



Marcellus Shale Gas Development: What Does It Mean for Pennsylvania Schools?

Summary

This research brief discusses findings from a survey of 940 school district superintendents, high school principals, high school directors of curriculum and instruction, and directors of Career and Technology Centers (CTCs) across the 17 intermediate units located within Pennsylvania's Marcellus shale region. The survey data are supplemented by data from interviews and focus groups with 50 educational and community leaders across Pennsylvania's northern tier in areas of intensive gas drilling. The purpose of the research was to better understand the challenges and opportunities associated with Marcellus shale gas development as perceived by educational leaders.

We found that about one-quarter of school district respondents report making curricular adjustments in response to changing workforce needs, although many report having insufficient information and lack of coordination regarding how best to meet the workforce development needs of students. CTCs have assumed a somewhat more robust role in this regard.

While school district respondents in areas with high drilling activity report significant local economic activity, they report that relatively little economic benefit has accrued back to schools. Some districts have leased land to gas companies, although some respondents expressed concern about the risks

of water contamination in cases in which district buildings relied on well water. Respondents from some school districts, especially in areas with high drilling activity, are concerned that Marcellus-related workforce demands may increase dropout rates as students contemplate leaving school to take advantage of emerging employment opportunities.

Respondents in areas with high drilling activity have reported significantly tightened housing markets, dramatic increases in housing rental costs, and increased residential insecurity and homelessness. Respondents report concerns about how this might affect recruitment and retention of staff when district salaries can neither keep pace with rising local costs nor match gas-industry-related salaries. School district respondents also report problems with road congestion, damage, and repair, issues that affect school bus routes and schedules as well as public safety. Respondents cite the need for more information, greater resources, and increased communication and coordination between school districts, CTCs, and the gas industry to inform and enhance Marcellus-related workforce development.

Introduction

The Marcellus shale formation lies beneath New York's southern tier, about two-thirds of Pennsylvania, and parts of Ohio and West Virginia

In cooperation with the Pennsylvania Association of Rural and Small Schools (PARSS)

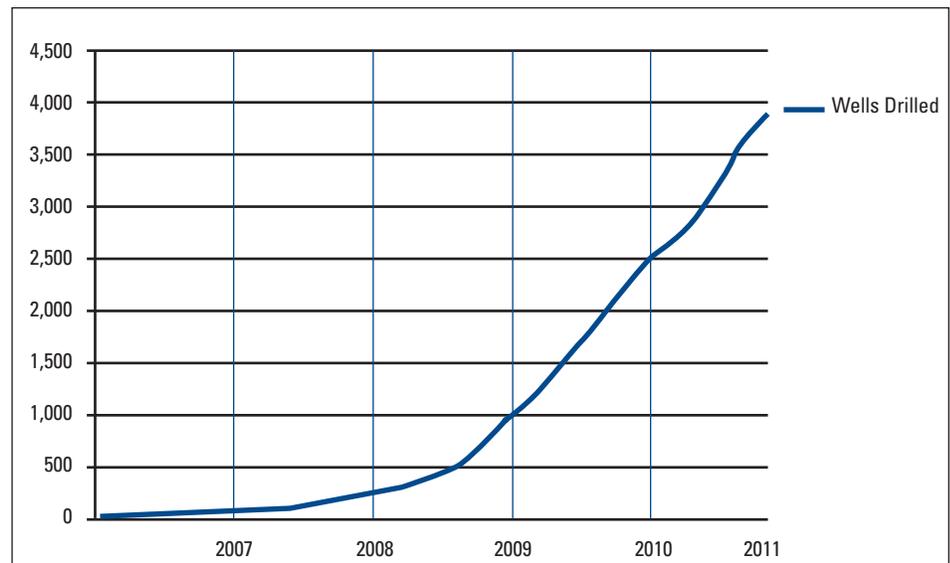


(Figure 1). Long known to contain significant amounts of natural gas, until recently large-scale natural gas extraction from the Marcellus shale was not technologically or economically feasible.

In the early 2000s, however, advances in technology enabled drilling rigs to bore into deep shale layers and then drill laterally through the formation for as much as a mile or more. Natural gas can then be recovered using a technique called hydraulic fracturing in which large quantities of water, sand, or ceramic proppants and chemicals are injected into the well at high pressure, causing the shale layers to break apart along fracture lines, while sand suspended in the fracturing fluid holds the shale fractures open. The gas previously trapped within the shale then flows into the well and to the surface, where it is moved through pipelines to consumer markets.

As a consequence of these new unconventional natural gas extraction techniques, estimates of recoverable natural gas from Marcellus shale rose from less than 2 trillion cubic feet (TCF) to as much as 489 TCF (see Engelder 2009; Coleman et al. 2011), setting off a gas rush within Pennsylvania's Marcellus region in about 2008, although permitting

Figure 2. Marcellus wells drilled from January 2007 through November 2011. Source: PA DEP spud data.



and limited drilling had begun a few years before that. As of November 2011, Pennsylvania Department of Environmental Protection data showed that nearly 4,000 gas wells within the state had been drilled in the Marcellus shale layer (Figure 2). As many as 60,000 or more may be drilled in the coming decades in Pennsylvania (see Johnson 2010). Because of this, indications strongly suggest that Pennsylvania is experiencing only the beginning stages of unconventional gas development.

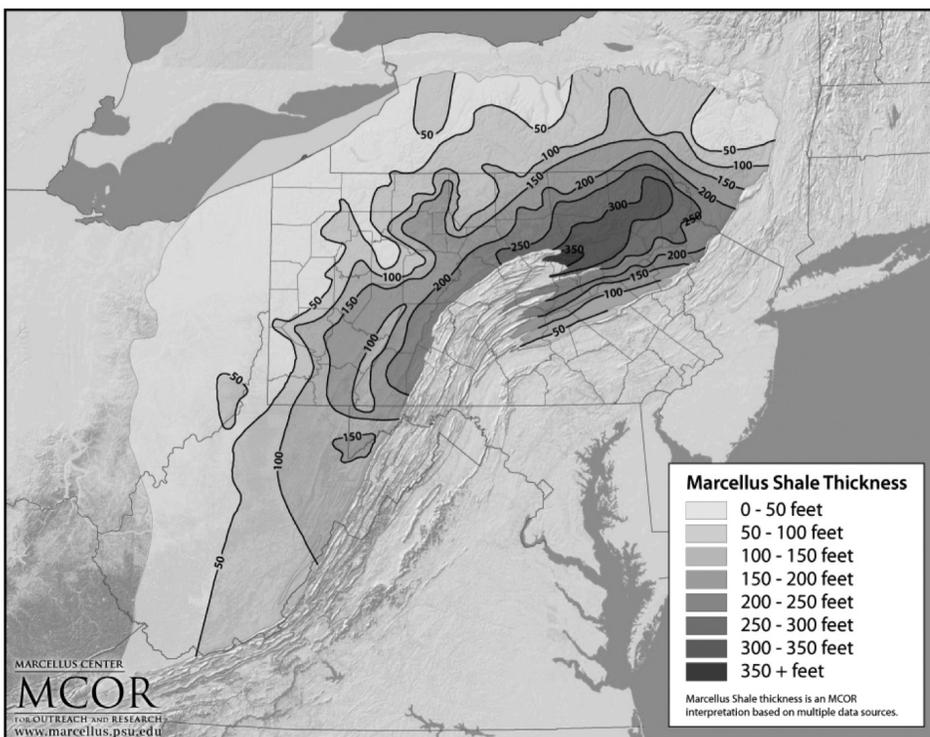
Marcellus Gas Development, Community Change, and Implications for Schools

The rapid development of gas extraction from Pennsylvania's Marcellus shale has already had profound impacts in many communities. A recent analysis suggests that in 2009 as Marcellus drilling activity was still in its early stages, between 23,000 and 24,00 jobs were created, with over \$3 billion added to Pennsylvania's economy (see Kelsey et al. 2011). Especially in places that have experienced long-term economic stagnation, gas-industry-related job growth and unanticipated local revenues from leasing drilling rights have been welcomed by many residents and businesses.

However, Marcellus shale gas development is accompanied by significant challenges as well. In this regard, while environmental concerns related to the impacts of unconventional gas extraction have arguably received the most media attention, natural resource "booms" also typically result in other types of community stress. These may include impacts on physical infrastructure such as roads and bridges, as well as social infrastructure, including human services, health care, housing, and schools.

In this fact sheet we will look at local challenges specifically connected to how rapid unconventional gas development may directly affect

Figure 1. Extent and thickness of Marcellus shale. Source: Marcellus Center for Outreach and Research.



schools and how schools within the Marcellus region of Pennsylvania have responded to community change associated with unconventional gas extraction.

What types of community changes associated with unconventional gas development can educators and educational administrators expect? What are the potential school and district-level impacts? What are the most appropriate ways to prepare for and respond to community change associated with unconventional gas development? Understanding and managing the opportunities and risks associated with the growing Marcellus gas industry will be critical to ensuring the long-term well-being of Pennsylvania residents and communities, and schools will play important roles in helping to manage these transitions.

Methods and Research Goals

The data we draw from in this report come from a survey sent to superintendents, high school principals, high school directors of curriculum and instruction, and directors of Career and Technology Centers (CTCs). Our respondents were selected by identifying all Pennsylvania school districts and CTCs located within the 17 intermediate units (including 1–11, 16–19, and 27–28) of the Marcellus shale region (Figure 3). This resulted in a total sample population of 940 from 309 school districts and 49 CTCs.

Surveys were administered

in spring and summer 2011, from which we received a 42 percent usable response rate. We supplemented the survey administration with interviews conducted with more than 50 educators, educational administrators, and county human service staff within counties heavily impacted by gas development in Pennsylvania's northern tier. Unless otherwise noted, in this publication we primarily discuss data from school district respondents only.

Findings

In this report we focus on four broad areas in which schools may see direct effects as a consequence of Marcellus shale gas development: school demographics; student outcomes and workforce development; effects on local roads and transportation; broader community services and infrastructure. We examine these impacts in part by comparing the perceptions of school district leaders in areas with high drilling activity to those in areas with lower drilling activity. (*Note:* The CTC data we use were not subclassified by drilling activity levels because of the larger areas covered by CTCs and the lower number of CTCs as compared with school districts.)

To classify school districts we used GIS techniques to calculate 10-mile buffer areas around the geographic area of each school district and then calculated the number of wells drilled as of July 2011 within each Pennsylvania school district and associated buffer area. We clas-

sified districts in area with high drilling activity as those that fell into the top 20 percent with regard to Marcellus wells drilled. We then compared school districts in areas with high drilling activity to all other school districts within the surveyed area of Pennsylvania's Marcellus region.

Districts in areas with high drilling activity area, including the 10-mile buffer zone, were those in which 69 or more Marcellus wells had been drilled. This included 61 school districts in the northern tier and 35 school districts in southwestern Pennsylvania.

During interviews in areas with high drilling activity, we asked school leaders what lessons they had learned and what advice they might offer their counterparts in other parts of the state regarding gas development and impacts on schools and communities. We use these interview data, in combination with the survey data, to suggest what the implications are for school leader practice as drilling activity increases.

Effects on School Demographics

One of the most pressing questions Marcellus development poses for schools is the extent to which gas industry jobs will be accompanied by influxes of new populations. If so, will this result in school enrollment changes and/or increases? Based on our survey data, school personnel have reported relatively low impacts on enrollments. While about 25 percent of respondents from areas with high drilling activity reported major or substantial new in-migration to local areas, only about 4 percent of those same respondents reported school enrollment increases (Table 1). Pennsylvania Department of Education enrollment data from academic years 2007–08 and 2010–11 likewise do not suggest significant differences in changes in total enrollment with regard to local drilling activity (data not shown here).

Similarly, a relatively small percentage of respondents from areas with high drilling activity report significant increases in English language learner (ELL) populations: less than 6 percent as compared to less than 1 percent in districts located

Figure 3. Map showing Pennsylvania school districts with Marcellus wells (surveyed area in gray).

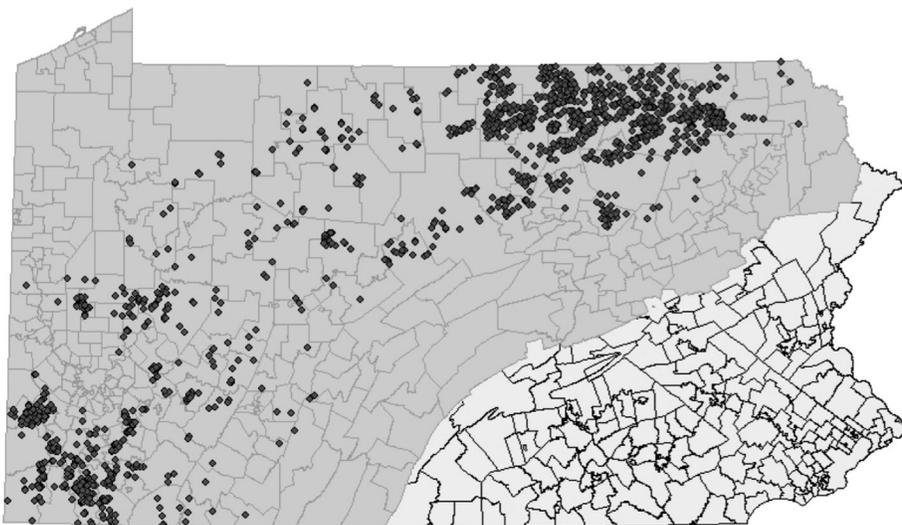


Table 1. Perceptions of effects of Marcellus development on local schools and communities: local and school demographics.

	<i>School district respondents in areas with lower drilling activity (%)</i>	<i>School district respondents in areas with high drilling activity (%)</i>
Respondents reporting major or substantial local effect on:		
New people moving into the area	2.4	25.4
School enrollment increases	1.2	4.3
Changes in school population	1.2	4.2
Increases in English language learner (ELL) populations	0.8	5.6
N=	294	78

in areas with lower drilling activity. This may be due to the influx of workers from out of state who are single or have left families behind. In some areas, minimal enrollment change may also be partially accounted for by the lack of housing opportunities. The likelihood of enrollment increases are diminished if local housing opportunities are limited, as in the case in many of the smaller, more rural districts where Marcellus shale gas extraction is taking place.

This does not mean, however, that enrollment change will not occur as drilling activity increases and spreads across Pennsylvania. Relatively stable total enrollment numbers can hide significant student turnover occurring as a consequence of economic insecurity, housing shortages, and rising rental prices. A northern tier school district administrator told us, “We’re seeing a lot more of the local population being more transient, [local residents] who may be in the lower income bracket and can’t afford housing, bouncing within the school district and also from school district to school district looking for cheap rent.” In either instance, enrollment change or increase may likely involve challenges in inte-

grating new students into school environments and accessing appropriate school records, especially if students are moving into local areas from out of state.

Implications for School Leaders

- New students are often home-sick and may experience “culture shock” in their new environment, especially if they arrive from out of state. Because of this, educators and administrators may consider special measures to introduce and integrate new students into the school environment and establish relationships with parents who are new to the area.
- Transfer of student records is important for the smooth transition of services and student placement. One strategy is for school districts to communicate with gas companies that can then pass information on to their workers with families about what kinds of information schools need in order to ensure a smooth registration and transition for students. These include immunization records, academic records, individualized educational plans (IEPs), and other necessary records.

Effects on Student Outcomes and Workforce Development

Advocates of Marcellus development note its job creation and economic development potential, especially in areas of the state that have long experienced economic decline and outmigration. How might schools and CTCs respond in the areas of education, training, and workforce development? How might new economic opportunities affect student career and educational aspirations?

Across all respondents, educational and workforce development related to Marcellus development is highly salient. Nearly half of school district respondents in areas with lower drilling activity had reported seeing, hearing, or reading “a great deal” about Marcellus development, while about 70 percent of school district respondents in areas with high drilling activity and CTC directors responded similarly. Differences are more evident in implementing workforce development and/or curricular change—while about 55 percent of CTC respondents reported Marcellus-related workforce development and/or curricular change, that percentage was far lower among school district respondents (Table 2). This is despite a substantial majority of respondents overall predicting a large effect of gas development on local economies and workforce.

Although one-third of school district respondents in areas with high drilling activity reported that most students were very aware of Marcellus-related job opportunities, almost two-thirds reported that they lacked sufficient information about workforce needs to make in-

Table 2. School district and CTC administrator awareness of Marcellus development, and institutional response.

	<i>School district respondents in areas with lower drilling activity (%)</i>	<i>School district respondents in areas with high drilling activity (%)</i>	<i>CTC respondents in all areas (%)</i>
Respondents reporting that:			
They have seen, heard or read a “great deal” about Marcellus development	45.1	71.8	66.7
They have discussed curricular and/or workforce development change in response to Marcellus development	40.6	73.1	95.8
Curricular and/or workforce development change in response to Marcellus development has been discussed <i>and</i> implemented within their district school or CTC	24.4	22.8	54.5
Respondents agreeing or strongly agreeing that:			
Marcellus development will have a big effect on our local economy	51.9	82.4	77.8
Marcellus development will have a big effect on our local workforce needs	59.3	82.4	91.3
N=	294	78	24

Table 3. School district and CTC administrator perceptions of Marcellus development on local schools and communities: student outcomes and workforce development.

	<i>School district respondents in areas with lower drilling activity (%)</i>	<i>School district respondents in areas with high drilling activity (%)</i>	<i>CTC respondents from all areas (%)</i>
Respondents agreeing or strongly agreeing that:			
Students seem very aware of Marcellus-related workforce opportunities	10.9	33.2	43.5
We lack sufficient information about workforce needs connected to Marcellus-related jobs to justify changes in curricula	76.8	61.4	41.6
Making investments of time and energy in workforce development and curricular change is risky because of how long Marcellus-related jobs will last	47.5	47.1	30.4
Balancing workforce development with core curricular requirements represents a significant challenge	70.0	72.3	75.0
Workforce development is a more appropriate role for CTCs than for high schools	35.3	47.2	87.5
Financial constraints would make it difficult for my district/CTC to make curriculum changes in response to Marcellus shale natural gas development	68.6	64.3	65.2
Most jobs connected to Marcellus development will not require a four-year college degree or more	71.1	72.1	86.4
Local workforce demands connected to Marcellus-related jobs has increased the likelihood of students dropping out to enter the workforce	11.0	17.4	4.8
Students see postsecondary education as a way to acquire skills and qualifications necessary for Marcellus-related job opportunities	22.8	40.3	35.0
New Marcellus shale natural gas jobs are more likely to be filled by men than women	67.7	83.6	81.8
N=	294	78	24

formed decisions about curricular changes that might meaningfully address workforce needs (Table 3). About half of all school district respondents expressed doubt regarding the longevity of Marcellus-related jobs. Respondents also expressed frustration over a relative lack of communication between school districts, CTCs, and the gas industry, and disagreement over the appropriate workforce development roles of school districts, CTCs, and the gas industry itself. While almost 90 percent of CTC respondents agreed or strongly agreed that workforce development was a more appropriate role for CTCs than high schools, less than half of school district respondents responded similarly.

One survey respondent related, “Schools lack workplace skill knowledge. What skills does the gas industry require? Are the skills technical in nature, or are they looking for well-rounded general education skills? Do the companies expect to hire highly qualified individuals who know the tasks, or do they provide the technical training?”

Another wrote, “In relation to educational programming changes specific to the needs of the Marcellus industry, little seems to be coming our way (K–12) in terms of specific information on modifying educational programming. STEM initiatives are not specific simply to this industry. . . . The county CTC is exploring educational opportunities to modify programming to meet

future demand with little direction from the Workforce Investment Board or regional economic development agencies. There doesn’t seem to be a very well-coordinated effort to ensure we prepare our students for careers in the industry.”

This uncertainty was less evident among respondents from CTCs, although even CTC directors expressed a need for more and better information to guide workforce development efforts. In an open-ended survey question about the most significant challenges associated with Marcellus development, CTC directors wrote that significant challenges included the “lack of information about the workforce needs and the industry in general,” “identifying the employers and what skills they need employees to have so we can adapt our curriculum to meet those needs,” and “providing timely curriculum and training.” Across all respondents, financial constraints and the need to address core curricular requirements were identified as impediments to devising and offering Marcellus-related workforce development.

Further, while many educators see student preparation for postsecondary education as part of their mission, almost three-quarters of respondents overall believe that most jobs connected to the Marcellus industry will not require a four-year college degree. This is consistent with a recent report suggesting that about three-quarters of the industry’s

direct workforce needs will require relatively little postsecondary education or trade certifications (Marcellus Shale Education and Training Center 2009). This led some interview and survey respondents to express concern about the possible effects on student educational aspirations and the transition to college.

In part because most of the direct industry workforce needs require relatively limited training, about 17 percent of respondents in areas with high drilling activity believed that local opportunities might actually increase dropout rates as students leave school for industry jobs. This concern was reiterated in the interviews, with some respondents identifying a “credibility gap” between the information schools were able to provide students about workforce requirements, the workforce requirements stated by industry representatives, and “common knowledge” within local communities about who might be eligible for work. Similarly, most respondents did not believe students were looking toward postsecondary education as a means of gaining skills and credentials for Marcellus-related jobs.

Despite uncertainty and a perceived lack of information, interviews with educational leaders in Pennsylvania’s northern tier suggest that not only have Marcellus-related workforce needs created new opportunities for young people exiting secondary school, but that

these opportunities have made CTC programming more attractive to students. A principal from a northern tier district explained that Marcellus-related job opportunities had largely removed the stigma previously associated with vocational education. “(The students) know that they’re only going to be held back by how hard they’re willing to work.” A strong perception, however, also exists that opportunities are strongly gendered and jobs are more likely to be filled by men than women, raising questions about the equity of opportunity and how to best provide information and training to women regarding Marcellus-related employment.

Implications for School Leaders

- Educators need accurate and up-to-date information about industry workforce needs, both short and long range, to effectively advise students regarding workforce preparation and educational and training requirements. Educators and guidance staff also need information regarding the longevity of workforce needs. As much as 98 percent of direct workforce needs of the gas industry may be associated with the initial build-out phase connected to drilling and pipeline construction (Marcellus Shale Education and Training Center 2009). Educators and guidance counselors need information regarding workforce demand and how to communicate this effectively to students to best inform educational and career planning. Educators should be aware of the potential impacts of Marcellus development on postsecondary transitions and dropouts.
- More effective communication between school districts, CTCs, and the gas industry would help to streamline workforce development efforts, clarify roles of school districts and CTCs in workforce development, and reduce duplication of efforts.
- Educators should take advantage of opportunities to draw upon former students (male and female) working with gas companies in a variety of different capacities to give presentations and/or speak with current

students about industry-related workforce opportunities.

- A common perception is that Marcellus industry jobs heavily favor men. Therefore, a need exists for information about work opportunities for women within the industry and industry-related employment.
- Budgetary constraints may significantly limit workforce development efforts by school districts and CTCs. Dovetailing Marcellus-related workforce development with core curricular requirements may represent an important opportunity to enhance these workforce development efforts.

Effects on Local Roads and Transportation

While shallow gas drilling has taken place in Pennsylvania for decades, unconventional gas extraction is a far more industrially intensive activity because of its scale and the materials used. Typically, a well pad site covers approximately 3–5 acres, with access roads built to the site for heavy equipment. A standard Marcellus well pad with seven well heads can require thousands of tanker truck and heavy equipment trips for building, drilling, and hydraulic fracturing. Much of the traffic is associated with the 3–5 million gallons of water required per well, all of which needs to be transported onto the site, and much of which subsequently needs to be taken off site and treated as wastewater (see National Park Service 2009).

This can result in significant physical impacts on the roads themselves. In many areas of the state where Marcellus drilling has rapidly expanded, local roads have not been able to withstand the heavy truck traffic and in some instances roads (including those used by school bus routes) have become temporarily impassable due to damage and repair. Repaired roads can also result in new hazards when road beds are built up to accommodate heavier vehicles if road shoulders are not also improved and built up to avoid steep drop-offs at the road edge.

Congestion and road damage and/or repair has, in some cases,

vastly increased travel time for local residents, and in other cases it has directly interfered with school bus routes and otherwise hindered travel to and from school for staff and students. There have also been public safety concerns associated with road accidents and the presence of heavy truck traffic while school buses load and unload.

Over 63 percent of respondents from areas with high drilling activity reported significantly increased traffic congestion and the increases in big truck traffic. This compares with about 12 percent for respondents from less affected areas. In interviews, respondents repeatedly described challenges associated with roads, traffic, transportation, and public safety. Many school leaders told us that the initial experiences the gas industry had with road damage would likely lead to more proactive practices regarding road repairs and improvements. Nonetheless, disruption to school bus routes and public safety concerns were frequently noted.

Implications for School Leaders

- Before gas development begins, identify roads in the district that may be most heavily affected and/or damaged by heavy truck traffic. Advocate for the improvement of those roads by gas companies prior to heavy use of those roads by heavy trucks associated with the gas industry.
- Make efforts to establish productive working relationships early on with gas companies operating within the local area and ensure that open lines of communication are established early. This is especially critical with regard to school bus transportation routes and bus route schedules so that, if possible, heavy truck traffic can be scheduled to avoid roads and times of day when school buses are picking up and dropping off students.

Effects on Broader Community Services and Infrastructure

Many communities within Pennsylvania’s Marcellus region have seen a dramatic increase in economic activity, not only as a consequence of direct drilling efforts, but also in

services and retail sectors (see Kelsey et al., 2011; PA Dept. of Labor and Industry 2011; Ward and Kelsey 2011). Key counties with heavy development activity have experienced pronounced drops in unemployment rates. Survey data suggest the ways in which active gas industry development has affected local economies through job and wealth creation and business start-ups.

In most cases, however, local economic development has fewer direct and immediate effects on schools. In Pennsylvania, subsurface property is not subject to property tax, and there is no severance or extraction tax on the production of mineral resources. Recent proposals for an impact fee do not include provisions that would funnel resources directly back to schools (see Costanzo and Kelsey 2011; Jacobson 2011).

Respondents report that property taxes, from which schools receive local funding, have not been significantly affected. In a number of instances school districts have earned revenue from leasing land to gas companies. In interviews, however, many educators expressed concern about the possibility of contamination or methane migration into well water in instances in which school districts were not dependent on municipal water and sewer systems. Over 38 percent of

respondents in areas with high drilling activity reported major or substantial local problems with water and/or environmental quality issues associated with the gas industry. This compared to about 7 percent in areas with lower drilling activity (Table 4).

Other than road congestion and damage, the most significant community impact reported by educators concerned housing costs and availability, especially in rural areas with limited housing stock, and strains on local public services. Housing impacts are likely to be especially felt within smaller communities with limited pre-existing housing stock, and felt by renters and others at the economic margins, including the unemployed and/or disabled, those relying on government assistance, and the working poor (Williamson and Kolb 2011). As Table 4 shows, while respondents in areas with high drilling activity describe pronounced economic activity, including job and wealth creation and economic growth, only 5 percent note any real increase in local tax revenues (despite noting increased property values). However, nearly half of respondents report increased rents, and over one-third report housing shortages. Over a fifth noted the displacement of low- and fixed-income residents and strains on public services.

In interviews, respondents described local rents increasing by as much as three- or fourfold. This has led to short-term residential stopgap solutions, including “couch surfing” or “doubling up” with local friends or family. New forms of homelessness have emerged in many districts where homelessness previously had not been experienced, including among students from gas worker families living in campers and mobile homes because of local housing shortages. Housing shortages and increased costs also have raised questions for school districts regarding the recruitment and retention of teachers and other district staff, especially under circumstances in which district budgets are not able to provide wages commensurate with increased housing costs.

Implications for School Leaders

- Housing will likely play a very significant role in the demographic effects of Marcellus development. This may affect not only the families of students and local resident more broadly but also the ability of school districts to recruit and retain staff and teachers if affordable and adequate housing is not available.
- School district personnel should keep close track of enrollment and student demographic changes as well as changes in student needs. These changing conditions should be communicated to legislators and public policy makers to ensure the well-being of residents within Pennsylvania’s Marcellus communities.
- Schools dependent on well water should test water and get reliable baseline data before the onset of significant local drilling activity. This should be completed by third-party chain-of-custody testing by certified labs. If a district leases property, water monitoring should be included as part of the lease agreement.
- School district personnel should have accurate and up-to-date information regarding available social services that may be utilized by families and children within the district, especially those who are new or newly displaced.

Table 4. Perceptions of effects of Marcellus development on local schools and communities: community services and infrastructure.

	<i>School district respondents in areas with lower drilling activity (%)</i>	<i>School district respondents in areas with high drilling activity (%)</i>
Respondents agreeing or strongly agreeing that:		
My school district may lose employees to the natural gas industry or industry-related jobs	7.4	20.9
Reporting agreeing or strongly agreeing on the following:		
Road congestion and/or wear and tear	11.6	63.4
Increases in rental costs	4.2	45.4
Strains on local public services	3.0	43.6
Water and/or environmental quality problems	7.0	38.3
Housing shortages	4.0	35.9
Job creation	6.0	33.8
Increases in property values	5.7	29.7
Displacement of low and fixed income residents	1.2	22.6
Business start-ups	3.3	21.6
Increases in local tax revenues	1.2	4.9
N=	294	78

Conclusions

School district administrators within Pennsylvania's Marcellus region, like the communities they serve, need to be aware of and plan for the different phases of gas development. There is a close interrelationship between community well-being and school well-being. Because of this interrelationship, schools are well placed to be active community partners with other community stakeholders in engaging in discussion and debate about how Marcellus development can be strategically managed for long-term and sustainable community development. While rapid expansion of economic activity can have many positive effects for schools and communities, Pennsylvania's natural gas is a finite resource. A pressing—and difficult—question is how the shorter term economic boom of Marcellus development can be strategically managed so that Pennsylvania schools and communities can maximize their opportunities for long-term social, economic, and environmental sustainability.

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