

Shale Energy's Challenges and Opportunities

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Science Sundays, February 19, 2012

Nothing in the past 50 years has changed the energy supply picture in the U.S. as rapidly as shale energy (often considered to be part of what is called "unconventional" oil and gas by the petroleum industry). The ability to produce natural gas and oil from shale came about as a result of combining horizontal drilling with hydraulic fracturing. Hydraulic fracturing has been around for over fifty years as a routine method for enhancing oil production. Horizontal drilling came on the scene fairly recently (arguably 5-10 years ago) and this new technology is likely to push the "peak oil" timeline out into the future several decades. Prior to the development of horizontal drilling (which will significantly increase production in all geologic formations; not just shale), the energy security and supply picture for the U.S. was bleak, and the U.S. economy was bracing for an extremely rocky energy future. Now, there is some hope that we will have enough energy to feed our energy-hungry economy, and provide energy security for our Nation. Ohio's resource of shale energy puts our State in a position to benefit economically from shale resources.

Energy, environment, and economics are the facets of the sustainability triangle in society, and university education, and research and development will envelop all three. We cannot ignore the fact that the potential cost of shale energy might be to sacrifice some of our environmental integrity, and risk losing the chance to mitigate carbon emissions in a reasonable time frame. Our environmental responsibility is to find the ways and means to ensure sound environmental stewardship of shale energy development. I would also argue that for a number of reasons, the pressure to move forward rapidly with development, at this point in time, is great at all levels of the economic spectrum: people need jobs, the government (particularly local governments) needs tax revenues to operate, and we need a secure source of energy in the U.S. As a result, drilling and production are in all probability going to proceed fairly rapidly, and the questions for a university become: How can we contribute to ensuring that environmental protection keeps pace with these activities? How can we ensure that our students are educated to work in this industry as environmentally and socially conscious, geologists and engineers? And, what are the research opportunities in this new incarnation of subsurface energy development?

For several decades, research in subsurface science and engineering was conducted by universities with traditional ties to the petroleum industry (Stanford, Penn State, MIT, Texas, Oklahoma, Colorado School of Mines, etc.), but the technological needs of shale energy and the geographic distribution of shale resources opens research opportunities for less conventional university partners to develop unconventional scientific and technological approaches to unconventional oil and gas. Specifically, what can university research do to advance technological changes in the field that will ensure that our environment is protected (which will also help protect the industry in the long-run), and advance the petroleum industry's ability to efficiently and safely extract oil and gas? Some of these new areas of research and development could be: 1) surface and ground water monitoring, 2) chemical and mechanical engineering of borehole casing and grouting, 3) new chemical and technological approaches to desalination and purification of flow-back and production water, 4) monitoring and mitigation technologies for subsurface core and cuttings that come to the surface, 5) new methods to remotely monitor subsurface physical and chemical changes associated with drilling, and looking farther into the future 6) in-situ manufacturing methods that utilize the oil and gas in the subsurface and produce a more refined product to the surface, thereby keeping all of the raw petroleum materials below ground.