA nonattainment standards for ozone. Vehicle emissions are a major source of ground-level ozone. Natural gas, however, is cleaner burning than traditional petroleum-based motor fuels, producing 60% to 90% less smog-producing pollutants. Studies show that using CNG as a replacement for gasoline in light duty vehicles reduces emissions of carbon monoxide by 90% to 97%, nitrogen oxide (NOx) by 35% to 60%, and virtually all particulate matter (PM), while at the same time eliminating evaporative emissions.
 - ◇ The state has a significant amount of usable railroad right of way. Upgrading this right of way to move both oil products and other state economic output such as agricultural products would maximize the state's ownership of these lines.
 - ◇ Electric vehicles (EVs) are a strategic fit for a power generation system that takes advantage of Oklahoma resources. Because the wind blows strongest at night (when demand is typically lowest), charging EVs during low-demand periods can allow the system to shift demand peaks, effectively store generation, and realize wind resources in a smarter way. But this is only enabled by increased natural gas power generation, the state's most abundant energy resource, which complements wind's variability with flexible, firm, and rampable generation capability.

Building Oklahoma First

In April 2011, Stillwater, Oklahoma, welcomed the opening of its newest compressed natural gas (CNG) fueling station. The station will serve Oklahoma State University's (OSU) newly converted CNG fleet as well as the public. OSU's conversions are saving the state money through lower fuel costs and are taking advantage of Oklahoma's most abundant natural energy resource.



Challenges

- ◇ The OEM market for alternative fuel vehicles in the United States is greatly limited.
- ◇ Current alternative fueling infrastructure is underdeveloped and difficult to access, especially in rural areas of the state.
- ◇ Burdensome CNG conversion costs and premiums on OEM NGV options are hindering market penetration.
- ◇ Insufficient oil gathering and distribution pipeline capacity exists, which impacts producers looking to bring new production from the field to the market.
- ◇ The lack of adequate takeaway capacity, particularly out of Cushing, Oklahoma, is restricting access to markets and impacting both producers' oil prices and consumers' gasoline costs.
- ◇ Transportation fuels are fungible and subject to international pressures and influence.
- ◇ Weak rural community demand for natural gas impairs utility incentive for local system pipeline expansion and maintenance.



Strategy

- ◇ **Make new CNG vehicle purchases and conversions a viable and economic option for both the state and individual consumers**
 - Recommendations:
 - Coordinate efforts to influence and incentivize the development of affordable and functional OEM for alternative fuel vehicles
 - Promote top-down leadership with state purchases of and conversion to CNG and EV fleet vehicles to increase network density
 - Work with other natural gas-producing states to assess commitment levels for new state purchases of fleet NGVs to help meet threshold automaker demand requirements
 - Coordinate with local businesses to increase continued commitments for NGV fleet conversions
 - Provide automakers with a request for proposal (RFP) providing vehicle specifications and requirements that will enable coordinated state purchases sufficient to approximate this demand threshold, allowing the marketplace to drive competitive proposals
 - Engage industry to provide seed financing for large-scale state fleet alternative fuel vehicle conversions or purchases, allowing repayment through cost savings
- ◇ **Strategically expand CNG and EV fueling and charging infrastructure**
 - Recommendations:
 - Simultaneous to state efforts to promote NGVs and EVs, secure commitments from local retailers to invest in and build new fueling and charging stations, predicated on potential increased state demand
 - Continue to support existing legislative goals regarding the geographic placement and density of CNG fueling stations
 - Leverage new rural CNG infrastructure to help assist the preservation and sustainability of rural natural gas distribution systems
 - Coordinate efforts with neighboring states to

Oklahoma Leadership

In November 2011, Gov. Mary Fallin and Colorado Gov. John Hickenlooper announced their intent to pursue a coordinated effort to transition state vehicle fleets to run on natural gas. In a letter to governors throughout the United States, Gov. Fallin invited widespread participation in transitioning state fleet vehicles through a multi-state joint request for proposal designed to entice auto manufacturers in the United States to develop and produce a functional and affordable passenger original equipment manufacturer natural gas vehicle.



- o strategically attract investment commitments from retailers along proposed CNG development corridors
 - o Consider options that provide leverage on other potential markets such as postal or municipal fleets where the fueling facilities could also be accessed by the public
 - o Promote research opportunities to leverage existing gasoline distribution infrastructure by developing drop-in fuels from natural gas and/or biofuels
- ◇ **Clear transportation impediments in the marketing and distribution of new, increasing supplies of crude oil**
- Recommendations:
 - o Promote development of oil-gathering lines to service emerging unconventional oil development in central and western Oklahoma
 - o Utilize railroads where possible to alleviate pipeline constraints, recognizing that rail can be one of the most efficient methods for transportation

Objective: Drive a coordinated effort between states to reach a tipping point for the production of functional and affordable original equipment manufacturer alternative vehicles.



Background

The demand for a skilled workforce in the energy industry is higher than ever. According to the American Petroleum Institute, one out of every four U.S. engineers, geoscientists, multiskilled maintenance professionals, process and production operators, and health and safety professionals is currently eligible for retirement. Meanwhile, the energy industry is growing and evolving rapidly as technology and innovation continue to unlock new ways to harness the potential of domestic energy resources. Meeting industry's growing skilled human resource needs will require a strong educational foundation.



During the summer of 2011, the national unemployment rate hovered around 10%. Fortunately, Oklahoma remained largely resilient to the economic troubles plaguing other states. During this same period, unemployment across the state averaged 5.3% and was as low as 2% in areas in certain counties. Surging oil and gas and wind development, along with business-friendly policies, have helped to create and sustain the jobs that are allowing Oklahomans to make it through these difficult times.

Opportunities

- ◇ In 2009, the average personal income for wage and salary employees in the oil and gas industry was just over \$107,000 per year—more than twice the Oklahoma average. The energy industry's employment opportunities are among the most competitive and attractive positions for working Oklahomans. Oklahoma is home to one of only two technical oil-field training facilities in the United States in addition to various nationally acclaimed programs at its universities. Programs offered at these institutions offer opportunities for a new generation of energy workers, both at the professional level and in highly skilled technical positions.

Challenges

- ◇ K-12 math and science programs are failing to inspire or prepare students to pursue science, technology, engineering, and mathematical (STEM) careers.
- ◇ Classrooms are growing, but education resources have been strained to keep up in a tight budget environment.
- ◇ Programs for technical training are full, and the availability of qualified instructors limits the expansion of additional training opportunities, despite an impressive portfolio of physical facilities.
- ◇ Technical institutions fight a perception that they train for "dirty jobs," despite the high-level, technical training programs they currently offer.
- ◇ Educational opportunities can be cost-prohibitive for those looking to enroll in postsecondary institutions.
- ◇ Oklahoma's low unemployment rates combined with competition for its skilled and experienced energy workforce from other states that are rapidly developing their own resources create local workforce challenges for Oklahoma energy companies.

Building Oklahoma First

In 2012, more than 3,000 veterans in Oklahoma's National Guard are scheduled to return home. Many of these highly disciplined soldiers will be eager to find promising employment opportunities. The energy industry provides tremendous opportunity for these technically trained returning veterans. Recognizing this, Gov. Mary Fallin called upon the energy industry to reach out to the National Guard and give a hard look at how Oklahoma's returning soldiers can meet industry's growing employment needs.



Strategy

- ◇ **Equip educational institutions with the resources necessary to enable successful energy training**
 - Recommendations:
 - Provide the necessary financial and qualified teaching resources that lay the foundation for energy education in K-12 classrooms
 - Coordinate with the Secretary of Education and the State Superintendent of Schools to encourage strong STEM preparation early in students' educational lives
 - Coordinate with the Secretary of Science and Technology to endeavor to attract world-renowned faculty to universities to solidify and improve the national position of energy programs at the state's universities, in part by bolstering R&D commitments and programs, which are key attractors for top professors
 - Endeavor to attract experienced, qualified instructors to teach energy courses and programs in Career Tech programs, especially leveraging the upcoming wave of retiring energy professionals
 - Maximize existing resources for training students that enroll in Career Tech programs
 - Ensure institutions are equipped to provide initial and follow-up safety training, allowing companies to realize the benefits of lower incident rates and workers' compensation costs
- ◇ **Address the need and promote the promising opportunity for employment in Oklahoma's energy industry**
 - Recommendations:
 - Promote the important role energy education plays in ensuring the continued vitality of Oklahoma's energy industry
 - Coordinate with the Secretary of Education and the State Superintendent of Schools to continue to support K-12 outreach programs to encourage and motivate students to consider careers in STEM fields to prepare them for jobs in the energy industry
 - Coordinate with the military and National Guard to ensure adequate industry representation at job fairs
 - Encourage the importance of industry-student engagement through robust mentoring programs

Objective: Provide the foundation for a competitive, trained, world-class energy workforce.



Background

Energy and the environment are inextricably linked, making the manner in which energy is produced and consumed critically important to the goal of ensuring Oklahoma remains a clean and healthy place to live. The U.S. Clean Air Act (CAA), originally passed in 1970, regulates threshold levels of air toxins and criteria pollutants through emissions limitation standards, such as the National Emissions Standards for Hazardous Air Pollutants (NESHAP) and the National Ambient Air Quality Standards (NAAQS). Under the Clean Air Act, states and local agencies are responsible for ensuring attainment with these standards. Together, the Oklahoma Department of Environmental Quality (ODEQ) and industry work hard to ensure the health, well-being, and aesthetic preservation of Oklahoma's environment.



Beyond air quality, the importance of clean, available water cannot be understated. For the energy industry, water plays an important role in natural gas and oil completion processes, such as hydraulic fracturing and EOR water floods that are helping to bring new energy supplies to market. The OCC and the Oklahoma Water Resources Board (OWRB) have a long and successful history of regulating and protecting Oklahoma's water resources for oil and gas operations. Water is also critical to electric power generation for cooling purposes. Ensuring industry access to water supplies is critically important, and protecting the integrity and quality of Oklahoma's water will be the key that enables continued industry use.

Opportunities

- ◇ Experts estimate that Oklahoma's potential for peak load reduction through energy efficiency is 20% to 30%. And assuming 20% potential total savings, this would translate into 9,934 GWh of electricity savings, or 2,327 MWs of avoided power generation and its associated emissions by 2018.
- ◇ New commercial technology developments in natural gas combined cycle electric power generation equipment have led to major improvements in the thermal efficiency of both fuel consumption and emissions performance. These new machines are also specifically designed to complement variable power generation from renewable power sources such as wind. Natural gas combined cycle also requires far less water for cooling purposes than traditional thermal power generation operations. The unique combination of natural gas combined cycle and wind, perfectly matched to Oklahoma's resources, has the potential to substantially reduce air emissions and cooling water requirements, while at the same time maintaining reliable and affordable electricity delivery to consumers.
- ◇ Decoupling is a regulatory framework that disconnects a utility's revenues from its energy sales. In effect, it makes a utility indifferent to its energy sales volume, allowing compensation not for the amount of energy sold but for reliably and affordably keeping the lights on. Because profits are not affected by the amount of energy sold, this means that utilities can aggressively pursue energy efficiency and conservation, both of which reduce emissions, all without negatively impacting their financial performance. Full to partial decoupling is already being successfully utilized by more than half of the states in the United States.

Challenges

- ◇ Oklahoma's warm and bright summers create a prime environment for ozone formation, exacerbating concerns for present ozone levels.
- ◇ EPA standards place Oklahoma City and Tulsa at risk for exceeding the 0.075 parts per million ozone standard.
- ◇ Oklahoma's transportation system is geared toward single-passenger vehicles, which is the highest-emitting form of transportation.



- ◇ EPA sulfur dioxide (SO₂) attainment status is oftentimes based on modeling, not actual monitoring, data, which poses unwarranted federal pressure to enforce SO₂ emission standards where Oklahoma is not in actual violation, but SO₂, PM₁₀, and mercury (Hg) levels are of concern, particularly SO₂ levels, which are nearing the EPA one-hour standard
- ◇ Emissions standards are periodically reevaluated, meaning that emission-reduction investments and decisions are typically made with reference to moving targets.
- ◇ Although annual rainfall over the past 10 to 20 years has been above average, recent drought conditions are leading to near-term water availability concerns for natural gas and oil drilling and completion operations. In the hot summer of 2011, water availability became of increasing concern for electric power generation cooling needs as well.
- ◇ Public perception regarding industry use of water is largely unfavorable, despite an exemplary track record.
- ◇ Utilities and companies are subject to a variety of complicated and disconnected regulations that could force suboptimal decision making based on nearsighted federal compliance mandates (e.g., Cross-State Air Pollution Rule (CSAPR); Maximum Achievable Control Technology (MACT) for Hazardous Air Pollutants (HAPs); Coal Combustion Residuals (CCR); updated NAAQS for NO_x, ozone, SO_x, PM_{2.5}, and PM₁₀; New Source Performance Standards (NSPS) for volatile organic compound (VOCs) emitted during hydraulic fracturing).

Building Oklahoma First

Since January 1, 2011, the Oklahoma Department of Environmental Quality awarded \$2,698,848 in federal grant money through the Diesel Emissions Reduction Act. Thirty-five projects were completed to replace or retrofit 296 school buses in the state of Oklahoma. The idle reduction requirement associated with these grants led to the reduction of 98,550 gallons of diesel fuel, which saved schools a total of \$295,650. The projects amounted to a yearly reduction of 24.5 tons of NO_x, 1.9 tons of PM, 3.2 tons of hydrocarbon, and 15.4 tons of carbon monoxide.

Strategy

- ◇ **Increase utilization of natural gas and renewable energy sources for electric power generation**
 - Recommendations:
 - Enable utilities to rely more fully on Oklahoma wind and natural gas to meet reasonably foreseeable federal regulations through legislation or rule makings that enable utilities to make economically viable decisions regarding investments in existing and future assets
 - Communicate the impacts that wind and gas, working in conjunction, can have on addressing ozone and other air quality concerns
- ◇ **Utilize demand-side management and energy efficiency to control emission levels and ensure air quality**
 - Recommendation:
 - Promote the continued spread of energy efficiency programs and smart meters/grids in homes and businesses, communicating the message that more informed consumption often leads to lower demand peaks, which precludes the need for additional generation or the utilization of less-efficient generation sources for meeting peak demand
- ◇ **Promote increased awareness of air quality issues**
 - Recommendations:
 - Working in conjunction with the Secretary of Environment and ODEQ, support practical and actionable public education programs, such as those related to ozone alerts, transportation, and energy efficiency, to minimize the risk of nonattainment and the associated costs and inconveniences thereof
 - Increase publicity for general air quality issues and support efforts regarding increased participation in incentive programs



- ◇ **Endeavor to communicate better understanding of the safe and important use of water in energy processes**
 - Recommendations:
 - Promote policies, practices, and research that advance the natural gas and oil industry to use innovative technologies that reduce reliance on freshwater resources for exploration and production and encourage reducing, recycling, and reusing water resources wherever possible
 - Continue supporting strong state regulation at the OCC regarding the safe handling and disposal of water in oil and gas drilling, completion, and recovery processes
 - Provide support for the OWRB regarding water planning with respect to energy
 - Optimize water use for electric power generation
- ◇ **Reduce ozone levels through a decrease in transportation-related emissions**
 - Recommendations:
 - Create transportation options through making alternative fuels more available
 - Promote more efficient land use and traffic planning, which decreases time spent in commutes and emissions created during idling
 - Promote public transit

Objective: Leverage all Oklahoma resources to provide a clean environment and spur economic growth.



Background

Both private and public investments in R&D programs play a key role in positioning Oklahoma at the forefront of the emerging energy industry. Companies throughout the state are leading the way, developing new technologies to extract traditional energy resources that are transforming the U.S. energy supply. But the state also has an important role in promoting new ideas and innovation that can lead to further job and economic growth opportunities. Through programs like the Oklahoma Center for the Advancement of Science & Technology, which received more than \$18 million in funding for fiscal year 2012, and the Oklahoma Bioenergy Center, with more than \$15 million in cumulative research, the state makes a serious commitment to supporting projects and proposals with the potential to create jobs and opportunity in Oklahoma. Yet jointly leveraging both private and public efforts may create an even greater opportunity.



Opportunities

- ◇ In 2007, Congress enacted the U.S. Energy Independence and Security Act. This piece of legislation effectively requires the production of 36 billion gallons of ethanol by 2022. Nearly half of this production will come from cellulosic feedstocks. This is where Oklahoma can play a key role. If Oklahoma were to dedicate 35% of the farm land in the state to biofuel feedstocks, Oklahoma could supply the United States with as much as 49.5 million tons of switchgrass used to generate these biofuels. In fact, the EPA estimates that, by 2022, 85% of the biofuel produced from switchgrass in the United States will come from biorefineries located in Oklahoma. Meeting this federal legislative mandate is going to require significant biofuels R&D investments in the state.
- ◇ At the Oklahoma Bioenergy Center, (OBC), a consortium between the University of Oklahoma, Oklahoma State University, and the Noble Foundation, researchers specializing in energy and agricultural development are working to advance the next generation of renewable alternatives for petroleum-based transportation fuels. This effort was the vision of the Oklahoma legislature and is producing exceptional results. Conservative estimates suggest that the state's \$15.4 million investment, of the \$40 million originally anticipated, into the center has already resulted in an economic development impact of nearly \$97 million, a return on investment of more than 6:1. Assuming a similar return in the future, full funding of the Oklahoma Bioenergy Center could result in an economic development impact on the state of almost \$252 million, meaning about \$155 million remains unrealized.
- ◇ Oklahoma's state-based programs, such as the Oklahoma Wind Power Initiative, its national programs, such as the Norman-based National Weather Center, its world-renowned energy programs at its major universities, and the immeasurable expertise at companies throughout the state collectively present the ideal knowledge base from which to create a cooperative private-public effort dedicated to maximizing Oklahoma's potential as an energy state. By using Oklahoma's human resources to advance Oklahoma's natural resource base, the state can benefit from increased economic growth in Oklahoma industries.

Challenges

- ◇ Garnering funding is difficult in a constrained fiscal environment.
- ◇ Oklahoma is significantly underrepresented in venture capital investment.
- ◇ Oklahoma is still in a growth phase for attracting cutting-edge researchers to Oklahoma institutions.
- ◇ Reduced availability of federal funding for research is increasing the competition for available research money.



Strategy

◇ Promote efforts to support existing Oklahoma R&D efforts

- Recommendations:
 - Foster communication between private and public industry to ensure coordination, not duplication, of research efforts
 - Leverage Oklahoma's expertise in water management for unconventional resource development toward improving and preserving the use of hydraulic fracturing technology
 - Support efforts aimed at equipping the Oklahoma Bioenergy Center with the resources necessary to continue to increase Oklahoma's competitiveness in biofuels research
 - Continue assisting efforts to advance the large-scale storage of energy to increase the size and economics of Oklahoma's variable renewable resources

◇ Advance new R&D efforts through the creation of the Oklahoma Energy Initiative

- Recommendations:
 - Draw individuals from Oklahoma's state, national, and private agencies, programs, institutions, and companies to form a cooperative effort focused on advancing Oklahoma's core energy resource competencies in unconventional natural gas, CO₂ EOR, wind forecasting, and advanced biofuels
 - Promote state seed funding that can be leveraged against both federal and private-source funding to establish sufficient startup resources
 - Strategically select R&D projects to ensure balanced benefits to all industries and regions of the state, not one particular industry or region

◇ Brand Oklahoma as a traditional energy and renewable resource R&D state

- Recommendations:
 - Attract best-in-class researchers to Oklahoma in competency areas aligned with Oklahoma's native resource base
 - Coordinate with the Oklahoma Department of Commerce to enhance venture capital investment in energy-related research and business opportunities

Building Oklahoma First

In 2011, through a project made possible by the Oklahoma Bioenergy Center, researchers at the Samuel Roberts Noble Foundation uncovered a gene responsible for controlling the growth density of plant material. The discovery, termed "biomass densification," has been heralded as a key advancement in biomass feedstock research.

Objective: Establish Oklahoma as the nation's capital for unconventional and renewable biofuel resource development.

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Lt. Governor Todd Lamb

Oklahoma Corporation Commissioner Chair Dana Murphy

Oklahoma Corporation Commissioner Bob Anthony

Oklahoma Corporation Commissioner Patrice Douglas

Former Oklahoma Corporation Commissioner Jeff Cloud

Office of the Governor

- ◇ Denise Northrup
- ◇ Katie Altshuler
- ◇ Andrew Silvestri
- ◇ Alex Weintz
- ◇ Aaron Cooper

Cabinet Members

- ◇ Secretary of Veteran Affairs Rita Aragon
- ◇ Secretary of State Glenn Coffee
- ◇ Secretary of the Military Major General Miles Deering
- ◇ Secretary of Finance Preston Doerflinger
- ◇ Secretary of Education Phyllis Hudecki
- ◇ Secretary of Science & Technology Dr. Stephen W.S. McKeever
- ◇ Secretary of Agriculture Jim Reese
- ◇ Secretary of Transportation Gary Ridley
- ◇ Secretary of Environment Gary Sherrer
- ◇ Secretary of Safety & Security Michael C. Thompson
- ◇ Special Advisor on Economic Development Bob Sullivan
- ◇ Secretary of Commerce Dave Lopez

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State Agencies

- ◇ Department of Career and Technology Education
- ◇ Department of Central Services
- ◇ Department of Environmental Quality
- ◇ Department of Mines
- ◇ Department of Transportation
- ◇ Oklahoma Corporation Commission
- ◇ Oklahoma Mining Commission

Member Organizations

- ◇ Association of Central Oklahoma Governments
- ◇ Farmers Royalty Co.
- ◇ Mid-Continent Oil & Gas Association
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- ◇ Oklahoma Aggregates Association
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- ◇ The Wind Coalition

Companies

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- ◇ AES Shady Point, LLC
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- ◇ Apex Wind Energy, Inc.
- ◇ Arkansas-Oklahoma Railroad
- ◇ CenterPoint Energy
- ◇ Chaparral Energy
- ◇ Chermac Energy Corporation
- ◇ Chesapeake Energy Corporation
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- ◇ Competitive Power Ventures
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- ◇ Holly Refining Corporation
- ◇ Horizon Wind Energy
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