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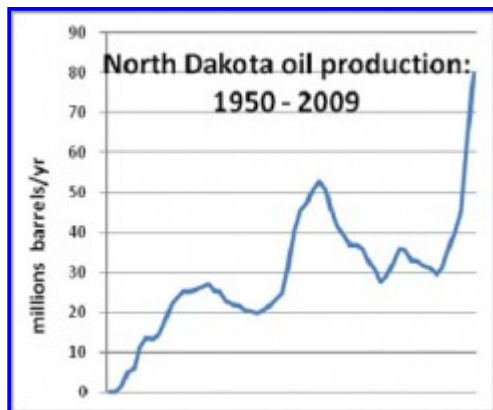
The most significant onshore oil development in the Lower 48 over the past decade has occurred in the upper Great Plains. Horizontal drilling of the deep Bakken shale has doubled North Dakota's oil production, with further growth ahead.

The Bakken is not a "field"; it's an extensive formation that underlies up to 200,000 square miles of the upper Great Plains, crossing the border into Saskatchewan and Manitoba. Thanks to advanced drilling technology, the Bakken today supplies about 200,000 barrels/day, or roughly one percent of U.S. consumption. Regrettably, the Bakken has also unleashed a gusher of blogosphere hype.

A handful of shameless promoters has been touting the Bakken as "the USA's Saudi Arabia." One massively delusional promo for an investor newsletter raved that the Bakken "has the potential to eliminate all American dependence on foreign oil." You've probably received one of these wacko missives yourself.

The hype has its roots in a breathless November 2006 report published by the U.S. Energy Information Administration. Titled "Shale Shock," page 2 noted that "estimates range from 271 to 503 billion barrels (mean of 413 billion) of potential resources in place." That's more oil than the U.S. has used in its entire history, and much more than Saudi Arabia's proven reserves. It didn't matter that the EIA likely meant to quantify "original oil in place," not "recoverable reserves;" the damage had been done. Trade magazines and the lay press spread the (misleading) word.

The US Geological Survey published a more realistic and tempered assessment in 2008, estimating "mean undiscovered volumes of 3.65 billion barrels of oil"-or 1/100th the amount referenced by the EIA. But as someone once noted, a falsehood can be halfway around the world before the truth gets its shoes on.



Thanks to the Bakken, North Dakota oil production has soared

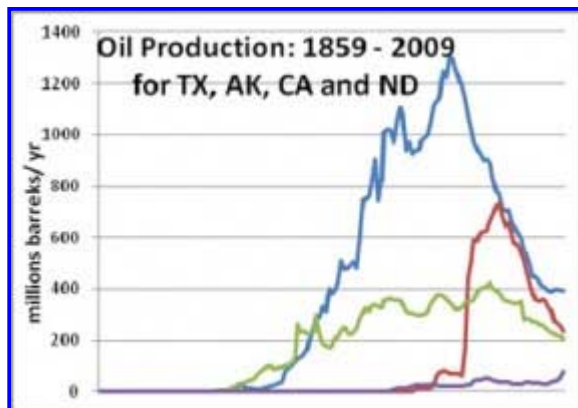
What's the real story? First discovered in 1953 on land owned by Henry Bakken, the formation contains three key producing layers: a lower shale layer (50 feet thick), a middle layer of silty dolomite (85 feet thick, with more variability), and an upper shale layer (25 feet thick). Despite its enormous geographic scope, extracting liquids from the Bakken is complex, challenging and expensive. Today, a typical horizontal well in the Bakken takes weeks to drill and typically costs \$5 million and up. Recovery rates of oil-in-place are very low, a few percent. Bottom line: while the Bakken is an absolute game-changer for North Dakota, and a tribute to oil industry ingenuity, it's no cure for America's petroleum challenge.

The rapidly growing amounts of Bakken oil wouldn't be on the market without mind-boggling technological advances in horizontal drilling, drilling hardware, hydraulic fracturing, and 3 D seismic. Many of the horizontal legs are two miles long, the drilling bit tracking through a target zone only a few feet thick. If your house was 10,000 feet underground, these guys could bring a drill bit through the front door and out the back.

Success didn't happen overnight. The Bakken was drilled with vertical wells after oil prices spiked in the 1970s. But because the rich zones are so thin and most of the rock so tight, the wells were not very productive. The Bakken's first horizontal well was drilled in 1987, but it wasn't until the early 2000s that the industry "broke the code," using improved drilling and completion technology at places like Montana's Elm Coulee field to profitably unlock the oil.

Production in North Dakota's share of the Bakken ballooned from 2 million barrels a year in 2006 to 49 million last year. For the state as a whole, oil companies extracted a record 79.7 million barrels in North Dakota during 2009—an average of 218,000 barrels a day. While that was up 28 percent over the prior year, it met just over 1% of total US demand. An average Bakken well produces 100 barrels a day—almost 10 times the US average—but no comparison with the 4,000+ b/d wells in the Middle East. Again, the Bakken is no Saudi Arabia.

Oil production in North Dakota doubled during the last three years and looks primed for further growth. In 2009, the active drilling rig count fell by half, before rebounding at year's end. By the end of 2010, up to 150 rigs might be at work. According to the North Dakota Geological Survey, as expensive, so-far undrilled land leases near their expiration date, the pace of drilling may increase even more. There's literally no room at the inn in Williston: righands are sleeping in tents and cars.



But the Bakken isn't our salvation: Here the spike in North Dakota's production (line at very bottom), is shown in context with historic production in Texas (blue line), Alaska (red), and California (green).

Yet behind the Bakken boom, the field continues to present major challenges. The formation is "tight;" its upper and lower shale layers consist of low porosity and low permeability rock from which oil either doesn't flow naturally or flows so slowly as to be uneconomic. Unlike the case with conventional oil, the shale oil doesn't migrate out of its source rock and pool beneath cap rock above, but stays firmly locked within the formation. Drilling the two-mile-long horizontal laterals is a high-stakes business, followed by massive fracc'ing jobs, in which water, sand, and proprietary chemicals are pumped downhole at staggering pressure. Some recent, so-called "superfracs," which target up to 22 different zones, can have a total price tag approaching \$1 million.

Fracc'ing makes the wells economic, but it can't overcome all the inherent limitations of the formation. In its study, the US Geological Survey estimated that a typical Bakken well might end up recovering just 3 percent of the "original oil in place." Several Bakken producers admit they're probably only extracting between 1 and 2 percent of the OOIP in some of their wells. By contrast, in conventional oil reservoirs, the assumption usually starts with 15 to 20 percent recovery factors and goes up from there.

Finally, the Bakken is transportation-challenged. There isn't enough takeaway pipeline capacity to transport south all the Bakken oil and slowly growing imports of Canadian tar sands. Two years ago, one company paid \$22 a barrel to ship some of its oil to refineries by truck. Earlier this month, another producer shipped 10,000 barrels via rail tankers. Pipeline expansions are in the works, but are likely to lag production growth

After decades of steady declines in US oil production, 2009 saw a turnaround. Due primarily to the Bakken and first oil from several deepwater Gulf of Mexico giants, American production grew by 300,000 b/d. Still, we are now producing less than 8 million barrels/day of the 19 million barrels of petroleum liquids we consume. Yes, the Bakken has been a boon for North Dakota's economy. But given the constraints of the formation, we think it's unlikely that the entire Bakken province, covering five states and Canadian provinces, will produce more than 500,000 b/d by 2020. At that rate, the Bakken will be mainly offsetting some of the expected declines elsewhere. The Bakken is a triumph of technology, but forget the "oil independence" hype.

Steve Andrews (Westcliffe, CO) and Randy Udall (Carbondale, CO) write and speak about broader energy issues.



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