

Regulation, Conversation, and Impact of Shale Gas and Oil in a Low-Price Environment



Dave Grossman, Rapporteur

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and Impact of Shale Gas and Oil in a
Low-Price Environment

2015 Aspen Institute Modern Shale Gas and Oil Production Forum

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FOREWORD

The second annual Aspen Institute Modern Shale Gas and Oil Production Forum was convened in Aspen, Colorado, June 6-8, 2015, to continue discussions initiated at the inaugural Forum in 2014 about state-level strategies to deal with impacts of increased gas and oil production from shale. The 2015 Forum convened about 60 invited energy leaders, including regulators from leading producing states and representatives from industry and the environmental community. This report summarizes those discussions.

The overarching goal of the Forum is to encourage new, collaborative, cross-disciplinary, and non-partisan thinking among stakeholders with diverse experiences, disciplines, and views. Brief presentations kicked-off each session, with the majority of time reserved for informal and candid dialogue. To encourage candor and create a safe place to explore ideas, all discussions are off the record.

The highly qualified group of speakers provided a wealth of information and a variety of perspectives, and the diverse expertise of a particularly well-qualified group of participants added to the richness of the dialogue.

The 2015 Forum specifically sought to bring greater clarity to concerns about a range of environmental and community effects, including water use and availability, surface and groundwater contamination, air emissions, land use impacts, induced seismicity, and

local nuisance issues. Among other things, individual sessions this year examined:

- *How the conversation regarding shale development has changed over the past year;*
- *The current price, policy, and market trends for oil and gas and their impact on the regulation of shale production*
- *Impacts of shale development on air quality and climate change; and*
- *How water resource needs and impacts (both at the surface and below ground) from shale production can be better understood, measured, and managed.*

This year the Forum also benefited from a meeting of state regulators convened in conjunction with the Interstate Oil and Gas Compact Commission, Ground Water Protection Council, and the Environmental Defense Fund that took place in the days immediately preceding the Forum. The focus of this meeting was to discuss the concept of a State Oil and Gas Regulatory Exchange peer assessment process – an idea initially discussed during the 2014 Modern Shale Gas and Oil Production Forum. The pre-meeting made great progress towards defining a collaborative and voluntary process that:

- *Promotes and documents continuous regulatory improvement by states;*
- *Provides a platform for open communication and sharing between states;*
- *Develops best practices; and*
- *Assists states in efficiently developing and implementing regulatory solutions.*

Some of the key takeaways from this pre-meeting are captured in this report as well, and the spirit of progress from that meeting carried over to the Forum and helped generate very productive discussion.

Dave Grossman wrote this report. His extensive knowledge of energy enabled him to understand and capture the highlights of the wide-ranging discussion and distill them into this report. I also thank Avonique DeVignes, whose efficient and good-natured

handling of the administrative arrangements contributed to a pleasant and smoothly run Forum. Timothy Olson provided important input and guidance on the development of the agenda and speaker management.

The Aspen Institute acknowledges and thanks the Cynthia and George Mitchell Foundation and the Rodel Foundation for their continued financial support of the Forum. Without their generosity and commitment to our work, this Forum could not have taken place.

This report is issued under the auspices of the Aspen Institute; the Forum speakers, participants, and sponsors are not responsible for its contents. Although it is an attempt to represent views expressed during the Forum, all views expressed were not necessarily unanimous and participants were not asked to agree to the wording.

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EXECUTIVE SUMMARY

Oil and gas prices have declined substantially over the course of the past year, leading to a rapid and significant decline in rig counts for oil and, to a lesser extent, gas. As a result, oil and gas production is starting to level off, though operators have been able to avoid severe shale oil and gas production declines by focusing activity on the best wells. The equity markets have kept companies going through the price downturn, with the availability of capital allowing companies to continue development. Even with the slowing oil and gas production growth, North America is projected (with some uncertainty) to remain the largest source of oil production growth and technology could further boost future supplies.

With continued robust oil and gas production from shale, issues concerning the impacts on water and air will have continued salience. Public concerns about production in general, and hydraulic fracturing in particular, have focused on contamination of groundwater, surface spills, the quantity of water used during times of drought, methane leakage, and the health impacts of air pollutants. In the summer of 2015, the U.S. Environmental Protection Agency released its draft assessment of the impact of hydraulic fracturing on drinking water resources in the United States, identifying potential vulnerabilities but finding no evidence of widespread systemic impacts. Still, leading companies are pursuing impressive efforts to figure out how to do water recycling and reuse cost effectively, including diversifying their supply with brackish aquifer water, pro-

duced water, and local cities' wastewater plant effluent. Increased water recycling and reuse has a range of potential benefits, including reducing induced seismicity. With regard to air pollution, leak detection and repair (LDAR) programs are using tools such as infrared cameras to address the problem of fugitive emissions, and programs are underway to try to reduce the cost of monitoring and measuring emissions of methane and aromatics by orders of magnitude.

It is essential for regulators and the industry in the United States to make sure that oil and gas production from shale occurs in an environmentally responsible way. Primary regulatory responsibility lies at the state level, and state regulators have been experimenting with regulatory approaches and solutions. States have pursued leadership through the States First Initiative and, specifically, via its State Oil and Gas Regulatory Exchange, a platform for state regulators to undertake a form of state-based peer-level due diligence. State regulators have also tried to enhance their credibility with the public by increasing stakeholder involvement, improving communications and transparency, gathering and sharing key data indicators, and addressing issues of public concern. Federal agencies, meanwhile, are working in an array of areas, both regulatory and research, and are trying to strike the proper balance in terms of federalism, regulatory coordination, and broader national interests. Serious tensions have arisen about local attempts at regulation as well, as several courts and state legislatures have overturned local government ordinances seeking to ban or severely restrict oil and gas activities. In the midst of these regulatory efforts, the industry has been pursuing leadership through voluntary programs and standards to address environmental and community concerns.

One driver of companies' participation in voluntary programs and standards is their recognition that it is important for industry to manifest some leadership in order to protect their social license to operate. That license is being challenged by a vitriolic, emotional public conversation regarding shale development, with groups on both sides trying to hijack the facts and the conversations for their own purposes. There is an abundance of fear and a lack of understanding, empathy, and reasoned discussion. There is still a persuadable public

willing to listen to pros and cons even in the midst of an otherwise bipolar conversation, but the industry needs to treat people like concerned citizens, significantly improve its communications and community outreach efforts, and become passionate about compromise if it wishes to preserve its social license to operate.

Major takeaways from the 2015 Aspen Institute Modern Shale Gas and Oil Production Forum included the following:

- *Leak detection and repair programs are a key part of addressing the problem of fugitive emissions and can be very cost-effective, paying for themselves in relatively little time.*
- *Water impacts remain a particular challenge for shale oil and gas development, but by recycling, reuse and better overall management of water some companies are effectively addressing current problems and avoiding future ones.*
- *Support from the equity markets have kept many oil and gas companies solvent through the recent price decline but the resulting revenue decline of these same companies may cause that support to end resulting in a wave of industry consolidation.*
- *Aggregate production of oil and gas is still increasing because operators have been drilling the best of the best wells in all basins via technological advances.*
- *States as the primary regulators of oil and gas development must promote and document continuous regulatory improvement to reaffirm that they are protecting the public interest, but the onus remains on the oil and gas industry to preserve its social license to operate.*

**REGULATION, CONVERSATION,
AND IMPACT OF SHALE GAS
AND OIL IN A LOW-PRICE
ENVIRONMENT**

Dave Grossman
Rapporteur

MARKET TRENDS

The markets for oil and natural gas have been through some turbulent times recently, which has had a range of impacts on the industry and other stakeholders.

Plummeting Prices

Oil and gas prices have declined about 40% over the course of the past year. In mid-2014, oil prices were around \$100 per barrel (Brent) and natural gas prices around \$4 per thousand cubic feet (Henry Hub). Oil prices dropped below \$50 for a while and were around \$60 as of June 2015, while gas was around \$2.70 then. Forecasts by the Energy Information Administration (which, of course, involve some uncertainty) are for oil to recover to maybe the \$70s by the middle or end of 2016, with a similar slow recovery in gas prices.

The price of oil crashed for three main reasons. First, non-OECD economic growth was forecast to be around 5% but turned out to be only 3%, which translates to significantly lower demand. Second, non-OPEC supply growth, especially from U.S. light tight oil, continued to rise rapidly, even faster than people expected. Third, OPEC did not offset the supply increase by the United States as expected, which reinforced the downward price dynamic; in the past, when oil prices fell, Saudi Arabia cut production, which raised prices back up, at which point it increased production again. Saudi Arabia did not

perform that balancing act this time, instead adopting a more laissez faire approach to global markets.

Impacts of the Price Drop

The price drop has led to a rapid and significant decline in rig counts for both oil and gas (though not as extreme for gas, particularly in the Marcellus). The number of rigs dropped by 50% or more over the course of just a few months in the major U.S. basins. (Process improvements have played a small role in the rig count decline as well; drilling times per well have declined from 15-20 days to five or less, which means more wells can be drilled with fewer rigs.)

As a result, with a little bit of lag in the process, oil and gas production from shale is starting to level off. Production growth is slowing down, but aggregate production is still increasing. Several gas plays are still economic at the sub-\$3 range, particularly in the Northeast, and by drilling the best of the best in all basins, operators

The main driver keeping companies going through the downturn has been the equity markets.

have been able to avoid severe oil and gas production declines. In the Barnett and Fayetteville plays, for example, even as rigs have declined, production is declining at a much lower rate. The wells still being produced are the really good ones, and the increased competition and low prices mean those wells are working

even harder to be efficient. There has also been and will continue to be strong focus on cost control, which improves well economics, as do declining prices for services.

The price drop has had other repercussions for the industry as well. With regard to exploration, the industry has turned mainly toward trying to determine if there are more hydrocarbons in already identified fields (i.e., in existing operations) and is looking at stacked plays in the Northeast. The price collapse is also extending the build-out of some complicated projects (e.g., comprehensive water reuse and recycling systems); many are still on track, just at slower speeds.

One repercussion that has not yet materialized in a meaningful way is industry consolidation, even though the U.S. industry is highly fragmented both regionally and in terms of types of companies. The main driver keeping companies going through the downturn has been the equity markets. During previous price declines, funding was non-existent, but the availability of capital this time is a big difference, as the cash markets have allowed companies to remain viable and continue development. There are also billions of dollars this time going to very small, nimble start-up companies who are on the front lines of technology. Consolidation will likely occur at some point during this period of low prices, but the equity markets are currently keeping it at bay.

Industry actors are not the only ones feeling the price drop. The shale boom had impacts on state and local government revenues – boosting local public finances while at the same time increasing costs as demand for services increased – and the price drop could have serious ramifications for local and state government budgets as companies halt operations and lay off workers.

Looking Forward

Even with the slowing oil and gas production growth, North America is projected to remain the largest source of oil production growth. There is lots of uncertainty looking forward, though. Depending on the scenario, U.S. crude oil production from tight oil could plateau, spike, or decline over the next 25 years. Shale oil, in particular, has a very shallow cost curve; a price rise from \$70 to \$80 per barrel could trigger a massive increase in shale oil production.

Even with the slowing oil and gas production growth, North America is projected to remain the largest source of oil production growth.

With regard to gas, price and technology drive behaviors in the major producing basins. Projecting forward, the Barnett has a production range of about 44-47 Tcf through 2045, about twice what it has produced today, while

Fayetteville's range is around 14-20 Tcf, both with relatively little sensitivity to price. Haynesville, in contrast, is not very mature and has great but expensive wells, which means it has huge variability, with a production range of 36-57 Tcf. The Marcellus, meanwhile, is really big – about equivalent to four Barnettts.

Future supply could also be boosted by technology. Technological advances are already enabling the industry to use big data to better understand rock formations, hydraulic fracturing techniques, and ways to improve recoveries. Coming technologies include smaller, lighter grains (which float better and can be better distributed), as well as smart sensors and nano-fabrics. Multi-well pads will keep improving, and around the well pads, there will be safer fluid handling, elimination of flaring, and minimized methane leaks, as well as a range of other process improvements. Current technologies are also only capturing somewhere around 6-10% of the hydrocarbon resources in place, which means new technologies could unleash a huge amount of the resources still out there. On the other hand, there are some predictable supply constraints ahead, such as a gap in natural gas takeaway capacity limiting operations in the Northeast over the longer term.

WATER

Water issues keep returning to the fore in debates about hydraulic fracturing. Public concerns have focused on contamination of groundwater, surface spills, and the quantity of water used during times of drought, among other issues. Even while water issues are a current challenge, they are also likely to be at the center of some even bigger fights over the next several years.

Potential Impacts to Water

In the summer of 2015, the U.S. Environmental Protection Agency released its draft assessment of the impact of hydraulic fracturing on drinking water resources in the United States. The assessment is meant to be a synthesis of the state of the science, and it could be tremendously useful in framing conversations between industry, government, and NGOs.

The EPA's draft assessment identified potential vulnerabilities for drinking water resources from hydraulic fracturing activities, including: (1) impacts on the quality and quantity of drinking water due to withdrawals in areas of low water availability; (2) spills of fracturing fluids and flowback and produced water; (3) instances (albeit rare) where fracturing activities are conducted directly into formations that contain oil and gas as well as a drinking water resource; (4) well integrity problems; (5) subsurface migration of gases and liquids; and (6) inadequate treatment of wastewater. While these are the potential

vulnerabilities, the number of actual examples in the literature was relatively small; there was no evidence of widespread systemic impacts on drinking water due to hydraulic fracturing activities.

It is unclear if that absence of evidence is because the instances of vulnerabilities are actually rare or if there is just an incomplete information record. In other words, the lack of information makes it hard to characterize frequency of occurrence throughout the industry. For instance, it is not known what the frequency of spills is per well, and there is similarly little data that enables separating out the impacts of geology from the impacts of oil and gas activity on the chemistry of a well or aquifer. Some of this data might be producible, but other data gaps (particularly ones involving causal assessment) may not be fillable.

Water Recycling and Reuse

Water is still hard to beat as a fluid for hydraulic fracturing; it is an excellent solvent, can be cleaned up if spilled, and, unlike any gas, is an incompressible fluid. Oil and gas companies that cannot manage water effectively and cost-effectively have a real problem, as hydraulic fracturing requires managing enormous quantities of water.

Leading companies are pursuing impressive efforts to figure out how to do water recycling and reuse cost effectively, and there is lots of sharing going on within the industry on best practices dealing with water.

Leading companies are pursuing impressive efforts to figure out how to do water recycling and reuse cost effectively, and there is lots of sharing going on within the industry on best practices dealing with water. Some operators have created their own wholly-owned water management companies to ensure cradle-

to-grave internal expertise on water, recognizing that sustainability, environmental responsibility, economics, and desire for continuing growth all require changing the way they approach water.

Some companies are trying to get off of freshwater as much as possible, not wanting to compete with municipalities and people for drinking water. They are diversifying their supply with brackish water, produced water, and municipal wastewater plant effluent. Using those sources can require a lot of learning on how the subsurface of a play works (in detail), how those types of water flow, and how to redo fracking chemistries to enable their use. Companies also have to be engaged in infrastructure planning for their water needs, whether pipelines, lay-flat pipes, or distribution, treatment, storage, or recycling systems. Cost is critical; the key is figuring out how to make the whole system work in a way that is cheaper than buying freshwater, treating wastewater, drilling disposal wells, and trucking wastewater to the wells.

Beyond cost, there are other benefits from using brackish and produced water instead of disposing of it, such as significantly reducing truck traffic on the roads near frack sites. Transporting large volumes of produced brine water around in a truck, which is incredibly common, may also be higher risk than putting it in properly managed and monitored pipes and storage facilities. (Whether tanks or ponds are the better way to store produced water is unclear; at the very least, one unique problem with tanks is that people sometimes use them for target practice.) In addition, increased water recycling and reuse would reduce the amount of wastewater being disposed of in injection wells, which would have the added benefit of reducing earthquakes in some places. (Seismologists say wastewater can seep from injection wells into faults, effectively lubricating them until the rocks slip, producing an earthquake.) Induced seismicity has become a topic of growing concern as wastewater disposal injection wells proliferate and the incidence of earthquakes rapidly increases in certain places unused to experiencing them.

The industry has an opportunity to get in front of water issues not just by managing their own water use but also by figuring out how to use produced water to meet others' needs.

Water reuse and recycling are more common in some states than in others. In some states, it is really cheap to obtain new freshwater and dispose of wastewater, which minimizes the incentive for operators to try to treat and reuse produced water. Some states also have little regulatory encouragement for operators to reuse water and in fact have several agencies with strong regulatory interest in how produced water is handled, processed, stored, and treated; in some places, there could be six or more state or federal agencies with some input on water reuse. Other states have rules that make it easier for operators to share produced and treated water, ensuring the volumes needed to make treatment efforts cost-effective.

Some operators face an additional challenge from the fact that surface owners, during negotiations with operators to allow access to their land, sometimes require operators to buy water from their water wells; those landowners will fight attempts to advance water recycling because they do not want to lose the revenue. Liability is another concern that has some operators cautious about recycling and distributing produced water; if one company sells recycled produced water to another, the buyer puts it in their hole, and something bad happens, it is unclear who owns that liability.

The industry has an opportunity to get in front of water issues not just by managing their own water use but also by figuring out how to use produced water to meet others' needs. The billions of gallons of water produced in arid locations, in particular, need not be waste; the industry can demonstrate leadership and figure out how to make produced water a useful resource in water-stressed areas.

AIR QUALITY AND METHANE

Oil and gas production from shale raises concerns about a range of air pollutant emissions. With the Clean Power Plan from the EPA (issued under the agency's Clean Air Act authority) looking like it will rely at least in part on natural gas, and with the industry's social license to operate in some places being questioned, efforts to reduce these air pollutant emissions are essential if the industry is to seize the opportunity to achieve substantial market gains.¹

Drivers of Action

The climate change case for using natural gas is that it has only about half the carbon dioxide emissions of coal when used for producing power. Methane, however, is many times more potent a greenhouse gas than carbon dioxide. If the natural gas system is losing more than a tiny amount of methane, the climate advantages of natural gas disappear, sapping a potentially massive driver of increased natural gas usage.

While greenhouse gas concerns are the driver for some states taking action on fugitive emissions, ozone and air quality are also top concerns of state environmental offices (though not so much for state energy offices). Methane and volatile organic compounds (VOCs) are precursors of ozone, and homeowners affected by

¹ President Obama and EPA announced the Clean Power Plan on August 3, 2014 – discussions at this Forum focused on the proposed/expected version of the plan.

development are concerned about VOCs, benzene, and other air pollutants from oil and gas operations that have more direct health impacts. Studies are underway looking at the concentration of particular air pollutants at different distances downwind from well sites. From a health perspective, it is known what levels of pollutants are harmful; the challenges are connecting actual sources of pollutants to actual exposures of people downwind to actual harms experienced by those people.

Some states have pursued regulatory and collaborative innovation. The shale gas caucus for the Environmental Council of States (ECOS), for instance, is creating an online tool for best management practices that operators can use (and the public can access) to reduce methane and VOCs from oil and gas operations. Some states are creating early action credits to incentivize the industry to take action now to monitor and reduce methane and VOCs without having to worry about being punished on the back end if and when a region goes into non-attainment. Baselines are thus a key issue; there is a need to figure out where operators start from, how they get credit for actions taken to reduce emissions, and how governments can verify efforts. Baseline measurement can be very hard to do, though, and getting hung up on measuring and getting early action credits could distract attention from just eliminating leaks and thereby increasing the overall value of using natural gas as opposed to other fuels.

Leak Detection and Repair

Leak detection and repair (LDAR) programs are a key part of addressing the problem of fugitive emissions. Colorado promulgated the first major state methane rules in the country in 2014, which required controls for storage tanks and enhanced LDAR for upstream oil and gas operations. The rules set forth requirements for owners and operators to inspect components at natural gas compressor stations and well production facilities for leaks, with infrared (IR) cameras being a vital tool. The rules are focused on finding and fixing leaks – not on classifying or measuring the amount of emissions.

IR cameras are already becoming more common within the industry, with or without rules in place, as companies recognize the need to address fugitive emissions. IR cameras are expensive (about \$100,000 each), which can be hard for small operators, and they do not tell you what the emission is or how much of it there is. They do, however, make it glaringly clear where leaks are happening, creating an imperative to fix them – and the fixes are cheap (many just need a wrench). IR cameras and LDAR programs more broadly can help identify where the ‘fat tails’ are – the 10-20% of leaking components that account for about 80-90% of emissions. LDAR programs can be very cost-effective, paying for themselves in relatively little time. Companies have done thousands and thousands of these inspections, and they have really made a difference. Beyond the environmental and reputational gains, finding and fixing leaks also has safety benefits (if there are no methane leaks, there are no explosions) and economic benefits (more product stays in the pipeline).

Leak detection and repair programs can be very cost-effective, paying for themselves in relatively little time.

LDAR programs with IR cameras are very effective, but they are fairly expensive and do not run continuously 24/7. There are programs underway, both from government and NGOs, to try to reduce the cost of fugitive emission monitoring and measurement by orders of magnitude, which would enable wider use of monitoring and facilitate voluntary reductions in emissions of methane and aromatics. Some programs aim to spur development of monitors that can not only detect leaks quickly and cheaply, but also measure the flow rate and identify the gas. Technologies being explored include small tunable laser spectrometers, unmanned aerial vehicle laser spectroscopy, backscatter spectrometers, portable imaging spectrometers, on-chip optical sensors, carbon nanotube point sensors, fiber optic sensing systems, and smart materials (e.g., sensors embedded in the pipeline from the beginning). Once there are cheap, continuous monitors that can enable immediate leak detection and repair, we will see big reductions in emissions of methane and aromatics, and markets for methane reductions will become more feasible.

REGULATION & VOLUNTARY STANDARDS

Many other countries, as they wrestle with what to do about shale gas, are watching to see how the United States is handling hydraulic fracturing, questioning whether they should exploit their own resources and/or import American LNG given the environmental consequences of development. For that and many other reasons, it is essential for regulators and the industry in the United States to make sure that production occurs in an environmentally responsible way.

State Activity

Oil and gas have been regulated primarily by the states. With the range of challenges the past few years created by the shale boom, states have been experimenting with regulatory approaches and solutions. (At the same time, state agencies tend to have low staffing, which is a trend that is likely here to stay, so it can be a high bar to ask them to tackle an industry that is experiencing rapid technological innovation; there is a question as to whether greater use of independent third-party auditors would be helpful.)

In 2013, several leading oil and gas producing states decided to pursue leadership through the States First Initiative, a partnership between the Interstate Oil & Gas Compact Commission (IOGCC) and the Groundwater Protection Council (GWPC) that was initiated by 14 governors representing both parties. The States First Initiative has five main components: underground injection control, hydro-

lic fracturing, inspector training and certification, science and technology transfer, and continuous improvement through a State Oil & Gas Regulatory Exchange (SOGRE). Under these work streams have come a range of efforts, including FracFocus to address chemical disclosure, a recently created seismicity task force, state oil and gas inspector and certification programs, and a state-to-state consultation and assessment process (through SOGRE) to help develop new regulations and improve existing ones. While SOGRE is still in development, it reflects a willingness among member states to voluntarily promote and document continuous regulatory improve-

It is important for state regulators to have credibility and to be able to demonstrate that they are protecting the public interest.

ment, provide a platform for open communication and sharing, develop best practices, and provide assistance in efficiently developing and implementing regulatory solutions.

Cross-state comparisons, however, can be tricky. Using setbacks as an example, some states have bigger setback requirements than others, but what is appropriate in each state depends on ground conditions.

Some states may also have tight regulations but lax enforcement, or vice versa. In addition, undertaking cross-state comparisons of regulatory approaches could just as easily lead to a race to the bottom as a race to the top. Efforts such as SOGRE hope to provide a disciplined, multi-step process that would enable a state to show that it has undertaken a form of state-based peer-level due diligence aimed at achieving continuous improvement.

It is important for state regulators to have credibility and to be able to demonstrate that they are protecting the public interest. Priority-setting, management of agency staff, using good problem-solving tools, and engagement of the public are all essential. Credibility-building involves relying on both qualitative and quantitative approaches. Qualitative approaches include increasing involvement by stakeholders and improving communications and transparency with the public (e.g., official state websites describing what regulators know about earthquakes and where they are occur-

ring, demonstrating and explaining to the public how regulators are making sure materials stay in pipelines). Quantitative approaches – data collection, monitoring, key performance indicators, and the like – are also important aspects of best-in-class enforcement, oversight, and transparency and are essential for public confidence. That includes robust monitoring to determine whether impacts are or not happening and whether the industry’s actions to address risks are actually working or not, though there are some technological gaps in being able to do that monitoring well and present the data to the public.

The Alberta Energy Regulator of Canada, for example, facing similar challenges selected the University of Pennsylvania Law School to lead a major, independent initiative to define and measure regulatory excellence. Drawing on public consultations as well as analysis from experts from around the world, the Best-in-Class Regulator Initiative will generate a framework for identifying and achieving important organizational, legal, policy, and deliberative responsibilities facing energy regulators and other regulatory authorities around the world. In the automotive field, the Health Effects Institute was created to ask retrospective and prospective questions about whether what the industry was doing was making any difference with regard to health and the environment; a similar science-based NGO in the oil and gas space could be very helpful. Once the initiative is complete, the Alberta Energy Regulator expects to measure its performance against best-in-class attributes on a regular basis

To build credibility with the industry, some regulators are actively trying to demonstrate how they are reducing regulatory burdens in areas that do not affect public safety or the public interest, eliminating redundant regulation, and streamlining their own operations in order to reduce costs to the industry and ensure the cost-effectiveness of regulations.

Regulators have to deal with divergent feedback from the public, industry, the scientific community, and other stakeholders, and it can be a huge challenge to strike a balance. The public’s perception of risks is always different than the scientific assessment of risk; that

is true in virtually every field. As a regulator, the public's emotions, perceptions, and issues are real, regardless of whether industry thinks they are real or not. If the issues of public concern are not dealt with, the regulator cannot build trust, and the public will not listen to

The public's perception of risks is always different than the scientific assessment of risk; that is true in virtually every field.

facts, statistics, or anything else. If the public perceives there to be an issue, and regulators believe it to be non-scientific and non-substantive, then regulators need to engage the public in ongoing dialogue (perhaps in smaller community groups) and educate them. The state's job is to balance all of the reactions and concerns about safety, economics, the environment, and other topics with

thorough science – though there are scientific gaps, which means it is hard to always regulate based on sound science.

Many state regulations on the industry over the past few years have addressed things designed to make the public feel better, as opposed to substantive things designed to actually advance responsible production. (This is not strictly black and white, though; it is more of a spectrum.) Methane rules, for example, have the potential to be really substantive. Similarly, fixing well casing rules actually protects water, whereas doing pre- and post-frack monitoring of water provides information but does not actually protect water; the public, however, tends to fixate on the latter and barely notice the former. On the other hand, some view information disclosure rules (included hydraulic fracturing chemical disclosure efforts) as being quite substantive, providing essential data to researchers that allows for creation of standards on treating and discharging water, recycling water, and the like.

Federal Activity

States are generally cautious about any federal agency rules. Governors want everything to stay under state control and are wary of federal overreach into processes that have traditionally been the

domain of the states. That is part of the reason behind states' resistance to (and litigation against) the Bureau of Land Management's new hydraulic fracturing rule; they see the rule not only as very restrictive and having negative effects on oil and gas activity, but also as intruding on states' traditional ability to regulate and manage oil and gas. (Many in industry, too, feel like they can have a dialogue with state regulators to find practical, effective solutions, whereas at the federal level, they feel like they have virtually no voice and are just getting run over by a train.)

Nevertheless, addressing the challenges presented by shale oil and gas requires collaborative efforts among state and federal agencies. Federal agencies are working in an array of areas, both regulatory and research, including on fugitive emissions, induced seismicity, chemical disclosure, input water, water disposal and treatment, and the energy-water nexus. Research agencies such as some within the Department of Energy try to make the results of their research programs available to states to inform state regulatory activity, though they have faced challenges in getting their content to state regulators on a regular basis.

Like state regulators, federal regulatory agencies also have balances to strike, not just in terms of competing stakeholder inputs and demands, but also with regard to federalism, coordination, and broader national interests. With regard to federalism, some in the states perceive some federal rules as just creating an additional overlay of control without addressing a particular deficiency or need. This can be particularly problematic when the federal processes take markedly longer and are much more complicated than state processes, even though a well drilled on private or state land and a well drilled on federal land will act the same, produce the same, and have similar environmental controls on them.

Coordination is also a challenge for federal regulators. There are many different federal rules coming out – on ozone, methane,

Addressing the challenges presented by shale oil and gas requires collaborative efforts among state and federal agencies.

VOCs, hydraulic fracturing, and other areas – that could restrict oil and gas development, particularly in non-attainment areas. At the same time, there are rules like the Clean Power Plan that could drive greater demand for natural gas, which could be problematic if the other rules are making development in many areas impractical. The rules do not seem to be coordinated. There are also concerns that some of these rules will not be performance-based but rather will be enormous, time-consuming paper exercises.

More broadly, there are concerns that if regulations on oil and gas get too strict and burdensome, oil and gas development may just move overseas, forcing the United States to import more oil and gas from places with fewer environmental and other protections. There are continued conversations within the government on these types of balances, with different views within and among agencies (and Congress).

Local Activity

Oil and gas activities, of course, tend not to have direct impacts at the national or even state scale, but rather at a local scale. There has been a growing trend of local governments trying to impose restrictions within their borders, creating tensions about regulatory authority.

Local governments have passed ordinances that impact oil and gas activities both directly and indirectly, regulating where oil and gas activities can take place and how they may be conducted. Common restrictions have involved zoning, siting, setbacks, noise, odors, air emissions, visual impacts, water use and disposal, and traffic / road use. More than 170 local governments have gone further, enacting permanent or temporary bans on hydraulic fracturing and other oil and gas activities.

The bans, in particular, have raised legal issues about the extent of local authority. Local governments derive their power from the state and have only as much authority as the state gives them either through the state constitution or legislation. Most oil and gas producing states have constitutional provisions that give municipalities

home rule authority, and local governments' authority traditionally includes zoning, land use, and police power. When local governments intrude into an area of state authority, however, ordinances may be pre-empted and thus invalid.

In Texas, for instance, the focus has been around Denton, where the city council voted against a proposed ordinance to ban hydraulic fracturing but submitted the issue to voters in a citywide election, which resulted in the citizens of Denton voting to ban it within the city limits. Lawsuits were immediately filed by the Texas Oil & Gas Association challenging Denton's authority, as well as by some mineral owners alleging takings without due process or compensation. A few months later, the Texas Governor signed a law expressly preempting regulation of oil and gas operations by municipalities, with the exception that they can regulate surface activity if an ordinance is "commercially reasonable", does not effectively prohibit an oil and gas operation, and is not otherwise preempted. Some view the exception as being essentially meaningless; at the very least, it shifts the burden of proof from the industry to the city to show that an ordinance is not preempted. The Denton City Council decided not to withdraw the ban and was considering its options.

Local governments have clearly become increasingly active in regulating oil and gas activities within (or affecting) their jurisdictions.

Other states have weighed in on these issues as well. Oklahoma passed a law similar to the one in Texas, preventing local bans of oil and gas activities but allowing reasonable ordinances concerning road use, traffic, noise odors, and reasonable setbacks and fencing requirements. In Ohio, the city of Munroe Falls passed ordinances to try to stop an oil and gas operator that had received a permit from the state; in February, the Ohio Supreme Court ruled that the city ordinances were preempted by Ohio's oil and gas law. In New Mexico, the Mora County commissioners voted to ban extraction of hydrocarbons in the county, but a federal district court over-

turned the ban in January 2015, finding that it contradicted the U.S. Constitution and was preempted by state and federal law. In California, the City of Compton adopted an ordinance regulating oil and gas activities within the jurisdiction and any outside the jurisdiction that affected the city, but the city withdrew the ordinance following the filing of a lawsuit by the Western States Petroleum Association. In Colorado, five cities approved ballot measures banning hydraulic fracturing, and as of June 2015, three of those bans had been struck down by state courts. On the other hand, in New York, a June 2014 ruling from the state's highest court upheld local ordinances banning oil and gas activities, finding no preemption, which means New York towns can zone out oil and gas activities within their jurisdictions.

Local governments have clearly become increasingly active in regulating oil and gas activities within (or affecting) their jurisdictions. States, in turn, are trying to preserve a unified regulatory framework, and industry similarly does not want to have to go to every town for every application to do hydraulic fracturing. They will likely have to do so anyway, though, as cities can still pass ordinances regulating oil and gas activities to some extent. Ultimately, the extent of local authority will be decided by the courts.

Voluntary Standards and Programs

Regulations alone likely will not be enough to realize the promise of responsibly produced hydrocarbon resources. Industry leadership is also required.

Voluntary environmental and community standards and programs can spur exemplary performance. Such standards can be particularly important at a time when the process to adopt regulations is very slow, regulatory agencies are limited in their abilities to be aggressive, and legislatures are polarized and gridlocked. By being non-regulatory, voluntary performance standards can be adopted more quickly and can go above and beyond regulatory requirements. Such standards can cover a range of water, air, and community issues, including emissions from storage vessels, capture of pipeline quality gas during completions, truck emissions, and

inspection and maintenance requirements. There is not yet a LEED-type voluntary certification for sustainably developed gas, but there are those who are exploring that potential.

Such voluntary standards and programs can be developed by industry in collaboration with environmental organizations, such as is occurring under the auspices of the Center for Sustainable Shale Development. They can be developed by industry and regulators, as is the case with the new enhanced Natural Gas STAR program that the EPA is launching by the end of 2015; some in industry are working closely with the EPA to make sure the voluntary program is very robust, has better accountability, and can draw increased participation levels. Programs and standards can also be developed through collaboration across the industry, such as the ONE Future coalition, in which leading companies across the natural gas value chain are collaborating with the aim of getting below a 1% leakage rate for methane (perhaps closer to 0.87%), which would make natural gas better than coal in all timeframes and all applications.

One driver of companies' participation in voluntary programs and standards is their recognition that it is important for industry to manifest some leadership in order to protect their social license to operate. Successful voluntary programs can also forestall additional regulation. NGOs, on the other hand, might support voluntary standards to give some credit to leading producers and hopefully bring other producers up to that higher bar.

THE BROADER CONVERSATION

There are many stakeholders in the oil and gas industry, including local communities, consumers, those concerned about environmental protection, governments, resource owners, and others. These stakeholders have varying interests, including revenue, safety, stability, low prices, clean air and water, and a healthy planet. In the background, driving public opinion, are the news and social media, as well as dramatic energy-related events such as Fukushima and the Macondo Gulf spill. Swirling within this context are significant amounts of misinformation, distrust, and fear, with groups on both sides trying to hijack the facts and the conversations for their own purposes. The industry needs to significantly improve its communications and community outreach efforts if it wishes to preserve its social license to operate.

The Public

In some places, oil and gas development is now right next to residential development, which represents a huge community relations challenge. The public's reactions to shale gas and oil development can be very emotional, driven by fear, misinformation, and frustration that no one in power seems to be listening or caring. While some public concerns may be volatile and unsubstantiated, there are also public concerns that are valid yet are not validated by the private sector or regulators.

The extremes in the conversation are not really trying to be constructive, and they will not be convinced, but there is still a persuadable public willing to listen to pros and cons even in the midst of an otherwise bipolar conversation. In some places, the shrillness of the conversation has declined, allowing for more time to be spent on substantive concerns.

It is unclear whether we have seen the apex of the anti-fracking and broader anti-oil-and-gas movements or not. The focus of the movements and the conversations may just be shifting over time, with new concerns front and center for the public. At the very least, climate change concerns will ensure that the pressure on the industry will not let up any time soon. Until the industry is seen as accepting and being

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part of the climate movement, the anti-fossil-fuel crowd will continue to pose enormous challenges to the industry, jumping onto whatever the latest issue is that comes along.

The battles about overriding local fracking bans have also re-energized anti-fracking activists, who are more irate at the same time they are becoming more institutionalized, better organized, and better funded. The

public, too, may only just be starting to get a sense of the degree of power and influence it can have. Communities are starting to realize that they have a lot of say in how things go. Expectations of regulators and the industry have forever changed, and there will be continuous expectations of engagement, innovation, and regulatory change.

Investors

Investors occupy an interesting niche in the broader conversation about shale oil and gas development, in some sense bridging the gap between the industry and the public.

Investors have real worries about community rejection of shale operations because many companies are not responding to legiti-

mate public concerns in a way that investors can see. Companies tend to disclose very little about what the local concerns are, how they have responded to them, and how they aggregate and report the concerns upwards in the company. For instance, there is very little systematic reporting about what percentage of complaints or engagements dealt with which issues (e.g., truck traffic, setbacks).

Investors are also somewhat caught in the midst of a public debate about divesting from fossil fuels. What some in the industry once viewed as a fringe part of the conversation is increasingly being seen as a serious threat, in the same way the ‘ban fracking’ movement was a year ago. The divestment movement is mostly a political and moral movement, as opposed to an economic or financial one; others are always willing to buy the stocks. (On the other hand, some analyses of the effects on portfolios appear to show no losses from divestment.) Investors more focused on the economic and financial angle are engaging with companies rather than divesting, pushing companies to disclose their risks and management strategies and publicly backing companies doing the right thing in order to try to produce a race to the top.

Industry

The industry’s role in the broader conversation can also be driven by fear – fear of extreme groups stirring up locals and spurring regulations that are neither helpful nor necessary – as well as by a lack of empathy.

The industry has generally done a abysmal job of communicating; far too many companies essentially shoot themselves in the foot with their communications strategies. The industry’s resistance to disclosure of the chemicals in fracking fluids was the worst public relations black eye it has given itself in decades and took five years to get over. The battle against local oil and gas ordinances may have similar results. There may be a legal right underlying these actions, but the public perceives them with fear and distrust. By defeating local fracking bans, the industry and state regulators lost the opportunity to create value for themselves and the public by actually working to solve problems; instead, they left no recourse for communities and people who, rightly

or wrongly, have concerns. These actions could end up haunting the industry, creating negative long-term implications in terms of trust in the industry and state agencies. Colorado tried to address this by giving municipalities resources in the aggregate through a state office to do technical work and negotiations with companies about above-ground effects of oil and gas development, empowering municipalities while focusing their efforts on areas of direct municipal concern.

Changing the conversation involves building trust, and that takes a lot of personal authentic engagement, real rapport, and real relationships over time.

Oil and gas companies must be relentless students of why some people mistrust them so much and work to build understanding. The default approach should be to treat everyone as a concerned citizen until they prove themselves otherwise. A lot of people may look like radical activists because

it is very easy to activate people through fear, but if the industry treats everyone as a concerned citizen first and tries to understand their concerns, the sources of their information, and their receptivity to getting other information, many people can end up in a movable, constructive middle.

The industry needs people within it whose skill sets are about engagement and building trust. Changing hearts, minds, and conversations is a very personal undertaking. Companies and trade associations need to build real community outreach programs, where people who are actually accountable (i.e., not consultants) are on the front lines, so the public knows they are owning what they are doing. Changing the conversation involves building trust, and that takes a lot of personal authentic engagement, real rapport, and real relationships over time. People in the industry need to learn how to talk about the industry when at dinners or barbeques, feel pride in the work they are doing, and learn how to engage and communicate with others. Industry workers need to ask opponents where they heard their information and if they are interested in learning more; spouting facts at someone who is worried about their kids getting

sick and is angry at the industry for glibly dismissing them as ill-informed and emotional will be completely ineffective. Community and personal relations efforts are absolutely vital, and the industry tends not to handle them very well.

The industry, as individuals and organizations, has to be passionate about compromise. Every time it chooses not to engage, the conversation gets dominated by ‘ban fracking’ on one side and ‘drill, baby, drill’ on the other. As part of being passionate about compromise, companies and trade associations who care about making progress should look at every decision through the lens of whether it is de-escalating or escalating the fracking war, and de-escalation should be the goal (though there are numerous forces trying to do exactly the opposite). Being passionate about compromise also involves celebrating and articulating progress; complaining about regulators, environmentalists, or others in the industry cannot become the industry culture. The industry needs to do a better job of communicating the progress that has occurred; there is still more to do, more technologies to develop, and more practices to spread, but there is a need to incentivize that good behavior by talking about how it is being done well. Finally, being passionate about compromise involves celebrating the industry’s smart, engaged, worthy opponents – without whom no deals would get done – and trying to understand their drivers and what they want to deliver to their constituencies.

In addition, the industry needs to proactively pursue efforts to address current concerns. Some leading operators are trying to take a bigger role in environmental stewardship, community relations, transparency, and public education, with serious, funded, and staffed sustainability programs. At the same time, the industry should also work collaboratively to try to look around the corner to see and collectively prepare for what the next big issues are going to be. (Ten years ago, no one was worried about induced seismicity.) The industry, of course, will never know precisely what the next big issues will be, so it needs to develop fundamental skills that will enable a productive conversation regardless of the exact issue – skills such as communications, data, transparency, and connecting with stakeholders.

APPENDICES

AGENDA

Sunday, June 7

9:00 AM – 10:30 AM SESSION ONE: Setting the Tone; Changing the Conversation

Most states with shale activity now require some level of disclosure of the chemicals utilized in fracking fluids; have updated their well construction rules; and have established setback regulations, among other regulatory programs. Meanwhile, at the federal level, EPA is moving forward with efforts to require greenhouse gas reporting for certain additional hydraulic fracturing operations, and to regulate methane emissions associated with oil and gas production. Moreover, state regulations, increasingly, are addressing concerns related to induced seismicity, protection of groundwater, and waste disposal. How has the conversation regarding shale development changed in the past year?

Moderator: David Monsma, Executive Director, Energy & Environment Program, The Aspen Institute

Discussants:

States First Initiative

Larry Bengal, Director, Arkansas Oil and Gas Commission

Best-in-Class Regulator Initiative

Stephen Smith, Senior Advisor, National and International Stakeholder and Government Relations Division, Alberta Energy Regulator

Federal Priorities

Lynn Orr, Under Secretary for Science and Energy, US Department of Energy

10:45 – NOON **SESSION TWO: “Data Room” – Prices,
Consolidation and Value**

The U.S. is now the world’s largest natural-gas producer and is on track to become the biggest oil producer. Much of this is the result of shale production. In this session, we will examine current price, policy and market trends for oil and gas and their impact on the regulation of shale production.

Moderator: Richard Newell, Professor and Director, Energy Initiative, Duke University

Discussants:

Research Overview

Scott Tinker, Director, Bureau of Economic Geology, Jackson School of Geosciences, The University of Texas at Austin

New Production Economics

James Bolander, Senior Vice President, V+ Resource Development, Southwestern Energy Company

Local Regulation and Preemption

Heather Palmer, Partner, Bracewell & Guiliani LLP

1:30 – 3:00 PM **SESSION THREE: Air Quality**

How can oil and gas production from shale lead in the overall reduction of air pollutant emissions in a cost-effective manner that addresses true threats and still helps improve over-all air quality?

Moderator: David Monsma, Executive Director, Energy & Environment Program, The Aspen Institute

Discussants:

Colorado LDAR Update

Martha Rudolph, Director, Environmental Programs, Colorado Department of Public Health and Environment

**Improved Monitoring
Techniques and Technology**

Bryan Willson, Director, ARPA-E, US Department of Energy, and Director, Energy Institute, Colorado State University

Improved Practices

Susan Packard LeGros, President and Executive Director, Center for Sustainable Shale Development

3:15 – 5:00 PM SESSION FOUR: Water Quantity and Quality

High-volume hydraulic fracturing technologies are not free from environmental risks to regional water quality, such as gas migration, contaminant transport through induced and natural fractures, wastewater discharge, and accidental spills. How can the water resource needs and impacts (both at the surface and below ground) from shale production be better understood, measured, and managed?

Moderator: Matt Lepore, Director, Colorado Oil and Gas Conservation Commission

Discussants:

EPA Study of Potential Impacts of Hydraulic Fracturing on Drinking Water Resources

Jeff Frithsen, Senior Scientist, National Center for Environmental Assessment, Office of Research and Development, US Environmental Protection Agency

Cost-Effective Water Management

Cal Cooper, Director, Special Projects & Emerging Technology, Apache Corporation

State Regulator

Tom Kropatsch, Deputy Agency Supervisor, Wyoming Oil and Gas Conservation Commission

Monday, June 8

8:30 – 10:30 AM SESSION FIVE: Methane Regulation

How will federal methane rules impact shale production? What has been the response to the regulations by key constituencies?

Moderator: Matt Lepore, Director, Colorado Oil and Gas Conservation Commission

Discussants:

Federal Methane Regulation

Aliza Wasserman, Program Director, Environment, Energy & Transportation Division, Center for Best Practices, National Governors Association

Technology and Practices to Lower the Carbon Footprint

Daniel Domeracki, Vice President, Government and Industry Relations, Schlumberger

**Federal Regulation –
State Impacts**

John Baza, Director, Utah Division
of Oil, Gas and Mining

10:45 – NOON

SESSION SIX: Emerging Topics and Next Steps

Building upon discussions in the preceding sessions and looking forward strategically, what are the priority needs that this group can identify or help clarify? Where should this discussion go next? What emerging topics are likely to significantly impact oil and gas production in the coming year?

Moderator: David Monsma, Executive Director, Energy & Environment Program, The Aspen Institute

Discussants:

Induced Seismicity

Michael Teague, Secretary of
Energy and Environment,
State of Oklahoma

**Water Management as
Business Opportunity**

Stephen McNair, President, Pioneer
Water Management and Power

Changing the Conversation

Tisha Schuller, President,
Colorado Oil and Gas Association

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