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Natural Gas Drilling in the Marcellus Shale:

Regional Economic Opportunities and Infrastructure Challenges

Natural gas drilling has taken off rapidly around the U.S. in recent years. From Colorado to Texas to Pennsylvania, energy companies are investing in cutting-edge technology to tap into a vast energy reserve which lies below the surface of many communities. This heightened drilling activity holds tremendous economic development potential for many rural regions. However, the growth of this industry also poses numerous challenges, including strains on local transportation networks and other types of infrastructure as well as environmental impact concerns. This issue brief examines how regional development organizations in Pennsylvania and New York are addressing these challenges, and what sort of measures can be taken to ensure that natural gas extraction brings the best possible benefits to regions and communities, while minimizing potential negative effects.

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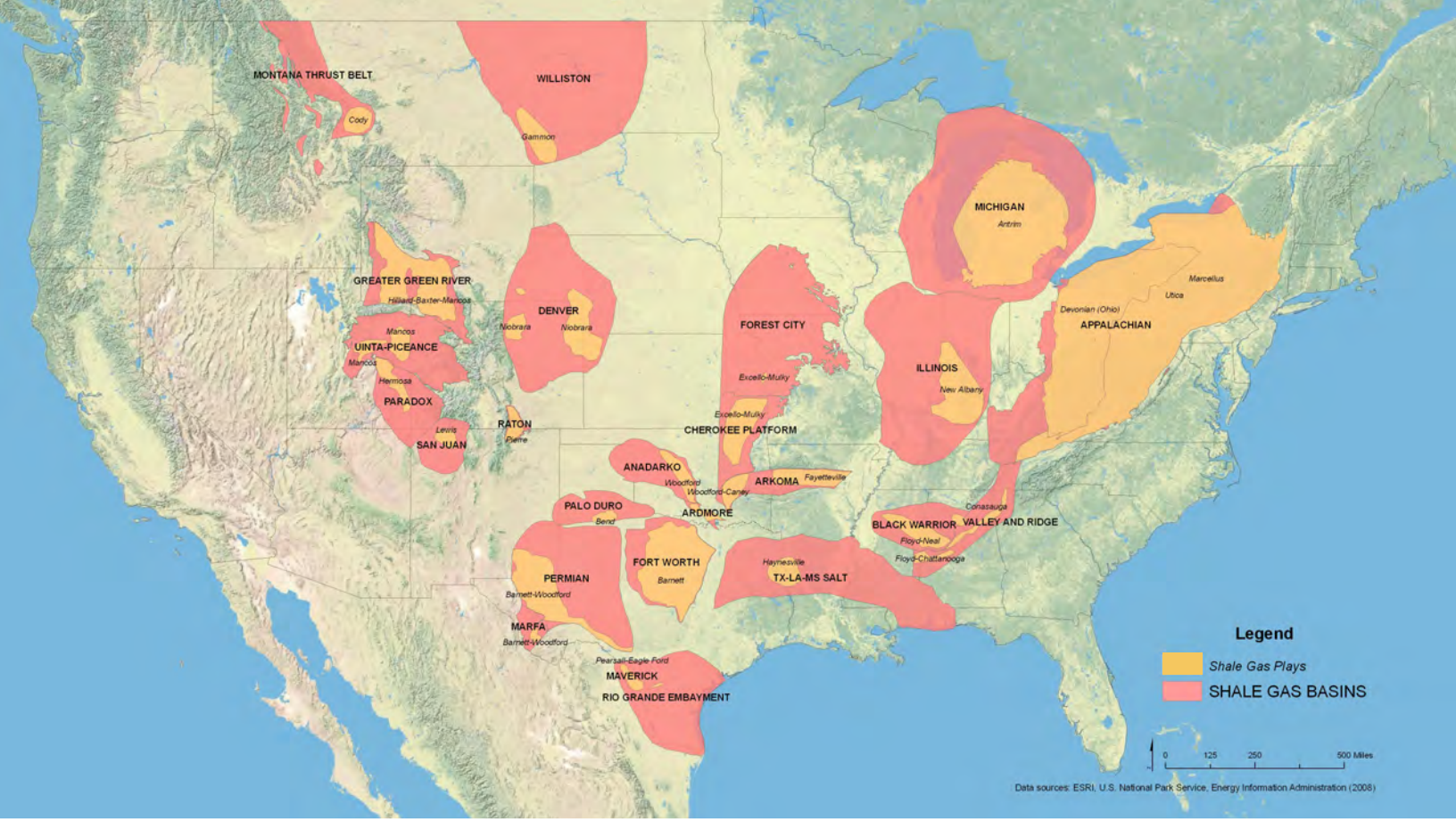


More than 20 different basins of varying sizes and capacities hold gas in geological formations around the country. The most productive shale plays to date are the Barnett Shale (located in Texas), the Haynesville Shale (Texas and Louisiana), the Antrim Shale (Michigan), the Fayetteville Shale (Arkansas), the Marcellus Shale (Appalachia) and the New Albany Shale (Illinois). source: Energy Information Administration.

Background

While natural gas drilling in the U.S. dates to the early 19th century, large-scale drilling operations only began in the past two decades. Much of our nation's natural gas reserves are trapped in shale rock formations deep below the Earth's surface, and only recently have geologists begun to understand just how much of this resource can be recovered from these reservoirs.

Previously, shale gas was thought to be too difficult to extract because it was buried in nearly impermeable rock and geologists believed it was sparsely distributed across landscapes, making extraction too costly to be economically viable. However, recent technological innovations have allowed extraction to become much more cost-effective, and fluctuations in oil prices have led shale gas production in the U.S. to become more profitable.[1] Extensive gas production from shale began in Colorado, Wyoming and Texas in the 1990s. The Dallas-Fort Worth region sits atop the Barnett shale play, for example, which is currently the most productive natural gas play in the U.S., producing 6 percent of all natural gas in the lower 48 states.[2] A shale play is the active gas-producing area within a shale gas basin, which is the underlying geological formation that holds reserves of natural gas.

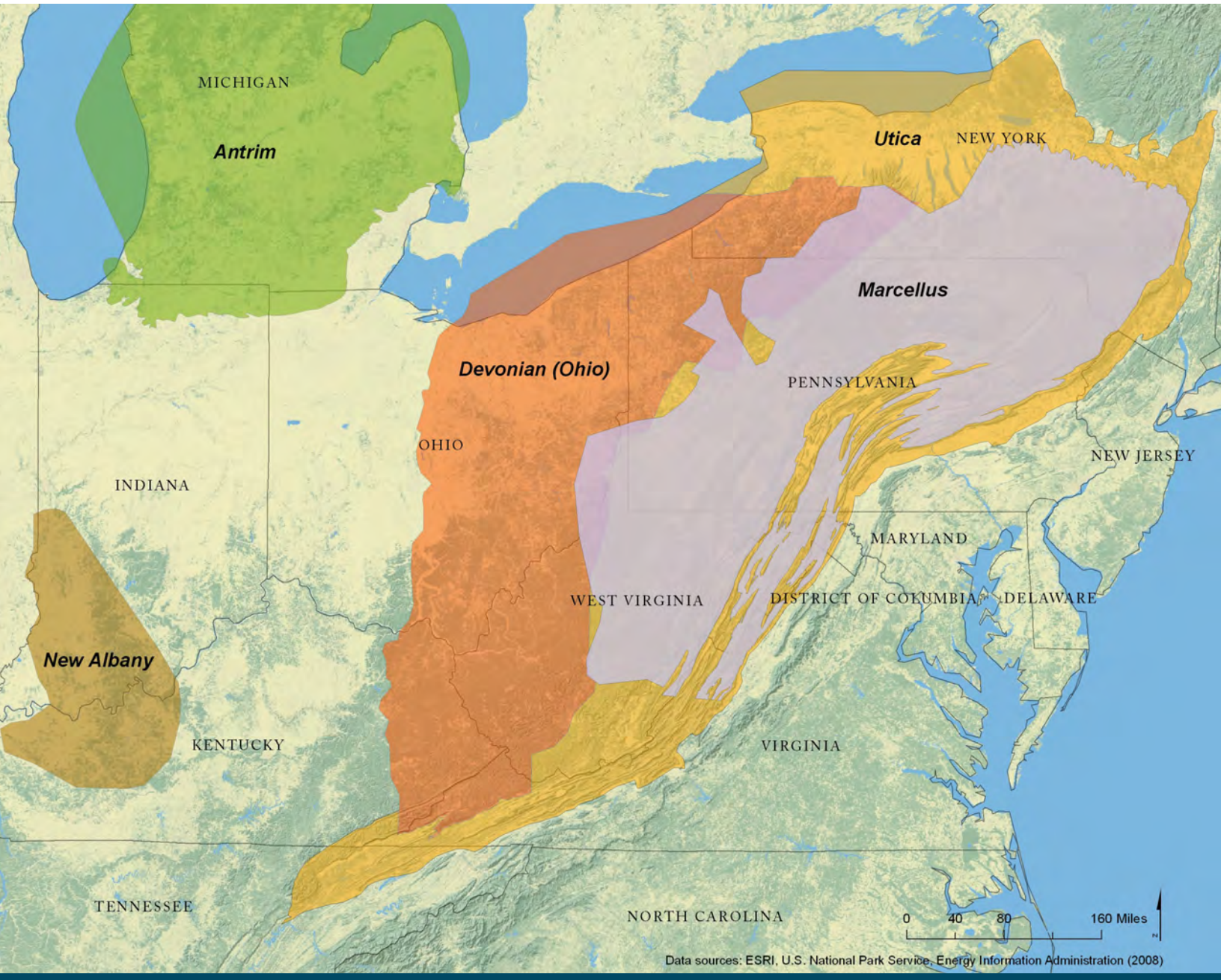
In 2009, the Energy Information Administration estimated that the U.S. has more than 1,744 trillion cubic feet (TCF) of technically recoverable natural gas, which experts estimate could supply the U.S. with natural gas for the next 100 years or so, based on current consumption rates.[3] Today, natural gas provides about 22 percent of the nation's energy, used primarily for electrical generation and residential heating.[4] Expansion of natural gas as an energy source offers a number of advantages: when burned, natural gas emits about half the carbon dioxide as

coal and about 30 percent less than oil.[5] Concerns about climate change as well as a possible cap on carbon emissions under pending climate change legislation have allowed natural gas to emerge as a clean energy alternative. Furthermore, if U.S.-sourced natural gas can supply a larger share of the nation's energy demand, it could help reduce America's dependency on foreign oil and promote job creation and economic development in the U.S.

Marcellus Shale

Most recently, the gas industry has devoted more attention to the Marcellus shale formation, which underlies a multi-state region in central and northern Appalachia. The existence of the shale formation and its reserves of natural gas have been known since the early 1800s, yet the full extent of the reserve has only been realized recently due to advances in gas extraction technology and the growing search for alternative energy sources. Geologists now estimate

The Marcellus shale gas play is one formation within the Devonian shale plays of the Appalachian region. The Utica Shale play partially underlies the Marcellus. This issue brief focuses primarily on drilling activity within the Marcellus, but similar issues affect other areas within the Appalachian basin adjacent to the Marcellus shale play.



that the Marcellus is the largest shale gas deposit in the world, holding 262 TCF of technically recoverable gas, up from a United States Geological Survey 2002 estimate of only 1.9 TCF.[6] Some geologists have indicated that based on the formation's distribution and thickness, the most lucrative portions of the Marcellus may lie in northeast Pennsylvania and the eastern Southern Tier of New York, which has prompted a significant increase in drilling activity in these areas over the past several years.[7]

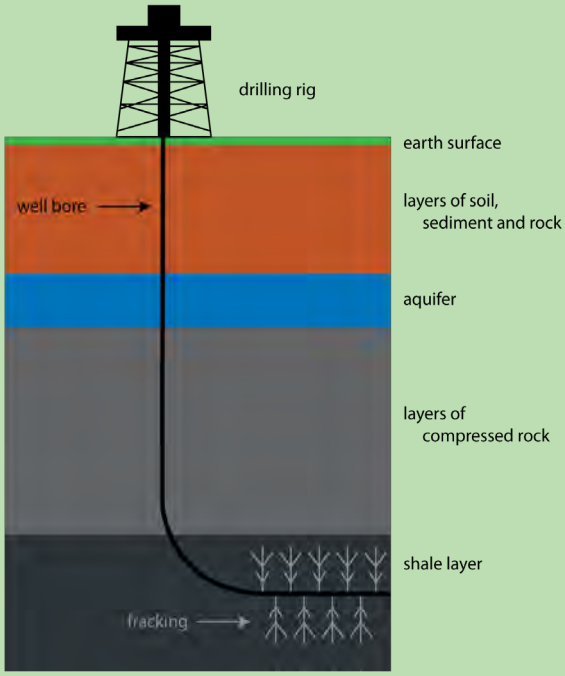
In addition, this relative "gold mine" of energy is adjacent to the nation's most highly-populous region, the Northeast megaregion, which reaches from the District of Columbia to Boston and is home to approximately 50 million people, about one-sixth of the U.S. population. The development of a secure source of energy in close proximity to the country's largest concentration of residents and businesses could prove vital to national economic security and energy independence.

Rick Biery, Regional Planning Program Manager of the Northern Tier Regional Planning and Development Commission, which supports a 4,000-square mile area in north central Pennsylvania, has witnessed a rapid increase in drilling activity in his region since late 2008. He states, "This could be just the tip of the iceberg; gas companies are saying they will be here at least for the next 20 years, and that they are finding the cleanest gas they've ever found in the Northern Tier, meaning that little or no post-processing is required. And, it's the most high-pressure gas they've found."

TECHNOLOGICAL INNOVATIONS

Natural gas is difficult to extract from shale because the gas is trapped in tiny pores within the rock. Two technological innovations have made extraction commercially viable in recent years. First, the process known as hydraulic fracturing, or fracking, was pioneered by Halliburton and was initially used on a large-scale basis to drill shale gas in the Barnett shale basin in Texas in the 1990s. The fracking process shatters the tight shale formation by pumping a mixture of water, chemicals and sand into the rock through a well bore at extremely high pressure, creating tiny cracks and fissures in the rock, which release the gas so it can be conveyed to the Earth's surface through pipelines.

The second innovation that has enabled extensive shale gas extraction is horizontal drilling. Typically, the shale layer is about a mile underground, beneath the aquifer. The well bore (encased in steel and cement) is drilled vertically through the Earth's surface, the aquifer and the layers of rock below. Upon entering the shale layer, the drill bit is steered sideways to access more of the shale through the single well. This process allows multiple wells to be drilled from a single platform, thereby increasing production efficiency.[10] This method also enables energy companies to harvest gas that is embedded in shale formations that lie underneath structures or roads, or in natural areas that are difficult to access, such as thick forests or steep slopes.



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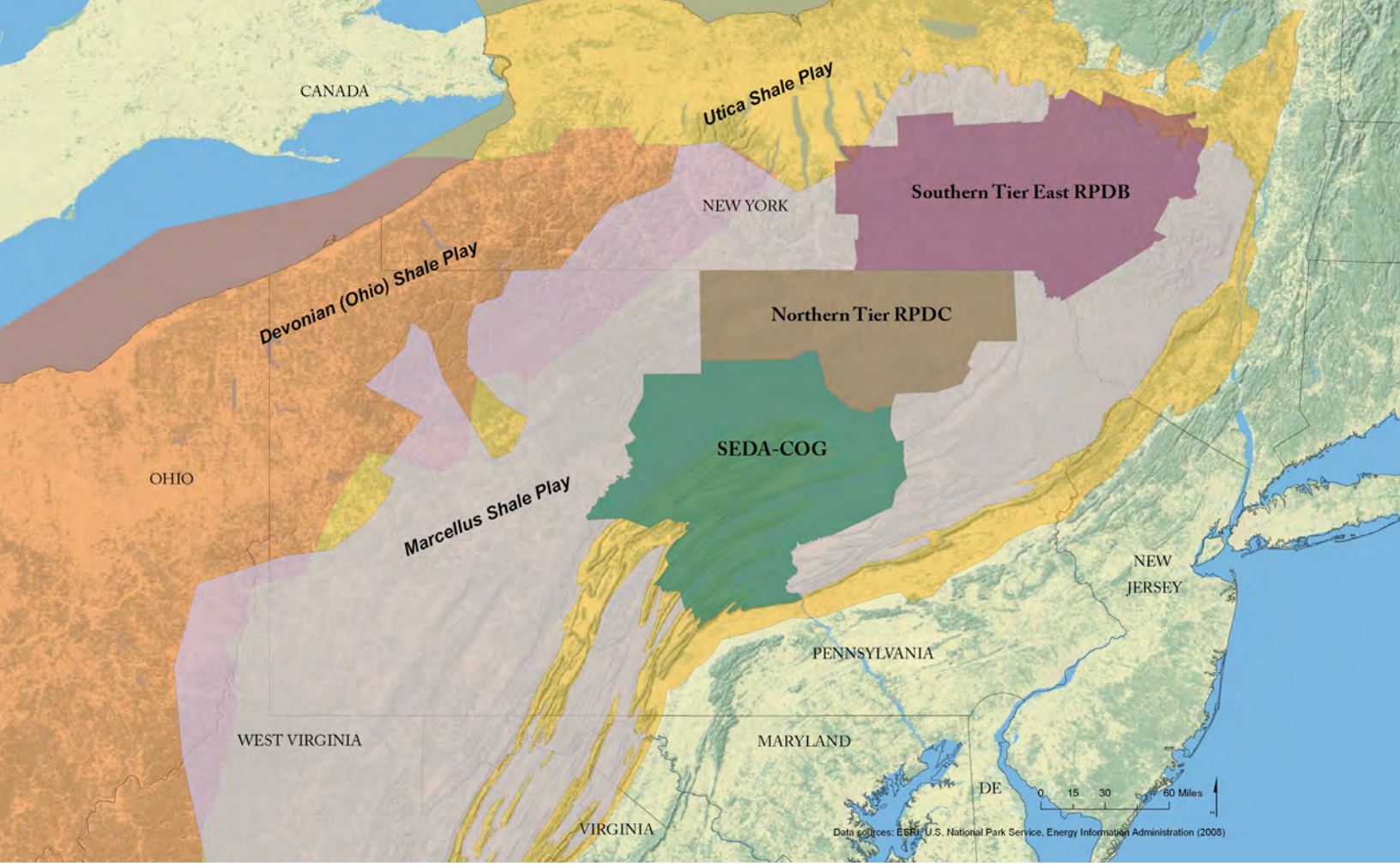
Graphic created based on information provided by U.S. Department of Energy's "Modern Shale Gas Development in the United States: A Primer" and NPR's "Exploring Shale: The Quest for Natural Gas" series.



Geographic boundaries of three of the regional development organizations interviewed for this issue brief are highlighted above.

The discovery of such prodigious quantities of a major energy source has powerful implications, not only for the national and global economies, but also for the communities that sit atop this valuable resource. The upsurge in shale gas drilling in rural parts of the Northeast, and the knowledge that this could be just a hint of what's to come, has already begun to transform these communities.

Infrastructure Development

The first stage of the shale drilling process involves the exploration of gas reserves and negotiations with landowners to lease mineral rights and right-of-way to allow gas companies to build pipelines and conduct drilling operations. Next, the energy companies determine the optimal well site locations, which may include a seismic survey, wherein gas companies use equipment to produce vibrations that generate sound waves though the ground.[8]

The initial drilling and fracking work can then take several weeks to six months or more, depending on the conditions of the location. This phase represents the highest level of activity, including:

- land clearing
- construction of access roads
- hauling of heavy drilling equipment, piping, water, sand and chemical mixtures for fracking
- construction of the drilling rig and fracking ponds

The drilling itself consists of driving the drill bit and pipeline into the ground and pumping the fracking mixture through the well bore. After this phase is completed, the rig equipment is removed along with any remaining fracking fluid, which is treated and recycled according to state regulations.

A freight train crossing the Susquehanna River.

The second stage is the extraction phase, which usually takes at least one year but can last for many years, depending on productivity of the well. Production is typically highest when the well is first drilled, and then slowly tapers off over a period of several months. The gas enters pipelines and is usually treated onsite to remove water vapor and other gases, and may be transported to a larger facility for additional processing. Natural gas is also pressurized at compression stations and odorants such as mercaptan, which has a sulfurous smell, are added to the gas at odorant injection stations. Since natural gas, which is primarily made up of methane, is naturally colorless and nearly odorless, odorants ensure that leaks may be detected before a fire or explosion occurs.

Thousands of miles of gathering lines and pipelines must be built to connect the natural gas of the Marcellus to the major markets of the East Coast. Finally, since a new gas well is most productive when it is first drilled, energy companies must continue drilling new wells to support revenue streams.[9]

Transportation Network

Regions at the center of the natural gas drilling boom are grappling with a number of drilling-related impacts, including the effects of drilling on local transportation networks. Energy companies must transport heavy equipment and pipes to drilling sites to develop the well pad and construct the drilling rig. The fracking process requires large amounts of water, sand and chemicals, and all of those materials must be transported. According to Biery, some well pads in his region contain six to eight wells, and the fracking process for these wells requires approximately three to four million gallons of water per well, which are transported by truck to the drilling site in batches of approximately 5,000 gallons at a time. The frequent traffic and heavy loads have resulted in considerable wear and tear on rural roads that were not built with such activity in mind. Bob Augenstern, Executive Director of the Southern Tier East Regional Planning and Development Board, which supports a multi-county region in New York State, just north of the Northern Tier in Pennsylvania, says that his region is concerned about local roads that can erode and crush under heavy weights, and are often too narrow to accommodate big trucks and equipment.

In some cases, local officials have negotiated with energy companies to offset the costs of repairing roads damaged by truck traffic related to the drilling. In the Northern Tier, the Pennsylvania Department of Transportation (PennDOT) has placed weight limits on state roads; companies whose vehicles exceed the limit must post a bond to use the road, which is then used to fund repairs. More than 130 state roads in Bradford County (located within the Northern Tier region) are now posted with weight limits, a more than four-fold increase over the past two years. PennDOT has hired three more inspectors in Bradford County to ensure the roads are repaired and passable, and has begun to charge companies for inspections on posted roads to offset the increased costs to the agency.[11]

In addition to the water that must be trucked in, the fracking process requires sizable quantities of sand, which also must be transported to the well pads. In Pennsylvania, the sand required is a spherical shape, rather than the angular shape which is native to the state, so the energy companies have been transporting sand into the region from the Midwest and New Jersey via freight rail. The sand is then offloaded to tractor trailers at a rate of 16 tractor trailers for every four rail cars, which is enough sand to frack one well.

Jeff Stover, Chief of the SEDA-COG Joint Rail Authority (JRA), which owns five short-line railroads in central Pennsylvania, says that the JRA "has seen a great impact on freight; rail traffic is burgeoning." The SEDA-COG JRA now has ten energy companies as customers, and Stover states that "short line freight rail traffic was down all across the country in late 2008 and 2009, but in SEDA it went up primarily due to Marcellus shale."

Stover attributes the gas boom with buffering the region and the JRA from the worst of the economic downturn. While this represents a boon to the JRA economically, the organization is also considering its capacity to accommodate increased rail activity over the long-term. The SEDA-COG JRA is working with a local Chamber of Commerce to identify new rail-serve industrial sites. The JRA is even seeking to acquire land itself to offer additional sites that can handle the transfer of these commodities from rail to truck. This may involve greenfield development and the rezoning of agricultural land to allow this type of industrial development.

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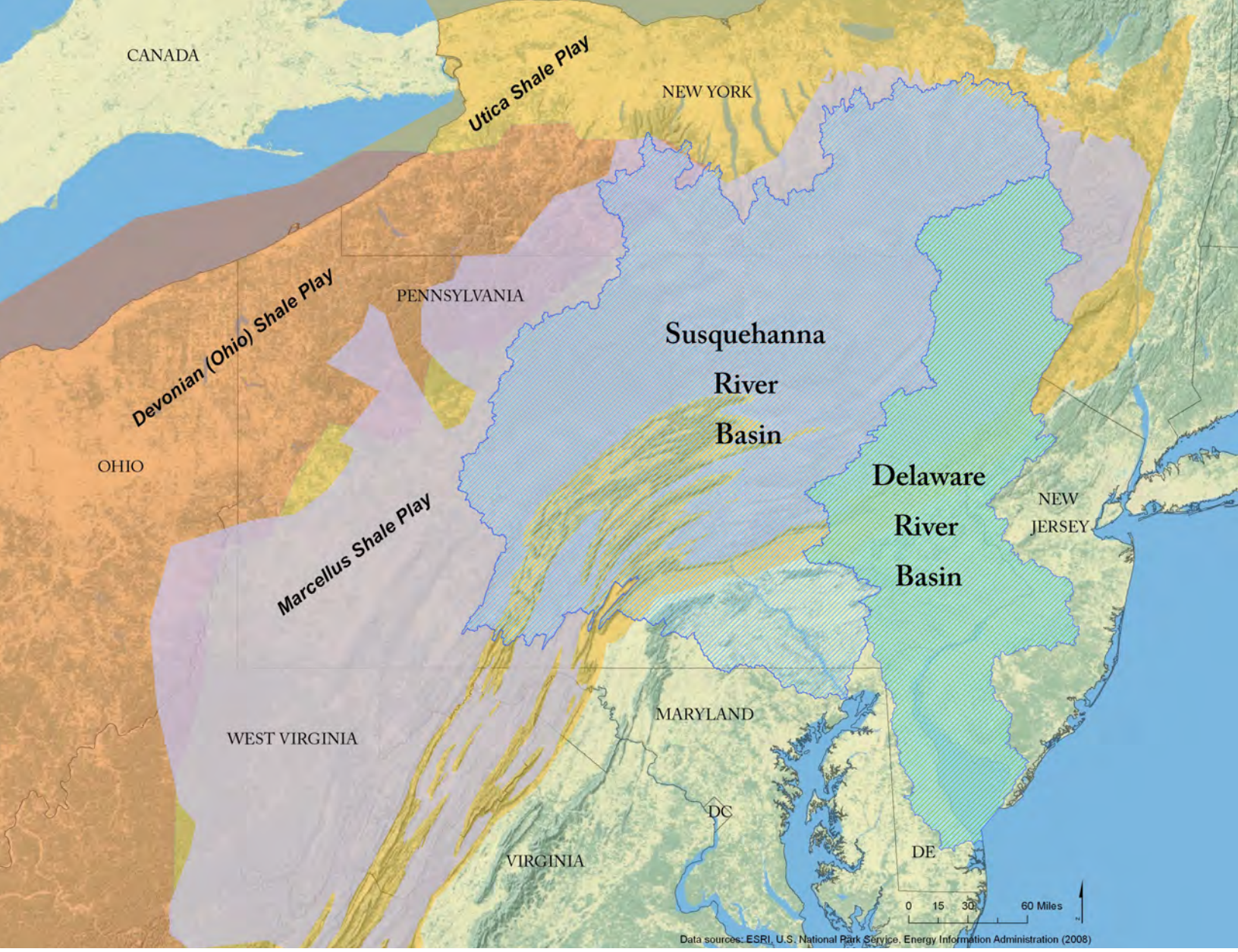
Jeff Stover
Chief of the SEDA-COG Joint Rail Authority

Biery has had similar experiences in the Northern Tier: "Our region has seen a tremendous increase in railroad traffic due to the transportation of sand, pipes and water. One railroad is inundated, having the most traffic it has had in 20 years." In the Northern Tier, rail owners are currently considering the replacement of some rail lines and the ad-



Locations of major river basins in relation to the northeast shale gas plays.

dition of double track and switching capabilities to keep up with the new demands. The Northern Tier RPDC recently was awarded supplemental planning funds from the Federal Highway Administration and PennDOT to address the increased freight traffic. The region intends to coordinate planning with the gas companies, as well as PennDOT, to plan for future improvements to the road network as well as intermodal transfer facilities.

Aside from the transportation activity directly related to the drilling and fracking process, these areas have also seen greater air travel activity related to the influx of industry executives and an out-of-state workforce. The Williamsport Regional Airport has reportedly seen a surge in private landings of corporate jets carrying energy company executives from Oklahoma and Texas. The Elmira-Corning Regional Airport in the Southern Tier of New York has also reported an increase in charter flights associated with the importation of drilling crews. Furthermore, the additional workers in the region performing land exploration and leasing activities as well as drilling have contributed to increased traffic congestion on roadways.

Water Supply

Other infrastructure issues that have arisen from natural gas drilling include water supply and wastewater treatment. The amount of water needed to

frack a new well varies, but can be anywhere from two to seven million gallons of water per well.[12] The Susquehanna River Basin Commission (SRBC), Delaware River Basin Commission (DRBC) and the Pennsylvania Department of Environmental Protection (DEP) regulate the energy companies' water consumption by requiring permits for water withdrawals and consumptive use over certain thresholds. The SRBC regulates activity in the 27,000-square mile Susquehanna River watershed, which includes parts of New York, Pennsylvania and Maryland and drains to the Chesapeake Bay. The basin provides drinking water to approximately 3.8 million people and supplies water for agricultural and industrial purposes. More than 72 percent of the Susquehanna River Basin overlaps with the Marcellus play.[13]

The DRBC regulates the 13,000-square mile watershed of the Delaware River, which encompasses parts of New York, New Jersey, Pennsylvania and Delaware, to the east of the Susquehanna River Basin. The Delaware River Basin is the largest unfiltered water supply system in the U.S., providing high-quality drinking water to over 15 million people, including about seven million people in New York City and northern New Jersey who live outside the basin. Approximately 36 percent of the Delaware River Basin intersects with the Marcellus play, and nearly all of New York City's water supply comes from the portion of the Delaware River Basin that is atop the Marcellus.

Although the major energy markets of the East Coast could benefit from the energy reserves located

A natural gas well.

in the Marcellus, their water supply (and likewise, their economic stability) may also be threatened by increased drilling activity. Both the SRBC and the DRBC have expressed concerns about the impact of withdrawals on local public water supplies, possible contamination of groundwater supplies or surface water bodies from the well bores or from the fracking ponds, runoff from well pad sites and roadways, fragmentation of wildlife habitat and disturbance of sensitive lands adjacent to water bodies.[16]

Approximately one-third of the water used in fracking will return to the surface.[15] This byproduct, known as produced water or frack water, may be contaminated from contact with natural gas and with the chemicals used in fracking. More than 200 chemicals are inserted into the ground in the fracking process, but energy companies are exempt from detailing the names of the chemicals or how they are used because it is deemed proprietary information.[16] It is known that the chemicals used in fracking include toxins and carcinogens such as benzene and formaldehyde, although energy companies emphasize that the chemicals are highly diluted and are injected through

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Bob Augenstern, Executive Director, Southern Tier East RPDB (NY)

steel and concrete pipelines thousands of feet below the aquifer, preventing the fracking fluid from entering groundwater supplies.[17] The produced water which returns to the surface must be stored and treated, often in lined ponds onsite. Some companies, such as Chesapeake Energy, use a closed-loop system that reuses the produced water to limit the fracking fluid's contact with the environment.[18]

To Augenstern, "the biggest issue is the water issue: will drilling affect aquifers and contaminate wells, and will the wastewater contaminate our streams?" His region is concerned about what composes the fracking fluid, and how best to treat the produced water. The Southern Tier East region is characterized by a large number of small-scale water systems and wastewater facilities, and many residents rely on well water. The fragmentation of the water supply and treatment system coupled with the uncertainty of the impacts of the natural gas drilling process have created an atmosphere of apprehension among some residents.

Likewise, Ryan Unger, Senior Program Analyst at SEDA-COG, states, "Wastewater disposal is a concern for a lot of municipalities; many of our rural areas don't have wastewater treatment capacity and the residents rely on well water, so there is a lot of pressure on the local municipalities. The impact on the Chesapeake Bay and the Susquehanna watershed are concerns."

Noise and Light

Noise and light pollution stemming from the drilling process can also affect local communities. Because the drilling rigs sometimes operate at odd hours or through the night, operations can be disruptive to neighbors. Noise may be associated with the operation of heavy equipment such as bulldozers, drill rigs and diesel engines, as well as noise and vibrations from the seismic surveys undertaken prior to drilling and from the periodic pressure releases from valves at the well sites, in addition to increased truck traffic. Some reports indicate that drilling rigs can reach up to 100 decibels at the drilling site.[19] These impacts may be mitigated with noise walls, lighting shields or other technology, or limitations on operating hours.

Air Quality

Another side effect of natural gas drilling is increased air emissions, which may include nitrous oxide, volatile organic compounds, particulate matter, sulfur dioxide and methane.[20] There have been isolated incidents of residents in proximity to natural gas drilling operations experiencing reduced air quality. The town of Dish, Texas, located outside of Fort Worth, houses 11 natural gas compression stations. When the residents voiced concerns about unusual odors in the vicinity of the compression stations and unexplainable health problems, such as headaches and dizziness, the town spent 15 percent of its $70,000 annual budget for an environmental consultant to

conduct an air quality study in 2009. The analysis revealed extremely high levels of both carcinogens and neurotoxins, including benzene, in the residential areas near the compression stations.[21] According to the U.S. Department of Energy (DOE), gas field emissions are controlled and minimized through a combination of federal and state regulations as well as technologies and practices to minimize and mitigate air emissions associated with natural gas extraction and production.[22]

Natural Landscapes

Drilling operations in rural areas can disrupt natural landscapes, as land must be cleared for the well pads, the access roads, the pipelines and other facilities. Potential side effects can include increased stormwater runoff as well as disturbances to wildlife habitat. Pennsylvania has leased out 700,000 acres of public lands for gas drilling, which generated $128 million in 2009, helping to close the gap in the state budget.[23] Much of that land is forested area. Unger reports that local residents are concerned about how regulators will balance drilling activity in natural areas with the needs of both recreational users and the timber industry.

Housing & Community Services

Much of the natural gas exploration and extraction efforts in the Marcellus are being carried out by small to medium-size companies, many of which

Image used under Creative Commons license from helio

One study estimates that the natural gas drilling industry could create 175,000 new jobs in Pennsylvania by 2020.

are based out of state and have brought temporary work crews to perform the initial drilling and fracking. This influx of new population has created some additional challenges for these regions. The housing supply is stressed. In the Northern Tier, rents have reportedly risen by 100 to 300 percent. There have also been reports of gas companies building "factory towns" to house temporary workers brought into the area by the gas companies. Unger reports, "Hotels are booked nearly year round, and there is not enough student housing or rental housing because the increase in high-paying energy jobs have led landlords to raise rents." Furthermore, the additional population can strain community services and emergency services such as police and fire.

Planning

The drilling boom has happened so quickly in the Marcellus that local governments and regional bodies haven't had the opportunity to lay out comprehensive strategies to address many of these concerns. In addition, local governments have little control over the drilling activity. According to state statute, the Pennsylvania Department of Environmental Protection has primary authority over regulation of natural gas drilling. Under the Pennsylvania Oil and Gas Act, local regulations may not apply to the siting of wells, the protection of local waterways, well safety issues or permitting.[24] According to a 2009 State Supreme Court ruling, municipalities can limit the locations of natural gas wells through zoning, although the state retains control over permitting.[25] The leasing of mineral rights is carried out through negotiations between landowners and energy companies, while well permits and permits

Potential Roles of Regional Development Organizations

- Develop an understanding of the natural gas drilling process, impacts, regulations and permitting timeframes.
- Provide educational resources to landowners seeking to lease land for drilling, and facilitate community meetings to share information and answer questions.
- Track data related to well-drilling activity, employment, income, housing, crime and emergency calls.
- Participate in a natural gas task force with other regional stakeholders to provide a forum for developing long-term goals and strategies.
- Communicate with natural gas company officials to learn about future drilling plans and develop mutually acceptable approaches to mitigate potential negative community impacts.
- Develop long-term strategies related to all aspects of natural gas drilling. Determine the region's goals, objectives and policies, and update regional planning documents to reflect these strategies.
- Create a regional land use strategy that will encourage new development in a way that is sustainable and fits in with existing communities, and will protect important regional assets such as historic sites, farmland and sensitive ecological resources.
- Facilitate inter-governmental collaboration and work with local governments to develop local land use regulations that will allow communities to support new population growth and ensure that the region retains a housing supply that can accommodate residents of all income levels.
- Bring together gas companies, local government officials and planners, and state transportation planners to determine short- and long-term transportation facility needs.
- Meet with regional and state agencies that regulate natural gas drilling activity and issue permits to coordinate planning.
- Work with the gas industry to ensure that regional assets are protected and enhanced throughout the drilling process.
- Collaborate with municipalities to develop strategic community investment plans to capitalize on increased tax revenue. Investment opportunities could include building and improving infrastructure and community facilities, as well as working with local businesses and entrepreneurs to maximize their growth potential to support a diverse, sustainable economy in the long-term.

Sources:
Pennsylvania Department of Community and Economic Development:
"Marcellus Shale Fact Sheet" and "Natural Gas Development Checklist for Municipal Officials."

for water withdrawals are regulated by state and inter-state agencies. Biery states that in Pennsylvania, "since the permits are issued at the state level, local governments have very little involvement, and most of the leasing agreements are already in place" in the Northern Tier. Unger added that comprehensive plans related to well-siting are not yet in place because drilling has become profitable only recently.

The State of New York currently has in place a moratorium on the issuing of new permits for natural gas drilling while the Department of Environmental Conservation prepares a Supplemental Generic Environmental Impact Statement (GEIS) to assess issues unique to horizontal drilling and hydraulic fracturing in the Marcellus. Until the Supplemental GEIS is finalized, applicants for a permit to drill in the Marcellus must undergo a site-specific environmental review. Recently, regulators announced that the New York City and Syracuse watersheds will be removed from the regulations being developed for other parts of the Marcellus shale region in southern New York. Applicants for natural gas wells in these watersheds will be required to prepare an individual environmental impact statement for each proposed well site.

Planners in New York are closely watching Pennsylvania's experience with shale gas drilling. Augenstern reports that while no comprehensive planning around the gas wells siting and infrastructure is taking place, a number of citizen groups have organized at the local level to hold community meetings and debate both sides of the drilling issue. Groups of landowners have also formed to negotiate leasing agreements with energy companies to ensure favorable pricing. He states, "It is confusing to a lot of people because there has not been a good appraisal of people's options and what control they have over what will happen. We are closely watching Pennsylvania's experience and there is a degree of apprehension on this side of the border."

Economic Impact

The potential economic impact of natural gas drilling cannot be overlooked. Drilling activity in Pennsylvania's portion of the Marcellus holds significant potential to create jobs, generate tax revenue, increase wages and offer landowners significant royalties and dividends. Because the drilling activity has begun so recently and taken off so quickly, and because the amount of recoverable gas is still under debate, economic impact estimates vary. One study completed by Penn State University found that the natural gas industry generated a total of $2.3 billion in Pennsylvania in 2008; this figure includes the creation of more than 29,000 jobs and $240 million in state and local tax revenue. Penn State estimates that by 2020, the industry may add a total of $13.5 billion to the economy, including almost 175,000 jobs (cumulative).[26]

In Pennsylvania, much of the drilling activity is being carried out by companies based in Texas or Oklahoma who have had success with shale gas drilling in the South and West, such as Chesapeake Energy, Cabot Oil & Gas and Range Resources. Since the fracking and extraction processes require skilled workers, the initial work has been performed by employees that the energy companies have imported to the region in shifts. However, they have

also begun to partner with local colleges and other organizations to develop workforce training courses for local residents. According to Biery, a drilling rig in his region typically operates with a crew of eight, including one trainee, so it will take several more years of education and training before crews can be staffed fully by local workers. The shale gas industry demands not only drilling crews, but also workers to design and construct pipelines, access roads, compressor stations and other facilities, all of which require a high degree of specialization. In addition, the industry relies upon teams of landmen, surveyors, engineers, attorneys and other professionals involved in the legal processes required to negotiate agreements between landowners and energy. In the Southern Tier East, Augenstern finds that there is "a lot of dispute over whether drilling will create local jobs or bring in transient workers."

Property owners could reap handsome rewards from the gas located under their property. Gas companies negotiate with landowners to lease their mineral rights to allow drilling on their land, and prices have risen dramatically in the past few years. Companies were leasing mineral rights for $300 an acre just two years ago, but prices are now up to $4,000 to $5,000 per acre and have gone as high as $14,000 per acre.[27] According to the Pennsylvania DEP, over 8 million acres in Pennsylvania have been leased to natural gas companies to date.[28]

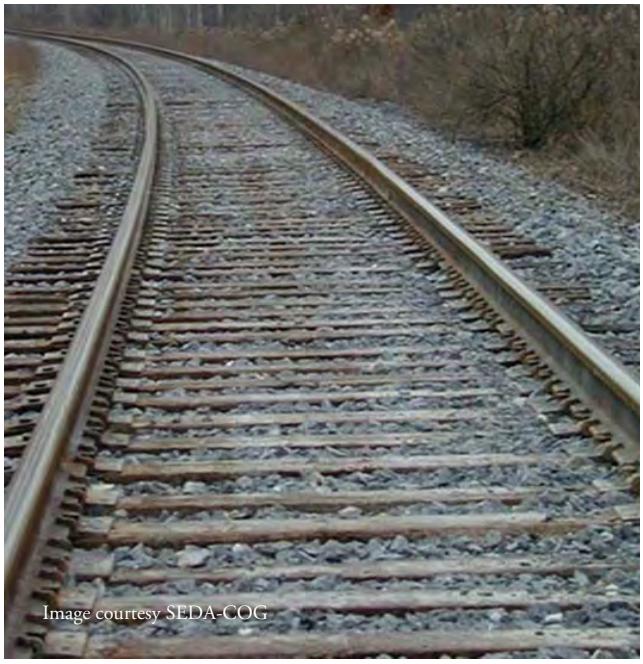
Image courtesy SEDA-COG

Landowners also negotiate royalty agreements which will grant them a percentage of the profits that the gas company earns from drilling on their property. In Pennsylvania, state statute mandates that landowners must receive royalties of at least 12.5 percent of a well's production. Current royalty agreements provide landowners with approximately 15 percent, and have gone as high as 21 percent.[29] Future production estimates vary wildly, but if the market plays out according to some expectations, landowners could see astronomical returns. For many rural residents, these windfall profits could represent the ticket to long-term financial security for themselves and their families.

Municipal budgets hope to benefit both from increased property tax revenue and sales tax revenue as well as the payment of impact fees or bonds to finance the repair and construction of transportation facilities and other community facilities. Pennsylvania Governor Ed Rendell has proposed imposing a severance tax on the extraction of natural gas. Under his plan, drillers would be charged five percent of the value of gas extracted plus an additional 4.7 cents per 1,000 cubic feet of gas. If it is adopted, a severance tax could generate $160.7 million in the first year and $1.8 billion over five years for the state budget.[30]

What's Next?

The shale gas drilling boom has raised many questions for the residents of Pennsylvania and New York. The economic development potential is enormous, both for local communities and the state and national economies. However, there are debates over how long the drilling will last and what will be left behind. What are the hidden costs, and how can they be accounted for? When wells are no longer active, what types of infrastructure will remain? How will rural landscapes change? How can communities employ sound planning techniques to take advantage of these opportunities to support the long-term sustainability of their regions?

ENDNOTES

[1] *Modern Shale Gas Development in the United States: A Primer.* U.S. Department of Energy: Office of Fossil Energy and National Energy Technology Laboratory, April 2009. p. ES-1.

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[4] Ibid.

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