Oil Shale and Tar Sand Resources
Resources vs. Reserves

• Resources
  – Naturally occurring concentrations or deposits of a mineral resource in the earth's crust, in such forms and amounts that economic extraction is currently or potentially feasible

• Reserves
  – Parts of the resource base which could be economically extracted or produced at the time of determination considering environmental, legal, and technologic constraints
Oil Shale

• Definition: fine-grained sedimentary rocks containing relatively large amounts of organic matter from which significant amounts of shale oil and combustible gas can be extracted by destructive distillation.

• Generally considered to be oil and gas “source material” or an immature oil and gas deposit
FIGURE 5.57. (a) Oil shale deposits in the United States. (b) The major oil shale deposits in the Green River formation of Wyoming.
GEOLOGY OF THE MAHOGANY OIL SHALE ZONE, UINTA BASIN

Line showing thickness, in feet, of a continuous sequence of oil shale containing 25 or more gallons per ton.

Outcrop of Mahogany Zone
Oil Shale Resources

- U.S. Primary Resources in Green River Formation in Wyoming, Utah, and Colorado
- Green River Formation estimated to contain over 2 trillion barrels of oil
- Equivalent to 1 to 2 times total world oil reserves
Impediments to Oil Shale Development

• Economic
  – Current Costs > $60 per barrel

• Environmental
  – Global warming and greenhouse gas emissions
  – Disposal of spent shale
  – Process requires water

• Regulatory
  – U.S. presently has no regulations to lease oil shale
Tar Sands

- Definition: A type of oil sand or sandstone from which the lighter fractions of crude oil have escaped, leaving a residual asphalt to fill the interstices
# Utah Tar Sand
## Estimated In-Place Resources

<table>
<thead>
<tr>
<th>Deposit</th>
<th>Known (MMB)</th>
<th>Additional Projected (MMB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sunnyside</td>
<td>4,400</td>
<td>1,700</td>
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<tr>
<td>Tar Sand Triangle</td>
<td>2,500</td>
<td>420</td>
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<tr>
<td>PR Spring</td>
<td>2,140</td>
<td>2,230</td>
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<tr>
<td>Asphalt Ridge</td>
<td>820</td>
<td>310</td>
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<tr>
<td>Circle Cliffs</td>
<td>590</td>
<td>1,140</td>
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<tr>
<td>Other</td>
<td>1,410</td>
<td>1,530</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td><strong>11,860</strong></td>
<td><strong>7,330</strong></td>
</tr>
</tbody>
</table>
Impediments to Tar Sand Development

• Economics – cost to mine and produce more expensive than conventional oil production
• Some of same environmental concerns as oil shale
• Federal deposits previously leased with oil and gas as Combined Hydrocarbon Leases