Chapter Three

Confronting An Uncertain Future
How US Communities are Responding to Shale Gas and Oil Development

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Abstract

"Fracking" (horizontal drilling / high volume hydraulic fracturing) for shale gas and oil is a widespread, industrializing endeavor that will affect a variety of regions in the majority of US states. This chapter assays what we know historically about natural resource development cycles in general, the particular social and economic impacts and local government responses associated with unconventional fossil fuel development in the US, and what our existing knowledge implies for planning and the design of policies that will address the risks of shale development and sustain affected communities through the boom-bust cycle and for the long term.

Introduction

When people think about natural resource extraction, they think of places that are sparsely settled and far from cities and suburbs. The US has a rich lore of "boomtowns" and "ghost towns," yet people rarely connect this history -- and the boom-bust cycle it depicts -- to contemporary resource development (Cortese and Jones 1977; Freudenberg and Wilson 2002; Kassover and McKeown 1981). Today's natural gas and oil development using horizontal drilling and high volume hydraulic fracturing (HVHF, commonly referred to as "hydrofracking" or just "fracking") is both similar to and different from our previous experience. It will produce the same cycle of boom and bust at the local level, but it is occurring on a scale nationally that raises policy concerns for at least 28 states[1], thousands of local governments,

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[1] The latest US Energy Information Administration map (http://www.eia.gov/oil_gas/rpd/shale_gas.pdf) shows "current" or "prospective" shale plays in 27 states, but does not account for the Triassic Basin shales in North Carolina (http://geology.com/articles/north-carolina-natural-gas/). According to Davis (2011) and Wiseman (2013), 27 states *currently* have identifiable deep shale or coalbed methane deposits *and* enough gas producing activities to warrant regulation. Davis (2013) cites 33 gas-producing states overall, while America's Natural Gas Alliance (ANGA) "representing North America's largest independent natural gas exploration and production companies" identifies 32 (http://anga.us/why-natural-gas/abundant/shale-plays - .UkgdG4WkLbk) -- but again, not including North Carolina.

and for the federal government as well. Significantly, drilling is occurring or may occur in a wide variety of landscapes – in or near major cities, in residential neighborhoods, in semi-rural environments, and in isolated rural communities. And the risks of shale development extend outward -- to communities from which drilling materiel and water are drawn, those located along the pipelines, roads and rails en route to and from the drill sites, and those through which wastewater is transported for disposal or the gas and oil flows to market. The controversial mining of 'frac sand' in the Midwest (Karnowski 2012), or the earthquakes caused by an injection well near Youngstown Ohio (Choi 2013), or the explosion of a unit train carrying shale oil in Lac-Megantic, Quebec – all places far from the drilling fields – illustrate just how consequential these risks can be.

But the same is true of the distribution of benefits, and Youngstown again provides an illustration: just two miles from that injection well, V&M Star is repurposing a mill shuttered 34 years ago by Youngstown Sheet and Tube, to produce seamless pipe for the burgeoning hydrofracking industry infrastructure (Niquette and Varghese 2012). This vignette captures two realities of shale gas development -- that job creation and economic benefits, as well as risks, occur all along the supply and distribution chain, not just within the drilling regions -- and also that drilling regions may not see job creation and economic benefits proportionate to their risks. Risks are localized, and frequently long lasting [e.g. public health effects, community social-psychological disruption] (Brasier 2011; Jacquet 2013; Perry 2012). Benefits last only as long as new wells are being drilled and new investment is occurring. And, benefits follow the money: when it comes to jobs and indirect or induced economic benefit, it is not where the activity takes place but where the money is spent that counts.

On a national scale, the discovery and exploitation of large shale gas and oil deposits in many areas of the country has been welcomed as a source of jobs in a period of long-term economic stagnation, and touted as a source of lower energy prices for consumers and energy security for the US.[2] The shale gas and oil boom is stimulating construction of an energy infrastructure based on natural gas, despite increasing skepticism among industry leaders about its duration (Ayres, 2013; Chazen, 2013).

Whatever the number of states that eventually experience HVHF shale *drilling*, the extraction of drilling materiel, the disposal of waste products, and the transportation of the gas and oil produced will affect many non-producing states.

[2] Neither lower US prices nor US "energy independence" is assured. Absent a national energy policy that retains shale gas and oil produced in the US for domestic use, the industry is free to export them to the highest bidder, and the price and availability of those products will continue to be determined by supply and demand on the world market. Further, to the extent that the gas and oil are used for electric power generation, the energy prices actually paid by US consumers are determined by large electric utility companies. Customers in the states that have de-regulated their energy markets (including New York, California and Texas) pay higher rates for electricity, notwithstanding the price or availability of the source of energy used to generate it (American Public Power Coalition 2013; Texas Coalition for Affordable Power 2012).

At a regional or local level, the calculation of costs and benefits is even more complicated. State and local policy makers are beginning to confront a list of risks, social and economic as well as environmental. Some may arise in the immediate "boom" phase; others pertain to the long term, after the boom dissipates. The extent of these risks differs from one region to another. What is consistent is the central dynamic of natural resource development: a cycle of dramatic growth and then decline, sometimes precipitous, over which policymakers have had little control. The uncertainties presented by shale gas and oil development, and the wide variety of US regions it may affect, have stimulated unprecedented public education and participation. They have also raised new concerns about the post-hydrofracking future that require new policy approaches.

One indication of that uncertainty is the strong local community response to shale gas and oil development. The issues that dominate local public discussion include environmental risks, but extend to perceived threats to existing industries and to a highly valued quality of life. In the next sections, we examine some of the social and economic risks associated with shale development. We then describe results from a study of local government responses to HVHF that illuminate how communities in the Marcellus Shale perceive the risks they face and whether those risks will be addressed. In the final section, we look at how policy makers can approach the social and economic risks connected with shale oil and gas development, even with the limited systematic knowledge we have about those risks and the underlying uncertainty that characterizes unconventional fossil fuel development.

Some Key Economic and Social Dynamics of Contemporary Shale Gas and Oil Development

Easy Come, Easy Go: The Big Picture

Like any nonrenewable resource development, shale development does bring an economic "boom" to extraction regions, at least during the period when drilling sites and support facilities are set up and drilling takes place. As drilling companies move into a community, population flows in. Local expenditures rise on everything from auto parts to pizza and beer. There is a modest increase in jobs outside the extraction industry itself (Freudenberg and Gramling 1998; Marchand 2011) in construction, transportation, retail, hotels and restaurants, entertainment and services. Landowners receive royalty payments and have extra money to spend. The tax base may expand, providing a windfall for a local government. Research on actual employment impacts in resource development regions indicates that job projections are typically over-stated (Weinstein and Partridge, 2011; Weber, 2012), but notwithstanding

the exaggerated estimates and guesstimates that abound about this increased economic activity, any increased activity is very welcome in light of the "great recession"

But while a natural resource extraction boom may bring job and population growth for a few years, it also increases public service costs and the cost of living for residents, and "crowds out" other industries. Shale development brings an additional level of uncertainty: if a number of US states are engaged in shale gas and oil extraction, drilling rigs may move at short notice from one region to another, causing a series of economic disruptions as drilling starts up, shuts down, and then starts up again (Best 2009).

Boomtowns frequently experience social problems brought about by the influx of a transient population that follows the oil and gas industry rigs from one place to another. After the boom ends and the drilling crews and their service providers depart, the region may have a smaller population and a poorer economy than before the extraction industry moved in (Feser and Sweeney 1999). If this boom-bust cycle is combined with environmental damage, the long-term costs to regions hosting shale gas and oil extraction may be considerable.

What is certain is that: 1) natural resource development -- including unconventional fossil fuel development -- is positive for some segments of the population (mineral rights owners, some businesses) and negative for others (renters, land owners without mineral rights, businesses in competing industries), and 2) when the commercially viable resources are depleted, drilling ceases -- either temporarily or permanently -- and there is an economic "bust". The businesses and personnel connected to resource extraction leave the community (Christopherson and Rightor 2012). Population and jobs depart the region (Feser and Sweeney 1999).

More difficult to assess is: how great do the gains actually prove to be, how long do they last, how widely distributed are the benefits, how great are the costs – social costs as well as monetary ones, and do those who benefit also pay the costs?

Lowering the Boom: Local Impacts

Documenting the extent and trend of social and economic impacts on local communities new to shale gas and oil development is difficult. With the exception of crime statistics, there are no data compilations that support ready comparison of social and economic impacts across counties in conjunction with the progress of the drilling cycle. Data, if available at all, must be assembled county-by-county or agency-by-agency. What we do have are analyses of the social and economic impacts on counties in the Western

States where shale gas and oil development has occurred for two decades, and anecdotal evidence from the northern tier counties of Pennsylvania where the most intense Marcellus Shale drilling has been underway since 2008. While not a precise forecast, this accumulating body of evidence provides at least a picture of what more rural or urban-adjacent localities should anticipate with shale gas and oil extraction.

Data definitively documenting how localities are affected by HVHF shale gas and oil development is currently not available because neither the states nor the federal government have been willing to collect it. The absence of data on impacts has hampered states' ability to realistically assess the costs of HVHF development and impose impact fees or taxes to compensate for losses. However, despite the absence of statistical data, there is a large literature documenting similar social and economic impacts among localities in different shale plays. This literature includes: environmental impact statements, public policy reports, academic journal articles and eyewitness accounts by journalists. In some cases, there are multiple accounts of social and economic impacts in the same area, such as Sublette County Wyoming or Williston North Dakota, at different points in time. This literature forms the evidence used in this paper. [3]

The consistent theme in this now extensive literature is that state and local governments --- counties, cities, townships, villages --- are subjected to a wide range of demands for new services or increased levels of service, and that the administrative capacity, staffing levels, equipment, and outside expertise needed to meet those demands are beyond what has been locally budgeted.

The drilling phase of shale gas development usually depends on an out-of-state workforce (Jacquet, 2011). Although resident workers may be employed during the drilling phase as truck haulers or in service and construction jobs, even these jobs may be filled by workers who move into the drilling area while maintaining a permanent residence in another state. This in-migration of transient workers has been exacerbated by the great recession in the US and the paucity of job opportunities elsewhere in the nation. In the case of the drilling workforce itself, this means a sudden influx of young men --- some with families, many without. Some will be experienced gas field veterans; others will be those drawn from other places to the boom and the prospect of work.

[3] In addition to the references cited on particular topics, key sources include: Fuller 2007; Headwaters Economics 2009, 2012; Kelsey et al 2012; King 2012; Putz 2011; Perez-Burgos and Donaghy 2012; Pinedale Anticline Working Group 2006; Wilber 2012.

In Sublette County Wyoming, for example, as the number of gas wells drilled *per year* climbed from one hundred in the year 2000 to more than five hundred in 2006, the population of Sublette County swelled by 24%. During that same period, Wyoming's population grew by just 4%, indicating that workers and their families were flocking to the area to meet the new labor demand. The most dramatic increase in population came from teens and young adults age 15 to 24, and even as adults age 25 to 44 were decreasing statewide, they were increasing in the County. Indeed, all cohorts of working age adults increased more rapidly in Sublette County than statewide. (Ecosystem Research Group, 2008: 20-24)

According to Jacquet (2009), this short-term population influx creates significant demands on public services. Add enough young men with hard jobs, disconnected from family and community ties and seeking "a good time", and both legal and illegal forms of entertainment prosper. So, communities needed more police. Traffic on major roads increased, as did the number of traffic accidents, the number of emergency room visits, and the demand for emergency response services. In addition, local schools experienced increased demand as some workers entering the region enrolled their children. And, as demand for all manner of goods and services increases and local businesses seek to exploit the boom, prices go up --- not just for temporary residents, but for long-time local residents as well; Jacquet found that local prices in Sublette County increased by twice the national rate over a six-year "boom" period.

The price inflation characteristic of shale boom regions especially affects rental housing. Evidence from across contemporary shale plays indicates that rents rise dramatically in drilling areas. Local long-term renters who cannot afford their apartments are displaced, and may seek housing assistance from local government. Hotels and motels, vacation rentals, RV parks, and campgrounds fill up with transient gas drilling workers, and drilling companies may resort to the construction of storage-facility-like "man camps" to alleviate the housing shortage (Rumbach 2011; Rubinkam 2010).

Williston, North Dakota is an isolated prairie town where a shale oil and gas boom is now underway. The city has been inundated by people from all over the US looking for work, and while in-migrants to Williston frequently find work, they have nowhere to live. The homelessness rate in the city rose above 19 per cent in 2011, with many people living for long periods in temporary quarters. Unfortunately, Williston has experience with the boom-bust cycle of oil and gas development, and that experience has discouraged investment in the housing needed for this workforce. Local interviews indicate that: "Developers have been slow to build more apartments, largely because they got stung by the region's last oil boom that went bust in the 1980s" (McPherson, 2011).

And, in an example of "crowding out", the increased demand for accommodations may benefit hotel and motel owners and local restaurants, but it hurts other local businesses, as there are few rooms available for a more traditional clientele: business travelers, recreation seekers, and tourists.

While reliable regional data on the numbers of transient workers are difficult to come by, one Wyoming drilling community estimated that they would easily increase the town's census by 20% or more (Town of Marbleton 2007). In the long run, given the population declines suffered by many communities in potential drilling regions, an influx of new people might be welcome if the newcomers like the area and decide to stay. Indeed, the small state of Wyoming has seen population increases and an unemployment decline over the past decade, especially in communities near gas drilling areas. But perhaps unexpectedly, a rapid increase in drilling activity is not always associated with a commensurate increase in population *resident* in the counties where the drilling occurs. An analysis of population change in core natural gas drilling counties in the Marcellus Shale during the first decade of the 2000s indicates that the resident population in these largely rural counties has grown marginally if at all. (Christopherson and Rightor, 2011)

There are various reasons that population growth does not occur in these core counties, but the most frequently cited are the absence of services, the higher cost of living, and the lower quality of life in an industrialized environment. A reporter interviewing drillers working in the northern tier of Pennsylvania about why they reside across the border in southern New York, captured the reason in one quote:

> *"There is nothing there — there's no entertainment, there's nothing to do," he said of that Pennsylvania locale as he sipped a margarita. "Chemung County"* (in New York)*, Mr. Cullen added, "is where we spend our money."* (Navarro, 2012) [4]

Spreading the Cost: Regional Impacts

The impact in New York of gas development in rural Pennsylvania is but one example of how the economic and social impacts of shale gas and oil development – both positive and negative -- are likely to be felt not only locally but regionally, affecting cities and counties in areas adjacent to the drilling localities and beyond.

[4] For a close-up of this border region between the "Northern Tier" counties of Pennsylvania and the "Southern Tier" counties of New York, see the map generated by the Susquehanna River Basin Commission at http://www.srbc.net/atlas/downloads/BasinwideAtlas/PDF/1404b_ABR.pdf. For an overview of the entire Marcellus Shale Formation area, featuring the state and county borders, see the map drawn by Timothy Murtha (using data from the National Atlas of the United States and the United States Geological Survey) at http://march.rutgers.edu/2011/11/marcellus-shale-the-cultural-landscape-of-natural-gas-in-pennsylvania/.

Well sites are not the only feature of the industrialization brought about by shale gas development. Water extraction sites must be developed. Sand must be mined. These inputs and a variety of chemicals must be transported by trucks – many, many, heavy trucks -- to the well pads. After extraction, gas flows from the well sites to the main transmission lines via a network of pipelines, compressor stations, and storage facilities. Oil moves by pipeline, or frequently by rail car, to the refineries. Flowback and produced water from the wells has to be transported to treatment facilities, which must be equipped to handle the increased volume and particular array of toxic and non-toxic wastes, or to injection wells. The facilities required will be located where geologic or logistical factors dictate, but these operations may touch communities hundreds of miles from the drilling regions, often in another state.

Among the support facilities needed by a drilling region are man camps (caravan sites for transient workers), staging sites, water extraction sites, landfills for drill tailings, water treatment facilities, pipelines, compressor plants, gas storage facilities, and railroad spurs. These facilities create a wide range of potential environmental, economic, and social stressors, all of which have implications for the regional economy and existing industries, particularly tourism and agriculture. (McGowan 2011; Rumbach 2010; Adams and Kelsey 2011).

For example, apart from the dangers inherent in a widespread network of pipes full of methane or in high-pressure equipment generally, noise is a major concern related to compressor stations: they produce noise levels in the 85 to 95 decibel range. These levels are at or above the US Occupational Safety and Health Administration (OSHA) threshold of safety for an 8-hour day, and compressors work a 24-hour day. Environmental stressors can have an effect on nearby citizens, adjacent property values, and on other industries in the vicinity, including those in near-by cities.

Another example of the impact shale development facilities may have on a rural region is provided by the proposed gas storage facility in the Finger Lakes region of New York State, a major area for tourism because of its scenic beauty, small towns and vineyards. This facility is being planned by Inergy Midstream, LLC for the former US Salt plant just north of Watkins Glen, New York, with underground storage for 1.45 billion cubic feet of natural gas. The new owners propose to add an up-to-88.2 million gallon liquid propane storage facility, also underground, plus 2 large brine ponds on the surface.

The site for this major facility is near the intersection of two gas transmission pipelines and, as a salt mine, is an appropriate natural gas storage site. But Watkins Glen, in largely rural Schuyler County, is

not part of the 'fairway' --- the purported 'sweet spot' for Marcellus drilling in New York, so it is not likely to obtain local tax revenue from well production. Whatever the plant may contribute in the way of local taxes, Watkins Glen currently depends on revenue from Finger Lakes tourism, attendance at its famous auto races, the local wine industry and agriculture.

Industrialization for All: Remote Impacts

The industrial inputs to the drill site may come from rural areas far from the oil and gas extraction sites. Of particular note here is the connection between the growing use of HVHF technology and the proliferation of sand mining in Western Wisconsin and Eastern Minnesota, transforming what were once small rural towns whose economies centered on agriculture and tourism, and dividing the populace over what the environmental and public health hazards of silica dust may do to them and to those industries (Karnowski 2012; Deller and Schreiber 2012).

Transportation of the product also has far flung impacts. The shale oil pumped from North Dakota's Bakken Shale play travels across rural America every day in thousands of rail cars, in train sets up to 120 cars long, along routes that bisect major populated areas, to the Port of Albany in New York. These unit trains, carrying millions of gallons of oil, create environmental and safety risks along the rail route and at transshipment sites. In May 2013, the Department of Environmental Conservation of New York State approved the transshipment of 1.8 billion gallons of oil per year from rail cars to barges on the Hudson River.

We're All In This Together

Although the regulatory focus has been on well sites, a similar set of questions applies to these industrial facilities and logistics and transport services: Who – the federal government, the state, or localities -- is to regulate them, and monitor and enforce standards? Do they have the staffing and resources that will require? How shall the funds to support those efforts be provided?

In the US, regulation of this extensive industrial infrastructure is likely to occur at a level of government above that of the locality (through a state public utilities commission, for example), but the balance between federal, state, and local regulation is in flux, as pivotal cases work their way through the courts in each state (Negro 2012). Strong "home rule" states like Texas permit localities a greater role (Fullenwider 2010), while the Commonwealth of Pennsylvania's Act 13 precludes all local regulation (Christopherson, Frickey and Rightor 2013). Court decisions in New York, West Virginia and Ohio

(Ohio Ninth Appellate District Court of Appeals 2013, for example) have attempted to prescribe and proscribe what types of local ordinances and administrative requirements are permissible under state law.

Depending on the state, localities may have a role in the permitting of pipeline routes along city/county rights-of-way, or the regulation of road use. Local government may also require filings and notice to abutters, and demand incident reporting and filing of as-built drawings for emergency planning. For compressor stations, local regulation may be able to establish setbacks, maximum noise levels, fencing and landscaping requirements, and enhanced standards for units adjacent to residential areas. Flowback fluids from the hydro-fracking process or the produced water from producing wells, if not reused, must be removed from the well sites by trucks and transported to treatment facilities or injection wells. While regulated by the federal EPA and/or state agencies, this traffic and these facilities also may be subject to permit or construction standards that are set or implemented at the local level.

All of these local or regional activities require expertise, administration, monitoring, and enforcement capacity, and all entail planning and public administration costs.

All together, the elements of this new industrial landscape spread far beyond the jurisdictions where drilling is taking place or production is being generated. Yet, severance taxes and other tax revenue schemes that are supposed to compensate communities for dealing with the attendant risks and impacts of shale gas and oil development are devised at the state level. Some yield revenue only for the state (e.g. California, Ohio). Some have discretionary revenue sharing that may route a portion of the proceeds to local governments (e.g. Colorado, Wyoming). Some permit local taxation as well (e.g. Texas). At least one (New York) supports local taxation only. Some (e.g. Pennsylvania) allocate arbitrary "impact fees". (Allegheny Conference on Community Development 2009).

None are based on an analysis of actual costs or potential costs to localities. Many have loopholes that favor oil and gas producers, or lags in payment that leave localities in arrears (see Lepori in Christopherson 2011). Most are based on the volume or the value of the gas or oil produced, and frequently are allocated according to the *place* where it was produced – i.e. the drilling region – which does not serve the needs of localities impacted by facilities or operations upstream or downstream of the actual extraction of the resource. If you have impacts but no drilling, you are often on your own.

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These descriptions of some of the economic and social impacts on localities provide a sense of the types of risks communities may face over the shale gas and oil development cycle. They also demonstrate that the risks faced by communities are likely to differ from place to place. Variations in location, climatic conditions, local economies, and types of shale-development-related operations and facilities, as well as differences in local government capacity, make predictions of the consequences difficult. And the difficulty of doing a systematic analysis of risks is sometimes exacerbated by state policies regarding data gathering and transparency.

But, these limitations do not eliminate the need for an effective risk governance framework that will enable localities to anticipate what is likely to occur, and help local and state officials design both preventive and ameliorative actions to reduce the impact of the social and economic consequences of shale development.

What Did Local Officials Tell Us About Community Perceptions of These Risks?

In 2012, we conducted a systematic study of local government responses to HVHF shale gas development in the Marcellus Shale states. We first developed a database of 298 localities or counties that had passed resolutions or legislation on shale gas development in the four states that contain most of the Marcellus and Utica shale plays: New York, Ohio, Pennsylvania, and West Virginia. 266 of the communities we identified were in New York (which has not yet authorized HVHF natural gas development) and Pennsylvania (which has). We then selected a stratified sample of communities in those two states, and conducted structured interviews with the highest-ranking public official or his or her designee in each community. These 53 interviews obtained information on the process of decision-making, on the critical issues discussed in public meetings, and on community expectations regarding oil and gas industry practices and State regulation/monitoring of the industrial activities associated with HVHF. Although environmental issues topped the ranking of community concerns, particularly effects on water supply and water quality, localities that had taken legislative action were also concerned about public costs associated with increased traffic and road damage, and a variety of disruptions to local life.[5]

It is these costs – both monetary and to the quality of life – that are likely to be felt outside the immediate drilling areas: in communities from which drilling materiel and water are drawn, or on the roads and rails

[5] A full report on our research results is available at: http://www.GreenChoices.Cornell.edu.

en route to the drill sites, or through which wastewater is transported for disposal or the gas and oil flows to market.

The Deliberative Process

In New York and Pennsylvania communities taking action to restrict HVHF we surveyed, the deliberative process was extensive. Of the 45 communities responding to a question about the extent and content of official public meetings dedicated to discussing shale gas issues since 2008, 22 (49%) had between 1 and 3 public meetings or hearings, 9 (20%) had between 4 and 8 public meetings/hearings, and 13 (29%) had more than 8. By contrast, in the New York communities we interviewed who passed resolutions in favor of state control (6 communities), 4 had no public meetings. Although that sample is small, the minimal public involvement in these resolutions is substantiated by press accounts about a larger number of communities (Reilly, 2012).

Community Concerns

Interviewees indicated that residents who testified during the meetings that preceded the legislative decision expressed concerns about a range of issues. Residents had concerns about environmental impacts from shale gas development, but also raised public health issues, traffic congestion, and how the industrialization of the region would affect their quality of life. Not surprisingly, there was more discussion of potential community disruptions in communities that passed restrictive legislation, both in New York and Pennsylvania, whereas in communities that passed resolutions supporting shale gas development the focus was more on community benefits, although road maintenance and traffic congestion were mentioned as concerns.

Community meetings also included discussion of the benefits of shale gas development in places that passed restrictive legislation (but only in New York). Officials in the 33 "restrictive" communities we surveyed in New York were asked to rank the top three issues discussed in their deliberations. Out of a total of 95 entries, a benefit from shale gas drilling received a top-three ranking 10 times. Among the benefits mentioned were tax benefits, economic benefits to local citizens, economic benefits to local businesses, and induced commercial development. The most frequently cited benefit was economic benefits to local citizens (6). In Pennsylvania, our survey respondents did not list any of these benefits as being among the top three issues discussed in their public meetings.

We probed which concerns were most significant in driving action, as indicated by which were most discussed during public deliberations. Our respondents indicated that the primary concern of 37 out of

the 45 communities responding to the question among those that had passed restrictive legislation was with water issues. Water issues were among the top three issues for 44 out of the 45. In the 2 of the 6 communities we interviewed that passed supportive legislation, water concerns were also mentioned as one of the top three items of discussion.

With respect to community impacts, the top concerns were road maintenance, public health, and traffic. 35 of 49 respondents (71%) said road maintenance was one of their top three most-discussed community impacts during public deliberations. The second most commonly discussed community impact during public deliberations was public health, with 27 of 49 respondents (55%) listing public health in their top three. Finally, traffic issues and traffic congestion were the third most-discussed community impact, with 25 of 49 respondents (51%) listing this issue among their top three most discussed prior to legislative action.

Regulatory Preferences

Interviews with political leaders in our sample of New York and Pennsylvania communities that have enacted legislation or resolutions on HVHF indicate that the issue of shale gas development is important to local decision-makers, but equally important is the ability of the community to control its own destiny. Asked what level of government should control shale gas extraction, 43 of 50 respondents (86%) indicated that local government should play a substantial role in regulating shale gas drilling: 24 respondents indicated a preference for local control only, while 19 more favored a multi-level distribution of regulatory authority that includes localities. Indeed, only one of the six communities we talked to that had passed resolutions in *support* of pursuing shale gas development under state regulation advocated state regulation exclusively.

Public Costs and Local Capacity

We asked about local capacity to respond to the needs and expectations of the public and of gas companies for services during the drilling phase. On the scale of 1 to 5, with 1 being good, 3 being "Stressed but OK", and 5 being "Overwhelmed", 39 of 50 respondents (78%) rated their capacity as somewhere between "Stressed but OK" and "Overwhelmed" (17). The median response was 3.5.

Communities are unsure about how any costs related to shale gas development will be covered. When asked how they anticipated that any increased demand for local services would be paid for, 24 of 50 respondents (48%) said they were not sure. Only 14 (28%) respondents anticipated state aid in the form of impact fees. No respondent anticipated that state taxes would be used to pay for their additional costs.

Trust Issues

Beyond their perception of specific environmental, economic or social risks lies a concern that those responsible for mitigating these risks or monitoring, assessing, and ameliorating any damage may be unwilling or unable to do so. We asked our interviewees four questions about their degree of confidence that the gas industry or their state government would protect the interests of affected communities, rated on a scale of 1 ("Very confident") to 5 ("Not at all confident").

- Asked their confidence that the natural gas industry will protect the environment, health and safety of affected communities, 31 of 48 respondents (65%) said their confidence was low (4) or they were not at all confident (5).
- Asked their confidence that the natural gas industry will protect the economic and social stability of affected communities, 32 of 49 respondents (65%) said their confidence was low (4) or they were not at all confident (5).
- Asked their confidence that the State has the capacity to enforce environmental, health and safety regulations to protect affected communities, 31 of 50 respondents (62%) said their confidence was low (4) or they were not at all confident (5).
- Asked their confidence that their State will regulate drilling activity effectively to protect the economic and social stability of affected communities, 33 of 49 respondents (67%) said their confidence was low (4) or they were not at all confident (5).

We conclude that a lack of trust in those responsible for creating these risks and dealing with the harms is as much responsible for local community responses as fear of the risks themselves.

A Framework for Policymaking to Address These Risks (Notwithstanding Their Complexity, Uncertainty and Political Controversy)

Some US states where unconventional fossil fuel development is occurring -- such as Colorado, West Virginia and Texas -- already have major fossil fuel extraction industries. Others -- such as New York, Maryland, Virginia, and Illinois -- have historical experience with fossil fuel extraction, but not with the types of extraction that transform regional economies, or that require widespread industrial facilities and extensive alteration of the landscape. In all the states and localities where HVHF drilling is a geological possibility, the social and economic risks associated with HVHF have been controversial, and the calculation of costs and benefits difficult to determine. People living in or near areas where extraction may occur are concerned with how an influx of transient workers will affect their cost of living and quality of life. They want to know about how hydraulic fracturing will affect existing industries. They

want to know how the public costs associated with shale gas development, such as road repair or emergency services, will be paid. In all these cases, we have sufficient information to indicate that risks are present, but insufficient information to predict their extent and cost.

Contemporary evidence from community and regional case studies is limited in its ability to tell state and local policy makers exactly what to expect from hydraulic fracturing as it moves through the development and extraction cycle. The variety of types of places affected, the differences in legacy effects from previous resource development cycles, differences in land ownership patterns, and differences in local and state government policy, necessarily mean that the extent of social and economic impacts will differ among extraction regions. What we can be confident of, however, is that natural resource extraction is characterized by a boom-bust cycle that is most acutely felt at the local level, and that the greater the scale and pace of drilling (the number of wells drilled, how quickly, and how consistently over time), the more intense will be the social and economic impacts on a region during the boom portion of the development cycle. Some communities are able to recover more rapidly than others, however, because of their location in suburbs with other industrial employers or as gateways to national parks (Brown et al 2005).

To secure the long-term economic sustainability of regions and communities affected by HVHF natural gas and oil development, state and local policy makers need to address the risks in several ways.

Analysis

First, given the differences among regions that could be affected by unconventional fossil fuel development, policy makers need to conduct a thorough analysis of how their state, region, or community may be affected. The full extent of potential social and economic risks needs to be acknowledged, and addressed through regional and state policy. This includes communities anywhere along the industry's supply lines, waste disposal operations, or oil and gas transportation system. Both historical and contemporary evidence indicates that unconventional fossil fuel development will entail an industrialization process in which social and economic risks are created far beyond the well site.

As for drilling regions, community dialogue and education about the risks can help public officials weigh the costs and benefits for a particular community or region. For example, regions with an important tourism industry may want to consider the risk of losing a substantial piece of that industry to "crowding out" or an industrialization that damages their "brand". Drilling's competition for transportation services or a limited labor supply in the short term may hurt manufacturers and other employers of moderate skill workers that have committed to the area for the long term. Hardest to gauge is "opportunity cost": what

new enterprises will shy away from locating in a drilling region because of cost of living, labor supply, social disruption, or "image" concerns.

Control the Pace and Scale of Development

Second, government officials need to anticipate the natural resource development cycle, and recognize that effective governance requires controlling the pace and scale of development. Moderating the pace and scale of development can reduce adverse "boom" related impacts in the short run, enable the community to adapt, and promote longer-term economic sustainability by controlling negative impacts on other local or regional industries.

Local zoning regulations, comprehensive planning requirements such as those currently proposed in Maryland[6], and state permitting regulations can all be used as tools to limit the pace and scale of drilling while not preventing shale development altogether, and reduce the impact on local and state government services, public infrastructure, and other industries.

Cover the Costs

Third, to ensure that states cover the real costs of shale development and secure the long-term economic viability of affected regions, state and local policy makers need to jointly develop revenue sources and/or revenue sharing mechanisms that compensate communities for the uptick in need for facilities and services during the boom, and economic development programs that will capture and extend private investment to weather the decline (see Lepori in Christopherson 2011).

- Create a tax that effectively pays for the short term and long-term costs of shale development. States can impose a severance tax without risk of reducing production or industry jobs. If a state has a severance tax that is too low, shale extraction will produce a significant amount of additional government costs without commensurate fiscal benefits.
- Distribute tax revenue predictably and fairly between state and local governments. There are many ways to allocate revenue that are aligned with the costs of shale gas development. Regardless of the exact distribution, the primary purpose of a severance tax is to cover costs born by the local and county governments affected.
- Limit deductions and exemptions. Many states have relatively high tax rates, but so many tax loopholes that the effective tax rate does not cover the cost of administering it nor the short and long

[6] The June 25, 2013 *Recommended Practices for Marcellus Shale Drilling Released for Public Comment* is available on the Maryland Department of the Environment website at: http://www.mde.state.md.us/programs/Land/mining/marcellus/Pages/MSReportPartII_Draft_for_Public_Comment.aspx. Accessed July 10, 2013.

term costs of shale development. Constructing a tax that is straightforward and simple makes compliance easier for gas producers and tax officials. And because the structure of the tax determines how volatile it will be, exemptions and loopholes should be minimized.

- Establish a Permanent Fund. A permanent fund is the most effective way to promote long-term economic development. For example, every state in the intermountain west invests in a permanent find. The permanent fund serves to protect the state against future recessions and revenue volatility, and enables ongoing fiscal benefits from the depletion of a non-renewable natural resource.

Plan Ahead

Fourth, local officials need to plan for both the boom and the bust that accompanies resource development. Well-documented baseline data gathered *before* the boom phase is a necessary prerequisite for local, county, or state governments to "price" the uptick in need for facilities and services, and the additional costs of social disruption and impacts on existing industries resulting from shale development.

Then, when new drilling falls off and as production declines – and tax receipts, royalty payments, business income, and jobs with it -- affected regions may find themselves with overcapacity. This can be a period of steep decline in population and tax base, or simply one of significantly slower growth. Foresighted infrastructure planning and financing can help mitigate the stresses. Flexible fiscal tools can enable localities or the state to accommodate fluctuating revenues and service demands. Budgeting to build reserves and support economic development can help communities weather the period after extraction ends.

Engage and Cooperate

Finally, good policymaking to protect communities from the social and economic risks of boom-bust development and to insure economic and environmental sustainability depends on good inter-governmental cooperation and citizen engagement. The goal should be to ensure that citizens trust the fairness of the policymaking process, and are justifiably confident that the costs and benefits of resource development will be appropriately and equitably distributed.

* * *

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