ENERGY = JOBS

pennsylvania STATE ENERGY PLAN

Tom Corbett, Governor | Commonwealth of Pennsylvania | January 2014

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Table of Contents

List of Figures

List of Tables

Message from Governor Tom Corbett

Governor Tom Corbett

From its earliest days, when timber and coal powered the American industrial revolution, Pennsylvania has been on the forefront of energy development in the nation. Our Commonwealth is blessed to have a rich diversity and abundance of natural resources, the very building blocks upon which our society thrives. We use these resources to fuel our factories, heat our homes, manufacture products and move people and goods to wherever they need to be. Our greatest resource and strength, however, are our citizens who call Pennsylvania home. Their innovation, creativity, optimism, tremendous work ethic and can-do attitude are second to none.

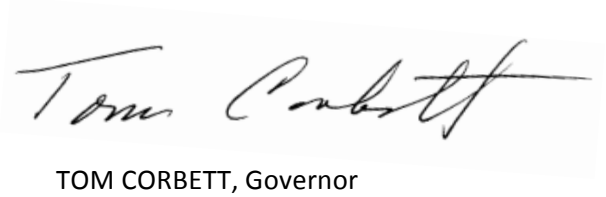
Together, Pennsylvania's portfolio of resources makes up the Keystone of a new industrial revolution. Thanks to the emergence of new technologies, the refinement of old ones, access to new and abundant natural resources, a renewed focus on the importance of energy and a steeled commitment to be good stewards of our environment, Pennsylvania is poised to lead the charge toward economic growth and energy independence.

In Pennsylvania, I have tasked my administration with carrying out three key objectives that will ensure prosperity for generations to come. We're putting Pennsylvania on sound fiscal ground, working to make a job available for every Pennsylvanian and ensuring that a trained and educated Pennsylvanian is available for every job.

Partnering with citizens, local communities, job creators and energy producers, we are meeting these objectives. By recognizing the opportunities before us and the critical importance energy plays in raising the quality of life of Pennsylvanians, powering our economy and increasing the competitiveness of job-creators, Pennsylvania is poised once again to be the energy capital of the nation.

Here in the Keystone State, we know that energy equals jobs. Pennsylvania's abundant natural resources, sound public policies, improved business climate, skilled workforce and commitment to competitive markets are second to none. We welcome the intense competition to attract jobs and capital investment, and Pennsylvania is committed to winning this competition.

Come see how.



TOM CORBETT, Governor

1. EXECUTIVE SUMMARY

Energy = Jobs

The energy to innovate. The energy to create. The energy to make today's opportunity tomorrow's reality. Simply put, energy equals jobs. For any business, energy costs are a critical operating expense. Pennsylvania's abundant natural resources and competitive energy markets are an advantage in today's global economy where every dollar matters. Significant growth markets are nearby as Pennsylvania lies within a day's drive of 60% of North America's population. To help capture these markets, Pennsylvania's diverse and abundant resources offer nearly endless opportunity due to affordable and less volatile energy prices. Jobs and capital are mobile in today's competitive marketplace. We understand this and are committed to winning business investment and improving the bottom line.

Through businesses, communities, educators and workforce partners, Pennsylvania proactively prepares citizens for the jobs of today and tomorrow. Energy = Jobs is a serious commitment in Pennsylvania. It reflects our commitment to continue to promote our hard work ethic, provide education and training for jobs that match company needs and our citizens' strengths and encourage the ingenuity inherent in our entrepreneurs, businesses and research institutions.

Philosophy of Government

Private investment, entrepreneurial spirit and American ingenuity create jobs. The government's role is to protect public health and safety and to foster a welcoming atmosphere for job creators. This means high, but fair, standards and consistent, predictable rules that protect the environment and the men and women developing our natural resources. We offer an open, transparent, fiscally disciplined state government that values business and growth, matching every business' commitment to the future of Pennsylvania with our commitment to the future of every business.

> ***"Government cannot be the competitor to business; it must be the partner. It cannot be the adversary; it must be the advocate."***
>
> – Governor Tom Corbett

Pennsylvania's favorable business climate helps make our state economically competitive. In fact, Site Selection magazine ranked Pennsylvania first in the Northeast and third in the nation for corporate growth in 2012. Pennsylvania is also attractive beyond the United States' borders. In 2011, 23 foreign-based companies made the move to Pennsylvania with a total investment of more than $371 million.

Pennsylvania's Energy Policy: All of the Above - *and Below*

Pennsylvania's energy policy is straight forward - All of the Above - *and Below* – reflecting our diverse energy portfolio. Pennsylvania's energy portfolio reflects what a real "*All of the Above*" approach looks like. Home to abundant resources such as oil, natural gas, coal, nuclear, hydropower, wind, solar and other renewables, the Keystone State is a national leader in both energy production and resource diversity. This array of resources, paired with competitive energy markets, means affordable and

abundant power delivered in a way that meets business needs. We're modernizing our infrastructure, making sure we have a reliable grid that can efficiently harness all of our resources to drive our economy forward.

Supporting our energy policy are a few core concepts. Our commitment is to make certain the decisions we make about our "*All of the Above"* approach reflect these concepts now and in the future.

Embracing Free Markets

Our "*All of the Above*" approach to energy rests upon the most critical tenet of the American dream – free markets work. When consumers choose, we all win. That's why we have embraced and fostered a robust market for energy suppliers. Our competition laws let customers choose their electric and natural gas supplier. This rewards innovation and creativity and empowers the consumer to choose the best product that suits their needs. We understand that at the heart of any successful business enterprise is access to safe, affordable, abundant and reliable energy. The global marketplace doesn't shy away from competition – neither should the choice of energy suppliers.

Energy Independence Leads to Security

An energy independent state and nation means supporting jobs here, utilizing our resources instead of sending our capital abroad and being subjected to volatile geo-political climates. Pennsylvania's diverse energy portfolio allows the Keystone State to produce energy such as natural gas, coal, nuclear and renewables right here in Pennsylvania. Pennsylvania is well-positioned to help ensure that our state and our nation are energy secure.

Abundant, Affordable and Domestic

A secure energy future means domestically produced energy. This leads to more affordable energy bills for all Pennsylvania consumers; cost effective energy solutions that attract new and expanded industrial and commercial business investment; a reliable electric grid free of the disruptions which threaten critical facilities; dependable and affordable public transportation; and cost-effective shipping and transportation of goods using increasingly cleaner and domestically produced fuel.

Enhancing Our Environment

Here in Pennsylvania, we protect the environment *and* grow the economy. Yesterday's environmental challenges are today's opportunities. Pennsylvania's award-winning brownfields law has helped turn abandoned industrial sites into landmark economic engines. We're diverting wastewater away from our streams and into innovative uses, such as hydraulic fracturing to free natural gas from the largest unconventional shale field in the nation. And we're consuming cleaner, domestic fuels that improve air quality and help lower greenhouse gas emissions. Economic prosperity means a bright future for our environment, and no one cares more about our air, land and water quality than we do.

Seizing the Opportunity

We're fortunate to have diverse and abundant energy resources in Pennsylvania - the 2nd largest energy field in the world. This fortune is matched by a commitment that is second to none: to make Pennsylvania the energy and jobs capital of the nation. We value the high quality of life available in Pennsylvania – and are resolute in our commitment to ensure our young people have this same opportunity to raise their families right here. Drawing on a trained, educated, skilled and dedicated workforce, Pennsylvania is moving forward: creating jobs; raising the standard of living for our citizens; enhancing our environment; fostering a business climate that encourages and rewards innovation and creativity; advancing our nation's energy independence; and making business ideas a reality. We are ready to work in partnership with every business to achieve these common goals.

We are focused on several opportunities that build on the foundation of Pennsylvania's energy portfolio. Carrying out these opportunities - and creating new opportunities in the future - will ensure that Pennsylvania leads the way in securing our nation's energy future. Here's our commitment and our vision:

Abundant, Affordable, Domestic Energy
Continue to Advance Our Nation's Energy Independence

Advance Innovative Technologies
Make Today's Cutting Edge Technologies Commonplace in the Future

Community Readiness
Encourage Ready-to-Go Communities to Partner with Businesses to Create New Jobs

Competitive Energy Markets
Continue to Support Electric and Natural Gas Choice for Pennsylvania's Citizens and Businesses

Economic Development
Attract New Business Investment by Taking Full Advantage of Pennsylvania's Energy Portfolio

Energy Efficiency & Storage
Encourage Energy Efficiency and Storage Efforts that Prevent Energy Waste

Increase Alternative & Renewable Deployment
Support Market-Based Decisions that Increase the Use of Naturally Regenerative Energy Sources

Workforce Development and Education
Prepare Pennsylvanians for High Quality Energy-Related Jobs

2. Introduction

Purpose

This energy plan articulates Pennsylvania's energy policy for 2014 and beyond. The policy ensures the framework is in place to continue to have an abundant, reliable supply of energy through all types of resources for all Pennsylvanians – both residents and businesses alike. Safe and reliable energy, water, sewer and transportation infrastructure - combined with a superior workforce and many scenic and vibrant communities - come together to make Pennsylvania an attractive location for business investment and an unparalleled place to live. The commitment to ensure our energy infrastructure is modernized and the unprecedented opportunity made possible by shale gas development - coupled with the increasing volatility associated with foreign energy markets - provide a newfound driving force to craft an energy plan for Pennsylvania. This plan meets the Commonwealth's overarching goals of fiscal responsibility, helping to provide jobs for every Pennsylvanian and continuing to develop the workforce to fill those jobs.

Content

This energy plan was written to provide key business decision-makers – and all Pennsylvanians – with the information needed to demonstrate the competitive advantages Pennsylvania has to offer. Our diverse energy resources combined with an attractive business climate, superior workforce and entrepreneurial spirit make the Keystone State an attractive location for private sector investment. To convey what Pennsylvania offers, this plan includes:

- An overview of Pennsylvania's diverse energy portfolio from the Commonwealth's pioneering contributions to energy development in the 19th century to our ability to harness an impressive array of energy resources today;
- A synopsis of how Pennsylvania uses energy resources and a second-to-none infrastructure network to our competitive advantage;
- An overview of how Pennsylvania transforms energy opportunities into reality; and
- A demonstration of how we are transforming these resources into action that will grow jobs, expand our economy, protect our environment and further enhance our communities and quality of life.

Development

Pennsylvania's energy plan was developed with support from the U.S. Department of Energy in collaboration with a diverse group of representatives that work every day on producing, using, conserving and improving our energy and natural resources. Partners from state agencies, economic and community development, workforce development, environmental and conservation, education, research and development and communities that provide the framework for a coordinated response to maximize our energy opportunities also provided critical input in developing this energy plan.

Going Forward

Pennsylvania intends this first statewide energy plan to be a working document, flexible to meet tomorrow's energy needs. We welcome every reader of this document to partner with Pennsylvania to continue to make the Keystone State *the* choice to locate a business, create new jobs, enhance our environment and improve our quality of life. We encourage local communities to build upon this plan and craft their own plan to highlight and demonstrate the unique resources available in their region.

3. The Keystone State's Energy Portfolio

Pennsylvania's Energy History

Our nation's energy history starts right here in Pennsylvania. From the first coal mine at Mount Washington that supplied the garrison at Fort Pitt, to the world's first commercial oil well drilled to light the homes of our ancestors, to the lumber mills that literally built a nation, Pennsylvania's innovative entrepreneurs and abundant resources fueled the world's industrial revolution while powering the war efforts that secured the democracy we enjoy today. From Benjamin Franklin's experimentation with electricity, to historic legislation ushering in the era of energy deregulation, Pennsylvania has led the way in marshaling our abundant resources to the benefit of all. Pennsylvania's strategic geographic position makes it ideally suited to serve as the Keystone to our country's domestic energy future.

Keystone State Energy Facts

The facts tell the story of the diversity and strength of Pennsylvania's vast energy portfolio. Pennsylvania is:

- 2nd second largest energy field in the world.
- 4th in the nation in energy production.
- 2nd in the nation for net electricity generation.
- 2nd in the nation in natural gas production.
- 2nd in the nation in nuclear generation.
- 4th in the nation in coal production and the only producer of high-heat value anthracite coal.
- 9th in the nation in total solar capacity installed.
- 15th in the nation in total wind capacity installed and 9th in the nation for new capacity wind installations in 2012.
- 19th in the nation in crude oil production.
- Significantly increasing biodiesel production, up over 60% since 2008.
- A national leader in competitive energy markets, including nearly 2.2 million electric choice customers.

Energy Portfolio Snapshot

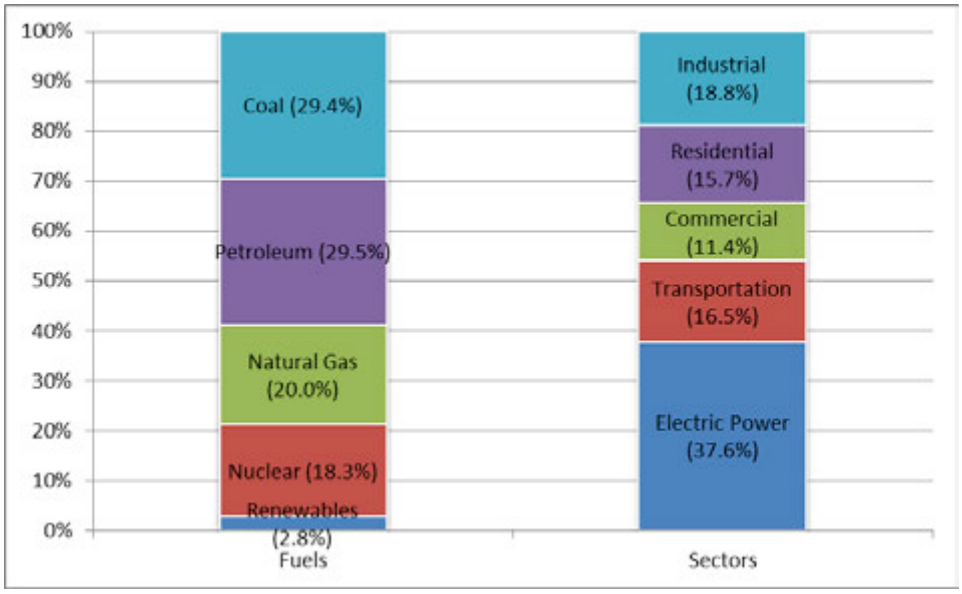
Pennsylvania's energy portfolio includes an abundance of natural resources made possible by a diverse landscape like no other. Varying topography and geologic formations combine with ample water resources to make Pennsylvania's energy portfolio one of the most distinct in the nation. As noted throughout this plan, our energy sources and the ingenuity of Pennsylvanians played a key role in the industrial revolution in the 19th century and the Commonwealth continues to be a Keystone to our nation's energy future, security and independence. Today, Pennsylvania is the 4th largest producer of energy in the nation at 3,858 trillion BTU.[i]

Several key factors are changing the dynamic between what energy resources Pennsylvania is producing and how these resources are being utilized. The exploration and production of natural gas from unconventional shale formations, such as the Marcellus and Utica, is nothing short of a game-changer. Advances in horizontal drilling and hydraulic fracturing techniques have enabled the safe extraction of

natural gas from shale reserves once thought untouchable. The ability to tap these previously unreachable resources presents significant new opportunities for economic growth throughout Pennsylvania. Refer to the *Oil & Gas* portion of this section for additional details.

Figure 1 includes a snapshot of Pennsylvania's energy portfolio in 2010, showing consumption by both source and sector. Pennsylvania currently consumes relatively equal amounts of petroleum and coal at nearly 30%. While natural gas is consumed in smaller quantities compared to coal and petroleum, it is likely that natural gas will continue to increase as exploration and production has increased tremendously over the past 5 years. Renewable energy, currently 2.8% of energy consumption, is also set to increase, particularly as Pennsylvania continues to expand its commitment to competitive energy markets and implement the Alternative Energy Portfolio Standards Act. The Act sets requirements for energy generation from alternative and renewable resources.

Figure 1 – Pennsylvania Energy Consumption by Source and Sector, 2010 (trillions of BTU)

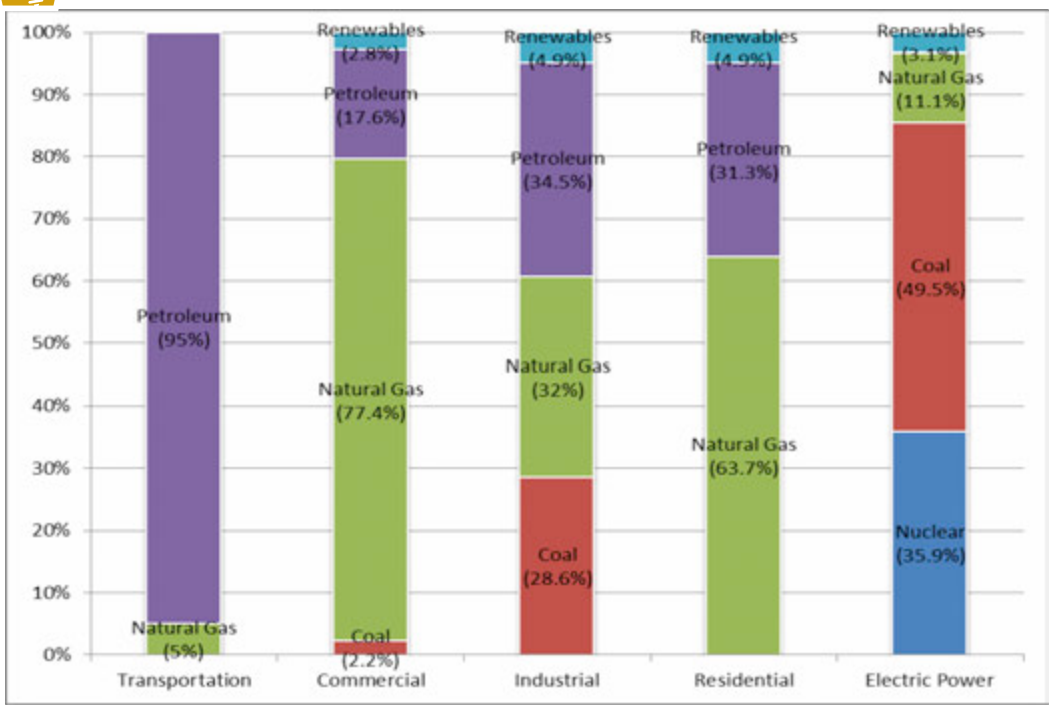


Source: Commonwealth Economics, LLC
Note: Graph excludes electricity and electrical system losses

Pennsylvania relies significantly on its robust coal production, reflecting the Commonwealth's prominence as the 4th largest coal-producing state in the nation in 2011.[ii] In 2012, Pennsylvania also ranked 2nd in the nation in electricity generation from nuclear power, benefitting from nuclear facility uprates and increased generation efficiency.[iii]

Current energy consumption in Pennsylvania varies widely by sector. For example, petroleum is used heavily in the transportation sector and natural gas makes up more than half of the state's consumption in both the commercial and residential sectors. Figure 2 provides a detailed breakdown of energy consumption by sector in 2010.

Figure 2 – Pennsylvania Energy Consumption by Sector (2010)



Source: Commonwealth Economics, LLC
Note: Graph excludes electricity and electrical system losses

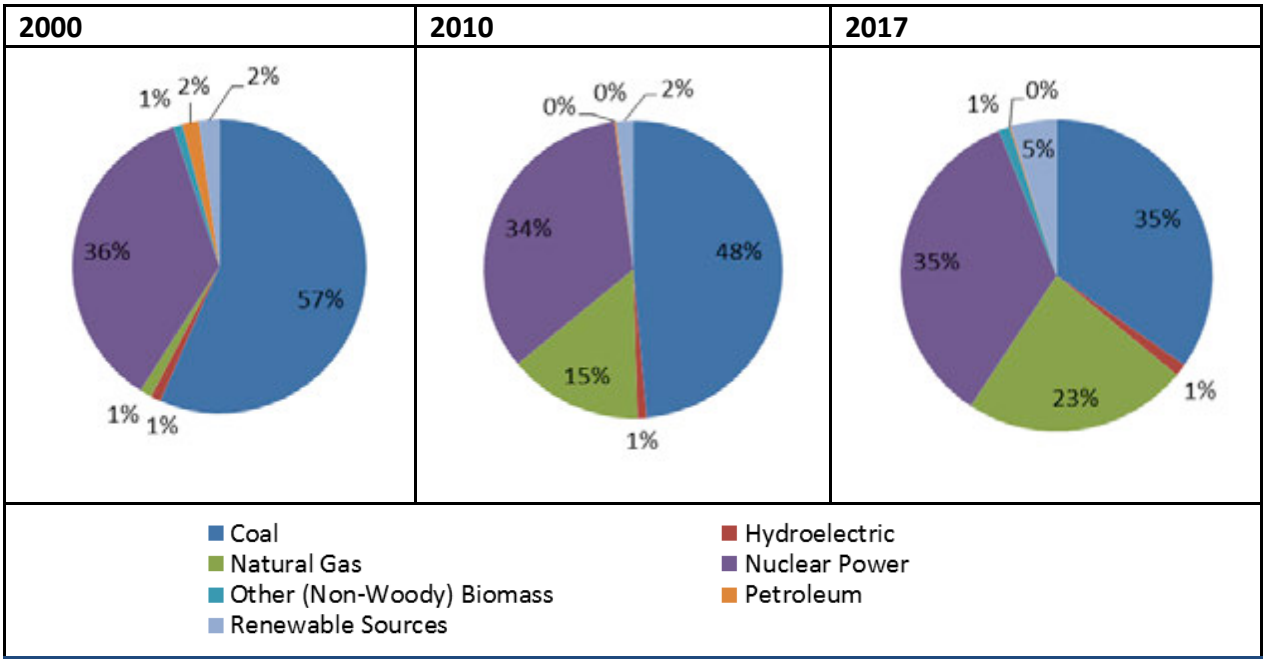
Electric Generation

Electric generation has been an important industry in Pennsylvania since the first generation station began operating in the late 1800's. Pennsylvania ranked 2rd in the nation for net electricity generation, and is the nation's largest electricity exporter.[iv] Pennsylvania is well-positioned in the mid-Atlantic region of the country to provide electricity to high load centers and has the important factors required to make electric production successful: water, fuel sources and transmission.

Coal has been the dominant fuel type used to produce electricity in Pennsylvania for decades. The prominence of nuclear energy and the acceleration of natural gas production continue to reshape and further diversify Pennsylvania's energy portfolio.

Between 2010 and 2017, the use of renewable energy sources to generate electricity is projected to increase from 2% to 5%. Figure 3 shows electricity generation by fuel source in Pennsylvania from 2000 to 2017.

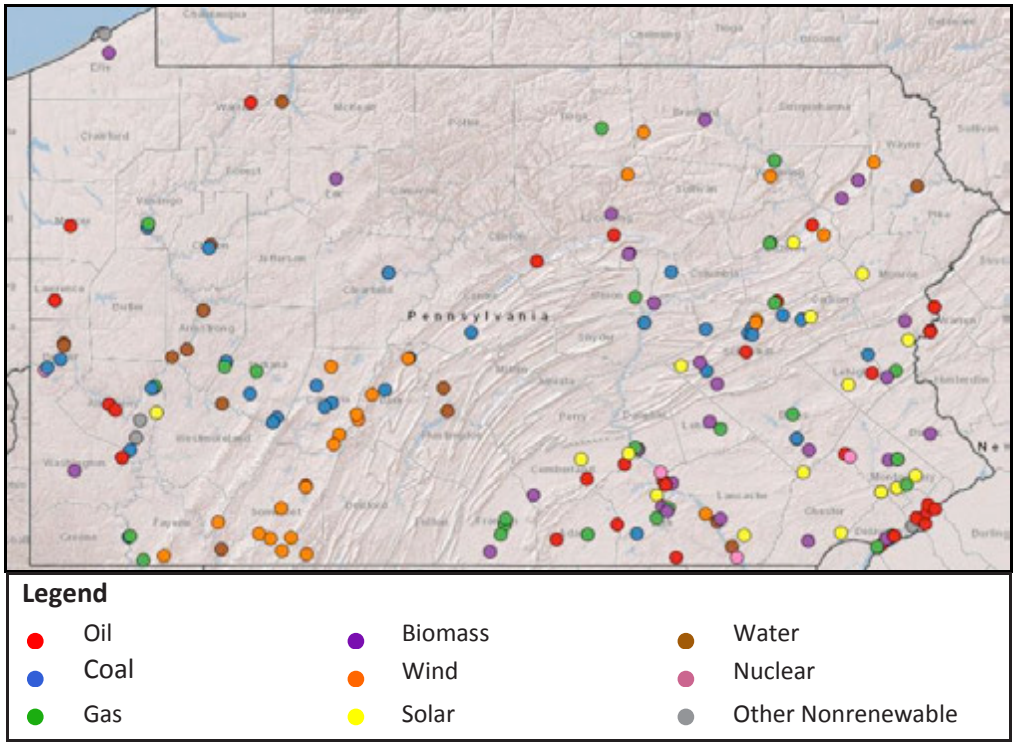
Figure 3 – Pennsylvania Electricity Generation by Fuel Type



Source: Commonwealth Economics, LLC

Pennsylvania currently has 211 major electric generation facilities.[v] Figure 4 shows the location of these facilities throughout Pennsylvania. While coal, oil and natural gas comprise the greatest number of facilities, the output of the state's five nuclear power plants will continue to generate over one-third of Pennsylvania's electricity. It is anticipated that the number of gas-fired power plants will continue to increase as natural gas continues to be plentiful and older coal-fired generation plants are retired. Figure 4 shows that Pennsylvania also has a sizeable amount of renewable generation facilities as well as an impressive array of non-utility commercial and institutional generation facilities including small and community scale wind systems and farm and food processing anaerobic digesters and gasifiers.

Figure 4 – Locations of Non-Renewable and Renewable Electric Generation Facilities



Source: Electric Power Generation Association

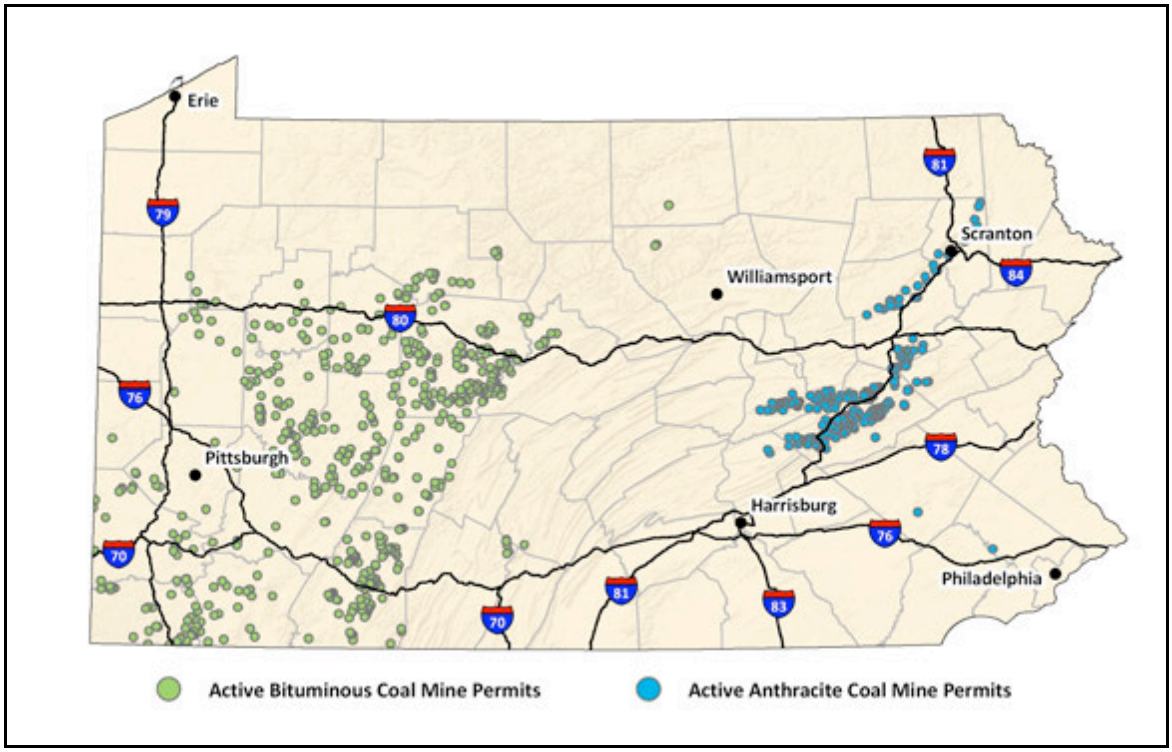
COAL

In 2011, 44% of Pennsylvania's net electricity generation came from coal. About 75% of the coal mined in Pennsylvania is used to generate electricity, with the remainder used in steelmaking and heating.

The history of coal mining in Pennsylvania dates back to the colonial 1760's and has been a core industry in Pennsylvania ever since. During the world wars, production peaked at over 200 million tons of coal mined per year. Pennsylvania's bituminous coal production peaked in 1918, with 177.2 million tons. In 1918, the state's total anthracite and bituminous coal output of 277 tons set a record for production by any state which stood until 1996.[vi] The coal mining industry still employed more than 8,100 miners in Pennsylvania in 2012.

Two types of coal are mined in Pennsylvania - bituminous and anthracite. Both can be mined from the surface or underground. Bituminous coal is found primarily in the western and portions of the central part of the state, while anthracite coal is found in the northeast. Pennsylvania is the last remaining state producing anthracite coal, which has a higher heat value than other kinds of coal. Pennsylvania has more than 600 active coal mines, with the vast majority of coal mined from subsurface mines. Figure 5 shows the locations of active bituminous and anthracite coal mines throughout the state.

Figure 5 – Pennsylvania Coal Mine Locations



Source: Pennsylvania Department of Environmental Protection

Mine Safety

Pennsylvania's mining safety record is among the best in the nation. In 2008, Pennsylvania's General Assembly unanimously enacted a comprehensive update to its coal mine safety law. A national model, this law created the Board of Coal Mine Safety, which includes representation from the Pennsylvania Department of Environmental Protection, as well as mining labor and management, to ensure regulations are sufficient to protect the men and women at work in Pennsylvania's mines. Mine safety compliance is routinely monitored through frequent inspections conducted separately by Pennsylvania Department of Environmental Protection and the federal Mine Safety and Health Administration.

Remining and Reclamation

The historical legacy of mining in Pennsylvania has left about 250,000 acres of abandoned mine lands, containing over 2 billion tons of coal refuse. In 1977, Congress passed the Surface Mining Conservation and Reclamation Act, establishing new mining practices and creating a new mine reclamation fee which provides certain legacy states some funding to pay for the restoration of abandoned mine land. Pennsylvania has a robust abandoned mine reclamation program. The program has won several national awards for its reclamation work, most recently in 2012 for a project restoring wetlands and dozens of acres of habitat for the state's wild elk herd in Elk County.

Coal operators play an important role in protecting and enhancing our environment, particularly when it

comes to remining. Surface mining often includes remining of areas where historic mining occurred. An excellent example of this is coal refuse reprocessing, where legacy coal refuse piles are removed for power generation while reclaiming the affected area. Remining can also include the reclamation of abandoned highwalls and spoil piles, which pose public safety hazards as well as environmental problems.

Coal Refuse-to-Energy

For decades, Pennsylvania's anthracite and bituminous coal mine fields provided the state and mid-Atlantic region with abundant and low-cost electricity, which was critical to powering the industrial revolution and fueling many of the nation's war efforts. However, this extraction left scars across Pennsylvania's landscape, impacting over 5,500 miles of waterways.

Pennsylvania's award-winning abandoned mine reclamation program is dedicated to addressing this legacy environmental issue. So too is Pennsylvania's coal refuse-to-energy electric generation fleet, which is the largest in the nation. Pennsylvania currently has 15 coal refuse-to-energy facilities, with a total generating capacity of 1,451 MW. As of April 2012, these facilities have helped to remove nearly 200 million tons of coal refuse, reclaimed nearly 7,000 acres of abandoned mine lands, provided nearly $200 million in reclamation value to Pennsylvania taxpayers, while directly and indirectly supporting thousands of jobs.

Pennsylvania's Alternative Energy Portfolio Standards law recognizes coal refuse-to-energy as an alternative energy source, providing an important option for electric utilities and generation suppliers to comply with the law while incentivizing the continued reclamation of abandoned mine lands and improvements to the state's waterways.

Making an Impact

Coal has made a positive impact on Pennsylvania's economy for generations. Consider the following:

- More than 62,900 jobs can be attributed to Pennsylvania's coal industry, including more than 8,100 miners.[vii]
- Coal extraction jobs are high paying, averaging $72,228 per year; exceeding Pennsylvania's average annual wage of $48,511.
- Total annual payroll for industry jobs in 2011 was more than $571 million.

COAL: MAKING AN IMPACT

- 4th Largest Coal Producer in the Nation
- High Wage Jobs
- Remining and Reusing: Waste Coal
- Treating Acid Mine Drainage

Furthermore, innovative energy technologies are helping to solve the environmental legacy of acid mine drainage and are making lasting impacts. In northeast Pennsylvania, hydroelectric generation is being powered by acid mine drainage, producing power while mitigating environmental impacts to nearby waterways.

Southwestern Pennsylvania is home to two of the largest coal research facilities in the country – the U.S. Department of Energy's National Energy Technology Laboratory and CONSOL's Energy Research and Development Center. Collectively, these facilities account for close to $500 million in coal-related

research and development which is focused on new technology that allows coal to be used to generate electricity while reducing emissions such as sulfur, nitrogen oxides, mercury and carbon. Pennsylvania's technological expertise presents an opportunity to export the equipment and license clean coal technologies to other countries, where coal-fired electricity production is quickly rising. Exporting our clean coal technology is another way that Pennsylvania helps improve environmental quality in our state, nation and throughout the world.

Advancing Pennsylvania's Energy Policy

Coal continues to remain a valuable energy resource in Pennsylvania. Coal helps to meet the Commonwealth's need for abundant, affordable and domestic energy resources, diversify our overall energy portfolio, further our nation's energy independence and power our economy. Pennsylvania supports coal mining operations and the job and economic benefits this valuable energy resource brings to our communities.

OIL & GAS

Pennsylvania's long history of oil and gas drilling and tremendous reserves of natural gas put the Commonwealth at the center of the push to make America truly energy independent, while providing affordable, domestic, clean-burning fuel to power an American manufacturing renaissance.

Pennsylvania is home to the first commercial oil well ever drilled in the United States, when Colonel Edwin Drake struck oil near Titusville, Pennsylvania in 1859. Since then, Pennsylvania has been a leader in oil and gas production, with more than 350,000 oil and gas wells drilled. Today, oil producers in Pennsylvania operate more than 19,000 oil wells that produce 3.6 million barrels of Pennsylvania Grade crude oil annually, ranking Pennsylvania 19th in the nation for crude oil production.[viii] This oil is refined into high quality waxes and lubricant base oils, gasoline and other fuels for use in vehicles, machinery and numerous manufacturing operations. This production is critical to supporting several refineries in Northwestern Pennsylvania that trace their roots back more than a century.

Recent advancements in drilling have allowed recovery of natural gas from the Marcellus, Utica and other unconventional shale formations - layers of dense sedimentary rock deep in the earth estimated to contain hundreds of trillion cubic feet of natural gas. Efficiently extracting natural gas from shale formations utilizes a combination of vertical and horizontal drilling, which is combined with advancements in hydraulic fracturing. Pennsylvania has adopted world-class well casing, construction and cementing standards designed to protect freshwater aquifers and established new wastewater treatment standards that have led to increasing water reuse and recycling of flowback and production water. Shale gas underlies more than two-thirds of the Commonwealth, with development activities in nearly 40 of Pennsylvania's 67 counties. Figure 6 shows the expanse of the Marcellus and Utica shale gas plays in Pennsylvania and surrounding states.

Figure 6 – Marcellus & Utica Shale Gas Plays

Source: Pennsylvania Department of Environmental Protection

Figure 7 shows the locations and number of conventional natural gas wells drilled in Pennsylvania for calendar year 2013. Figure 8 shows unconventional wells drilled in shale gas formations during 2013.

Figure 7 – Pennsylvania Conventional Wells Drilled (2013)

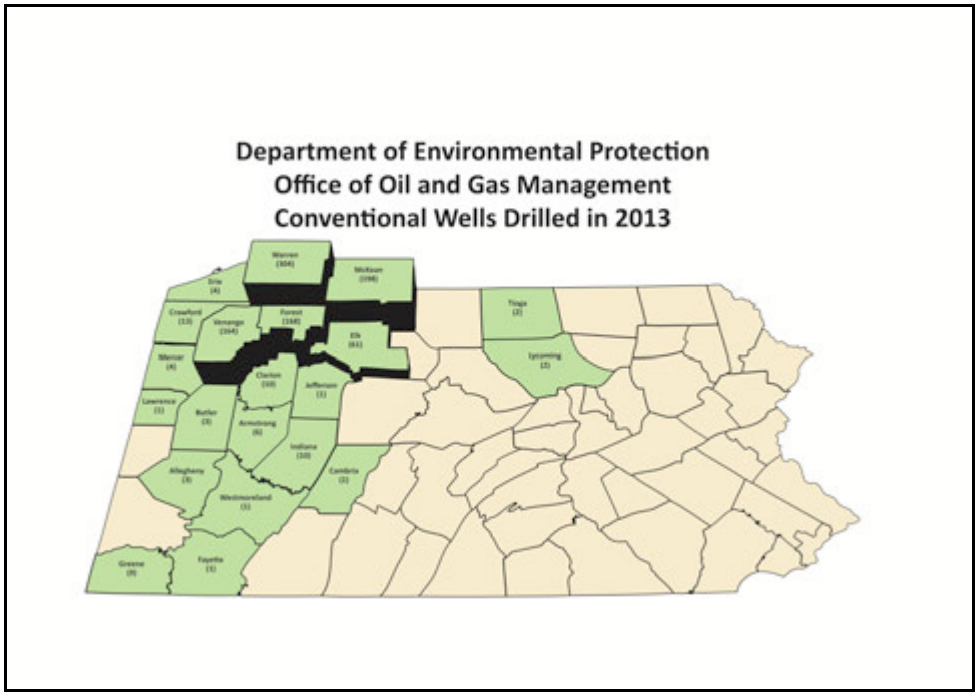
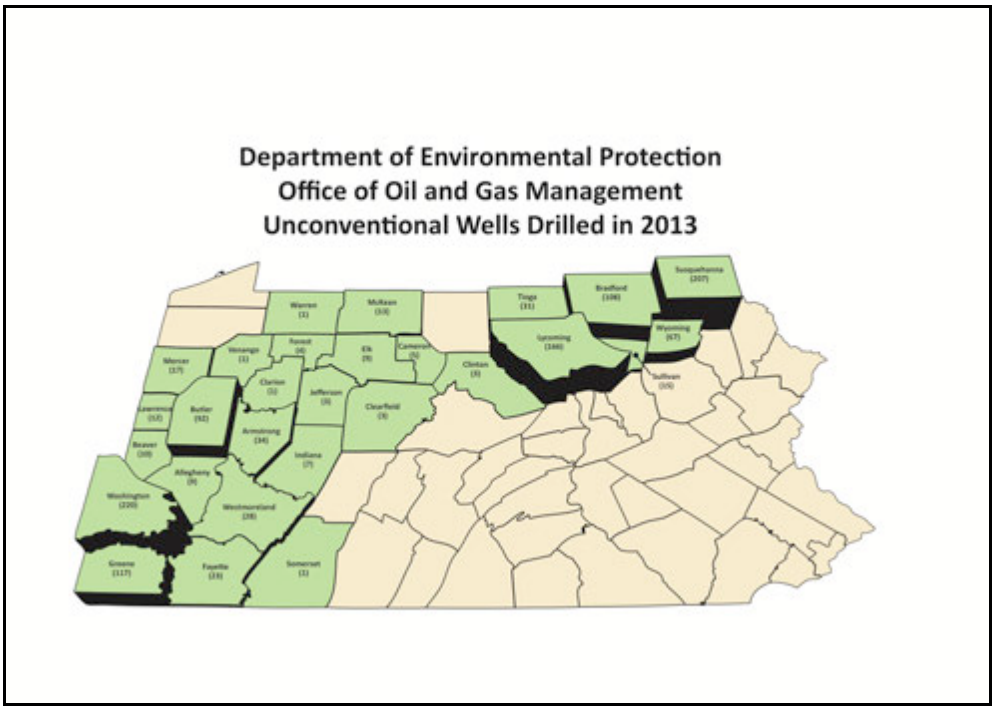


Figure 8 – Pennsylvania Unconventional Wells Drilled (2013)



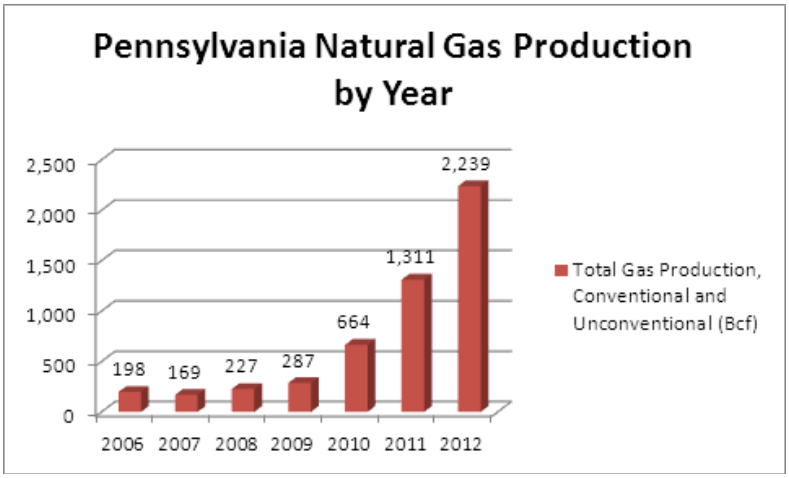
Drilling into the Marcellus Shale started in earnest in Pennsylvania just six years ago. Since then, Pennsylvania has gone from importing 75% of the natural gas we use to being a net exporter of natural gas in June 2011 for the first time in 100 years. Between 2009 and 2011 alone, Pennsylvania's natural gas production more than quadrupled, to over 1 trillion cubic feet. Likewise, production for 2012 topped 2 trillion cubic feet, enough to meet nearly 10% of the nation's natural gas needs.

In 2012, Pennsylvania ranked 3rd among 33 states that produced natural gas and ranked 2nd in 2013.[ix] Figure 9 shows total natural gas production in Pennsylvania from 2006 to 2012. The increase in the amount of natural gas production starting in 2010 is substantial and clearly demonstrates the impact natural gas production is having on Pennsylvania's energy portfolio.

Pennsylvania went from importing 75% of its natural gas just 5 years ago to being a net exporter of natural gas for the first time in 100 years.

Primary uses of natural gas are typically to fuel heat and hot water systems, and for electricity generation. This abundant electric generation resource has lowered wholesale electricity prices over 40% in just the past five years. This decrease has saved the average Pennsylvania household nearly $1,000 a year and considerably lowered energy costs for commercial and industrial customers. It has also contributed to the significant decline in carbon dioxide and other greenhouse gas emissions, which reached a 20-year low in 2012.

Figure 9 – Pennsylvania Natural Gas Production by Year



Source: Pennsylvania Department of Environmental Protection

Pennsylvania is committed to fully maximizing the economic, environmental and public health benefits of its shale gas resources, while ensuring that our environment and the communities where development is occurring are protected. To further this objective, on March 8, 2011 Governor Tom Corbett issued Executive Order 2011-01, which created the Governor's Marcellus Shale Advisory Commission (the Commission). Chaired by Lieutenant Governor Jim Cawley, the Commission was charged with developing a "*comprehensive, strategic proposal for the responsible and environmentally sound development of Marcellus Shale*." The Commission acknowledged from the outset that its findings and recommendations were applicable to all of the unconventional shale formations underlying Pennsylvania.

Comprised of representatives from business and industry, environmental and conservation, academic, local and state government communities, the Commission developed its report and recommendations through public meetings held over a 120-day period. The Commission's recommendations set forth a path toward addressing key issues associated with the development of Pennsylvania's Marcellus Shale and other unconventional natural gas resources:

- Protecting and enhancing our environment and natural resources,
- Identifying and meeting infrastructure needs,
- Enhancing emergency response and protecting public health,
- Addressing local community impacts, and
- Matching education and job training with emerging job opportunities.

The Commission's unanimously adopted report, including its 96 recommendations, was delivered to Governor Corbett on July 22, 2011. On October 3, 2011, Governor Corbett outlined his steps to implement the recommendations of the Commission, setting the stage for the Pennsylvania General Assembly's enactment of the first comprehensive update to Pennsylvania's Oil and Gas Act since 1984 (Act 13 of 2012). (Go to: www.dep.state.pa.us, click on 'Public Participation' to view the report.)

In addition to Act 13, Pennsylvania's General Assembly has enacted several other key pieces of legislation to ensure natural gas development occurs safely and responsibly. These steps include:

- More frequent and transparent well production reporting,
- Authorizing the state's Public Utility Commission to enforce federal pipeline safety standards,
- Adopting emergency response planning standards for well sites, and
- Modernizing the state's Coal and Gas Resource Coordination Act to properly balance the property rights of coal and natural gas producers.

Making an Impact

Pennsylvania's oil and natural gas industries have made a tremendous economic and workforce impact in recent years and will continue to do so in the future.

- Over 240,000 Pennsylvanians work in core and ancillary jobs associated with the oil and gas industry, with core job wages substantially higher ($84,388) than the statewide average of $48,824.
- By 2020, shale gas development will contribute nearly $14 billion in economic activity to Pennsylvania and generate nearly $5.6 billion in federal, state and local taxes. [x]
- Industry investment is expected to be substantial in 2014. The Marcellus Shale Coalition, an industry led organization formed to address issues regarding the production of natural gas from the Marcellus and Utica Shale plays, has studied industry investment. According to a 2012 survey of coalition members, total investment by exploration and production companies was projected at $13.5 billion in 2013. This includes leasing and bonuses, exploration, drilling and completion, pipelines and processing and royalties. [xi]
- A March 2012 study by Wells Fargo Securities estimated that shale gas development could help grow Pennsylvania employment by 570,000 jobs or more by 2020, as production increases demand for services and professions

Fueling Pennsylvania Industry with Pennsylvania Shale Gas

Procter & Gamble

Mehoopany, Wyoming County

Situated on the banks of the Susquehanna River, Procter & Gamble (P&G) made a key decision to enter into a gas lease and purchase agreement with Colorado based Citrus Energy Corporation and take advantage of a local supply of natural gas: right beneath its feet. At its largest U.S. manufacturing plant – where they make paper towels, toilet tissue and diapers – P&G has benefitted from the natural gas flowing from wells on its property. They have replaced 10 bcf of gas a year which was previously sourced from the Gulf Coast producing region, and now have the opportunity to generate revenue by selling excess gas into the market.

This locally produced gas also provided the financial incentive for P&G to add additional on-site electric cogeneration capacity with excess power being supplied and sold into the local power grid. Recent conversions of fleet vehicles and forklifts to run on natural gas will save nearly $1 million annually and reduce carbon emissions by 850 tons per year. This Pennsylvania success story has strengthened P&G's commitment to it's over 2,000 local employees while significantly elevating its competitiveness in the global marketplace.

like hospitality, leisure, engineering and surveying.

- IHS Global Insight projects that, between 2010 and 2015, the shale gas industry's contribution to Pennsylvania's economy will grow by nearly 19% annually, with job growth averaging 14% annually.
- The total contribution to Pennsylvania's economy from shale gas development is projected to increase nearly six-fold, to over $42 billion annually, from 2010 to 2035.

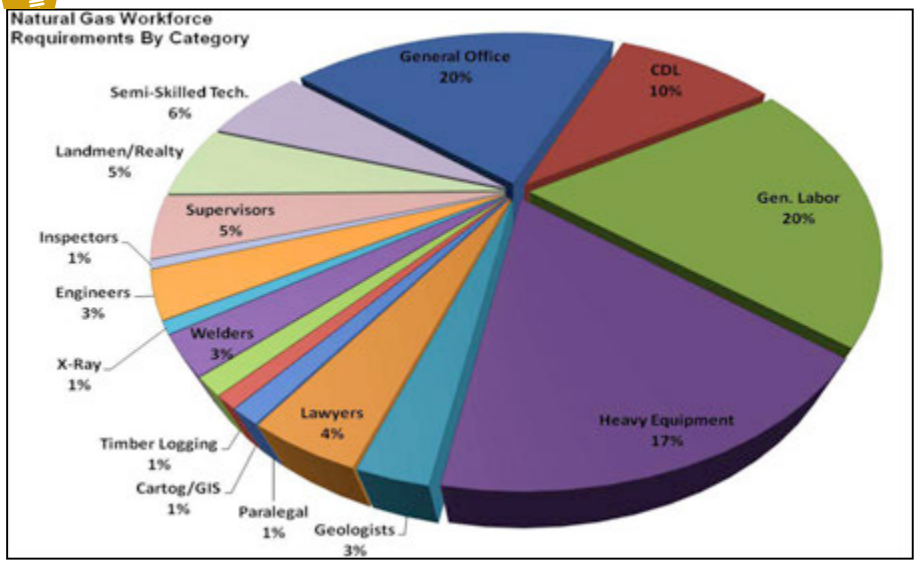
OIL & NATURAL GAS: MAKING AN IMPACT

- Significant Job Creation
- Downstream Economic Benefits
- Fostering Economic Security
- Transportation Fuel for Tomorrow

The types of jobs made possible through oil and gas industries are impressive. As demonstrated in Figure 10 developed by the Shale Training & Education Center (ShaleTEC), a collaboration between Pennsylvania College of Technology and Penn State Extension, drilling just one well requires over 400 people in nearly 150 occupations.

Pennsylvania is aggressively pursuing efforts to diversify its transportation fuel portfolio as well, particularly through the use of compressed natural gas (CNG) and liquefied natural gas (LNG). The Pennsylvania Natural Gas Energy Development Program, along with the Alternative Fuel Incentive Grant Program (Go to: www.dep.state.pa.us and click on 'Grants & Loans'), is encouraging the conversion of fleet vehicles to natural gas and prompting the development of private-public sector partnerships for both vehicle conversions and supporting infrastructure. Recognizing that every gallon of fuel imported results in the export of significant Pennsylvania dollars, Pennsylvania is also a leader in joining the multi-state collaboration among state governors to pool their buying power to encourage United States automakers to expand natural gas fueled vehicle choices.

Figure 10 – Natural Gas Workforce Needs



Source: ShaleTEC, www.msetc.org

One of the most significant benefits for Pennsylvania businesses and residents resulting from the advent of abundant natural gas supplies is lower and less volatile electricity and natural gas pricing. See the *Making Use of Our Resources* section for more detailed information on the significant and sustained decrease - in excess of 40% - in electricity and natural gas prices for Pennsylvania consumers.

Advancing Pennsylvania's Energy Policy

Pennsylvania has many prospects to capitalize on newly emerging opportunities to increase the use of natural gas in all sectors.

By 2015, expected coal-fired power plant retirements will reduce generation capacity by 4,820 MW. Proposed gas-fired power plants have the potential to nearly double the capacity (7,049 MW) of retired facilities.[xii] So-called "wet gas" - containing natural gas liquids like ethane, butane, propane and pentane - is produced in abundance in western Pennsylvania, providing game-changing feedstock to fuel a new industrial revolution right here in Pennsylvania. Increased conversion to natural gas in homes, businesses and industry is being made possible by supplying low-cost Pennsylvania-extracted natural gas through new and existing pipelines. Refer to the *Making Use of Our Resources* for additional information on each of these opportunities.

Pennsylvania will continue to support the many opportunities to advance responsible shale gas exploration and production throughout the Commonwealth. This leads to increased economic prosperity by creating new jobs and lower energy costs for Pennsylvanians and increasing revenues for Pennsylvania businesses and communities.

NUCLEAR

The first commercial United States nuclear power plant came online in 1957 in Shippingport, located in southwestern Pennsylvania. Today, Pennsylvania has five nuclear power plants with nine nuclear reactors, ranking 2nd in the nation behind Illinois in electricity generation from nuclear power. Pennsylvania's nuclear reactors account for over one-third of the state's electric generation and 95% of the Commonwealth's emission-free power.[xiii] The power plants operating in Pennsylvania will continue to meet a significant portion of the state's baseload generation for decades to come. Figure 4 shows the location of Pennsylvania's nuclear power plants. PPL Corporation is proposing to construct a 1,600 MW nuclear power plant on land adjacent to its existing Susquehanna nuclear power plant in Berwick, Pennsylvania and is pursuing a license from the Nuclear Regulatory Commission.

Pennsylvania has strived to combine reasonable regulation with modern technology to allow nuclear power plants to produce energy while minimizing risk to local communities. State regulators have developed a comprehensive nuclear power plant oversight review program to monitor plant operations and the management and disposal of radioactive waste. The state also maintains plans to respond to incidents involving nuclear power plants and radioactive material, in the unlikely event they should occur. Pennsylvania's continuous high marks from federal emergency preparation drills show the state is well-prepared and is recognized as a leader in nuclear safety. Additionally, Pennsylvania has developed a program to remotely access real-time information from within plants, ensuring necessary information is in hand to take immediate action in the event of an emergency to protect public health and safety.

Pennsylvania's innovation is hard at work in nuclear energy, as half of the world's existing reactors are based on technology developed in the Pittsburgh region. This results in demand for both services and supplies. Westinghouse, employing nearly 6,000 people in the Pittsburgh region, is a global leader in nuclear energy technology. In addition, the nuclear industry is partnering with Pennsylvania's community colleges to develop a trained workforce. Through these partnerships, Montgomery County Community College has developed curriculum for an Associate Degree in Applied Science in Nuclear Engineering Technology which trains students for positions in nuclear power plants and related fields.

PPL Corporation partnered with Luzerne County Community College to develop an Associate Degree in Applied Science in Nuclear Engineering Technology.

Making an Impact

Nuclear energy makes a positive impact on Pennsylvania's economy. A few key facts:

- Jobs at Pennsylvania's nuclear energy facilities total nearly 5,000.
- Economic output totals nearly $4.3 billion in revenue.
- Pennsylvania's nuclear facilities contribute $470 million to local economies and pay more than $45 million in local and state taxes annually.[xiv]

NUCLEAR: MAKING AN IMPACT

- Ranks 2nd nationally for electric generation
- Supplying more than one-third of Pennsylvania's electric generation
- Global Research & Development presence

As a substantial contributor to the Commonwealth's electric generation portfolio, nuclear energy has helped to improve and enhance Pennsylvania's air quality, while providing affordable and reliable energy to consumers at a predictable price.

Advancing Pennsylvania's Energy Policy

Pennsylvania's nuclear facilities generate over one-third of Pennsylvania's electricity. With sensible regulation, modern technology and global technical expertise located here in Pennsylvania, nuclear energy will remain a key to our energy portfolio for years to come. Pennsylvania supports research and development to further enhance nuclear energy, with a focus on deployment both here in Pennsylvania and around the world. Pennsylvania continues to urge the federal government to develop long-term nuclear waste storage solutions by adopting the recommendations of the Blue Ribbon Commission on America's Nuclear Future, which would remove a tremendous amount of uncertainty impacting one of the state's most important energy resources.

ALTERNATIVES & RENEWABLES

Alternative and renewable energy resources are key components of Pennsylvania's energy portfolio. Renewable energy is derived from resources that are naturally regenerative or are practically inexhaustible (such as biomass), as well as sources such as geothermal, solar, hydropower and wind energy. Alternative energy can either be a renewable or nonrenewable energy source, but it is used in a way that differs from traditional energy technology.

In Pennsylvania, the amount of electricity generated from alternative and renewable energy resources is growing. Solar, wind, hydropower and other resources that do not require cooling water avoid the consumptive water use and the thermal effects of traditional electric generation plus no air emissions or waste products are produced. In addition, the costs of alternative and renewable energy sources continue to decline. For example, the cost of installing solar in the United States dropped more than 4% per year on average for the last 15 years. In Pennsylvania, solar installation costs have declined by 50% since 2007.[xv]

In 2004, Pennsylvania's General Assembly enacted the Alternative Energy Portfolio Standards Act (AEPS), which requires that 18% of all energy generation comes from alternative and renewable sources by 2021. Of that, 8% must be derived from renewable energy sources (Tier I Sources), such as wind, solar photovoltaic and solar thermal energy, and low impact hydropower, with 10% derived from alternative energy sources (Tier II). In addition, the Alternative Energy Investment Act authorized the creation of a $650 million Alternative Energy Investment Fund.

While commercial solar energy represents a relatively small portion of Pennsylvania's renewable generation total in 2011, this portion does not reflect the entire solar generation activity taking place throughout Pennsylvania. There has been significant growth in small scale solar installations not feeding directly into the electric grid and installed capacity has grown significantly over the past few years. Figure 11 reflects recent trends in electricity generation from alternative and renewable energy sources.

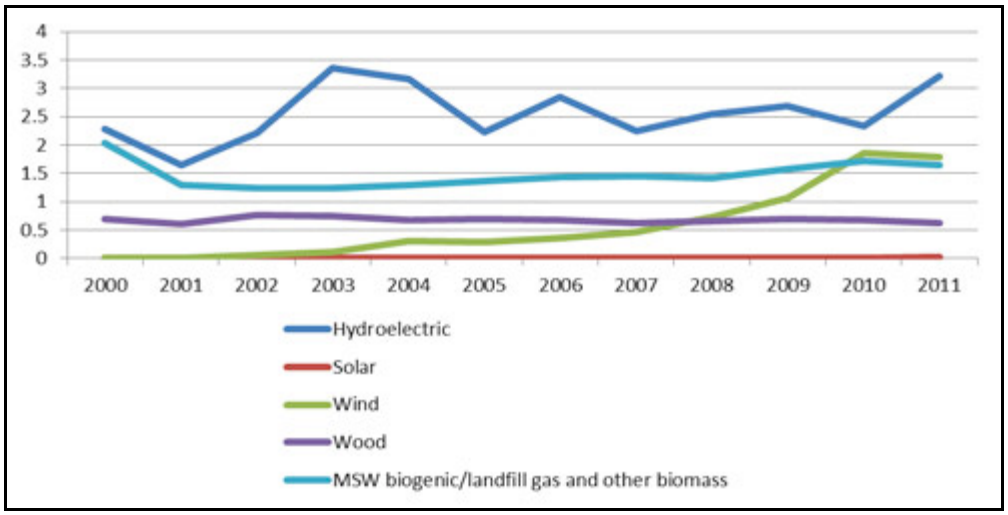
TIER I

Solar photovoltaic energy
Solar thermal
Wind power
Low-impact hydropower
Geothermal energy
Biologically derived methane gas
Fuel cells
Biomass energy
Coal mine methane
Black liquor
Large-scale hydropower

TIER II

Waste coal
Distributed generation systems
Demand-side management
Large-scale hydropower
Generation from wood processing
Integrated combined coal
Gasification technology

Figure 11 – Electricity Generation Trends by Alternatives & Renewables (billions of kWh)



Source: Commonwealth Economics, LLC

Solar

Solar power comes in two forms: solar photovoltaic (PV) which converts the sun's energy into electric energy, and solar thermal which uses the sun's energy to heat water or air for residential and commercial use. Pennsylvania has ample amounts of sunlight to make solar deployment feasible throughout the state.

According to a study prepared by the American Council for an Energy-Efficient Economy (ACEEE), solar energy is expected to be utilized as a major source of energy in Pennsylvania into the future, helping to further diversify the state's energy portfolio.

Solar deployment has increased due to a strong net-metering policy in Pennsylvania that permits customer-generators to sell excess power into the grid which helps to strengthen the reliability of the state's electric grid and mitigate transmission line upgrade costs.

A summary of the solar energy policy and program initiatives in Pennsylvania is shown in Table 1.

Largest Solar PV System in Pennsylvania

PA Solar Park

Nesquehoning, Carbon County

Completed in December 2012, PA Solar Park is the largest solar farm in Pennsylvania. Located in northeast Pennsylvania in Carbon County, PA Solar Park is an 11.5 mega-watt solar farm installed on 60 acres. The largest photovoltaic system in Pennsylvania it includes 39,644 solar PV modules.

Table 1 – Solar Energy Policy and Program Initiatives in Pennsylvania

Alternative Energy Portfolio Standards	• Set requirement of 860 MW PV by 2021 • Specified solar water heating as an energy efficiency option for offsetting electric water heating
Alternative Energy Investment Fund	• Set aside $100 million for solar incentive program • Established $80 million for economic development for solar manufacturers and large scale projects
Net Metering	• For residential solar up to 50 kW • For nonresidential solar up to 3 MW • For nonresidential solar > 3 MW and up to 5 MW, if available to the grid for emergencies
Standardized Interconnection Rules	• Established standardized fees and streamlined application process for customer-site distributed generation

Source: Pennsylvania Solar Energy Industries Association

By the end of 2012, over 6,600 solar PV systems have been installed in Pennsylvania with a combined capacity of 187 MW. Pennsylvania is currently ranked 9th in the nation for total solar capacity.[xvi] In addition, solar PV module prices have dropped approximately 90% over the past ten years. This cost reduction has made installation of solar energy more affordable and resulted in shorter payback periods for system owners.[xvii]

Wind

Situated along the mountain ridges of Somerset County, Pennsylvania is home to the first commercial wind farm east of the Mississippi River.

Since then, wind development has grown to over 660 turbines, representing 1,300 MW and ranking Pennsylvania 15th in the nation in total installed wind capacity and 9th in the nation for new capacity wind installations in 2012.[xviii] Electricity generated by wind, increased by 68.9% annually between 2000 and 2010."[xix]

According to the American Wind Energy Association, Pennsylvania's existing wind farms generate enough electricity to power 250,000 homes. A total of 41 MW of installed capacity was added in 2011, with an additional 550 MW installed in the first three quarters of 2012. An estimated 1,484 MW was in the planning and development stages in early 2013.[xx] The National Renewable Energy Lab estimates that Pennsylvania's wind resource could provide up to 6.4 % of the state's current electricity needs.[xxi]

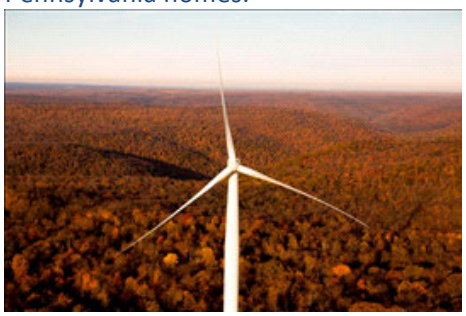
To make certain that Pennsylvania is positioned to maximize wind resources; the state is a partner in two wind-focused organizations: the Great Lakes Offshore Wind Energy Consortium and the Governors' Wind Energy Coalition. The Great Lakes Offshore Wind Energy Consortium, initiated by the U.S. Department of Energy, coordinates efforts to evaluate the potential for offshore wind generation projects in the Great Lakes and fosters collaboration and information sharing between state and federal regulatory agencies. Pennsylvania - along with the states of Illinois, Michigan, Minnesota and New York and federal agencies - joined the consortium in February 2012 under the leadership of the U.S. Department of Energy.

Pennsylvania's Largest Wind Farm – Powering More Than 40,000 Homes

Mehoopany Wind Farm

Wyoming County

Consisting of 88 wind turbines and covering nearly 9,000 acres, the Mehoopany Wind Farm is a 141 MW generation facility situated in northeastern Pennsylvania's Wyoming County. Owned jointly by BP Wind Energy and Sempra U.S. Gas & Power, the $250 million wind farm became commercially operational in December 2012. As Pennsylvania's largest wind farm, it provides enough renewable electricity to power over 40,000 Pennsylvania homes.



Pennsylvania served as a founding member of the Governors' Wind Energy Coalition. The coalition is a

bipartisan group of the nation's governors dedicated to the development of the nation's wind energy resources to meet domestic energy demand, reduce dependence on imported energy, collaborate on best practices and regulatory consistency and spur economic development.

Photo courtesy Gamesa

The wind industry is spurring economic development in Pennsylvania. The state is home to at least 22 facilities that manufacture and assemble components for the wind energy industry. Wind manufacturers have found that Pennsylvania's workforce possesses skills easily transferable to wind energy manufacturing.

From an environmental perspective, generating wind power creates no emissions and uses no water. The wind power installed in Pennsylvania avoids over 1.75 million metric tons of carbon dioxide emissions annually.[xxii] To protect birds and mammals from potential impacts of wind turbines, the Pennsylvania Game Commission has developed a Voluntary Wind Energy Cooperation Agreement with wind farm developers to monitor and respond to potential impacts to birds and mammals resulting from wind turbines. Most of the wind farms in Pennsylvania operate under this agreement.

Geothermal

In Pennsylvania, closed loop geothermal heat systems (ground source heat pumps) are typically used in homes or in small scale commercial and industrial applications, saving considerable heating and cooling costs.

In addition to local ground source heat pumps, large scale geothermal energy resources can be used to generate power. To better assess these resources and to make all geothermal data publically available, the American Association of State Geologists initiated a project to compile all state data into a national database with the Pennsylvania Geological Survey compiling information for Pennsylvania.

Hydropower

Pennsylvania has 17 large hydroelectric power plants and two pumped storage facilities. All together, these facilities have a capacity of over 2,000 MW. Figure 4 shows the locations of hydroelectric power plants in Pennsylvania.

With an efficiency rating of about 90%, hydroelectric power plants are one of the most efficient means of producing electricity and have the ability to generate power for decades. Another key to the usefulness of Pennsylvania hydropower plants is their ability to generate power near where electricity is needed, reducing the power inevitably lost during transmission. Quick response to changing system conditions is an additional favorable characteristic that continues to make hydropower plants attractive sources of electric power.

Pennsylvania has great potential in the application of micro-hydropower water turbines, generating up to 100 kW of electricity, which can produce power continuously. If properly sized and sited, these plants use little, if any, stored water to provide water flow through the turbines.

Biomass

With 17 million acres of forestland, Pennsylvania - "Penn's Woods" - possesses significant biomass resources. Biomass is organic material from plants or animals, such as rice hulls, corn, manure, switchgrass, wood, wood residues and algae that can be burned for heat; digested to produce methane, which in turn can be used to generate electricity; or fermented to produce fuels. Woody biomass is found in forests and includes wood, bark, sawdust, timber slash and mill scrap.

Woody biomass and cellulosic ethanol are emerging options for producing fuel, heat, electricity and combinations of these while simultaneously lowering greenhouse gas emissions.[xxiii] Because the national focus for corn-based ethanol production has brought about increasing concerns concerning competition for food resources, opportunity and investment has shifted to woody biomass, and the ability to generate cellulosic ethanol from both natural forests and short rotation woody crops such as hybrid poplar or willow.

Research on non-food biomass sources, such as willow, miscanthus and switchgrass, is being conducted in Pennsylvania. In 2012, the U.S. Department of Agriculture awarded approximately $10 million in research funding to Pennsylvania State University to develop biomass supply chains for the production of liquid transportation and aviation biofuels in the Northeast United States. The research will establish private-public partnerships with a goal of generating at least 100 supply contracts and supporting more than 50 new supply chain businesses to harvest, transport and pre-process biomass. This is one of six Regional Biofuels Systems established in the nation.

Turning Waste into Energy

Kline's Services

Salunga, Lancaster County

Recipient of a 2013 Governor's Award for Environmental Excellence, Kline's Services, Inc. is a commercial wastewater management firm putting grease, oil waste and wastewater sludge to good use. Kline's processes wastewater from a variety of sources, and also processes food wastes from many different industries. Kline's processes the wastes through a digester that produces methane, which in turn generates up to 600 kW of electricity year round.

The process is so productive Kline's creates more electricity than it needs. In addition to sending excess electricity back to the grid, which both lowers the firm's costs and increases grid reliability, Kline's has cut down on the number of solids produced from its wastewater processing by more than 20%.

Research and development is also being conducted in Pennsylvania on converting algae, septage and sewage to energy using bio-digestion. Using combined heat and power generation technology, bio-digestion harnesses methane from decomposing organic matter, or biomass, manure and food waste as a fuel for electric and heat generation, with capacity factors approaching 95%. More than 30 farms and food processors in the state have on-site bio-digesters to capture methane and use it to make hot water or electricity. Combined, these facilities generate more than 5 MW of electricity a year, or enough to

power 3,000 homes, all while reducing waste. Wastewater treatment plants in Philadelphia, York, Lackawanna, Northumberland, Northampton, Dauphin and Mercer are also using bio-digestion technologies to simultaneously reduce environmental impacts and energy costs.

Biofuels

The Biofuel Development and In-State Production Act (Act 78 of 2008) seeks to have Pennsylvania produce and use one billion gallons of clean and renewable liquid fuels annually. One billion gallons of biofuel represents about 12.5% of all transportation fuel consumption in the state, and by 2017, would equal approximately the amount of fuel Pennsylvanians bought from the Persian Gulf in 2007. Starting May 1, 2010, all diesel fuel sold in the Commonwealth contained 2% biodiesel, which will displace 400 million gallons of oil by 2020. The level will increase incrementally from 2% up to 20% as the in-state biodiesel annual production increases to the Act's goal of 400 million gallons.

Pennsylvania's fuel distribution system is capable of blending in excess of 2.3 billion gallons of biodiesel annually. Since 2008, biodiesel production has increased from an initial annual production of 25 million gallons to more than 45 million gallons in 2012.

Pennsylvania has established the largest biodiesel industry in the eastern United States with facilities that have a total capacity of approximately 82 million gallons. In addition, 20 biodiesel capable pipeline terminals enable Pennsylvania to distribute over 3.8 billion gallons of biodiesel blends annually.

Hydrogen Fuel Cells

Fuel cells use the energy of hydrogen to produce electricity with water and heat as by-products. Compared to combustion-based technologies used in power plants and vehicles, fuel cells emit no harmful emissions at the point of operation. If pure hydrogen is used as a fuel, fuel cells emit only heat and water as by-products. Fuel cells are flexible and can provide energy for systems as large as a city or as small as a home appliance. Pennsylvania is home to manufacturers of world-class hydrogen fuel cell

Turning Woody Biomass into Biofuels

Renmatix

King of Prussia, Montgomery County

Pennsylvania timber is used far and wide as a sturdy and reliable construction material. In King of Prussia, Renmatix has developed an innovative way to turn low-value woody biomass and waste from sawmills into cellulosic sugars. These sugars can be used as a petroleum alternative in biofuels and biochemicals. The company's business not only boosts the economies of agricultural and timber communities where Renmatix is purchasing its materials, but also supports jobs throughout the sugar supply chain, including the chemical, fuel and materials manufacturers who require affordable, renewable sugars to make biobased products. Currently, Renmatix is headquartered in southeastern Pennsylvania, taking advantage of the area's highly skilled and knowledgeable workforce. Renmatix has more than doubled its workforce in the last 12 months, in part to staff a new processing facility onsite – the Bioflex Conversion Unit – that tests and converts a range of locally and globally available plant materials including perennial grasses, agricultural residues, softwoods and waste streams, into sugar using the company's proprietary water-based Plantrose™ process. The company's sugars are enabling the transition to biofuels and biobased products, resulting in a cleaner Pennsylvania and renewable global environment.

technology and components, such as Air Products and Chemicals.

Making an Impact

In addition to creating jobs, alternative and renewable fuels add significant diversity to Pennsylvania's energy portfolio. Electric generation from wind, solar, hydropower and other alternative and renewable energy resources can provide zero emission energy, mitigate new transmission costs and help to strengthen the reliability of the electric grid.

ALTERNATIVES & RENEWABLES: MAKING AN IMPACT

- Inexhaustible, domestic energy sources
- Pennsylvania is the 3rd leading solar state in the nation
- Ranked 15th in the nation for installed wind capacity
- Ranked 9th for new wind installations in 2012

This diversity of resources, combined with the Commonwealth's strong commitment to competitive energy markets (see the *Competitive Energy Markets* section), grows job and career opportunities while expanding the generation choices available to consumers. Alternative and renewable energy resources are positively impacting job and economic growth in Pennsylvania. Here are a few highlights:

- The Pennsylvania Department of Labor & Industry projected jobs associated with alternative and renewable energy development to increase 6% between 2010 and 2012.[xxiv]
- More than half of these jobs are in construction; manufacturing; and professional, scientific and technical services.
- The Solar Foundation's National Solar Jobs Census 2011 estimated the number of solar jobs in Pennsylvania at 4,703.[xxv]
- The American Wind Energy Association reports that in 2011 Pennsylvania's wind industry:
  - Supported between 3,000 and 4,000 direct and indirect jobs,
  - Generated $1.4 million in property tax payments by wind project owners, and
  - Resulted in annual land lease payments of more than $2.3 million.[xxvi]

Advancing Pennsylvania's Energy Policy

Alternative and renewable energy sources are increasingly playing an important role in Pennsylvania's energy portfolio. Wind, solar, and other alternative and renewable resources are helping to create jobs, stabilize and strengthen our electric grid and diversify our energy portfolio. Biofuels are increasingly fueling our transportation sector, lessening our dependence on foreign oil, cleaning our air, and strengthening our energy security. Pennsylvania will continue to support market-based decisions that increase the use of naturally regenerative and domestic energy resources.

ENERGY EFFICIENCY, DEMAND RESPONSE & STORAGE

Energy Efficiency

Energy efficiency – using the energy you need with as little waste as possible - plays a prominent and growing role in meeting the growing energy demands of Pennsylvania consumers. According to the Keystone Energy Efficiency Alliance, "(Energy efficiency) is in virtually every building and every commercial process in Pennsylvania. It is the largest clean energy resource in the state."[xxvii] Based on a 2009 study by the American Council for an Energy-Efficient Economy, energy conservation and efficiency can cost effectively meet fully 30% of Pennsylvania's energy requirements.[xxviii]

Key to maximizing the benefits of energy efficiency is developing and implementing energy-saving policies, energy conservation outreach programs and partnerships with commercial and industrial establishments, educational institutions, residents, local governments and others. The Pennsylvania Department of Environmental Protection's Office of Pollution Prevention and Energy Assistance is committed to advancing key strategies to promote energy efficiency.

In 2008, the Pennsylvania General Assembly enacted Act 129, which requires the Pennsylvania Public Utility Commission (PUC) to adopt an energy efficiency and conservation program for the reduction of energy demand and consumption by each Pennsylvania Electric Distribution Company with at least 100,000 customers. The major energy efficiency and conservation provisions of Act 129 include the following:

- 3% reduction in electricity consumption by 2013.
- Peak load reduced by 4.5% by 2013.
- Smart meters installed throughout Pennsylvania within 15 years.
- Voluntary, flexible electricity pricing schedules for consumers.

As of May 2012, utilities have reported almost 3.5 million MWh in energy efficiency savings. The companies also reported 500 MW of peak demand reductions through their programs.

The PUC recently determined that additional potential, cost-effective savings are available in the state and directed utilities to develop plans that will further reduce electricity usage over three years, starting in June 2013. For Phase 2 of the initiative, the PUC has adopted different energy reduction targets for each utility service territory, averaging to a total statewide reduction of 3.3 million MWh, or 2.2% through May 2016. Refer to Table 2. These reductions must demonstrate a net savings to Pennsylvania consumers. Phase I of the energy efficiency and conservation program resulted in excess of $1 billion in savings to Pennsylvania consumers.

Table 2 – Energy Efficiency Targets by Utility Territory (2013-2016)

Utility Territory	Three-Year % of Energy Efficiency Reductions
Duquesne	2.0
Met-Ed	2.3
Penelec	2.2
Penn Power	2.0
PPL	2.1
PECO	2.9
West Penn	1.6
Average	**2.2**

Source: Pennsylvania Public Utility Commission

Since the enactment of Act 129, Pennsylvania has saved 3,383,465 MWh of electricity and avoided 3,113,207 tons of CO_2 emissions.[xxix] Further, as Pennsylvania's Electric Distribution Companies have met Act 129 goals they have helped foster the economic development benefits associated with the energy efficiency industry, including 800 jobs created since 2009. Studies cite the local nature of energy efficiency-related economic activity, showing that dollars generated by investment in energy efficiency remain in-state.

Net Metering

Distributed generation technologies are net metered. Net metering uses bi-directional meters that are able to measure energy that is delivered to the end user and, more importantly, measure energy that the end user sells back to local utilities. In Pennsylvania, the majority of net meters connect users to the grid and the users are credited for the power they generate but do not use. Under Pennsylvania law, the excess generation is owned by the system owner and, under rules established by the PUC, system owners are compensated for the electricity they sell back to the grid. This provides a significant incentive to both install distributed generation as well as scale the project appropriately to provide a potential revenue source for the system owner. There are approximately 8,024 net metering systems in place in Pennsylvania, with an installed capacity of 184.7 MW. In total, these end users sold 6,742.5 MWh of electricity to electrical distributors in 2011. Solar photovoltaic systems, primarily those of residential customers, generated more than 95% of the capacity and 99% of the energy sold.[xxx] Table 3 shows net meters by fuel type and net metering customers.

Table 3 – Net Meters in Pennsylvania

Fuel Type and Sector	Net Metering Customers	Installed Capacity (MW)	Energy Sold to Utilities (MWh)
Photovoltaic (solar)	7,766	175.9	6,704.6
Wind	224	1.0	1.4
All Other	34	7.8	36.5
Total	**8,024**	**184.7**	**6,742.5**

Source: Commonwealth Economics, LLC

Combined Heat and Power

Combined Heat and Power (CHP), or cogeneration, generates power and thermal energy from a single fuel source. Heat is a by-product of conventional power generation that is often wasted. CHP projects recycle that thermal energy and put it to beneficial use such as heating buildings and heating water, processes that would typically require the use of additional forms of energy. CHP projects can also capture waste heat in the form of steam and use it to generate electricity. Combined heat and power generation and consumption can substantially increase the percentage of input energy that is productively utilized. According to ICF International, there are approximately 135 CHP installations in Pennsylvania.[xxxi] These installations are fueled by many different sources with the dominant source being natural gas. Table 4 lists CHP installations by fuel type.

Table 4 – Pennsylvania Combined Heat and Power Installations

Fuel Type	# of Installations	Capacity (MW)
Biomass	23	81
Coal	24	1,113
Natural Gas	54	1,475
Oil	7	18
Waste	22	555
Wood	2	31
Other	3	5
Total	**135**	**3,276**

Source: Commonwealth Economics, LLC

In addition, a 2012 survey of small distributed generation facilities (i.e. less than 1 MW capacity) by the U.S. Energy Information Administration estimated that 270 such facilities exist in Pennsylvania with a total generating capacity of nearly 105 MW. Over 99% of this capacity is used for emergency backup service and the generation is provided primarily by internal combustion/reciprocating engines. These dispersed generation facilities are not connected to the electrical grid, as their critical function is to provide continuity of service when there are power outages on the grid.[xxxii]

Waste-to-Energy

Landfill gas and other waste-to-energy projects use a waste product as a resource. Decomposing waste emits methane gas and these emissions are managed either by flaring or by capturing and using the energy in the gas for electricity or thermal needs. Landfills serve as tremendous opportunities to capture this gas to generate electricity, power on-site operations or refine and sell in the retail market. Currently, 90,000 homes in Pennsylvania are powered through waste-to-energy generation.

Pennsylvania's municipal solid waste landfills were early adopters of both landfill gas collection systems and landfill gas-to-energy (LFGTE) equipment. As a result, Pennsylvania ranks 2nd in the nation in the number of operating gas-to-energy projects. In June 2004, there were approximately 24 projects operating statewide. Today, Pennsylvania has 40 gas-to-energy projects generating 171 MW of electricity, supplying gas through four pipelines for direct use by manufacturing and other facilities, and producing high BTU gas that is injected into natural gas pipelines for use by consumers, including commercial power plants. The electricity produced at gas-to-energy facilities at Pennsylvania landfills reduces greenhouse gases by 7.23 million metric tons per year, which is the equivalent to the annual greenhouse gas emissions that occur from 1.4 million passenger cars. Pennsylvania recognizes the benefits of electric generation from landfill gas by including it as a Tier I resource under the state's Alternative Energy Portfolio Standards Act.

Pennsylvania also hosts six waste-to-energy facilities that burn over 3.2 million tons of waste per year. These facilities generate approximately 270 MW of electricity. Each of these facilities is equipped with air pollution controls and continuous emission monitoring systems to control and reduce emissions of metals, particulates, nitric oxides and sulfur oxides. While overall waste disposed in Pennsylvania has

been decreasing, the quantity of waste burned to recover energy has been increasing.

Agriculture serves as Pennsylvania's number one industry, which provides opportunities for decomposing manure and waste food products to generate methane. More than 30 Pennsylvania farms and food processors have anaerobic digesters that generate electricity or hot water from the methane collected at their facilities. Combined, this generation totals nearly 5 MW of power, or enough for approximately 3,000 homes. More importantly, the digesters help farmers save money by transforming waste into a resource. The digesters also improve with nutrient and odor management, and reduce pathogen loading of the digested manure.

Workforce Needs

Implementing energy efficiency efforts requires a skilled workforce to assess and make recommendations to improve a structure's overall efficiency. Pennsylvania currently has two training centers that are approved by the U.S. Department of Energy to provide energy efficiency training, specifically for weatherization: the Energy Coordinating Agency in Philadelphia and Pennsylvania College of Technology in Williamsport. The Energy Coordinating Agency is on track to become the only accredited training center in the Mid-Atlantic region. Additionally, the Energy Efficient Building Hub located in Philadelphia, sponsored in part by the U.S. Department of Energy, conducts training and provides career development for energy efficiency professionals.

Energy efficiency training and certification in Pennsylvania is also provided through Building Performance Institute (BPI) training and testing centers. BPI certified professionals are credentialed to assess the comfort, safety, durability and energy efficiency of existing housing. BPI is also a partner in the U.S. Department of Energy's Guidelines for Home Energy Professionals project. The Energy Coordinating Agency and Pennsylvania College of Technology also offer Home Energy Professional certification exams through this effort.

Demand Response

Demand response is the temporary reduction of electric consumption by end-use customers in response to a signal, such as an emergency alert from PJM Interconnection or simply high prices. Customers may curtail their usage by allowing building temperatures to increase, shutting down unnecessary lighting, moving operations to off hours or operating properly permitted emergency engines.

The benefits of demand response include greater reliability protection against blackouts, reduced costs to consumers by avoiding the use of the most expensive power plants during the most expensive hours and keeping energy dollars in the Commonwealth in the form of payments to businesses and institutions who participate in demand response markets.

Demand response is saving Pennsylvania consumers billions of dollars in reduced capacity payments to the PJM Interconnect. The PJM Independent Market Monitor, an economist that monitors the markets that PJM runs, estimated that energy efficiency and demand response saved customers in the PJM territory $11.8 billion in the 2013/14 market year.[xxxiii] Most of this was from demand response. Because Pennsylvania has a little over one-fourth of the overall demand in PJM, that means that Pennsylvanians saved a little around $3 *billion* in one year alone by the presence of demand response in the PJM markets.[xxxiv]

These are savings to all Pennsylvanians who use electricity and do not include the millions of dollars in payments to Pennsylvania businesses and institutions for actually participating in demand response programs. Additionally, the avoided costs of new generation and transmission demonstrates the benefits of embracing a market approach to demand response, by deploying these critical resources to where they make the most economic sense.

Energy Storage

Because generated electricity is relatively fixed over short periods of time even though demand for electricity fluctuates throughout the day, developing technology to store electrical energy so it is available to meet demand whenever needed represents a major opportunity for efficiency within electricity distribution. These devices can also help make renewable energy, whose power output cannot be controlled by grid operators, available for dispatch to meet baseload energy needs. Due to energy use fluctuation, the energy lost in transmission, and the cost associated with firing up power plants for a short period of time to meet peak demand, ensuring there is enough power on the grid is one of the most difficult challenges in the energy industry. Pennsylvania is taking the lead in developing energy storage with several Pennsylvania companies positioned as industry leaders in energy storage devices.

Improving Energy Storage

Aquion Energy

East Huntingdon Township, Westmoreland County

In February 2012, Aquion Energy announced it selected a site in Westmoreland County to build its first full-scale manufacturing facility to produce sodium ion batteries and energy storage systems. One of the solutions is to store the energy in batteries and storage systems across the grid to meet demand. Aquion, a company that started as an idea at Carnegie Mellon University, has developed an innovative new battery using sodium ions that costs much less, lasts much longer and presents considerably reduced environmental concern during disposal than existing battery storage systems. The facility will develop both high and low voltage battery packs to meet a variety of needs and expects to produce 500 MWh per year of storage capacity.

Energy storage is also a key and critical component of effectively deploying electric vehicles in Pennsylvania. Continuing advances in energy storage will increase the amount of electric vehicles on the road.

Making an Impact

Energy efficiency has proven extremely beneficial to improving the effectiveness of Pennsylvania's overall energy portfolio while saving businesses and other consumers' money. Consider the following:

- 3,383,465 MWh of electricity saved from 2009 to August 2012 in Pennsylvania.[xxxv]
- 582 MW of total demand reduction

ENERGY EFFICIENCY & STORAGE: MAKING AN IMPACT

- 5th highest number of energy efficiency jobs in the nation in 2010
- Act 129 efficiency programs saved electric customers $278 million annually through 2011
- Bringing advanced technology to consumers to improve energy efficiency

achieved.

- 3,113,207 tons of reduced CO2 emissions.
- Annual savings of approximately $278 million for electric ratepayers.[xxxvi]

In 2010, Pennsylvania had the 5th highest number of energy and resource efficiency jobs in the nation with 42,548 employees.[xxxvii] As the PUC continues to implement energy efficiency and conservation programs, and other regional efforts like Philadelphia's Optimal Energy continue to take hold, it is estimated that energy efficiency programs will create over 1,600 jobs in 2013.[xxxviii] Consumers have seen approximately $8.00 in ratepayer savings for every $1.00 spent on the program.[xxxix]

Advancing Pennsylvania's Energy Policy

Energy efficiency and storage continue to be the least expensive, safest, cleanest and most accessible ways to recover energy. Similarly, new advances in energy storage will help conserve resources used to generate energy, stabilize the electric grid and maximize electric generation opportunities at times of traditional low demand. Pennsylvania's recognition of the benefits of energy efficiency and storage, and its commitment to pursuing the development and deployment of new and innovative efficiency and storage technologies, will provide increasing benefits to energy consumers into the future.

COMPETITIVE ENERGY MARKETS

Pennsylvania's competition laws, the Electricity Generation Customer Choice and Competition Act (Act 138 of 1996) and the Natural Gas Competition Act (Act 21 of 1999), let the consumer choose their electric and natural gas supplier. Pennsylvania was the 2nd state in the nation to deregulate electricity and natural gas. Competition spurred by deregulation rewards innovation and creativity and lets the consumer choose the product that best suits their needs.

Competitive markets incent suppliers to offer commercial, industrial and residential customers a variety of products to manage energy costs, save money and pursue a preferred energy generation source if they desire.

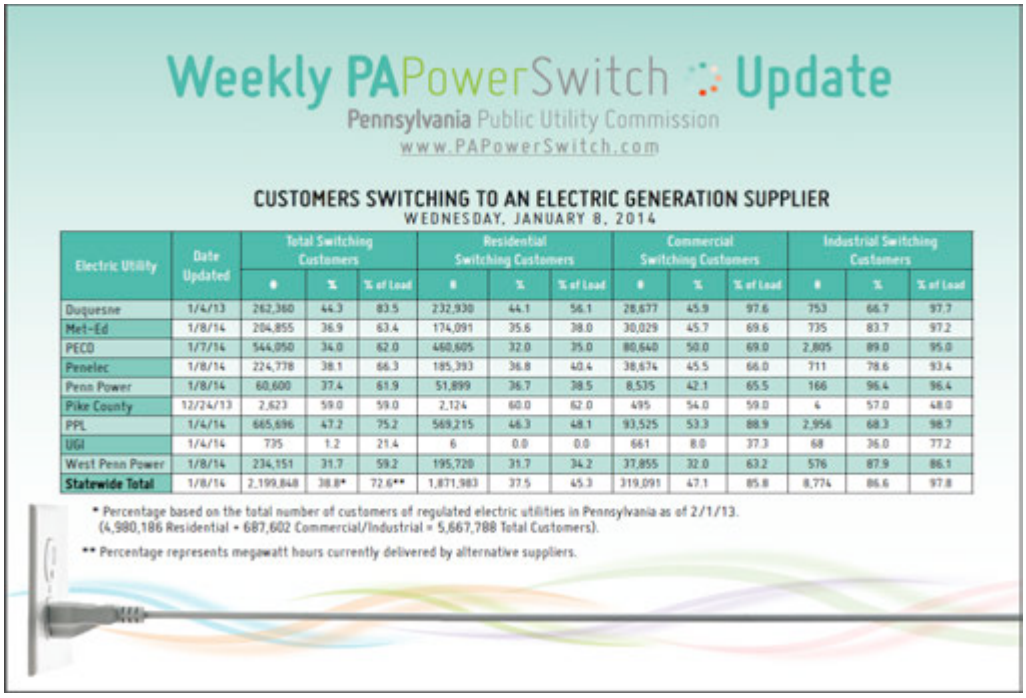
Competition provides customers opportunities to realize cost savings. The average price of electricity, adjusted for inflation, has fallen in many states with successful competitive retail markets, providing customers some of the lowest electricity prices in years. In Pennsylvania, the abundance of affordable natural gas, combined with a robust electric choice program, has lowered wholesale electricity prices over 40% in just the past five years, saving the average household nearly $1,000 a year and even greater savings for commercial and industrial customers. Lower utility overhead costs mean more money to invest in business operations and create new jobs.

Competition also enables the cost-effective development and expansion of alternative and renewable energy resources, benefitting consumers and the environment. This market-based option allows customers to support the development of Pennsylvania's renewable energy portfolio and choose suppliers that generate electricity through renewable energy sources such as wind or solar, while providing a strong foundation to better ensure the long-term sustainability of these growing industries.

Electric & Natural Gas Choice is Working

The Pennsylvania Public Utility Commission provides weekly reports (PAPowerSwitch.com) to monitor Pennsylvania's progress in providing choice to consumers. To date, over 2 million customers have switched electric generation suppliers, with 35% of these customers switching since December 31, 2010. Over 86% of all industrial customers, nearly 45% of commercial customers and over 34% of residential customers have switched electric generation suppliers. Refer to Figure 12. In Pennsylvania, over 70% of the commercial electric load and nearly 95% of the industrial electric load is provided by competitive electricity suppliers.

Figure 12 – PAPowerSwitch Update



Weekly PAPowerSwitch Update

Pennsylvania Public Utility Commission

www.PAPowerSwitch.com

CUSTOMERS SWITCHING TO AN ELECTRIC GENERATION SUPPLIER

WEDNESDAY, JANUARY 8, 2014

Electric Utility	Date Updated	Total Switching Customers			Residential Switching Customers			Commercial Switching Customers			Industrial Switching Customers		
		#	%	% of Load	#	%	% of Load	#	%	% of Load	#	%	% of Load
Duquesne	1/4/13	262,360	44.3	83.5	232,930	44.1	56.1	28,677	45.9	97.6	753	66.7	97.7
Met-Ed	1/8/14	204,855	36.9	63.4	174,091	35.6	38.0	30,029	45.7	69.6	735	83.7	97.2
PECO	1/7/14	544,050	34.0	62.0	460,605	32.0	35.0	80,640	50.0	69.0	2,805	89.0	95.0
Penelec	1/8/14	224,778	38.1	66.3	185,393	36.8	40.4	38,674	45.5	66.0	711	78.6	93.4
Penn Power	1/8/14	60,600	37.4	61.9	51,899	36.7	38.5	8,535	42.1	65.5	166	96.4	96.4
Pike County	12/24/13	2,623	59.0	59.0	2,124	60.0	62.0	495	54.0	59.0	4	57.0	48.0
PPL	1/4/14	665,696	47.2	75.2	569,215	46.3	48.1	93,525	53.3	88.9	2,956	68.3	98.7
UGI	1/4/14	735	1.2	21.4	6	0.0	0.0	661	8.0	37.3	68	36.0	77.2
West Penn Power	1/8/14	234,151	31.7	59.2	195,720	31.7	34.2	37,855	32.0	63.2	576	87.9	86.1
Statewide Total	1/8/14	2,199,848	38.8*	72.6**	1,871,983	37.5	45.3	319,091	47.1	85.8	8,774	86.6	97.8

* Percentage based on the total number of customers of regulated electric utilities in Pennsylvania as of 2/1/13. (4,980,186 Residential + 687,602 Commercial/Industrial = 5,667,788 Total Customers).

** Percentage represents megawatt hours currently delivered by alternative suppliers.

Pennsylvania's commitment to competitive markets is working. In December 2012, Pennsylvania was recognized as the top state for the number of electric generation suppliers, according to the Annual Baseline Assessment of Choice in Canada and the United States (ABACCUS). Pennsylvania achieved this ranking in the ABACCUS report for having significant individual residential consumer choice; having a growing number of eligible residential consumers selecting a supplier, a pricing plan, and the services they prefer; and having a growing number of diverse, innovative customer offers. [xl]

In addition, according to a study completed for the COMPETE Coalition, a nationwide organization of stakeholders supporting competitive electricity markets, "During the past three years, the growth in retail electric choice in both the C&I (commercial and industrial) and the residential segments has been stunning. … C&I electric load in Pennsylvania will likely become totally competitive over time."[xli] The report attributes this growth in large part to the proactive monitoring and oversight of the Pennsylvania Public Utility Commission.

Following upon the success of electric competition in Pennsylvania, the Legislature passed the Natural Gas Choice and Competition Act in 1999. The act allows all natural gas customers to choose who

supplies their natural gas. As with electricity, the transmission and distribution infrastructure is still maintained by the utility.

To date, over 350,000 residents and businesses representing 12% of customers have switched to a competitive supplier for their natural gas needs. Over 120 suppliers are licensed in Pennsylvania to meet the needs of natural gas customers. Pennsylvania is exploring ways to further enhance the natural gas supply competitive market.

Making an Impact

Pennsylvania's competitive electricity and natural gas energy markets provide substantial savings for households, businesses and industry. Energy costs have been on the decline with average wholesale electricity prices dropping over 40% in the past five years. Competitive electric markets provide the ideal opportunity for alternative and renewable energy resources to flourish, while attracting customers seeking to choose a preferred supplier. Competitive natural gas markets offer the opportunity to take advantage of Pennsylvania's abundant natural gas resources.

COMPETITIVE ENERGY MARKETS: MAKING AN IMPACT

- Ranking 5th in the Nation for Electricity Generation
- Improving the Economic Bottom Line – 40% decrease in wholesale electricity prices in the past 5 years
- Over $15.3 billion in direct economic impact

Advancing Pennsylvania's Energy Policy

Through the efforts of Pennsylvania's elected officials, and the Public Utility Commission, Pennsylvania has made remarkable strides in working with local distribution companies to make electricity and natural gas affordable and reliable. In an era of increasing national and international business competition, Pennsylvania's successful embrace and recognition of the benefits of competitive energy markets means more savings – and more options – for business investment in the Commonwealth.

4. MAKING USE OF OUR RESOURCES

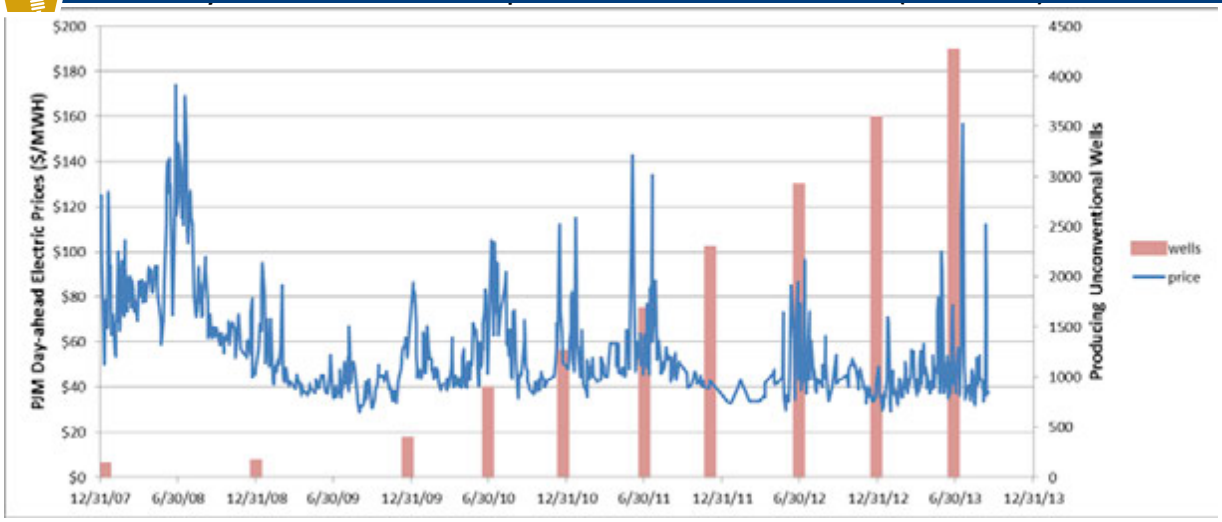
Pennsylvania has no shortage of opportunities to maximize the benefits our impressive energy portfolio. This section includes a synopsis of those benefits and how we use our energy resources to our competitive advantage.

Abundant, Affordable, Domestic Energy

Whether it is your retirement portfolio or your workforce, diversity is essential to success. Pennsylvania is fortunate to have one of the most diverse energy portfolios in the nation. Local communities are benefitting. For example, a December 2012 Brookings Institution study pegged Pittsburgh, located in the heart of natural gas development and home to a still robust coal industry and growing renewables sector, as one of only three United States cities to recover to pre-recession economic levels. The U.S. Bureau of Labor Statistics listed Washington and Butler counties, located in Southwest Pennsylvania near Pittsburgh, on their top 10 list of counties for employment growth for 2010. And the U.S. Department of Commerce listed Williamsport, located in Lycoming County in Northcentral Pennsylvania, as the 7th fastest growing metropolitan area in the country in 2011.

Pennsylvania's key industries, from agriculture to manufacturing, look to a bright future thanks in no small part to the energy security provided by the state's many energy resources. The average price for the PJM day ahead electricity market continues to decrease and show less volatility, in great part due to abundant and inexpensive natural gas as a fuel for power generation. See Figure 13, which shows the trend in lower PJM day-ahead prices compared to the increase in unconventional gas wells between 2007 and 2012.

Figure 13 – PJM Day-Ahead Electric Prices Compared to Unconventional Gas Wells (2007-2013)



Source: Pennsylvania Public Utility Commission, Pennsylvania Department of Environmental Protection

In December 2011, the Philadelphia Inquirer reported that "the five big regional utilities that serve Pennsylvania and New Jersey customers have reduced their prices on the gas portion of bills by amounts ranging from 37% to 52% since December 1, 2008, reflecting the steady fall in market prices that experts attribute to new supplies of shale gas." This means significant savings – totaling tens of thousands of dollars - for customers served by these utilities.

Figure 14 and Figure 15 show a significant drop in the cost of overall power prices between 2008 ($84.66/MWh) and 2012 ($47.77/MWh). The most significant component of these decreases is the *energy* portion of the price, which has declined from $71.00/MWh to $35.23/MWh.

Figure 14 – PJM Wholesale Cost (2008)

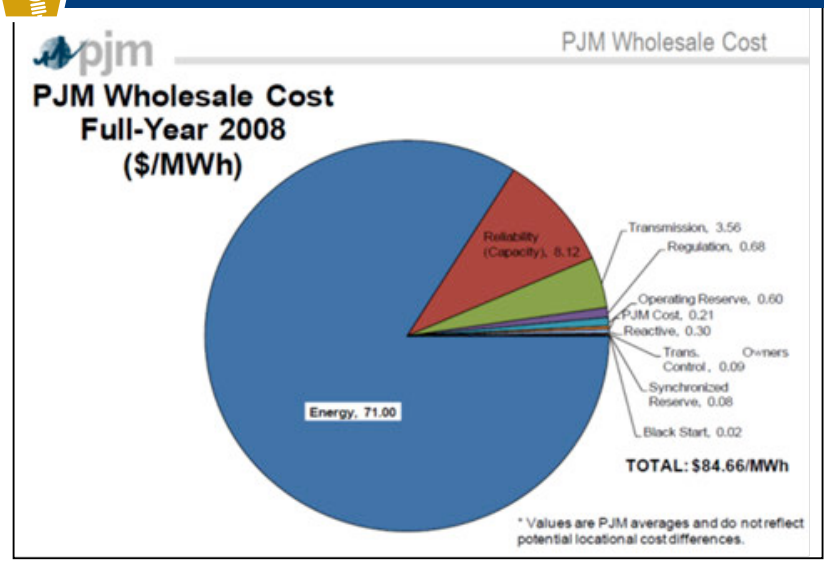
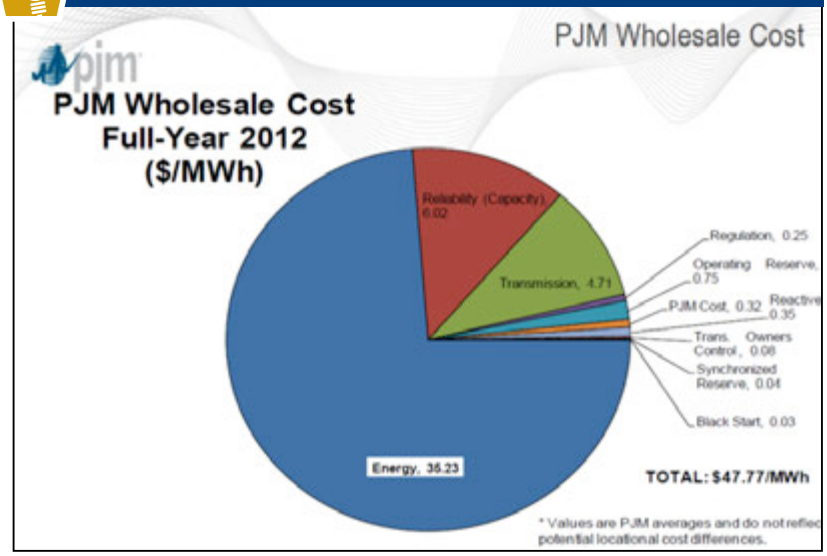


Figure 15 – PJM Wholesale Cost (2012)



A November 2012 report from TD Bank showed that low natural gas prices are expected to save the average American household about $650 per year in 2013 – for a total of $75 billion in saved utility costs across the country. The same report showed the entire manufacturing sector could save more than $50 billion per year in the form of reduced energy costs. Pennsylvania's location within a robust shale-gas region – accounting for over 25% of the United States' shale gas production in 2013 – means that these benefits are magnified even further. Table 5 shows how reductions in purchased gas costs by natural gas suppliers are saving Pennsylvania consumers money.

Table 5 – Reductions in Purchased Gas Cost (PGC) Rates

Utility	PGC Rate / mcf		% Change	Customer^ Savings
	2008*	2012*	2008-2012	Monthly
PECO	$11.10	$5.49	51%	**$84.15**
NFG	$10.34	$4.82	53%	**$82.80**
PGW	$10.58	$4.71	56%	**$88.05**
Columbia	$10.25	$4.15	60%	**$91.50**
Equitable	$11.81	$5.56	53%	**$93.75**
UGI	$11.79	$6.38	46%	**$81.15**
UGI Penn	$10.66	$5.22	51%	**$81.60**
Peoples	$9.53	$3.39	64%	**$92.10**

* 1st Quarter 2008 and PUC-approved rate for 2012 ^ Residential heating customer using 15 mcf/month

Source: Pennsylvania Public Utility Commission, 2012

Pennsylvania is within a day's drive of 60% of North America's population and six of the nation's 10 largest markets, meaning hundreds of millions of people are accessible with minimal transportation and delivery costs. The flows of pipelines are also reversing. Where once gas flowed from the west and southwest to the northeastern United States, Pennsylvania, having become a net exporter of gas in 2011, is providing energy to the growth markets of the Atlantic seaboard and beyond. Additional Pennsylvania energy from coal, nuclear and renewables are fueling a revived manufacturing sector in our state and in the nation.

Diversifying Transportation Fuel

Today, 95% of Pennsylvania's transportation sector is fueled by petroleum. Abundant, affordable, domestic energy makes diversifying this portfolio achievable. Pennsylvania's ingenuity is readying new transportation infrastructure opportunities, including natural gas, electric vehicles and propane.

The Pennsylvania Turnpike Commission operates the Pennsylvania Turnpike, which traverses the southern tier and northeastern portion of the Commonwealth and was one of the first limited access fee based roadways in the country. Feasibility studies assessing the deployment of CNG, LNG and electric infrastructure have been completed by the Turnpike Commission. In a few short years, the Pennsylvania Turnpike, which spans 360 miles east-west across the width of the state, will likely have infrastructure in place to fuel both natural gas and electric vehicles. During the summer of 2013, construction of electric vehicle charging stations began at select turnpike service plazas.

In addition to vehicles, there are potential opportunities to switch the type of fuel used to transport goods along our navigable waterways. This is demonstrated by the Port of Pittsburgh Commission, which launched the Clean Fuels/Clean Rivers initiative. The initiative is focused on building a natural gas

marine corridor extending from Morgantown, West Virginia through Pennsylvania, and down the Ohio River to Huntington, West Virginia. The end goal is to replace diesel with natural gas to fuel the transport of commodities along the inland waterway system, which encompasses about 12,000 miles of navigable waters.

Energy Security through Energy Independence

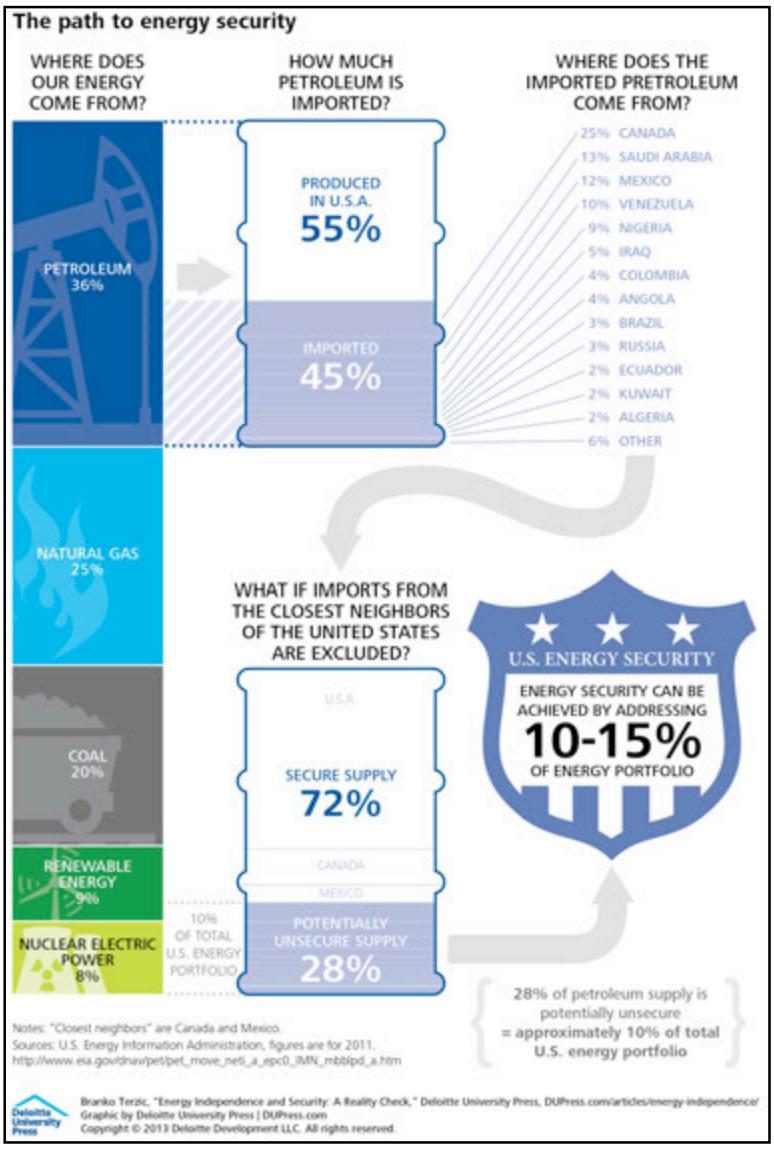
Key to any strong energy portfolio is protection from price volatility and supply disruptions. Pennsylvania's diverse energy resources have been significant contributors to stabilizing energy prices for consumers. The PUC and PJM Interconnection work to ensure a steady and affordable flow of energy to power Pennsylvania's business.

The U.S. Energy Information Administration (EIA) forecasts that the United States energy budget in 2035 will remain dominated by oil, natural gas and coal. Combined, these sources will provide 73% of our energy usage, just below what these sources provide today. Pennsylvania is home to the 2nd largest energy field in the world, with more BTU energy equivalent of natural gas in the state than Saudi Arabia has in oil, and can help supply our nation's energy budget.

EIA's *Annual Energy Outlook 2013 Early Release* projects United States natural gas production to increase 44% from 23.0 trillion cubic feet in 2011 to 33.1 trillion cubic feet in 2040. Almost all of this increase in domestic natural gas production is due to growth in shale gas production, which is projected to increase from 7.8 trillion cubic feet in 2011 to 16.7 trillion cubic feet in 2040. Indeed, shale gas production in Pennsylvania topped 2 trillion cubic feet in 2012; nearly double the output for 2011 and four times the output of 2010.

In Pennsylvania, we understand that energy independence translates into energy security. According to Deloitte Consulting, 72% of the nation's energy supply is secure – produced by the United States or neighboring countries. The remaining 28% is potentially unsecure, imported from other countries which are often great distances from the United States and subjected to volatile geo-political considerations. Pennsylvania, through its diverse energy resources, is clearly positioned to produce ample, domestic energy to account for unsecure sources. Figure 16 outlines suggested steps for our nation to achieve energy security.

Figure 16 – Achieving U.S. Energy Security



Source: Deloitte Consulting

Transmission Benefits

Distributed Generation Benefits

Distributed Generation (DG), demand response and energy storage are important components of future electricity distribution in the Commonwealth. Distributed generation systems include: combined heat and power systems, natural gas micro-turbines, boilers, generators, fuel cells, solar PV, wind turbines, plug-in vehicles and energy storage units such as battery, flywheel and thermal based units. Renewable energy DG systems such as PV, wind, geothermal, biomass boilers are recognized to meet the compliance obligations of the state's AEPS law.

As more business and residential customers engage in distributed generation, demand response and energy storage, the distribution infrastructure will need to change and adapt. Distribution circuits of the future will need to accommodate bi-directional power flows and incorporate new monitoring and self-healing technologies. Distribution will become more like transmission with increased automation and integrated controls.[xlii]

Pennsylvania's electric distribution companies are already working to include DG in their capacity planning. DG has benefits for both the customer and utilities. Customer benefits of DG include reduced power consumption with lower electric bills and excess energy that can be net metered to the grid, providing a valuable credit to the customer-generator. In addition, dispatchable DG can provide alternate sources of power generation to provide system redundancy.

DG also provides peak shaving at times of greatest energy usage and highest prices. This decreases the requirement for construction of new generation and reduces overall electric prices in PJM. DG is also well-suited for backup generation.

Pipeline Safety

The Pennsylvania legislature has authorized the Pennsylvania Public Utility Commission to oversee and enforce federal safety standards for pipeline facilities and regulate safety practices of certificated utilities engaged in the transportation of natural gas and other gas by pipeline.

The PUC enforces federal safety standards as an agent for the U.S. Department of Transportation's Office of Pipeline Safety. The safety standards apply to the design, installation, operation, inspection, testing, construction, extension, replacement and maintenance of pipeline facilities. The PUC may prescribe additional pipeline safety standards over and above federal standards, provided they are not in conflict.

Specifically, the Gas and Hazardous Liquids Pipelines Act (also known as "the Pipeline Act" or Act 127 of 2011) was signed by Governor Corbett on December 22, 2011 and went into effect on February 20, 2012. This law expands the PUC's authority to enforce federal pipeline safety laws as they relate to gas and hazardous liquids pipeline equipment and facilities within Pennsylvania. The Pipeline Act requires the PUC to develop and maintain a registry of pipeline operators within Pennsylvania. This new law is critical to ensuring the safe and reliable transport of natural gas and natural gas liquids to market.

Stabilizing the Electrical Grid

Beacon Power Frequency Regulation Plant

Hazle Township, Luzerne County

Beacon Power is installing 200 flywheels in a 20 MW frequency regulation plant in Hazle Township, Luzerne County. Flywheels support the electricity market by responding to unpredictable real-time imbalances between generation and load which is critical to maintaining grid reliability and security. Flywheels instantaneously store excess energy in the grid and inject it back when there is an energy shortfall. Flywheels use no fuel, have no hazardous chemicals and zero emissions.

Downstream Benefits of Shale Gas Development

Economic Resurgence

Pennsylvania is fortunate to have new and abundant downstream development opportunities made possible by natural gas exploration and production in unconventional shale formations.

In 2010, shale gas accounted for 27% of total United States natural gas production. By 2015 this share will increase to 43% and by 2035, it is expected to increase to 60%. According to America's Natural Gas Alliance, this growth will help power the creation of one million new Unites States jobs.[xliii] These new jobs will create opportunities for a wide range of skilled workers - from scientists and technicians, to

business managers and office staff, to construction workers and truck drivers. From high school graduates to individuals with advance degrees, jobs await in the natural gas industry.

Refinery Renaissance

The shale gas industry is bringing new economic development to old refinery sites in Southeast Pennsylvania in and around Philadelphia. During the summer of 2011, owners of three refineries announced their intention to sell or close down their refinery operations. Approximately 3,000 direct and upwards of 25,000 to 30,000 indirect jobs were threatened. One year later, all three refineries were revitalized:

- **Monroe Energy – Trainer, Delaware County** Delta Airlines' subsidiary Monroe Energy acquired the 347-acre ConocoPhillips refinery site to produce aviation jet fuel. The refinery was at full operating capacity in March 2013 and will use crude oil from North Dakota's Bakken formation, which could save $300 million of Delta's $12 billion annual fuel costs. The $350 million project retained 400 direct jobs and 5,000 jobs in related industries in Southeast Pennsylvania. Planned upgrades at the facility will increase production from 185,000 to 200,000 barrels per day.

  To receive crude oil from the Bakken formation a new rail company, the Eddystone Rail Company, was formed. The rail project is expected to be the largest unit-train facility to receive Bakken and other light sweet crude oils directly into Philadelphia area refineries.

- **Braskem Corporation – Marcus Hook, Delaware County** Braskem Corporation purchased portions of Sunoco's Marcus Hook refinery in July 2012 to produce polypropylene. Additionally, Range Resources, Sunoco Logistics and Markwest Energy Partners announced an agreement to ship propane and ethane from western Pennsylvania to Marcus Hook. This agreement creates significant manufacturing opportunities throughout southeastern Pennsylvania.

- **Philadelphia Energy Solutions – Philadelphia, Philadelphia County** Philadelphia Energy Solutions, a partnership between the Carlyle Group and Sunoco, was formed to operate a facility that can process up to 330,000 barrels a day and is the largest refinery on the United States East Coast. A critical aspect of its future is utilizing natural gas from the Marcellus Shale formation to power the facility and offset facility operating costs.

Revitalizing the Petrochemical Industry

While the shale gas industry is in a relative infancy, large scale downstream investment decisions by industry are key opportunities for a manufacturing resurgence, particularly for businesses which use natural gas as a feedstock to produce non-energy products like chemicals.

According to the Pennsylvania Chemical Industry Council, millions of dollars of capital investment have kept the chemical manufacturing plants operating in Pennsylvania modern and efficient. Providing quality products cost-effectively is critical and ensuring manufacturing facilities are state-of-the-art helps businesses remain competitive. Energy costs are a major component of plant operation budgets and reliable, affordable energy is critical to plant success. Chemical feedstock is needed to serve a variety of industries such as agriculture, plastics, automotive, pharmaceutical, personal health care and cosmetics, packaging, aerospace, defense, construction and energy efficiency. The availability of low cost, Pennsylvania produced natural gas is providing the industry with a competitive advantage. Lower

natural gas costs are available for plant operations and new natural gas and gas liquid feedstock is available for processing.

Pennsylvania is just beginning to see project opportunities like a multi-billion dollar ethane cracker plant proposed in Beaver County, located in Western Pennsylvania. The economic impacts of this proposed project, along with the indirect and induced investment and jobs that come with a project of this magnitude, are significant. According to a report prepared by the Pennsylvania Department of Labor & Industry:

- Every $1 billion spent constructing a new manufacturing structure, such as the proposed ethane cracker plant, is projected to result in 8,194 direct jobs, 1,593 indirect jobs and 4,178 induced jobs. This is a total of 13,965 jobs.

- For every $1 billion in sales at a petrochemical manufacturing plant, such as the proposed ethane cracker plant, 177 direct jobs, 1,576 indirect jobs and 1,023 induced jobs are projected to be created. This is a total of 2,776 jobs.[xliv]

Pennsylvania has adopted several critical incentives to attract new manufacturing and processing investment, including an expansion of Keystone Opportunity Zones, designated locations which provide significant tax abatements, and a new Resource Manufacturing Tax Credit to promote the development and use of ethane in the Commonwealth.

LNG Export Potential

A December 2012 NERA Economic Consulting study completed for the U.S. Department of Energy concluded that the United States is projected to gain significant economic benefits from liquefied natural gas (LNG) exports.[xlv] The vast supplies of natural gas resources now available as a result of the shale gas revolution have fundamentally changed the energy equation, positioning the United States to provide ample, affordable supplies to both domestic and foreign markets. An analysis of the impacts of LNG exports is being prepared by ICF International to quantify these benefits. Preliminary figures from the analysis indicates that a modest United States LNG export market reaching 8 billion cubic feet per day (bcfd) would increase the United States gross domestic product by up to $57 billion in 2035. Further, overall employment would increase by over 300,000 jobs in 2035. Pennsylvania's ports are well situated to explore and capitalize on these opportunities.[xlvi]

Fueling Transportation with Natural Gas

Natural gas is a transportation fuel source that can improve both air quality and our energy security. A diverse energy portfolio means our economy can better withstand volatility in the global marketplace. Fueling our vehicles with natural gas in the future means less dependence on imported fuel sources.

Cleaner Vehicle Emissions

Vehicles designed or converted to run on natural gas have significantly lower emissions than their diesel and gasoline counterparts. The specific emissions reduction ranges depend on the types of vehicles and engines being compared. Table 6 demonstrates the environmental benefits, in the form of reduced emissions, attributable to using natural gas in vehicles.

Table 6 – Emission Reductions Obtained from Natural Gas Vehicles

Emission Type	Percent Reduction
Volatile Organic Compound (VOC)	45% - 55%
Carbon Dioxide (CO_2)	20% - 29%
Particulate Matter 10 (PM10)	25% – 40%
Nitrogen Oxides (NOx)	10% – 50%
Air Toxics	99%

Source: U.S. EPA, U.S. DOE

Note: Compared to gasoline or diesel powered vehicles

Fuel Diversification & Energy Security

Petroleum currently accounts for almost 95% of the fuel that powers our transportation systems. In addition, about half of that oil is imported from outside the United States. This leaves our country and our economy vulnerable to price shocks from political instability and worldwide energy demand. In 2011, the United States imported 45% of the oil it consumed. By increasing the number of natural gas vehicles in the United States, we can expand markets for natural gas and displace a significant amount of foreign-produced petroleum.

Stability of Fuel Pricing

Historically, natural gas prices have been indirectly linked to other energy prices, particularly oil. However, as the United States began to develop and implement technologies to unlock the vast potential of natural gas reserves in unconventional shale formations, the coupling between oil and natural gas pricing shifted significantly. Natural gas pricing, based on regional markets, has become decoupled from oil pricing, which is priced in response to worldwide markets. That means that the pricing for natural gas at the wholesale level has become much more stable and consistently lower than oil. While there was historically little price difference on a dollar per energy unit basis between natural gas and oil, wholesale prices of natural gas have historically been about 75% lower than oil. According to the U.S. Energy Information Administration's *2012 Long-Term Energy Outlook*, this trend is expected to continue through most of the first half of this century. Therefore, the use of natural gas in place of petroleum is expected to result in consistently lower and more-stabilized fuel prices for the transportation sector. The average price for compressed natural gas in Pennsylvania is affordable, with current prices around $2.00 per gasoline gallon equivalent.

The average price for compressed natural gas in Pennsylvania is currently around $2.00 per gasoline gallon equivalent.

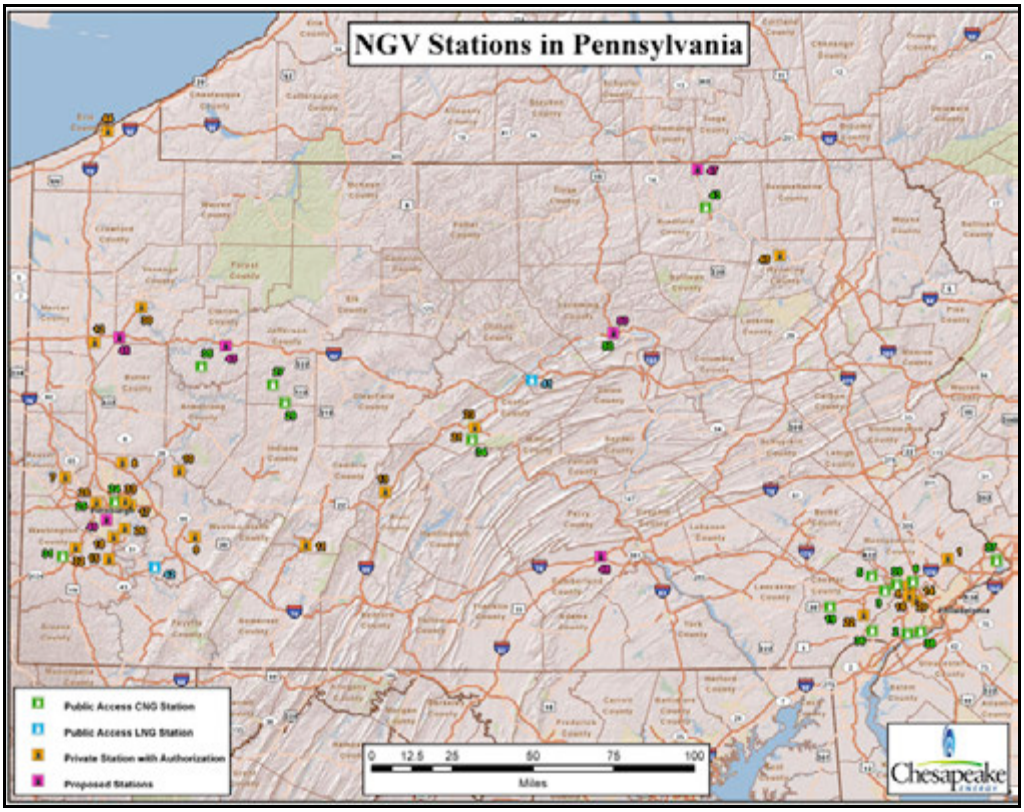
Natural Gas Vehicles and Infrastructure

Several feasibility studies are being completed throughout Pennsylvania to demonstrate the benefits of using natural gas to fuel vehicles. Feasibility studies for both CNG and LNG have been conducted by the Pennsylvania Turnpike Commission. To spark industry innovation, governors from 13 states, including Pennsylvania, sent a letter to the CEO's of 19 auto companies encouraging them to manufacture vehicles that use natural gas. The outreach is part of a multi-state Memorandum of Understanding to pool the collective buying power of state governments to encourage the commercialization of additional

vehicle models operating on natural gas.

Increasing the use of natural gas vehicles also means constructing natural gas infrastructure, making it possible to refuel natural gas vehicles across Pennsylvania. Through Act 13, DEP has implemented the Pennsylvania Natural Gas Energy Development Program to increase the number of fleet conversions and spur private sector investment in natural gas infrastructure. (For more information, go to: www.dep.state.pa.us and click on 'Grants & Loans') Currently 44 existing and 6 proposed natural gas fueling stations; either public, private or both are located throughout Pennsylvania. Many more are in planning and development. Figure 17 shows the locations of natural gas vehicle fueling stations across Pennsylvania.

Figure 17 – Pennsylvania Natural Gas Vehicle Fueling Stations



Source: Chesapeake Energy

Environmental Enhancement through Energy Development

Energy development presents numerous opportunities to enhance our environment and further protect our natural resources. Pennsylvania has been proactively improving the environment while developing and implementing new energy technology.

Land Recycling – Old Legacies, New Opportunities

All across Pennsylvania, former brownfield sites are providing ideal locations for new and expanded business opportunities – including energy-related uses. These locations, once environmental burdens, now provide new economic development made possible by energy. Pennsylvania's voluntary cleanup program, also known as the Land Recycling Program (or Act 2), encourages the cleanup and reuse of contaminated commercial and industrial sites. The program is built on four cornerstones that break down redevelopment obstacles including: 1) Uniform cleanup standards 2) Liability relief 3) Standardized reviews and time limits and 4) Financial assistance.

Pennsylvania's Land Recycling Program continues to be a national model to address environmental legacy issues and prepare sites for new economic opportunity. The diverse energy projects locating on Pennsylvania's brownfields are impressive, with the predictability and reliability of the Land Recycling Program making these projects feasible within realistic timeframes. Table 7 highlights just a few of the energy-related businesses locating on abandoned industrial lands.

Table 7 – Energy Projects on Brownfields

Brownfield Site Name	Company Name - Energy Project	County	Energy or Energy-related Product
Former USX Steel plant; now Keystone Industrial Port Complex	Gamesa Wind US	Bucks	Wind turbine manufacturer
Former USX Steel plant; now Keystone Industrial Port Complex	AE Polysilicon	Bucks	High silicon fabrics used to produce of solar panels
Former Sunoco Marcus Hook Refinery, Phillips Island	Florida Power	Delaware	Gas turbine electrical generators
Baer property, Eddystone Borough	PECO	Delaware	Gas turbine electrical generators
Former Bethlehem Steel plant; now Bethlehem Commerce Center	Calpine Energy	Northampton	Energy plant powered by natural gas
Former fruit processing waste site	Knouse Foods	Cumberland	4 MW photovoltaic field
Former US Steel Duquesne Works	Dura Bond	Allegheny	Shale gas transmission pipe manufacturer
Former International Paper	HERO BX	Erie	Biodiesel production
Former Sayre Lehigh Valley RR Maintenance Facility	Fort Worth Pipe	Bradford	Gas pipeline storage and distribution
Former Montgomery Mills	Moran Industries	Lycoming	Gas industry support/R&D
Clinton County Economic Partnership	Renovo Rail Industries	Clinton	Gas industry support/R&D

Source: Pennsylvania Department of Environmental Protection, January 2013

Treating and Reusing Acid Mine Drainage

Acid mine drainage is one of Pennsylvania's largest legacy environmental challenges, impairing more than 5,500 miles of waterways. Pennsylvania has an active, award winning program to restore abandoned mine lands and develop projects to mitigate such discharges. In addition, numerous local watershed and conservation groups work to restore these waterways. The active mining industry has also worked to remine legacy sites and supports work to treat water being discharged from mines. Pennsylvania's Department of Environmental Protection finalized a white paper in January 2013 outlining how existing regulations and processes can be used to encourage the use of mine-influenced water as a water source for the oil and gas industry. Hydropower is also being used to treat acid mine drainage – using a turbine that receives power from the water it will be treating.

Treating Acid Mine Drainage through Hydropower

Antrim AMD Power Plant

Antrim, Tioga County

In July 2012, DEP officials were on hand to flip the switch on a turbine that gets its power from the very same acid mine drainage water it will be treating. Acid mine drainage impacts more than 5,500 miles of the state's 86,000 miles of waterways. The power plant, the first of its kind in the state, draws on the impacted water to provide hydropower to its turbines to produce electricity for the water treatment system. The project is helping to clean up more than 2,000 gallons per minute of acid mine drainage. The power plant is expected to generate $10,000 per year in additional revenue to the trust fund that was established to pay for the costs of treating the water. The Antrim power plant demonstrates that with some creativity and savvy engineering, even a legacy environmental issue as big as acid mine drainage can have a solution that allows for a cleaner environment and more power to the grid.

Coal Refuse-to-Energy

As previously discussed, fifteen waste-coal facilities exist across Pennsylvania. In addition to employing more than 1,000 people, coal refuse power plants are a private sector solution to an ongoing environmental problem, converting piles of low BTU coal set aside decades ago into power for Pennsylvanians. Since 1987, these facilities have helped to remove nearly 200 million tons of coal refuse from Pennsylvania hillsides, reclaimed nearly 7,000 acres of abandoned mine lands that would have otherwise contributed to acid mine discharges into our waters, and provided nearly $200 million in reclamation value to Pennsylvania taxpayers, while directly and indirectly supporting thousands of jobs.

Reducing Emissions, Enhancing Air Quality

Since 2008, when natural gas drilling using horizontal hydraulic fracturing began in earnest in Pennsylvania, the state has achieved significant, across the board reductions in statewide emissions from stationary sources. As a result of better controls on coal-fired power plants, as well as natural gas taking on an increased share of the state's power generation portfolio, annual emissions of sulfur dioxide were down more than 500,000 tons per year.[xlvii] Using the same methodology as EPA did in several of its air quality rules, this reduction of sulfur dioxide, a precursor to the harmful airborne pollutant known as fine particulate matter, translates to an annual public health benefit of between $14 billion to $37 billion in the form of longer lifespans, fewer sick days and lower health care costs. The state has also seen significant reductions in nitrogen oxides, volatile organic compounds, and carbon monoxide emissions – a trend that is expected to continue as coal-fired power plants retire and more natural-gas fired plants come online.

By 2015, announced and expected coal-fired power plant retirements will reduce generation capacity by 4,820 MW. However, several large natural gas-fired power plants are proposed across the Commonwealth, driven in large part by the abundance of and proximity to natural gas production. Table 8 lists several new gas-fired generation plants proposed throughout Pennsylvania.

Table 8 – Proposed Gas Fired Power Plants

Applicant	County	Approximate Capacity (MW)
Moxie Liberty, LLC	Bradford	900
Berks Hollow Energy Associates, LLC	Berks	855
Moxie Patriot, LLC	Lycoming	900
Bakers Farm Energy, LLC	York	650
Hickory Run Energy, LLC	Lawrence	750
Tenaska Pennsylvania Partners, LLC	Westmoreland	900
Tenaska Pennsylvania II Partners, LLC	Lebanon	900
Sunbury Generation LP	Snyder	1,064
Future Power PA, Inc.	Schuylkill	300
	TOTAL	**7,219**

Source: Pennsylvania Department of Environmental Protection, January 15, 2013

5. PENNSYLVANIA'S COMMITMENT – TRANSFORMING OPPORTUNITY INTO REALITY

Beyond Pennsylvania's impressive energy portfolio, the Commonwealth is equipped to efficiently and effectively facilitate business location and expansion. Necessary infrastructure, including not only the physical infrastructure such as roads and water to move commodities and finished goods, but the professional infrastructure to facilitate business development, is in place. This includes Pennsylvanians dedicated to streamlining permits and approvals, ensuring a skilled and ready workforce, advancing new research and development, and more.

Pennsylvania's infrastructure helps to create jobs. Site Selection magazine ranked Pennsylvania first in the northeast and third in the United States for corporate growth in 2012. Pennsylvania's business also booms far beyond its borders. In 2011, the state had 23 foreign-based companies make the move to Pennsylvania with a total investment of more than $371 million.

Infrastructure Supporting Superior Market Access

Pennsylvania's ideal location gives global companies access to many North American markets – especially the East Coast and Midwest United States. Four of the top 10 logistics metro areas in the Northeast United States are located in Pennsylvania. Six out of 10 major United States market areas lie within a 500-mile radius of Pennsylvania's capital of Harrisburg. Within this radius lies access to vital markets that encompass: 40% of the United States population and purchasing power, more than 60% of Canada's population and 45% of United States manufacturers.

Pennsylvania's strong intermodal transportation network allows for the rapid movement of goods to markets. Reaching customers and markets is easy and convenient with the state's extensive transportation network of six international airports, three major ports and expansive major highway and freight systems. In addition, Pennsylvania provides seven approved general-purpose foreign trade zones to facilitate import and export activity. Products and materials stored, manufactured, repackaged or exhibited in a U.S. Customs Bonded Warehouse qualify for a lower duty or, upon re-export, the duty can be eliminated.

On November 25, 2013 Governor Corbett signed Act 89, which will invest an additional $2.3 billion annually within five years to enhance Pennsylvania's roadways, bridges, aviation, rail, ports and other critical facilities. This unprecedented investment will significantly improve public safety, while modernizing and increasing the efficiency of Pennsylvania's transportation infrastructure.

U.S. Interstates and The Pennsylvania Turnpike

A total of 23 United States interstate highways traverse Pennsylvania providing direct access to Northeast, Mid-Atlantic and Midwest states. The Interstate highway system in Pennsylvania boasts 12 primary and 11 auxiliary routes with a combined length of 1,953 miles. Twenty-four percent of all vehicle traffic in Pennsylvania moves on the Interstate system.

The Pennsylvania Turnpike, one of the first turnpikes in the nation, is starting to build the next phase of its Southern Beltway through Allegheny and Washington counties in Southwest Pennsylvania. The expansion will be a real "energy highway" that will open up hundreds of acres of former coal mining

land for industrial development. The project will link shale gas drilling companies based in Washington County with the site of the proposed cracker plant in Beaver County, while supporting development of ready-to-go business locations for energy-related companies.

Airports

Pennsylvania boasts six international airports and 15 scheduled service airports, boarding over 20 million passengers and moving nearly 1.2 million metric tons of cargo annually. Figure 18 maps Pennsylvania's public-use airports.

Figure 18 – Pennsylvania Public Use Airports

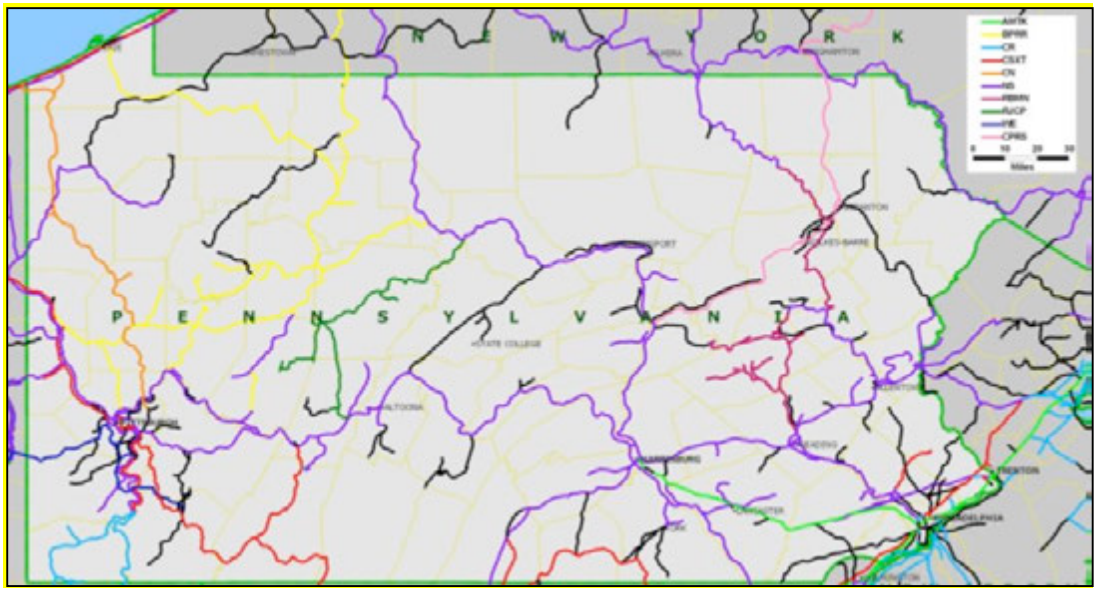
Source: Pennsylvania Department of Transportation

Major Freight Railroad System

Major rail freight carriers combined with Pennsylvania's superior short line rail system give Pennsylvania a competitive market advantage. Rail is making a strong comeback in Pennsylvania, in large part due to the delivery of bulk commodities necessary in the natural gas drilling process.

Transporting goods by rail is efficient, moving one ton of freight 484 miles on a single gallon of fuel, greatly reducing emissions and helping to protect our environment. The railroad industry collectively employs more than 13,000 Pennsylvanians while operating more than 5,000 miles of track. Figure 19 shows the location of Pennsylvania's expansive rail freight network.

Figure 19 – Pennsylvania's Rail Freight Network



Source: Pennsylvania Department of Transportation

PennPORTS

Pennsylvania's ports provide a competitive advantage for the Commonwealth in attracting and retaining business. Pennsylvania boasts a deep water port in Philadelphia; a busy, sprawling inland port in Pittsburgh; a Great Lakes port in Erie with access to the world through the St. Lawrence Seaway; and a number of privately-owned and operated ports throughout the Commonwealth. PennPORTS is the Commonwealth's initiative for maximizing the use of its ports, both public and privately-owned and operated.

The Port of Philadelphia, one of the busiest along the Atlantic coast, is the 4th largest port in the United States for the handling of imported goods; handling more than one-quarter of the entire North Atlantic District's annual tonnage. The Port of Pittsburgh moves more than 44 million tons of cargo annually along its three major waterways – the Allegheny, Monongahela and Ohio Rivers – making it the second largest inland port in the United States and the origin for more tons of raw materials than any other port in the world. Midway between New York and Chicago, Erie is within a 300-mile radius of one-third of the population of the United States, making it easy to reach major markets such as Detroit, New York, Chicago, Washington D.C., parts of Canada and Europe.

Each of Pennsylvania's ports is experiencing increased demand due to energy-related commodities.

- Port of Erie – A biomass firm is constructing two wood pellet manufacturing facilities in northwest Pennsylvania with pellets being exported to European power generators. In the coming years, the Port of Erie will be a focal point for biomass exports.

- Port of Pittsburgh – The Port of Pittsburgh has huge potential for domestic waterway shipping of energy-related raw materials and products. Currently, significant quantities of coal are shipped on

Pittsburgh's rivers for domestic use and export. Efficiently and cost effectively shipping shale gas commodities through the Port of Pittsburgh is revitalizing waterway shipping in the region. With an ethane cracker facility proposed in the region, it is envisioned that ethane and other chemicals will be shipped via the Port of Pittsburgh.

The Port of Pittsburgh Commission recently launched the Clean Fuels/Clean Rivers initiative to build a natural gas marine corridor that extends from the Morgantown area in West Virginia through Pennsylvania, and down the Ohio River to Huntington, West Virginia. The ultimate goal of this effort is to expand the potential of natural gas as a replacement for diesel fuel to the often overlooked inland waterway system, which encompasses nearly 12,000 miles of navigable waters.

- Port of Philadelphia – With the transformation of the major oil refineries in southeastern Pennsylvania, port traffic associated with petroleum and natural gas import and export is anticipated to increase. Other energy commodities, such as fertilizers, chemicals and wood pellets are also being transported through the Port of Philadelphia.

Pipelines

Pennsylvania has an extensive system of safe, reliable pipelines to transport fuels efficiently. The amount of pipelines being constructed across the state is increasing tremendously to transport natural gas and natural gas liquids to processing facilities, interstate pipelines, utility distribution lines and industrial parks. Pennsylvania adopted significant pipeline safety standards through the enactment of Act 127 of 2011, which authorized the Pennsylvania Public Utility Commission to oversee and enforce federal pipeline safety standards.

Natural Gas and Electric Infrastructure Improvements

Pennsylvania's policy makers are aware of the need to continuously update the Commonwealth's utility infrastructure. In 2012, Governor Corbett signed Act 11 into law, which established a Distribution System Improvement Charge (DSIC) for electric and gas utilities. The DSIC mechanism, which originated in Pennsylvania in 1997 for water infrastructure and is viewed as both a best practice and model legislation, is a small surcharge that reflects the costs of improvements and replacements of distribution infrastructure currently in service. These costs would otherwise be recovered through the filing of base rate cases, a lengthy and expensive process. The DSIC removes the disincentives of the traditional rate case process and has resulted in a tripling of annual distribution investment for water infrastructure. This new legislation – a national model – is expected to result in a significant increase in infrastructure investment serving natural gas and electric customers.

Predictable and Timely Permits and Approvals

Pennsylvania knows that time is money. The ability to predictably and efficiently secure permits and approvals means that development projects can be completed on time and within budget. This also means that jobs are being created and revenue is being generated, benefitting the economy at all levels.

With an eye on the objective to ensure that Pennsylvania continues to be an attractive location to create jobs, Governor Corbett has tasked state agencies to meet business' needs of consistency and efficiency, while at the same time carrying out the Commonwealth's duty to protect our vast resources. Significant initiatives are underway at the Department of Environmental Protection, Department of Transportation

and Department of Community and Economic Development to facilitate predictable and timely approvals.

DEP Permit Decision Guarantee

At the direction of Governor Corbett, the Pennsylvania Department of Environmental Protection instituted a dramatic shift in how it reviews and processes permit applications. DEP's Permit Decision Guarantee review process provides regulatory certainty, clarity and consistency across DEP's six regional offices. DEP is focused first and foremost on its commitment to protect the natural resources of Pennsylvania and balances that with an understanding that businesses need certainty and predictability in the permitting process. The new permit review policy guarantees that a decision on administratively complete permit and authorization requests will be made within specified and transparent timeframes. The Permit Decision Guarantee review process gives businesses and the regulated community regulatory certainty. Regulatory certainty saves time and money.

In addition to predictable and efficient permit review, a reasonable set of regulations has been put in place to protect Pennsylvania's environment and guide land development. Pennsylvania is proud of its bipartisan accomplishments to enact and implement key statutes that drive energy and environmental policy within the Commonwealth. A summary of these statutes is included in ***Appendix C***.

PennDOT Electronic Permitting System

The Pennsylvania Department of Transportation (PennDOT) reviews and approves projects, through issuance of a Highway Occupancy Permit, that impact a state road. The length of time to obtain the permit has been significantly shortened by PennDOT's implementation of an electronic permitting system (ePermitting). ePermitting allows applicants to create, submit, track and print permit applications online. The system is transparent in that it allows applicants to see where their application is in each step of the review process. This reduces phone calls from applicants to PennDOT and from PennDOT to applicants. It also reduces paperwork for both the applicant and PennDOT. Since ePermitting was implemented in 2011, over 5,000 Highway Occupancy Permit applications have been submitted electronically. To date, 98% of all application submissions are being reviewed in less than 30 days with an average review time of nine days. Before ePermitting, some applications took almost 60 days. This is a dramatic improvement that is complimenting PennDOT's efforts to improve customer service and become more business-friendly.

In addition to ePermitting, PennDOT has implemented electronic grant submission through dotGrants. This online system allows applicants for air, rail freight and public transit funding to submit online. Similar to electronic permitting, online grant submission shortens review times and makes the review process transparent.

DCED Local Government Permit Review Initiative

Pennsylvania's has a strong legacy of local governments that shape the Commonwealth's exceptional quality of life. Pennsylvania's local governments work together with state agencies as required to facilitate land development projects. Governor Corbett has tasked the Pennsylvania State Planning Board to review local permitting processes and report findings. The goal of the permit review initiative is to develop consistency in the local permitting process throughout Pennsylvania and enhance coordination between local government and agency officials.

Competitive Business Climate

Supportive public policy that helps the business climate remain competitive is a top priority in Pennsylvania. Public policy beneficial to all industries is a key focus, including reductions to corporate tax rates, enactment of "fair share" tort reform legislation, and recent changes to DEP's Permit Review Process, which is making the review process more predictable to save time and money and respect the time sensitivities of economic development projects.

Pennsylvania's business climate is undergoing significant reforms under the leadership of Governor Corbett, headlined by the continued phase-out of the Capital Stock and Franchise Tax, which will be completely eliminated by January 1, 2016. Partnering with the General Assembly, Governor Corbett signed legislation instituting significant tort reforms in the state, and Pennsylvania continues to enhance its business climate through innovative approaches such as Keystone Opportunity Zones, a nationally recognized economic development tool which eliminates select state and local taxes in specified locations; adopting a single sales factor; and use of the net operating loss to support start-up business growth.

Skilled and Ready Workforce

Pennsylvania's workforce development network proactively addresses workforce development needs to ensure employers have trained, proficient Pennsylvania professionals at the ready. The Pennsylvania Department of Labor and Industry (L&I) oversees Pennsylvania's workforce development network. L&I coordinates and supports the alignment of workforce programs and service delivery. This includes:

- Oversight of the Pennsylvania CareerLink® System that connects job seekers and employers,
- Chartering and certification of 23 local workforce investment areas across the state,
- Guidance to 22 local workforce investment boards (LWIBs) on the development of local workforce plans to meet the state's vision and strategy,
- Policies and procedures to guide the overall workforce system, and
- Technical assistance related to programming and the development of local initiatives.

The Pennsylvania Workforce Investment Board (PA WIB) is the Governor's employer-driven workforce development advisor for programs and policies and serves in an advisory capacity for the implementation of the Governor's workforce development strategy. The PA WIB successfully builds consensus at the state level and partners with LWIBs to do the same at the local level.

In addition to staff driven workforce development efforts, in 2012 L&I launched a new web portal, JobGateway℠. Through technological and process improvements, JobGateway℠ provides quality matches for employers seeking workers and job-seekers seeking employment. The website continues to be upgraded and includes job-spidering technology to show available job opportunities across the Commonwealth. See the website at: www.jobgateway.state.pa.us.

Workforce development initiatives geared towards energy sectors have been proactively developed by workforce partners across Pennsylvania. As an example, ShaleNET is a multi-state coordinated network of industry, the public workforce system and training providers formed to build an industry-recognized,

uniform training and certification program, developing and augmenting curricula and adopting best practices in the oil and gas industries. ShaleNET has trained hundreds of people and established curriculum for six occupations in the industries.

Appendix A includes a summary of Pennsylvania's energy-related workforce development initiatives.

Renowned Universities and Solid K-12 Education

Pennsylvania is home to 260 degree-granting institutions, ranking third in the nation. Four of the nation's top 50 schools lie within Pennsylvania's borders - including two ranked in the top 50 universities in the world, Carnegie Mellon University and the University of Pennsylvania. The state's educational institutions are consistently among the top-ranked schools in business, biomedical research, material science, engineering and computer science.

Pennsylvania has a solid K-12 educational system, with a high school graduation rate of 82.6% for school year 2010 – 2011.[xlviii] A total of 75.7% of students performed at-or-above grade level in math, 71.9% performed at-or-above grade level in reading, 73.2% performed at-or-above grade level in writing and 61.4% performed-at-or-above grade level in science.

Preparing younger Pennsylvanians for the jobs of tomorrow requires additional focus to ensure advancement into technical and science related fields. To that end, Pennsylvania places emphasis on Science, Technology, Engineering, Math (STEM) education. The Pennsylvania Governor's School for the Sciences selects over 50 of the state's brightest incoming high school seniors to spend five weeks at Carnegie Mellon University over the summer for intense instruction in biology, chemistry, computer science, math and physics. One hundred percent of alumni from the program entered college and approximately 90% pursued careers in STEM fields.

Re-Energizing the Philadelphia Navy Yard – Our Country's 1st Naval Shipyard

Energy Efficient Buildings Hub

City of Philadelphia

The Energy Efficient Buildings Hub (EEB Hub) was established in Philadelphia by the U.S. Department of Energy as an Energy Regional Innovation Cluster (E-RIC) in 2011. The EEB Hub has a unique, dual mission of improving energy efficiency in buildings by literally re-energizing them for the future and promoting regional economic growth and job creation. The Hub's location is the Philadelphia Naval Shipyard, the country's first naval shipyard and one of the largest and most dynamic redevelopment opportunities in Pennsylvania.

The prime efficiency goal of the EEB Hub is ambitious: to reduce energy use in the Greater Philadelphia region's commercial buildings sector by 20% by 2020. To reach this goal, efforts are concentrated on accelerating the adoption of Advanced Energy Retrofits of average size commercial buildings. This type of retrofit is one that makes use of new, but proven, technologies, systems and processes to achieve significant energy and, ultimately, economic savings. The mission is to design, demonstrate and deploy customized retrofits that are both technically sound and financially feasible in the Greater Philadelphia region.

Cutting-Edge Research, Development and Commercialization

Pennsylvania is home to nationally and internationally recognized research universities, ranking 9th in Research & Development Input in the Milken Institute's 2010 State Technology and Science Index. The Center for Measuring University Performance's 2010 report on the Top American Research Universities ranked three of Pennsylvania's research universities in the top 25. The University of Pennsylvania ranked in the top 25 in nine out of nine measures, the same as Columbia, MIT and Stanford.

Pennsylvania's research universities are focused on continually developing and commercializing cutting edge technology. In addition, commercializing research and development has been taking place in Pennsylvania for decades through the award-winning Ben Franklin Technology Partners (BFTP). BFTP is one of the nation's longest-running technology-based economic development programs. For more than 30 years, BFTP has provided both early-stage and established companies with funding, business and technical expertise and access to a network of innovative, expert resources. BFTP's energy activities are focused on four areas to grow Pennsylvania's energy sector: seed-stage investment, translational research, incubation and management support/business and technical assistance. BFTP has committed over $26 million to energy-related projects leveraging private sector match totaling more than $37 million.

Pennsylvania is also home to several nationally sponsored research and commercialization initiatives including the Energy Efficient Buildings Hub located in Philadelphia and the Energy Regional Innovation Cluster. The Energy Efficient Building Hub is transforming the nation's first naval shipyard and is highlighted on this page. The Energy Regional Innovation Cluster is working with southwest Pennsylvania small and medium sized manufacturing businesses to grow and develop new technologies, grow sales and expand the energy sector in southwest Pennsylvania. Both Ben Franklin Technology Partners and Catalyst Connection, the Industrial Resource Center which serves southwest Pennsylvania, are partnering on this initiative with the National Energy Technology Laboratory and the state.

These initiatives are located in Pennsylvania due to the state's outstanding research institutions, forward thinking communities and economic development organizations, and strong industry supply chains.

Solid Manufacturing Base

In addition to a ready and able workforce and the transportation infrastructure that allows Pennsylvania to efficiently and effectively transport goods, Pennsylvania's existing manufacturing firms provide the foundation to enable the production of those goods and places to put people to work. This manufacturing foundation serves as an important backbone to Pennsylvania's economy. In fact, the manufacturing sector is Pennsylvania's largest source of Gross State Product and the state's fourth largest employment sector. Pennsylvania was the sixth largest manufacturing state in the nation for Gross State Product in 2009.[xlix] The productivity and presence of Pennsylvania's manufacturers enables the state to maintain a robust supply chain that is in place and ready to serve the needs of energy firms seeking to locate or expand in the state.

Strategic Investments to Encourage Energy Growth

While Pennsylvania knows free markets drive economic development, the Commonwealth makes strategic investments to encourage economic development led by private industry.

Qualified businesses which manufacture machinery and equipment or component parts, or headquarters projects, may potentially be given consideration for financial incentives based on the merits of the project including permanent new job creation, investment, competitiveness and need. Financial incentives are available through the Department of Community and Economic Development (DCED); the Commonwealth Financing Authority (CFA), an independent agency of the Commonwealth that administers several of Pennsylvania's economic development programs; and the Department of Environmental Protection.

DCED and the CFA have made significant investments in alternative energy, infrastructure projects, and high-growth companies throughout the state in order to bolster growth and create jobs in Pennsylvania. Pennsylvania's economic development programs continue to channel new resources to communities in need of new and improved infrastructure, while providing the tools to enable our traditional industries, especially manufacturing, to enhance productivity.

Pennsylvania's energy-focused incentives are diverse and include tax credits, tax abatements, loans, loan guarantees and grants for different types of energy-related uses. Pennsylvania has funded all types of energy projects provided those projects are financially sound and demonstrate a return on investment for the Commonwealth in terms of high paying jobs, strategic targets or community benefit. In addition, DCED's Single Application for Assistance allows for online application to both DCED and Commonwealth Financing Authority funding sources. ***Appendix B*** includes a description of Pennsylvania's key funding sources.

Single Point of Contact

To facilitate business development, the Governor's Action Team (GAT), Pennsylvania's lead economic development office, serves as a Single Point of Contact for businesses investing in Pennsylvania. GAT's project managers are highly experienced economic development professionals working directly with company officials or site selection consultants as businesses look to establish new or expand existing business operations in Pennsylvania.

Focus is given to projects which will leverage significant economic impact including, but not limited to, private capital investment and new or retained jobs. These projects often prompt a

Pennsylvania's Economic Development Partners

- Governor's Action Team
- State Agencies
- Economic Development Network
- Pennsylvania's Communities
- Workforce Development Network
- Research & Development Network
- Higher Education Institutions

customized incentive package prepared by GAT which outlines the Commonwealth's financial commitment to a business' project. For large economic development projects, GAT serves as a chief coordinating office of multiple state and local agencies assisting companies to successfully locate in Pennsylvania. GAT also provides statewide site selection services by providing businesses with the information required to make an informed assessment of the Commonwealth and its communities as a business location.

Assisting the Governor's Action Team is an extensive network of professionals ready to bring new opportunities into Pennsylvania and expand upon existing ones. Professionals from state agencies, local economic development organizations, workforce development and communities work every day to improve Pennsylvania's business climate and create new jobs and investment in the Keystone State. Contact the Governor's Action Team at: www.newpa.com.

This network of professionals as well as private sector business leaders throughout Pennsylvania are forming public-private partnerships to maximize available resources. Pennsylvania supports public-private partnerships, in which private entities have a defined interest in the development, ownership, operation or maintenance of state assets. These partnerships give the state the flexibility to continue to provide the public with valuable services while reducing costs. Deployed strategically, public-private partnerships allow for creative problem solving and responsible use of resources. These approaches are needed as Pennsylvania continues to build and maintain all types of infrastructure and projects, including energy projects.

State Agencies

Both the Pennsylvania Department of Environmental Protection and Pennsylvania Department of Transportation provide comprehensive management for environmental and transportation related permits and authorizations. With district and regional offices throughout Pennsylvania, the agencies work in a coordinated effort to assist businesses to expand and locate in Pennsylvania while at the same time being protective of public health, safety and welfare. The Pennsylvania Department of Revenue and Pennsylvania Department of Labor & Industry provide the financial and workforce information required for business leaders to make an informed assessment about a Pennsylvania location. Additional Commonwealth agencies are consulted as required to help businesses locate or expand in Pennsylvania.

Economic Development Network

To coordinate economic development efforts, the Partnerships for Regional Economic Performance Program (PREP), administered by the Department of Community and Economic Development was designed to create integrated service delivery by encouraging regional coordination of service providers including Industrial Resource Centers (IRCs), Industrial Development Organizations (EDCs/IDCs), Local

Figure 20 – PREP Partners and Services

Development Districts (LDDs), and Small Business Development Centers (SBDCs). The result is customer service for businesses and a comprehensive, efficient, statewide economic development delivery strategy. PREP partner organizations coordinate business development services designed to encourage the creation of new businesses and to increase and strengthen the capacity of all Pennsylvania businesses to compete successfully in the global economy. For more information, go to: www.newpa.com; keyword search PREP.

In addition, the Team Pennsylvania Foundation, a non-partisan, charitable, non-profit created in 1997 as a private-public partnership to improve Pennsylvania's business climate; manages and hosts PA SiteSearch along with its partners at the Department of Community and Economic Development and utility partners, PECO and PPL Corporation. PA SiteSearch is the nation's only statewide site selection and corporate real estate database and is used by GAT as a starting point statewide site searches.

Pennsylvania's Communities

Every business calls a Pennsylvania community 'home'. Therefore, Pennsylvania's land use legislation, the Municipalities Planning Code, allows for Pennsylvania municipalities - which include a county, city, township or borough - to include an energy plan element as part of their comprehensive plan. An energy plan makes certain that energy-related uses are part of a community's blueprint for tomorrow. Several counties and local municipalities throughout Pennsylvania have adopted energy plan elements and a fair number are developing model ordinances addressing alternative and renewable energy sources. The land use documents ensure the framework is in place for businesses and local governments to work together to effectively site energy projects. At the state level, the Governor's Center for Local Government Services works effectively with local governments to help address new and emerging trends in land use such as energy. The Governor's Center works closely with the Governor's Action Team on high priority projects to ensure seamless community and economic development access.

Act 13 funding, created in 2012, may be used for local or regional planning initiatives under the Municipalities Planning Code which is helpful as many communities in unconventional shale gas regions are home to natural gas drilling activities. Properly preparing for land uses now will help communities maintain their quality of life now and in the future.

6. Leveraging Pennsylvania's Energy Opportunities

Pennsylvania's energy opportunities are numerous. From the diverse array of energy sources made possible through the entrepreneurial spirit and creativity of Pennsylvanians over the years, to new technologies being developed by entrepreneurial Pennsylvanians today, the Keystone State is a location second to none. But how do we maximize what we have to offer and create opportunities? A statewide energy policy will help guide the direction to maximize our numerous energy opportunities.

Pennsylvania's Energy Policy

Pennsylvania's energy policy was developed to be straight forward - All of the Above - *and Below* - reflecting our diverse energy portfolio. Renewables and alternatives, coal, nuclear, gas and oil – each of these energy sources is produced here is Pennsylvania. Combined with our competitive energy markets and energy efficiency strategies, Pennsylvania's energy portfolio translates to affordable and abundant power delivered in a way that meets business' needs.

Our "*All of the Above*" energy policy is reinforced by four core concepts to guide our support of energy source development: free markets; independence and security; abundant, affordable and domestic; and environmental enhancement.

Embracing Free Markets

Our "*All of the Above*" approach to energy rests upon the most critical tenet of the American dream - free markets work. When consumers choose, we all win. That's why we have embraced and fostered a robust market for energy suppliers. Our competition laws allow the consumer to choose their electric and natural gas supplier. This rewards innovation and creativity and empowers the consumer to choose the best product that best suits their needs. We understand that at the heart of any successful business enterprise is access to safe, affordable and reliable energy. The global marketplace doesn't shy away from competition – neither should the choice of an energy supplier.

Energy Independence Leads to Energy Security

An energy independent state and nation means supporting jobs here, utilizing our resources instead of sending our capital abroad and being exposed to a potentially volatile geo-political climate. Pennsylvania's diverse energy portfolio allows the Keystone State to produce energy such as natural gas, coal, nuclear and renewables right here in Pennsylvania. This not only helps Pennsylvania in securing our future energy resources, but the nation as well.

Abundant, Affordable and Domestic

A secure energy future means domestically produced energy for all Pennsylvanians; cost effective energy solutions that attract new and expanded industrial and commercial business investment; a reliable electric grid free of black- or brown-outs threatening hospitals, nursing homes and other critical facilities; dependable and cost-efficient public transportation that runs on clean energy; and affordable shipping and transportation of goods using tractor trailers running on natural gas.

Enhancing Our Environment

Here in Pennsylvania, we protect the environment *and* grow the economy – we effectively do both. Yesterday's environmental challenges are today's opportunities. Pennsylvania's award-winning brownfields law has helped turned abandoned industrial sites into landmark economic engines. We're

diverting wastewater away from our streams and into innovative uses, such as hydraulic fracturing to free gas from the largest unconventional shale field in the nation. And we're burning cleaner, domestic fuels that improve air quality and help lower greenhouse gas emissions. Economic prosperity means a bright future for our environment, and no one cares more about our air, land and water quality than we do.

Leveraging Opportunities

How does Pennsylvania propose to advance our *All of the Above* energy policy? Development of the energy plan has led Pennsylvania to identify several opportunities to maximize the Keystone State's diverse energy portfolio, continue to develop new energy innovations in the future and prepare our citizens for jobs of today and tomorrow. These opportunities are presented below and will change over time as energy markets continue to evolve in Pennsylvania and throughout the nation.

Abundant, Affordable, Domestic Energy

Continue to Advance Our Nation's Energy Independence

- ✓ Support advancements in coal technology to reduce emissions while retaining jobs in Pennsylvania's mining industry.
- ✓ Urge the federal government to develop long-term nuclear waste storage solutions by adopting the recommendations of the Blue Ribbon Commission on America's Nuclear Future.
- ✓ Position Pennsylvania to be the first state in the nation to make Natural Gas Vehicles commonplace.
- ✓ Continue to back the resurgence of Pennsylvania's refineries made possible by natural gas.

Advance Innovative Technologies

Make Today's Cutting Edge Technologies Commonplace in the Future

- ✓ Promote market driven biofuels development.
- ✓ Continue to support co-generation, promoting energy efficiency and reducing energy costs.
- ✓ Support new technology to treat legacy environmental issues such as treating acid mine drainage through hydropower.

Community Readiness

Encourage Ready-to-Go Communities to Partner with Businesses to Create New Jobs

- ✓ Make certain Pennsylvania's communities are willing and ready for new energy-related businesses through a structure of sound land use planning that reflects individual community needs and predictable, efficient local review processes.

Competitive Energy Markets

Continue to Support Electric and Natural Gas Choice for Pennsylvania's Citizens and Businesses

- ✓ Support market-based approaches to electricity and natural gas supply that lowers prices and encourages innovation in the types of products retail suppliers offer.
- ✓ Continue competitive energy supply offers that provide both low prices and ancillary energy products to meet the needs of any business operation.

Economic Development

Attract New Business Investment by Taking Full Advantage of Pennsylvania's Energy Portfolio

- ✓ Proactively meet with business leaders and site selection consultants in targeted energy industries to explain the attributes and advantages of a Pennsylvania business location.
- ✓ Proactively meet with existing Pennsylvania firms in supply chains focused on targeted energy industries to identify ways to increase industry partnerships and promote business expansion.

Energy Efficiency & Storage

Encourage Energy Efficiency and Storage Efforts that Prevent Energy Waste

- ✓ Promote programs that encourage businesses and energy generators to maximize efficiency and conserve energy.

Energy Infrastructure

Continue to Support Improvements to Make Our Energy More Affordable, Reliable and Efficient

- ✓ Support efforts to improve the security and reliability of Pennsylvania's electric grid.
- ✓ Support infrastructure to effectively provide natural gas to businesses and homes.
- ✓ Ensure our transportation infrastructure is modern, reliable and efficient to transport energy-related commodities.

Increase Alternative & Renewable Deployment

Support Market-Based Decisions that Increase the Use of Naturally Regenerative Energy Sources

- ✓ Continue to support co-generation to promote the efficient use of resources and reduce energy costs.
- ✓ Support new technology to treat former environmental issues such as the treatment of acid mine drainage through hydropower.

Workforce Development and Education

Prepare Pennsylvanians for High Quality Energy-Related Jobs

- ✓ Continue to support state, regional and educational initiatives that match energy industry needs with trained Pennsylvanians

Appendix A Energy-Related Workforce Development Initiatives

Pennsylvania has many energy focused workforce development initiatives designed to provide all Pennsylvanians - from seasoned workers changing careers to new high school graduates – with the opportunity to work in expanding energy fields. The main goal is to ensure trained workers are ready when businesses are ready to expand in or relocate to Pennsylvania. The following initiatives and educational programs are a sampling of how Pennsylvania's workforce development network partners with industry to respond to ever changing workforce needs – quickly and effectively.

Energy-Related Workforce Development Initiatives		
Agency / Organization	**Initiative / Program**	**Description**
PA Department of Labor & Industry (L & I) / PA Workforce Investment Board (PA WIB)	Pennsylvania CareerLinks®	PA CareerLink®, Pennsylvania's one-stop workforce delivery system, provides access through a network of 66 physical sites located across the state and online. One of the key responsibilities of PA CareerLink® is to ensure that Workforce Investment Act core services are available including: outreach, intake and orientation; initial assessment of skill levels, aptitudes, abilities and supportive service needs; job search and placement assistance; career counseling; providing of labor market information; providing of information about education and training providers; and financial aid advice.
PA Department of Labor & Industry (L & I)	JobGateway℠	Through technological and process improvements, JobGateway℠ provides quality matches for employers seeking workers and job-seekers seeking employment. The website continues to be upgraded and includes job-spidering technology to show available job opportunities across Pennsylvania.
U.S. Department of Labor / Pennsylvania College of Technology / Westmoreland County Community College	ShaleNET	ShaleNET is a multi-state coordinated network focused on designing a comprehensive recruitment, training, placement and retention program for high priority occupations in the natural gas drilling and production industry. ShaleNET provides the natural gas industry with a ready and well-trained local workforce for occupations that are in high demand such as: derrick operator, rotary drill operator, service unit operator, roustabout, welder/brazer, and commercially licensed drivers. ShaleNET was launched in 2010 with a $4.9 million grant awarded to Westmoreland County Community College by the U.S. Department of Labor. ShaleNET recently received an added $14.9 million grant in 2012 from the Department of Labor to expand the initiative.
Pennsylvania Commission of Community Colleges / Community College of Philadelphia	JobTrakPA	Part of a $20 million federal grant program announced in November 2012, Pennsylvania's 14 community colleges are preparing students and retraining unemployed and underemployed Pennsylvanians for high demand jobs in industries looking to hire career-specific, skilled employees. The program is administered by the Community College of Philadelphia and coordinated through the Pennsylvania Commission of Community Colleges in Harrisburg. Energy distribution, production and conservation is one of 3 high-growth industries targeted. Approximately 15,000 displaced workers in Pennsylvania are eligible for JobTrakPA retraining.

Energy-Related Workforce Development Initiatives (continued)		
Agency / Organization	**Initiative / Program**	**Description**
Pennsylvania Department of Labor & Industry	Career Pathways for the Energy Sector Guide	The Career Pathways for the Energy Sector Guide was developed as part of the Northeast Pennsylvania Green Machine grant awarded by the PA Department of Labor & Industry under a State Energy Sector Partnership, American Recovery and Reinvestment Act (ARRA) grant. The grant funded a regional energy sector training, career awareness and career pathway initiative completed in 2012 involving four Northeast Pennsylvania Workforce Investment Boards (WIBs). In addition to the grant's successful outcomes of energy-related training completion and job placement, the Career Pathways for the Energy Sector Guide was developed to highlight green energy-related career pathway maps and showcase high priority occupations, certification information and training aligned to energy-related fields. The Guide is targeted to job seekers, but can also be used by employers for incumbent workforce development and for youth career awareness efforts. Go to: www.lvwib.org and click on 'Lehigh Valley Green Machine Guide' to view the guide.
Pennsylvania Higher Education Assistance Agency (PHEAA)	Pennsylvania Targeted Industry Program	The Pennsylvania Targeted Industry Program, implemented by the Pennsylvania Higher Education Assistance Agency (PHEAA), provides grants to students enrolling in 2 year certificate programs for certain high-priority occupations. Energy is one of 3 industry clusters targeted for the program. The initiative is designed to increase access to postsecondary education in targeted programs by reducing education costs.
Venango College of Clarion University / Precision Manufacturing Institute	Natural Gas Technology Program	A new Associates of Applied Science, Industrial Technology degree concentration in Natural Gas Technology was developed by the Venango College of Clarion University in partnership with the Precision Manufacturing Institute (PMI) in Meadville, Pennsylvania. Initiated in the fall of 2011, the 19-month program prepares students for entry-level employment opportunities in natural gas and unconventional shale gas related industries, with the added value of providing the educational foundation for further education and upward career mobility. Students begin their technical coursework at PMI, finish their general education and support courses for an associate degree at Venango College of Clarion University, and become employed. If a student decides to continue and pursue a bachelor's degree, Venango College of Clarion University's new Bachelor of Applied Science degree in Technology Leadership is an online degree-completion program. The online format allows technicians to continue to work in the natural gas industry and complete coursework online. Eighteen students graduated from the Natural Gas Technology Program in December 2012.
Marcellus Institute at Mansfield University	2 + 2 + 2 Natural Gas Technology Program	The Marcellus Institute at Mansfield University is establishing a 2+2+2 Natural Gas Technology program to support the workforce needs of industry and connect student graduates to well-paying careers in the region. Mansfield University's program built off of DCED's 2+2+2 Program by leveraging the knowledge developed from the existing programs funded by DCED. Tioga County, home to Mansfield University, has 3 school districts, but has neither a county career and technology center nor a community college. To meet the components needed to offer a 2+2+2 career pathway program at Mansfield University, Pennsylvania College of Technology serves as the middle '2' institution (associates degree) and Susquehanna County Career and Technology Center, a designated Shale Gas Training Center, serves as the first '2' (high school degree).

Energy-Related Workforce Development Initiatives (continued)		
Agency / Organization	**Initiative / Program**	**Description**
Marcellus Institute at Mansfield University	Associate of Applied Science in Natural Gas Production and Services	The Marcellus Institute in cooperation with natural gas industry partners is developing new academic programs for Mansfield University students focused on the expanding shale gas industry. The programs offer targeted continuing education and certification programs to meet the need of a well-qualified workforce in the region. The Associate of Applied Science in Natural Gas Production and Services degree was designed to prepare graduates for various career paths in the natural gas industry. The five concentrations within the program include: permitting and inspection specialist, mud logging/geology specialist, environmental specialist, GIS specialist, and safety management specialist. These concentrations have been identified by natural gas employers and major corporations in the Commonwealth's Northern Tier as meeting critical employment needs. The program is closely aligned with the emerging and growing careers in the drilling industry as outlined by the Pennsylvania Independent Oil and Gas Association (PIOGA).
Marcellus Institute at Mansfield University	Bachelor of Science in Safety Management	The Bachelor of Science in Safety Management degree program was designed to prepare graduates for the expanding unconventional shale industry and associated energy businesses that have an immediate need for safety professionals. It also prepares graduates for a range of occupational health and safety positions in other industries, both regionally and globally. Both PA DEP and a statewide workforce needs assessment indicated a strong demand for safety workers.
Southwest Corner Workforce Investment Board	Mining Technology Career Camp	The Mining Technology Career Camp is a 1-week training camp funded through employer contributions and sponsored by the Southwest Corner Workforce Investment Board. Students receive CPR/First Aid Certification and learn the basics of the mining industry including: history of mining, geology, mine safety, mine rescue techniques, environmental issues in mining and educational opportunities in mining. Students are also able to experience a mine simulation at the National Institute for Occupational Safety and Health located in the Pittsburgh area.
Southwest Corner Workforce Investment Board / Southwest Training / Job Training for Beaver County / Western Area CTC / Western Area Career & Technology Center	Oil & Gas Industry Youth Career Expo	An Oil & Gas Industry Youth Career Expo was held at Western Area Career & Technology Center and sponsored by the Southwest Corner WIB and the Tri-County Oil and Gas Expo Committee along with Southwest Training, Job Training for Beaver County and Western Area CTC. Over 800 high school students attended this interactive event. The Expo was designed to focus on career opportunities and begin to develop a pipeline of future workers in the oil and gas industry. Students and educators learned about job opportunities in the oil and gas industry, networked with companies, established connections with other educators and trainers and surveyed company representatives about their careers.

Appendix B Strategic Incentives to Encourage Investment

The following table includes a brief overview of Pennsylvania's energy related incentives and other key economic development incentives designed to leverage private sector investment. Go to: www.dep.state.pa.us and click on 'Grants & Loans' for further details on DEP programs or www.newpa.com and click on 'Funding and Programs' for further details on DCED or CFA programs.

Strategic Incentives to Encourage Investment							
Agency	Program	Description	Tax Credit/Abatement	Loan	Loan Guarantee	Grant	Rebates
PA Department of Environmental Protection	Pennsylvania Natural Gas Energy Development Program	Act 13 of 2012 established this three-year program making $20 million in competitive grant funds available to purchase or convert eligible vehicles to natural gas. By supporting the purchase or retrofit of natural gas vehicles that use new or existing natural gas fueling stations within Pennsylvania, the program aims to increase the use of domestically produced natural gas, resulting in both economic and environmental benefits.				✓	
PA Department of Environmental Protection	Alternative Fuels Incentive Grant (AFIG)	Alternative Fuels Incentive Grant (AFIG) funding can be used for advanced or renewable energy projects including: fleet vehicle retrofits to operate on alternative fuels, purchase of alternative fuel fleet vehicles, cost to install refueling equipment for alternative fuel vehicles and incremental cost associated with purchasing biofuels.				✓	
PA Department of Environmental Protection	Alternative Fuel Vehicle Rebate Program	The Alternative Fuel Vehicle Rebate Program provides rebates to consumers for the purchase of new plug-in hybrid, plug-in electric, natural gas, propane and hydrogen fuel cell vehicles.					✓
PA Department of Environmental Protection	Pennsylvania State Clean Diesel Grant Program	The Pennsylvania State Clean Diesel Grant Program is open to both public and private entities to fund projects that reduce emissions from diesel powered vehicles and equipment. The base funding for the program is allocated to each state by the EPA, which receives the funds as a result of the federal Diesel Emission Reduction Act. The program funds projects that replace older diesel vehicles and equipment with newer vehicles or equipment, retrofit existing diesel sources with verified technologies to reduce emissions, repower eligible diesel engines to cleaner emission standards and reduce diesel vehicle and equipment idling through verified idle reduction technologies. Funding is awarded annually through a competitive bid process.				✓	
PA Department of Environmental Protection	Small Business Advantage Grant	The Small Business Advantage Grant Program provides Pennsylvania small businesses with 50% matching reimbursement grants of up to $9,500 to implement pollution prevention or energy efficiency projects and assists businesses to help transition into competitive markets. Examples of eligible projects include HVAC and boiler upgrades, high-efficiency lighting, solvent recovery systems, waste recycling systems and auxiliary power units deployed as anti-idling technology for trucks.				✓	
PA Department of Environmental Protection	Pennsylvania Energy Development Authority (PEDA)	Pennsylvania Energy Development Authority (PEDA) funding can be used for equipment purchase and installation and renovations to a major facility to improve energy-efficiency. Renovations must save at least 25% of the energy currently used by the system being replaced or save at least 25% of the entire facility's energy consumption. Funding can be used for the following types of energy projects: solar energy, wind energy, low-impact hydropower, geothermal, biologically derived methane gas, biomass, fuel cells, coal mine methane & waste coal, integrated gasification combined cycle, demand management measures (e.g., recycled energy, energy recovery), energy efficiency and load management. The maximum grant amount is $1 million with an average award of $375,000. To date, PEDA has invested over $65 million in over 150 alternative energy projects.				✓	

Strategic Incentives to Encourage Investment (continued)							
Agency	**Program**	**Description**	Tax Credit/Abatement	Loan	Loan Guarantee	Grant	Rebates
PA Department of Environmental Protection	PA Sunshine Program	PA Sunshine funds solar electric (solar photovoltaic), solar hot water (solar thermal) projects and battery back-up systems for Pennsylvania homeowners and small businesses. Residents are provided rebates up to $7,500 based on $0.75 per watt up to a 10KW system. Small businesses are offered rebates up to $52,500 toward the purchase of a 100KW photovoltaic system. Solar thermal projects rebates are offered at 35% of the cost.					✓
PA Department of Environmental Protection	Environmental Education Grant Program	The Environmental Education Act of 1993 created the Environmental Education Grants Program and mandates that 5% of all pollution fines and penalties collected annually by DEP be set aside for environmental education. In April 2012, DEP awarded 147 grants totaling more than $642,000 to support environmental education programs across the state. Since 1993, DEP has awarded nearly $8 million in grants to teach Pennsylvania's schoolchildren and general public about conservation and energy.				✓	
Commonwealth Financing Authority	Alternative and Clean Energy Program	The Alternative and Clean Energy Program (ACE) provides financial assistance in the form of grant and loan funds for the utilization, development and construction of alternative and clean energy projects in Pennsylvania. The program is administered jointly by DCED and DEP, under the direction of the CFA. Loans for manufacturers of alternative and/or clean energy generation equipment or components shall not exceed $40,000 for every new job created within three years after approval of the loan. Loans for any alternative energy production or clean energy project shall not exceed $5 million or 50% of the total project cost, whichever is less. Grants for manufacturers of alternative and/or clean energy generation equipment or components shall not exceed $10,000 for every job projected to be created by the business within three years after approval of the grant. Grants for any alternative energy production or clean energy project shall not exceed $2 million or 30% of the total project cost, whichever is less. Municipalities, counties and economic development organizations may apply for grants under the program. Private businesses may apply for grants, loans or a combination thereof.		✓		✓	
Commonwealth Financing Authority	High Performance Building Program	The High Performance Building Program provides financial assistance in the form of a grant or loan to individuals or small businesses to underwrite the cost premiums associated with the design and construction or major renovation of high performance buildings. The amount of the matching investment must be at least $1 for every $1 of program funds. The maximum grant award is $500,000 or 10% of the project cost, whichever is less. The maximum loan for individuals is $100,000 and $2 million for small businesses.		✓		✓	
Commonwealth Financing Authority	Solar Energy Program	The Solar Energy Program provides financial assistance in the form of grant and loan funds to businesses, economic development agencies or government agencies to promote the generation and use of solar energy and the manufacture or assembly of solar equipment. Grant and loan amounts vary based on the intended use of the funds. The amount of the matching investment must be at least $1 for every $1 of program funds.		✓		✓	
Commonwealth Financing Authority	Renewable Energy Program - Geothermal and Wind Projects	The Renewable Energy Program provides grants and loans to economic development organizations, municipalities, counties and private businesses to finance geothermal systems and wind energy generation or distribution projects. Grants of up to $1 million are available for wind energy projects. Loans of up to $5 million are available for wind energy and geothermal projects. Funds are also available to manufacturers of renewable energy generation equipment. The amount of the matching investment must be at least $1 for every $1 of program funds. Planning grants of up to 50% of the cost of the planning project (up to $175,000) are also available through this program.		✓		✓	
Commonwealth Financing Authority	Business in Our Sites (Loans)	The Business in Our Sites program provides low interest loans for the acquisition and development of key sites for future use by businesses, private developers and others. No maximum or minimum loan amounts are set, except that the maximum amount of the funding for projects located within a single city, borough, town or township may not exceed 15% of the funds available for the program. Loans are patient and no repayment is required until property is sold or leased or 5 years from the date of closing. Sites must be previously utilized property or undeveloped property that is planned and zoned for development.		✓			
Commonwealth Financing Authority	New PA Venture Capital Investment Program	The New PA Venture Capital Investment Program is a $60 million fund designed to provide loans to venture capital companies seeking to make investments in Pennsylvania companies. It will allocate 50% of the funds available to venture capital partnerships which operate locations in historically underserved areas of Pennsylvania. These areas are defined as counties outside of the Philadelphia MSA and those with populations below 1 million. The program also ensures that 50% of the funds are invested in these areas. The program requires a match by the VC of $3 of investment into Pennsylvania companies for every $1 the Commonwealth provides. This creates $240 million in investment capital for Pennsylvania companies.		✓			

Strategic Incentives to Encourage Investment (continued)							
Agency	Program	Description	Tax Credit/Abatement	Loan	Loan Guarantee	Grant	Rebates
The Reinvestment Fund / PA Department of Environmental Protection	Green Energy Loan Fund	The Green Energy Loan Fund (GELF) provides loans for energy conservation and efficiency improvements in commercial, nonprofit, government, multi-family residential and industrial buildings and facilities. Projects must result in a 25% reduction in energy consumption. Applicants may include building owners, developers or commercial tenants. GELF is managed by The Reinvestment Fund (TRF) through DEP.		✓			
PA Department of Community and Economic Development	PA Resource Manufacturing Tax Credit (PARMA)	The PA Resource Manufacturing Tax Credit (PARMA) was designed to stimulate investment in Pennsylvania by businesses which use ethane in the manufacturing process by offering a tax credit.	✓				
PA Department of Community and Economic Development	Keystone Opportunity Zones (KOZ) / Keystone Opportunity Expansion Zones (KOEZ)	Keystone Opportunity Zones (KOZ) and Keystone Opportunity Expansion Zones (KOEZ) provide specific state and local tax benefits in 12 geographic areas throughout Pennsylvania. The goal of the KOZ/KOEZ program is to revive economically distressed urban and rural communities with one of the most powerful market-based incentives – eliminating taxes. The program provides certain state and local tax abatement to businesses and residents locating in designated zones. The tax benefits available under KOZ and KOEZ programs may be available through December 31, 2025. In addition, KOZs and KOEZs are given priority for various state and local community-building assistance programs.	✓				
Ben Franklin Technology Partners	Ben Franklin Technology Partner's Challenge Grant and Alternative Energy Development Program (AEDP)	The Ben Franklin Technology Partner's Challenge Grant and Alternative Energy Development Program (AEDP) provides funds to businesses through the 4 Ben Franklin Technology Partners for access to capital, business expertise and technology commercialization services to advance the development of new technologies and for the generation, conservation and transportation of alternative and clean energy.				✓	
PA Department of Community and Economic Development	Pennsylvania First Program	The Pennsylvania First Program (PA First) is a comprehensive funding tool to facilitate increased investment and job creation within the Pennsylvania. Funding can be used for: machinery/equipment; job training; infrastructure; land and building improvements; environmental assessment/remediation; acquisition of land, buildings, right-of-ways; working capital; and site preparation, demolition, and clearance. Competitive projects must offer substantial economic impact, either for the Commonwealth as a whole or for the locality or region in which a business will locate or expand. Both private match and job creation/preservation are required.		✓	✓	✓	
PA Department of Community and Economic Development	Job Creation Tax Credit Program	The Job Creation Tax Credit program awards a $1,000-per-job tax credit to businesses that exhibit leadership in technology and create new jobs in the state within 3 years of a project start date.	✓				

Appendix C Notable Statutes Driving Energy & Environmental Policy

Pennsylvania has enacted and implemented the following key statutes that drive energy and environmental policy within the Commonwealth.

Notable Statutes Driving Energy & Environmental Policy	
Alternative Energy Portfolio Standards Act (Act 213 of 2004)	The Alternative Energy Portfolio Standards (AEPS) Act provides for the sale and acquisition of electric energy generated from renewable and environmentally beneficial sources by electric distribution and supply companies administered through the Pennsylvania Public Utility Commission. The legislation ensures a percentage of the electric energy sold by an electric distribution company or electric generation supplier to retail electric customers in Pennsylvania includes electricity generated from Tier I energy sources (solar photovoltaic energy, solar thermal, wind power, low-impact hydropower, geothermal energy, biologically derived methane gas, fuel cells, biomass energy, coal mine methane, black liquor, large-scale hydropower) and Tier II energy sources (waste coal, distributed generation systems, demand-side management, large-scale hydropower, generation of electricity from wood processing, integrated combined coal gasification technology).
Bituminous Coal Mine Safety Act (Act 55 of 2008)	The Bituminous Coal Mine Safety Act ensures the Commonwealth uses all of its powers to protect the lives, health, and safety of miners and others in and about underground bituminous coal mines. The Act, through an expeditious rulemaking process, requires operators at underground bituminous coal mines and every individual at every mine comply with set standards and improves and expands research, development, and training programs aimed at preventing underground bituminous coal mine accidents and occupationally caused diseases in the industry. The Act enables the Commonwealth to respond as necessary and appropriate to accidents and other emergencies at underground bituminous coal mines.
Unconventional Shale Natural Gas Act (58 Pa.C.S.) (Act 13 of 2012)	The Unconventional Shale Natural Gas law provides for the permitting, inspection, and oversight of oil and natural gas development within the Commonwealth. Act 13 ensures the protection of the Commonwealth's air, land, and water quality as it relates to oil and natural gas development and authorizes the imposition of an impact fee on unconventional natural gas wells, and provides for the distribution of revenue. The Act provides for uniformity, consistency and review of local zoning ordinances which regulate oil and natural gas development.
Energy Efficiency and Conservation and Electric Procurement (Act 129 of 2008)	Act 129 provides Pennsylvanians with adequate, reliable, affordable, efficient, and environmentally sustainable electric service at the least cost, taking into account any benefits of price stability over time and the impact on the environment. The Act Implements energy procurement requirements designed to ensure that electricity reduces the possibility of electric price instability, promotes economic growth, and ensures affordable and available electric service to all residents. Act 129 also expands the use of alternative energy and explores the feasibility of new sources of alternative energy to provide electric generation in the Commonwealth.
Natural Gas Competition Act (Act 21 of 1999)	The Natural Gas Competition Act provides for supply choice for customers of natural gas utilities and for restructuring of the natural gas utility industry. Act 21 allows retail gas customers to choose among natural gas suppliers and natural gas distribution companies in order to choose the best supplier for a variety of products, including but not limited to, different supply and pricing options. The Act requires natural gas distribution companies to unbundle natural gas supply services such that separate charges for the services can be set forth in tariffs and on retail gas customers' bills.

Notable Statutes Driving Energy & Environmental Policy (continued)	
Electricity Generation Customer Choice and Competition Act (Act 138 of 1996)	The Electricity Generation Customer Choice and Competition Act permits retail customers to obtain direct access to a competitive generation market as long as safe and affordable service is available at levels of reliability that are currently enjoyed by the citizens and businesses of this Commonwealth. The Act protects and preserves customer choice for the member-consumers of electric cooperative corporations, the financial integrity, operations and independence of electric cooperative corporations.
Alternative Energy Investment Fund (Act 1 of 2008)	The Alternative Energy Investment Act provided $650 million in funding and tax credits for alternative energy and energy efficiency projects for families, businesses and governments. It created two funding streams: $500 million in bonds and $20 million in annual funding and tax credits over 8 years. Funds are administrated through the Commonwealth Financing Authority, Department of Environmental Protection, Ben Franklin Partners, Pennsylvania Housing Finance Agency, Department of Public Welfare, and Department of Revenue. Types of projects funded include: geothermal and wind, alternative and clean energy, small business energy efficiency, and solar for residential and business.
Guaranteed Energy Savings Act (Act 77 of 2004)	Through the Guaranteed Energy Savings Act (Act 77, preceded by Acts 29 and 57), enables government entities such as counties, municipalities, townships, boroughs, and school districts to enter into a performance contracting agreement for energy services and energy-efficient equipment. Act 77 permits government entities to enter into an agreement with an energy service company for not longer than 10-years with the agreement including a written guarantee that the energy savings or operating cost savings will meet or exceed the project cost. Energy savings pay for specific improvements such as HVAC system replacements, indoor air quality improvements, energy recovery systems, energy efficiency improvements for swimming pools, building automation systems, and lighting. Savings are generated through energy, operational, maintenance, and capital avoidance.
Pennsylvania Climate Change Act (Act 70 of 2008)	The Pennsylvania Climate Change Act requires the Department of Environmental Protection to annually compile an inventory of greenhouse gas emissions in Pennsylvanian and create a voluntary greenhouse gas registry, establish a Climate Change Advisory Committee, develop a Climate Change Action Plan and a Climate Change Impacts Assessment.
Alternative Fuels Law (Act 78 of 2008)	The Biofuel Development and In-State Production Incentive Act requires minimum volumes of cellulosic ethanol and biodiesel be blended into gasoline and diesel fuel, proportionate with specified in-state production levels of the biofuels.
Municipalities Planning Code (Act of 1968; provisions of Act 39 of 2008)	The Municipalities Planning Code (MPC) allows for the inclusion of an energy plan element into municipal comprehensive plans. The MPC provides the framework to develop consistency between state and local energy policies and gives Pennsylvania local governments the authority to develop energy policy consistent with local energy resources and needs. The MPC sets the framework for local governments to implement energy plans and all other municipal land uses.
Clean Streams Law (Act 394 of 1937)	The Clean Streams Law ensures streams are clean and unpolluted in order to attract new manufacturing industries to the Commonwealth and to develop Pennsylvania's full share of the tourism industry. The Law promotes the creation of adequate out of door recreational facilities in the Commonwealth, puts pollutions preventions measures in plan, reclaims and restores polluted streams to clean, unpolluted conditions, and creates a comprehensive plan of watershed management and control.
Air Pollution Control Act (Act 787 of 1959)	The Air Pollution Control Act is the primary law governing all air quality issues in Pennsylvania, including the permitting, monitoring, and enforcement of all air contamination sources.

Notable Statutes Driving Energy & Environmental Policy (continued)	
Solid Waste Management Act (Act 1980 – 97)	This law establishes requirements for regulation of solid waste storage, collection, transportation, processing, treatment, and disposal. DEP issues various permits pursuant to this statute, including those for beneficial use of residual wastes. The law establishes the Pennsylvania Hazardous Waste Facilities Plan, which plan shall address the present and future needs for the treatment and disposal of hazardous waste.
Radiation Protection Act (Act 147 of 1984)	This statute authorizes DEP to implement a Statewide radiation protection program, provides for radiation emergency response, and establishes requirements for transport of spent reactor fuel and fee implementation.
Dam Safety & Encroachment Act (Act 325 of 1978)	This statute provides DEP with the authority to regulate construction, operation, maintenance and removal of water obstructions and encroachments in order to prevent unreasonable interference with water flow and to protect navigation. The Department issues various permits under this statute, including those for stream crossings under Chapter 105.
Surface Mining Conservation & Reclamation Act	The Surface Mining Conservation & Reclamation Act provides the statute for mine reclamation and remining activities. It requires obtaining an operator's license from DEP and provides DEP powers and duties related to enforcement and civil penalties. The Act Establishes the Mining and Reclamation Advisory Board and creates the Small Operator's Assistance Fund to promote mine reclamation activities.
Land Recycling and Environmental Remediation Standards Act (Act 2 of 1995)	The Land Recycling and Environmental Remediation Standards Act encourages the voluntary cleanup and reuse of contaminated commercial and industrial sites. The Act provides for uniform cleanup standards, liability relief, standardized reviews and time limits, and financial assistance.
Delaware River Basin Compact (Act 268 of 1961)	The Delaware River Basin Compact Act established the Delaware River Basin Commission (DRBC) which is authorized to formulate, adopt, and implement a comprehensive plan that addresses near and long range development and usage of water. The Act allows DRBC to regulate the storage, allocation, withdrawal, diversion and release of ground and surface waters; acquire, construct, operate and control projects and facilities for the storage and release of water, for quality and quantity purposes; and develop and authorize hydroelectric power development. The Delaware River Basin includes portions of Pennsylvania, Delaware, New Jersey, and New York.
Susquehanna River Basin Compact (Act 181 of 1968)	The Susquehanna River Basin Compact Act established the Susquehanna River Basin Commission (SRBC) which is authorized to formulate, adopt, and implement a comprehensive plan that addresses near and long range development and usage of water. The Act allows SRBC to regulate the storage, allocation, withdrawal, diversion and release of ground and surface waters; acquire, construct, operate and control projects and facilities for the storage and release of water, for quality and quantity purposes; and develop and authorize hydroelectric power development. The Susquehanna River Basin includes portions of Pennsylvania, Maryland, and New York.
Great Lakes Compact Act (Act 43 of July 2008)	This statute prohibits any diversions of the Great Lakes Basin with limited exceptions and provides DEP with regulatory authority over withdrawals that equal or exceed 100,000 gallons per day and joint authority over consumptive uses exceeding 5 million gallons per day.
Hazardous Sites Cleanup Act (Act 108 of 1988)	This statute governs hazardous sites cleanup including providing for response and investigations for liability and costs recovery. Cost recovery is provided through the Hazardous Sites Cleanup Fund.

Endnotes

[i] U.S. Energy Information Administration, accessed August 29, 2013, http://www.eia.gov/beta/state/rankings/?sid=PA#series/101.
[ii] U.S. Energy Information Administration, accessed February 5, 2013, http://www.eia.gov/state/rankings/?sid=PA#series/48.
[iii] U.S. Energy Information Administration, accessed March 13, 2013, http://www.eia.gov/nuclear/state/.
[iv] U.S. Energy Information Administration, accessed October 16, 2013, http://www.eia.gov/state/rankings/?sid=PA#series/51.
[v] Electric Power Generation Association (February 2013).
[vi] Pennsylvania Coal Alliance, *Pennsylvania's Coal Hard Facts 2012,* 13.
[viivii] Ibid., 47.
[viii] U.S. Energy Information Administration, accessed October 16, 2013, http://www.eia.gov/state/rankings/?sid=PA#series/46.
[ix] Pennsylvania Department of Environmental Protection and U.S. Energy Information Administration.
[x] IHS, Inc., *America's New Energy Future: the Unconventional Oil and Gas Revolution and the US Economy, Volume 2 – State Economic Contributions* (2012), 31, 52.
[xi] Marcellus Shale Coalition (February 2013).
[xii] Pennsylvania Department of Environmental Protection (January 2013).
[xiii] PA Energy Alliance (February 2013).
[xiv] Ibid.
[xv] Pennsylvania Department of Environmental Protection (January 2013).
[xvi] Solar Energy Industries Association, accessed October 7, 2013, http://www.seia.org/research-resources/solar-industry-data.
[xvii] PA Solar Industries Association (February 2013).
[xviii] American Wind Energy Association, *3rd Quarter 2012 Market Report* (2012).
[xix] Commonwealth Economics, LLC, *Energy in Pennsylvania: Past, Present, and Future* (March 2013), 61.
[xx] American Wind Energy Association, *Wind Energy Facts* (October 2012).
[xxi] Ibid.
[xxii] Ibid.
[xxiii] Pennsylvania Department of Conservation and Natural Resources, *Guidance for Harvesting Woody Biomass for Energy In Pennsylvania* (2008), 2.
[xxiv] Pennsylvania Public Utility Commission and Pennsylvania Department of Environmental Protection, *2010 Annual Report: Alternative Energy Portfolio Standards Act of 2004* (August 2011), 23.
[xxv] The Solar Foundation, National *Solar Jobs Census 2012* (October 2011), 64.
[xxvi] American Wind Energy Association, *Wind Energy Facts* (October 2012).
[xxvii] Keystone Energy Efficiency Alliance (February 2013).
[xxviii] Ibid.
[xxix] Pennsylvania Public Utility Commission, *PA Act 129 Statewide Evaluator Quarterly Report, 1st Quarter, Program Year 4,* http://www.puc.state.pa.us/electric/pdf/Act129/SWE_PY4-Q1_Report.pdf.
[xxx] Commonwealth Economics, LLC, Energy *in Pennsylvania: Past, Present, and Future* (March 2013), 86.
[xxxi] ICF International (2011), accessed February 20, 2013,

http://www.eea-inc.com/chpdata/index.html.

[xxxii] Commonwealth Economics, LLC, *Energy in Pennsylvania: Past, Present, and Future* (March 2013), 89.

[xxxiii] The Independent Market Monitor for PJM, *Analysis of the 2013/14 RPM Base Residual Auction Revised and Updated*. September 20, 2010, 52.

[xxxiv] Estimated from Table 2 B: Comparison of Demand Resources and Energy Efficiency Resources Offered versus Cleared in the 2013/14 BRA, *2013/14 Base Residual Auction Results*, PJM Interconnection. 7.

[xxxv] Pennsylvania Public Utility Commission, *Act 129 Statewide Evaluator Quarterly Report, 1st Quarter, Program Year 4,* http://www.puc.state.pa.us/electric/pdf/Act129/SWE_PY4-Q1_Report.pdf.

[xxxvi] Optimal Energy, *Pennsylvania 2013 – 2018 Energy Efficiency Goals,* accessed February 18, 2013, http://www.pennfuture.org/UserFiles/File/FactSheets/Report_Act129goals_20111220.pdf.

[xxxvii] Brookings Institute: http://www.brookings.edu/research/interactives/aggregate-clean-economy#/?ind=3&geo=1&vis=0&dt=1&z=0&x=0&y=0

[xxxviii] Optimal Energy: http://www.pennfuture.org/UserFiles/File/FactSheets/Report_Act129goals_20111220.pdf

[xxxix] Ibid.

[xl] Pennsylvania Public Utility Commission, press release, *Pennsylvania Ranks High in National Electric Competition Report, Ongoing PUC Improvements Should Boost Future Ranking*. December 17, 2012.

[xli] COMPETE Coalition, *Retail Electric Choice: Proven, Growing, Sustainable (*April 3, 2012), 14.

[xlii] Edison Electric Institute, *Future of US Electric Distribution* (July 2012).

[xliii] America's Natural Gas Alliance website, accessed January 16, 2013, http://www.anga.us/why-natural-gas/jobs

[xliv] Pennsylvania Department of Labor & Industry, Center for Workforce Information & Analysis. *Ethane Cracker Pennsylvania's Workforce Needs Roadmap* (November 2012), 2.

[xlv] NERA Economic Consulting, *Macroeconomic Impacts of LNG Exports from the United States* (2012).

[xlvi] U.S. Department of Energy, *2012 LNG Export Study – Reply Comments of the American Petroleum Institute*. February 25, 2013. From Attachment: ICF International , *Status Report and Preliminary Results: The Economic Impacts of U.S. LNG Exports.* February 22, 2013.

[xlvii] As of 2011, when the state's most recent comprehensive emissions inventory was submitted to the U.S. Environmental Protection Agency.

[xlviii] Pennsylvania Department of Education: http://www.education.state.pa.us/portal/server.pt/community/pennsylvania_department_of_education/7237/info/757639

[xlix] Cleveland State University, *Pennsylvania's True Commonwealth, The State of Manufacturing, Challenges and Opportunities* (2011), 10.

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