Summary of the Washington Energy Policy Conference

"The Unconventional Gas Revolution"
Held March 9, 2010
Notes prepared by Sarah McKinley

Paradigm Shift – Political Perspective

A View from the Hill: Bob Simon, Chief of Staff for the Senate Energy committee, described developments for shale gas in the U.S. the "pivotal point in the policy debate" on energy. Not only have recent developments impacted domestic supply, with about 1800 trillion cubic feet (TCF) added to domestic resources (raising the total to 3,000 TCF, at least a 100-year supply), but recent discoveries in Poland and elsewhere have geopolitical implications as well.

In Alaska, the development of LNG and the proposed pipeline to the lower-48 will become options rather than necessities. Gas will also lower the carbon footprint for America, if it is used to swap out old coal plants. Resistance to production in New York State and other non-traditional producing regions concerned about environmental damage to watersheds could be a show stopper.

Will gas price volatility be stabilized at $5-$7 over the long term? How will consumers respond and how will this impact the development of renewables? What will we do with it? Will it be a transition fuel to replace coal plants, and how will it impact transportation fuels? T. Boone Pickens wants to replace transportation fuels, particularly the 18-wheelers, with LNG, which has less carbon content than diesel. The refueling times aren't too bad, but how do truckers feel about this?

Simon used a chart that showed the relative energy efficiency of different natural gas options for fueling transportation. In terms of energy use, converting natural gas to electricity for use in plug-in hybrids (PHEV) was the most thermodynamically efficient option, more efficient than using CNG tanks or fuel cells, for example.

He outlined the Bingaman-Murkowski energy bill that passed out of committee last June. Its major sections include: improvements in electric transmission; energy efficiency in the manufacturing sector, including buildings and appliance; funding for energy innovation and work force training; market improvements like cyber security, information on energy markets, and availability of energy supplies during natural disasters; and transition to the future including exploration in the Eastern Gulf of Mexico, carbon capture and storage. His committee would hold hearings that week on efficiency standards for outdoor lighting and Home Star appliances.

The path forward is murky, said Simon. Controversies over water and fracking may represent the "mystery quotient." The House discussed this issue but went looking for data.

A View from the Obama Administration: Joseph Aldy, Special Assistant to the President for Energy and Environment and member of the National Economic Council in the Office of Energy and Climate Change, discussed the role of shale gas in Obama's energy policy.

To date natural gas has been treated as an orphan child in bills, with Bingaman and Markey's drafts as examples. "Are we missing something?" asked Aldy. He sited

three major tenets of the Obama policy going forward—security, economy and environment. How does natural gas fit into all three of those?

Energy use, based on fossil fuels, carries with it security implications. Oil affects military policy, and represents a homeland security issue, with oil representing 94% of transportation fuel and few substitutions that don't involve disruptions. Europe feels dependent on Russian oil and gas.

What we've seen recently is a decoupling of prices between gas and oil, and gas prices dropping below that of coal. Both gas and efficiency measures can play a role in the industrial sector. Around the world, discoveries of shale gas can decentralize the oil cartels and allow many countries to become producers, but none of this will make us more secure unless we can use the gas to displace oil in transportation.

As for the economics, people know what the price of gasoline is, at almost any moment. When it gets close to $3/gallon there are political implications. Right now the supply of shale gas is elastic. If we can move quickly to gas there will be fewer adverse impacts. Right now the U.S. is the leader in shale gas technology and know-how. Innovations in research and development can play a key role, particularly in the transportation sector, either through PHEV or CNG vehicles.

Environmental issues are more complicated. Petroleum and coal have a higher CO2 content than natural gas, so there is value for gas to back out dirtier fuels. This would include baseload in the power sector, substituting home heating oil in the residential sector. As for transportation, we've seen the benefits of CNG for fleets, but the use of CNG or LNG in trucking is a question. Right now gas is helping to meet clean air standards.

The biggest environmental issue is the use of fracking in aquifers, and there is need for regulatory certainty. Perhaps Congress should adopt a model statute that could be available to states that don't already have experience with drilling. Obama is pushing ahead for a price on carbon. When that happens Aldy believes that demand for gas will rise.

What Aldy was more reluctant to comment on was the impact of low gas prices on the adoption of renewables, whose future may depend on rising energy costs to be competitive. Other speakers were less reticent about the comparison.

How Much is Out There?

Vello Kuuskraa, President of Advanced Resources International, pointed to headlines like "Mission Critical: Can Shale Gas Save the World," and a quote from Fred Julander, who said that this was the "most important energy development since the discovery of oil."

Over a decade ago this new revolution began with low-cost coalbed methane production in the San Juan Basin. Then the scene moved to tight gas formations at the Pinedale and Jonah fields in western Wyoming. Now shale gas deposits are being explored in the "Magnificent Seven" basins, five in the U.S. and two in Canada. The U.S. fields include Barnett (250 Tcf), Haynesville (790 Tcf), Woodford (300 Tcf),

Fayetteville (320 Tcf), and the largest of all, the Marcellus formation (1,760 Tcf). The Canadian fields include Horn River and Montney. Other newly-discovered fields, in addition to the "Magnificent Seven" include the Antrim, Huron, Eagle Ford and Utica in the U.S. We really don't know how much there is out there.

Shale gas represents deposits of continuous areas of production rather than discrete traps, but they are geologically complicated. Technology is critical because a lot of gas is not economic at $7/Mcf.

Shale gas production has grown by ten-fold over the past couple of years and is expected to reach 10 Bcf/d, about 18% of U.S. supply, by the end of 2010. Kuuskraa predicts that by 2020, 46 Bcf/d, or more than two-thirds of U.S. gas production, will come from unconventional sources. The three big questions are: will there be adequate supplies, what role will technology play to assure that they remain affordable, and can they be developed in an environmentally sound manner.

What changed the game? Production from shallow shale formations had been underway for decades. But what has changed is the ability to create permeable deep reservoirs through intensively stimulated horizontally fracturing. Some might assume that this is expensive, but actually production of unconventional shale gas lies at the low-cost portion of the supply curve for producers.

The environmental questions may drive production. Three big issues to be addressed include: (1) reducing surface impacts, especially spills and leakage of fluids from above-ground facilities, (2) capturing methane emissions and (3) reusing water that is brought to the surface from drilling.

Being able to drill multiple wells from one pad (up to 11 wells from one site) is a major advantage. As for capturing emissions, Kuuskraa argued that gas shale producers had eliminated over 500 Bcf of emissions since 1990 and made money doing it. Williams spent $17 million on environmental equipment but made $159 million on gas that it captured and then sold into the market.

Jennifer Snyder, Head of North American Gas Research for Wood Mackenzie, reported that since 2009 drilling in the U.S. declined precipitously but production volumes actually increased. Southwest Energy, for example, reduced its drilling costs by two-thirds in three years, from the $5/Mcf range in 2006 to $3.50 range the next year. In the Marcellus region, innovation by a group of producers has optimized costs, which were cut in half between 2007-2010.

There are differences in production in each of the resource areas, and some acreage works better than others. The average well performance is strongest in Northwest Louisiana. Deep wells wear out equipment quickly, but she predicts that shale gas production will grow steeply, from 9 Bcf/d now to 15 Bcf/d in 2015 and 25 Bcf/d in 2020.

The real problem is lack of market. Shale gas will compete directly with LNG, and this will become very clear once the new coal plants, approved in 2001-2002 are built. She thinks this will be the last round for coal use in electric generation. She also predicts a growing industrial market for the use of natural gas in petrochemicals. The U.S. Gulf Coast is the best place in the world to invest in petrochemical plants.

Mike Watts, Team Leader – Fracture Stimulation for Halliburton, talked primarily about developments in production that would reduce environmental impacts, like the use of UV light to process water for fracturing, recycling drilling muds into building materials, and the evolution in recycling drilling fluids. He pointed out that the major advances really took advantage of the integration of different technologies all along the producing chain, from rigs and bits to casing and cement, logging and directional drilling. Detailed analysis of the rock formation and digital mapping also allows operators to stimulate generation with three-dimension precision.

In addition, the footprint area needed for well construction has been reduced by 40%, not only through the use of drilling from a single well pad, but also the materials and trucks needed for operations.

Although these shale structures are continuous, that doesn't mean that well production is the same everywhere. The highly-productive shale wells tend to cluster into "core" areas, and producers will rush to these areas to drill.

Raoul LeBlanc, Senior Director, Financial Advisory, PFC Energy, is bullish in the medium term. He doesn't think the market can sustain prices above $6.50. In 2009 most analysts were wrong about the durability of supply. The rig count was cut in half but production did not decline. The system is being carried by a small number of good wells.

He believes that a lack of energy policy favors natural gas because it is the only fuel that meets the four basic critical criteria: it's clean, affordable, domestic and impactful.

Right now gas is out-competing coal for future capacity. We may be seeing the end of coal build-out. But retirements of old coal units won't go fast enough to firm up the gas market until 2012-2013. Gas prices will be contained, if nothing else, by LNG. North America doesn't need LNG, but we're going to get plenty of it anyway.

How long will we have shale gas at reasonable prices? Kuuskraa believes that the fundamental resource base is there at affordable prices for 20-40 years. About 80% of the shale wells in the world are right here in the U.S., providing benefits in jobs and taxes for local economies. Severance taxes shouldn't be a problem. If anything, producers argue that adding on 40 cents for state revenues just gives them greater political leverage.

Defining fracturing liquids as "witch's brew" seems to be the biggest issue, although the industry has been using this practice for over 50 years. Another issue is with land owners, who may have surface rights but not mineral rights, to their property.

Murry Gerber, Chairman and CEO of EQT Corporation, gave the keynote address. He focused on the company launched by George Westinghouse, who started with one gas well in Pennsylvania and built a distribution line all the way to Pittsburgh.

The Russians are still the largest owners of gas reserves, with 1.1 Tcf of proved reserves and 10,000 miles of gas pipeline. But the shale fields of the U.S. have potential reserves of 26 Tcf. He predicts U.S. reserves of over 2,000 Tcf of recoverable resources, at least 120 years of supply.

Abundant reserves mean price stability, according to Gerber. The impact of this wealth is that nearly three million Americans will be employed, totaling $250 billion in

labor income, producing at least 10,000 industry jobs in 31 states, with an annual economic impact of $385 billion. Gerber pointed out that currently there are five times as many people now employed by the gas industry in Pennsylvania than by the coal industry in that state.

The real question is whether this new natural gas resource can be used as transportation fuel. Right now over half the oil imported by the U.S. is used in vehicles. If we converted all our cars to natural gas, we would reduce oil imports by 68% and save $265 billion a year.

Gerber argues that the Obama budget gives natural gas unfavorable tax treatment. He would prefer changes in Obama's budget, along with changes in the climate change bill and in government response to fracturing, which is turning out to be a major issue in the debate. He favors adequate safeguards to protect freshwater, and state regulation to ensure protection of water sources.

Gerber points out that the industry has had over 60 years of hydraulic fracturing without incident. He points to two new developments that will eliminate a lot of fears. First, his company has been phasing out "high-viscosity fluid" that leaves small bits of sand, with low-viscosity, "slick" fluid, which seeps more deeply into the rock and creates more efficient drilling. EQT has also developed a technique to use air instead of fluids in its fracturing process. The economics of the wells continue to increase. Payback used to be in 6-10 years for a well, said Gerber. Now it's three years or less, and he's had one well that paid out in six weeks.

The biggest problem is spilling water, not hydraulic fracturing, according to Gerber.

International Implications from Shale Gas

Ivan Sandrea, Vice President of International E&P Strategy for Statoil, discussed the global implications of unconventional gas. He believes there is a worldwide gas price reform now underway. European markets aren't growing as fast as emerging markets. And the LNG market now has overcapacity with new liquefaction plants now on-line. The major stories in that market are: the presence of LNG, deregulation, and in-roads in power generation.

Worldwide, conventional drilling has leveled off. But there are new players, including smaller independent producers, that can expand into areas that can't be accessed by the majors. His company is now screening 400 possible basins worldwide and believe they will find between 20-50 that will be very profitable.

In Asia, there are basins in China and Indonesia that could be explored. In Europe, these shale deposits lie in Eastern Denmark, Southern Sweden and Eastern Poland. Another large field extends from Western England into Northwest Germany. The Paris Basin begins in Southwest England, extending into Northern Germany and Switzerland. In all, there may be 500 Tcf in these fields, four times conventional reserves. Again, no one knows exactly how much gas is there.

There are industry players in dozens of countries, fragmented but forging joint venture deals, to begin exploration. Unlike the U.S., the rest of the world may not have tax breaks that our producers have, or access to competitive service industries. So far they haven't found anything that rivals the Marcellus Shale, but there are sizeable fields.

Ben Shlesinger, President of BSA Energy, addressed the impact that shale production in the U.S. would have on world gas markets. He pointed out that Europe and Industrialized Asia (Japan, Korea) are basically gas importers, while Eurasia (primarily the former Soviet Union countries) are exporters. And LNG has brought them all together. Europe's gas demand shows an increase for power generation and industrialization, expected to grow by 150 Bcm over the next few years. Right now North America, at 28.5 Tcf, is self-sufficient.

LNG capacity under construction in Qatar, West Africa, will result in a 38% increase in world liquefaction capacity. Currently over 225 billion cubic meters (Bcm) of liquefaction capacity are in service with over 80 Bcm under construction in 2010. Regasification is overbuilt by design and is increasing. Currently there is almost 400 Bcm in service, another 100 Bcm under construction in 2010 and almost 150 Bcm of additional capacity already approved/certificated. The U.S. has 19 Bcf/d in regasification capacity.

In most of the world the LNG price is tied to that of oil. But in the U.S., a gap has opened between oil and gas prices. Why is this important?

The world geared up to supply North America with LNG. But we don't need it with all this shale gas coming online at low prices. Now the world needs a diversion tactic. For the past few winters LNG destined to the U.S. was diverted mid-Atlantic to go to Europe. Now prices have been converging for LNG at the Algonquin Citygate (Boston), Henry Hub and Zeibrugge in Europe.

This downward pressure on European LNG prices will create a shift from long-term contracts to spot deals, according to Shlesinger. He compared it to the 1980s in the U.S., when deregulation led to dropping spot prices undercutting long-term deals.

The move toward the spot-market in Europe was recently signaled by Gazprom, which announced that it would sell 15% of its gas output on the spot market through 2012.

Alan Hegburg, Senior Fellow, Energy and National Security Program, CSIS, discussed the importance of shale gas in world energy security. He pointed out that there had been 20 disruptions in the crude oil market since the 1973 embargo by Saudi Arabia. Just last year China wanted to discuss shale gas production, with 18 Tcf in reserves. Right now there are only 2-3 shale gas wells in Europe but he predicts a big surge in the next 10 years. Europe's shale gas deposits are deeper, hotter and more pressurized. But he predicts that our biggest export to Europe will be producer expertise to bring that gas to the surface.

Fracking and Watersheds

Paul Rush, Deputy Commissioner, New York City Department of Environmental Protection, put a damper on the rush of enthusiasm that panelists may have been expressing up to that point. His agency administers 19 reservoirs and three controlled lakes that supply 550 billion gallons for half the population of New York State, delivering 1.2 billion gallons per day from a 2,000-square mile watershed in parts of eight upstate counties.

His agency studied the possibility of shale gas drilling in upstate New York and evaluated the effects of "industrialization" of the watershed, infrastructure risks and subsurface migration, water quality, surface spills, water withdrawals and wastewater treatment and disposal issues, and came to the conclusion that it would not support this effort.

The study concluded that there would be high levels of site disturbance, truck traffic and intense industrial activity on a relatively constant basis for decades. They estimated 12,000 truck trips per well and millions of tons of chemicals going into the watershed, with potential future environmental problems that could not even be calculated.

Even a 1% concentration of chemical additives to the fracking fluids would result in 160 tons of "chemistry," some of it benign, some hazardous and much of it unknown and undisclosed, said Rush. Cumulatively, the danger was unacceptable for a public water supply.

In addition, a chronic and persistent occurrence of small-scale surface spills and contamination incidents would inevitably accompany the operations, which would also undermine confidence in the ability to maintain current high water quality standards.

Initially there could be as low as 5-20 wells per year, but that could grow to 100-300 wells, potentially peaking at 500 new wells being drilled every year in the New York watershed. Full buildout would be in the order of 3,000-6,000 wells. The cumulative impacts for site disturbance, water consumption, chemical use, flowback of fracture fluid, water being pumped out and truck trips made the prospect unacceptable. In all, there could be over seven million truck trips into the watershed. The agency predicts that such a venture would create an "unfunded mandate" to build a filtration facility costing $10 billion to build and another $100 million a year to operate.

Paul Hagemeier, Vice President of Regulatory Compliance for Chesapeake Energy, provided counterpoint from the industry. His company is the second largest U.S. gas producer, and the most active explorer, with 117 active drilling rigs. Chesapeake employs over 8,200 employees in 10 states. Independent producers are leading the way to produce shale gas, representing the top 10 companies producing gas in shale deposits. The major oil companies play only a minor role.

All of these projects cannot be lumped together, he said. They are all produced at different depths and every one will be reviewed by multiple agencies. There isn't a single shale well out there that isn't a part of some watershed area. And most of the drilling is thousands of feet below the usable water level underground.

Most of the innovations in the industry today are in surface containment, and the industry is moving to self-contained systems at site to protect against spills and to keep materials contained. He believes that groundwater can be protected through proper casing methods, knowing where the fresh water is located underground (which is established by state water protection agencies), and designing protective well designs with multiple layers of protection.

Hydraulic fracturing has been used for over 50 years, and states that are familiar with the process have developed guidelines. Hagemeier was not aware of any significant spills or releases of chemicals that have impaired watersheds in the Marcellus. To date, he maintained that there was not a single example of undiluted frac

fluid being released to a watershed. However, he is supportive of a system that would require registration of chemicals.

As for water being used in production, approximately five million gallons of water would be needed to drill and fracture a Marcellus deep shale gas well. This is equivalent to the water consumed by New York City in eight minutes, or the water that a 1,000 megawatt coal-fired plant uses in 13 hours, or a golf course uses in 28 days, or nine acres of corn uses in one season.

Hagemeier also pointed out the consumption of water to produce electricity. Shale gas, used in a combined cycle turbine, only used 204 gallons/MWh, compared to 364-472 gallons/MWh for coal, 704 gallons/MWh for nuclear units and 750 gallons/MWh for concentrated solar.

Gas on Green Competition

Predicting energy prices always feels like people are throwing darts at the wall. But in this case, all of the predictions, and the implications for the mix of energy choices, may hinge on whether carbon pricing becomes reality.

Frank Verrastro, Senior Vice President and Director, Energy and national Security Program, Center for Strategic & International Studies (CSIS), predicted that gas demand was expected to grow, especially in a carbon-constrained world. Gas is 40% clean than coal, but not emission free. He pointed out that an increased reliance on gas means perpetuating a less desirable (albeit cleaner) fossil fuel system. But in the near term, there are no scalable emission-free alternatives that don't carry challenges of their own. With demand growth, there would be room for some alternatives. But low gas prices would crowd out some alternatives (like renewables) out of the mix.

Glen Sweetnam, from the Energy Information Administration, believes that gas consumption will grow by 7% by 2035, but its share of the total fuel mix would decline from 24% to 22% by 2035. The cost of new shale gas production would strongly influence future wellhead gas prices. Already it has resulted in a dramatic drop in gas prices in 2010.

The strongest growth will occur in the power sector, although that slow growth in U.S. electricity demand would create a somewhat limiting factor. Gas-fired generation and renewables would account for the majority of power generation capacity additions. Sweetnam believes that about half of the additions (116 gigawatts) between 2008 and 2035 would come from gas with hydro and other renewables accounting for 92 gigawatts. Coal would provide 31 gigawatts and nuclear would provide only 8 gigawatts. In his predictions, renewables would gain a share of the electricity market, mostly at the expense of coal.

An important consideration is measuring the effects of climate policy on gas consumption. Gas prices have to be relatively low, or carbon prices relatively high, for existing gas-fired plants to dispatch ahead of existing coal plants. Given its mature technology, short-lead times, and low capital costs, gas-fired generation is very competitive for new power plants over a wide range of gas and carbon prices.

Sabine Miltner, Director, Office of the Vice Chairman, Deutsche Bank, worried that the U.S. has the least momentum of any of the industrialized countries to act on climate change. She believed that science was the excuse being used for people to remain inactive. Worldwide, between now and 2020 we need to remove 12 gigatons of carbon dioxide out of the atmosphere. The Waxman Markey bill will only take out 1.3 gigatons. The U.S. needs to do more. We are seeing real action in other countries. Germany and China are lining up to take the lead.

As for energy security, the job creation and health benefits of climate change policy initiatives are enormous, but investors need some TLC—Transparency, Longevity, Certainty—within a regulatory framework.

We need to be willing to put a price on carbon and create incentives for energy efficiency. Gas and renewables can be paired at the $6 range, but renewables will not be able to compete with gas if prices come down below that level. At the $4 level we won't get a low-carbon environment. Gas and renewable interests have to discuss the right mix of incentives to allow gas to be the backup of renewable power to resolve the intermittency problem.

As for the transportation sector, China is taking electric vehicles seriously. So should we.

Stephen Brown, Non-Resident Fellow with Resources for the Future (RFF), argues that gas is NOT a bridge to a low-carbon future without a low carbon policy. After all, reduced energy prices stimulate consumption, with increases carbon emissions.

He presented five scenarios with and without a low-carbon policy:

1. Business as Usual, Low Gas Prices
2. Business as Usual, High Gas Prices
3. Low-Carbon Policy, Low Gas Prices
4. Low-Carbon Policy, High Gas Prices
5. Low-Carbon Policy, High Gas Prices, Limited Alternatives

In Scenario 1, carbon emissions would rise by at least 1%. A low-carbon policy with more abundant natural gas, would result in gas use increased in the electric power sector, and the cost of meeting emissions goals reduced. Emissions allowance would fall about 1%.

Brown concluded that abundant natural gas could help facilitate a bridge to a low-carbon future, but it would depend on implementation of a low-carbon policy. Without abundant natural gas, reducing CO2 emissions would actually reduce gas use in the power sector, while abundant gas would increase its use in power plants.

The major conclusion of almost all the panelists of this event was that natural gas was the big winner, regardless of environmental policy or carbon pricing. The main issue was how quickly old coal plants would be replaced by combined cycle natural gas turbines, and how much of a disincentive lower gas prices would pose to wind and solar companies.