Intellectual Property Request Broadcast Description

Basic Information

IP Title	Oil Shale
IP Serial No.	IPR-007-2 105-071112

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Description of Requested Intellectual Property

A new process and technology to produce oil from Oil Shale (kerogen)

Background

The term oil shale generally refers to any sedimentary rock that contains solid bituminous materials (called kerogen) that are released as petroleum-like liquids when the rock is heated in the chemical process of pyrolysis. Oil shale was formed millions of years ago by deposition of silt and organic debris on lake beds and sea bottoms. Over long periods of time, heat and pressure transformed the materials into oil shale in a process similar to the process that forms oil; however, the heat and pressure were not as great. Oil shale generally contains enough oil that it will burn without any additional processing, and it is known as "the rock that burns".

Oil shale can be mined and processed to generate oil similar to oil pumped from conventional oil wells; however, extracting oil from oil shale is more complex than conventional oil recovery and currently is more expensive. The oil substances in oil shale are solid and cannot be pumped directly out of the ground. The oil shale must first be mined and then heated to a high temperature (a process called retorting); the resultant liquid must then be separated and collected. An alternative but currently experimental process referred to as in situ retorting involves heating the oil shale while it is still underground, and then pumping the resulting liquid to the surface.

Oil shale

Oil Shale Resources

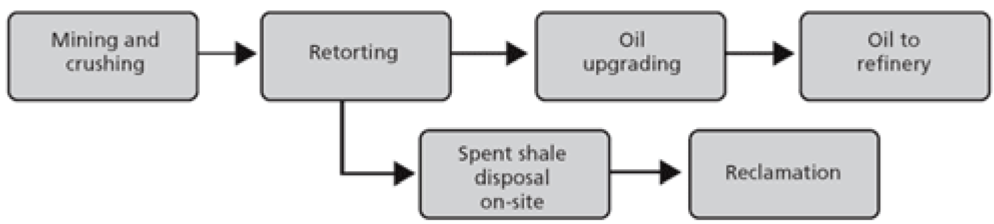
According to a study by RAND Corporation, while oil shale is found in many places worldwide, by far the largest deposits in the world are found in the United States in the Green River Formation, which covers portions of Colorado, Utah, and Wyoming. The oil resource in the Green River Formation is estimated to range from 1.2 to 1.8 trillion barrels. Not all resources in place are recoverable; however, even a moderate estimate of 800 billion barrels of recoverable oil from oil shale in the Green River Formation is three times greater than the proven oil reserves of Saudi Arabia. Present U.S. demand for petroleum products is about 20 million barrels per day. If oil shale could be used to meet a quarter of that demand, the estimated 800 billion barrels of recoverable oil from the Green River Formation would last for more than 400 years.

Oil Shale Mining and Processing

1- Mining and Surface Retorting

In this approach, oil shale is mined with conventional mining methods and transported to a retorting plant. After heating and removal of fine solid particles, the liquid product is upgraded to produce a crude oil substitute that can enter the nation's existing oil pipeline and refinery infrastructure. After retorting, the spent shale is cooled and disposed of, awaiting eventual reclamation.

Major Process Steps in Mining and Surface Retorting

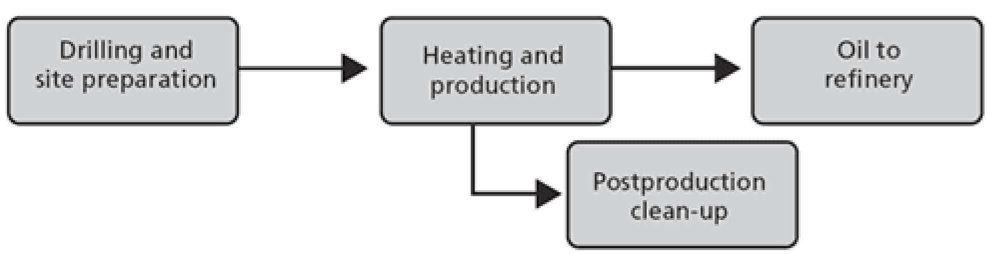


RAND *MG414-3.1*

2- In Situ Retorting

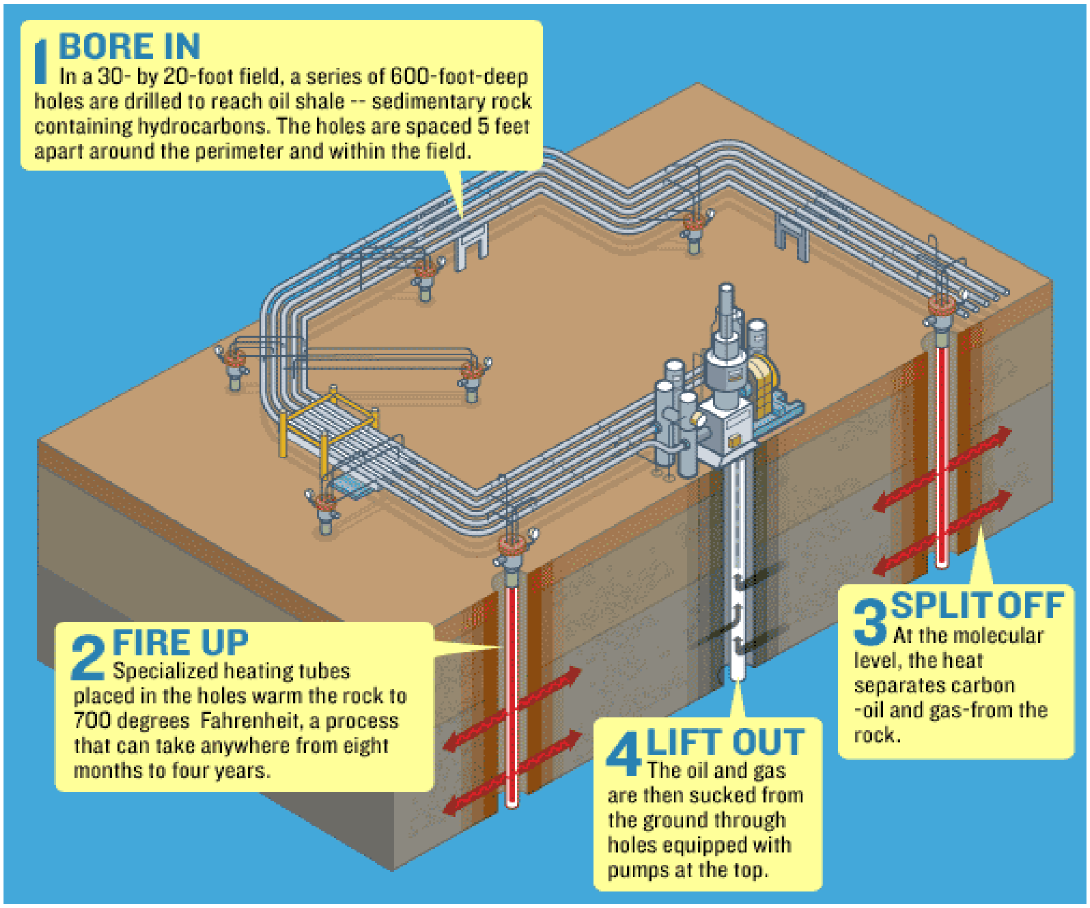
Shell Oil is currently developing an in situ conversion process (ICP). The process involves heating underground oil shale, using electric heaters placed in deep vertical holes drilled through a section of oil shale. The volume of oil shale is heated over a period of two to three years, until it reaches 650–700 °F, at which point oil is released from the shale. The released product is gathered in collection wells positioned within the heated zone.

Major Process Steps in Thermally Conductive In-Situ Conversion



RAND *MG414-3.3*

Shell's process involves drilling a series of holes, each as deep as 600 feet, which are then filled with heavy duty electric heaters that warm the rock to 700 degrees Fahrenheit. The heating process releases a combination of oil and gas that can then be pumped out of the well.



SOURCES: BUREAU OF LAND MANAGEMENT; SHELL

Oil Shale Economics

The various attempts to develop oil shale deposits will succeed only when the cost of shale-oil production in a given region comes in below the price of crude oil or its other substitutes. According to a survey conducted by the RAND Corporation, the cost of producing a barrel of oil at a surface retorting complex in the United States (comprising a mine, retorting plant, upgrading plant, supporting utilities, and spent shale reclamation), would range between US$70–95. However, according to Chevron the cost of producing a barrel of oil using the same process is above $120. In order to run a profitable operation, the price of crude oil would need to remain above these levels.

Request for Proposals (RFP)

Texas Institute of Science is seeking new and cost-effective technologies that provide superior process and could lead to cost reduction of producing a barrel of oil from Oil shale (kerogen) and significantly less than the cost of producing oil from the conventional process.

The purpose of this request is to identify the most advanced technologies and designs that could provide our clients with a potential solution. If you or your group has a potential solution for the above mentioned topics, please contact TxIS with an initial description of your capabilities. TxIS will evaluate all submissions and select top 3 unique proposals to move forward with the idea. TxIS will compensate you $2000.00 if your idea is selected and will finance your work immediately.

The proposals should give a clear picture as to why the scientist thinks he/she can solve the problem, a brief definition of foreseeable way(s) the problem will be solved, and an explanation of the readiness of the development (in those cases where prior work has been conducted). It also should include the approximate time and estimated cost to reduce the solution to the proposed problem to practice.

NON-DISCLOSURE AGREEMENT

To ensure the protection of information contained in the RFP form ("Confidential Information"), and to preserve any confidentiality necessary under patent and/or trade secret laws, Texas Institute of Science, Inc. ("TxIS") hereby agrees that it shall limit disclosure of Confidential Information within its own organization to its directors, officers, partners, members, employees and/or independent contractors (collectively referred to as "affiliates") having a need to know, and only upon execution of a confidentiality agreement prior to disclosure. TxIS and affiliates will not disclose the Confidential Information obtained from the discloser unless required to do so by law. Disclosure of the Confidential Information to TxIS and affiliates is solely to enable TxIS and/or affiliates to evaluate such Confidential Information in order to determine its potential commercial utility and should not be construed as an offer to buy and/or sell.

Texas Institute of Science
Hossein Pasvar
Senior Vice President

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Signature

July10, 2012
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Date