RedLeaf Resources Ecoshale Project
Overview
DEER 2008
Energy demand is exploding but “renewable energy” can’t fill gap.
Existing conventional oil production is “peaking”
Lower extraction costs and demand have accelerated unconventional oil sands.
• **Unconventional Hydrocarbons - The hidden opportunity**, oil industry consultancy **Wood Mackenzie**:

“by 2025 unconventional oil is expected to supply more than 20% of global demand.”
Canada’s **UNCONVENTIONAL** climb to the top of world oil reserves.

![Bar chart showing oil reserves by country](chart.png)

**Global Crude Oil Reserves by Country**

Canada, with 175 billion barrels in Oil Sands reserves, ranks 2nd only to Saudi Arabia in global oil reserves.

175 billion bbls = 5MMBOPD for 96 yrs!

*Source: Oil & Gas Journal Dec. 2004*
American oil shale dwarfs all other oil shale reserves – worldwide.
Quality of USA Oil Shale is superior to Canadian oil sands crude.

### Economics of Tar Sand vs. Oil Shale

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Athabasca tar sand</th>
<th>Green River oil shale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade (richness)</td>
<td>25 gal bitumen/ton</td>
<td>30 gal kerogen oil/ton</td>
</tr>
<tr>
<td>Hydrogen content (tar sand bitumen/kerogen oil)</td>
<td>10.5 wt %</td>
<td>11.8 wt %</td>
</tr>
<tr>
<td>Nitrogen and sulfur requiring removal</td>
<td>6.2 wt % (mostly sulfur)</td>
<td>4.0 wt % (mostly nitrogen)</td>
</tr>
<tr>
<td>Loss of liquids to coke and gas</td>
<td>40 lb/ton-ore</td>
<td>11.6 lb/ton-ore</td>
</tr>
<tr>
<td>Net yield of oil</td>
<td>0.53 bbl/ton processed</td>
<td>0.73 bbl/ton processed</td>
</tr>
<tr>
<td>Quality of oil</td>
<td>34° API</td>
<td>38° API</td>
</tr>
</tbody>
</table>
BLM: 800 billion barrels recoverable oil in Utah, Colorado & Wyoming.
Red Leaf controls oil shale leases containing approximately **800 Million to 1.5 billion barrels of oil** on Utah state lands – about 16,500 acres.
First 60 feet down average: 20 gpt

- Down to 63’ feet there are an average of 58,830,000 million barrels of oil per square mile.
- $3.529 billion per square mile at $60 average oil price.
- 19.91 GPT / Ton
Surface Retorts

Lawrence Livermore Laboratory Retort

Parahoe Retort

Oil Tech Retort
Retort Problems

- **High co2** output
- **Costly steel** fabrication
- **Clogging** of retort
- **Handling shale** twice
- Spent shale **tailings**
- Low scalability -- “pin hole” capacity
- High **CAPEX**
Shell’s New ICP Process

Oil Shale Development Concept
Freeze Wall Concept
Better Feedstock For Upgrading

Shell In Situ Pyrolysis

45 API Gravity

19 API Gravity

Surface Retort Pyrolysis

SHALE OIL EXAMPLE

Naphtha - 30%
Jet - 30%
Diesel - 30%
Resid - 10%

800°C Surface Retort

Tar Like Solid

350°C In Situ

Weight %

Carbon Number

0 5 10 15 20 25 30 35 40 45 50 100 120
EcoShale Process
In-Capsule Extraction
Patent - Pending

- High Volume & Scalable
- Protects surface water
- Protects aquifers
- Reduces Co2 (Pyrolysis instead of combustion)
- Amenable for Carbon Sequestration
- Produces Higher Quality API
- Reclaims Surface
- Uses Standard Mining Equipment
- Avoids Steel & Welding
- Impounds Spent Shale to EPA Standards
EcoShale Process
In-Capsule Recovery & Reclamation
Step 1. Prepare the Capsule in quarry and add Bentonite permeability barrier
Step 4. Pipes to distribute gas heat are placed in-capsule.
Natural gas or propane fires a burner to heat CSP embedded in the capsule. Oil shale is produced.
EcoShale Process
In-Capsule Hydrocarbon Recovery

- Continuous mining reclamation
- Ground water protection
- Surface water protection
- Approximate topography restoration