THE IMPACTS OF MARCELLUS DEVELOPMENT: AND THE LONG-TERM CHANGES THEY CAN BRING TO THE SMALL TOWNS OF SULLIVAN COUNTY

Luke Zeller
INTRO:
The Marcellus Shale formation is currently seeing large amounts of development as gas companies are sinking large amounts of extraction wells throughout Pennsylvania. Much of the Marcellus Shale Formation can be found in less populated areas of Pennsylvania. Small rural communities are seeing large amounts of development required to support the extraction of the natural gas located beneath the Marcellus Shale. Natural gas workers add to the development by spending money earned on wellpads, etc at local restaurants and hotels. While the amount of activity in the Marcellus Shale will certainly slow after the development phase. Pennsylvania will see long term impacts that will exist well beyond natural gas production exits the state.

SULLIVAN COUNTY:
Sullivan County sits in a unique setting, it is the second least populated area in all of the state of Pennsylvania. The area also has a median income of $36,250, well below the national average. As a result many individuals welcome the Marcellus Development and are hoping to profit from the benefits it brings. While it has not seen as much development to date as surrounding counties, there is a large amount of development planned for Sullivan County. Sullivan County does not possess the infrastructure required for this development and is going through dramatic changes as new infrastructure is constructed. The area, composed of small towns, will see major changes in composition in a relatively short period of time.

DEVELOPMENT PROJECTIONS:
In this study, we use the high development projections from The Nature Conservancy to develop scenarios of how small towns in Sullivan County will be affected.
A CHANCE AT A BRIGHTER FUTURE:

Individuals throughout Sullivan County, and Pennsylvania, are enjoying the benefits that come with Marcellus Development. Many individuals who are living on a modest income, are utilizing extra income for needed improvements to homes, farming equipment, etc.

It is also important to note that the population in Sullivan County has seen a steady decline in population for the past 100 years. The areas current economic drivers: Agriculture, Tourism, and Forestry have not been enough to stabilize the declining population. Marcellus Development provides a foundation upon which Sullivan can build upon, stabilizing or even increasing population growth.

CASE STUDIES:

In this study we examined the impact of 3 small towns of various scales. The amount of wells within a 5 mile radius were used to predict the extent of changes that can be seen in these towns. The towns are spread throughout the county, with different levels of development occurring around them.
Natural Gas Extraction includes three stages:

**DEVELOPMENT:**
This stage focuses on the drilling of natural gas wells and the creation of pipelines to transport natural gas. The Development stage will bring a large amount of workers from outside Sullivan County to drill/frack the natural gas wells. There will be a large amount of business activity in hotels, restaurants and gas stations to support the workers. However, there will be little long-term development in housing, as workers will be commuting from outside the county or renting existing existing property.

**PRODUCTION:**
The production stage is focused on extracting natural gas from the wells. The Production stage will bring a large amount of long-term jobs to Sullivan County. This will require a growth in the housing market, and businesses around the county in order to support the extra population. This stage also brings a large amount of jobs which are indirectly tied to Marcellus Development, Construction Workers, Maintenance Personnel, etc.

**POST-PRODUCTION:**
The post-production stage occurs once the wells “run dry”, or cease to produce feasible amounts of gas. This stage requires much less jobs than the production phase. The amount of jobs tied to Marcellus development are severely cut. There is relatively little information on how many jobs can be indirectly supported after wells begin to run dry. For this project we used a multiplier of 1.2 which was derived from the estimated multiplier for forestry, agriculture, and fishing jobs.

### Stages of Development

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
<th>Jobs Created</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEVELOPMENT</td>
<td>This stage focuses on drilling natural gas wells and creating pipelines to transport natural gas. The Development stage will bring a large amount of workers from outside Sullivan County to drill/frack the natural gas wells.</td>
<td>Large amount of workers</td>
</tr>
<tr>
<td>PRODUCTION</td>
<td>The production stage is focused on extracting natural gas from the wells. This stage will bring a large amount of long-term jobs to Sullivan County.</td>
<td>Large amount of long-term jobs</td>
</tr>
<tr>
<td>POST-PRODUCTION</td>
<td>The post-production stage occurs once the wells “run dry”, or cease to produce feasible amounts of gas. This stage requires much less jobs than the production phase.</td>
<td>Severely cut</td>
</tr>
</tbody>
</table>

### Economic Multiplier

**What is an Economic Multiplier?**
An economic multiplier is the ratio of total economic impacts associated with a given project or policy to the direct expenditure. For example:

1 DIRECT JOB = 2 INDIRECT JOBS

**Multiplier Calculation**

- **Development:***
  - 1 Natural Gas Well Pad = 13.1 Full-Time Direct Jobs + 9.75 Full-Time Jobs for Each Subsequent Well Drilled

- **Production:***
  - 100 High-Production Wells = 100 x 0.39 Full-Time Direct Jobs = 39 Full-Time Direct Jobs

- **Post-Production:***
  - 100 Dry Gas Wells = 100 x 0.19 Full-Time Direct Jobs = 19 Full-Time Direct Jobs

**Post-Production Multiplier:***

- Post Production Multiplier is an estimate, not enough data at this time

**Multiplier Calculation:**

1 DIRECT JOB = 1.20 INDIRECT JOBS

**Multiplier Result:**

- Full-Time Direct + Indirect Jobs per 100 Wells = 78 Jobs
- Full-Time Direct + Indirect Jobs per 100 Wells = 27 Jobs

**Notes:**

- Numbers are based upon findings by Kelsoy and coworkers.
The figures to the left explain the process which was used to determine the job creation for Sullivan County. Using the amount of wells predicted by the nature conservancy, job creation estimates by Kelsey and Considine, and the economic multiplier that we are assuming in this study we are able to determine how many jobs are created.

DEVELOPMENT STAGE:
The development stage requires a little more calculation than the production and post-production stages. The amount of jobs required for each subsequent well on a wellpad is less than the amount of jobs created for the first well.

While Kelsey estimates that it takes 420 individuals to drill a single well many of these workers are here temporarily. For example, the truck drivers that supply the water used in the fracturing process are only on site temporarily, and are often only in the area for a short time. In this study we are focused on the full-time jobs rather than the part-time jobs. It is predicted that Marcellus Development will bring 147 full-time jobs during it's 10 yr phase.

### JOB CREATION IN SULLIVAN COUNTY:

<table>
<thead>
<tr>
<th>Stage</th>
<th>Calculation</th>
<th>Jobs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Development</strong></td>
<td>(13.1 \times 193)</td>
<td>2,528</td>
</tr>
<tr>
<td></td>
<td>(9.75 \times 193)</td>
<td>1,881</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>(2,528 + 1,881)</td>
<td>4,409</td>
</tr>
<tr>
<td><strong>Production</strong></td>
<td>(386 / 100)</td>
<td>3.86</td>
</tr>
<tr>
<td></td>
<td>(3.86 \times 39)</td>
<td>151</td>
</tr>
<tr>
<td><strong>Post Production</strong></td>
<td>(386 / 100)</td>
<td>3.86</td>
</tr>
<tr>
<td></td>
<td>(3.86 \times 19)</td>
<td>73</td>
</tr>
</tbody>
</table>
In this study it has been determined that the only area that can see possible long term development during the development stage is Dushore.

Dushore is the only area in Sullivan County with the existing infrastructure to develop housing at this time. Even with the ability to develop, it is predicted that long-term growth will be limited during the development stage. The ability for workers to rent housing throughout Sullivan County, and the fact that the majority of the workers are currently commuting from surrounding counties results in a low demand/expectation for the development of new housing.

As stated earlier this does not take into account the large amount of business hotels, restaurants, etc will see during this stage. Long-term housing development in the area is expected to grow by 7 houses at most during the 10 years of development.
After the completion of the development stage, we enter into the production stage. The extraction of natural gas found within the Marcellus commences, and a large amount of jobs are created. The work during this stage also creates a large amount of jobs which are indirectly tied to the extraction of natural gas.

By looking at the number of wells that fall within the 5 mile boundary of these towns, and assuming that the people would settle in the town, we can see which areas see the majority of the development.

Looking about 25 years into the future, well after the completion of the development stage, we can see the extent of changes occurring in Sullivan County. As you can see there has been a large amount of development in Laporte and Forksville that is tied to Marcellus Development. Both towns experience unprecedented growth with a large amount of their populations now directly, or indirectly, dependent on the extraction of natural gas.
The average life of a natural gas well is approximately 40 years. After the well ceases to produce a viable amount of natural gas is enters into the post-production stage. This stage requires much less jobs than the production stage, and as the people who are directly tied to the Marcellus leave, the people that are indirectly tied to the Marcellus follow.

Looking about 50 years into the future, once the majority of wells have ceased to produce natural gas, we can see the what happens to the people and infrastructure that came with the Marcellus. A large amount of workers have left the area, leaving behind their homes, as they search for another job. Laporte and Forksville, which experienced unprecedented growth in population numbers are now witnessing an exodus of people.

This shows that the Marcellus Development has potential of bringing the boom-bust cycle in Sullivan County. If towns such as Laporte and Forksville develop to the full extent to support Marcellus Development they will ultimately bust, leaving a crippled shell of what was during the production stage.
147 JOBS \times 5\% \text{ NEED} = 7 \text{ RESIDENCES (AT MOST)}

\text{RESIDENCES:}
\begin{itemize}
  \item Workers often come without families
\end{itemize}

\text{DIRECTLY ATTRIBUTED TO WACCELUS DEVELOPMENT}

\textbf{DUSHORE}
DUSHORE Production Phase – 25 Years

18 WELLS x 0.39 FULL-TIME DIRECT JOBS x 2 ECONOMIC MULTIPLIER = 14 RESIDENCES

7 DIRECT RESIDENCES
7 INDIRECT RESIDENCES
LAPORTE

Production Phase – 25 Years
LAPORTE

Post-Production – 50 Years

66
x 1.9 (ECONOMIC MULTIPLIER)
= 15 RESIDENCES (5 TOTAL)
1.2 INDIRECT RESIDENCES

Monitoring and tracking the economic impact of the post-production phase.
Present Condition

FORKSVILLE
FORKSVILLE

Production Phase – 25 Years
Post-Production — 50 Years

FORKSVILLE
The following pages include supporting animations for each area of study. The areas are defined by whether or not the houses are directly related or indirectly related to Marcellus Development, and cover each of the three stages.

Blue - direct relation to Marcellus Development
White - indirect relation to Marcellus Development
Grey - extra housing left after the end of gas extraction
Small Towns are seeing significant changes that are not possible, without the income from natural gas. Natural gas is a finite resource, it won’t last. Assuming an average production life per Marcellus Well is 40 yrs., wells will begin to run dry anywhere between 40-50 yrs from now. This will cause a mass exodus of workers who depend on Marcellus Gas for income and work. With a large dependence upon the Marcellus for growth, towns such as Forksville and Laporte will face problems such as an overabundant housing stock and overbuilt infrastructure. The current development may set the stage for a repeat of the boom-bust cycle not seen since the loss of the coal industry.

PREVENTING THE BUST SCENARIO:
Sullivan County needs to carefully limit development to levels that they can support once work dependent upon Marcellus leaves the area. Developing infrastructure that can be converted for alternate uses is an aspect that must be considered.
The county seat of Sullivan, Laporte will see large amounts of development in the area over the next 25 years. Currently the area has a population of 316 individuals, if the Marcellus was completely developed, Laporte can see its population grow to the extent of another 127 individuals. This is a roughly 40% increase over current population numbers. The increase in population would cause Laporte to become more densely populated.

The increase in population would allow Laporte to begin to support more businesses. With these numbers Laporte could begin to see the development of multistory apt buildings, or mixed development. This should be preferable form of development, as these buildings would limit the amount of land disturbance in the area.

**RECOMMENDATION:**
Mixed development, multistory, and infill development would give Laporte a tighter sense of community, making the town more attractive to visitors and businesses that would support them. It would also limit sprawl, and destruction of the surrounding environments.
Forksville, being a small town of only 136 residents could see unprecedented growth in it's future. Developed to it's extent there could be an addition of another 105 individuals. This would be a 33% increase over current numbers.

Although there is could be a large amount of housing development in the area it is less likely for more businesses to move into Forksville. Even with the increase in population Forksville would only have a population of 241 individuals. Areas such as Laporte and Dushore see also see more through-traffic. As the area is located between the mountains, it is likely that the area will need to develop on upon surrounding agricultural fields, as there are limited areas which one can develop.

RECOMMENDATION:
Forksville should be careful to limit development as the increased disturbance could diminish the areas highly popular fall festival. New housing should be kept small in size, and located in areas that make them attractive to outsiders. This would allow the homes to be converted to vacation homes/retirement homes with minimal effort once natural gas production dies down.
In our study we found that Dushore did not see large amounts of development tied to Natural Gas. However, the area can still see development from other industries that wish to profit from the increased activity in the area.

RECOMMENDATION:
Dushore should focus on creating a welcoming image for other industries. It should be careful that the development does not overwhelm the town. Establishment of zoning laws that maintain the best image of the town should be considered.

NOTE:
For perspectives of possible changes to Dushore, please see work created by Jenny Ryan which focuses on the impact of Marcellus Development on Dushore.
ACT 13: UNDERSTANDING THE IMPACT FEE

Luke Zeller
INTRO:
As Marcellus development is ramping up, it is clear that most of the development is occurring in the more sparsely populated areas of the state. Most of these areas are largely undeveloped and include large amounts of forested and agrarian lands. The establishment of Act 13 requires drilling companies to pay an annual impact fee, which is used to mitigate the stress on the environment and infrastructure of these areas. Unfortunately, the impact fees generated are minimal when compared to the amount of disturbance caused by these developments. From these maps you can see that a large amount of disturbance is occurring in the Northern Tier. In this particular case we will focus on Sullivan County.

WHAT IS THE IMPACT FEE:
The impact fee is an annual fee that gas companies must pay to compensate for the destruction/deterioration that they bring to the areas of development. The impact fees are determined by the number of years a well has been in production and the market value of natural gas. Impact fees are used by municipalities, counties, and states to repair roadways, bridges, natural areas etc. The impact fee also includes a 15% legacy fee, which goes statewide (including areas with no development) based on population.

For a more details on the Impact Fee and breakdown of where funds are to be allocated please visit: http://www.google.com/url?sa=t&rct=j&q=pennsylvania%20impact%20fee%20summaries&source=web&cd=1&cad=rja&ved=0CDEQFjAA&url=http%3A%2F%2Fphx.corporate-ir.net%2FExternal.File%3Fitem%3DUGFyZW50SUQ9NDU4ODYzfENoaWxkSUQ9NDg2NTgyfFR5cGU9MQ%3D%3D&ei=rNzIUIbjA4aB0QGEplFw&usg=AFQjCNHotjGKW9ync0zsB1iJrErrBGmzkQ
SULLIVAN COUNTY: While Sullivan County falls amidst some of the most extensive Marcellus development in the state, it is surprising to find that it receives very little in the way of impact fees. This is largely due to the fact that gas companies are currently focusing their efforts in surrounding counties including: Bradford, Susquehanna, Tioga, and Lycoming (not pictured). This does not mean that Sullivan is not seeing extensive damage. Major roadways through Sullivan County, including 87 and 220, see large amounts of truck traffic that damage roads and bridges. As Impact Fees are disbursed according to municipality where the development is occurring Sullivan will get little to no aid from the Impact Fees.

INCOME FROM IMPACT FEES:

<table>
<thead>
<tr>
<th>COUNTY</th>
<th>IMPACT FEE</th>
<th>STATE RANKING</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRADFORD</td>
<td>$8,428,630</td>
<td>1</td>
</tr>
<tr>
<td>SULLIVAN</td>
<td>$386,849</td>
<td>25</td>
</tr>
<tr>
<td>SUSQUEHANNA</td>
<td>$3,937,702</td>
<td>5</td>
</tr>
<tr>
<td>TIOGA</td>
<td>$4,792,619</td>
<td>2</td>
</tr>
<tr>
<td>WYOMING</td>
<td>$881,084</td>
<td>13</td>
</tr>
</tbody>
</table>
DEVELOPMENT IN SPARSELY POPULATED AREAS:
Looking at the Chart to the left we can see that the counties within the Northern Tier are some of the smallest in the State. Sullivan County is the second smallest, only behind Cameron County in terms of smallest population size. This area, known as the Endless Mountains, is seeing unprecedented development that is harming the natural beauty that these areas possess. With a large amount of impact fees going to road repairs, the environment will ultimately suffer.

MUNICIPALITY INCOME:
Looking at the Income Per Municipality we can see a detailed view of where the money is going, and just how much money there is. A municipality's income is limited to $500,000 a year from Impact Fees (with the remaining going to the Housing Affordability and Rehabilitation Enhancement Fund). Several municipalities in Bradford, Susquehanna, and Tioga are receiving the maximum amount of income from impact fees this year.

PROBLEMS:
With a municipality cap on revenue from Impact Fees, and no limit on Marcellus Development these areas are not receiving enough funds to cover the impacts on the environment and infrastructure caused by the drilling for natural gas. Problems are likely to worsen as development continues.
FUTURE DEVELOPMENT:
While Sullivan may not be seeing the largest amount of development currently. The future could bring large amounts of development to Sullivan County. The MARC-1 Pipeline, which aims to connect three other major interstate pipelines to the East Coast is currently being developed in Sullivan County. The majority of the pipeline falls within Sullivan County. This development will destroy a large amount of natural habitat and fragment a variety of plant and animal ecosystems.

The area could also see the development of 193 well-pads under The Nature Conservancy’s full-scale Marcellus Development Projections. Assuming an avg of 2 wells per wellpad, Sullivan County has the potential to have 386 wells developed in the next 10 years.

PROJECTING IMPACT FEES:
Using the predicted wells for Sullivan County, and applying a base impact fee of $10,000 per well, we see that several municipalities throughout Sullivan County have the potential to exceed the $500,000 municipality cap.

RECOMMENDATION:
It is recommended that Marcellus Development is limited to no more than 50 wells per municipality. This would mean that the municipalities could get the most from the Impact Fees without going above the current cap of $500,000. Developing any more than 50 wells would create additional environmental and infrastructure impacts that could not be covered with the limited Impact Fees.
LACK OF COMPENSATION:
On a final note, it needs to be made clear that even with the large amounts of revenue generated from Impact Fees, there is still a severe lack of compensation for the amount of impact among the environment and infrastructure in Sullivan County. There needs to be more pressure, from local and state governments, to ensure that the gas companies are repairing the disturbance they bring to the region.

ROADWAYS:
Gas companies are required to pay bonds to ensure that they repair the roads they use. Existing agreements require drillers to post a bond of $12,500 for each mile of paved road and $6,000 for each mile to insure that the damage is repaired. Even with these bonds there is large amount of money still required to make necessary repairs, it costs around $432,346.91 to resurface a two-lane road with 5 ft. shoulders. This number could be even larger due to the location of the development being in a distant rural location.

BRIDGE RECONSTRUCTION:
The large amount of weight generated by the hydraulic fracturing vehicles, trucks carrying water and other heavy equipment rapidly accelerate the deterioration rate of bridges. With bridge reconstruction costing around $5,000 per linear ft., bridges are a costly expense that gas companies need to address. For example

LOSS OF FORESTED CONDITIONS:
A large amount of Marcellus Development is occurring in forested regions. Including well pads, access roads, truck storage, etc. each well in a forested region results in loss of apx. 34 acres. The timber value of a region that size is roughly the equivalent of $50,000.
"A User Handbook for the Regional Input-Output Modeling System (RIMS II)." 


