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**THIS TEST SITE** at the Mahogany Research project for oil shale production was photographed in 2005 in the Piceance Basin. Shown is Kenneth Brown, manager of Colorado operations for Shell Exploration and Production at that time.

**DEAN HUMPHREY**  
The Daily Sentinel

## SHALE: France, Brazil, Japan want to take part

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Even China has taken an interest in the potential riches of oil shale in general, and specifically those in western Colorado.

AuraSource, an Arizona-based, publicly held company, wants one of the BLM's 160-acre research parcels, so it can test technology patented by the Chinese government and originally used with coal.

AuraSource has an exclusive license for the method pioneered by the Energy and Environmental Research Institute of Heilongjiang, a Chinese government-owned energy research institute. The institute is affiliated with the China Chemical Economic Cooperation Center.

According to company statements, the technology allows for the extraction of clean fuel, such as lightweight fuel oil and oil dry gas, from oil shale by low temperature catalyzing.

"With oil shale and low-rank coal being so prevalent

*Other companies are hoping to free the petroleum-like substance using microwaves.*

worldwide, this technology will increase yields dramatically while reducing the resultant wastewater, air pollution and residual pollution," AuraSource Chief Executive Officer Philip Liu said in a statement.

Other companies are hoping to free the petroleum-like substance from the rock using microwaves, and a company in Utah is mining and heating shale in a retort to release petroleum.

Research into oil shale went into obscurity, but not dormancy, after the collapse of the shale-based economy in 1982.

Major oil companies, notably Shell and ExxonMobil, however, continued to experiment with ways to tease oil from the rock on lands they owned.

Six leases of 160-acre parcels were awarded in Colorado and Utah after the research program for federal lands was established in the 2005 Energy Policy Act.

Interior Secretary Ken Salazar earlier this year announced a second round of research leases to be issued after they are reviewed by officials from three federal agencies and the states of Colorado, Utah and Wyoming.

Leases will be awarded on the potential of proposals to advance knowledge of effective technology, their economic viability and the effects of development on the environment.

The economic heft of oil shale hardly can be overstated.

"If low-cost shale oil production methods can be achieved, direct economic profits in the \$20-billion-per-year range are possible for an oil shale industry producing 3 million barrels per day," the RAND Corp. said in its 2005 analysis.

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## TESTING: Horizontal drilling instead of vertical drilling limits amount of surface disturbance

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That heat would be contained within the rock and couldn't be detected from several thousand feet above on the surface, McGinn said.

The process the company envisions calls for the use of horizontal drilling instead of vertical drilling to limit the amount of surface disturbance, McGinn said.

Assuming that the process works on a large scale, ExxonMobil sees tantalizing prospects for shale: up to 162,000 barrels of oil per surface acre at a 50 percent recovery rate.

The results suggest a 3-to-1 ratio of energy recovered over energy expended to obtain it, McGinn said.

The Green River Formation in western Colorado, eastern Utah and Wyoming is believed to contain the equivalent of as many as 2 trillion barrels of oil.

Even under the most optimistic of scenarios, ExxonMobil sees no production coming from oil shale for 10 to 24 years, McGinn said.

That leaves plenty of time for the company to plan what would be an extensive network needed to generate the electricity necessary to heat the shale, collect the kerogen and begin moving it to refineries and then to markets.

Exxon can use some of the natural gas it's drilling on the Piceance Basin to supply the electricity needed to collect the kerogen, McGinn said.

It appears ExxonMobil can make its process work using about 1.5 barrels of water for each barrel of oil produced, he said.

To place that in some perspective, production of 500,000 barrels a day, "and that would

## Utah firm plans to 'roast' oil shale

By GARY HARMON  
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A Utah company hopes to coax petroleum from oil shale as soon as 2013, possibly even 2012, by digging up the rock, lining the pit with heating tubes, replacing the rock and firing up the pipes.

The company, Red Leaf Resources, is gearing up to produce petroleum from shale on state land in Utah and now is trying to raise money to put together a commercial demonstration project.

Once it has the investors, "We believe we can do that from the time of permitting to construction in 18 to 24 months," said Laura Nelson, vice president of energy and environment for Red Leaf.

Once all its pieces are in place, the company expects to "roast" the shale for three months to bring it to the point it gives up the hydrocarbon trapped within, Nelson said. That's far shorter than the yearslong heating period anticipated by many of the companies working on in situ approaches that would

leave the shale undisturbed deep below the surface.

Red Leaf Resources "EcoShale in-capsule" process will be 92 percent efficient in coaxing the petroleum from the rock and use little water, about one barrel for every five barrels of high-quality oil it produces, Nelson said.

Natural gas also will be freed from the shale and used to heat the rods, Nelson said.

"We'll be energy self-sufficient after the first cell," she said.

At full production of 30,000 barrels a day, Red Leaf Resources can deliver its product for \$20.21 per barrel, not including transportation, the company said.

While Red Leaf Resources has an ownership share in a small refinery in Green River, Utah, it's not looking to become a major refiner, preferring to own the resource and technology needed to collect the hydrocarbons.

be huge," would require about 3,500 acre-feet per year of water, McGinn said.

About 14 million acre-feet of water on average run through the Upper Colorado River basin. ExxonMobil has yet to

study the economic and social implications of development, McGinn said.

"We're talking about research and development," he said. "We're not in the project-planning mode."

## Chinese technology considered

By GARY HARMON  
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An Arizona company is aiming to use technology tested on coal in China to draw kerogen from oil shale in Colorado and send fuel to markets around the globe.

The company, AuraSource Inc., also plans to build a refinery capable of processing as many as 1 million tons of oil shale a year, possibly in eastern Utah or western Colorado.

Both areas, as well as others, are under consideration, AuraSource Chief Financial Officer Eric Stoppenhagen said in a statement to The Daily Sentinel.

AuraSource is traded over the counter as ARAO, and it owns the exclusive license to use technol-

ogy patented in China on low-grade coal.

"AuraSource's ability to secure high-grade oil shale resource together with its strategic location for processing oil shale puts it in a very unique position to utilize our technology," Cao Zhide, president of the Energy and Environmental Research Institute of Heilongjiang, said in a statement issued when the 20-year license was granted. "We look forward to a long-term cooperation between our Chinese and U.S. companies."

AuraSource will apply to participate in the second round of leases of 160-acre research, development and demonstration tracts on shale land in western Colorado and eastern Utah.

The process uses what the

company calls an "economical and highly efficient low temperature catalytic process to convert oil shale, bitumen or low-rank coal to oil, gas and semi-coke."

AuraSource, which has tested its process with shale in China, uses a surface-retorting process, Stoppenhagen said.

"We enter in a catalyst to enable processing of oil shale to occur at a much lower temperature than competing technologies," Stoppenhagen said.

"The other technologies have required much higher temperatures in which the kerogen in oil shale is converted into synthetic crude oil. The higher temperatures make these other technologies more costly and less efficient."

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