Marcellus Shale Education & Training Center

Marcellus Shale Workforce Needs Assessment

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June 2009

Needs assessment conducted by:

Marcellus Shale Education & Training Center (MSETC)

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Executive Summary

The purpose of the Marcellus Shale Workforce Needs Assessment was to examine the expanding workforce of the natural gas industry currently engaged in developing the Marcellus Shale region and to determine the education and training needs required to support this expanding workforce. This assessment was created by the Marcellus Shale Education & Training Center (MSETC), which was formed to serve as a primary workforce development resource for the natural gas industry.

Most workforce and economic modeling concepts utilize three labor forces: direct, indirect, and induced. For purposes of this study, *direct labor* includes occupations that are directly involved in the drilling and production phases including direct energy company employees as well as employees of contractors directly involved in these phases. These *direct labor* jobs include occupations associated with staking, scoping, permitting, engineering, logging, clearing, drilling, moving, finishing, cementing, completing, fracturing, and producing a well, as well as the majority of jobs required to clear, dig, and construct collector pipeline and compressor station infrastructure for the well. *Indirect labor* includes the supply-chain industries such as quarries, real estate, machinery manufacturers, etc. *Induced labor* includes such items as housing, food and drink, higher education, etc.

The MSETC team interviewed and surveyed the natural gas industry to determine the make-up of the workforce needed to develop the Marcellus Shale region. The data was subsequently analyzed using a workforce projection model developed specifically by the MSETC team to estimate the total *direct workforce* requirements for the industry. Since predicting future trends in the gas industry, particularly with respect to workforce needs, is challenging at best given the uncertain nature of the industry, the MSETC team developed three possible projection scenarios for the Central and Northern Tier Workforce Investment Board (WIB) regions in Pennsylvania. These three scenarios provide a “low scenario” estimate, a “likely scenario” estimate, and a “high scenario” estimate. The MSETC team then matched the workforce needs by occupational category to the education and training opportunities available in the two WIB regions to determine educational and training needs for the gas industry.

Workforce Requirements

According to the energy companies currently working in the region, the Northern Tier WIB region can expect dramatic increases in development over the next five years. This development will make up a large portion of Pennsylvania’s total Marcellus Shale activity. The Central WIB region can expect smaller, albeit significant, levels of activity. MSETC recognizes there are several limitations when predicting the location of future workforces and the residency of these workers, especially in the early stages of a significant natural gas play. This report does not take into account "commute sheds" (how far will workers drive for a job), which are actually created by the workers. Workforces were, therefore, calculated by the WIB region where the work is taking place, but it is recognized that office locations and worker residences may be contained in other WIB regions or even other states. The greater

Williamsport area; Horseheads, NY; and the Towanda area currently appear to be favored for industry offices and supply-chain centers locating in the area.

An analysis of the data using the MSETC workforce projection model indicates that the direct workforce needed to **drill** a single well in the Marcellus Shale region is comprised of over 410 individuals working within nearly 150 different occupations. The total hours worked by these individuals are the equivalent of 11.53 full-time, direct jobs over the course of a year. (The industry definition of a full-time equivalent is based on working 260 days [or 2,080 hours] a year.) Unfortunately, the vast majority of these "drilling phase" jobs do not compound each year; thus, the total workforce may increase or decrease depending on how many wells are drilled each year. Potential increases (or decreases) were calculated using a baseline rate of 11.53 jobs per well drilled. It is important to note that more than 98% of these jobs are required only while wells are being drilled. In addition, since the workplace location and residency of these workers will depend on a multitude of factors and will likely change over time, it is impossible to predict the impact of workforce needs for any one specific location.

By comparison, 0.17 long-term, full-time "permanent" jobs associated with the **production** phase of development are created for each well drilled in a given field. While comprising a very small percentage of the overall workforce, these long-term jobs do compound each and every year as more wells are drilled. For example, if 100 wells were drilled each year for ten years, 17 production jobs would be created each year. If that rate of development were to continue, then a total of 170 production jobs would be created after 10 years. Most of these workers would be based at company offices near the well locations.

The MSETC team determined that the Northern Tier WIB region would require between 1,292 and 2,153 direct, full-time jobs in 2009, depending on development intensity. These jobs include both drilling phase and production phase jobs. The direct, full-time equivalent workforce is expected to increase to between 2,107 and 3,511 jobs by 2011; direct, full-time equivalent workforce by 2013 will be between 3,281 and 5,468, depending on levels of development intensity.

The workforce requirements for the Central WIB region were less, with direct, full-time equivalent jobs projected to fall between 325 and 542 in 2009. However, by 2011-2013, workforce requirements are expected to increase to between 1,347 and 2,245 full-time equivalent positions, again depending on levels of development intensity.

The Pennsylvania Economy League recently estimated that each direct job in the Pennsylvania oil and gas industry creates an additional 1.52 indirect and induced jobs throughout the economy. Utilizing the Pennsylvania Economy League's multiplier, the projected job increases by 2013 for the Northern Tier region would be between 8,268 and 13,779; for the Central region, it would be between 3,394 and 5,657.

While not a focus of this study, the MSETC estimated the Marcellus Shale direct workforce requirements for all of Pennsylvania and concluded that the equivalent of between 3,500 to 7,500 workers will be

directly employed in drilling operations during 2009, depending on development intensity. By 2012, the equivalent of between 5,000 and 13,000 workers could directly be employed by the industry.

Education and Training Needs

Approximately 75% of the natural gas industry's direct workforce is comprised of occupations that require little formal post-secondary education and relatively few trade certifications. Instead, these jobs depend heavily on the experience-driven skills and knowledge unique to the natural gas industry. Company respondents indicated that finding workers with the unique skill sets, knowledge, and work ethic gained from experience in the gas industry remains a significant barrier to finding adequate local workforces.

Initially, a large portion of natural gas industry jobs will be filled by non-local workers; however, over time nearly all of these jobs could potentially be filled by local workers. Local educational and training institutions need to develop appropriate education and training programs to enable local workers to fill these jobs. This report examines in detail the needs for education and training to support jobs in the drilling phase (including pre-drilling or exploratory activities) and production phases of development.

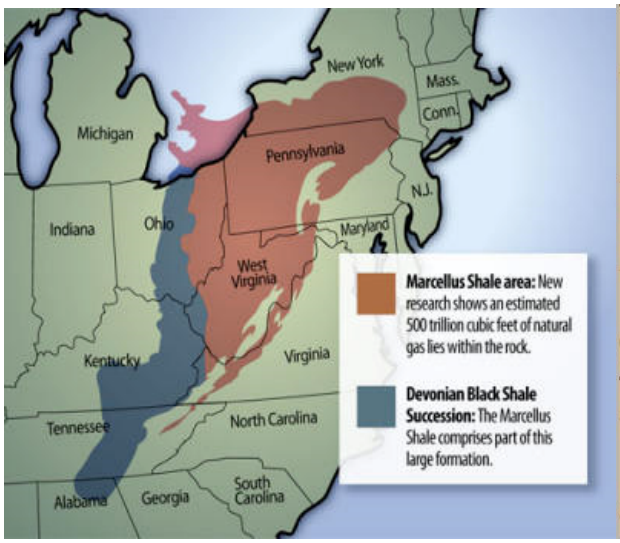
The majority of the natural gas industry workforce will be required only during the drilling phase of development. The degree and training programs currently being planned that target careers associated with the immediate drilling phase will take some years of operation before providing the workers currently being demanded or imported by the gas industry, and this gap will likely widen as development intensity increases. On the other hand, education and training programs that target those careers associated with the long-term production phase of development offer the greatest opportunity for building a sustained workforce in the natural gas industry. Current and pending degree and training programs that target long-term production phase careers may effectively provide for much of the eventual workforce demand in this area, depending on sustained enrollment and recognition of quality from energy companies. Available education and training programs that target "traditional" careers found in many industries, including natural gas, will likely be adequate to meet projected demand.

Finally, to ensure that vocational and career and technical education programs effectively support the growing need for workers in the gas industry, existing education programs will need to be re-orientated towards the specific knowledge, skills, and work ethics required by the natural gas industry.

Introduction

Introduction to the Marcellus Shale Region

The Marcellus Shale formation, located throughout a large swath of Pennsylvania and into parts of New York, West Virginia, and Ohio, holds a great though unproven potential for wide-scale natural gas development. The amount of recoverable gas located within the formation is currently unknown, and estimates of the amount of recoverable gas in the Marcellus Shale have recently ranged from 50 to 390 trillion cubic feet. Regardless of the estimate, most geologists place the recoverable gas reserve potential among the largest in the nation.



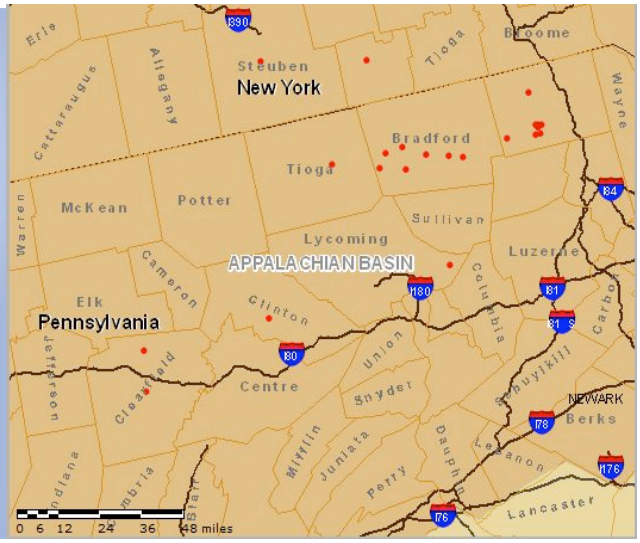


Figure 1 (left): Map of Marcellus Shale Occurrence

Figure 2 (right): Map of Drilling Rig Locations in North Central PA as of June 1, 2009. Source: Baker-Hughes

While extraction of this natural gas is still in the initial stages of development (as of June 2009), energy companies have already invested hundreds of millions of dollars in exploration and development programs throughout Pennsylvania to drill gas wells to tap into the gas reserve and to build the necessary infrastructure to make these wells operational and connect them to the natural gas pipeline. These companies have stated that they intend to dramatically expand their development operations in 2009 and beyond.

Currently, there are two main areas of Marcellus Shale development, with several smaller areas of development also occurring. The two main areas include an area of Southwestern Pennsylvania that primarily includes Fayette, Washington, Greene, and Westmoreland counties, and an area of North Central Pennsylvania that primarily includes Tioga, Bradford, and Susquehanna counties and is contained within the Northern Tier Workforce Investment Board (WIB) region. One area that has shown

a smaller yet notable level of development includes a Central Pennsylvania region that is contained within the Central WIB region and includes Clinton, Centre, Lycoming, and northern Columbia counties.

The fourth quarter of 2008 and first half of 2009 has seen the price of natural gas and the amount of gas drilling in the United States collapse. However, drilling activity in the Marcellus Shale has either remained steady or has increased during this period. Additionally, most companies operating in the Marcellus Shale have repeatedly stated their intention to expand operations in 2009 and beyond. The reasons for this expansion are due to a number of factors, including the relative infancy of the gas play and the close proximity of large transmission lines and large consumer markets. The very early stages of natural gas development typically require companies to invest large amounts of capital with a delayed rate of return even under ideal circumstances. The close proximity of the Marcellus Shale gas play to consumer markets ensures that a positive return on investment (ROI) is possible at a lower commodity price when compared with the ROI on other natural gas fields located throughout the country.

Development Patterns in the Northern Tier and Central WIB Regions

Marcellus Shale Natural Gas Development Activity in Selected WIB Regions 2007 – 06/01/2009
Sources: PA-DEP; Baker Hughes

Region	Wells Drilled			Permits Issued		Peak Drilling Rigs		
	2007	2008	06/01/2009	2008	06/01/2009	2007	2008	06/01/2009
Northern Tier	4	54	36	141	294	2	13	16
Central	6	21	5	64	59	2	5	5
Rest of Pennsylvania		121	95	307	263			

Figure 3: Historical Drilling Activity in North Central PA 2007-2009

Projected Marcellus Shale Wells Drilled Per Year 2009-2013[1]

	Northern Tier WIB Region						Central WIB Region					
Year	2008[2]	2009	2010	2011	2012	2013	2008[2]	2009	2010	2011	2012	2013
Low Scenario	54	105	166	172	233	267	21	26	48	110	110	110
"Likely" Scenario	54	140	221	229	311	356	21	35	64	146	146	146
High Scenario	54	175	277	286	389	445	21	44	80	183	183	183

Figure 4: Projected Marcellus Shale Wells, Drilled Per Year 2009-2013

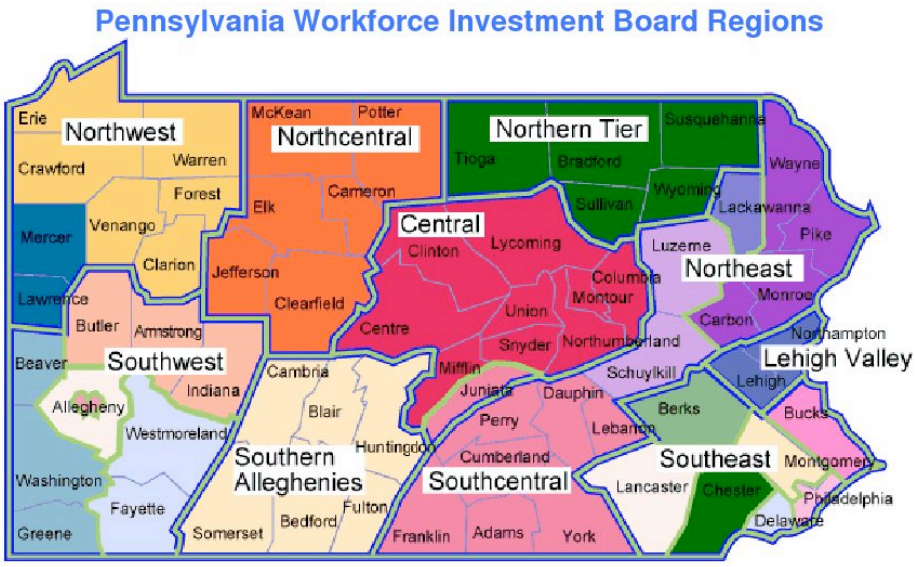


Figure 5: Map of Pennsylvania WIB Regions

Northern Tier WIB Region

The Northern Tier WIB region includes the counties of Bradford, Susquehanna, Sullivan, Tioga, and Wyoming. In 2008, Bradford, Susquehanna, and Tioga counties saw a large increase in the amount of natural gas development activity, and this upward trend continues today. While Marcellus Shale development within Pennsylvania first occurred with significant intensity in the southwestern corner of the Commonwealth, the building of successful wells and the attractive financial returns on the initial investment in the Northern Tier WIB region have ensured that development will continue. Some of the principal energy companies operating within the Northern Tier WIB region include Cabot Oil and Gas, Chesapeake Energy, Chief Oil and Gas, Fortuna Energy, Ultra Petroleum, East Resources, Seneca Resources, EOG Resources, and Epsilon Energy. Most of these companies have made repeated statements that they intend to dramatically increase levels of development intensity within the Northern Tier WIB region by the end of 2009. Rig counts and permitting activity within the first four months of 2009 have indicated that activity levels during this year will easily double that seen in 2008. According to an analysis of publicly made statements by energy companies with operations in the region, the number of wells drilled per year could increase from 54 wells in 2008 to 140 wells in 2009 and 221 wells in 2010. Company estimates for 2009 and beyond indicate that development activity in the Northern Tier WIB region will likely surpass activity in the southwestern part of the Commonwealth.

Central WIB Region

The Central WIB region includes Clinton, Centre, Columbia, Lycoming, Mifflin, Montour, Northumberland, Union, and Snyder counties. The Central WIB region experienced a brief flurry of activity in 2008 that focused largely on Lycoming and Centre counties, and this activity has slowed

significantly since the fall of 2008. Activity in 2009 is expected to increase to some degree, perhaps eventually equaling 2008 levels. However, energy companies operating in the Central WIB region have indicated they expect to expand drilling operations by the end of 2009 and into 2010. According to an analysis of publicly made statements from energy companies with operations in the area, the number of wells drilled in the region could increase from 21 wells drilled in 2008 to 26 wells drilled in 2009 and 48 wells in 2010. Principal energy companies operating in the Central WIB region include Anadarko Petroleum, Exco North Coast Energy, Chief Oil and Gas, Chesapeake Energy, Rex Energy, and Range Resources.

The Industry Partnership Model

Pennsylvania is among the leading states in addressing workforce development needs through an Industry Partnership Model approach. The focus of this approach is to bring companies together from a specific industry cluster within a specific geographic region to address a wide range of issues that include education and training, supply-chain dynamics and logistics, and transportation, to name a few. The main assumption behind the Industry Partnership Model is that regional companies within a targeted industry sector can do a better job maintaining their competitive advantage in a global marketplace if they work together to maximize the benefits of economies of scale. In addition, the synergies that often result from the collaborative efforts of an industry partnership can impact long-term strategic viability as much as short-term profitability. In the context of education and training, the Industry Partnership Model provides foundational and functional support for training initiatives and allows participating companies to leverage and maximize the value of scarce training resources. The Central WIB and the Northern Tier WIB together supported the development of this assessment and the natural gas industry partnership, as well as several other industry partnerships in key industry sectors, leveraging local, state, and federal dollars to provide support to the industry.

Introduction to the Natural Gas Industry Workforce

Due to differences in geology, technology, and energy company practices, the Marcellus Shale development process differs significantly than that of the traditional shallow gas development that has historically occurred in Pennsylvania. Marcellus Shale gas is considered “unconventional” in that the formation requires hydraulic-fracturing, directional drilling, and other methods to produce economically feasible levels of natural gas. These processes are much more industrial in nature, labor intensive, and technologically advanced than conventional shallow gas development. Additionally, the energy companies and contractors that perform this type of drilling are mostly national or international in size, and subsequently utilize contractors and personnel from around the country and from other parts of the world to perform this work.

History has shown that predicting future trends of the natural gas industry can be challenging and estimating the workforce requirements of this particular industry represents an even greater challenge. Natural gas development trends can be difficult to predict as commodity prices, technological changes, and other factors can change the intensity and scope of development rather quickly. Additionally, a wide array of energy companies and an even wider array of subcontractors comprise the industry, and the

resulting complex web of occupational needs and workforce requirements can be difficult to estimate even under ideal circumstances. Employees are often based from multiple locations within a region to develop hundreds of different wells, pipeline, and compressor station locations. Many industry workers do not work conventional schedules and often work on rotation. Workers will sometimes work 12-hour shifts for weeks at a time, and then be afforded several continuous weeks of leave while an entirely new crew of workers takes their place.

Locations and Residency

Due to the inherent uncertainty of development intensity and locations, many workers remain only transient residents of a development location and keep permanent residency at a location hundreds or thousands of miles away.

Since many contractors and subcontractors are accustomed to working at multiple and changing locations throughout North America or the world, it is commonplace within the natural gas industry to utilize non-local workforces and supply-chain services. However, as development moves forward over the course of months or years, some contractors or subcontractors will either relocate to the local area or local businesses may be created. This transition is already occurring to some degree in North Central Pennsylvania, as local companies that have historically catered to conventional natural gas development have significantly augmented their roles to include work in the Marcellus Shale, and other national or international companies have opened local offices. The experience of natural gas plays in other areas have shown that the majority of jobs created by natural gas development in Central and Northern Pennsylvania will be initially filled by workers either transient or non-local in nature, but that the majority of these jobs have the potential to eventually be filled locally if the properly trained skilled workers are available.

Drilling Phase Jobs vs. Production Phase Jobs

The natural gas development process is such that a very large proportion of the total industry workforce will be required during the well drilling phase, while a small minority of the workforce will be required for the long-term production phase. Before the well is drilled, an initial workforce is needed in a “pre-drilling” phase that relates to the exploration, leasing, surveying, engineering, permitting, etc. of a well and well location. Pre-drilling and drilling phase jobs are grouped together in this section of the report.

Drilling Phase Jobs

The phase of natural gas development during which the natural gas wells are drilled and the associated pipeline infrastructure is put into place is an extremely labor-intensive process. MSETC found that the workforce needed during this phase constitutes over 98% of the industry workforce needs. Once the process of drilling gas wells in an area is completed, this segment of the workforce will no longer be needed. In the oil and natural gas industries, this drilling phase period is often referred to as “the boom” as a vast number of workers is often suddenly required to perform tasks associated with natural gas development. Marcellus Shale development currently appears to be experiencing the early stages of a boom in development. Conversely, the drilling phase can suddenly decline, which is often referred to within the industry as the “the bust.” Given the level of uncertainty, many employees in the drilling

phase of gas development are "imported" to the local drilling area and maintain temporary residency in a given area – such as in motels, RVs, "man camps," etc.

No one can say for certain how long the drilling phase will last within the Marcellus Shale, or within specific areas of the shale formation, especially during the early stages of development that are currently underway. Drilling phase estimates have ranged from 10 to 70 years; however, due to future fluctuations in commodity prices, economic conditions, regulatory changes, and technological changes, among other variables, the true length of drilling activity is unknown. A number of scenarios can be envisioned, ranging from sustained decades-long drilling activity, to drilling activity that jumps from hotspot to hotspot within the state after a few years in each area, to a relatively quick flurry of activity that subsides after a number of years.

Production Phase Jobs

In contrast to drilling phase jobs, jobs associated with the production phase are well defined and predictable, as these jobs are required to manage production operations for existing wells. Industry experts believe that the wells created as part of the Marcellus Shale region will likely produce gas for 30 years or more. Even if drilling were to cease completely, the "production phase" jobs necessary to manage and maintain these wells would still be required.

Within the industry, careers associated with the production phase are often referred to as long-term or even "permanent." Occupations during the production phase, in addition to being long-term, tend to be less labor intensive, with less risk involved, and more specialized than development phase occupations, while still retaining excellent salary and benefits.

Workforce Estimates

Given the complex web of occupations that constitute the natural gas industry workforce, traditional methods of measuring future job creation used in other industries are often inadequate. Commercially available input-output economic models are usually predicated on a national-average flow of goods and services within local industries, but do not account for the far-flung workforces and supply chains used by the natural gas industry. Additionally, many of the industries that participate in the development of a natural gas field are usually not present in the area before the natural gas development process begins, thus capturing their workforce needs using most workforce projection models is ineffective at best given there is no local baseline data to provide a starting point.

Similarly, given the uncertainty in natural gas development, job estimates predicated solely on posted job openings or industry questionnaires – while providing an accurate snapshot of current demand – are largely inflexible to the constantly changing intensity of development activity.

Workforce Model Methodology

Introduction

The method used in this study to estimate the workforce requirements of the natural gas industry focused on analyzing the types and numbers of workers needed to drill a single Marcellus Shale gas well and then extrapolating that data to achieve a total workforce requirement based on estimates of future well drilling activity. As discussed below, this method has a number of both advantages and limitations over other previously used estimation methods.

At the core of this method is a calculation of the full-time work equivalent (FTE) for each worker associated with drilling a Marcellus Shale well. Many tasks that occur during the well drilling process may only require a few workdays to complete. Therefore, the per-well work requirement for most of the occupational categories ranged from 1/10 to 1/100 of an FTE. In addition, some very labor-intensive occupations such as heavy equipment operation, office staff, and drilling rig operation (roughnecks) constituted an equivalent that ranged between 1/10 to as many as 2 FTE per well.

$$\frac{\text{(Workers Per Well) x (Work Days per Well)}}{260} \times \text{(Drilling Rigs * 10)} = \textbf{Workforce Requirements}$$

Figure 6: General Equation Behind Workforce Model. 260 represents the average number of workdays per year for an FTE worker. 10 represents the average number of wells drilled per year by each drilling rig.

Determining fractional FTE numbers for each worker directly associated with drilling a natural gas well is a complex process. FTE numbers for the majority of occupations is a matter of simply identifying the number of workers in a particular occupation or work crew and then identifying the number of days these workers typically spend on a well site. FTE numbers for a portion of the occupations – including pipeline construction, land clearing, office staff, etc. – were highly variable based on specific conditions and "ballpark" averages were used. The MSETC team worked closely with representatives from a number of energy firms, drilling companies, and subcontractors to identify nearly 150 occupational categories and/or skill groups and to identify FTE numbers and estimates for the workers in these occupational categories. The results from the gas industry workforce survey performed by MSETC also aided in identifying and confirming this data.

After the occupations were identified and the FTE numbers were determined, the next major step in creating a viable workforce projection model was to determine the estimate of future drilling rig activity. In addition to working with energy operators and subcontractors, the MSETC reviewed investor statements, press releases, and public statements made by energy company officials regarding their plans for future drilling activity in the region. The results from the gas industry workforce survey helped to confirm these estimates. With this method, estimates were determined for all the major and most minor energy companies operating in the region.

Summary of Model Components and Creation Process

The process to create a viable workforce projection model for the gas industry involved a series of brainstorming sessions, meetings, discussions with energy company representatives, and analysis of relevant document sources. The timetable in this process is highlighted below:

- Brainstorming session with energy companies, direct support, and subcontractors at the February 2 and March 23 partnership meetings to identify occupations and FTE data
- Detailed discussion with select energy companies and their service providers about their contracting and employee needs, which often included a step-by-step analysis of workforce requirements
- Multiple gas field tours
- Development, distribution, and analysis of energy industry workforce survey results
- Well count estimates determined by discussions with energy company representatives, public and investor statements, newspaper articles, and official statements made at public meetings

Advantages, Disadvantages, and Key Assumptions of This Model

This model allows the user to identify a projected level of development intensity, in this case measured by wells drilled per year (the input) and determine, or project, the number of workers based on occupational categories (the output) required for that level of development.

For the purposes of assessing workforce education and training capacities, this type of model is superior to a number of different methods. However, this model also has a number of limitations as well.

Limitations to Location and Residency

It is recognized that a limitation to this methodology is the difficulty in determining the exact location of offices that may serve as the base of operations for many companies, as well as the residency locations for these workers. Companies working in the natural gas industry are known for commuting long distances and quickly changing the locations of offices, yards, and staging areas. The majority of workers and companies predicted in this model are not yet located in the region, and the future locations of many companies are unknown. For this reason, the "commute sheds" (distances which workers are willing to travel) have not yet been determined. For example, it is likely that many of the workers performing operations in the Northern Tier WIB region will be located in the Central WIB region or beyond and vice versa. At this early stage in the development process, several areas have emerged that have the potential to host many of the major companies operating in the region, including the greater Williamsport, PA area; the Horseheads, NY area; and Towanda, PA. This model avoids the problem of estimating the exact locations of company offices by estimating the workforce requirements by the location of the development site. It is hoped that by providing workforce requirement estimates for these regions, exact locations of offices, yards, and staging areas can be incorporated as the development process advances.

Advantages:

- Offers much more specific occupational descriptions than generic "industrial classifications" especially in a newly emergency industry

- Does not include/exclude based on industrial classifications
- Uses direct worker requirements, not complex I/O economic modeling
- Does not include/exclude based on the geographic locations of business offices
- Does not rely on sampling or response rates (such as surveys)
- Can easily be changed as development scenarios fluctuate

Limitations:

- Does not (currently) calculate the specific workplace locations
- Does not (currently) calculate indirect or induced economic or workforce impact
- Is dependent on the accuracy of development projections
- Does not provide business-specific information such as name, size, location, etc.
- Does not include most indirect or supply-chain industries or workforces
- Does not include all workers/contactors (such as all contracted legal services)

Key Assumptions:

- Full-time equivalent is defined at 260 work days (or 2,080 hours) per year
- Average drilling rig will drill approximately 10 wells per year
- Each well will require, on average, 1 mile of pipeline construction
- For every 20 wells, 1 compressor station will be constructed, on average
- Companies' current drilling rig projections are relatively accurate (for the 'likely' scenarios)

Natural Gas Workforce Requirements Survey

The key to making accurate workforce projections was getting accurate foundational information from the energy companies working in the Marcellus Shale region. To that end, the MSETC team created and conducted an industry-specific survey and then analyzed the results.

Survey Introduction

The MSETC team created an online questionnaire intended for companies with operations in the development of Marcellus Shale natural gas. The survey was not designed to provide a comprehensive picture of natural gas industry demands, but rather was primarily designed for 1) collecting information on specific education and training needs and 2) validating certain assumptions made within the workforce requirements model.

The survey was administered via the Internet, and invitations to respond to the survey were sent to an internally-collected list of approximately 170 natural gas industry contacts.

Fifty-three (53) respondents completed at least some part of the survey, and of these, approximately thirty (30) respondents answered the majority of questions in detail. By the respondents' own collective estimation, the respondents employed 2,868 persons in the area, although not all of these persons are solely involved in Marcellus Shale-related activities.

Summary of Respondents
MSETC Workforce Needs Assessment Survey April 2009

	Total Respondents		Full Respondents		Employees Represented	
Category	Percent	Number	Percent	Number	Percent	Number
Energy Company	41.50	22	37.93	11	19.18	550
Direct Service Provider	30.20	16	41.38	12	67.43	1934
Engineering/Surveying Services	15.10	8	13.79	4	7.43	213
I Do Not Wish to Answer This Question	7.50	4	0.00	0	…	…
Legal Services	1.90	1	0.00	0	…	…
Regulatory/Government Services	1.90	1	3.45	1	5.75	165
Supply Chain Services	1.90	1	3.45	1	0.21	6
Total		**53**		**29**		**2868**

Figure 7: Summary of Natural Gas Industry Survey Responses

It is important to differentiate the labor requirements of the intensive and time-consuming Marcellus Shale-related development with that of the less intensive and time-consuming shallow or conventional gas development. Nearly all of the energy company respondents indicated that all of their regional activity was in the Marcellus Shale, while direct service and engineering companies indicated a much broader array of development in both Marcellus and non-Marcellus activity. Direct service providers indicated that on average 61% of their activity was in Marcellus Shale development.

Survey Findings in Education and Training Needs

Through responses to a number of different questions, survey respondents indicated that while certain trade certifications, degrees, and technical skills are important, finding employees with a combination of basic skills and experience in the natural gas industry and the ability to work the hours needed are a far larger barrier than finding qualified workers.

Q64. What are Biggest Challenges to Finding New Workers? (check all that apply)

	All Respondents		Energy Company		Direct Service		Engineering	
Answer Options	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Hard to find workers with the experience needed	20	76.90%	8	100.00%	11	84.62%	1	33.33%
Hard to find workers with the basic skills or background needed	17	65.40%	5	62.50%	10	76.92%	1	33.33%
to find workers willing to do the work and/or work the hours needed	14	53.80%	2	25.00%	11	84.62%	1	33.33%
Hard to find workers with the technical skills needed	11	42.30%	4	50.00%	6	46.15%	0	0.00%
Hard to find workers with the proper degree or certification needed	4	15.40%	2	25.00%	0	0.00%	1	33.33%
Hard to find workers with the proper interpersonal skills needed	4	15.40%	1	12.50%	2	15.38%	1	33.33%
Other (please specify)	1	3.80%	0	0.00%	0	0.00%	0	0.00%
Total Respondents:	**27**		**8**		**13**		**3**	

Figure 8: Biggest Challenges to Finding New Workers

When asked what specific areas of education or training are most needed in the region, generalized training programs that favor basic experience over technical skills were the most popular (such as well operations, water disposal procedures, and gas field safety). This information largely corroborated the larger, industry-wide distribution of occupational categories produced by the workforce requirements projection model. Industry experts overwhelmingly indicated that the majority of natural gas occupations require specialized skills and experience rather than formal education or training.

Respondents were largely split on whether additional or expanded training programs in the Northern and Central regions of Pennsylvania would be beneficial in helping the industry find qualified workers. About 71% of the energy companies, which tend to demand more specialized technical skills, indicated that the current programs are not sufficient; while a majority of service companies and engineering firms indicated that the current offerings were indeed sufficient. When asked what specific training programs they utilize in the area, respondents indicated they use some public programs, but mostly utilize private or in-house training programs. In total, the survey results seemed to indicate that – in addition to a few specialized training and certification programs – survey respondents would attach the greatest value to training programs that could provide an approximation of the skills and work ethic that would normally be gained by years of experience in the industry.

Q65. In your opinion, are there sufficient educational and training programs in Central and Northern Pennsylvania to create prospective new employees in your line of work?

	All Respondents		Energy Company		Direct Service		Engineering	
Answer Options	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Yes	14	53.85%	2	28.57%	8	61.54%	3	75.00%
No	12	46.15%	5	71.43%	5	38.46%	1	25.00%
Total	**26**		**7**		**13**		**4**	

Figure 9: Level of Sufficient Educational and Training Programs (Survey)

Q66. In general, what kind of education or training programs are you most in need of? (Check all that apply)

	All Respondents		Energy Company		Direct Service		Engineering	
Answer Options	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1 or 2 year technical college or vocational degrees	9	36.00%	2	25.00%	2	15.38%	2	66.67%
4 year college degrees	7	28.00%	1	12.50%	1	7.69%	2	66.67%
trade certifications	5	20.00%	4	50.00%	4	30.77%	0	0.00%
Other (please specify in next question)	3	12.00%	0	0.00%	3	23.08%	0	0.00%
Graduate Degrees	1	4.00%	0	0.00%	1	7.69%	0	0.00%
Total Respondents:	**25**		**7**		**11**		**4**	

Figure 10: What Educational and Training Programs Are You Most in Need Of?

Survey Findings in Workforce Model Assumption Validation

The survey results appeared to validate a number of the workforce model assumptions; none of the survey findings appeared to contradict any assumptions used in the model.

Per-Well Workforce Estimates

Respondents were asked to indicate the total number of wells that could be serviced per year by their current staffing capacity and then to indicate their exact staffing capacity throughout a variety of different occupational categories. With this information, a general per-well workforce requirement could be made for each of the occupational categories. The intent of this information was to provide a "ball park" estimate to validate or not validate what is considered to be the far more reliable estimates compiled in the workforce matrix. While not all respondents sufficiently completed the "number of wells" question, the per-well workforce requirements from the survey were overall consistently similar to, but slightly higher than, the per-well requirements indicated by the workforce requirements projection model. However, as the workforce projection model is intended to offer a somewhat

conservative estimate of workforce needs, the survey results in this specific area appeared to generally validate the workforce model.

Five-Year Development Projections

Respondents of the survey were asked for their estimates of development intensity for the next five years within the two WIB regions. The workforce model is predicated on five-year estimates of development intensity within the two WIB regions, and the estimates contained in the model were made based on the available public statements of nearly every energy company operating in these regions. The intent of the survey questionnaire was to validate or not validate these estimates on this subject by providing energy operators a completely anonymous venue to offer development estimates and by soliciting the estimates of non-energy companies working within the industry. The results of this questionnaire showed that respondents, on average, expected development intensity similar to, but slightly lower than, that obtained by MSETC through energy company statements. Using these results, the workforce model was adjusted to account for slightly lower development intensity.

Workforce Model & Survey Findings

An analysis of the data using the MSETC workforce projection model indicates that the direct workforce needed to drill a single well in the Marcellus Shale region is comprised of over 410 individuals working within nearly 150 different occupations. The total hours worked by these individuals directly needed to drill a single well are the equivalent of 11.53 full-time jobs over the course of a year. It is important to note that these jobs are not permanent and do not compound year-after-year. These workers are required only while wells are being drilled and are merely a function of the number of wells being drilled each year. For example, if 100 wells are drilled per year, then the total workforce will be 1153. If 100 wells are drilled per year for 10 straight years, the total workforce will remain very close to 1153, with a slight increase for the long-term production phase jobs that are created (as discussed below). These job requirements will float with the intensity of development – if the number of wells drilled in a year decreases, the number of workers required will drop accordingly.

The number of Marcellus Shale industry workers includes the vast majority of occupations directly associated with the drilling and completion process, but does not include many of the indirect jobs that will be created in a variety of occupations ranging from legal advice to gravel quarrying to steel pipe fabrication. The vast majority of jobs directly associated with the staking, scoping, permitting, engineering, logging, clearing, drilling, moving, finishing, cementing, completing, fracturing, and producing a well are included in the estimate, as well as the majority of jobs required to clear, dig, and construct collector pipeline and compressor station infrastructure for the well.

Workforce Locations

The majority of these jobs will be located in the immediate vicinity of the well being drilled; however, office workers and some geologic science, engineer, and supervisor jobs will be located at energy company offices or perhaps subcontractor company offices, which may or may not be located near the vicinity of the well site or even within a particular WIB region. The location of these jobs is difficult to determine, as many of these office locations vary from company-to-company and subcontractor-to-subcontractor, and companies may change the location of their offices as development locations emerge. The location of regional offices will also determine the location of long-term production jobs created in the region.

Short-Term Drilling Phase Jobs vs. Long-Term Production Jobs

As noted above, the overwhelming majority of jobs associated with the natural gas industry are only needed while wells are being drilled. However, a very small minority of jobs associated with monitoring the long-term production of natural gas throughout the life of the well will be needed. These jobs will be required for as long as wells are producing gas, which is currently estimated by the energy companies in the Marcellus Shale to be over a 30 to 40 year period. The workforce model estimates that 00.17 of these long-term, full-time jobs are created for each well drilled in a given field (or approximately one worker for every 6 wells drilled). These jobs *do compound* each year, and if a large total number of wells is drilled in a given area after several years, then these jobs can add up to a significant semi-permanent

workforce. For example, if 100 wells are drilled per year for ten years, 17 long-term jobs would be created each year, for a total of 170 long-term jobs created after 10 years. In addition to being long-term in nature, these jobs typically are less hazardous and less labor-intensive than jobs associated with the drilling phase, while retaining excellent benefits.

Occupational Categories Within the Natural Gas Industry

Occupational Category	Percent of Workforce
General Office (Accounting, IT, Reception, Secretary, etc.)	20.27
General Labor (Roughnecks, Roustabouts, etc.)	20.04
Heavy Equipment Labor (Frac Crew, Crane, Rig Move, etc.)	16.91
CLD	9.80
Semi-Skilled Tech	6.01
Landmen/Realty	5.43
Supervisors	4.61
Lawyers	4.07
Engineers	3.36
Geologists	2.59
Welders-Helpers	1.32
Timber Logging	1.25
Paralegal	1.13
Cartog/GIS	0.90
Welders-Helpers	0.89
X-Ray	0.81
Inspectors	0.59

Figure 11: Occupational Composition of Natural Gas Workforces

The model and related research found that the majority of the occupations in the direct workforce associated with Marcellus Shale natural gas development are comprised of unskilled or semi-skilled occupations including heavy equipment operation, CDL truck operation, general labor, pipefitters, and a variety of office-related occupations. These occupations account for roughly 75% of the workforce. Industry representatives, survey respondents, and additional research indicated that most of these occupations require no formal post-secondary education and only a few (such as CDL, welding, X-ray, etc.) require a specialized license or trade certification. However, nearly all of them require the skills and knowledge unique to the natural gas industry; skills and knowledge that are best learned through experience. Workers within all occupations of the natural gas industry are additionally prized for their hard work ethic and willingness to work very long hours in unfavorable conditions. The majority of the remaining 25% of workers are in occupations that are white collar in nature, including foremen, supervisors, legal, realty, engineering, geological sciences, etc.

Indirect and Induced Job Creation

As noted above, the jobs discussed here are those only directly associated with drilling and completing of a Marcellus Shale natural gas well and related pipeline construction. Jobs that are not directly

associated with the industrial process are not tallied in this model. In a recent report, the Pennsylvania Economy League estimated that each direct job in the Pennsylvania oil and gas industry creates an additional 1.52 indirect jobs throughout the economy[1]. Using the direct workforce model in combination with the Pennsylvania Economy League's multiplier, a total of 29.06 direct and indirect jobs can be estimated to be created from each Marcellus Shale well drilled per year, but only while the drilling process is underway.

Direct Workforce Requirements for Each WIB Region

Northern Tier WIB Region

An analysis of the data using the workforce projection model indicated that the Northern Tier would require between 1,292 and 2,153 direct, full-time jobs in 2009, with 1,723 being the average estimate. These jobs include both drilling phase and production phase jobs. In addition, 350 of these jobs were classified within the 'general office' occupational category; however, it is unknown how many offices will be located in the Northern Tier WIB region at this time. Several such offices are located just outside the borders of the Northern Tier WIB region; however, more may relocate within the region as development progresses.

Further analysis of the data indicates that the number of jobs will increase rather dramatically over the five-year period from 2009 to 2013, as energy companies have indicated an intention to increase the intensity of development during this period. The direct, full-time equivalent workforce is expected to increase by over 1,000 within two years, with 2,107 to 3,511 jobs expected in 2011 (with 2,809 a likely estimate). By 2013, the number is expected to range from 3,281 to 5,468 (with 4,375 a likely estimate). Of these workers, 25 are expected to be long-term production phase jobs created by wells drilled in 2009, and the total number of long-term production phase jobs created by wells drilled between 2009-2013 in the Northern Tier region is expected to be approximately 225.

Central WIB Region

The study revealed that fewer jobs will be required in the Central WIB region as compared to the Northern Tier WIB region, a finding which reflects the fact that the energy companies working in the area are currently developing fewer sites in the Central WIB region and have fewer plans for developing future sites. An analysis of the data using the workforce projection model indicated that the Central WIB region would require between 325 to 542 direct, full-time jobs in 2009, with 434 being a likely estimate. Due to the larger number of industry offices located in and around Williamsport, a higher proportion of the 75 jobs tallied in the 'general office' occupational category may be expected to remain in the region when compared to the Northern Tier WIB region. In fact, some of the jobs associated with the Northern Tier WIB region may be located within the Central WIB region.

[1] The Pennsylvania Economy League of Southwestern Pennsylvania, LLC 2008. *The Economic Impact of the Oil and Gas Industry in Pennsylvania*, prepared for the Marcellus Shale Committee. Available online: http://www.alleghenyconference.org/PEL/PDFs/EconomicImpactOilGasInPA1108.pdf

As is expected with the Northern Tier WIB region, the number of jobs in the Central WIB region should also increase rather dramatically over the five-year period from 2009 to 2013, as energy companies have also indicated a desire to increase development levels in the Central WIB region. Direct, full-time equivalent workforces are expected to increase greatly within two years, with 1,347 to 2,245 full-time equivalent requirements expected in 2011 (with 1,796 a likely estimate). However, unlike the projected job growth in the Northern Tier WIB region, energy companies have not thus far indicated an intention to increase development in the Central WIB region beyond 2011 levels, so workforce numbers in 2012 and 2013 currently reflect 2011 levels. Of these workers, 9 are expected to be long-term production phase jobs created by wells drilled in 2009, and the total number of long-term production phase jobs created by wells drilled between 2009-2013 in the Central WIB region is expected to be approximately 96.

Beyond 2013

Given the fluctuations in development activity that are inherent in the natural gas industry, multi-year development projections can be unreliable. However, the projections in this study are formulated using the best information available at the current time. Projections beyond 2013 are difficult to estimate; however, there are some indications that drilling activity may increase over the projected 2013 levels. Continued growth will depend on a multitude of factors, including economic conditions, demand, supply, commodity prices, technological innovations, regulatory constraints, etc.

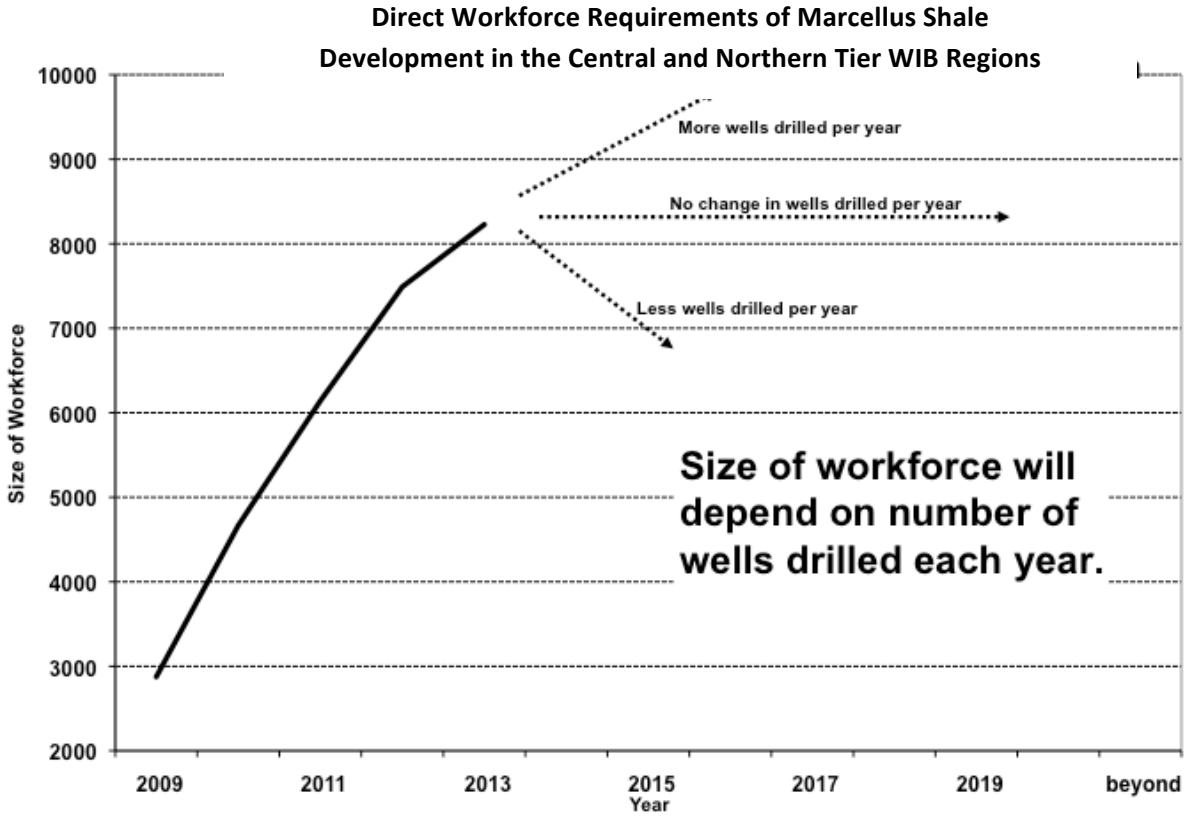


Figure 12: Illustration of Relationship Between Wells Drilled Per Year and Workforce

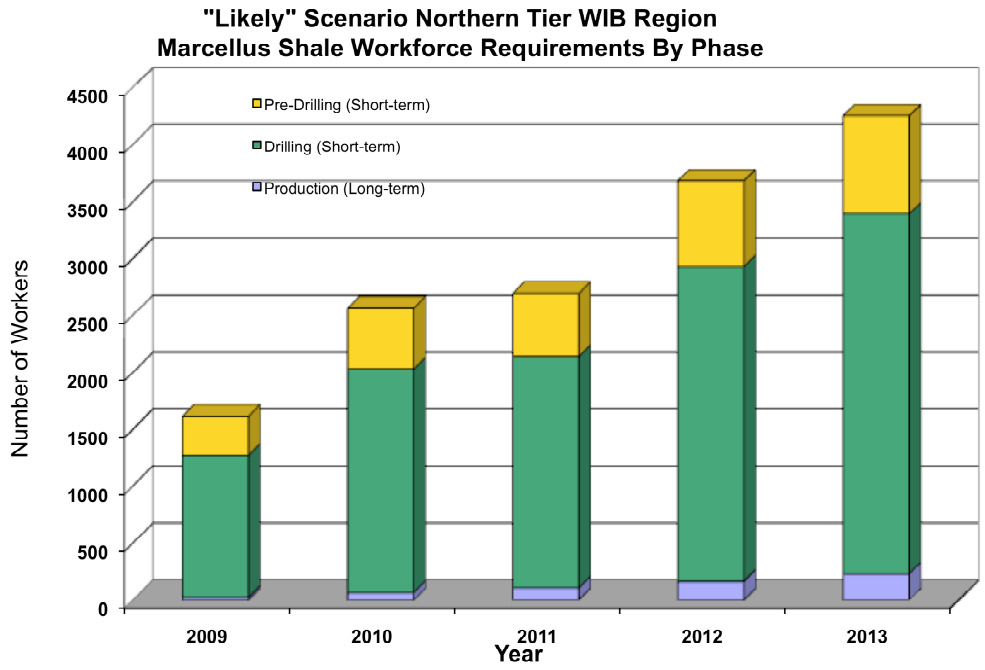


Figure 13: Workforce Requirements by Industry Phase, Northern Tier WIB Region

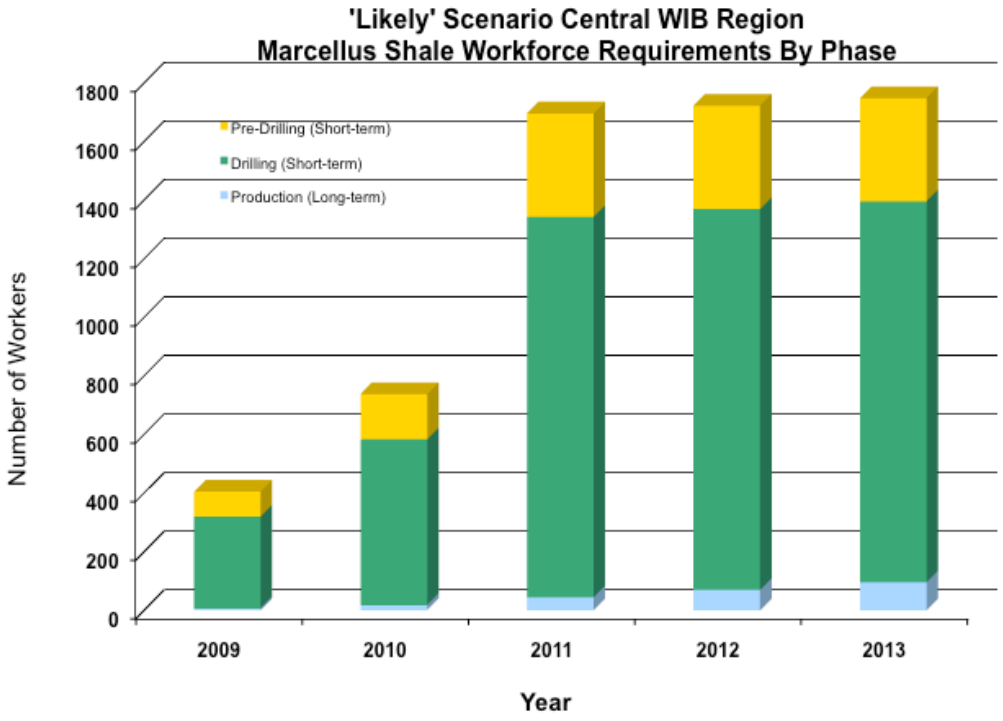


Figure 14: Workforce Requirements by Industry Phase, Central WIB Region

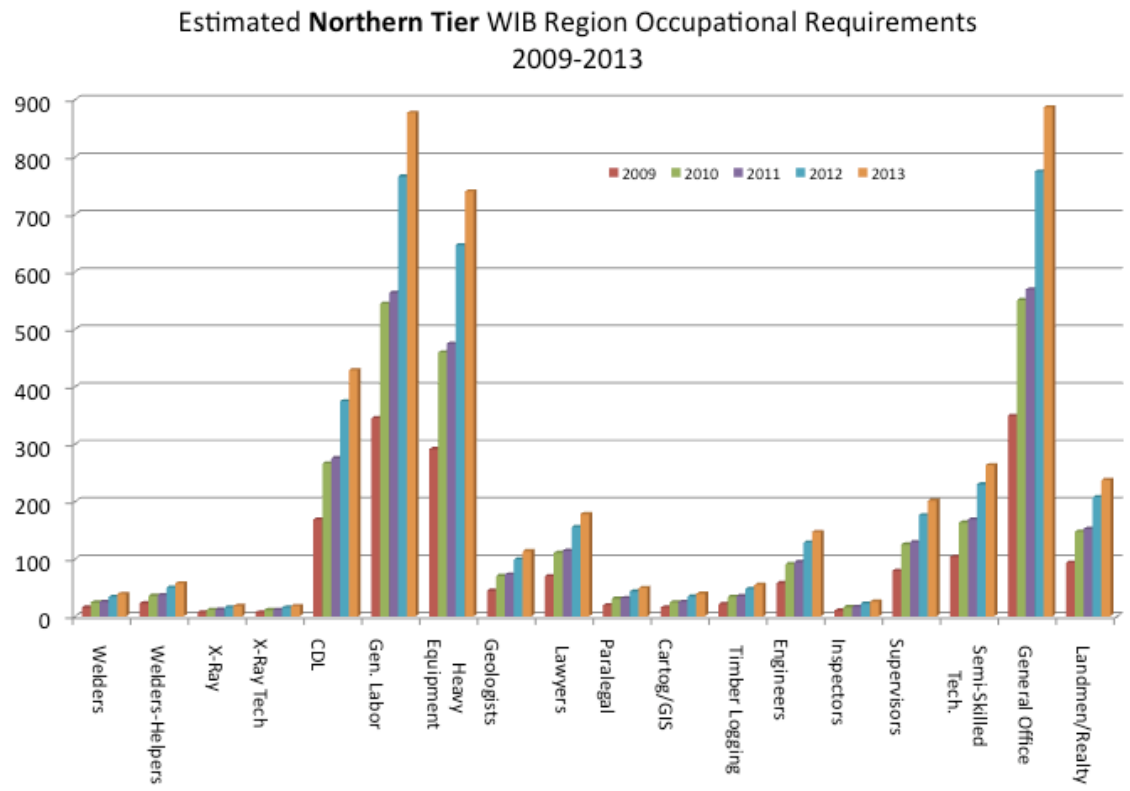


Figure 15: Northern Tier WIB Region Occupational Requirements 2009-2013

Per Well FTE Requirements by Occupation For Northern Tier WIB Region Scenarios

Occupation	Low Scenario					'Likely' Scenario					High Scenario				
	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013
Welders	12	18	19	26	29	15	24	25	34	39	19	30	31	43	49
Welders-Helpe	17	27	28	38	43	23	36	37	50	58	28	45	46	63	72
X-Ray	5	8	9	12	14	7	11	12	16	18	9	14	15	20	23
X-Ray Tech	5	8	9	12	13	7	11	11	16	18	9	14	14	19	22
CDL	127	200	207	281	322	169	266	275	375	429	211	333	344	468	536
Gen. Labor	259	408	422	575	658	345	545	563	766	877	432	681	704	958	1096
Heavy Equipm	219	345	356	485	555	291	460	475	646	740	364	574	594	808	925
Geologists	33	53	55	74	85	45	70	73	99	113	56	88	91	124	142
Lawyers	53	83	86	117	134	70	111	114	156	178	88	138	143	194	223
Paralegal	15	23	24	32	37	19	31	32	43	49	24	38	40	54	62
Cartog/GIS	12	18	19	26	30	16	25	25	35	40	19	31	32	43	49
Timber Loggin	16	26	26	36	41	22	34	35	48	55	27	43	44	60	69
Engineers	43	68	71	96	110	58	91	94	128	147	72	114	118	161	184
Inspectors	8	12	12	17	19	10	16	16	22	26	13	20	21	28	32
Supervisors	60	94	97	132	151	79	125	129	176	201	99	156	162	220	252
Semi-Skilled Te	78	123	127	172	197	104	163	169	230	263	129	204	211	287	329
General Office	262	413	427	581	665	349	551	569	775	887	436	688	712	968	1108
Landmen/Real	70	111	114	156	178	93	147	152	207	237	117	184	191	259	297
Total	1292	2038	2107	2867	3281	1723	2717	2809	3822	4375	2153	3396	3511	4778	5468

Figure 16: Northern Tier WIB Region FTE Requirements

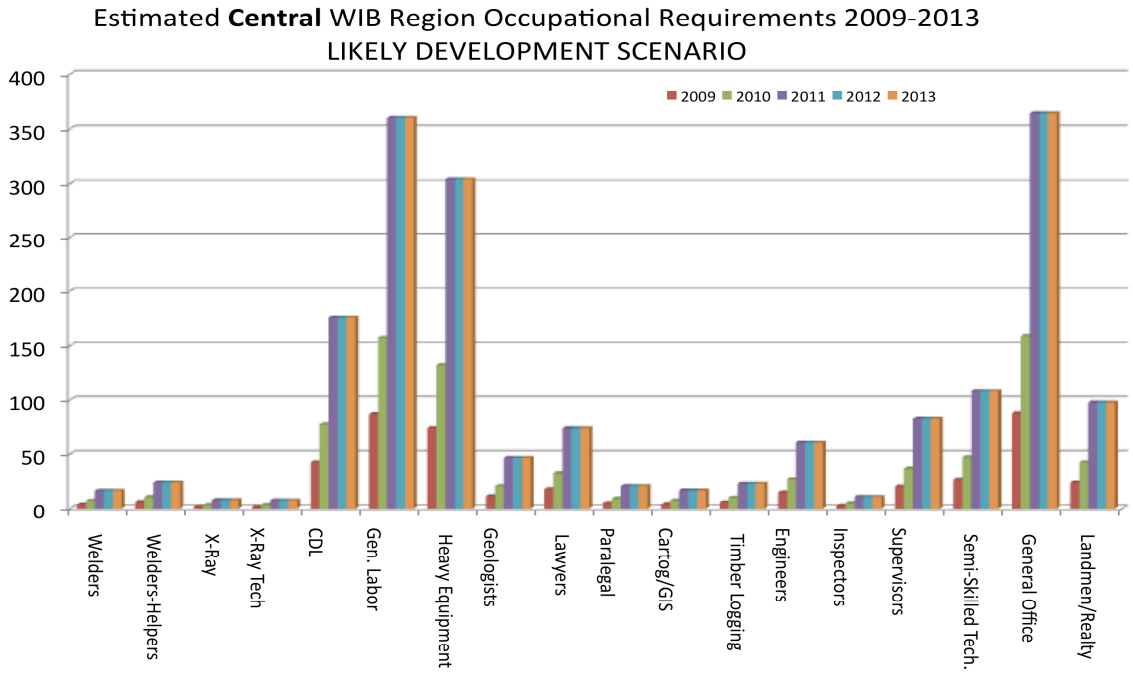


Figure 17: Central WIB Region Occupational Requirements 2009-2013

Per Well FTE Requirements by Occupation For Central WIB Region Scenarios

Occupation	Low Scenario					'Likely' Scenario					High Scenario				
	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013
Welders	3	5	12	12	12	4	7	16	16	16	5	9	20	20	20
Welders-Helpe	4	8	18	18	18	6	10	24	24	24	7	13	30	30	30
X-Ray	1	2	6	6	6	2	3	7	7	7	2	4	9	9	9
X-Ray Tech	1	2	5	5	5	2	3	7	7	7	2	4	9	9	9
CDL	32	58	132	132	132	43	77	176	176	176	53	96	220	220	220
Gen. Labor	65	118	270	270	270	87	157	360	360	360	109	196	450	450	450
Heavy Equipm	55	99	228	228	228	73	132	304	304	304	92	166	380	380	380
Geologists	8	15	35	35	35	11	20	47	47	47	14	25	58	58	58
Lawyers	13	24	55	55	55	18	32	73	73	73	22	40	91	91	91
Paralegal	4	7	15	15	15	5	9	20	20	20	6	11	25	25	25
Cartog/GIS	3	5	12	12	12	4	7	16	16	16	5	9	20	20	20
Timber Loggin	4	7	17	17	17	5	10	23	23	23	7	12	28	28	28
Engineers	11	20	45	45	45	15	26	60	60	60	18	33	75	75	75
Inspectors	2	3	8	8	8	3	5	11	11	11	3	6	13	13	13
Supervisors	15	27	62	62	62	20	36	83	83	83	25	45	103	103	103
Semi-Skilled Te	20	35	81	81	81	26	47	108	108	108	33	59	135	135	135
General Office	66	119	273	273	273	88	159	364	364	364	110	198	455	455	455
Landmen/Real	18	32	73	73	73	24	42	97	97	97	29	53	122	122	122
Total	**325**	**587**	**1347**	**1347**	**1347**	**434**	**783**	**1796**	**1796**	**1796**	**542**	**979**	**2245**	**2245**	**2245**

Figure 18: Central WIB Region FTE Occupational Requirements

Current Education and Training Capacity

The MSETC team performed a cursory review of the available post-secondary education and career and technical education programs available in each WIB region and then compared the skill set development offered by these programs to the skill sets required by the natural gas industry. For the purposes of this study, MSETC reviewed the course offerings at each of the institutions in the two WIB regions. In addition, the MSETC team contacted college and university personnel of several institutions to note programs that typically would address some of the core skills and education required within the specified occupational categories. A detailed analysis of the hundreds of programs offered by the more than 17 institutions of higher education contained within the WIB region and the capacities of these programs was beyond the scope of this study, especially when considering the wide range of unique skills required within each natural gas occupational category. Individual program-specific assessments will need to be performed by institutions to determine if specific programs being offered are best suited for the needs of the industry.

In general, it is noted that many of the occupations within the natural gas industry rely on skill sets that defy traditional workforce training curriculum and currently are largely the product of on-the-job training. Additionally, many occupational categories within the industry are comprised of a diverse array of workers utilizing very different skill sets even within occupational categories. Some educational programs may offer effective training for only part of an occupational category. However, the industry does employ workers in occupations that are widespread in other industries or that require two- or four-year degrees – such as office and computer-related staff, geographic information systems (GIS), geology, engineering, and trades such as welding, commercial driver's license (CDL), crane operation, etc. – and for which education and training curriculum have been developed in this region. While each WIB region was analyzed separately, it is recognized that programs in one region can and likely will be utilized by residents of other WIB regions.

Career and Technical Education Programs

There are 86 career and technical education (CTE) programs across the state of Pennsylvania, including 22 comprehensive centers and 64 stand-alone occupational centers. The Central WIB and the Northern Tier WIB regions feature nine stand-alone career and technical centers, two in the Northern Tier WIB and five in the Central WIB. These two WIBs also have seven comprehensive high schools that offer several approved CTE programs. These programs can offer a valuable introduction to the skills required for an array of occupations including computer technicians, agricultural production, nursing, and welding. For careers in the natural gas industry, however, these programs are typically not extensive enough to provide the skill sets needed, and very few are a "direct match" to the unique occupations within the industry. Some of the CTE programs can indeed provide an opportunity to acquire foundational skill sets as an introduction to a career in the gas industry and place students into a workforce training and education pipeline that may eventually provide these skills. However, to ensure that vocational and career technical education programs effectively support the growing need for

workers in the gas industry, existing education programs will need to be re-orientated towards the specific knowledge, skills, and work ethics required by the natural gas industry. Figure 19 shows the career and technical education programs with a direct match to occupations within the natural gas industry. These direct matches – many focusing on office staff positions – address only a small fraction of the diverse occupations within the industry, and many of these programs are currently not offered in the Northern Tier WIB region.

Career and Technical Education Programs with "Direct Match" to Gas Industry Occupations

		2009 Enrollment by WIB Region	
C&TE Program	Occupational Match	Central	Northern Tier
Nat'l Resource Mgt/Pol, Ot	Land Clearing, Logging, Enviro Tech	136	1
Security/Loss Prevention	Security, Safety, OSHA	21	…
Welding Technology/Welder	Welder, Welder Helper	162	…
Accounting	Accounting	266	57
Adm Asst/Secr Sci, Gen	Office Support, Admin Asst	32	28
Computer Network/Telecom	Computer, IT	106	18
Computer Programming, Gen	Computer, IT	126	…
Computer Technology	Computer, IT	28	…
Criminal Justice/Police	Security	43	…
Pipefitting/Steamfitting	Pipefitting	34	…

Figure 19: Direct Match Career and Tech Education Programs

An additional 18 programs were identified that indirectly provide skills useful to the industry. Such programs include vehicle maintenance technician, engineering technology, agricultural mechanization, and heavy equipment maintenance and can indirectly provide students with an introduction to skills requiring physical labor, mechanical aptitude, industrial equipment, and other experience highly valued by the natural gas industry (See Workforce and Education Matrix contained in the Appendix).

Post-Secondary Education

The Central and Northern Tier WIB regions of Pennsylvania host a number of colleges and universities that offer degrees in hundreds of different fields. Of the careers in the natural gas industry that require a two- or four-year degree, most can find a direct match within one of the colleges or universities in the region. However, the vast majority of workforces in the natural gas industry do not require a two- or four-year degree, and the universities do not provide many non-degree courses that directly match these occupations in the industry. Due to population densities of the two WIB regions and due to the locations of Pennsylvania College of Technology and Penn State University, the Central WIB region has more institutions and offers many more programs than the Northern Tier region.

Northern Tier WIB Region

The primary post-secondary institutions in the Northern Tier region are Mansfield University and the satellite locations of Lackawanna College and Keystone College located in Towanda. All of these schools offer a wide range of degrees related to the "white collar" jobs located in the natural gas industry, such as computer technology, information technology, office staff, administrative assistant, accounting, financial and business management, and security.

Lackawanna College recently implemented two programs directly related to the natural gas industry: natural gas industry accounting and natural gas technology. At the present time, these are the only programs identified by MSETC available in the region that are directly orientated to careers in the natural gas industry. These programs will prove critical to providing the necessary training for long-term production phase careers available in the natural gas industry.

Central WIB Region

Advanced education and training opportunities in the Central WIB region are aided by the presence of Penn State University in State College, PA and Pennsylvania College of Technology in Williamsport, PA. Penn State University offers advanced degrees in the geological and engineering sciences that are crucial to the industry. In fact, it has been noted that many of the engineers and geologists working in the industry in Pennsylvania and Texas have degrees from Penn State University. In addition, Penn State offers a suite of advanced degrees in law, cartography, GIS, accounting, finance, environmental and natural resource management, etc.

Pennsylvania College of Technology offers degrees and training in a number of mechanical and industrial applications that are directly related to many careers in the gas industry, including welding, pipefitting, heavy machinery operation, excavation, and timber logging, as well as programs targeting such careers as accounting, computer technology, finance, and environmental inspection. In addition, Penn College plans to implement a number of training initiatives specifically designed for careers in the natural gas industry. Such training initiatives being designed include general gas field operations, gas production technology, drilling rig operations, CDL certification, well logging, and others.

In addition to these institutions, the Central WIB region hosts 12 other post-secondary colleges or technical training institutions that include Lycoming College, Newport Business Institute, Lock Haven University, CPI of Science and Technology, South Hills School of Business & Technology, Susquehanna University, Bucknell University, McCann School of Business & Technology, Triangle Tech/Sunbury, Professional Drivers Academy, and Bloomsburg University (of PA). Many of these institutions provide degrees or vocational training in careers such as accounting, law, computer technology, administration, finance, cartography, etc., as well as engineering and geology in some institutions.

Education and Training Capacity Conclusions

Due to differences in population and geography, the Central WIB region offers many more vocational and post-secondary opportunities than the Northern Tier WIB region, although it is recognized that residents of both regions may be able to take advantage of all the programs available.

"Traditional" Careers Found Within Industry

In total, there appears to be great opportunity in the number of programs currently available to effectively train workforces for the careers that are found in a wide array of industries, in addition to the natural gas industry, such as law, finance, computer technology, accounting, business management and administration, cartography, natural resource management, etc. However, the majority of workforces in the natural gas industry, and the occupations with the greatest demand, require skill sets and training not found within traditional vocational and post-secondary education.

Production Phase

Programs recently implemented at Lackawanna College will provide needed training and education for some of the careers associated with the long-term production phase of natural gas development, and programs currently being designed at Pennsylvania College of Technology will provide production phase training in addition to curriculum targeting a wider array of careers associated with the drilling phase. Programs such as the one that will be offered at Lackawanna College typically include a two-year curriculum that offers a solid understanding of production phase gas industry operations that includes training in areas such as natural gas compression technology, natural gas chemistry and engineering, pneumatics, electricity, instrumentation, and mechanics, in addition to courses in safety, computer technology, math, and communication skills. Programs targeting long-term production phase careers will have the benefit of slow and steady buildup of demand for these jobs as the total number of wells entering production increases over many years of drilling. Assuming strong and sustained enrollment and capacity, as well as a determination of suitability from energy companies, these programs will go a long way to address the demand for career opportunities associated with the long-term production phase of natural gas development.

Drilling Phase

Programs that target the drilling-phase workforces will undoubtedly take time to ramp up enrollment, and many years of operation will be required before they can produce the number of qualified workers that are currently being demanded or imported by the natural gas industry. Moreover, these programs may only provide an introductory skill set that will still need to be augmented by experience within the gas industry. Programs that are in place in some areas but may require increased capacity and additional re-orientation to the natural gas industry include commercial driver's license training, welding, engineering, natural resource and environmental technologies, instrumentation, heavy equipment operations, pneumatics, and diesel engine technologies.

The greatest need at this time is for programs that pertain to a basic orientation of the processes, technologies, and skills used within the industry. Courses in drilling rig operation, gas field safety, cementing, environmental regulations, water transport, wellhead operation and maintenance, natural gas engineering and chemistry, and compression technology, as well as perquisite experience with basic computer and communication technologies, will provide workers with the basic skills, experience, and knowledge of the industry to enter the workforce.

Appendices

Workforce and Education Matrices

Main Occupational Categories and available Post-Secondary Programs offering core skills in the Northern Tier and Central WIB Regions.

Occupational Category	***Percent of Workforce***	Total Number of Institutions w/ programs ***Central WIB Region***	***Northern Tier WIB Region***
Roughnecks	18.51%	3	0
Office support - admin assist.	8.27%	8	3
(Rig Move)	5.64%	0	0
Heavy Equipment Operators	4.86%	2	0
Land Clearing	4.44%	1	0
Frac Crew	4.41%	1	0
Security	4.23%	6	3
Reality (lease admin/right-away)	4.07%	2	0
Roustabouts	3.29%	2	0
Lawyers	3.05%	11	0
Petroleum Engineers	2.98%	1	0
Accountants	2.55%	11	3
IT/Computer	2.55%	12	3
Completion Activities	2.39%	0	0
General Labor (Pipeline)	2.33%	2	0
Financial/Business Management	2.16%	11	3
Directional Drilling	1.97%	1	0
Civil Engineering	1.78%	5	0
Geologists & Geophysicists	1.77%	5	0
CDL Drivers/Water Haulers	1.61%	3	0
Pipe Fitters	1.55%	1	0
Landmen-for drilling/leasing	1.53%	1	0
Safety/ OSHA	1.53%	2	0
Logging (well and pipeline const)	1.41%	2	0
Welders	1.32%	3	0
Welder Helpers	1.16%	3	1
Permitting Tech	1.02%	0	0
Cartographer/GIS	1.02%	4	1
Local Liaison	1.02%	4	3
Environmental Tech/Inspection	0.96%	6	3
X-ray x-ray/tech	0.93%	2	0
Mudmen	0.88%	0	0
Superintendent	0.86%	2	0
Boreing Crew	0.74%	0	0
Const. Managers	0.66%	1	0
Operator (well and compressor)	0.57%	1	1

Applicability between Career and Technical Education programs offered and Natural Gas Industry Occupations

0 = No Match 1 = Indirect Match 2 = Direct Match

	Occupation																																			
C&T Program	Roughnecks	Office support - admin assist. (Rig Move)	Heavy Equipment Operators	Land Clearing	Frac Crew	Security	Reality (lease admin/right-away)	Roustabouts	Lawyers	Petroleum Engineers	Accountants	IT/Computer	Completion Activities	General Labor (Pipeline)	Financial/Business Management	Directional Drilling	CivilEngineering	Geologists & Geophysisists 1,2	Pipe Fitters	Landmen-for drilling/leasing	Safety/ OSHA	Logging (well and pipeline const)	Welders	Welder Helpers	CDL Drivers/Water Haulers	Permitting Tech	Cartographer/GIS	LocalLiaison	Environmental Tech/Inspection	X-ray x-ray/tech	Mudmen	Superintendent	Boring Crew	Const. Managers	Operator (well and compressor)	CDL Drivers (for water)
Accounting	0	1	0	0	0	0	0	0	0	0	2	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Adm Asst/Secr Sci, Gen	0	2	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Ag Mechanization, General	1	0	1	1	1	1	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0
Agric/Nat Resources Tech	1	0	1	1	1	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Automotive Mechanic Tech	1	0	1	1	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carpentry/Carpenter	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Computer Network/Telecom	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Computer Programming, Gen	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Computer Technology	0	1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction Technology	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction Trades, Oth	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Criminal Justice/Police	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diesel Mechanics Tech	1	0	1	1	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1
Drafting/Design Tech, Gen	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elec/Electronic Tech, Oth	1	0	1	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Elec/Pwr Trans Instal Oth	1	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Electromechanical Tech	1	0	1	0	0	0	0	0	1	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Electronic/Comm Eng Tech	1	0	1	0	0	0	0	0	1	0	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
Engineering Technology	1	0	1	0	0	1	0	0	1	0	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0
Gen Office Occ/Clerical	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Heavy Equip Maint Tech	1	0	1	1	1	1	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0
Machine Tool Tech	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mech/Install/Repr Tech	1	0	1	1	0	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0
Mgmt Info Systems, Gen	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Natl Resource Mgt/Pol, Ot	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Pipefitting/Steamfitting	1	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	0	2	0	0	0	1	1	0	0	0	0	0	1	1	0	0	0	0
Precision Metal Wrkrs,oth	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0
Precision Prod, Other	1	0	1	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0
Production Indust Tech	1	0	1	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0
Protective Serv, Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sales/Distrib/Mrkting Gen	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Security/Loss Prevention	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicle Maint Tech, Other	1	0	1	1	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Welding Technology/Welder	1	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	1	0	0	0	0	0

Occupational Matrices Pre-Drilling Phase:

Natural Gas Extraction
Education / Job Matrix Pre-Drilling Phase

		Associated Jobs	Secondary/ Career and Technical Centers	Work Experience/ Certification	Post Secondary/ Higher Education
Pre-Drilling	Geological Studies	Geologists & Geophysisists			x
		Hydro Geologist			x
		Petroleum Engineers			x
		Petroleum Chemists			x
		Cartographer			x
		GIS Technicians		x	x
	Seismic	Project Management		x	x
		CDL Drivers		x	
		Helicopter Pilot/Crew	x	x	
		Seismic Crew		x	x
	Public Land Only	Water Management			x
		Forester	x	x	x
		Archeology			x
		Biologist			x
	Mineral Rights	Landmen-for drilling/leasing		x	
		Lawyers			x
		Para-legal1	x	x	x
		Title-Abstract	x	x	x
		Lease Acquisition		x	x
		Lease Admin		x	
	Permitting Process	Environmental Technicians		x	x
		Lawyers		x	
		Permitting Tech1			x
	Staking the Well	Roadman		x	
		Surveyors		x	x
		Civil Engineering Tech			x
		Civil Engineer			x
		Leasing Agents (Right-of-Way)		x	
		Land Clearing		x	x
		Heavy Equipment Operators	x	x	x
		Heavy Equipment Maint Tech		x	x
		Logging		x	
	Water Mgmnt	Water transfer/Driver CDL		x	
		Hydrologist stream monitor			x

Drilling Phase:

Natural Gas Extraction
Education / Job Matrix
Drilling Phase

		Associated Jobs	Secondary/ Career and Technical Centers	Work Experience/ Certification	Post Secondary/ Higher Education
Drilling	Pipeline Construction	Construction Managers		x	x
		Foreman	x	x	x
		Superintendent		x	x
		Petroleum Engineers		x	x
		Pipe Fitters		x	x
		Welders		x	x
		Welder Helpers	x	x	
		Weld Inspectors		x	x
		Heavy Equipment Operators		x	x
		X-Ray		x	
		X-Ray Tech		x	x
		General Labor	x		
		Boreing Crew	x	x	x
		Environmetal Tech-monitor reclamition			x
		Operational landmen	x	x	
		Surveyors			x
		Civil Engineering			x
	Compressor Construction	Logging		x	
		Construction Managers		x	x
		Welders		x	
		Welders Helpers	x	x	
		X-Ray		x	
		X-Ray Tech		x	x
		General Labor	x	x	
		Land Clearing	x	x	
		Foreman		x	x
		Pipeline Inspection		x	x
	Drilling	Company Man/Geologist		x	x
		Drilling Engineer		x	x
		Drilling Superintendent		x	x
		Tool Pushers		x	
		Roughnecks	x	x	
		Roustabouts		x	
		Diesel Technicians		x	x
		Rig Mover		x	
		Heavy Equipment Operators	x	x	x
		CDL Drivers		x	
		Mudmen	x	x	x
		Welders		x	x
		CDL Drivers		x	
		Electricians		x	x
		Cement Pumpers		x	
		Well Logging			x
		CDL Drivers		x	
		Directional Drilling		x	x
		Finishing Rig		x	
	Fracing and Completion	Supervisors		x	x
		Safety		x	x
		Foremen		x	x
		Site Management		x	x
		Petroleum Engineers			x
		Frac Crew	x	x	
		Heavy Equipment Operators		x	x
		Heavy Equipment Maint Tech		x	x
		CDL Drivers	x	x	
		Roustabouts		x	
		Heavy Equipment Operations		x	x
		Crane Operations		x	x
		Environmental Inspection		x	x
		Flowback Analyzer		x	
	Water Management	CDL Drivers/Water Haulers	x	x	
		Hydrologist/water supervisor			x
		Completion-xaferers		x	
		Water Testing/Quality		x	x
		Flowback		x	
	Overall	Road Crews	x	x	
		Heavy Equipment	x	x	x
		CDL		x	
		Local Liaison		x	
		Safety/ OSHA			x
		First Aid		x	
		Security		x	
		Calibration Technician		x	x
		Office Management		x	x
		clerks/data entry/reception		x	
		Financial/Business Management			x
		Accountants			x
		Office support - admin assist.	x		
		IT/Computer	x		x
		Purchasing		x	x

Production Phase:

Natural Gas Extraction
Education / Job Matrix Post-Drilling Phase

		Associated Jobs	Secondary/ Career and Technical Centers	Work Experience/ Certification	Post Secondary/ Higher Education
Post-Drilling	Natural Gas Production	Petroleum Engineers			x
		Heavy Equipment Maint Tech		x	x
		Well Tenders/Roustabout		x	
		Operator		x	
		Compressor Operator		x	x
		Service Rig Operator		x	
		Production Engineer			x
		Equipment calibration		x	x
		Communications Tech offsite monitoring		x	x
		Production Foreman	x	x	
	Reclaimation	Plugging Crew		x	x
		CDL Drivers	x	x	
		Site Management		x	x
		Landscapers-architect	x	x	
		Environmental Inspection		x	x
		Civil Engineer		x	
		Government officials		x	
	Overall				
		Inspectors	x	x	
		Sewage treatment		x	x
		Lobbying		x	x
		Community Affairs/PR			x
		Calibration Officials		x	
		Corrosion Technicians			x
		Environmental Health & Safety			x
		Purchasing		x	x
		IT Tech			x
		Local Liaison		x	
		Office Management		x	x
		Office support-admin-non tech	x		

The Natural Gas Workforce Requirements Model

Summary of Key Model Components and Creation Process

Identification of Distinct Occupational Categories

The natural gas development process was divided into three phases (called pre-drilling, drilling, and production), and the distinct occupational categories that comprise the workforce requirements for each phase were identified. This process was relatively straightforward, as all major occupations were listed and further separated by the distinct educational and training requirements when possible. On occasion, crews of workers would be combined when individual occupational categories or training requirements are found to overlap.

An initial list was compiled from research and working knowledge and then expanded by:

- Brainstorming session with energy companies, direct support, and subcontracts at February 2 partnership meeting
- Detailed discussion with select energy companies and their service providers regarding contracting and employee needs
- Gas field tours
- Energy industry workforce survey results

Estimation of Occupational Workforce Requirements on a Per-Well Basis

Detailed discussions with a number of energy representatives yielded per-well workforce requirements for a number of occupations. Some occupational requirements (such as roughnecks) were relatively straightforward, while others required implementing a number of averages and assumptions. Such averages and assumptions included the amount of pipeline required for each well drilled (averaged at 1 mile per well), the length of pipeline constructed by each crew per day (averaged at 480 feet per day), and the number of days worked per year (averaged at 260 days [2,080 hours] per year).

Estimation of occupational workforce requirements on a per-well basis creation process included:

- Detailed discussion with select energy and service companies
- Gas field tours
- Additional research and working knowledge
- Energy industry workforce survey results

Key assumptions for the per-well workforce requirements:

- Full-time equivalent defined at 260 workdays (2,080 hours) per year
- Average drilling rig will drill approximately 10 wells per year
- Each well will require 1 mile of pipeline construction
- For every 20 wells, 1 compressor station will be constructed on average
- Average pipeline crew can complete 480 feet per day
- Drilling rig takes approximately 30 days to drill a well
- Hydro-fracturing process takes approximately 3 days (including set-up/removal)

Estimation of the Number of Wells That Will Be Drilled

The intensity of development expected in the Marcellus Shale can be measured by the number of wells that will be drilled per year. To estimate the number of wells that will be drilled, rig counts projections were obtained for all of the major operators and many of the minor operators in the Marcellus Shale. These projections were based on public investor statements, discussions with industry representatives, community presentations, and newspaper articles. The majority of these statements have been made after February of 2009, and each presumably takes into account the current economic considerations.

Estimation of the number of wells that will be drilled creation process included:

- Discussion with energy companies
- Examination of investor statements, newspapers, and presentations
- Examination of DEP permitting and drilling data
- Energy industry workforce survey results

Natural Gas Workforce Requirements Survey Graphs

Q66. In general, what kind of education or training programs are you most in need of? (Check all that apply)

	All Respondents		Energy Company		Direct Service		Engineering	
Answer Options	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1 or 2 year technical college or vocational degrees	9	36.00%	2	25.00%	2	15.38%	2	66.67%
4 year college degrees	7	28.00%	1	12.50%	1	7.69%	2	66.67%
trade certifications	5	20.00%	4	50.00%	4	30.77%	0	0.00%
Other (please specify in next question)	3	12.00%	0	0.00%	3	23.08%	0	0.00%
Graduate Degrees	1	4.00%	0	0.00%	1	7.69%	0	0.00%
Total Respondents:	**25**		**7**		**11**		**4**	

Q67. Please examine the following types of education and training. Please check the box if you feel that locally-provided training in these areas would help your company to find and train qualified employees.

	All Respondents		Energy Company		Direct Service		Engineering	
Answer Options	Number	Percent	Number	Percent	Number	Percent		Number
Gas Field Safety (OSHA and API)	14	53.85%	6	75.00%	6	46.15%	...	...
Well Control	12	46.15%	6	75.00%	6	46.15%	...	...
Well Operators	12	46.15%	7	87.50%	5	38.46%	...	...
Water Disposal procedures/ regulations	13	50.00%	7	87.50%	2	15.38%	3	75.00%
Water Withdrawal procedures/ regulations	12	46.15%	7	87.50%	1	7.69%	3	75.00%
Blow-out Prevention	11	42.31%	5	62.50%	6	46.15%	...	...
Hydrogen Sulfide Safety	10	38.46%	3	37.50%	7	53.85%	...	...
Well Tender Training	9	34.62%	8	100.00%	1	7.69%	...	...
Problem Solving	9	34.62%	3	37.50%	3	23.08%	...	...
Communication/Interpersonal Skills	9	34.62%	3	37.50%	4	30.77%	1	25.00%
Preventative Maintenance	9	34.62%	3	37.50%	6	46.15%	...	...
Well Pad and Site procedures/ regulations	9	34.62%	5	62.50%	1	7.69%	...	...
Basic Mathematics	8	30.77%	3	37.50%	5	38.46%	...	...
General Governmental Regulations / Permitting Procedures	8	30.77%	5	62.50%	...	...	3	75.00%
Drilling Rig Training Course	8	30.77%	2	25.00%	4	30.77%	1	25.00%
Crane and Rigging Safety	7	26.92%	1	12.50%	5	38.46%	...	...
Basic Literacy	7	26.92%	1	12.50%	6	46.15%	...	...
CDL Training	7	26.92%	...	...	6	46.15%	...	...
Management Training	6	23.08%	1	12.50%	3	23.08%	1	25.00%
Impoundment regulations	6	23.08%	3	37.50%	...	...	3	75.00%
Hydraulics	5	19.23%	2	25.00%	3	23.08%	...	...
Landman	5	19.23%	5	62.50%	...	...	...	...
Surveying	5	19.23%	1	12.50%	...	...	4	100.00%
Process Improvement	4	15.38%	2	25.00%	1	7.69%		
Computer Aided Drafting	4	15.38%	1	12.50%			3	75.00%
Electronics	4	15.38%	2	25.00%	2	15.38%	...	...
Basic Electricity	3	11.54%	1	12.50%	2	15.38%	...	...
Heavy Equipment Operation	3	11.54%	...	...	3	23.08%	...	...
Heavy Equipment Maintenance	3	11.54%	...	...	3	23.08%	...	...
Structural Welding	2	7.69%	...	...	2	15.38%	...	...
Technical Math	2	7.69%	2	25.00%	...	...	...	...
Blueprint Reading	2	7.69%	1	12.50%	...	...	1	25.00%
Power Transmission	1	3.85%			...	...	1	25.00%
Programmable Logic Control (PLC)	1	3.85%	1	12.50%	...	...	...	...
Pneumatics	1	3.85%	...	...	...	...	...	...
Pipe Welding	1	3.85%	...	...	1	7.69%	...	...
First Aid/CPR	1	3.85%	...	...	...	...	...	...
Fatigue Management	1	3.85%	...	...	...	...	...	...
Logging/ Land Clearing	...	...	...	...	...	...	...	...
Pipe Fitting	...	...	...	...	...	...	...	...
Total Respondents:	**26**		**8**		**13**		**4**	

Q70. If you currently use any types of training or certification programs for your employees, please list these specific programs and providers

Answer Options	Number of Respondents Giving this Answer
Outsource	3
In House Smart Safety	2
First Aid & CPR Training	2
Blasters License	1
In house crane certification	1
Operator Qualification Training	1
P.E./Engineering	1
P.L.S/SAP/SOLIS/Matt Vavro (Training Providers)	1
Well Control Training	1
Blow Out Prevention	1
Hydrogen Sulfide	1
Industry operations basics	1
MSOffice	1
Professional Disciplines	1
Hazmat Endorsement	1

History of the Marcellus Shale Education & Training Center

The Marcellus Shale Education & Training Center (MSETC) concept originated in late summer of 2008 and officially opened in January 2009. The MSETC is a partnership between Workforce Development & Continuing Education at Pennsylvania College of Technology and Penn State Cooperative Extension. The mission of the MSETC is to provide both the regional community and the natural gas industry with a central resource for workforce development and community education needs related to Marcellus Shale gas. The MSETC serves as a central resource for training and curriculum that is specific to the development of this natural resource. In addition, the MSETC has the capacity to deliver training at multiple locations throughout the Commonwealth to satisfy the needs of the industry.

The central operation of the MSETC is located in the Center for Business & Workforce Development on the campus of Pennsylvania College of Technology in Williamsport, PA. The MSETC is able to utilize the institutional infrastructure of both The Pennsylvania State University system as well as Penn College. In addition, through the Workforce and Economic Development Network of Pennsylvania (WEDnetPA), MSETC also has delivery and infrastructure capacity through WEDnetPA's 33 partner institutions including community colleges and the various universities in the Pennsylvania State System of Higher Education system.

