

**OIL SHALE UPDATE**  
**NATIONAL OIL SHALE ASSOCIATION**  
**MAY 2010**

With oil prices in the \$60-\$80 range, there is still considerable interest on the part of developers to continue oil shale projects in the United States. But progress has slowed for a number of reasons. Some companies that a few years ago had aggressive development plans now appear to be slowing down and taking a wait-and-see attitude about sinking millions of dollars into large-scale demonstration projects. The worldwide recession is partially to blame, but existing federal policies that do not encourage fossil fuel development in this country have also contributed.

Because most projects are in the research, development and demonstration (RD&D) phase, the cost of commercial shale oil production is still uncertain. Investment opportunities into projects that involve less political, regulatory and technical risk are undoubtedly being considered by many firms. With the disastrous spill in the Gulf of Mexico some in the public are questioning whether on shore resources such as oil shale are safer. Every source of energy has its unique safety and environmental issues, but it is true that domestic oil shale development would seem to provide lower overall risk. And, the prospect of increasing pressure on oil supplies worldwide, the expected increase in the cost of producing conventional petroleum, the national implications of continuing to import vast quantities of foreign oil (with its inherent spill risks), and increasing worldwide demand are factors keeping firms in the oil shale business for the long haul.

Finally, producing companies are looking at the benefit of placing large reserves as assets on their books when oil shale obtains the same financial status as the Canadian oil sands and conventional oil reserves.

### **Is it Oil from Shale or Oil Shale?**

For literally a century, when people spoke about “oil shale” it was commonly understood that they were referencing the rock that contained kerogen, a solid hydrocarbon that gave up shale oil and gas when heated. It was “the rock that burns” and the rock from which fluids did not flow without processing after mining, or by insitu techniques. Experts always

described oil shale as “not oil and not shale”, but nonetheless the name “oil shale” stuck. Now, however, the advances in recovering liquid oil (and gas) from shales through directional drilling and hydraulic fracturing have clouded the definitions.



*Scottish Oil Shale “The Rock that Burns”*

Perhaps it is time to resort to calling traditional oil shales “kerogeniferous marlstones” and plays such as the Bakken in the Williston Basin and the Marcellus in the Appalachian Basin as “oil and gas from shale rocks” (OSSR), as the U.S. Department of Energy has dubbed these new unconventional resources. I hope not, but for clarification, this update is about oil shale “the rock that burns” which exists in huge quantities in the Western United States.

### **Role for Independents and Non-Oil Companies**

In the past, the oil shale business has been dominated by the major oil companies because of the scale of the proposed projects and the billions of dollars of required investment. Majors still control much of the privately owned oil shale resources, and several are active in research, development and demonstration projects. They remain dominant players, but recent events show that independents and even firms that are not oil and gas companies can play important roles.

A case in point is EGL Resources Inc. based in Midland, Texas. The company was successful in obtaining one of the first-round Bureau of Land Management oil shale RD&D leases. After conceiving a unique insitu recovery technology based on new horizontal drilling and production

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techniques, EGL attracted a non-oil company partner in IDT Corporation and formed American Shale Oil, LLC (AMSO). Now, TOTAL, a French based international oil company, is a 50 percent partner, and AMSO is moving forward to pilot test the technology this year.

Another example is Red Leaf Resources, a small firm that has raised investment capital to test a unique modified in situ technology called the EcoShale™ process. Red Leaf is operating on private and state oil shale lands in Utah, and will not need federal oil shale lands to proceed. The potential beauty of its technology is that its developers believe it can be profitable on a relatively small scale and not require the billions of dollars of investment to move to commercial production.



*EcoShale Pit under Construction circa 2008*

Another Utah operator, Oil Shale Exploration Company (OSEC), was also successful in obtaining a first-round BLM oil shale RD&D lease at the site of the White River Oil Shale Mine in Utah that was opened in the 1970s. OSEC has been joined by Petrobras and Mitsui, and expects to operate a pilot plant on the lease using Petrobras' oil shale technology. From there, a commercial operation could evolve employing underground mining and surface oil shale retorting.

A final example is AuraSource, Inc., a new comer to the U.S. oil shale business. The company has what it believes is a unique surface retorting technology that uses a catalyst to dramatically increase the recovery of shale oil from the host rock. AuraSource has applied for a second round BLM research, development and

demonstration oil shale lease in Utah, and hopes to test the technology there on a pilot scale. The technology has already been tested on a small scale in China, and a 1 million ton/year plant is reported to be under construction there.

**Second Round R,D&D Applications**

As mentioned above, AuraSource is one of three companies that responded to BLM's solicitation for a second round of 160-acre oil shale RD&D leases. The other two were ExxonMobil and Natural Soda in Colorado. In the first round of RD&D leasing, there were 20 respondents. The lack of interest in the second round stemmed from the less-than-favorable lease terms. While in the first round, a lessee had the opportunity to expand its RD&D lease to 5,120 acres for commercial development, the second round offered only 640-acres. Many firms believed a commercial project could not be established on that small amount of acreage.

BLM has reported that review of the lease applications is underway, but has not indicated a date that decisions will be made on the selections.

Under the Obama administration, the U.S. Department of Interior has for all practical purposes withdrawn its support of the provisions in the Energy Policy Act of 2005 that supported commercial leasing of oil shale, and the continuation of planning by the Department of Energy for the commercial development of unconventional fuel resources in the United States.

**R,D&D Project Update**

In 2007, the BLM issued first-round oil shale RD&D leases to four firms in the Western United States. Since that time, these companies: Shell, Chevron, AMSO and OSEC have made progress by evaluating onsite geology and hydrology, conducting research and development off the leases, providing required environmental information to the BLM and the states of Colorado and Utah, completing detailed RD&D plans, informing the public and local officials about proposed plans, and generally preparing to conduct RD&D projects on each of

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the 160-acre leases.

Each developer has 10 years to successfully verify that its technology is technically viable, environmentally acceptable and sustainable before expanding each lease to as much as 5,120 acres for commercial production (with BLM approval).

Of the three firms with RD&D leases in Colorado, AMSO is leading the pack as far as progress toward conducting a pilot project on one of the leases. AMSO has obtained essentially all the regulatory permissions it needs to conduct a one-well in situ test this year. In May the company began installing the downhole heater and pilot test well, broke ground for the surface processing facilities, and anticipates initiating a pilot test by the end of the year. AMSO continued hydrologic monitoring of wells on the lease.



*AMSO R,D&D Site*

The technical approach being taken by AMSO is to heat oil shale in situ through horizontal drill holes beneath the zone of interest. The pilot test will be conducting in an impermeable clay-based oil shale zone in order to minimize, or perhaps even eliminate, the need to mitigate groundwater contamination.

Chevron is continuing to analyze cores obtained from its Federal core hole 397-5-1. Work continues on processing crosswell tomography data to better understand rock mechanics, fracture characteristics and potential anisotropy. Chevron is also developing a basin wide hydrology model. Its insitu approach is to use supercritical carbon dioxide to pull the kerogen out of the shale.

Shell continues to correlate both analytical

data and geophysical log information to support development of its three RD&D leases, and is assessing baseline groundwater quality across the Piceance Basin of Colorado. Shell is continuing its research on the “freeze wall” experiment on private lands, and reports that the ice wall has been successfully completed. Shell engineers are now moving toward testing the freeze wall’s characteristics. A freeze wall is Shell’s approach to groundwater mitigation during in situ oil shale processing.

Shell has numerous patents on the in situ recovery of shale oil. The approach most discussed by Shell is using downhole electric heating in vertical holes with vertical production wells adjacent to and in the near proximity of the heating wells. The company has been the leader in technology for in situ recovery of shale oil for decades and has conducted a number of pilot scale tests on its private property in Colorado.

OSEC has the sole first round RD&D lease in Utah. OSEC continues to evaluate its research options for the White River Mine site. Drill cores were sent to Brazil for testing in a bench scale test unit, and Petrobras has reported that Utah oil shale can be processed very well with the Petrosix™ retort. Samples of spent shale and crude shale oil are being analyzed. Through its partners Petrobras and Mitsui, OSEC has completed a feasibility study for a 50,000 barrel a day shale oil plant in the Uinta Basin of Utah, near the White River Mine site. Study details have not been reported.

### **Oil Shale Technology Advances**

A number of firms that are not involved in the BLM’s RD&D lease program have also made progress. For example, ExxonMobil has recently published papers describing the tests of its Electrofrac™ in situ technology. These tests, conducted at ExxonMobil’s Colony site in Colorado, are reported to have been successful. It is speculated that the Electrofrac process will be tested on one of the second round RD&D leases, if ExxonMobil is selected.

Queensland Energy Resources (QER) announced that it will shortly begin construction of a small scale oil shale technology

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demonstration plant north of Gladstone, Australia. The plant will employ the Paraho II™ technology. Oil shales from Australia have been tested at the Paraho pilot plant near Rifle, Colorado. When completed the plant in Queensland will produce about 40-barrels of synthetic crude oil per day.

EnShale is a small entrepreneurial firm that has completed construction of a surface retort pilot plant near Vernal, Utah. Testing results are not yet available.

Oil shale projects have been operating for decades in Estonia, Brazil and China. Technology transfer and licensing of these technologies is being proposed for commercialization in the United States. The proposed use of the Petrobras surface retort for the OSEC project is one example. Enefit, an Estonian firm, is actively seeking to enter the U.S. oil shale market, presumably to license and/or use the technology it developed in Estonia.



*Petrosix™ Shale Plant in Brazil*

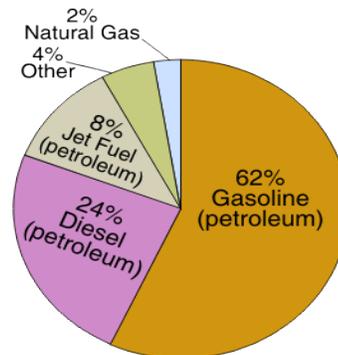
There continues to be new concepts for making oil shale economic. Entrepreneurs abound with ideas, and new patent applications are surfacing. It is not surprising that many of the ideas are not new, but the method of deployment and new approaches may make them viable. One of the concepts being revisited is to remove the kerogen from the host rock, thereby reducing the mass of material that needs

to be processed. Well known metallurgical techniques could be modified to make this approach potentially viable. Other inventors are proposing to use electromagnetic or fuel cell technologies to reduce the overall energy requirements for recovering shale oil. Raising capital and finding locations to test these concepts is the challenge facing these entrepreneurs.

Potatoes have been found to be a poor source of energy. A Modified Fischer Assay revealed that a potato yields about 3.5 gallons per ton of oil and 200 gallons per ton of water.

**The Bottom Line**

Over 90 percent of the nation's transportation fuels come from petroleum, and it will be decades before the United States can move away from petroleum as the primary source of gasoline, jet fuel and diesel.



The nation needs domestic energy supplies to overcome the geopolitical implications of importing so much petroleum. Oil shale is a domestic resource that can assist in providing the bridge to a society much less reliant on foreign supplies of energy. It can also play a significant role in providing a secure supply of military fuels. Oil shale alone is not the silver bullet that can solve the long-term energy security needs of the nation, but it can play a major role, and should be a key element in the nation's energy policy.

**Note:** *The opinions stated by the author are his alone and not those of any of the firms mentioned, the National Oil Shale Association, or its members.*

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