A few months ago, discussions about sustainability in the oil and gas industry focused on the environmental effects of shale oil and gas development. While technology had enabled the “first wave” of the unconventional resource revolution that swept North America and propelled it toward energy independence, concerns about the usage of water and chemicals and the environmental effect of large numbers of wells signaled the need for new thinking to address these concerns.

How quickly times have changed! While safety and environmental sustainability remain at the top of operational considerations, the precipitous drop in global oil prices has added another key question to the mix: At what price do unconventional plays cease to be economically sustainable? Basin-related, break-even prices are now top agenda items at planning and budgeting meetings. No longer are we discussing efficient well delivery, improving completion effectiveness and fracturing designs, and increasing estimated ultimate recovery as changes we should make. These are changes we now must make to boost production, ensure sustainable cash flow, and increase booked reserves during the “next wave” of unconventional resource development.

The high oil prices of the past several years shielded the industry from inefficiencies that were “built in” to the first wave of unconventional development. Of the hundreds of thousands of shale wells that have been drilled and hydraulically fractured, many have been significantly less productive than expected, delivering typical recovery factors below 10%. Despite these less-than-optimal recovery factors, efficiency remained our industry’s key focus of innovation in the unconventional plays. In fact, factory drilling of a large number of wells and geometric fracturing along the lateral continues to represent the most popular approach to developing unconventional assets. But with oil prices below USD 50/bbl, is drilling and stimulating more wells at lower cost really the solution for long-term economic sustainability of unconventional plays?

As an industry, it is critical that we start thinking about these unconventional assets differently. Large numbers of unconventional wells drilled in the past 5 to 7 years are now reaching the low end of the production curve and are ripe for rejuvenation. And the industry has already seen some positive results from rejuvenation efforts including wellbore cleanup, installation of artificial lift, and restimulation. Many of these projects have been effective at generating production rates that equal or even exceed the well’s initial production with less rapid decline rates.

But we can still do better. By using brainpower rather than horsepower.

Embracing an approach to unconventional rejuvenation that is grounded in science and fact will let us drive production and efficiency simultaneously. The key is developing a workflow that creates value through enhanced understanding of the reservoir rock and the reasons behind poor well performance, and then executing on that workflow.

With thousands of potential rejuvenation candidates in North America, we must be able to rapidly and reliably identify the wells with the greatest production potential; diagnose each individual well’s condition and specific rejuvenation needs; and

then prescribe and deliver the rejuvenation treatment efficiently and effectively to achieve the highest possible return on investment.

Selecting the Best Candidates
The first step in this workflow is screening and selecting the best rejuvenation candidates. Today, we have more data on these wells than ever before. And, while the sheer volume of data—from well locations and completion types to proppant volumes and production histories—can sometimes seem overwhelming, modern data-mining tools and techniques allow us to quickly sort through large volumes of information. This, in turn, facilitates the development of new, efficient workflows to screen a large number of wells, a focus on those capable of delivering the most additional production, and avoiding those with limited prospects.

Once we know which wells have production left to offer, we have to gain an intimate understanding of the unconventional reservoir surrounding the well and diagnose what is needed to unlock its full potential. We also need to understand whether there are any factors in the existing well that might compromise our ability to implement a specific rejuvenation solution. This will necessitate a deeper dive into the well’s historical record to review all available formation evaluation data and production logging. In some instances, it may be necessary to gather additional data to fill any gaps. Other activities in the diagnostics stage include confirming the well’s technical integrity and cleaning up the wellbore in advance of any rejuvenation efforts. This data assessment and detailed understanding of the well’s current state make it possible to effectively forecast each well’s production potential.

Proper Rejuvenation Treatment
After we have identified the wells we want to target and diagnosed what challenges need to be overcome, it is time to determine the best rejuvenation solution for a specific well. In some cases, we have seen that cleanouts alone have proven effective at restoring production to levels at which no further rejuvenation efforts are required. In other instances, a cleanout coupled with the installation of artificial lift offers the most cost-effective means of improving production. In recent years, many North American operators have experienced good success with electrical submersible pumps (ESP) purpose-built for the lower production rates commonly found in mature unconventional wells, boosting production by more than 40% with lower operating expenses compared with traditional rod-lift operations.

If the workflow determines that the optimal solution for boosting production is additional stimulation, refracturing programs can be designed to stimulate previously untreated zones, restimulate underperforming intervals, or re-establish wellbore connectivity through pre-existing fractures. Because this workflow has already investigated the well’s mechanical integrity, and formation evaluation data have been gathered, we can design an effective and efficient restimulation program that meets the well’s technical, production, and economic objectives.

Furthermore, if multiple wells in a field are targeted for rejuvenation, then microseismic and real-time downhole pressure monitoring during the treatment, as well as post-refrac production analysis, are critical to refining and enriching reservoir models for the next restimulation operation. That is because there are always new discoveries to be made and more understanding to be developed. As an industry, we are still working to fully understand the physics of fracture propagation in tight rock and the flow of fluids through fractures. The acquisition of more—and better—subsurface data will drive that improved understanding and enable more predictive, and more reliable, modeling and simulation.

Next Wave of Unconventional Redevelopment
Proper targeting and techniques can rejuvenate existing unconventional wells to drive meaningful additional cash flow and improve ultimate recovery—and thus reserves—by providing an avenue to economic sustainability. It simply requires a new, hard look at what we thought were the “truths” about unconventional plays and a willingness to embrace new concepts. For the future, the pathway to success may be “refrac-ready” wells based on learnings from current and upcoming rejuvenation projects. This next wave in the development of unconventional reservoirs will be key to generating a higher return on investment for a longer period of time.

In the end, it may be overly optimistic to say that the current oil price situation is an opportunity in disguise, but it does present both a warning and an opportunity to the industry that we must refocus our thinking from “business as usual” to new, more effective—and more sustainable—ways of developing unconventional resources.

With an approach leveraging new workflows for rejuvenating existing wells, the industry can achieve production and recovery levels needed to sustain unconventional plays in an environment of lower oil prices. We can also achieve the efficiency we have been seeking by drilling longer, cheaper wells. In this instance, we are replacing more wells with more productive wells. We are replacing field experimentation with analysis and planning.

We are replacing horsepower with brainpower. JPT