



U.S. DEPARTMENT OF
ENERGY

U.S. DEPARTMENT OF ENERGY
National Oil Program - National Petroleum Technology Report

Closed-loop extraction of hydrocarbons and bitumen from oil- bearing soils.

X-TRAC Energy, Inc.

Englewood, Colorado PR Springs and Asphalt

0-100 ft

Background

The P.R. Springs and Asphalt Ridge tar sand deposits in Uintah County, Utah, contain an estimated 15 billion barrels of bitumen and heavy oil with estimated potential reserves of 4.7 to 7.3 billion barrels. No technology or process had been demonstrated to be efficient and environmentally benign for the commercial extraction of marketable hydrocarbons from the shallow tar sand reserves within the United States.

Project Description

X-TRAC Energy has licensed proprietary technology which employs an entirely closed-loop extraction system using recyclable hydrocarbon solvents to extract hydrocarbons and bitumen from oil-bearing soil. The process requires mining and crushing of the oil-bearing sand and then mixing the crushed material with a hydrocarbon solvent in a pressurized vessel where the hydrocarbon components are extracted from the crushed material. The solvent is separated from the hydrocarbons by heating and the recovered solvent is then recycled through the system..



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TECHNOLOGY AREA Improved Oil Recovery

PROBLEM Recovery of Tar Sand Hydrocarbons are Uneconomic

SITUATION No Commercial Technology Available for Extraction Process

RESULTS Extraction Process Was Successfully Demonstrated

Extraction system using recyclable hydrocarbon solvents to extract hydrocarbons and bitumen from oil-bearing soil. The process requires mining and crushing of the oil-bearing sand and then mixing the crushed material with a hydrocarbon solvent in a pressurized vessel where the hydrocarbon components are extracted from the crushed material. The solvent is separated from the hydrocarbons by heating and the recovered solvent is then recycled through the system.

Results

Twenty thousand pounds of P.R. Springs tar sand and eighteen thousand pounds of Asphalt Ridge tar sand material were processed through the large-scale extraction demonstration test facility without difficulty, recovering approximately 125 gallons of bitumen from each of the two samples. 50-60% of the residual oil in place was recovered. 50-60% of the extracted hydrocarbon was high grade asphaltines, 20-25% was diesel, and 20-25% was light gas oil.

Economics

The operator used results of the demonstration project to develop production/cost numbers critical to justifying a full-scale commercial facility. Capital cost for construction of a 2,160 barrels of oil output per day facility is estimated at \$15,000,000. Economic analysis indicates that 9,500,000 barrels of incremental oil could be recovered (valued at \$29.12 per barrel) during an operating life of 12 years, with a NPV (discounted at 15%) of \$32,658,000.

Project Funding

A project award of \$147,359 (34% DOE, 66% X-TRAC) was made to E-TRAC Energy, Inc. for this technology demonstration project. 47



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**Project 11: Closed-Loop Extraction of Hydrocarbons and Bitumen from Oil-Bearing Soils,
X-TRAC Energy, Inc.**

Project Timing Started: 4-01-97 Ended: 11-30-97 Duration: 8 months

Problem The extensive tar sands reserves within the State of Utah, estimated between 20 and 30 billion barrels, are currently uneconomic because no efficient and environmentally benign commercial extraction process is available.

Proposed Solution Apply proprietary technology, which employs hydrocarbon solvents in a closed-loop system to extract & Technical hydrocarbons and bitumen from the oil bearing soils. Mine and crush the oil bearing tar sands and Description process the material through the proposed extraction process to recover the hydrocarbon components. Reservoir Setting The P.R. Springs and the Asphalt Ridge tar sand deposits in Uintah County, Utah, range in thickness & Information from 30 to 300 feet at depths from surface down to 600 feet, with hydrocarbon saturation around 50%

(0.6538 barrels of residual oil in place per ton of oil-bearing soil).

Objective/intent Program Objective: Develop new technology. Project Objective: Demonstrate that the proposed technology can efficiently extract and produce quality oil from shallow tar sand reserves obtained from a mining lease in Utah.

Working Test and develop new technology to extract the resource that could not be produced otherwise.

Hypothesis Baseline & Zero production prior to the project. Estimated 30,000 to 200,000 BOPM for a full-scale operation at an Forecast estimated operating cost of \$9.00 per barrel of oil extracted. Compare: The demonstration unit recovered approximately 50-60% of the oil in place. Actual vs baseline

Economic? Based on the results of the demonstration project, operating costs for a commercial scale operation are estimated at \$8.50 to \$13.00 per barrel of oil extracted. Operating costs will increase as the overburden to oil sand strip ratio increases. The total capital investment for a 2,100 BOPD output facility is estimated to be \$15 million. 50-60% of the extractant was asphaltines, 20-25% was diesel, and 20-25% was light gas oil. The asphalt market and the diesel markets are very strong in the area of Utah where the deposits are located. SHRP specific asphalt (a processed product) sells for \$200/ton, roofing quality asphalt sells for \$150/ton, diesel sells for \$0.55/gal, and light gas oil sells at WTI prices.

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| Economic Detail | Production (BO): 7,884,000 NCF (Undisc.) (\$): 67,364,000 Econ. Life (years): NRI Income (\$): 200,884,000 NPV (15% Disc.) (\$): 32,658,000 Inv. PO (months): Royalty Income (\$): 28,698,000 Investment (\$): 15,000,000 NTER: State Revenue (\$): 14,184,000 Expense (\$): 0 Undisc Profit (\$/BO): 8.54 Federal Revenue (\$): 20,047,000 Operating Cost (\$): 84,289,000 Disc Profit (\$/BO): | 10 16 5.49 4.14 |
| Project Objective Met? | The project objective was met. 19 tons of crushed tar sand were processed smoothly through the large scale demonstration extraction unit, recovering eight 55-gallon drums of bitumen (approximately 50% of the 6.5 weight percent of pre-test rock oil in place) leaving levels of 1,000 PPM residual hydrocarbons in the processed soil. The recovered oils had a sulfur content of approximately 0.3% and an API gravity in the range of 17-20 0 with compositions of 50% kerosene, diesel, and light gas oils and 50% asphalt. | |
| Program Objective Met? | The program objective was met. The project successfully demonstrated that the process is economic and environmentally safe. | |
| Application (area/region) | The technology has world-wide application to all mineable tar sand deposits with market availability. UTAR Energy (previously X-TRAC Energy) is proceeding to obtain partners and/or financing to begin commercial operations at the Utah tar sand deposit site with a 700-800 Tons/year processing plant. The western United States annual 1994 road asphalt market usage was 5.6 million tons and the roofing asphalt market usage was 671 thousand tons. The road asphalt market has been projected to increase at +10% per year, as the repair of the nations highway system becomes a high priority. | |
| Limitations | Requires mineable heavy oil/tar and deposits and market demand for the hydrocarbon product(s) produced. | |
| Recommendations | Encourage commercial development of this technology and incorporate into the Technology Transfer Program. | |