Scientists Working To Harness Energy Produced By Intense Fracking Debates
The Fracking Debate

1. Introduction
2. What is Fracking?
3. Does Fracking Contaminate Water?
4. Will Fracking Make Me Sick?
5. Does Fracking Cause Earthquakes?
6. Is There Any Regulation on Fracking?
7. Is Fracking Good or Bad for Climate Change?
8. Will Fracking Make the US Energy Independent?
9. Is Fracking Good for the Economy?
10. Will Fracking Spread Around the World?
11. Do People Living Near Fracking Love it or Hate it?
12. What's Next?
Map source: Drilling Info. Map shows all directionally and horizontally drilled wells. Data not available for Alaska.
Source rock
U.S. Natural Gas Production (trillion cubic feet per year)

Data source: U.S. EIA. Note: Shale production available only from 1/2007.
U.S. Crude Oil Production (million barrels per day)

Data source: U.S. EIA. Note: Tight oil production only available from 1/2000.
Marcellus Shale, Pennsylvania
Washington County, PA
Shale wells drilled and “stray gas” cases in Pennsylvania

<table>
<thead>
<tr>
<th>Year</th>
<th>New shale wells</th>
<th>New stray gas cases from shale wells</th>
<th>New stray gas cases per shale well</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>1,600</td>
<td>12</td>
<td>0.75%</td>
</tr>
<tr>
<td>2011</td>
<td>1,957</td>
<td>9</td>
<td>0.46%</td>
</tr>
<tr>
<td>2012</td>
<td>1,352</td>
<td>7</td>
<td>0.52%</td>
</tr>
<tr>
<td>2013</td>
<td>1,215</td>
<td>5</td>
<td>0.41%</td>
</tr>
<tr>
<td>2014</td>
<td>1,372</td>
<td>5</td>
<td>0.36%</td>
</tr>
<tr>
<td>2015</td>
<td>785</td>
<td>0</td>
<td>0.00%</td>
</tr>
</tbody>
</table>

Economic impacts of shale gas development in Pennsylvania

<table>
<thead>
<tr>
<th>Change from 2007 - 2010</th>
<th>No Marcellus wells</th>
<th>Most Marcellus wells</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rents, royalties, copyrights</td>
<td>+15%</td>
<td>+461%</td>
</tr>
<tr>
<td>Business net profits</td>
<td>-5%</td>
<td>+14%</td>
</tr>
<tr>
<td>Total taxable income</td>
<td>-8%</td>
<td>+6%</td>
</tr>
<tr>
<td>Wages &amp; salaries</td>
<td>-3%</td>
<td>+2%</td>
</tr>
<tr>
<td>Total employment</td>
<td>-3%</td>
<td>+1%</td>
</tr>
</tbody>
</table>

Data sources: Kelsey and Hardy (2015), Hardy and Kelsey (2015)
Permian Basin, Texas
Public perception in a Colorado context
The Front Range ain’t West Texas

Source: High Country News
Public perception: The Colorado context

- Colorado is perhaps the state with the most contentious debate over “fracking”
  - Dense population in close proximity to production
- There have been several focusing events
  - Local bans, Firestone, and others
- Many residents come for the natural amenities
  - Living near production may be unexpected
- The economy is healthy and diverse, especially along the Front Range
  - Residents may ask: do we “need” oil and gas production to support the economy?
Key concerns

- Quality of life impacts
  - Noise, light, traffic
- Environmental impacts
  - Climate change is at the forefront
- Local health impacts
  - Research in this area continues to develop
  - Regardless, local concerns are likely to persist
What next?

• Colorado is already a leader on stakeholder engagement
• But disputes over development are not going to go way, especially along the Front Range
• There are two models that operators and regulators could follow:
The “head down” model

- This model has been the default approach for many in industry and policymaking
- But this approach does not engage the full range of stakeholders

Identify technical task

Execute technical task

Done!
The “heads up” model

- Engaging with a broader range of stakeholders can be frustrating and time-intensive
- Two-way communication is difficult, but essential
The “heads up” model, simplified:
Thank You

Daniel Raimi
Senior Research Associate, Resources for the Future
raimi@rff.org
Lecturer,
Univ. of Michigan Ford School of Public Policy
Faculty Affiliate,
Univ. of Michigan Energy Institute

Learn more
www.thefrackingdebate.com

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