University Research Offers Way For Companies To Become Involved

As unconventional oil and gas recovery becomes more and more “conventional,” technology and training are paramount in these unique environments. There has been a surge in the development of new products and innovations aimed at producing these resources effectively. Some of this technology is based on well-established tools and techniques being applied in new ways, while others have popped up to serve specific needs during drilling and completion.

While many innovations have great potential, operators should use a cautious eye as they explore new opportunities and techniques. One of the best ways for operators to evaluate whether a new technology is right for them is to participate in its very development. This approach reduces the financial risk of trying something new while putting one’s company at a competitive advantage as a partner in developing the technology. A great way to do this is to partner with a research university.

There are several universities with established research programs looking at new ways to produce oil and gas. One such is the University of Kansas, which in a joint partnership between its Department of Chemical and Petroleum Engineering, and the Tertiary Oil Recovery Program, has unveiled a project called Sustainable Hydrocarbon Recovery in Unconventional Reservoirs. Research is being conducted in several areas related to unconventional production, and the project represents a unique opportunity for industry to take an active role in developing this new technology.

The team, composed of cross-departmental research scientists, has developed specific areas of interest based on industry feedback and more than 40 years of research and development in enhanced oil recovery.

The first thrust area is produced water treatment and is focused primarily on removing naturally occurring radioactive materials and scale-causing minerals. By using nanotechnology, specifically, polyelectrolyte complexes, KU is developing “nanoized” entrapment agents designed to form around target metals such as barium, strontium, and radium, directly in produced water. Once formed, these nanoparticles can be separated from the water through filtration or gravity separation, and possibly regenerated for additional use.

Additionally, KU is looking at applying fluidized-bed biological reactors to remove organics. Increasing contact between chemical contaminants (in this case, organics) and reactor components (microbes) using fluidized beds speeds the reaction rate, thereby processing large volumes in less space.

In its second thrust area, KU is studying ways to optimize hydraulic fracturing in shale formations. There is a lot of work in this area, however, university researchers are looking at four specific areas. Once again using its nanotechnology experience, KU is trying to develop nanoproppants capable of packing microfractures to prevent fluid loss and improve both effective fracture length and productivity of the fractured wells.

As part of this work, KU hopes to develop nanoparticle-stabilized carbon dioxide foam as a frac fluid. Specific areas of interest include fluid loss and fracture cleanup properties of CO₂ foam as a frac fluid, as well as nanoparticles and chemicals designed to optimize the performance of such fluids.

Work also is being conducted on identifying the levels below which chemical contaminants need to be reduced in order for reuse to be attractive to producers. This work is being performed in conjunction with produced water treatment activities and is focused on fracturing fluids being developed in the laboratory.

Finally, KU plans to develop an improved fracture propagation model. The hope is to develop robust models capable of modeling fracture propagation in a variety of lithofacies, including in brittle or semibrittle formations with natural fractures.

In the third thrust area, KU is looking at enhanced oil recovery in shale formations. This research is focused on gas injection and the feasibility of using different gases to improve oil recovery in tight shale formations. One unique feature is collaborating with the Department of Energy’s Idaho National Laboratory, which owns a geo-centrifuge that can be used as a “time machine” to model the recovery process by accelerating gas invasion into tight shale rock.

In its last thrust area, KU is studying reservoir characterization and simulation. Using improved correlations between seismic data and fracture properties, researchers are working on developing a more representative fracture network/property model for shale reservoirs that is capable of adjusting fracture spacing, based on the fracture characteristics of the reservoir.

With this work, KU wants to develop a small-scale model for producing from a naturally fissured shale block that captures the full physics behind the shale gas or oil production. Once complete, this model will be extended to reservoir scale models.

This work represents a unique opportunity for operators in Kansas and around the country to actively engage in university research. As unconventional technology becomes the industry convention, operators looking for ways to develop that technology should evaluate research programs such as those at the University of Kansas as well as others around the country.

Jeremy Viscomi is the executive director of technology transfer for PTTC. He also is director of technology transfer for the University of Kansas Tertiary Oil Recovery Project, and has more than a decade of experience organizing technical conferences and special events.