

Investing In The Future: Federal R&D

THE ISSUE:

The Administration's budget proposal for Fiscal Year 2006 eliminates all federal funding of oil and natural gas technology and regulatory evaluation programs. Funding for these programs needs to be restored.

The oil and natural gas technologies programs, under the Department of Energy's Office of Fossil Energy since its creation in 1977, are a vital investment in domestic oil and natural gas development. They have a proven track record of success. These programs include **research and development (R&D), technology transfer, and participation in regulatory development regarding domestic production issues.**

Independent producers are the beneficiaries of 85 percent of the program's R&D focus. Without this federal research, domestic oil and natural gas production will suffer from the loss of technology development and enhancements that are essential to maintain domestic production from existing resources and to find and produce new ones.

It has become clear that independent oil and natural gas producers are far too small to take on the huge investments of research and development. And as more and more companies merge, R&D budgets often top the list of expenditures to consolidate, meaning fewer corporate dollars are spent on the research and development so critical to the future of the industry.

Corresponding cuts in federal spending on R&D have created a critical situation.

If the United States is to maintain its ability to produce its domestic supplies of oil and natural gas at a reasonable cost to consumers, federal expenditures on R&D must fill some of the void left by private industry.

"Who Will Fund America's Energy Future", Interstate Oil and Gas Compact Commission

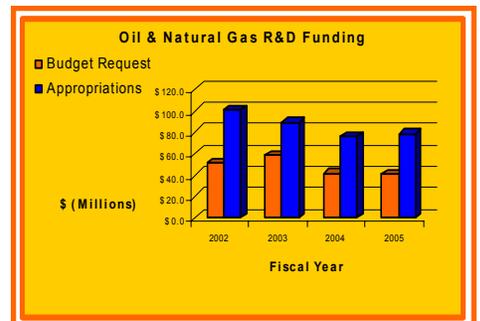
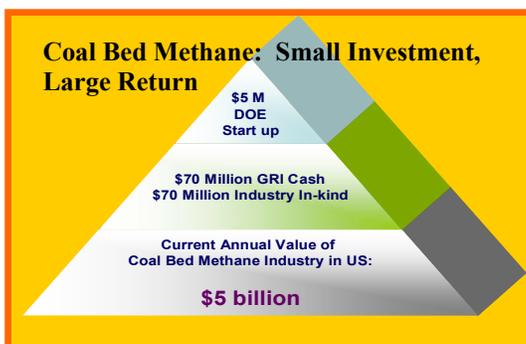
But these programs are more than just R&D. They include funding that supports efforts like the Petroleum Technology Transfer Council (PTTC) — an organization that creates the conduit to move research into the hands of producers, particularly small producers, where it becomes a production tool. Similarly, federal research is a significant element of the university research that educates the coming generations of petroleum geologists and engineers — professionals that are essential to maintain a strong domestic exploration and production industry. Significantly, these funds also provide for participation within the federal government on domestic oil and natural gas issues as they are considered by federal agencies; they keep the Department of Energy as an effective voice during these long and complicated processes.

Overall, in the opinion of the committee, DOE's program appears to have met its objectives of expanding the oil and gas resource base and increasing domestic production of oil and gas in response to mandates from Congress or the administration. It did this by utilizing DOE expertise and emphasizing high-risk projects. Also, DOE supports smaller companies and independent oil and gas producers, which make up a significant portion of the production capacity in the United States and which have limited resources to undertake R&D programs.

"Energy Research at DOE: Was It Worth It? Energy Efficiency and Fossil Energy Research 1978 to 2000", National Research Council, 2001

Successful during its initial years, the Fossil Energy R&D program has been plagued recently by inconsistent and decreasing funding. For example, DOE research efforts on coal bed methane yielded a 34 to 1 return on its investment. But now, planning a program based on annual budget requests hampers the continuity that is

essential to develop long-term research strategies. Long-term project funding becomes uncertain and short-term projects must be created. A better framework would improve the program. Requiring plans based on different funding levels could provide Congress with a clearer understanding of the potential research that could be done.



Research and Development: Improving domestic oil and natural gas production — Looking over the horizon for new technologies.

Faced with enormous potential research challenges, changing mandates for research, and inconsistent funding patterns, the Fossil Energy R&D program has, nonetheless, created a diverse R&D program. Moreover, the program requires significant cost sharing from non-Federal partners to assure its projects have a meaningful value. The program broadly addresses two key research needs — projects to improve the development of existing resources, including improved environmental management, and projects to meet future needs that will be essential to domestic resource development. Much of the research is conducted by universities and provides opportunities to attract strong students in petroleum geology and petroleum engineering — disciplines where enrollment has dropped 70 percent over the past 20 years — disciplines that are key to a strong domestic industry.



Marginal and Stripper Well Revitalization

This research effort supports an industry-driven program through the *Stripper Well Consortium* that identifies technology research and development needs that can sustain and improve the production performance of the Nation's low-producing oil and gas wells. Particular attention is focused on preventing the premature abandonment of marginal properties in the United States where significant quantities of unproduced oil and natural gas remain. In 2000, to assist small and independent operators who own the vast majority of the nation's stripper wells in the development, demonstration, and commercialization of technologies to improve production performance from stripper wells, the Department of Energy helped organize a *Stripper Well Consortium* in collaboration with Pennsylvania State University. The *Consortium* coordinates research projects in three broad areas: reservoir remediation, wellbore clean-up, and surface system optimization. Specific research proposals are developed by *Consortium* members, and there must be a minimum of 30% cost share from project participants. The *Consortium* currently has over 60 members including producers, universities, trade and state organizations, consultants, technology and tool developers, and entrepreneurs.

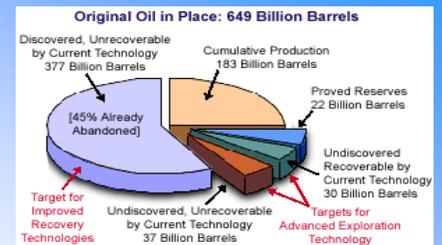
Enhanced Oil Recovery/CO₂ Injection

Production at most oil reservoirs includes three distinct phases: primary, secondary, and tertiary, or enhanced, recovery. With much of the easy-to-produce oil gone from U.S. oil fields, producers have attempted several tertiary, or enhanced oil recovery (EOR), techniques that offer prospects for ultimately producing 30 to 60 percent of the reservoir's original oil. The Department of Energy's Fossil Energy program has worked with the nation's oil producers for several decades to develop and test a variety of EOR techniques which have had varying degrees of success. EOR still holds considerable promise for recovering literally billions of barrels of oil that today are left behind in the nation's oil fields; yet, most EOR techniques are likely to be limited by economics.

One EOR technique, however, may attract additional market interest because of an added benefit. Carbon dioxide (CO₂) injection has proven to be one of the most efficient EOR methods since it was first tried in 1972 in Scurry County, Texas. CO₂ injection offers another benefit: it could be a promising way to sequester carbon dioxide from power plants and other energy facilities and reduce its buildup in the atmosphere where it can contribute to the "greenhouse effect."

Until recently, virtually all of the CO₂ used for EOR has come from naturally-occurring reservoirs. But in 2000, engineers completed the construction of a 204-mile pipeline to transport CO₂ produced at the Great Plains Coal Gasification Plant in North Dakota to the Weyburn oil field in Saskatchewan, Canada. Encana, the field's operator, is injecting the CO₂ to extend the field's productive life, hoping to add another 25 years and as much as 130 million barrels of oil that might otherwise have been abandoned. The U.S. Department of Energy has joined more than 15 government agencies, universities, and research institutions from around the world to monitor the fate of the CO₂ and determine whether injecting it into a producing oil field could be a viable climate change mitigation strategy.

The potential dual benefits of CO₂ injection for both oil recovery and carbon sequestration have led the Energy Department to reorganize its EOR research efforts to concentrate on this method in the near-term. CO₂ injection remains a highly specialized niche application, but if DOE's research program can expand its applicability, especially in regions where large power plants are located, the technology could gain additional market acceptance.





“Deep Trek” and Other Drilling R&D

“Deeper” and “smarter” will likely be the watchwords of America's drilling industry in the coming years, especially as the nation's natural gas producers try to keep up with growing demands for this clean-burning fuel. Although more than 70 percent of the natural gas produced in the United States already comes from wells 5,000 or deeper, only seven percent comes from formations below 15,000 feet. Yet, at these deeper depths, an estimated 125 trillion cubic feet of unclaimed natural gas is thought to be trapped.

To help develop the high-tech drilling tools industry will need to tackle these deeper deposits, the U.S. Department of Energy Office of Fossil Energy kicked off “Project Deep Trek” in 2002. The goal is to develop a “smart” drilling system tough enough to withstand the extreme temperatures, pressures and corrosive conditions of deep reservoirs, yet economical enough to make the gas affordable to produce. The target date for developing the advanced drilling system is 2010.

Project “Deep Trek” builds on a solid track record of achievements in past drilling R&D partnerships between the federal government and private industry. The Office of Fossil Energy's drilling program produced what could be the next major advance in downhole telemetry. In September 2002, the Energy Department announced a new system called IntelliPipe™ that turns an oil and gas drill pipe into a high-speed data transmission tool capable of sending data from the bottom of a well up to 200,000 times faster than mud pulse and other downhole telemetry technology in common use today.

Revolutionary new drill bits are also one of the “success stories” of the Energy Department's research program. The prime example is the polycrystalline diamond drill bit, now the industry standard for drilling into difficult formations. Prior to the early 1980s, drill bit manufacturers had been unable to adhere industrial-grade diamond cutters to the bit. Scientists at the Energy Department's Sandia National Laboratories solved the problem by developing a “diffusion bonding” approach. More recently, Penn State University, working under an Office of Fossil Energy contract, developed a way to use microwaves to harden the tungsten carbide of deep drilling bits, resulting in a 30 percent increase in strength.

The drilling system of the future may also employ new advances in drill pipe materials as a result of the Energy Department's research program. Early in 2003, the Department announced that a new lightweight, flexible drill pipe engineered from space-age composites rather than steel had passed an important field test and was being readied for its first commercial use.

Methane Hydrates — The Gas Resource of the Future

A methane hydrate is a cage-like lattice of ice, inside of which are trapped molecules of methane (the chief constituent of natural gas). Methane hydrates form in generally two types of geologic settings: (1) on land in permafrost regions where cold temperatures persist in shallow sediments, and (2) beneath the ocean floor at water depths greater than about 500 meters where high pressures dominate. The hydrate deposits themselves may be several hundred meters thick.

If only ONE percent of the domestic methane hydrate resource could be made technically and economically recoverable, the United States could more than double its domestic natural gas resource base.

Given the growing demand for natural gas, the development of new, cost-effective supplies can play a major role in moderating price increases and assuring consumer confidence in the long-term availability of reliable, affordable fuel. Yet, today, the potential to extract commercially-relevant quantities of natural gas from hydrates is speculative at best. With no immediate economic payoff, the private sector is not vigorously pursuing research that could make methane hydrates technically and economically viable. Therefore, federal R&D is the primary way the United States can begin exploring the future viability of a high-risk resource whose long-range possibilities might one day dramatically change the world's energy portfolio.

Improving Environmental Management

A host of advanced technologies now make it possible for America's oil and gas industry to produce resources from beneath sensitive environments. In the past 30 years, production footprints have shrunk dramatically – by up to 80 percent. The incredibly shrinking footprint of modern-day oil and gas operations provides one of the best ways of protecting the surface environment surrounding exploration and production activities.

Today, producers, in many instances, can drill a single well from the surface, then turn the well underground to reach an oil or gas production zone far away from the drill site and avoid disturbing surface ecosystems. But, it can be cost prohibitive. In 2003, the Energy Department announced the successful startup of a drilling rig that could reduce the surface footprint even more. Anadarko Petroleum Corporation's “Arctic Platform,” a lightweight, 100-by-100-foot aluminum drilling platform elevated a dozen feet above the frozen tundra on specially designed steel legs, is a prototype of a future environmentally-sensitive drill rig. Based on platforms similar to those used offshore, it is compact and modular, allowing it to be safely transported by air or with ultra-low-impact. The concept could also be used in the lower-48 states in ecologically fragile areas such as wetlands.



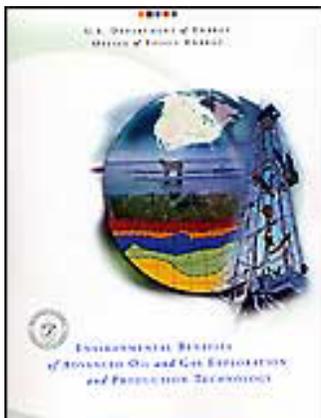
Technology Transfer — Putting New Technologies to Work

Using its National Energy Technology Laboratory, Fossil Energy has created programs to move technology from the laboratory to the field. For example, the PUMP (Preferred Upstream Management Practices) program helps slow the decline in America's oil production. PUMP pairs "best practices" with solutions coming from new technologies to an active campaign of disseminating information to domestic oil producers. It is a high-priority program to collect and distribute information that domestic producers can use to keep oil flowing from America's oil fields. Slowing the decline of domestic oil fields and maintaining the infrastructure to continue to produce oil has become a vital part of our National Security. The goals of PUMP are to reduce barriers to domestic production and address specific issues to maximize return on investment. The focus is very near-term, and with regional emphasis.



Through organizations like the Petroleum Technology Transfer Council, jointly funded with industry and universities, R&D from the Fossil Energy program expands throughout the nation. PTTC conducts workshops and seminars throughout the Oil Patch making research efforts and case study applications of new technology available to domestic producers — primarily small producers. Since its inception in 1994, PTTC has conducted over 1000 workshops and seminars. PTTC recently estimated economic impact in just **eleven areas** identified and directed by industry where independents are broadly applying technologies. Of 1,266 million barrels of oil equivalent reserves that were realized, 88 million barrels could be clearly attributed to PTTC activity.

Protecting Our National Energy Security — Making the Case in the Regulatory Arena



The Department of Energy lists, as one of its principal strategic goals, protection of "...our National and economic security by promoting a diverse supply and delivery of reliable, affordable, and environmentally sound energy." Federal regulation

development requires interagency consultation. The Office of Fossil Energy evaluates the impact of federal regulations and regulatory proposals on domestic oil and natural gas production. Because the May 2001 Executive Order requires agencies to assess the energy impact of major federal regulations, this role has become more critical. But, it is not a new role. Throughout its history, Fossil Energy has contributed to the regulatory debate. Whether it is EPA regulation of drilling fluids and produced waters under

RCRA or OPS regulation of gathering lines or EPA regulation of storm water discharges during the construction of exploration and production operations, Fossil Energy develops the technical analysis of the regulation on domestic production and argues for sound regulatory approaches during the interagency reviews. It does comprehensive reviews of regulations and evaluates the environmental benefits of using advanced oil and natural gas exploration and development technologies. Retaining these key functions is essential for domestic oil and natural gas production to be maintained and expanded.


ADVANCED RESOURCES INTERNATIONAL, INC.
MEMORANDUM

To: U.S. Department of Energy/Office of Fossil Energy
Date: December 7, 2004
From: Advanced Resources International, Inc.
Re: Estimated Economic Impacts of Proposed Storm Water Discharge Requirements on the Oil and Natural Gas Industry (Final)

In contrast, under the Higher Impact scenario, the proposed requirements could result in 280,000 barrels per day reduction in domestic oil production over the first five years, and over 500,000 barrel per day loss in production, on average, over the 2005 to 2025 time period. Similarly, over one Tcf per year of natural gas would not be produced on average, in the first 5 years, and an average of over 2.1 Tcf per year would be lost over the 2005 to 2025 time horizon. Cumulatively, as much as 3.9 billion barrels of oil and 45 Tcf of natural gas would not be produced by 2025.

WHAT SHOULD BE DONE:

Funding for the Office of Fossil Energy, Oil & Natural Gas Technologies Programs needs to be restored to FY 2005 levels. The Department of Energy should provide Congress with R&D plans at several levels of appropriations (\$50, \$75, & \$100 million/year) over at least a five year planning period.