API Oil Shale Subcommittee Education and Outreach Activities

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Presentation to the Consumer Energy Alliance

November 18, 2010

API Oil Shale Subcommittee
NOVEMBER 2010

Recently reorganized from the U.S. Oil Shale Task Force

Developed through the American Petroleum Institute Committee Structure

Members

- American Shale Oil (AMSO)
- ExxonMobil
- Oil Shale Exploration Company (OSEC)
- Red Leaf Resources
- Shell
- ConocoPhillips
- Chevron

U.S. OIL SHALE:
OUR ENERGY RESOURCE, OUR ENERGY SECURITY, OUR CHOICE

Goals

- Educate policymakers, energy consumers, etc., about the oil shale resource and its potential to contribute to national energy security;
- Promote vigorous administration of existing federal law enacted to promote research and development of domestic oil shale;
- Advocate for legislation and regulation that will provide a framework for responsible oil shale production;
- Identify advancements within the industry that support deployment of long-term sustainable development of domestic oil shale resources; and
- Encourage efforts to clarify appropriate oil shale deposits as proven reserves.

Challenges

- Fulfillment of Section 369 of the Energy Policy Act of 2005 (EPACT '05) in the Congress and Administration;
- Develop Congressional support for oil shale to implement pro-active legislative and regulatory strategies;

Section 369 of EPACT 2005 - Declaration of Policy. – Congress declares that it is the policy of the United States that

- *United States oil shale, tar sands, and other unconventional fuels are strategically important resources that should be developed to reduce the growing dependence of the United States on politically and economically unstable sources of foreign oil imports;*
- *The development of oil shale, tar sands, and other strategic unconventional fuels, for research and commercial development, should be conducted in an environmentally sound manner, using practices that minimize impacts; and*
- *Development of those strategic unconventional fuels should occur, with an emphasis on sustainability, to benefit the United States while taking into account affected States and communities.*

Two years later, the Federal Task Force created by the Act to study and implement this policy drew the following conclusions:

- *The Task Force concurs that the domestic and global fuels supply situation and outlook is urgent. Increasing global oil demand, declining reserve additions, and our increasing reliance on oil and product imports from unstable foreign sources require the Nation to take immediate action to catalyze a domestic unconventional fuels industry (emphasis added).*

Key Accomplishments

- API has developed oil shale informational briefs representing industry consensus and establishing metrics on issues impacting oil shale development such as water use, air quality, technology, and the challenges and solutions for mitigating undesirable economic and social impacts on communities.
- This information has been used to provide industry input into public policy and public discourse on oil shale including:

Key Accomplishments

- Comments to the U.S. BLM on the 2nd Round of oil shale R, D, and D Leasing;
- Comments to the State of Utah on the Utah 10-Year Strategic Energy Plan;
- Oil Shale Section on API website; and (http://www.api.org/aboutoilgas/oilshale/index.cfm)
- Various op-eds and articles on oil shale in newspapers and blogs at the regional and local level.

Current Projects

- API is facilitating on-going domestic and international efforts on oil shale development including meetings at the executive level, development of clear industry objectives, and advocacy as part of the 2010-11 goals.
- October 2010 – Presentation at the 30th Annual Oil Shale Symposium at the Colorado School of Mines
- November 2010 – Subcommittee will host a meeting of the Consumer Energy Alliance (members include air transport, trucking, courier, manufacturing, agriculture, petrochemical and fertilizer industries) for a presentation on oil shale resource and technologies.

Future Work Planned

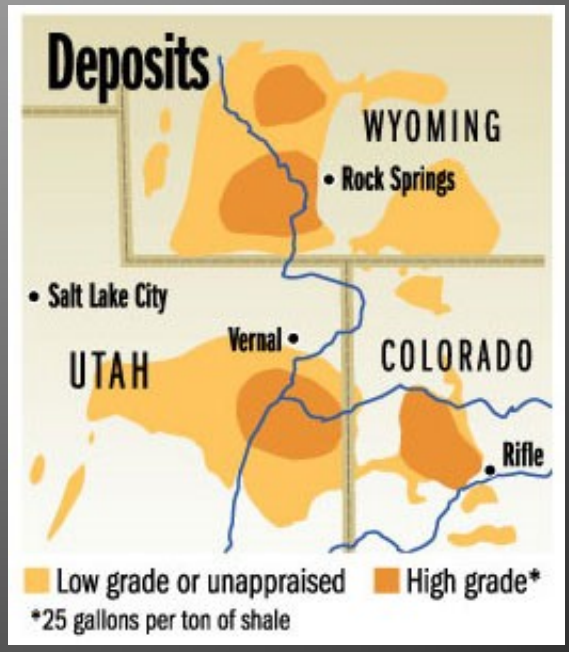
- Summer 2011 (est.) – API is working to develop a forum exploring Section 369 and a national oil shale/unconventional fuels technology with a major Think-Tank or university

U.S. OIL SHALE:
OUR ENERGY RESOURCE, OUR ENERGY SECURITY, OUR CHOICE

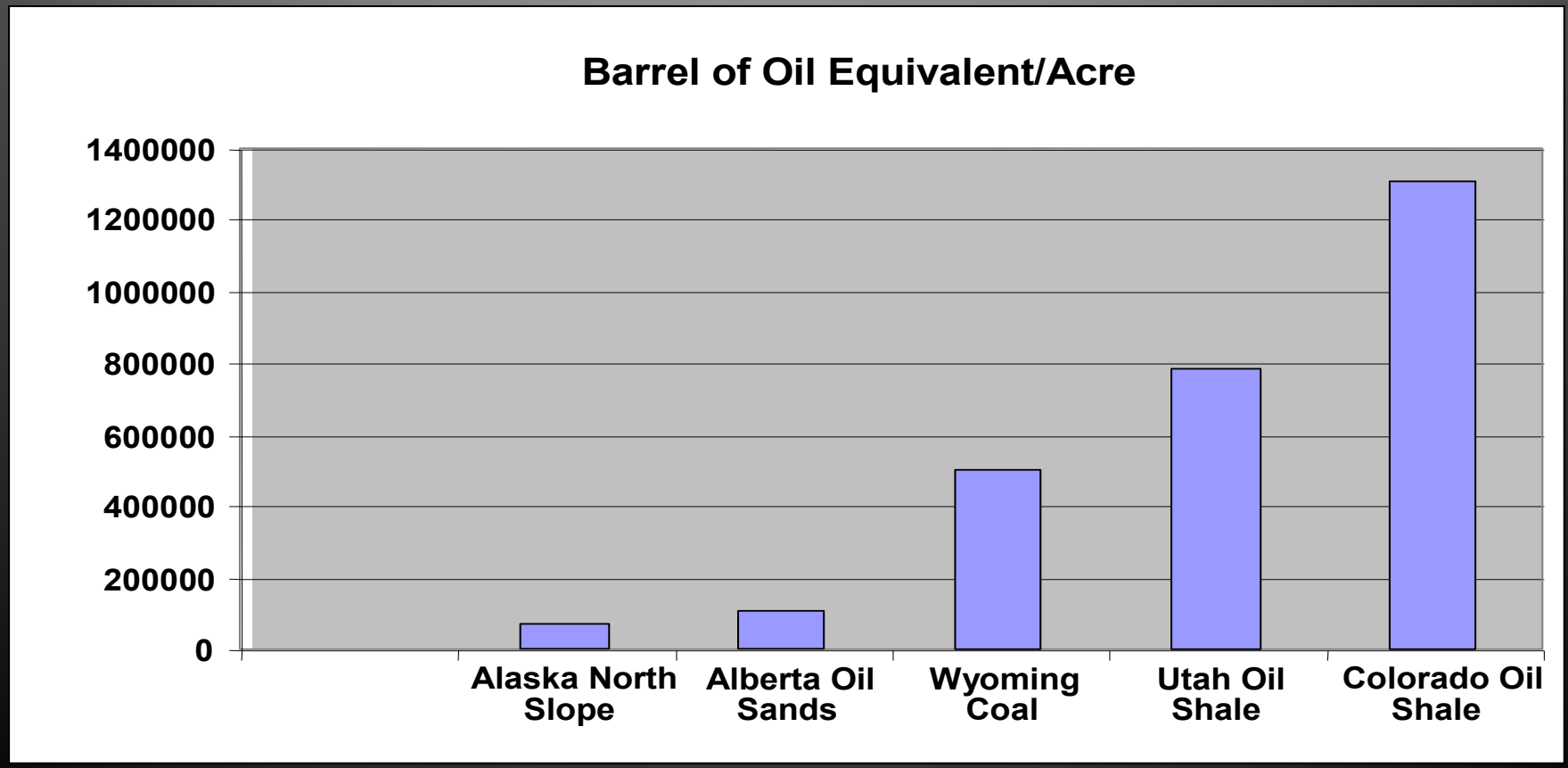
World Class Resource

- Located in Colorado, Wyoming & Utah, recoverable oil estimated at more than 800 billion bbls

3X proven reserves of Saudi Arabia



Energy Density of Selected Resources



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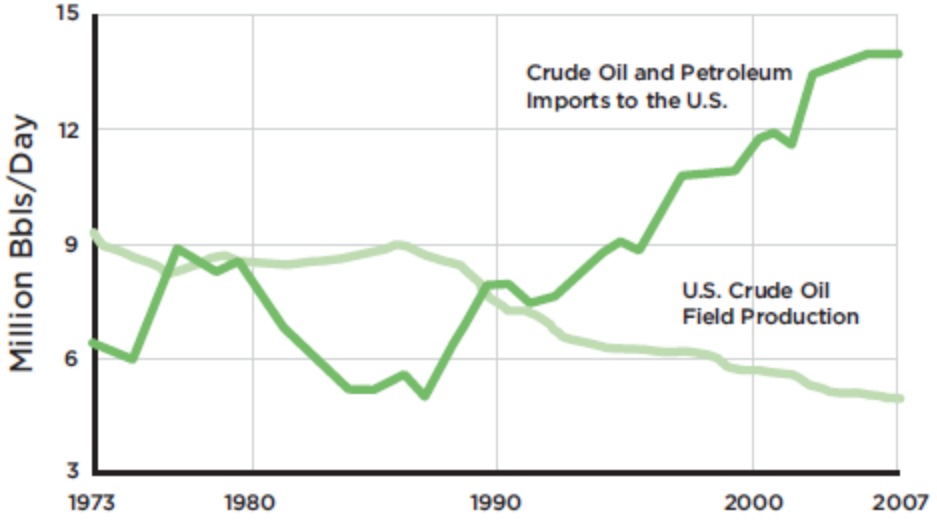
U.S. OIL SHALE:
OUR ECONOMY AND OUR JOBS

- Today, US gross imports comprise more than two-thirds of our transportation fuel supply
- In 2008, the price tag on petroleum-related products was $342 billion or 44% of the total US trade deficit of $764 billion

Figure 3. U.S. oil production and imports.



U.S. oil production has been on the decline since the mid-1980s, while imports have risen dramatically.[4]

U.S. OIL SHALE:
OUR ECONOMY AND OUR JOBS

- Oil shale production could help reduce the trade deficit through increased energy production
- Over an extended time a new oil shale industry could create up to 100,000 new jobs and contribute $1.9 trillion to the US GDP.**

**"Task Force on Unconventional Fuels....U.S. Task Force on Unconventional Fuels - Volume I – Preparation Strategy, Plan, and Recommendations" February 2007

Figure 1. Value of U.S. Imports of Energy-Related Petroleum Products

From 2007 to 2008, the average value of crude oil imports rose by 74%.[5]

Environmental Issues

- The Oil Shale industry is committed to environmentally responsible oil shale development including:
  - Reducing energy usage, carbon emissions & water consumption
  - Protecting ground water & surface water resources
  - Reducing surface disturbances & protecting wildlife resources

Water Issues: How Much Water?

- Water use is estimated at 1 to 3 barrels or less of water per barrel of oil produced
  - Based on experience from current oil shale pilot projects & ongoing development of oil shale technologies
- As technology & industry research efforts mature, water needs will decrease with increases in efficiency

Water Issues: Where Will the Water Come From?

- Potential oil shale developers are committed to minimizing the burden on water supplies
- One alternative source of process water is non-potable water produced from existing oil & gas wells in the area
- Another source for water is the oil shale itself:
  - Western oil shale has high water content with .25 barrels of water produced per barrel of shale oil

Oil Shale Subcommittee Company Technologies

- AMSO
- ExxonMobil
- Oil Shale Exploration
- Shell
- Red Leaf
- ConocoPhillips
- Chevron

Technologies

- Both *surface processing* and *in-situ* technologies have been conceived, developed and tested in the laboratory, field tested at pilot and semi-works scale, or demonstrated at commercially represented scale in demonstration plants

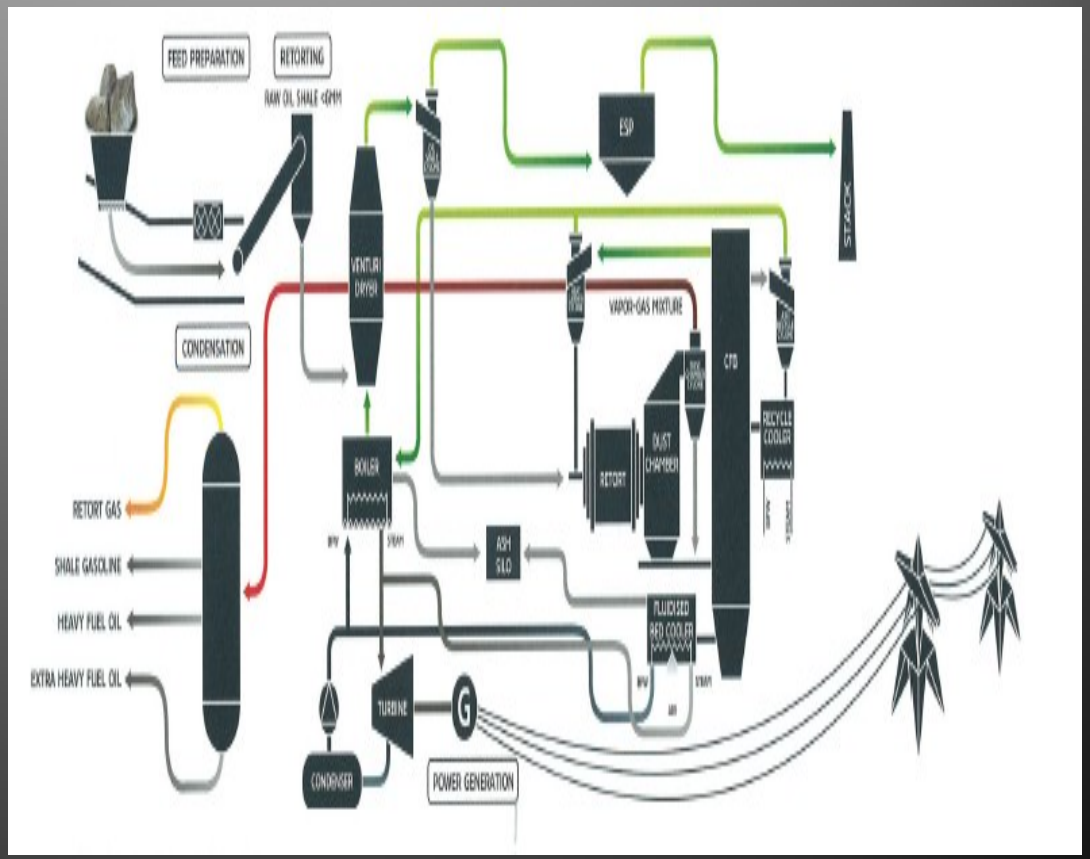
Surface Processing consists of 3 Major Steps:

- Oil Shale mining and oil preparation;
- Pyrolysis of oil shale to produce kerogen oil; and
- Processing kerogen oil to produce refinery feedstock and high-value chemicals

Surface Processing Technology

- ENEFIT Process – Estonian company and one of the more active players in oil shale technology.

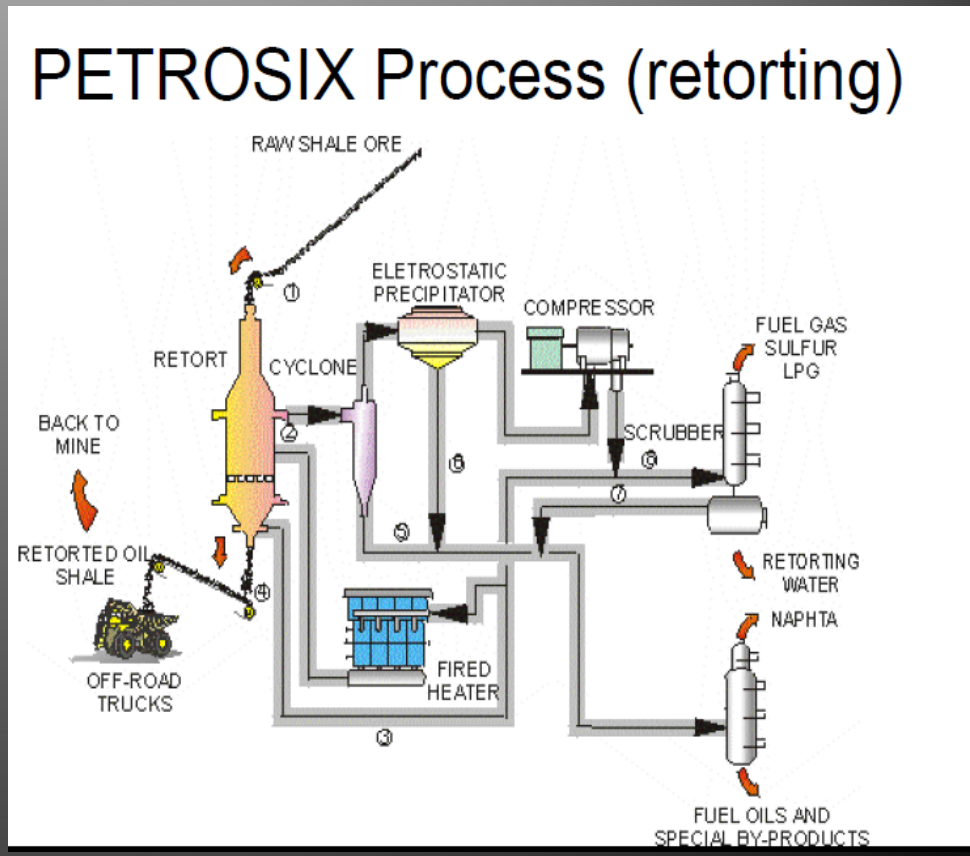
- Production is at 1.85 million bbl/year of shale oil; retort gas: 75 million; m^3/year; Electricity: 35 MWe by steam turbine



Surface Processing Technology

PETROSIX Process - Currently the world's largest surface oil shale pyrolysis retort with an 11 meters (36 ft) diameter vertical shaft kiln, operational since 1992

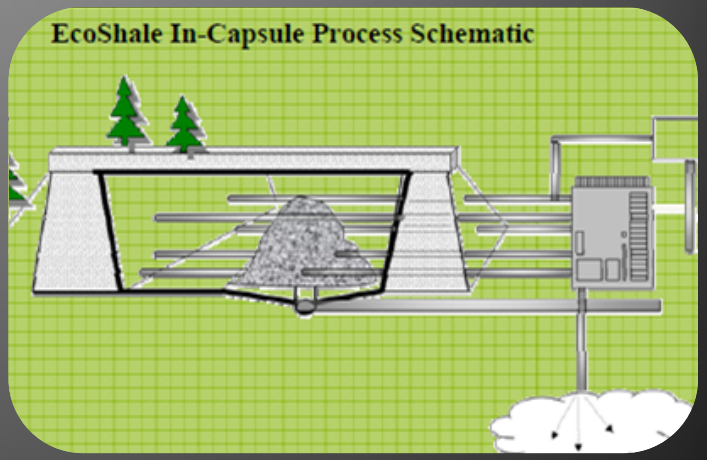
•6,200 tons of oil shale per day, and it yields a nominal daily output of 3,870 barrels of shale oil (1,412,550 bbls/year), 132 tons of shale gas, 50 tons of liquefied oil shale gas, and 82 tons of sulfur



Surface Processing Technology

Surface Extraction Process Technology

- EcoShale In-Capsule Process - Employs a low cost earthen impoundment structure to contain a high temperature treatment zone
- Benefits: extraction without water, rapid reclamation mining, protects surface & ground water, has no emissions, contains depleted shale, no aquifer interaction, & produces high quality oil/refinery feedstock

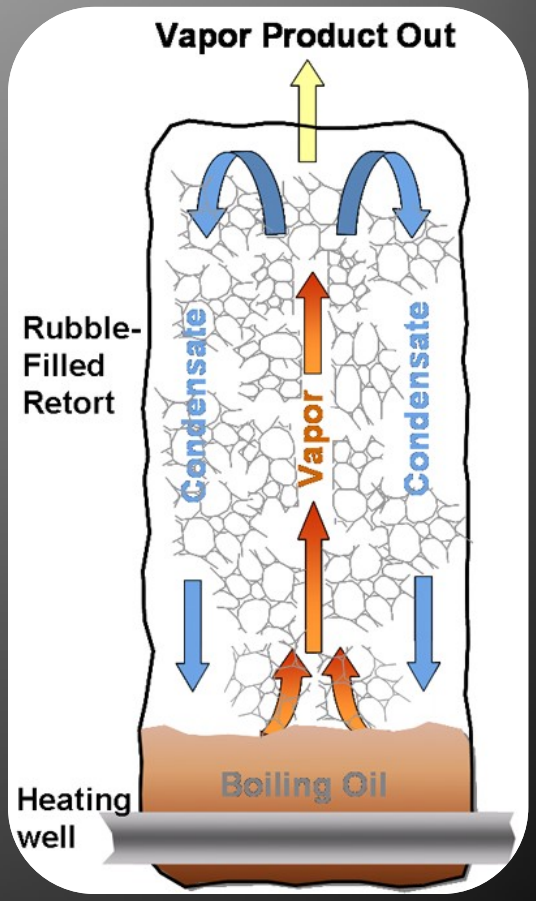


In-situ technology

- For deeper, thicker deposits, the kerogen oil can be produced by in-situ technology by heating the resource in its natural depositional setting

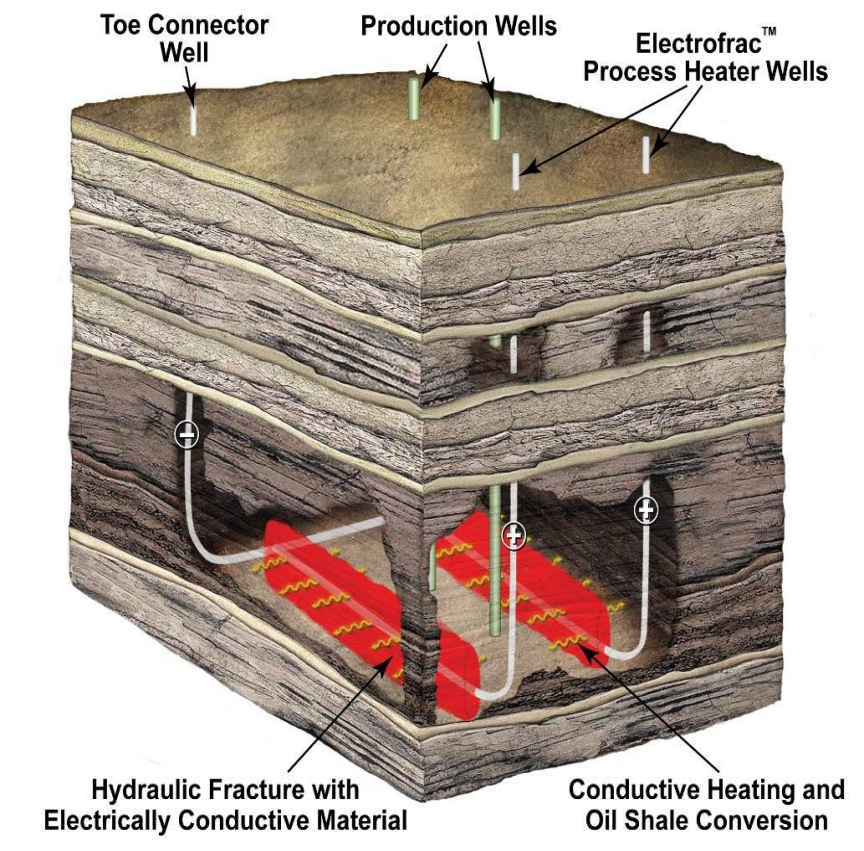
In-Situ Technology

- CCR Process - Patent pending in-situ convection, condensation, and reflux (CCR) technology to recover shale oil from the clay-rich illitic shale below the aquifers to protect water resources.
- Benefits: creates minimal surface disturbance, uses less than one barrel of water per barrel of oil & will use minimal imported energy



In-Situ Technology

- Electrofrac process – designed to heat oil shale in situ by creating hydraulic fractures with an electric conductive material
- Electricity is conducted from one end of the fracture to the other, making the fracture a resistive heating element.



In-Situ Technology

- Freeze Wall - In situ Conversion Process generates more oil & gas from a smaller surface pad area than previous oil shale processes
- Technique inserts heaters underground to convert kerogen in oil shale into high quality transportation fuels and using a frozen underground barrier to protect groundwater

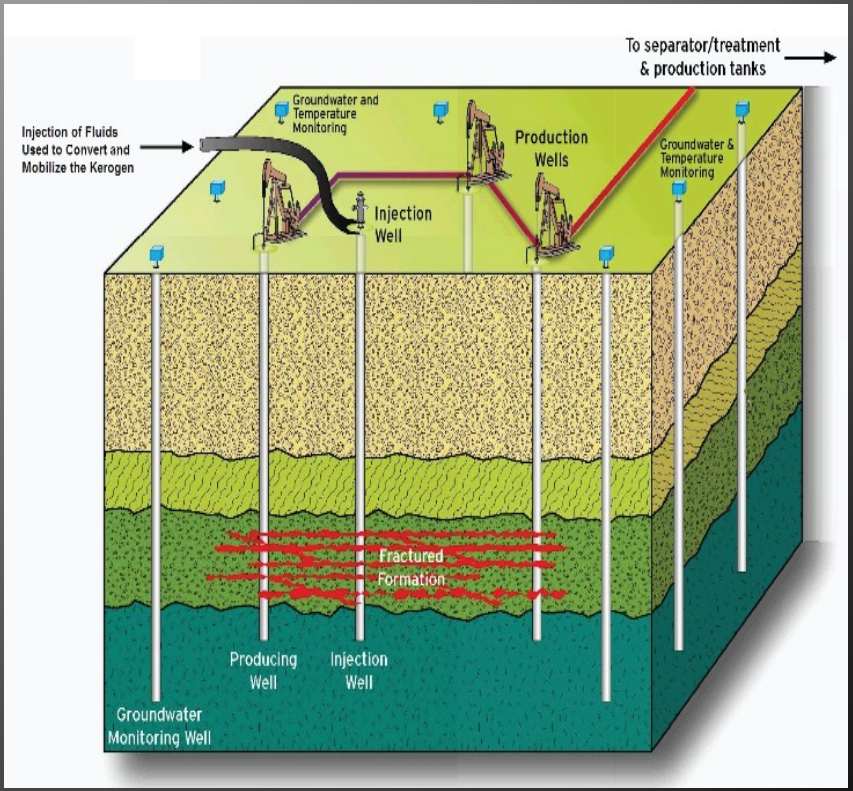
Figure 1.
Freeze wall schematic.

The Freeze Wall Test, located on a 25-acre parcel of Shell's private property in Rio Blanco County, Colorado, is an environmental study to demonstrate groundwater can be kept out of subsurface production areas using a frozen, underground barrier.

Courtesy of Shell Oil

In-Situ Technology

- Low-temp, low-water use *in situ* recovery technique
- Involves the application of a series of fracturing technologies to rubblize the formation to enhance the surface area of kerogen
- The exposed kerogen in the fractured area is then converted to oil and gas through chemistry



Any Questions?

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