PRESENTER'S NOTES

OIL SHALE - AN UNTAPPED U.S. DOMESTIC ENERGY RESOURCE
PUBLIC PRESENTATION

National Oil Shale Association

Notes for Slide 1 "OIL SHALE AN UNTAPPED U.S. DOMESTIC ENERGY RESOURCE"
Point out that the presentation was developed by the National Oil Shale Association in 2012

Notes for slide 2 "Presentation Outline"
Read the slide
Point out the fine print disclaimer

Notes for slide 3 "What is oil shale?"

Read the slide

Kerogen is a solid hydrocarbon that resulted from animal and plant matter buried year after year in ancient lakes in the three states in the Eocene geologic era. Deposition in these ancient lakes went on for millions of year transforming the organic matter into kerogen in a rock matrix.

Point out that a typical oil shale contains some 25 gallons of oil per ton of oil shale rock (a cube 3x3x3 feet). It is a rich resource with more hydrocarbon content than a typical conventional oil reservoir or Canadian tar sand.

Show samples of oil shale, if available, and offer samples to the audience to keep. (NOSA can supply samples upon request)

Discuss the size of the resource and that it would last some 100-years supplying the US demand for petroleum.

Key Point: the Federal government thru BLM controls over 70% of the oil shale resource in the three states.

There is oil shale in the Eastern United States. It received considerable attention in the 1970's but there is no activity there now. The deposits are generally lower grade, and mostly privately owned.

Discuss the confusion about terminology. What is being discussed today is Oil Shale, and has had that name for over 100-years. But now you may hear the term oil shale applied to deposits where oil and/or gas exist in shale or shale like rocks. We prefer to call the latter Tight Oil and Shale Gas. The geologic origin of Tight Oil and Shale Gas is kerogen, as well as the oil shale discussed in this presentation. Kerogen in oil shale is immature kerogen and has not had the time and geologic conditions necessary to convert it naturally into petroleum and natural gas. It is therefore necessary for oil shale processing to speed up the process that has taken millions of years to occur naturally and resulted in Tight Oil and Shale Gas deposits now under development across the U.S and the world. The reason there is a big up-tick in the production of Tight Oil and Shale Gas is the evolution of technology for directional drilling and hydrologic fracturing. The existence of oil and gas in shale like deposits has been known for decades, but it was not economic to recover the oil and gas until these new technologies were perfected. The same thing is happening with oil shale.

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Notes for slide 4 "Three State oil shale map"

Point out the location of Western Oil Shale in Colorado, Utah and Wyoming on the map. The names of the basins are Piceance in Colorado, Uinta in Utah, and Green River & Washakie in Wyoming. The largest oil shale resource is in Colorado where the oil shale is 1000 ft. thick in the center of the basin and will average 1.5 million barrels of shale oil per acre of surface ground. Utah has the second largest resource of oil shale, and Wyoming last, but all huge energy resources.

Notes for slide 5 "World Oil Shale Map"

Point out that oil shale is a common mineral found in many places in the world, but the largest deposits are found in the United States. Significant deposits are also found in China, Australia, Jordan, Israel, Estonia, Brazil and Morocco. Recent interest in oil shale in Mongolia and other Asian countries.

Notes for slide 6 "U.S. Oil Shale History"

(This section is very long so the presenter may wish to use portions that are relevant to the audience.)

Oil shale processing started over a century ago in Europe. The industry in Scotland ran from the 1850's until the 1930's. The use of shale oil preceded the use of petroleum as a replacement for whale oil for lamp fuel. The Bings in the picture above are hills created by the emplacement of spent shale from that processing. It is now considered an improvement in the topography of the region.

The high price of oil and lack of large oil fields in the U.S. led to the first oil shale boom after World War I (WWI). Prospectors came to the West and staked placer claims on oil shale. Those claims are now the oil shale that is in private ownership in Colorado, Utah and Wyoming. Placer claims required a discovery of the mineral on the surface (like gold in a stream bed). As a result the prospectors were limited to staking claims on the outcrops around the edges of the basins. The majority of the oil shale lies buried in the middle of the basins and remains in Federal ownership. But to finish the story, large oil fields were discovered in the U.S in the 1920's, the oil price dropped, and the first boom ended.

After WWI Naval Oil Shale Reserves (NOSR's) were established by the Congress in Colorado and Utah. The navy then used fuel oil for its ships, and there was concern over supplies. The NOSR's are now in BLM custody. In Colorado the NOSR is now a hotly contested area for natural gas drilling called the Roan Plateau. There is no consideration given to oil shale development on the Roan Plateau.

After WWII there was concern for oil supplies and a research mine and processing facility was established at Anvil Points west of Rifle, CO. (the mine is pictured above) It operated on and off for more than a decade, and technology was perfected for room and pillar mining and vertical kiln retorts (at demonstration scale).

The U.S. became dependent upon outside sources of oil for the first time in its history in the early 1970's. In 1974 oil supplies were cut off by the Organization of Petroleum Exporting Countries (OPEC), oil prices rose, gasoline lines at filling stations resulted, and the U.S government mounted a major push

to develop unconventional supplies of oil and become energy independent. The Synthetic Fuels Corporation (SFC) was formed, Congress appropriated billions of dollars, and companies rushed west to try to commercialize the oil shale resource. It all came to an end in the 1980's when oil prices dropped, foreign supplies stabilized, and Federal policies were reversed.

In the 1970's the U.S. issued four Prototype Oil Shale Leases, two in Colorado and two in Utah (known as Ca, Cb, Ua & Ub). Historically oil shale had been withdrawn from leasing for decades, even though oil and gas, coal and minerals had been and are now available for leasing. The successful bidders offered $450 million dollars in bonus payments. About $100 million came back to local communities in Colorado. Over a decade later, after the decline in oil prices and lack of interest in oil shale these leases were returned to the BLM, and little evidence of the extensive work done on the leases can be seen today. The picture in the lower right hand corner of the slide shows the development facilities built on Prototype Lease Tract Cb before they were torn down and the site reclaimed (head frames for large shafts to access the resource some 2000 feet below the surface).

There was one major oil shale project that continued into the 1980's – the UNOCAL (Union Oil Company of California) 10,000 b/d oil shale plant. It produced over 6-million barrels of oil that was refined into gasoline, diesel and jet fuel consumed by the military and commercial clients. It proved once and for all that oil shale could be successfully refined in to transportation fuels at commercial scale. Commercial scale underground room and pillar mining and environmentally acceptable disposal of spent shale were also successfully demonstrated. The UNOCAL plant shut down in the early 1990's. During its period of operation the sponsors received an oil price guarantee of about $40 per barrel for each barrel of oil produced.

There was little oil shale activity in the U.S., other than the UNOCAL plant, in the 23-years beginning in 1982, with the exception of a few companies researching new technologies. That changed with the passage by Congress of the 2005 Energy Policy Act. The Act instructed BLM to prepare to lease oil shale for commercial development. BLM acted, and in 2008 at the end of the Bush administration, a Programmatic Environmental Impact Statement (PEIS) was completed and leasing regulations were enacted - which opened the door to making the best U.S. oil shale available to industry. The PEIS authorized the BLM to designate areas potentially attractive for leasing.

At about the same time the BLM offered Research, Development and Demonstration (R,D&D) oil shale leases in Colorado, Wyoming and Utah. Twenty companies sought the 640-acre leases. Four companies satisfied BLM's criteria and were awarded six 10-year leases in 2007 – one in Utah and five in Colorado. If lessees successfully demonstrate the technical and environmental viability of their technologies the leases can be expanded to 5,120-acres for commercial development. (Activities on these leases will be discussed in more detail later in the presentation).

When the Obama administration came into office in 2009, the Department of Interior, through BLM, decided to revisit the policies of the previous administration, began a new PEIS and rescinded the leasing regulations. BLM also offered a 2nd round of R,D&D leases in this time frame. Three applicants applied and the two Colorado applicants were awarded leases in September 2012. (Activities on these leases will also be discussed in a later section of the presentation)

Notes for slide 7 "Current Government Activities"

(Presenter may wish to shorten the history portion of current events and discuss it here?)

As earlier discussed in the History Section, BLM awarded six first round RD&D leases in 2007.

BLM also offered a 2nd round of R,D&D leases in 2010. Three applicants: ExxonMobil and Natural Soda in Colorado, and AuraSource in Utah applied and were selected for further evaluation. The two Colorado applicants were awarded leases in September 2012 after completing Environmental Assessments and conducting public meetings. Award of the Utah lease is pending in September 2012, and little activity has been observed for the Utah 2nd round RD&D lease.

Reiterate the status of the current administration towards oil shale leasing (PEIS finalization pending as of Aug 2012 and the draft of the revised leasing regulations has not been offered by BLM). BLM's preferred alternative in the PEIS dramatically reduces the acreage available for potential oil shale leasing in all three states. It also limits leasing to R,D&D leases with no commercial leasing. NOSA commented on the new draft PEIS indicating it believed BLM should return to the provisions of the original 2008 PEIS. A majority of the Cooperating Agencies made the same comment to BLM. BLM has published the all the thousands of comments and is in the process of reviewing them as of August 2012. BLM's stated plan is to complete the PEIS by year end 2012.

In the Energy Policy Act of 2005, the Department of Energy (DOE) was instructed to provide strategic guidance concerning the development of an oil shale industry. DOE is not currently pursuing the mandates of EPA 2005.

As to State policies toward oil shale, Utah seems very bullish toward development of oil shale in its state. It has a number of state oil shale leases that have active participants (e.g. Red Leaf). Colorado appears less inclined to favor development, but the new governor is still reviewing his energy strategy. There is little interest by industry in developing the oil shale resources in Wyoming, so that state has not taken a great deal of interest in the resource.

Notes for slide 8 "How is Oil Shale Processed?"

Read the slide and point out that heating is required to get oil from oil shale, and it cannot be pumped directly from the ground like conventional oil and gas.

Read the slide directly focusing upon the two basic methods: ex-situ and in-situ approaches, and that because of all the past activities in oil shale, here and abroad, there is a great deal of information available to set the stage for initiating an oil shale industry. This is contrary to some reports that much more research is needed before commercial leasing could be initiated.

Briefly point out the picture of the Paraho demonstration scale plant that is operating in Australia. Paraho is an ex-situ vertical kiln process derived from and then improved from work done earlier at Anvil Points and in Brazil.

Indicated that later in the presentation other methods of recovery of oil from oil shale will be discussed, including modified insitu which uses a combination of mining and underground recovery techniques.

Notes for slide 9 "Mining and Ex-situ Oil Shale Processes"

Read the slide. Point out the picture of the Unocal Plant, earlier discussed in the History Section, and the fact that millions of tons of spent shale have been successfully reclaimed without environmental implications.

Notes for slide 10 "Insitu Oil Shale Processes"

Read the slide.

Point out the picture of Shell's R,D&D site. Shell has been the leader in this technology having successfully conducted pilot scale tests on private land over the last three decades. Their approach is to heat the oil shale with vertically emplaced electric heaters that retort the oil shale and drive the shale oil to adjacent vertical production wells. The process produces high grade (e.g. 35 degree API) oil by partially refining the shale oil in the ground.

Others such as AMSO, Natural Soda and ExxonMobil have also advanced their technologies. Chevron is no longer active in oil shale RD&D.

Point out that each company's approach is slightly different, but all are based upon doing the retorting underground without surface or underground mining.

Notes for slide 11 "Other Oil Shale Technologies"

Read the slide pointing out the other methods oil shale could be processed into petroleum, and pointing out that except of modified insitu these other technologies are generally in the laboratory/ research stage and not being developed in the field – although there are companies that are proposing to do so.

Then discuss Modified Insitu in more detail. It was first developed by Occidental Petroleum in the 1970's. A void is created by underground mining a fraction of the oil shale in a vertical column, fracturing (also called rubblizing) the remainder with explosives, and then insitu retorting the rubblized mass to produce shale oil.

An adaptation of modified insitu processing is practiced by Red Leaf Resources as shown in the diagram at the bottom of the page. Their EcoShale technology uses crushed oil shale mined near the surface that is then placed in a pit, covered with soil, and retorted using in-situ techniques. The picture in the upper part of the slide shows the pit before crushed oil shale was placed in it during a recently completed demonstration scale test. A commercial scale project is underway using the EcoShale technology in Utah.

Notes for slide 12 "Active Oil Shale Programs"

Point out the names of the key companies and those holding BLM RD&D leases.

AMSO, Enefit American Oil and Shell are moving forward with physical activities on their 1st round RD&D leases. AMSO is the furthest advanced with a one well pilot test of its CCR insitu technology in Colorado, reported to have passed the $50 million spending mark. Shell began physical work on the first of its three 1st round Colorado RD&D leases in the spring of 2012. Enefit has opened an office in Vernal, Utah and is continuing site investigations on its Utah RD&D lease, and is running pilot tests on its ex-situ retorting technology at a facility in Germany using oil shale from its Utah property.

Shale Technology International (STI), a Colorado company, licenses the Paraho ex-situ retorting technology. A demonstration scale plant built in Gladstone, Queensland, Australia began operations in 2011.

ConocoPhillips and ERTL (Ertl family are pioneers in oil shale) are holders of large oil shale resources, but at present do not have active development projects.

The Colorado School of Mines, Utah University and Utah State University have active oil shale R&D programs.

DOE's Idaho National Laboratory is an active participant in oil shale programs. DOE's NETL is also active in oil shale.

Many Entrepreneurs are actively pursuing innovative oil shale technologies.

Notes for slide 13 "Commercial Oil Shale Projects"

Point out that commercial oil shale projects have been active outside the U.S. for decades. Some 20,000 barrels per day of shale oil is currently produced in the world from ex-situ plants in these three countries.

The Estonian picture is a commercial ex-situ plant producing shale oil in the Baltic region of Europe. It is the technology proposed for use by Enefit American Oil at it Utah project. The Estonians are expanding their production of shale oil and in accordance with strict European Union environmental standards.

The middle picture is a commercial facility in Brazil. The origin of this vertical kiln retort was work done at Anvil Points in Colorado in the 1940's and 50's.

China has plants at Maoming and Fushun and has recently built an ATP rotary kiln ex-situ plant that is in the early stages of startup. The Chinese are active in developing their oil shale resources and looking abroad for opportunities in oil shale and tar sands projects. The picture was taken in Maoming by Glenn Vawter in 1980.

Point out that there are oil shale development projects in varying stages of maturity in Jordan, Israel, Morocco, Australia, India, Mongolia and other countries that generally do not have oil and gas resources.

Notes for slide 14 "Challenges for Developers"

Read the slide. Point out that at different points in history the most important challenges have changed. In the 1980's the price of oil and economics were the most important challenges. Now inconsistent policies from one U.S. Federal Administration to the next are very important.

There are still important risks associated with technology, production costs, and the future of oil prices.

As to socioeconomic concerns: in the past oil shale boom of the 1970's and 80's the communities in the West were much smaller and less capable of coping with the influx of population an oil shale industry might bring. Today because of the natural growth in population and evolution of other industries, such as natural gas, the region's infrastructure is much better prepared to handle a new industry. Communities and industry will have time to work together for the best interests of the public.

An industry will only develop if it meets all environmental requirements. Climate change is a key concern because of the uncertainty of future regulatory requirements. Technology is available to mitigate climate change impacts. Carbon dioxide can be captured and either used or sequestered. It will be expensive, however.

Water supply is not an issue that will make or break oil shale development. It is a myth that there is not enough water. There is enough water to supply and industry and meet public expectations. Water will be required for needs such as dust suppression, reclamation and process cooling. Much of the required water will be produced as a part of oil shale processing and can be used in the processing plant. Developers are continuously looking for methods of reducing water requirements and looking for alternate sources such as brine waste water from oil and gas production.

Water needs for oil shale are compared with other energy producing sources in the graphic on this slide. The needs fall in the mid-range and much lower than ethanol produced from irrigated crops.

(In the Facts vs. Myths section of the presentation, given later, the specific amount of water needed for a 1.55 million barrel per day shale oil industry is detailed as only 2-3% of the water in the Colorado River.)

Notes for slide 15 "Potential Benefits from Oil Shale"

Read the slide.

Point out that Commercial Federal Leasing of oil shale will provide royalty and bonus payment benefits that are shared with the states and local communities.

Point out that Battlement Mesa, the picture on the right, is a thriving community in Western Colorado that cost about $100 million to build in the 1980's (at least double that now), and was built totally with private funds.

In addition, the prototype leasing program of the 1970's provided some $100 million to local communities for infrastructure improvements and services, many of which are still a benefit to the public today (e.g. improvements to Grand Junction Airport, Rifle city facilities, regional school improvements).

Unlike oil and gas, the large concentrated oil shale resource can provide a stable future because, once the capital is spent to build a plant the ongoing operating costs are low enough to sustain production during times when oil prices may drop.

Notes for slide 16 "Four Examples of Facts vs. Myths"

There are many myths about oil shale, and here four examples of the facts vs. fictions about this resource and its potential.

Oil shale processing produces more energy than it uses. From 3 to 6 units of energy are produced in the form of oil and gas for every unit of energy used to produce raw shale oil and gas products.

Oil shale has higher hydrocarbon content by weight than conventional oil sands and Canadian Tar Sands. It is not an inferior energy resource – just more expensive to produce than some.

There is enough water available to support oil shale development in Colorado, Utah and Wyoming. An independent group in Colorado estimated that 120,000 AF/yr would be required for a 1.55 MMbbl/day production of shale oil. The analysis was done for the Colorado, White and Yampa River Roundtables and was included in the State of Colorado 50-year water plan. 120,000 acre-feet (AF) per year of water is 2-3% of average annual flow in Colorado River system as it flows into Lake Powell in Utah.

Many developers have water rights. Water rights are equivalent to property rights in the three state region and thus water rights can be acquired the same as land. Most developers and water experts agree that additional water storage projects may be needed for oil shale and general population growth. The series of dams and reservoirs in the region trap the water that comes from snow melt in the spring so it may be used during the dry period later in the year.

An oil shale industry will not develop overnight and cause extreme social impacts in the oil shale region. An oil shale industry will develop incrementally using private capital investment. Development will be deliberate if for no other reason than the limited availability of capital and competing investment opportunities for companies. It would only get on the fast track if the Federal Government created a crisis environment and threw money at it – something none of us would want to see.

There are other facts about oil shale that are contrary to some published reports. A complete list can be found on NOSA's web site under the tab "FACTS".

Notes for slide 17 "U.S. Energy Dilemma"

Read the slide. The good news is that consumption of petroleum in the U.S. is reduced over a peak in 2007. But we still import 10-million barrels per day from outside our borders.

Point out the information on the chart – 94% of U.S. transportation fuels come from petroleum – indicating it will take decades to significantly reduce U.S. dependence upon petroleum for fueling the transportation sector. Oil shale along with tight oil, gas shale, conversion of fleets to natural gas, oil from tar sands in Canada, and oil from Mexico can reduce North America's dependence upon oil supplies from off shore. Gasoline prices will continue to rise unless domestic supplies of petroleum are increased and conservation is expanded. Oil shale can help.

Notes for slide 18 "Summary and Conclusions"

Read the bullets and add any personal opinions.

Notes for slide 19 "Contact Information"

Point out that NOSA is a not-for-profit organization, and its mission is to educate the public and decision makers about oil shale.

Point out that more information is available from the NOSA web site: read to the audience – www.oilshaleassoc.org.

Point out that copies of the brochure Oil Shale – America's Untapped Energy Source can be obtained by mail by sending an e-mail to NOSA. (If you want to hand out copies of the Brochure at the presentation, email NOSA and we will send copies to you)

Also point out the NOSA web site has access to a NOSA video via YouTube titled Energy - Lifeblood of Our Society – The Importance of Oil Shale to Our National Transportation Fuel Supply. (If you wish to show this video at a presentation, contact NOSA via email or phone and a DVD will be mailed to you).

Thank you. Do you have questions?