PROJECT facts

DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY

OIL recovery PROGRAM

ARE GULF COAST OIL RESERVOIRS BEING "RECHARGED"? — THE LAMONT-DOHERTY PROJECT

PRIMARY PROJECT PARTNER
Columbia University
Lamont-Doherty
Earth Observatory
Palisades, NY

FOSSIL ENERGY PROGRAM
Oil Recovery Field Demonstration

MAIN SITES
Offshore Louisiana
Palisades, NY

TOTAL ESTIMATED COST
$19.5 million

COST SHARING
DOE - $9.7 million
Non-DOE - $9.8 million

DE-FC22-93BC14961

Project Description

The Lamont-Doherty Earth Observatory at Columbia University is leading a team of researchers studying the possibility that offshore Gulf Coast oil reservoirs are being "recharged" by oil flowing upward through fault zones. The possibility of active recharging of oil reservoirs is evident in production histories from tracts in the study area.

The DOE cost-shared field demonstration is providing insights into new ways to produce oil reservoirs deep below the salt formations underlying the Gulf of Mexico. Data from the research could reveal how some oil reservoirs are filled in the Gulf and other similar basins.

The focus is on "growth faults," structural pathways leading from deep oil sources upward to shallower reservoirs. While conventional petroleum geology measures the rate of upward migration of hydrocarbons from their deep sources in hundreds of thousands of years, the Lamont-Doherty researchers are detecting evidence that oil may be flowing to shallower reservoirs much more rapidly through these growth faults, perhaps in only decades.

If this geologic model is accurate, it may mean that certain reservoirs are actually being replenished during their productive life. This could lead to recovery of more oil than one-time "snapshot" estimates would indicate. Equally important is the potential for producers to use growth faults as shortcuts to tap deeper hydrocarbon accumulations.

Seismic modeling technology in four dimensions–multiple 3-D seismic surveys conducted over a period of years–has been developed in this project to locate areas in which fluid migration is replenishing reservoirs or oil bearing areas that are not being depleted by the existing wells. The first well drilled as a result of the 4-D seismic technology initially produced 1500 barrels per day. This well will provide federal royalties worth the full project value within five years (any tax benefits are additional). Because of the huge potential benefit of this technology, an industry consortium is funding post-project refinements of the 4-D technology.

Program Goal

In its cost-shared DOE project, Columbia is using improved methods to measure reservoir fluid flow, and innovative seismic surveying to locate Gulf Coast fault zones along which large quantities of oil may flow to replenish reservoirs. Federal royalties on oil recovered from Columbia's first completed well will pay for the entire cost of the project.

If this project is successful, it will give Gulf Coast producers a new method of drilling for oil that will significantly reduce costs and provide access to sharply increased volumes of oil. Columbia's network is conducting extensive technology transfer efforts to provide the technologies to other Gulf Coast producers, including publications, workshops and seminars, and lecture tours sponsored by scientific organizations.

Project Partners

COLUMBIA UNIVERSITY–LAMONT DOHERTY EARTH OBSERVATORY
Palisades, NY
- Project management, 4-D seismic, technology transfer

GLOBAL BASINS RESEARCH NETWORK
23 universities and oil and computer modeling companies
- Geoscience services

Are Gulf Coast Oil Reservoirs Being "Recharged"? — The Lamont-Doherty Project

Project Benefits

U.S. oil reservoirs located off the Gulf Coast offer complex and challenging geology — large "mushrooms" of salt that have moved into and displaced overlying rock strata, geo-pressured zones where fluids are trapped under exceedingly high pressures, and extensive growth faults where breaks in the rock structure formed while the ancient deposits were being laid down.

The field demonstration under way by the Global Basins Research Network is helping producers better understand these geologic complexities, and perhaps most importantly, revealing new approaches to take advantage of the complexities. The 3-dimensional geologic basin modeling computer program that has been developed by this project and is publicly available allows accurate modeling of subsurface fluid flow, temperature, and pressure that is related to sedimentation, faulting, and salt movement.

Most exciting is the possibility that hydrocarbons are migrating upward through the natural growth fault system, perhaps recharging shallower reservoirs during their productive life. For example, the production history of Eugene Island Block 330, 120 miles south of the Louisiana coast, shows that oil was produced in1993 that was not known to be present when wells began producing in 1973.

The 4-dimensional seismic modeling technology developed in this project was used to locate areas in which Columbia scientists suspect that fluid migration is replenishing reservoirs or oil-bearing areas that are not being depleted by the existing wells. The first well drilled as a result of this technology initially produced 1500 barrels per day. This well will provide federal taxes and royalties worth the full project value within five years (any tax benefits are additional). Because of its huge potential benefits, an industry consortium is funding post-project refinements of the 4-D technology.

If Columbia's new production strategies are successful, they may provide producers with the ability to tap directly into the growth fracture system, contacting high-volume, self-replenishing oil reserves, rather than drill large numbers of deep, expensive holes to less extensive sources. The new approach could increase production from Gulf Coast fields and lead to significant upward revision of oil supply estimates from this basin and possibly other similar sedimentary basins throughout the world.

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Cost Profile (Dollars in Millions)

	Budget Period 1 (07/15/93 – 06/30/94)	Budget Period 2 (06/30/94 – 10/30/95)
Department of Energy*	$7.7	$2.0
Private Sector Partners	$7.8	$2.0

* Obligated Funding

Key Milestones

FY93 + FY94 + FY95

- Fault-zone well drilled and tested
- 4-dimensional seismic technology developed
- Geologic basin modeling completed

Project Start (07/15/93) — End Project (10/30/95)

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