Measuring the Costs and Benefits of Natural Gas Development in Tioga County, Pennsylvania: A Case Study

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I. Executive Summary

Tioga County has been at the center of Pennsylvania’s natural gas boom. With more than 800 wells drilled in just five years and 13% of all unconventional gas wells in the state, it is the ideal county to assess the costs and benefits of rapid and sustained natural gas development.

Researchers at the Multi-State Shale Research Collaborative have set out to document the impact of unconventional gas development on the economy, communities, government agencies, and human service programs in five states. For this report, we conducted interviews with local officials and experts to understand how gas drilling has impacted Tioga County communities, services, and local government. We supplemented qualitative interviews with data collection and analysis where possible. The report is part of a larger examination of the social costs of gas drilling in rural communities in West Virginia, Ohio, and Pennsylvania.

In many ways, we found much of what we would have expected. The county and its residents have experienced many of the promised benefits of gas development and a multitude of impacts consistent with those identified in mineral booms in other rural communities.

This bucolic county that has capitalized on its natural beauty through tourism and logging, and as a destination for adults looking for a second or retirement home, was transformed with the coming of the gas industry. The boom brought an influx of out-of-state workers, industrial gas drilling sites, and a flood of heavy truck traffic. There was new construction and industrial development: a new wastewater processing facility and a concrete plant were built, and a dormant rail line from New York was placed back into service to carry sand and water to drill sites.

There was also an increase in crime, rapidly escalating housing costs, and a rise in homelessness. And longtime residents no longer knew all the faces in the diner in the morning.

The most significant finding is one that surprised us. While there were some notable economic benefits to the community, including a drop in the unemployment rate and a rise in employment, those benefits proved to be temporary, as the industry moved out, shifting to more lucrative shale plays in Ohio, Southwestern Pennsylvania, and North Dakota. Businesses opened during the boom are closed today, and individuals who left stable employment for higher-paying jobs with the drillers returned in search of a more standard work schedule or are out of work altogether.

In 2013, Tioga County residents were taking a breather from the rapid development of earlier years.

![Figure 1. Unemployment in Tioga County and Pennsylvania 2005-2013](source.png)
Overall we found a community unprepared for the sudden overwhelming presence of the industry, with few tools to manage, let alone plan for, growth and change. One official argued that the industry “parachuted in and we chased them around.” That sentiment was repeated by many of the officials we interviewed.

The benefits came with costs and impacts, with demonstrable changes in a number of areas:

**Employment grew in drilling-related sectors.** Employment in natural resources and mining, although a small share of the overall economy, grew by 376% between 2005 and 2012. Overall employment grew by 4.7% during this period, while employment statewide increased by only 0.5%.

**Unemployment fell, for a time.** Tioga County unemployment dipped below the state average between 2010 and 2012, the height of the boom, and industry employment helped cushion county residents from the worst effects of the Great Recession. The industry moved on, and unemployment grew, once again rising above the state as a whole.

**Residents benefited economically.** Income earned by Tioga County residents from higher rents, signing bonuses, and royalties grew between 2005 and 2010, from $6 million to $97 million, but fell in 2011 to $74.7 million. The number of taxpayers claiming income from rents, royalties, copyrights, and patents, almost tripled, from 1,037 to 3,078 in 2010, although that number fell in 2011.

**Housing prices escalated, outpacing income gains for low-income renters.** Rents in three drilling counties, Tioga, Bradford, and Sullivan, grew by 1% for the lowest-income renters, while their incomes fell by 11.5%. While incomes grew for middle- and high-income renters, by 7.8% and 4.6%, respectively, rents grew even more by 14% and 21%, respectively. Rental prices impacted everyone across the state except for high-end urban housing, which fell during this period.

**Crime grew during the boom.** The number of serious crimes grew from by 13% between 1999-01 and 2010-12. During that period crime fell statewide by 6%. Local police departments reported growth in new criminal cases and arrests.

**Demand for housing had a crowding out effect.** Competition for hotel space crowded out tourists during the peak season. The changing nature of the community, coupled with escalating housing prices, made Tioga less attractive as a retirement community, a key niche for the area. There was crowding out of less well-off residents, with the increasing housing prices causing hardship for low-income renters. Officials reported an increase in homelessness, doubling up of families, and more two-parent families requesting assistance. Some families moved out of the county in search of cheaper housing.

**Emergency room visits and STDs increased.** Soldiers and Sailors Hospital in Wellsboro saw rapid growth in emergency room visits, likely related to drilling workers with no other access to primary care, and few other providers in the area. Local officials confirmed a rise in sexually transmitted diseases traced to out-of-state addresses.

**Transportation costs rose.** Between 2008 and 2012, the Pennsylvania Department of Transportation (PennDOT) issued 797 road bond agreements with gas companies to ensure complete and timely repairs to roads damaged by heavy truck traffic. Road repair allocations grew from $17 million to $19 million between 2009 and 2011.

Local officials tried to be responsive to community concerns and to manage the impacts with the tools they had. But impacts occurred on multiple fronts, affecting multiple agencies and multiple municipalities simultaneously. The cumulative impact was, at times, overwhelming to the officials and human service professionals on the front lines.

Ultimately, Tioga County is a cautionary tale. The economic benefits associated with shale development are limited, come at a price, and may disappear as swiftly as they arrived.
II. Case Study Methodology

This research is a part of a larger effort by the Multi-State Shale Research Collaborative to document human and social service impacts of increased drilling. To launch this effort, the Collaborative conducted this case study and similar studies of Greene County, Pennsylvania, Carroll County, Ohio, and Wetzel County, West Virginia.

Our methodology for undertaking the case studies began with a review of research literature, including case studies of social and human service impacts in specific counties or regions: Sublette County, Wyoming (Ecosystems Research Group 2008; 2009; Jacquet 2009); Bradford County, Pennsylvania (Perry 2012); Northwest Colorado (Redifer, Jouflas, Chase & Morris 2007); Sweetwater County, Wyoming and Mesa and Garfield County, Colorado (Headwaters Economics 2008; 2009); and more than two dozen counties in New York and Pennsylvania (Alter & Ooms 2010).

For the Pennsylvania case studies, we supplemented the research literature by reviewing testimony from legislative hearings and hearings organized by the Citizens’ Marcellus Shale Commission. Hearings identified impact areas that were similar to those in the literature (see, for example, Coolidge 2011; Hill 2011; Schaeffer 2011; Troxell 2011).

To select two case study counties in Pennsylvania, and one each in West Virginia and Ohio, we screened counties first based on the level of unconventional gas drilling activity. In West Virginia and Ohio, this factor alone largely determined the selection of Wetzel and Carroll counties. In Pennsylvania, a half-dozen counties stood out with levels of drilling activity far above the rest of the state. To select among these counties, we considered two other variables: how rural the county was (measured by low population density) and economic vulnerability (measured by poverty and income). Both these variables are proxies for lower levels of human and social service capacity: if substantial human and social service impacts occur with drilling, they are more likely to be revealed by case studies of poorer, more rural counties. Finally, Greene and Tioga were selected because of their contrasts: Greene with a history of mineral extraction, Tioga with very little; Greene with both wet and dry gas, Tioga with predominantly dry gas.

To guide the overall study of human and social service impacts (not just the case studies), the research team conducted interviews with state-level associations of human and social service providers (e.g., County Commissioners, Head Start, school boards, hospitals) and, in some cases, with statewide non-profits.

The research team identified key county professionals in each human service area to interview, in some cases with the help of statewide associations and non-profits.

Prior to conducting interviews, researchers from Pennsylvania, West Virginia, and Ohio developed common interview guides for each human service impact area based on the research literature and guides on drilling impacts developed for local governments (Rodgers et al. 2008; Dahl, Price and Kalish 2010). In Tioga County, we conducted semi-structured interviews with 17 informants, which lasted, on-average, one hour each.

By definition, the qualitative components of this and the three companion case studies reveal the qualitative dynamics of drilling’s impact and how it varies in different county contexts. Qualitative analysis, although valuable, cannot provide a quantitative measure of the amount or cost of particular human service or infrastructure impacts.

In this and the companion case studies, we supplement our qualitative interviews with quantitative data provided directly by local officials and human service agencies, or extracted from official government data sources.
Tioga County, along Pennsylvania’s north-central border with New York State, is known for its natural beauty. Pennsylvania’s Grand Canyon lies only miles from the county seat of Wellsboro. This rugged and remote county differs from the rest of the state as a whole in a number of ways.

- **Population:** Tioga County’s 42,577 residents live in 37 rural municipalities and two communities classified as urban by the Center for Rural Pennsylvania, Mansfield and Wellsboro. Mansfield is home to Mansfield University, a member of the Pennsylvania State System of Higher Education, with a significant student population. Tioga’s population is much more homogeneous than the state as a whole. A full 97% of residents are Caucasian, and the county’s small African-American population (0.8%) is largely centered in Mansfield. (Center for Rural Pennsylvania). There is a small but growing Latino population, still just 1% of the total.

- **Education:** Compared to the rest of Pennsylvania, residents are less likely to have college degrees (17.8% vs 26.7%) and more likely to have high school diplomas or less (56.4% vs. 49.4 for the state) (Center for Rural Pennsylvania).

- **Age:** The population is older than the state as a whole and aging more rapidly. Between 2000 and 2010, the share of the population 18 and younger fell by 12.5%, while the share of residents 65 and older grew by 14%, far outpacing statewide growth of 2.1% (Center for Rural Pennsylvania).

- **Income:** Tioga County is relatively poor. Between 2007 and 2011, poverty averaged 15.7%, well above the state average of 12.6%, and county median household income of $42,027 was only 81% of the statewide median of $51,651 (Center for Rural Pennsylvania). Child poverty was 22% in 2011, higher than the state average of 19%. Despite the higher-than-average poverty, only 0.8% of residents received cash assistance in 2012, compared to 2.2% statewide, and 10% received nutrition assistance through the SNAP program, compared to 14% statewide (Center for Rural Pennsylvania).
Although 39 of Pennsylvania’s 67 counties had at least one operating gas well in 2012, most drilling activity has been concentrated in six counties – Bradford, Tioga, Lycoming, and Susquehanna in the north-central area and Washington and Greene in the southwestern corner. Together, these counties have 72% of the state’s unconventional wells.

In 2012, Tioga County had 811 wells, or 13% of the state total, second only to Bradford County with 1,125. Well density in both counties was high in 2012: 0.72 gas wells per square mile in Tioga County, and nearly one per square mile in Bradford (Pennsylvania Department of Environmental Protection spud reports).

While unconventional natural gas drilling, also known as “hydraulic fracturing,” began in 2004 in Pennsylvania, the state has a longer history of conventional, or “shallow,” natural gas drilling. In 2012, Pennsylvania had almost 50,000 conventional wells compared to 6,237 unconventional wells (U.S. Energy Information Administration). However, unlike Pennsylvania’s southwestern counties and neighboring Bradford, Susquehanna, and Lycoming, Tioga had little history of or experience with conventional gas production.

Tioga County’s natural gas boom “seemed to come and go so quick,” said one local official (Authors’ Interviews). While natural gas drilling proceeded rapidly between 2008 and 2011, the number of new wells drilled fell by 55% in 2012. Preliminary data for 2013 indicate a further decline.

This report uses data from the Pennsylvania Department of Environmental Protection (DEP) on the number of wells drilled, or spud, even if the wells are not yet in production, to measure drilling activity.

Table 1 shows the number of wells drilled by municipality. Most drilling activity has been concentrated in the central and eastern part of the county with more than 25 producing wells each in Charleston, Covington, Delmar, Jackson, Sullivan, Union, and Ward townships.

The number of new well permits issued has also slowed. New permits peaked at 556 in 2010, dropping to 279 in 2011, and 195 in 2012. This decline occurred even as the Department of Environmental Protection was authorized to expedite the permit process (Natural Gas Intelligence July 2012).
Total permits issued reached 1,365 in 2012, far more than the number of spud wells, indicating that drilling activity could increase quickly and substantially if economic conditions change.

<table>
<thead>
<tr>
<th>TIOGA COUNTY MUNICIPALITY</th>
<th>Wells Drilled (SPUD) By Year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2006</td>
</tr>
<tr>
<td>Bloss Twp</td>
<td>0</td>
</tr>
<tr>
<td>Blossburg Boro</td>
<td>0</td>
</tr>
<tr>
<td>Brookfield Twp</td>
<td>0</td>
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<tr>
<td>Charleston Twp</td>
<td>0</td>
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<tr>
<td>Chatham Twp</td>
<td>0</td>
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<tr>
<td>Clymer Twp</td>
<td>0</td>
</tr>
<tr>
<td>Covington Twp</td>
<td>0</td>
</tr>
<tr>
<td>Deerfield Twp</td>
<td>0</td>
</tr>
<tr>
<td>Delmar Twp</td>
<td>0</td>
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<tr>
<td>Duncan Twp</td>
<td>0</td>
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<tr>
<td>Elk Twp</td>
<td>0</td>
</tr>
<tr>
<td>Farmington Twp</td>
<td>0</td>
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<tr>
<td>Gaines Twp</td>
<td>1</td>
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<tr>
<td>Hamilton Twp</td>
<td>0</td>
</tr>
<tr>
<td>Jackson Twp</td>
<td>0</td>
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<tr>
<td>Lawrence Twp</td>
<td>0</td>
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<tr>
<td>Liberty Twp</td>
<td>0</td>
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<tr>
<td>Middlebury Twp</td>
<td>0</td>
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<tr>
<td>Morris Twp</td>
<td>0</td>
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<tr>
<td>Nelson Twp</td>
<td>0</td>
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<tr>
<td>Osceola Twp</td>
<td>0</td>
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<tr>
<td>Richmond Twp</td>
<td>0</td>
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<tr>
<td>Rutland Twp</td>
<td>0</td>
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<tr>
<td>Shippen Twp</td>
<td>0</td>
</tr>
<tr>
<td>Sullivan Twp</td>
<td>0</td>
</tr>
<tr>
<td>Tioga Twp</td>
<td>0</td>
</tr>
<tr>
<td>Union Twp</td>
<td>0</td>
</tr>
<tr>
<td>Ward Twp</td>
<td>0</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1</td>
</tr>
</tbody>
</table>

Source: Multi-State Shale Research Collaborative based on drilling data reported by the Pennsylvania Department of Environmental Protection

Pennsylvania produces two types of shale gas. Dry gas, or methane, is ready for the pipeline immediately after extraction. Wet gas has methane and other natural gas products, including propane and butane (liquid natural gas, or LNGs) that can be filtered out and sold. While the process of filtering out these other products can be expensive and time-consuming, they can be sold at a much high price (McGill n.d.).

In other states, such as Ohio and North Dakota, oil is also extracted from shale using hydrofracking technology.

After rising through much of the decade, natural gas prices fell precipitously in 2009, dropping to a 10-year low in the spring of 2012 (Hargreaves 2012). During this period, technological advances and rising prices made shale oil much more lucrative.
Since the price of natural gas began to decline, companies shifted focus to areas rich in wet gas and shale oil to boost profitability, including Ohio, Southwestern Pennsylvania, and Northern West Virginia (StateImpact n.d.a.). Officials interviewed for this study confirmed that companies were pulling workers out of Tioga County and moving them to these locations.

Figure 3 tracks the type of drilling rig used in the United States between 1990 and 2012. It shows a significant drop in gas-extraction rigs in 2009 and a historic rise in drill rigs devoted to oil production that same year.

While smaller local operators were prevalent early on, larger players moved into the county, and in 2013 only six companies were operating in Tioga County. Shell, which purchased East Resources in 2010, is by far the dominant player, with 55% of all producing wells, followed by Talisman at 19% and Seneca with 16% of producing wells (Pennsylvania Budget Policy Center data). Tioga County is the focus of Shell’s operation in the Marcellus region, although the company has expanded to Lawrence and Butler counties (Shell n.d.).

Because of its large stake in the county, Shell is often referred to as “the gas company.” Local officials report that Shell has better community relations than its predecessor, East Resources, and has introduced higher safety standards on sites and with subcontractors. Local officials also indicated that Shell standardized subcontracting relationships, which led to a consolidation of the subcontracting businesses as well.
V. Gas Development’s Impact on Tioga County: Population Spike, Rising Rents

Energy projects flow in three phases, each with its own “distinct effect on the local socioeconomics,” according to Ecosystems Research Group (2008).

- **Development:** In this labor-intensive period, companies search for and acquire land and sub-surface mineral rights, do seismic testing, build and expand roads, construct well pads, drill wells, and build pipelines and compressor stations. During this phase, communities experience a large influx of temporary workers and truck traffic.

- **Production:** Gas is produced and transported, wells are maintained, and fracking waste and wastewater are managed. The number of workers required drops during this phase.

- **Post-production:** A well’s average life span is about 40 years, but the volume of natural gas extracted peaks in the first three to five years and then tapers off. In post-production, machinery is removed, wells are plugged, and the project concludes.

**Population Surge**

Like other communities targeted for mineral extraction across the United States, Tioga County is sparsely populated. The county covers 1,134 square miles, with a population density of 37 people per square mile in 2010, far below the state average of 284 per square mile (Center for Rural Pennsylvania).

Local officials interviewed say the first signs of unconventional drilling activity came in summer 2008 with the arrival of “land men,” the representatives from East Resources and other, smaller companies who went door to door to secure mineral rights. At the same time, additional workers entered the county to obtain the necessary permits, conduct seismic testing, and prepare sites for drilling.

Gas workers quickly filled up hotel rooms, and parking lots were filled with white trucks and out-of-state license plates. To meet the demand for workers, two new hotels where constructed and the venerable Tioga Hotel in Wellsboro built an addition.

Consistent with the influx of workers, population in the county grew by 2.4% between 2005 and 2012, reaching a total of 42,577 in 2012. (U.S. Census Bureau)

The influx of new workers and traffic caught local officials by surprise. They had little warning and little hard data for planning. They now believe that population grew more than official estimates suggest, based on the observed shortage of rental housing, lack of hotel rooms, increased patronage at local restaurants, and increased traffic. Local planning officials worked with academics to “guestimate” that population grew by 25% at the height of the boom.

Despite that spike, the county seems to have experienced little permanent population growth. By 2012, the population boom began to subside, as gas workers no longer filled hotels, apartments, and restaurants.


Nearly every person we interviewed said that they or a family member experienced a financial gain from the natural gas industry, and all reported general knowledge of economic benefits to individuals or the community. One reported a family member had a large increase in tips from her waitressing job. Another’s husband worked at a local car dealership that did very well during the boom. Others already owned or purchased rental property,
hoping to benefit from the rise in rents. Still others had family members who were or had been employed with the industry.

Many of the people we interviewed also pointed to a surge in economic activity, including busier restaurants and the two new hotels in the county. Most noted that new businesses, including Walmart, Lowe’s, and a second Dunkin’ Donuts, opened their doors as the industry grew, although some suggested that increased traffic from the expansion of Route 15 near Mansfield was also partly responsible.

Still by 2012, much of the boom had subsided. Interviewees reported businesses closing, gas companies leaving, traffic declining, and people returning to their old jobs.

**Income: Signing Bonuses and Royalties**

One-time signing bonuses for leasing mineral rights produced one of the first and most tangible benefits for county residents, followed by royalties when wells began production. In Pennsylvania, the Guaranteed Minimum Royalty Act (GMRA) requires companies to pay owners at least 12.5% royalties on the value of oil or gas produced.

Income from mineral rights, combined with higher employment, boosted the total incomes of county residents. Inflation-adjusted per capita income rose 12.5% between 2006 and 2011 (Bureau of Economic Analysis 2014).

Research suggests that property owners are likely to treat royalty income differently from regular income, using it to invest in durable consumer goods or to build savings (Kelsey, Metcalf and Salcedo 2012). Mineral rights owners surveyed in Tioga and Bradford counties as part of this research reported they saved 55% of the income, spent 9% on motor vehicles, and used 17% to pay taxes. Less than 1% was spent on food, consumer goods, or travel and entertainment (Kelsey et al 2012).

Our research is consistent with these findings. Residents reportedly spent new income on cars, RVs, and flat screen TVs. In Sullivan Township, property tax collections improved because residents had new income to pay overdue bills.

Sales tax paid on motor vehicle purchases in Tioga County grew by almost 50% between 2004-05 and 2011-12, according to the Pennsylvania Department of Revenue.

![Figure 4. Motor Vehicle Sales Tax Collections, Tioga County, PA 2004-2013](image)
Revenue. This growth was likely driven by the gas industry and its subcontractors spending money on new vehicles as well as individual vehicle purchases.

Along with the economic benefits of lease signings came challenges for local government and for the community. One of the first steps in pre-development is research to establish ownership of mineral rights. Early on, the land men and title searchers flooded the recorder of deeds’ office, “tearing up the paper records,” in the words of one official (Authors’ Interviews). Ultimately, East Resources paid to computerize the county’s deed registry, with the condition that the company have remote access to the records (Authors’ Interviews).

Lease agreements varied widely, fostering resentment among neighbors. Residents who signed agreements early – some for as little as $5 an acre – received less than those who waited and were rewarded with more lucrative deals. After Penn State established a program to help individuals better understand their rights and negotiate leases, residents became more comfortable with gas drilling. The program helped some landowners negotiate better deals, reportedly for as much as $2,500 per acre. One large signing bonus, reportedly for $1 million, fed what one official called a “frenzy” that encouraged residents’ dreams of riches (Authors’ Interviews).

In the past two years, mineral rights owners have complained that royalty amounts are declining. Press reports indicate that some oil and gas companies have deducted transportation and processing costs from royalties, using complicated and opaque formulas which decrease royalty payments (Lustgarten 2013; Cusick 2013a). The watchdog group Propublica analyzed lease agreements and court and government documents, finding that underpayments were widespread and that “manipulation of costs and other data by oil companies has kept billions of dollars in royalties out of the hands of private and government landholders.”

While signing bonuses and royalties have undeniably brought more money into Tioga County, the benefits do not always stay local. Some spending leaks outside the county, and some royalties go to out-of-state landowners (Kelsey et al 2012). In Tioga County, 48% of landowners are county residents and 28% are not, with the remaining 25% of land publicly owned. Much of the property is concentrated in a few hands, with the top 20% of the largest landowners owning 90.5% of the property (Kelsey et al 2012).

B. Jobs, Income, and Local Economic Activity: Growth in Most Sectors

Natural gas extraction has increased employment in Tioga County, most significantly in the mining and natural resources sector. This new employment helped to insulate the county from the worst effects of the Great Recession.

Still, the employment-related benefits have been short-lived. Drilling-related jobs are a small share of total Tioga County employment, and manufacturing and other industries play a more significant role in the overall economy. After 2012, the number of jobs fell, and unemployment, which had fallen below the state average, rose.

Between 2005 and 2012, total employment rose by 4.7%, from 13,046 to 13,659. (See Table 2.) Employment in the natural resources and mining1 sector grew from 99 to 471 employees, almost a fourfold increase, bringing this sector to 3.4% of total employment in 2012.2

Other industries also saw significant growth between 2005 and 2012, including construction (33%); trade, transportation, and utilities (28%); and education and health services (24%). During this period, manufacturing declined by 26% and, in 2012, accounted for 15.9% of employment.

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1 Embedded in the natural resources and mining numbers is also the forestry industry.
2 In a previously published report, the Multi-State Shale Research Collaborative documented the ways in which the drilling industry and its supporters have exaggerated the job benefits connected to gas drilling in Pennsylvania. While unconventional gas drilling has created jobs, shale-related employment is small as a share of overall employment (Mauro et al 2013).
Total private-sector employment grew by 884 jobs between 2005 and 2012, while public-sector employment fell by 269 jobs. County officials cut positions as a result of budget constraints, and local public-sector employment fell by 12%, compared to 2% in state government. Local government cuts came at the very time demands on agencies were growing.

Table 2. Employment change 2005 to 2012 by Sector in Tioga County

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Total, all industries</strong></td>
<td>13,046</td>
<td>13,659</td>
<td>613</td>
<td>4.7%</td>
</tr>
<tr>
<td><strong>Private</strong></td>
<td>10,298</td>
<td>11,182</td>
<td>884</td>
<td>8.6%</td>
</tr>
<tr>
<td>Natural Resources and Mining</td>
<td>99</td>
<td>471</td>
<td>372</td>
<td>375.8%</td>
</tr>
<tr>
<td>Construction</td>
<td>274</td>
<td>365</td>
<td>91</td>
<td>33.2%</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>2,943</td>
<td>2,167</td>
<td>-776</td>
<td>-26.4%</td>
</tr>
<tr>
<td>Trade, Transportation, and Utilities</td>
<td>2,555</td>
<td>3,266</td>
<td>711</td>
<td>27.8%</td>
</tr>
<tr>
<td>Information</td>
<td>169</td>
<td>164</td>
<td>-5</td>
<td>-3.0%</td>
</tr>
<tr>
<td>Financial Activities</td>
<td>393</td>
<td>434</td>
<td>41</td>
<td>10.4%</td>
</tr>
<tr>
<td>Professional and Business Services</td>
<td>636</td>
<td>621</td>
<td>-15</td>
<td>-2.4%</td>
</tr>
<tr>
<td>Education and Health Services</td>
<td>1,684</td>
<td>2,088</td>
<td>404</td>
<td>24.0%</td>
</tr>
<tr>
<td>Leisure and Hospitality</td>
<td>1,170</td>
<td>1,226</td>
<td>56</td>
<td>4.8%</td>
</tr>
<tr>
<td>Other Services</td>
<td>377</td>
<td>381</td>
<td>4</td>
<td>1.1%</td>
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<tr>
<td><strong>Public</strong></td>
<td>2,747</td>
<td>2,478</td>
<td>-269</td>
<td>-9.8%</td>
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<tr>
<td>Federal</td>
<td>175</td>
<td>142</td>
<td>-33</td>
<td>-18.9%</td>
</tr>
<tr>
<td>State</td>
<td>735</td>
<td>718</td>
<td>-17</td>
<td>-2.3%</td>
</tr>
<tr>
<td>Local</td>
<td>1,837</td>
<td>1,618</td>
<td>-219</td>
<td>-11.9%</td>
</tr>
</tbody>
</table>

Source. Multi-State Shale Research Collaborative analysis of Quarterly Census of Employment and Wages data
While some local residents obtained hard-to-get jobs with the gas companies, many worked on the pipelines or for local water, trucking, or construction companies. Roustabouts and many types of laborers are employed by the drilling companies, but the pipefitting, welding, trucking, and security jobs tend to be with subcontractors (Authors’ Interviews).

Local workforce development personnel responded to industry need for water and waste truck drivers by opening a Commercial Driver’s License (CDL) program, but the program had problems placing its trainees. One service provider worried that they had trained people for jobs that were no longer in demand (Authors’ Interviews).

The leisure and hospitality industry grew by 4.7% during this period. New jobs were created for maids and wait staff. Tips for wait staff reportedly grew during the height of the boom (Authors’ Interviews).

Non-profits and the private and public sectors all reported losing staff to drilling companies and their much higher salaries. Tioga County lost a number of workers to the gas industry, as did the Southern Tioga School District. The local Pennsylvania Department of Transportation (PennDOT) office lost a traffic maintenance supervisor, and the local domestic violence organization lost two bookkeepers. Busing contractors and the Head Start Association had difficulty retaining drivers who could make more money with the drilling companies and often preferred the longer hours of work. The high turnover sometimes forced busing contractors themselves to fill in as school bus drivers.

The local hospital reported difficulty attracting and maintaining entry-level workers, including food service, housekeeping, maid service, and maintenance workers. Ward Manufacturing, an auto parts manufacturer and one of “the better employers in the county,” according to one interviewee, reportedly lost many laborers to the gas industry (Authors’ Interviews).

While many of the individuals we interviewed knew people who had gained jobs through the gas boom, many also had family members or friends who lost employment as the industry contracted. Younger people who were invited to move with the companies as they pulled out were likely to go because they had few other local options.

Some former employees wanted to return to their old jobs, either because industry-related employment dried up or they wanted more consistent hours and benefits.

**Unemployment: A Brief Improvement**

That industry development followed a course of boom and bust is reflected in Tioga County unemployment history. Between 2005 and 2008, while the state’s overall economy was growing, unemployment exceeded the national average in Tioga. During the early part of the recession, unemployment grew more sharply than the state as a whole. By 2010, Tioga’s unemployment rate fell below the statewide average and remained there until June 2012. Since then, the rate has remained higher than the state average.

Local social services officials were acutely aware that the boom had ended. “Families were doing well…[but since] the drilling stopped… you have people struggling with unemployment,” said one official (Authors’ Interviews). A second remarked that during the height of the boom, lists of job openings ran eight to 10 pages, but the lists have dwindled to only two pages, and most of the available jobs require a college degree (Authors’ Interviews).
C. Traffic and Roads

The impact of natural gas and oil extraction on traffic and roads, especially in rural areas, has been well documented. Road damage and repair costs are among the top concerns of local officials and community members in energy-producing communities. The costs of such damage in other states, including Texas and Arkansas, have proven to be significant, often exceeding state repair budgets (Campoy 2012; Oman 2010). Other researchers have linked increased traffic volume from significant extractive activity to an increase in traffic accidents and fatalities (Anderson and Theodori 2009). In Pennsylvania, local officials testifying before state legislative committees cited traffic, safety and road damage as key concerns (Schaeffer 2011; Troxell 2011).

In Tioga County, officials reported an increase in truck traffic, increased travel time, and heavily damaged roads resulting from drilling activity.

Anecdotal evidence suggested frustration with constant heavy truck traffic. Interviewees reported finding themselves behind slow-moving trucks on the county’s otherwise quiet, mostly rural roads, increasing travel times. For one local official, the traffic was so bad that he had a hard time pulling out of his own driveway (Authors’ Interviews).

Increased traffic brings additional costs to state and local governments. The Pennsylvania Department of Transportation (PennDOT) added a traffic light in Wellsboro and built a new bridge and road to improve traffic flow.

Vehicle-related accidents have also been on the rise. Between 2000 and 2012, vehicle accidents peaked in 2010 and 2011 — the height of the gas boom in Tioga County (Pennsylvania Department of Transportation).

School officials reported concerns about children’s safety. School bus drivers experienced “a number of close calls and near misses,” said Southern Tioga School District Superintendent Keith Yarger. “Some gas trucks were going pretty fast around the buses.” (Authors’ Interviews). The school district has been in close contact with the gas companies, which have reportedly been responsive to their concerns.

Road damage has been a problem in Tioga. County Commissioner Erick J. Coolidge told a state legislative committee that “the roads and bridges were not constructed to hold the volume of traffic and the reoccurring weight now inflicting them” (Coolidge 2011).

PennDOT oversees most of the roads in Tioga County, with local townships and boroughs responsible for a smaller number of roads, and the county responsible for maintaining several bridges.

Traffic volume increased from 50 or 60 cars per day to 400 trucks per day when drilling was at its height, according to local PennDOT officials. As a point of comparison, logging, another significant Tioga industry, requires only four or five heavy trucks per day (Authors’ Interviews).

County, township, and PennDOT officials were unprepared to address the rapid increase in heavy truck traffic. “When drilling first started, we didn't know what to do,” said one official (Authors’ Interviews).

Drilling companies accustomed to operating in warmer climates were also unprepared for road damage. The freeze and thaw cycle of the Northeast increased the problem.

The problem of overweight trucks serving the industry was widespread. Enforcement actions carried out by the Pennsylvania State Police, Public Utility Commission, and Department of Environmental Protection with the federal Motor Carrier Safety Administration in 2010 identified 2,600 violations in 3,500 vehicles inspected (Randall 2010).
Over time, a process was developed. PennDOT worked with local townships to post weight limits on roads that were not built for heavy truck traffic. Companies were also required to obtain road permits and post road repair bonds. Under this arrangement, companies must repair road damage using a PennDOT-certified contractor. If the conditions are not met, the bonds can be “pulled,” or cashed in, providing funds to carry out the repairs. More recently, municipalities have been issuing road use agreements (RUA) specifying road improvements to be made prior to use and detailing periodic maintenance and damage repairs.3

Pennsylvania sets road bond amounts at $12,500 per mile, which is insufficient to complete repairs in many instances. Figure 6 shows that road bonds were first used in Tioga County in 2008, but growth occurred rapidly. By 2011, a total of 797 bonds had been posted.

So far, the threat of the bonds has been sufficient to gain compliance, reports PennDOT, and neither PennDOT nor officials in drilling-intensive Sullivan Township have had to pull any bonds to fix the roads (Authors’ Interviews).

Companies do not always avoid posted roads, although these practices have improved over time, authorities report. Local residents have been key to enforcement, calling authorities when they see overweight trucks on posted roads.

With prior notice of what was coming, officials say, they might have handled things differently. Posting and bonding would have been done sooner and size requirements for drill pads would have been changed, so trucks delivering water or sand would be lined up on drill sites rather than public roadways (Authors’ Interviews).

Local officials uniformly say they have little prior communication with drilling companies and must chase down company officials to resolve issues. A lack of communication between local townships and the gas industry was also cited as a problem. Sullivan Township reportedly had to change road construction plans at the last minute when they learned for the first time about a drilling project about to get underway (Authors’ Interviews).

As Figure 7 shows, state and local repair and maintenance costs increased between 2000 and 2011. Costs rose between 2003 and 2005, then began to taper off until 2009, when gas drilling picked up. From 2009 to 2011, costs increased

3 See, for example, Marcellus Gas Activity and Community Planning Tools, Clinton County Marcellus Task Force, http://www.clintoncountypa.com.
State and local road repair and maintenance costs peaked in 2011 with total costs equaling $19,013,000. Officials have reported an increase in unscheduled repairs, especially for damaged shoulders and heavy rutting (Authors’ Interviews).

D. Housing: Tight Quarters, Rising Rents

Mineral booms often prompt an influx of new workers. Their higher-than-average incomes can create housing shortages by driving up rents and housing values, making housing less affordable for locals (Ecosystems Research Group 2009; Headwaters Economics 2008; Headwaters Economics 2009; Ooms and Tracewski 2011).

A housing shortage may have a number of secondary effects. The limited housing stock in rural communities may impact the ability of other employers, such as hospitals and colleges, to recruit new workers (Headwaters Economics 2008; Headwaters Economics 2009). The standard gas industry staffing model includes the creation of new mobile home parks or larger temporary man-camps to house workers (Jacquet 2009), which local officials may not have regulatory tools to manage.

Recent research has identified other potential impacts. Property values for homes near drilling activity, particularly homes with well water, can be negatively impacted (Gopalakrishnan and Klaiber 2012; Muehlenbacks, Spiller and Timmins 2012).

Consistent with the research, housing prices rose during the Tioga County boom. Higher rents brought additional income to local landlords and homeowners who sold or rented property. At the same time, higher housing prices created hardship for lower-income families and led to an increase in homelessness. The housing shortage has abated with the decline in drilling activity, according to our interviews.

Hotels Booked

With limited rental housing available, many drilling company employees stayed in local hotels. To meet demand, two new hotels were built, and a third was expanded.

The growth in the hotel business was welcome, but there were downsides. The lack of hotel space had a negative impact on the county’s tourism business (Coolidge 2011).

The county initially experienced a windfall in hotel occupancy tax, but the tax doesn’t apply to long-term stays, defined as occupancy of more than 30 days. Any increases in hotel tax revenues from increased occupancy were “largely offset by losses after the 30-day period passes,” testified one local official (Coolidge 2011).

RV parks also increased in Tioga County in 2009 and 2010. Jim Weaver, the County Planner, reported that many existing RV parks expanded and new ones were created, sometimes in individual yards. While some municipalities had zoning laws, the county’s Subdivision and Land Ordinance did not adequately address RV parks, which has since been updated. Weaver also reported that an effort was made to establish a “man-camp” in Farmington Township, but it never came to fruition.

The Owner-Occupied Housing Market: Prices Up

In 2010, 73% of Tioga County’s housing stock consisted of single-family homes. Apartment buildings and townhouses accounted for just 11% of all housing, while 16% of residences were mobile homes. Seventy-five percent of residents were homeowners, higher than the statewide average of 70%, while 25% were renters.

Housing prices escalated rapidly at the peak of the boom, local officials confirmed. Residents went into a buying frenzy, taking advantage of higher rental prices and seeming to believe they could “retire on the rental incomes
they could make,” said one local real estate agent (Authors’ Interviews). Now, with the exodus of the gas industry, many landlords are having a difficult time renting out their properties (Authors’ Interviews).

A school official who relocated to the area in 2010 reported difficulty finding an affordable home to purchase. “The housing market was very tight at the time,” he said. “Prices were skyrocketed. A house that might have sold for $100,000 a couple of years ago was now selling for $275,000-$300,000. I had to rent something before I could afford buying, and my family had to stay where they were before relocating…This was a hardship to leave my family” (Authors’ interviews).

Property owners sought to separate oil, gas, and mineral rights (OGMs) from surface rights. While this led to some creative arrangements between buyers and sellers, some potential buyers were reluctant to purchase property whose subsurface rights they could not control (Authors’ Interviews).

The housing boom increased rental incomes for property owners but appears to have had both a crowd-out and hangover effect. Tioga County has had a strong market in retirement homes, but interest from purchasers waned during the height of the boom as increased heavy truck traffic made the area less appealing (Authors’ Interviews).

Some gas-related workers who expected to stay in the area purchased homes. As companies pulled out of the area, these individuals sold their homes quickly at greatly deflated prices. The financial impact on the workers was reportedly minimal, because the oil and gas companies paid the difference, but the decline in prices has had an impact on appraisals (Authors’ Interviews).

**Rental Properties: Sizeable Increases**

Rents increased significantly with the influx of out-of-state gas workers. Rents grew from $350 to $1,000 per month in Wellsboro and from $450 to $1,200 in Mansfield, locals reported. Although the boom has abated, rents have not fallen to prior levels. An average house that rented for $350 per month before the gas industry – and rose to $1,000-$1,200 at its height – now rents for $750 per month (Authors’ Interviews).

The Tioga County Department of Human Services documented the increase in rents using classified ads in the Wellsboro Gazette. That report shows some growth in housing prices in 2010 with a significant increase by 2012.

<table>
<thead>
<tr>
<th>Date</th>
<th>Type of housing</th>
<th>Monthly rent asked</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 23, 2007</td>
<td>Large 1 bedroom in Wellsboro</td>
<td>$320</td>
</tr>
<tr>
<td></td>
<td>Remodeled 2 bedroom house</td>
<td>$600</td>
</tr>
<tr>
<td>May 21, 2008</td>
<td>Singlewide in Whitneyville</td>
<td>$435</td>
</tr>
<tr>
<td>May 20, 2009</td>
<td>3-4 bedroom house for rent</td>
<td>$400</td>
</tr>
<tr>
<td></td>
<td>2 bedroom, second floor</td>
<td>$550</td>
</tr>
<tr>
<td>May 19, 2010</td>
<td>3 bedroom rental</td>
<td>$800</td>
</tr>
<tr>
<td></td>
<td>2 bedroom trailer, east of Wellsboro</td>
<td>$525</td>
</tr>
<tr>
<td></td>
<td>3 bedroom house in Mansfield</td>
<td>$600</td>
</tr>
<tr>
<td>May 18, 2011</td>
<td>2 bedroom, 1 bath</td>
<td>$1300</td>
</tr>
<tr>
<td></td>
<td>3 bedroom, 2 bath house</td>
<td>$1500</td>
</tr>
<tr>
<td>March 24, 2012</td>
<td>Efficiency/studio furnished apartments</td>
<td>$1000</td>
</tr>
<tr>
<td></td>
<td>3 bedroom furnished</td>
<td>$2500</td>
</tr>
<tr>
<td></td>
<td>4 bedroom house</td>
<td>$1800</td>
</tr>
</tbody>
</table>

Source: Housing Report 2012, from Abby Thorborg. All data from Wellsboro Gazette classifieds.
Table 4 below compares changes in rents for low, median, and high-cost housing in the three northeast counties with significant gas activity – Bradford, Sullivan, and Tioga. Data are pooled across the three counties due to sample limitations. These counties are then compared to all urban counties without drilling and all rural counties without drilling during the same period.

While rents were falling across the rest of Pennsylvania, with the exception of a small increase in urban high-end rentals, rents in the drilling counties grew significantly, particularly for middle and high-end units, with rents at the 80th percentile growing by more than 20%.

The data sample includes long-term tenancies which, when calculated in the averages, can moderate the steep price increases for new rentals.

<table>
<thead>
<tr>
<th>State/County/Region</th>
<th>Percent change in rents by percentile</th>
<th>Change in wells drilled 2005-2007 to 2009-2011</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20th</td>
<td>50th</td>
</tr>
<tr>
<td>Pennsylvania, Rural Non-Drilling Counties*</td>
<td>-1.5%</td>
<td>-0.2%</td>
</tr>
<tr>
<td>Pennsylvania, Urban Non-Drilling Counties*</td>
<td>-1.2%</td>
<td>-0.6%</td>
</tr>
<tr>
<td>Bradford, Sullivan, &amp; Tioga PA</td>
<td>0.9%</td>
<td>14.3%</td>
</tr>
</tbody>
</table>


Even as housing prices were growing, low-income renters had declining incomes, making it harder to afford housing. Low-income renters in these counties actually saw their incomes fall more than those in Pennsylvania as a whole. The number of households in Bradford, Sullivan & Tioga paying 30 percent or more of income in rent - a measure of housing affordability - was essentially unchanged over the period. Reflecting the recession era's steep decline in incomes rural and urban counties without drilling in Pennsylvania saw large increases in the number of households paying 30% or more of their income in rent.

Incomes for median and higher-income renters grew during this period, but growth in housing prices outpaced growth in income.

<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>20th</td>
<td>50th</td>
</tr>
<tr>
<td>Pennsylvania, Rural*</td>
<td>-6.5%</td>
<td>-10.1%</td>
</tr>
<tr>
<td>Pennsylvania, Urban*</td>
<td>-11.3%</td>
<td>-10.1%</td>
</tr>
<tr>
<td>Bradford, Sullivan, &amp; Tioga PA</td>
<td>-11.5%</td>
<td>7.8%</td>
</tr>
</tbody>
</table>


Not surprisingly, county officials report an increase in the number of individuals seeking housing assistance. Between August 2008, when the department began tracking cases, and 2010, the number of cases per month grew from 3.4 to 14.8, before falling in 2011.

During that period, Abby Thorborg, then the Housing Specialist at the Tioga County Department of Human Services, saw an increase in individuals who had trouble finding or keeping affordable housing and were forced to double up with other families or relatives.
Table 6: People seeking help with housing at the Tioga County Department of Human Services, 2008–2012.

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of households seeking help with housing*</th>
<th>Average number of people seeking help per month</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008 (started tracking in August)</td>
<td>17</td>
<td>3.4</td>
</tr>
<tr>
<td>2009</td>
<td>163</td>
<td>13.6</td>
</tr>
<tr>
<td>2010</td>
<td>178</td>
<td>14.8</td>
</tr>
<tr>
<td>2011</td>
<td>140</td>
<td>11.7</td>
</tr>
<tr>
<td>2012 (through March)</td>
<td>35</td>
<td>11.7</td>
</tr>
</tbody>
</table>

Source: Data from Abby Thorborg’s Housing Report 2012.

*Those seeking help with housing were categorized as follows: doubled up with family or friend, transitional housing, homeless, eviction for nonpayment of rent, released from jail, transient, increased rent, chronically homeless, unsafe housing, release from hospital and care, domestic violence, no longer takes HUD, veteran, supportive housing, new to the area for gas industry.

The supply of low-income housing fell as landlords who had previously participated in low-income housing programs converted back to market-rate housing to take advantage of the higher rents.

The number of new families and two-parent families seeking help also grew. “Perhaps most striking to me was the population of people seeking help,” said Thorborg. “I saw a lot of people coming in who would say, 'I've never had to do this before.' Many were two-parent families with two incomes—people who have otherwise good jobs working in a factory or in the service industry, but they could no longer afford housing in the area” (Authors’ Interviews).

School officials noted a decline in low-income students during this period, as families left the community in search of affordable housing.

Commercial rents also rose during this period. The Bradford-Tioga Head Start program reported rents increasing at two of their facilities, in one case from $1,200 to $2,000. Because of high rent and lack of space, Head Start was forced to move a bit out of their service area so the families they serve must travel farther to utilize their services (Authors’ Interviews). The lack of affordable space also forced the local domestic violence organization to consolidate its shelter with its office (Authors’ Interviews).

Homelessness: A Rising Concern

Officials report an increase in homelessness associated with the gas boom. Families were living with friends or family, in campers, on campsites, or in their cars (Authors' Interviews).

The Tioga County Department of Human Services recognized an increase in homelessness and individuals seeking housing services in 2009, but there was no homeless shelter in the county to serve the growing population. In 2010, service providers and churches founded the Tioga County Homeless Initiative (TCHI), with area churches taking turns housing the homeless during the winter (Authors’ Interviews). A permanent shelter, established with state funding and a donation from Shell, will operate year round beginning in 2014. The Tioga County Homeless Initiative shelter now has a capacity of up to 16 currently homeless adults and children.

In the winter of 2011–12, the shelter housed 43 adults and 3 children. In the winter of 2012–13, the shelter housed 44 adults and 9 children (Authors’ Interviews).

Both the Southern Tioga School District and the Bradford-Tioga Head Start report an increase in the number of homeless children they serve. The number of homeless families rose from 6% of all Head Start families to 24% by 2012-13. Some of the growth is related to changes in the Head Start enrollment process, but the growth is

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4 Increases in homeless families within the Bradford-Tioga Head Start from 2010-11 to 2011-12 reflect, in part, changes in Head
consistent with reports from others in the county.

Of the homeless families that Head Start serves, only 23% could secure permanent housing during the 2012-13 school year. Rents remain considerably higher than most Bradford-Tioga Head Start families can afford (Authors’ Interviews).

E. Emergency Services

In Tioga County, the demand for emergency services has risen with increased gas drilling. As Figure 9 below shows, 911 calls grew by almost 20% between 2008 and 2009, peaking in 2010. Call volume began to fall in 2011. The firefighters and the Emergency Medical Service (EMS) in the county are mostly volunteer, except for certain shifts for Wellsboro Ambulance and the paramedics from the hospital. Since the gas industry moved to town, volunteerism has gone down in the county, which has impacted the volunteer emergency services (Authors’ Interviews).

The Director of Emergency Services in the county, David Cohick, reported that he has lost 27 paid emergency dispatchers, most of whom went to work for the gas industry. They now have a staff of 17 dispatchers, and he noted that their level of experience on the job has drastically declined — from well over 100 years per shift collectively to just four years’ experience (Authors’ Interviews).
Commissioner Coolidge testified in 2010 that the county’s emergency services plan required a unique 911 address for each well in case of emergency (Coolidge 2010). This update requires ongoing communications between the Department of Emergency Services and the drilling companies in the area. This communication process was not set up when drilling began, and gaining cooperation was a challenge at first, but communication improved over time (Authors’ Interviews). Denny Colegrove from Tioga County Department of Energy Services reported, “we have gotten fewer calls to well pads than you would expect” and have had less than a dozen major accidents on well pads in the county (Authors’ Interviews).

The Department of Emergency Services in Tioga County has five helicopters. Cohick, the director, reported that helicopter transport has gone up by 200%. Much of this increase is due to changing protocols for medical transfers, but overall population growth and vehicle crashes also contributed to this increase.

**F. Crime**

Several studies have noted that the influx of workers to oil and gas boom towns can lead to rising crime and the need for additional law enforcement personnel and other emergency services (Murray and Ooms 2008; Ecosystems Research Group 2009; Headwaters Economics 2009).

A study of seven of the heaviest drilling counties in Pennsylvania between 2007 and 2010, including Tioga, found that Pennsylvania State Police incidents/calls for service increased 6%, and arrests increased by 14% in Tioga County (Kowalski and Zajac 2012).

To complement locally-gathered data for this study, we assembled county-level data (covering both local police and state police) reported annually by the Pennsylvania State Police on serious crime.5 From 1999-01, long before unconventional oil and gas drilling began in Tioga County, there were 1,166 crimes reported for every 100,000 residents. In the last three year period, 2010-12, the number of serious crimes rose to 1,312 crimes reported for every 100,000 residents. Between 1999-00 and 2011-12, the crime rate in Tioga County grew by 13% while Pennsylvania’s crime rate fell by 6%. (See Figure 10.) The increase in crime in Tioga was driven by increases in aggravated assault, burglary, larceny, and motor vehicle theft.

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5 The Pennsylvania State Police defines serious crime to include murder, forcible rape, robbery, aggravated assault, burglary, larceny, motor vehicle theft, and arson. For more information, see [http://ucr.psp.state.pa.us/UCR/Reporting/Annual/AnnualSumArrestUI.asp](http://ucr.psp.state.pa.us/UCR/Reporting/Annual/AnnualSumArrestUI.asp) especially Table 2 of Appendix A.
Looking at lesser offenses not included in the “serious crime” rate, the number of offenses for driving under the influence (DUI) was also up in Tioga County in the most recent three-year period, from an average of 160 from 1999-2001 to 225 from 2010-2012, an increase of 40.1%. In Pennsylvania, DUls increased 28% to 53,578.

The increase in crime has also meant increased costs to the county. The average number of inmates at the county jail, typically 70 to 80, grew by 20% to an average of 100. The county is also responsible for monitoring gas workers who are on probation and for enforcing child support orders from other states (Authors’ Interviews).

The growth in crime is also evident in data on new criminal cases filed in the county, which jumped by more than 25% between 2010 and 2011. Although state police patrol the majority of the county, the two population centers, Mansfield and Wellsboro, have their own police forces. Both police departments also report an increase in crime.

Complaints to the Mansfield Police Department tripled from 934 to 2,868 between 2009 and 2011 (Przybycien 2012).

In Wellsboro, the total number of adult arrests increased between 2008 and 2011. Arrests dropped slightly in 2012 and more significantly in 2013, closely patterning drilling activity in the county.
Wellsboro Police Chief Jim Bodine reported an increase in crime during the gas boom, with significant increases from 2009 to 2010:

- Traffic stops increased from 1,704 to 2,087, a 22% hike.
- Traffic citations increased from 450 to more than 700.
- Non-traffic citations for lesser crimes such as disorderly conduct, harassment, and public intoxication rose by almost 20%, from 73 in 2009 to 87 in 2010.

Wellsboro police also saw an increase in both misdemeanor and felony arrests. Misdemeanor arrests rose by 82% from 2009 to 2011, before falling in 2012 and 2013. Felony arrests, which include aggravated assaults and sexual assaults, had remained steady at approximately eight per year between 2002 and 2011, according to Chief Bodine, but grew to 25 in 2011, the highest number he has seen over the last 10 years.

The Wellsboro chief also cited more alcohol and drug use in the county in recent years but noted that the increase in drug use may be part of a larger trend (Authors’ Interviews).

“People are quick to blame the increased crime on the gas drillers,” Bodine said. He noticed that local people “with more money in their pockets” are often the problem. “When the gas industry pulled out of the area, many locals lost their jobs and they no longer have the means to go out like they did” (Authors’ Interviews).

Some of the increased crime stemmed from clashes between out-of-town gas drillers and locals, Bodine said. Bar fights sometimes started because locals felt the out-of-towners came into their territory and “flaunted their money, buying drinks for the local ladies” (Authors’ Interviews).
For small-town police, this increase in calls, arrests, alcohol use, and crime can put a real stress on the department. Wellsboro had to add another patrol officer during the evening hours to handle increased crime (Authors’ Interviews).

**Domestic Violence and Sexual Assault: Rising Need for Services**

Sexual assault rose as drilling increased, according to Cristina Paternoster, director of HAVEN (Helping Abuse and Violence End Now) of Tioga County. There were instances of rapes at the hotels, and in some cases, date rape drugs may have been involved. Some women seeking services at HAVEN have not reported assaults to police, especially if drugs were involved. HAVEN occasionally will rent hotel rooms as temporary shelter, but the heavy presence of drillers made staying at the hotels uncomfortable for some women so the agency transferred them to shelters in other counties (Authors’ Interviews).

There has also been an increased need for domestic violence services and a change in the types of women requesting them. More women sought counseling during the gas boom, and the shelter grew from nine beds to 12, in part to accommodate demand. Officials also reported that partners of drilling employees, some of whom came with children, found themselves isolated and with very few social supports. The agency offered temporary shelter to the women and provided them with bus tickets to return home to, for example, Texas, Florida or Montana. Others have had problems leaving the county because of outstanding child custody disputes (Authors’ Interviews).

Wellsboro’s Chief Bodine reported a slight increase in domestic violence calls, more often for domestic arguments than for domestic assaults (Authors’ Interviews).

Although costs and demand for services increased at HAVEN during this time, agency funding did not grow, and staff time was cut, reducing capacity to offer counseling services.

**G. Schools: Declining Enrollment**

Population increases due to an energy boom can lead to rising enrollment in schools when gas workers move to an area with their families (Ecosystems Research Group 2009). However, Schafft and Glenna (2012) found no increase in school enrollment in Marcellus Shale drilling regions. Other studies identify a variety of impacts on schools, including an increase in student drop-out, an increase in special needs students within the schools, difficulty recruiting school staff due to high housing costs, and an increased need for ESL instruction (Ecosystems Research Group 2009; Headwaters Economics 2008; 2009; Schafft and Glenna 2012; White 2007).

Some Pennsylvania schools have also benefited from the gas boom, leasing their mineral rights to gas companies to raise revenue and reducing reliance on local property taxes (Weider 2011; Hartle 2012).

**Schools: Student Enrollment Continues to Decline**

Enrollment in Tioga County schools has been declining since 1988. In the boom years, school district officials expected to see new students, as gas workers settled into the county with their families, but this did not happen.

Enrollment in the Southern Tioga County School District continued declining during this period. While there was some small growth in enrollment of Latino students, the number of low-income students fell, as families relocated in search of affordable housing (Authors’ Interviews).

Tioga County enrolled eight Latino students in 2008-09 and 85 in 2010-11. The Latino population in the schools has declined slightly in 2012 and 2013 (Pennsylvania Department of Education). In the Southern Tioga School District, Spanish-speaking students have doubled in recent years. However, the number of students needing ESL services remains manageable, according to district officials, and is easily served with existing district resources.
Enrollment in three Tioga County school districts has continued to decline throughout the period. Overall student enrollment decreased between the 2008-09 school year and the 2012-13 school year by 376 students, a decline of 6.3% county-wide.

| Table 7. Overall Student Enrollment in Tioga County, including enrollment of Latinos |
|-----------------------------------|-----------------------------------|
|                                   | Enrollment                        | Tioga County (PA) |
| 2008-2009                         | Total                             | 5923               |
|                                   | Latino                            | 8                  |
| 2009-2010                         | Total                             | 5788               |
|                                   | Latino                            | 62                 |
| 2010-2011                         | Total                             | 5673               |
|                                   | Latino                            | 85                 |
| 2011-2012                         | Total                             | 5613               |
|                                   | Latino                            | 78                 |
| 2012-2013                         | Total                             | 5547               |
|                                   | Latino                            | 63                 |
| Total Enrollment, 5 Year Change  |                                   | -376               |
| % Change in total enrollment      |                                   | -6.30%             |
| Latino enrollment, 5 Year Change  |                                   | 55                 |
| % Change in Latino enrollment     |                                   | 687.50%            |

Source: Pennsylvania Department of Education

The Southern Tioga School District also reported an increase in the number of students requiring special education services, including emotional and learning supports. “Although our total student population went down 200 in the past three years, our special needs students increased by about 80 students,” said Southern Tioga School District Superintendent Keith Yarger. “We used to have 320 special needs students out of 2,100. Now we have 404 special needs students out of 1,900. The state has not given us more money for special needs, so this has been a hardship” (Authors’ Interviews).

**Staff**

During this period, the Southern Tioga School District furloughed 20 staff and moved some full-time assistants to part-time positions in response to funding reductions. New special education teachers were added to respond to the new demand. In October, the school board voted to close one of its three high schools in the 2014-15 school year.

**STEM Education**

The Southern Tioga School District has partnered with gas companies, including Shell, Talisman, and Chesapeake, to enhance STEM (Science, Technology, Engineering and Math) education in the schools. Shell introduced a week-long program for 9th and 10th graders in the Mansfield schools, and Talisman has come into local schools to teach energy education (Authors’ Interviews).

**H. Health Care**

One article on how gas drilling in the Marcellus Shale region has affected health care finds some increase in emergency room visits (although researchers did not know how much of the increase was due to gas drilling) and some increase in primary care for pediatric patients (Hessert 2012). Jersey Shore Hospital in neighboring Lycoming County reported an operating deficit for the first time in 2013, which its chief executive attributed to uncompensated care costs for uninsured sub-contractors in the gas industry (Republican Herald 2013).
Tioga County’s sole hospital, Soldiers and Sailors Memorial Hospital, is in the county seat of Wellsboro. Emergency visits were relatively steady between 2000-01 and 2007-08, increased by 6.2% in 2008-09, and rose almost 9% from 2010-11 to 2011-12, reaching 18,176 at the height of the gas boom.

Local officials offer a variety of explanations for the rapid increase in emergency room utilization at this local hospital. As reported in an article on the Marcellus Shale’s impact on health care, hospital President and CEO Jan Fischer said it was hard to determine how much of the increase can be attributed directly to increased drilling activity. “We just opened a new emergency room in January [2012], so that may have contributed to the increased activity as well,” she said. “But we had seen some increase before that…” (Hessert 2012).

Executive Vice President Ron Butler reported that utilization increased more than expected in the opening year, growing to almost 17,000 ER visits. Butler explained that many visits were for urgent care as opposed to emergency care. “Many people end up in our emergency room to get care quickly or because they don’t have regular primary care physicians,” he said (Authors’ Interviews).

Some increase in ER visits may be recession related, with the unemployed turning to emergency rooms in greater numbers. Some may also be attributable to the influx of out-of-state workers with no regular primary care physicians for routine health care needs.

One clear impact of gas drilling in Tioga County has been an increase in sexually transmitted diseases, Butler reported. Hospital officials definitively linked this increase to the influx of out-of-state workers because many STD patients listed out-of-state home addresses.

Not all subcontractors in the area provide health insurance to their workers, and the hospital has seen some uptick in uncompensated care. “Uncompensated care would normally fall as the unemployment rate has fallen, but recently, uncompensated care has not fallen” as unemployment in the county fell, Butler said (Authors’ Interviews).

Figure 15. Emergency Room Visits to Soldiers and Sailors Memorial Hospital, Tioga County, PA 2000-2012

![Graph showing emergency room visits from 2000-2012](image-url)

Note. Yearly dates are from July 1-June 30.
Marcellus Shale development has produced new tax revenue for state coffers, but because of Pennsylvania's particular tax structure, it has brought very little in the way of new revenue to local governments and communities that bear the brunt of the drilling activity.

Total personal income tax revenue (PIT) from Tioga County grew by 55% from 2005 through 2011, from $15.7 million to $24.4 million, but Tioga's share of Pennsylvania's total PIT collections remained steady and small, just 0.2%.

Income earned by Tioga County residents from higher rents, signing bonuses, and royalties grew exponentially between 2005 and 2011, from $6 million to $97 million in 2010, but fell in 2011 to $74.7 million. The county's share of the total income from rent, royalties, patents, and copyrights rose from 0.2% in 2005 to 1.7% in 2010.

The number of tax returns with income in this category, which includes royalty and lease payments as well as income from rental property, more than doubled between 2007 and 2010.

The rapid growth in the industry was also reflected in state sales tax collections, which grew by 10% in Tioga in the midst of the recession in 2009-10, while falling by 1% for the state as a whole. Sales tax revenue in Tioga was stronger in 2010-11 and 2011-12 than it was at the state level, growing by 12% and 6%, respectively. In 2012-13, the trend reversed with sales tax receipts in Tioga falling by 9% but growing by 1% in the state as a whole.

Pennsylvania has no county-level sales tax, so an increase in vehicle sales, drilling supplies, or food and alcohol will not affect county tax collections. Perhaps the biggest potential source of local tax revenue—property tax on drilling equipment and value of natural gas reserves—is no longer available, as a successful court challenge by the Pennsylvania Oil and Gas Association removed these products from the list of taxable items in 2002, although other minerals are still subject to the tax. The court case led to a significant revenue loss, particularly to school districts.

The loss of property tax revenue for local governments is significant. In Wetzel County, West Virginia, total property tax collections for school, county, and municipal governments almost tripled between 2005 and 2013, rising from $10 million to $27.5 million, largely as a result of increased assessments of gas inventories and property.

Local governments see little income from higher rents and royalty payments, which is not subject to local earned income taxes.
County and municipal officials advocated for tax revenue to help offset drilling costs and impacts. Act 13 of 2012 imposed a per well fee on all unconventional wells in the state, allocating 60% to local governments to be split between counties and municipalities hosting or adjacent to active drilling areas. Another 40% of the fee is allocated to transportation, environmental conservation programs, housing, water, infrastructure, and other statewide needs.

Pennsylvania collected $204 million for wells drilled through 2011, $202 million in 2012, and $224.5 million in 2013. The impact fee is expected to raise comparable amounts through the next 10 years.

Tioga County received a total of $9.1 million in Act 13 local impact fees in 2012, but most of that money was allocated to reserves.

Tioga County also received $275,000 in funding from the Pennsylvania Housing Finance Agency and through its PHARE program in 2012 for rental housing rehabilitation, providing up to $18,000 to landlords to rehab 14 or more units of low-income housing. PHARE is funded with Act 13 dollars. Three housing programs received funding in 2013, including $341,288 for the Tioga County Department of Human Services, $107,500 for the Tioga County Homeless Initiative, and $50,000 for a leased housing rental start up program.

![Figure 17. Sales and Use Tax Collections, Greene County, PA](source. Pennsylvania Department of Revenue.)
Tioga County’s experience with unconventional gas drilling has much in common with other high development communities. There was the swift and overwhelming impact of an extractive industry creating multiple, simultaneous impacts across communities. Both county and municipal governments lacked tools necessary to get a handle on, much less get out in front of drilling related impacts. Those tools are clearly lacking, and the recent Pennsylvania Supreme Court decision invalidating Act 13 prohibition against local zoning controls offers local governments an important lever. Most of Tioga’s municipalities are covered under zoning ordinances, a promising start.

Tioga County holds many lessons for areas that are or will experience an increase in gas extraction in the coming years. Our recommendations:

**Deeds and Permitting.** Leasing activity is the canary in the coalmine for future unconventional drilling. Counties should establish good leasing databases, and prepare regular reports for municipalities to help them anticipate and plan for future drilling activity.

**Zoning and Land Use.** Many states retain significant control over oil and gas operations at the state level, and keeping that control at the state, rather than local level, is a high priority for companies. Municipalities should attempt to keep a hand in siting authority. At minimum, all should adopt local zoning ordinances and modify existing ordinances to gain some handle on siting of wells within the confines of state law.

**Planning and Communications.** Communications between the industry and local officials is limited, especially when local governments have no permitting or siting authority. Counties should establish a local oil and gas commission early on to address the communication gap. This commission could include county commissioners and municipal officials, county agencies, landowner groups, industry and members of the public.

**Paying for drilling related impacts.** Coal companies pay local property taxes on the value of reserves, natural gas companies should do the same. This is the most direct way to match impacts to the location in which they occur. Enact a severance tax similar to that in effect in West Virginia. Pennsylvania is the only mineral-rich state that does not have a severance tax and is losing out on needed revenue. By 2019-20, a 4% natural gas severance tax could generate nearly 3 times as much money as the current impact fee. Funding could support better enforcement of environmental regulations, support economic development throughout the state and provide additional funds to local governments coping with drilling related impacts.

**Road repairs and safety.** Road damage from heavy trucks is one of the primary concerns of local officials. Costs are high for repair, enforcement, and traffic safety and should be borne by industry rather than local or state taxpayers.

- States should proactively post weight limits in areas where drilling is anticipated and provide funding for local governments to post local roads and bridges.
- Enforcement of speed and weight limits is a high priority. Funding for state and local police is necessary to ensure timely and regular enforcement.
- Localities should invest in a weight machine, around $10,000, to improve enforcement of weight limits. States could provide the funding, or funds could be allocated from severance taxes or impact fees.
- Heavy truck traffic should be limited to times outside of morning and afternoon pick-up and drop-off of
local school students.

- Require companies to contact local police for permission in advance for wide-load trucks that require a police escort.

**Housing Impacts.** Rapidly escalating rents are a burden on low income households, and increase homelessness and need to be addressed proactively.

- Probably the best temporary approach to housing is to allow the establishment of man-camps. Counties or localities should proactively identify appropriate sites, for example existing RV parks, and work with owners and companies to expand those sites.

- Counties should use local funds or drilling fee income to establish a local housing voucher program to help low-income families stay in their homes.

- Pennsylvania’s PHARE program, funded with Act 13 impact fee dollars and administered by the Pennsylvania Housing Finance Agency, is a good model for improving housing stock and addressing permanent housing solutions. Other states should adopt this model.

**Human Services.** In both Greene and Tioga counties we found that drilling activity is particularly hard on the poor, who can’t pay for housing, and who have not benefitted from employment or royalty income. Drilling activity has brought with it increased demand for a range of social services, for the poor and for drilling families, yet human service funding has not been identified as a high priority use for impact fee dollars.

For areas yet to experience an unconventional shale extraction boom, a clear lesson is to be prepared – to anticipate impacts, to have tools in place to avoid problems, and to ask for and receive advanced and regular information from drillers on their plans. States should assist, and should help to provide resources to address infrastructure and human service needs in a predictable and timely way. To do so also means state governments have to take a more balanced approach, better scrutinizing rosy economic claims and more quickly acknowledging and addressing costs and impacts.
The following persons were interviewed and/or provided us with information during our research:

- **Chief Jim Bodine**, Wellsboro Chief of Police
- **Ron Butler**, Executive Vice President and Chief Business Officer at Susquehanna Health
- **Tanya Chapel**, Early Head Start Supervisor/Social Service Program Coordinator at the Bradford-Tioga Head Start, Inc.
- **Barry Cleveland**, Chief Water Operator at Mansfield Borough Municipal Authority
- **Dennis A. Colegrove**, EMA Coordinator at the Tioga County Department of Emergency Services
- **Erick J. Coolidge**, Tioga County Commissioner and dairy farmer
- **Mark Foust**, Maintenance Manager at PennDOT Engineering District 3-7
- **Linda McNeill**, Real Estate Agent at Penn Oak Realty, Inc.
- **Cristina Paternoster**, Director (former) of HAVEN of Tioga County
- **Thomas Robbins**, Sullivan Township Supervisor
- **Jody Thomas**, Executive Director of the Bradford-Tioga Head Start, Inc.
- **Abby Thorborg**, Director of Operations at the Tioga County Homeless Initiative
- **Jim Weaver**, Director of the Tioga County Planning Commission
- **Keith Yarger**, Superintendent of the Southern Tioga School District
- **Sheriff Tom Young**, Tioga County Sheriff


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