

Natural Gas Technologies

Funding Profile by Subprogram

(dollars in thousands)

	FY 2003 Comparable Appropriation	FY 2004 Comparable Appropriation	FY 2005 Base	FY 2005 Request	FY 2005 Request vs Base	
					\$ Change	% Change
Natural Gas Technologies	45,860	42,994	42,994	26,000	-16,994	-39.5%
Total, Natural Gas Technologies	45,860	42,994	42,994	26,000	-16,994	-39.5%

Mission

This program will develop policies and new technologies that stimulate a diverse supply of natural gas - both in North America and around the world so that the market can function to the benefit of all Americans.

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 2002, a two-year effort, involving external peer review, was begun to integrate these two separate modeling systems into one system for improved simulation of resource and market conditions, and consistency of technology assumptions and model outputs. Under the previous two model systems, deficiencies, such as the assumption of unlimited industry capital availability, could result in an overestimation of industry's response to DOE's R&D products. Conversely, deficiencies, such as only modeling upstream R&D activities and not calculating the synergistic benefits of oil and gas R&D efforts, could result in an underestimation of the benefits of DOE's programs.

The new model will provide the following expected benefits:

- Complimentary technology development in oil and gas research.
- Full R&D program activities can be modeled.
- Ability to calculate synergistic benefits of the oil program on gas production and the gas program on oil production.

As part of the effort to conform to the President's Management Agenda in a shorter-term, Fossil Energy has undertaken 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, using the Energy Information Administration National Energy Modeling System (NEMS), is examining all Fossil Energy research programs on a common basis with respect to modeling assumptions and should enable aggregate and comparative assessments of the benefits of Fossil Energy research

programs. This spring, a complete explanation of methodology and assumptions will be posted on the Department's website.

Background

Natural Gas is the cleanest burning fuel, and we rely on it to provide a quarter of our Nation's energy needs. However, wide fluctuations in prices and concerns for adequate supplies have been directly responsible for the loss of American jobs.

This program supports three Presidential initiatives. Clear Skies, Climate Change, and energy security provide the underpinning for the Natural Gas Technologies program.

Clear Skies and Climate Change: Growing supplies of natural gas are required to meet the increased demand for electric generation and other residential and industrial use. A primary reason for this demand is that electricity generators can competitively meet increasingly more stringent environmental emissions, including the Clear Skies goal, provided natural gas remains abundant and therefore affordable. Through technology and policy options, the program will provide clean, abundant, affordable natural gas in support of these Presidential initiatives.

Energy Security: The natural gas technologies program goal provides technology and policy actions to increase domestic fuel supplies, expand import/export options, and assure reliable, and secure transmission, distribution, and storage infrastructures.

To meet the increasing U.S. demand for natural gas (AEO 2004 expects present use of 22.8 Tcf to grow to 31.4 Tcf by 2025, an almost 40% increase) at stable and affordable prices, new supplies must be found. Sources of North American natural gas are extensive, but much of it is uneconomic to find and produce. Technology is the key to producing this resource economically.

Natural Gas Exploration and Production-Sustainable Supply program will provide new tools and technologies that can improve access, economics and environmental performance of onshore and offshore gas operations. Significant emphasis will be placed on public lands in the Rocky Mountain region where much of the nation's undiscovered gas resource is located.

Natural gas storage will also assume increasing significance as more power plants require consistent, year-round supplies of natural gas. A nationwide, industry-led consortium will develop ways to improve the reliability and efficiency of the nation's gas storage system.

The program will also work to facilitate Liquefied Natural Gas (LNG) importation. Natural gas supply can be increased through liquefied natural gas (LNG) imports, which can respond readily to demand swings. The global gas industry and domestic consumers will benefit through an association of value chain participants who can openly and freely exchange both technical and market information.

Gas Hydrates: Over the long-term, the production of natural gas from the U.S.'s vast deposits of methane hydrates, which is the program goal, could strengthen energy security. Understanding hydrates can also improve the scientific understanding of greenhouse gases and possibly offer future mechanisms for sequestering carbon dioxide. In the near-term, implications for drilling or producing oil and gas near

or through hydrate formations must be understood to avoid significant environmental damage that could occur with conventional oil and gas operations.

Effective Environmental Protection-Environmental Science: Improved technology and policy will facilitate increased access to Federal and environmentally sensitive lands. The environmental science program includes a focus on issues constraining produced water from coalbed methane production.

Strategic and Program Goals

The Department's Strategic Plan identifies 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 Coal and Other Power Systems program supports 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 Natural Gas Technologies program has one program goal which contributes to General Goal 4 in the "goal cascade".

Program Goal 04.56.00.00: Natural Gas Technologies, Abundant Affordable Gas: The Natural Gas Technologies' goal is to provide technology and policy options capable of ensuring abundant, reliable, and environmentally sound gas supplies.

Contribution to Program Goal 04.56.00.00 Natural Gas Technologies, Abundant Affordable Gas

The Program Goal will support General Goal 4 through three long-term goals that increase the amount of gas available to the domestic consumer and support the transition to the hydrogen economy. Benefits from these long-term goals are based upon the target funding level. Benefits from natural gas environmental funding are combined with benefits from the oil environmental funding and reported with the oil program.

- Over the planning horizon (2003-2015), program efforts through public-private partnerships will add 50 Tcf of economically recoverable natural gas resources to domestic supply resulting in a cumulative cost savings of \$85 billion by lowering the price of natural gas. Annually, the National Energy Modeling System (NEMS) will be used to assess the cost savings associated with abundant gas supply.
- Over the planning horizon (2003-2025), program efforts will add 22 Tcf of technically recoverable methane hydrates to the gas resource base.

The key to affordable natural gas in a rising demand environment is increasing supply, and the key to increasing supply is technology coupled with appropriate policy. The program will work in public-private partnerships with industry, universities, and other stakeholders to develop technologies to increase the supply of natural gas through technology and policy.

Annual targets for the gas supply target will track advances in key technology areas like advanced drilling, stripper-well production, and storage. Roughly half of the program's projects are successful. Based upon modeling considerations, four successful projects are sufficient to keep the program on target. Successful projects decrease cost of production and/or increase efficiency of finding gas. Either increases the economically recoverable natural gas resource. When this technology is implemented by industry, the production (supply) of natural gas increases and the price of natural gas likely declines. The price drop results in a cost savings to the consumer.

Annual targets for the methane hydrates will track critical progress in key program areas including resource characterization and safety and seafloor stability that will eventually led to identification of technically recoverable resources.

The program's performance measures will be tracked on a quarterly basis using DOE's JOULE Performance Measures system. In this system the quarterlies will roll up to the annuals and the annuals will roll up to the Program Goal. To date, the program has received perfect scores on its FY 2003 performance measures.

The key to affordable natural gas in a rising demand environment is increasing supply in an environmentally acceptable manner. The key to increasing supply is a balanced policy and technology initiative focused on expanding the gas supply from key regions in the U.S., and diversifying the supply portfolio through increased imports. The program will work in public-private partnerships with industry, universities, and other stakeholders to develop policies and technologies to increase the supply of natural gas.

The program's performance measures will be tracked on a quarterly basis using DOE's JOULE Performance Measures system. In this system the quarterlies will roll up to the annuals and the annuals will roll up to the Program Goal.

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Annual Performance Results and Targets

FY 2000 Results	FY 2001 Results	FY2002 Results	FY 2003 Results	FY 2004 Targets	FY2005 Targets
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Program Goal 04.56.00.00 Natural Gas Technologies, Abundant Affordable Gas

Exploration and Production

Demonstrate a cost-effective horizontal well and advanced exploration and stimulation technologies in low permeability natural gas formations for increasing recovery of the 5,000+ TCF of gas in place in the Greater Green River and Wind River Basins. (NEARLY MET GOAL)

Demonstrate safe economic slimhole drilling technology in actual use under Arctic conditions. This technology can significantly reduce cost and environmental impacts. (MET GOAL)

Develop and demonstrate two technologies to detect and quantify areas of high fracture density in currently uneconomic low permeability gas reservoirs. This program has the near-term commercial potential to double average per-well productivity. (MET GOAL)

Complete basin model for the Wind River basin and well site selection in Greater Green River Basin to evaluate integrated remote sensing, seismic surveys and basin structural analysis to differentiate gas-bearing from uneconomic fractured reservoirs, complete a conceptual model of regional water distribution to help operators avoid poor production areas, and build and have field ready an initial prototype of a 400-geophone receiver array to improve seismic resolution necessary to locate economically productive gas zones. (MET GOAL)

Conduct 2 field tests of improved drilling technology that will improve the productivity of gas reservoirs and reduce drilling costs and 2 field tests of technologies to improve natural fracture detection to increase the percentage of economically producing wells of all wells drilled. (MET GOAL)

Conduct laboratory studies and feasibility analyses necessary to justify the next stage of R&D for a drilling vibration monitoring and control system, a novel mud hammer, high-temperature high-pressure cements, gas resources in the Uinta and Anadarko basins, and high-temperature electronics. This is accomplished by completing prototype development and validation testing of data fusion algorithms, a power amplifier, and simulating software for fractured reservoirs prior to field trials.

Complete field tests and analysis of stripper well technologies, a jet assisted drilling system, advanced fracture stimulation designs, natural fracture predictions, and downhole power and communications systems to determine the overall technical and cost efficiency of the technology and the next step(s) to be taken, i.e., commercialization, additional modifications and testing, or termination.

Complete four of the prototype near-term products or field tests from three critical technology areas: advanced drilling, stripper-well enhancement, and gas storage. When these technologies are fully transferred to industry, they will substantially reduce costs or increase efficiency in gas exploration, production and storage. The prototype projects can be found on the program's website. Based on modeling estimates.

Gas Hydrates

Identify a site containing gas hydrates suitable for testing the feasibility of methane recovery. (MET

GOAL) Quantify a hydrate deposit by correlating core samples with geophysical and well log data. (MET GOAL)

Exchange information and coordinate effort between government agencies. Award subprojects under Joint Industry Projects for

Hold interagency meetings to exchange hydrate information and coordinate hydrate efforts between government agencies; issue

FY 2000 Results	FY 2001 Results	FY2002 Results	FY 2003 Results	FY 2004 Targets	FY2005 Targets
GOAL)			<p>Gulf of Mexico seafloor stability and monitoring programs. Issue newsletters, publish available technical reports on the methane hydrate website, and hold 2 workshops to communicate program results to researchers. Conduct annual Federal Advisory Committee meeting. (MET GOAL)</p>	<p>newsletters; and hold workshops to communicate program results to stakeholders.</p>	
			<p>Complete hydrate modeling for Alaska drilling program. Report strength and thermal property tests at national labs, this is fundamental data needed to model production and seafloor stability of hydrates. Develop prototype Raman Spectroscopy to use lasers to define hydrate molecular structure. (MET GOAL)</p>	<p>Complete laboratory analysis of core samples from the Malik research well and the Hot Ice No. 1 well, thermal property and thermal conductivity measurements, and complete installation of a 12-liter hydrate cell to obtain the necessary data for modeling and characterizing hydrate deposits.</p>	<p>Conduct an ocean expedition to retrieve gas hydrate samples for laboratory analysis. This will increase the understanding of sub-sea resources, which is a prerequisite for development of safe production technologies.</p>
			<p>Complete initial report of improved hydrate coring device on Ocean Drilling Program, Leg 204. Study of oceanic samples is essential to understanding the distribution and properties of hydrates in nature. Drill 1 test well to determine aerial extent of hydrate occurrence in Alaska. Complete evaluation of hydrate occurrence in Gulf of Mexico to understand the interaction of hydrate and seafloor stability. (MET GOAL)</p>	<p>Complete field tests of hydrate logging and coring operations in the Gulf of Mexico, and drilling and coring Hot Ice No. 1, and analyze results and publish reports on ODP leg 204 and Malik well to advance our understanding of seafloor stability and production potential.</p>	

FY 2000 Results	FY 2001 Results	FY2002 Results	FY 2003 Results	FY 2004 Targets	FY2005 Targets
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Infrastructure

Complete laboratory testing and begin field demonstration of an improved remedial technology for storage wells. (MET GOAL)

Conduct 4 field tests to demonstrate technical feasibility of advanced remote sensing and pipeline inspection technologies to reduce unintentional damage and increase pipeline integrity. Complete 2 field tests for underground gas storage facilities to improve gas storage well deliverability. Complete field testing of energy meter prototype.

Effective Environmental Protection

Analyze results of bench-scale reverse osmosis in produced water treatment equipment. Develop kinetics for model compounds to be used in enzymatic and biomimetic catalysts for upgrading heavy crude oils. Construct greenhouse prototype for phytoremediation for methane (natural gas) from coal beds (CBM) water. Collect data on fine particulate matter emission factors. These studies will provide the scientific basis for lower-cost commercial-scale environmental technologies. (MET GOAL)

Ensure that refining and gas production and use are safe for the environment and the public by conducting field tests and data analysis for remediation, produced water treatment, and synthetic mud technologies. Also preparing baseline characterization of impacts of Wyoming and Montana coalbed methane (gas from coal seams) production on groundwater systems and utilizing laser-coupled technology to identify natural gas distribution system leaks.

Efficiency Measure: Meet the procurement plan metric which requires successfully completing greater than 90 percent of the procurement milestones (e.g., solicitation

FY 2000 Results	FY 2001 Results	FY2002 Results	FY 2003 Results	FY 2004 Targets	FY2005 Targets
					issue date, proposal ranking deadline, signing of selection statement, Congressional notification, making awards, etc.).

Means and Strategies

Three Presidential initiatives: Clear Skies, Climate Change, and energy security provide the underpinning for the Natural Gas Technologies program. These initiatives form the basis for the program strategy: (1) protecting the environment through enhanced design and efficiency of domestic natural gas exploration, production, transport, and storage operations; (2) supporting technology paths that private companies cannot risk undertaking alone; (3) providing scientific and technological information and analysis to assist policymakers in their decision-making; and, (4) optimizing environmental protection by contributing to science-based improvements in regulations that reduce uncertainties and costs.

The Natural Gas Technologies program will use various means and strategies to achieve its program goals. However various external factors may impact the ability to achieve these goals. The program also performs collaborative activities to help meet its goals.

The strategies related to increasing domestic supplies are achieved by: increasing recovery through lower cost drilling, wellbore improvements, and improved stimulation technology; improving geoscience technologies to locate and measure gas within reservoirs; extending the life of mature gas fields and reducing well abandonments; and modeling estimates of potential economic recovery of domestic gas through a range of technologies, economic criteria, and legislative and regulatory scenarios.

Validation and Verification

The program is a major supporter of DOE's performance measures tracking system (JOULE) and has pioneered many of the system's tracking and reporting tools. GPRA reporting requirements are handled through the JOULE system, and the program has also used the same software JOULE to track performance on a number of additional measures covering the full breath of the program's activities (FE JOULE) including efforts to track the status of key outreach milestones into JOULE. In FY 2003, the program got to and stayed at "Green."

To validate and verify program performance, FE will conduct 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, the Nuclear Regulatory Commission, the U.S. Environmental Protection Agency, state environmental and health agencies, the Defense Nuclear Facilities Safety Board, and the Department's Office of Engineering and Construction Management. Each year, the Office of Engineering and Construction Management conducts external independent reviews of selected projects. 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.

Collaboration Activities: The impact of the Domestic Gas Supply program is expanded 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; seeking synergy of the capabilities of multiple governmental agencies and industry, including the unique capabilities of National Laboratories; collaborating with other agencies to effectively promulgate domestic production technologies; investing jointly with other groups in promising technologies for target resource areas; conducting, with input

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from National Laboratories, field demonstrations in collaboration with industry, academia, and others; and transferring technologies in cooperation with State and industry organizations.

External Factors Affecting Performance: Access to public land is the single most important factor impacting the supply of domestic natural gas. Additional factors include world oil prices, corporate mergers and acquisitions, availability and cost of capital, and new and evolving environmental legislation and regulation may affect gas program results.

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) product 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. DOE has recently developed specific metrics to better quantify and value R&D results. In addition, program benefits are estimated using the National Energy Modeling System (NEMS) supported by macroeconomic and detailed industry-specific models. Modeling assumptions and methods are reviewed externally, and the results are compared to results from other programs to determine the best application of R&D resources. Headquarter and field teams have been established to insure close cooperation in the implementation of performance measure and benefit calculations.

Program Assessment Rating Tool (PART)

The Department implemented a tool to evaluate selected programs. 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. The Gas Technologies program has incorporated feedback from OMB into the FY 2005 Budget Request and has taken or will take the necessary steps to continue to improve performance.

Assessment under PART found the program was ineffective and lacks a vigorous peer review. Its annual and long-term measures have been agreed upon, but modeling assumptions need to be made more transparent.

Funding by General and Program Goal

(dollars in thousands)

	FY 2003	FY 2004	FY 2005	\$ Change	% Change
General Goal 4, Energy Security					
Program Goal 04.56.00.00, Natural Gas Technologies, Abundant Affordable Gas					
Exploration and Production.....	22,712	22,203	17,500	-4,703	-21.1%
Gas Hydrates	9,218	9,383	6,000	-3,383	-36.1%
Infrastructure.....	8,780	8,939	0	-8,939	-100.0%
Emerging Processing Technology	2,593	0	0	0	0.0%
Effective Environmental Protection.....	2,557	2,469	2,500	+31	+1.3%
Total, General Goal 4 (Natural Gas Technologies)	45,860	42,994	26,000	-16,994	-39.5%

Natural Gas Technologies

Funding Schedule by Activity

(dollars in thousands)

	FY PY	FY CY	FY BY	\$ Change	% Change
Natural Gas Technologies					
Exploration and Production	22,712	22,203	17,500	-4,703	-21.1%
Gas Hydrates.....	9,218	9,383	6,000	-3,383	-36.1%
Infrastructure	8,780	8,939	0	-8,939	-100.0%
Emerging Processing Technology	2,593	0	0	0	0.0%
Effective Environmental Protection	2,557	2,469	2,500	+31	+1.3%
Total, Natural Gas Technologies	45,860	42,994	26,000	-16,994	+39.5%

Detailed Justification

(dollars in thousands)

	FY 2003	FY2004	FY 2005
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Exploration and Production..... 22,712 22,203 17,500

In FY 2005, this program will continue develop technologies that will overcome major market and technological barriers to increase domestic supply of natural gas at reasonable prices without harm to the environment.

▪ **Sustainable Supply..... 0 0 12,375**

In FY 2005 the program will focus on resources in high-priority regions to find and produce gas from non-conventional and deep gas reservoirs with minimal environmental impact. Deep Trek projects for EM telemetry, microwave drillpipe, advanced diamond cutters and fluid systems will complete field testing. Deep Trek projects for high temperature electronics, super cement, and advanced MWD will complete prototype development. Projects selected under the FY 2004 Deep Gas Imaging and Technologies for Tight Gas Solicitation will continue. DOE will continue the long-term sustainability program and

(dollars in thousands)

FY 2003	FY2004	FY 2005
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complete ongoing projects in advanced diagnostics and imaging, and drilling completion and stimulations.

DOE will continue the National Stripper Well Consortium involving industry and the research community to investigate multiple technologies to improve stripper well production and prevent the abandonment of 8% of total U.S. production. In addition, DOE will support industry-led efforts in technology transfer through workshops and publications focused on the small- to mid-sized independents.

To assure efficient and reliable availability of natural gas to end users, DOE will continue funding a National, industry-driven consortium in gas storage (similar to the Stripper Well Consortium), to improve the reliability and efficiency of the existing storage system. In addition, DOE will conduct two research projects to develop advanced sensors for plastic and metal pipes.

Participants include: Honeywell, Schlumberger, E-Spectrum, Cementing Soutions, Hart Publications, PTTC, PSU, ACPT, Terra Tek, CSI, GTI, E2S, NETL, State of California, TBD.

In FY 2004 and FY 2003, project activities were funded in other key activities, below

- **Advanced Drilling, Completion and Stimulation .** **9,870** **9,876** **0**

No activity in FY 2005. Technologies for advanced drilling and drilling greater than 15,000 feet included in Sustainable Supply above.

FY 2003 and FY 2004 funding continued development of real-time fracture height growth diagnostic tool, ultra-light weight cement for deep water applications, high-pressured coiled tubing drilling system, mud hammer, long-term, revolutionary technologies such as laser drilling and perforations, technologies for drilling deeper than 16,000 feet including high performance drilling and completion systems, advanced coatings and hardening of "Smart" systems and sensors. *Participants included: NETL, Novatek, Mauer, Tempress, Tech Int., Cementing Solutions, Real-Tme Zone, Terra Tek, GTI, TBD*

- **Advanced Diagnostics and Imaging Systems** **3,964** **3,952** **0**

No activity in FY 2005. Advanced Diagnostics and Imaging Systems are combined under Sustainable Supply above.

FY 2004 and FY 2003 funding continued development of infill drilling optimization in the San Juan basin and Delaware basin of New Mexico, next generation of fracture detection technologies, long-term sustainability of gas supply study in Rocky Mt. basins, improved completion technologies, solutions to high water production problems in tight sand regions, super high resolution seismic tools and shear wave imaging. *Participants included: NETL, ARI, Stanford, LBL, SUNY, SNL, Paulsson Geophysical, University of Texas, Cementing Solutions, N. Mex. Tech.*

- **Multi National Laboratory/ Industry Partnership** **1,987** **1,975** **0**

No activity in FY 2005.

(dollars in thousands)

FY 2003	FY2004	FY 2005
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FY 2004 and FY 2003 funding continued research in 10 projects focused on advanced drilling, completion, and stimulation technologies and advanced diagnostics and imaging technologies.

- **Secondary Gas Recovery Program** 497 0 0

No activity in FY 2005 or FY 2004.

FY 2003 funding was used to issue a broad based financial assistance competition for secondary gas recovery studies in regions outside of the Gulf of Mexico. *Participants to be determined.*

- **Stripper Well Revitalization** 1,192 1,185 0

In FY 2005, this activity will continue under the Sustainable Supply effort described above.

FY 2004 and FY 2003 funding continued National, industry-driven consortium to investigate multiple technologies to improve stripper well production. *Participants included: Penn St. Univ.*

- **Technology Transfer** 497 494 0

In FY 2005, this activity will continue under the Sustainable Supply effort described above.

FY 2004 and FY 2003 funding continued industry led efforts in technology transfer. *Participants included: PTTC, Hart Publications.*

- **Deep Trek** 1,490 1,481 0

In FY 2005, this activity will continue under Sustainable Supply effort described above.

FY 2004 and FY 2003 funding continued development of technologies for drilling deeper than 16,000feet below the earth's surface, including high performance drilling and completion systems, advanced coatings and hardening of "Smart" systems and sensors, low friction, wear resistant coatings/materials. *Participants included: SNL, Honeywell, Schlumberger.*

- **Liquefied Natural Gas**..... 0 0 4,950

Increased gas supplied to the market place through LNG imports will reduce the price volatility in the market. In FY 2005, initiatives will be started to complete analyses of the economic impact of LNG supplies in the US gas market, the impact LNG tanker traffic on shipping in U.S. ports, and specific safety and security issues related to the delivery of LNG to terminals in the U.S. A federal agency task force will be established to streamline the LNG terminal approval process. An analysis of the benefits of LNG production vs. flaring will be completed for presentation to nations currently wasting associated gas produced along with oil. *Participants include: Conversion Gas Imports, NYSEG, TBD.*

- **Arctic Research** 2,982 2,964 0

No funding requested for this activity in FY 2005.

FY 2004 and FY 2003 funding supported the Arctic Energy Office and research concerning the natural gas pipeline.

- **Program Support** 233 276 175

Fund technical and program management support.

(dollars in thousands)

FY 2003	FY2004	FY 2005
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Gas Hydrates **9,438** **9,383** **6,000**

Gas Hydrates, located in Alaska and the Gulf of Mexico and other offshore locations of the U.S., contain huge resources of natural gas (if only 1% were economically producible, we could triple our resource base). In addition to their potential as a resource, hydrates appear to have implications for the global climate. Significant research is needed to provide the knowledge and technology to understand the fundamental characteristics of hydrates by 2010, and commercially produce gas from hydrates starting in 2015-2020, when more conventional resources decline. Because this research is high risk and long-term, and could potentially lower the value of current reserves, there is little incentive for industry to take the lead in hydrate development.

▪ **Gas Hydrates** **9,124** **9,290** **5,940**

In FY 2005 and FY 2004 the program will support one ongoing joint industry project needed to drill initial coring wells in the Gulf of Mexico in order to assess the potential resource in the Gulf of Mexico. In addition, one Alaska hydrate project funded in FY 2003 will be continued to assess the extent of gas resources locked in hydrate formations in Alaska. Main emphasis will be on taking stratigraphically deep cores from hydrate formations in the Gulf of Mexico. *Participants include: TBD, Chevron Texaco*

FY 2003 funding continued industry-led field activities to drill and collect samples of naturally occurring hydrate from Alaska permafrost for characterization, Joint Industry Project to understand fundamental hydrate issues in the Gulf of Mexico, national lab work and Gulf of Mexico Seafloor Monitoring work.. *Participants included: U. Miss., Chevron Texaco, BP, Maurer.*

▪ **Program Support** **94** **93** **60**

Fund technical and program management support.

Infrastructure **8,780** **8,939** **0**

This program develops technology to ensure the operational reliability and integrity of transmission and utility distribution pipeline systems. The research is focused on five categories: inspection technologies, remote sensing, materials development, operational technologies, and storage. Benefits of the program are expected to be reduced greenhouse methane emissions, increased pipeline capacity, improved pipeline assessment techniques, more efficient pipeline operations, and increased safety and security.

▪ **Storage Technology** **1,940** **1,956** **0**

In FY 2005, this activity has been combined with the Sustainable Supply program described above.

FY 2004 and FY2003 funding was used to continue development of an energy meter, to establish an industry driven underground gas storage consortium, initiate bedded salt and electronic flow meter data modeling efforts, and initiate field testing of critical components of a novel LNG process. *Participants included SwRI, Terralog, Schlumberger, Conversion Gas Imports, Furness-Newbruge, Penn State University.*

(dollars in thousands)

FY 2003	FY2004	FY 2005
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- **Delivery Reliability** 6,790 6,845 0

No funding is requested for this activity in FY 2005. See Sustainable Supply above.

In FY 2004 and FY 2003, continue research directed to ensure the reliability and integrity of the gas transmission and distribution network, develop smart automated inside pipeline inspection sensor systems, conduct research on obstacle detection systems for horizontal boring applications for laying distribution pipelines, develop systems capable of detecting external force damage, develop technology to improve the efficiency for reciprocating and turbo compressors, and develop advance technology capable of determining pipeline wall integrity. *Participants included SwRI, Tuboscope, NYGAS, GTI, Battelle, CSU, ARC, ANL, INEEL, LLNL, SNL, ORNL, PNNL, NETL.*

- **Program Support**..... 50 138 0

Fund technical and program management support.

Emerging Processing Technology..... 2,593 0 0

- **Coal Mine Methane** 2,566 0 0

No activity in FY 2005 or FY 2004.

FY 2003 funding will complete three existing projects in coal mine methane. Fuel Cell Energy will conduct a demonstration of using a fuel cell to produce electricity from coal mine methane. The funding provided in FY 2003 was sufficient to fully fund all remaining project obligations. One project will likely be active in FY 2005, however, no new funding is requested.

- **Program Support**..... 27 0 0

Fund technical and program management support.

Effective Environmental Protection..... 2,557 2,469 2,500

This program seeks to reduce the environmental impacts of gas operations and reduce the cost of environmental compliance through a combination of technology development, risk assessment, and regulatory streamlining. The program will emphasize research that will improve access to onshore public lands.

- **Environmental Science**..... 0 2,444 2,475

In FY 2005 and FY 2004, conduct targeted initiatives to define and solve specific problems in key focus areas, specifically: 1) environmental barriers to coal bed methane production, and 2) air quality issues affecting natural gas production. Develop objective, credible scientific data for regulatory decisions as part of a program-wide environmental strategy for maintaining sustainable supplies of natural gas. *Participants include: NETL, National Labs, TBD.*

In FY 2003, project activities were funded in separate key activities described below.

- **Program Planning Data and Analysis**..... 357 0 0

In FY 2005 and FY 2004, activity continued in Environmental Science above.

(dollars in thousands)

FY 2003	FY2004	FY 2005
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FY 2003 funding continued data collection and the development of analytical tools for program planning, for outreach and technology transfer, including the capability to quantify environmental costs and assess constraints to gas resource recovery, collection and distribution. Continue to perform legislative and regulatory impact analysis related to both upstream and downstream gas environmental issues. *Participants to be determined.*

- **Technology Development** **993** **0** **0**

Activity continued in Environmental Science above in FY 2005 and FY 2004.

FY 2003 funding continued efforts to develop and demonstrate technologies for improving the environmental performance of all gas exploration and production. *Participants to be determined.*

- **Outreach and Technology Transfer** **1,181** **0** **0**

Activity continued in Environmental Science above in FY 2005 and FY 2004.

FY 2003 funding continued outreach and technology transfer efforts on environmental issues affecting natural gas supply, including compliance efforts with industry, states, and others to identify and address environmental challenges to expanded natural gas production. *Participants to be determined.*

- **Program Support** **26** **25** **25**

Fund technical and program management support.

Total, Natural Gas Technologies	45,860	42,994	26,000
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Explanation of Funding Changes

FY 2004 vs. FY 2005 (\$000)

Exploration and Production

• Funding in FY 2005 will support research to address critical barriers to the expansion of gas storage and LNG supply. Several ongoing technical projects in drilling and advanced diagnostics and imaging will be terminated. New work will be started in Deep Trek. The National Lab Partnership will be terminated. Arctic Energy Office funding will be eliminated	-4,602
• Program Support	-101
Total, Exploration and Production	-4,703

Gas Hydrates

• Decreased funding in FY 2005 for Alaska project	-3,350
• Program Support	-33
Total, Gas Hydrates	-3,383

Infrastructure

• In FY 2005, most ongoing projects will be terminated	-8,801
• Program Support	-138
Total, Infrastructure	-8,939

Effective Environmental Protection

▪ Continues the program at current year level of effort	+31
Total Funding Change, Natural Gas Technologies	-16,994