SHALE GAS AND OIL

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Oil and natural gas liquids have been the feedstock for the bulk of global transportation fuel and chemical production for many decades. Natural gas, more specifically methane, is used as a feedstock on a limited scale for chemical production, and is used on a large scale for electricity generation. For many years, the United States has imported from abroad a significant portion of the oil used to power the domestic economy, and the need for these critical hydrocarbon resources has profoundly impacted our foreign policy. However, in October of 2013, for the first time in nearly two decades, the US has produced more oil domestically than it imported from abroad. What has led to this fundamental shift in where our hydrocarbon resources are produced?

The boom in domestic production of gas and oil from shale resources has been facilitated by the development and implementation of hydraulic fracturing, or "fracking" technologies. These technologies have facilitated significant new capital investment in the USA, providing the impetus for significant domestic job creation. But with these new technologies come concerns associated with continued reliance on hydrocarbon resources for energy production and the associated carbon dioxide emissions that accompany their use. In parallel, there are concerns about water contamination associated with hydraulic fracturing technologies as well.

The light gases such as methane, ethane and propane that are produced by hydraulic fracturing can be directly used as fuels, but their valorization as chemicals requires conversion and upgrading. Ethane and propane are readily converted in conventional technologies to make higher value products, but methane, the most abundant of the light gases, continues to challenge technoeconomic barriers for upgrading. To this end, the development of technologies that facilitate the conversion of these light gases into chemicals is a key research challenge facing broader utilization of these gaseous resources. This utilization can occur domestically, creating new domestic manufacturing jobs, or the resources can be exported as liquefied natural gas (LNG), positively affecting the US balance of trade. This session will provide an overview of these interconnected logistical, chemical, and environmental, issues associated with utilization of the new shale gas/oil resource, identifying research problems at the forefront of this field.

The first speaker, Stephen Ingram (Halliburton), will provide an overview of the location and nature of the domestic shale gas and oil resources and introduce hydraulic fracturing as technology, including logistical and infrastructure challenges associated with its use. The second speaker, Kelvin Gregory (Carnegie Mellon), will address the environmental challenges that are associated with utilization of shale gas and oil, including increased carbon dioxide production and the significant water resource challenges associated with hydraulic fracturing. Eric Stangland (Dow Chemical), the third speaker, will discuss the utilization of shale gas for chemical production, elaborating research challenges associated with methane conversion.