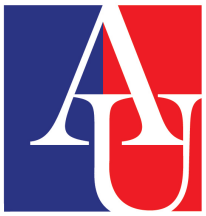

CENTER FOR ENVIRONMENTAL POLICY
SCHOOL *of* PUBLIC AFFAIRS

Governing Environmental Impacts from Hydraulic Fracturing:

Complex Issues in a Complex Democratic Framework

Odelia Funke
Center for Environmental Policy
Department of Public Administration and Policy
American University

April 23, 2013

6/23/2013

Working Paper #5

Governing Environmental Impacts from Hydraulic Fracturing: Complex Issues in a Complex Democratic Framework

Hydraulic fracturing ("fracking"), a technology used in oil and gas development, is the basis of optimistic projections for improving the economy, national security and the environment. Fracking[1] refers to a process of injecting a large volume of liquid – mostly water, with propping agents (usually sand), and chemicals -- at very high pressure into rock formations deep underground to create fractures, or extend existing fractures, through which gas and oil can flow for collection. It was first introduced about 60 years ago, and has proved very successful for extracting gas and oil trapped in low-permeability rocks, like shale. Industry has estimated that this technology has been used in over a million wells, multiple times in many of them. Techniques have continued to evolve since its introduction and according to industry, fracking is now used in more than 90% of new natural gas wells.[2]

A break-through change in the process was developed about a decade ago with the ability to turn the drill head and do horizontal drilling; further technical advance came with increased ability to guide and track the drill head with precision at great depths. Horizontal drilling makes it possible to access far more gas and oil resources with significantly fewer vertical wells, which substantially reduces surface disturbance, waste, and cost. Improvements in the technology have spurred a boom in exploration and extraction of previously economically unrecoverable oil and gas resources located far underground.

[1] As noted, hydraulic fracturing is the technology used for a phase of the extraction process. This technology raises some concerns about potential environmental effects, but most of the risks associated with natural gas production relate to other aspects of gas extraction, production and transportation processes. The term 'fracking' has become a short-hand means of referring to both the technology itself and the numerous other technologies and processes associated with the development of natural gas, from well construction to processing and transport of natural gas through pipelines and disposal of wastes. In this sense, it encompasses technologies and processes that precede and follow the actual fracking phase.

[2] M. Tiemann and A. Vann, "Hydraulic Fracturing and Safe Drinking Water Act Issues," Congressional Research Service, 07/12/12, p. 2.

These newly accessible sources of gas and oil are located in 33 states across the US, and thus the extraction and processing has the potential to affect a very large number of areas and ecosystems across the country. The number of what are called "unconventional" gas wells[3] in the US has increased dramatically since 2005.

This expansion includes developing sites above shale formations in more populated areas, where residents are unfamiliar with large gas and oil extraction operations. Federal agencies have authority over various environmental issues raised by oil and gas production, but permitting and regulation of the associated industrial activities is controlled primarily by state governments. Decisions affecting unconventional oil and gas development are increasingly of great interest to towns and counties, some with significant populations, and many of which are unfamiliar with gas and oil extraction industries.[4] While fracking is used for both oil and gas production, this study is concerned only with gas extraction and production. It is primarily concerned with one important aspect of the debate: governance.

How does government respond to the potentially competing needs for energy development and protection of public health and the environment, and what is the role of each level of government? Myriad important technical, process, and political issues are under dispute. While this study will not try to resolve the technical issues or judge the merits of opposing technical arguments, it will review key issues to explain the complexity and importance of the policy issues

[3] "Unconventional" gas refers to resources widely dispersed throughout a geological formation with very low permeability rather than accumulated in a specific location or interconnected space that allows it to flow ("conventional").

[4] As the PA Advisory Committee on Marcellus Shale said:
"…the size, scale and accelerated pace of development of the Marcellus Shale natural gas reserve is a new phenomenon for Pennsylvania. Advances in extraction technologies, such as horizontal and directional drilling, along with the refinement of hydraulic fracturing techniques used to stimulate the flow of natural gas from the Marcellus Shale formation, have raised questions among citizens across the Commonwealth and caused the Commonwealth to revisit and refine its current statutory and regulatory framework charged with overseeing this industry." "Governor's Marcellus Shale Advisory Commission Report," 7/22 /11, p.7: http://www.portal.state.pa.us/portal/server.pt?open=512&objID=14295&mode=2&PageID=590867&q=DEP%20Staff&cp=Site,Documents,News; accessed 01/11/03.

involved. Debates are about current extraction, production, and transportation processes, but also about the desirability of maximizing access to this fossil fuel energy source. The stakes are very high. Aside from the complicated and contentious science and technology issues related to natural gas development, there is a parallel debate: *When and how should government intervene? How should government policy makers determine which activities are more appropriately (or effectively) undertaken at the federal, or state or local level?* The multidimensional governance debate is the primary focus here.

What Is At Stake? - Weighing the Risks and Benefits

Benefits

Public policy decisions typically weigh the risks associated with an activity against the benefits expected. Not only are the risks of unconventional gas development controversial and unresolved, but projecting environmental benefits from natural gas development is also a complicated matter.

Development of domestic natural gas resources promises many benefits, providing both domestic and international political advantages related to increased energy independence, job growth, and a cheap domestic energy supply. U.S. Steel Chairman John Surma noted that developing the now recoverable oil and gas resources "has the potential to be the once-in-a-lifetime economic engine that coal was nearly 200 years ago."[5] There are strong economic incentives, including jobs for skilled and unskilled workers, across a large number of categories, improvements to US balance of payments deficit, and increased tax revenues at all levels of government. At the local level, this new industry has revived long-stalled economies by providing jobs and funds. For

[5] Steven Mufson, "The new boom: Shale gas fueling an American industrial revival," *The Washington Post,* 11/14/12.

those leasing their land, it has meant economic survival to some who faced bankruptcy or foreclosure, and produced new wealth for others.

Domestically it promises to provide a cheap source of energy for decades to come, though projections differ, and some are far more optimistic than others. Supporters of aggressive development claim it is creating millions of US jobs,[6] and improving local economies in the many areas with gas resources as well as giving a boost to feeder industries. That is, a large array of products are needed to develop gas resources, and the economic benefits ripple across other industries, such as, chemicals and sand for fracking, steel and cement for well construction, trucks and tanks for handling water and wastes, pipelines and compressors. In addition, the gas boom has brought substantially lower prices for industries whose processes depend on gas, lowering their costs and increasing their international competitiveness.[7]

Environmentally it has promised cleaner burning fuel, with fewer negative health impacts than those associated with burning coal, and with 50%-70% reduction in greenhouse gas emissions per unit of energy compared to coal. From this prospective, natural gas seems to be part of a solution to the problem of climate change in the near term. It has been touted as a 'bridge' fuel on the way to reliance on renewable energy sources, which are not yet developed sufficiently to meet our needs.

These projected benefits are based on assessments that are not universally accepted. A key component of the benefits equation is the size of the untapped gas sources and what is recoverable. According to the Department of Energy (DOE), gas production is expected to continue increasing

[6] E.g., America's Natural Gas Alliance and Conoco Phillips both cite a study claiming that natural gas is creating nearly three million jobs in direct employment and supplier industries.

[7] Industrial companies are betting that increases in domestic production of natural gas are not just a blip. According to Dow Chemical, not only is the chemical industry planning to invest in US plants, but also fertilizer, steel, aluminum, tire and plastics manufacturers, for a total of up to $80 billion. Steven Mufson, op. cit.

through at least 2035.[8] Estimates of the available gas trapped in shale formations, how long wells will remain productive, and how long the supply will last depend not only on complex calculations from geological scientists, but also on assessing the overall efficacy of recovery technologies. Fracking techniques differ across sites as well as formations, and knowledge for optimizing recovery is evolving. Nation-wide estimates of a 90-100 year supply have been frequently repeated. However, in 2012, US government estimates were revised downward, though estimation purposes, techniques, and the results differ somewhat across agencies; recoverable resources are debated by private sector researchers as well.[9] Expert assessments of recoverable sources differ substantially and will continue to change as experts gather more data and further refine their estimation techniques. Gauging the overall supply is important for the benefits equation that should inform near-term policy as well as investment decisions. For example, whether to build the infrastructure for liquefied natural gas (LNG) export, requiring a long-term cost recovery, is a significant risk decision for investors; related government decisions on pipelines and trade agreements for LNG should consider the full cost impacts on domestic uses and pricing, as well as pollution, that would result from exporting gas.[10]

---

[8] Energy Information Administration, *Energy Outlook 2012*, DOE/EIA-0383(2012, Department of Energy, Washington, DC., June 2012, pp. 61-62. Tens of thousands of wells are being drilled each year in the US, according to the EIA, p. 59.

[9] See, EIA, pp. 56-60; US Geological Survey, "National Oil and Gas Assessment 2012 Assessment Updates," Energy Resources Program; http://energy.usgs.gov/OilGas/AssessmentsData/NationalOilGasAssessment/AssessmentUpdates.aspx ; David Hughes, "Will Natural Gas Fuel America in the 21st Century?" Post Carbon Institute, May 2012; http://www.postcarbon.org/report/331901-report-will-natural-gas-fuel-america , and Jim Fuquay, "Report questions long-term productivity of gas wells in Barnett Shale," Post Telegram, 02/12/13; http://www.star-telegram.com/2013/02/12/4617558/report-questions-long-term-productivity.html .

[10] The debate surrounding DOE's decision whether to approve expanding the export of liquefied natural gas (LNG) provides an example of the complexity and contention that permeates so many aspects of natural gas development. Developing LNG capacity is promoted as a way to support and stabilize gas prices, which have been low, and thereby encourage development of this energy source. Critics emphasize at least two positions not accepted by LNG proponents – that gas production involves high levels of methane emissions and other pollutants (therefore benefits of the increased production encouraged by LNG will be more than offset by increases in pollution) and that underlying estimates of the available gas resources used to show that LNG is economically beneficial are greatly overstated (arguably making the development of the infrastructure cost-ineffective and driving domestic costs higher than admitted). Some proponents of gas development are against LNG because advocates do not take negative effects on domestic industries into account; selling it abroad would raise domestic prices for industrial users high enough to damage their international market share and cause job losses for the industries dependent upon cheaper gas. These arguments are discussed in: Doug Obey, "Environmentalists Charge LNG Exports Would Boost GHG, HAP Emissions," Inside EPA, 01/31/13.

Environmentally, replacing dirtier fossil fuels with natural gas is very appealing, including the fact that burning natural gas produces far less greenhouse gas than coal. Claimed environmental benefits are challenged in several ways, however. One challenge focuses on net benefits for climate change, based on a life cycle assessment of pollution throughout the extraction/processing/ transport and use of natural gas; other challenges relate to expected impacts of natural gas production on overall energy production and use.

There is growing concern about the methane leaks (fugitive emissions) associated with extraction, production, and transport of natural gas. Methane is a very potent greenhouse gas and the harm from significant fugitive emissions could outweigh the benefits of a cleaner burning fuel during use. That fugitive methane emissions occur is not contested, but no comprehensive data exist on the amount of methane escaping at the tens of thousands of well sites, mostly during extraction, but also during processing and transport. Experts differ widely in how they calculate estimates. Depending upon these estimates, life cycle assessments of natural gas use can show far less environmental benefit, or even that gas is not preferable to coal in terms of total greenhouse gas effects.[11]

The Environmental Defense Fund (EDF) judges that natural gas benefits over coal are valid if the methane leaks (well to city) stay under 3.2%. They considered what it would take to get sustained benefits from natural gas, and concluded that "…new natural gas combined cycle power

[11] Robert W. Howarth et al published results estimating far larger methane releases than those being used in government or private sector assessment calculations; see, "Methane and the greenhouse-gas footprint of natural gas from shale formations," Climatic Change, June 2011, Vol. 106, Issue 4, pp. 679-690. Duane Nichols, "NPR: Fracking's Methane Trail: A NOAA Detective Story," May 18, 2012, http://www.frackcheckwv.net/2012/05/18/npr-frackings-methane-trail-a-noaa-detective-story/ ; accessed 01/14/13. David Hughes, "REPORT: Life Cycle Greenhouse Gas Emissions from Shale Gas Compared to Coal: An Analysis of Two Conflicting Studies, Postcarbon Institute, 07/11; http://www.postcarbon.org/reports/PCI-Hughes-NETL-Cornell-Comparison.pdf . Hughes, a geoscientist, reaches the conclusion that GHG emissions at current levels are very significant.
Ramon A. Alvarez et al, "Greater focus needed on methane leakage from natural gas infrastructure," agrees on the importance of better data and analysis of methane emissions, and shows how gas efficiency differs across various uses, depending upon methane lifecycle leakage; PNAS, vol. 109, no. 17, 04/24/12, pp. 6435-40; www.pnas.org/cgi/doi/10.1073/pnas.1202407109 .

plants reduce climate impacts compared to new coal plants…as long as leakage remains under 3.2%."[12] If methane fugitive emissions are generally as high as some experts have concluded, they far exceed EDF's 3.2% cutoff, and current natural gas development could actually be worse than coal with respect to climate change.[13] Other research has challenged the high estimates. One study emphasized the significant difference between potential and actual emissions, and found evidence that points to lower actual emissions.[14] In a draft of its most recent greenhouse gas emissions inventory, released in February 2013, EPA has lowered its estimates of methane emissions from gas development, based on more recent information which industry claims is more representative.[15] Methane estimates will undoubtedly continue to be a significant area of debate. Experts do not agree about which sources and data are representative. In addition to challenging the conclusions drawn from existing data, researchers disagree on the models used to estimate national emissions. A study being conducted by the University of Texas at Austin and EDF, expected to be completed in early 2014, should be helpful in narrowing the disagreements. They are analyzing emissions along the natural gas development cycle from production through local distribution of gas, including data of natural gas use in the transportation sector.[16]

Aside from this issue is a debate about what plentiful natural gas will mean for the development of viable renewable energy industries. While some see cleaner gas as a bridge fuel to

[12] See EDF, http://www.edf.org/methaneleakage; accessed 01/18/13.
[13] Jeff Tollefson,"Methane leaks erode green credentials of natural gas," *Nature*, Vol. 493, 01/03/13: 12. Also, see footnote 9.
[14] Francis O'Sullivan and Sergey Paltsev 2012 *Environ. Res. Lett.* **7** 044030, 11/26/12: http://iopscience.iop.org/1748-9326/7/4/044030/pdf/1748-9326_7_4_044030.pdf . They found that companies use flaring and reduced emission completions to reduce fugitive emission levels from shale well completion operations to a substantially lower level than widely quoted higher estimates. They noted that in most cases the revenues gained from using reduced emissions completions to capture the gas from typical flowbacks cover the cost of doing it. Based on data from about 4000 wells drilled in 2010, they concluded that, although methane emissions from gas development are of concern, emissions from fracking have not substantially changed the intensity of emissions in gas production.
[15] See http://www.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2011.pdf .
[16] Tollefson, *op. cit*. EDF and Univ. of Texas have industry partners and agreement by NOAA scientists to participate. Scientists are reviewing industry data and also collecting field measurements at facilities across the country. The study will be conducted in several phases.

replace coal until renewable energy sources become more affordable, others are concerned that decades of cheap gas availability will cripple newly emerging renewable energy companies and associated research during a critical phase of development. Another concern related to net climate change benefits is that as natural gas replaces coal in the US, the coal will be sold abroad, with little or no net reduction of greenhouse gasses globally. Thus, even if touted benefits of energy independence, fewer entanglements in volatile international politics, new jobs, and cheaper fuel were to be realized, and methane emissions are not as high as some calculate, the benefits of reduced greenhouse gasses will not be realized if the dirtier fossil fuels are exported for use elsewhere.

From a foreign policy perspective, natural gas production has several important benefits. Significantly improving US energy independence could reduce the need for US involvement in volatile Middle East politics and protection of international oil routes. It would make the US economy less dependent upon fluctuations in international oil markets, and improve our balance of payments, both of which would generally strengthen US flexibility and bargaining position. Reducing US greenhouse gas emissions would increase US credibility for addressing global warming issues and attracting international support for proposed solutions.

Risks

The industry and many federal and state officials say gas development is safe when done properly, and though faulty wells, company errors, and accidents have caused some localized problems, the industry has a pretty good record. Some critics give more weight to contamination incidents or have concerns about insufficient oversight to identify and control problems. More importantly, opponents emphasize inherent risks, including significant releases of toxins to air, land

and water, as well as inevitable human and materials failure rates along a chain of complex industrial activity, which can result in long term, irreversible contamination and regional or ecosystem health effects from pollutants. For these concerns, a lack of clear data proving current damage is not evidence of safe processes and practices.

Multiple concerns are raised about the short- and long-term impacts this industry might have on health and the environment.[17] Several studies confirm greater human and environmental exposures from air emissions than previously estimated.[18] Consensus on risks is not possible without an agreed upon health impacts assessment, which is lacking primarily because data are sparse, but also because of debates about which data, or geological conditions, or industry practices should be used to estimate exposures from gas development in a region, or nationally. Formations, well constructions, and industry practices vary in relevant ways. The potential for broader ecosystem impacts through contamination of surface and groundwater, as well as from air

[17] GAO's report, "Oil and Gas Information on Shale Resources, Development, and Environmental and Public Health Risks" GAO 12-732, Washington, DC, September 2012: pp. 32 – 55, offers a very useful summary of the many exposure pathways and the uncertainty about actual releases or risks. A recent report from EPA's Inspector General found that harmful pollutants from the oil and gas industry, including air toxics and greenhouse gases such as methane, "can result in serious health impacts such as cancer, respiratory disease, aggravation of respiratory illnesses, and premature death," but that EPA has very limited air emissions data. The IG recommends that EPA implement a comprehensive strategy to improve its air emissions data for the oil and gas sector; Office of Inspector General, "EPA Needs to Improve Air Emissions Data for the Oil and Natural Gas Production Sector," Report No. 13-P-0161, 02/20/13.

[18] E.g., Roxana Witter et al, "Potential Exposure-Related Human Health Effects of Oil and Gas Development: A White Paper," NRDC, 09/15/08; accessed at: http://docs.nrdc.org/health/files/hea 080091701702a.pdf ; Gabrielle Petron et al, " Evidence of Emissions from Oil and Gas Drilling Operations in Northeastern Colorado," http://www.esrl.noaa.gov/gmd/annualconference/previous/2011/slides/44-110414-A.pdf , accessed 01/14/13; Lisa McKenzie, Roxana Witter, Lee Newman, John Adgate, "Human Health Risk Assessment of Air Emissions from Development of Unconventional Natural Gas Resources," *Science of the Total Environment*, 424 (2012): 79-87; and J. B. Gilman et al, "Source Signature of Volatile Organic Compounds from Oil and Natural Gas Operations in Northeastern Colorado," *Environmental Science & Technology*, 2013, 47 (3): pp. 1297–1305. The Gilman et al study illustrates that the lack of a widely-accepted health impacts assessment creates problems in setting environmental standards. Colorado (which has over 50,000 oil and gas wells) has been revising its oil and gas regulations. Some of these rules were delayed when this University of Colorado-NOAA study was published and received media attention; it found that propane pollution from oil and gas operations near Erie [CO] higher than the average in 28 other US cities, and four to nine times higher than in Houston and Pasadena, Calif. Bruce Finley, "Colorado regulators delay vote on oil and gas setbacks," *The Denver Post,* 012413; accessed at: http://www.denverpost.com/breakingnews/ci_22436897/oil-and-gas-setback-rule-vote-delayed?IADID=Search-www.denverpost.com-www.denverpost.com . In late 2012, Colorado announced plans for a $1.3 million state health study. Also in 2012, three private sector health organizations in Pennsylvania announced a collaborative, large-scale, multi-disciplinary health impacts study of Marcellus gas production. Over a number of years, they will use data from electronic health records, looking for long and short term endpoints, including trauma and diseases such as asthma, diabetes, cancer, and cardiovascular diseases. See "Susquehanna Health joins Geisinger in Marcellus shale research effort," www.newsitem.com, 11/16/12.

emissions and inadequate waste management, is vigorously debated. Establishing consensus on how to use existing or new data collections to assess overall health impacts is unlikely in the near future.[19] In addition to health and environmental impacts, communities are worried about social disruption and discord, loss of local businesses dependent on environmental health, burdens on local infrastructure, and aesthetic degradation.

From extraction to transmission and disposal of wastes, gas production can pose risks to air, land and water. In the extraction process, protecting water resources, particularly drinking water, has been the central focus for environmental concerns. Fracking requires very large amounts of water; estimates vary, but generally fall in the range of 2 – 8 million gallons of water for each fracking process.[20] Water used for fracking ('frack water') is laced with toxic chemicals and generally is not recovered for other purposes. Considered regionally, or nationally, with hundreds of thousands of wells in production,[21] a huge volume is removed from the water cycle. Water usage is particularly a concern in dry climates and regions experiencing droughts. Some companies are now recycling the water that comes back from a fracked well, which allows recovery and reuse of some of it for fracking other wells, and reduces the demand for fresh water. Research and testing of innovative technologies to reduce water consumption, or use nontoxic additives or already tainted water, hold hope for improvements in this area.

[19] A recent human health effects study indicates the breadth and complexity of the issue: "[I]n any assessment of health impact on a region, occupational fatalities, injuries and illnesses should be taken into account along with the health impact on the local community, given that national data indicate significant rates of occupational illness, injury and fatality associated with the oil and gas industry. Also, the literature supports the concept that oil and gas boom and bust cycles have deleterious effects on the psychosocial welfare of a local population." See Witter et al, *op. cit.*, p. 39.

[20] USGS notes that several factors affect the amount of water used. To illustrate the variability, they cite seven reports on average water usage per well, from four states and British Columbia; the range is 1.5 to 15.8 million gallons; http://www.usgs.gov/faq/index.php?sid=54684&lang=en&action=artikel&cat=229&id=2292&artlang=en .

[21] EIA estimates the number of producing on-shore gas wells in 2011 at over 510,000. See EIA's Number of Producing Wells website: http://www.eia.gov/dnav/ng/ng_prod_wells_s1_a.htm According to industry, most wells use fracking technology.

A persistent issue is whether frack water will seep into aquifers and contaminate them, as common additives include highly toxic chemicals.[22] There is no established proof that fracking itself has caused such contamination, but frack water has contaminated ground and surface water because of faulty well construction, overflows, leaks and accidents. Contaminated surface waters poses risks to plants and animals, as well as drinking water sources. Toxins released at well sites can travel through the environment, resulting in broader ecosystem contamination, with both long and short-term effects. Potential risks raise especially strong opposition when industrial development threatens ecologically sensitive areas, such as the watershed that provides drinking water for New York City, which currently does not need, and does not have, a treatment system for drinking water.

Air emissions during extraction and transmission of gas have been gaining increased attention. The amount and significance of fugitive air emissions, volatile organic compounds (VOCs) and methane, raises issues about human health effects from the VOCs,[23] and overall effects of the methane. EPA has not directly regulated methane releases, which is strongly criticized by environmental organizations, particularly since fugitive releases are of concern all along the transmission and distribution lines, not only at the well site. In its 2012 air rules for natural gas well sites, EPA focused on VOC contaminants, but explained that methane will also be reduced by the VOC controls required. The analysis includes expected methane reductions as part of the benefits of

[22] These concerns have been exacerbated because drilling companies refused to divulge the names of chemicals they were using, claiming it a business secret. Disclosure is improving due to a voluntary disclosure program and public pressure, as well as requirements issued by some states, though not resolved.

[23] Witter et al found "dangerous levels of benzene and other chemicals of potential concern;" they noted that "continued ignorance of the status of the air and water quality and the potential health impacts…should not be considered acceptable." *Op. cit.*, p. 38. Other studies are finding VOCs at levels of concern, e.g., Gabrielle Petron et al, "Hydrocarbon emissions characterization in the Colorado Front Range - A pilot study," *Journal of Geophysical Research*, doi: 10.1029/2011JD016360, and McKenzie et al, *op. cit*., looked at residential populations near well sites and found exposures of concern during well completions, study strongly recommends greater attention to air exposures from gas development.

the rule.[24] Health concerns related to VOC air pollution are resulting in calls for additional studies and monitoring of those emissions. Air pollution from the huge volume of truck traffic and building the industrial site are other sources of exposure.

Waste transport and management is another area of concern. Large amounts of water flow to the surface after fracking operations. Some of this water is returning frack water which is injected as part of the extraction process (called "flowback'); in addition, groundwater with chemicals, minerals, including dense brine, and often with radioactive elements from deep underground comes to the surface (called "produced water"). Estimates for the percentages of returning waters vary tremendously, depending upon the volume of injected frack water and the formation.[25] Contaminated flowback and produced waters pose risks related to improper handling onsite, spills, leaks, accidents in transport, and improper or inadequate disposal.

Available disposal methods for waste water all have associated risks, and there are no comprehensive disposal standards for it. Deep well injection, the most frequent method, is regulated under the Safe Drinking Water Act. It has raised periodic concern because of a demonstrated relationship to seismic activity, but most of these earthquakes are deemed minor, often unnoticeable at the surface. At least a few have been considerably stronger. A 4.0 earthquake in Youngstown, Ohio on New Year's Eve, 2011, attracted national attention, particularly because it

[24] In April 2012, EPA issued New Source Performance Standards under the Clean Air Act to control emissions of VOCs from oil and gas production sites. There rules cover VOCs from leaking components at onshore natural gas processing plants and well sites. Environmental critics expressed concern that the standards fall far short of sufficient protection. They are particularly dissatisfied that a major problem, methane emissions, is not directly addressed, though the rule emphasizes that methane emissions will be reduced by the technology required for controlling VOCs. Industry complained about costs and disagreed with the methane fugitive emissions estimates used for the analysis.

[25] According to DOE, the range of returning frack water (flowback) falls between less than 30% to more than 70%; Department of Energy, Office of Fossil Energy and National Technology Laboratory, *Modern Shale Gas Development in the United States: A Primer*, DE-FG26-04NT15455, April 2009, p. 66: http://fossil.energy.gov/programs/oilgas/publications/naturalgas_general/Shale_Gas_Primer_2009.pdf . A Duke University scientist (Dean of the Nicholas School of the Environment) states a range of 10% - 100%; see Bill Chameides, "Natural Gas, Hydrofracking and Safety: The Three Faces of Fracking Water," The Great Energy Challenge, 09/20/11: http://www.greatenergychallengeblog.com/2011/09/20/three-faces-of-fracking-water/ .

was the eleventh earthquake in that area in eight months, all within 2 miles of an injection well, though Youngstown had never had a recorded earthquake before.[26] Ohio stopped using two waste injection wells permanently, and paused to assess other wells before continuing their use. Another disposal practice is to take the wastewater to treatment facilities, which process and discharge it. Facilities are generally not equipped to remove all of the toxins in this waste, and some of its constituents can damage treatment processes in addition to releasing contaminated waters into the environment. EPA has committed to developing standards to address disposal issues related to surface waters.[27] Other means of handling these wastes have been open air evaporation, burying in shallow pits, or spraying untreated wastes on roadways as a de-icing agent.[28] Many pits for temporary storage or disposal are not lined, though more states are moving to require liners. There have been some instances of illegal dumping, but these seem to be exceptions.

Solid wastes from drill cuttings and muds are sometimes buried but often brought to landfills; whether contaminants leaching from these wastes pose a threat has not been assessed. Levels of radioactivity in wastewater and solid wastes, and associated exposures, are not well understood. Several studies from different shale formations indicate that levels of radioactivity in

[26] John Daly, "U.S. Government Confirms Link Between Earthquakes and Hydraulic Fracturing," 11/11, http://oilprice.com/Energy/Natural-Gas/U.S.-Government-Confirms-Link-Between-Earthquakes-and-Hydraulic-Fracturing.html , accessed 01/11/13; and Bob Downing, "Northeast Ohio rocked by 11th earthquake linked to Youngstown injection wells," 01/01/12: http://www.ohio.com/news/local-news/northeast-ohio-rocked-by-11th-earthquake-linked-to-youngstown-injection-wells-1.252977 ; accessed 01/11/13.

[27] In October 2011, EPA announced the intention to develop effluent standards for these wastewater discharges from natural gas extraction, to ensure that treatment plants can properly handle the wastes (due in 2014), and to revise its water quality criteria for chloride discharge permits to address the high level of chlorides associated with fracking wastewater (due in 2013): http://www2.epa.gov/hydraulicfracturing#wastewater .

[28] Given the wide variety of toxic contaminants in these wastewaters, a NRDC study concluded, currently available options for handling and disposal are inadequate to protect human health and the environment. NRDC urges closing the federal loophole that exempts hazardous oil and gas waste from the requirements applicable to other hazardous waste, in addition to setting treatment standards for discharge to water bodies. See Rebecca Hammer and Jeanne VanBriesen, "In Fracking's Wake: New Rules are Needed to Protect Our Health and Environment from Contaminated Wastewater," NRDC Issue Brief, May 2012: http://www.nrdc.org/energy/files/Fracking-Wastewater-IssueBrief.pdf .

well materials are far higher than previously believed.[29] Large volumes of waste are transported, sometimes considerable distances, which increases traffic, noise and potential accidents and spills. Pennsylvania, for example, has few injection wells and sends its wastes to neighboring states. In addition to the risks associated with the transport and injection, imported wastes could crowd out needed capacity for wastes produced within the receiving states.[30]

The overall tally of local risks and benefits is unclear. Some lease holders have prospered and appreciate the economic boost form gas production. On the other hand, both lease holders and neighbors to properties with gas production have complained of contaminated drinking water, significant health impacts, erosion, or environmental degradation of land or water resources that threatens their livelihood, including livestock illness or death. There are also social impacts. Aside from health and environmental risks, fracking for shale gas is a large, dirty, noisy and potentially dangerous industrial process. It dramatically affects the quality of life in the community. Impacts on local infrastructure, such as deterioration of roads due to truck traffic (which also increases air pollution significantly, affects safety, and creates noise and congestion) are common problems. Disruption and discord can arise from disagreements over allowing fracking in the community, or the divisions between those who gain financially and those who do not. Businesses depending on

[29] E.g., see Alisa L. Rich and Ernest C. Crosby, "Analysis of Reserve Pit Sludge From Unconventional Natural Gas Hydraulic Fracturing and Drilling Operations for the Presence of Technologically Enhanced Naturally Occurring Radioactive Material (TENORM)," *New Solutions*, Vol. 23(1) 117-135, 2013: http://baywood.metapress.com/media/lhe1qpmuml7qhfpuupvn/contributions/k/6/2/1/k621376330557386_html/fulltext.html . Higher-than-expected levels were also measured in wastewater going to Ohio; see "Ohio: Fracking brine gas-well waste full of radium," Climate Connections, 09/03/12: http://climate-connections.org/2012/09/04/ohio-fracking-brine-gas-well-waste-full-of-radium/ .

[30] An Ohio news outlet reported on a study released in January 2013, warning about the large and growing transport of wastewater from Pennsylvania to Ohio. It referenced 6,400 Marcellus Shale wells already drilled and another 3,500 that permitted In Pennsylvania, compared to 200 wells drilled and about 300 others permitted in Ohio. More than half of the millions of barrels of wastes injected in Ohio came from Pennsylvania and West Virginia. The volume threatens to overwhelm the available infrastructure, it concluded. Bob Downing, "Ohio Study warns of Pennsylvania wastewater," Pittsburgh Post Gazette, 01/23/13: http://www.post-gazette.com/stories/local/marcellusshale/ohio-study-warns-of-pennsylvania-wastewater-671539/ . There is concern in Maryland about risks. In 2012 a Bill was introduced to ban the transport of gas wastes into the state, "Prohibiting a person from storing, treating, discharging, or disposing of… wastewater resulting from hydraulic fracturing." http://mgaleg.maryland.gov/webmga/frmMain.aspx?pid=billpage&stab=01&id=sb0513&tab=subject3&ys=2013RS.

the guarantee of a clean environment – tourism, organic farming of produce and meats – are at grave risk. The influx of outside workers brings higher crime rates and stresses on local services, including health care, hospitals, police, food, lodging, entertainment, etcetera, which also raises local prices.[31]

The long list of risks and concerns demonstrates that that there are many unresolved issues. As industry operations have moved closer to larger populations (for example, along the front range in Colorado and in eastern Pennsylvania), where hydraulic fracturing and horizontal drilling in shale formations is relatively new, community opposition has increased. Since there is little baseline data from the areas where fracking has occurred, even near-term analytic results are debated. Studies are being published, but with seemingly conflicting results that do not resolve the technical questions. Since many factors contribute to environmental conditions, it is not surprising that studies have differing results; industry practices and state oversight vary, and external conditions related to geography and weather can minimize or magnify pollution. Longer term consequences to groundwater are a significant concern, for which no data exist to resolve differing assessments. Debates are further confused by inaccurate assertions, and especially by differing uses of key terms. Because "fracking" can refer to a specific extraction process or to the entire set of activities associated with the extraction, production, and transport of the gas, seemingly contradictory

[31] A northern Pennsylvania community-owned not-for-profit hospital provides an example of infrastructure costs off-loaded onto communities. The hospital is experiencing its first budget loss in five years, due in part to workers in the oil and gas industry who do not have health insurance. According to the hospital's CEO, there are industrial accidents and many subcontractors who came for the area's Marcellus Shale drilling boom do not cover employees' insurance. See "Gas field workers cited in Pa. hospital's losses," Preeconnects.com, 12/24/12; http://www.pressconnects.com/viewart/20121224/NEWS11/312240043/Gas-field-workers-cited-Pa-hospital-s-losses . This phenomenon of rapid industrial growth brought to small communities, and bringing with it a host of social and infrastructure impacts, is not new with fracking for natural gas. It is known as a "boomtown" phenomenon, and previous cycles of growth, with stress on services and massive social disruption, have been frequently studied. See R. C. Stedman, J. B. Jacquet, M. R. Filteau, F. K. Willits, K. J. Brasier, and D. K. McLaughlin. 2012. "Marcellus Shale Gas Development and New Boomtown Research: Views of New York and Pennsylvania Residents." *Journal of Environmental Practice* 14:287-298.

statements about the environmental safety record of fracking are reported, which can confuse discussion about whether and where additional regulatory oversight is needed.

Finally, issues, risk assessment findings, and decisions are further clouded by suspicions of bias on the part of some researchers. There have been high-profile cases involving studies led by individuals affiliated with universities, who had received substantial undisclosed sums of money from the gas industry. In a couple of well-publicized instances the study presented unsubstantiated, if not false, conclusions favorable to gas development. In these cases, the university publicly criticized the author(s) and disassociated itself from them and the study. Discredited studies can continue to muddy the waters from secondary reference to them in other scholarly work, speeches, or testimony. Such instances unfortunately fuel a broader distrust of research,[32] particularly for research funded by the oil and gas industry. Answers to key questions of interest to the public as well as industry could advance the science and drive further technology improvements. Industry, especially large companies, needs long-term public trust, and has a vital interest in developing good data and analysis, to improve methods and planning, and for liability protection as well.

In the complex set of industrial processes and practices used to extract, process, and transport natural gas, some are demonstrated to be far more likely to result in environmental damage than others. It is important to be clear about terms, and distinguish where the serious risks actually lie, in order to assess, prioritize, and adopt policies that address them. Oversight, preventive steps, and mitigation activities should focus on the areas of greatest concern, to minimize unnecessary demands

[32] The ongoing problem caused by researchers' failure to disclose financial ties to industry is illustrated by a seismicity study ordered by New York State as part of their regulatory assessment for gas development in the Marcellus Shale. New York's selection of geologist Robert Jacobi is controversial. Despite good credentials, he has industry ties, and is tainted by having run the short-lived Shale Resources and Society Institute at SUNY-Buffalo, which was shuttered last year after releasing its first report and getting massive media criticism for failing to disclose industry ties. All of the study's co-authors had direct ties to the oil and gas industry, as did four out of five of its peer reviewers. The university admitted it affected the appearance of independence and integrity of the institute's research.

on government and on companies undertaking the complex and expensive activities associated with gas extraction and production. To this end, one respected research organization conducted an effort to find some common ground. They gathered information from experts representing major stakeholder categories in order "to identify the priority environmental risks related to shale gas development—those for which the experts believe government regulation and/or voluntary industry practices are currently inadequate to protect the public or the environment."[33]

Context for Governance Decisions

The promised benefits of natural gas development are very attractive and have drawn a lot of enthusiastic support. But voices of caution related to both near-term and long-term environmental and health threats make this a difficult terrain for public policy at all levels of government. Public policy with respect to fracking faces formidable difficulties. Decision makers define and defend policy choices in terms of societal goals and values, that is, that the policy selected maximizes overall benefits (including risk reduction) at reasonable costs. Most federal and state agencies have decided that risks associated with natural gas development using fracking can be sufficiently controlled to justify proceeding. But that position is not universally embraced and is increasingly challenged. Opponents and skeptics ask whether gas production can be done without severe impacts to human health and the environment. It is not yet clear whether the majority of public opposition is firmly formed and seeking to stop development, or is a cautionary step, seeking answers to key questions before deciding whether risks are indeed acceptable.

[33] Alan Krupnick et al, "Pathways to Dialogue: What the Experts Say about the Environmental Risks of Shale Gas Development," Washington, DC., Resources for the Future: February 2013; accessed at: http://www.rff.org/Documents/RFF-Rpt-PathwaystoDialogue_FullReport.pdf . RFF correctly notes (p.1) that opposing positions are grounded not only in differing data, but in "differing values surrounding how society should balance uncertainty over the risks of action with the risks of inaction."

While risk issues are being debated, gas development continues. Strong supporters, anxious to reap the benefits nationally or locally, tend to find the risks acceptable, perhaps exaggerated, or likely to decline with evolving industry experience and technologies. Opponents think that expected benefits are exaggerated, but in any case they are more focused on the risk side of the equation, from environmental and health concerns, including climate change,[34] to local issues related to infrastructure strains, social and small business impacts, and reduced quality of life. Between these positions of enthusiasm and opposition are those who want to proceed, but cautiously. They want more data and think it prudent to go slow, starting with fewer sites in order to gauge impacts, or postponing industrial activity until more is known of health impacts. Some seek more regulation and greater industry transparency before committing fully to development. Delaying development can also seem reasonable, as it increases the possibility that new technologies (e.g., waterless or low water fracking) will be available to reduce risks.

Clearly there is tremendous pressure to pursue this known and valuable resource. While there are reasonable concerns about potential damages, both near-term and long-term contamination, much of this is based on concerns about lack of sufficient care by industry, or technology failures. In fulfilling its responsibilities to protect public health and the environment, how does government weigh clear benefits against possible problems? These decisions are further complicated by debates about whether positions are based on good science and reliable data (for example, assertions about whether fluids used to frack formations could migrate to aquifers; fugitive methane emissions estimates). It will take time and considerable resources to collect and evaluate enough data to try and settle these issues. Meanwhile,

[34] Further evidence supporting high methane emissions could change the equation for some, particularly if the economy were showing robust signs of recovery, with job opportunities aside from energy development. If the Obama administration moves to address climate change (a promise in his second inaugural address), surely it will be pushed to address the implications of methane emissions associated with natural gas development. Because the Obama Administration (EPA) might seek or be pushed to regulate methane emissions, some Republicans are already gearing up to limit or stop regulation of greenhouse gas (GHG) unless/until heretofore unattainable international agreements are in place, which would guarantee long delays or prevent action entirely. Ranking Republican on the Senate's Environment Committee, David Vitter (R-LA), introduced Bill S. 163, co-sponsored by Sen. Inhofe (R-OK), to keep the Obama administration from regulating GHG emissions until China, India and Russia have implemented and enforced similar reductions. It also seeks to nullify "any regulation, proposal, or action in effect before such certification is made that requires any carbon dioxide or other greenhouse gas emissions reduction." See US Congress, http://beta.congress.gov/bill/113th-congress/senate-bill/163 .

government agencies must decide whether existing regulatory frameworks to oversee gas production are sufficient to protect public health and the environment. Given variations in geology and differing processes at sites, as a practical matter, researchers will differ on what data can be used to characterize the industrial practices. Further studies, while important, are unlikely to settle key technical issues soon, which guarantees that uncertainty and debate among key interests will continue. Even the same data analyzed using differing technical assumptions and models can lead to differing conclusions. Such matters require political solutions. In this context of uncertainty and contentious debate, the range of discretion is very broad, and the exercise of governance is critical. Focusing on "governance," rather than government, refers to the need for non-government stakeholders to engage actively. Governance highlights the importance of broad participation, collaboration and accountability, rather than hierarchy, legal procedures and control mechanisms to define workable solutions.[35]

The risk equation arguably supports continued gas production. With so many wells fracked, the costs in terms of acknowledged environmental and health impacts appear to be acceptable to decision makers at the state and federal levels. Since there is no dataset of verified contamination problems, and those claims that receive broad attention typically are found to be due to faulty materials or company errors, problems ought to be preventable and manageable. With so many expected benefits at stake, weighed against arguably preventable risks, the impetus to proceed is high. Government is responsible for protecting human health and the environment, but also for encouraging, or at least not unnecessarily impeding, the development of a natural resource that would enhance national security and provide substantial economic benefits at national, state and local levels. The issues have become highly politicized, with competing assertions and press attention; public concerns about the risks associated with gas extraction and processing have increased exponentially. Not surprisingly, some communities and local governments are wary of having this industry in their midst. In some areas, whether opposed to or for development, communities have begun

[35] Harry C. Boyte, "Reframing Democracy: Governance, Civic Agency, and Politics," *Public Administration Review*, Sep/Oct 2005; 65, 5: 536-546.

to press for greater decision-making authority (i.e., some level of home rule) in matters related to hydraulic fracturing.

Excessively cautious or restrictive controls slow gas production and raise costs, which commensurately reduces some of the benefits. Affecting profitability might slow the development of innovative technologies that could mitigate risks. Effective governance calls for identifying the risks that should be addressed, the appropriate level of mitigation, and the means to mitigate (or avoid) the risk, while collecting new data to reassess the existing regulatory balance. These governance questions raise a separate but parallel set of debates: Which government entities should have responsibility for which decisions in defining the proper balance of controls necessary to protect human health and the environment? Stakeholders disagree about who should govern. That is, aside from the debates over scientific and technical facts which would drive regulatory decisions, there is a debate about which level of government, and which entities, should have primary authority for decisions.

Governance issues and tensions exist across the three levels of government – among federal agencies, between federal and state agencies, and between states and local governments. Before communities and officials can resolve these issues, they must reexamine some of the mechanisms of governance and appropriate roles at each level.

Who Governs?

Federal Level

Statutes largely determine the various roles among federal executive agencies, but there is some overlap in authority. This is the case with the three agencies having most of the responsibilities for gas development, the Environmental Protection Agency (EPA), the Department

of Energy (DOE) and the Department of Interior (DOI).[36] Agencies' respective goals are not always compatible. Agencies have differing missions and cultures, and decisions made in one agency's areas of authority often have implications for decisions made in other agencies. These kinds of issues typically are resolved within the executive branch itself, though issues falling in areas of statutory overlap can be further complicated by Congressional pressures exerted both from individual members and through Congressional committee oversight of agency statutory implementation.

In DOI, the Bureau of Land Management (BLM) has authority over federal lands; their role is both to protect federal lands and to facilitate the use of resources on those lands. These two roles can be in tension with each other. The US Geological Survey (USGS) in DOI does geological assessments relating to the available supply of natural gas resources, water resources, and seismic activity, all of which are issues related to fracking.

DOI has statutory responsibility to protect federal lands and their ecosystems, allow for recreational uses of these lands, and also sponsor use of the resources on these lands by companies. The roles of protecting lands but also promoting and managing their use can be in tension, and DOI must prohibit or limit use in some areas of the federal lands they administer.[37] Having federal lands available for public use, or protecting environmental assets, precludes some other uses of those areas. At the same time, BLM has the responsibility to define conditions and processes for resource use, including gas extraction, and to oversee compliance with the conditions and requirements it puts in place. Having responsibility for both of these functions can lead to the

[36] The Federal Energy Regulatory Commission (FERC) regulates the routes and construction of interstate gas pipelines, which is a very important set of issues for the industry and the environment. But the FERC does not oversee fracking (or gas extraction).
[37] E.g., the Endangered Species Act, which is implemented by DOI, instructs the Department to identify and protect endangered species. Some protected species are on federal lands.

reality or perception of either too-strict control over access to and use of lands (a charge leveled by industry with respect to DOI's 2012 draft regulations on fracking on federal lands) or an overly trusting or accommodating relationship with the industries using federally-controlled areas (as was the charge in the 2010 BP explosion and oil spill in the Gulf of Mexico).

USGS is charged with assessing energy resources and reserves, including the estimated size and location of shale plays and estimates of the accessible resources in each shale formation. These are scientific assessments that take several years to complete, and which must be reviewed and revised periodically, as knowledge and technologies evolve. DOE must use these estimates in calculating its annual energy assessment.

DOE both promotes and supports energy solutions, including technologies. It has a network of labs to conduct research and controls a rich funding source to support research through grants as well. Its role is to plan for, identify, and assess energy needs and development in the US, and act as a catalyst for innovative energy technologies. DOE works closely with industries to develop energy resources and promote greater US energy independence, improve the efficiency and efficacy of technologies, and develop innovative technologies. DOE's primary tools in addition to the research funding it controls are its expertise, and executive branch authority to address energy policy issues, including an influential annual assessment of national and international energy uses, markets and prospects. DOE is also the authorizing agency for export of natural gas; they have a key role in approval of overseas LNG sale,[38] which would affect domestic prices and increase natural gas infrastructure.

[38] Applications for free trade agreement partners are expected to be approved, but export to countries with which the US does not have a free trade agreement is controversial.

The Energy Information Administration (EIA) in DOE is responsible for an annual energy assessment and forecast. It examines energy market trends as a starting point, and includes analysis of potential changes in U.S. energy policies or regulations, or potential technology breakthroughs. EIA's statistical expertise and analysis is meant to provide independent and impartial energy information as a basis for policymaking, efficient markets, and public understanding of energy and how it interacts with the economy and the environment.

EPA's role is protection of human health and the environment. Its tools are primarily statutory authorities, which give EPA responsibility for identifying environmental threats and options for avoiding or mitigating the risks. EPA takes regulatory or other policy actions to limit, control, or prohibit activities and products creating unacceptable risk. EPA's most frequently used tool, as indicated in its statutes, is regulatory limits on pollution sources. Though the Agency can, and has at times, used incentives, negotiations and partnership agreements to meet shared goals with industry, EPA's actions are subject to review by multiple stakeholders, making voluntary programs and agreements rather difficult to launch and sustain. EPA funding includes grant money, most of which is aimed at helping states develop their environmental programs and carry out implementation of EPA rules and priorities. Some funding is used for environmental research and assessment as well.

Agency overlap with respect to gas development

In principle, DOI may or may not adopt EPA regulations/policies in governing federal lands. In the case of developing new standards to address the issues raised by fracking, EPA's role is

limited by the range of exemptions Congress has given the oil and gas industry for key requirements across major environmental statutes.[39]

EPA and DOI can each be affected by rules put in place by the other agency. When DOI issued draft standards for fracking on federal lands (2012)[40] it was fulfilling its programmatic responsibilities, and working in the context of pressure to open more federal lands to fracking. But at the same time DOI rules could create pressure or confusion with respect to future EPA decisions and responsibilities for fracking activities everywhere else. Federal agencies might use differing principals or measures of acceptable risk, or impose differing requirements for similar risks. It would be useful for agencies to recognize some of the same studies as authoritative as a basis for their analyses, and clearly explain reasons for any differences. Significant differences can establish a rebuttable presumption for the other agency (in this case EPA), and could create grounds for ongoing challenges to either DOI or EPA standards. DOI responsibilities also overlap with DOE's responsibilities in that USGS has a lead role in assessing oil and gas resources. In 2011, USGS revised its assessment of undiscovered but technically recoverable gas (what is believed to be in the shale formations and accessible with current technology), and although the estimate was far above its previous (2002) estimate, it was substantially lower than parallel 2011 estimates from DOE.[41] As noted earlier, there are reasons their estimates might differ, but such differences can result in confusion, particularly related to policy conclusions at the federal level – for example, the feasibility

[39] A key and often cited exemption prohibits EPA from regulating the fracking process under the Safe Drinking Water Act. For a summary of exemptions to EPA rules for oil and gas development, see Attachment 1, from GAO, "Unconventional Oil and Gas Development: Key Environmental and Public Health Requirements," GAO-12-874, Washington DC, September 2012, p. 46.

[40] DOI/BLM proposed rules to govern hydraulic fracturing on public lands on 05/11/12: https://www.federalregister.gov/articles/2012/05/11/2012-11304/oil-and-gas-well-stimulation-including-hydraulic-fracturing-on-federal-and-indian-lands.

[41] DOE's 2011 estimate was more than twice as much as the USGS estimate published after it. DOE reduced its 2012 estimate dramatically, but 2012 estimates still exceeded those of USGS. DOI and DOE estimates have differing purposes and timetables and their data can come from different sources. GAO discussed this issue in, "Oil and Gas: Information on Shale Resources, Development, and Environmental and Public Health Risks," GAO-12-732, Washington DC, September 2012, pp.: 16-25.

and desirability of promoting LNG export to some extent depends on expected supplies into the future.

Since EPA has been slow in promulgating new rules for natural gas development, DOI regulations for gas development on federal lands will address issues EPA rules do not yet address, and will inevitably set a kind of rebuttable presumption for any future EPA regulation of those activities. This is particularly important, since DOI received considerable pushback on its 2012 proposal, and many are watching to see what changes and concessions appear, and whether BLM issues a re-proposal or a final rule. The Obama administration's avowed support for energy production (an 'all-of-the-above' approach), but done in an 'environmentally safe' manner, creates a difficult policy target for agencies to meet, particularly because what is judged safe enough is not an objective standard.

EPA and DOE have different, but not conflicting, interests in innovative technologies. Their decisions can create difficulties in the pursuit of specific technologies or program directions. DOE has been vigorous in its support for developing innovative technologies for energy extraction, including fracking, which have raised new environmental issues and challenges that EPA has not yet fully addressed. On the other hand, EPA standards sometimes lock sources into controls that make the adoption of new solutions more difficult. Some EPA rules are based on new ("best available") technologies, which could take advantage of innovative technologies for gas exploration and production supported by DOE. Fracking techniques requiring less water or non-toxic chemicals, for example, could help solve or mitigate several important environmental issues associated with existing technologies.

Clean water has been the primary environmental concern related to natural gas development. Two main statutes define EPA responsibilities for clean water. The Safe Drinking Water Act (SDWA) covers drinking water and ground water, and the Clean Water Act (CWA) requires oversight of surface waters. Activities associated with gas extraction through fracking are exempted from EPA regulation, except for extractions using frack water with diesel additives). EPA released guidance applicable to federal implementation of non-delegated SDWA programs for fracking operations using diesel fuel in the frack water. (How it might affect diesel use in state delegated programs remains to be seen.) EPA rules prohibit direct discharge of wastewater into US waters, but some shale gas wastewater is transported to treatment plants which are not properly equipped to treat this type of wastewater. EPA is developing rules (due in 2014) to set standards for proper treatment of these wastes.[42] Deep well injection of wastes is covered by SDWA regulations. While some environmental stakeholders are pressing for a repeal of the exemption of oil and gas fracking operations from SDWA regulation, EPA is remaining silent. The Agency is conducting a multi-year study on risks to water related to the entire lifespan of water in hydraulic fracturing, which is expected in 2014. Decisions to further regulate ground or drinking water are likely to depend on the results of this study.

DOE's work with researchers and industries on the efficacy and safety of technologies/processes is a very different focus from EPA's focus on sources of pollution. Since DOE's core mission includes using technologies to address energy challenges, its assessments are likely to place significant value on energy development. EPA's assessments tend to focus on risks to public health and the environment, which puts greater emphasis on setting standards for energy

[42] See EPA website on hydraulic fracturing, http://www2.epa.gov/hydraulicfracturing#swdischarges

industry activities. Since DOI has both protection and promotion roles, its emphasis in any given case is more difficult to predict.

The practical policy purpose of DOE's annual energy outlook (i.e., to be used for planning) differs from DOI's periodic source assessments, and while DOE takes USGS estimates into account, the agencies' estimates can differ. The potential importance of the recoverable gas resource estimate for LNG export policy has been noted. Since LNG requires a very expensive infrastructure, and expanding export would raise domestic gas prices and create additional environmental impacts, it is important to other agencies. Reactions to DOE's January 2013 draft study on LNG benefits highlight differences in agency perspective. The study was criticized for focusing on gas industry benefits and ignoring significant economic impacts on other industries as well as environmental impacts.

Resolving agency differences

Differences in mission and perspective will continue to generate areas of policy disagreement among federal agencies. These differences can be managed and resolved within the executive branch. In 2012, DOE, EPA and DOI signed a memorandum of understanding (MOU) to formalize their cooperation in governing fracking research.[43] In 2013, they are considering whether to add other key agencies, such as the Department of Health and Human Services and National Science Foundation, to integrate a broader health and science expertise into their work. The President also issued an Executive Order in 2012 to require coordination across more than a dozen federal departments and organizations on natural gas development policies, including key White

[43] http://www.epa.gov/hydraulicfracture/oil_and_gas_research_mou.pdf

House policy offices.[44] Of course, even if the federal agencies with overlapping aspects of hydraulic fracturing are able to coordinate their decisions, interventions by the legislative branch, which has a strong and vocal interest in the oil and gas industry, and the fracking boom in particular, are a potentially disruptive factor. But insofar as the executive branch can agree on an approach, successful intervention from Congressional interests is less likely.

Federal Versus State Control

A more complicated and potentially contentious set of issues surrounds the federal-state division of authority. Federal-state tension is typical, but seems an especially potent issue in this case. It receives ongoing attention, not only at federal and state agencies, but in Congress and from nongovernmental environmental organizations.

There are several reasons for federal action on environmental problems, rather than leaving these issues entirely to states. The federal government makes policy with respect to problems that affect national security and national interest, including cross-border issues. Aside from issues affecting international relations, the federal government collects data and performs assessments for cross-state issues. It also develops standards and policies to address problems that cross state lines, which provides uniform national standards for industry, guarantees minimal levels of protection for citizens and coming generations, and prevents states from creating a competitive advantage by lowering standards (the so-called 'race to the bottom').

[44] Executive Order 13605, "Supporting Safe and Responsible Development of Unconventional Domestic Natural Gas Resources," 04/13/12. Working group members named in addition to DOE, DOI and EPA are the Departments of Defense, Agriculture, Commerce, Health and Human Services, Transportation, and Homeland Security, as well as the Council on Environmental Quality, the Office of Science and Technology Policy, the Office of Management and Budget, and the National Economic Council; chaired by the Domestic Policy Council, which has authority to add members. Published 04/17/12; http://www.gpo.gov/fdsys/pkg/FR-2012-04-17/pdf/2012-9473.pdf .

Congress has given federal agencies the responsibility to assess and address a wide range of environmental problems. The federal government conducts assessments of risks and of environmental and health impacts of current technologies and practices, including full life cycle effects, as well as available alternatives. Based on the analyses, federal agencies might take a variety of actions, such as, defining a goal, baseline, or regulatory standard for protecting human health and the environment, setting technology or performance standards or concentration limits, defining best practices, or providing guidance to states. Or it might establish partnerships with industry and/or states to work out a consensus approach.

The federal role centralizes the tasks of technical, scientific and economic assessments, including environmental and health risks, which are the basis for national standards. Theses assessments are also used by state programs. Gathering and analyzing data centrally is useful, because it requires access to nation-wide information, a wide range of expertise, and substantial funding over years of effort. Individual states cannot afford to conduct all of the assessments needed, nor would it make sense to duplicate efforts, and differing assessments would likely result in differing levels of protection. Assessments are based on technical findings that are typically open to review and comment. When federal findings are published, it resolves many of the difficult political and economic trade-offs nationally (i.e., risk-benefit analyses) rather than requiring each state to take on these battles.

Supporters of robust federal programs emphasize the need for uniform national standards to protect human health and the environment, particularly given the cross-boundary nature of pollution and intergenerational effects. For example, waste waters from gas extraction operations cannot be adequately cleaned by the technologies at most treatment plants, and waste taken to

such facilities, processed and released into the environment retains toxic pollutants. Allowing each state (or facility) to decide whether to accept these wastes affects people and the environment not only near the facility but downstream, including in other states. National standards define acceptable contaminant limits, based on national data, and also act to prevent any state from gaining competitive advantage by lowering environmental requirements. While federal action puts constraints on the authority of state governments to determine their own policies, it provides needed support to states in meeting environmental challenges and sets minimum standards for protecting all citizens. Federal requirements provide some uniformity, so that companies are subject to similar criteria and requirements in each state.

EPA has the primary role in federal environmental oversight, with authority under several statutes to regulate aspects of natural gas development.[45] Its standards often take the form of an allowable concentration of some pollutant, or identifying a technology to use that meets some demonstrated level of pollution control. Major EPA regulatory programs are implemented primarily through delegation of program authority to states. States must produce plans to meet basic program requirements defined in EPA regulations in order to receive delegated authority to administer their own programs. EPA programs allow states flexibility for permitting decisions and program enforcement, to meet state-specific priorities and conditions. States must meet federally-defined requirements, but can go beyond these requirements to more stringent levels of protection as they see fit.[46] In addition to creating rules to implement federal standards, state laws cover key

[45] GAO names eight separate EPA statutes with relevant authorities in GAO, "Unconventional Oil and Gas Development," *op. cit.*; see pp. 17- 46. The most important authorities are found in the Safe Drinking Water Act, the Clean Water Act, the Clean Air Act, the Resource Conservation and Recovery Act, and perhaps the Toxic Substances Control Act, if the Agency decides to set requirements for chemical disclosure, as they were petitioned to do in 2011.

[46] In some matters, federal rules pre-empt state rules and industry has a single standard nation-wide. Auto emission standards are one example. (Even here, the state of California has a special waiver possibility, negotiated at the time the Clean Air Act was written, and incorporated into the statute).

issues not addressed by federal rules, for example, requirements related to well construction and integrity, and the abandonment and plugging of wells.

In most program areas, states have the front-line responsibility for environmental protection. The state role includes: communicating state program needs and priorities; working with federal programs on the development of national assessments and federal regulations; working with companies and communities to implement standards in the context of regional and local needs; going beyond national standards as needed (and allowed under federal law); and providing technical and programmatic expertise for implementation and enforcement. The division of authority recognizes that states have expert knowledge of regional conditions and facilities, and need some flexibility in setting priorities and addressing site-specific issues.

Federal-state relations regarding environmental policy can be quite tense, and it is not uncommon that at least some states disagree with EPA policies or with interpretations of regulations in particular circumstances. This tension is particularly evident in the governance of natural gas production. Opposition to further federal regulation is voiced directly by states, which take the position that they protect human health and the environment, have the personnel to oversee their programs, and do not want or need additional federal standards. Having new areas of federal regulation would mean a loss of state control and would require new state legislation to adopt EPA standards, causing disruption in state programs. States insist that they need very broad authority in regulating shale gas production and processing; they argue that big differences in geology, hydrology and other important conditions require different rules, and that states are far better positioned to address important differences than a uniform federal rule could achieve. In short, states should have broad authority to address their environmental needs and issues.

The existence of several robust state organizations adds to state pressure for greater autonomy. Three key organizations are the Groundwater Protection Council (GWPC), the Interstate Oil and Gas Compact Commission (IOGCC), and the State Review of Oil and Natural Gas Environmental Regulations (STRONGER).[47] STRONGER's voting members represent industry and environmental as well as state perspectives. These organizations as well as the National Governors Association support state primacy to make decisions related to this industry.[48]

In issues related to natural gas development, states have powerful allies in their push for significant autonomy. Typically industry advocates the importance of national standards for consistency and certainty, even pre-emption of state authority to set stricter standards, rather than being forced to deal with a patchwork of varying standards and decision criteria across state programs. Industry usually finds that dealing with national standards is more efficient and less costly than dealing with a host of separate state laws. It also allows industry to focus primary attention on influencing federal regulatory outcomes with less at stake in individual state rulemakings. For gas development, however, industry is very vocal in its support for state authority; they argue that differing geological and site conditions are so important that states should set their own standards without federal interference, in order to provide the flexibility that is critical for industrial processes from one formation to another. From their perspective, further federal regulation would inevitably be too rigid, and would add procedural layers and costs.

[47] In 1999, STRONGER was formed to take on a state review program for oil and gas, which EPA and the IOGCC had begun in 1988. Teams of state, industry and environmental stakeholders conduct reviews of state programs and provide recommendations for states that volunteer to be reviewed. Guidelines for hydraulic fracturing were first published in 2010. The guidelines do not propose specific standards but speak to issues, considerations and qualities states should address in their rules. Six states have undergone review since the hydraulic fracturing guidelines were published. See http://strongerinc.org/.

[48] The National League of Cities generally supports a robust federal role in energy oversight. Their statement on the federal role in natural gas production endorses not only an assessment role (which states also support) for impacts on the environment and public safety, but also responsibility for setting requirements, specifically to protect water resources, and for chemical disclosure. See Policy statement from its Energy, Environment and Natural Resources Committee: http://www.nlc.org/Documents/InfluenceFederalPolicy/NMP/2-EENR-NMP-2013.pdf, pp. 27-29.

Pressure comes from Congress as well, where many members are opposed to what they see as increased burdens on gas development and unnecessary federal authority pushing further into state programs. Members of Congress, particularly Republicans from states with a large oil and gas industry presence, have insisted that federal agencies, particularly EPA, should not further regulate fracking. The Republican-controlled House created a new subcommittee in January 2013, to focus on energy issues. The chair of the Subcommittee on Environment and Economy, John Shimkus, has said that fracking is "being regulated by the states right now and they are doing a very good job …. It's curious how people believe that state legislators or state regulators aren't concerned about their state's citizens…"[49] They argue that this has been a state function and must remain so. Lisa Murkowski, ranking Republican on the Senate Energy and Commerce Committee, noted a number of serious problems with current federal regulation of energy development. She argued that states have successful regulatory regimes and, especially given the federal deficit, federal agencies should focus on actions "where they are most needed and warranted," rather than expanding federal requirements.[50] Some who support state authority see it as a Constitutional issue, where talk of additional federal regulation is a threatened encroachment by the federal government on areas that should properly be controlled by states.[51] State, industry and Congressional critics of federal action

[49] Ari Natter and Lynn Garner, "Congress: Energy and Commerce Committee to Target EPA, Federal Fracking Rules in New Congress," 01/23/13, www.bna.com . Daily Environment Report; accessed 01/28/13. See also "Shimkus Vows To Fight EPA Fracking, Ash Rules," Inside EPA's Clean Energy Report, 01/14/13; and, "New House Rules Target EPA Rules," www.insideepa.com, 01/04/13.

[50] Murkowski is concerned that additional federal regulation will put the many benefits of energy production at risk "under a new federal regime that only makes it harder or impossible to produce." Lisa Murkowski, "Energy 20/20: A Vision for America's Energy Future," 02/04/13, p. 92. The document offers proposals for streamlining federal rules, and proposes a temporary moratorium on new federal regulation as well as a comprehensive review of the impacts of existing rules, see esp. pp. 88-93, 96-99. http://www.energy.senate.gov/public/index.cfm/files/serve?File_id=099962a5-b523-4551-b979-c5bac6d45698 .

[51] States have in the past legally challenged the federal government's right to put regulatory burdens on them, arguing that it commandeers state resources to pursue federal policy objectives. But court decisions have not clearly delineated the limits of federal authority. Lack of clarity results not only from the complexity of the issue, but because the Supreme Court has explicitly recognized the legality and efficacy of another mechanism for the federal government to achieve this same end: conditional offers of funding. See Laura S. Jensen, "Federal Authority vs. State Autonomy: The Supreme Court's Role Revisited," Public Administration Review, Mar/Apr 1999, 59, 2, pp.97-99; http://www.jstor.org/stable/977628 . Since state environmental programs rely heavily on EPA

all emphasize that states are competent and doing a good job of addressing the issues, and that advocates of federal action wrongly imply that states are not sufficiently willing or able to protect their citizens and their environment. It should be noted that at least some of those in Congress who oppose further federal action are really talking about executive branch action; they are not averse to using legislative action to shape decisions. Murkowski, for example, has an ambitious agenda of things that should be done (primarily Congress pressing federal agencies rather than new legislation) to further the goal of more rapid and extensive energy development.

In administering policy for federal lands, BLM oversees oil and gas development on approximately 700 million subsurface acres. The rules BLM proposed to govern fracking operations on federal lands cover activities such as requirements for how operators drill the well and install casing, and disclosure of the chemicals used in fracking. These rules would govern activities similar to those covered by state regulatory programs, and would inevitably be at odds with some state policies. In addition to substantive disagreements with BLM provisions, states object to having differing requirements for federal and non-federal lands within their territory. BLM's proposed rules illustrate the challenge for federal action on fracking. States want to control land within their boundaries and do not want separate standards for federal lands. Differing standards between federal and state agencies raise the question of whether the less strict standard is protective enough or the stricter standard is overly restrictive. Industry has criticized BLM's rules as too restrictive, while environmentalists focused on elements they found insufficiently protective, and likely to permanently diminish the public's access to and use of lands leased for gas development. In response to the negative comments on its proposed rules, BLM revised them in early 2013; the

---

funding, the importance of constitutional separation of powers is probably less important to governance than the flexibility allowed to states within federal regulations and working relations between federal programs and their state counterparts.

White House is involved in the deliberations, and stakeholders are pressing their views on the rule. Meanwhile, gas companies are pushing their applications for access to more federal lands to develop gas fields.

Many advocates of environmental and health protection call for additional EPA regulation on a number of issues, including disclosure of chemicals used in frack water, disposal of waste water, and fugitive methane emissions. Some call for removing statutory exemptions given under several EPA statutes as well as reversing an EPA waste management exemption for the oil and gas industry, freeing EPA to develop a comprehensive set of requirements to address the various risks to water, air and land posed by these industrial processes. Though receiving less attention, the safety of gas pipelines across the country is a related concern, especially given some deadly and otherwise costly explosions, and the lack of information about the many miles of pipelines. This issue takes on greater importance if gas development accelerates and expands as DOE and others predict, because a massive effort would be needed to build a large network of pipelines to move the gas from well platforms to centers for distribution and then to users.

The federal-state tension over who will set standards to oversee hydraulic fracturing is not a technical problem; it is a political issue that must be resolved through political processes. Whether (and, if so, how) EPA will develop new national standards to regulate natural gas production is unclear. As attention to the issue of federal versus state regulation has increased, so has the scrutiny on federal action. The typically slow process of developing draft regulations has been slowed even further, with multiple reviews of every step, and demands for additional public (and industry) input at each step. With frequent challenges to its assessment and regulatory processes related to the oil and gas industry, EPA is under intense scrutiny and moving slowly and, it appears,

cautiously. The White House also seems to be concerned that the administration not be seen as placing barriers to energy development.

While EPA and BLM assess risks and options on a national level, and proceed with rather cumbersome regulatory processes, states can act more quickly. States have been revising their existing laws for natural gas development for many months now, and their rules are quickly evolving to address concerns about gas extraction and processing. The longer the federal assessment processes take, the more likely it is that states will have a full range of regulations in place. Not surprisingly, some states are moving much more quickly than others, and state rules and processes set differing levels of accountability and protection from state to state. States have been taking action to address risk concerns, and this puts yet more pressure on federal agencies, particularly EPA, to avoid disturbing existing frameworks, even though they have unequal standards of protection. Federal action would require states to align their laws with federal requirements, which would be disruptive and costly at best.

States have their own limitations with respect to governance of fracking. They are facing many of the same difficult issues that affect EPA, such as disagreements among experts and studies, debates on how best to regulate extremely complex industrial activities, tradeoffs between possible risks and near-term benefits, competing budget priorities for rule development and oversight; and pressures from both some unhappy communities and a very powerful industry – all of which bring competing political agendas that hamper consensus. Some state legislative processes have significant limitations, for example, legislative assemblies with short sessions to conduct rulemaking (MD), or that do not meet annually (TX). States do not have to consider all national variations, though. States have expertise related to their jurisdiction, and can set priority for staff to oversee

specific local oil and gas activities to an extent simply not feasible for federal regulators. Insofar as there are similar needs or issues across states, states can benefit by more standardized approaches. Federal standards are one way to provide consistency, but states can share ideas in their state organizations, particularly the GWPC and the IOGCC. Inevitably, decisions to take federal action must weigh feasibility and costs of new federal requirements to fill perceived holes in the regulatory framework against the efficacy of existing state programs in addressing the key risks.

The mutual desire of states and industry to minimize additional federal regulation provides an incentive for industry to cooperate with states in addressing key issues and perceived risks, to demonstrate that state policies are sufficient for protection of human health and the environment. For example, states collaborated with each other and with the oil and gas industry to agree on a set of important information elements for a chemical disclosure registry, posted on a publicly accessible website (FracFocus) for voluntary company disclosure of information. The effort, launched in 2011, was led by the GWPC and IOGCC. By April 2013, over 41,000 wells were registered, and FracFocus listed about 525 companies as participants.[52] States also claim success for their voluntary, multi-stakeholder process to assess the adequacy of specific aspects of individual state oil and gas programs, run by STRONGER.[53]

FracFocus addresses one national issue, the disclosure of chemicals added to frack water, but it can also be said to illustrate the need for federal rules, in order to establish a minimum data set and other key requirements. Critics note that not all companies or states provide data, and there

[52] http://fracfocus.org/ .

[53] STRONGER explains the review program as a unique approach "developed by state, industry and environmental stakeholders, with assistance by the Federal government, to improve state oil and gas exploration and production environmental programs. The Interstate Oil and Gas Compact Commission (IOGCC) spearheaded a collaborative effort to benchmark state regulatory programs, develop recommended state program guidelines, address regulatory gaps identified by EPA in its 1988 regulatory determination, and establish a review process to evaluate state regulatory programs against those guidelines. The purpose of the state review process is to assist states in improving their oil and gas environmental regulatory programs. Review teams of state, industry and environmental stakeholders conduct state reviews. States volunteer to be reviewed." http://strongerinc.org/process. This does not promote model rules; see also ft. nt. #46 above.

is no penalty for withholding some or all information. Further, there are no defined limits to what can be claimed confidential, and no mechanism for challenging such claims. Others argue that the timing of the disclosures is not sufficient, that pre-fracking disclosure is needed to help guide baseline chemical testing, which is important for determining if a fracking operation has caused contamination. The concern is that, while FracFocus will develop further, what are deemed basic information needs are not going to be universally accepted through voluntary arrangements. Individual states have incorporated disclosure requirements into their laws, and chosen FracFocus as the mechanism for collection and access. Relying on individual state laws is unlikely to result in a uniform set of basic requirements, or a dataset that can be used to hold all companies accountable, or to compare data across companies and states to assess regional and national trends.

As more companies provide at least some information voluntarily, and some states require disclosure, it is increasingly difficult for EPA to conduct a federal rulemaking to require this same kind of information. Even though the existing tool is largely voluntary and not universally used, does not cover all of the important elements advocates seek, or screen claims of confidential business information, the fact that it exists and largely satisfies state officials is an argument against similar action by EPA, especially considering how long it would take EPA to complete a final rulemaking, and then develop and launch a system for information collection and dissemination. The potential value of such an undertaking is further diminished by a GWPC commitment to enhance FracFocus to address some of the criticisms about its limitations across companies and states.

Resolving federal-state tensions

The issue of federal or state control is not as clear a contrast as many supporters of state regulation imply. Conditions always differ from state to state, and federal rules usually leave room

for state interpretation, as well as setting priorities for enforcement. The sheer scope and complexity of state decisions means that federal intervention in state implementation decisions is limited. But states have a large stake in being able to take advantage of a boom in natural gas production, and they understandably want the ability to manage development decisions to feed economic recovery, including jobs and increased tax revenues. And, as discussed, many states have been revising state rules to address issues raised by new technologies and expansion of areas affected by natural gas development.

Federal and state actors are likely to agree on the value of national assessments for health and environmental impacts, risks, and technology that federal agencies conduct. States typically welcome federal assessments for science and technology issues, and find these assessments useful for making program decisions. The question is whether assessments should spur federal regulatory action to mitigate risks or if this should be left to states. The longer the delay in federal rules, the more fully developed state rules become, and the greater the resistance to adopting alternate standards from a federal agency. On the other hand, to the extent critics find some state rules inadequate, they will encourage the push for federal standards.

Leaving regulatory decisions to the states could mean inaction in some states, or levels of control that result in health and environmental impacts, which could have interstate effects as well, through contaminated air and waterways, greenhouse gas emissions, and contaminated farm goods sold outside the state. That is, the federal role of preventing a 'race-to-the-bottom' competition among states requires that there be some assurance that states will take appropriate action. Federal agencies are unlikely to stop at the assessment phase unless states are committed to further action as warranted. A solution that gives states greater authority to set standards should

incorporate mechanisms that ensure state adoption of minimally protective standards, and accountability of state agencies as well as industry.

An approach led primarily by the states, with little additional federal regulatory action, might be acceptable to major stakeholders. But it would require a level of coordination not often seen, and difficult to attain. Fracking issues elicit a strong anti-regulatory commitment from some stakeholders in contrast to the conviction by other stakeholders that command-and-control rules are needed to guarantee accountability. Federal and state agencies are not the only actors in these matters. Other important stakeholders, including industry and environmental organizations, are also keenly interested in the balance between federal and state exercise of authority.

State willingness to identify and adopt model rules to address significant issues would increase confidence in a state-led approach. Such models could be technology standards, performance standards, or best practices. Building broad state consensus around approaches identified as a best practice already adopted by one or more states would not be an easy process, but it would take advantage of what the states have already been doing, and acknowledge their expertise. This effort would attract energy and support. Some states grappling with gas development issues have developed standards already recognized as potential models. EDF, a respected national environmental organization, has been working on model rules and their work might provide a starting point. Identifying the best models for addressing various issues and differing geological formations would have to be done in a transparent manner, with clear criteria. It might be spear-headed by EDF or another trusted third party in conjunction with federal and state regulators, or led by a joint federal-state group. A model rules effort could work in conjunction with one or more national organizations of states (GWPC or IOGCC, e.g.), with participation as needed

from state organizations representing air and waste officials. This kind of initiative should include substantial input from other important constituencies, particularly industry and the environmental community.

It might be possible to stimulate widespread adoption of model rules outside of any government framework. A limited but important experiment with a voluntary, non-governmental approach to best practices is being launched in 2013. In March 2013, a new organization in the Marcellus Shale region was announced. The Center for Sustainable Shale Development is a collaborative effort joining environmental organizations, industry and foundations (eleven in total) in the development of performance standards for air quality, water resources, and climate. These initial standards, 15 in total, are the basis for a certification program; companies will be able to apply for certification if they are willing to meet the standards, with third party auditing.[54] Developing new standards with a group of diverse experts (such as the Center for Sustainable Shale Development) avoids the difficulty of selecting one stakeholder's or state's approach to another. The question is whether it is important that such standards be enforceable under state laws, and if so, whether state regulatory agencies will start adopting them, or if they will remain purely voluntary.

Either a state-led or an independent approach to put standards and best practices in place would probably be quicker than relying on new federal regulations. Federal standards require cumbersome formal rulemaking processes and would trigger political opposition and delay, which members of Congress have already signaled in their explicit opposition to additional federal rules. A

[54] Founding members are Chevron, Citizens for Pennsylvania's Future, Clean Air Task Force, CONSOL Energy, Environmental Defense Fund, EQT, Group Against Smog and Pollution, Heinz Endowments, Pennsylvania Environmental Council, Shell, and William Penn Foundation. They worked together for two years to develop these standards and expect to be ready for certifying companies for gas development sometime in 2013. http://037186e.netsolhost.com/site/ or, www.sustainableshale.org.

model rule or independent certification approach would not fully satisfy anyone. However, a voluntary approach might not become general practice and would have weaker sanctions than rules, which could be unacceptable to communities and environmental advocates. If states agree to adopt model rules as requirements, they must give up some flexibility to set their own policies individually. On the positive side, states could avoid federal requirements, and save some of the resources required for their own rule development if they adopt model rules. Companies might embrace either an independent certification process or state model rules as a preferred alternative to federal standards. In so far as states are willing to adopt identified model rules, federal agencies might agree that national standards are not needed to address the environmental risks. Adoption of model rules for selected issues would surely narrow the number and range of additional federal rules, and thereby allow agencies to focus their resources on specific areas, and also reduce the number of likely confrontations with Congressional members opposed to further federal action. A federal-state collaborative effort that recognizes and relies on state expertise, and perhaps recognizes a role for independent certification processes, would be mutually beneficial.

Another collaborative approach that could provide an alternative to federal regulations is to create partnership agreements for addressing some problems. The National Petroleum Council suggested that government's role in reducing methane fugitive emissions should be to use industry-government partnerships to promote technologies, protocols, and best practices to measure, estimate, report and reduce emissions.[55] Such agreements would give a larger role to industry actors than state-identified model rules process. The output of such agreements could be less specific than model rules, and would probably be more difficult to enforce through the courts, especially for the public or organizations not party to the agreement. Partnerships can be effective

[55] National Petroleum Council, "Prudent Development," National Petroleum Council, Washington, DC, September, 2011: 31.

in promoting best practices, if there are strong assurances of progress, backed by mechanisms for accountability, and for joint problem-solving as new issues and technologies emerge. Successful partnerships build trust that can serve other objectives as well, and could be employed to address a broader array of energy development issues.

State Versus Local Authority

The struggle for greater local authority is a related but separate phenomenon. This tension is manifest in activities at the county and local government levels and in community organizations that are not part of local government.

Local governments generally have little or no role in environmental regulation related to federal statutory programs. Most local governments have few resources to spend on these issues. Unlike state government, they have limited or no expertise on the complex technical and legal issues; any such expertise would be by chance and quite probably would not be among local government personnel. Local governments typically have little funding available to conduct assessments or challenge industry or state agency expert findings, nor are they well equipped to deal with large companies. Their principal tool for addressing unwanted development in their jurisdiction is zoning laws, which provide some control over local development. Many rural areas lack local government infrastructure to identify and address issues as they arise; many have no zoning laws. State laws and decisions often trump local laws and decisions, including zoning laws. So aside from lack of experts and resources, the belief that state laws will pre-empt local laws, and that challenging state authority will lead to expensive legal battles, is a disincentive to local action in any case. Nevertheless, fracking activism has stimulated a significant wave of local zoning actions. Pre-

emption of local laws is a hot topic. Some local actions have been challenged by states or industry, resulting in a number of ongoing court battles in New York, Pennsylvania, and Colorado.

As gas development activities have greatly increased and the use of fracking has spread to new areas, some local governments have begun to challenge the assumption that states should oversee these matters entirely, and that state decisions can override local decisions in all cases. States make a strong argument for their ability, as compared to the federal government, to deal with regional and local differences that affect gas development activities, which require flexible responses. States do not extend this logic (emphasizing local knowledge and conditions) to state-local relationships and authorities.[56] States assert that it is neither feasible nor desirable for local governments to have authority over fracking. States are responsible for environmental programs, and have the needed personnel and expertise; state environmental laws specify how federal delegated programs will be carried out but also identify state requirements and goals that go beyond federal rules in specificity but also in scope. State arguments have merit, but local governments are not talking about taking over regulatory programs; they are arguing for status in making key decisions about whether gas development will occur in their communities. Localities lack the expertise, personnel, and infrastructure for governing these matters. Local governments might add requirements related to issues of local concern and risk reduction without taking over programs. However, states are concerned that local rules would create a confusing diversity of

[56] Pennsylvania county governments are aware that local knowledge can be very important to decisions about fracking. See, e.g., Gant Team, "Shale Gas Impacts Listed as One of Nine Key PA County Government Priorities for 2013," Ganatdaily.com, 02/05/13. E.g., counties support including conservation districts in the erosion and sedimentation permit review process for oil and gas operations, as this would provide a local perspective and strong local geologic and topographic knowledge to both permitting and monitoring these operations. This article also notes growing county government concerns about safety and planning related to pipelines, "as current methods of deployment affect a community's ability to engage in effective long-term land use and development planning, according to the Penn State Extension." Some counties monitor impacts of shale gas drilling on local water quality, conducting efforts such as stream monitoring, developing source water protection plans and doing educational forums. They want to ensure that wells are appropriately regulated and that the public has input in the permitting process. http://gantdaily.com/2013/02/05/shale-gas-impacts-listed-as-one-of-nine-key-pa-county-government-priorities-for-2013/.

requirements; companies would not be able to deal with a patchwork of local rules, criteria, and authorities. In short, states make arguments parallel to those the federal government uses in explaining the need for national standards.

State authority over resource development has generally been accepted by communities. But natural gas development has brought major industrial development into communities and changed the equation. Communities see they have a lot at stake, and that they are not only affected by the industrial processes, which bring substantial environmental and social disruption and pollution but they are also most at risk if there are accidents, spills or failures to follow good technical practices.

Companies deal with state governments to secure the necessary permits and meet regulatory requirements; they negotiate with private land owners to buy rights to drill or for surface access. The primary way localities affect fracking is through the decisions of individual property owners. But the lines separating authority and responsibility, rights and obligations, are further confused. Property rights do not always include rights to subsurface resources. In some areas, mineral rights and surface rights are separate. Where rights to subsurface minerals are separate from surface property ownership, the holder of mineral rights typically has a right to access the resource. State laws differ, but states uphold rights to access subsurface minerals despite surface owner opposition, with some provision for protecting surface owners' interests. Surface land owners, particularly when they do not share in royalties for gas extracted, are likely to be most concerned that the industrial processes can do permanent damage to the environment, contaminate land and water, and reduce property value. An additional element is that many property owners are not owner occupants, and thus a decision for gas development does not

directly affect their quality of life.[57] Finally, some states have rules that force owners who do not want to sign leases to be included if they are in the minority in a group of properties a company is seeking to frack. The disconnect between those making decisions and those bearing the primary risks also applies to state and federally-owned lands, which can represent a significant percentage of property holdings. Localities have in many cases felt powerless in the face of large industry action, not only because of state-enforced rights to access subsurface minerals and state-forced participation by owners to facilitate area fracking, but because companies bypass community participation.

When communities do have the opportunity to debate the decision, it can result in fierce local divisions. Negative community impacts (e.g., noise, congestion, crime, infrastructure burdens, reduced property values) as well as increased risks to health and environment have led to anxiety and opposition. Additionally, events in segments of the oil and gas industry, e.g., the BP oil spill, have diminished confidence in the industry. There have been many charges that gas development operations have caused damage to health and property or have contaminated wells or streams. Proving such charges can be very difficult, and expensive. Thus, increased anxiety about social and environmental impacts, and inability to effectively engage and exert influence over the process, have led to an increase in local activism. Some communities, not satisfied that their state regulations are sufficiently protective, advocate more federal oversight, in hopes of increased

[57] See, e.g., Timothy W. Kelsey, et al, "Marcellus Shale: Land Ownership, Local Voice, and the Distribution of Lease and Royalty Dollars," CECD Research Paper Series, Pennsylvania State University, 07/18/12: http://aese.psu.edu/research/centers/cecd . One study found that homes depending upon groundwater, without access to piped water, are more likely to see significant (17%) drops in property value if near fracking operations; Lucija Muehlenbachs, Elisheba Spiller, Christopher Timmins, "Shale Gas Development and Property Values: Differences across Drinking Water Sources," Resources for the Future, RFF DP 12-40, July 2012.

controls over industrial activities.[58] But some towns are pushing for home rule principles to protect their interests, challenging the scope of authority state governments have claimed regarding permitting decisions. Not all towns seeking greater authority are opposed to hydraulic fracturing; but the issue has engendered greater awareness of state-claimed authority over these important issues, and some communities think they should have a say in what can affect their lives and property and way of life so profoundly.

Avenues for greater local control in governance

- **Local laws**

Local laws have not in previous decades played a significant role in decisions about gas development, but increasing numbers of local governments are trying to use zoning requirements to gain some leverage with respect to gas development within their boundaries. It is common for states to claim authority for regulating major industrial activities, such as energy development. Some states have acted to pre-empt local authority altogether for oil and gas development decisions.[59] In three states – Pennsylvania, New York and Colorado – many communities have been discussing and testing the boundaries of local authority. Pennsylvania and Colorado are in the midst of the gas development boom, while New York currently does not allow fracking.

[58] E.g., in Boulder County, Colorado; see John Fryar, "Boulder County wants federal lawmakers to address local oil, gas concerns," Longmont Times-Call, 01/05/13. However, as noted earlier, there is no agreed upon health impacts assessment, which makes it difficult to justify strict standards at the national or state level.

[59] Two recent examples: in Ohio, an energy company successfully challenged town ordinances regulating oil and gas development upheld at a lower court level. The appeals court found that the local government did not have the authority to regulate; Ohio state government has claimed 'sole and exclusive authority,' aside from federal rules, to regulate oil and gas well operations in the state. That is, despite home rule in Ohio, localities are highly restricted even when rules do not conflict with, but just add to, state requirements. The appeals court did recognize a narrow area of legitimate action for zoning laws, but ruled out most authority, including any actions that would obstruct oil and gas activities, in *State ex rel. Morrison v. Beck Energy Corp.*, 2013-Ohio-356, at ¶ 76 (9th Dist. Feb. 6, 2013): http://www.sconet.state.oh.us/rod/docs/pdf/9/2013/2013-ohio-356.pdf . Unlike Ohio, Virginia is not a home rule state. In Virginia, the attorney general issued an opinion on state-local authorities for oil and gas development. He noted that local zoning laws can control the location and siting of oil and gas drilling operations, but such laws must be reasonable in scope and consistent with state law, and cannot have the effect of prohibiting drilling altogether: http://www.jdsupra.com/legalnews/virginia-ag-localities-cannot-ban-gas-d-72769/ .

All but six US states allow for some form of municipal home rule.[60] In 1968, Pennsylvania adopted a new local government article to its constitution, guaranteeing the right of all counties and municipalities to adopt home rule charters and exercise home rule power. Under Pennsylvania's constitution, local governments can assert a right of self-governance if they go through a formal process of establishing home rule. With "home rule" the authority to act in municipal affairs is shifted from state law to a local community, under a charter adopted and amended by the voters, whose laws must conform to US and Pennsylvania laws. The alternative to home rule is referred to as being under "Dillon's Rule," which means community governments are treated like administrative extensions of the state. Local governments without home rule can only act where specifically authorized by state law; home rule municipalities can act anywhere except where they are specifically limited by state law.[61] The Community Environmental Legal Defense Fund, a non-profit organization, is offering communities legal assistance to create home rule charters. One of the clear motivations for this activity is to position local governments to be able to ban fracking.[62]

In Pennsylvania, some local governments took action to ban or regulate natural gas development. Pittsburgh, for example, had voted unanimously for a ban in November 2010, the first

[60] For break out of home rule states, see CELDF: http://celdf.org/home-rule-in-the-states .

[61] Community Environmental Legal Defense Fund, "Home Rule,"; http://celdf.org/section.php?id=40 . Dillon's Rule (named for an Iowa Supreme Court Justice's 1868 opinion) maintains that each political subdivision of a state is connected to the state as a child is connected to a parent. Community governments are seen as administrative extensions of the state and not elective bodies for local self-governance. According to Dillon's Rule, unless the state expressly confers the authority for a community to exercise a right to self-governance, they do not have independent authority.

[62] Community Environmental Legal Defense Fund, http://celdf.org/celdf-press-release-city-charter-amendment-adopted-by-popular-vote-elevates-community-rights-over-corporate-privileges-bans-fracking-injection-wells-shale-gas-development-in-the-township . Although this type of community organizing focuses on the adoption of local laws, the intent is to promote an ideological position, by demonstrating the use of governing authority to protect community rights and exposing the misuse of governing authority to benefit corporations. As such, the adoption of rights-based municipal ordinances is not a legal strategy, but CELDF's organizing strategy. As discussed above regarding attempts to use zoning laws to control gas development, courts predictably deny the legal authority of municipalities to legislate in defiance of state and federal law. CELDF knows that legal action by corporations and government agencies to overturn these ordinances are forced to argue in opposition to the community's right to make governing decisions on issues with harmful and direct local impact.

such ban in the nation.[63] The Commonwealth of Pennsylvania took new legislative action in 2012 (part of Act 13) to declare existing zoning laws pre-empted by state agency decisions on gas development. After Act 13 was passed, the state Public Utilities Commission, given authority by Act 13 to judge local zoning laws, declared that Pittsburgh's ordinance and regulations of gas development in another town, South Fayette, violated state authority and were void. On the other hand, seven local governments challenged Act 13's preemption,[64]and scores of towns passed resolutions to support their action. The Pennsylvania State Association of Township Supervisors, representing 1,455 townships, passed resolutions opposing any state attempts to limit or remove zoning authority.[65] The court agreed with the local governments that the state exceeded its authority in declaring unilateral pre-emption of zoning laws; that decision was quickly appealed to the Pennsylvania Supreme Court. By October, many amicus briefs were filed, and almost 90 towns and counties adopted resolutions or letters to support the lower court finding.[66] Arguments for both sides were presented to the Supreme Court in October 2012, but there was no indication of when the judges would announce a decision.[67] Insofar as the status of local law is tied to a state's constitution, the final decision in Pennsylvania will not necessarily be applicable to decisions in other state courts. While the legal battle is still unresolved, including how this might limit access to subsurface mineral rights, some towns are exerting limited authorities. For example, a town in Washington County (Robinson) is holding permit hearings on two gas well sites, and industry (Range

[63] http://www.huffingtonpost.com/brendan-demelle/pittsburgh-bans-natural-g_b_784489.html.
[64] Pittsburgh had been the first city in the US to take a very strong stand; the city council unanimously banned fracking in November 2010. See, Chris Tittle, "Pittsburgh City Council: Fracking with corporate personhood," Mother Nature Network; http://www.mnn.com/local-reports/pennsylvania/local-blog/pittsburgh-city-council-fracking-with-corporate-personhood .
[65] Andrea Iglar, "Communities See Marcellus Law As Striking at Heart of Autonomy," 07/ 26/12: http://www.post-gazette.com/stories/local/neighborhoods-west/communities-see-marcellus-law-as-striking-at-heart-of-autonomy-646296/#ixzz21jzm9d6L.
[66] Tom Corbett, "ACT 13 – 32 Amici go to Pennsylvania Supreme Court," ShaleShockMedia.org, 10/18/12: http://blog.shaleshockmedia.org/2012/10/18/act-13-32-amici-go-to-pennsylvania-supreme-court/ .
[67] The ruling is expected in 2013, but as of March 2013, no decision has been announced.

Resources) is not challenging its jurisdiction but is suing because they claim the county is not following its own land use rules in extending the hearings.[68] Allegheny County has been developing proposed shale gas drilling rules for about two years to help it monitor air emissions; it hopes to make them final in 2013.[69]

New York put a moratorium in place over four years ago, which has been extended several times and is still in effect. The state has delayed a final decision on gas development in response to an avalanche of comments on proposed rules and citizen demands for additional assessments. In early 2013, it appeared that New York was very close to issuing new rules for shale gas development. Opening a limited area for exploration, with close monitoring, seemed likely. A well organized opposition called for more transparency regarding completed assessments and a public comment period on the health impacts assessment prior to publishing rules or approving even limited drilling. New York has become a focal point for fracking opponents, including celebrities as well as health and environmental experts, who have run a campaign to appeal for greater attention to health and environmental impacts. New York's governor has been persuaded to continue delaying the decision. The state government has not, as in several other states, been at the forefront of challenging local government actions to regulate or ban gas development. Industry and those supporting development have challenged some local laws.

Many municipalities have taken action over the past few years. New York's constitution recognizes that local authority and home rule is a widely supported principle in New York. It appears to be more deeply engrained there than in Pennsylvania. Legal challenges regarding state versus

[68] Timothy Puko, "Gas company sues township over permit delays in Washington County," TribLive, 01/29/13; http://triblive.com/news/adminpage/3385796-74/company-gas-township#axzz2KEy3iOiX .
[69] Timothy Puko, "Allegheny County moves forward with rules on gas drillers' emissions," TribLive, 01/22/13; http://triblive.com/news/adminpage/3341663-74/county-officials-rules#axzz2KEy3iOiX .

local authority, parallel to those in Pennsylvania, have been taken up. Two cases regarding the legality of local zoning went to the NY State Supreme Court in 2012, and in both cases the court upheld the authority of local government to control land use through zoning laws. In both cases the court clearly distinguished local authority to regulate land use from regulation of gas development, which is an authority belonging to the state. These decisions were in keeping with previous state court decisions that pre-dated the fracking controversy.[70] When both of those cases were subsequently appealed,[71] 53 townships petitioned the appellate court to offer a legal brief in support of home rule. Townships joining the petition are not necessarily opposed to fracking; they are in support of home rule. Several court cases still are underway in early 2013.

On the other hand, New York landowners who wish to lease their land for gas development are seeking to force an end to the moratorium, which is now been in place for four-and-one-half years. An umbrella organization claiming to represent tens of thousands of landowners is reportedly moving forward to sue New York for a "de facto taking."[72] With the controversy still very much

[70] State Supreme Courts in Tompkins County and Otsego County ruled in two separate cases (*Anschutz Exploration Corp v. Town of Dryden; Cooperstown Holstein Corp v.Town of Middlefield*) in support of municipalities' authority to ban fracking or use zoning laws to prevent drilling. The gas company and Cooperstown dairy farmer have appealed their respective decisions to the Appellate Divisions of the Supreme Court. (NB: in New York State, the highest court in their Court of Appeals). The case is *Anschutz Exploration Corp. v. Town of Dryden*, New York State Supreme Court, Tompkins County No. 2011-0902, Feb. 21, 2012. Reuters carried articles: www.reuters.com/article/2012/02/22/usa-newyork-fracking-idUSL2E8DM09820120222. Second case, where a dairy farmer wanted fracking; Judge Cerio found: "Municipalities are not pre-empted ... from enacting local zoning ordinances which may prohibit oil, gas and solution drilling or mining," Cerio wrote. "The state maintains control over the 'how' of (drilling) procedures while the municipalities maintain control over the 'where.'" The case is *Cooperstown Holstein Corp. v. Town of Middlefield,* New York State Supreme Court, Otsego County No. 011-0930. Feb. 24, 2012; www.reuters.com/article/2012/02/26/usa-newyork-fracking-idUSTRE81P01820120226 . For legal analysis of zoning decisions see Ronald Steinvurzel and Jessica Buno, "Municipalities and Natural Gas Extraction…What the Frack?" *New York Law Journal*, May 23, 2012, http://www.newyorklawjournal.com/PubArticleNY.jsp?id=1202555600129&thepage=all; accessed at http://www.scribd.com/doc/94539709/Municipalities-and-Fracking , Michelle Kennedy, "The Exercise of Local Control Over Gas Extraction," 22 *Fordham Environmental Law Review*, Vol. 22, 375-392, 2010-2011, and M. Kenneally and T. Mathes, "Natural Gas Production and Municipal Home Rule in New York," *New York Zoning Law and Practice Report*, Vol. 10, No. 4, January/February 2012; http://counties.cce.cornell.edu/yates/documents/NaturalGasProduction.pdf . Regarding municipal support for home rule, see Jon Campbell and Albany Bureau, "Towns, cities look to get involved in hydrofracking homerule case," Presconnects, 10/30/12; http://www.presconnects.com/article/20121030/NEWS11/310300076/Towns-cities-look-get-involved-hydrofracking-home-rule-case?gcheck=1 .

[71] Briefs for the appeal were presented to the court in October 2012.

[72] "77K NY Landowners Prepare Lawsuit Against DEC," Marcellus Drilling News, 02/11/13: http://marcellusdrilling.com/2013/02/77k-ny-landowners-prepare-lawsuit-against-dec/ **.** and "JLCNY Loses Faith in Cuomo, Initiates Lawsuit over Fracking Rules,": http://marcellusdrilling.com/2013/02/jlcny-loses-faith-in-cuomo-initiates-lawsuit-over-fracking-rules/ .

underway, many municipalities are taking positions. In April 2013, there were 54 bans, 105 moratoriums, and 92 movements for prohibitions (bans or moratoriums) in New York State. Municipalities in more than a dozen counties (covering a significant part of four counties) have taken anti-ban action.[73]

Some conclude that gas development is unlikely to start in New York in 2013 even if the moratorium were lifted, because of multiple levels of uncertainty and therefore risk. Companies seek to minimize their risks and legal ambiguities. Low market prices for gas will probably push developers toward areas where they are confident of high gas capture, and companies do not have much experience in New York's portion of the shale play. Further complicating the picture for industry is that dozens of New York communities have enacted bans or moratoriums on drilling. Since judges found for the towns in two industry challenges of such bans, the possibility of such bans constitutes substantial uncertainty. Industry claims local bans are invalid because of a state law asserting that only the state can regulate oil and gas development, but recent cases have explicitly rejected the logic that land use planning laws constitute regulation of oil and gas development. It is currently unclear what role local governments might play in this process, and companies want clear understanding of the requirements and risks before they commit to spending the kind of capital necessary to develop gas resources.[74] The future of natural gas development in New York is unclear, and at this time, the status of existing leases is also caught in ambiguity and some disputes.[75]

Colorado presents a range of local approaches. Law suits contesting local government actions did not hit a boiling point as quickly as in Pennsylvania and New York, but Colorado filed suit against its town of Longmont in response to standards Longmont enacted for gas development within the

[73] FracTracker, http://www.fractracker.org/maps/ny-moratoria/ .
[74] Mary Esch, "New York Shale Gas Boom Is Unlikely in 2013, Even If Gov. Cuomo Lifts Fracking Moratorium," Huffington Post, 12/26/12: http://www.huffingtonpost.com/2012/12/26/new-york-marcellus-shale-gas-boom-2013_n_2365058.html?utm_hp_ref=fracking.
[75] See, e.g., "Instructions for Landowners Who Received a Letter from Chesapeake After November 15, 2012, Claiming Lease Extensions Due to June 2012 Agreement with NYS Attorney General," www.fleased.org, 030213.

town. After establishing a four-month moratorium on drilling late in 2011, Longmont passed a ban, which the governor also deemed in conflict with Colorado's state authority regarding gas development. This time the state did not sue but left it to the gas industry. The oil and gas industry agrees with the state government in rejecting local governments' authority to ban gas development and is ready to challenge such attempts. Residents of Erie, Colorado, became alarmed when people were becoming sick. There are over 300 wells in and around Erie, some close to a school, and more planned. The state health department would not investigate their concerns, so citizens organized a group and website, Erie Rising,[76] and took further action. Early in 2012, the town of Erie instituted a novel approach by implementing local air and water quality rules. The town asked companies to provide their drilling plans for review and to capture 100 percent of air emissions at new wells; they initiated discussion with the gas companies to reach agreement on a range of protective measures. The town bought equipment to test water for hydrocarbons. The state attorney general said local officials could inspect but not enforce against companies.[77] Further concern arose when a NOAA study was released, showing elevated levels of air contamination around Erie that were attributed to oil and gas development.

Colorado's governor created a task force in February 2013, to clarify and better coordinate the line between state and local regulatory authorities for oil and gas operations. The task force recommended several actions aimed at representing local views in state regulatory deliberations and providing more transparency to state processes.[78] In March 2012, Erie voted for a six-month

[76] http://www.erierising.com/ . They describe themselves as a grassroots, mom-powered organization.
[77] Bruce Finley, "Drilling concerns: Erie monitoring air, water quality but can't enforce rules," denverpost.com, 04/10/12: http://www.denverpost.com/environment/ci_20360063/drilling-concerns-erie-monitorin; see also, John Aguilar, "Fracking fury reaches fever pitch in Erie," dailycamera.com, 01/10/12: http://www.dailycamera.com/erie-news/ci_19696245.
[78] See summary of task force findings, April 2013, http://www.colorado.gov/cs/Satellite/GovHickenlooper/CBON/1251621390178 .

moratorium.[79] Before the moratorium expired, Erie worked out agreements with the companies, signed memoranda of understanding (MOUs)[80] with them, and let the moratorium expire. Erie was the first city to achieve this kind of agreement for standards beyond state requirements. The state regulatory body, the Colorado Oil and Gas Conservation Commission (COGCC), indicated that these best management practices could be incorporated into the permits COGCC writes, so that the local conditions will be enforceable.[81]

In May 2012, the Loveland City Council passed an emergency temporary (nine-month) moratorium on new gas development within the city, to allow time for revising its zoning code and developing regulations for energy development.[82] Early in 2013, Loveland has draft rules under review, and a citizen group pressing for a ban has not persuaded city leaders that a ban is within the city's authority.[83] Fort Collins City Council voted in March 2013 to enact a ban, replacing a temporary moratorium established in December 2012.[84] The governor has promised to sue towns which try to ban fracking, but he cannot be anxious to have more state-local lawsuits. After Fort Collins voted for a ban in March 2013, he commented that it might be possible to purchase subsurface rights to resolve the issue.[85] This does not appear to be a signal for compromise, as

[79] John Aguilar, "Erie passes gas drilling moratorium, goes into effect immediately," dailycamera.com, 03/07/12: http://www.dailycamera.com/erie-news/ci_20124467/erie-passes-gas-drilling-moratorium-goes-into-effect?source=pkg
[80] See http://www.erieco.gov/?nid=129, including links to MOUS; notes expectation that COGCC will enforce the agreements.
[81] John Aguilar, "Erie passes regulations on oil, gas drillers," dailycamera.com, 08/28/12: http://www.dailycamera.com/erie-news/ci_21422946/erie-passes-new-regulations-oil-and-gas-drillers?source=pkg.
[82] Bobby Magill, "Loveland enacts emergency fracking ban, Fort Collins may follow," 05/16/12: http://www.9news.com/news/local/article/268237/346/Loveland-enacts-emergency-fracking-ban-Fort-Collins-may-follow . Other towns also were voting for moratoriums, Colorado Springs and Commerce City, e.g.
[83] Tom Hacker, "Protesters confront Loveland planning commission on Fracking," 02/06/13: http://www.reporterherald.com/news/loveland-local-news/ci_22470191/protesters-confront-loveland-planning-commission-fracking.
[84] "Ft Collins Approves Ban on Fracking," CBS Denver, 03/06/13: http://denver.cbslocal.com/2013/03/06/fort-collins-approves-ban-on-fracking/ . Also, Patrick Malone, "Councilman Horak proposes ordinance to ban fracking, bypassing ballot," 02/05/13; http://www.coloradoan.com/article/20130205/NEWS01/302050018/Fracking-ban-question-lands-council-s-lap . "Hickenlooper: State may be willing to help anti-fracking cities compensate mineral owners," Coloradan.com. 03/06/13: http://www.coloradoan.com/article/20130306/NEWS01/303060024/Hickenlooper-State-may-willing-help-anti-fracking-cities-compensate-mineral-owners .

towns cannot afford the cost of purchasing subsurface mineral rights. But no suit was filed by the state (as of April 2013). The governor has emphasized fairness for those (gas companies) holding subsurface mineral rights, rather than the underlying governance question of state versus local authority. Critics note that he might place greater emphasis on community rights to control land use rather than subsurface mineral rights for resources which have only recently become extractable.

Boulder County has tried a different strategy. They had a moratorium in place for over a year, and extended it further in early 2013 to allow time for implementing new rules. Boulder County commissioners have avoided enacting a ban because of concerns that it might be overturned if challenged in court. They have opted instead to put strict local laws in place to increase protections and decrease the attractiveness of gas development, while adhering to a safer legal strategy. The gas industry is getting impatient and indicating the possibility of legal action.[86] In Garfield County, western Colorado, local concerns have not resulted in action by local government to further regulate gas development. A study of air quality conducted by the Colorado School of Public Health raised concerns about pollution in 2008, but that study was discontinued. Another study from that research will be published in early 2013. The county agreed to another air study, announced in 2012, to be conducted by Colorado State University and a private firm, with an advisory panel. There are signs that citizens are deeply divided, with many continuing to raise concerns about the effects of drilling, and also whether county commissioners are too accommodating to oil and gas

[86] Troy Hooper, "Boulder approves 'toughest' oil, gas rules in Colorado," The Boulder i Journal, 12/14/12: http://www.boulderijournal.com/article.php?id=7743 . In February 2013, Boulder County further extended its moratorium, to complete rules (that will dovetail with Colorado's). Commissioners noted concerns with being sued by industry: In January 2013, Encana Oil and Gas sent a letter objecting to a moratorium extension. Encana noted that it had been almost a year "'since Encana and other operators were first denied the ability, due to the moratorium, to access and develop valuable mineral interests in Boulder County. This denial and any extension of the moratorium likely gives rise to an actionable taking of property rights.'" John Fryar, "Boulder County commissioners formally extend oil, gas drilling moratorium," Longmont Time-Call, 02/05/13; http://www.timescall.com/news/longmont-local-news/ci_22525560/boulder-county-commissioners-formally-extend-oil-gas-drilling .

interests.[87] La Plata County in western Colorado has a history of coal bed methane gas development, including fracking, though not shale gas drilling. At least some of the residents are increasingly concerned with environmental and health impacts. La Plata continues to accept gas development, but they have negotiated agreements with gas companies that add conditions beyond those covered by state rules. Swift Energy signed a memorandum of understanding with the county for the first shale gas exploration with horizontal drilling in March 2013; they agreed to requirements including emissions controls and water-sampling standards.[88] This kind of action across Colorado challenges the idea that there is a fundamental divide in attitudes between eastern and western states with respect to oil and gas extraction industries.

Issues related to local government authority continue to evolve, and are being tested in courts, in Pennsylvania, New York and Colorado. It is not clear how the struggle over zoning laws will be resolved. State decisions might have been accepted in the past, insulating specific issue areas or industries from local rulemaking, and this appears to be the expectation of gas developers. But many local governments are not satisfied to leave matters solely to the state when it comes to gas development. With fracking technology, subsurface rights are being exercised within towns, and this is an important change. Attempts by state governments to unilaterally curtail local laws raise conflicts that might be resolved by the courts with reference to the powers defined in the state constitutions. Resolutions may well differ from state to state, depending upon constitutional provisions and previous court decisions. Courts do not appear to distinguish municipal zoning from

[87] "Garfield County to Partner With CSU on Air Quality Impacts of Gas Drilling," Colorado Energy News, 08/20/12; http://coloradoenergynews.com/2012/08/colorado-state-pitch-study-air-quality-impacts-gas-drilling/ . John Colson, "Crowd fills Garfield County session on Thompson Divide drilling," Denverpost.com, 02/06/13; http://www.denverpost.com/breakingnews/ci_22530629/crowd-fills-garfield-county-session-thompson-divide-drilling . "Bipartisan Poll: Garfield County Commissioners' actions on drilling, oil shale dividing voters," Checks and Balances Project, 09/26/12; http://checksandbalancesproject.org/2012/09/26/ .

[88] http://www.bizjournals.com/denver/morning_call/2013/03/la-plata-county-oks-shale-oil-drilling.html.

county zoning rules, even though municipalities cover smaller areas (i.e., more likely that subsurface gas could be accessed from a distance through horizontal drilling and fracking), and would generally have denser populations for which gas development processes pose more serious risks.

If the only goal acceptable in a community is to prevent gas development, it might be that seeking a ban, or strong enough zoning laws to make compliance too costly, are the only feasible alternatives. One state (Vermont) has banned fracking and several others are considering bans, but the benefits of, and pressure for, gas development make that an unlikely option for most states. Bans appear extremely difficult for individual towns and counties, because of the imbalance of power and the cost and time it takes to wage legal battles against state and industry challenges. Zoning laws are an interesting strategy, but one which seems more likely to be successful in setting additional conditions than in preventing fracking entirely. Pursuing zoning protection laws, if upheld in principle by the state courts, might provide useful tools for local governments to set requirements for a variety of concerns such as local planning, risk mitigation, testing and monitoring, accountability guarantees, noise and traffic controls, and greater transparency and communication from the companies. As noted below, in same states, local governments might be prohibited from using zoning laws to require additional controls for gas development.

Relying on zoning laws to address concerns (whether a ban or imposing additional protections), is an uncertain strategy, currently being tested in several state courts. If state courts uphold local government's authority to impose zoning restrictions, there are seemingly quite different things at stake in different states. The lower level courts agreed with local governments that they may ban fracking in New York, but also made it clear that local government may not further regulate it. That is, the courts upheld the authority of local land use (zoning) laws but also

affirmed the state law that pre-empts direct regulation of gas development at the local level. In contrast, it appears previous case law in Colorado establishes that local governments may not ban fracking[89] but they may impose additional zoning conditions. Boulder County made a concerted effort to avoid a ban, in large part to avoid what they saw as legally too risky, while trying to constrain development through land use requirements. Local governments in New York, and probably Pennsylvania, move toward a ban as their more legally defensible approach.

Another variation on the pre-emption issue asserts federal pre-emption of local zoning laws and state decisions. In Maryland, the industry and the state government are on opposite sides of this pre-emption issue; Maryland is endorsing the legitimacy of local zoning laws. Maryland (at the time of this study) has a moratorium on fracking in place. Other activities related to the industry are occurring, however, such as disposal of out-of-state fracking wastes, a planned LNG plant for export of natural gas, and pipelines to distribute gas from (and to) places outside Maryland.

A company (Dominion Transmissions, Inc.) has filed suit against both a town (Myersville) and the state of Maryland related to local zoning laws. The suit holds that federal law pre-empts local laws "in their entirety" and thus local zoning requirements have no force whatsoever in this matter; the company also challenges the state's refusal to consider the company's permit before local zoning requirements are met. The company's broad claim for federal pre-emption seems to include pre-emption of both state and local authorities.[90] The case in Maryland is interesting because a

[89] In Voss v. Lunvall Brothers, Inc., 830 P.2d 1061 (Colo. 1992), the Colorado Supreme Court struck down a local (Greeley) home rule law which banned oil and gas development within city limits. The court found that the ordinance was in conflict with a 1990 Colorado court decision, which had determined that, when both state and local concerns are at stake, a home rule municipal ordinance may co-exist with a state law only if there is no conflict between the two; Patrick Fitzgerald, "Should States or Cities Regulate Fracking: Colorado the Latest State to Confront the Issue," Energy Center, Univ. of Texas, 01/03/13; http://www.utexas.edu/law/academics/centers/energy/author/patrick_fitzgerald/ .

[90] Paul Roberts, "Natural Gas – Breaking News," Appalachian Independent, February 5, 2013 at http://www.appindie.org/index.php/our-blue-earth/89-our-blue-earth/3128-natural-gas-breaking-news. As Roberts notes, Dominion

company is arguing for pre-emption of local law while the state government acknowledges local authority. Further, the issue is not about gas extraction or fracking processes; at the time of the filing, Maryland did not allow drilling. This particular case relates to a gas distribution network. The governance issue is about the extent to which federal pre-emption of state or local laws is intended, and legitimate. Are federal requirements and approval in such instances the only approval needed, or are states (and localities) justified in having their own approval processes, in order to address other questions and issues? The company plans to build a compressor station at their existing pipeline, which would serve as an important component of its export infrastructure for gas from southern Pennsylvania's Marcellus wells. The Federal Energy Regulatory Commission (FERC) gave the company approval to build. The town is asking the FERC to reconsider, but asserts that its zoning requirements are valid and must be followed in any case. A further concern is the effects the station will have on air quality. A petition to the FERC notes that the air standards Maryland enforces are EPA standards, and as federal law, are not subject to pre-emption.[91]

A battle pitting local communities against federal decisions is unfolding in other places, on the issue of federal leases for resource extraction on federal lands. It is not unusual for national and regional environmental organizations to sue the federal government on substantive and procedural grounds related to federal decisions.[92] Colorado is one such place, where communities are fighting to push back at least some proposed elements for leasing lands for gas development. One battle, in

---

can claim broad authority under federal law, particularly in light of the various exemptions to environmental law that Congress gave to the oil and gas industry. This lawsuit initiates what could be a protracted legal battle that might lead to landmark judicial decisions. The courts could be pressed to answer whether or to what extent towns, or even the state, can control the industrial activity within its borders.

[91] Roberts, Ibid.

[92] See, e.g., a case initiated by a consortium of environmental organizations in 2008 against a BLM leasing decision for wilderness and recreation area in Colorado. In 2012, a federal judge agreed that BLM's decision must be reworked, based on more complete, and available, information. Early in 2013, BLM announced its plan to re-evaluate the decision. Scott Streater, "BLM agrees to completely re-evaluate its drilling plan on Colo.'s Roan Plateau," www.eenews.net/gw 01/25/13

Paonia, Colorado, was highlighted in the national news.[93] Opponents are concerned about lasting environmental damage and about destroying existing businesses whose viability depends upon the beauty and healthiness of the environment. Issues seem to pit the interests of oil and gas companies against small businesses, such as tourism or organic farming, as well as individuals who use the land for recreation. These same issues have been raised in New York State and western Maryland. An interesting aspect of this community activism is that Paonia is in the heart of Colorado, not in the populous and more liberal towns of the eastern front range. Concerns in Paonia and Garfield County seem to undercut the argument that opposition to oil and gas development is associated with its appearance in more populous areas (the front range in Colorado; rural Pennsylvania). Similarly, these battles crack the image of solid support for oil and gas development in the conservative west. When community interests and values deviate from existing public policy and power coalitions, it is all the more important to have mechanisms for participation.

The FERC addresses national energy needs and goals, including regulation of siting, construction and abandonment of interstate natural gas pipeline routes and storage facilities, as well as the siting and operation of LNG facilities and pipelines for import and export. These responsibilities are by definition multi-state or national in scope and cannot be delegated to states or localities. Establishing and carrying out these policies inevitably raises issues of federal versus state authority, and whether policies are excessively prescriptive and inflexible or, on the other hand, sufficiently protective. In pursuit of national energy policy, should the FERC, based on company plans, be able to overrule state and local laws? And if so, under what conditions, and who

[93] Jackie Healy, "Colorado Communities Take on Fight Against Energy land Leases," New York Times, 02/03/13, pp. 15, 21,

has the authority to judge whether those conditions have been met in any given situation?[94] The FERC might be focused on what they deem are overriding national interests in goals such as energy self-sufficiency or reducing pressure on global markets. Understandably, state and local governments do not want to be left out of decisions regarding development within their boundaries, or have their laws pre-empted. The FERC notes that it includes environmental safeguards in its process. It conducts environmental assessments and takes into account the decisions of other agencies (including EPA and DOI) that have overlapping responsibilities before making decisions. However, the FERC's emphasis appears to be on facilitating a reliable and safe energy infrastructure rather than environmental protection.[95] Decisions that are made at the federal level and announced in the state are likely to bring resentment and perhaps opposition, especially when federal agencies making the determinations are suspected of being too accommodating to the large companies they regulate. These issues might come to the fore in the suit brought by the gas distribution company, Dominion, against the town of Myersville and state of Maryland, in which case the stakes will be very high.

- **Methods of extra-legal engagement**

All parties would benefit if there were less contentious and expensive ways to reach agreement. If appropriate tools for resolving these difficult issues could be adopted, they would surely provide speedier and less expensive options for resolving these tough issues than seeking

[94] If the FERC approves a pipeline plan and the company has not reached agreement with property owners on conditions for an easement/leasing of their lands, "the pipeline [i.e., the company] may acquire the easement under eminent domain…with a court determining compensation." Pipelines require land for storage and compressors along the route as well. The FERC notes that companies generally must follow local and state laws, though if there is a conflict, the FERC's decision prevails. See the FERC's citizen guide, "An Interstate Natural Gas Facility on My Land? What Do I Need to Know?" July 2010, pp. 8-9: http://www.ferc.gov/for-citizens/citizen-guides/citz-guide-gas.pdf.

[95] The FERC's mission statement confirms this interpretation in referencing "reliable, efficient and sustainable energy" as a reasonable cost, with no mention of environmental protection. See http://www.ferc.gov/for-citizens/about-ferc.asp. It should be noted that the FERC's responsibilities for gas development do not involve fracking technologies, but transport of the product.

relief from courts. The National Petroleum Council acknowledges the importance of community engagement for companies conducting natural gas development as a means of building trust, starting prior to drilling and including transparency about processes and practices.[96]

The approach of using zoning laws might yield some success, but it is path not available to communities lacking a zoning framework and appropriate zoning laws, and one that is slow and uncertain at best. The question is likely to be tested further in state courts, and whatever the lower courts decide, the losing side will likely take the issues to higher courts. Limiting property rights, if possible through local zoning, can split communities into warring factions. Using mechanisms other than zoning means that a complete ban is not sought or not feasible. This position has far greater traction, as it does not completely frustrate the many forces pressing for development. Methods of community engagement have been successfully used to address issues important to communities, including environmental issues. Three approaches will be discussed here, public participation, community benefits agreements, and community support resources, which could be used in conjunction with either of the other approaches.

Public Participation

Public participation provides a means for people to affect key social and economic decisions. It respects the community's need for and interest in information about proposed activities. Transparency is a key component of successful outreach to communities, and it can help educate the public about the issues and correct disinformation. Incorporating public input acknowledges that communities have a right to know about and engage in important decisions affecting them, and that important aspects of gas development decisions do not require understanding of complex technical issues. Participation is a means of building trust among stakeholders, and results in

[96] "Prudent Development," *op. cit*.: 25, 30.

decisions that are far more likely to be accepted as legitimate, with less contention and fewer court battles.

A variety of public participation tools and models have been used in developing environmental policy, and no one approach is appropriate for all situations.[97] While public participation is important in democratic rule-making, how much and what kind should vary depending upon the issues at hand. It is important to recognize how much power or influence any given approach is likely to have regarding public decisions. In any case, mechanisms for community participation should not be seen as an alternative to political representation and expertise, but should complement them.[98]

Creating mechanisms to facilitate local involvement is a familiar challenge in national environmental policy. EPA learned the need for public participation when it launched the Superfund program in the 1980s. Superfund sites raised issues of intense local concern, and the Agency responded by introducing tools and techniques for public outreach, education and involvement. It emphasized the need to provide information about each site to the public. Over time, the Agency created a wide variety of materials, and disseminated kits to support efforts for public engagement and feedback. EPA's Superfund community involvement is meant "to advocate and strengthen early and meaningful community participation," through an ongoing process of dialogue and collaboration with the community. That is, public involvement creates a relationship with two-way communication. EPA directs its staff to encourage and enable community involvement, listening to community feedback and dealing with concerns, including a willingness to change plans. EPA

[97] For an overview of types and uses of public participation approaches, see Daniel J. Fiorino, "Citizen Participation and Environmental Risk: A Survey of Institutional Mechanisms," *Science, Technology, & Human Values*, 15, 2 (Spring, 1990): 226-243.
[98] Archon Fung, "Varieties of Participation in Complex Governance," *Public Administration Review*, suppl. Special Issue on Collaborative Public Management 66 (Dec. 2006): 66-75.

commits to keeping the community informed of current and planned activities, starting with the assessment that leads to adding sites to the Superfund priority list for clean-up, and to explain "what EPA has done and why."[99]

Each Superfund site has a site team headed by either a Remedial Project Manager (RPM) or On-Scene Coordinator (OSC), who is responsible for all site activities. Having a dedicated team, and emphasizing the importance of community participation as part of their responsibility, provides a framework for community involvement supported by clear means for communication throughout the process. One example of the program's commitment to community involvement is a publicly available memorandum from a senior manager to the national policy managers in EPA's regional offices directing them to plan, budget for, and support community involvement in decisions from the very outset of work at a site, and describing six practices they should follow.[100]

Superfund experience provides useful lessons about the need to engage communities when large industrial enterprises are coming into their midst, particularly when toxic chemicals are involved. One of the key elements of the Superfund program for public participation has been to create reliable channels for information. People living near major operations involving toxins want to know about the ongoing processes and what they can expect to have happening around them. They need a reliable source with up-to-date information. They want to know whom to contact about activities or issues of concern. These same community concerns and needs are common to gas development.

---

[99] See, .e.g, "Superfund Community Involvement" at http://www.epa.gov/superfund/community/ . For a more detailed discussion see "Superfund Community Involvement Handbook," USEPA, 540-K-05-003, April 2005; www.epa.gov/superfund .

[100] See Elaine F. Davies, "Early and Meaningful Community Involvement," Memorandum signed 10/12/01; http://www.epa.gov/superfund/community/policies.htm . Superfund's policy of public involvement was further strengthened by the EPA Administrator's endorsement of "vigorous public outreach and involvement" by the Agency; ibid.

These program techniques are not entirely applicable or transferable to natural gas development sites, however. Superfund is a national program, run by EPA, and thus there was an opportunity to standardize techniques, terminology and types of content for outreach. Lessons learned at one site can be used to improve communication and participation at others. Since EPA is not responsible for the contamination of the site, the Agency can be seen as a neutral party. Further, public participation processes have been developed and refined over the past several decades in the federal government, especially for environmental issues. State and local governments have less experience with these activities, and funding them is even more difficult during this period of cutbacks in many state budgets.

State governments define requirements companies must meet in order to receive approval to conduct gas development operations, and states have inspectors who oversee the permits. But with thousands of well sites in states where the industry is booming, states do not have the resources to give close attention to individual operations, much less engage the public and keep abreast of activities at each site. There is no central program or set of requirements or processes governing gas development operations across state lines.

If gas companies do not have to deal with local governments or communities, and can negotiate private leases and state government approvals, local communities can be virtually left out of the loop. Public participation processes require reliable information channels and data transparency from government agencies. More than state government outreach would be needed to change the feeling of community powerlessness, however; companies would have to cooperate. At least some of the gas companies know how important it is to gain local trust. In some areas, citizens have noticed a greater willingness by individual companies to engage in open discussion and

attempt to address local concerns. On the other hand, many companies appear to believe that they have no obligation, or need, to share information about their business activities with the local community; or perhaps they fear that disclosure and communication will only create opportunities for delay and even additional liability. If companies and states were willing to engage in a more robust public participation process, local governments and communities would likely take an active role, and to the extent that information would address important community concerns, relations between industry and communities would improve. Public participation processes seem feasible only if states help press the issue. States can encourage public input to the permitting process, and make local acceptance an issue for companies to take seriously.

Processes and expectations for participation would undoubtedly vary, making standardization and process learning more limited. Site data collected varies from state to state, and these data are usually not easily accessible to the public. Gas extraction and production often take place on private property, under a private leasing contract with the property owner. Providing information to the community has not been a requirement or important objective. Dramatic changes in attitudes and operational behavior by companies would be required for meaningful public participation. With increased information and transparency from companies, communities could engage in dialogue about the overall plan for a site. But this would be of limited value in many situations. Communities are confronted with multiple site developments for which there is no overall plan or coordination required, and whose cumulative impacts have not been assessed. Companies owning the leasing arrangements often subcontract to multiple individual companies to conduct the various phases of the operation, which further fragments and complicates accountability for each site. Creating and sharing area plans would be a significant challenge for

developers, but states could promote such planning by requiring or creating a more comprehensive assessment as part of the permitting process.

Public participation programs need not be defined by regulation, but state program rules and policies can help drive information sharing. States differ in whether plans are subject to any local comment, and who in the affected community, if anyone, receives notification or documentation, with or without the ability to comment. Colorado is among the states that require some notification, at least to neighboring property owners, if gas development is going to take place. The incentives for natural gas developers are far different from those driving cleanup operations; the expiration date of leases, for example, can create added pressure to complete some steps in the development process to extend the lease, but hurried steps can compromise environmental safety. If the public is able to comment on plans, any resulting changes and delays would most likely directly affect the profits of gas developers, which is not the case with EPA's public participation outreach for Superfund sites.

Activities overseen by Superfund are designed to clean up past contamination; these activities raise complex and controversial issues, but the cleanups should benefit the entire community by reducing the chance of exposures to toxins. Fracking brings the potential for substantial wealth to some land owners, but additional risks to the entire community, including strains on the local infrastructure as well as toxins and polluting industrial processes. Environmental and aesthetic conditions do not improve, and are likely to become worse from heavy equipment, development activities, and pipelines, even if there are no spills or leaks. The economic benefits are highly disproportionate across the community. Superfund experience provides useful lessons in the importance of public involvement, and offers a wealth of techniques for possible adoption. But the

successes of the Superfund outreach program cannot be so easily translated into the context of highly dispersed and profit-driven gas development activities.

Community Benefits Agreements

A second possible model for building local collaboration might be found in a community benefits agreement (CBA). It differs significantly from public participation approaches discussed above in that it does not depend upon, or necessarily include, government to create or manage the activities.

Community benefits agreement is a term used to describe a way community groups have reached agreement with private developers on a variety of issues that might not be included, or adequately addressed, in formal planning and approval processes required by government regulation. Laura Wolf-Powers summarizes scholarly understanding of the CBA as "a documented bargain outlining a set of programmatic and material commitments that a private developer has made to win political support from the residents of a development area and others claiming a stake in its future." It is a legal contract between the company and non-governmental parties it deems critical to a smooth approval process.[101]

The community must form a coalition for conducting negotiations, though it need not have a totally unified set of interests. The community might be represented by a loose coalition of diverse interest groups. The process brings individuals together and links them through concerns about their area/territory. It requires but also creates community ties. Developers make a political decision to participate because they see this deliberation process as a risk mitigation activity, a way

[101] Laura Wolf-Powers, "Community Benefits Agreements and Local Government: A Review of Recent Evidence," *Journal of the American Planning Association*, Vol. 76, No. 2, Spring 2010, First published on: 23 February 2010 (iFirst); http://dx.doi.org/10.1080/01944360903490923 .

to address uncertainties and avoid delays or possible derailment.[102] Delays can be a costly matter for business.

CBAs are negotiated directly between the developers and the community and do not go through government offices. The goal is to create a context of deliberation and mutual learning rather than an adversarial, antagonistic situation, which is typically carried out as a zero-sum game. The process can include workshops to help community participants understand technical issues and define specific issues. Communities often reject the risk-benefit assessment that the developers (or government) use; they have differing valuations or interpretations of risks and benefits, and might have their own experts as well. The deliberative process is meant to move from a list of interests and concerns toward specific commitments. The CBA process results in a commitment by the developer to do certain things that help the community and in turn, the community will support the project. The agreement might include activities of interest to parts of the community that are not directly related to the planned project.[103]

Government has taken part in some cases by providing a moderator to make sure the process runs smoothly; this person might also act as a mediator or referee if needed. It tends to legitimize the deliberations.[104] Wolf-Powers makes the point that government administrators usually take part, and that this is an important element.[105] Having government participate in the deliberation process helps to ensure that commitments would meet regulatory requirements. In some cases the administrative process incorporates agreed upon benefits as part of the approval

[102] Murtaza H. Baxamusa, "Empowering Communities through Deliberation," *Journal of Planning Education and Research*, 27, 2008: 261-276. Baxamusa makes the point (p. 271) that if government conducts an approval process "without accurate assessment and liability of the socioeconomic impacts of new development, it is shifting the uncertainty from the developer to the community." In this situation, the developer has no reason to negotiate with the community.
[103] Baxamusa, Ibid.
[104] Baxamusa, p. 268.
[105] Wolf-Powers, *op. cit*.

requirements, which strengthens the status and reliability of the agreement, including those terms into government oversight of implementation.

CBAs emerged in the context of renewed interest in urban growth and redevelopment projects proposed by private investors as they became interested in finding opportunities in cities, and as Smart Growth concepts were driving new ideas. This approach achieved notable successes in the first decade of the 2000s and gained broad use. Agreements were reached in a variety of cities, including New York, Los Angeles, and Washington DC, for many projects including university expansion (Yale, Columbia), sports arenas (New York, Pittsburg, Los Angeles), revitalization (Denver, San Diego, San Jose, Washington DC), an industrial park (Los Angeles), and a beltway transit (Atlanta).[106] CBAs were recognized as a new and potentially powerful method for civic participation. They give communities a way to take responsibility and some control for important development decisions affecting them, which are usually decided by administrators in processes that are difficult for non-expert citizens to influence substantially.[107]

Note that CBA's might be negotiated as a private matter, between companies and a coalition of citizens or citizen organization, but would seem most likely to guarantee results if they coordinated with the government entity holding approval authority over the project. All parties to a CBA would want to ensure that regulatory policies would not be violated by the agreement; in addition, having negotiated agreements incorporated into the requirements or conditions of the formal government approval would confirm compatibility with government decision rules but also

[106] For information on projects, see http://communitybenefits.blogspot.com/ . For evaluations, see Wolf-Powers, op. cit., and Patricia E. Salkin and Amy Lavine, "Understanding Community Benefits Agreements," *The Practical Real Estate Lawyer*, July 2008: 19-34; http://ssrn.com/abstract=1157613.
[107] Baxamusa, *op. cit*.

would help provide a basis for trust among parties to the agreement and more certainty that agreed upon actions would be taken.

The CBA model grew in response to a demand by local communities to have a greater voice in city development projects affecting them, and to incorporate considerations of equity and social justice. There are obvious and important differences between cities and the rural communities and townships where fracking is occurring. These differences relate to the amount of planning that is required in cities compared to resource extraction projects in rural areas, the local infrastructure available to deal with the issues, and feasibility of overseeing the development, in addition to the density and diversity of affected populations.

City development projects require input from a variety of sources, which creates opportunities for local information sharing and outreach. In cities, citizens have clear stakes in projects to develop their neighborhood; often there are formal mechanisms (such as public meetings) to discuss development proposals. Local authorities expect and plan for public input, though the growth of CBAs attests to the fact that these mechanisms have been inadequate. In any case, companies cannot simply make private contracts and proceed with a large metropolitan development project without local approvals. If approved, development activities are in the public eye. All of these aspects of public concern create planning vulnerabilities that give local communities bargaining power.

Gas companies, in contrast, have not needed local approvals and in most cases have not been required to share, much less vet, planning documents locally. With state approval, they have not needed to deal with neighbors to their leasing arrangements or to get local permission for the large industrial site, or to tie up local roads. The fact that the oil and gas industry is one of the

nation's most powerful business sectors makes the challenge of convincing companies that negotiation with communities is in their self-interest more difficult. In short, if companies are motivated to engage in CBAs as a risk mitigation step, this motivation is severely diminished if there is no legal requirement for them to deal with local authorities.

Not only do considerations about the industrial development itself differ, but also the availability of organizational networks to help negotiate a CBA by defining issues and interests and managing community deliberations. Further, cities have a wider scope of interests and tradeoffs the community might bring to the negotiation table. CBAs have often relied on coalitions of existing groups and organizations, with processes and experience in polling members and reaching consensus. Communities where fracking occurs might have little private organizational infrastructure upon which to rely. They lack the depth of resources and expertise for negotiation, but also the range of needs that provide flexibility for tradeoffs in CBA deliberations. CBAs often contain elements that are unrelated to the goals or safety of the proposed development project itself. For example, a company might agree to build a park or low income housing, projects which are more valuable to the community than steps to mitigate non-major risks or disturbances associated with the project. Gas development companies have in some cases agreed to contribute to infrastructure needs in communities, such as road repairs and hospitals, and there are other concerns that might be addressed in a CBA. Communities contemplating shale gas development might focus attention on industrial issues, such as, an agreed upon scope for site and area planning, public access to those plans, baseline testing, public notification before various phases of the development process, the use of best practices (e.g., closed loop systems, recycling of frack water),

and identified protocols for responding to leaks, spills and other accidents. Nonetheless, a narrower range of potential benefits means less flexibility in trading off interests to reach overall agreement.

The CBA model could fit local and industry shale gas development interests in using private sector processes to address community concerns and thus move beyond local opposition to mutual interest. The CBA model also points to the potential benefits of negotiating gas leases as a group rather than individually; when there is more at stake, companies will be more willing to negotiate terms. CBAs can be seen as part of the move toward governance, a term that emphasizes methods of collaboration, deliberation and negotiation in the private sector, engaging private organizations and non-public networks and processes, instead of relying entirely upon government action to resolve policy issues. These private sector networks are horizontal rather than hierarchical. CBA deliberations identify and address issues that could clog or derail decision-making relying entirely on formal government processes. The work of citizen stakeholders can be seen as active participation in the work of government.[108] Numerous scholars assessing governance tools note that environmental issues are a particularly important arena for these kinds of techniques and processes.

Key concerns and risks associated with shale gas development are associated with the efficacy of existing technologies, but also with the companies planning and conducting the extraction and production of gas. Citizens do not have authority over company decisions and practices; government permitting and approval processes can address many of these issues, but the

[108] See Lisa Blomgren Bingham et al, "The New Governance: Practices and Processes for Stakeholder and Citizen Participation in the Work of Government," *Public Administration Review* 65, 5 ((Sep/Oct 2005): 547-558. Bingham et al do not discuss CBAs in particular; they are looking more broadly at a variety of new tools and techniques for public involvement that, they argue, that in fact takes over part of the task of governing. They emphasize the adjustments in approaches and skills ("informed best practices") public managers need to develop in order to work effectively with these new governance tools, practices and processes.

scope, stringency and enforcement of standards vary widely. And, these authorities lie with state (or, in some cases, federal) entities rather than local government. Many issues related to quality of life (noise, congestion, infrastructure stressors, e.g.) are unlikely to be addressed adequately, if at all, in state oversight programs. Communities can be without even reliable information about the status and of the project. States do not have sufficient resources to closely oversee the thousands of well operations they approve. Given local concerns and the community's considerable stake in the outcomes, local engagement to reach agreement directly with companies seems prudent and appropriate.

Support Resources for Communities

To bridge the gap between weak local infrastructures and a powerful industry, a key resource is missing – easily accessible information. Local governments and rural community groups have few resources to assist them in efforts to grapple with fracking issues. Many communities face the daunting prospect of assessing issues and options and planning responses largely on their own. It is unrealistic to expect substantial outside funding or even involvement to address all of the issues in potentially hundreds of townships and counties. But each community does not need to invent its own strategy. At best, having each community on its own to discover or create workable processes and identify key issues represents an unnecessary expenditure of time and resources. There are examples of successful community engagement to address concerns, but few if any effective means to share these methods broadly. Similarly there is a growing body of academic research to assess community attitudes, networks, and governance mechanisms used to leverage local power for community benefit, but finding that information can be very difficult.

Creation of independent information centers should serve both methodological and substantive needs.[109] Universities are a likely place for such centers, because they are sources for much valuable information, and can act as independent information brokers. Communities could benefit tremendously from self-help tools. Expanding knowledge about risk factors and technologies could help citizens focus local concerns on the most important matters, and would provide data for identifying specific issues for attention.[110] There are studies underway that are designed to be shared with the public, including an outreach and education component, encouraging a 'citizen science.'[111] State by state summaries of existing regulatory requirements also provide important information for communities identifying and ranking their concerns.[112] Local participation and negotiation could be more collaborative and more effective, with fewer delays, if there were one or more centers to act as a clearing house for identifying, collecting and cataloguing data and models for successful collaboration between communities and industry for shale gas development. Information centers could provide specific ideas regarding key issues to negotiate, including agreements successfully negotiated in other communities. This could save critical time and resources for communities. Collections could also house models for legal documents such as home-rule charters, and local zoning rules and ordinances related to natural gas development activities.

[109] The National Petroleum Council has suggested regional industry-led councils, which would build on existing organizations (GWPC, IOGCC, STRONGER) to increase information transfer, collecting and disseminating effective environmental, health, and safety practices to all stakeholders. NPC noted that such organizations could act as centers of excellence to gather and disseminate best practices; NPC, *op. cit*., pp. 25-26. But industry would not be seen as an honest broker of information; and the existing organizations they favor focus largely on water issues.

[110] For example, see RFF study, "Pathways to Dialogue," *op. cit*.

[111] The University of Colorado won a NSF grant that included a citizen-focused element. Their research results will eventually be shared with the public through outreach and education activities, including a "citizen science" component that encourages the public "to make science measurements, including air quality readings made with portable instruments compatible with smart phones, and share the results with the SRN research team." University scientists believe that the citizen science aspect of the project will strengthen connections between the public and the science used to make regulatory decisions, CU Press Statement: "NSF awards $12 million to study effects of natural gas development," http://alumni.colorado.edu/2012/10/02/nsf-awards-12-million/ .

[112] Organizations which track issues and activities nationally provide great assistance, but this information is at the state level and depends upon sometimes differing interpretation of state rules; more importantly, state rules are changing constantly and it is difficult to keep such comprehensive documents current. Communities need more specific information and guidance as well, related to local issues and strategies. With a continuously evolving landscape of technologies and issues, they need a continuing stream of information.

Given the resource limitations in many rural communities and small towns, resource centers could provide essential help for developing zoning laws, or preparing for public participation processes, and especially in preparing for negotiations. All parties might reduce contention and seek to find agreement based on models that have worked elsewhere. Industry would benefit by having communities better able to identify issues and needs. Reaching agreement saves costs associated with legal processes, and the community helps build a reputation based on trust rather than suspicion. At a minimum, communities would have assistance in focusing on key issues, and companies would then benefit from fewer delays.

Enhanced mechanisms for public participation in approving and overseeing shale gas development are needed to help protect health and environmental quality, and to build trust that this important industrial effort can and will be conducted with appropriate care and inevitable accidents will be dealt with swiftly. Resource centers would be an important component of public involvement in governance, as well as a mechanism for encouraging high standards of responsibility and accountability from companies.

Conclusion

Technical and environmental complexities raised by the gas production boom made possible with fracking technologies are mirrored in our governance debates. There will continue to be a dynamic tension permeating the federal–state relationship. States have been active in improving their oversight of the industry as its practices continue to evolve. Strong state and industry support for avoiding new federal regulations, and incentives for federal agencies to seek controls through a quicker, less costly and contentious process than rulemaking, could provide motivation for

developing alternatives. Mutual interest could drive a process for instituting baseline standards with federal input but without additional federal regulation for at least some of the issues. But calls for additional federal regulation are likely. States will continue to provide unequal levels of protection and some companies as well as states will not implement best practices and best available technologies without more pressure to do so. States are not likely to address key issues that need national attention, such as methane releases.[113] For these reasons additional national standards probably will be needed in at least a few areas.

At the federal level the incoming political leadership in key agencies will affect how well decisions are coordinated across agencies, and how aggressively the federal government pushes to address perceived risks. It is widely believed that Congress will reach no agreements in the next few years, and that EPA leadership on climate issues will be the one possible path forward for new controls. The president announced the nominees for DOE and EPA top leadership together, which signifies the overlap in their missions and need for coordination. The DOE nominee, Ernest Moniz, a physics professor from MIT with previous DOE management experience, directs MIT's Energy Initiative and co-chaired a 2011 MIT report, "The Future of Natural Gas." In 2011 testimony before the US Senate, he supported the use of hydraulic fracturing and advocated the feasibility and benefit of natural gas as a bridge fuel for a few decades, but also the need to transition to zero-carbon alternatives. In addition to commenting on the need for regulatory controls, he noted the importance of having a strong role for community interests affected by shale gas development in

[113] The World Resources Institute (WRI) argues the importance of EPA as well as state action now to address methane leakage (among other issues) and reduce greenhouse gasses. Even though the magnitude of methane emissions is uncertain, WRI judges that methane reductions are some of the lowest cost opportunities available. Nicholas Bianco, "Can US Get There From Here? Summary for Policymakers," Washington, DC: WRI, February 2013: http://www.wri.org/publication/can-us-get-there-from-here.

assessing the trade-offs.[114] The EPA nominee, Gina McCarthy, has EPA executive experience, including responsibility for recent air program rules affecting both gas drilling and greenhouse gas controls. Her actions as EPA chief of the air office are strongly criticized by some with ties to the fossil fuel industry, but praised by others for a willingness to listen to all sides, respect state capabilities (she has led two state environmental departments), and build partnerships.

These nominees confirm the intention to move forward with natural gas production, and probably with additional federal regulation in some areas. Methane emissions are likely to pose ongoing national concerns that require national attention. If further research confirms the larger estimates published by several experts, pressure to reduce this greenhouse gas pollutant would only increase. Others areas are less clear, but the disclosure of chemicals added to frack water seems an issue that calls for a uniform national requirement, though it might be implemented using the state FracFocus database. Federal assessments, and perhaps comprehensive rules, might be needed to address growing concerns about disposing of waste from extraction and production processes. Any state rules identified as potential models should meet efficacy standards sufficient to guarantee adequate performance by wastewater facilities, and perhaps contamination levels of concern for solid wastes going to landfills. Such standards might be best defined through a national analytic effort. For these and other issues, federal rule making might be restricted to setting standards for environmental release, while states or government-industry partnerships or industry best practice committees responsible for selecting technologies and processes that would achieve the goals. Practically and politically, any additional regulation would have to take existing state rules

[114] Jenny Mandel and Peter Behr, "DOE nominee Moniz foresees global gas trade curbing carbon emissions," EnergyWire, 03/05/13: http://www.eenews.net/public/energywire/2013/03/05/1 .

into consideration,[115] but could set minimal standards in some important risk and disclosure areas. Federal findings on key issues would provide more certainty for industry regarding key areas to be addressed by federal or state agencies as the gas boom continues.

Standards for a number of processes might be set in collaboration with state and industry stakeholders, and could be articulated as best practices if mechanisms for accountability are incorporated in agreements. Both from her past experience in state programs and from her EPA statements McCarthy respects the capabilities and perspective of states and seems likely to seek partnerships with them that would provide considerable state flexibility. Similarly, federal rules might be defined collaboratively, based on existing state rules that are embraced as workable national models. Such an approach would pose challenges for all stakeholders, but would probably be achieved more quickly and with less cost overall than new federal rulemaking, which is a very expensive, multiyear process, often followed by litigation and delays. As noted earlier, there are organizations which are active in trying to identify or create model rules and encourage their broader adoption.

Federal-state, but also state-local, tensions will be affected by the national process, and will unfold in context created by more or less collaborative approaches, and the degree of consensus or contention engendered by the processes.

Diverse state-local tensions offer a lot of opportunity for creative solutions – or years of litigation. Even if state courts find in favor of state government pre-emption of local laws (far from

[115] Strong opposition from powerful members of Congress is evident. At McCarthy's confirmation hearing, Sen. Inhofe's opening statement accused EPA of trying "to seize regulatory power over the hydraulic fracturing process away from the states," and of acting secretly to undermine cooperative federalism. See: http://www.utilityproducts.com/news/2013/04/12/inhofe-opening-statement-at-nomination-hearing-of-gina-mccarthy-to-epa-administrator.html.

guaranteed), the residual dissatisfaction and resentments will undermine relations into the future. If local authority for land use decisions is upheld, these laws might help address community concerns but cannot be a complete solution for them. These are political issues requiring negotiation and creative approaches for resolution. It is unlikely that many areas will want, or be able, to stop fracking. Communities need tools to help them define and establish protections against high risks, extreme consequences of the boom-bust cycle, and methods to secure other community objectives. Elements for collaborative solutions might be gleaned from experiences with the Superfund public participation programs and collaborative processes used in creating community benefits agreements for city development projects. A related but different model might be found in the approach taken by Erie, Colorado, where local government responded to a grassroots campaign by developing new rules and starting air and water monitoring for local oversight of shale gas development, but also undertaking direct negotiations with gas companies. If local MOUs are backed by state regulator through permitting requirements, as suggested by Colorado's COGCC, this could provide an important model for local involvement. Across the range of issues and methods communities might employ to exert influence over gas development projects, they will need assistance in finding and sorting through existing models and methods. This critical role might be filled by creating information centers at several regionally dispersed universities, which communities could access for self- help and, with some modest financial support, available personnel who could provide additional guidance and reference assistance.

All levels of governments should embrace collaboration and greater public involvement, not only to support democratic decision-making but as a way to put workable standards in place and encourage greater accountability from companies. Community involvement can supplement formal

rules by expanding accountability and adherence to good practices by companies. It should also inspire greater public trust in government's oversight role. Industry benefits by avoiding litigation and delays, improving public relations, and weeding out or controlling irresponsible actors. Perhaps new models for successful governance involving all levels of government as well as industry and environmental stakeholders can emerge from the gas development boom.

Attachment 1

GAO 12-874, Unconventional Oil and Gas Development, Sept. 2011, p.44

Table 2: Exemptions or Limitations in Regulatory Coverage for the Oil and Gas Exploration and Production Industry in Six Environmental Laws

Law	Description of exemption or limitation in regulatory coverage	Source	Type of program related to exemption or limitation in regulatory coverage	
			Preventive	Response
SDWA	Hydraulic fracturing with fluids other than diesel fuel does not require a UIC permit.	Statutory (2005)	X	
CWA	Federal stormwater permits are not required for uncontaminated stormwater at oil and gas construction sites or at oil and gas well sites.	Statutory (1987, 2005)	X	
CAA	Emissions of hazardous air pollutants from oil and gas wells and their associated equipment may not be aggregated together or with those of pipeline compressors or pump stations to determine whether they are a major source.	Statutory (1990)	X	
	In the Risk Management Program, many naturally-occurring hydrocarbons in oil and gas are not included in the threshold determination of whether a facility should be regulated.	Regulatory/EPA decision (1988)	X	
RCRA	Oil and gas exploration and production wastes are not regulated as hazardous waste.	Regulatory/EPA decision (1988)	X	
CERCLA	Liability and reporting provisions do not apply to injections of fluids authorized by state law for production, enhanced recovery, or produced water.	Statutory (1980)	X	
EPCRA	Oil and gas well operations are not required to report releases of listed chemicals to the TRI.	Regulatory/EPA decision (1997)	X	

Source: GAO.

Note: In some cases, states may have requirements in these areas. State requirements are discussed in the next section of this report.