Montana’s New Energy Frontier
What are the Prospects?
Tom Richmond, Administrator and Petroleum Engineer, Montana Board of Oil and Gas

Ranchers in Sidney, Montana, are receiving $1 million royalty checks. Homeowners are renting unheated garages to oil workers for $600 a month. And new technology has opened up billions of barrels of oil in the Bakken, arguably the largest inland oil find in the U.S. in the past 50 years. From 2000 to 2006, Montana’s oil production more than doubled (Figure 1) as the oil industry developed and implemented a number of variations of the horizontal drilling technique in the development of the Elm Coulee Field in Richland County.

Science and technology have had a long history of influencing the development of Montana’s oil and gas resources. The extraordinary and continuing interest in development of the Bakken formation in Montana and North Dakota is the product of two technologies, horizontal drilling and hydraulic fracturing. Both technologies have been in use in Montana for several years, horizontal drilling since 1989 and hydraulic fracturing at least since the 1950s. Neither by itself would have made the long known, but marginally productive oil-bearing Bakken formation the target of so many drilling rigs and oil and gas developers.

Just east of the Montana border, North Dakota has become a magnet for investment dollars, creating new jobs and bringing revenues into the state. Energy development is going strong in eastern Montana, but does it have the potential of our North Dakota neighbors?

Science, Technology, and Exploration

Montana’s complex and diverse geologic setting has long provided opportunities for successful exploration and development activities aided by science and technology advancements.

The oil and gas industry has explored virtually every geologic basin in state over the last century, albeit some have been only lightly explored. The traditional producing areas include the Montana portions of the Williston, Powder River in southeastern part of the state, and Big Horn Basins in the south central Montana. The Sweet Grass Arch and other central Montana areas contribute to the state’s production. Figure 2 shows oil production trends throughout the state.

Montana’s complex and diverse geologic setting has long provided opportunities for successful exploration and development activities aided by science and technology advancements. The oil and gas industry has explored virtually every geologic basin in state over the last century, albeit some have been only lightly explored. The traditional producing areas include the Montana portions of the Williston, Powder River in southeastern part of the state, and Big Horn Basins in the south central Montana. The Sweet Grass Arch and other central Montana areas contribute to the state’s production. Figure 2 shows oil production trends throughout the state.
The original oil-finding technology was applied in Montana as it was in many other places. In the late 1880s and early 1900s, oil developers looked for natural oil seeps as evidence of potential commercial production.

The science of oil finding progressed as geologists found and explored anticlines and domes throughout the state. Montana’s first commercial oil production occurred in 1915 (see timeline). From that time through the 1960s, advances in geologic exploration methods, along with the occasional success of random drilling, increased success rates.

By the 1970s, seismic exploration and the ability to use electronic processing to analyze great quantities of data, produced a rush to explore the deep geological features that trapped oil in the Red River formation in the Williston Basin. In the process of exploring for Red River oil, other oil-bearing formations were penetrated and successful wells developed. The recent development of three-dimensional seismic techniques and data processing advancements continues to improve the ability of geologists and geophysicists...
to successfully tap oil resources from features that would otherwise escape detection.

### The Bakken: Promise and Reality

The Bakken development currently drawing so much attention honors a much more recently developed exploration model, that of the “continuous resource” or “resource play.” This concept suggests that organic rich shale formations like the Bakken or the Marcellus of the eastern U.S. and the Barnett of Texas are continuously productive over large areas. While the concept admits to significant variations in well-to-well productivity, the risk of dry holes is largely eliminated. Montana’s Elm Coulee field has currently about 750 producing Bakken oil wells; during the process of development, only two dry holes were drilled. It is this level of success that the continuous resource model predicts and delivers.

Bakken may be the magic name for oil resource plays in the northern plains, but the Bakken is not the same in all areas. Due in large part to the wide variation in reservoir properties, the technology used successfully in Montana’s initial Bakken development was altered significantly in the North Dakota development.

The North Dakota Bakken development has been dependent on technology changes that improved the efficiency of the drilling and completion practices to match the Bakken realities in that state. Those same technologies have returned to the Elm Coulee Field, bringing more effective completion techniques for infill and step out wells and the recovery of additional oil. Application of this “customized” technology to Bakken development in Richland, Roosevelt, and Sheridan Counties holds great promise for migration of the very active development in North Dakota to this portion of eastern Montana.

However, the Williston Basin is asymmetrical and the center of Bakken deposition occurred in an area east of the Nesson anticline, well beyond the border into western North Dakota. The much thicker Bakken formation in this area and the additional pay zones found in the Sanish Sand and Three Forks formation have attracted many investors. This intense level of North Dakota activity changes the timing, but not the potential for significant Bakken development in Eastern Montana.

### Montana’s Energy Future

Although the Bakken formation is present in other areas of the state, the dispositional environment and subsequent geologic history may not be identical to that of the Williston Basin. Recent exploration indicates that oil is present in the Bakken as far west as Glacier County. It remains to be determined if technology developed in the Williston Basin will be effective in the shallower, less pressured areas of Bakken occurrence. However, exploratory interest in other areas remains high.