



Marcellus Shale: What Local Government Officials Need to Know



FACT-BASED INFORMATION

natural gas

Marcellus Education Team

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Shale: What
Local Government
Officials Need to
Know**



Natural gas has been extracted from underground sources in Pennsylvania since the early 1800s, with the state currently hosting about 40,000 active gas wells and approximately 4,000 new wells drilled each year. Most of these wells tap gas reserves a few thousand feet below the earth's surface, but new technologies—in particular, horizontal drilling and hydraulic fracturing—are making gas extraction from deep reserves such as the Marcellus shale more economically feasible. Increasing demand for cleaner domestic energy will bring about continuing exploration. The gas industry is seeking points of access to high-volume reservoirs of natural gas, called “plays,” that lie far below the hills and valleys of Pennsylvania.

The potentially large economic impact of natural gas exploration and extraction, with estimates of up to \$500 billion in recoverable gas in Pennsylvania, could be a valuable economic stimulus for Pennsylvania communities. As landowners receive compensation for the use of the resource and as the gas industry develops the regional drilling infrastructure, the economic gains can pose significant benefits for the entire community. Yet there will be challenges and costs accompanying these benefits; the scale of drilling activity may increase the local population, pressuring local housing markets, schools, and local government services. There will be environmental impacts, particularly on water use and quality, forest defragmentation, and wildlife. Local leaders and communities need to be aware of how natural gas drilling may affect them and their residents, how these disturbances may occur, and how to manage them.

IT'S IMPORTANT TO REMEMBER...

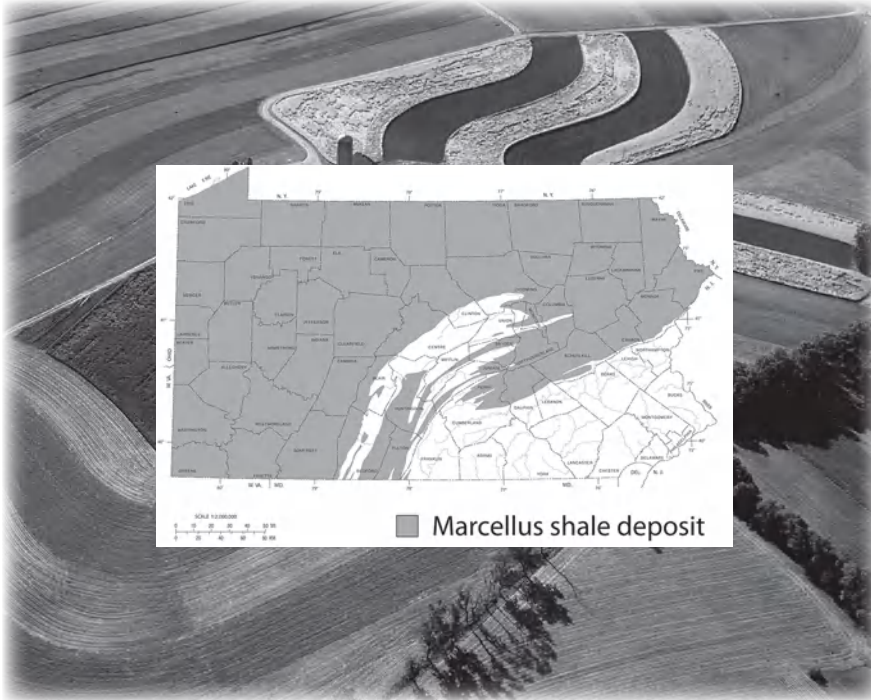
While the gas industry can greatly benefit a community and its residents, it is vital throughout the interest and development of the Marcellus for citizens, local officials, and community members to constantly remember that this is a nonrenewable natural resource. If this natural gas “play” evolves as people suggest, it could have economic benefits for Pennsylvania for the next thirty to fifty years. Throughout this time, local leaders and citizens should be thinking about how the short-run opportunities and benefits of these plays can both benefit and distress their local communities and the state of Pennsylvania in the long run. The large amounts of income and capital that may be generated



from Marcellus give communities and citizens the chance to invest for the extended future, not just for short run gain. While these opportunities unfold, it is crucial that local communities remain aware of the effects drilling activity will have on the environment and on the social fabric of their areas.

The Commonwealth already has prime examples of what happens when the long run is forgotten and is now paying the price as it tries to remediate the negative impacts resulting from acid mine drainage and abandoned coal mines. The method of extraction used for Marcellus shale is a young technology that may harbor repercussions that have yet to be documented or encountered. The challenge, but also the opportunity for local officials and citizens, is to do the most we can to help the Marcellus drilling leave Pennsylvania better off once it has played out.

An important economic factor in whether or not communities experience beneficial impacts depends critically on how many of these new dollars stay within Pennsylvania communities. Will it be Pennsylvanians who get the jobs? Will workers from other states move into Pennsylvania and become active members of their communities or will they simply



contain as much as 516 trillion cubic feet. The United States currently produces roughly 30 trillion cubic feet of gas a year and demand for this gas is increasing steadily.

Where and How Does Drilling Take Place?

Natural fractures in the Marcellus shale are important to recovering large amounts of gas. As heavily organic sediments were deposited 380 million years ago, the black shale that makes up the Marcellus was formed. As the organic material decayed, methane and other components of natural gas formed and are now trapped tightly in the dense shale. About 300 million years ago the pressure of the gas caused fractures in the formation. These fractures run as slices from the northeast to the southwest and are fairly close together. While a vertical

commute? Will the gas companies and supporting industries locate in Pennsylvania? To what extent will Pennsylvania businesses provide the services that the gas companies require? Will the wages workers earn and the royalties landowners receive be spent within Pennsylvania or will they go elsewhere? The answers to these questions are vital in helping communities grasp how and why they must prepare and plan for the growing gas industry in a way that will enable them to fully benefit.

THE MARCELLUS SHALE

The Marcellus shale is a deep layer of rock that lies 5,000 to 9,000 feet underground and runs from the southern tier of New York through the western portion of Pennsylvania, into the eastern half of Ohio, and through West Virginia. In Pennsylvania, the formation extends from the Appalachian plateau into the western valley and ridge. While this area has produced natural gas for years, many gas production companies are now interested in the Marcellus shale because of higher energy prices and new drilling technologies that could recover an estimated 50 trillion cubic feet of natural gas. Conservative estimates state that the Marcellus shale contains 168 trillion cubic feet of natural gas; in reality, it could

well may cross one of these fractures and other possibly less productive fractures, new technology allows for horizontal drilling, which crosses a series of fractures and may be more productive.

Gas wells are drilled in locations where a gas company has obtained the right to explore for and develop natural gas. Wells are spaced according to mineral laws and regulations, with the goal of extracting gas efficiently using as few wells as possible. Geologists and geophysicists working for gas companies use seismic data to interpret the formations of rock layers underground. If seismic data suggest a reasonable possibility of efficient gas access, a well will be drilled in a specific location using long sections of drill pipe. Depending on the geology, the drillers may drill vertically for several thousand feet and then use special joints to turn the shaft 90 degrees over the course of several hundred feet and continue drilling horizontally for an additional distance of up to 5,000 feet. A steel casing is cemented in place to stabilize the surface of the well bore and protect groundwater resources. Horizontal drilling enables companies to extract more gas in a cost-effective manner. In many cases, multiple wells may be drilled side by side on the same well pad, radiating out in different directions.



Natural Gas Well Development

Development of an individual natural gas well site typically follows this basic timeline, though it may vary somewhat at any one site. The stages include:

1. Leasing activity, during which land is put under contract and secured for natural gas exploration and development. This stage normally lasts four to six months.
2. Exploration and seismic testing, which is done to find the areas that will offer the highest potential natural gas yields. Exploration and seismic testing typically last about four months.
3. Site preparation and drilling stage, including earth moving, road grading, and well pad construction as well as drilling and fracing. This stage lasts from four to eight weeks. Pipeline is laid to connect the well to feeder pipelines, allowing the gas to reach market.
4. Site reclamation activities, during which stage the active well site is stabilized and vegetation is established. Site reclamation lasts about two weeks.
5. Extraction and transport of natural gas from the well, which can potentially last from five to thirty years (depending on the productivity of that individual well). Wells receive active maintenance throughout their lifespan, which means ongoing access is required. In addition, it is possible that the well may be refraced at some later date, temporarily bringing back much of the equipment.
6. Closure plan, a procedure that is influenced by the landowner's leasing terms, during which the inactive well is closed and the site restored.

When their role on an individual site is completed, the different crews typically move to a new well site nearby to do site prep and drilling. Thus, within any one community at any one time, there will be well sites in different stages of development.

Why Marcellus Is Different from Shallow Wells

The gas produced from deep well drilling is under a higher pressure than in shallow or traditional wells, which necessitates different handling techniques and equipment. Unlike shallow wells with natural gas reserves, gas derived from the Marcellus shale is held tightly within the shale so the method of extraction is quite different. Current technology uses significant quantities of water under very high pressure to fracture (frac) the shale. Due to the fact that wells are

horizontally drilled to access more shale, the amount of water required for fracing these wells is significant, between one and five million gallons or more per well. This quantity of water required for fracing may contribute to a significant number of issues in affected communities.

Experience in Other States

Several other states have significant experience with deep natural gas drilling, including Texas and Wyoming. The experience in those states and the more comprehensive time frame of activity is a helpful indicator of the potential impact in Pennsylvania and suggests the types of issues local officials should be considering.





Experience in North Texas

The Barnett shale play in northern Texas, around the Dallas/Fort Worth area, is very similar in geology to the Marcellus, making it a good indication of technological and industry needs. Since the development of the Barnett shale started in earnest in 2001, employment and income impacts have been documented.

In 2008, the Perryman Group, a Texas-based economic consulting group, conducted an economic impact study of activity in the Barnett shale on Fort Worth and the surrounding area. At the time of the Perryman analysis, there were a total of 7,170 gas wells across the Barnett shale region, 541 of them within the Fort Worth city limits. Their findings should help illustrate potential impacts in Pennsylvania.

The analysis includes an industry-by-industry estimate for impacts on the gross product, permanent income, and permanent jobs. The Perryman analysis is specific to the local economy surrounding Fort Worth, so the properties and numbers cannot be applied directly to Pennsylvania. Extrapolating to Pennsylvania is also particularly difficult because the oil and natural gas sector and supporting infrastructure are not as fully developed in some of the rural areas with the Marcellus shale, therefore much of the economic activity, at least initially, will have to be conducted by firms and employees located outside the region,

which will lessen the local economic impact. Yet the Perryman analysis does provide useful indications of the general impacts that could be expected and which Pennsylvania policy makers should consider.

Overall Economic Impact

Overall, the Perryman Group report estimates that Barnett shale accounts for \$8.2 billion in annual output (8.1 percent of total output in the regional economy) and 83,823 jobs (8.9 percent of total jobs). This is a significant number, particularly because the Barnett shale region is predominantly an urban area that already boasts a large and extensive economy. In addition, experts suggest that the stability of the natural gas economy has essentially shielded the region from economic downturns. Potential impacts in areas of Pennsylvania could be much higher on a percentage basis considering that the local economy is relatively smaller.

Where the Jobs and Income Are

As with most economic activity, the impacts of natural gas affect more than just the specific firms directly involved in the industry. There are also important employment and income effects on local businesses that supply the industry (such as oil field service companies, local contractors, area surveyors, attorneys, and local fuel and stone suppliers) and effects that result from employees spending their wages locally (local retailers and restaurants).

Leasing and royalty income, which is currently of much interest in Pennsylvania, actually accounts for a very small share of the economic impact. The Perryman report identifies three separate types of economic activities related to natural gas and outlines their share of economic activity, including:

1. Exploration, drilling, and operations (67 percent gross product, 62 percent personal income)
2. Leasing and royalties that go to landowners (11 percent gross product, 12 percent personal income)
3. Pipeline infrastructure (22 percent gross product, 27 percent personal income)

The employment impacts related to natural gas in the Perryman report show similar trends:

1. Exploration, drilling, and operations (58 percent of new permanent jobs)
2. Royalty and lease payments (14 percent)
3. Pipeline infrastructure (28 percent)





As the industry expands within Pennsylvania more of these jobs and revenues should be reaching local residents, either as new hires or as the industry employees relocate to the region. Communities can increase the possible economic benefits of a growing natural gas industry by planning ahead to respond to the growing population within their areas.

Which Industries Benefit

As expected, the industrial sector with the largest gain from the Barnett shale is the crude petroleum and natural gas industry, accounting for about one-fifth (21 percent) of increases in personal income and 7 percent of new jobs. Retail trade accounts for about 16 percent of increased personal income and 27 percent of the new jobs, while new construction accounts for 10 percent of increased personal income and 9 percent of new jobs. Eating and drinking establishments similarly benefit, accounting for 5 percent of personal income and 15 percent of new employment.

For any individual industry the difference between their impact on gross product and on employment partially reflects wages and salaries within that industry. Retail trade and dining establishments, for example, together account for 21 percent of new personal income but 42 percent of total new employment, reflecting that many such jobs are relatively low paying.

Experience in Sublette County, Wyoming

Sublette County is the largest gas-producing county in Wyoming, accounting for 44 percent of the state's gas production in 2006. Unlike the North Texas play, Sublette County is a very rural area with a population of only 5,920 in 2000. The small population size means that the impacts of natural gas development are

much more apparent than those of the Barnett shale.

Studies in the county have demonstrated that gas exploration and drilling has had a direct and significant influence on the county's population, affecting almost all sectors of the community, including housing construction, the demand for public services, and culture. They found that much of the oil and gas employment was transient (not local citizens). For example, during development of the gas fields, a little over half (53 percent) of the workers were living in camps or motels. Housing needs have proved to be a constraint on local hiring because the high cost of living and saturated housing market inhibits new employees from finding places to live. Reports found that the availability of housing unmistakably affects nonresident workers' desire to move into the county.

A wage and salary study in the county also found that the highest paying jobs are gas field jobs, which generate significant opportunities for employees. This also creates challenges for existing businesses, which must pay higher wages to keep their existing workers. The gas field jobs offer nearly unlimited opportunity for overtime along with substantial opportunities for wage advancement. Seasonal fluctuations in employment and unemployment have effectively stopped due to the continuous nature of the gas industry.

Natural gas drilling has had significant effects on the local governments and school districts as well. Due to the population increase, including a dramatic increase in the number of school students, the county government and schools have acquired major infrastructure expenses. In addition to increased costs of municipal infrastructure, the nonviolent crime rate has increased in Sublette County, particularly for driving under the influence, drug possession, and larceny.

REGULATING NATURAL GAS EXPLORATION

Regulating the expanding gas industry is a central concern for government agencies. It is important to remember that in addition to the social and economic changes that may accompany drilling there is the possibility of significant impacts on the environment and natural resources. Several principal state and federal groups are involved in regulating natural



gas exploration in Pennsylvania, including two state agencies and two commissions created by federal regulations: the Department of Environmental Protection (DEP), the Department of Conservation and Natural Resources (DCNR), the Susquehanna River Basin Commission (SRBC), and the Delaware River Basin Commission (DRBC). Each of these groups derives its regulatory authority from various sources, including state statutes and federal regulations. In addition, several other state agencies affect natural gas activity.

Role of the Department of Environmental Protection (DEP)

The Pennsylvania Department of Environmental Protection enforces Pennsylvania's oil and gas laws relating to resource management, well construction activities, and waste management practices. The DEP's Bureau of Oil and Gas Management is responsible for the statewide oil and gas conservation and environmental programs. The bureau facilitates the exploration, development, and recovery of Pennsylvania's oil and gas reservoirs in a manner that is intended to protect the Commonwealth's natural resources and the environment. It also develops policy and programs for the regulation of oil and gas development and production in accordance with the

Oil and Gas Act, the Coal and Gas Resource Coordination Act, and the Oil and Gas Conservation Law; it oversees the oil and gas permitting and inspection programs, develops statewide regulation and standards, conducts training programs for industry, and works with the Interstate Oil and Gas Compact Commission and the Technical Advisory Board.

An operating gas company must secure a bond before applying for a well permit. It is DEP's responsibility to approve bonds and well permits, inspect wells and environmental controls, and permit and inspect waste disposal facilities and waste management activities. Operators must submit reports on well completion, waste management, annual production, and well plugging. Well operators are required to report production annually, and state agencies must keep this information confidential for five years, except for enforcement proceedings, as provided in the Oil and Gas Act. DEP has the authority to take action to enforce compliance with applicable laws and to seek civil penalties for violations of these laws. Depending on the project's acreage, the local county conservation district may also play an important role in regulating construction activities relative to erosion and sedimentation control.

Municipalities can be alerted regarding well permit applications filed with DEP though a no-cost





subscription service called ENotice. ENotice notifies municipalities with an e-mail when a well permit application is received. This system enables municipalities to receive notice of a permit application at the same time that DEP receives the application. This will allow the municipality to obtain information about potential drilling activity much earlier in the process so bond requirements can be considered in advance of operations. ENotice can be accessed through DEP's Web site: www.depweb.state.pa.us.

Role of the Department of Conservation and Natural Resources

The Department of Conservation and Natural Resources has authority under the Conservation and Natural Resources Act to lease state forestland for natural gas exploration. The act also gives the department the ability to lease state forestlands for underground storage of natural gas—a practice currently less common in Pennsylvania than in other areas of the country. The Oil and Gas Lease Fund stipulates that all rents and royalties from these leases are to be placed in a fund used exclusively for conservation, recreation, dams, or flood control or used to match any federal grants for those purposes.

Role of the Susquehanna River Basin Commission (SRBC) and Delaware River Basin Commission (DRBC)

The DRBC and SRBC hold more influence than the DEP in regulating water usage and other water-related aspects of gas well drilling that fall under their jurisdiction. SRBC's regulations are intended to protect the environment and existing water users from unapproved water use and water-use conflicts. The agency regulates issues such as water withdrawals, deep well injection of fracturing waste fluids, and disposal of fracturing fluids from constructed lagoons. In cooperation with the DEP the DRBC will also investigate and manage situations in which drilling damages neighboring wells. Companies operating without prior water-use approval for drilling and other water-related activities will be considered in willful noncompliance if they continue to operate after receiving the distributed notice sent out in early June 2008.

This consumptive water use is regulated in several different ways. Consumptive use in gas drilling is considered any water that is used in a way that results in it not being returned to the basin. An example

is the injection of waste fluids into a subsurface formation where it would not be reasonably available for future use or any diversions of water out of the Susquehanna watershed. These consumptive uses are defined in regulations through volume over a certain period of days.



SRBC also has the authority to make an across-the-board determination that well development activities in the Marcellus shale formations may require approval regardless of the amount of water used. The SRBC can exercise this broad authority if it determines that the water-use activities may affect interstate water quality, have a significant effect on SRBC's Comprehensive Plan, or have an adverse, cumulative, or interstate effect on the basin's water resources.

Land situated outside the basin commissions' boundaries, such as in southwest Pennsylvania, are solely under the regulatory authority of DEP and are not monitored or regulated by a basin commission.

Role of the Fish and Boat Commission

The Fish and Boat Commission's responsibility is to preserve and protect the Commonwealth's aquatic resources while providing fishing and boating opportunities. Their water quality officers work closely



with DEP field personnel to monitor the impacts of drilling and other activities on stream quality and aquatic life, and offer input to DEP on regulatory decisions.

Role of the Pennsylvania Emergency Management Agency (PEMA)

The Pennsylvania Emergency Management Agency coordinates state agency response to emergencies or disasters. The agency supports county and local governments in the areas of civil defense, disaster mitigation and preparedness, planning, and response to and recovery from human-made or natural disasters. PEMA is an important resource for local governments adapting to the changing emergency management needs arising from increased natural gas exploration and drilling, and can provide training, information, and resources to local emergency responders.

If emergencies occur, the local municipality should engage the local Emergency Management Team prior to and during the response. The municipality should have the site(s) listed in its Municipal Emergency Operations Plan, including emergency

contact information. It is important that the municipality has accurate information regarding the precise location of the site in terms of GPS coordinates and can identify the closest access road(s). The municipality should also encourage the posting of signs that list the name of the site operator, the address of the actual site, the emergency contact number of the company, and any additional information.

The type of roadways or access ways to a site may make it difficult for standard firefighting, rescue, and emergency medical services vehicles to access. These vehicles may not have sufficient ground clearance to traverse the roadways. Fire and rescue services should be aware of the areas and test-drive the access roads to ensure that the vehicles can gain access to sites.

Additionally, sites may be in rural or extremely rural areas and could be thousands of feet from any inhabited structures. Despite remote locations, the emergency plans and site plans should still include the identification of the nearest inhabited structures and list the distance and direction. Other structures, facilities, and chemical or hazardous material sites should also be listed.



Even though large quantities of chemicals are not found on the well sites, the municipality and the county Local Emergency Planning Committee (LEPC) should be informed of the number, names, and quantities of chemicals stored or used at the site(s). The county LEPC and the Pennsylvania Department of Labor and Industry PENNSAFE Program are able to provide assistance and guidance.

Role of Pennsylvania Oil and Gas Act

The ability of municipalities to regulate natural gas exploration is limited by the Oil and Gas Act, which states that “no ordinances or enactments, adopted pursuant to the aforementioned acts shall contain provisions which impose conditions, requirements or limitations on the same features of oil and gas well operations regulated by this act.” Essentially, this statutory provision means that the Oil and Gas Act preempts a municipality or county from regulating a matter that has been addressed in the act. As of August 2008, the precise extent of the Oil and Gas Act’s preemption of local regulation is not clear, as there are two cases on this issue pending before the Pennsylvania Supreme Court. Each of these cases was appealed to the Supreme Court following a Commonwealth Court decision ruling that the Oil and Gas Act had preempted the municipal ordinance in question.¹

In light of pending Supreme Court cases, a municipality should determine the current state of the law before enacting an ordinance that will be regulating natural gas drilling operations. A municipality also should consult the Oil and Gas Act to determine the specific issues that are the subject of state regulation. The Oil and Gas Act addresses topics including well permitting, well registration and identification, well location, well site restoration, protection of water supplies, bonding, reporting requirements, gas storage, inspection of facilities and records, public nuisances, enforcement orders, and civil penalties.

¹ *Great Lakes Energy Partners v. Salem Township*, 931 A.2d 101 (Pennsylvania Commonwealth Court 2007); and *Huntley & Huntley, Inc. v. Borough of Oakmont*, 929 A.2d 1252 (Pennsylvania Commonwealth Court 2007).

LOCAL ISSUES

Roads

The process of drilling, fracing, and maintaining natural gas wells can create significant heavy truck traffic on rural roads, many of which were not designed for carrying vehicles of this size. A recent well in Lycoming County, for example, reportedly required 77 tractor trailer loads simply to bring the drilling equipment to the site. Traffic will also include trucks carrying large amounts of water. A report from Denton, Texas, suggests that each drilling site could require 364 such water truck trips, which would be equivalent to 3,494,400 car trips (Denton County Oil and Gas Task Force, 2005).

Local governments do have the option of requiring companies to post a bond, but this requires careful planning ahead of time in order to achieve this, and the local government must be diligent about following procedures to recover costs if the gas company causes damage.





Water Issues

Water usage has been a concern in other states where deep well drilling and hydrofracing have generated both a demand for large quantities of water and resulting waste fluids that require removal and treatment. The millions of gallons of water required for drilling and the associated waste products are also major concerns here in Pennsylvania. As in other

states, the source of water used in drilling raises an issue, as do the waste fluids, their treatment and disposal, and natural bodies of water in the vicinities of drilling activity and the communities tied to them.

Use

The Susquehanna River Basin Commission (SRBC) regulates significant water use within its jurisdiction (discussed below) and recently ruled that companies can purchase water from

other permitted users with excess capacity without prior approval of the SRBC, provided that the total amounts used do not exceed the permitted quantity. As a result, widespread interest has arisen among natural gas companies

in purchasing water from municipal water systems and other already permitted users. If approached by such a company, municipal water systems need to carefully consider how much surplus capacity they can sell without jeopardizing other users or other future water-dependent economic development opportunities.

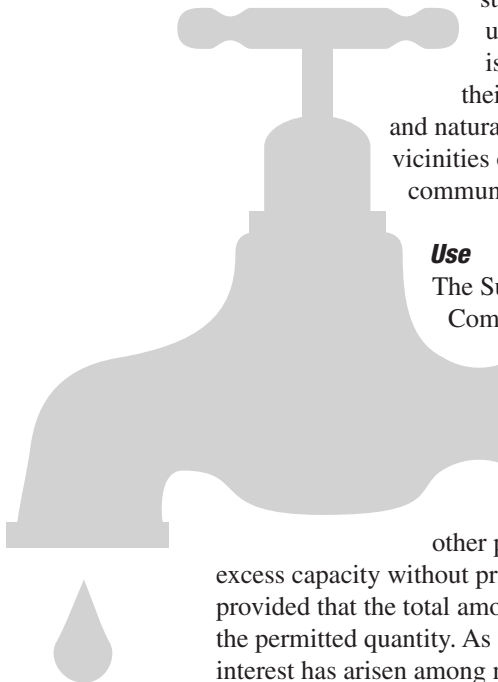
Large water withdrawals may come from many sources other than municipal water companies (streams, ponds, lakes, etc.) and can have significant effects if not performed carefully. Water withdrawals generally exceeding 10,000 gallons per day require permits or registration with DEP under authority of the Water Resources Planning Act. Withdrawals occurring in the Susquehanna or Delaware River watersheds also require permits from the Susquehanna River Basin Commission or the Delaware River Basin Commission (discussed ahead). In addition, the Clean Streams Law limits the amount of water that can be withdrawn from streams to maintain sufficient stream flows to protect aquatic life. These various regulations have all caused the shutting down of gas well drilling operations that failed to acquire the proper permits or exceeded allowable withdrawals from streams.

Another concern with deep gas well drilling technologies is the disposal of large volumes of wastewater resulting from the hydrofracturing process. The water used in the drilling process is mixed with sand and other products, and then is pumped into the shale formation under high pressure to fracture the shale so the natural gas can be accessed. The volume of wastewater produced during gas well drilling and operation can vary considerably depending on the depth and location of the gas well. One study in Pennsylvania found that the average volumes of water produced during shallow gas well drilling in western Pennsylvania was 25,000 gallons during drilling, 50,000 gallons during stimulation, and 150 gallons per day during production.

Drilling companies must identify where they plan to obtain and store the water used in the drilling operations and where the wastewater generated as part of the drilling process (“frac” water) is to be stored, treated, and disposed.

Erosion and Stormwater

Gas well construction involves extensive earth disturbance, including roads, drilling pads, and pipelines that can speed erosion. Drilling pads alone may be four to six acres in size for deeper gas wells,





which is a larger portion of disturbed earth than used for shallow well pads.

Various regulations, implemented through DEP and Pennsylvania Conservation Districts, are in place to protect surface water and groundwater from erosion and sedimentation due to these disturbances.

Erosion and sediment control plan requirements under state law apply to any earth disturbance activities, including oil and gas drilling (Pa. Code Chapter 102). Erosion and sediment plans require gas companies to use preventative measures such as filter fence, sediment traps, vegetation, hay bales, culverts with energy dissipaters, and rock road entrances to minimize erosion. These plans also include a requirement to restore vegetation to the drill site within nine months of well completion by planting grass, trees, or crop plots.

For oil and gas activity on less than five acres, an erosion and sediment control plan must contain best management practices to minimize point-source discharges to surface waters, preserve the integrity of stream channels, and protect the physical, biological, and chemical qualities of the receiving waterway.

For oil and gas activities that disturb more than five acres at one time, a notice of intent and general permit for authorization to control erosion and sediment must be completed. The erosion and sediment control plan or the notice of intent must be submitted to DEP or an authorized county conservation district for review and approval.

The DEP's Bureau of Oil and Gas and each individual county's Conservation District oversee the enforcement of erosion and sediment regulations related to gas well operations.

Groundwater

While many residents throughout Pennsylvania have voiced concerns about private water well and spring contamination that can occur from gas well drilling, the reality of these fears has shown to be less prominent than assumed. Data collected thus far from various regulatory agencies responsible for enforcement of gas well drilling regulations indicate that more than 95 percent of complaints received from homeowners suspecting problems from nearby gas well drilling are in actuality due to preexisting problems or other land-use activities such as agriculture. However, when contamination does occur as a result of drilling, the impacts can vary greatly. While the instances are low, it is important





to be aware of the range of possible complications.

Pennsylvania law requires that before drilling to deeper zones, gas drillers must install cemented steel casing through all freshwater aquifers. This casing protects groundwater by isolating the borehole from the groundwater system. It also keeps water from the surface and other geologic strata from mixing with and contaminating groundwater through the borehole. When pollution of private water supplies from gas well activity occurs, it is often documented as primarily stemming from absent or corroded well casings on older or abandoned gas wells. That does not mean that there are not pollution risks in newer deep well drilling. Groundwater contamination can result from flooded or leaking brine pits that contain bottom-hole stimulation and production fluids from drilling activities.

In the event of these types of mishaps and negligence, pollution can still occur despite the variety of regulations through DEP and the SRBC and DRBC. When contamination does occur, it should be noted that gas well brines are highly mineralized and contain levels of some pollutants that are far above levels considered safe for drinking water supplies. As a result, even small amounts of brine pollution can result in significant impacts to drinking water supplies.

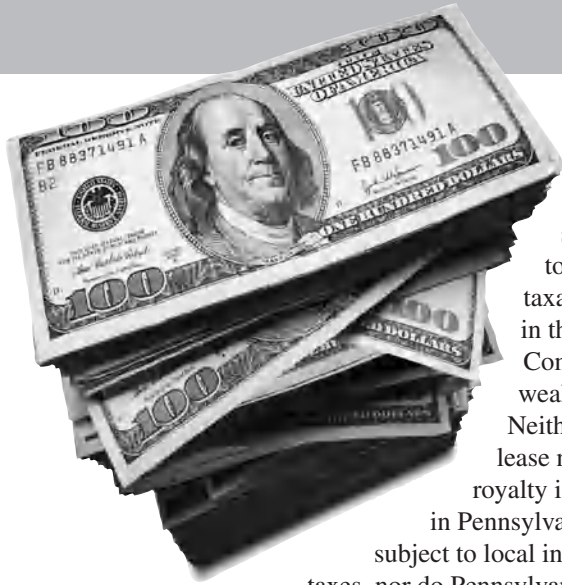
If problems with drinking water supplies are encountered, state law requires drilling operators to replace or restore water supplies affected by drilling. Landowners should contact the drilling company if problems with water supply wells develop. Landowners who are not satisfied with the drilling company's response should contact the nearest DEP regional office. DEP will investigate complaints within ten days and issue orders as necessary to replace or restore water supplies.

More information about water contaminants can be found in related publications available through the local Penn State Cooperative Extension office or www.naturalgas.psu.edu.

Revenues

Due to Pennsylvania's local tax structure, the revenue impacts of Marcellus shale on Pennsylvania local governments and taxpayers will likely be relatively small compared to the cost and service impacts. Natural gas exploration and drilling by itself will provide relatively little new tax revenues to local jurisdictions in Pennsylvania since natural gas is not





subject to local taxation in the Commonwealth. Neither lease nor royalty income in Pennsylvania is subject to local income taxes, nor do Pennsylvania

local jurisdictions benefit directly from higher local retail sales since they lack authority to levy a local sales tax.

Greater employment owing to natural gas activity will of course increase local earned income taxes, but because earned income taxes generally go to the jurisdiction where taxpayers live rather than where they work, the specific jurisdictions facing higher service costs due to the Marcellus may not be those who receive higher earned income tax revenues. Most Pennsylvanians do not work in the same municipality where they live and there is little reason to expect new natural gas workers to be any different.

Real property tax collections will increase some due to new building construction associated with the Marcellus; but, because reassessment is typically infrequent in Pennsylvania counties, rising real property values due to Marcellus will not have an immediate impact on property tax collections. Under current law natural gas will not significantly increase the local tax base, and thus will not significantly increase local tax revenues.

Tax collections by the state government will increase in Pennsylvania through the corporate income tax and sales tax, but these collections will have little direct benefit to the local jurisdictions, which will face higher service costs due to natural gas exploration.

In other words, local jurisdictions with natural gas wells very likely will face higher demands for services and thus higher costs, and yet receive little new revenues to pay for those services. The result could be higher local taxes (paid for by everyone, not just those directly benefiting from lease or royalty revenues) or cuts in other services. Because Pennsylvania law

limits municipalities' and counties' abilities to employ land-use planning tools to influence the location of natural gas drilling activities, local governments will have little ability to prevent or affect drilling in locations, which will significantly affect local service costs and taxes.

It is important to recognize that school districts and the county and municipal governments that own land leased for natural gas extraction may receive significant revenues from leasing and royalties, so they will receive some benefits. Yet the amount they receive will not relate directly to the overall costs they may experience across their jurisdiction. In addition, some may be tempted to use these windfalls for basic operations (keeping taxes low in the years the monies are received) rather than to use the monies for capital expenditures and other investments in their communities' future. The natural gas money provides a great opportunity for local jurisdictions to improve infrastructure, such as by creating parks or other investments to be enjoyed by current and future generations.

Clean and Green Act

Under Pennsylvania law, county governments administer the Clean and Green program, which provides preferential tax assessments for eligible





farm- and forestland. County governments have some discretion in how they interpret the law, which at the time of this writing is silent about whether leasing land for natural gas drilling makes the land ineligible for Clean and Green (and, if so, whether the rollback is on the entire enrolled parcel or only on the acreage directly affected by the drilling). County commissioners and assessment offices need to carefully think about how they will treat such land and the impact of that decision on landowners, neighbors, taxpayers, Clean and Green land, and gas leasing activity.

In Harrisburg there currently is policy discussion about whether to revise the Clean and Green Act to provide more clarity on issues of interpretation. For more information, visit the Pennsylvania Department of Agriculture Web site, www.agriculture.state.pa.us.

Infrastructure

The potential impact of the increased drilling associated with the Marcellus shale extends beyond the wells, pipelines, and other natural-gas-related sites and equipment. The economic and social changes a region will experience once the industry has established itself in the area may lead to stress on local infrastructure, such as increases in road traffic, school enrollment, and housing needs.

Access Roads

Once a well site is chosen and established, private access roads will be built to enable the necessary

large equipment and trucks to reach and service that particular well. In addition to these newly constructed roadways to the well pad, the initial preparation to begin drilling and producing gas delivers a considerable amount of heavy traffic to surrounding local roads. It is important to remember, however, that after site construction, the wells will still generate consistent truck traffic and road use. Holding tanks on site for water by-products created during drilling must be emptied at least once, if not several times, per week and will be hauled to treatment or injection facilities. Since wells produce year-round, road use and truck traffic on both access and local roads will be occurring year-round.

Compressors

Compressors are used to increase the gas pressure from the wells before being shipped to market and can produce significant amounts of unwanted noise. Since compressors run nonstop, this can create concerns for local officials who handle noise disturbances. Some well sites will house the compressors in buildings to decrease the output of noise, which can improve the problem but also results in the creation of permanent structures on site.

Pipelines

Any gas produced from wells is valueless unless it reaches market. Pipelines are necessary for moving the gas and are laid to travel from the site out to





central gathering points where the lines continue transporting larger quantities of gas from numerous wells to market. The pipeline construction affects environmental and aesthetic aspects of the area and generates additional construction sites and associated disturbances.

Pipelines should be acknowledged as permanent infrastructure of the gas industry and their construction should be strategic and efficient.

Local officials need to concern themselves with influencing pipeline construction in hopes of minimizing potentially unnecessary lines. Excessive lines across local landscapes could result from poorly planned or disjointed networks of pipelines.

Population Change and Impacts on the Community

Housing, Schools, Crime

As indicated by the experience in Texas and Wyoming, it is important for local officials to prepare for the population changes that may occur due to the Marcellus. As noted in the studies conducted in similar circumstances across the country, some of the major associated changes in the community will likely be:

- The need for adequate housing stock. If an inadequate amount of housing is an issue, the influx of workers will not live in the community, therefore affecting the large array of possible economic benefits for local business and government.
- Impacts on schools and service industries will change the dynamic of the community as well, seeing student population increases, higher government infrastructure expenses, etc.
- An increase in crime, particularly nonviolent crimes such as driving under the influence and drug violations.
- Social tension or animosity between “newcomers” and “old timers,” or between residents gaining personally from natural gas and others in the community who feel they are not benefitting.
- Local officials should reevaluate their comprehensive plan, official map, and other planning tools they use in their communities to cater to or prepare for these changes. In addition, education and communication can be important tools to deal with potential changes in the social fabric of the community.



Economic Development

The size of the economic impacts from Marcellus depend critically on whether the businesses exist within the Pennsylvania communities to support ancillary economic activity created by natural gas exploration and development. The more spending that occurs outside the community, the less economic benefit will accrue locally since those dollars will simply leave the community rather than recirculating among local businesses. Similarly, to the extent nonresidents hold new jobs, the lower the benefit to the community. The twofold economic development challenge is thus:

1. Finding ways to help local businesses and workers compete for the new business opportunities arising from natural gas.



2. Finding ways to encourage businesses, workers, and royalty owners to spend their new dollars locally rather than out of town. New business start-up and technical assistance should target business opportunities related to natural gas, and workforce development training should focus on the new specialized jobs that will be created (such as land men who service the wells).

General local business and community development programs focused on helping local businesses or downtowns be competitive could similarly help Pennsylvania communities better compete for the new spending resulting from the natural gas revenues.

Environmental Impacts

The construction, activity, and existence of natural gas wells in the community and industry may cause significant environmental changes to the areas. These issues should be considered when planning and enforcing local action to accommodate the developing gas industry. Possible environmental concerns that could arise from drilling activity include:

- Aesthetics and recreation—heightened noise and the effects of drilling may affect the aesthetics and recreational value of a resource for both nonconsumptive (e.g., hiking, birding) and consumptive (e.g., fishing, hunting) recreational use. This may affect communities that are promoting natural-resource-based tourism.
- Habitat fragmentation—well sites and associated infrastructure may fragment Pennsylvania forests. Fragmentation will decrease habitat quality for many wildlife species that are dependent on deep forest habitat; it is also associated with an increased spread of nonnative and invasive plants, causing further habitat degradation for native plants and animals.
- Water impacts—water consumption and wastewater disposal may affect aquatic resources both locally and within the larger watershed.
- Timber resources—access roads and pipelines may cause damage to timber stands, resulting in loss of forestry income, appraisal, and sale of timber.
- Soil compaction and long-term site fertility—well sites may compact the soil, affecting the long-term health and fertility of the area.



Forestry concerns that show effects on forests, wildlife, ecology, and local natural balance need to be addressed by DEP, Conservation Districts, and other associated agencies through regulation and enforcement. After drilling has occurred in an area, proper site restoration is a necessity. The best ways to restore sites depend on the location and natural surroundings, making it necessary for officials to gather information on the pros and cons of different methods of site restoration. The type and quantity of vegetation replanted will make a large impact on the natural ecology and balance.

WHAT LOCAL OFFICIALS CAN DO

Local government officials concerned about the impact of Marcellus shale development on their community need to greatly expand and upgrade their comprehensive community planning efforts. The fast pace of gas drilling—and all its related activities—means that planning must be done on a continuous, daily basis. Every new well that is drilled causes small changes in the community. Monthly meetings of the planning commission are not sufficient to keep up with these changes. We also need a new way to think about how communities plan for gas exploration.

Comprehensive community planning is more than just the established “comprehensive plan.” A comprehensive plan, as permitted in the Municipalities Planning Code, serves as a useful tool for municipal management by providing a broad, general framework for common development issues projected ten to twenty years into the future. This would be acceptable if things did not change very quickly, but that is not the case with gas drilling. Few comprehensive plans were prepared with major natural gas development in mind, so they are not adequately prepared to address the potential impacts of the Marcellus shale formation.

A more comprehensive view must take into account all the important issues and how they interrelate to one another. This view involves more than just land use. Gas drilling brings many new factors to communities that have not been experienced previously in many areas of Pennsylvania. Exploration of the Marcellus shale will generate large amounts of money from the leasing of land, construction, trucking, commerce, and housing development. Some residents will have to more money to spend, but will they spend it in the community and

region? Will they take that capital somewhere else if there are no places for them to spend their money locally? New opportunities for business development should increase with gas drilling, which will require infrastructure investments in roads, water, and sewer facilities. Housing needs for gas and related workers will increase. Will their needs be met with a temporary variety of housing or is the plan to build long-term residential areas that will be attractive to gas industry workers and their families? There will also be new service, public safety, and other expenses imposed on local governments that may not be consistent with tax revenues derived from natural gas drilling or leasing activities.

To address these complex issues, the comprehensive planning undertaken by municipalities and counties should have four components:

1. Taxation and municipal finance: a component to examine tax revenues and expenditures related to gas exploration and project future financial resources needed for municipal and county operations, and school districts in the region.
2. Public investment: for examining and developing a plan on how municipalities, counties, and school districts can use their assets and facilities to generate revenues from drilling, transmission, water, and wastewater activities related to gas exploration.
3. Comprehensive land use: a plan to incorporate natural gas development as a new and distinctive land use and provide for economic development, new commercial and residential activity, and improvements to the local transportation system.
4. Municipal management: a component of planning to provide personnel that will keep track of mining activities, carry out inspections, anticipate production changes, and encourage workforce development to supply skilled workers. Since gas exploration is regional in scope, the management process needs to be carried out jointly by affected municipalities, counties, and school districts, as well as the private sector.

The vast economic and social impacts related to exploration of the Marcellus shale deposit call for new thinking. Sound, innovative, continuous comprehensive planning is needed for Pennsylvania municipalities to maximize the long-term benefits from Marcellus shale development while minimizing potential negative impacts.



The experience of some local governments with the gas companies has been very positive, and many companies have shown a desire to conduct themselves appropriately within the community. The companies are investing millions of dollars into drilling and pipeline construction with plans to remain in the drilling areas for years. The length of these relationships demands a certain level of cooperation between parties, and jeopardizing the ability of the companies to operate would be detrimental to a productive and beneficial relationship. It is important for municipal officials to ensure good communication and collaboration, with a method for quickly and easily addressing problems if they occur.

Areas to Consider

Road Bonding

The Commonwealth can prohibit the use of and impose size or weight restrictions on highways and bridges under its jurisdiction in accordance with Department of Transportation regulations. Trucks considered heavy haulers must pay for the road damages that they create; thus, bonding is necessary.

No vehicles in excess of the size or weight limitations specified are allowed on Pennsylvania highways unless the department or local authority grants a waiver. Local authorities that post size or weight restrictions, either in accordance with the size, weight, and load chapter or that differ from that chapter, must comply with the department regulations.

Posting and bonding municipal roads is authorized in the state vehicle code. The PennDOT Bureau of Maintenance and Operations is in charge of municipal road posting and bonding information. You can also find codes for the authorization to use bridges posted owing to condition of the bridge and to use highways posted because of traffic conditions. Some of the key provisions of road bonding include:

- **Posting:** a road must be posted with a weight limit before a bond can be required of a hauler. The steps taken to establish a weight limit include (1) completing an engineering and traffic study that supports the need for a weight restriction; (2) passing an ordinance identifying the road segment and setting the weight restriction; (3) advertising the posting two times in a general circulation newspaper at least five days prior to actual posting; (4) contacting known heavy haulers who are using the road about executing a



- maintenance agreement; and (5) erecting standard signs showing the weight limit.
- **Excess maintenance agreement:** after posting a road, the local government enters into an excess maintenance agreement with each hauler who will be operating overweight vehicles on that road. This agreement allows the local government to shift responsibility for repairing road damages on a pro rata basis to the haulers who damage the road. Note that haulers are only responsible for damage they cause in excess of normal wear and tear on the road.
- **Permits:** driving an overweight vehicle on posted roads generally requires a permit. The type of permit depends on the number of vehicles, the number of posted roads used, and the amount of use. Permits are issued only after an excess maintenance agreement has been signed.
- **Inspections and monitoring:** before overweight hauling begins, the local government inspects the road to determine its condition. The hauler who pays for this service has the right to be present. After hauling begins, the local government is



responsible for monitoring the condition of the road and notifying the hauler of any necessary repairs. If the local government is responsible for making the repairs under the excess maintenance agreement, the local government bills the hauler for the costs.

- **Security (bonding):** haulers generally must provide security to ensure payment for any road repairs for which they are responsible under the agreement. This security is usually a performance bond, a standby letter of credit, or a certified bank check. The regulations specify the amount of security that may be required for unpaved roads (\$6,000 per linear mile) and paved roads (\$12,500 per linear mile) in cases wherein the hauler agrees not to downgrade the road. When the local government and the hauler agree that the road type can be downgraded during hauling and restored after hauling ceases, the amount of security required is \$50,000 per linear mile. If the hauler uses several roads for only a short time or makes relatively few trips, the rates per mile may be replaced with a flat rate of \$10,000. By following these rules, local officials can assure taxpayers that they will not have to pay for road repairs caused by overweight vehicles.

Local governments considering road bonding or posting weight limits on bridges should carefully

consider potential impacts on other road users since they may unintentionally affect others. Bridge weight limits, for example, could make it difficult for milk trucks or feed trucks to reach farms, hurting those businesses.

For more about road bonding, see PennDot publication 221: *Posting and Bonding Procedures for Municipal Highways*, which may be purchased from the PennDOT store. <ftp://ftp.dot.state.pa.us/public/PubsForms/Publications/PUB%2012.pdf>

Zoning and Subdivision and Land Development Ordinances

At the time of the writing of this publication, Pennsylvania's Oil and Gas Act and the Municipalities Planning Code restrict the ability of local governments to zone or permit drilling, so zoning has limited usefulness to influence where and when drilling occurs. Yet zoning and subdivision and land development ordinances remain a vitally important tool for influencing the potential secondary effects of natural gas activity, such as from possible new residents, housing, supporting businesses, patterns of development, and the other spinoff impacts. Much of the economic opportunity (and challenge) from Marcellus will be these secondary effects, which can be influenced and regulated through zoning and other land-use tools.





Capital Budgeting

Capital budgeting is a powerful but often underutilized tool of Pennsylvania local governments. By planning future expenditure needs for infrastructure and other capital expenses, such as road maintenance and repair, trucks, and equipment, capital budgets allow the local government to ensure it has the funds in hand to pay for upcoming needs. This includes a schedule of setting funds aside for future needs and anticipating spending for future needs in current budget decisions.

Local Natural Gas Task Force

Given the localized nature of many of these impacts, a local, comprehensive, and proactive approach can help ensure that a wide range of the community's interests are represented—and importantly—taken into account when decisions are made. One important way to meet this challenge is to create a local task force or a similar organized effort to guide community discussions, information gathering, and decision making. Members should reflect the broad community, including businesses, the chamber of commerce, nonprofits, schools, local government, and citizens, among others. Such a task force can ensure that regular communication occurs among local governments, the business sector, real estate, workforce development, academics, service providers, and citizens, and that the community is able to be proactive about the opportunities.

As of this publication, several counties in Pennsylvania have already formed local task forces to address gas exploration and development issues in their communities. Several counties in Texas helped pioneer this approach to responding to the natural gas opportunities and challenges and have found it useful. For a more in-depth discussion of ways to build a successful local strategy, see the Penn State publication “Creating and Fostering a Local Task Force” available from www.naturalgas.psu.edu.

Leasing Municipal Land

Many Pennsylvania local governments themselves will have the opportunity to lease their own land, such as parks, open space, reservoirs, and other municipal property, and may receive substantial royalty income in the future. If a local government has this opportunity, it is vital to take care during the leasing process. As with landowners, Penn State Cooperative Extension's Marcellus Education Team recommends

talking with several companies and with an attorney familiar with leasing issues because the typical contract offered by the companies may not adequately protect or represent municipal interests and likely will require some amendments written by an attorney. Those issues may include the ability to jointly approve the location of access roads, drilling pad locations, and how land is cleared (and disposal of the trees).

Site restoration is another postdrilling issue that local officials should try to address. Restoration is a requirement for all drilling sites and is regulated by DEP. However, it is important for local officials to talk with gas companies about the specifications of each site's restoration to ensure that the recreated habitat is appropriate for the area. Site restoration should be conducted in accordance to the surrounding ecology of the well site so that local wildlife is provided the proper vegetation species and coverage for their environment.

It is also critical for local officials to carefully consider how leasing and royalty income will be used. It may be tempting to use the funds to cover current operating expenses, reducing taxes in the short run. But the dollars result from the sale of a capital asset, so they should be used for capital expenditures that benefit more than just current residents; the gas being sold also is owned by future generations of residents, who also should benefit from the sale. Good fiscal management suggests viewing these dollars as a way to invest in the future of the jurisdiction, such as building infrastructure or purchasing land and other assets that benefit current and future residents; in other words, use the windfall gains to improve the community for the long run, not just for the period when the gas is flowing.

LOOKING AHEAD

Marcellus shale is providing many Pennsylvania communities a significant opportunity for strong economic development and improvements in the quality of life. Along with these strong opportunities, major challenges will need to be addressed directly. The role of local officials should be to help balance these challenges and benefits to ensure the focus is not just short-term gain. They must constantly keep in mind how to use this opportunity to improve the community for the long run so that when the Marcellus play is over, the community has improved and is poised for the future. ■



HELPFUL RESOURCES

Penn State Resources

PENN STATE COOPERATIVE EXTENSION: www.naturalgas.psu.edu

PENN STATE AGRICULTURAL LAW RESOURCE AND REFERENCE CENTER: www.dsl.psu.edu/centers/aglaw/gas.cfm

PENNSYLVANIA'S GAS RUSH: UNCOVERING THE IMPACTS OF NATURAL GAS DEVELOPMENT:
www.wpsu.org/gasrush

CENTER FOR DIRT AND GRAVEL ROAD STUDIES: www.dirtandgravel.psu.edu

State Agencies

PENNSYLVANIA DEPARTMENT OF AGRICULTURE: www.agriculture.state.pa.us

PENNSYLVANIA DEPARTMENT OF COMMUNITY AND ECONOMIC DEVELOPMENT: GOVERNOR'S CENTER
FOR LOCAL GOVERNMENT SERVICES: www.newpa.com/default.aspx?id=20

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES: www.dcnr.state.pa.us

PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL PROTECTION: www.depweb.state.pa.us

PENNSYLVANIA BUREAU OF OIL AND GAS MANAGEMENT:
www.dep.state.pa.us/dep/DEPUTATE/MINRES/OILGAS/oilgas.htm

PENNSYLVANIA DEPARTMENT OF TRANSPORTATION (PENNDOT): www.penndot.state.pa.us

Other Agencies

SUSQUEHANNA RIVER BASIN COMMISSION (SRBC): www.srbc.net

DELAWARE RIVER BASIN COMMISSION (DRBC): www.state.nj.us/drbc

PENNSYLVANIA LOCAL TECHNICAL ASSISTANCE PROGRAM (LTAP): www.dot7.state.pa.us/LTAP

PENNSYLVANIA FARM BUREAU (PFB): www.pfb.com

Local Government Associations

PENNSYLVANIA STATE ASSOCIATION OF TOWNSHIP SUPERVISORS: www.psats.org

PENNSYLVANIA STATE ASSOCIATION OF TOWNSHIP COMMISSIONERS: 800-237-7282

PENNSYLVANIA STATE ASSOCIATION OF BOROUGHES: www.boroughs.org

PENNSYLVANIA LEAGUE OF CITIES AND MUNICIPALITIES: www.plcm.org

COUNTY COMMISSIONERS ASSOCIATION OF PENNSYLVANIA (CCAP): www.pacounties.org

Other Educational Associations

PENNSYLVANIA PLANNING ASSOCIATION (PPA): www.planningpa.org

PENNSYLVANIA MUNICIPAL PLANNING EDUCATION INSTITUTE (PMPEI): cax.aers.psu.edu/pmpei

Written by Michele Rodgers, writer, Ag Communications and Marketing; Neal Fogle, extension educator in economic and community development; Timothy W. Kelsey, professor of agricultural economics and state program leader of economic and community development; Stan Lembeck, professor emeritus of rural sociology; Ross Pifer, director, Penn State Agricultural Law Resource and Reference Center; Walt Whitmer, extension associate in economic and community development; and Peter Wulfhorst, extension educator in economic and community development.

The “Road Bonding” section was adapted from *Timber Harvesting in Pennsylvania: Information for Citizens and Local Government Officials*, produced by Penn State’s School of Forest Resources.

Penn State Cooperative Extension provides educational resources for landowners concerned about the natural gas leasing and exploration process. County extension offices may host an educational workshop, discuss leasing arrangements, or refer you to regulatory or legal specialists. Although extension educators cannot provide legal advice, they can provide additional insights about natural gas issues.

Visit Penn State’s College of Agricultural Sciences on the Web: www.cas.psu.edu

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