THE GLOBAL ENERGY OUTLOOK TO 2040 & THE FACTS SURROUNDING THE ROLE OF UNCONVENTIONAL RESOURCES & HYDRAULIC FRACTURING

Kris Nygaard,
Senior Stimulation Consultant,
ExxonMobil Upstream Research Company
Houston, Texas

ExxonMobil's analysis contained in the report *"Outlook for Energy: A View to 2040"* forecasts that global energy demand is expected to increase around 35 percent from 2010 to 2040.[1] Driving increased energy demand is anticipated population growth that will reach nearly 9 billion in 2040 from about 7 billion today, and a projected doubling of the global economy - at an annual growth rate of nearly 3 percent - largely in the developing world where rising living standards will continue to lift millions of people out of poverty. It is forecast oil will remain the largest single source of energy to 2040, but the most significant shift in the energy mix occurs as natural gas displaces coal as the second-largest fuel by 2025. Gas will grow faster than any other major fuel source, with global demand up 65 percent by 2040.

In North America, unconventional gas production is expected to grow substantially to satisfy around 80 percent of gas demand by 2040. The outlook projects that oil and natural gas will continue to meet about 60 percent of energy needs by 2040. Natural gas will continue to be the fastest-growing major fuel source as demand increases by about 65 percent. Natural gas is projected to account for more than one quarter of all global energy needs by 2040.

The rapid increase in development of unconventional resources is very clearly unlocking vast new volumes of natural gas and oil in North America and enabling United States energy security. At the same time, unconventional development has also led to increasing public concern over a range of potential safety, health, environmental risks and social impacts. For example, concerns over the potential for the well construction process or hydraulic fracturing fluids to contaminate the groundwater, excessive water consumption, chemical spillage and water disposal issues, air emissions, induced seismicity, and local community impacts from increased traffic, noise, and dust are select examples of specific public concerns, which are subject to numerous research efforts and increasing regulatory attention.

While it has been shown through extensive experience the hydraulic fracturing technique poses little risk to groundwater due to multiple geological and well design features, sound operational practices concerning well construction and integrity, water management, air emissions, and surface impacts exist and should be followed to prevent accidental releases and mitigate other concerns. Sound development of unconventional resources will bring significant economic and environmental benefits to the nation and to the communities where the resources are produced. An appropriate regulatory framework considering the local context, coupled with an operator's implementation of an effective risk management framework which is supported by the consistent use of sound engineering practices and standards will enable safe and sound development of these resources.

The inherent risks associated with shale development are managed by assessing the risk level, understanding risk in the context of probabilities and consequences, and implementing mitigation methods based on the local context to reduce the risk to an acceptable level. An effective and widely-adopted approach is use of a "risk matrix" methodology to assess and understand risk levels and subsequently identify suitable risk mitigation approaches. Using this type of methodology a recent comprehensive study[2] presents data that suggests key potential risks to consider include: (a) surface chemical spills and material transport accidents (b) subsurface fluid migration due to hydraulic fracturing, poor well construction or shallow faults, (c) GHG emissions, (d) public nuisances such as noise, traffic, dust, and (e) induced seismicity from waste-water injection.

This presentation will discuss in detail these key risks, including:

- The risk of potential surface release and/or spill of chemicals and unplanned subsurface fluid migration will be described based on data from a comprehensive Groundwater Protection Council report[3] from ~389,000 wells; with data indicating incident frequency ~0.1% and very localized site impact consequence. The methods used to mitigate risks and exposures will be described and include discussion of prudent regulation and inspection; use of redundant barriers and containment; implementation of improved standards for reserve pit construction; improved standards for demonstrating well integrity; addressing "orphan" well and "legacy" site issues; and proactive remediation when issues may be encountered.

- The risk of potential shallow water aquifer contamination from the hydraulic fracturing process will be described based on data from thousands of micro-seismic fracture diagnostic measurements[4] and extensive state and federal investigations that have found no evidence of fracturing chemicals contaminating aquifer sources; with understanding that poor well construction can lead to isolated instances of gas migration. The methods used to mitigate risks and exposures will be described and include discussion of engineered well designs and multiple barriers considering local geology and aquifer location; integrity testing of well prior to operations; monitoring of operations; and remediation of well construction issues if they are encountered.

- The risk of potential impacts of methane leakage and increased green-house gas emissions will be discussed, and while methane has a global warming potential 20-25 greater than CO_2, it is important to consider a full life-cycle analysis to compare natural gas to coal, for example. Data from multiple studies[5-10] will be discussed that suggest when considering the full life cycle, natural gas is much better than coal from an emissions standpoint, specifically, the consensus of these studies suggest that life cycle GHG emissions from gas are about half of those from coal when the fuels are utilized for power generation (their only common use), noting and only one study[10] suggests lifecycle GHG emissions from coal may be less than natural gas. The methods used to mitigate risks and exposures will be described and include adherence to country regulations and directives; application of company-specific environmental standards for emissions through the life cycle; a philosophy surrounding "design right the first time"; and effective programs to monitor and maintain equipment and facilities.

- The risk of potential induced seismicity will be discussed, considering both waste-water injection operations and hydraulic fracturing operations. It has been documented that seismicity can be induced or triggered when stress or pore pressure changes promote slippage along a fault. The risk of induced seismicity will be characterized from data collected as part of a comprehensive USA National Academy of Sciences report[12], as well as studies associated with hydraulic fracturing in the U.K.'s Bowland Shale[13] and the Horn River Basin[14] in Canada. The data will show hydraulic fracturing is clearly a very low risk activity relative to potentially inducing negative consequence seismicity; under very rare and unique geologic circumstances, waste-water injection (disposal) operations may be identified as a elevated risk; and risk mitigation could be considered in these rare instances to futher reduce the overall risk level. Mitigation approaches will be described and include avoiding high-pressure large volume injection directly into significant and active faults and use of a "stoplight approach" based on local conditions when significant risk may exist.

- The issues surrounding public and community concerns associated with increased surface activities and human labor / material intensive operations will be described. It is clear that with the high volume of surface activity and larger volumes of material transport, development nuisances are indeed emotional and real issues in the local communities. The concerns are further amplified when development occurs in higher population density areas or urban areas. Risks associated with resource access, noise, increased traffic, dust, etc. will be described, and various approaches to proactively and collaboratively engage with local communities will be highlighted, including mitigation measures such as proactive community engagement, careful site selection and preparation, multi-use drilling pads, spill containment / noise barriers, regulatory / emissions compliance, and reclamation / landscaping.

In evaluating the risks associated with shale gas development, it is also important to discuss the benefits to enable and guide regulatory and policy decisions surrounding energy supply sources and economic development strategies. Recently, energy expert Daniel Yergin put the transformation associated with shale gas development into perspective, noting that "shale gas has risen from two percent of domestic production a decade ago to 37 percent of supply [today]" while also highlighting that the unconventional revolution supports 1.7 million direct, indirect and induced jobs and was responsible for $62 billion in taxes in 2012.[15] Meanwhile, America's greenhouse gas emissions have fallen to levels not seen in two decades, due substantially in part to power plants burning natural gas in place of coal. Reliable and safe development of shale resources, enabling substantial economic and environmental benefit while meeting the forecast energy demand, can be achieved with a collaborative engagement between the public, regulators, and operating companies. It is important that reasonable regulations considering local conditions be in place, coupled with a responsible operations philosophy and effective risk management framework implemented by all operators, supported by the consistent and appropriate use of sound engineering practices and standards.

Selected References:

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