Written Testimony

Committee on Science, Space, and Technology

U. S. House of Representatives

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Good Morning. I am Dan Hill and I am the Head of the Petroleum Engineering Department at Texas A&M University. I have been a faculty member for over 30 years after working in industry for about 5 years, and throughout my career I have conducted research on methods to improve oil and gas production. For the past ten years, I have been supervising research projects funded by the Department of Energy studying horizontal wells and hydraulic fracturing.

Unconventional oil and gas production has changed the U. S. energy game.

In just a few years, applications of advanced technology have led to the most dramatic economic boost our country has seen in my lifetime. Production of natural gas and oil from unconventional reservoirs, primarily shale formations, is soaring, daily lessening this country's dependence on imported oil. Slide 1 is a history and forecast of the U. S. natural gas supply – in less than 10 years, gas production from shale formations has grown to over 30% of the U. S. supply, and continues to grow. This is great news in every possible way – natural gas is the cleanest burning fossil fuel, it yields the least CO_2, and it is low cost, thanks to its newfound abundance in unconventional reservoirs.

Even more dramatic is the rapid increase in domestic oil production from unconventional reservoirs. Slide 2 shows that oil production from the Bakken formation in North Dakota is now close to 500,000 barrels per day. Forecasts are

that Bakken production will reach a peak of 1 – 2 million bpd – equivalent to peak production from the Alaskan North Slope. Production from the Eagle Ford formation in South Texas has grown from about 800 bpd to almost 300,000 bpd in only 3 years (Slide 3). These are just two examples. There are many other unconventional reservoirs in other parts of the country that are also rapidly adding to domestic production. Without question, there is a revolutionary change in U. S. energy supply underway, solely due to oil and gas production from unconventional reservoirs.

How did this happen?

This shale production revolution is a result of major advances in the technologies of horizontal drilling and hydraulic fracturing, and, in particular, the combination of these two technologies. These advances have been aided greatly by a modest level of research funding from the Department of Energy, funding that supported research primarily at universities, small businesses, and the national laboratories.

Let me give you one example. Beginning in the early 80's and through the mid-90's, the Department of Energy, along with the Gas Research Institute, supported fundamental research on measuring the sounds made as hydraulic fractures are created. This research, led by a team at Sandia National Laboratory, resulted in a commercial technique for mapping hydraulic fractures that is now called microseismic monitoring. This technique, which has now been applied to tens of thousands of fracture treatments, and which is now itself a multi-million dollar industry, has allowed engineers to greatly improve hydraulic fracturing and well completion practices by providing a means to measure the extent of the fractured region. Slide 4 shows a microseismic map of the area affected by a multi-stage fracturing operation. The development of microseismic monitoring of hydraulic

fracture treatments was clearly enabled by the Department of Energy funded research that proved its viability. This basic research was greatly aided by research funding by GRI and the U.S. Department of Energy.

Is the current domestic energy growth sustainable?

The goal of energy security, and possibly energy independence for the United States is no longer just political rhetoric, but is technically attainable. We know where the resources can be found, but we still need technical improvements to be able to produce much of the resource at prices that are beneficial to the public. However, it will not be easy, and it will require two things – further developments in technology, and the trained engineers and geoscientists needed for continued growth. The proposed Department of Energy research funding will be a great help with both of these needs.

On the technology side, although hydraulic fracturing methodologies have obviously been developed to the point that oil and gas are economically recoverable from very low permeability unconventional reservoirs, there is still a great deal of improvement that can be made to this technology. One of the major challenges is the development of various ways to lessen the environmental impacts of hydraulic fracturing operations, including using less fresh water in the process, and drilling fewer wells to contact the same amount of reservoir. Another challenge is the development of lower cost hydraulic fracturing techniques. Ironically, the success of the industry in rapidly developing huge new volumes of natural gas from shales has led to a low gas price, which has slowed gas drilling markedly. If the rapidly increasing oil production has a similar effect, unconventional oil development will inevitably slow down, unless lower cost methods can be applied to achieve the same results. The Department of Energy has

been funding fundamental research in conjunction with the Research Partnership to Secure Energy for America (RPSEA) on topics like these for the past several years, and this research is having a visible impact on industry practices. It is important to continue supporting RPSEA as they have a proven track record of producing important research results using a unique public – private partnership model.

Perhaps most important is the role that Department of Energy funding for unconventional oil and gas research will have on the training of the engineers and scientists needed to sustain growth in unconventional oil and gas development. The research funded by DOE occurs primarily in universities and most of the money ends up in the pockets of graduate students in the form of research assistantships. The demand for engineers in this field is huge – the COO of a major service company recently told me that his company alone hired 15,000 new employees in the U. S. in 2011. That is a lot of jobs, and many of them need to be highly trained engineers and scientists. Because of this booming demand for petroleum engineers to work in unconventional oil and gas development, we are receiving unprecedented demand for places in our graduate program. Other universities with graduate programs in Petroleum Engineering are also receiving numerous applications for graduate school. To attract and retain high quality graduate students, a university has to offer financial aid, and this is usually in the form of a research assistantship funded by an external grant. The research funding provided to universities through the proposed Department of Energy research program will help support the graduate students who will become the future technology leaders of our country.