In the Rocky Mountains in Wyoming, a manufacturing approach is being developed to enable fracture stimulation of hundreds of gas wells from one semipermanent location that can operate around the clock. This development is in response to the area’s unconventional gas fields that offer unique environmental, social, and operational challenges. Fig. 1 shows this concept, called FracFactory service, in schematic form.

Fig. 2 illustrates that the FracFactory service concept is appreciably different from the conventional layout of a frac spread. For every well treated, the conventional frac-equipment spread is transported from a logistical base directly to the location, set up for operation, broken down after the stimulation job is completed, and transported back to the base/satellite storage facility. The process is repeated for every well treated, with potentially significant impact to the environment, resources, and required man-hours. This is the current practice across the industry.

To help reduce the environmental footprint, many wells can be drilled in clusters from a single location. Surface piping can be installed to provide a conduit for the frac fluid from the FracFactory service facility to the well cluster for placement downhole. An efficient system of manifolding at each well cluster completes the connection from the pressure pumps to the appropriate wellhead. Fig. 3 shows the concept in greater detail—supplies, crew quarters, pumping and blending gear, and water reclamation equipment within a single footprint. High-pressure pumping is housed nearby in an enclosure designed to reduce the noise level for the crew and the surrounding local environment.

Opportunities Wrapped in Challenges
Recent authorizations to drill for gas on Bureau of Land Management (BLM) lands has handed E&P companies and service companies an opportunity wrapped tightly in a number of challenges. Companies must:

- Operate with a small footprint on the mountains and prairie valleys of Wyoming.
- Avoid lowering the water table to supply fluids required in fracture stimulation of production from unconventional (tight) reservoirs.
- Avoid creating excessive traffic on local roads and across lands that are home to numerous game animals.
- Protect aquifers from contamination.
- Provide efficient well-stimulation operations with minimal nonproductive time caused by the logistics concerned.

The Rockies are believed to hold enough gas to heat and cool 70 million homes for nearly 50 years, but reserves are located in
Two challenges facing operators are unique to the region. First, for more than 5 months of the year, companies must curtail operations in this high, sagebrush-rich desert in sight of the Wind River Mountain Range to avoid disturbing migrating mule deer and pronghorn antelope. Second, the region lacks an infrastructure of natural-gas pipelines, creating a bottleneck that forces producers to sell their gas at a discount—roughly U.S. $3/Mcf less than the benchmark price on the U.S. Gulf Coast.

The heart of the FracFactory service concept involves the use of centralized well-treatment operations equipment. Contained at an integrated single frac-pad location, the facility may contain a centralized power unit, a pumping grid, a central manifold, a proppant-storage system, a chemical-storage system, and a blending unit. As shown in Fig. 1, the service facility may be connected via the central manifold to one or more well clusters containing a number of wellheads. The benefits include reduced environmental impact, increased protection from the elements to benefit safety and reliability, and improved efficiencies in energy usage and recycling of consumables. It also allows for optimized equipment use and simplified logistics to supply operations.

**Field Application**

One major operator drilling in the Rockies desired a new method to efficiently, expediently, inexpensively, and safely complete a large inventory of wells. A business development team combined with the Rocky Mountain technical team was able to use one fleet of fracturing equipment to service the entire field.

The process has allowed the operator to create a lower unit cost. A comprehensive scorecard has helped maintain an outstanding record of safety and quality performance. The current rate of service is fracturing 12 stages in a 24-hour period. With new technology development under way, the vision is to achieve up to 25 frac stages daily. In this project, there were:

- Zero recordable incidents.
- 861 fracs performed.
- 70% of frac treatments graded as “exceptional” by the operator.
- 141 million lbm of proppant pumped.
- 70% fracs performed in 1 month by a single crew.
- Man camps and rig-up crews operating 24 hrs.
- A decrease in the operator's unit cost of completions.
- A six-fold increase in the number of fracture treatments per week.

Significant environmental improvements also were achieved, including a reduction in the use of potable water by using significant amounts of produced water for hydraulic fracturing. Equipment trips to location were virtually eliminated except for crew changes, and trips for the supply of materials were reduced by about a third. In addition, the environmental footprint was greatly reduced because of the much smaller area required at each wellsite.

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