Land and Property Valuations with Shale Development
Spring 2014

Jeffrey Kern, ASA, AIMA
Appraiser
Resource Technologies Corporation
 Setting the Stage
 Value Enhancement
 Transitory / Permanent Effects
 Case Study
 Value Diminished
 Transitory / Permanent Effects
 NIMBY
Production/Consumption 2004 thinking
What If We Never Run Out of Oil?
New technology and a little-known energy source suggest that fossil fuels may not be finite. This would be a miracle—and a nightmare.
**Four-fold increase in shale gas production offsets declines in other U.S. supply, meeting consumption growth and lowering import needs**

<table>
<thead>
<tr>
<th>U.S. dry gas trillion cubic feet per year</th>
<th>History</th>
<th>2009</th>
<th>Projections</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Net imports</strong></td>
<td>11%</td>
<td>14%</td>
<td>1%</td>
</tr>
<tr>
<td><strong>Shale gas</strong></td>
<td>20%</td>
<td></td>
<td>46%</td>
</tr>
<tr>
<td><strong>Non-associated onshore</strong></td>
<td>9%</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Non-associated offshore</strong></td>
<td>28%</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Tight gas</strong></td>
<td>8%</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Coalbed methane</strong></td>
<td>2%</td>
<td>8%</td>
<td></td>
</tr>
<tr>
<td><strong>Associated with oil</strong></td>
<td>9%</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Alaska</strong></td>
<td>7%</td>
<td></td>
<td>7%</td>
</tr>
</tbody>
</table>

Data source: EIA 2012 Predictions
Horizontal Well and Fracing

- Treatable Groundwater Aquifers
- Private Well
- Municipal Water Well: <1,000 ft.
- Additional steel casings and cement to protect groundwater
- Protective Steel Casing
- Approximate distance from surface: 6,000 feet

Not to scale
Utica

Northwest PA – Range holds ~190,000 net Utica/Point Pleasant acres

- Net Point Pleasant Thickness = 150 - 250 feet
- Organic Content = TOC up to 7.0%
- Higher carbonate content and low clay content similar to Eagle Ford
- Expect good porosity and permeability in section
- First well drilled and completed during 3Q 2012
- Second well expected to be spud in 4Q12

From Q3 2012

Note: Townships where Range holds 3,000+ acres are shown in yellow

* CHK rates include ethane
Dry/Wet

Natural Gas

Dry Gas
- Methane
- Ethane <15%

Wet Gas
- Methane < 85%
  - Ethane
  - Butane
  - Propane
  - Pentane
Price Differential

Marcellus Wet Gas Provides Significant Price Uplift

$/Wellhead Mcf

$8.00
$7.00
$6.00
$5.00
$4.00
$3.00
$2.00
$1.00
$0.00

Dry Gas
Gas (1040 Btu)

Wet Gas - Ethane Rejection

Gas (1140 Btu) 14% shrink

Wet Gas - Ethane Extraction

Gas (1055 Btu) 24% shrink

NGLs (C3+)
Condensate

Current

Projected

Assumptions: $4.00 NG, $90.00 WTI, 40% WTI (C3+), 2.27 GPM (ethane rejection), 5.60 GPM (ethane extraction), all processing, shrink, fuel & ethane transport included. Based on SWPA wet gas quality (1275 processing plant inlet btu). Wet Gas (Ethane Extraction) based on full utilization of current ethane / propane agreements.

July 2013
Rig Activity in PA – dry/wet gas MARCELLUS
Rig Activity in OH – wet gas/oil
UTICA
LIQUIDS-FOCUSED PRODUCTION GROWTH

- NGL, boe/d
- Oil, boe/d
- Associated natural gas from liquids plays, boe/d
- Natural gas from shale plays, boe/d
- Base natural gas, boe/d
- % Liquids

- 30,000 bbls/d in 1Q'09
- 2.2 bcf/d
- 3.1 bcf/d
- 168,000 bbls/d in 2Q'13

Drillbit production growth outpacing asset sales
Marcellus Dry Gas Decline

Marcellus West Virginia Decline

Production

Period

\[ P = -1346173 \times \ln(x) + 6946267 \]
### Declining Pattern

<table>
<thead>
<tr>
<th>Year</th>
<th>Initial Production</th>
<th>Closing Production</th>
<th>Decline from Previous Year</th>
<th>Annual Royalties $4/mcf Gas 12.5% Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>5.0 Mmcf/d</td>
<td>1.1 Mmcf/d</td>
<td>78%</td>
<td>$328,500</td>
</tr>
<tr>
<td>Second</td>
<td>1.1 Mmcf/d</td>
<td>0.79 Mmcf/d</td>
<td>28%</td>
<td>$164,250</td>
</tr>
<tr>
<td>Third</td>
<td>0.79 Mmcf/d</td>
<td>0.62 Mmcf/d</td>
<td>22%</td>
<td>$127,750</td>
</tr>
<tr>
<td>Forth</td>
<td>0.62 Mmcf/d</td>
<td>0.52 Mmcf/d</td>
<td>17%</td>
<td>$107,675</td>
</tr>
<tr>
<td>Fifth</td>
<td>0.52 Mmcf/d</td>
<td>0.48 Mmcf/d</td>
<td>8%</td>
<td>$93,075</td>
</tr>
<tr>
<td>Sixth</td>
<td>0.48 Mmcf/d</td>
<td>0.43 Mmcf/d</td>
<td>11%</td>
<td>$85,775</td>
</tr>
<tr>
<td>Total</td>
<td>8.51 Mmcf/d</td>
<td>0.43 Mmcf/d</td>
<td></td>
<td>$779,402</td>
</tr>
</tbody>
</table>
## NEPA Single Well Valuation Assumptions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>UR Potential</td>
<td>4,400,000</td>
<td>Geologic</td>
</tr>
<tr>
<td>Acres</td>
<td>80</td>
<td>Geologic /experience technical pattern</td>
</tr>
<tr>
<td>Discount RI</td>
<td>0.184</td>
<td>higher risk</td>
</tr>
<tr>
<td>Discount WI</td>
<td>0.124</td>
<td>lower risk</td>
</tr>
<tr>
<td>Price</td>
<td>$3.00</td>
<td>current and forward</td>
</tr>
<tr>
<td>Royalty</td>
<td>15.0%</td>
<td>average</td>
</tr>
<tr>
<td>Cap Cost</td>
<td>$5,500,000</td>
<td>average</td>
</tr>
<tr>
<td>Op Cost</td>
<td>$10,000</td>
<td>survey (EY)</td>
</tr>
<tr>
<td>Cost Infl rate</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Price Infl rate</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Years</td>
<td>15</td>
<td>conservative</td>
</tr>
<tr>
<td>Plug Cost</td>
<td>$0</td>
<td>average</td>
</tr>
<tr>
<td>Initial Prod</td>
<td>1,553,000</td>
<td>average</td>
</tr>
<tr>
<td>Ultimate Production</td>
<td>4,319,600</td>
<td></td>
</tr>
</tbody>
</table>

**Harmonic Well Decline:**

\[ q = q_1 \times (1 + bD^t)^{-\frac{1}{b}} \]

- \( q \) - flow at time \( t \)
- \( d \) – decline \( 0.711 \)
- \( D \) - decline fraction \( (1/d) \) 1.406
- \( t \) - unit of time Years
- \( b \) - hyperbolic exponent 1
<table>
<thead>
<tr>
<th>Year</th>
<th>NGL Production (Bbls)</th>
<th>Gas Production (Mcf)</th>
<th>Gross</th>
<th>Royalty Revenue Stream</th>
<th>Free Gas Revenue Stream</th>
<th>Annual Cost</th>
<th>Working Interest</th>
<th>PV Royalty Interests</th>
<th>PV Free Gas</th>
<th>PV Working</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>0</td>
<td>1,553,000</td>
<td>$4,659,000</td>
<td>$698,850</td>
<td>$0</td>
<td>$3,695,000</td>
<td>($3,695,000)</td>
<td>$0</td>
<td>$0</td>
<td>($3,485,229)</td>
</tr>
<tr>
<td>2014</td>
<td>0</td>
<td>1,645,450</td>
<td>$1,936,349</td>
<td>$290,452</td>
<td>$0</td>
<td>$1,825,000</td>
<td>$2,135,150</td>
<td>$542,446</td>
<td>$0</td>
<td>$1,791,756</td>
</tr>
<tr>
<td>2015</td>
<td>0</td>
<td>407,382</td>
<td>$1,222,145</td>
<td>$183,322</td>
<td>$0</td>
<td>$10,000</td>
<td>$1,635,897</td>
<td>$190,413</td>
<td>$0</td>
<td>$1,221,350</td>
</tr>
<tr>
<td>2016</td>
<td>0</td>
<td>297,611</td>
<td>$892,833</td>
<td>$133,925</td>
<td>$0</td>
<td>$10,000</td>
<td>$748,908</td>
<td>$62,629</td>
<td>$0</td>
<td>$683,375</td>
</tr>
<tr>
<td>2017</td>
<td>0</td>
<td>234,440</td>
<td>$703,320</td>
<td>$105,496</td>
<td>$0</td>
<td>$10,000</td>
<td>$587,822</td>
<td>$41,669</td>
<td>$0</td>
<td>$309,052</td>
</tr>
<tr>
<td>2018</td>
<td>0</td>
<td>193,391</td>
<td>$580,172</td>
<td>$87,026</td>
<td>$0</td>
<td>$10,000</td>
<td>$483,147</td>
<td>$29,031</td>
<td>$0</td>
<td>$225,995</td>
</tr>
<tr>
<td>2019</td>
<td>0</td>
<td>164,575</td>
<td>$493,724</td>
<td>$74,059</td>
<td>$0</td>
<td>$10,000</td>
<td>$409,665</td>
<td>$20,866</td>
<td>$0</td>
<td>$170,483</td>
</tr>
<tr>
<td>2020</td>
<td>0</td>
<td>143,232</td>
<td>$429,697</td>
<td>$64,455</td>
<td>$0</td>
<td>$10,000</td>
<td>$355,243</td>
<td>$15,338</td>
<td>$0</td>
<td>$131,526</td>
</tr>
<tr>
<td>2021</td>
<td>0</td>
<td>126,790</td>
<td>$380,370</td>
<td>$57,056</td>
<td>$0</td>
<td>$10,000</td>
<td>$313,315</td>
<td>$11,467</td>
<td>$0</td>
<td>$103,205</td>
</tr>
<tr>
<td>2022</td>
<td>0</td>
<td>113,734</td>
<td>$341,202</td>
<td>$51,180</td>
<td>$0</td>
<td>$10,000</td>
<td>$280,022</td>
<td>$8,688</td>
<td>$0</td>
<td>$82,063</td>
</tr>
<tr>
<td>2023</td>
<td>0</td>
<td>103,116</td>
<td>$309,347</td>
<td>$46,402</td>
<td>$0</td>
<td>$10,000</td>
<td>$252,945</td>
<td>$6,653</td>
<td>$0</td>
<td>$65,950</td>
</tr>
<tr>
<td>2024</td>
<td>0</td>
<td>94,311</td>
<td>$282,933</td>
<td>$42,440</td>
<td>$0</td>
<td>$10,000</td>
<td>$230,493</td>
<td>$5,139</td>
<td>$0</td>
<td>$53,466</td>
</tr>
<tr>
<td>2025</td>
<td>0</td>
<td>86,891</td>
<td>$260,674</td>
<td>$39,101</td>
<td>$0</td>
<td>$10,000</td>
<td>$211,573</td>
<td>$3,996</td>
<td>$0</td>
<td>$43,663</td>
</tr>
<tr>
<td>2026</td>
<td>0</td>
<td>80,554</td>
<td>$241,662</td>
<td>$36,249</td>
<td>$0</td>
<td>$10,000</td>
<td>$195,413</td>
<td>$3,131</td>
<td>$0</td>
<td>$35,879</td>
</tr>
<tr>
<td>2027</td>
<td>0</td>
<td>75,078</td>
<td>$225,235</td>
<td>$33,785</td>
<td>$0</td>
<td>$10,000</td>
<td>$181,450</td>
<td>$2,465</td>
<td>$0</td>
<td>$29,640</td>
</tr>
<tr>
<td>2028</td>
<td>0</td>
<td>70,300</td>
<td>$210,899</td>
<td>$31,635</td>
<td>$0</td>
<td>$10,000</td>
<td>$169,264</td>
<td>$1,949</td>
<td>$0</td>
<td>$24,599</td>
</tr>
<tr>
<td>2029</td>
<td>0</td>
<td>66,093</td>
<td>$198,279</td>
<td>$29,742</td>
<td>$0</td>
<td>$10,000</td>
<td>$158,537</td>
<td>$1,548</td>
<td>$0</td>
<td>$20,498</td>
</tr>
<tr>
<td>2030</td>
<td>0</td>
<td>62,361</td>
<td>$187,084</td>
<td>$28,063</td>
<td>$0</td>
<td>$10,000</td>
<td>$149,021</td>
<td>$1,233</td>
<td>$0</td>
<td>$17,142</td>
</tr>
<tr>
<td>2031</td>
<td>0</td>
<td>59,028</td>
<td>$177,085</td>
<td>$26,563</td>
<td>$0</td>
<td>$10,000</td>
<td>$140,523</td>
<td>$986</td>
<td>$0</td>
<td>$14,381</td>
</tr>
<tr>
<td>2032</td>
<td>0</td>
<td>56,034</td>
<td>$168,101</td>
<td>$25,215</td>
<td>$0</td>
<td>$10,000</td>
<td>$132,886</td>
<td>$791</td>
<td>$0</td>
<td>$12,100</td>
</tr>
<tr>
<td>2033</td>
<td>0</td>
<td>53,328</td>
<td>$159,985</td>
<td>$23,998</td>
<td>$0</td>
<td>$10,000</td>
<td>$125,987</td>
<td>$635</td>
<td>$0</td>
<td>$10,206</td>
</tr>
<tr>
<td>2034</td>
<td>0</td>
<td>50,872</td>
<td>$152,616</td>
<td>$22,892</td>
<td>$0</td>
<td>$10,000</td>
<td>$119,724</td>
<td>$512</td>
<td>$0</td>
<td>$8,629</td>
</tr>
<tr>
<td>2035</td>
<td>0</td>
<td>48,632</td>
<td>$145,896</td>
<td>$21,884</td>
<td>$0</td>
<td>$10,000</td>
<td>$114,012</td>
<td>$413</td>
<td>$0</td>
<td>$7,310</td>
</tr>
<tr>
<td>2036</td>
<td>0</td>
<td>46,581</td>
<td>$139,743</td>
<td>$20,961</td>
<td>$0</td>
<td>$10,000</td>
<td>$108,782</td>
<td>$334</td>
<td>$0</td>
<td>$6,206</td>
</tr>
<tr>
<td>2037</td>
<td>0</td>
<td>44,696</td>
<td>$134,088</td>
<td>$20,113</td>
<td>$0</td>
<td>$10,000</td>
<td>$103,975</td>
<td>$271</td>
<td>$0</td>
<td>$5,277</td>
</tr>
<tr>
<td>2038</td>
<td>0</td>
<td>42,958</td>
<td>$128,873</td>
<td>$19,331</td>
<td>$0</td>
<td>$10,000</td>
<td>$99,542</td>
<td>$220</td>
<td>$0</td>
<td>$4,495</td>
</tr>
<tr>
<td>2039</td>
<td>0</td>
<td>41,349</td>
<td>$124,048</td>
<td>$18,607</td>
<td>$0</td>
<td>$10,000</td>
<td>$95,441</td>
<td>$179</td>
<td>$0</td>
<td>$3,834</td>
</tr>
<tr>
<td>2040</td>
<td>0</td>
<td>39,857</td>
<td>$119,572</td>
<td>$17,936</td>
<td>$0</td>
<td>$10,000</td>
<td>$91,636</td>
<td>$146</td>
<td>$0</td>
<td>$3,275</td>
</tr>
<tr>
<td>2041</td>
<td>0</td>
<td>38,469</td>
<td>$115,407</td>
<td>$17,311</td>
<td>$0</td>
<td>$10,000</td>
<td>$88,096</td>
<td>$119</td>
<td>$0</td>
<td>$2,801</td>
</tr>
<tr>
<td>2042</td>
<td>0</td>
<td>37,174</td>
<td>$111,523</td>
<td>$16,728</td>
<td>$0</td>
<td>$10,000</td>
<td>$84,795</td>
<td>$97</td>
<td>$0</td>
<td>$2,399</td>
</tr>
<tr>
<td>1st 15 Years</td>
<td>0</td>
<td>4,319,555</td>
<td>$12,958,665</td>
<td>$1,943,800</td>
<td>$0</td>
<td>$5,660,000</td>
<td>$5,354,865</td>
<td>$1,045,437</td>
<td>$0</td>
<td>$1,904,741</td>
</tr>
<tr>
<td>30 Year Total</td>
<td>0</td>
<td>5,077,289</td>
<td>$15,231,866</td>
<td>$2,284,780</td>
<td>$0</td>
<td>$5,810,000</td>
<td>$7,137,086</td>
<td>$1,054,870</td>
<td>$0</td>
<td>$2,047,894</td>
</tr>
</tbody>
</table>
Single Well Value
Brought on Line Today – NEPA

<table>
<thead>
<tr>
<th>Delay</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Results</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
</tr>
<tr>
<td>Production</td>
<td>4,319,555</td>
</tr>
<tr>
<td>Gross</td>
<td>$12,958,665</td>
</tr>
<tr>
<td>Royalty</td>
<td>$1,943,800</td>
</tr>
<tr>
<td>Working</td>
<td>$5,354,865</td>
</tr>
<tr>
<td>Total</td>
<td>$7,298,665</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Present Worth</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1,045,737</td>
</tr>
<tr>
<td>$1,904,741</td>
</tr>
<tr>
<td>$2,950,478</td>
</tr>
</tbody>
</table>
## Single Well Value
### Brought on Line 5 Years - NEPA

<table>
<thead>
<tr>
<th>Delay</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Results</td>
<td>Total</td>
</tr>
<tr>
<td>Production</td>
<td>4,319,555</td>
</tr>
<tr>
<td>Gross</td>
<td>$12,958,665</td>
</tr>
<tr>
<td>Royalty</td>
<td>$1,943,800</td>
</tr>
<tr>
<td>Working</td>
<td>$5,354,865</td>
</tr>
<tr>
<td>Total</td>
<td>$7,298,665</td>
</tr>
</tbody>
</table>
## SWPA Single Well Valuation Assumptions

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>UR Potential</td>
<td>3,800,000 mcf</td>
<td>Geologic</td>
</tr>
<tr>
<td></td>
<td>260,000 bbls</td>
<td></td>
</tr>
<tr>
<td>Acres</td>
<td>80</td>
<td>Geo /experience technical pattern</td>
</tr>
<tr>
<td>Discount R</td>
<td>0.184</td>
<td></td>
</tr>
<tr>
<td>Discount W</td>
<td>0.124</td>
<td></td>
</tr>
<tr>
<td>Price</td>
<td>$3.00/mcf</td>
<td>current and forward</td>
</tr>
<tr>
<td></td>
<td>$37.99/bbl</td>
<td></td>
</tr>
<tr>
<td>Royalty</td>
<td>15.0%</td>
<td>average</td>
</tr>
<tr>
<td>Cap Cost</td>
<td>$5,500,000</td>
<td>average</td>
</tr>
<tr>
<td>Op Cost</td>
<td>$10,000</td>
<td>survey (EY)</td>
</tr>
<tr>
<td>Cost Inflate</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Price Inflate</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Years</td>
<td>15</td>
<td>conservative</td>
</tr>
<tr>
<td>Plug Cost</td>
<td>$0</td>
<td>average</td>
</tr>
<tr>
<td>Initial Prod</td>
<td>1,106,100</td>
<td>average</td>
</tr>
<tr>
<td></td>
<td>75,320</td>
<td></td>
</tr>
<tr>
<td>Ultimate Production</td>
<td>3,813,072 mcf</td>
<td></td>
</tr>
<tr>
<td></td>
<td>259,652 bbls</td>
<td></td>
</tr>
</tbody>
</table>
Harmonic Well Decline: \( q = q_1 \times (1 + b \times D \times t)^{-\frac{1}{b}} \)

\( q \) - flow at time \( t \)
\( d \) – decline 1.076
\( D \) - decline fraction \((1/d)\) 0.930
\( t \) - unit of time Years
\( b \) - hyperbolic exponent 1
## Single Well Cash Flow SWPA – Wet Gas

<table>
<thead>
<tr>
<th>Year</th>
<th>NGL Production (Bbls)</th>
<th>Gas Production (Mcf)</th>
<th>Gross</th>
<th>Royalty Revenue Stream</th>
<th>Free Gas Revenue Stream</th>
<th>Annual Cost</th>
<th>Working Interest</th>
<th>PV Royalty Interests</th>
<th>PV Free Gas</th>
<th>PV Working</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>75,320</td>
<td>1,106,100</td>
<td>$6,179,707</td>
<td>$772,463</td>
<td>$0</td>
<td>$3,695,000</td>
<td>($3,695,000)</td>
<td>$0</td>
<td>$0</td>
<td>($3,485,229)</td>
</tr>
<tr>
<td>2014</td>
<td>75,320</td>
<td>1,106,100</td>
<td>$6,179,707</td>
<td>$772,463</td>
<td>$0</td>
<td>$1,825,000</td>
<td>$3,582,243</td>
<td>$599,584</td>
<td>$0</td>
<td>$3,006,115</td>
</tr>
<tr>
<td>2015</td>
<td>39,030</td>
<td>573,168</td>
<td>$3,202,252</td>
<td>$400,282</td>
<td>$0</td>
<td>$10,000</td>
<td>$2,791,971</td>
<td>$262,414</td>
<td>$0</td>
<td>$2,084,467</td>
</tr>
<tr>
<td>2016</td>
<td>26,339</td>
<td>386,802</td>
<td>$2,161,039</td>
<td>$270,130</td>
<td>$0</td>
<td>$10,000</td>
<td>$1,880,909</td>
<td>$149,569</td>
<td>$0</td>
<td>$1,249,354</td>
</tr>
<tr>
<td>2017</td>
<td>19,876</td>
<td>291,893</td>
<td>$1,630,788</td>
<td>$203,848</td>
<td>$0</td>
<td>$10,000</td>
<td>$1,416,939</td>
<td>$95,329</td>
<td>$0</td>
<td>$837,342</td>
</tr>
<tr>
<td>2018</td>
<td>15,960</td>
<td>234,383</td>
<td>$1,309,482</td>
<td>$163,685</td>
<td>$0</td>
<td>$10,000</td>
<td>$1,135,797</td>
<td>$64,651</td>
<td>$0</td>
<td>$597,153</td>
</tr>
<tr>
<td>2019</td>
<td>13,333</td>
<td>195,805</td>
<td>$1,093,947</td>
<td>$136,743</td>
<td>$0</td>
<td>$10,000</td>
<td>$947,204</td>
<td>$45,616</td>
<td>$0</td>
<td>$443,060</td>
</tr>
<tr>
<td>2020</td>
<td>11,449</td>
<td>168,131</td>
<td>$939,336</td>
<td>$117,417</td>
<td>$0</td>
<td>$10,000</td>
<td>$811,919</td>
<td>$33,082</td>
<td>$0</td>
<td>$337,882</td>
</tr>
<tr>
<td>2021</td>
<td>10,031</td>
<td>147,311</td>
<td>$823,017</td>
<td>$102,877</td>
<td>$0</td>
<td>$10,000</td>
<td>$710,140</td>
<td>$24,481</td>
<td>$0</td>
<td>$262,924</td>
</tr>
<tr>
<td>2022</td>
<td>8,926</td>
<td>131,079</td>
<td>$732,332</td>
<td>$91,541</td>
<td>$0</td>
<td>$10,000</td>
<td>$630,790</td>
<td>$18,398</td>
<td>$0</td>
<td>$207,781</td>
</tr>
<tr>
<td>2023</td>
<td>8,040</td>
<td>118,070</td>
<td>$659,647</td>
<td>$82,456</td>
<td>$0</td>
<td>$10,000</td>
<td>$567,191</td>
<td>$13,997</td>
<td>$0</td>
<td>$166,220</td>
</tr>
<tr>
<td>2024</td>
<td>7,314</td>
<td>107,409</td>
<td>$600,088</td>
<td>$75,011</td>
<td>$0</td>
<td>$10,000</td>
<td>$515,077</td>
<td>$10,754</td>
<td>$0</td>
<td>$134,295</td>
</tr>
<tr>
<td>2025</td>
<td>6,708</td>
<td>98,514</td>
<td>$550,393</td>
<td>$68,799</td>
<td>$0</td>
<td>$10,000</td>
<td>$471,594</td>
<td>$8,331</td>
<td>$0</td>
<td>$109,393</td>
</tr>
<tr>
<td>2026</td>
<td>6,195</td>
<td>90,980</td>
<td>$508,300</td>
<td>$63,537</td>
<td>$0</td>
<td>$10,000</td>
<td>$434,762</td>
<td>$6,498</td>
<td>$0</td>
<td>$89,724</td>
</tr>
<tr>
<td>2027</td>
<td>5,755</td>
<td>84,516</td>
<td>$472,187</td>
<td>$59,023</td>
<td>$0</td>
<td>$10,000</td>
<td>$403,164</td>
<td>$5,098</td>
<td>$0</td>
<td>$74,024</td>
</tr>
<tr>
<td>2028</td>
<td>5,373</td>
<td>78,910</td>
<td>$440,866</td>
<td>$55,108</td>
<td>$0</td>
<td>$10,000</td>
<td>$375,758</td>
<td>$4,020</td>
<td>$0</td>
<td>$61,380</td>
</tr>
<tr>
<td>2029</td>
<td>5,039</td>
<td>74,001</td>
<td>$413,441</td>
<td>$51,680</td>
<td>$0</td>
<td>$10,000</td>
<td>$351,761</td>
<td>$3,184</td>
<td>$0</td>
<td>$51,122</td>
</tr>
<tr>
<td>2030</td>
<td>4,744</td>
<td>69,668</td>
<td>$389,229</td>
<td>$48,654</td>
<td>$0</td>
<td>$10,000</td>
<td>$330,575</td>
<td>$2,532</td>
<td>$0</td>
<td>$42,742</td>
</tr>
<tr>
<td>2031</td>
<td>4,482</td>
<td>65,813</td>
<td>$367,695</td>
<td>$45,962</td>
<td>$0</td>
<td>$10,000</td>
<td>$311,733</td>
<td>$2,020</td>
<td>$0</td>
<td>$35,860</td>
</tr>
<tr>
<td>2032</td>
<td>4,247</td>
<td>62,363</td>
<td>$348,419</td>
<td>$43,552</td>
<td>$0</td>
<td>$10,000</td>
<td>$294,867</td>
<td>$1,617</td>
<td>$0</td>
<td>$30,177</td>
</tr>
<tr>
<td>2033</td>
<td>4,035</td>
<td>59,257</td>
<td>$331,064</td>
<td>$41,383</td>
<td>$0</td>
<td>$10,000</td>
<td>$279,681</td>
<td>$1,298</td>
<td>$0</td>
<td>$25,466</td>
</tr>
<tr>
<td>2034</td>
<td>3,844</td>
<td>56,445</td>
<td>$315,355</td>
<td>$39,419</td>
<td>$0</td>
<td>$10,000</td>
<td>$265,936</td>
<td>$1,044</td>
<td>$0</td>
<td>$21,543</td>
</tr>
<tr>
<td>2035</td>
<td>3,670</td>
<td>53,888</td>
<td>$301,070</td>
<td>$37,634</td>
<td>$0</td>
<td>$10,000</td>
<td>$253,436</td>
<td>$842</td>
<td>$0</td>
<td>$18,265</td>
</tr>
<tr>
<td>2036</td>
<td>3,511</td>
<td>51,553</td>
<td>$288,023</td>
<td>$36,003</td>
<td>$0</td>
<td>$10,000</td>
<td>$242,020</td>
<td>$680</td>
<td>$0</td>
<td>$15,518</td>
</tr>
<tr>
<td>2037</td>
<td>3,365</td>
<td>49,412</td>
<td>$276,060</td>
<td>$34,507</td>
<td>$0</td>
<td>$10,000</td>
<td>$231,552</td>
<td>$551</td>
<td>$0</td>
<td>$13,209</td>
</tr>
<tr>
<td>2038</td>
<td>3,231</td>
<td>47,441</td>
<td>$265,051</td>
<td>$33,131</td>
<td>$0</td>
<td>$10,000</td>
<td>$221,919</td>
<td>$446</td>
<td>$0</td>
<td>$11,263</td>
</tr>
<tr>
<td>2039</td>
<td>3,107</td>
<td>45,622</td>
<td>$254,886</td>
<td>$31,861</td>
<td>$0</td>
<td>$10,000</td>
<td>$213,025</td>
<td>$363</td>
<td>$0</td>
<td>$9,619</td>
</tr>
<tr>
<td>2040</td>
<td>2,992</td>
<td>43,937</td>
<td>$245,472</td>
<td>$30,684</td>
<td>$0</td>
<td>$10,000</td>
<td>$204,788</td>
<td>$295</td>
<td>$0</td>
<td>$8,227</td>
</tr>
<tr>
<td>2041</td>
<td>2,885</td>
<td>42,372</td>
<td>$236,729</td>
<td>$29,591</td>
<td>$0</td>
<td>$10,000</td>
<td>$197,138</td>
<td>$240</td>
<td>$0</td>
<td>$7,046</td>
</tr>
<tr>
<td>2042</td>
<td>2,786</td>
<td>40,915</td>
<td>$228,587</td>
<td>$28,573</td>
<td>$0</td>
<td>$10,000</td>
<td>$190,013</td>
<td>$196</td>
<td>$0</td>
<td>$6,042</td>
</tr>
<tr>
<td>2043</td>
<td>2,693</td>
<td>39,554</td>
<td>$220,986</td>
<td>$27,623</td>
<td>$0</td>
<td>$10,000</td>
<td>$183,363</td>
<td>$160</td>
<td>$0</td>
<td>$5,187</td>
</tr>
<tr>
<td>1st 15 Years</td>
<td>259,652</td>
<td>3,813,072</td>
<td>$21,303,381</td>
<td>$2,662,923</td>
<td>$0</td>
<td>$5,660,000</td>
<td>$12,980,458</td>
<td>$1,341,823</td>
<td>$0</td>
<td>$6,175,886</td>
</tr>
<tr>
<td>30 Year Total</td>
<td>314,280</td>
<td>4,615,313</td>
<td>$25,785,448</td>
<td>$3,223,181</td>
<td>$0</td>
<td>$5,810,000</td>
<td>$16,752,267</td>
<td>$1,357,290</td>
<td>$0</td>
<td>$6,477,172</td>
</tr>
</tbody>
</table>
## Single Well Value

Brought on Line Today - SWPA

<table>
<thead>
<tr>
<th>Delay Results</th>
<th>Total Prod</th>
<th>Present Worth</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3,813,072</td>
<td>$15,643,381</td>
</tr>
<tr>
<td></td>
<td>34,280</td>
<td>$7,517,709</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>Present Worth</td>
</tr>
<tr>
<td>Gross</td>
<td>$21,303,381</td>
<td>$1,341,823</td>
</tr>
<tr>
<td>Royalty</td>
<td>$2,662,923</td>
<td>$6,175,886</td>
</tr>
<tr>
<td>Working</td>
<td>$12,980,458</td>
<td>$7,517,709</td>
</tr>
<tr>
<td>Total</td>
<td>$15,643,381</td>
<td>$7,517,709</td>
</tr>
</tbody>
</table>
Single Well Value
Brought on Line 5 Years - SWPA

<table>
<thead>
<tr>
<th>Delay</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Results</td>
<td>Total</td>
</tr>
<tr>
<td>Production</td>
<td>3,813,072</td>
</tr>
<tr>
<td></td>
<td>34,280</td>
</tr>
<tr>
<td>Gross</td>
<td>$2,662,923</td>
</tr>
<tr>
<td>Royalty</td>
<td>$12,980,458</td>
</tr>
<tr>
<td>Working</td>
<td>$15,643,381</td>
</tr>
</tbody>
</table>
Vacant Land Values Higher

- Rural Property:
  - Where oil and gas is owned in fee with the surface
  - Sufficient size to develop and/or within a unit
  - Within an active or desired drilling area
  - Transient values

- 45 vacant land sales of 30 acres or more during time period
- O&G rights contributed no discernable amount to value of property

<table>
<thead>
<tr>
<th>Acres</th>
<th>WITH Gas Rights</th>
<th>NO Gas Rights</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-50</td>
<td>$2,562</td>
<td>$2,755</td>
</tr>
<tr>
<td>50-100</td>
<td>$2,131</td>
<td>$2,373</td>
</tr>
<tr>
<td>100+</td>
<td>$1,599</td>
<td>$1,461</td>
</tr>
</tbody>
</table>
Vacant Land: Bradford County

- Vacant sales after start of gas boom (2009-2012)
  - 17 vacant land sales of 30 acres or more during the time period
  - Owners started severing oil & gas rights from surface properties

Sales of vacant land without gas rights, on average, take 2 to 3 months longer to sell than sales with oil & gas rights.

Buyers paid anywhere from $2,000 to $6,000 more per acre, for properties with oil & gas rights.

The interest from Oil & Gas companies in leasing land for Shale gas exploration likely caused more severing of gas rights and less land being sold on the market.

<table>
<thead>
<tr>
<th>Acres</th>
<th>No Gas Rights</th>
<th>With Gas Rights</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-50</td>
<td>$2,755</td>
<td>$4,782</td>
</tr>
<tr>
<td>50-100</td>
<td>$2,373</td>
<td>$4,776</td>
</tr>
<tr>
<td>100+</td>
<td>$1,461</td>
<td>$7,797</td>
</tr>
</tbody>
</table>
Vacant Land: Susquehanna County

- Vacant Sales From 2012-2013
  - Gas companies focused newer efforts and activity in Susquehanna County from 2012 to Present

- 13 vacant land sales of 25 acres or more during the time period of 2012-2013

- Sales of vacant land without gas rights, on average, take over four months longer to sell than sales with oil & gas rights.

<table>
<thead>
<tr>
<th>Susquehanna Vacant Land Sales 2012 to 2013</th>
<th>No O&amp;G Rights</th>
<th>100% O&amp;G Rights</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avg Per Acre: 2012-2013</td>
<td>$2,629</td>
<td>$9,450</td>
</tr>
<tr>
<td>Avg Per Acre: 2013</td>
<td>$2,629</td>
<td>$8,147</td>
</tr>
<tr>
<td>Avg Days on Market (DOM)</td>
<td>206</td>
<td>64</td>
</tr>
<tr>
<td>List Price to Sales Price</td>
<td>-10%</td>
<td>-4%</td>
</tr>
<tr>
<td>Gas Rights with Existing Lease</td>
<td>na</td>
<td>$7,927</td>
</tr>
<tr>
<td>Gas Rights without Existing Lease</td>
<td>na</td>
<td>$10,527</td>
</tr>
</tbody>
</table>
Vacant Land in Southwest Pa
Greene County / Washington County

- **Greene County:**
  - 16 sales over 100 acres
  - $2,000 to $3,000 more per acre if gas rights are included
  - 200 - 300% of transaction value related to gas rights
  - Before 2007 there was no discernable difference

- **Washington County**
  - Poor sales records
  - Assessment office personnel have observed $3,000 to $5,000 per acre difference between large lot vacant land sales with gas and those without gas rights since 2008
Vacant Land Values: Transient
Case in Point
Two Views: IRS/Taxpayer

- **Estate:** Surface and subsurface, less timber

- **Date of Transaction:**
  - Completed: March 2008
  - Recorded: June 2008

- **Size (multiple adjacent tracts):**
  - Surface: 9,000
  - Sub surface: 7,500

- **Title Issues:** some prior old prior claims on Oil and gas (up to 50% on some oil and gas)

- **Value Issues:** Fee Estate
  - Surface, less timber
    - Subject to wind farm lease
  - Subsurface subject to potential oil and gas lease
    - leased after transaction before recordation
    - No wells, no permits by recordation date

- **IRS Valuation:** $ 28,000,000
- **RTC Valuation:** $ 4,600,000
Case in Point
Two Views: IRS/Taxpayer

- **IRS Value**: $28,000,000 based on sum of:
  - Land Values
    - Comp Sales
  - Present worth of Wind farm lease payments
    - Signing lease and future rents/royalties
  - Gas Value
    - Lease Bonus Values
      - (County search after transaction before recordation)
    - Present worth of potential gas royalty income
      - established leases, assumed full development
Subject Property

7,500 ± acres

Transaction: March 2008
Recordation: June 2008
Title Issues: Contested, Prior claims
Quiet Title Action
Case in Point
Two Views: Gas Estate

**IRS**
- Used all Acreage
- Used High Values
  - Bonus $2,500/acre
  - Royalty value at 16%
  - **Countywide** pattern of leases increases after March Transaction
- Assumed large property could demand favorable terms
- Assumed full development
  - Entire property drilled +-80 wells
  - full production within 5 +- years
- Valued at:
  - $2,600 per acre
  - $25,000,000

**RTC View**
- Used acreage with more certain ownership
- Unlikely to be leased at high value
  - Bonus at $500/acre
  - Royalty at 12.5%
  - Local pattern of leases 6 months prior to transaction
- No bargaining power related to size without consideration of location
- Unlikely to be developed soon
  - Only minimal well drilled to hold lease
  - Unlikely to ever see full production
- Value at:
  - $500/acre
  - $3,700,000
Appraisal Assignment
Retrospective Appraisal: Oil/Gas

- 7,500 total acres (not leased at date of transaction) (6,000 acres of more certain ownership but still with cloud on portion of title)
- Located:
  - South-central part of County, northeastern Pennsylvania
  - Within 20 miles north of southern Marcellus crop
- Regional Production
  - No drilling or production within 10 miles prior to 2008
  - Some successful drilling 25 miles to the north / none to south or east
- Closest pipeline 30 miles north and 15 miles south
- Lease activity:
  - High Bonus amounts in county to the north
  - Modest bonuses in central portion of county unless “tied” to large transaction with most acres to north
  - Non-existent in county to the south
- Informal negotiation was going on between transaction date and recording date at a reported $1,500 per acre bonus
- Lease survey:
  - Sources:
    - 50+- leases in county, court house, door to door, and phone calls
    - Semi-monthly lease reporter
    - Other clients
  - Results
    - $50 to $3,000 per acre bonus, depending on date and location
    - 12.5% to 20% royalty, depending on date and location
RTC Valuation Factors

- **Likelihood of development**
  - Absorption (Development Schedule)
  - Acres of resource
  - Acres of subject property
  - Market for gas (Supply/Demand)
  - Access to market/proximity to pipelines
  - Active rigs
  - Lease Control/Owneership
  - Third party lease
  - Active company
  - Pooling practice

- **Reserve Type**
  - Proven
  - Probable
  - Possible/Speculative

- **Volumetric Adjustments**
  - Typical well
  - Nearby well performance
  - Wet vs. dry
  - Property utilization

- **Market**
  - Price
  - Consumption
  - Timing
  - Accessibility to market
  - Pipelines
  - Capital investments
    - Plants
    - Compressors

- **Capital Investment**

- **Cost to Produce**
  - Acquisition
  - Development
  - Operating/Process
  - Sales

- **Discount Rate**
  - Producer (Lessee) vs.
  - Land Owner (Lessor)
All Producing Wells Through 12/2007
Regional Local Examination
Reserve Classifications

- **IRS**
  - Proven Reserves
  - Probable Reserves
  - Possible Reserves
  - Property
    - Recoverable Reserves

- **Geophysical**
  - Proven Reserves
  - Probable Reserves
  - Possible Reserves
  - Speculative Reserves
Reserve Designation Reality Check

- Proven Reserves
  - Field development
  - Single to two offsets

- Probable Reserves
  - Field expansion (Step-out with excellent geology)

- Possible Reserves
  - Big step with excellent geology and solid play

- Speculative
  - Wild Cat
Well Spacing / Offset Interpretation:
Well Spacing / Offset Interpretation:
Well Spacing / Offset Interpretation:
Leasing Activity ~ Prior to 2008
Leasing Activity ~ Early 2008
### Exhibit 14: Summary of Lease Data

<table>
<thead>
<tr>
<th>Date</th>
<th>Company</th>
<th>Township</th>
<th>Acreage</th>
<th>Royalty</th>
<th>Term (Yr.)</th>
<th>Extension Payment/ac (+5 yrs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/3/2007</td>
<td>Magnum Land Services</td>
<td>Eaton/Tunkhannock</td>
<td>503.26</td>
<td>0.125</td>
<td>5</td>
<td>75</td>
</tr>
<tr>
<td>9/2/2007</td>
<td>Magnum Land Services</td>
<td>Eaton/Lebanon</td>
<td>41.05</td>
<td>0.125</td>
<td>5</td>
<td>175</td>
</tr>
<tr>
<td>10/2/2007</td>
<td>Chesapeake</td>
<td>Eaton</td>
<td>89.47</td>
<td>0.125</td>
<td>10</td>
<td>-</td>
</tr>
<tr>
<td>11/6/2007</td>
<td>Magnum Land Services</td>
<td>Eaton</td>
<td>180.00</td>
<td>0.15</td>
<td>7</td>
<td>-</td>
</tr>
<tr>
<td>11/7/2007</td>
<td>Magnum Land Services</td>
<td>Eaton/Lebanon</td>
<td>42.38</td>
<td>0.125</td>
<td>5</td>
<td>125</td>
</tr>
<tr>
<td>11/18/2007</td>
<td>Magnum Land Services</td>
<td>Eaton</td>
<td>61.00</td>
<td>0.15</td>
<td>7</td>
<td>-</td>
</tr>
<tr>
<td>12/14/2007</td>
<td>Magnum Land Services</td>
<td>Eaton/Lebanon</td>
<td>75.47</td>
<td>0.15</td>
<td>7</td>
<td>-</td>
</tr>
<tr>
<td>12/15/2007</td>
<td>Magnum Land Services</td>
<td>Eaton</td>
<td>66.68</td>
<td>0.15</td>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td>12/16/2007</td>
<td>Magnum Land Services</td>
<td>Eaton/Lebanon</td>
<td>22.09</td>
<td>0.15</td>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td>12/17/2007</td>
<td>Magnum Land Services</td>
<td>Eaton/Lebanon</td>
<td>25.23</td>
<td>0.15</td>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td>12/18/2007</td>
<td>Magnum Land Services</td>
<td>Eaton/Lebanon</td>
<td>93.96</td>
<td>0.15</td>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td>12/19/2007</td>
<td>Magnum Land Services</td>
<td>Eaton/Lebanon</td>
<td>61.00</td>
<td>0.15</td>
<td>7</td>
<td>-</td>
</tr>
<tr>
<td>12/20/2007</td>
<td>Magnum Land Services</td>
<td>Eaton/Lebanon</td>
<td>75.47</td>
<td>0.15</td>
<td>7</td>
<td>-</td>
</tr>
<tr>
<td>12/21/2007</td>
<td>Magnum Land Services</td>
<td>Eaton/Lebanon</td>
<td>66.68</td>
<td>0.15</td>
<td>5</td>
<td>-</td>
</tr>
</tbody>
</table>
Company Activity Map

Active Companies - April 2013
- ALPH SHALE RES LP
- AMER NATURAL RESOURCES LLC / AMER OIL & GAS LLC
- ANADARKO EP ONSHORE LLC
- BURNETT OIL CO INC
- CABOT OIL & GAS CORP
- CARRIZO MARCELLUS LLC
- CHEVRON APPALACHIA LLC
- CHEVRON APPALACHIA LLC / ATLAS RESOURCES INC
- CHEIF OIL & GAS LLC
- CITRUS ENERGY CORP
- CNX GAS LLC
- CONSOL GAS CO
- EQT RESOURCES INC
- EQT PRODUCTION CO
- EXCO RESOURCES PA INC
- EXCO RESOURCES PA LLC
- HALCON OIL INC
- HILCORP ENERGY CO
- HUNT MARCELLUS OPERATING CO LLC
- INFLATION ENERGY LLC
- INFLATION ENERGY LLC
- RANGE RESOURCES APPALACHIA LLC
- RE GAS DEV LLC / REX ENERGY OPERATING CORP
- RICE DRILLING LLC
- SENNECA RESOURCES CORP
- SOUTHWESTERN ENERGY PROD CO
- STONE ENERGY CORP
- SWEPF EAST RESOURCES
- TAUSMANN ENERGY USA INC
- TENASKA RES LLC
- ULTRA RESOURCES INC
- WYX ENERGY APPALACHIA LLC
- XTO ENERGY INC
Marcellus Shale (PA Only)
18.3 Million Acres

Core Area (PA only)
12.8 Million Acres

12,800,000 acres
80 acres per well
85% efficiency of development
75 rigs
15 wells/ year/rig
120 years to fully develop
Table 3.4-2 Active Companies: 2006 Through January 31, 2010

<table>
<thead>
<tr>
<th>Company</th>
<th>Bradford</th>
<th>Lackawanna</th>
<th>Lycoming</th>
<th>Sullivan</th>
<th>Susquehanna</th>
<th>Tioga</th>
<th>Wayne</th>
<th>Wyoming</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allegheny Gas Company</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Alta Opr Co</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>16</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Anadarko E&amp;P</td>
<td>0</td>
<td>0</td>
<td>26</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Cabot Oil &amp; Gas</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>138</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Central New York Oil &amp; Gas Co</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Chesapeake Appalachia</td>
<td>273</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>44</td>
<td>0</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Chief Oil &amp; Gas</td>
<td>14</td>
<td>0</td>
<td>29</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Citrus Energy Corp</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Dominion Trans</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>East Resources</td>
<td>5</td>
<td>0</td>
<td>14</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>221</td>
<td>0</td>
</tr>
<tr>
<td>Enervest Opr</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>EOG Resources</td>
<td>26</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>EXCO North Coast Energy</td>
<td>0</td>
<td>28</td>
<td>6</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Fortuna Energy</td>
<td>197</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>64</td>
<td>0</td>
</tr>
<tr>
<td>Novus Operating</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>PA Gen Energy Co</td>
<td>0</td>
<td>0</td>
<td>16</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Penn Virginia Oil &amp; Gas</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Pennswood Oil &amp; Gas</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Range Resources Appalachia</td>
<td>5</td>
<td>0</td>
<td>88</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Rice Drilling</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Schrader</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Seneca Resources</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>31</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Southwestern Energy Production</td>
<td>10</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Stone Energy</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Turm Oil, Inc.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>30</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Ultra Resources</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>53</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>VAVCO</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Victory Energy</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>XTO Energy</td>
<td>0</td>
<td>0</td>
<td>12</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Total Permitted Sites: 546
Total Active Rigs - Feb. 1, 2010: 16
### Regional Activity

#### “Absorption Rates”

<table>
<thead>
<tr>
<th>COUNTY</th>
<th>AC. PRIME MARCELLUS</th>
<th>MAX WELLS @ 80 ACRES</th>
<th>No. OF RIGS JAN</th>
<th>MAX No. RIGS</th>
<th>12 WELLS/YR/Year</th>
<th>AC. DRILLED/YR AT AC SPACING</th>
<th>% OF CTY DRILLED ANNUALY</th>
<th>YRS TO DRILL COUNTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>PENNSYLVANIA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BRADFORD</td>
<td>743,258</td>
<td>9,291</td>
<td>13</td>
<td>15</td>
<td>180</td>
<td>14,400</td>
<td>1.94%</td>
<td>52</td>
</tr>
<tr>
<td>CENTRE</td>
<td>285,379</td>
<td>3,567</td>
<td>2</td>
<td>3</td>
<td>36</td>
<td>2,880</td>
<td>1.01%</td>
<td>99</td>
</tr>
<tr>
<td>CLINTON</td>
<td>343,103</td>
<td>4,289</td>
<td>1</td>
<td>2</td>
<td>24</td>
<td>1,920</td>
<td>0.56%</td>
<td>179</td>
</tr>
<tr>
<td>LACKAWANNA</td>
<td>297,684</td>
<td>3,721</td>
<td>2</td>
<td>2</td>
<td>24</td>
<td>1,920</td>
<td>0.64%</td>
<td>155</td>
</tr>
<tr>
<td>LYCOMING</td>
<td>557,437</td>
<td>6,968</td>
<td>4</td>
<td>5</td>
<td>60</td>
<td>4,800</td>
<td>0.86%</td>
<td>116</td>
</tr>
<tr>
<td>LUZERNE</td>
<td>174,002</td>
<td>2,175</td>
<td>4</td>
<td>5</td>
<td>60</td>
<td>4,800</td>
<td>2.76%</td>
<td>36</td>
</tr>
<tr>
<td>POTTER</td>
<td>692,659</td>
<td>8,658</td>
<td>1</td>
<td>2</td>
<td>24</td>
<td>1,920</td>
<td>0.28%</td>
<td>361</td>
</tr>
<tr>
<td>SULLIVAN</td>
<td>289,441</td>
<td>3,618</td>
<td>0</td>
<td>2</td>
<td>24</td>
<td>1,920</td>
<td>0.66%</td>
<td>151</td>
</tr>
<tr>
<td>SUSQUEHANNA</td>
<td>521,396</td>
<td>7,161</td>
<td>1</td>
<td>1</td>
<td>15</td>
<td>14,400</td>
<td>1.35%</td>
<td>37</td>
</tr>
<tr>
<td>TIOGA</td>
<td>727,840</td>
<td>9,008</td>
<td>6</td>
<td>8</td>
<td>96</td>
<td>7,680</td>
<td>1.06%</td>
<td>95</td>
</tr>
<tr>
<td>WAYNE</td>
<td>288,318</td>
<td>3,604</td>
<td>0</td>
<td>2</td>
<td>24</td>
<td>1,920</td>
<td>0.67%</td>
<td>150</td>
</tr>
<tr>
<td>WYOMING</td>
<td>259,270</td>
<td>3,241</td>
<td>1</td>
<td>2</td>
<td>24</td>
<td>1,920</td>
<td>0.74%</td>
<td>135</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5,191,227</td>
<td>64,890</td>
<td>47</td>
<td>63</td>
<td>756</td>
<td>60,480</td>
<td>1.17%</td>
<td>86</td>
</tr>
</tbody>
</table>
Development of a 7,500 acre area across Pennsylvania

2007 JAN – DEC Unconventional Wells
7,500 Acre Grid Analysis
Development of a 7,500 acre area across Pennsylvania

2007 JAN – 2008 JUN Unconventional Wells
7,500 Acre Grid Analysis
Development of a 7,500 acre area across Pennsylvania

2007 JAN – 2008 DEC Unconventional Wells
7,500 Acre Grid Analysis
Development of a 7,500 acre area across Pennsylvania

2007 JAN – 2009 JUN Unconventional Wells
7,500 Acre Grid Analysis
Development of a 7,500 acre area across Pennsylvania

2007 JAN – 2009 DEC Unconventional Wells
7,500 Acre Grid Analysis
Development of a 7,500 acre area across Pennsylvania

2007 JAN – 2010 JUN Unconventional Wells
7,500 Acre Grid Analysis

7,500 Acre Grid
Marcellus Core
13 to 38 (24)
5 to 13 (62)
2 to 5 (115)
1 to 2 (138)
0 to 1 (1577)

Marcellus Core 2012
Region

Major Gas Lines
Line
PA Counties
Region
Development of a 7,500 acre area across Pennsylvania

2007 JAN – 2010 DEC Unconventional Wells
7,500 Acre Grid Analysis
Development of a 7,500 acre area across Pennsylvania

2007 JAN – 2011 JUN Unconventional Wells
7,500 Acre Grid Analysis
Development of a 7,500 acre area across Pennsylvania

2007 JAN – 2011 DEC Unconventional Wells
7,500 Acre Grid Analysis
Development of a 7,500 acre area across Pennsylvania

2007 JAN – 2012 JUN Unconventional Wells
7,500 Acre Grid Analysis
Development of a 7,500 Acre Area Across Pennsylvania

2007 JAN – 2012 DEC Unconventional Wells
7,500 Acre Grid Analysis
Development of a 7,500 acre area across Pennsylvania
Subsequent Facts 2012

- **South of property:**
  - Three nearby wells drilled on leases to the south abandoned
  - No new leases signed south of property since 2010

- **North of property**
  - Wells 15 to 30 miles north of property have been successfully drilled
  - Lease bonus values to the north continued to climb through 2010

- No additional drilling on or near property since 2008
Discount Rate
Producer vs. Land Owner
Who has more risk associated with their income?

In a field development scenario, the producer/developer continues to drill so that the company can maintain or increase production.

**Problem #1:**
As older wells de-pressure through production over time, newer wells will dominate the system. This will prematurely decrease production levels from older wells, lowering the land owners income while the overall system maintains or increases total production.

**Problem #2:**
If petroleum prices falter, wells can be shut in for the benefit of the producer, decreasing income to the land owner to a bare minimum.

**Problem #3:**
Pooling and the production unit designation and drilling pattern.
Discount Rates

Producer
- 12- 14%
- Based on S & P, Ibbotson, and Morningstar surveys of Weighted Average Cost of Capital for Oil and Gas Producers
- Risk related to:
  - Development costs
  - Market changes
- Rate would be higher in a “wildcat” situation

Royalty owner
- 16 – 18%
- 40 to 50 % higher than producer
- No control
  - Income at “mercy” of producer. Many wells currently shut-in or “squeezed-off”
- Risks related to Market
Valuation Factors Used

- **Likelihood of development**
  - Absorption (Development Schedule)
  - Acres of resource
  - Acres of subject property
  - Market for gas (Supply/Demand)
  - Access to market/proximity to pipelines
  - Active rigs
  - Lease Control/Ownership
  - Third party lease
  - Active company
  - Pooling practice

- **Reserve Type**
  - Proven
  - Probable
  - Possible/Speculative

- **Volumetric Adjustments**
  - Typical well
    - Nearby well performance
    - Wet vs. dry
  - Property utilization

- **Market**
  - Price
  - Consumption
  - Timing
  - Accessibility to market
  - Pipelines
  - Capital investments
    - Plants
    - Compressors

- **Capital Investment**

- **Cost to Produce**
  - Acquisition
  - Development
  - Operating/Process
  - Sales

- **Discount Rate**
  - Producer (Lessee) vs. Land Owner (Lessor)
Case in Point
Outcome Gas Estate

RTC procedures accepted, Defendants dates rejected

Value at +- $12,000,000

- Bonus at $1400/acre
  - Based of Recordation
  - Local pattern of leases following transaction and before recording date
  - Effected by cloud on title (50%)

- Perspective Income at $1,500,000
  - Based on unlikely to be developed soon
  - Only minimal well drilled to hold lease
  - High discount rate
  - Unlikely to ever see full production

Lessons Learned

- Dates Matter:
  - Gas Lease signed after transaction before recording
  - Comparable “Sales” of contemporaneous date
  - Geology must be considered

- Likelihood of Development Matters
  - Rate of absorption or development is important
  - Discount rates should match risk and circumstances

- Adjustments for reality:
  - Gas lease subsequently found defective because of title issues – discounted heavily
Case in Point: Conclusion
Total: Oil/Gas, Surface less timber with Wind farm

Value at +- $14,350,000

- **Oil/Gas: +/- $12,000,000**
  - Bonus: $1400/Acre: $10,500,000
  - Production $200/Acre: $1,500,000

- **Surface: +/- $2,350,000**
  - Land with no timber rights in perpetuity: $750,000
    - $50 to $100 per acre
  - Speculative Wind farm: +/-$1,600,000,
    - No income
    - No development

Source

- Comp Leases
  - date specific
  - Discounted for title issues
  - Adjusted for location

- Income Approach
  - applied to speculative/possible reserves
  - Discount rate appropriate to risk and timing

- Comp Sales
  - Less Timber
  - Less control

- Capitalized Hunting lease

- Discussion with Wind developer
  - Likelihood of Development Matters
  - Rate of absorption or development is important
Gas Activities Effect On Housing And Commercial Values

- Value Increases
- Value Decrease
- Timing and Location
Boom to Bust

Nov 1865
Production peaks and oil price drops to $4.50 a barrel.

Boom to Bust

Pithole City
Site of oil boom town of 15,000. Established in 1865, a ghost town by 1868.

Administered by the Pennsylvania Historical and Museum Commission
Trends in “Higher” Value

Housing demand:
- Temporary demand
  - During intense drilling /development period
    - After leases are “held” by drilling value to return
      - temporary housing demand diminished
  - Tends to affect the marginal properties (rentals, ‘disposables’)
  - Rents up / rents down
  - Can result in development of “marginal” motels etc.

Sustained housing demand
- Area has significant infrastructure development
- Serves as a headquarters or staging area
- More permanent development
  - New structures
  - Higher value development
Trends in “Higher” Value Boom Time Examples

- Housing shortage in Greene County
  - population +-35,000
- Farmers leasing space for camper trailers at $500 to $600/month
- All the 5 motels are fully occupied
  - Prior to gas 2 existing motels maintained occupancy at 60+%  
  - After gas development:  
    - two new ones opened this past year
    - third under construction
- Common Level Ratio:
  - 2004: 88.7
  - 2007: 86.4
  - 2010: 84.8
  - 2013: 71.1
Trends in “Higher” Value Boom Time Examples

- **Williamsport area**
  - Rural Areas: Shortage of Rental Units, very few occupied land transfers, prices up and rental rates up (Bradford, Susquehanna, Lycoming, Greene, rural parts of Washington)
  - Urban areas: More readily cope with surges in demand, demand while higher mimics normal market
  - Affluent areas; not interested in renting

- see Jonathan Williamson, Ph.D., Marcellus Natural Gas Developments Effect on Housing in Pennsylvania (2011)
Negative Effects on Value

- Appears to be related to both time and location; a portion of loss based on perception
  - while drilling is active value decrease because of nuisance and fear or perception of impact
  - Amount of diminished value related to well water dependent vs. public water
  - Nearness of well

- There is some recovery in value within 6 months of drilling (no water loss, nuisance minimized)
  - Properties with public water experienced little value decrease, except during drilling period

See: Washington County PA Study 2012, Klaiber and Gopalakrishnan
Negative Effects on Value

- Value of groundwater-dependent homes is negatively affected by nearby shale gas development.

- Homes dependent on piped water appeared to receive small benefits from that development -- drilling increases property values, likely through the boost to the local economy of increased activity.

- Wells permitted for more than a year but not yet drilled have a negative effect on property values that is larger than the positive effect from drilling in general.
  - Permitted, undrilled wells still creating a disamenity through the clearing of land, but could also be from a drop in expectations.
  - The expectation of damage is usually greater than actual effect.

Market Externalities
Always Effect Somebody

- Who
- When
- Where
- How Long
“The Plaintiffs have no adequate remedy at law for the injuries just described. The injuries and losses are continuing. The property and rights owned by Plaintiffs are unique and irreplaceable so that it will be impossible to measure accurately in monetary terms the damages caused…”

From a lawsuit filed by Exxon CEO Rex Tillerson and former Republican U.S. House Majority Leader Dick Armey to stop construction of a water tower that the complaint says will be used to support fracking near his horse ranch outside Dallas.

Where do we go from here?

- Questions?

- Contact:
  - J. R. Kern, ASA
  - Jeffrey R. Kern
  - Resource Technologies Corporation (RTC)
  - [www.resourcetec.com](http://www.resourcetec.com)
  - PO Box 242
  - State College, PA, 16801
  - [jrkern@resourcetec.com](mailto:jrkern@resourcetec.com)
  - 814 237 4009