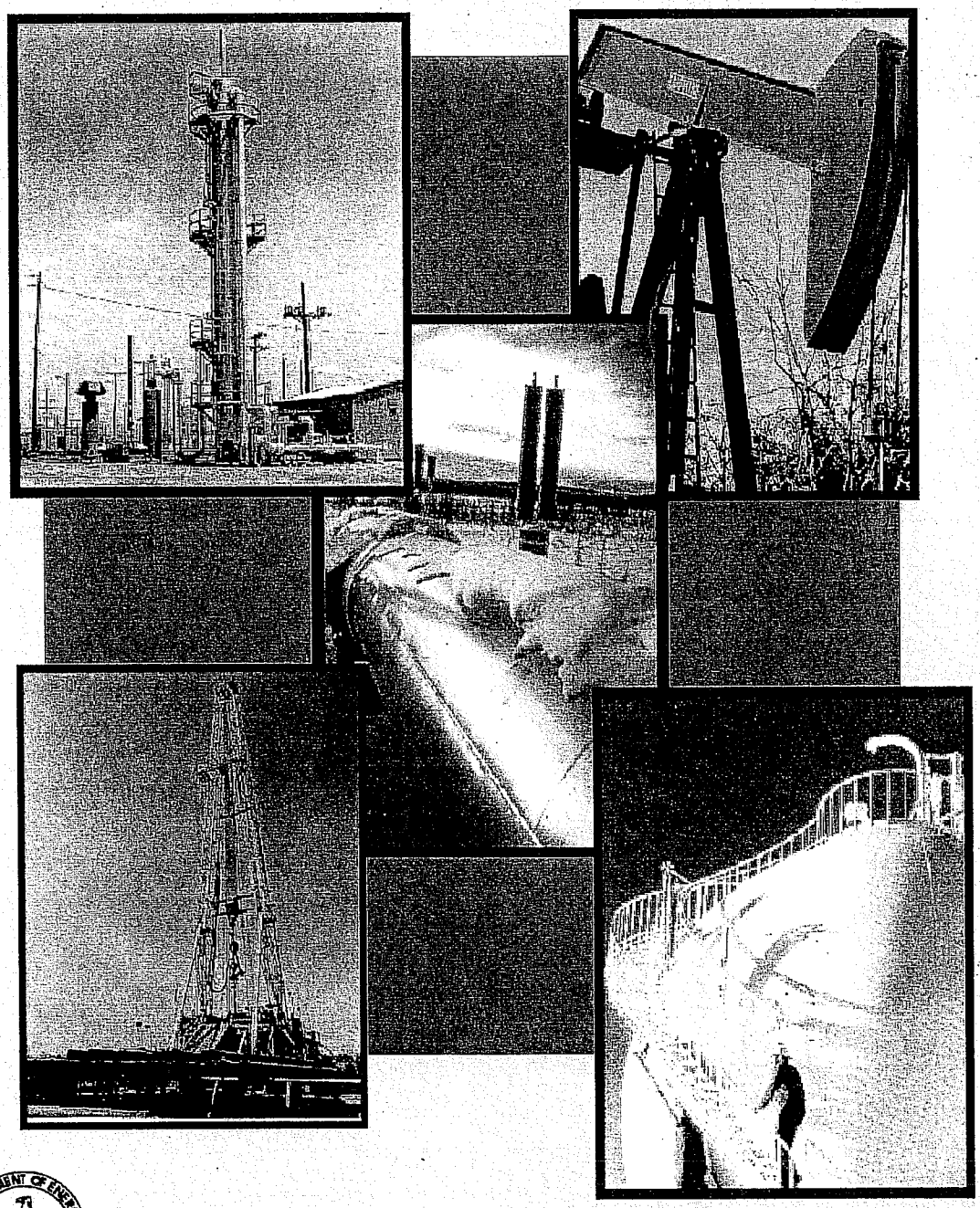
Analysis of U.S. Department Of Energy's Oil and Gas Programs

In Response to

The National Petroleum Council Study

On the

RD&D Needs of the Oil and Gas Industry



U.S. Department of Energy

November 1995

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RD&D Needs of the Oil and Gas Industry

OFFICE OF FOSSIL ENERGY
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WASHINGTON, DC 20585

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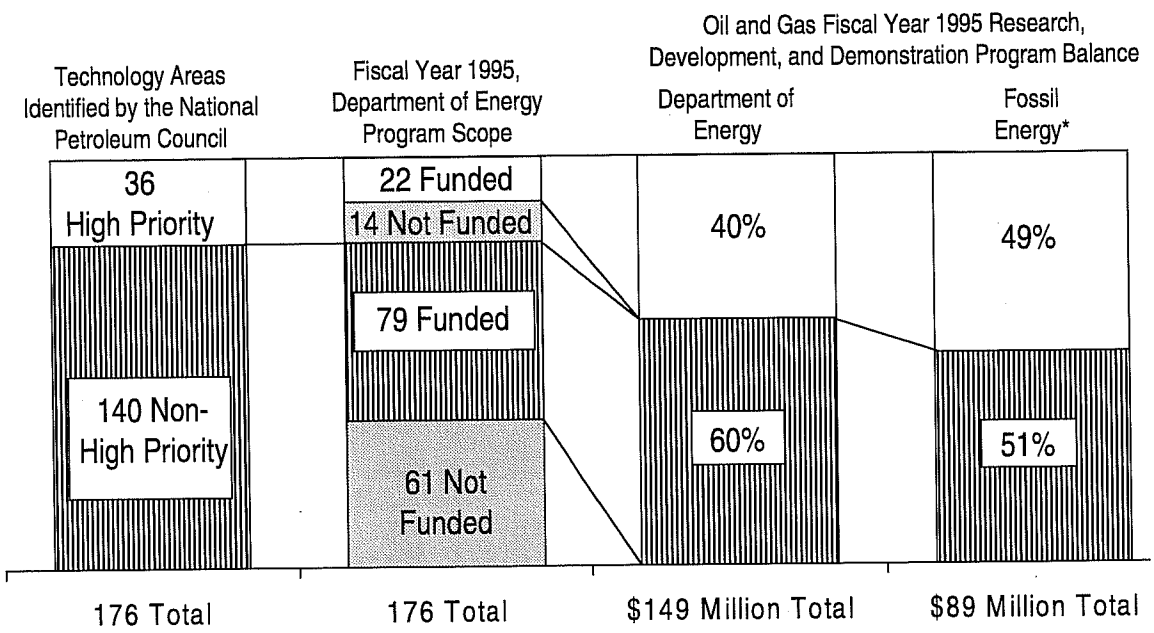
HIGHLIGHTS



*Fossil Energy funded 18 of the 36 high priority areas.

- In 1994, the Department of Energy (the Department) asked the National Petroleum Council (the Council) to identify oil and gas industry technology needs.
- Of 176 technology areas, the Council identified 36 as high priority.
- The Department's Fiscal Year 1995 oil and gas programs address 22 of the 36 high priority areas.
- 14 high priority areas are not addressed by the Department's oil and gas programs. Nine of these are in Deepwater Offshore and Arctic areas.
- 40% of the Department-wide and 49% of Fossil Energy oil and gas Fiscal Year 1995 research, development, and demonstration funds were spent on the Council-identified high priority areas.
- The Department will use this information and other inputs as the basis for ongoing discussions with industry to plan and evaluate oil and gas programs with the goal of addressing priority industry needs consistent with the National interests.

Introduction and Background

In August 1995, the Office of Fossil Energy (Fossil Energy) initiated an analysis of the Department of Energy's (DOE or the Department) Fiscal Year (FY) 1995 oil and gas research, development, and demonstration (RD&D) programs. The purpose of this analysis was to determine the degree to which DOE's programs address industry's priority technology needs as identified in the National Petroleum Council's (the Council or NPC) study entitled, "RD&D Needs of the Oil and Gas Industry" (August 1995).

The Council's Oil and Gas Industry RD&D Needs Study was requested by the Secretary of Energy.

The Council is an advisory body to the Secretary of Energy on matters relating to oil and natural gas or the oil and gas industries. The Council's study provides a listing of 176 industry technology RD&D needs, of which 36 are designated as high priority. An overview of the Council's study, including its methodology and recommendations, is provided in this report.

Based on this program analysis, the Department will examine all high priority technology areas to determine whether there is an appropriate Federal RD&D role under current Departmental policy, regulation, and statutory mandates. In an ongoing dialogue with the industry, DOE will redirect current programs, as appropriate to DOE's mission, and identify cooperative RD&D opportunities with industry in the high priority areas.

This report consists of three parts. Section 1 summarizes the NPC report, its findings, and recommendations. Section 2 discusses and analyzes the current DOE oil and gas RD&D programs. Program match with the NPC-identified RD&D needs and FY 1995 budget breakdown are also presented in this section. Section 3 provides a discussion of next steps.

The purpose of the DOE analysis was to determine the degree to which its oil and gas programs address industry's priority technology needs.

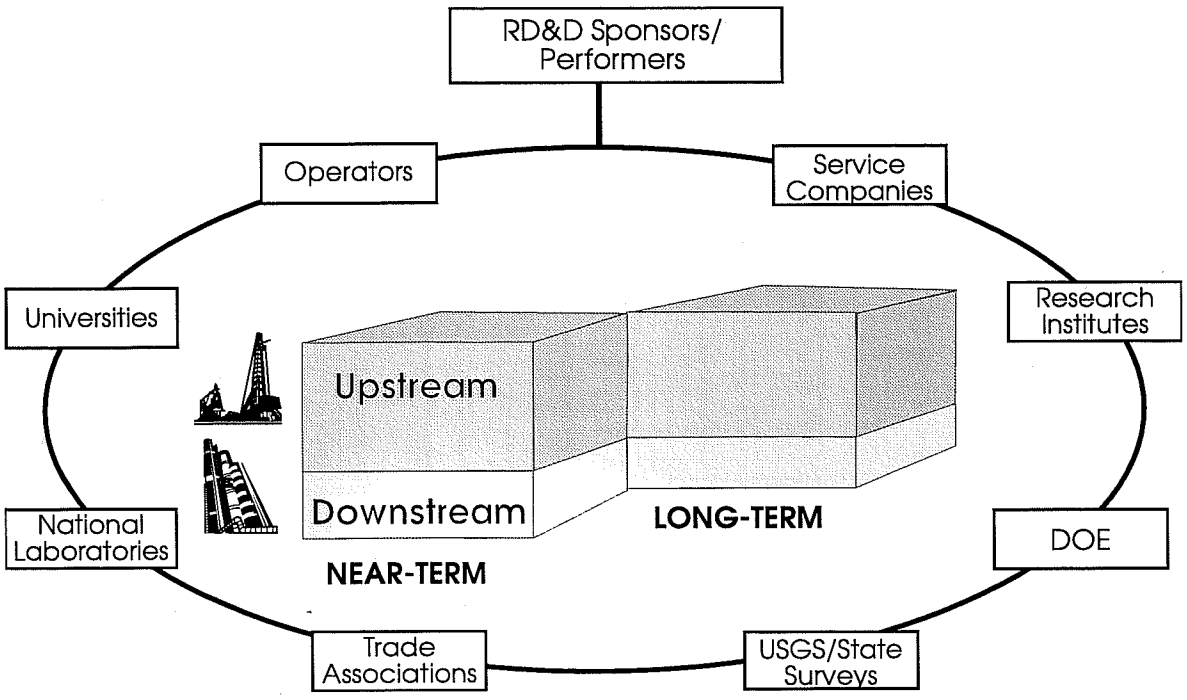
1.0 The National Petroleum Council Study

On July 27, 1994, Secretary of Energy Hazel O'Leary asked the Council to identify the RD&D needs of the U.S. oil and gas industry. Specifically, the Secretary requested:

> "...that the National Petroleum Council conduct a study of research, development, and demonstration needs of the natural gas and oil industry. This study should analyze the needs of all components of the industry, considering the near- and long-term needs of both the upstream and downstream sectors."

As shown in Exhibit 1, the NPC study investigated the near- and long-term RD&D needs, both upstream and downstream, to be addressed through collaborations with developers and suppliers of advanced technology.

Exhibit 1 - NPC Study Addresses Industry Technology Needs

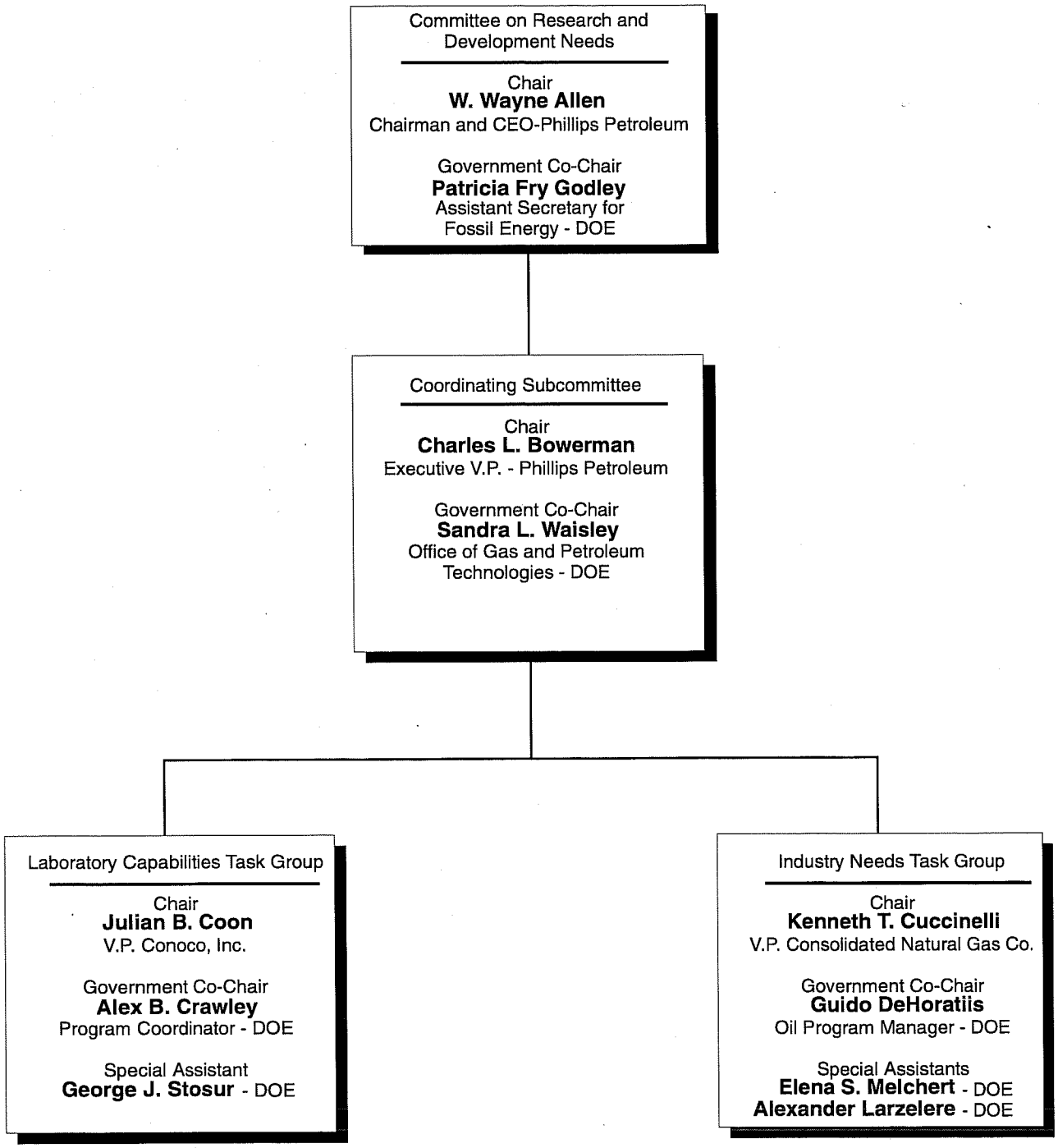


The Council formed a Committee on Research and Development Needs to prepare a report in response to the Secretary's request. The Committee was assisted by a Coordinating Subcommittee and two Task Groups as shown in Exhibit 2. The Committee comprised representatives from the Council, major oil and gas producers, service companies, universities, the Petroleum Technology Transfer Council, the National Laboratories, and DOE's oil and gas program offices.

The NPC study analyzed industry's technology needs and also examined the relevant capabilities and roles that the nine DOE National Laboratories, and the National Institute for Petroleum and Energy Research (NIPER), or "the Labs," could play in providing technical and scientific support to industry. (See Appendix E, Volume III, of the NPC study).

In addition to presenting information on the technology needs of the oil and gas industry, the study addresses the importance of the oil and gas industry to the U.S. economy, and provides insights to new approaches for conducting oil and gas RD&D through 2010. A further purpose was to determine the degree of industry's willingness to collaborate to advance these technologies, and to identify issues that are barriers to technical collaborations with other oil and gas companies, DOE, the National Laboratories, and other public and private laboratories.

Exhibit 2 - NPC RD&D Needs Study Group Organization



1.1 National Petroleum Council Survey Methodology

Industry RD&D needs were determined through use of a comprehensive, 31-page survey sent to a large cross-section of the industry. The Council also conducted an analysis of other pertinent studies completed in the last several years and applied the best judgement of the study Task Group members in formulating the scoring criteria and selection of high priority technology areas.

The Council's survey was designed to determine industry-desired technology advances, their impact on the respondent's business, and the respondent's judgement of the likelihood of the advance not being commercially available under a business-as-usual scenario, in both the near-term (by 1999) and the long-term (between 2000 and 2010).

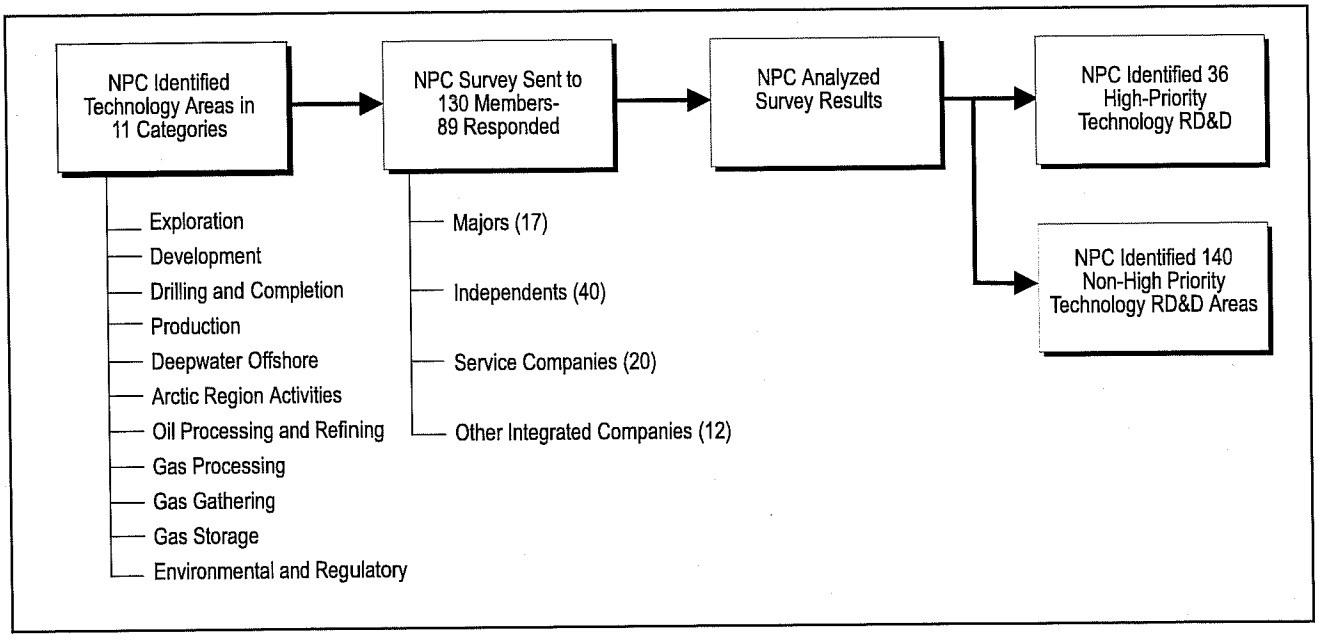
Prior to the survey, the Council identified 176 individual oil- and gas-related technologies grouped under 11 general categories. (See Appendix A). From this list, industry was queried on technology RD&D needs. Respondents also had an opportunity to write-in technologies that they did not find listed and believed would have a high impact on their business performance (see the Council's survey steps in Exhibit 3).

1.2 Survey Results

The survey was sent to all 130 NPC members, of which 89, or almost 70 percent, responded. (See Exhibit 3 and also Appendix B).

The survey respondents account for U.S. reserves of 12 billion barrels of oil and 75 trillion cubic feet of natural gas, or about 50 percent of total U.S. oil and gas reserves. Respondents account for worldwide reserves of 24 billion barrels of oil and 128 trillion cubic feet of natural gas. They also account for approximately 9 million barrels per day, or about 60 percent of U.S. refining capacity.

Exhibit 3 - NPC Industry RD&D Needs Identification Process



- New approaches to refining heavy oil feeds
- Improved energy efficiency of processes and equipment
- Improved plant and process reliability

Environmental:

- A scientific basis for risk-based environmental regulation

1.3 National Petroleum Council Recommendations

The Council's study made several recommendations with regard to redirecting DOE's oil and gas RD&D program activities; improving government-industry interaction on cooperative RD&D; and removing barriers to collaborations. These recommendations are:

- Focus Federal oil and gas RD&D efforts on user-identified technology needs, as well as being timely and cost-effective.
- Incorporate the Council's study analysis into current DOE realignment activities, program development, spending prioritization, and budgeting activities at all levels of DOE strategic planning.
- Focus RD&D sponsorship on areas of technology needs that cannot be effectively conducted in the private sector.
- Analyze current and newly proposed RD&D expenditures to match high impact needs identified in the Council's report with the unique capabilities of the Labs.
- Provide continuity for logical (cost-effective) completions of all short-term projects.
- Place greater emphasis on prioritizing RD&D programs based on industry needs and participation.
- Develop a project definition system which utilizes broadly-based industry input to prioritize and recommend all DOE funding that is directly related to oil and gas RD&D needs.
- Remove barriers to collaboration with DOE and the government laboratories. Initiate simplified administrative procedures that minimize paperwork and the turnaround time for bringing technology to practical application.

The Council indicated that the Oil and Gas Industry RD&D Needs Study could be the starting point for establishing an improved process of focused oil and gas RD&D unprecedented by previous efforts.

- Strengthen efforts in fundamental science and engineering, both at the National Laboratories and at universities. Maximize research relevance by industry participation.
- Ensure that government laboratories do not become technical services organizations competing with industry. The Labs should become involved in an area only if the competence of the laboratory already exists and if there is clear industry consensus that private sector sources for technology development are not adequate.

2.0 DOE's Oil and Gas Program Analysis

DOE's oil and gas programs fit into the Department's business line of "Energy Resources." Within the Department, the oil and gas programs primarily reside at Fossil Energy, but related and/or supporting programs also exist in other parts of DOE, including the Offices of Energy Research, Energy Efficiency and Renewable Energy (or Energy Efficiency), Defense Programs, and the Energy Information Administration.

The Fossil Energy oil and gas RD&D programs are currently implemented at field offices located in Bartlesville, Oklahoma; Morgantown, West Virginia; and Pittsburgh, Pennsylvania. However, the Department's recent Strategic Alignment Implementation Plan, released on August 3, 1995, calls for the integration of the oil and gas supply, storage, processing, and environmental activities from the three field offices to a single site in Golden, Colorado. Integration of these programs will improve operational efficiencies, provide "one-stop shopping" for customers, and achieve budgetary savings.

Through its programs, the Department has been working with industry to develop advanced, more efficient, and cleaner energy technologies that make it possible to use fossil fuel resources in ways that can promote economic growth while maintaining the Nation's commitment to environmental quality and energy security. The mission of the DOE's oil and gas program is to work in partnership with industry to meet the energy needs of the Nation. The key program objectives are to leverage private industry RD&D funds; promote industry and state partnerships; assist small businesses who lack RD&D centers; and convert defense capabilities of the National Laboratories to private sector applications (e.g., through activities funded by the Natural Gas and Oil Technology Partnership).

The mission of the DOE's oil and gas programs is to work in partnership with industry to meet the energy needs of the Nation.

The following is a summary of the oil and gas programs in DOE's offices.

Fossil Energy

The mission of the office is to foster advanced, more efficient, and cleaner fossil energy (oil, natural gas, coal) technologies through RD&D programs. Fossil Energy's oil and gas program elements are described below.

Natural Gas RD&D Program

Exploration and Production: Identify and address industry technology and methodology needs in reservoir characterization, extraction research, exploration, and drilling. Develop a new generation of technologies to reduce costs and risks for operators; and ensure long-term supply of gas and increase consumer confidence in the availability of gas.

Utilization: Ensure long-term gas supply by upgrading low quality gas to pipeline specifications; and access vast quantities of remote gas by developing a means for it to be converted to a hydrocarbon liquid suitable for transportation in existing pipelines.

Environmental and Regulatory Analysis: Reduce environmental compliance costs to operators while improving their environmental performance; and ensure sound regulatory decisionmaking.

Delivery and Storage: Improve and advance technologies to lower costs and develop information models to increase efficiency and reliability of the natural gas system.

Oil RD&D Program

Exploration and Production Research: Identify and address industry technology and methodology needs in reservoir characterization, extraction research, exploration and drilling, risk-based management, analysis and planning, and technology transfer; and develop a new generation of technologies to reduce costs and risks for operators.

Reservoir Class Field Demonstrations: Address common production problems in specific types of reservoirs and demonstrate solutions in the field with industry.

Oil Processing: Develop cost-effective and cleaner heavy oil and residual upgrading and processing technologies to maximize the output of transportation fuels (e.g., environmental compliance, pollution prevention).

The mission of Fossil Energy is to foster advanced, more efficient, and cleaner fossil energy technologies through RD&D programs.

2.1 Value of the NPC Study to the Department

Advances in the RD&D areas identified by the Council are essential to maintaining the U.S. technological edge in increasingly competitive global markets. As indicated in the study, the Council and its members are interested in working with DOE on programs that focus on user needs and to develop new programs and policies that meet the changing RD&D needs of the oil and gas industry. Because respondents were asked to address all needs pertaining to oil and gas, including upstream and downstream, and near- and long-term, RD&D needs identified in the Council's study are useful in examining the Department-wide RD&D portfolio.

Advances in the RD&D areas identified by the Council are essential to maintaining the U.S. technological edge in increasingly competitive global markets.

2.2 DOE Analysis Steps and Methodology

The first step in the DOE program analysis required program managers of oil and gas and related programs to review their respective projects and make a determination as to which NPC technology areas each project addresses. The next step involved compilation and analysis of results to determine the program balance. The program offices involved in this analysis included Fossil Energy, Energy Research, Defense Programs, and Energy Efficiency.

Because Fossil Energy is the lead office for oil and gas RD&D, the entire portfolio of Fossil Energy projects was reviewed. Fossil Energy programs are composed of the following: (1) technology RD&D; (2) data analysis and modeling; (3) regulatory/legislative analysis and input; (4) tax/financial incentives analysis; (5) outreach and technology transfer; and (6) program management. In this analysis, the activities under the categories 2 through 6 are referred to as RD&D Management Support and Analysis (see also pages 15 and 16). Only those projects that address and/or relate to NPC technology areas were extracted from programs of Energy Research, Energy Efficiency, and Defense Programs.

DOE's Fossil Energy is the lead office for oil and gas RD&D.

Although some of the technology RD&D conducted at other DOE offices are indirectly applicable to oil and gas industry (e.g., drilling and formation evaluation projects funded by the Office of Environmental Management for waste disposal and remediation, and certain programs at Energy Research), they were not included in this analysis in order to focus on industry-specific problems.

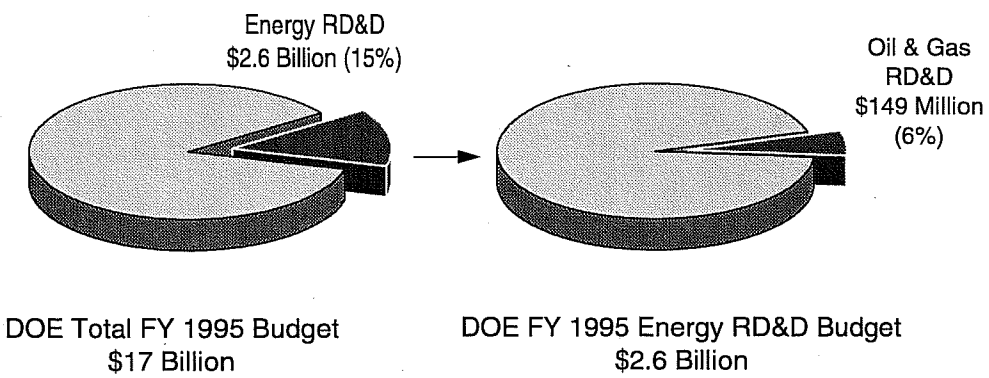
In cases where a project applied to more than one Council-identified technology area, its budget was allocated to each area in proportion to the level of its applicability (for example, the Oil Reservoir Class Program). Some of the technology area titles utilized by the Council are subject to interpretation as to their exact definition, either by survey respondents, the Council, or DOE. Therefore, best judgement was used to interpret such titles. It should be noted that because of these issues, this analysis represents DOE's initial effort toward placing current projects in the appropriate NPC categories. This will nevertheless serve as a valuable starting point for discussing future years' programs.

2.3 Fiscal Year 1995 Program and Budget Analysis

DOE's total FY 1995 budget was $17 billion of which $2.6 billion was energy RD&D. Of this amount, DOE funded $149 million in oil and gas RD&D. This total includes the upstream and downstream program activities in Fossil Energy, Energy Research, Defense Programs, and Energy Efficiency; but excludes end-use or utilization sector activities, e.g., gas-based fuel cells and turbines for the utility sector. The oil and gas programs represent 6 percent of the Department's FY 1995 total energy RD&D budget. (Exhibit 5)

The oil and gas programs represent 6 percent of the Department's FY 1995 total energy RD&D budget.

Exhibit 5 - Oil and Gas RD&D Budget Comparison



Distribution of DOE's technology RD&D program budget by the Council's technology categories is as shown in Exhibit 6.

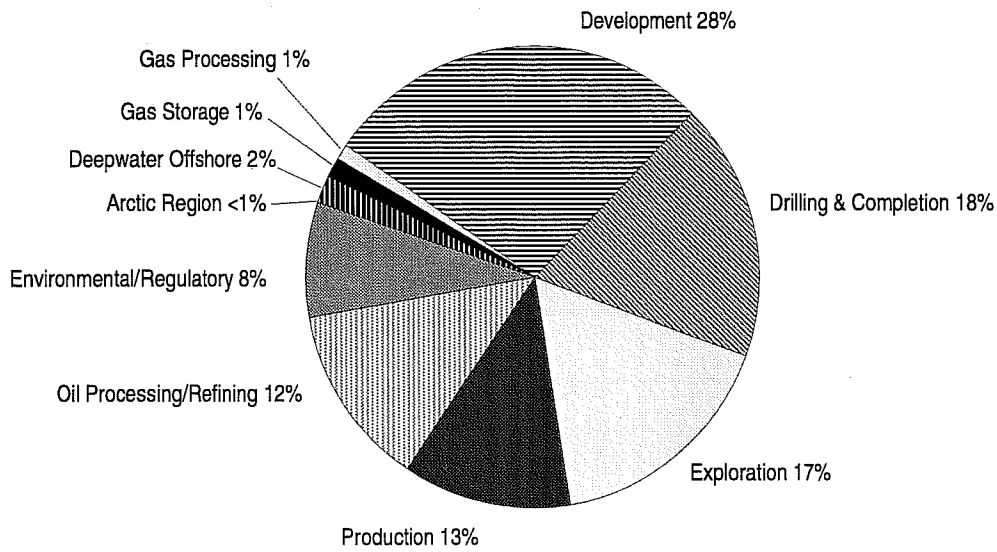


Exhibit 6 - DOE FY 1995 Oil and Gas RD&D Budget By NPC Category: $149 Million Total

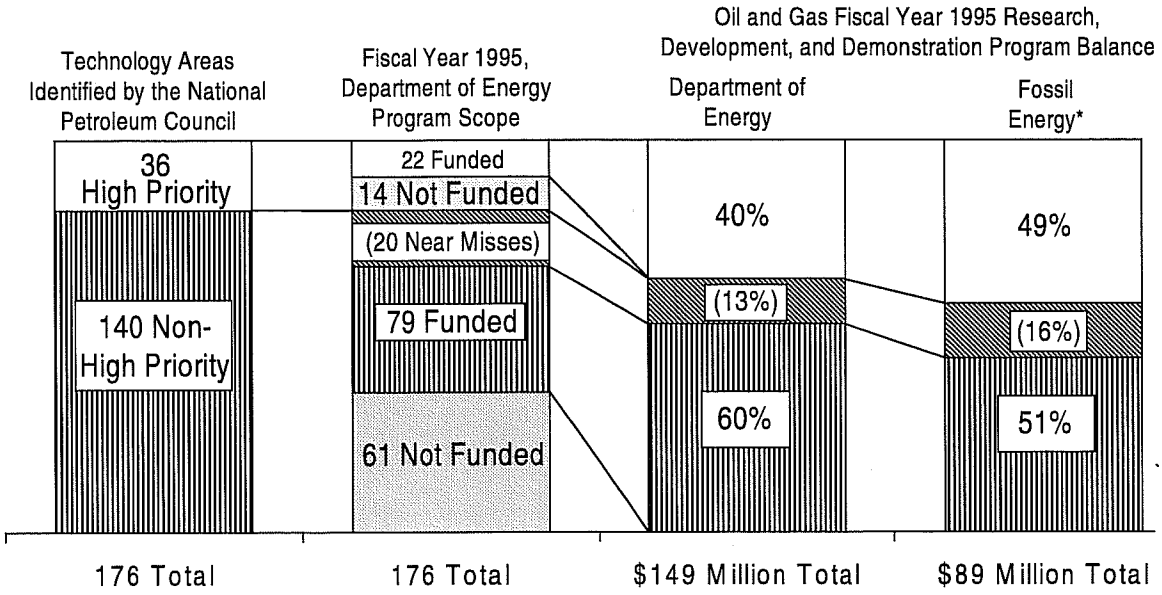
2.4 Observations from the Analysis

The following is a summary of analysis results:
(see Exhibit 7, page 14).

- 20% of technology areas were identified as high priority by the Council.
- Fiscal Year 1995 DOE programs address 22 of the 36 high priority technology areas identified by NPC.
- Fourteen of the 36 high priority areas are not addressed by the current programs. Nine of these are in Deepwater Offshore and Arctic Region technology categories.
- The Department supports research in 61% of the Council's high priority areas and spends 40% of its oil and gas RD&D budget on them. (Similar figures for Fossil Energy are 50% and 49%, respectively).

DOE's Fiscal Year 1995 programs address 22 of the 36 high priority technology areas identified by the Council.

Exhibit 7 - Summary of Analysis Results



*Fossil Energy funded 18 of the 36 high priority areas.

- 13% of DOE and 16% of Fossil Energy FY 1995 RD&D funds were spent on "Near Misses" that DOE believes may be important (explained further on page 15).
- The breakdown of the overall RD&D budget by Office is $88.5 million for Fossil Energy; $18.9 million for Energy Research; $20.7 million for Defense Programs; and $20.7 million for Energy Efficiency. (Exhibit 8)

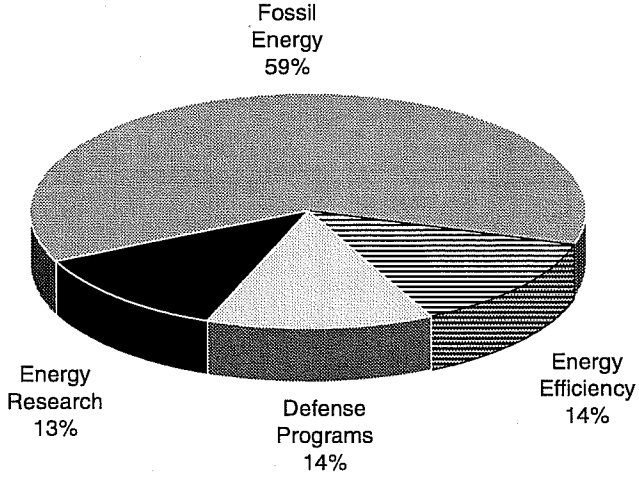


Exhibit 8 - DOE Oil and Gas RD&D Budget by Office: $149 Million

- Fossil Energy's RD&D Management Support and Analysis, totalling $16.8 million, includes projects that are significant to DOE's mission and responsibilities related to broad national issues such as national energy security, resource development on Federal and tribal lands, health and safety issues, data analysis and modeling (for example, Tertiary Oil Recovery Information System oil reservoir economic model and Gas System Analysis Model), and program management.
- Exhibit 9 provides distribution of DOE technology RD&D funds by the NPC high-priority areas (includes programs under Fossil Energy, Energy Research, Defense Programs, and Energy Efficiency).
- Exhibit 10 shows DOE project funding in NPC "Near-Miss" technology areas that almost qualified as high priority. DOE determined these by modifying the NPC criteria as follows: threshold for number of respondents was reduced to 4 or more (changed from 5 or more respondents), with near-term impact score reduced to at least 3.5 (instead of at least 4.0). DOE created this category to indicate what the next tier of technology needs would be with a slight modification of the NPC scoring criteria. This exercise resulted in 20 additional technology areas, of which DOE conducts research in 11 areas with a total funding of $19.5 million.
- If "Near-Miss" categories are included, the Department supports research in 59% of the high priority areas and spends 53% of its RD&D budget on them (Fossil Energy figures are 50% and 65%, respectively).
- Energy Efficiency has 33% of its RD&D program in the Council's high priority areas, while Defense Programs have 36% and Energy Research has 5%.
- The Department provides no support for 39% of the Council's high priority categories. Interestingly, nine of the 14 Council's high priority areas not being addressed are in the Deepwater Offshore and Arctic Region categories. Historically, the Department has not had a concentration of funding in these categories. However, there are several projects that address these areas directly: (1) gas-to-liquids program includes activities targeted to provide a means of marketing natural gas in the Arctic region, (the Council classified such work under Oil Processing/Refining); and (2) two projects in the ACTI and Oil Reservoir Class programs.

DOE supports research in 61% of the Council's high priority technology areas, which accounts for 40% of the FY 1995 oil and gas RD&D budget.

Exhibit 9 - Alignment of DOE Oil & Gas Programs with NPC Technology Areas

	FY 1995 Funding ($ in Millions)				
High Priority Areas Addressed	**FE**	**ER**	**EE**	**DP**	**DOE**
High-resolution seismic depth imaging (1-3)	3.5	0.1	-	-	3.6
Advanced seismic acquisition (1-14)	1.1	-	0.7	0.3	2.1
Computer-based 3D geological modeling (2-2)	PYF	0.2	-	2.2	2.4
Development-scale seismic applications (2-3)	2.6	-	-	1.2	3.8
Through-casing logging (2-15)	1.8	-	-	1.7	3.5
Advanced fracture techniques (3-3)	3.0	-	-	-	3.0
Well productivity (3-6)	10.9	-	-	1.5	12.4
Stimulation techniques (4-11)	3.1	-	-	-	3.1
Recompletion techniques (4-13)	SYF	-	-	-	SYF
Near well bore stimulation (4-25)	0.7	-	-	-	0.7
Advanced recovery of natural gas (4-27)	6.0	-	-	0.7	6.7
Deepwater extended reach drilling or production (5-2)	2.0	-	-	-	2.0
Deepwater risers (5-9)	-	-	-	0.7	0.7
Catalysts with improved selectivities, yields, lifetimes (7-1)	0.2	-	1.8	-	2.0
Plant and process reliability (7-3)	-	-	0.4	-	0.4
Energy efficiency of processes (7-16)	-	-	0.3	-	0.3
Separations technologies (7-19)	-	0.6	3.6	-	4.2
New approaches to refining heavy feeds (7-21)	3.6	-	-	-	3.6
Performance characteristics of new hydrocarbon fuel compositions (7-27)	0.03	-	-	-	0.03
Environmental characteristics of new hydrocarbon fuels compositions (7-28)	0.4	-	-	-	0.4
Reservoir management (10-3)	0.2	-	-	-	0.2
Provide scientific basis for risk-based regulation (11-14)	4.4	-	-	-	4.4
Total High-Priority Areas	**$43.5**	**0.9**	**6.8**	**8.3**	**59.5**
Non-High-Priority Areas	**$45.0**	**18.0**	**13.9**	**12.4**	**89.3**
Total RD&D Funding	**$88.5**	**18.9**	**20.7**	**20.7**	**148.8**
RD&D Management Support and Analysis	**$16.8**	**-**	**-**	**-**	**16.8**
Total DOE Oil and Gas Funding	**$105.3**	**18.9**	**20.7**	**20.7**	**165.6**

PYF: Prior Year Funding - Projects Ongoing
SYF: Subsequent Year Funding - Projects Planned

High Priority Areas Not Addressed By Current DOE Projects

Permeability logging techniques (2-20)
New directional drilling (4-26)
Deepwater offshore flowlines (5-5)
Deepwater offshore flow metering (5-6)
Deepwater subsea equipment (5-7)
Deepwater offshore drilling (5-11)
Deepwater offshore workover (5-12)
Deepwater hydrate prevention (5-14)
Deepwater multi-phase pumps (5-15)
Arctic development (6-3)
Arctic drilling (6-4)
Energy efficiency of equipment (7-17)
Gas compression (9-1)
Base gas minimization techniques (10-5)

FE: Fossil Energy; ER: Energy Research; EE: Energy Efficiency; DP: Defense Programs

Exhibit 10 - DOE Program Funding in Near-Miss Technology Areas
FY 1995 Funding ($ in Millions)

Near-Miss Areas Addressed	FE	ER	EE	DP	DOE
Geophysical fracture detection methods (1-16)	-	0.4	1.4	-	1.8
Reservoir property identification (2-14)	5.1	0.4	-	1.2	6.7
Deep investigation techniques (2-16)	0.4	-	-	-	0.4
Unconventional drilling technology (3-13)	0.7	-	1.9	-	2.6
Paraffin control/removal (4-5)	1.0	-	-	-	1.0
Conversion of methane to liquid fuels (7-23)	4.0	0.1	-	-	4.1
Relating chemical compositions to process and product performance (7-24)	1.6	-	-	-	1.6
Acid gas removal (8-2)	0.2	-	-	-	0.2
Separation of high concentrations of impurities (nitrogen, CO_2, H_2S) (8-8)	0.3	0.2	-	-	0.5
Unconventional development techniques (10-7)	0.1	-	-	-	0.1
Treatment and disposal of produced fluids (11-2)	0.5	-	-	-	0.5
Total Near-Miss Areas	**13.9**	**1.1**	**3.3**	**1.2**	**19.5**

Near-Miss Areas Not Addressed by Current DOE Projects

4-3 Corrosion control (Production)
4-12 Gas compression techniques (Production)
5-16 Structures (Deepwater Offshore)
6-5 Production (Arctic Region)
6-6 Deepwater offshore activities (Arctic Region)
7-18 Energy efficiency of separations (Oil Processing/Refining)
9-3 Plastic pipe (higher pressure rating) (Gas Gathering)
9-5 Multi-phase metering (Gas Gathering)
10-2 Leak detection and mitigation (Gas Storage)

"Near-Miss" Technology Areas are defined by DOE as areas with a Technology Score of 10.0 or more, an Impact score of 3.5 or more, and respondents of 4 or more.

In addition, the Department supports deepwater royalty relief for the industry such as Senate Bill 395. This Bill lifts the 22-year old ban on Alaskan North Slope oil exports and provides royalty relief for deepwater oil and gas producers. This Bill was recently signed into law by the President.

- The Department supports an Industry Partnership Program which includes ACTI and the Oil Reservoir Class Programs. It is interesting that 55 percent of the current project funding associated with these programs does not fall within the Council's high priority areas, even though project selections for both of these programs were made by industry panels or from projects proposed by industry sponsors. This illustrates the difficulty in determining an industry consensus on RD&D issues.

3.0 Next Steps

The Department has developed an Action Plan in response to the recommendations of the Council's study. This plan, included in Appendix C, was presented to the Council and its members on October 31, 1995. Subsequently, on November 7, 1995, Secretary of Energy Hazel O'Leary forwarded a letter to the Council providing a list of several near-term action items that were agreed upon at the October 31st meeting. This letter, presented in Appendix D, also includes actions with reference to the Council's companion study, *Future Issues*.

As indicated in the letter, the Department will work with industry to examine its role in all NPC-defined high priority areas at the planned January 1996 workshop in Golden, Colorado.

The Department will also consider the recommendations of the Galvin and the Yergin Task Forces along with those of the Council's study.

DOE will work with industry to examine its role in all high priority technology areas identified by the Council.

APPENDIX A

OIL AND GAS INDUSTRY TECHNOLOGY RD&D NEEDS IDENTIFIED BY THE NATIONAL PETROLEUM COUNCIL

1. Exploration

1-1 3D Basin modeling
1-2 Risk assessment methods
1-3 High-resolution seismic depth imaging
1-4 Specialized seismic processing
1-5 Sequence stratigraphy techniques
1-6 Workstation seismic modeling
1-7 Geochemical analysis
1-8 Airborne/satellite remote sensing
1-9 Fault seal analysis
1-10 Multi-component seismic techniques
1-11 3D Paleostructural restoration
1-12 Amplitude versus offset (AVO) in 3D
1-13 3D Visualization tools
1-14 Advanced seismic acquisition
1-15 Geographic information systems
1-16 Geophysical fracture detection methods

2. Development

2-1 Advanced reservoir analog models
2-2 Computer-based 3D geological modeling
2-3 Development-scale seismic applications
2-4 Tracers (biologic/chemical/ radioactive)
2-5 Core analysis/imaging
2-6 Geostatistical reservoir descriptions
2-7 Outcrop analog studies
2-8 Fluid-rock interaction
2-9 Rock physics
2-10 Cross-well geophysical imaging
2-11 Advanced attribute processing
2-12 Seismic/log/core calibration
2-13 Cuttings analysis
2-14 Reservoir property identification
2-15 Through-casing logging
2-16 Deep investigation techniques
2-17 High resolution borehole imaging logs
2-18 Specialized core analysis
2-19 Characterization of rock wettability
2-20 Permeability logging techniques
2-21 Tracer techniques
2-22 CT scanning and NMR imaging
2-23 Formation water chemistry
2-24 Fluid sampling and analysis
2-25 Advanced reservoir simulation modeling
2-26 Workstation single well simulations
2-27 Procedures for data scale-up
2-28 Expert systems applications
2-29 Time lapse seismic imaging
2-30 Advanced monitoring of EOR processes
2-31 Advanced well testing and interpretation
2-32 Material balance applications
2-33 Decision and risk analysis
2-34 Expendable well bore instrumentation

3. Drilling & Completion

3-1 Horizontal well bore applications
3-2 Drilling fluid design
3-3 Advanced fracture techniques
3-4 Cementing
3-5 Perforating and well bore cleanup
3-6 Well productivity
3-7 Multilateral technology
3-8 Innovative bit and tubular technology
3-9 Slim hole drilling
3-10 Under balanced drilling
3-11 Measurements while drilling
3-12 Coiled tubing drilling
3-13 Unconventional drilling technology

4. Production

4-1 Injection water treatment
4-2 Produced water treatment
4-3 Corrosion control
4-4 Scaling inhibitors
4-5 Paraffin control/removal
4-6 Oil/water/gas/separation
4-7 Beam pump analysis
4-8 Gas lift analysis
4-9 Submersible pump analysis
4-10 Rod/tubing wear evaluation
4-11 Stimulation techniques
4-12 Gas compression techniques
4-13 Recompletion techniques
4-14 Remote control and data analysis
4-15 Compact processing on offshore platforms
4-16 Modification of reservoir fluid mobilities
4-17 Miscible contact/displacement
4-18 Viscosity reduction of heavy oils
4-19 In situ generation of foams/emulsions
4-20 Thickeners for CO_2 floods
4-21 Microbial EOR processes
4-22 High-velocity gas flow modeling
4-23 Thermal processes
4-24 Combustion processes
4-25 Near well bore stimulation
4-26 New directional drilling
4-27 Advanced recovery of natural gas

5. Deepwater Offshore

5-1 Produced fluid disposal
5-2 Extended reach drilling or production
5-3 Extended reach control systems
5-4 High pressure systems
5-5 Flowlines
5-6 Flow metering
5-7 Subsea equipment
5-8 External corrosion protection
5-9 Risers
5-10 ROV systems
5-11 Drilling
5-12 Workover
5-13 Water/gas injection
5-14 Hydrate prevention
5-15 Multi-phase pumps
5-16 Structures

6. Arctic Region

6-1 Transportation
6-2 Exploration
6-3 Development
6-4 Drilling
6-5 Production
6-6 Deepwater offshore activities
6-7 Mobile ice

7. Oil Processing/Refining

7-1 Catalysts with improved selectivities, yields, lifetimes
7-2 Hydrogen production and recovery
7-3 Plant and process reliability
7-4 Unconventional process technology
7-5 New materials of construction
7-6 Reactor engineering and modeling
7-7 Catalyst manufacturing technology
7-8 Risk assessment methodology
7-9 Solid acid catalysts
7-10 Alternatives to olefin alkylation process
7-11 Techniques for integration of environmental solutions into process and plant design
7-12 Improved on-line NDE inspection technology
7-13 Predicting useful remaining lifetimes of aging equipment
7-14 Robotics for safety applications
7-15 Worker safety systems
7-16 Energy efficiency of processes
7-17 Energy efficiency of equipment
7-18 Energy efficiency of separations
7-19 Separations technologies
7-20 Determining chemical composition of crudes, refinery intermediates, and products
7-21 New approaches to refining heavy feeds
7-22 Processing synthetic fuels
7-23 Conversion of methane to liquid fuels
7-24 Relating chemical compositions to process and product performance
7-25 Advanced computational modeling of processes/reactions
7-26 Advanced control and information systems
7-27 Performance characteristics of new hydrocarbon fuel compositions
7-28 Environmental characteristics of new hydrocarbon fuels compositions

8. Gas Processing

8-1 Gas dehydration
8-2 Acid gas removal
8-3 H_2S scavenger technology
8-4 Natural gas liquid separation
8-5 Nitrogen separation
8-6 Trace constituent (arsenic, Hg, etc.) removal
8-7 Sulfur recovery
8-8 Separation of high concentrations of impurities (nitrogen, CO_2, H_2S...)

9. Gas Gathering

9-1 Compression
9-2 Leak detection
9-3 Plastic pipe (higher pressure rating)
9-4 High pressure measurement
9-5 Multi-phase metering

10. Gas Storage

10-1 Well deliverability restoration
10-2 Leak detection and mitigation
10-3 Reservoir management
10-4 Gas migration control
10-5 Base gas minimization techniques
10-6 Inert base gas research
10-7 Unconventional development techniques

11. Environmental/Regulatory

11-1 Disposal methods for drilling fluids
11-2 Treatment and disposal of produced fluids
11-3 Screening procedures for injection wells
11-4 Risk and reclamation analysis of disposal methods
11-5 Leak detection
11-6 Hydrological modeling
11-7 Compliance with CAAA stationary source issue
11-8 Advanced computation models to predict dispersion, transformation, and fate of air pollutants
11-9 Model transport and remediation of contaminants in ground water and soils
11-10 Effluent and emission monitoring, minimization, and control
11-11 Recycling of waste and byproduct streams
11-12 Remediation technology
11-13 Catalyst recycling
11-14 Provide scientific basis for risk-based regulation
11-15 NORM disposal

Note: Bold indicates top 36 technologies

APPENDIX B

NATIONAL PETROLEUM COUNCIL SURVEY RESPONDENTS

Major Companies* and Other Integrated Oil and Gas Companies that Responded to the NPC Survey of Research and Development Needs

Major Companies	Other Integrated Oil and Gas Companies
Amoco Exploration & Production Technology	BHP Petroleum Americas Incorporated
Anadarko Petroleum Corporation	Columbia Gas System
ARCO Exploration and Production Technology	Consolidated Natural Gas
Ashland Oil, Incorporated	ENSERCH Corporation
Chevron	Equitable Resources
Conoco, Incorporated	Flying J Incorporated
Exxon	Murphy Oil Corporation
Fina, Incorporated	Panhandle Eastern Corporation
Kerr-McGee Corporation	Sonat, Incorporated
Marathon Oil Company	Southern California Gas Company
Occidental Petroleum Company	Tenneco
Phillips Petroleum Company	The Williams Companies
Shell Oil Company	
Sun Company, Incorporated	
Texaco, Incorporated	
Union Pacific Resources Company	
Unocal Corporation	

*For the purposes of the NPC study, a major company is one which is part of the Department of Energy's Financial Reporting System. All but two of the above companies also qualify as major companies by the IRS' definition.

Independent Companies that Responded to the NPC Survey of Research and Development Needs

Company
Alcorn Exploration
Armstrong Energy Corporation
Axem Resources Incorporated
Badger Oil Corporation
Ballard and Associates, Incorporated
Celsius Energy Company, an Affiliate of Questar Corporation
CMS Nomeco Oil and Gas Company
Coulson Oil Company, Incorporated
Crown Central Petroleum Corporation
Devon Energy Corporation (Nevada)
Diamond Shamrock
Enervest Management Company, L.C.
Forest Oil Company
Gunn Oil Company
Julander Energy Company
Lynx Petroleum Consultants, Inc.
Meridian Oil Incorporated
Mesa Incorporated
Mitchell Energy Corporation
National Cooperative Refinery Association
Newfield Exploration Company
Osyka Producing Company, Incorporated
Parker and Parsley Petroleum Company
Parker and Parsley Petroleum USA, Incorporated
Pitts Oil Company/Dallas Production, Inc.
Sanchez-O'Brien Oil and Gas
Seagull Energy Corporation
Seneca Resources
Southwest Research Institute
Taylor Energy Company
Tesoro Petroleum
The Louisiana Land and Exploration Company
Tosco Corporation
Total Petroleum, Incorporated
True Oil Company
Union Texas Petroleum
Ward Petroleum Corporation
Washington Gas
Winn Exploration, Incorporated
Yates Petroleum Company

Service Companies that Responded to the NPC Survey of Research and Development Needs

Company
Axelson, Incorporated
Baker Hughes, Incorporated
Barold Drilling Fluids
Copestone, Incorporated
Dresser Oilfield Valve Division
Dresser-Rand Company
Flournoy Drilling Company
Halliburton Energy Services
Ingersoll-Dresser Pump Company
Lone Star Steel Company
Parker Drilling Company
Premier Enterprises, Incorporated
Rowan Companies, Incorporated
Schlumberger
Security DBS
Sperry-Sun Drilling Services
Sperry-Sun Drilling Services, a Dresser Industries Incorporated Company
The M.W. Kellogg Company
Western Atlas International Incorporated
Wheatley Canada, Limited, A Dresser Industries Incorporated Company

APPENDIX C

DEPARTMENT OF ENERGY ACTION PLAN IN RESPONSE TO THE NPC STUDY

DEPARTMENT OF ENERGY ACTION PLAN FOR THE NATIONAL PETROLEUM COUNCIL RD&D NEEDS STUDY RECOMMENDATIONS

The attached Action Plan has been developed at the request of Hazel R. O'Leary, Secretary of Energy, as the Department's response to the National Petroleum Council (Council) study, "Research, Development, and Demonstration Needs of the Oil and Gas Industry," (August 1995).

The Action Plan consists of the following sections:

NPC Recommendation: Includes specific recommendations of the Council as listed in the study.

DOE Position: States the position of the Department with reference to the specific recommendations.

Champion/Participants: Provides a listing of the Department staff and indicates the Champion (or the alternate person) responsible for implementation of the Action Plan commitments made by the Department for the Council recommendation. A listing of key participants who will support the Action Plan Champion is also provided. Please refer to the last page of the Action Plan for descriptions of the staff organization codes.

Action: Comprises Commitment and Schedule subsections. Commitment subsection includes Initiatives and Expand/Continue categories. **Initiatives** include descriptions of new actions that the Department will undertake in response to the recommendation. **Expand/Continue** category includes descriptions of ongoing Departmental actions that relate and/or contribute to resolving issues with regard to the specific Council recommendation. Specific Action implementation elements and milestones/completion dates for the commitments made are provided in the **Schedule** subsection.

DOE Action Plan for the National Petroleum Council (NPC) RD&D Needs Study Recommendations

NPC RECOMMENDATION	DOE POSITION	CHAMPION/ PARTICIPANTS	ACTION
A. Focus RD&D on Industry Needs			
A.1 Utilize and fully incorporate this study's analysis into DOE's current realignment activities, program development, spending prioritization, and budgeting activities at all levels of DOE's strategic planning activities.	Support	**P. Godley, ASFE (lead)** **G. DeHoratiis, FE (alternate)** Participants: S. Waisley, FE N. Johnson, FE E. Melchert, FE B. Felber, BPO P. Mandel, CI R. Marlay, PO J. Sullivan, PO	**COMMITMENT** **Initiatives:** Strategic Alignment: The Department's Strategic Alignment Implementation Plan was released on August 3, 1995. Members of the alignment teams were informed of the findings of the NPC report, which were incorporated into this plan. This plan calls for the integration of the oil and gas supply, storage, processing, and environmental activities from three field offices at a single site in Golden, Colorado, proximate to the customers of those activities. Integration of these programs currently performed at the Bartlesville, Oklahoma; Metairie, Louisiana; and Morgantown, West Virginia field offices will maximize operational efficiencies, avoid duplication, provide "one-stop shopping" for customers, increase customer services, and achieve budgetary savings. The Strategic Alignment Implementation Plan also calls for the privatization of the National Institute for Petroleum and Energy Research (NIPER) in Bartlesville and the "in-house" research and development (R&D) that it performs. Budget Preparation: Current Strategic Alignment Implementation Plan calls for integration of DOE energy supply and use research, development, and demonstration (RD&D) programs in an Energy Resources Business Line (Business Line) and development of an integrated Energy Research and Development Strategic Plan within the purview of DOE's Research and Development Council. Strategic alignment efforts will enhance corporate decisionmaking; facilitate integration of energy programs and policy, technology and energy research; and provide more effective customer/industry interface. Strategic alignment efforts also offer us an opportunity to develop new and improved processes to prioritize spending. The Department, utilizing non-DOE expert teams, when appropriate, will examine the specific technologies identified in the NPC study, compare them to the RD&D efforts being conducted under the auspices of the oil and gas programs, and utilize this analysis in the preparation of the Fiscal Year (FY) 1997 oil and gas RD&D budget. **SCHEDULE** A management plan for the Fossil Energy activities to be conducted at the Golden field office will be adopted in October 1995. Subject to congressional approval through appropriations reprogramming, the integration of the environmental and oil and gas supply programs at Golden will be completed by June 1996 or sooner, and a plan regarding privatization of NIPER will be developed by October 1995 and implemented by June 1996. Increased customer/stakeholder participation will be incorporated in the strategic planning process by June 1996.

DOE Action Plan for the National Petroleum Council RD&D Needs Study Recommendations (Continued)

NPC RECOMMENDATION	DOE POSITION	CHAMPION/ PARTICIPANTS	ACTION
A.2 Develop a project definition system, which utilizes broadly based industry input to prioritize and recommend all DOE funding that is directly related to oil and gas RD&D needs.	Support	**G. DeHoratiis, FE** Participants: S. Waisley, FE A. Hartstein, FE E. Melchert, FE B. Felber, BPO P. Mandel, CI J. Sullivan, PO	**COMMITMENT** **Expand/Continue:** Natural Gas and Oil Technology Partnership: The National Laboratory-Industry Partnership program (Partnership), which includes the Advanced Computational Technology Initiative (ACTI), utilizes active industry interfaces, such as industry review panels, to define industry needs and provide annual reviews, evaluations, and prioritization of both new proposals and ongoing projects. The first round of ACTI projects selection was based on recommendations of the industry review panel. Two-thirds of the projects selected are in the high-priority RD&D area of 3-D seismic data acquisition, processing, and analysis. Future ACTI and other Partnership projects in three additional technology areas -- Borehole Seismic Technology, Oil Recovery Technology, and Drilling and Completion Technology -- will continue to focus on these high priority areas. DOE will meet with designated representatives of NPC to review this process for improvement. It will assess its application to other parts of our program, and incorporate other processes such as those utilized by the Gas Research Institute (GRI) in prioritizing work. Petroleum Technology Transfer Council (PTTC): PTTC is a new national umbrella organization formed by the Independent Petroleum Association of America and its 45 cooperative oil and gas producer associations at the State and regional level. The mission of PTTC, which was initiated with and currently supported by DOE funds, is to foster effective transfer of exploration, production, and processing technologies from the research and development community to domestic oil and gas producers in all regions of the Nation. DOE - Gas Research Institute Cooperation: DOE and GRI signed a Memorandum of Understanding in May 1994 to ensure that government and industry work together in the most cost-effective manner, and to increase communication and streamline cooperation to better coordinate industry and government research ideas. DOE's FY 1995 strategic plan for the Department-wide natural gas program structure follows the technology areas of the GRI program and it was developed with input from GRI and other industry organizations.

DOE Action Plan for the National Petroleum Council RD&D Needs Study Recommendations (Continued)

NPC RECOMMENDATION	DOE POSITION	CHAMPION/ PARTICIPANTS	ACTION
A.2 Continued			**Initiatives:** The New Outreach Program: Recently, the "Energy Resources" Business Line has developed a new oil and gas outreach program which will utilize the existing PTTC regions to seek continued stakeholders input from both producers and refiners. DOE will utilize the existing regional centers of PTTC to ensure that industry needs are appropriately analyzed and incorporated into the RD&D portfolio analysis and budgeting processes. Project Definition System: The Energy Resources Business Line has initiated efforts to develop a project evaluation system, through the Portfolio Analysis process, that will be used to establish a balanced RD&D portfolio that is responsive to industry needs. Industry RD&D Needs Update: The Secretary will task NPC to contact its members every three years and update the survey of industry RD&D needs. Because of the changing industry dynamics and energy needs of the U.S. economy, the need for advanced technology will increase and their utilization will become more critical in recovering domestic oil and gas resources at competitive costs. Periodic survey of industry needs, in addition to the feedback obtained through existing outreach and communication mechanisms, will allow DOE to focus its RD&D program on the most recent urgent industry needs and priorities. **SCHEDULE** The final implementation plan for the new outreach program will be completed by December 1995, after running a pilot test earlier in the Fall. The Energy Resources Business Line will develop program evaluation methodologies by January 1996.

DOE Action Plan for the National Petroleum Council RD&D Needs Study Recommendations (Continued)

NPC RECOMMENDATION	DOE POSITION	CHAMPION/ PARTICIPANTS	ACTION
A.3 Place greater emphasis on prioritizing RD&D programs based on the industry's needs and participation.	Support	**G. DeHoratiis, FE** Participants: S. Waisley, FE A. Hartstein, FE E. Melchert, FE B. Felber, BPO B. Porter, FE P. Lagiovane, FE P. Mandel, CI A. Joseph, ER J. Sullivan, PO	**COMMITMENT** **Expand/Continue:** Natural Gas and Oil Technology Partnership: See A.2, B.1 The Domestic Natural Gas and Oil Initiative (DNGOI): One of the objectives of DNGOI is to advance and disseminate natural gas and oil technologies. The 49 specific DOE actions associated with DNGOI allowed the Department to work with the industry and establish a dialogue on industry issues and needs and implement programs and undertake activities to assist industry in solving technology, environmental, and policy and regulatory related barriers and difficulties. One-third of the actions have already been completed (the First Annual Progress Report of DNGOI, Spring 1995, summarized the specific accomplishments) and, DOE will continue to work with industry through the communication channels established and ongoing actions. Interagency and Industry Cooperative Efforts: DOE is currently a member of over 40 internal and external energy and environment related working groups, committees, and councils. Through these organizations, DOE seeks input to its RD&D program decisionmaking, supports industry activities, advocates removal of impediments to market operation, promotes policy and legislation in support of the industry, and provides data and information to Federal and State agencies for science-based environmental regulatory decisionmaking (examples include California Oil Survival Team, Gas Research Institute Research Coordinating Committee, Petroleum Environmental Research Forum, and the Common Sense Initiative). DOE will intensify its efforts to assist industry in overcoming barriers and addressing the technology needs, and will involve other Federal agencies in outreach programs.

DOE Action Plan for the National Petroleum Council RD&D Needs Study Recommendations (Continued)

NPC RECOMMENDATION	DOE POSITION	CHAMPION/ PARTICIPANTS	ACTION
A.3 Continued			**Expand/Continue:** (Continued) Natural Gas and Oil Program Strategic Planning: DOE institutionalized a strategic planning effort for the **Natural Gas Program** in 1994 that integrates the Department-wide programs for supply, delivery and storage, power generation, industrial, residential and commercial, natural gas vehicles, and the environment. The overall effort is coordinated through the Natural Gas Strategic Planning Committee comprising members from the program offices (e.g., Fossil Energy, Energy Efficiency and Renewable Energy, Energy Research, the Energy Information Administration) and, as observers, officials from industry stakeholders and universities (e.g., Gas Research Institute, American Gas Association, Interstate Natural Gas Association of America, Petroleum Technology Transfer Council). For the **Oil Program**, DOE will expand the strategic planning process and coordinate efforts under a planning committee that also includes members from industry as observers. The new strategic plan will incorporate the findings and recommendations of the NPC reports and focus the program on the industry needs and priorities identified. Stakeholders involvement in the annual strategic planning efforts will continue and is critical to development of industry-driven RD&D programs. This process will allow frequent exchange of views between DOE and industry on issues, needs, and priorities and also provide an opportunity for industry to comment yearly on proposed projects for the next fiscal year and a review of research results from completed and ongoing projects. **Initiatives:** The New Outreach Program: See A.2 Current Program Analysis: DOE initiated a review of the current oil and gas RD&D programs to determine the level of match with priority technology RD&D areas identified in the NPC study. DOE will discuss with the NPC representatives the exact definition of the RD&D categories identified in the NPC study where uncertainty exists. Based on this analysis, DOE will redirect the current program to establish cooperative RD&D opportunities in high priority areas not addressed by the existing program. Projects involving and/or related to the high priority areas will be further reviewed to assess their effectiveness and value in terms of responding to industry needs. Projects that are not in high priority areas will be critically evaluated. During this reassessment, opportunities for redirection, modification, or orderly phase-out will be explored. See also B.2.

DOE Action Plan for the National Petroleum Council RD&D Needs Study Recommendations (Continued)

NPC RECOMMENDATION	DOE POSITION	CHAMPION/ PARTICIPANTS	ACTION
A.3 Continued			**Initiatives:** (Continued) Industry Communication Plan: DOE will develop a two-way communication plan to assure that industry issues, needs, and priorities are effectively addressed by the oil and gas RD&D program. This communication plan will be interactive and the mechanisms established will also allow industry feedback to the designated action champions for comments and suggestions. DOE will utilize the existing tools such as the FE Home Page at Internet and special program newsletters and reports (e.g., *Natural Gas and Oil Bulletin*, *The Class Act* on the Class Field Demonstration Program, the *Annual Progress Reports of the Domestic Natural Gas and Oil Initiative*) as part of this communication plan. In addition, through the new outreach program, DOE will also utilize the PTTC regional centers to disseminate the progress on these actions to producers and refiners. **SCHEDULE** Initial review of the ongoing programs will be completed in October 1995. The communication plan will be developed by December 1995 and full implementation will take place in 1996. New strategic plans for oil and gas programs will be available in 1996.

DOE Action Plan for the National Petroleum Council RD&D Needs Study Recommendations (Continued)

NPC RECOMMENDATION	DOE POSITION	CHAMPION/ PARTICIPANTS	ACTION
B. Improve National Laboratory RD&D Collaboration			
B.1 Remove barriers to collaboration with DOE and the government laboratories.	Support	**G. DeHoratiis, FE** Participants: G. Stosur, FE R. Lemmon, BPO P. Mandel, CI A. Joseph, ER D. Goldman, TP	**COMMITMENT** **Expand/Continue:** Natural Gas and Oil Technology Partnership: DOE had recognized the existing barriers to collaboration with the National Laboratories through the Partnership's interaction with industry and as noted in the Galvin Task Force report. In order to encourage collaboration, DOE established less formal and simpler agreement mechanisms for cost-shared Partnership projects between industry and the National Laboratories. Such mechanisms have been successfully utilized since the inception of the Partnership in 1988 -- then called the Oil Recovery Technology Partnership -- and DOE will expand their use to other applicable programs. Class Field Demonstration Program: DOE has been successful in initiating a total of 33 cost-shared projects with industry through the Program Opportunity Notices (PONs), which allowed industry to propose a spectrum of technology applications to increase oil and gas production from domestic fields. The Class Program and its effectiveness is currently "peer reviewed" by the National Academy of Sciences' Committee on Earth Resources Board on Earth Sciences and Resources. This review will result in recommendations for enhancing the value of the program to industry and the scientific community, and for streamlining and improving the process through which the industry proposals are procured and selected. The early analysis and recommendations point toward a process similar to the one utilized by the Partnership -- less formal and less administratively cumbersome -- for future program announcements in order to increase and diversify the industry participation. DOE has already decreased the amount of paperwork for contract awards and reporting and further improvements will be explored. **Initiatives:** Simplify and Streamline Procedures: DOE will work to simplify administrative procedures, reduce paperwork, and accelerate turnaround time to bring technology to application. For example, considerable progress has been made in getting the National Laboratories to work together as a system under the direction of the newly established Laboratory Operating Board that includes a subgroup of private sector advisors. This Board will also ensure implementation of the Management Improvement Roadmap, which was developed to help the Department address inefficient actions identified in the Galvin report, and define the program efforts of each Laboratory while not jeopardizing their multi-disciplinary and crosscutting research capabilities. (See B.3 also)

DOE Action Plan for the National Petroleum Council RD&D Needs Study Recommendations (Continued)

NPC RECOMMENDATION	DOE POSITION	CHAMPION/ PARTICIPANTS	ACTION
B.1 Continued			**Initiatives:** (Continued) Customer Satisfaction: DOE will seek input from current and recent cost-shared industry-National Laboratory project partners in developing and implementing continuous mechanisms that will minimize the barriers, address the issues and perceptions, and enhance RD&D collaboration. **SCHEDULE** Laboratory Operating Board has been established. First meeting was held in May 1995. Quarterly meetings are planned for this continuing work. Meeting minutes will be published with tasks to be accomplished and will be made available to NPC and its members. Customer satisfaction input will be initiated in January 1996.

DOE Action Plan for the National Petroleum Council RD&D Needs Study Recommendations (Continued)

NPC RECOMMENDATION	DOE POSITION	CHAMPION/ PARTICIPANTS	ACTION
B.2 Analyze current and newly proposed expenditures in order to match the high impact needs identified by the analysis in this report with the unique capabilities of the National Laboratories.	Support	**G. DeHoratiis, FE** Participants: G. Stosur, FE R. Lemmon, BPO P. Mandel, CI A. Joseph, ER D. Goldman, TP	**COMMITMENT** **Expand/Continue:** New Industry Paradigm: DOE has been advocating government involvement in advanced technology RD&D during congressional briefings in support of oil and gas program budget requests. These briefings highlighted the new paradigm for oil and gas RD&D in that low oil prices, increasing competition, and environmental compliance expenditures have forced the industry to reduce and focus investment in RD&D. The industry now focuses on urgent near-term needs, looks for and implements programs to increase research efficiency, and seeks cost-shared RD&D opportunities and collaborations to leverage its resources. DOE has been going through a similar paradigm shift through the **Strategic Alignment** effort in defining its RD&D focus, determining near- (urgent industry needs) and long-term (high-risk, high-payout) priorities, and in integrating programs to maximize efficiency and effectiveness (e.g., integration of the oil, gas, and environmental programs currently performed at Bartlesville, Oklahoma; Metairie, Louisiana; and Morgantown, West Virginia field locations to a single site at Golden, Colorado). DOE will continue its efforts in promoting a process that embodies the current industry trends in RD&D investments. Natural Gas and Oil Technology Partnership: The Partnership will utilize the findings of NPC in providing overall guidance for program direction and recommendations for funding distribution among the four Partnership technology areas of advanced computational technology, borehole seismic technology, oil recovery technology, and drilling and completion technology. Industry interface for each technology area is through either an industry review panel (for ACTI and oil recovery technology area) or a forum (for borehole seismic technology area). For drilling and completion technology area, two industry organizations -- Drilling Engineering Association and Completion Engineering Association -- serve as the industry interface. These elements within each technology area provide industry perspective and insight into research priorities and ensure formulation of balanced industry-driven program for collaborative RD&D projects between the National Laboratories and industry. **Initiatives:** Current Program Analysis: DOE will meet with representatives of NPC to complete the analysis of the RD&D Needs study results to see how the Department's programs address those technology areas identified as having the highest priority (see A.3). They will utilize the criteria identified in the RD&D Needs study to determine if the Federal Government should participate in new research areas. Our analysis also will include applying that criteria to our current RD&D portfolio.

DOE Action Plan for the National Petroleum Council RD&D Needs Study Recommendations (Continued)

NPC RECOMMENDATION	DOE POSITION	CHAMPION/ PARTICIPANTS	ACTION
B.2 Continued			**Initiatives:** (Continued) Focus Laboratory RD&D: DOE will utilize the results of the above program analysis effort to determine the level and type of Laboratory involvement in the high impact needs identified by NPC. The unique capabilities of the Laboratories -- that are not available in industry -- will then be matched with user identified technology areas where industry collaboration is desirable and the private sector resources are not adequate. DOE program offices will develop a plan to integrate appropriate project evaluation and selection criteria into the RD&D decisionmaking process so that high impact needs of the industry can be addressed through collaborative programs. Future DOE program budget will reflect the results of this analysis. **SCHEDULE** Program analysis will be completed in October 1995. DOE will meet with the NPC representatives by November 1995. The plan for developing and implementing the Laboratory RD&D focus criteria will be completed in January 1996.

DOE Action Plan for the National Petroleum Council RD&D Needs Study Recommendations (Continued)

NPC RECOMMENDATION	DOE POSITION	CHAMPION/ PARTICIPANTS	ACTION
B.3 The government laboratories should not become a technical services organization competing with industry resources.	Support	**G. DeHoratils, FE** Participants: G. Stosur, FE R. Lemmon, BPO P. Mandel, CI A. Joseph, ER D. Goldman, TP	**COMMITMENT** **Expand/Continue:** Natural Gas and Oil Technology Partnership: By law, the National Laboratories cannot compete with industry. DOE has already established a mechanism within the Partnership in order to avoid undertaking of projects that would be perceived as competition with industry resources (e.g., competition with industry service companies). Industry interface group of each technology area of the Partnerships (currently four technology areas exist -- see B.2 for detail) reviews all proposed Laboratory-industry proposals and determines their status in terms of competition with industry. DOE will expand this practice into other collaborative program areas (involving the National Laboratories) outside the Partnership. **Initiatives:** Focus Laboratory RD&D: See B.2 Laboratory Operating Board: While DOE is moving aggressively to improve its current system, we must guard against these institutions moving away from longer term research and into a "job shop" mentality as cautioned by the Galvin report. This will also be a prime responsibility of the Laboratory Operating Board. The Board would have jurisdiction over issues such as: high-level strategic direction for the Laboratories, including validation of strategic plans, crosscutting programmatic and management issues; and managing development and implementation of a Strategic Laboratory Mission Plan, which will include a mission statement for the entire Laboratory system and a more tightly focused mission for each Laboratory -- this plan will serve as the framework for downsizing and "rightsizing" efforts that would tailor the Laboratories to the size of their purpose. **SCHEDULE** The Laboratory Operating Board has been established and is expected to meet quarterly. Meeting minutes will be published with tasks to be accomplished and will be made available to NPC and its members.

DOE Action Plan for the National Petroleum Council RD&D Needs Study Recommendations (Continued)

NPC RECOMMENDATION	DOE POSITION	CHAMPION/ PARTICIPANTS	ACTION
C. Redirect Government RD&D			
C.1 Focus sponsorship of research on areas of technology needs that cannot be effectively conducted in the private sector.	Support	**G. DeHoratiis, FE** Participants: S. Waisley, FE A. Hartstein, FE E. Melchert, FE B. Felber, BPO A. Joseph, ER R. Marlay, PO J. Sullivan, PO	**COMMITMENT** **Expand/Continue:** Natural Gas and Oil Technology Partnership: See A.2, B.2, B.3 Interagency and Industry Cooperative Efforts: See A.3 New Industry Paradigm: See B.2 The New Outreach Program: See A.2 Petroleum Technology Transfer Council (PTTC): DOE will work with the Petroleum Technology Transfer Council for continued industry input. See also A.1. Technology Transfer Programs: DOE currently participates in several existing internal and interagency technology transfer programs designed to conduct technology RD&D. In supporting these programs, DOE will look for opportunities to sponsor projects on areas where private sector research funds have been identified as insufficient. These programs include the following: Technology Reinvestment Project, Energy Research Laboratory Technology Transfer Program, Energy Related Inventions Program, Small Business Technology Integration Program, and Small Business Technology Transfer Pilot Program. **Initiatives:** Project Definition System: See A.2 Current Program Analysis: See A.3, B.2 Industry Communication Plan: See A.3 Budget Preparation: The NPC study identified technologies that would benefit from government RD&D, although it was ambiguous as to whether the government should actually sponsor research in these areas. The Department will meet with representatives of NPC to remove this ambiguity and to determine which research areas cannot be effectively conducted in the private sector. This information will then be utilized in the preparation of the FY 1997 oil and gas budget.

DOE Action Plan for the National Petroleum Council RD&D Needs Study Recommendations (Continued)

NPC RECOMMENDATION	DOE POSITION	CHAMPION/ PARTICIPANTS	ACTION
C.1 Continued			**SCHEDULE** Tools for fossil energy RD&D portfolio analysis are being investigated and will be utilized as part of the FY 1997 budget cycle (in progress), with a more detailed analysis conducted as part of the FY 1998 process. DOE will meet with the NPC representatives by November 1995. The review of technology transfer programs supported by DOE will be completed by January 1996.

DOE Action Plan for the National Petroleum Council RD&D Needs Study Recommendations (Continued)

NPC RECOMMENDATION	DOE POSITION	CHAMPION/ PARTICIPANTS	ACTION
D. Complete Ongoing Short-Term Projects			
D.1 Provide continuity for logical (cost-effective) completions of all short-term projects, no matter how the industry-National Laboratory R&D collaborations change over the next few years.	Support within budget limits.	**G. DeHoratiis, FE** Participants: E. Melchert, FE B. Felber, BPO R. Marlay, PO	**COMMITMENT** **Expand/Continue:** Redefine RD&D Strategy: The Administration recognizes the value to the Nation of continuing to perform high priority oil and gas technology research. Therefore, even under this austere budget climate, the Administration will continue to seek funding for high priority RD&D projects that are identified in the NPC study. However, it should be noted that DOE needs broad-based industry support to identify the high priority RD&D needs and in order to secure the necessary funding from Congress. Current DOE strategy provides for the logical completion of ongoing work, which is included in the Strategic Alignment activities, contingent upon Congressional appropriations. At present, language contained in the FY 1996 Congressional Committee reports also supports this. **Initiatives:** Strategic Alignment: See A.1 Portfolio Analysis: See A.1, C.1 Project Definition System: See A.2 **SCHEDULE** The above described efforts have been ongoing. See the schedule for the listed initiatives.

Departmental Organization Abbreviations:

ASFE : Assistant Secretary for Fossil Energy
BPO : Bartlesville Project Office
CI : Congressional and Intergovernmental Affairs
ER : Office of Energy Research
FE : Office of Fossil Energy
PO : Policy Office
TP : Office of Technology Partnerships and Economic Competitiveness

APPENDIX D

SECRETARY OF ENERGY'S LETTER TO THE NATIONAL PETROLEUM COUNCIL

The Secretary of Energy
Washington, DC 20585

November 7, 1995

Mr. H. Laurance Fuller
Chairman, National
Petroleum Council
1625 K Street, NW
Washington, DC 20006

Dear Mr. Fuller:

I would like to express again my appreciation for the candid discussion with and the insights from the members of the Coordinating Co-Chairs' Committee of the National Petroleum Council. The important outcomes of our discussion focus on implementing the recommendations in the Council's *Future Issues* and *Research, Development, and Demonstration Needs* reports.

Consistent with our discussions on Tuesday, we have agreed to several action items:

1. By December 1, 1995, the Department of Energy will identify appropriate Assistant Secretary-level representatives from the Environmental Protection Agency; Departments of State, Defense, Treasury, Commerce and Interior; the Council on Environmental Quality; and the National Economic Council to form a permanent working group. This working group, chaired by the Assistant Secretary for Fossil Energy, will address policy or regulatory issues identified by the Council that significantly affect industry competitiveness and require coordinated consideration or action by the Government. Participants from other agencies will be added as needed.

   As a follow-on activity, I request that, by December 15, the Committee provide Assistant Secretary Patricia Godley with a list of specific top priority issues to be addressed by the working group. Once Assistant Secretary Godley receives the list, she will meet with the working group members to establish a schedule for addressing the issues with appropriate actions or responses to the Council. I will personally participate in this process as required.

2. By December 1, 1995, Deputy Assistant Secretary Reggie Spiller, working with the Department's Laboratory system, will complete an analysis of the Department's oil and natural gas research, development and demonstration portfolio using criteria identified in the Council's report on *Research, Development, and Demonstration Needs*. That review will be forwarded to the Council. Meanwhile, the Department will

schedule a workshop with research managers from the industry. Patricia Godley will seek Council input on appropriate attendees from industry. The workshop will be scheduled for the week of December 11, or otherwise at the convenience of industry participants. The workshop will be held in Golden, Colorado, at the field office where management of the newly integrated natural gas and oil supply RD&D program will occur under the Department's strategic alignment initiative.

3. I will convene a national conference on the "Petroleum Industry and the Environment." Invitees will include representatives from industry, the environmental community and State and Federal Governments to discuss the role of the oil and natural gas industry in the U.S. economy; the environmental impact of industry activities; and appropriate and cost-effective means of mitigating such impacts while enabling the industry to accomplish its mission. This conference will build on the communication among industry stakeholders in the *Future Issues* study. Participants will be asked to recommend specific industry action and government policy or regulatory reform. This conference will be held during the first quarter of calendar year 1996.

4. By December 8, 1995, as requested by Committee members, the Department will prepare a fact sheet titled "DID YOU KNOW . . . ?" a display of little-known facts that make the oil and gas industry strategic to the United States.

5. We will facilitate participation by industry in the Administration's new XL program as discussed with Kathleen McGinty, Chair of the President's Council on Environmental Quality, at the Committee meeting on Tuesday.

I heard the Committee's commitment of collaboration. Oil and gas will remain a dominant part of this Nation's energy portfolio in the 21st Century. I remain committed to follow through on all of the actions forwarded to you with my letters of October 25, 1995. I commit to collaboration with the industry. I will refocus our work with the National Petroleum Council to achieve a secure energy future for the Nation.

Thank you for your strong leadership of the Council. Its most recent work will galvanize the industry's positive and effective role in shaping public opinion and a sound national energy policy.

Sincerely,

Hazel R. O'Leary

Hazel R. O'Leary