# Oil Technology

## Funding Profile by Subprogram

(dollars in thousands)

| | FY 2004 Comparable Appropriation | FY 2005 Comparable Appropriation | FY 2006 Base | FY 2006 Request | FY 2006 Request vs Base | |
|---|---|---|---|---|---|---|
| | | | | | $ Change | % Change |
| Oil Technology | 34,107 | 33,921 | 33,921 | 10,000 | -23,921 | -70.5% |
| Total, Oil Technology | 34,107 | 33,921 | 33,921 | 10,000 | -23,921 | -70.5% |

### Mission

The mission of the Oil Technology Program has been to implement a policy and technology research and development program to resolve the environmental, supply, and reliability constraints of producing oil resources. Budget discipline necessitated close scrutiny of all Fossil Energy programs, using strict guidelines to determine their effectiveness and compare them to other programs offering more clearly demonstrated and substantial benefits. As a result, the 2006 Budget proposes to conduct orderly termination of the program.

The Program Assessment Rating Tool (PART) was developed by OMB to provide a standardized way to assess the effectiveness of the Federal Government's portfolio of programs. The structured framework of the PART provides a means through which programs can assess their activities differently than through traditional reviews. A PART assessment of the Oil R&D program was conducted for the FY 2004 Budget and a reassessment was conducted for the FY 2005 Budget. These programs were rated "Ineffective" in the PART analysis, based primarily on not demonstrating clear results of the research efforts.

### Benefits

Each year Fossil Energy estimates the benefits of program activities to support Government Performance and Results Act (GPRA) reporting. Methods are complex and vary by program. The Oil and Gas Programs have traditionally used two separate economic and engineering modeling systems to calculate selected economic and energy security benefits. In 2004, as part of the effort to better conform to the President's Management Agenda, Fossil Energy undertook an integrated program benefits analysis of oil, natural gas, coal and power systems research within Fossil Energy to develop Fossil Energy-wide program benefits estimates. This analysis was to examine all Fossil Energy research programs on a common basis with respect to modeling assumptions and should have enabled aggregate and comparative assessments of the benefits of Fossil Energy research programs.

The Department is working to improve consistency across programs in the methodology and assumptions used in estimating program costs and benefits.

**Background**

The Oil Technology program budget delineated program goals, such as Enhanced Oil Recovery/$CO_2$ Injection, Domestic Resource Conservation, and Environmental Science, as funding categories. When appropriate, collaborations with other Federal agencies, industry, academia, and states were used to meet program goals.

The Oil Technology Program included research to support technology development and policy decision-making and to allow greater access to energy resources with minimal environmental impact.

**Strategic and Program Goals**

The Department's Strategic Plan identified four strategic goals (one each for defense, energy, science, and environmental aspects of the mission) plus seven general goals that tie to the strategic goals. The Oil Program supported the following goal:

Energy Strategic Goal

General Goal 4: ENERGY SECURITY: Improve energy security by developing technologies that foster a diverse supply of reliable, affordable and environmentally sound energy by providing for reliable delivery of energy, guarding against energy emergencies, exploring advanced technologies that make a fundamental improvement in our mix of energy options, and improving energy efficiency.

The Oil Technology program has one program goal, which contributed to General Goal 4 in the "goal cascade".

Program Goal 04.57.00.00: Oil Technology, Abundant Oil: Enhance U.S. energy security by managing and funding oil exploration and production (E&P) research and policy which results in development of domestic oil resources in an environmentally sound and safe manner.

**Contribution to Program Goal 04.57.00.00: Oil Technology, Abundant Oil**

In FY 2006, with program closeout, the only remaining benefit will be that reflected in the FY 2005 Joule submission to "develop technologies through 4 projects which will contribute to increased domestic oil supplies in an environmentally friendly manner." This work will be conducted utilizing FY 2005 and prior year funds.

**Comment [d1]:** Benefits from ongoing projects should be included but were deleted.

## Annual Performance Results and Targets Program Goal 04.57.00.00 Oil Technology, Abundant Oil

| FY 2001 Results | FY 2002 Results | FY 2003 Results | FY 2004 Results | FY 2005 Targets | FY 2006 Targets |
|---|---|---|---|---|---|
| Complete demonstration of five advanced secondary and tertiary technologies. Based on models, it is estimated these technologies will increase near-term incremental production by 1.7 million barrels of oil, and long-term incremental production by over 2.4 billion barrels of oil. (NEARLY MET GOAL)<br><br>Demonstrate the field application of a shoulder-mounted, portable video methane leak detection system that can be used to significantly reduce costs of leak monitoring at refineries and other facilities while reducing harmful air emissions. Annual savings of $500,000 per year per refinery, on average, would result from regulatory acceptance and application of this technology. (BELOW EXPECTATIONS) | Demonstrate a small-diameter, lightweight composite drill pipe for ultra-short radius drilling. (MET GOAL) | Increase access to the domestic oil resources remaining in the reservoir due to lack of advanced technology. Focus on high risk research (award 6 projects and issue 1 solicitation - Micro-hole technologies) for future applications on state and federal lands and waters, and on addressing nearer-term barriers. Select and award 4 projects with independents, and on a regional basis award 4 projects-PUMP. Award 2 projects in Advanced Technologies and select band award projects under the Broad Funding Announcement. (MET GOAL)<br><br>Advance the state-of-the-art in oil recovery processes by conducting bench tests (in surfactant behavior, and in paraffin deposition) and develop conceptual models and techniques related to chemical flooding, reservoir and flow simulation, reservoir characterization for enhanced oil recovery technologies to increase the amount of oil that can be recovered from discovered reservoirs (MET GOAL)<br><br>Reduce the number of dry holes drilled in frontier areas, and increase near-term energy security through field testing (3 projects) improved oil recovery techniques, seismic (1 project), data acquisition (2 projects), and interpretation (1 project) in existing light and heavy oil reservoirs at sites ranging from Alaska to Utah. Initiate full-scale test of newly developed | Enhance access to remaining domestic oil resources using advanced technology by focusing on high-risk research (award 3 projects—Micro-hole technology); issuing competitive solicitation and awarding three projects. Initiate Russian cooperative Research Program; and conduct model integration peer review and industry strategic program review. (MET GOAL) (4.57.1)<br><br>Advance the state-of-the-art in oil recovery processes by conducting bench tests in surfactant behavior (2 projects); modeling on-conventional reservoirs, studying gel control of water production, developing seismic algorithms to better identify hydrocarbon targets; testing 2 prototypes (3-phase separator and micro-hole completion), modeling sweep efficiency for enhanced oil recovery technologies to increase the amount of oil that can be recovered from discovered reservoirs, and completing tundra modeling and pond work, conducting wettability studies as well as initiating fracture development study. (MET GOAL) (4.57.2) | Develop technologies through 4 projects which will contribute to increasing domestic oil supplies in an environmentally friendly manner. (4.57.1) | Orderly terminate all activities. |

## Annual Performance Results and Targets Program Goal 04.57.00.00 Oil Technology, Abundant Oil

| FY 2001 Results | FY 2002 Results | FY 2003 Results | FY 2004 Results | FY 2005 Targets | FY 2006 Targets |
|---|---|---|---|---|---|
| | | vibration sonic tool. (NEARLY MET GOAL)<br><br>Stimulate current production through accelerated transfer of technology to U.S. producers, especially small independent companies that have limited exposure to the technology needed to increase the oil resource base through 66 regional workshops, including one on micro-hole technologies, publish 2 newsletters, and 2 reports. (MET GOAL) | | | |

**Means and Strategies**

For FY 2006, the strategy will be to conduct orderly termination of the program  Funding in FY 2006 will be used for legal obligations incurred by the termination process.

**Validation and Verification**

The Oil Program has impacted the domestic oil supply by performing R&D activities in partnership with universities, State and local governments, industry, and other stakeholders; using cost-share projects and diverse technology paths to improve chances of success, and to create a direct technology transfer component and seeking synergy of the capabilities of multiple governmental agencies, including the unique capabilities of National Laboratories and industry collaborating with other agencies to effectively promulgate and transfer domestic production technologies to the public.

Planned Program Evaluation:
The Office of Natural Gas and Petroleum Technology annually performs an internal review of the R&D portfolio as an integral part of annual budget preparation. Projects are evaluated periodically at contractor review conferences and as part of road-mapping workshops to determine R&D gaps. National Energy Technology Laboratory (NETL) technology managers individually monitor projects with status and major milestone reporting documented in a NETL project database. NETL in-house R&D projects are peer reviewed by external experts from academia and industry.

To validate and verify program performance, FE conducts various internal and external reviews and audits. FE's programmatic activities are subject to continuing review by the Congress, the General Accounting Office, the Department's Inspector General. In addition, various Operations/Field Offices commission external independent reviews of site baselines or portions of the baselines. Additionally, FE Headquarters senior management and Field managers conduct quarterly, in-depth reviews of cost, schedule, and scope to ensure projects are on-track and within budget.

**Program Assessment Rating Tool (PART)**
PART was developed by OMB to provide a standardized way to assess the effectiveness of the Federal Government's portfolio of programs. The structured framework of the PART provides a means through which programs can assess their activities differently than through traditional reviews. A PART assessment of the Oil Technology program was conducted for the FY 2004 Budget and a reassessment was conducted for the FY 2005 Budget.

The program was rated "Ineffective" in the Program Assessment Rating Tool analysis, based primarily on not demonstrating clear results of the research efforts

The Department has developed preliminary baseline benefit estimates for its applied R&D programs, but needs to improve consistency across programs in the methodology and assumptions used in estimating program costs and benefits.

## Funding by General and Program Goal

| | FY 2004 | FY 2005 | FY 2006 |
|---|---|---|---|
| General Goal 4, Energy Security | | | |
| Program Goal 04.57.00.00, Oil Technology, Abundant Oil | | | |
| Exploration and Production | 17,939 | 18,736 | 10,000 |
| Reservoir Life Extension/Management | 6,723 | 5,916 | 0 |
| Effective Environmental Protection | 9,445 | 9,269 | 0 |
| Total, General Goal 4 (Petroleum – Oil Technology) | 34,107 | 33,921 | 10,000 |

# Oil Technology

## Funding Schedule by Activity

(dollars in thousands)

| | FY 2004 | FY 2005 | FY 2006 | $ Change | % Change |
|---|---|---|---|---|---|
| Oil Technology | | | | | |
| Exploration and Production | 17,939 | 18,736 | 10,000 | -8,736 | -46.6% |
| Reservoir Life Extension/ Management | 6,723 | 5,916 | 0 | -5,916 | -100.0% |
| Effective Environmental Protection | 9,445 | 9,269 | 0 | -9,269 | -100.0% |
| Total, Oil Technology | 34,107 | 33,921 | 10,000 | -23,921 | -70.5% |

## Detailed Justification

(dollars in thousands)

| | FY 2004 | FY 2005 | FY 2006 |
|---|---|---|---|
| **Exploration and Production** | **17,939** | **18,736** | **10,000** |

The program focused on development of technologies to economically recover the oil remaining in mature fields by expanding the technology options for enhanced oil recovery. In FY 2006, the program will orderly terminate all Oil Technology activities.

- **Conclude Program** ..... **0** **0** **9,900**

  In FY 2006, conduct orderly termination of the Oil Technology Program activities in Exploration and Production, Reservoir Life Extension and Effective Environmental Protection. Funding in FY 2006 will be used for legal obligations incurred by the termination process. *Participants: NETL, TBD.*

  No activities in FY 2004 and FY 2005.

- **EOR/$CO_2$ Injection** **1,975** **2,386** **0**

  FY 2006 closeout activities included above.

  In FY 2005, conduct work on short and long term efforts to enhance utilization of industrial $CO_2$. The strategy is to increase the adoption of 'best practices' to opportunities existing in the near-term. Specifically, basin-wide strategies will be examined to identify ways to lower cost and accelerate infrastructure development to cost effectively deliver $CO_2$ from industrial sites to candidate oil fields; this effort includes resolving potential permitting and regulatory issues. *Participants include LBNL, LANL, NETL, TBD.*

(dollars in thousands)

| FY 2004 | FY 2005 | FY 2006 |
|---|---|---|

In FY 2004, reservoirs will be identified based upon economics, technological issues, and feasibility for benefit from $CO_2$ injection. Technology to make $CO_2$ flooding applicable to a wider class of reservoirs will be pursued. Oil reservoirs will be mapped with locations of existing industrial sources and the price and/or incentives for $CO_2$ that would be needed to make the project economical. Flooding scenarios will be considered to leave maximum $CO_2$ in the reservoir. Program success will offer options for future carbon management policy choices. *Participants: NETL, Northrop Grumman, National Labs, TBD.*

- **Diversity of Global Oil Supply** ..... **0** **976** **0**

FY 2006, closeout activities included above.

In FY 2005, conduct work on diversification of international sources of oil supplies through bilateral activities with nations that are expanding their oil industry, including Norway, Canada, Mexico, and others. Bilateral and multi-lateral work will include technology exchanges and joint research, development and demonstration under the Administration's North American Initiative and other international agreements. *Participants to be determined.*

No funding was requested for this activity in FY 2004.

- **Advanced Drilling, Completion and Stimulation** .... **1,972** **2,071** **0**

FY 2006 closeout activities included above.

In FY 2005 conduct work on upgrades to the Advanced Cuttings Transport Facility that allow high-temperature/high-pressure experimentation on energized fluids (air, mist, gas assisted, foam, etc.) and synthetic drill fluids, cements, and transport of fluids in horizontal and inclined wellbores. *Participants included: Northrop Grumman, University of Tulsa, DEA, APS Technology, Impact Technologies, National Labs, NETL.*

In FY 2004 funding continued upgrades to the Advanced Cuttings Transport Facility that allowed high-temperature/high-pressure experimentation on energized fluids (air, mist, gas assisted, foam, etc.) and synthetic drill fluids, cements, and transport of fluids in horizontal and inclined wellbores. *Participants included: Northrop Grumman, University of Tulsa, DEA, APS Technology, Impact Technologies, National Labs, NETL.*

- **Advanced Diagnostics and Imaging Systems**..... **4,939** **4,832** **0**

FY 2006 closeout activities included above.

In FY 2005, conduct work on development of advanced reservoir diagnostics and imaging systems to optimize oil discovery and recovery. Develop quantitative engineering parameters that control rock-fluid interactions which impact oil production. Complete work on fundamental geoscience efforts focusing on geoscience/engineering reservoir characterization on naturally fractured reservoirs. *Participants included: Cal Tech, Northrop Grumman, Univ of Houston, Univ of Kansas, CSM, Stanford Univ, Univ of TX @ Austin, Mich Tech, Univ of Illinois, MT BOM, NMIMT, Western Michigan Univ, Adv Resources, Wm Marsh Rice Univ, NETL.*

(dollars in thousands)

| FY 2004 | FY 2005 | FY 2006 |
|---|---|---|

In FY 2004, funding continued development of advanced reservoir diagnostics and imaging systems to optimize oil discovery and recovery. Developed quantitative engineering parameters that control rock-fluid interactions which impact oil production. Continued fundamental geoscience efforts focusing on geoscience/engineering reservoir characterization on naturally fractured reservoirs. *Participants included: Cal Tech, Northrop Grumman, Univ of Houston, Univ of Kansas, CSM, Stanford Univ, Univ of TX @ Austin, Mich Tech, Univ of Illinois, MT BOM, NMIMT, Western Michigan Univ, Adv Resources, Wm Marsh Rice Univ, NETL.*

- **Multi-National Laboratory/Industry Partnership and National Laboratory Supporting Research**..... **1,975** **1,479** **0**

FY 2006, closeout activities included above.

In FY 2005, conduct work on the transfer of technologies that advance understanding of the characteristics and producibility from oil reservoirs. *Participants included: National Labs*

In FY 2004, funding continued the transfer of technologies that advance understanding of the characteristics and producibility from oil reservoirs. *Participants included: National Labs*

- **Reservoir Efficiency Processes**..... **4,432** **3,875** **0**

FY 2006 closeout activities included above.

In FY 2005, conduct work on development of improved gas flooding recovery methods and advanced the state-of-the-art in reservoir simulation. *Participants included: NETL, Northrop Grumman, NMIMT, Univ of TX, Cal Tech, Univ of OK, Univ of Kansas, Univ of TX @ Austin, Stanford Univ, Correlations Company, Adv Resources Intl, Univ of Utah, Univ of Pitts, Univ of Houston, Univ of Oklahoma, TBD.*

In FY 2004, funding continued development of improved gas flooding recovery methods and advanced the state-of-the-art in reservoir simulation. *Participants included: NETL, Northrop Grumman, NMIMT, Univ of TX, Cal Tech, Univ of OK, Univ of Kansas, Univ of TX @ Austin, Stanford Univ, Correlations Company, Adv Resources Intl, Univ of Utah, Univ of Pitts, Univ of Houston, Univ of Oklahoma, TBD.*

- **Arctic Research**..... **1,481** **1,954** **0**

FY 2006, closeout activities included above.

In FY 2005, conduct research on the oxygen transport membrane being conducted at the University of Alaska, Fairbanks. Complete research in oil-related projects through the Office of Arctic Energy including tundra travel model for the North Slope of Alaska, characterization and alteration of wettability states of Alaskan reservoirs, and physical, biological and chemical implications of mid-winter pumping of tundra ponds. Participants included UAF, AK Dept. Natural Resources, TBD.

(dollars in thousands)

| FY 2004 | FY 2005 | FY 2006 |
|---|---|---|

In FY 2004, research continued on the oxygen transport membrane being conducted at the University of Alaska, Fairbanks. Other research was conducted in oil-related projects through the Office of Arctic Energy including tundra travel model for the North Slope of Alaska, characterization and alteration of wettability states of Alaskan reservoirs, and physical, biological and chemical implications of mid-winter pumping of tundra ponds. *Participants included UAF, AK Dept. Natural Resources, TBD.*

- **Russia Technology Program**..... **988** **976** **0**

  FY 2006 closeout activities included above.

  In FY 2005, conduct work on the Russian Cooperative Research Program including one or more of the following technology focus areas: USGS-Russian Offshore Arctic Resource Assessment; World Bank Global Gas Flaring Initiative; Arctic Construction and Operations Technology Transfer Initiative; "Full Value Chain" Oil Spill Restoration; Prevention, and Response Program; and/or, U.S.-Russia Commercial Energy Summit Education Initiative. Participants: TBD

  In FY 2004, the Russian Cooperative Research Program will include the following technology focus areas: USGS-Russian Offshore Arctic Resource Assessment; World Bank Global Gas Flaring Initiative; Arctic Construction and Operations Technology Transfer Initiative; "Full Value Chain" Oil Spill Restoration; Prevention, and Response Program; and/or, U.S.-Russia Commercial Energy Summit Education Initiative. Participants: TBD

- **Program Support**..... **177** **187** **100**

  Fund technical and program management support.

**Reservoir Life Extension/Management** ..... **6,723** **5,916** **0**

- **Domestic Resource Conservation** ..... **6,653** **5,857** **0**

  FY 2006 closeout activities included above.

  In FY 2005, conduct work on the following elements: 1) Key technology prototype development, such as micro-hole technologies, for enabling improved access and minimizing environmental impact; 2) Technology transfer with special emphasis on independents; and 3) Policy analysis and planning to prioritize program efforts and provide policy evaluations to maximize impact on domestic oil recovery over a wide range of technological and economic conditions. *Participants include PTTC, Northrop Grumman, CDO, Univ of Kansas, Penn State, NETL and TBD.*

  In FY 2004, elements include: 1) Key technology prototype development, such as micro-hole technologies, for enabling improved access and minimizing environmental impact; 2) Technology transfer with special emphasis on independents; and, 3) Policy analysis and planning to prioritize program efforts and provide policy evaluations to maximize impact on domestic oil recovery over a wide range of technological and economical conditions. *Participants: Bandera Petroleum, Western Well Tool Company, Baker Hughes, Schlumberger, Northrop Grumman, Penn State Stripper Well Consortium, Veneco, Dennis Tool, CDO, Stolar Research, Gas Production Specialists, NETL, TBD.*

(dollars in thousands)

| | FY 2004 | FY 2005 | FY 2006 |
|---|---|---|---|
| ▪ **Program Support**..... | **70** | **59** | **0** |
| Fund technical and program management support. | | | |
| **Effective Environmental Protection**..... | **9,445** | **9,269** | **0** |

The Effective Environmental Protection has focused on technologies and practices that reduce the environmental impact of oil exploration, production, and processing while minimizing the cost of effective environmental protection and compliance. The program has supported energy security by helping to overcome the environmental barriers that limit access to domestic resources. The program also has supported the President's Clear Skies Initiative by reducing emissions from oil production and processing. In addition, the program has supported the recommendations of the National Energy Policy by encouraging additional recovery from existing wells, providing technology to allow additional oil development on Federal lands and providing answers to environmental questions that are limiting oil exploration and production in the National Petroleum Reserve - Alaska. Activities have provided a complete examination of specific impact of produced water and the more general problem of water management. A detailed roadmap of the necessary actions has been presented in a public workshop for discussion and inclusion of stakeholder views. The overall objective has been to help balance the need to develop the Nation's energy resources while maintaining our environmental values. This program has filled critical information and technical gaps that are needed to meet the Nation's energy needs without sacrificing environmental quality.

| | | | |
|---|---|---|---|
| ▪ **Environmental Science** | **9,349** | **9,176** | **0** |

FY 2006 closeout activities included above.

In FY 2005, conduct work on targeted activities to define and solve specific problems in key areas, specifically: 1) management of produced water and technology development that makes produced water a resource for beneficial uses; and 2) ensuring maximum sustainable access to oil resources on Federal lands. *Participants include: KS State Univ, Northrop Grumman, TX -EES, Univ of N Carolina, Univ of TX at Austin, IOGCC, GWPC, CSM, CDO, NETL, LBNL, LLNL TBD.*

In FY 2004, targeted activities were conducted to define and solve specific problems in key focus areas, specifically: 1) management of produced water and technology development that makes produced water a resource for beneficial uses; and, 2) ensuring maximum sustainable access to oil and gas resources on Federal lands. An outreach program was conducted to ensure that accurate information about the impacts of oil and gas development is presented to the public. Develop objective, credible data for regulatory decisions as part of a program-wide environmental strategy for maintaining U.S. oil production capacity. *Participants: NETL, LANL, NIST, IOGCC, KS State Univ, Northrop Grumman, TX-EES, Univ of N Carolina, Univ of TX at Austin, Aera Energy, GWPC, LBNL, LLNL, BLM, and TBD*

| | | | |
|---|---|---|---|
| ▪ **Program Support**..... | **96** | **93** | **0** |

Fund technical and program management support.

(dollars in thousands)

| | FY 2004 | FY 2005 | FY 2006 |
|---|---|---|---|
| **Total, Petroleum - Oil Technology** | **34,107** | **33,921** | **10,000** |

## Explanation of Funding Changes

| | FY 2006 vs. FY 2005 ($000) |
|---|---|
| **Exploration and Production** | |
| • Budget discipline necessitated close scrutiny of all Fossil Energy programs, using strict guidelines to determine their effectiveness and compare them to other programs offering more clearly demonstrated and substantial benefits. As a result, the 2006 Budget proposes to conduct orderly termination of the program in FY 2006 | -23,921 |
| **Total Funding Change, Oil Technology** | **-23,921** |