Local, Regional, and State Government Perspectives on Hydraulic Fracturing-Related Oil and Gas Development

Full Report

By Samuel Gallaher

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Extended Summary

By Samuel Gallaher
PhD Student at the School of Public Affairs, University of Colorado Denver
Graduate Research Fellow at the Buechner Institute for Governance

Acknowledgements

The investigator would like to thank The Wirth Chair in Sustainable Development and the Colorado Energy Group, Inc. for their consultation in creating the survey and comments on initial drafts of the report. The National League of Cities and the National Association of Regional Councils (NARC) for support in the distribution of the survey. Additional thanks to NARC for providing initial information on regional issues and access to meeting notes. Jennifer Kagan for commenting on initial drafts. Finally, thanks to the Buechner Institute for Governance and Dr. Brian J. Gerber for support and general guidance throughout the research endeavor.

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INTRODUCTION

The United States is in the midst of an extraordinary oil and natural gas development boom. The use of hydraulic fracturing and horizontal drilling (referred in this pilot study to as fracking-inclusive development) has opened numerous shale and other porous formations to oil and gas development in nearly every region of the continent (U.S. Geological Survey, 2013). Reserves lay underneath rural and metropolitan areas alike. The Energy Policy Act of 2005 signaled the beginning of a national focus on hydraulic fracturing regulation. In 2007, states with fracking-inclusive development began updating their rules and regulations to address hydraulic fracturing related technologies and processes (Colorado Oil and Gas Conservation Commission, 2008; Railroad Commission of Texas, 2006; Railroad Commission of Texas, 2007). As the oil and gas boom gained momentum, and moved into populated areas unfamiliar to development activity, a national debate ensued over the costs and benefits of fracking-inclusive development. Potential benefits of developing the oil and gas reserves include multi-billions of dollars to industry, individuals, and governments; U.S. oil independence; and employing the natural gas as a bridge fuel between gasoline and renewable resources (Congressional Research Service, 2012). Common concerns heard nation-wide include ground and surface water contamination, air pollution, and surface degradation (Congressional Research Service, 2012; Congressional Research Service, 2009). At the local level, the debate over costs and benefits of fracking-inclusive development is more nuanced (Rodgers, Fogle, Kelsey, Lembeck, Pifer, Whitmer, and Wulfhorst, 2008; Anderson and Theodori, 2009).

Core management of oil and gas development issues is the responsibility of local governments, however because oil and gas plays span jurisdictions, both local and regional perspectives are needed. Industry will inevitably move through communities as new oil and gas reserves are discovered, developed, and depleted. What is left in the wake of development is uncertain. Empirical evidence shown in this report and anecdotal evidence from the disputes between local and state governments around the country indicate great care and research is needed to find mutually beneficial policies for communities and industry.

Previous studies by the Community & Regional Development Institute at Cornell and Pennsylvania State University's Marcellus Education Team and our initial discussions with the National Association of Regional Council (NARC) staff indicate multiple areas of local concern (Christopherson and Rightor, 2011; Rogers et al., 2008). These include boom-and-bust economic cycles; local wealth capture issues such as training the local workforce for employment in the oil and gas industry; housing, social service, and public school needs for a rapidly-expanded population; public safety and nuisances from increased truck traffic and drill sight operations; emergency management at the drill site; environmental concerns such as air quality, water use, and water contamination; surface damage and reclamation from road use, erosion, pipelines, and drill pads; land use issues such as setbacks, zoning, surface rights; and informing and working with the public and industry to develop mutually beneficial policy solutions or agreements. Because local governments vary in their regulatory structures and management experiences, not every community faces the same issues; a policy or management approach which works well for one area of the country or state may not work for another. In general, local governments and regional planning organizations are seeking help. This pilot study focusses on development-related issues from local government and regional planning organization perspectives.

ABOUT THE PILOT STUDY

Given the potential positive and negative impacts of oil and gas resource extraction on local communities, the purpose of this study is to develop a better understanding of the above issues and their potential solutions from a local and regional governance perspective. To do so we contacted local government and regional planning officials, with the aid of nationally reaching member organizations, to determine their perception of issues and management solutions, via interviews and surveys, associated with recent oil and gas development. The selection of officials was not a random probability sample. Survey and interview respondents were from a convenience sample of local and regional government representatives in Colorado, Wyoming, New Mexico, Texas, Ohio, Pennsylvania, New York, West Virginia, and North Carolina. While these states are not an exhaustive list of those with current or potential fracking-inclusive oil and gas development, they do provide an arguably national representation of oil and gas industry experiences, concerns, and regulatory approaches.

An electronic survey and semi-structured phone interviews were used to collect perspectives from local government and regional planning representatives from each selected state. The survey and phone interviews questions revolved around the above

social, economic, and environmental issues, and focused on problem perceptions of and management options for each topic. Survey responses were given on a seven-point Likert scale ranging from Strongly Agree to Strongly Disagree.

Overall, eighty-one respondents completed the forty-four question electronic survey. Survey respondents were local government representatives (67%), regional and state government representatives (23%), and members of advocacy organizations (10%). Seventy-five percent of respondents were from metropolitan areas; the remainder represented rural communities. Ninety-three percent of the responses came from five of the nine target states — North Carolina (31%), New York (26%), Wyoming (15%), Colorado (14%) and Texas (7%). New Mexico, Ohio, West Virginia, and Pennsylvania representatives made up the remaining seven percent. Finally, the respondents were divided by their state's oil and gas industry maturity. Respondents from states with a mature oil and gas industry, compared to a nascent industry, will likely have more familiarity with local and state debates, and as a result, may have better developed regulations or management strategies related to fracking-inclusive development. Thirty-eight percent of the survey respondents represented states with a mature oil and gas industry and 62% of respondents represented communities in states with a nascent oil and gas industry. Five phone interviews with with subject matter experts (SMEs) from regional planning organizations and local governments provided approximately 10 hours of contextual information about their specific experiences which the survey could not provide.

HYDRAULIC FRACTURING-RELATED DEVELOPMENT ISSUES

The following section is an executive summary of the issues addressed and description of key questions used in this research to understand local governments' and regional planning agency's perceptions of each issue. This section is followed by, key findings from the research and then a discussion of recommendations.

Short and Long-term Economic Impacts

The economic benefits of oil and gas resource extraction are incentives for local, state, and national governments to support fracking-inclusive development. Wealth capture (e.g. taxes, jobs) and boom-and-bust cycles are key topics related to local economies. Not all communities have the same wealth capture mechanisms in-place and so may experience an imbalance of benefits and costs from oil and gas development. In addition, the duration of potential economic and population growth is a local and regional concern. Localities who experience a rapid industry-driven growth in economy and population may experience an equally rapid decline in economy and population as local resources are extracted and the industry moves on (Brown et al., 2011). This is commonly referred to as a boom-and-bust cycle. We asked questions related to understand current wealth capture mechanisms and how boom-and-bust cycle concerns are impacting local government economic investment strategies. We also inquire into ways local governments are mitigating boom-and-bust cycle concerns.

Land-Use and Local Control

Fracking-inclusive development and land-use issues span environmental and economic debates. Land-use issues include road damage, road maintenance, and environmental nuisance issues (e.g. noise, light, and dust). Local control issues include property right conflicts between surface and mineral owners and jurisdictional conflicts between state, local governments, and industry. Land-use and local control issues were addressed through questions related to potential land use problems, the status quo of individual property rights and lease agreements, and potential policy solutions to reduce land-use conflicts.

Community Capacity and Social Dynamics

The potential temporary nature of fracking-inclusive development that can cause fluctuation in local economies and and population raises concerns for community planning and can disrupt local social dynamics. Furthermore, if the local population is not impacted, there may be an influx of temporary workers who stay in work camps near the wells. Additionally, there is concern about the truck traffic to and from the well negatively impacting public safety. These factors have the potential to impact housing, social services and other city services, and create animosity between residents and industry employees. This research focused on four broad areas of community capacity and dynamics. These areas were i) housing with respect to potential temporary population growth; ii) public services such as schools, social services, and police with respect to rapid increase in demand; iii) paying for increased services; and iv) integrating the new workforce into the community.

Emergency Management

Emergency response is a specific local investment and capacity issue. During different phases of the operation (i.e. drilling, fracturing, or extraction) there are numerous potential hazards. Many of these include chemicals or explosive materials that are unique to oil and gas development. Because of this, special training for the local first responders may be necessary. We asked respondents if their emergency responders have had any specific training regarding potential hazards at the well site.

Environmental Concerns

Environmental issues related to fracking-inclusive development range from air pollution and water pollution, water use and supply for fracturing, produced water treatment and storage, erosion, and noise and light pollution from well site operations. Substantiation and importance of these environmental issues is a continual, and often divisive, discussion between community members, governments, and industry representatives. We asked questions focused on the each of these with respect to the perception of the problem, the efficacy of current regulations aimed to mitigate these issues, and the source and impact of disagreements on developing policy solutions.

Information and Communication

The last issue area we focussed on is potentially the most important when it comes to developing management and policy solutions: gathering and sharing accurate and complete information and open communication between stakeholders. Policy and management discussion can be divisive; stakeholders may have been misinformed or are entrenched in particular points of view. Policy outcomes vary across municipalities and states. While any of these outcomes may be the appropriate solution for the given community, the number of disputes and lawsuits which occur afterward provide evidence that not all parties are satisfied. This research asked questions about the perceptions of the quality and level of communication public officials have with other stakeholders, the utility of public meetings to inform and gather information from the public, and the most commonly used communication tools employed by governments to inform the public about fracking-inclusive topics.

KEY SURVEY AND INTERVIEW FINDINGS

Survey responses are grouped by the respondents' geographic region, the level of government the respondent represents, if the respondent is from a rural or non-rural community, and if the respondent is from a state with a mature or nascent industry. The greatest variation in problem perception is found between local and non-local government respondents and between respondents from nascent and mature industry states; highlighting the contextual nature of issues related to hydraulic-fracturing and oil and gas development. Whether the identified variation in survey responses is due to actual differences in problem susceptibility, information, or perception; the findings point to a need for further investigation. The key findings are divided by the six issue groups described above.

Short and Long-term Economic Impacts Summary Results

Survey and SME interviews suggest local economies will be drastically impacted by fracking-inclusive development – survey responses indicate this is a greater concern for local government representatives than regional or state level respondents. Results also suggest some of the anticipated impacts are negative; there is general concern over local wealth capture and boom-and-bust cycles. Sixty-one percent of all survey respondents believe their workforce is not trained to work in oil and gas industry that uses hydraulic fracturing, and 47% of all respondents agreed that their area's tax structure is adequate for communities to benefit from the industry. Adding to this general concern, survey respondents indicate boom-and-bust cycle mitigation planning has not occurred; only thirty-one percent of respondents agreed that regional or county investment plans for income from development have been discussed to reduce boom-and-bust cycle issues.

Finally, results suggest there are large differences in problem perception between respondents from nascent and mature industry states and local and non-local government respondents. Differences in opinion between local and nonlocal governments were greatest with respect to perceptions of wealth capture capability, taxes and fees returning to local governments, investment planning for boom-bust cycles, regional energy planning importance, and local economy impacts. The largest differences between mature and nascent industry state respondents were local workforce training, wealth capture capability, investment planning for boom-bust cycles, the perception of workforce training levels, and regional energy planning importance.

Land Use Summary Results

Results suggest a general concern that development-related damage to the landscape dramatically offsets the economic benefits of shale development. Local government representatives and those from states with a nascent oil and gas industry agreed between 25 and 30 percent points more than their counterparts. One SME interviewee portrayed their road conditions were like "a third world country" due to development-related use. Another SME indicated they were required to upgrade local road to handle the trucks, but portrayed the issue positively because of the added work to the area.

Respondents from mature industry states are less confident than respondents from nascent industry states that financial bonds between town and oil and gas companies work as solution to damage issues. Furthermore, local government representatives and respondents from nascent industry states feel less comfortable with the current regulatory structures and processes related to well placement and operation times than their nonlocal government representative and mature industry state counterparts.

Finally, results suggest that individuals or governments entering into leases with oil and gas operators are not able to create contracts which provide the individual or government with the maximum benefit possible from development. Respondents from states with a mature industry and non-local government respondents agree more that the leaser knows how to devise a contract to yield the maximum benefits. Similarly, survey respondents are not confident that landowners surrounding the drill site are financially reimbursed for nuances related to oil and gas development.

Community Capacity Summary Results

Results suggest government representatives are concerned about development-related population growth having an impact on the local housing market. Within this issue Local government representatives agree over twice as often as non-local government representatives that local housing will be affected by population growth. Respondents from mature industry states are less concerned than respondents from states with a nascent industry.

There was broad consensus among respondents that local policing is needed to ensure road safety is preserved in light of increased truck traffic due to development. SMEs and survey respondents were also concerned that the wealth captured from resource extraction would not be enough to cover increased demand on schools, social services, emergency personnel and other infrastructure; though this issue is less of a concern for respondents from states with a mature oil and gas industry.

Emergency Management Summary Results

Results suggest emergency responders are not being trained for development-specific hazards ahead of industry's arrival. SME interviews, analyses of survey responses indicate regions where fracking-inclusive development is newer have less emergency management training. Results also suggest there is a disconnect in problem perception between local and non-local government representatives: Local government respondents agreed only 22% of the time compared with non-local government representatives who agreed 42% of the time that emergency responders were trained for development related hazards.

Environmental Issues Summary Results

Results suggest environmental issues such as air quality, water use and supply, and water contamination, is a concern for government representatives. Respondents from states with a nascent oil and gas industry, especially local government representatives, are more concerned than respondents from states with a mature industry and non-local government's representatives. Survey results indicate disagreements and lack of information are hampering water protection policy development at the local level more so than at the regional or state level. Similarly, states with a nascent oil and gas are more concerned than respondents from mature industry states that a lack of information about fracking-inclusive development processes is impeding water protection policy.

Communication Summary Results

Survey responses indicate that states with nascent industries lack the communication methods necessary to develop solutions to development-related concerns such as environmental quality or public safety. Local governments, especially those from states with a nascent industry believe lack of communication is a barrier to developing policy or management solutions. Results also suggest that regardless of the states' industry maturity, local governments communicate less, and are not as involved in hosting development-specific meetings as their regional planning organization and state representative counterparts.

Results also suggest public meetings, particularly meetings focused on fracking-inclusive development issues, are the most effective ways to understand community, industry, and government issues and extend information about fracking-inclusive development to stakeholders.

RECOMMENDATIONS FOR LOCAL AND STATE GOVERNMENTS AND REGIONAL PLANNING ORGANIZATIONS.

Our findings highlight the highly contextual nature of hydraulic fracturing and shale development across the United States. Local government representatives view problems differently than regional planning organization and state government representatives. Officials from metropolitan communities have different problems and understanding of fracking-inclusive policies and impacts than do officials from more rural areas. Therefore two broad recommendations are for state governments and regional planning organizations:

- Increase the number of fracking-inclusive development meetings that include multiple government, industry, and public representatives to understand local-level issues and for government representatives and agents to share management successes and failures.
- Actively seek out and engage local governments who have little or no experience in fracking-inclusive development in regional discussions with local government officials from municipalities and counties with development experience prior to industry's arrival.

Based on the survey and interview results a few specific areas of focus for state, regional and local collaboration and information sharing sessions should include:

- Protecting local economies from boom-bust-cycles through improved wealth capture mechanisms and ways in which to invest in community development opportunities and infrastructure that can support fracking-inclusive development and other local economies.
- Educating the public, particularly land and adjacent landowners of well locations, on fracking-inclusive development processes.
- Educating land and mineral owners on their legal rights when entering into lease agreements with industry.
- Revisiting water use and water contamination monitoring and protection strategies and policies.
- Revisiting air quality protection strategies and policies, especially in populated areas.

FUTURE RESEARCH

This report represents an initial exploratory study of local and regional governance issues on the topic of fracking. This is important because prior work in this area has not attempted to examine distinctions between local and regional officials, nor has there been a comprehensive review across the range of the substantive public management issues addressed here. While the small sample size and nonprobability sampling process is a limitation, the report represents an important step for further systematic, broadly-based sampling to provide additional information on these policy questions.

It is important to note that many concerns, as shown in this report, are dependent on the nature of the landscape and local geology, regulatory structure, or other factors inherently specific to the jurisdiction or location where the drilling occurs. For example, an issue which has received minimal attention and is a concern for many communities is the boom-and-bust economic cycle a municipality or county may experience through the course of fracking-inclusive development. The number of potential wells and their life cycles are finite as is the revenue captured through drilling. The more efficient a corporation is at entering an area and drilling, the more drastic impacts may be realized on revenue, roads, schools, housing, social services, job training, property values, etc.; any investment by the government or community members must take into account this life cycle and possibility of economic fluctuation. However, there are multiple factors which influence how a local government may address economic lifecycle issues, such as: state and local development regulatory structures, severance or other taxes, local political context and public opinion, impacts on other local economies, local workforce employability in industry-related jobs, or the amount and recoverability of oil and gas reserves in the area. Systematic research and collaboration between organizations and institutions will improve our understanding of these complex issues and aid in the successful regulation and management of oil and gas development.

Table of Contents

INTRODUCTION

The oil and gas industry is experiencing a revolution. New extraction methods that employ both horizontal drilling and hydraulic fracturing (referred to as fracking-inclusive development in this report) have opened vast resources of oil and gas across the United States that were previously unreachable in tight sand and shale deposits thousands of feet below the surface. Examples in the U.S. include the Eagle Ford Shale and Barnett Shale plays in Texas, the Niobrara Shale play in Colorado, the Marcellus Shale play in New York, Pennsylvania, Ohio, and West Virginia and the Bakken Formation in North Dakota. As the oil and gas industry expands its operations into these tight sand and shale deposits, it may also move into highly populated communities inexperienced with oil and gas development. As seen in public debates and newspaper reports, citizens and the local governments of communities who have not experienced the activities associated with oil and natural gas drilling and extraction are often shocked by the impact the industry has on their day-to-day lives. As a result disputes between citizens, government, and industry have sprung across the United States.

The new techniques and/or drill site locations have moved governments, community members, and industry and environmental groups into deliberations of how, where, and when to regulate the fracking-inclusive oil and gas extraction processes. Within almost every state where oil and gas reserves have been identified in shale or tight sand deposits, there are active discussions and conflicts over issues associated with the oil and gas extraction and periphery processes. State and national level debates largely hinge on the costs and benefits of fracking-inclusive development to the environment, public health and safety, and the economy. Local debates focus more closely on public safety, land-use and local control, community impacts, as well as environmental and economic concerns. Debates in some states are contentious. In Longmont, Colorado, for example, counties and municipalities are moving against state authority (Healy, 2012); in New York state-wide bans are years old and are set until further information is available (New York DEC, 2013; New York State Assembly, 2013). Even Texas, known for its oil and gas industry, has had disputes at the local level in Dallas (Mosqueda, 2013) and a brief moratorium in Flower Mound (Kofler, 2010). Bans and moratoria are often based on a lack of information regarding the impacts that hydraulic fracturing may have on local air quality, drinking water sources, and water consumption.

Even though most jurisdictions in the United States have not moved to ban fracking-inclusive oil and gas development, they are still concerned and are working to manage and find solutions with the industry and community to mitigate the negative impacts associated with the expansion of drilling operations. The majority of the states targeted in this report have some regulatory structures in place to address fracking-inclusive development with specific policies that address environment and health concerns, but they often lack policies that manage a litany of development-related issues that dramatically affect municipalities and counties. These issues include:

- Boom-and-bust economic cycles and local wealth capture mechanisms
- Housing, social service, and public school needs for a rapidly-expanded population;
- Public safety and nuisances from increased truck traffic and drill sight operations;
- Emergency management at the drill site;
- Environmental concerns such as air quality, water use, and water contamination;
- Surface damage and reclamation from roads use, erosion, pipelines, and drill pads;
- Land use issues such as setbacks, zoning, surface rights; and
- Informing and working with the public and industry to develop mutually beneficial policy solutions or agreements.

State governments and state regulatory agencies are not deliberately ignoring these issues. Rather, these issues are often under the jurisdiction of city and county governments. As such, local governments and regional planning agencies are seeking regulatory guidance.

The purposes of this pilot study and resulting report are threefold. First is to identify local and regional concerns and how those concerns vary across the United States. Second is to highlight topics for further research to help governments and

regional planning agencies develop solutions in what can turn out to be a volatile political environment. The final purpose is to provide some potential policy solutions to address these issues.

Research Approach

The researchers strategically selected states with a broad range of fracking-inclusive development experience **(see Figure 1)**. The states included Colorado, Wyoming, New Mexico, Texas, Ohio, Pennsylvania, New York, West Virginia, and North Carolina. While these states are not an exhaustive list of those with current or potential fracking-inclusive oil and gas development, they do provide breadth in oil and gas industry experience and regulatory variation. For example, at the time of the survey, North Carolina was investigating potential costs and benefits of recently discovered shale deposits with the potential of oil and gas development and were discussing lifting a *de facto* ban on hydraulic fracturing (North Carolina Department of Environment and Natural Resources and the North Carolina Department of Commerce, 2012); New York, who had begun development in the Marcellus Shale play, was in the middle of a statewide moratorium to review the State General Environmental Impact Statement (SGEIS), Colorado and Texas, states with years-long experience in hydraulic fracturing-based development, had recently begun expansion into new shale plays through the Niobrara and Eagle Ford plays, and Wyoming was reacting to studies of potential water contamination related to oil and gas development ("Environmental Protection Agency Region 8", 2013).

Within each state, the participant sample was not a random probability sample. A convenience sample of local government representatives, regional planning organizations, and state government representatives was created with the aid of two nationally reaching governance organizations. Participation requests were also passed on to acquaintances' of the initial recipient and so the actual N of the sample is unknown. This targeted approach gave the pilot study a wide range of experience and perceptions to enable a high level of understanding of the variation of concerns across the United States and different levels of government.

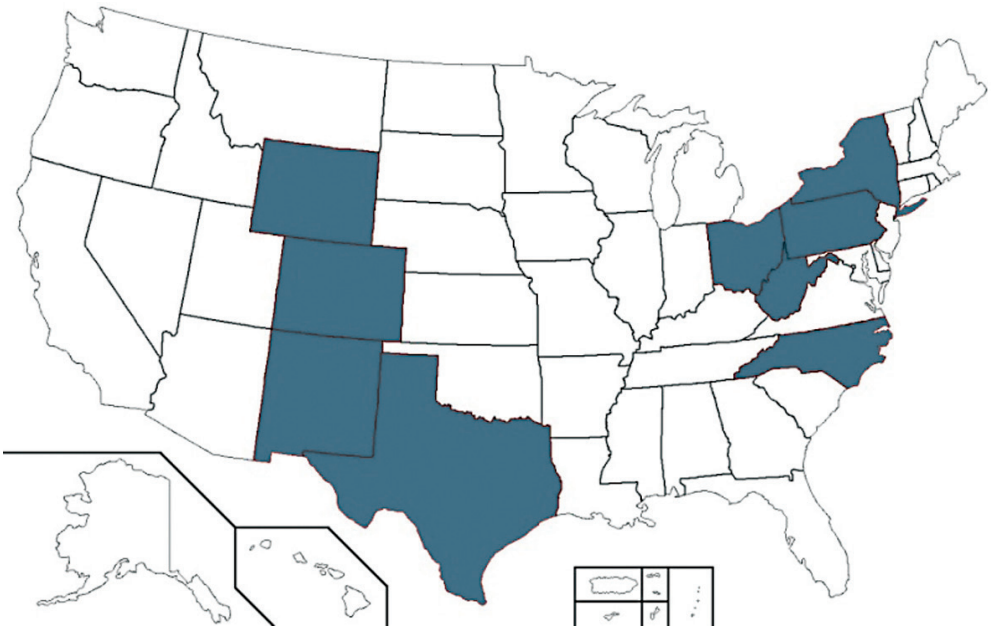

Figure 1. States targeted in the survey and interviews: Wyoming, Colorado, New Mexico, Texas, Ohio, Pennsylvania, New York, West Virginia, and North Carolina.

Survey Design and Distribution

An electronic survey - distributed to local and state government, regional planning agency representatives, and advocacy organization members - and in-depth phone interviews of subject-matter-experts (SMEs) were used for data collection. The survey and interview questions were designed to address each of the local and regional issues outlined above. Survey and interview questions were developed over six months between 2011 and 2012 and based on preliminary SME interviews, discussions with the National Association of Regional Councils, who provided concerns from their membership, NARC meeting notes, and from published research and state reports focused on local and state costs and benefits from fracking-inclusive oil and gas development (Rodgers et al., 2008; Randall, 2010; North Carolina Department of Environment and Natural Resources and the North Carolina Department of Commerce, 2012; Olenych, Lawrence, Mutchler, Mendillo, Morfei, and Robson, 2011). The work from the Community & Regional Development Institute at Cornell and Pennsylvania State University's Marcellus Education Team were particularly helpful. Questions and methods were approved by the Colorado Multiple Institutional Review Board.[1]

The survey consisted of forty-four questions related to i) housing issues; ii) economic growth issues; iii) boom-and-bust economic cycles; iv) local control and protection of land; v) public safety; vi) property rights; vii) water supply and sourcing; viii) population growth; ix) and information and stakeholder involvement. Each question asked the respondent to rate their level of agreement on a seven-point Liker-scale ranging from Strongly Disagree to Strongly Agree. Survey responses were collected and phone interviews conducted between April and December 2012. Each survey question asked the respondent to rate their level of agreement to questions or statements on a seven point Likert-scale ranging from 'Strongly Agree' to 'Strongly Disagree'. The in-depth phone interviews focused on similar topics as the survey. Interviews were conducted with subject matter experts (SMEs) from local governments and regional planning agencies across our surveyed states.

Respondent Description

Overall, eighty-one individuals or organizations completed the survey and five SME interviews were completed.[2] During the analyses, the responses were grouped by state, population density (metropolitan versus non-metropolitan areas), level of government, and the maturity of the industry in the state, and geographic region.[3, 4] Gross State Product from the oil and gas industry was used as an indicator for a state's industry maturity.[5] States with a Gross State Product form the oil and gas industry greater than the national average were categorized as states with a *mature* oil and gas industry. States with a Gross State Product from the oil and gas industry less than the national average were categorized as states with a *nascent* oil and gas industry. The tables below provide a breakdown of the number of responses per category. **Table 1** shows the number of completed surveys by state and how the respondents varied by level of government and population density. **Table 2** shows which states (and total number of response) were categorized as having a mature industry versus and nascent industry based on the states' percent GSP from oil and gas as it compared to the national GDP from the oil and gas industry. **Table 3** shows the states assigned to each region and the corresponding total number of response in parentheses.

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2 In addition to the 81 responses included in the analysis 33 surveys were excluded because they left more than half the survey unfinished. A majority of these stopped taking the survey after the first page of questions.

3 Respondents self-identified which level of government they represented. Government respondents were both elected or appointed officials. The advocacy organizations representatives' responses are not reported separately in this report. Generally the advocate organizations' responses aligned with local government representatives' responses.

4 Respondents provided their zip code which was then cross-referenced with the USDA 2003 rural-urban continuum categorizations of the county and corresponding zip code (See Appendix X).

5 Gross State Product (GSP) and national Gross Domestic Product from the oil and gas industry was provided by U.S. Bureau of Economic Analysis.

Table 1. Number of surveys responses received each state divided by the level of government the respondent represented and the population density they reside.

	RESPONDENT LEVEL OF GOVERNMENT			POPULATION DENSITY		
STATE	Local Gov. Rep.	Non-Local Gov. Rep.[6]	Advocacy Group	Metropolitan Area	Non-Metropolitan Area	TOTAL
Wyoming	7	4	1	0	12	**12**
Texas	0	5	1	5	1	**6**
New Mexico	0	1	1	0	2	**2**
Colorado	11	0	0	7	4	**11**
West Virginia	0	1	0	1	0	**1**
Pennsylvania	0	1	0	0	1	**1**
Ohio	0	2	0	2	0	**2**
New York	16	0	5	16	5	**21**
North Carolina	20	5	0	14	11	**25**
TOTAL N =	**54**	**19**	**8**	**45**	**36**	**81**

6 The total non-local government and planning representatives include 15 surveys from regional planning agencies and four state level government representatives. All state government representatives are from Wyoming.

Table 2. Industry Maturity Determined by Percent of Gross Domestic Product of state (GDPS) from oil and gas extraction in 2010.

AREA	Percent of GDP from Oil and Gas Extraction in 2010	INDUSTRY MATURITY
Wyoming	14.19%	**Mature Industry (31)**
Texas	6.26%	
New Mexico	4.99%	
Colorado	2.25%	
United States	**1.02%**	
West Virginia	0.68%	**Nascent Industry (50)**
Pennsylvania	0.26%	
Ohio	0.10%	
New York	0.0030%	
North Carolina	0.0005%	

Source: Bureau of Economic Analysis

Table 3. Regional assignments for the participating states.

Mountain West (25)	Northeast (24)
Colorado (11)	Ohio (2)
Wyoming (12)	Pennsylvania (1)
	New York (21)
Southwest (6)	**Southeast (26)**
New Mexico (2)	North Carolina (25)
Texas (4)	West Virginia (1)

Analyses and Interpretation Notes and Caveats

Each section of this report includes general overviews of all survey responses to questions and statements in the survey using percent agreement. The analyses focus on the difference in perception of respondents from states with a mature or nascent oil and gas industry, the differences between local and nonlocal government representatives, and rural versus metropolitan views. Pairwise correlation using Pearson's Chi-square is also used on choice questions within each issue group (described below) to provide more evidence for whether industry maturity or the level of government represented by the respondent were driving the results. More granular analyses, such as state to state differences, are avoided because of the pilot study's small number of responses and co-variation with other levels of analysis. For example, Colorado's eleven responses were from local government representatives while five of six of Texas' survey responses were completed by regional planning agencies and all state level representative responses were from Wyoming).

First, a brief introduction of each issue group is provided. Following the issue introduction, is detailed description of the survey and interview results of each issue group. The issue groups are:

1) Short and Long-term Economic Impact;
2) Land-use and local control;
3) Community capacity: Housing, public services, social dynamics;
4) Emergency management and workforce safety;
5) Environmental concerns;
6) Communication and Information.

FRACKING-INCLUSIVE DEVELOPMENT ISSUES

Short and Long-term Economic Impacts

The economic benefits of oil and gas resource extraction are incentives for local, state, and national governments to support fracking-inclusive development. Local government and regional organizations concerned with short and long-term economic impacts often discuss wealth capture and boom-and-bust cycles. Wealth capture in this report is defined as mechanisms or processes that infuse revenue from an industry into the community and local government. Ways in which communities and local governments capture wealth from oil and gas development include local employment and income tax; increased property values and taxes; severance tax and royalties; opportunities for auxiliary manufacturing sectors to support the resource industry; and investment and spending by the industry in communities where extraction is conducted. However, not all communities have the same wealth capture mechanisms in-place. If a community is lacking in ways to capture wealth they may experience an imbalance of benefits and costs from oil and gas development. One such method, taxes, vary by state and county: Colorado has a state severance tax between 2% and 5% and an ad valorem tax at the county level between 3% and 10% on extracted oil and gas resources. New York does not have a severance tax; the majority of oil and gas related revenue to local governments comes from royalties, property tax, and through lease agreements. West Virginia divides a 5% severance tax between the state, counties and municipalities – 90% of the tax goes to the states, 7.5% to the jurisdictions where the resource was recovered, and 2.5% to all counties and municipalities in the state. In Texas, the severance tax is kept at the state but local governments control royalty payments and use property taxes to collect funds.

In addition to wealth capture, the duration of potential economic and population growth is a local and regional concern. At the local level, the rapid growth of economy and population driven by development may result in equally rapid negative consequences once local resources are extracted and the industry moves on (Brown et al., 2011). Fracking-inclusive development includes a broad range of economic benefits, but there are limits to these benefits due to the five to thirty year life-cycle of hydraulically fractured oil and gas wells (Rodgers, et al., 2008; Christopherson and Rightor, 2011). This rapid increase and decrease in economy and population is commonly termed a boom-and-bust economic cycle.

We asked questions related to understand current wealth capture mechanisms and how boom-and-bust cycle concerns are impacting local government economic investment strategies. We also inquired into ways local governments are mitigating boom-and-bust cycle concerns.

Land-Use and Local Control

Previous fracking-inclusive development research has highlighted industry-related truck traffic and subsequent road damage as cause for concern because the financial burden to repair the road is often on the community (Rodgers et al, 2008; Randall, 2010). Conflict over land-use related control between local and state governments and industry is also an issue. Examples of local control conflicts include a lawsuit in August, 2011 where Dryden, NY was sued by industry for using zoning rights to ban development and in September, 2012 where Longmont, CO was sued by the State for creating a set of oil and gas rules that included restrictions to drilling in certain zones and then again in December 2012 by the Colorado Oil and Gas Association for banning development inside city limits.

Furthermore, to gain access to the oil and gas, operators typically create a private contract with the mineral right owner through a temporary lease. Two issues arise from this transaction. First, the leaser (individuals or governments) do not always have the knowledge or information to create a mutually beneficial lease with the operator. Second, when split estates are present – as is often in the United States, the mineral rights owner is not the user or occupant on the surface. Therefore, situations arise where the surface owners and/or tenants on the surface are negatively impacted and not compensated adequately. Finally, adjacent landowners to well sites can be subject to negative externalities from the development of neighboring lands, such as landscape and visual disturbances, operating noise and light, air quality issues from dust or exhaust, and increased truck traffic, but rarely have legal mechanisms to compensate them from these nuisances.

Land-use and local control issues were addressed through questions related to potential land use problems, the status quo of individual property rights and lease agreements, and potential policy solutions to reduce land-use conflicts. Specific questions include perceptions about i) the damage to the landscapes from access road and well pad preparation affecting other local economies and ii) property rights as a barrier to county level control over access road and well pad siting iii) whether or not adjacent landowners are financially compensated to offset nuisances from nearby oil and gas development and iv) whether or not those involved in creating lease agreements with the industry know how to draw up a lease that provides them with the maximum benefits; and v) the utility of policy tools such as bonds, zoning, and formal agreements with industry to reduce conflict or negative impacts of development.

Community Capacity and Social Dynamics

Many of the components of hydraulic fracturing-inclusive gas development that drive economic issues (i.e. the temporary nature of a hydraulically fractured gas well and/or an increase in a transient or permanent workforce and their families to communities) also raise community planning and social dynamic issues. Prior studies have highlighted general concern as well as evidence from specific cases of smaller communities' populations increasing at a high enough rate due to new oil and gas wells to impact housing needs for workers and community members and local schools (Rodgers et al, 2008; North Carolina Department of Environment and Natural Resources and the North Carolina Department of Commerce, 2012). In other regions, oil and gas employees live outside of the development area and either communities or stay in temporary work camps near the wells. Animosity between residents and industry employees may be present because transient workers spend money outside of the community that is affected by fracking-related development (Rodgers et al, 2008). Additionally, there is concern about the truck traffic to and from the well negatively impacting public safety (NARC meeting notes; Anderson and Theodori, 2009; Randall, 2010).

This research focused on four broad areas of community capacity and dynamics. These areas were i) housing with respect to potential temporary population growth; ii) public services such as schools, social services, and police with respect to rapid increase in demand; iii) paying for increased services; and iv) integrating the new workforce into the community.

Emergency Management

Emergency response is a specific local investment and capacity issue. Emergency management at the worksite is an important community level responsibility and activity. During different phases of the operation (i.e. drilling, fracturing, or extraction) there can be numerous sources of potential injury such as chemical storage tanks, heaving drilling equipment, water storage tanks or pits and natural gas flows. Many of these hazards are unique to oil and gas development so

special training for the local first responders may be necessary. Furthermore, drill sites can be in remote areas with limited access (Rodgers et al. 2008). We asked respondents if their emergency responders have had any specific training to potential hazards at the well site.

Environmental Concerns

Environmental issues related to fracking-inclusive development range from air pollution (including fugitive methane emissions, dust, and exhaust from truck or on-site engines); water pollution (including surface and ground water sources); water use and supply for fracturing; produced water treatment and storage before and after the fracturing event; surface issues (including erosion and degradation from access roads and well pads); and nuisance issues (including as noise and light pollution). Substantiation and importance of these environmental issues is a continual, and often divisive, discussion between community members, governments, and industry representatives. Indeed, local bans and moratoriums against fracking-inclusive development are often driven by environmental concern.

We asked questions focused on the following areas: i) general air quality; ii) water use and sources; iii) water contamination; iv) current regulations and laws related to water protection and monitoring; and v) the impact water issues and current levels of information have on developing policy solutions.

Information and Communication

The last issue area we focus on is potentially the most important when it comes to developing management and policy solutions: gathering and sharing accurate and complete information and open communication between stakeholders. One SME interviewee describes information related issues well: Misinformation is "the biggest threat" to fracking-inclusive development discussions" and has caused fear to develop in the communities (Interview # 4). The same interviewee described communication between citizens, industry, and government officials as difficult because "when people enter the discussion, they have their minds made up" and, as a result neither side understands the others' concerns. Misperceptions, Interviewee #4 continued, are hard to overcome, and the "credibility and trust" between the groups is difficult to build. The atmosphere described by this interviewee is in public forums discussing oil and gas development across the country. While many fracking-related discussions may begin this way, the results vary. As described above, local and state debates result in bans and moratoriums, as well as memorandums of understanding (MOUs) or policies that continue fracking-based development but with more stipulations or regulatory controls than before, such as the MOU between the Colorado Oil and Gas Conservation Commission and Arapahoe county in 2013(Arapahoe County, 2013). While any of these outcomes may be the appropriate solution for the given community, the number of disputes and lawsuits which occur afterward provide evidence that not all parties are satisfied.

This research asked questions about the perceptions of the quality of and level of communication public officials have with other stakeholders, the utility of public meetings to inform and gather information from the public, and the most commonly used communication tools used by governments to inform the public about fracking-inclusive topics.

RESULTS

The following section includes survey and SME interview results for each issue group. Survey responses are summarized using comparisons between groups of the percent-agreement to survey questions with the exception of a few environmental issue questions. As seen below, percent-disagreement to certain environmental questions are used in order to keep positive and negative signs consistent with more or less concern of the issue in question. Pairwise correlation results are interjected when appropriate. Appendix 2 provides Pearson's Chi-square values and their significance for selected questions.

Short and long-term economic impact results

General Economic Impact

A strong majority (75%) of all respondents believe their local economies will be dramatically impacted by fracking-inclusive gas development. Survey responses from local government representatives compared with non-local government representatives show local governments believe local economies will be dramatically impacted 25% more often than non-local government representatives (See Figure 2 for difference in percent agreement between subgroups). Respondents

from Southeastern states have the lowest level of agreement that their local economies will be dramatically impacted by development (64%) compared to an average of 80% of Mountain West, Southwest, and Northeastern respondents. Survey responses indicate no difference in perception of economic impact when states are divided based on their industry maturity. However, SME interview respondents from regions within a state with a developed oil and gas industry see the increase in drilling activity due to unconventional oil and gas as an incremental increase to the economy, while regions whose current economic base do not include oil and gas resource extraction see the influx and incorporation of new fracking-related jobs and industry as either a challenge or an opportunity (Interview #1, 2, 3, 4). Pairwise correlations between local and non-local government respondents when controlling for industry maturity shows a significant difference in nascent industry states with a Pearson chi-square value of 14.08 significant at the 95%. Correlation between nascent and mature industry respondents when controlling for local government resulted in a 9.8 Pearson chi-square value at an 87% confidence. These evidence points to the concern over economic impact to be a local, rather than a state issue and that the concern is concentrated in states with a nascent industry.

SMEs gave a range of responses when asked about economic impact. Some interviewees say new jobs and wealth created directly from oil and gas development as well as industries that support the development, such as new pipe and fitting plants, are a great benefit to their communities (Interview #1). Others indicate the economic importance of fracking-inclusive development to their communities in light of the 2008 economic downturn and the housing-bubble burst (Interview #4). However, there is concern about a boom-and-bust economic cycle, worrying that fracking-related development benefits will be short-lived (Interview #3, 4).

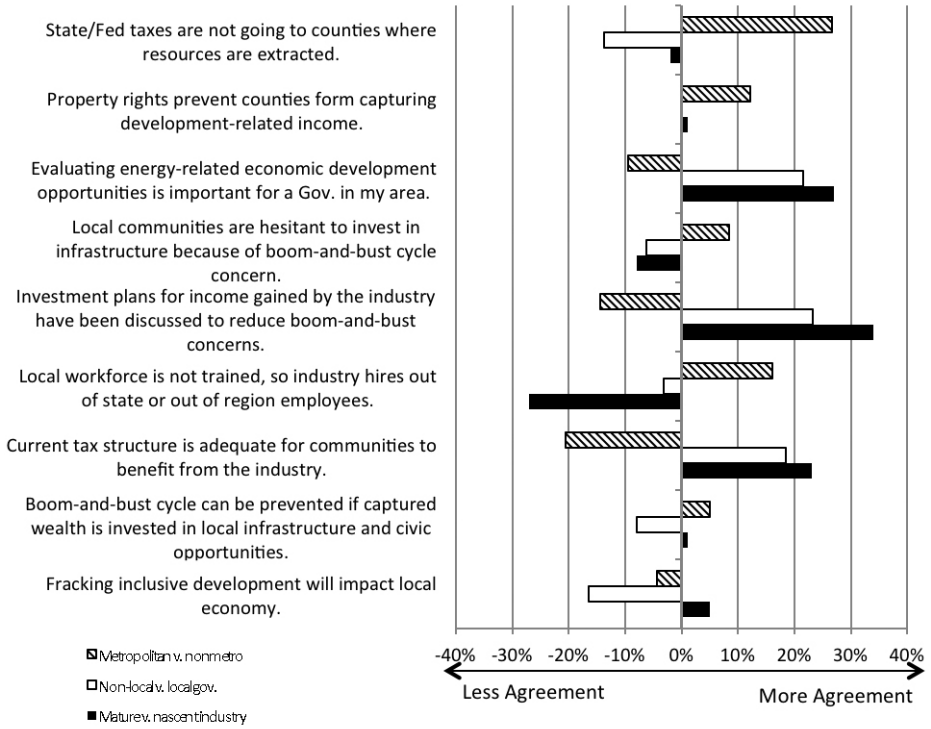

Figure 2.
Difference in agreement responses to economic impact questions by population density, industry maturity, and level of government.

Boom-and-bust Cycle

Overall, 47% of respondents agree (and 37% disagree) that a boom-and-bust cycle can be prevented if wealth from fracking-inclusive gas development is adequately captured (i.e. taxes, fees, royalties) and invested in local infrastructure (i.e. roads, schools, utilities, police) and civic opportunities (i.e. recreation centers, arts, museums). There is slight variation between levels of government, respondents from mature or nascent industry states, or between those from metropolitan or non-metropolitan area. The largest variation is seen at the regional level. Respondents from Northeastern and Mountain West states are the most pessimistic about preventing a boom-and-bust cycle (28% and 36% respectively, believe it can be prevented by appropriate wealth capture and investment). Sixty percent of Southeastern and 83% of Southwestern state respondents believe a boom-and-bust cycle can be prevented.

Slightly more than half of respondents feel communities are hesitant to invest in businesses, job training, or housing and other infrastructure because of boom-and-bust cycle worries. Respondents from metropolitan areas are more likely than non-metropolitan respondents (54% and 47% respectively) to agree communities are hesitant to invest because of boom-and-bust concerns.

SME interviews support the survey responses: Some areas are worried about a boom-and-bust cycle; others believe the jobs will not be given to local residents; and some areas that have begun infrastructure improvements related to fracking-inclusive development. Infrastructure investments include building manufacturing operations that will support the oil and gas industry, implementing job training programs specifically to the industry and working with water treatment plants to aid in process water disposal (Interview #1). However, other SMEs suggest the burdens of oil and gas industry are on the shoulders of the local governments and the economic benefits may be distributed elsewhere (Interview #4).

Wealth Capture

Less than half of survey respondents believe local tax structures, workforce, land ownership, and other businesses provide avenues for wealth to be distributed locally in a way to provide an overall benefit from the natural gas industry. Sixty five percent of regional and state level respondents believe current wealth capture mechanisms are adequate compared to only 46% of local government respondents. Metropolitan respondents were 20 percentage points less likely than non-metropolitan respondents to think current wealth capture mechanisms are adequate. Sixty-one percent of respondents from states with mature oil and gas industry believe current wealth capture mechanisms are adequate, compared to 38% of respondents from states with a nascent oil and gas industry believe this to be the case.

Local government respondents were more likely than regional and state respondents to believe that state or federal taxes or fees from the oil and gas industry are not distributed back to the county where the gas is being extracted. Survey results also point to a divide between respondents from different population densities: A strong majority (71%) of respondents from metropolitan areas believe state and federal taxes are not returned to the community compared to a minority (44%) of respondents from non-metropolitan areas.

Property rights and land or mineral ownership, in general, is not seen as a roadblock for counties to capture income from natural gas extraction. However, based on survey response, differences exist between metropolitan and non-metropolitan areas and regions of the United State. Forty percent of respondents from metropolitan areas believe current property rights prevent counties from capturing income from natural gas extraction compared to 28% of non-metropolitan respondents. Respondents from Southwestern states had the highest level of agreement (67%) and Mountain West states had lowest (28%).

Another method to capture wealth identified by SME interviews is through locally provided employment and support services. Some governments are working with local industry and universities to build the know-how and manufacturing support (such as pipes and fittings) for the industry. Other SMEs pointed out that residents from rural areas that have newly discovered shale plays will likely not be hired by the industry due to the specific training required to work on drilling and extraction processes.

Sixty-two percent of all survey respondents believe their workforce is not trained to work in the oil and gas industry that uses hydraulic fracturing. Seventy-two percent of respondents states with a nascent industry see this as an issue

compared to only 45% of states with a mature industry see this as an issue. A significant difference is seen in perceptions of workforce training between local governments officials from states with a nascent industry and mature industry; pairwise correlation test resulted in a Pearson chi-square of 9.8 at a 95% confidence level. Metropolitan respondents agree more often than non-metropolitan respondents that their workforce is not trained.

Economic Development Evaluation and Regional or County Investment Plans

Results suggest that regional or county level economic planning to mitigate boom-and-bust cycles is not occurring. Only 31% of all respondents agree that regional or county investment plans for income gained from fracking-inclusive gas development have been discussed to reduce the effects of, or chances of, a boom-and-bust cycle. The survey results suggest that there is more planning occurring in states with a mature industry: 18% of respondents from states with a nascent industry compared to 52% of respondents from states with a mature oil and gas industry agree that such planning is occurring. Regional and state level representatives believe more planning has occurred than local government representatives: only 24% of local government representative respondents and 47% of non-local government representative respondents feel planning discussions had taken place. Pairwise correlations show significant differences between local and non-local government respondents in nascent industry states (a Pearson's chi-square of 15.1 with a 95% confidence level) and between respondents from nascent and mature states (a Pearson's chi-square of 14.3 at 95% confidence when controlling for local government representatives and a Pearson's chi-square of 7.8 at a 74% confidence when controlling for non-local government respondents).

Even though development-related economic planning is generally not occurring, the majority of respondents feel that evaluating potential local economic development opportunities (e.g. jobs) associated with all future energy production options is important. Regional and state representatives agreed it is important more often than local government representatives: 57% of local government respondents agreed, compared with 79% of nonlocal government representatives, that evaluating potential local economic development opportunities associated with energy production is important. Respondents from states with a nascent industry were least likely to agree (54%) and states with a mature oil and gas industry were most likely to agree (81%) that energy-related economic development plans were important.

Land-use and local control results

Land use issues faced by communities and local governments

Sixty percent of respondents agree that the damage to the landscape due to drill sites and access roads hurt other local industries and dramatically offset the economic benefits of fracking-inclusive gas development. Local government representatives agree more often than regional planning organization or state government representatives. Metropolitan respondents feel landscape damages hurt other economies more than non-metropolitan respondents (69% compared to 50%, respectively). States with a mature industry agree 45% of the time compared with respondents from states with a nascent industry who agree 70% of the time on this issue. Respondents from Mountain West states were least likely to agree (40%) compared to respondents from Northeast, Southeast, and Southwestern states who on average agreed 70% of the time. Pairwise correlations show a significant difference between local and non-local government representatives from states with a nascent oil and gas industry (Pearson's chi-square of 14.9 at a 95% confidence) and between respondents from states with a nascent and mature industries when controlling for local government (Pearson's chi-square of 17.7 at a 99% confidence).

A minority (43%) agree that property rights were preventing counties from regulating drill sites and access roads, however, local government representatives agree nearly twice as often as regional and state respondents (44% compared to 26% average). Population-density and industry maturity sub-divisions are fairly equal and on-par with the average response with their level of agreement. Respondents from states in the Northeast agree 56% of the time, compared to 32% of respondents from the Southeast.

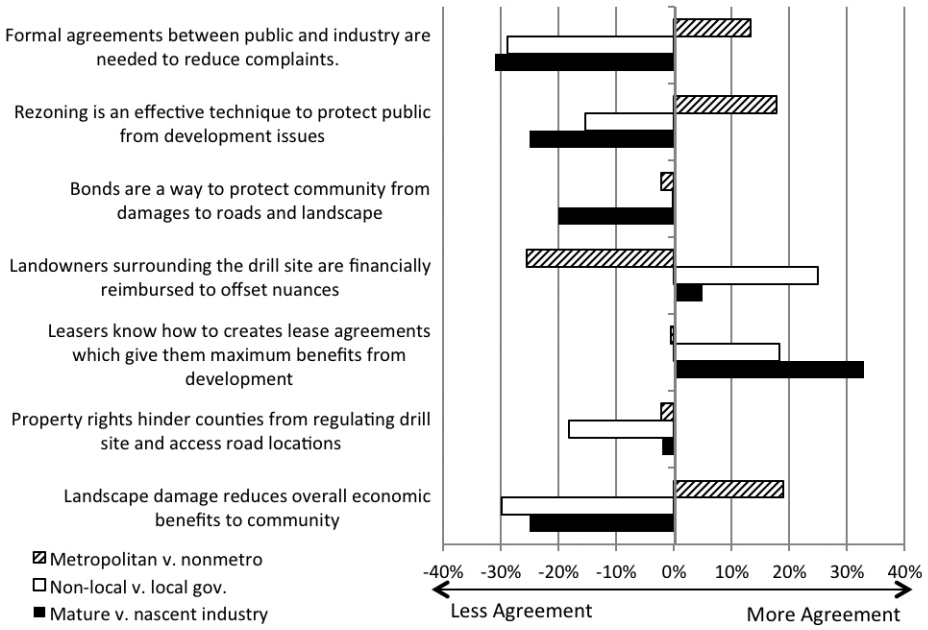

Figure 3.
Difference in agreement responses to land use and local control questions by population density, industry maturity, and level of government.

Land-use issues faced by property owners and individuals

Only ¼ of respondents agree that the individuals or governments involved in creating oil or gas lease agreement know how to draft a lease that gives them maximum benefits from the resulting fracking-inclusive development. Concern about this issue is greatest at the local level. Nineteen percent of local government respondents, compared to 26% of regional and state respondents agree that those making the lease know how to get maximum benefits from development. Respondents from states with a mature the oil and gas industry are less concerned by over 30 percent points than to states with a nascent oil and gas industry. Pairwise correlation show significant differences in the responses between government representatives from states with a nascent industry and those from states with a mature oil and gas industry (Pearson's chi-square value of 14.8 at 95% confidence when controlling for local government and a Pearson's chi-square of 8.5 at an 80% confidence when controlling for non-local government respondents).

Thirty-six percent of respondents agree that adjacent landowners to operations are financially reimbursed to offset the nuisances. Local government respondents agreed less often than regional and state respondents that adjacent landowners are compensated for nuances. Respondents from metropolitan areas are half as likely as respondents from non-metropolitan areas to believe adjacent landowners are financially reimbursed for the nuisances due to development.

Potential policy solutions for local governments to mitigate land-use issues

The majority of respondents (54%) agreed financial bonds and re-zoning lands would be an effective way to protect the community from the negative impacts due to oil and gas development. Seventy-four percent of respondents feel that formal agreements between operators and the public that regulate operating times are required or is required to reduce complaints by landowners and other residents. The greatest variation in agreement for each surveyed land-use policy solution is between industry states with mature and nascent industries. Sixty-two percent of states with a nascent industry compared to 42% of respondents from states with a mature industry agree bonds are effective ways to financially protect communities from landscape and road damage.

Re-zoning lands had similar overall agreement rates as bonds (54%), but greater variation along each sub-division. Local government representatives agree, on average, 15 percentage-points more than non-local government respondents. Respondents in metropolitan areas believe re-zoning is an effective tool to protect the public 20 percent points more (62% compared to 44% agreement) than non-metropolitan areas. Finally, respondents from states with a mature industry agree ~20 percentage point less than respondents from states with a nascent oil and gas industry (39% agreement compared to 64% agreement, respectively).

Formal agreements (i.e. contracts, lease stipulations) between the public and oil companies which specify drill site operation times was widely accepted as a solution to reduce complaints by landowners or residents (74% agreement from all respondents). The variation of percent agreement between groups mirrored that of responses to re-zoning as a policy solution. Local level government representatives have the highest level of agreement (81% agreement) compared to non-local respondents regional (~50% agreement). Respondents from metropolitan areas believe formal agreements are required more often than respondents from non-metropolitan areas (80% compared with 67% agreement). States with a mature oil and gas industry are less likely to agree formal agreements are necessary (55% agreement) when compared to respondents from states a nascent oil and gas industry (86% agreement).

Community Capacity: Housing and Public Services

Housing

Few respondents agree (30% agreed and 60% disagreed) that population growth related to fracking-inclusive gas development will NOT impact local housing in the respondents area. Even fewer agree (20% of respondents) that doing nothing is a solution for housing because workers may be temporary. Fewer still agree (15% of respondents) temporary housing is an appropriate solution because of the potentially temporary nature of the industry. Forty-five percent of survey respondents agree that more housing is needed because the workers on drill sites are displacing others and subsequent rent increases are pushing out low income residents. According to SME interviews, the recent housing bubble burst has left a number of homes available and would welcome new employees and families to stabilize the local economy; others described their housing stock as old and would welcome new development driven by oil and gas development.

Local government representatives are less likely to agree that population growth related to fracking-inclusive gas development will NOT impact local housing than regional organization or state government respondents. The differences between local and non-local government representatives are statistically significant; correlation results show a Pearson chi-square of 11.8 at a 90% confidence when controlling for a nascent oil and gas industry and a Pearson's chi-square of 8.7 at an 81% confidence when controlling for a mature oil and gas industry). States with a mature oil and gas industry were nearly twice as likely to agree that population growth would NOT impact housing compared to states with a nascent oil and gas industry (42% agreement versus 24% agreement), though when differences were not statistically significant when controlling for local and non-local government responses, indicating the level of government is driving the issue.

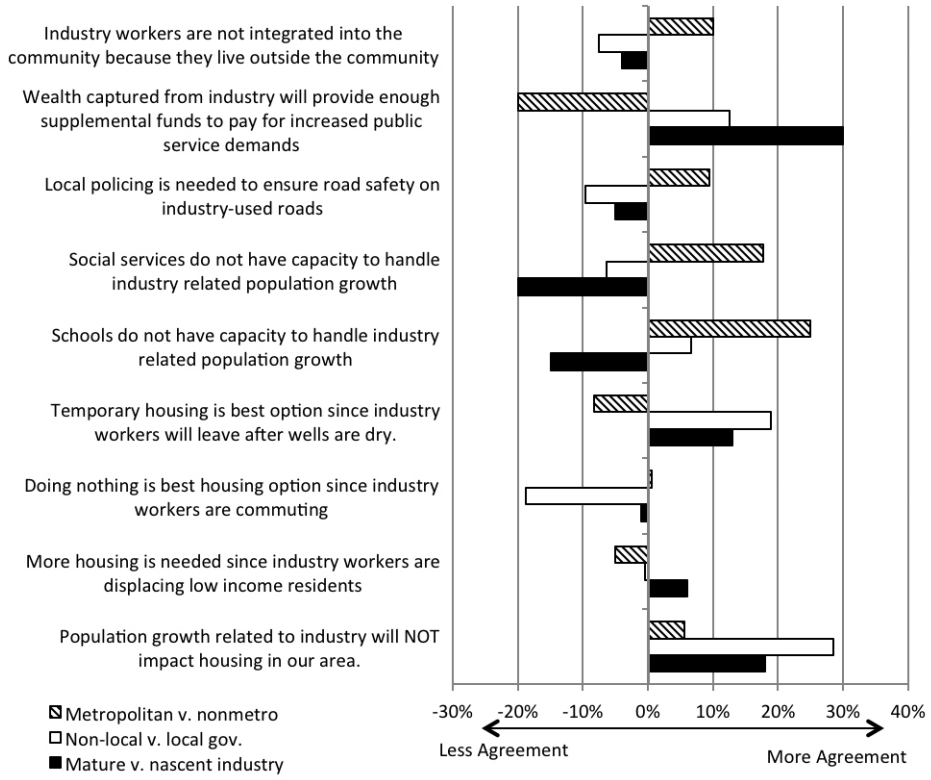

Figure 4.
Difference in agreement responses to housing and public service questions by population density, industry maturity, and level of government.

Public services

Survey results suggest limited concern among government representatives about public service capacity being negatively impacted by industry related population growth. On average, 44% of respondents agree that their schools do not have the capacity to handle an increase in students. Fifty-four percent of respondents agree, at their present capacity, the region's social services cannot handle an increase in work load caused by a potentially increased population. Non-local government respondents agree about 10 percent-points less than local level government respondents that school and social services do not have extra capacity. Metropolitan respondents are more concerned than non-metropolitan respondents about capacity issues: 56% agreed that school capacity is an issue and 62% agree that social services would be strained, while less than half of respondents from rural areas agree school and social service capacity would be risk if the population increased. Respondents from states with a nascent oil and gas industry are more concerned with both issues than states with a mature oil and gas industry. Interviews with SMEs showed similar mixed level of concern. With respect to schools, there was little concern; many said their communities' schools could handle additional students or would welcome the growth for "economic and community stability" (Interviews #1, 2, 3, 4). However, there was general concern with a potential for increased public service requirements because of the accompanying costs. One interviewee noted any additional local government costs is an issue "until we can figure out how to money from shale" (Interview #1).

Survey responses show a strong indication (80 % agreement) that local police involvement is necessary to maintain public safety due to truck traffic to and from well sites. The greatest variation to this response is between respondents at different levels of government and between metropolitan and non-metropolitan respondents. Local government representatives and metropolitan respondents agree about 10% more often than their non-local and non-metropolitan counterparts.

Financing public services

One-third of survey respondents believe the income captured from the extraction of natural gas and other substances related to fracking-inclusive gas development will be enough income to supplement potential higher demand on schools, social services, emergency personnel and other infrastructure. Variation among survey respondents and SMEs was large. From the survey results, level of government, population density, and industry maturity all showed large variation in the level of agreement that the income from new fracking-inclusive development could pay for the ancillary services communities may need to provide to support the workforce and their families. Local government representatives agreed about 12 percent-points more than non-local government respondents. Non-metropolitan respondents and those from states with a mature oil and gas industry were over twice as likely to agree as their metropolitan or nascent industry state counterparts. Pair wise correlation show a statistically significant difference between local and non-local government representatives when controlling for states with a nascent oil and gas industry (Pearson's chi-square of 8.4 at a 79% confidence) and between respondents from a nascent and mature industry when controlling for local government (Pearson's chi-square of 11.3 with a 90% confidence).

Similarly, SMEs vary in their level of concern, some view oil and gas development as a positive for the economy and no extra burden on services (Interview #1) and others have some concern at the present but are optimistic about creating income from development to support increased government services or confident in the communities' abilities to adapt and "gear up to industry needs" (Interview #1, 4). Other interviewees see the industry as an overall negative because the community will not be able to capture income from development to pay for any increased local government costs.

Integration of new workforce into the community

Forty-four percent of respondents agree that employees from fracking-inclusive gas development industry are not integrated into the community because they live in camps near the work site and then leave the area for their permanent homes when they are not working. The largest variation in this question was from respondents from metropolitan and non-metropolitan areas. Respondents from metropolitan areas agree 10-percentage points more than respondents from non-metropolitan areas. Interviews indicate population growth is not always a result of development because workers do not permanently move to the area. In one SME's area, it is normal for industry workers to commute to and from work sites, rather than displace permanently; in some another area discussed, workers stay in camps for 12 days at a time then return home (often out of state) for 12 days(Interview #2, 3). An interviewee reported issues with the temporary nature of the work force: work camps having drug-use issues and because the workforce's permanent homes are out of state, the money they earn is spent elsewhere (Interview #3).

Emergency Management and Workforce Safety

SME interviews showed specific training for emergency responders to fracking-inclusive gas development related accidents is not addressed until after the industry is well established (Interview #1, 2, 3, 4). SMEs in areas with established oil and gas industry were confident in their emergency management training and discussed multiple ways which emergency responders had been explicitly trained for well-pad related accidents (Interview #2). Survey responses support interview with the highest percent agreement that emergency responders have training specific to fracking-inclusive oil and gas development seen among respondents from states with a mature industry. Within nascent industry states, a significant difference is seen between local and non-local government officials perception of emergency management training (Pearson's chi-square of 10.1 at an 88% confidence) and between respondents from nascent and mature industry states at the local level (Pearson's chi-square of 24.4 at a 99% confidence). Forty-four percent of all respondents agreed live monitoring of the well site would improve safety of operations and response to hazards.

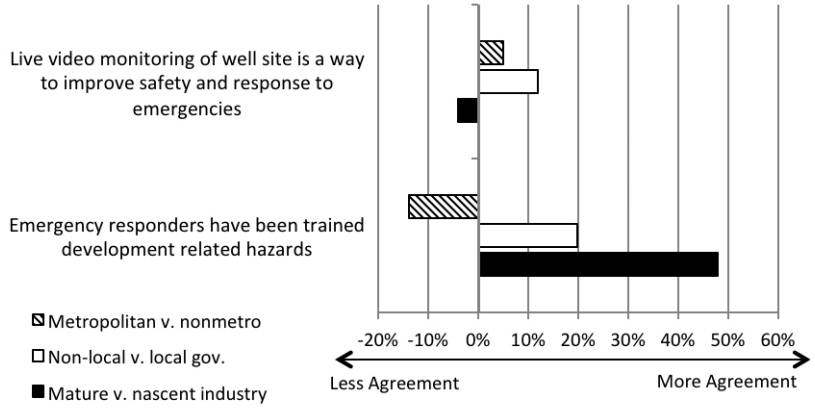

Figure 5.
Difference in agreement responses to emergency management questions by population density, industry maturity, and level of government.

Environmental Issues

Air quality

Over three-fourths of respondents (77%) agree air quality around the drill site is a concern to the community for health, social, or environmental reasons. Respondents representing local government are more concerned than respondents representing regional or state governments; eighty-one percent of local government respondents agree air quality is an issue, compared to approximately 64% of regional and state level respondents. Respondents from metropolitan regions are more concerned over air quality than rural respondents; 82% of metropolitan respondents agree air quality is an issue compared to 69% of non-metropolitan respondents. Respondents from the states with and nascent oil and gas industry agree 84% of the time that air quality is an issue compared to 65% of respondents from states with a mature oil and gas industry agree air quality is an issue.

The variation in level of concern seen in the air quality question continued for every environmental issue question; Local government representatives, metropolitan respondents, and those from states with a nascent industry were more concerned than their counterparts. Note: To consistently show that a negative difference between groups' answers is *less concern*, in this section some questions are reported using percent disagreement, rather than percent agreement.

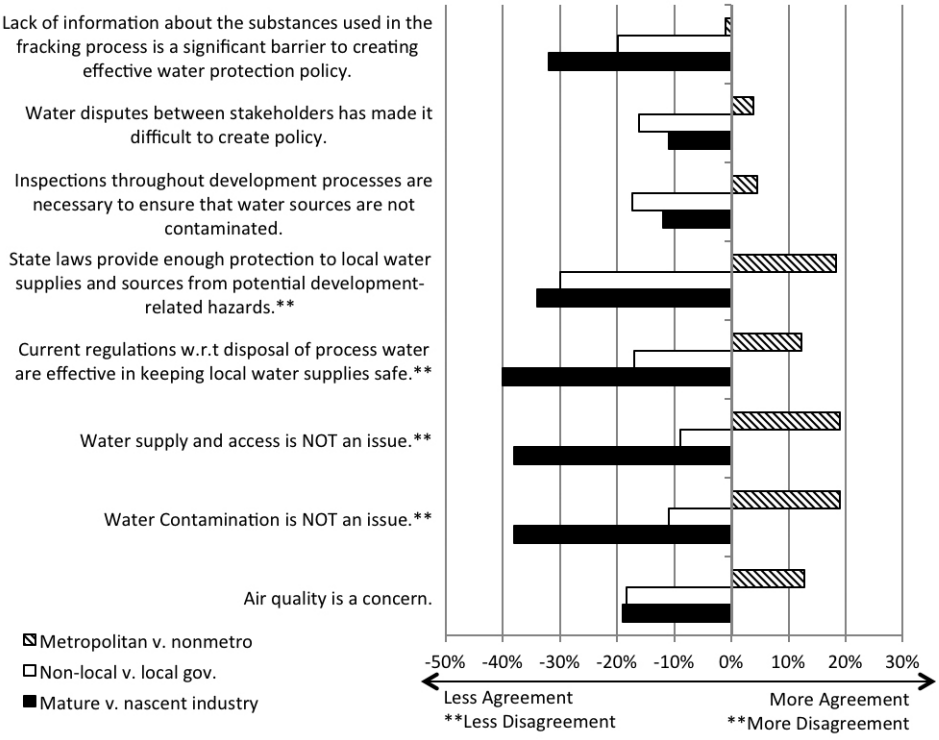

Figure 6.
Difference in agreement (or disagreement signified by **) responses to communication and planning questions by population density, industry maturity, and level of government.

Water

Water: Contamination, Supply, and Access

Seventy-two percent of respondents disagree that water contamination, supply, and access is NOT an issue. As with air quality, local government representatives, metropolitan respondents, and those from states with a nascent industry are more concerned than regional and state level respondents, respondents from non-metropolitan areas, and those from states with a mature oil and gas industry. Within nascent industry states, a significant difference is seen between local and non-local government officials perception water contamination (Pearson's chi-square of 7.3 at an 88% confidence) and between respondents from nascent and mature industry states at the local level (Pearson's chi-square of 25.1 at a 99% confidence)and supply issues (Pearson's chi-square of 7.3 at an 81% confidence) and between respondents from nascent and mature industry states at the local level (Pearson's chi-square of 22.3 at a 99% confidence) and at the non-local level (Pearson's chi-square of 9.7 at an 86% confidence).

Water: Current regulations, laws, and mitigation

Overall 56% of respondents feel current regulations concerning the disposal of process water are not effective in keeping local water supplies from being contaminated. Similarly, 64% of respondents feel state laws do not provide enough protection to local water supplies and sources from potential contamination due to fracking-inclusive gas development processes. Non-local government representatives are less concerned with current regulations than local government officials. Respondents from states with a mature industry feel regulations are inadequate only 33% of the time compared to 72% of respondents from states with a nascent industry.

The majority of all respondents (91%) and sub-groups of respondents agree that inspections during drilling, fracking, and extraction processes are necessary to ensure that water sources are not contaminated by hydraulic fracturing-inclusive gas development.

Water: Information and Finding Policy Solutions

Seventy-two percent of all survey respondents believe disagreements related to water quality and contamination between stakeholders, citizens, or policymakers has made it difficult to finalize the issues from a regulatory or planning perspective. Respondents representing local governments agree that water related disagreements are an issue more often than regional planning organization and state government respondents; a difference of 15 percentage-points. Correlations between local and non-local respondents and between respondents from states with nascent and mature industry show the 15 percent-point difference is not statistically significant.

Seventy percent of respondents agree that a lack of information about the substances used in the fracturing process is a significant barrier to creating effective plans or regulations that protect water supplies and the public from contamination. The biggest variation in response is between respondents from states with a mature industry and a nascent industry; respondents from mature industry states agreed over 30 percentage points less than those from states with a nascent industry. Local government representatives are more concerned about a lack of information concerning process substances than non-local government respondents. Pairwise correlations show significant relationships between local and non-local governments' responses when controlling for nascent industry states (Pearson's chi-square of 11.6 at a 90% confidence level) and mature industry states (Pearson's chi-square of 10.7 at a 90% confidence level. A significant relationship is also seen between respondents from states with a nascent and mature industry when controlling for local government respondents (Pearson's chi-square of 17.1 at a 99% confidence level).

Communication and Planning

Results suggest regional energy planning occurring, but at a higher rate among states with a mature oil and gas industry when compared to nascent industry states. Local government representatives feel energy planning is occurring more and that is a more important activity than nonlocal government survey respondents.

Approximately 80% of respondents agree that public meetings are effective at providing fracking-inclusive development information to the public and gathering public concerns about development. While there is little variation with respect to gathering public concern via public meetings, respondents from metropolitan area and those from states with nascent industry are less certain that public meetings can be used to inform the public about fracking-inclusive development.

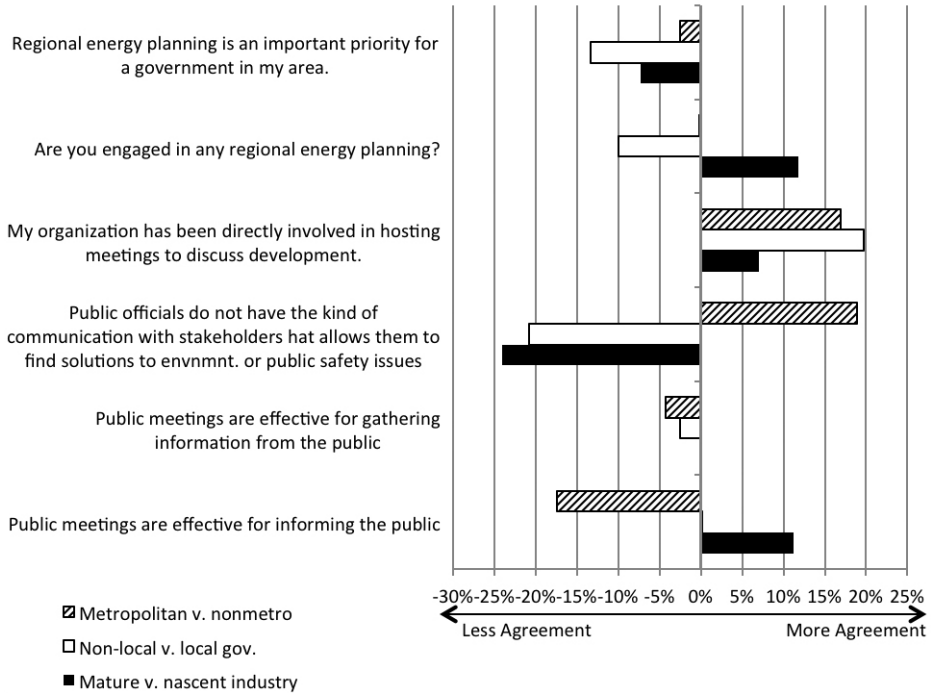

Figure 7.
Difference in agreement responses to communication and planning questions by population density, industry maturity, and level of government.

Forty-four percent of respondents agree (and 36% of respondents disagree) that public officials do not have the kind of communication with the land owners, natural gas/oil companies, and community that allows them to find solutions to environmental or public safety issues (water quality, road safety, noise, air quality). Survey respondents from metropolitan areas, local government representatives, and those from states with a nascent industry are less confident in the communication tools of public officials. Pairwise correlation results show a significant relationship between level of government when controlling for nascent industry states (Pearson's chi-square of 13.6 at a 95% confidence level) and between respondents from states with nascent and mature industries when controlling for local government (Pearson's chi-square of 12.8 at a 95% confidence level).

Just over half (54%) of respondents agree that their organization has been involved in hosting fracking-inclusive development related meetings. Nonlocal government respondents and those from metropolitan areas agreement rate is approximately 15% greater than their counter parts when asked about hosting development-related meetings. Respondents from states with a mature industry are slightly more-likely to say they have hosted a development-related meeting. Pairwise correlation results show a significant relationship between respondents from different levels of government when controlling for nascent industry states (Pearson's chi-square of 5.5 at a 95% confidence level) and when controlling for mature industry states (Pearson's chi-square of 3.8 at a 95% confidence level).

The most common forms of communication used by all respondents to discuss fracking-inclusive development are general public meetings, face-to-face meetings, and specific public meetings addressing development issues (Table 4). Respondents from states with a mature oil and gas industry are more likely than respondents from states with a nascent industry to use each of these methods as well as the newspaper. State and regional government respondents in general used all communication methods more than local government respondents.

Table 4. Total and difference in percent use of respondent communication methods.

COMMUNICATION METHOD	Overall Use	Mature v. nascent industry	Non-local v. local gov.	Metropolitan v. non-metro
General public meetings	51%	2%	-3%	-4%
Face to face meetings	47%	8%	16%	-6%
Specific public meetings addressing hydraulic fracturing and shale gas development	47%	13%	26%	4%
Newspaper articles	36%	5%	2%	-6%
Emails to specific groups or people	35%	-4%	4%	7%
Group phone conferences with specific groups or people	14%	-6%	7%	4%
Blogs or internet based social networks	14%	-6%	8%	14%
Other	10%	-11%	8%	8%

DISCUSSION OF SURVEY AND INTERVIEW RESULTS

Local Economy

Our results indicate that state and regional governments and states with a mature oil and gas industry are not as concerned short and long-term economic impacts as local governments and states with a nascent oil and gas industry. Most respondents from states with a mature industry feel their workforce is trained for the industry, and their local businesses and tax structures provide enough opportunities for their communities to benefit from fracking-inclusive oil and gas development.

SME interviews highlighted that even among states with mature oil and gas industry, work force training and local employment with the industry can be an issue. Colorado and Texas, who have a long history of oil and gas development, include counties where oil and gas industry workers do not live in the communities where the resources are being extracted. This is due to the recent development of the Niobrara Shale play (in Colorado) and Eagle Ford Shale play (in Texas) driving industry into new areas of the state. As a result employees at the well sites travel from outside of the city and county where drilling operations are being performed to do the work. These workers may commute daily, or stay in work camps for weeks at a time before returning home. Thus, while respondents from Texas are not concerned about population growth due to hydraulic fracturing-based job growth, local respondents in some areas are concerned about wealth capture since their constituents are not directly employed. Additional community dynamics dealing with permanent relocating or commuting workforces are described later in the *community capacity section*.

SME interviews provide further evidence for boom-and-bust concern and a need for wealth capture options among local governments who are experiencing oil and gas development for the first time. Furthermore, when compared to states with a nascent oil and gas industry, survey respondents from states with a mature industry feel their governments are prioritizing planning that evaluates potential local economic development opportunities associated with energy production and ways to prevent boom-and-bust cycles. In other words, our results indicate states with a less mature oil and gas industry are more worried about boom-and-bust cycle and other wealth capture issues, less equipped to gain economically from the industry, and less likely to have discussed plans to reduce boom-and-bust cycle issues.

Results also suggest landscape and road damage may detract from fracking-inclusive economic benefits by negatively impacting other local economies. Among all respondents, local government representatives, metropolitan areas, and those from states with a nascent oil and gas industry were most concerned about the local economy trade-off. Colorado based interviews highlighted this issue where outdoor recreation or tourism based economies may be damaged by the patchwork of well sites and rough roads. One SME interviewee described their road conditions to be like "a third world country" due to development-related use. But this issue is not universal. Another SME indicated they were required to upgrade local road to handle the trucks, but portrayed the issue positively because of the added work to the area. Similarly, survey respondents – particularly local government representatives - are not confident that landowners surrounding the drill site are financially reimbursed for nuances related to oil and gas development.

Land-use and local economy issue mitigation

Preliminary meetings with NARC membership and interviews with SMEs revealed a few solutions that local governments with oil and gas development experience have used to address land-use issues and gain financially from resource extraction. Four of these potential policy solutions were posed in the survey were i) creating financial bonds between localities and operators to financially protect the community from damages; ii) rezoning lands to direct the location of drill sites and access roads to protect surface users; iii) formal agreements (contracts, lease stipulations) that address operating times of drilling and extraction operations; and iv) tax structures to divert wealth to local governments. The greatest variation between agreements to policy solutions, as with problem perception shown above, is between the states and between levels of government. These results show the solutions may not be universally appropriate and the distance from land-use issues (shown by level of government) may distort the perception of the problem or perceived effectiveness of the solution. They also suggest states with a mature industry have better programs in place than states with a nascent industry and that as governments experience development-related issues, they learn which policy or management tools work. For example, respondents from mature industry states do not think rezoning or bonds are effective ways to protect the community from adverse development effects such as road or landscape damage.

Community capacity

Survey and interview results suggest that community development and capacity issues due to population changes are a concern for policy makers at multiple levels of government and regions of the United States; public service capacity concern is higher among local governments and those with little experience with fracking-inclusive development. Survey and interview results also suggest community development and public service capacity is highly variable even within local governments and dependent on the local context. For example, a majority of survey respondents believe fracking-inclusive gas development will increase population and impact local housing; the impact is not always negative. Housing, explained on SME, is largely available in some areas due to stock left by the housing-bubble burst. Another interview said there are areas with old stock and local governments would welcome new fracking-inclusive development to spur their economy to provide new homes for workers and their families. Because survey questions related to housing solutions included specific scenarios, they provide little policy guidance. However, there is overall agreement among survey respondents that a housing solution is needed.

Other public capacity questions included school, social services, police, and emergency response. School capacity is less of a concern among survey respondents than social service capacity. Interviewees described that social services are more impacted by the economic downturn from 2008 than schools and less able to handle a sharp increase in population. Survey responses suggest greater policing will be needed to preserve road safety once development begins. Survey and SME interviews indicate emergency responders are not being trained for development-specific hazards ahead of industry's arrival. Results also suggest there is a disconnect in problem perception between local and non-local government representatives: Local government respondents agreed only 22% of the time compared with non-local government representatives who agreed 42% of the time that emergency responders were trained for development related hazards.

Interviews and the survey results offered an array of options to improve safety at the drill site. Interviewees with established oil and gas industry have invested in specific training for their emergency responders for accidents which may occur at the well pad, their emergency responders are in direct contact with operators, and some communities have

installed cameras for live monitoring of wells. Other areas which are experiencing oil and gas development for the first time due to new hydraulic fracturing techniques are beginning to plan with the operators to enable emergency responders to reach the drill pads, but others are less concerned and their emergency responders have only had general HAZMAT training. However, these potential solutions require financial and human resources.

Coupling community capacity concerns with hesitation to invest (as described above) show that innovative approaches and solutions are needed for communities to flourish during and after oil and gas development have moved through the area. Few survey respondents believe wealth can be captured in a way that pays for the increased services communities will need to provide to the industry; though this issue is less of a concern for respondents from states with a mature oil and gas industry.

Finally, whether new development results in population growth due to oil and gas employees moving permanently to the communities where development is occurring, or the employees are more transient, our results suggest social dynamic issues may result. Nearly half of survey respondents agree employees are not integrated into the community because they live in work camps. A SME indicated higher rates of drug use at the camps and the fact that they spend money elsewhere was causing issues in the community.

Environmental Issues

Results suggest environmental issues such as air quality, water use and supply, and water contamination, is a major concern for government representatives. Respondents from states with a nascent oil and gas industry, especially local government representatives, are more concerned than respondents from states with a mature industry and non-local government's representatives. Metropolitan respondents are more concerned than non-metropolitan respondents.

The majority of all respondents agree that inspections throughout the drilling and extraction processes are necessary to protect water supplies. Survey results indicate disagreements and lack of information about the substances used in hydraulic fracturing processes are hampering water protection policy development at the local level more so than at the regional or state level. Similarly, states with a nascent oil and gas are more concerned than respondents from mature industry states that a lack of information about fracking-inclusive development processes is impeding water protection policy.

The survey focused on current regulations of two specific areas related to protecting water sources: regulations concerning the disposal of process water and State regulations protecting water supply from contamination due to hydraulic fracturing-inclusive gas development processes. Respondents from most groups do not believe current regulations are adequate to protect water supplies from contamination.

Communication

Survey responses indicate that states with nascent industries lack the communication methods necessary to develop solutions to development-related concerns such as environmental quality or public safety. Local governments, especially those from states with a nascent industry believe lack of communication is a barrier to developing policy or management solutions. Results also suggest that regardless of the states' industry maturity, local governments communicate less, and are not as involved in hosting development-specific meetings as their regional planning organization and state representative counterparts.

Results also suggest public meetings, particularly meetings focused on fracking-inclusive development issues, are the most effective ways to understand community, industry, and government issues and extend information about fracking-inclusive development to stakeholders.

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APPENDIX 1.

2003 RURAL–URBAN CONTINUUM CODES	
Code	**Description**
	Metro counties:
1	Counties in metro areas of 1 million population or more
2	Counties in metro areas of 250,000 to 1 million population
3	Counties in metro areas of fewer than 250,000 population
	Nonmetro counties:
4	Urban population of 20,000 or more, adjacent to a metro area
5	Urban population of 20,000 or more, not adjacent to a metro area
6	Urban population of 2,500 to 19,999, adjacent to a metro area
7	Urban population of 2,500 to 19,999, not adjacent to a metro area
8	Completely rural or less than 2,500 urban population, adjacent to a metro area
9	Completely rural or less than 2,500 urban population, not adjacent to a metro area

Source: http://www.ers.usda.gov/data-products/rural-urban-continuum-codes/documentation.aspx

Discussion of Rural-Urban Continuum: http://www.ers.usda.gov/data-products/rural-urban-continuum-codes/documentation.aspx

APPENDIX 2.

Pairwise correlation between level of government and industry maturity when controlling for industry maturity and level of government, respectively.

	Local vs. Non-local Government		Nascent vs. Mature Industry	
	Nascent Industry	Mature Industry	Local Gov.	Nonlocal Gov.
Fracking inclusive development will impact local economy.	14.08**	5.2	9.8 (0.13)	1.3
Local workforce is not trained, so industry hires out of state or out of region employees.	7.2	4.9	14.3**	7.8 (0.23)
Investment plans for income gained by the industry have been discussed to reduce boom-and-bust concerns.	15.1**	4.7	8.98 (0.11)	14.5**
Landscape damage reduces overall economic benefits to community	14.9**	0.91*	17.7***	7.97
Leasers know how to creates lease agreements which give them maximum benefits from development	4.4	4.9	14.8**	8.5 (0.20)
Population growth related to industry will NOT impact housing in our area.	11.8*	8.7 (0.19)	4.1	1.9
Wealth captured from industry will provide enough supplemental funds to pay for increased public service demands	8.4 (.213)	5.98	11.3*	5.4
Emergency responders have been trained development related hazards	10.1 (0.12)	5.8	24.4***	4.1
Water Contamination is NOT an issue.	7.3 (0.12)	6.8	25.1***	4.5
Water supply and access is NOT an issue.	7.3 (0.198)	5.7	22.3***	9.7 (0.14)
Water disputes between stakeholders have made it difficult to create policy.	4.9	4.5	4.6	4.4
Lack of info. about the substances used in the fracking process is a significant barrier to creating effective water protection policy.	11.6*	10.7*	17.1***	6.8
Public officials do not have the kind of comm. with stakeholders that allow them to find solutions to env. or public safety issues	13.6**	4.1	12.8**	5.9
Have not communicated with stakeholders about fracking-inclusive development	5.5**	3.8**	0.04	0.003

p-value 0.1 = *, 0.05**, 0.01***. If p-value was between 80% and 90%then p-value is in parentheses

APPENDIX 3.

Survey Questions and Overall Agreement/Disagreement*

SHORT AND LONG-TERM ECONOMIC DEVELOPMENT	
Statement	**Overall agreement**
Fracking inclusive gas development industry will drastically impact our local economy.	75%
If wealth from fracking inclusive gas development can be captured and used to invest in local infrastructure and civic opportunities, we can prevent a boom-and-bust cycle.	45%
Our area's tax structure, local workforce, land ownership, and other businesses provide enough opportunities for our communities to benefit from the natural gas industry.	47%
The local workforce is not trained to work in the fracking inclusive gas development industry; therefore gas producers hire employees from out of state or out of the region.	61%
Regional or county investment plans for income gained from fracking inclusive gas development have been discussed to reduce the effects of, or chances of, a boom-and-bust cycle.	31%
Local communities are hesitant to invest in business/ training/ housing and other infrastructure because of worries of a boom-and-bust cycle.	51%
Evaluating potential local economic development opportunities associated with future energy production options is likely to be important for a government in my area in 2012.	65%
Property rights and land/mineral ownership prevent counties from capturing income from natural gas extraction.	35%
State or federal taxes or fees that generate income from the fracking inclusive gas development generally are not distributed back to the county where the gas is being extracted.	59%

LAND-USE AND LOCAL CONTROL	
Statement	**Overall agreement**
The damage to the landscape due to drill sites and access roads hurts other local industries and dramatically offsets the economic benefits of fracking inclusive gas development.	60%
Property rights and land/mineral ownership prevent the counties from regulating where drill sites and access roads are located.	43%
Those involved in creating lease agreements with gas producers know how to make a lease that gives the leaser maximum benefits from the fracking inclusive gas development.	25%
Landowners surrounding the drill site are financially reimbursed to offset the nuisances produced by fracking inclusive gas development.	36%
Financial bonds between towns and oil/gas companies is an effective way to financially protect communities from paying for damages to road and landscape due to the oil and gas company use.	54%
Rezoning lands is an effective way to protect home, business, and land owners from placement of a drill site or access road that will have too many adverse effects to areas directly adjacent to the drill site.	54%
Formal agreements between the public and the oil company which specify drill site operation times are required or will be required to reduce complaints by landowners or residents adjacent to the drill site.	74%

COMMUNITY CAPACITY AND SOCIAL DYNAMICS	
Statement	**Overall agreement**
More housing is needed because the workers on drill sites are displacing others and subsequent rent increases are pushing out low income residents.	45%
Doing nothing is the best option because those who work at the drill site are commuting from their permanent homes outside the area of the drill sites and do not need housing in the area.	20%
Because the wells have an average life of 5-30 years and the gas industry employees may leave the area once wells have been exhausted, building temporary housing is the best option for my area.	15%
Currently the school system does not have the capacity to handle an increase in the number of school children due to the related population growth.	44%
At their present capacity the region's social services cannot handle an increase in work load caused by the needs of the new population and other economic shifts noted above.	54%
Local policing is needed to enforce traffic laws on the access roads and other routes used by heavy trucks to and from the extraction site to ensure that road safety is preserved.	80%
Income captured from the extraction of natural gas and other substances related to fracking inclusive gas development would be enough income to supplement potential higher demand on schools, social services, emergency personnel and other infrastructure.	33%
The employees from fracking inclusive natural gas development industry are not integrated into the community because they live in camps near the work site and then leave the area for their permanent homes when they 're not working.	44%

EMERGENCY MANAGEMENT	
Statement	**Overall agreement**
Emergency responders have been trained specifically for potential emergencies at the drill site throughout the preparation, drilling and fracturing, and extraction processes.	28%
Live monitoring of operations (i.e. Onsite video monitoring) is a successful way to improve the safety and response to emergencies at drill sites.	44%

ENVIRONMENTAL CONCERNS	
Statement	**Overall agreement/ disagreement***
Air quality around the drill site is a concern to the community for health, social, or environmental reasons.	77%
Water contamination due to fracking inclusive gas development processes is not an issue.	72%*
Water supply and access for fracking inclusive gas development processes is not an issue.	72%*
Current regulations concerning the disposal of process water are effective in keeping local water supplies from being contaminated.	56%*
State laws provide enough protection to local water supplies and sources from potential contamination due to fracking inclusive gas development processes.	62%*
Inspections during the drilling, fracking, and extraction process are necessary to ensure that water sources are not contaminated by the fracking inclusive gas development.	91%
Disagreements related to water quality and contamination between stakeholders, citizens, or policymakers has made it difficult to finalize the issues from a regulation or planning perspective.	72%
Lack of information about the substances used in the fracking process is a significant barrier to creating effective plans or regulations that protect water supplies (and our citizens) from contamination.	71%

INFORMATION AND COMMUNICATION	
Statement	**Overall agreement**
Public meetings are effective methods for informing the public about hydraulic fracturing and natural gas extraction.	74%
Public meetings are effective methods for gathering information from the public about their concerns.	84%
Public officials do not have the kind of communication with the land owners, natural gas/oil companies, and community that allows them to find solutions to environmental or public safety issues (water quality, road safety, noise, air quality).	44%
My agency/council/office has been directly involved in hosting meetings or gathering stakeholders to discuss hydraulic fracturing and natural gas development.	54%
Are you engaged in any regional energy planning?	64%
Regional energy planning is an important priority for a government in my area.	63%

APPENDIX 4. SURVEY

Introduction

Thank you for taking your time to complete this important survey regarding hydraulic fracturing based oil and gas development in your region.

The Buechner Institute for Governance at UC Denver, the National League of Cities, and the National Association of Regional Councils are gathering information on the concerns and obstacles that local and regional governing agencies have encountered when addressing hydraulic fracturing and their current methods for addressing those obstacles.

The information you provide is critical for us report to the U.S. Department of Energy and other universities where future research around shale gas development and hydraulic fracturing should focus. The National League of Cities and the National Association of Regional Councils will share the report with their membership as a means to provide a source of productive policy solutions for hydraulic fracturing based oil and gas development.

The questions in this survey were drafted from issues brought forth by regional planning organizations and state agencies in meetings and phone interviews over the past year. The intent of the survey is to understand how concerns vary across the country and aid in the development of local and state policy solutions. Please answer each question from your perspective as a local policy maker, regional planning organization representative, or state department official.

Your responses will be STRICTLY CONFIDENTIAL. When you click "Send Survey" your responses will be saved only with a unique identifier. Your name and organization will never be directly linked to your responses. This study has been reviewed by the Institutional Review Board at UC Denver.

If you have any questions, please contact Sam Gallaher (samuel.gallaher@ucdenver.edu). Thank you in advance for your time and thoughtful responses!

1. Please enter your office zip code. This information will be used for regional comparisons *(i.e. western state issues versus eastern state issues)***.**

2. Please indicate the type of organization you represent:

- ☐ State Government Agency
- ☐ Regional Planning Organization
- ☐ Other Regional Governance Organization
- ☐ Local Government Agency
- ☐ Other *(please specify organization type)*

A note the on language and terms used in the survey:

Experience with hydraulic fracturing, the natural gas industry, and natural gas extraction will vary greatly between survey respondents. Because of this, the language used to discuss the pros and cons of hydraulic fracturing and all of the pieces of gas development that occur before and after the actual fracturing event will also vary. IN THIS SURVEY, to keep questions concise, we use the phrase "fracking-inclusive gas development" as an umbrella phrase to discuss the entire natural gas extraction process including site preparation, drilling, well completion including hydraulic fracturing, and production. We use the word "fracking" when we specifically mean to discuss the specific event in the drilling process employing hydraulic fracturing to access the natural gas in a shale deposit. We chose the word fracking and its spelling to reflect the most commonly understood word to discuss hydraulic fracturing. Please accept its use for this survey.

Unless otherwise stated, each question is answered on a 7 point Likert-scale with an option to state 'No Opinion'

1. Strongly Agree
2.
3.
4. Neutral
5.
6.
7. Strongly Disagree
No Opinion

Housing Issues:

Some regions and localities have witnessed large numbers of people entering the community to work on the extraction sites to prepare for operations, drill and fracture, or extract the natural gas. Because of this, the communities where the drill sites are located may need more housing. The following are a few solutions for housing these employees.

3. **Population growth related to fracking-based gas development will not impact housing in our area.**
4. **Because the wells have an average life of 5-30 years, and the gas industry employees may leave the area once wells have been exhausted, building temporary housing is the best option for my area.**
5. **Doing nothing is the best option because those who work at the drill site are commuting from their permanent homes outside the area of the drill sites and do not need housing in the area.**
6. **More housing is needed because the workers on drill sites are displacing others and subsequent rent increases are pushing out low-income residents.**

Economic Growth Issues

Wealth capture from the fracking-inclusive gas development processes can be a concern for some communities. Some areas have been more successful than others at capturing the wealth created by the fracking-inclusive natural gas extraction industry. Rate how much you agree with the following statements.

7. **Our area's tax structure, local workforce, land ownership, and other businesses provide enough opportunities for our communities to benefit from the natural gas industry.**
8. **The local workforce is not trained to work in the fracking-inclusive gas development industry, therefore gas producers hire employees from out of state or out of the region.**
9. **State or federal taxes or fees that generate income from the fracking-inclusive gas development generally are not distributed back to the county where the gas is being extracted.**
10. **Property rights and land/mineral ownership prevent counties from capturing income from natural gas extraction.**
11. **Evaluating potential local economic development opportunities (e.g. jobs) associated with future energy production options is likely to be important for a government in my area in 2012.**

Boom and Bust Cycle Concerns

One concern sometimes raised in recent discussions is that due to the limited life cycle of a natural gas well (5-30 years) and a limited number of potential well sites in one region, the industry created by hydraulic fracturing will be a temporary source of income; consequently the region may be subject to a boom-and-bust economic cycle. The next few statements relate to boom-and-bust cycle concerns. Rate each with your level of agreement for the economic impact hydraulically fractured natural gas development will have on your municipality, county, or region.

12. **Fracking-inclusive gas development industry will drastically impact (either positively or negatively) our local economy.**
13. **Local communities are hesitant to invest in business/training/housing and other infrastructure because of worries of a boom-and-bust cycle.**
14. **If wealth from fracking-inclusive gas development can be captured and used to invest in local infrastructure (roads, schools, utilities, police) and civic opportunities (recreation centers, arts, museums), we can prevent a boom-and-bust cycle.**
15. **Regional or county investment plans for income gained from fracking-inclusive gas development have been discussed to reduce the effects of, or chances of, a boom-and-bust cycle.**

Local Control and Protection of Land Modification

Many drill sites require modifications to landscape to prepare the area for extraction and to create access roads through public and private lands. Heavy trucks also haul fresh/waste water to and from the drill site. Each of these activities can cause damage to roads and landscape.

16. Financial bonds between towns and oil/gas companies is an effective way to financially protect communities from paying for damages to road and landscape due to the oil and gas company use.

17. Those involved in creating lease agreements with gas producers know how to make a lease that gives them (the land owner, city, county, etc.) maximum benefits from the fracking-inclusive gas development.

18. Property rights and land/mineral ownership prevent the counties from regulating where drill sites and access roads are located (for example, the land is federally owned so the Federal Bureau of Land Management (BLM) has regulative authority over the extraction of oil and gas.)

19. The damage to the landscape due to drill sites and access roads hurts other local industries (for example, recreation, housing, tourism) and dramatically offsets the economic benefits of fracking-inclusive gas development.

20. Rezoning lands is an effective way to protect home, business, and land owners from placement of a drill site or access road that will have too many adverse effects to areas directly adjacent to the drill site.

Public Safety

Drill site creation and operations along with moving materials to and from the area all have inherent risks. Blowouts and other accidents may occur. Some well pads are located in remote areas without out clear addresses and their access roads may be difficult for emergency vehicles to traverse. Truck traffic discussed above may be along domestic routes as well. Rate your level of agreement with each statement or possible policy solution:

21. Local policing is needed to enforce traffic laws on the access roads and other routes used by heavy trucks to and from the extraction site to ensure that road safety is preserved.

22. Emergency responders have been trained specifically for potential emergencies at the drill site throughout the preparation, drilling and fracturing, and extraction processes. 23. Live monitoring of operations (i.e. Onsite video monitoring) is a successful way to improve the safety and response to emergencies at drill sites.

Adjacent Landowner Issues

Drilling and extraction require engine-driven machinery that produce noise and exhaust. Rate your level of agreement for each statement or possible policy solution:

24. Formal agreements *(contracts, lease stipulations, etc.)* **between the public and the oil company which specify drill site operation times are required or will be required to reduce complaints by landowners or residents adjacent to the drill site.**

25. Air quality around the drill site is a concern to the community for health, social, or environmental reasons.

26. Landowners surrounding the drill site are financially reimbursed to offset the nuisances produced by fracking-inclusive gas development.

Water Supply and Water Source

Communities have voiced concern over possible contamination and depletion of their water sources/supply and the ability of municipal water treatment processes to support fracking-inclusive gas development processes.

27. Water CONTAMINATION due to fracking-inclusive gas development processes is not an issue.

28. Water SUPPLY AND ACCESS for fracking-inclusive gas development processes is not an issue.

29. Disagreements related to water quality and contamination between stakeholders, citizens, or policymakers has made it difficult to finalize the issues from a regulation or planning perspective.

30. Lack of information about the substances used in the fracking process is a significant barrier to creating effective plans or regulations that protect water supplies *(and our citizens)* **from contamination.**

31. Inspections during the drilling, fracking, and extraction process are necessary to ensure that water sources are not contaminated by the fracking-inclusive gas development.

32. Current regulations concerning the disposal of process water are effective in keeping local water supplies from being contaminated.

33. State laws provide enough protection to local water supplies and sources from potential contamination due to fracking-inclusive gas development processes.

Population Growth

As discussed above, some areas have witnessed a large increase in population growth due to fracking-inclusive gas development industries. In addition to housing issues, past respondents have indicated a) strains on emergency management personnel, schools, water/road ways, and social welfare programs in the community; and b) integration issues between the new population and current population.

34. At their present capacity the region's social services cannot handle an increase in work load caused by the needs of the new population and other economic shifts noted above.

35. Currently the school system does not have the capacity to handle an increase in the number of school children due to the related population growth.

36. Income captured from the extraction of natural gas and other substances related to fracking-inclusive gas development would be enough income to supplement potential higher demand on schools, social services, emergency personnel and other infrastructure.

37. The employees from fracking-inclusive natural gas development industry are not integrated into the community because they live in camps near the work site and then leave the area for their permanent homes when they are not working.

Information and Stakeholder Involvement

Informing the public and working with stakeholders have been used to find solutions to issues surrounding hydraulic fracturing and natural gas development. Which of the following strategies or statements do you agree with?

38. Public meetings are effective methods for informing the public about hydraulic fracturing and natural gas extraction.

39. Public meetings are effective methods for gathering information from the public about their concerns.

40. Public officials do not have the kind of communication with the land owners, natural gas/oil companies, and community that allows them to find solutions to environmental or public safety issues (water quality, road safety, noise, air quality).

41. My agency/council/office has been directly involved in hosting meetings or gathering stakeholders to discuss hydraulic fracturing and natural gas development.

42. Check the methods that your organization has used to communicate with various stakeholders about fracking-inclusive gas development and/or the fracking process.

Check each method that has been used.

- ☐ We have not communicated with stakeholders about fracking-inclusive gas development
- ☐ Emails to specific groups or people
- ☐ Face to face meetings
- ☐ Group phone conferences with specific groups or people
- ☐ Newspaper articles
- ☐ General public meetings (For example, regularly scheduled city council meetings)
- ☐ Blogs or internet based social networks
- ☐ Specific public meetings addressing hydraulic fracturing and shale gas development
- ☐ Other (please specify)

General Management of Gas Development and Mitigation of Issues

The hydraulically fractured natural gas issue, new federal environmental (air quality) standards, renewable energy portfolio standards (RPSs) and huge sums of federal energy efficiency stimulus dollars devoted recently to local governments has put energy planning, especially regional energy planning, on many local government agendas.

43. Are you engaged in any regional energy planning?

- ☐ yes we are
- ☐ yes we have plans to become engaged
- ☐ no we are not engaged but will be in the near future
- ☐ no we are not engaged and have no plans
- ☐ No Opinion

For each of the following statements use the scale below to give your level of agreement:

44. State level laws, rules, or policies prevent the counties from regulating/monitoring fracking practices and fracking-inclusive gas development to the extent they would like.

45. Regional energy planning is an important priority for a government in my area.

46. Our local government leaders are concerned about the possibility of future energy outages. (e.g. grid concerns, supply/demand issues, brownouts).

Thank you very much for your time and responses.

If you would like to be contacted for any follow-up conversations on the topic please provide your name, organization, and email address. This information will not be published or linked with survey results. The information will only be used in private communication with your member organization on the subject of natural gas development.

APPENDIX 5. PHONE INTERVIEW SCHEDULE

Let me tell you a little about the project before we get started. I am from the University of Colorado Denver, working with the National Association of Regional Councils to gather regional and community concerns and priorities about hydraulic fracturing practices and shale gas development. Many of the questions were developed based on a Roundtable discussion with NARC in July of this year on the state of shale development and publications around hydraulic fracturing techniques and local government concerns. The information collected in this phone interview will help create a larger survey that will go to local and regional government officials in seven states who have the potential to experience shale gas development. Summaries of these interviews will also be a part of a report which will compare the concerns of states regarding fracking and guide further research into addressing those concerns.

I will be asking you questions relating specifically to the stakeholders involved, local management of shale gas development, financial and economic impacts, environmental impacts, how your government is mitigating risks associated with shale gas, the regulations that affect your ability to manage and benefit from development, and how your government communicates with the community.

The interview will take from 30 to 45 minutes. I do have a fair amount of questions, so we won't be spending a large allotment of time on any specific one. I will be taking notes during the course of the interview. If there is something that you wish to tell me that you want to remain off the record, please let me know and I will not record it. Furthermore, unless I get specific consent from you, all of your responses will kept anonymous in the report.

Please be as direct as possible. It's ok to say, "I don't know" or to ask me to clarify a question that is unclear.

Part 1: Stakeholder Involvement

In this first section, I'd like to discuss the stakeholders related to shale gas development and your agency's interaction with them.

Q1.1 Who has been active in shaping policy and implementation in your area specifically on fracking?

Q1.2 Has your agency/council done any work to engage stakeholders related to shale gas development? If so what does that look like?

Part 2: Information and Perception

Next, I'd like to discuss information sources about and the local understanding and perception of shale gas development.

Q2.1 From your perspective what is the key information source for fracking? (i.e. federal, industry, or university sources)

Q2.2 Does state or local governments where you live have any information campaigns to inform the public about fracking and shale gas development? If so, what does that look like?

Q2.3 Based on your experiences and interactions what is the perception from both key decision makers/elites and general public about fracking?

Part 3: Long-term Economic Impacts

Next, I'd like to discuss long-term economic impacts and concerns related to shale gas development in your area. Long-term economic impacts involve local economic stability of business and government with the rapid rise and fall of revenue created by shale gas development in mind.

Q3.1 From an economic perspective, in your view is this technology a plus or a minus for your community?

Q3.2 What do you think are the key community economic impacts of fracking; good or bad?

Part 4: Population Growth and Community.

The shale gas industry development also has the potential to bring new people to the area. A possible new mixture of residents as well as potential increases in population might have implications on the community interactions, public services, and local resources.

Q4.1 If there is an increase in population due to shale gas development, what do you think that would mean for housing and other infrastructure in your area (for example, land use, water, electricity, and schools)

Q4.2 At present do you have any concerns about the impact an increase in population could have on human services or social welfare programs in your community?

Q4.3 With respect to shale gas development, is the potential for people moving out of or into your community a concern at present?

Part 5: Public Safety Concerns

Now let's discuss other a couple of issues related to the community's public safety and emergency response resources.

Q5.1 Has your community devoted any special resources to prepare for emergency incidents at the drill site?

Q5.2 Has your community encountered any issues with public safety due to shale gas development (i.e. increased truck traffic or other traffic safety issues, hazardous materials, or explosions?)

Part 6: Environmental Concerns

Now I'm hoping to get your input on issues raised at past meetings and reports about the environmental effects of shale gas development and the hydraulic fracturing process.

Q6.1 Do you or other people in your community have concerns about environmental effects hydraulic fracturing and shale gas development could bring to your community? (For example: Water supply, storage, treatment; air pollution; road damage and erosion)

Q6.2 Have you taken any specific steps to avoid or reduce the environmental impacts due to shale gas development?

Q6.3 Some communities have experienced conflict over well locations where neighbors have had issues with a well site adjacent to their property (eye sore, noise). Have you experienced this conflict in your community?

Part 7: Nature of Regulatory Scheme in the State

In the next section I'd like to ask you about state and local policies specifically relating to the issue of hydraulic fracturing and shale gas development as well as your government structure.

Q7.1 Where you live does the state or county collect taxes/revenue from shale gas development and extraction and does the local community get anything back?

Q7.2 Do state policies prevent you from being able to adequately plan for shale gas development in your community?

Q7.3 Do the governors' office and city council collaborate when solving problems or meeting the demands related to shale gas development?

APPENDIX 6. DISCLAIMER

This work was funded by the Buechner Institute for Governance. The Buechner Institute for Governance has a working university research partnership with the National Association for Regional Councils, who provided assistance in distributing the survey, but had no role in the analysis or interpretation of the collected data. All information and analysis in this report is the product of standard social science research methods, represents the best professional judgments of the project investigator and all analysis contained herein should be attributed to the project investigator. In no way should this report be construed as reflecting the official views or opinions of the University of Colorado Denver, nor should the report be construed as having been endorsed as an official statement by the University of Colorado Denver.

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