

Status and Importance of Oil Shale*

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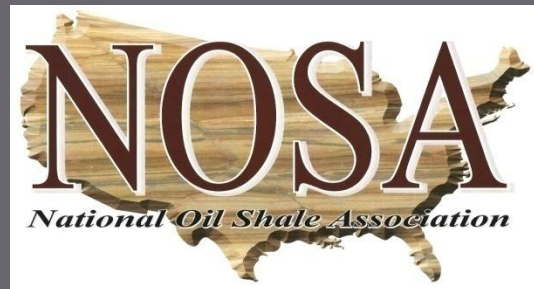
Abstract

Significant progress has been made in oil shale research and development in the United States during the past year. Similar advances have been made outside U.S. borders. Technologies for ex-situ and in-situ processes are much more advanced than those anticipated for use and tested in the 1970 – 1980 era. The approach to project development is entirely different than the rush to commercialization of the last boom. There are significant challenges facing a developer hoping to move toward building a commercial oil shale project in the United States. Technology risk is one challenge. In-situ technologies have not yet been tested at a scale that provides adequate confidence to design a commercial project. Ex-situ technologies commercialized abroad have advanced beyond the experimental stage, but still need to be demonstrated using U.S. oil shale. Companies are investing in their proprietary technologies without U.S. government funding to solve these technical problems. Technology development is not the most significant challenge. The lack of a consistent U.S. Federal policy for oil shale leasing and regulation, similar to what already exists for other minerals and oil & gas, is restraining long-term investment in the development of the resource. States that have oil shale resources also have differing policies toward oil shale development. The federal government has the most and best oil shale resource, so it has a unique and vested interest to help facilitate an orderly development of an industry that can reduce the nation's dependence upon overseas oil supplies. Unfortunately, current Federal policies are not favorable for the commercial leasing of oil shale lands or its development as a domestic energy source.

STATUS AND IMPORTANCE OF OIL SHALE

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Presentation Outline



Colorado Oil Shale Outcrop

The opinions voiced during this presentation are those of the author and do not necessarily reflect the opinions of the companies discussed or of individual NOSA's members. The facts presented resulted from significant research into each topic.

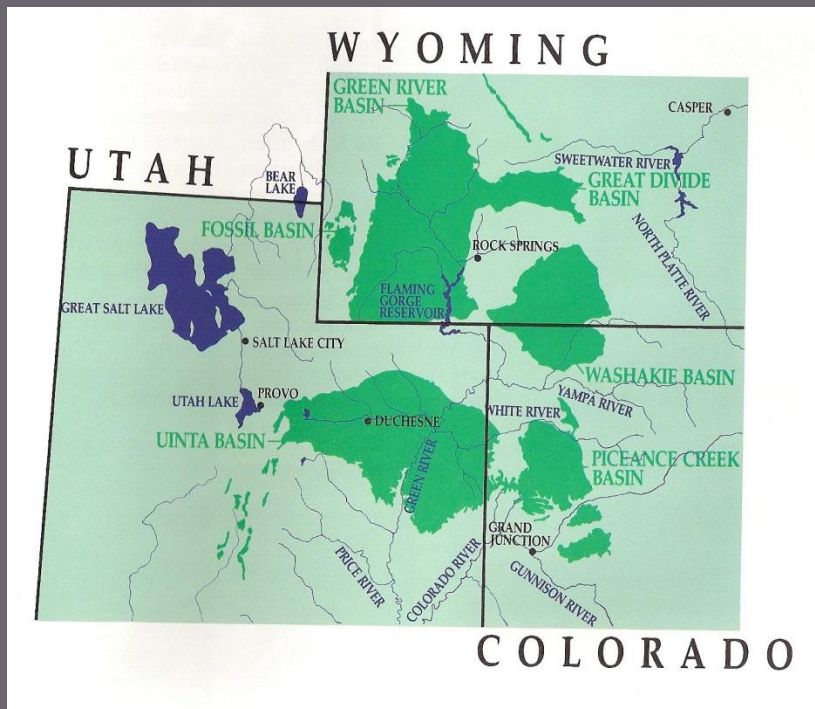
QUESTIONS TO BE ANSWERED

- ▣ What oil shale are we talking about and who owns most of it?
- ▣ Why is oil shale an important domestic energy resource?
- ▣ Why is BLM not leasing oil shale like other minerals?
- ▣ Who are the key player and what is going on with industry and government?
- ▣ What are facts and what are myths about oil shale?
- ▣ What happens next ?

WHAT IS OIL SHALE?

Oil Shale is a resource that produces petroleum-based fuels. It is found in many places in the world but the largest deposits are found in the United States. The three states of Colorado, Utah and Wyoming contain an amount of shale oil that is comparable with the conventional oil reserves in the Middle East.

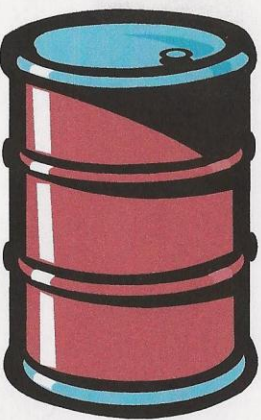
The hydrocarbon in oil shale is a solid, and is immature kerogen.



Oil shale to be discussed in this presentation is not the oil/gas from source rocks now being developed around the country, and the world – that we prefer to call Tight Oil or Liquid Rich Shale and Shale Gas

BLM controls 70% of the Resource

World Oil Shale Resources



1. Green River Formation
 >3,000,000 million barrels
 Tertiary, lacustrine

11. Canada
 15,241 million barrels
 Ordovician-Devonian, marine
 Carboniferous, lacustrine
 Mesozoic, marine

13. Sweden
 6,114 million barrels
 Cambrian-Ordovician, marine

10. Estonia
 16,286 million barrels
 Ordovician, marine

4. Russia
 270,944 million barrels
 Ordovician-Jurassic, marine

15. Ukraine
 4,193 million barrels

16. Kazakhstan
 2,837 million barrels

3. China
 328,000 million barrels
 Primarily Tertiary, lacustrine

12. Thailand
 6,401 million barrels
 Tertiary, lacustrine

9. Australia
 24,000 million barrels
 Cretaceous, marine
 Tertiary, lacustrine

2. Other United States
 619,000 million barrels
 Eastern Devonian, Phosphoria,
 Heath
 Devonian-Permian, marine

8. Morocco
 37,800 million barrels
 Cretaceous, marine

17. Turkey
 1,985 million barrels
 Tertiary, lacustrine

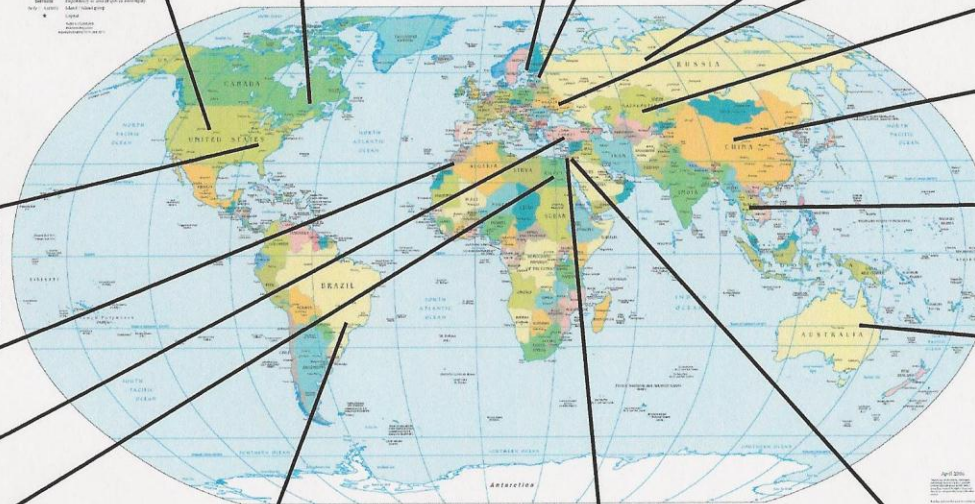
14. Egypt
 5,700 million barrels
 Cretaceous, marine

7. Brazil
 80,000 million barrels
 Permian, lacustrine or marine
 Tertiary, lacustrine

5. Israel
 250,000 million barrels
 Cretaceous, marine

6. Jordan
 102,000 million barrels
 Cretaceous, marine

Political Map of the World, April 2006



Data Source: J. R. Dyni, Geology and Resources of Some World Oil-Shale Deposits, (2006) U. S. Geological Survey Scientific Investigation Report 2005-5294, U. S. Geological Survey, Reston VA

Updates from 26th through 30th Oil Shale Symposia, Colorado School of Mines

How is Oil Shale Processed?



Enefit oil shale plant in Estonia
Circa 2010
Photo courtesy Enefit

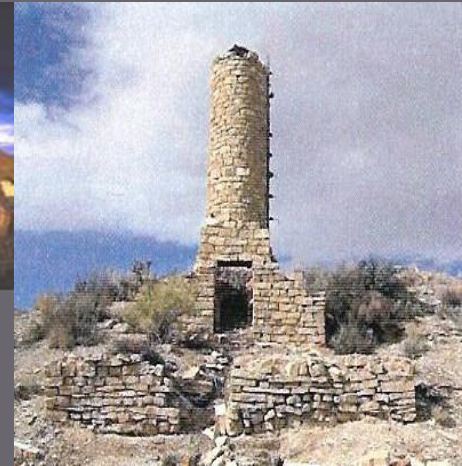
- ▣ Oil shale must be heated to from 600 to 900 deg F to recover shale oil and gas. (pyrolysis)
- ▣ It cannot be pumped directly from the ground like conventional oil and gas
- ▣ There are two basic method for recovery
 - Ex-situ processing
 - In-situ processing
- ▣ R&D into more economic and environmentally acceptable technologies are underway in Colorado and Utah
- ▣ Cost estimates - \$40 to \$80/Bbl

U.S. Oil Shale History

- ❑ 1917-20 prospecting boom
 - Placer claimable deposit
 - Changed to leasable
- ❑ 1930's leasing withdrawal
 - Tea Pot Dome scandal
 - 1952 rescinded, but...
- ❑ 1970's major gov't push
 - Syn-Fuels Corp
 - \$\$\$\$ spent by industry
 - Prototype leases issued
- ❑ 1980's The Exodus
- ❑ Very little activity until 2005 Energy Policy Act



Scotland 1850's to 1930's



Old Utah Retort 1920's



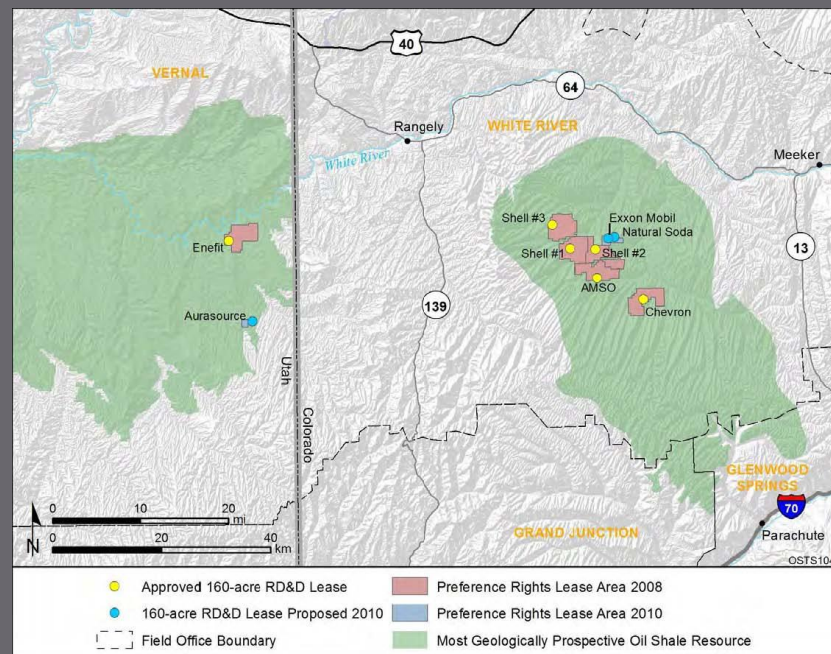
Anvil Points Mine 1940's



Cb Tract 1979

U.S. Government Activities

- ▣ 2005 Energy Policy Act
 - Told BLM to lease oil shale
- ▣ BLM finalized PEIS and commercial oil shale leasing regulations in 2008
- ▣ DOI now revisiting oil shale PEIS and Regs
- ▣ Six 1st round BLM R,D&D Oil leases awarded in 2007 in CO and UT (20 applicants)
- ▣ Two 2nd round BLM R.D&D leases awarded Sep 2012 (3 applicants)



BLM R,D&D Lease Map - 2012

Major Oil Shale Developers

- Shell Mahogany¹
- AMSO¹
 - Genie & TOTAL
- ExxonMobil²
- Enefit American Oil¹
- Red Leaf Resources
- Shale Tech Int'l
- Natural Soda²
- ConocoPhillips & ERTL

1. 1st Round R,D&D Lease Holder
2. 2nd Round R,D&D Lease Holder



Paraho QERL oil shale plant in
Australia circa 2011
Photo courtesy Paraho

Challenges for Developers



AMSO In-situ pilot project
Flag Day – 2012
Photo by G. Vawter

- ▣ R,D&D risk and cost
- ▣ Public perceptions
 - Oil shale myths
 - Stigma from last boom & bust
 - Socioeconomic concerns
 - ▣ Public fear of rapid growth
- ▣ Environmental impacts
 - Particularly climate change
- ▣ Regulatory hurdles
 - Duplicative permitting steps
- ▣ Political factors
 - Inconsistent policies from one Administration to the next

Potential Benefits from Oil Shale

- ▣ Public sector revenue
 - Taxes, bonus payments, and royalties
 - Economic development
 - Infrastructure enhancement
- ▣ Sustainable industry
 - Long term employment
 - Educational growth
 - Skill development
- ▣ Secure domestic oil supply
 - Lower gasoline prices
 - Improved national security



Battlement Mesa, CO built by industry for oil shale population increase postulated in 1970's
Photo by G. Vawter circa 2010

Four Examples of Facts vs. Myths

- ▣ Oil shale does produce more energy than it uses
 - Estimates range from 3:1 to 6:1
- ▣ Oil shale is not an inferior energy resource
 - Higher hydrocarbon content than oil sands
- ▣ Water is available to support oil shale development
 - 120,000 AF/yr for 1.55 MMbbl/day shale oil
 - 2-3% of flow in Colorado River
 - Many developers have water rights
 - Additional storage desirable
- ▣ An oil shale industry will not cause extreme social impacts
 - An industry will develop incrementally using private investment.
 - An industry will meet all regulatory requirements.
 - An industry will provide economic benefits

What Happens Next?

- ▣ R,D&D will continue
 - Huge resource is the incentive
 - Projects are at different levels of development
 - ▣ 5 to 10 years before commercial plants operating
 - Development overseas may move faster
 - Developers will weigh risks with other investments
 - No boom and bust as before
 - ▣ No Federal push as seen in the 1970's
- ▣ Development is hampered by Federal policy
 - Policy changes from one administration to the next
 - Absence of commercial leasing program
- ▣ Oil shale is an important national energy resource
 - Needs to be part of a long term energy strategy

Contact Information

NOSA is a not-for-profit organization that stands for responsible development of oil shale to benefit the long term domestic energy needs of the nation.

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Members include 13 corporations, 2 non-profits and 25+ individuals

Video : Energy – Life Blood of our Society
Brochure: Oil Shale – America's Untapped Energy Source

