Natural Gas Valuation and Related Topics – “Facts” and Fracas*

David Kay, Senior Extension Associate,
Community and Regional Development Institute
Department of Development Sociology
dlk2@cornell.edu

October 1 Panel: 10:00 – 12:00
NYS Assessors

*Fracas: noisy quarrel, brawl; from fraccasser, to shatter
Things to Think About

Scale of Marcellus alone is **BIG** - though how big is debated, and **NOT** yet accurately known

- **84.2 Tcf of technically recoverable undiscovered reserves** – USGS (2011)
  - Compare: 24.4 Tcf US consumption (2011)

- Large area, **much** money in total, per well & per landowner
  - ~100,000 surface square miles or 64 million acres (~ 15% in NY)
  - ~$40 billionrecoverable gas in NY (@$3/mcf)
    - NY economy is ~$1.16 trillion as measured by gross state product (2010)
  - ~$2 million ‘landowner’ share per well – typical for PA early on
    - (80 acre well spacing, 12.5%+ share, higher prices than now)
More Things to Think About

• Nonrenewable resource-based economic development

  ➢ When it’s “gone”, it’s gone BUT...
    ➢ The resource is rarely *fully* depleted physically
    ➢ Instead, it reaches a point that further extraction is impractical or uneconomic
      ➢ Technology (cost of extraction) and price of product (market forces) affect definition of “practical” and “economic”

  ➢ Geographies of depletion (pace and scale)
    ➢ The well, the property, the unit
    ➢ The community, the town
    ➢ The watershed, the region, the state, the Marcellus, all gas bearing shales...
Well Location, Muni Boundaries, Impacts
Even More Things to Think About

- New ‘haves’ and ‘have nots’, new winners and losers
- Public discussion increasingly divided and antagonistic
  - Many people have minds made up already, not open to new information
  - “a man hears what he wants to hear and disregards the rest”  Paul Simon
- Extractive energy economy historically volatile - multiple boom and bust cycles
“It is unlikely that new well construction would occur under a steady, constant rate... The actual track of well construction would likely be much more cyclical in nature than as described.”

Revised Draft SGEIS
“On a final note, the policy decisions and industry reaction must be considered in the context of a glut in the natural gas market that has reduced prices, lowered the amounts of lease payments and royalties to landowners, and eased political pressure to move quickly in New York. Natural gas prices move in cycles with demand, so that could change.”

http://tomwilber.blogspot.com/
April 2011: My Impact Review: Four Key Issues Highlighted

- Most critical factor affecting the economy (and valuation) – the uncertain pace, scale and location of drilling in NYS
Location? - Marcellus Fairway

Marcellus Fairway (yellow)

Special: 2 for 1 - Utica and Marcellus fairways overlap in southern counties

Data source: Geologists at NYS Museum

Data source: 9-2011 revised SGEIS
Critical Parameters for Local, Regional and State Economic Development Studies

- The pace, scale, and location of leasing
- The pace, scale and pattern of drilling – the driver of everything else
- The value of the gas taken out of the ground (price x quantity)
- The money industry spends on business versus the money spent on landowners (leases/royalties)
- The in-region vs. out of region expenditures of:
  - Businesses (on materials, labor)
  - Businesses (taxes, profits)
  - Landowners
  - Wage earners
Critical Parameters for Local, Regional and State Economic Development Studies
Critical Parameters for Local, Regional and State Economic Development Studies

Table 2
Estimated Ultimate Recovery from Marcellus after a 50-year decline. Power-law model assuming that 70% of the sections in each county are accessible and a well spacing of 80-acres.

<table>
<thead>
<tr>
<th>Counties</th>
<th>Sections</th>
<th>Total Risked Potential</th>
<th>Total Risked Potential</th>
<th>Total Risked Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>P90 Bcf</td>
<td>P50 Bcf</td>
<td>P10 Bcf</td>
</tr>
<tr>
<td>Maryland</td>
<td>1</td>
<td>656</td>
<td>3,123</td>
<td>6,980</td>
</tr>
<tr>
<td>New York</td>
<td>17</td>
<td>13,906</td>
<td>30,955</td>
<td>71,859</td>
</tr>
<tr>
<td>Pennsylvania</td>
<td>42</td>
<td>32,622</td>
<td>133,240</td>
<td>291,648</td>
</tr>
<tr>
<td>Ohio</td>
<td>18</td>
<td>9,298</td>
<td>18,361</td>
<td>41,166</td>
</tr>
<tr>
<td>West Virginia</td>
<td>39</td>
<td>16,851</td>
<td>35,022</td>
<td>77,588</td>
</tr>
<tr>
<td>Totals</td>
<td>117</td>
<td>73,333</td>
<td>220,701</td>
<td>489,241</td>
</tr>
</tbody>
</table>
Long vs Short Run – not everything happens at once

- "Long Run" facilities
  - Staging areas
  - Worker housing
  - Office areas
  - Pipe, sand and other storage
  - Maintenance facilities
  - Compressor stations
  - Water withdrawal sites
  - Water treatment
  - Etc.

- "Short run" facilities
  - Well pads

Simple Example
Decline Curves and Production

Arps Exponential Equation

(a single phase, incompressible fluid production from a closed reservoir)
(gas drive maintains pressure)

$$\frac{q(t)}{q_i} = \frac{1}{e^t}$$

Standard decline curve

Cumulative production curve

Steep decline from initial production

Most gas is produced in first few years

Oriskany Sandstone in the Appalachian Basin
Decline Curves and Production:
“0 b, or not 0 b, that is the question”

Arps Rate-Time Equations

\[ q(t) = \frac{1}{q_i \left[1 + b D_i t \right]^b} \]

Big b’s mean LOTS more gas over time

\[ D_i = 1 \, t^{-1} \]
Decline Curves and Production: Same Story, Different Perspective

Cumulative Production Curves

- Gas Shale Produces for Long Time
- Dissolved Gas-Drive Reservoir Depletes Rapidly

Exponential
Hyperbolic (b<1)
Harmonic
Hyperbolic (b>1)
Importance of the production decline rate – think royalties, severance & property taxes
Decline Curves and AREAWIDE Production

The following graph shows the annual production “wedges”.

Production Profile by Year – Flat Rig Count & Well Quality

Overall production grows as the new wells add a consistent amount of production, which is additive to the production “tail” from the wells drilled in previous years.

Source: Pickering Energy Partners, Inc.
Workforce Timing

Jonah Anticline, Wyoming: Shown to illustrate phasing only

Data source: Ecosystem Research Group/Jacquet
Obvious? The big dollars flow with the production & sale of oil and gas.
About the Money: A Well Owner’s Perspective

- Revenues: Bonus payments up front, royalties only for producing wells…
  - Only the latter have DIRECT impact on the assessment rolls

- Law requires that landowners receive royalties of at least 12.5 percent… Representatives of the companies interviewed for this piece said royalties these days average around 15 percent.

- Range Resources: typical predicted 4.4 billion cubic feet of natural gas during its lifetime, which can be 50 years or more.
  - Assume average $5 per thousand cubic feet during the well's life
  - Production worth $22 million, landowner's share $3.3 million…
    - But the money will not come all at once, nor will it even come in a steady stream
    - About half of total production happens within the first two years (eg. $1.65 million for landowner).
    - Multiple landowners per well typical (spacing units, compulsory integration important here)

Economic Impact – Lease and Royalty Payments

• Lease and royalty payments related to Marcellus shale development in Pennsylvania in 2010….
  – Accounted for about one third of gas industry spending in Pennsylvania between 2008 and 2010
  – What do they spend on? Is it local spending?

Considine, Watson and Blumsack, 2011
2009 Economic Impacts of Marcellus Shale in PA: Best Study Based on “Real Data” So Far

<table>
<thead>
<tr>
<th>Sectors</th>
<th>Total Spent</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumer Goods</td>
<td>$4,738</td>
<td>0.2%</td>
</tr>
<tr>
<td>Food</td>
<td>$229</td>
<td>0.01%</td>
</tr>
<tr>
<td>Farming</td>
<td>$103,191</td>
<td>4.36%</td>
</tr>
<tr>
<td>Motor Vehicles</td>
<td>$213,658</td>
<td>9.02%</td>
</tr>
<tr>
<td>Health Services and Insurance</td>
<td>$38,977</td>
<td>1.65%</td>
</tr>
<tr>
<td>Investments, Savings, &amp; Finances</td>
<td>$1,307,501</td>
<td>55.19%</td>
</tr>
<tr>
<td>New Building Construction/Home</td>
<td>$41,561</td>
<td>1.75%</td>
</tr>
<tr>
<td>Improvements</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Real Estate</td>
<td>$122,100</td>
<td>5.15%</td>
</tr>
<tr>
<td>Taxes</td>
<td>$415,150</td>
<td>17.52%</td>
</tr>
<tr>
<td>Vacations, Travel, &amp; Entertainment</td>
<td>$8,430</td>
<td>0.36%</td>
</tr>
<tr>
<td>Other</td>
<td>$113,387</td>
<td>4.79%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$2,368,902</td>
<td>100.00%</td>
</tr>
<tr>
<td><strong>N = 42</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fiscal Impacts

- Impacts on both costs and revenues for NYS remain unclear
- The experience of Pennsylvania municipalities - relevant?
  - On costs probably yes, but even there we only have good data about the early stages (first few years) of development
  - On the revenue side limited relevance - we don’t share the same tax systems

In NYS, local assessors will add assessed value to their tax rolls ANNUALLY based on
- The amount of gas produced per well during the applicable year
- The Unit of Production Value (UPV) for Marcellus wells, as calculated by the state’s Office of Real Property Tax Services (ORPTS).
Tax Impacts

➢ The only real way local government can affect the taxes raised from natural gas operations is by deciding what tax rate they should set.

➢ Annual additions to the tax base from gas properties must be taxed at the same rate as other taxable real property.
Revenue Issues

- Note that the addition to the tax base from each well is calculated each year.
  - Because production from a single well declines very rapidly from initial high rates of production, tax base will likely also increase dramatically as production begins, then decline steeply.

- How will town officials respond to significant increases in the tax base?
  - Typically, tax relief and lower rates?
  - Best response if large addition to tax base is only temporary?
Local assessors will add assessed value to tax roll annually based on amount of gas produced locally per well and UPV.

* Gas formation UPV \( \times \) well production volume = assessed value of a specific gas property.
Local assessors will add assessed value to tax roll annually based on amount of gas produced locally per well and UPV.

NY State ORPTS Formula to Determine Gas Formation UPV*
(Unit of Production Value)

\[
\text{Cash Flow} = \frac{\text{NET CASH FLOW}}{\text{DISCOUNT RATE} \% \text{ average over previous 5 years}}
\]

* Gas formation UPV $\times$ well production volume = assessed value of a specific gas property.
Tax Impacts – The UPV formula

Local assessors will add assessed value to tax roll annually based on amount of gas produced locally per well and UPV.

NY State ORPTS Formula to Determine Gas Formation UPV*
(Unit of Production Value)

\[ \text{PRODUCTION INCOME} \times \text{BASE RATE} \times \frac{\%}{\text{FINANCIAL RISK}} \]

\[ \text{PRODUCTION COSTS} \]

\[ \text{NET CASH FLOW} \]

\[ \text{$/MCF UNIT OF PROD. VALUE} \]

* Gas formation UPV × well production volume = assessed value of a specific gas property.
Tax Impacts – The UPV formula

Local assessors will add assessed value to tax roll annually based on amount of gas produced locally per well and UPV.

NY State ORPTS Formula to Determine Gas Formation UPV*
(Unit of Production Value)

PRODUCTION INCOME $
- gross income minus royalties paid out to landowners

PRODUCTION COSTS $
- operating expenses, dry hole costs, depreciation, tangible investments, depletion, other royalties

BASE RATE %
- not less than 17.5%
+ represents risk, intangible costs, property and income taxes

% Current average yearly rate from U.S. Federal Reserve

DISCOUNT RATE %
- average over previous 5 years

Cash Flow

NET CASH FLOW

$ / MCF UNIT OF PROD. VALUE

Financial Risk

* Gas formation UPV $ well production volume = assessed value of a specific gas property.
Selected Issues

- Relation between possible future state severance tax and this existing property tax system (which, though a property tax, is a tax on annual production of gas)
- Reporting of production values – accuracy, verifiability
- UPV formula
  - How will it be implemented for shale gas? So far we have zero years of data for UPV calculations
  - Extended periods of low gas prices…. Can costs exceed revenues for extended periods? UPV = 0 => $0 assessment
- Should the legislatively mandated formula be revised?
  - Eg. is 17.5% the right discount rate base?

http://www.tompkins-co.org/tccog/Gas_Drilling/Focus_Groups/LandValues_Assessment.html
Selected Issues – Time Lags

Gas Drilling, Production and the Assessment Cycle

Well is constructed—Mid year, Year 1

LAG BETWEEN DRILLING & PRODUCTION

Year 1
- PRODUCTION—Year 1
  - Production for Year X reported
  - Value Placed on Assessment Roll
  - Taxed on School Taxes

Year 2
  - PRODUCTION—Year 2
  - Production for Year X reported
  - Value Placed on Assessment Roll
  - Taxed on School Taxes

Year 3
  - Taxed on County Taxes
  - Taxed on Village Taxes

Year 4
  - Taxed on County Taxes
  - Taxed on Village Taxes

http://www.tompkins-co.org/tccog/Gas_Drilling/Focus_Groups/LandValues_Assessment.html
Effects on Property Values: DEC rDSGEIS

“Significant increases in property value are expected where the subsurface mineral rights and land are held jointly with land ownership... Properties where the mineral rights are not held jointly with land ownership, or where there is some restriction on drilling, would not experience this increase in value.”

It is possible that... various impacts, particularly those associated with the construction phase, could reduce the value of properties close to the wells relative to similar properties not located close to wells.

Conclusions based on literature review, not new studies
“Things are very much in a holding pattern for the present, and we have no idea when a change might occur (or even if it will occur!)

As to the assessors ... I do know that some are seeing higher land prices that are gas-related, and are wondering what that should mean for assessments. Our advice has been to avoid any attempt to incorporate gas value until production starts, but of course the wait is frustrating.”

Jim Dunne
Office of Tax Policy Analysis
NYS Department of Taxation and Finance
(For our take on it, please see following link: http://www.tax.ny.gov/research/property/legal/oil_gas_memo03_30_10.htm)
Oil and Gas

March 30, 2010

We have recently received questions concerning the treatment of short-term leases of the rights to search for and extract natural gas. The particular questions concern leases for five-year periods. These leases can be for as much as $5,000 per acre, a price far in excess of what land similar to the leased land had sold for previously. The leases also contain a royalty payment if gas is extracted.

The first point for assessors to be aware of is that these leases are speculative. They are premised upon the use of horizontal drilling and high-volume hydraulic fracturing drilling in the Marcellus Shale. At present the Department of Environmental Conservation has not issued permits for this type of drilling.

While it is possible to separately assess oil and gas rights (4 Op.Counsel SBEA No. 77; 7 Op. Counsel SBEA No. 20), we strongly recommend against doing so in these situations. Separate assessment would require entry on an assessment roll of a lease of short duration. Should the lease appear as a parcel and taxes not be paid, the normal enforcement process would take place. Given the length of time involved in foreclosure, the foreclosing authority would necessarily be foreclosing against the remaining term of the lease, which could be quite short. There may be little value remaining at that point.

Separately assessing the lease would of course require the assessor to determine what the value of the lease is. A one-time payment for these rights does not establish the value of the lease itself. Similarly, it would be unsound appraisal practice to assume that this one-time payment establishes the value of the land subject to the lease in an open market transaction. It would be even more unsound to assume these payments establish the market value of other properties.

Assessors in the affected areas should closely monitor land sales to see if these leases are having any effect on sales prices. Even if an assessor determines that the possibility of extracting gas has come to permeate a market, as with any other factor the assessor would also have to consider whether this factor has any effect on the value of particular parcels.

Finally, we remind local officials that there is already a program in place to incorporate oil and gas production into the local property tax. Officials in the affected areas may wish to familiarize themselves with the oil and gas units of production program as described elsewhere on this website /sas/oil_gas These provisions are applicable when oil or gas is actually extracted.

Thank you!

For further information contact:
David Kay, CaRDI
Department of Development Sociology
Cornell University
607-255-2123
dlk2@cornell.edu