

2009 Annual Plan
**Ultra-Deepwater and Unconventional Natural Gas and Other
Petroleum Resources Research and Development Program**

DOE/NETL-2009/1343



**Provided in Response to Energy Policy Act of 2005
Title IX, Subtitle J, Section 999B(e)**

December 2008



DISCLAIMER

The Administration has submitted to Congress a legislative proposal to repeal Subtitle J of Title IX of the Energy Policy Act of 2005 which authorized the Ultra-Deepwater and Unconventional Natural Gas and Other Petroleum Resources Research Program. However, the Department of Energy is currently implementing Title IX, Subtitle J according to the requirements of the law, and will continue to do so unless the law is repealed.

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Other Petroleum Resources Research and Development
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Executive Summary

This document is the *2009 Annual Plan* for the Ultra-Deepwater and Unconventional Natural Gas and Other Petroleum Resources Research and Development Program established pursuant to Title IX, Subtitle J (Subtitle J) of the Energy Policy Act of 2005 (EPAct). Subtitle J is reproduced in Appendix A to the *2009 Annual Plan*.

As required by Subtitle J, the Department of Energy (DOE) contracted with a consortium (Program Consortium) to administer three program elements identified in EPAct: ultra-deepwater architecture and technology, unconventional natural gas and other petroleum resources exploration and production technology, and technology challenges of small producers.

A fourth program element of complementary research identified in EPAct is being performed by the National Energy Technology Laboratory (NETL). NETL is also tasked with management of the consortium contract, and review and oversight of the Program Consortium.

In 2006, NETL awarded a contract to the Research Partnership to Secure Energy for America (RPSEA) to function as the Program Consortium.

The *2007 Annual Plan, the first annual plan*, resulted in a total of 15 solicitations from which 43 projects were selected¹.

In August 2008, the *2008 Annual Plan* was transmitted to Congress and published in the Federal Register. Implementation will include a total of 13 solicitations that are expected to be issued by the Program Consortium in late fall/early winter 2008, with selections anticipated in early 2009.

As further required by Subtitle J, in September 2008, two Federal advisory committees, the Ultra-Deepwater Advisory Committee and the Unconventional Resources Technology Advisory Committee, began their respective reviews of the draft 2009 Annual Plan. In October 2008, the two advisory committees provided their recommendations.

Section 999B(e)(3) of EPAct requires DOE to publish all written comments on the annual plan. Accordingly, the Program Consortium's final 2009 draft Annual Plan is included here as Appendix B² and the comments and recommendations provided by the advisory committees are included here as Appendix C. No other written comments were received.

¹ All projects will fully comply with the National Environmental Policy Act and any applicable regulations and project impacts will be managed appropriately.

² References to "Program" in the 2009 draft Annual Plan (Appendix B) refer to the consortium-administered elements of the overall Title IX, Subtitle J research program.

The *2009 Annual Plan* provides a comprehensive outline of the Program Consortium's research activities planned for 2009. The primary focus of these activities is to fill in any technology gaps not addressed by the projects and solicitations to date. A highlight of this year's plan is the attention that will be given to technology transfer.

Technology transfer is an important focus of the program. Section 999C(d) of EPO Act requires 2.5% of the amount of each award to be designated for technology transfer activities. The Federal advisory committees recommended that more information on technology transfer be included in future annual plans. In response, the *2009 Annual Plan* includes the structure for the overall technology transfer program.

Section 999 H (a) of EPO Act provides that the Ultra-Deepwater and Unconventional Natural Gas and Other Petroleum Research Fund be funded at \$50-million-per-year, with funds generated from Federal lease royalties, rents, and bonuses paid by oil and gas companies. Seventy-five percent of these funds are obligated to the Program Consortium's contract to execute three program elements. After allocations for program management by NETL and program administration by the Program Consortium, the amount to be invested in research activities by the Program Consortium totals \$31.88 million per year.

Under the Stage/Gate approach applied to prior year activities, all Program Consortium administered projects will be fully funded to the completion of the appropriate decision point identified in each contract, which may include multiple stages. If a decision is made to move to the next stage or decision point or to gather additional data, additional funding will be provided from available funds.

The NETL Strategic Center for Natural Gas and Oil is responsible for management of the consortium contract, and review and oversight of the Program Consortium. Complementary R&D is being carried out by NETL's Office of Research and Development. Planning and analysis related to the program, including benefits assessment and technology impacts analysis, is being carried out by NETL's Office of Systems, Analysis, and Planning.

Section 999F of EPO Act contains a general sunset provision for Title IX, Subtitle J, of September 30, 2014.

1. Background

1.1 Title IX, Subtitle J, of the Energy Policy Act of 2005: Sections 999A through 999H

Title IX, Subtitle J of EPAct, Sections 999A through 999H, support oil and gas research and development (R&D). The complete text of Title IX, Subtitle J, is included in Appendix A.

A portion of the funding is directed towards cost-shared research partnerships, while another portion is used by NETL to carry out complementary R&D.

Section 999A(a) provides: “[T]he Secretary shall carry out a program under this subtitle of research, development, demonstration, and commercial application of technologies for ultra-deepwater and unconventional natural gas and other petroleum resource exploration and production. Section 999B(a) requires the Secretary to carry out the activities that will maximize the value of natural gas and other petroleum resources of the United States, by increasing the supply of such resources while improving safety and minimizing environmental impacts.” The legislation identifies NETL as the DOE entity responsible for review and oversight of the resulting Ultra-Deepwater and Unconventional Natural Gas and Other Petroleum Resources Program. The legislation further states in Section 999B(c) that “[T]he Secretary shall contract with a corporation that is structured as a consortium to administer the programmatic activities”

Section 999H(a) sets the funding for this program at a level of \$50-million-per-year provided from Federal lease royalties, rents, and bonuses paid by oil and gas companies. The funds are to be directed towards research specifically targeting four areas: ultra-deepwater resources, unconventional natural gas and other petroleum resources, technology challenges of small producers, and research complementary to these areas. The complementary research is being performed by NETL, while all other research is administered by the consortium subject to NETL’s review and oversight. See Table 1.1.1 for a breakdown of the funding, as required by Title IX, Subtitle J, Section 999H.

The Administration’s priority is to enable potentially high-payoff activities that require a Federal presence to attain long-term national goals, especially national security and energy independence.

1.2 Overall Implementation Scheme

NETL is responsible for managing the Ultra-Deepwater and Unconventional Natural Gas and Other Petroleum Resources Program. Within NETL, the responsibility for overall program management, including oversight of the Program Consortium contract, has been assigned to the Strategic Center for Natural Gas and Oil.

Complementary research is being carried out by NETL’s Office of Research and Development. Planning and analysis related to the program, including benefits assessment and technology impacts analysis, are carried out by NETL’s Office of Systems, Analysis and Planning.

A. Consortium Selection

NETL contracted RPSEA, a 501(c)(3) not-for-profit corporation consisting of over 130 member organizations, to administer the distribution of about \$32 million per year in R&D contracts (Table 1.1.1). The Federal Government will maintain management oversight of the program, and RPSEA's administration costs are limited to no more than 10 percent of the funds.

Area	Allocation	Area Funds	NETL Mgmt. 5%	RPSEA Admin.	R&D Funds for Distribution
Ultra-deepwater	35%	17,500,000	875,000	1,750,000	14,875,000
Unconventional and Other	32.5%	16,250,000	812,500	1,625,000	13,812,500
Small Producers	7.5%	3,750,000	187,500	375,000	3,187,500
Program Consortium Total		37,500,000	1,875,000	3,750,000	31,875,000
Complementary	25%	12,500,000	0	0	12,500,000
Sec 999 Total	100%	50,000,000	1,875,000	3,750,000	44,375,000

*Does not match Table 1.1 in RPSEA Draft Annual Plan due to Contract Modification.

Table 1.1.1: Distribution of Funds as Directed by Section 999H (US\$)

RPSEA has a broad membership base that includes representatives from all levels and sectors of both the oil and gas exploration and production (E&P) and oil and gas R&D communities. RPSEA members represent major elements of the natural gas and oil supply technology value chain. For a complete list of consortium members see Appendix B. Roughly 19 percent of the RPSEA membership is made up of small and independent oil and gas producers, 6 percent are large producing companies, 20 percent are universities, 31 percent are technology development companies of all sizes, 11 percent are national labs or research institutes and the remaining 13 percent are other organizations involved in the oil and gas industry. This breadth of membership helps to ensure that consortium-administered R&D funds are directed towards key problems in ways that leverage existing industry efforts.

A variety of advisory committees and meetings drawn from this membership are incorporated into RPSEA's planning process, as well as in the recommendations of R&D projects to be awarded and the review of project results.

The companies, universities, and other organizations that receive funds through this program will provide cost-share contributions of at least 20 percent of total project costs. The involvement of industry partners in all phases of the oil and gas R&D process increases the likelihood that technologies developed by the program will move into the marketplace.

B. Planning Process

In late 2006 NETL contracted with RPSEA to begin its work with an effective date of January 4, 2007. Each year, RPSEA, as the Program Consortium, must present its recommendations in the form of a draft annual plan (DAP). The Secretary of Energy must then prepare the annual plan for the consortium-administered research program and transmit it to Congress before the solicitation of R&D project proposals can begin.

Prior to submitting the DAP to the Secretary, the legislation calls for DOE to gather input on the DAP from two Federal advisory committees. The legislation allows for input from other industry experts as well. The two Federal advisory committees are the Ultra-Deepwater Advisory Committee (UDAC) and the Unconventional Resources Technology Advisory Committee (URTAC). DOE's Office of Fossil Energy is responsible for organizing and managing both of these committees. This approach is designed to bring together a broad range of ideas. The comments received from these advisory committees related to the *2009 Annual Plan* are included in Appendix D.

Upon his approval of the annual plan, the Secretary of Energy must transmit the Annual Plan to Congress, along with the recommendations from the Program Consortium, the advisory committees, and any other experts from whom comments have been received.

Subsequent years' annual plans must include details of ongoing activities, a list of solicitations for awards to carry out research, development, demonstration, or commercial application activities, including topics for such work, which would be eligible to apply, selection criteria, duration of awards, and a description of the activities expected of the program consortium to fulfill their oversight responsibility.

C. RPSEA Structure and Consortium Plan Development

Key features of RPSEA's organization are illustrated in Figure 1.1.1. The make up of the Board of Directors (BOD) and the external advisory committees and groups are provided in Appendix B, and their respective roles are described below:

Board of Directors (BOD) - In addition to operational oversight, the BOD provides significant input and direction to the preparation of the RPSEA DAP.

Strategic Advisory Committee (SAC) - RPSEA established the Strategic Advisory Committee (SAC) to provide strategic direction, advice on the shape of the research portfolio, long range planning recommendations, and metrics determination to the BOD and to the President. The SAC is comprised of a group of industry leaders in the energy field, including both RPSEA members and non RPSEA members. The SAC provided guidance regarding the process used to develop the RPSEA DAP, the proposed R&D portfolio, and the metrics to be used to track progress toward program goals.

Environmental Advisory Group (EAG) - The Environmental Advisory Group (EAG) is designed to provide all program elements with advice regarding environmental issues. The EAG organizes and brings together key individuals from academia, regulatory entities, non-

governmental organizations and industry for road mapping exercises to identify key regulatory barriers/issues.

Program Advisory (PACs) and Technical Advisory (TACs) Committees - The roles of the PACs and the TACs are described in Section 2 of this document, as they are specific to their program element. Generally, the PACs provide recommendations on elements of the proposed plan, review proposals and recommend project selections. The TACs provide subject specific technical advice on the development of the proposed plan and on proposal reviews at the direction of the PACs.

Small Producers Research Advisory Group (RAG) - The Small Producer program element will receive guidance from a Small Producer Research Advisory Group (RAG) consisting of representatives from industry and academia that are closely tied to the national small producer community. The RAG will follow each project’s progress, plans and results and especially technology transfer. All projects will be reviewed by the RAG semi-annually.

While the RAG will be responsible for directing the Small Producer program, the Unconventional Onshore PAC will remain responsible for oversight of the entire onshore program, which includes the small producer program element.

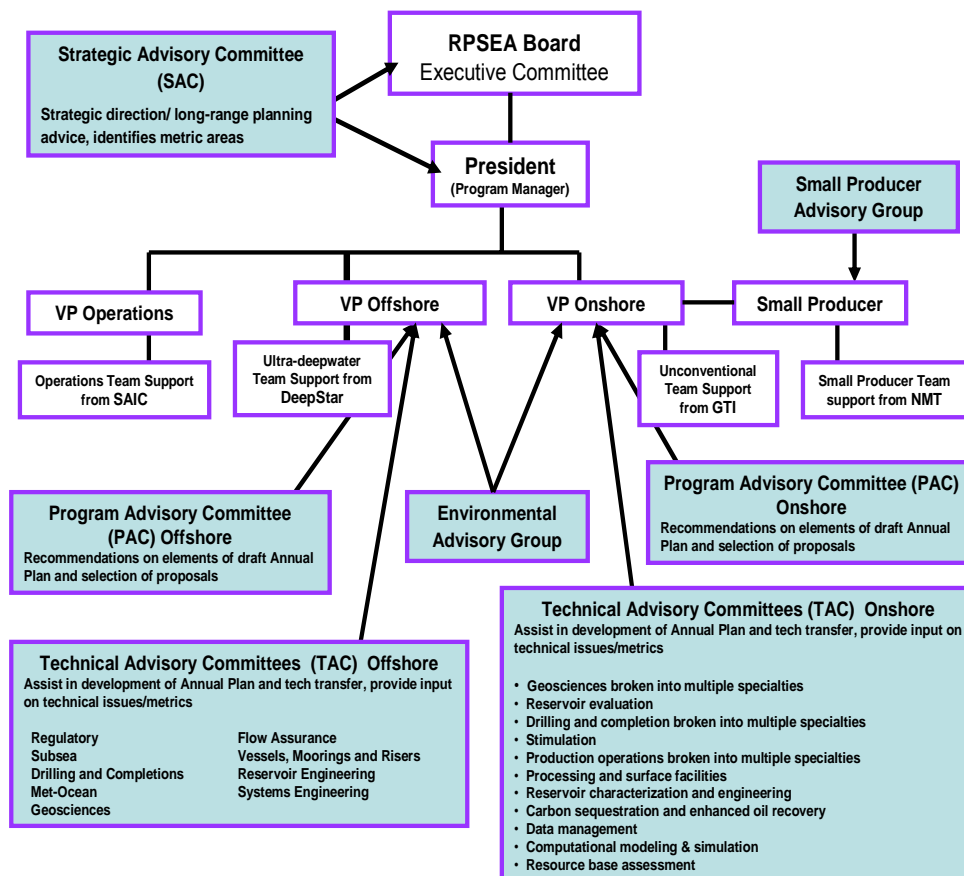


Figure 1.1.1: Organization of RPSEA and Advisory Committee Relationships

RPSEA has been operating as a consortium since 2002. Additionally, RPSEA has contracted with four organizations, the Chevron administered DeepStar Consortium (DeepStar), Gas Technology Institute (GTI), SAIC, and New Mexico Institute of Mining Technology (New Mexico Tech or NMT), as part of its management team.

RPSEA has received broad and diverse input from its member organizations, as well as from additional experts. Input was solicited and/or developed from:

- Nineteen RPSEA member forums held in various regions of the country; universities have served as hosts of the majority of the RPSEA member forums. While RPSEA members hosted the forums, participation was not limited to RPSEA members. Member forums included 940 individual participants representing multiple organizations with interests in technologies to enhance domestic natural gas and oil production. Most of these forums have been oriented to the Unconventional Resources Program and the Small Producer Program. While a few of the forums have been oriented to UDW, the primary inputs for UDW are the TAC meetings. Additional forums and meetings are being planned in order to secure input to future plans and R&D solicitations.
- Multiple individual meetings and contacts with individual RPSEA members
- RPSEA’s offshore and onshore PACs and the Small Producer RAG for general guidance and project selection, the various TACs, and the SAC for high level direction
- Multiple road-mapping exercises conducted by DOE, RPSEA, and others prior to 2007

The process of integrating these inputs is illustrated in the schematic shown in Figure 1.1.2.

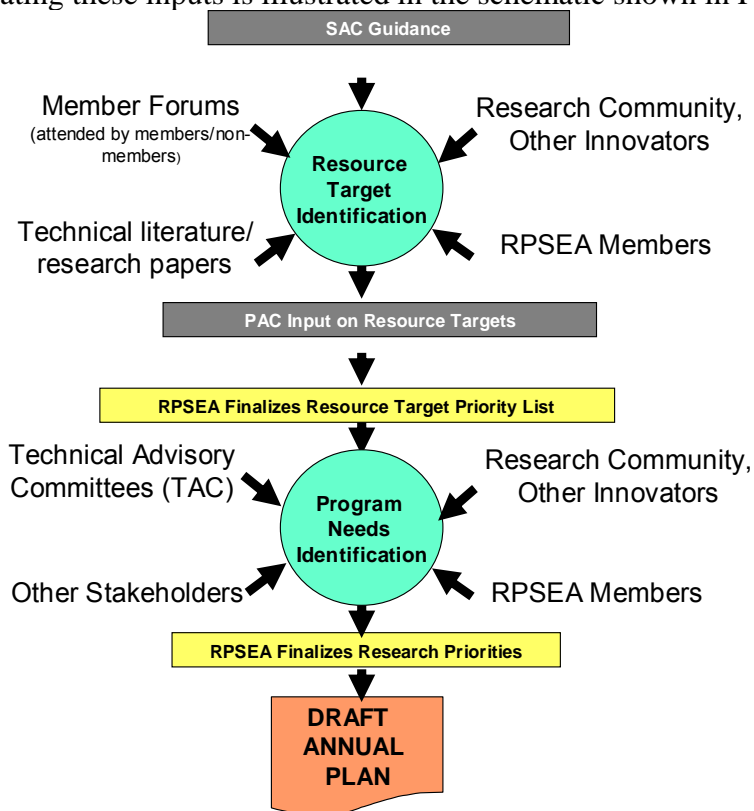


Figure 1.1.2: Process Leading to RPSEA Draft Annual Plan

2. Consortium-Administered R&D Plan

Subtitle J of EPO Act specifies that the Program Consortium selected by DOE is to administer a program of research, development, demonstration, and commercialization in three of the nation's most promising—but technically challenged—natural gas and petroleum resource areas:

- *ultra-deepwater* (UDW) areas of the Outer Continental Shelf,
- *unconventional natural gas and other petroleum resources*, with unconventional being defined as “economically inaccessible,” and the
- *unique technology challenges of small independent producers*.

Further, cross-cutting all elements of the program is a focus on the environment, including projects that minimize or mitigate environmental impact or risk, mitigate water usage, reduce the “footprint” of E&P operations, and lower emissions.

Another crosscutting objective of each element of the program is technology transfer. While only 2.5% of the amount of each contract is specifically set aside for funding technology transfer, the entire program will be planned and executed with the knowledge that the desired impact will not be achieved without significant transfer of technology beyond the direct participants in funded projects.

Projects will be scoped and funded to ensure that the necessary materials are developed to support the required technology transfer activities and that the necessary participants have the support to fully participate in technology transfer events. In order to obtain the greatest leverage for technology transfer funds, the Program Consortium will make maximum use of existing technology transfer networks and organizations. Section 2.6 describes the plan for development of a technology transfer program in more detail.

Each of these three Program Elements is individually outlined in the plan that follows.

2.1 Ultra-Deepwater Program Element

A. Mission & Goals

The mission of the UDW element of the consortium-administered R&D program is to identify and develop economically viable (full life cycle), acceptable risk technologies, architectures, and methods to explore for, drill for, and produce hydrocarbons from UDW and formations in the Outer Continental Shelf (OCS) deeper than 15,000 feet.

This mission of technology development encompasses (not in order of priority):

- *Extending basic scientific understanding,*
- *Developing “enabling” technologies,*
- *Enhancing existing technologies to help lower overall cost and risks, and*
- *Pursuing “Grand Challenges” (transformational technologies which, if successfully developed, are capable of “leapfrogging” over conventional pathways).*

- *Accomplishing development of the ultra-deepwater resource in an environmentally responsible manner*

The emphasis of the program will be on “Grand Challenges”, on long-term, high-risk research, on applied science, and on key leveraging and cross-cutting technologies, rather than on short-term, incremental advancements, product development activities, and field specific needs.

Relevant EPO definitions for the UDW program element include:

- *Deepwater* -- a water depth that is greater than 200 meters (~660 feet) but less than 1,500 meters (~5,000 feet).
- *Ultra-deepwater* -- a water depth that is equal to or greater than 1,500 meters (~5,000 feet).
- *Ultra-deepwater architecture* -- the integration of technologies for the exploration for, or production of, natural gas or other petroleum resources located at UDW depths.
- *Ultra-deepwater technology* -- a discrete technology that is specially suited to address one or more challenges associated with the exploration for, or production of, natural gas or other petroleum resources located at UDW depths.

The goals of the UDW program element are to increase the size of the UDW resource base and to convert discovered resources into economically recoverable resources while protecting the environment. These goals will be achieved by:

1. Reducing the costs to find, develop, and produce such resources,
2. Increasing the efficiency of exploration for such resources,
3. Increasing production efficiency and ultimate recovery of such resources,
4. Improving safety, and
5. Improving environmental performance, by minimizing any environmental impacts associated with UDW exploration and production.

B. Objectives

To meet the goals of converting the UDW resource base to economically recoverable resources, the program intends to build new planning and analytical models; design and manufacture new equipment; develop new exploration and production technologies as well as integrated systems technologies; and demonstrate that the equipment and technologies are dependable and reliable. This will be achieved by meeting the following near term and mid term objectives.

Near-Term

Objective #1: *Technology Needs Assessment* – The process to identify the specific technology gaps will continue to be revisited periodically through stakeholder input and focused workshops.

Objective #2: *Cost-Share Development* – Network with academia, industry, capital markets, and other key stakeholders to identify and capture cost-share funding for development of new technologies.

Objective #3: *Ultra-Deepwater Technology Development* – Design and administer multiple rounds of solicitations for R&D contracts designed to meet the stated goal of the UDW program

element. Administer a selection process that results in a portfolio of R&D contracts that will best achieve that goal.

Mid-Term

Objective #4: *Ultra-Deepwater Technology Development and Deployment* – Through assessment of R&D results and additional solicitations (as needed), continue the development and maturation of the most promising technologies identified during the first set of solicitations. Maintain a strong focus on longer-term, high-risk research and development. Terminate weaker prospects and focus budget and efforts on those technologies that carry the greatest potential for meeting the UDW program element goal.

Objective #5: *Environmental Technology Development and Deployment* – Work with appropriate regulatory agencies, academia, industry, and other key stakeholders to identify strategies to improve environmental performance during deepwater development, and develop and administer solicitations for contracts to develop technologies that can achieve this improvement.

Objective #6: *Safety Technology Development and Deployment* – Work with appropriate regulatory agencies, academia, industry, and other key stakeholders to identify strategies to improve safety performance during deepwater development, and develop and administer solicitations for contracts to develop technologies that can achieve this improvement.

Objective #7: *Technology Demonstration* – Work with industry, appropriate regulatory agencies, and other key stakeholders to provide seed-level funding and other incentives for demonstration and validation of newly developed technologies.

Objective #8: *Technology Commercialization and Industry Deployment* – The UDW will work with industry, appropriate regulatory agencies, and other key stakeholders to provide seed-level funding and other incentives to assist commercialization and industry deployment of emerging technologies.

C. Implementation Plan

The UDW program element will be implemented in a different manner than the other two parts of the consortium-administered program (Unconventional Resources and Small Producer elements) which focus on broader research topics. Section 999B(d)(7)(A) of EPAct states the UDW program element “*shall focus on the development and demonstration of individual exploration and production technologies as well as integrated systems technologies including new architectures for production in ultra-deepwater.*” The Program Consortium has subcontracted management of the UDW program element to a third party, which already has a process developed and operating. The following section outlines the major steps in the implementation plan.

DeepStar and Advisory Committee Roles in UDW Program Element

The UDW Program Element is being managed by the Chevron administered DeepStar Consortium through a subcontract with the Program Consortium. DeepStar is the world’s largest UDW stakeholders group and has an 18 year history of managing collaborative research. Through this arrangement, the UDW program will have access to 700+ technical and

management committee volunteers as well as a successful process for technology research, development, and commercialization. In addition to providing high level input from operating companies that are ultimately responsible for the production of deepwater energy resources, this highly developed process formally facilitates the direct input of universities, regulatory bodies, and other key stake holder groups. This process of broad engagement through expansive and inclusive advisory committees will provide the UDW Program with significant *pro bono* expertise as well as potentially significant matching funds to further accelerate the development of UDW technologies.

DeepStar will be assisted in carrying out its subcontract by the UDW PAC and nine TACs (see Appendix B for committee membership). The UDW PAC members represent asset owners that are currently operating in the UDW Gulf of Mexico. The UDW PAC provides high level input on program priorities, field areas of interest, and technology dissemination, as well as a link to the producer and research communities, but its primary role is project selection. PAC engagement in the process is important as these operators will be the organizations called upon to actually deploy and operate the new technologies developed under the program.

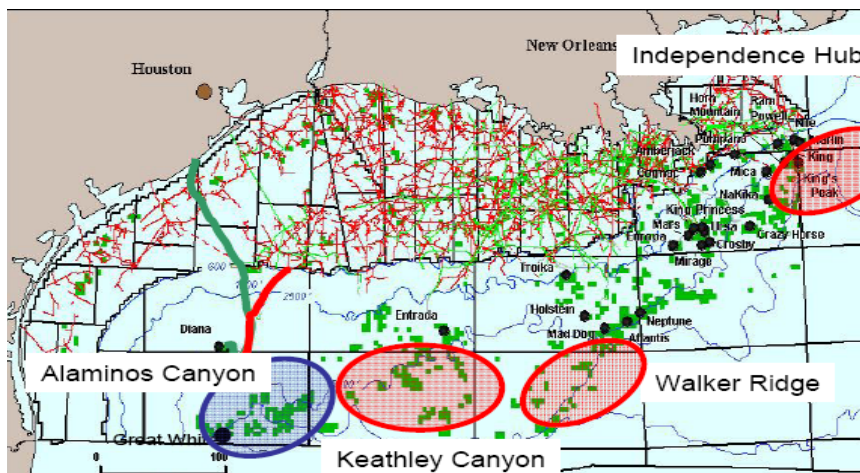
Supporting the PAC are nine TACs, each of which is focused on a particular UDW technology area (see Table 2.1.1). The role of the TACs, with representation from Subject Matter Experts who study and apply UDW technologies in real field situations, is to identify current technology gaps and define the specific R&D efforts to address these gaps. As such, the TACs provide a bottom-up end-user-driven program.

Drilling & Completion	Environmental, Safety & Regulatory	Floating Facilities
Flow Assurance	Geo-Science	Met-Ocean
Reservoir	Subsea Facilities	System Engineering & Architecture

Table 2.1.1: UDW Technical Advisory Committees

Identification of Focus Areas for New Technology Development

In developing the list of focus areas for solicitations, DeepStar performed a systems engineering study based on industry UDW experience and needs. Four base case field development scenarios were identified as representative of future Gulf of Mexico UDW developments with technical challenges. These scenarios are drawn from four key areas of activity in the deepwater Gulf of Mexico (Walker Ridge, Keathley Canyon, Alaminos Canyon, and the Eastern Gulf), and the associated technology challenges (Figure 2.1.1). Four generic fields were created (Canopy, Gumout, Coyote, and Diablo) based upon the areas of current activity. Each of the generic fields is characterized by a unique design feature that challenges technical and economic development (Table 2.1.2). The field development scenarios will be further matured into design bases and will be used as input for the UDW Program Element activities. The systems engineering study will be revisited periodically over the duration of the UDW Program to ensure relevance with ongoing industry exploration and development activities.



- Walker Ridge / Keathley Canyon**
 - sub-salt
 - deeper wells
 - tight formations
- Alaminos Canyon**
 - viscous crude
 - lacking infrastructure
- Eastern Gulf – Gas Independence Hub**
 - higher pressure & temp.
 - CO₂ / H₂S
- Overall**
 - higher drilling costs
 - challenging economics

Figure 2.1.1: Technical challenges for identified basins

Field Type	Technology Challenge	Development Options
Canopy Field	Low Permeability Reservoir	Semi with Wet Trees
		FPSO with Wet Trees
		FPSO EPS
		Produce to Beach
Gumout Field	High Viscosity Oil	Dry Tree Structure
		Satellite Tieback to Host
Coyote Field	Small Reserve Fields	Satellite Tieback to Host
Diablo Field	XHPHT (22.5 ksi x 350+°F)	Semi w/ Gas Sweetening
		Produce to Beach thru Sour Gas Pipeline

Table 2.1.2: UDW Base Case Scenarios

Prioritization of Technology Development Needs

For 2007 and 2008, the nine TACs reviewed the four base case scenarios described above and, for their respective disciplines, identified the highest priority technology “themes” required to bridge the technology challenges to development. Because each of the four base case scenarios represents a complete field development, a number of the themes identified are either multi-disciplinary or cut across several TAC discipline areas. These four base case scenarios still form the basis for 2009 priorities.

In 2009, the process differed from the process used in 2007 and 2008, in that the UDW PAC reviewed the 2007 and 2008 portfolios to develop the appropriate balance for the UDW program.

The PAC input for 2009 was submitted to the TACs to develop project ideas to meet the initiatives set forth by the PAC. The project ideas will be developed into solicitations for 2009. Upon technical review of the 2009 proposals, the PAC will make the decision as to which projects to fund. Figure 2.1.3 describes the 2009 project selection process.

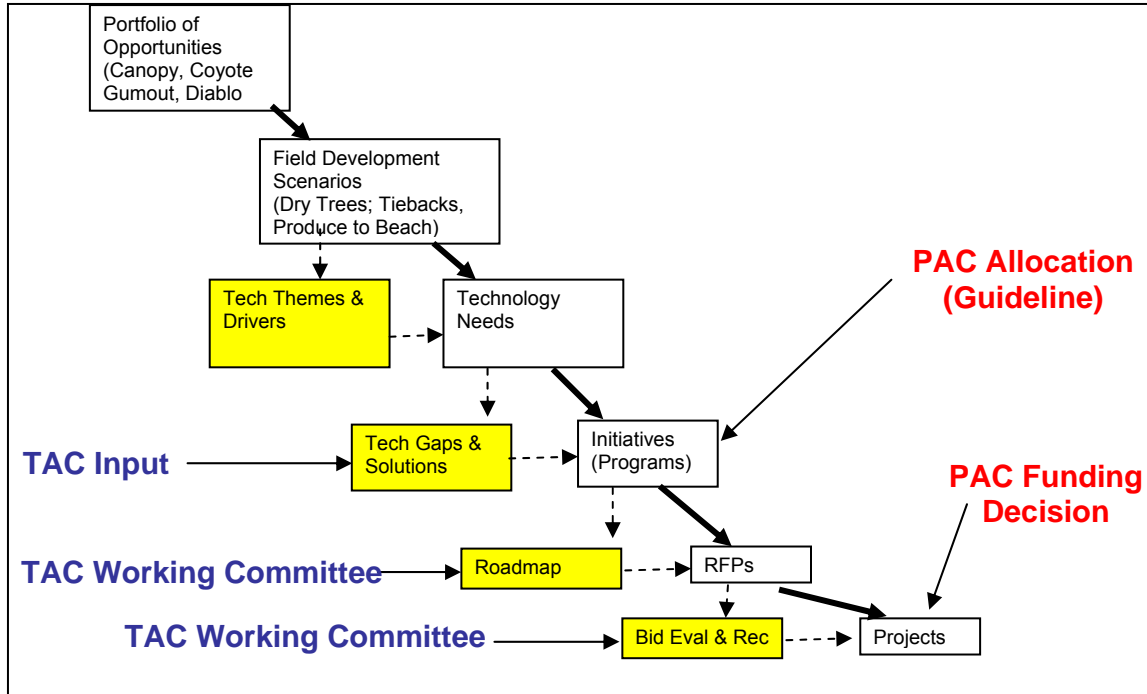


Figure 2.1.3: 2009 UDW Project Selection Process

Field Type / Focus Areas	Technology Challenge	Themes
Canopy Field	Low permeability reservoir	<ol style="list-style-type: none"> 1. Completion of long reservoir sections. 2. Deep reservoir stimulation technology. 3. Formation Integrity at Commercial Production Conditions (fluid rates, differential pressures).
Gumout Field	High Viscosity Oil	<ol style="list-style-type: none"> 4. Intervention strategies and well architecture for downhole equipment maintenance (e.g., pumps). 5. Viscous Oil Production Technology.
Coyote Field	Small Reserve Fields	<ol style="list-style-type: none"> 6. Drilling with small margin between overburden and fracture pressure (dual density drilling is a potential solution for this issue).
Diablo Field	XHPHT (22.5 ksi & 350+°F) Sour service	<ol style="list-style-type: none"> 7. Materials Sciences for UDW Risers and Moorings, tubulars, tools, instrumentation, and completion equipment. 8. HPHT Flow Assurance Technologies. 9. HPHT Formation Evaluation.
Crosscutting	Environmental	<ol style="list-style-type: none"> 10. Safety Barrier Testing and Validation Criteria. 11. Environmental and Regulatory Impact of Emerging Technologies. 12. Deepwater Produced Water Management.
	Floating Facilities	<ol style="list-style-type: none"> 13. Optimized UDW Field Development Concepts for Improved Economics. 14. Improved Design and Analysis Methods. 15. Mooring and Riser Integrity Management.
	Flow Assurance	<ol style="list-style-type: none"> 16. Organic, Inorganic and Solids Management.
	Geo-Science	<ol style="list-style-type: none"> 17. Subsalt Imaging & Geo-mechanics. 18. Reservoir & Fluid Characterization. 19. Economics.
	Met-ocean	<ol style="list-style-type: none"> 20. Effect of changing weather patterns on hurricane severity. 21. Operational 3-D current forecast model capable of simulating the Loop/eddies. 22. Modeling for strong near-bottom currents along the Sigsbee Escarpment.
	Reservoir	<ol style="list-style-type: none"> 23. Appraisal. 24. Field development. 25. Production and Reservoir Surveillance.
	Subsea Facilities	<ol style="list-style-type: none"> 26. Subsea Production Equipment Enhancements. 27. Mature Subsea Processing Technology. 28. Pipeline, Flowline and Umbilical Technology. 29. Subsea Well Intervention Tech. improvement.
	Systems Engineering and Architecture	<ol style="list-style-type: none"> 30. Design Criteria for the Base Cases. 31. System impact of proposed technologies on the field development scenarios. 32. Grand Challenge projects. 33. Small Business Initiatives.

Table 2.1.4: UDW Program Element Technology Themes

Restructuring in Response to Stakeholder Feedback

For 2009, the structure of the program has changed from 2007 as a result of ongoing input from the PAC, TACs, and other stakeholders, including the UDAC.

The 32 themes listed on Table 2.1.4 have been organized under six high level categories. This restructuring both preserves the granularity of the specific technology themes identified while enabling stakeholders to clearly see the focused objective of the technologies being developed.

Table 2.1.5 illustrates the transition of the Ultra-Deepwater Program element from its initial construct in 2007 to the current structure for 2009. The UDW program structure will continuously evolve over the duration of the program to maintain technological relevance.

The solicitations for 2008 listed in Table 2.1.7 have been sorted according to this updated program structure to show how each correlates to the six major development and operation challenges currently pursued by the worldwide UDW community.

2007 UDW Element Structure	2008 UDW Element Structure	2009 UDW Element Structure
8 cross-cutting challenges	4 major and 1 minor challenges	6 high level categories
1. Environmental 2. Floating Facilities 3. Flow Assurance 4. Geo-Science 5. Met-Ocean 6. Reservoir 7. Subsea Facilities 8. Systems Engineering and Architecture	1. Extended Subsea Tieback Distances/Surface Host Elimination 2. Enable Dry Trees and Risers in 10,000 Feet Water Depths 3. Cost Effective Subsea Intervention 4. Continuous Improvement 5. Technology Facilitation	1. Drilling, Completion and Intervention Breakthroughs 2. Appraisal and Development Geoscience and Reservoir Engineering 3. Significantly Extend Subsea Tieback Distances/Surface Host Elimination 4. Dry Trees/Direct Well Intervention and Risers in 10,000 Feet Water Depth 5. Continuous Improvement/Optimize Field Development 6. Associated Safety and Environmental Concerns

Table 2.1.5: UDW Program Structure Transition from 2007 Through 2009

2009 Solicitations

Upon transmittal of the *2009 Annual Plan* to Congress, the 2009 requests for proposals (RFPs) will be developed and released. The primary focus of these RFPs is to fill-in technology gaps not addressed by the prior years' projects and solicitations. One modification in the 2009 UDW Program Element solicitation strategy, as compared to the 2007 & 2008 UDW solicitations, is that in addition to solicitations for proposals to address the specific theme areas, broader, initiative-based RFPs will also be invited.

Anticipated Awards for 2009

Each year, almost \$15 million is available for project awards. Cost sharing beyond the minimum is encouraged in all solicitations. In 2009, the UDW Program Element will target the award of five to 10 projects with a value of \$1 to \$5 million per project, each with duration of one to three years. The projects will be aligned with the six high level categories identified (Table 2.1.5), and integration across multiple disciplines will be encouraged.

Under the Stage/Gate approach described in Section 2.5, all projects will be fully funded to the completion of the appropriate decision point identified in each contract, which may include multiple stages. If a decision is made to move to the next stage or decision point or to gather additional data, additional funding will be provided from available funds.

D. Ongoing Activities

As implementation of the program continues, activities include administration of current contracts, solicitation of new proposals, and planning for the following year. In addition to releasing RFPs and awarding subcontracts, the Program Consortium will be performing project management functions for the current contracts and for future awards during the year.

2007 Activities

Under the *2007 Annual Plan*, the Program Consortium issued a total of 13 solicitations for the UDW Program Element from which 17 projects were selected. A listing of all projects can be found in Table 2.1.6. Abstracts and project status information for each of the projects can be found on the DOE website at www.netl.doe.gov/technologies/oil-gas/EPAAct2005 and on the Program Consortium website at www.rpsea.org.

PROJECT / DURATION	LEAD PERFORMER	ADDITIONAL PARTICIPANTS
DW1201: Wax Control / 24 months	University of Utah	SINTEF Petroleum Research, BP, StatoilHydro, University of Tulsa
DW1301: Improvements to Deepwater Subsea Measurements / 24 months	Letton-Hall Group	Chevron, Shell, Total, ConocoPhillips, BHP, StatoilHydro, Petrobras, Oceaneering, Multiphase Systems Integration Welker Engineering, Lake Charles Instruments/Neftemer Axept, Intertek, BP, Southwest Research Institute, ENI, Anadarko, Devon, Schlumberger, Weatherford
DW1302: Ultra-High Conductivity Umbilicals / 12 months	NanoRidge Materials	Rice University, Duco, Technip
DW1401: Carbon Fiber Wrapped High Pressure Drilling and Production Riser Qualification Program / 24 months	Lincoln Composites	Stress Engineering
DW1402A: Ultra-Deepwater Dry Tree System for Drilling and Production / Stage1 3 months	Houston Offshore Engineering	Keppel Fels, Kiewit Offshore Services
DW1402B: Ultra-Deepwater Dry Tree System for Drilling and Production / Stage1 3 months	Floatech	Seadrill Americas, Inc., GE/VetcoGray, 2H Offshore
DW1403: Fatigue Performance of High Strength Riser Materials / 18 months	Southwest Research Institute	
DW1501: Extreme Reach Development / 9 months	Tejas	Total, Chevron
DW1603-A: Graduate Student Design Project. Design of Extreme High Pressure and High Temperature Subsurface Safety Valve / 24 months	Rice University	
DW1603-B: Graduate Student Design Project. Robotic MFL Sensor for Monitoring and Inspection of Deepwater Risers / 24 months	Rice University	itRobotics
DW1603-C: Graduate Student Design Project. Hydrate Plug Characterization and Dissociation Strategies / 24 months	Tulsa University	BP
DW1603-D: Graduate Student Design Project. Flow Phenomena in Jumpers / 24 months	Tulsa University	Chevron
DW1701: Improved Recovery / 18 months	Knowledge Reservoir	Anadarko
DW1801: Effect of Global Warming on Hurricane Activity / 12 months	National Center for Atmospheric	Georgia Institute of Technology

	Research (NCAR)	
DW1901: Subsea Processing System Integration Engineering / 12 months	GE Global Research	GE/VetcoGray
DW1902: Deep Sea Hybrid Power System / 12 months	Houston Advanced Research Center	Lawrence Livermore National Laboratory, Naval Facilities Engineering Service Center, Yardney Lithion, GE, Shell, Chevron
DW2001: Synthetic Benchmark Models of Complex Salt / 24 months	SEAM	3DGeo Development, Anadarko, BHP Billiton, CGGV Veritas, Chevron, Conoco Phillips, Devon, EMGS ASA, EnI, Exxon Mobil, Geotrace Technologies, Hess Corporation, ION, Landmark Graphics, Maersk Oil, Marathon Oil, Petrobras, PGS Americas, Repsol Services, Rock Solid Images, StatoilHydro, Total, WesternGeco

Table 2.1.6: UDW 2007 Projects

2008 Activities

The Program Consortium is currently developing the 2008 Requests for Proposals (RFPs). As discussed above, Table 2.1.7 lists the pending 2008 solicitations reflecting the updated program structure to show how each correlates to the six major development and operation challenges.

Pursuant to the *2008 Annual Plan*, a total of 11 new solicitations will be released during December 2008 and January 2009 with selections expected early 2009. The subject areas for the 2008 solicitations are presented in Table 2.1.7 below.

RFP Number	Project Idea Description	Applicable Themes (see Table 2.1.3)
Category 1: Drilling, Completion, and Intervention Breakthroughs		
DW1502	Coil Tubing Drilling and Intervention System Using Cost Effective Vessels	2, 4, 5, 11, 23, 24, 25, 29, 31
DW2301	Deepwater Riserless Light Well Intervention	2, 4, 11, 23, 24, 25, 29, 31
DW2501	Early Reservoir Appraisal, Utilizing a Low Cost Well Testing System - Phase I	9, 11, 13, 18, 23, 24, 25, 31
DW2502	Modeling and Simulation of Managed Pressure Drilling for Improved Design, Risk Assessment, Training, and Operations	6, 11, 31

Category 2: Appraisal and Development Geoscience and Reservoir Engineering		
DW2701	Resources to Reserves Development and Acceleration through Appraisal	9, 18, 23, 24, 25, 31
Category 3: Significantly Extend Subsea Tieback Distances/Surface Host Elimination		
DW1202	EOS improvement for xHPHT	8, 9, 18, 23, 25
DW2201	Viscous Oil PVT	2, 5, 16, 18
DW2901	Reliable deepwater power distribution & components (Component Qualification - performed in steps.)	26, 27, 28, 31
Category 5: Continuous Improvement/Optimize Field Development		
DW2101	New Safety Barrier Testing Methods	10, 11
DW2902*	Student Design Projects and Novel Technology Solicitation	7, 30, 31, 33
Category 6: Associated Safety and Environmental Concerns		
DW2801	Gulf 3-D Operational Current Model Pilot	21, 22

* Project renumbered from DW2902

Table 2.1.7: UDW Program Element Solicitation Topics (2008 Funding)

E. Metrics

Overall metrics for the Program Consortium in general are discussed in Section 2.7. Shorter-term metrics specific to the UDW program include the completion of annual milestones that show progress towards meeting the program element objectives. As a minimum, short term metrics to be completed before the end of FY 2009 include:

- Issue 11 solicitations for 2008
- Review 2007 and 2008 projects to determine portfolio technology gaps, and prepare and issue 2009 RFPs
- Select and award 5 to 10 projects for 2009.
- Establish FY 2010 R&D priorities based on results of 2007-09 contracts, project selections, solicitations, and inputs from the TACs, PAC, and UDAC.
- Prepare the 2010 Draft Annual Plan

F. Milestones

The first solicitations for 2009 will be released after submittal of the *2009 Annual Plan* to Congress, and will remain open for a minimum of 60 days. The review and selection process will take about 2 months, and the award process will take approximately three months. The solicitations will be released in groups of 3-4 solicitations, with all solicitations released within 6 months of annual plan transmittal.

An important activity for the Program Consortium will be the active management of all R&D projects to date, as well as planning the R&D program for 2010. All milestones for the 2009 Ultra-Deepwater Program element are listed in Table 2.1.8 below.

2009 Consortium Process Timeline															
Month		-2	-1	1	2	3	4	5	6	7	8	9	10	11	12
2009 Draft Plan Submitted (July 31, 2008)	◆														
Plan Published		◆													
Plan Approved					◆										
Obtain DOE Approval of Solicitation						◆									
Solicitation Open Period															
Proposal Evaluation and Selection															
DOE Approval															
Contract Negotiation and Award															
Manage 2009 Awards															
Manage 2007 & 2008 Awards															
Report Program Deliverables															
Conduct Technology Transfer Workshops & Activities															
Establish 2010 R&D Priorities & Annual Plan															

Table 2.1.8: Ultra-Deepwater Program Element Timeline

2.2 Unconventional Natural Gas and Other Petroleum Resources Program Element

A. Mission & Goal

The mission of the Unconventional Resources Program Element of the consortium-administered R&D program is to identify and develop economically viable technologies to locate, characterize, and produce unconventional natural gas and other petroleum resources, in an environmentally acceptable manner.

An “unconventional natural gas and other petroleum resource” is defined in Section 999G of EPOA as “*natural gas and other petroleum resource[s] located onshore in an economically inaccessible geological formation, including resources of small producers*” (emphasis added).

The overall goal of the Unconventional Resources Program Element is to increase the supply of domestic natural gas and other petroleum resources through the development, demonstration, and commercialization of technologies that reduce the cost and increase the efficiency of exploration for and production of such resources, while improving safety and minimizing environmental impact.

The contribution of natural gas to the Nation's gas supply from three specific unconventional resources—gas shales, coal seams, and tight sands—has grown significantly during the past 20 years. These resources have been highlighted by the Energy Information Administration (EIA) and others as important supply sources during the next 20 years. According to the latest estimate by the National Petroleum Council (NPC 2003), the volume of technically recoverable gas from these three resources in the lower 48 states is in excess of 293 trillion cubic feet (TCF).

Due to their potential and significance, gas shales, tight gas sands, and coalbed methane were determined to be the unconventional resources to be specifically addressed in the initial years of the program. Opportunities to leverage developed technologies through application to other unconventional natural gas and petroleum resources will be sought, and other petroleum resources may be specifically targeted in subsequent years. Oil shale and unconventional oil resources are addressed by the NETL Complementary Research Program and the DOE traditional oil and gas research program.

In order for the program to successfully increase the supply of domestic natural gas and other petroleum resources through new technology, the transfer of that technology to companies operating in the targeted resources will need to be an integral part of program planning and execution. Additionally, any development of new resources must be accomplished in an environmentally acceptable manner, so it will be important that technologies developed under the program be applied in ways that minimize the impact of resource development on natural and cultural resources.

B. Objectives

Objectives for the Unconventional Resources Program Element have been developed with input from the Program Consortium's unconventional onshore PAC. This input has been combined with information gathered during a number of relatively recent efforts to identify and prioritize the technology challenges to development of unconventional resources.

These recent efforts include: (1) a series of eight forums on topics relevant to unconventional resources held in various producing basins by RPSEA members beginning in late 2007 and continuing through May 2008, (2) participation by RPSEA staff in industry meetings, addressing unconventional resources organized by professional societies such as SPE and AAPG, as well as organizations such as Hart's Energy Publishing, Platts, and Pennwell, (3) input provided to the *2007 and 2008 Annual Plan* by the URTAC, and (4) input provided by PAC and TAC members associated with projects selected for the 2007 program.

All of these inputs were combined to arrive at the prioritized list of technology challenges that underlie both the objectives of this Program Element and the list of solicitation topics found in the implementation plan.

The objectives are defined in terms of the resource (shales, coal, tight sands), and the level of field development category (existing, emerging and frontier). All three resources are important but gas shales, the most difficult and least developed, was identified during this process as the top priority. It was the consensus of the advisory groups that gas shales promised the greatest

potential return on investment in terms of reserves additions. The three development categories are:

- Existing - Active development drilling and production.
- Emerging - Formations, depth intervals, or geographic areas with limited commercial development activity and very large undeveloped areas remaining.
- Frontier Area - Formations, depth intervals, or geographic areas from which there has with no prior commercial development.

The relative balance of the program’s focus among these three categories, as well as the priority basins identified within each of the three resource areas, are illustrated within Table 2. 2.1. The basins noted are representative based on expressed industry interest and are not meant to exclude opportunities in other basins within the three resource types.

Level of Field Development	Program Balance	Priority Gas Shales	Priority Coalbed Methane	Priority Tight Sands
Existing	45%	Ft Worth - Barnett	Appalachian	Green River/Uinta
		Appalachian	San Juan	South Texas
			Powder River	Appalachian
Emerging	45%	Permian	Uinta-Piceance	Appalachian
		Arkoma/Ardmore/Anadarko	Powder River	Piceance
		Illinois & Michigan		Uinta
Frontier Area	10%	Permian-Woodford	Illinois & Michigan	Western Oregon
		Green River	N. Mid-continent	Washington

Table 2.2.1: Resource Prioritization Matrix

In the near-term, the primary challenge facing gas producers is the rapid depletion rate of new wells and their relatively high cost. Rapid decline rates require that many new wells be drilled just to maintain production. To address these concerns, R&D activities associated with the near term will have a significant field-based component with supporting analytic work.

Methods and techniques developed in this phase will be tested in the field through industry cooperative field work. This near-term research and development will be built on recent technology successes in advancing these technologies to a higher level and broadly disseminating the results. Near term projects will primarily focus on field testing, technology dissemination, and commercialization.

In the mid-term, program emphasis again will be placed on industry cooperative field work in emerging areas. Working models developed through the near term program will be applied in less developed fields, modified as required, and documented to make the technology readily available to the industry. The focus of the mid-term research will be the development of at least one new emerging resource area to the point where a substantial portion of the technical resource becomes economic reserves.

Further out in the mid-term, the program aims at identification and characterization of two or more resource-rich plays or basins with limited current activity. The objective will be to provide information, knowledge, and methodologies to spur activity in currently undeveloped and low

activity resources, thereby allowing access to gas that is technically not feasible to drill and produce with current technologies.

Specifically, the objectives of the Unconventional Resources Program Element are:

Near term

Objective 1: Develop tools, techniques, and methods that substantially increase, in an environmentally sound manner, commercial production and ultimate recovery from established unconventional gas formations and accelerate development of existing and emerging unconventional gas plays.

Objective 2: Develop tools, techniques, and methods that substantially decrease the environmental impact of unconventional gas development with particular emphasis on water management and operations footprint.

Objective 3: Integrate the results and deliverables of the existing portfolio of projects to encourage industry to demonstrate and apply new technologies to enhance safe and environmentally responsible production of the domestic unconventional gas resource base. Successful technology transfer is an important component of this objective.

Mid-Term

Objective 4: Develop techniques and methods for exploration and production from high priority emerging gas shale, coal, and tight sand fields, as well as frontier basins and formations, where these operations have been hindered by technical, economic, or environmental challenges.

Development of an Integrated Program

An important aspect of this program element is encouragement of teaming efforts to develop integrated production technologies for unconventional gas resources. To the extent possible, integration of geologic concepts with engineering principles to overcome production and environmental issues is encouraged. The intent is to develop a coordinated program, as opposed to individual projects, such that the whole has much greater value than the sum of the parts.

C. Implementation Plan

The Unconventional Resource Program Element is being implemented by developing and administering solicitations for R&D projects in areas that address the objectives outlined above. The following section outlines the major steps in the implementation plan.

Prioritized Technology Challenges

The 2007 solicitation was broad in scope in order to allow consideration of a broad range of research topics addressing key issues. The solicitation for the 2008 program continued to seek a broad range of technical solutions, but placed particular emphasis on addressing key technical or resource gaps within the current portfolio of projects.

The 2009 program solicitations will encourage the development of integrated programs targeting specific resources with a likely focus on technology or resource gaps that may remain in the program after the 2007 and 2008 selections. Areas that were identified as requiring additional emphasis include the development of unconventional gas in the Appalachian region, decreasing

the environmental footprint of unconventional gas development, water management associated with unconventional gas development, and improved methods for complex multi-zone completions.

2009 Solicitations

The topic areas planned to be included in solicitations during the 2009 program year are summarized below. In order to ensure that areas of particular interest and need in the portfolio are addressed, a small number of individual solicitations may be issued that emphasize a particular subset of the technology or resource focus areas described below.

In particular, the resource focus of solicitations will help achieve the desired program balance among gas shales, tight sands, and coalbed methane as the 2007 and 2008 projects are selected.

One to three solicitations are anticipated to be issued during the 2009 program year, depending upon the evolving needs of the program. Some or all of the areas below may be covered by solicitations during the 2009 program year.

The 2009 Unconventional Resources Program will seek to broaden the specific unconventional resources to be targeted, while supplementing active projects by addressing technology needs that have arisen during the execution of those projects. Solicitations issued during 2009 will continue to target gas shales, tight sands, and coalbed methane resources with priorities as shown in Table 2.2.1 and further driven by 2008 program selections when made.

Solicitations will continue to be directed towards the development of tools, techniques, and methods that may be applied to substantially increase in an environmentally sound manner, commercial production, and ultimate recovery from established unconventional gas resources and accelerate the development of gas from emerging and frontier unconventional plays.

For new technologies to have an impact on energy production, they must be applied by energy producers. The program is designed to support work leading to field applications that will demonstrate the applicability of new technology and encourage its commercial availability. Solicitations in this area will seek innovative approaches to integrate the results of individual research projects to address key technical issues in the development of unconventional resources, develop such research into commercially available services, and educate the wide and diverse community of producers on the successful application of new technologies to the development of unconventional resources.

This program encourages partnerships between oil and gas producers and research organizations. Partnerships are encouraged in order to facilitate the transition from research to application. In addition, the program encourages oil and gas producers who are not familiar or have expertise in proposal submissions to partner with universities and service companies familiar with this process.

A more complete description of the solicitation process is included in Section 2.4 of this report.

Area of Interest 1: Gas Shales

Solicitation(s) will request ideas and projects for development of tools, techniques, and methods that may be applied to substantially increase, in an environmentally sound manner, commercial production and ultimate recovery from established gas shale formations and accelerate development of gas from emerging and frontier gas shale plays. The concepts may include but are not limited to the areas listed below. Solicitations will particularly encourage proposals that integrate multiple technologies to address particular challenges.

- Develop multi-zone completion and stimulation methods applicable to complex shale reservoirs.
- Characterization of geologic, geochemical, geophysical, and operational parameters that differentiate high performing wells.
- Development of technologies for comprehensive characterization of the geological, geochemical, and geophysical framework of gas shale resource plays, particularly emerging plays.
- Development of methods to accurately assess the potential of shale for gas production from common industry petrophysical measurements.
- Development of methods to plan, model, and predict the results of gas production operations.
- Accurate delineation of the natural fracture system for guiding horizontal wells to intersect a large number of open fractures.
- Development of extra-extended single and multi-lateral drilling techniques.
- Development of steerable hydraulic fractures.
- Development of suitable low-cost fracturing fluids and proppants; e.g., non-damaging fluids and/or high strength low density proppants.
- Development of advanced drilling, completion, and/or stimulation methods that allow a greater volume of reservoir to be accessed from a single surface location with decreased environmental impact.
- Development of stimulation methods that require less water and other fluids to be injected into the subsurface.
- Development of stimulation methods that result in a lower volume of treatment fluids produced to the surface.
- Development of approaches for improved treatment, handling, re-use, and disposal of fluids produced and/or used in field operations.
- Extension of the commercial life of a producing well through reduction of the initial drilling and completion costs, elimination of workovers and recompletions, as well as reduction of production costs, particularly those associated with water disposal and management.

- Performance of preliminary studies of novel concepts for unconventional gas development in gas shale resources, and for the initial assessment of the potential of frontier gas shale resources.
- Development of improved drilling methods that lower cost, reduce time on location, use fewer materials or otherwise increase the efficiency and effectiveness of well construction.
- Evaluation of the potential resources associated with new or underdeveloped unconventional gas plays and identification of technical and economic barriers to their development.
- Development of comprehensive approaches for the conservation and management of water resources used and produced during all aspects of unconventional gas development.
- Development of advanced drilling approaches that minimize the surface impact of well construction associated with the targeted unconventional gas resource.
- Development of advanced completion, stimulation, and/or reservoir management approaches that minimize the environmental impact associated with the development of the targeted resource.
- Development of methods for planning and site selection that minimize the surface impact of drilling and production operations
- Development and execution of innovative approaches to integrate the results of individual research projects to address key technical issues in the development of unconventional gas resources and development of such research into commercially available services.

Area of Interest 2: Produced Water Management Associated with Coalbed Methane and Gas Shale Production

Solicitations will request proposals for development of tools, techniques, and methods that may be applied to substantially decrease the cost and environmental impact of coalbed methane and gas shale development through more effective management of water used and produced in drilling, completion, stimulation, and production operations. The concepts may include but are not limited to the areas listed below. Solicitations will particularly encourage proposals that consider an integrated, life-cycle approach to water management.

- Development of water management approaches that minimize the impact of drilling, completion, stimulation and production operations on natural water resources.
- Development of methods for the treatment of produced water.
- Development of methods for sustainable beneficial use of produced water.
- Development of methods to control fines production.
- Development of techniques to minimize the volume of water produced to the surface.

- Development of comprehensive approaches for the conservation and management of water resources used and produced during all aspects of unconventional gas development.
- Development and execution of innovative approaches to integrate the results of individual research projects to address key technical issues in the development of unconventional gas resources and development of such research into commercially available services.

Area of Interest 3: Tight Sands

Solicitations will request proposals for development of tools, techniques, and methods to increase commercial production and ultimate recovery from established tight gas sand formations and accelerate development of emerging and frontier tight gas plays. The concepts may include but are not limited to the areas listed below. Solicitations will particularly encourage proposals that integrate multiple technologies to address the challenges associated with tight sand resources.

- Development of multi-zone completion and stimulation methods applicable to complex tight sand reservoirs.
- Characterization of geologic, geochemical, geophysical, and operational parameters that differentiate high performing wells.
- Development of technologies for comprehensive characterization of the geological, geochemical and geophysical framework of tight sand resource plays, particularly emerging plays.
- Accurate delineation of the natural fracture system for guiding horizontal wells to intersect a large number of open fractures.
- Development of extra-extended single and multi-lateral drilling techniques.
- Development of steerable hydraulic fractures.
- Development of suitable low-cost fracturing fluids and proppants; e.g., non-damaging fluids and/or high strength low density proppants.
- Development of advanced drilling, completion, and/or stimulation methods that allow a greater volume of reservoir to be accessed from a single surface location with decreased environmental impact.
- Development of efficient and safe water management schemes.
- Extension of the commercial life of a producing well through reduction of the initial drilling and completion costs, elimination of workovers and recompletions, as well as reduction of production costs, particularly those associated with water disposal and management.
- Performance of preliminary studies of novel concepts for unconventional gas development in tight sands, and for the initial assessment of the potential of frontier tight sand resources.

- Development of improved drilling methods that lower cost, reduce time on location, use fewer materials or otherwise increase the efficiency and effectiveness of well construction.
- Evaluation of the potential resources associated with new or underdeveloped unconventional gas plays and identification of technical and economic barriers to their development.
- Development of comprehensive approaches for the conservation and management of water resources used and produced during all aspects of unconventional gas development.
- Development of advanced drilling approaches that minimize the surface impact of well construction associated with the targeted unconventional gas resource.
- Development of advanced completion, stimulation, and/or reservoir management approaches that minimize the environmental impact associated with the development of the targeted resource.
- Development of methods for planning and site selection that minimize the surface impact of drilling and production operations.
- Development and execution of innovative approaches to integrate the results of individual research projects to address key technical issues in the development of unconventional gas resources and develop such research into commercially available services.

Anticipated Awards for 2009

It is anticipated that there will be \$13.8 million available for funding the Unconventional Resources Program Element during each fiscal year. Approximately 5 to 15 awards are anticipated to be awarded in 2009.

The typical award is expected to have a duration of one to three years, although shorter or longer awards may be considered, if warranted, by the nature of the proposed project.

Under the stage/gate approach, all projects will be fully funded to the completion of the appropriate decision point identified in each contract, which may include multiple stages. If a decision is made to move to the next stage or decision point or to gather additional data, additional funding will be provided from available funds.

Technical Advisory Committees

An important part of the solicitation/selection process involves input from a number of TACs that are established to help review and evaluate proposals from those submitted in response to the solicitations. The TACs will also play a role in helping to refine subsequent solicitations.

These TACs are formed, conduct their work, and disband when no longer needed, as the program changes and projects are completed. The mix of proposals received determines the type of discipline-oriented groups, interdisciplinary problem-focused groups, or some combination group that will be required.

D. Ongoing Activities

As implementation of the program continues, activities include administration of current contracts, solicitation of new proposals, and planning for the following year. In addition to releasing RFPs and awarding subcontracts, the Program Consortium will be performing project management functions for the current contracts and for future awards during the year.

2007 Activities

Nineteen projects were selected from the 50 proposals submitted in response to the solicitation for the Unconventional Resources Program Element released pursuant to the *2007 Annual Plan*. As many of these projects were planned for time frames of two or three years, 35% of the 2008 funds were allocated to the support of these 2007 program projects.

Table 2.2.2 provides a listing of each of the projects selected. Abstracts and project status information for each of the projects can be found on the DOE website at www.netl.doe.gov/technologies/oil-gas/EPAAct2005 and on the Program Consortium website at www.rpsea.org/en/cms/?1560.

Project Title/ Duration	Lead Performer	Other Participants
A Self-Teaching Expert System for the Analysis, Design, and Prediction of Gas Production from Shales / 36 months	Lawrence Berkeley National Laboratory	Texas A&M University, University of Houston, Anadarko
Advanced Hydraulic Fracturing Technology for Unconventional Tight Gas Reservoirs / 24 months	Texas A&M University	Carbo Ceramics, Schlumberger, Halliburton Energy Services, BJ Services
An Integrated Framework for the Treatment and Management of Produced Water / 36 months	Colorado School of Mines	Kennedy/Jenks Consultants, Argonne National Laboratory, Stratus Consulting, Eltron Research and Development, Chevron, Pioneer Natural Gas, Marathon, Triangle Petroleum, Anadarko, Awwa Research Foundation, Stewart Environmental, Southern Nevada Water Authority, Veolia Water, Hydration Technology, Petroglyph Operating Co.
Application of Natural Gas Composition to Modeling Communication Within and Filling of Large Tight-Gas-Sand Reservoirs, Rocky Mountains / 24 months	Colorado School of Mines	U.S. Geological Survey, University of Oklahoma, University of Manchester, Fluid Inclusion Technology, Permedia Research Group, Williams Exploration and Production Co., ConocoPhillips, ExxonMobil, Newfield Exploration, BP, Anadarko
Comprehensive Investigation of the Biogeochemical Factors Enhancing Microbially Generated Methane in Coal Beds / 24 months	Colorado School of Mines	University of Wyoming, U.S. Geological Survey, Pioneer Natural Resources, Pinnacle Gas Resources, Coleman Oil and Gas, Ciris Energy, Inc.
Enhancing Appalachian Coalbed Methane (CBM) Extraction by Microwave-Induced Fractures / 12 months	Pennsylvania State University	Nottingham University

Gas Condensate Productivity in Tight Gas Sands 36 months	Stanford University	
Gas Production Forecasting From Tight Gas Reservoirs: Integrating Natural Fracture Networks and Hydraulic Fractures / 36 months	University of Utah	Utah Geological Survey, Golder Associates, Utah State University, HClasca
Geological Foundation for Production of Natural Gas from Diverse Shale Formations / 36 months	Geological Survey of Alabama	
Improved Reservoir Access through Refracture Treatments in Tight Gas Sands and Gas Shales / 36 months	University of Texas - Austin	Noble Energy, BJ Services, Anadarko, Jones Energy, Pinnacle Technologies
Improvement of Fracturing for Gas Shales / 36 months	University of Houston	Daneshy Consultants, BJ Services
New Albany Shale Gas / 30 months	Gas Technology Institute	Amherst College, University of Massachusetts, ResTech, Texas A&M University, Pinnacle Technologies, West Virginia University, Texas Bureau of Economic Geology, Aurora Oil and Gas, CNX Gas, Diversified Operating Corporation, Noble Energy, Trendwell Energy Corporation
Novel Concepts for Unconventional Gas Development in Shales, Tight Sands, and Coalbeds / 12 months	Carter Technology	University of Oklahoma, University of Houston, M-I LLC
Novel Fluids for Gas Productivity Enhancement in Tight Formations / 36 months	University of Tulsa	Williams Exploration and Production Co.
Optimization of Infill Well Locations in Wamsutter Field / 36 months	University of Tulsa	Texas A&M University, Devon Energy
Optimizing Development Strategies to Increase Reserves in Unconventional Gas Reservoirs / 24 months	Texas A&M University	Unconventional Gas Resources Canada Operating Inc., Pioneer Natural Resources Co.
Paleozoic Shale-Gas Resources of the Colorado Plateau and Eastern Great Basin, Utah: Multiple Frontier Exploration Opportunities / 36 months	Utah Geological Survey	Bereskin and Associates, GeoX Consulting, Halliburton Energy Services
Petrophysical Studies of Unconventional Gas Reservoirs Using High-Resolution Rock Imaging / 36 months	Lawrence Berkeley National Laboratory	Schlumberger, Chevron, BP
Reservoir Connectivity and Stimulated Gas Flow in Tight Sands / 24 months	Colorado School of Mines	University of Colorado, Mesa State University, iReservoir, Bill Barrett Corporation, Noble Energy, Whiting Petroleum Corporation, ConocoPhillips

Table 2.2.2: Unconventional Resources 2007 Projects

2008 Activities

The 2008 program is focused on filling research gaps within the existing R&D portfolio, including geographic focus. The 2008 Unconventional Resources solicitation was issued November 2008, with proposals due mid-January 2009, and selections expected first quarter of 2009. Stakeholder input has indicated that a stronger presence in the Appalachian area of the

country and an emphasis on produced water technology issues and ongoing environmental focus are warranted.

E. Metrics

Overall metrics for the Consortium in general are discussed in Section 2.7. Shorter-term metrics specific to the Unconventional Resources Program include the completion of annual milestones that show progress towards meeting the program element objectives. Short term metrics to be completed before the end of FY 2009 include:

- Issue and complete at least one solicitation.
- Engage technical advisory committees to review that the solicitation reflects sufficient breadth and depth of industry experience
- Select and award 5 - 15 projects
- Establish FY2010 R&D priorities based on results of 2007-09 solicitations and other inputs from stakeholders, including the program advisory committees and the URTAC.

F. Milestones

The 2009 Unconventional Resources solicitations will be released after transmittal of the *2009 Annual Plan* to Congress, and will remain open for a minimum of 60 days. The review, selection, and award process will take approximately three months. The 2008 Unconventional Resources solicitation was issued November 2008, with proposals due mid-January 2009, and selections expected first quarter of 2009.

Additional activities by the Program Consortium will be the active management of all R&D awards, planning and development of the R&D program for 2010, and holding program level technology transfer workshops.

All milestones for the 2009 Unconventional Resources Program element are listed in Table 2.2.3 below.

2009 Consortium Process Timeline															
Month		-2	-1	1	2	3	4	5	6	7	8	9	10	11	12
2009 Draft Plan Submitted (July 31, 2008)	◆														
Plan Published		◆													
Plan Approved					◆										
Obtain DOE Approval of Solicitation						◆									
Solicitation Open Period							■	■							
Proposal Evaluation and Selection									■	■					
DOE Approval											◆				
Contract Negotiation and Award												■	■	■	
Manage 2009 Awards													■	■	■
Manage 2007 & 2008 Awards		■	■	■	■	■	■	■	■	■	■	■	■	■	■

2009 Consortium Process Timeline													
Report Program Deliverables													
Conduct Technology Transfer Workshops & Activities													
Establish 2010 R&D Priorities & Annual Plan													

Table 2.2.3: Unconventional Resources Program Element Timeline

2.3 Small Producer Program Element

A. Mission & Goals

The mission of the Small Producer Program Element of the consortium-administered R&D program is to increase the supply from mature domestic natural gas and other petroleum resources through reducing the cost and increasing the efficiency of production of such resources, while improving safety and minimizing environmental impact, with a specific focus on the technology challenges of small producers.

“Small producer” is defined in Section 999G of EPAAct as *an entity organized under the laws of the United States with production levels of less than 1,000 barrels per day of oil equivalent.*

The goal of the Small Producer Program Element is to address the needs of small producers by focusing on areas including complex geology involving rapid changes in the type and quality of the oil and gas across the reservoir; low reservoir pressure; unconventional natural gas reservoirs in coalbeds, deep reservoirs, tight sands, or shales; and unconventional oil reservoirs in tar sands and oil shales.

B. Objectives

The small producer community is quick to adopt new technology that has been shown to have an economic benefit in their operating environment. The small producer program element helps make leading edge exploration and production technology available to small producers, helping them to increase their contribution to the nation’s secure energy supply.

The approach to enhancing the impact of small producers on energy production involves two related but distinct activities. First, individual small producers facing representative challenges will be engaged to work with technology providers on the development and application of technology to enhance economic and environmentally responsible production and resource recovery. The support provided through the program will mitigate the economic risk normally associated with the application of new technologies. Second, the information acquired as a result of projects funded through the program will serve as the basis for technology transfer efforts that will promote appropriate novel technology applications throughout the small producer community.

The specific objectives of the Small Producer Program Element are:

Near term

Objective 1: Apply technologies in new ways to enable improvements in water management and optimization of water use in mature fields.

Objective 2: Apply technologies in new ways to improve oil and gas recovery from mature fields, extending their economic life.

Objective 3: Apply technologies in new ways to reduce field operating costs.

Mid term

Objective 4: Apply lessons from all near-term projects to new basins/areas and develop new technologies to address the problems of Objectives 1-3.

C. Implementation Plan

The Small Producer Program Element is being implemented by developing and administering solicitations for R&D projects in areas that address the objectives outlined above. The following section outlines the major steps in the implementation plan.

Small Producers Program Element Advisory Groups

The Small Producer Program receives guidance from a Small Producer Research Advisory Group (RAG) consisting of industry and academic representatives that are closely tied to the national small producer community (Appendix B). The RAG focuses on identifying, targeting, and prioritizing specific technology needs. This advisory group also provides a key communications focal point for encouraging the formation of the requisite research consortia (see next subsection for description of this requirement). After projects are initiated, the RAG follows each project's progress, plans, and results, with particular attention to tech transfer. All projects are reviewed by the RAG annually.

While the RAG will be responsible for directing the Small Producer Program Element, the Unconventional Onshore PAC will remain responsible for oversight of the entire onshore program, which includes the Small Producer Program Element as well as the Unconventional Resources Program Element. The RAG will interact with the Unconventional Onshore PAC through the RPSEA Onshore VP and through its chairman, who will hold a seat on the Unconventional Onshore PAC reserved for a representative of the Small Producer RAG.

The Small Producer RAG is the body primarily responsible for the management of the selection process for awards under the Small Producer Program, and the RAG will continue to draw on the expertise of the specialized Unconventional Onshore TACs. These TACs will be available to provide in depth technical reviews on proposals to supplement the expertise of the RAG.

Prioritized Technology Challenges

The Small Producer Program Element has been able to draw on the input from a number of the exercises and workshops conducted in coordination with the Unconventional Resources Program Element as well as specific events aimed at small producers conducted by New Mexico Tech and West Virginia University. The overarching theme expressed by small producer representatives at these events was the need for technology which allows small producers to maximize the value of the assets they currently hold, primarily in mature fields.

Accordingly, the solicitation under the Small Producer Program Element has been aimed toward developing and proving the application of technologies that will increase the value of mature fields by reducing operating costs, decreasing the cost and environmental impact of additional development, and improving oil and gas recovery. Reducing risk is seen as key to reducing costs and improving margins. Improved field management, best practices, and lower cost tools (including software) are all within the scope of this effort.

In order to ensure that technologies developed under this program are applied to increase production in a timely fashion, each proposal has been required to outline a path and timeline to an initial application. A specific target field for an initial test of the proposed development must be identified, and ideally the field operator will be a partner in the proposal.

In compliance with section 999B(d)(7)(C) of EPAAct, all awards resulting from this solicitation “shall be made to consortia consisting of small producers or organized primarily for the benefit of small producers.” For the purposes of the solicitation, a small producer consortium shall consist of two or more entities participating in a proposal through prime contractor-subcontractor or other formalized relationship that ensures joint participation in the execution of the scope of work associated with an award. The participation in the small producer consortium of the producer that operates the asset that is identified as the initial target for the proposed work will be highly encouraged.

2009 Solicitations

The 2009 Small Producer solicitation(s) will continue to focus on the theme of advancing technology for mature fields. However, opportunities will be sought to further focus the program to complement the project selections in the 2007 and 2008 programs.

The 2009 solicitation will request proposals addressing the following technology challenges:

- Development of approaches and methods for water management, including produced water shutoff or minimization, treatment and disposal of produced water, fluid recovery, chemical treatments, and minimizing water use for drilling and stimulation operations.
- Development of methods for improving oil and gas recovery and/or extending the economic life of reservoirs.
- Development of methods to reduce field operating costs, including reducing production related costs as well as costs associated with plugging and abandoning wells and well site remediation. Consideration will be given to those efforts directed at minimizing the environmental impact of future development activities.
- Development of cost-effective intelligent well monitoring and reservoir modeling methods that will provide operators with the information required for efficient field operations.
- Development of improved methods for well completions and recompletions, including methods of identifying bypassed pay behind pipe, deepening existing wells, and innovative methods for enhancing the volume of reservoir drained per well through fracturing, cost-effective multilaterals, in-fill drilling, or other approaches.

- Implementation and documentation of field tests of emerging technology that will provide operators with the information required to make sound investment decisions regarding the application of that technology.
- Collection and organization of existing well and field data from multiple sources into a readily accessible and usable format that attracts additional investment.
- Creative capture and reuse of industrial waste products (produced water, excess heat) to reduce operating costs or improve recovery.
- Leverage existing wellbores and surface footprint to maximize recovery of additional hydrocarbons

Additional solicitations may be issued based on assessment of proposals received and available funding.

Anticipated Awards for 2009

It is anticipated that \$3.2 million will be available for the Small Producer Program Element during FY 2009. Approximately 4 to 12 awards are anticipated to be awarded under FY 2009 solicitations issued in 2009.

The typical award is expected to have a duration of one to three years, although shorter or longer awards may be considered if warranted by the nature of the proposed project.

Under the Stage/Gate approach described in Section 2.5, all projects will be fully funded to the completion of the appropriate decision point identified in each contract, which may include multiple stages. If a decision is made to move to the next stage or decision point or to gather additional data, additional funding will be provided from available funds.

D. Ongoing Activities

2007 Activities

The solicitation using 2007 funds focused on application of available technologies for oil and gas recovery, water management issues, cost-effective intelligent well monitoring, and collection and organization of existing data from multiple sources. There was \$3.2 million of 2007 funding available for R&D awards under this program element. Seven projects were selected for negotiations leading to an award. These projects are listed in Table 2.3.1.

Project Title	Lead Performer	Other Participants	Project Duration
Cost-Effective Treatment of Produced Water Using Co-Produced Energy Sources for Small Producers	New Mexico Institute of Mining and Technology	Robert L. Bayless, Producer LLC and Harvard Petroleum Company, LLC	24 months
Enhancing Oil Recovery from Mature Reservoirs Using Radial-Jetted Laterals and High-Volume Progressive Cavity Pumps	University of Kansas	Kansas Geological Survey and American Energies Corporation	12 months

Field Site Testing of Low Impact Oil Field Access Roads: Reducing the Footprint in Desert Ecosystems	Texas A&M University	Rio Vista Bluff Ranch and Halliburton	24 months
Near Miscible CO ₂ Application to Improved Oil Recovery for Small Producers	University of Kansas	Carmen Schmitt, Inc.	24 months
Preformed Particle Gel for Conformance Control	University of Missouri, Rolla	ChemEOR Company and BJ Services	24 months
Reducing Impacts of New Pit Rules on Small Producers	New Mexico Institute of Mining and Technology	Independent Petroleum Association of New Mexico and New Mexico Oil Conservation Division	36 months
Seismic Stimulation to Enhance Oil Recovery	Lawrence Berkeley National Laboratory	U.S. Oil & Gas Corporation and Berkeley GeoImaging Resources, LLC	24 months

Table 2.3.1: Small Producers Program 2007 Projects

2008 Activities

The 2008 solicitation was released November 2008 with proposals due mid-January 2009. It has the same general focus as that for the 2007 program year. Project selections for 2008 are expected in first quarter 2009.

E. Metrics

Overall metrics for the Program Consortium in general are discussed in Section 2.7. Shorter-term metrics specific to the Small Producer Program Element include the completion of annual milestones that show progress towards meeting the program element objectives. As a minimum, short term metrics to be completed before the end of FY 2009 include:

- Issuance of at least one solicitation
- Integration of input from an advisory group that reflects sufficient breadth and depth of industry experience
- Selection and award of a minimum of 4-12 projects
- Establishment of FY2010 R&D priorities based on results of 2007-09 solicitations and other inputs from stakeholders, including the program advisory committees and the URTAC.

F. Milestones

The 2009 Small Producer solicitation will be released after transmittal of the *2009 Annual Plan* to Congress, and will remain open for a minimum of 60 days. The review, selection, and award process will take approximately three months. The Program Consortium will work closely with each awardee to develop a mutually acceptable technology transfer plan. Additional activities by the Program Consortium will be the active management all R&D awards, planning and

development of the R&D program for 2010, and holding program level technology transfer workshops.

All milestones for the 2009 Unconventional Resources Program Element are listed in Table 2.3.2 below.

2009 Consortium Process Timeline															
Month		-2	-1	1	2	3	4	5	6	7	8	9	10	11	12
2009 Draft Plan Submitted (July 31, 2008)	◆														
Plan Published		◆													
Plan Approved					◆										
Obtain DOE Approval of Solicitation						◆									
Solicitation Open Period															
Proposal Evaluation and Selection															
DOE Approval															
Contract Negotiation and Award															
Manage 2009 Awards															
Manage 2007 & 2008 Awards															
Report Program Deliverables															
Conduct Technology Transfer Workshops & Activities															
Establish 2010 R&D Priorities & Annual Plan															

Table 2.3.2: Small Producers Program Element Timeline

2.4 Solicitation Process

A. Eligibility

In accordance with Subtitle J of EAct, in order to receive an award, an entity must either be:

- a) a United States-owned entity organized under the laws of the United States; or
- b) an entity organized under the laws of the United States that has a parent entity organized under the laws of a country that affords to United States-owned entities -
 - a. Opportunities comparable to those afforded to any other entity, to participate in any cooperative research venture similar to those authorized under this subtitle;
 - b. Local investment opportunities comparable to those afforded to any other entity; and
 - c. Adequate and effective protection of intellectual property rights.

RPSEA is not eligible to apply for an award under this program.

B. Organizational/Personal Conflict of Interest

The approved RPSEA Organizational Conflict of Interest Plan will govern all potential conflicts associated with the solicitation and award process.

In accordance with the conflict of interest requirements of Section 999B(c)(3) of EPAct, RPSEA submitted an Organizational Conflict of Interest (OCI) Plan which addressed the procedures by which RPSEA will (1) ensure it's board members, officers, and employees in a decision-making capacity disclose to DOE any financial interests in or financial relationships with applicants for or recipients of awards under the program and (2) require board members, officers, and employees with disclosed financial relationships or interests to recuse themselves from any oversight of awards made under the program. RPSEA's OCI Plan was reviewed by DOE. After DOE's comments and questions were addressed, a final OCI Plan was approved.

In addition, the Contract between DOE and RPSEA includes the following OCI clauses: H.22 Organizational Conflict of Interest (NOV 2005); H.23 Organizational Conflict of Interest (OCI) Annual Disclosure; and H.24 Limitation of Future Contracting and Employment.

These Contract clauses and the approved RPSEA OCI Plan will govern potential conflicts associated with the solicitation and award process.

C. Solicitation Approval and Project Selection Process

The overall structure of the solicitation approval and project selection process is illustrated in Figure 2.4.1. Project selection will be through a fully open and competitive, process. Within the Program Consortium's project proposal review and selection process, the TACs will be responsible for providing technical reviews of proposals, while the PACs will be primarily responsible for the selection of proposals for award. NETL will be responsible for the final review and approval of recommended projects.

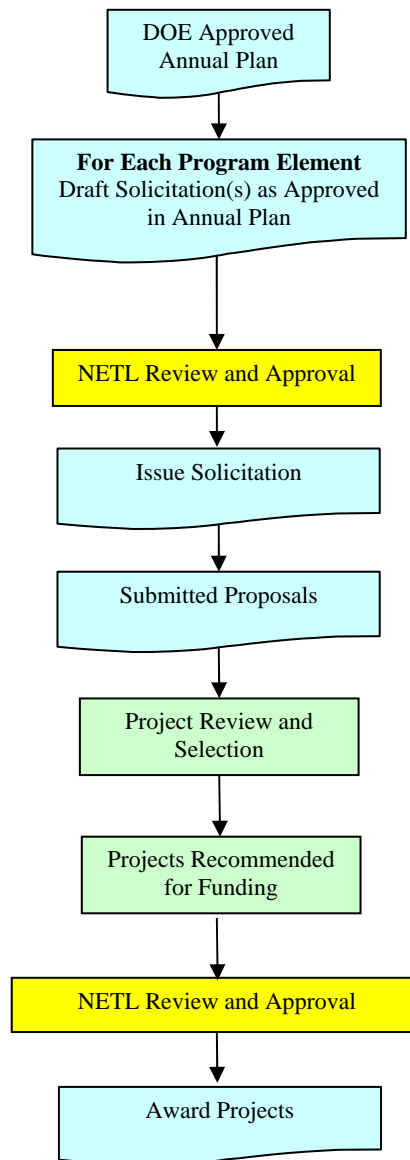


Figure 2.4.1: Project Solicitation Process

D. Selection Criteria

The following general criteria will be used to evaluate proposals. The detailed selection criteria and weighting factors vary depending on the specific technology area and will be clearly and specifically identified in each solicitation.

- Technical merit and applicable production or reserve impact
- Statement of Project Objectives

- Personnel qualifications, project management capabilities, facilities and equipment, and readiness
- Technology transfer approach
- Cost for the proposed work
- Cost share
- Environmental impact (including an assessment of the impacts, both positive and negative, that would result from the application of a developed technology)
- Health and Safety Quality Assurance/Quality Control
- Exceptions to contract terms and conditions

In the Small Producer Program Element, the following criteria will be used to evaluate proposals in addition to those stated above: Approach to application of the results, involvement of small producers, and the overall strength of the small producer consortium.

It should be noted that a bidder may be required to meet with the RAG to present their proposal and to answer any outstanding questions.

E. Schedule and Timing

The schedule for the 2009 solicitations will be determined in consultation with NETL after the *2009 Annual Plan* has been submitted to Congress. After issuance, solicitations will remain open for a minimum of 60 days.

F. Proposal Specifications

The structure and required elements of proposals submitted in response to each of the solicitations, as well as the specific details regarding format and delivery, will be developed in consultation with DOE and will be provided in each solicitation. The proposal must also comply with the Department of Energy Acquisition Regulations (DEAR) and Federal Acquisition Regulations (FAR) clauses listed in the solicitation.

G. Funding Estimates

It is anticipated that \$14.96 million per year will be available for the UDW Program Element with approximately five to 10 awards, and \$13.89 million per year for the Unconventional Resources Program Element with approximately five to 15 awards.

The typical award is expected to have a duration of one to three years, although shorter or longer awards may be considered if warranted by the nature of the proposed project. Under the stage/gate approach, all projects will be fully funded to the completion of the appropriate decision point identified in each contract, which may include multiple stages. Once a decision is

made to move to the next stage or decision point, additional funding will be provided from available funds.

It is anticipated that \$3.21 million per year will be available for the Small Producer Program Element. Approximately 4 to 12 awards are anticipated during FY 2009. The typical award is expected to have a duration of two years, although shorter or longer awards may be considered if warranted by the nature of the proposed project.

H. Advertising of Solicitations

Each solicitation will be advertised in a manner that ensures wide distribution to the specific audience targeted by each solicitation.

The vehicles used will include but not be limited to:

- Publication on the NETL website, supported by DOE press releases
- Publication on the RPSEA website, supported by RPSEA press releases and newsletters
- Announcements distributed via e-mail to targeted lists (e.g., small producer solicitation to members of state producer organizations)

Other vehicles that may be used include:

- Advertising in recognized industry publications (e.g., *Oil and Gas Journal*, *Hart's E&P*, *Offshore*, *American Oil and Gas Reporter*, etc.)
- Presentations at industry meetings by both RPSEA and NETL representatives, as appropriate given the timing of the solicitations
- Subscribing to funding-alert organizations that send e-mails once a week about funding opportunities to members in their specific areas of expertise
- Working with the various professional, industry, state, and national organizations to utilize their established networks

I. Additional Requirements for Awards

The following items are specified in Section 999C as requirements for awards. This information must be addressed in the solicitations, if applicable.

- ***Demonstration Projects*** – An application for an award for a demonstration project must describe with specificity the intended commercial use of the technology to be demonstrated.
- ***Flexibility in Locating Demonstration Projects*** – A demonstration project relating to an ultra-deepwater (≥ 1500 meters) technology or an ultra-deepwater architecture may be conducted in deepwater depths (>200 but <1500 meters).

- **Intellectual Property Agreements** – If an award is made to a consortium, the consortium must provide a signed contract agreed to by all members of the consortium describing the rights of each member to intellectual property used or developed under the award.
- **Technology Transfer** – 2.5 percent of the amount of each award must be designated for technology transfer and outreach activities.
- **Information Sharing** – All results of the research administered by the program consortium shall be made available to the public consistent with Department policy and practice on information sharing and intellectual property agreements.

2.5 Project Management

The Program Consortium will employ a Stage/Gate approach to the research, development, and commercialization (RD&C) process for each awarded project. The Stage/Gate process (Figure 2.5.1) is a method of logical thought and decision making designed to facilitate the efficient development of new technologies. The process will integrate three parallel, but interdependent streams of activities—technical, business, and administrative—needed to develop a product from its initial conception through research and on to the marketplace.

These activities will be integrated, such that progressively better information about the project and product—market potential, customer needs and wants, benefit-to-cost ratio, economics, and technical feasibility—is provided at each stage of the process. The process will be dynamic and flexible so that as stakeholders and project managers’ interests evolve, the process can evolve as well.



Figure 2.5.1: Stages and Gates Process Schematic

Each project will be designed to include a series of stages punctuated by decision points, whereby the contributors and decision makers will make a decision to: 1) go forward with the project, 2) go back to resolve key issues, or 3) terminate the project.

Each stage is designed to make technical progress and gather the information needed to move the project to the next decision point and on to the next gate. These information collection activities are not ends in themselves, but are the means to ultimately produce a successful product.

The gathering and analysis of information in each stage is focused on reducing levels of uncertainty, and thus risk. Armed with this information, project contributors can make sound technical and business decisions. Initial stages of research, development, and commercialization generally encounter the highest *technical* risks while later stages face the greatest *business* risks.

The project contributors must address both technical and business risks and attempt to reduce the overall uncertainty of the project.

In addition to helping manage risk, the structure of the RD&C process to be employed by the Program Consortium provides flexibility. For example, a project may begin the RD&C process at whatever stage is most appropriate for the circumstances. Consider a manufacturer who desires to broaden applications of an existing product. It may seek assistance exploring potential applications of the product to address a significant need other than that for which it was originally developed. Thus, from the perspective of the Program Consortium, the project might begin the RD&C process after the product has already been developed, i.e. at a stage well beyond Idea Generation (Stage 1).

Just as a project may begin at whatever stage is most appropriate, a project may end at whatever stage is most appropriate. For example, if the Program Consortium or NETL is satisfied that the Program Consortium has added the research and development value needed and that the manufacturer should continue with commercialization independently, the Program Consortium's support of the work may end successfully before the last gate (Gate 7).

Each gate in the process will have the following specifications:

- A set of required information from the preceding stage which is reviewed by the gatekeepers
- A set of quantitative and/or qualitative criteria to judge the merits and progress of the project
- A decision on whether the project should go ahead or be stopped
- Approval or release of funds
- A path forward for the next stage

Each gate will have its own set of quantitative and/or qualitative criteria for deciding whether the project should be continued into the next stage. These criteria are agreed upon in advance by the project contributors and the gatekeeper(s) for that gate. The evaluation criteria will help to answer the following questions:

- Does the concept still have strong potential for being a marketable product?
- Does the product concept still fit with the strategies, goals, and objectives of the appropriate program element?
- Have essential activities been completed at the proper level of detail?
- Is the project on time and within budget? Have key criteria been met since the previous gate?
- Should the project be continued to the next stage of development? Should it be terminated?
- What activities need to be performed in the next stage of the project? What key information is needed for making decisions at the next gate?

The current stage of the project is determined by whether it has met all the agreed upon criteria for the preceding gates. Therefore, a project can only be in one stage at a given point in time.

For example, a project cannot be at the deployment stage (Stage 6) when technical development activities (Stage 4) are still ongoing.

Progression through each gate is determined by gatekeepers who are identified at the time the project begins the RD&C process. These gatekeepers determine whether the project moves forward given the information developed in the preceding stage. Depending on the gate, gatekeepers may be RPSEA members or advisory committee members, program element management, or executive management.

2.6 Technology Transfer

The Program Consortium will engage in technology transfer at both the project and the program level, and will coordinate with its subcontractors to develop an appropriate approach that fulfills both the project and program technology transfer requirements.

Further, the Program Consortium's effort will be part of the larger technology transfer effort led by NETL.

The framework of the overall technology transfer strategy is characterized by five primary elements based on distinct technology transfer mechanisms:

1. Engage project performers, through collaborative agreements, in actively disseminating the results of their research efforts through regular meetings (conferences, industry meetings).
2. Maintain the DOE website as a centralized repository of all information related to the oil and gas program and undertake efforts to direct stakeholders to the website as the source of that information.
3. Publish research results on a routine basis via trade press articles, technical articles, and targeted in-house newsletters or journals.
4. Produce CD/DVD compilations of research reports and digital versions of specific information products related to individual projects.
5. Contract with third party technology transfer organizations to meet the needs of specific audiences.

A Knowledge Management Database (KMD) is being designed to archive project related information. The KMD will include all subcontractor awards made by the Program Consortium as well as information from DOE's other programs. NETL and the Program Consortium will continue working together to ensure that all relevant project information will be made available to the public in a timely manner.

Types of information to be stored in the KMD for each individual project include: a statement of work or statement of project objectives, status reports and updates, all topical reports and final reports set under the project contract, field data and experimental data as appropriate, and links to other related products. This information will be made available to the public via the Internet.

2.7 Performance Metrics and Program Benefits Assessment

The program will monitor and report on shorter-term performance metrics, program management performance and budget metrics, and benefits assessment, including royalty estimates. Highlights of a separate plan for the benefits assessment and methodologies for measuring performance metrics are provided below.

A. Monitoring Short-Term Performance Metrics

The program will develop quantitative short-term performance metrics. Some, but not all, of the short-term metrics will require that individual project metrics be established. The degree to which individual project objectives are met and the degree to which project objectives meet program objectives must be quantified. However, quantification of project-specific metrics will require the research program to be implemented and underway. Accordingly, the following steps will be followed with regard to quantifying short-term program impacts that are project dependent.

1. The first round of project proposals must be awarded before establishing project level objectives and metrics.
2. During this time, the Consortium will review with DOE and select the most appropriate methodology for quantifying and tracking short-term program metrics.
3. After a methodology has been selected, a baseline will be established for all areas where short term metrics will be measured.
4. With the above information in hand, a projection of program short-term results based on an assumed R&D budget per year for a specified number of years will be modeled.
5. Based on the results of Step 4, more precise and quantifiable program objectives will be established.
6. The results will be reviewed with each of the Consortium advisor groups before submission to DOE for approval.
7. The process will be repeated on a yearly basis to quantify incremental project/program results and cumulative impacts.

The degree to which project milestones are completed on time, papers are delivered, patents are filed, companies contribute cost-share funds, companies obtain third-party financing for new technologies, commercial sales derive from new technologies, and new technologies are determined to be successful and become commercialized are important indicators of the Program's success. The long term success of the program will ultimately be determined by the degree to which these short-term achievements are translated into the benefits outlined earlier.

B. Monitoring and Reporting Program Management Performance and Budget Metrics

In addition, as detailed within the RPSEA Management Plan, a monitoring process has been implemented for tracking budgeted versus actual financial information and other project schedule parameters. This monitoring process includes measurements of:

1. ***Obligated/uncosted funding in relation to total funds*** – The Consortium will establish a database to track obligated funding as well as uncosted amounts for the total program (including administration), as well as for each project. Funds will be tracked by year appropriated, in order to determine the age of all funds in all categories.
2. ***Earned value assessment for each research project including individual project cost and schedule variation*** – Earned value management (EVM) metrics will measure the cost and schedule performance of each research project. These metrics will be based on three essential variables:
 - **Budgeted Cost of Work Scheduled (BCWS)** which is extracted from the initial project plan. This variable lays down the baseline of planned expenditures at any given time.
 - **Budgeted Cost of Work Performed (BCWP)** which is extracted from the initial plan and computed based on the reported work completed.
 - **Actual Cost of Work Performed (ACWP)** which is extracted from a project's periodic reports and is the actual expenditure to complete a given task.

From these three variables, the Consortium administrator will determine the cost and schedule variance for each project.

Cost and schedule data will be collected from researchers on a schedule negotiated with the provider during the contract finalization process. The nature and characteristics of projects funded under the program will vary widely. The reporting frequency established for each project will consider these differences and vary as appropriate for individual projects, and will balance the need for information required to effectively monitor project execution against project schedules, milestones, and magnitude.

3. ***Project completion targets (within budget and project period)*** – The Consortium will utilize the three variables identified above to compute and report the estimated time at completion (ETAC) and estimated cost at completion (ECAC) for each project.
4. ***Adherence to project schedule (for solicitation and awards)*** – The Consortium will apply the same earned value techniques described above to the program level schedule for developing solicitations and making project awards. Earned value measurements will be made against the baseline schedule for the solicitation process.

In addition to the above, the Consortium will develop procedures to capture, monitor, and analyze data related to:

- Minimization of the amount of time from invoice to payment,

- Processing time for project change requests,
- Project report quality and adherence to set standards, and
- The number of small business, minority owned, and other disadvantaged category program participants.

C. Program Benefits Assessment

The primary overall goal of the Consortium-administered R&D program is to increase the supply of domestic natural gas and oil by increasing the supply through cost reduction and efficiency improvement while protecting the environment. DOE/NETL and the Program Consortium are working jointly to develop a methodology for determining benefits related to the Subtitle J program. In general, a comprehensive benefits analysis that evaluates a full range of impacts stemming from the program over the next few decades will be performed.

There are four primary objectives of the planned benefits assessment methodology:

- To accurately characterize the full suite of benefits to be assessed, as to both type and timing,
- To define reasonably accurate methods for quantifying these benefits as they accrue or for estimating how they are likely to accrue in the future,
- To produce benefits assessments considered valid and reasonable by a panel of knowledgeable experts, and
- To further develop the methodology needed to estimate increases in royalty receipts resulting from the R&D program.

The specifics of the methodology are currently being developed. The schedule for methodology development is provided in Table 2.7.1. A description of the benefits assessment methodology will be finalized through incorporation into the Annual Plan.

Evaluate Benefits Assessment Methodology Options	June 2008 (accomplished)
Validation Testing of Methodology	August 2008 (accomplished)
Independent Merit Review	January 2009
Revise Benefits Assessment Methodology	February – April 2009
Complete Benefits Assessment Methodology	May 2009
Initiate Benefits Assessment Methodology	2009

Table 2.7.1: Benefits Assessment Methodology Schedule

Acronyms

AMIGA	All Modular Industry Growth Assessment
BOD	Board of Directors
CBNG	coal bed natural gas
DEAR	Department of Energy Acquisition Regulations
DOE	Department of Energy
E&P	Exploration and Production
EAG	Environmental Advisory Group
EIA	Energy Information Administration
EOR	enhanced oil recovery
EPA	Environmental Protection Agency
EPAct	Energy Policy Act
FAR	Federal Acquisition Regulations
GIS	geographic information system
GTI	Gas Technology Institute
HPHT	high pressure and high temperature
LIDAR	light detection and ranging
MMS	Minerals Management Service
MMV	measuring, monitoring, and verification
NEMS	National Energy Modeling System
NETL	National Energy Technology Laboratory
NMT	New Mexico Tech University
NPC	National Petroleum Council
O&G	oil & gas
OCI	Organizational Conflict of Interest Plan
OCS	Outer Continental Shelf
ORD	Office of Research and Development
OSAP	Office of Systems, Analysis and Planning
PAC	Program Advisory Committee
PTTC	Petroleum Technology Transfer Council
RAG	Research Advisory Group
RFP	Request for Proposal
ROP	rate of penetration
RPSEA	Research Partnership to Secure Energy for America
S1	Solicitation 1 of 3 planned for Ultra-Deepwater
S2	Solicitation 2 of 3 planned for Ultra-Deepwater
S3	Solicitation 3 of 3 planned for Ultra-Deepwater
SAC	Strategic Advisory Committee
SAIC	Science Applications International Corporation
SCNGO	Strategic Center for Natural Gas and Oil
SDI	subsurface drip irrigation
SWC	Stripper Well Consortium
TAC	Technical Advisory Committee
TCF	trillion cubic feet
TVD	total volume daily
UDW	Ultra-Deepwater

Appendix A: Title IX, Subtitle J of EPO Act 2005 - Sections 999A through 999H

Title IX, Subtitle J--Ultra-Deepwater and Unconventional Natural Gas and Other Petroleum Resources

SEC. 999A. PROGRAM AUTHORITY.

(a) *In General.*--The Secretary shall carry out a program under this subtitle of research, development, demonstration, and commercial application of technologies for ultra-deepwater and unconventional natural gas and other petroleum resource exploration and production, including addressing the technology challenges for small producers, safe operations, and environmental mitigation (including reduction of greenhouse gas emissions and sequestration of carbon).

(b) *Program Elements.*--The program under this subtitle shall address the following areas, including improving safety and minimizing environmental impacts of activities within each area:

(1) Ultra-deepwater architecture and technology, including drilling to formations in the Outer Continental Shelf to depths greater than 15,000 feet.

(2) Unconventional natural gas and other petroleum resource exploration and production technology.

(3) The technology challenges of small producers.

(4) Complementary research performed by the National Energy Technology Laboratory for the Department.

(c) *Limitation on Location of Field Activities.*--Field activities under the program under this subtitle shall be carried out only--

(1) in--

(A) areas in the territorial waters of the United States not under any Outer Continental Shelf moratorium as of September 30, 2002;

(B) areas onshore in the United States on public land administered by the Secretary of the Interior available for oil and gas leasing, where consistent with applicable law and land use plans; and

(C) areas onshore in the United States on State or private land, subject to applicable law; and

(2) with the approval of the appropriate Federal or State land management agency or private land owner.

(d) *Activities at the National Energy Technology Laboratory.*--The Secretary, through the National Energy Technology Laboratory, shall carry out a program of research and other activities complementary to and supportive of the research programs under subsection (b).

(e) *Consultation With Secretary of the Interior.*--In carrying out this subtitle, the Secretary shall consult regularly with the Secretary of the Interior.

SEC. 999B. ULTRA-DEEPWATER AND UNCONVENTIONAL ONSHORE NATURAL GAS AND OTHER PETROLEUM RESEARCH AND DEVELOPMENT PROGRAM.

(a) *In General.*--The Secretary shall carry out the activities under section 999A, to maximize the value of natural gas and other petroleum resources of the United States, by increasing the supply of such resources, through reducing the cost and increasing the efficiency of exploration for and production of such resources, while improving safety and minimizing environmental impacts.

(b) *Role of the Secretary.*--The Secretary shall have ultimate responsibility for, and oversight of, all aspects of the program under this section.

(c) *Role of the Program Consortium.*--

(1) **IN GENERAL.**--The Secretary shall contract with a corporation that is structured as a consortium to administer the programmatic activities outlined in this chapter. The program consortium shall--

(A) administer the program pursuant to subsection (f)(3), utilizing program administration funds only ;

(B) issue research project solicitations upon approval of the Secretary or the Secretary's designee;

(C) make project awards to research performers upon approval of the Secretary or the Secretary's designee;

(D) disburse research funds to research performers awarded under subsection (f) as directed by the Secretary in accordance with the annual plan under subsection (e); and

(E) carry out other activities assigned to the program consortium by this section.

(2) **LIMITATION.**--The Secretary may not assign any activities to the program consortium except as specifically authorized under this section.

(3) **CONFLICT OF INTEREST.**--

(A) **PROCEDURES.**--The Secretary shall establish procedures--

(i) to ensure that each board member, officer, or employee of the program consortium who is in a decision-making capacity under subsection (f)(3) shall disclose to the Secretary any financial interests in, or financial relationships with, applicants for or recipients of awards under this section, including those of his or her spouse or minor child, unless such relationships or interests would be considered to be remote or inconsequential; and

(ii) to require any board member, officer, or employee with a financial relationship or interest disclosed under clause (i) to recuse himself or herself from any oversight under subsection (f)(4) with respect to such applicant or recipient.

(B) **FAILURE TO COMPLY.**--The Secretary may disqualify an application or revoke an award under this section if a board member, officer, or employee has failed to comply with procedures required under subparagraph (A)(ii).

(d) *Selection of the Program Consortium.*--

(1) **IN GENERAL.**--The Secretary shall select the program consortium through an open, competitive process.

(2) **MEMBERS.**--The program consortium may include corporations, trade associations, institutions of higher education, National Laboratories, or other research institutions. After submitting a proposal under paragraph (4), the program consortium may not add members without the consent of the Secretary.

(3) **REQUIREMENT OF SECTION 501(c)(3) STATUS.**--The Secretary shall not select a consortium under this section unless such consortium is an organization described in section 501(c)(3) of the Internal Revenue Code of 1986 and exempt from tax under such section 501(a) of such Code.

(4) **SCHEDULE.**--Not later than 90 days after the date of enactment of this Act, the Secretary shall solicit proposals from eligible consortia to perform the duties in subsection (c)(1), which shall be submitted not later than 180 days after the date of enactment of this Act. The Secretary shall select the program consortium not later than 270 days after such date of enactment.

(5) **APPLICATION.**--Applicants shall submit a proposal including such information as the Secretary may require. At a minimum, each proposal shall--

(A) list all members of the consortium;

(B) fully describe the structure of the consortium, including any provisions relating to intellectual property; and

(C) describe how the applicant would carry out the activities of the program consortium under this section.

(6) **ELIGIBILITY.**--To be eligible to be selected as the program consortium, an applicant must be an entity whose members have collectively demonstrated capabilities and experience in planning and managing research, development, demonstration, and commercial application programs for ultra-deepwater and unconventional natural gas or other petroleum exploration or production.

(7) **FOCUS AREAS FOR AWARDS.**--

(A) **ULTRA-DEEPWATER RESOURCES.**--Awards from allocations under section 999H(d)(1) shall focus on the development and demonstration of individual exploration and production technologies as well as integrated systems technologies including new architectures for production in ultra-deepwater.

(B) **UNCONVENTIONAL RESOURCES.**--Awards from allocations under section 999H(d)(2) shall focus on areas including advanced coalbed methane, deep drilling, natural gas production from tight sands, natural gas production from gas shales, stranded gas, innovative exploration and production techniques, enhanced recovery techniques, and environmental mitigation of unconventional natural gas and other petroleum resources exploration and production.

(C) **SMALL PRODUCERS.**--Awards from allocations under section 999H(d)(3) shall be made to consortia consisting of small producers or organized primarily for the benefit of small producers, and shall focus on areas including complex geology involving rapid changes in the type and quality of the oil and gas reservoirs across the reservoir; low reservoir pressure; unconventional natural gas reservoirs in coalbeds, deep reservoirs, tight sands, or shales; and unconventional oil reservoirs in tar sands and oil shales.

(e) *Annual Plan.*--

(1) **IN GENERAL.**--The program under this section shall be carried out pursuant to an annual plan prepared by the Secretary in accordance with paragraph (2).

(2) **DEVELOPMENT.**--

(A) **SOLICITATION OF RECOMMENDATIONS.**--Before drafting an annual plan under this subsection, the Secretary shall solicit specific written recommendations from the program consortium for each element to be addressed in the plan, including those described in paragraph (4). The program consortium shall submit its recommendations in the form of a draft annual plan.

(B) **SUBMISSION OF RECOMMENDATIONS; OTHER COMMENT.**--The Secretary shall submit the recommendations of the program consortium under subparagraph (A) to the Ultra-Deepwater Advisory Committee established under section 999D(a) and to the Unconventional Resources Technology Advisory Committee established under section 999D(b), and such Advisory Committees shall provide to the Secretary written comments by a date determined by the Secretary. The Secretary may also solicit comments from any other experts.

(C) **CONSULTATION.**--The Secretary shall consult regularly with the program consortium throughout the preparation of the annual plan.

(3) **PUBLICATION.**--The Secretary shall transmit to Congress and publish in the Federal Register the annual plan, along with any written comments received under paragraph (2)(A) and (B).

(4) **CONTENTS.**--The annual plan shall describe the ongoing and prospective activities of the program under this section and shall include--

(A) a list of any solicitations for awards to carry out research, development, demonstration, or commercial application activities, including the topics for such work, who would be eligible to apply, selection criteria, and the duration of awards; and

(B) a description of the activities expected of the program consortium to carry out subsection (f)(3).

(5) **ESTIMATES OF INCREASED ROYALTY RECEIPTS.**--The Secretary, in consultation with the Secretary of the Interior, shall provide an annual report to Congress with the President's budget on the estimated cumulative increase in Federal royalty receipts (if any) resulting from the implementation of this subtitle. The initial report under this paragraph shall be submitted in the first President's budget following the completion of the first annual plan required under this subsection.

(f) *Awards.*--

(1) **IN GENERAL.**--Upon approval of the Secretary the program consortium shall make awards to research performers to carry out research, development, demonstration, and commercial application activities under the program under this section. The program consortium shall not be eligible to receive such awards, but provided that conflict of interest procedures in section 999B(c)(3) are followed, entities who are members of the program consortium are not precluded from receiving research awards as either individual research performers or as research performers who are members of a research collaboration.

(2) **PROPOSALS.**--Upon approval of the Secretary the program consortium shall solicit proposals for awards under this subsection in such manner and at such time as the Secretary may prescribe, in consultation with the program consortium.

(3) **OVERSIGHT.**--

(A) **IN GENERAL.**--The program consortium shall oversee the implementation of awards under this subsection, consistent with the annual plan under subsection (e), including disbursing funds and monitoring activities carried out under such awards for compliance with the terms and conditions of the awards.

(B) **EFFECT.**--Nothing in subparagraph (A) shall limit the authority or responsibility of the Secretary to oversee awards, or limit the authority of the Secretary to review or revoke awards.

(g) *Administrative Costs.*--

(1) **IN GENERAL.**--To compensate the program consortium for carrying out its activities under this section, the Secretary shall provide to the program consortium funds sufficient to administer the program. This compensation may include a management fee consistent with Department of Energy contracting practices and procedures.

(2) **ADVANCE.**--The Secretary shall advance funds to the program consortium upon selection of the consortium, which shall be deducted from amounts to be provided under paragraph (1).

(h) *Audit.*--The Secretary shall retain an independent auditor, which shall include a review by the General Accountability Office, to determine the extent to which funds provided to the program consortium, and funds provided under awards made under subsection (f), have been expended in a manner consistent with the purposes and requirements of this subtitle. The auditor shall transmit a report (including any review by the General Accountability Office) annually to the Secretary, who shall transmit the report to Congress, along with a plan to remedy any deficiencies cited in the report.

(i) *Activities by the United States Geological Survey.*--The Secretary of the Interior, through the United States Geological Survey, shall, where appropriate, carry out programs of long-term research to complement the programs under this section.

(j) *Program Review and Oversight.*--The National Energy Technology Laboratory, on behalf of the Secretary, shall (1) issue a competitive solicitation for the program consortium, (2) evaluate, select, and award a contract or other agreement to a qualified program consortium, and (3) have primary review and oversight responsibility for the program consortium, including review and approval of research awards proposed to be made by the program consortium, to ensure that its activities are consistent with the purposes and requirements described in this subtitle. Up to 5 percent of program funds allocated under paragraphs (1) through (3) of section 999H(d) may be used for this purpose, including program direction and the establishment of a site office if determined to be necessary to carry out the purposes of this subsection.

SEC. 999C. ADDITIONAL REQUIREMENTS FOR AWARDS.

(a) *Demonstration Projects.*--An application for an award under this subtitle for a demonstration project shall describe with specificity the intended commercial use of the technology to be demonstrated.

(b) *Flexibility in Locating Demonstration Projects.*--Subject to the limitation in section 999A(c), a demonstration project under this subtitle relating to an ultra-deepwater technology or an ultra-deepwater architecture may be conducted in deepwater depths.

(c) *Intellectual Property Agreements.*--If an award under this subtitle is made to a consortium (other than the program consortium), the consortium shall provide to the Secretary a signed contract agreed to by all members of the consortium describing the rights of each member to intellectual property used or developed under the award.

(d) *Technology Transfer.*--2.5 percent of the amount of each award made under this subtitle shall be designated for technology transfer and outreach activities under this subtitle.

(e) *Cost Sharing Reduction for Independent Producers.*--In applying the cost sharing requirements under section 988 to an award under this subtitle the Secretary may reduce or eliminate the non-Federal requirement if the Secretary determines that the reduction is necessary and appropriate considering the technological risks involved in the project.

(f) *Information Sharing.*--All results of the research administered by the program consortium shall be made available to the public consistent with Department policy and practice on information sharing and intellectual property agreements.

SEC. 999D. ADVISORY COMMITTEES.

(a) *Ultra-Deepwater Advisory Committee.*--

(1) **ESTABLISHMENT.**--Not later than 270 days after the date of enactment of this Act, the Secretary shall establish an advisory committee to be known as the Ultra-Deepwater Advisory Committee.

(2) **MEMBERSHIP.**--The Advisory Committee under this subsection shall be composed of members appointed by the Secretary, including--

(A) individuals with extensive research experience or operational knowledge of offshore natural gas and other petroleum exploration and production;

(B) individuals broadly representative of the affected interests in ultra-deepwater natural gas and other petroleum production, including interests in environmental protection and safe operations;

(C) no individuals who are Federal employees; and

(D) no individuals who are board members, officers, or employees of the program consortium.

(3) **DUTIES.**--The Advisory Committee under this subsection shall—

(A) advise the Secretary on the development and implementation of programs under this subtitle related to ultra-deepwater natural gas and other petroleum resources; and

(B) carry out section 999B(e)(2)(B).

(4) **COMPENSATION.**--A member of the Advisory Committee under this subsection shall serve without compensation but shall receive travel expenses in accordance with applicable provisions under subchapter I of chapter 57 of title 5, United States Code.

(b) *Unconventional Resources Technology Advisory Committee.*--

(1) **ESTABLISHMENT.**--Not later than 270 days after the date of enactment of this Act, the Secretary shall establish an advisory committee to be known as the Unconventional Resources Technology Advisory Committee.

(2) **MEMBERSHIP.**--The Secretary shall endeavor to have a balanced representation of members on the Advisory Committee to reflect the breadth of geographic areas of potential gas supply. The Advisory Committee under this subsection shall be composed of members appointed by the Secretary, including--

(A) a majority of members who are employees or representatives of independent producers of natural gas and other petroleum, including small producers;

(B) individuals with extensive research experience or operational knowledge of unconventional natural gas and other petroleum resource exploration and production;

(C) individuals broadly representative of the affected interests in unconventional natural gas and other petroleum resource exploration and production, including interests in environmental protection and safe operations;

(D) individuals with expertise in the various geographic areas of potential supply of unconventional onshore natural gas and other petroleum in the United States;

(E) no individuals who are Federal employees; and

(F) no individuals who are board members, officers, or employees of the program consortium.

(3) **DUTIES.**--The Advisory Committee under this subsection shall--

(A) advise the Secretary on the development and implementation of activities under this subtitle related to unconventional natural gas and other petroleum resources; and

(B) carry out section 999B(e)(2)(B).

(4) **COMPENSATION.**--A member of the Advisory Committee under this subsection shall serve without compensation but shall receive travel expenses in accordance with applicable provisions under subchapter I of chapter 57 of title 5, United States Code.

(c) *Prohibition.*--No advisory committee established under this section shall make recommendations on funding awards to particular consortia or other entities, or for specific projects.

SEC. 999E. LIMITS ON PARTICIPATION.

An entity shall be eligible to receive an award under this subtitle only if the Secretary finds--

- (1) that the entity's participation in the program under this subtitle would be in the economic interest of the United States; and
- (2) that either--
- (A) the entity is a United States-owned entity organized under the laws of the United States; or
- (B) the entity is organized under the laws of the United States and has a parent entity organized under the laws of a country that affords--
- (i) to United States-owned entities opportunities, comparable to those afforded to any other entity, to participate in any cooperative research venture similar to those authorized under this subtitle;
- (ii) to United States-owned entities local investment opportunities comparable to those afforded to any other entity; and
- (iii) adequate and effective protection for the intellectual property rights of United States-owned entities.

SEC. 999F. SUNSET.

The authority provided by this subtitle shall terminate on September 30, 2014.

SEC. 999G. DEFINITIONS.

In this subtitle:

(1) **DEEPWATER.**--The term "deepwater" means a water depth that is greater than 200 but less than 1,500 meters.

(2) **INDEPENDENT PRODUCER OF OIL OR GAS.**--

(A) **IN GENERAL.**--The term "independent producer of oil or gas" means any person that produces oil or gas other than a person to whom subsection (c) of section 613A of the Internal Revenue Code of 1986 does not apply by reason of paragraph (2) (relating to certain retailers) or paragraph (4) (relating to certain refiners) of section 613A(d) of such Code.

(B) **RULES FOR APPLYING PARAGRAPHS (2) AND (4) OF SECTION 613A(d).**--For purposes of subparagraph (A), paragraphs (2) and (4) of section 613A(d) of the Internal Revenue Code of 1986 shall be applied by substituting "calendar year" for "taxable year" each place it appears in such paragraphs.

(3) **PROGRAM ADMINISTRATION FUNDS.**--The term "program administration funds" means funds used by the program consortium to administer the program under this subtitle, but not to exceed 10 percent of the total funds allocated under paragraphs (1) through (3) of section 999H(d).

(4) **PROGRAM CONSORTIUM.**--The term "program consortium" means the consortium selected under section 999B(d).

(5) **PROGRAM RESEARCH FUNDS.**--The term "program research funds" means funds awarded to research performers by the program consortium consistent with the annual plan.

(6) **REMOTE OR INCONSEQUENTIAL.**--The term "remote or inconsequential" has the meaning given that term in regulations issued by the Office of Government Ethics under section 208(b)(2) of title 18, United States Code.

(7) **SMALL PRODUCER.**--The term "small producer" means an entity organized under the laws of the United States with production levels of less than 1,000 barrels per day of oil equivalent.

(8) **ULTRA-DEEPWATER.**--The term "ultra-deepwater" means a water depth that is equal to or greater than 1,500 meters.

(9) **ULTRA-DEEPWATER ARCHITECTURE.**--The term "ultra-deepwater architecture" means the integration of technologies for the exploration for, or production of, natural gas or other petroleum resources located at ultra-deepwater depths.

(10) **ULTRA-DEEPWATER TECHNOLOGY.**--The term "ultra-deepwater technology" means a discrete technology that is specially suited to address 1 or more challenges associated with the exploration for, or production of, natural gas or other petroleum resources located at ultra-deepwater depths.

(11) **UNCONVENTIONAL NATURAL GAS AND OTHER PETROLEUM RESOURCE.**--The term "unconventional natural gas and other petroleum resource" means natural gas and other petroleum resource located onshore in an economically inaccessible geological formation, including resources of small producers.

SEC. 999H. FUNDING.

(a) *Oil and Gas Lease Income.*--For each of fiscal years 2007 through 2017, from any Federal royalties, rents, and bonuses derived from Federal onshore and offshore oil and gas leases issued under the Outer Continental Shelf Lands Act (43 U.S.C. 1331 et seq.) and the Mineral Leasing Act (30 U.S.C. 181 et seq.) which are deposited in the Treasury, and after distribution of any such funds as described in subsection (c), \$50,000,000 shall be deposited into the Ultra-Deepwater and Unconventional Natural Gas and Other Petroleum Research Fund (in this section referred to as the "Fund"). For purposes of this section, the term "royalties" excludes proceeds from the sale of royalty production taken in kind and royalty production that is transferred under section 27(a)(3) of the Outer Continental Shelf Lands Act (43 U.S.C. 1353(a)(3)).

(b) *Obligational Authority.*--Monies in the Fund shall be available to the Secretary for obligation under this part without fiscal year limitation, to remain available until expended.

(c) *Prior Distributions.*--The distributions described in subsection (a) are those required by law--

(1) to States and to the Reclamation Fund under the Mineral Leasing Act (30 U.S.C. 191(a)); and

(2) to other funds receiving monies from Federal oil and gas leasing programs, including--

(A) any recipients pursuant to section 8(g) of the Outer Continental Shelf Lands Act (43 U.S.C. 1337(g));

(B) the Land and Water Conservation Fund, pursuant to section 2(c) of the Land and Water Conservation Fund Act of 1965 (16 U.S.C. 4601-5(c));

(C) the Historic Preservation Fund, pursuant to section 108 of the National Historic Preservation Act (16 U.S.C. 470h); and

(D) the coastal impact assistance program established under section 31 of the Outer Continental Shelf Lands Act (as amended by section 384).

(d) *Allocation.*--Amounts obligated from the Fund under subsection (a)(1) in each fiscal year shall be allocated as follows:

(1) 35 percent shall be for activities under section 999A(b)(1).

(2) 32.5 percent shall be for activities under section 999A(b)(2).

(3) 7.5 percent shall be for activities under section 999A(b)(3).

(4) 25 percent shall be for complementary research under section 999A(b)(4) and other activities under section 999A(b) to include program direction funds, overall program oversight, contract management, and the establishment and operation of a technical committee to ensure that in-house research activities funded under section 999A(b)(4) are technically complementary to, and not duplicative of, research conducted under paragraphs (1), (2), and (3) of section 999A(b).

(e) *Authorization of Appropriations.*--In addition to other amounts that are made available to carry out this section, there is authorized to be appropriated to carry out this section \$100,000,000 for each of fiscal years 2007 through 2016.

(f) *Fund.*--There is hereby established in the Treasury of the United States a separate fund to be known as the "Ultra-Deepwater and Unconventional Natural Gas and Other Petroleum Research Fund".

Appendix B: RPSEA Membership and Committee Lists

RPSEA Members (as shown on website)

ACERGY US
ACUTE TECHNOLOGY SERVICES
ADVANCED RESOURCES INTERNATIONAL
AEROVIRONMENT
ALTIRA GROUP
(THE) AMERICAN GAS ASSOCIATION
ANADARKO PETROLEUM CORPORATION
APACHE CORPORATION
APEX SPECTRAL TECHNOLOGY
APS TECHNOLOGY
BAKER HUGHES
BILL BARRETT CORPORATION
BJ SERVICES
BP AMERICA
BREITBURN ENERGY
BRETAGNE LLC
BROWNSTEIN HYATT FARBER SCHRECK
CAMERON/CURTISS-WRIGHT EMD
CARBO CERAMICS
CENTRE FOR MARINE CNG, INC.
CHESAPEAKE ENERGY
CHEVRON CORPORATION
CITY OF SUGAR LAND
COLORADO ENERGY RESEARCH INSTITUTE/COLORADO SCHOOL OF MINES
COLORADO OIL & GAS ASSOCIATION
CONOCOPHILLIPS
CONSERVATION COMMITTEE OF CALIFORNIA OIL & GAS PRODUCERS
CORRELATIONS COMPANY
CRANE CORPORATION
CSI TECHNOLOGIES
DCP MIDSTREAM, LP
DELCO OHEB ENERGY, LLC
DET NORSKE VERITAS (USA)
DEVON ENERGY CORPORATION
(THE) DISCOVERY GROUP, INC.
DYNAMIC TUBULARS
ENCANA OIL & GAS (USA) INC.
ENERCREST
ENERGY CORPORATION OF AMERICA
ENERGY VALLEY
ERGON EXPLORATION
(THE) FLEISCHAKER COMPANIES

FLORIDA INTERNATIONAL UNIVERSITY
GAS TECHNOLOGY INSTITUTE
GE/VETCO
GEOTRACE TECHNOLOGIES
GREATER FORT BEND ECONOMIC DEVELOPMENT COUNCIL
GROUNDWATER SERVICES
HALLIBURTON ENERGY SERVICES
HARVARD PETROLEUM COMPANY, LLC
HOUSTON ADVANCED RESEARCH CENTER
HOUSTON OFFSHORE ENGINEERING
HOUSTON TECHNOLOGY CENTER
IDAHO NATIONAL LABORATORY
INDEPENDENT PETROLEUM ASSOCIATION OF AMERICA
INDEPENDENT PETROLEUM ASSOCIATION OF MOUNTAIN STATES
INTEGRATED OCEAN DRILLING PROGRAM
INTERSTATE OIL AND GAS COMPACT COMMISSION
JACKSON STATE UNIVERSITY
K. STEWART ENERGY GROUP
KNOWLEDGE RESERVOIR
LAWRENCE BERKELEY NATIONAL LABORATORY
LAWRENCE LIVERMORE NATIONAL LABORATORY
LOS ALAMOS NATIONAL LABORATORY
LOUISIANA STATE UNIVERSITY
MARATHON OIL COMPANY
MASSACHUSETTS INSTITUTE OF TECHNOLOGY LABORATORY FOR
ENERGY & THE ENVIRONMENT
MAXWELL RESOURCES CORP.
MERRICK SYSTEMS
MISSISSIPPI STATE UNIVERSITY
NALCO COMPANY
NANORIDGE MATERIALS
NATURAL CARBON
NAUTILUS INTERNATIONAL LLC
NEW ENGLAND RESEARCH
NEW MEXICO INSTITUTE OF MINING AND TECHNOLOGY
NEW MEXICO OIL & GAS ASSOCIATION
NGAS RESOURCES, INC.
NICO RESOURCES
NOBLE CORPORATION
NOBLE ENERGY, INC.
NOVATEK
(THE) OHIO STATE UNIVERSITY
OILFIELD TECHNOLOGY NEEDS ASSESSMENT
OKLAHOMA INDEPENDENT PETROLEUM ASSOCIATION
OXANE MATERIALS
(THE) PENNSYLVANIA STATE UNIVERSITY

PETRIS TECHNOLOGY
PETROLEUM TECHNOLOGY TRANSFER COUNCIL
PIONEER NATURAL RESOURCES COMAPNY
PROVIDENCE TECHNOLOGIES
QUANELLE
RICE UNIVERSITY
ROBERT L. BAYLESS, PRODUCER
ROCK SOLID IMAGES
RTI ENERGY SYSTEMS
SANDIA NATIONAL LABORATORIES
SCHLUMBERGER
SHELL EXPLORATION & PRODUCTION
SIMMONS & COMPANY INTERNATIONAL
SITELARK LLC
SOUTHWEST RESEARCH INSTITUTE
STANFORD UNIVERSITY
STATOIL GULF OF MEXICO
STRATA PRODUCTION COMPANY
STESS ENGINEERING
TECHNIP
TECHNOLOGY INTERNATIONAL
TEJAS RESEARCH & ENGINEERING, LP
TENARIS GLOBAL SERVICES
TEXAS ENERGY CENTER
TEXAS ENGINEERING EXPERIMENT STATION, TEXAS A&M UNIVERSITY
SYSTEM
TEXAS INDEPENDENT PRODUCERS & ROYALTY OWNERS ASSOCIATION
TEXAS TECH UNIVERSITY
TOTAL E&P USA
UNIVERSITY OF ALABAMA
UNIVERSITY OF ALASKA FAIRBANKS
UNIVERSITY OF HOUSTON
UNIVERSITY OF KANSAS
UNIVERSITY OF MICHIGAN
UNIVERSITY OF OKLAHOMA
UNIVERSITY OF SOUTH CAROLINA
UNIVERSITY OF SOUTHERN CALIFORNIA
(THE) UNIVERSITY OF TEXAS AT AUSTIN
UNIVERSITY OF TULSA
UNIVERSITY OF UTAH
UTE ENERGY
UTE INDIAN TRIBE
VERSAMARINE ENGINEERING LLC
WATT MINERAL HOLDINGS, LLC
WEATHERFORD

WELLD OG
WESTERN STANDARD ENERGY CORP.
WEST VIRGINIA UNIVERSITY
WILLIAMS PRODUCTION
WOODS HOLE OCEANOGRAPHIC INSTITUTE

RPSEA Board of Directors

Board Member	Affiliation
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Dr. Roger L. King	Mississippi State University
Dr. Daniel H. Lopez	New Mexico Institute of Mining and Technology
Mr. Dirk McDermott	Altira Group
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Mr. Brook J. Phifer	NiCo Resources LLC
Mr. Jim Schroeder	Representing IPAMS
Dr. Scott W. Tinker	The University of Texas at Austin
Mr. Timothy N. Tipton	Marathon Oil Company
Ms. Lori S. Traweek	The American Gas Association
Mr. Tony D. Vaughn	Devon Energy Corporation
Mr. Michael Wallen	NGAS Resources
Dr. Arthur B. Weglein	University of Houston
Mr. Thomas E. Williams	Noble Drilling Corporation
Mr. C. Michael Ming – RPSEA President	RPSEA

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Ralph Cavanagh	Natural Resources Defense Council
Peter Dea	Independent
Dr. Steven Holditch - Chairman	Texas A&M University
Melanie Kenderdine	Gas Technology Institute
Vello Kuuskraa	Advance Resources International
Daniel Lopez	New Mexico Institute of Mining & Technology
Dirk McDermott	Altira Group
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RPSEA Ultra-Deepwater PAC

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David Martinueau	Pitts Energy
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Bill Van Wie	Devon Energy Corporation
John Lewis	Noble Energy
Mark Glover	BP America
Dr. Julio Friedman	Lawrence Livermore National Lab
Brook Phifer	Nico Resources
Kurt Reinecke	Bill Barrett Corp.
Dr. John Lee	Texas A&M University
Bob Stayton	Weatherford International Ltd.
Dr. Valerie Jochen	Schlumberger Limited
Dr. Dag Nummedal	Colorado School of Mines (CERI)
Dr. Nafi Toksoz	Massachusetts Institute of Technology
Roy Long	DOE (NETL), Ex-Officio
Virginia Weyland	DOE (NETL) Ex-Officio

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Øyvind Strøm	Statoil (Houston)
Mason Tomson	Rice University
Scott Anderson	Environmental Defense
Sharon Buccino	NRDC
Assheton Carter	Conservation International
Joe Kiesecker	The Nature Conservancy
Roy Long	NETL

Appendix C: RPSEA 2009 Draft Annual Plan

The following 81 pages encompass the original RPSEA 2009 Draft Annual Plan submission.

RPSEA

2009 Draft Annual Plan

July 2008

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Executive Summary

This document is the Research Partnership to Secure Energy for America (RPSEA) 2009 Draft Annual Plan (DAP) for the Ultra-Deepwater and Unconventional Natural Gas and Other Petroleum Resources Research and Development Program (Program) established pursuant to Subtitle J, Section 999, of the Energy Policy Act of 2005 (EPAcT). RPSEA administers three of the four programs identified in EPAcT, pursuant to an annual plan, which include: ultra-deepwater architecture and technology, unconventional natural gas and other petroleum resources exploration and production technology, and technology challenges of small producers. The Department of Energy (DOE) through its National Energy Technology Laboratory (NETL) implements a complementary research and development (R&D) program of Section 999. RPSEA previously submitted DAPs for 2007 and 2008 and gathered extensive input through industry workshops, road mapping sessions, and expert opinion in their development, including input from two Federal Advisory Committees. The 2009 DAP is an evolutionary document building upon the foundation of the 2007 and 2008 Annual Plans, both of which DOE has submitted to Congress, and both of which incorporated RPSEA's 2007 and 2008 DAPs.

RPSEA Activities

The first solicitations were released by RPSEA in mid-October 2007 with proposals received in early December 2007. Additional solicitations were released in November 2007, December 2007, and February 2008. Proposals from the Small Producer Program and the Unconventional Natural Gas and Other Petroleum Resource Program (Unconventional Resources Program) were received in early December 2007. The proposal reviews were completed in early January 2008 and submitted to the RPSEA Program Advisory Committees (PACs) for project selections. Seven projects were selected for award under the Small Producer Program, and 19 projects were selected for award under the Unconventional Resources Program. In the Ultra-Deepwater Program (UDW), 17 projects have been selected for award. The project selections were approved by NETL and are described in their respective program chapters.

In addition to the activities associated with commencement of operations under EPAcT, RPSEA also has undertaken other activities in order to leverage the valuable public investment from Section 999. These activities are intended to support research and promote broad involvement and include a private Fellowship/Scholarship Program, a RPSEA summer internship, participation and exhibits at multiple industry functions, and sponsorship of innovative initiatives such as the Young Professionals in Energy and the Oil & Gas Innovation Center.

Organization and Planning

The extensive advisory network that provides input and direction for the DAP and operational activities has involved many hours and meetings. In the overall process, there have been 40 meetings with 840 participants, who have volunteered almost 3,800 hours of time and effort. As an example, the UDW advisory committees met 29 times with 591 participants involving over 2,800 hours of time and effort to focus the 120+ project ideas for 2007 and 2008 down to 26 ideas representing approximately \$30 million in R&D funds.

In addition, RPSEA broadly reached out to involve the oil and gas community through an outreach program of technology forums, holding 19 forums hosted by member organizations in which 940 people participated (not including RPSEA or Department of Energy (DOE) personnel). This participation amounts to over 9,500 hours of participant commitment and does not include the hours of commitment from the host organization or individual efforts, which in terms of time, effort, and monetary support have been substantial.

Moreover, RPSEA membership continues to grow, doubling since January 2007 from 66 members to the current membership of 132 members and includes natural gas and oil stakeholder groups from universities, private research organizations, integrated oil and gas companies, large and small independent producers, trade associations, financial entities and institutions, service companies and providers, national labs, non-governmental organizations, and consumer and civic organizations. These members represent 28 states, the District of Columbia, and the Province of Newfoundland, Canada. From information gathered from their public websites, RPSEA has found that these members collectively have more than 500,000 employees worldwide and represent approximately 50 percent of U.S. natural gas and oil production.

2009 Planning

The UDW for 2007 and 2008 was divided into theme areas based on four generic field types that represent the most challenging field development scenarios facing ultra-deepwater operators in the Gulf of Mexico: low permeability reservoirs, flow assurance, small field development, and high pressure/high temperature. RPSEA solicited R&D projects to develop technologies that will facilitate development of these field types. For 2009, six need areas further define the four field development scenarios:

1. Drilling, completion, and intervention breakthroughs
2. Appraisal and development geoscience and reservoir engineering
3. Significantly extend subsea tieback distances/surface host elimination
4. Dry trees/direct well intervention and risers in 10,000 foot water depth
5. Continuous improvement/optimization of field development
6. Associated safety and environmental concerns

The Unconventional Resources Program for 2007 and 2008 focused on three theme areas that target gas shales, water management for both coalbed methane and gas shales, and tight sands, emphasizing unconventional natural gas rather than “other petroleum resources” (e.g., shale oil, oil sands, deep gas). Unconventional oil resources are currently being addressed within National Energy Technology Laboratory’s (NETL) R&D portfolio and will continue to be addressed by NETL consistent with the recommendation from the 2008 Unconventional Resources Technology Advisory Committee. For 2009, the focus on unconventional natural gas remains essentially unchanged, with gas shales as the highest priority. The 2009 solicitation(s) will encourage the development of integrated programs targeting specific resources with a likely focus on technology or resource gaps that may remain in the program after the 2007 and 2008 awards. Areas that are currently identified as requiring additional emphasis include the development of unconventional gas in the Appalachian region, decreasing the environmental footprint of unconventional gas development, and innovative approaches for integrating program

results and ensuring that technologies developed under the program are made available to the producer community.

The Small Producer Program for 2007 and 2008 targeted advancing technologies for mature fields, which primarily covers the technology challenges of managing water production, improving recovery, and reducing costs. Mature fields are the domain of small producers, and they face these three challenges on a daily basis. Accordingly, the initial solicitation under this Program was aimed toward developing and proving the application of technologies that will increase the value of mature fields by reducing operating costs, decreasing the cost and environmental impact of additional development, and improving oil and gas recovery. For 2009, the focus will remain on the theme of advancing technology for mature fields, however, opportunities will be sought to complement the project selections in the 2007 and 2008 Programs by funding research that builds upon earlier results and expands their geographic application.

Chapter 1 Background

Energy Policy Act of 2005: Section 999

The Energy Policy Act of 2005 (EPAAct), Subtitle J, Section 999 supports oil and gas research and development (R&D) through a program of research, development, demonstration, and commercial application of technologies for ultra-deepwater and unconventional natural gas and other petroleum resource exploration and production to maximize the value of natural gas and other petroleum resources of the United States.

Section 999 sets the funding for the Ultra-Deepwater and Unconventional Natural Gas and Other Petroleum Resources Research and Development Program (Program) at a level of \$50-million-per-year provided from federal lease royalties, rents, and bonuses paid by oil and gas companies. The funds are to be directed towards research specifically targeting four areas: ultra-deepwater resources, unconventional natural gas and other petroleum resources, technology challenges of small producers, and research complementary to these areas. The complementary research is being performed by the National Energy Technology Laboratory (NETL), while all other research is administered by the Research Partnership to Secure Energy for America (RPSEA). See Table 1.1 for a breakdown of funding as directed by Section 999.

The investment in research provides the public with a two-for-one benefit. New federal revenues are created because much of the technology investment impacts natural gas and oil production from federal lands, and the projects enhance the nation's intellectual capital through the process of new technology development. The technology also applies to non-federal lands, which although don't directly provide federal royalties, they do make a significant contribution to gross national product and domestic energy security. Technically challenging resources cannot be fully exploited to their full public economic and security benefit potential without the necessary technology. One example of such a required technology is the *Ultra-High Conductivity Umbilicals*' project, which has the potential of improving power transmission to the sea floor from formerly non-producible water depths on federal tracts. The research and subsequent technology developed from this effort could also impact the energy sector well beyond the scope of just natural gas and oil. Another example onshore is the *New Albany Shale Gas* project. This extensive resource has been known and produced for some time, but has never reached its full potential. Without new R&D, it will continue to languish. By bringing together the best and brightest minds and capabilities nationwide to discover methods to better understand and more efficiently produce this onshore natural gas shale resource, this project will increase our nation's national security by enhancing the domestic supply of energy making the United States less vulnerable to foreign supply disruptions and costs, and providing plentiful clean burning natural gas to Americans for years to come. Details on both projects can be found in the following sections regarding each program at <http://www.rpsea.org/en/cms/?1560> and http://www.rpsea.org/attachments/contentmanagers/1417/RFP2007DW1302_Final_Archive2.pdf on the NETL/SCNGO webpage at <http://www.netl.doe.gov/technologies/oil-gas/EPAAct2005> . To enable high-payoff activities and attain longer-term national goals, especially national security and increased energy independence, there must be extensive collaboration of researchers

and service providers, both supported by industry. This extensive collaboration is not easily achieved with current industry constraints and market incentives and can only happen with effective public policy and leadership. A fundamental objective of the Program is to generate collaborative projects that are not well suited or practical for industry to perform itself by combining the unique and valuable contributions of industry, academia, and the research community leveraged by significant public investment. This is especially crucial for independent producers who drill 90 percent of the wells in the United States and produce 82 percent of the nation’s natural gas and 68 percent of the nation’s oil, yet many have little or no internal technology development capability.

([http://www.ipaa.org/issues/testimony/IPAA Testimony-HouseOversiteGovtReform10-31-2007.pdf](http://www.ipaa.org/issues/testimony/IPAA%20Testimony-HouseOversiteGovtReform10-31-2007.pdf)). An example is exemplified in the project *An Integrated Framework for the Treatment and Management of Produced Water*. This project has 15 participants, whose participation is the result of the creation of an effective mechanism for collaboration on a project that addresses a critical need associated with domestic production. Another example of collaboration between industry, academia, and a state regulatory agency is the project *Reducing Impacts of New Pit Rules on Small Producers* under the Small Producer Program. This project seeks to improve access to and functionality of data necessary for compliance with new rules in order to improve the permitting process.

A. Consortium Selection

NETL contracted with RPSEA, a 501(c)(3) not-for-profit corporation consisting of more than 130 member organizations, to administer the distribution of about \$32 million per year in R&D contracts (Table 1.1). The federal government will maintain management oversight of the Program, and RPSEA’s administration funds are limited to no more than 10 percent of the funds.

Area	Allocation	Area Funds	NETL Review & Oversight 5%	RPSEA Administration 10%	R&D Funds for Distribution
Ultra-Deepwater	35%	17,500,000	875,000	1,662,500	14,962,500
Unconventional and Other	32.5%	16,250,000	812,500	1,543,750	13,893,750
Small Producers	7.5%	3,750,000	187,500	356,250	3,206,250
Consortium Total		37,500,000	1,875,000	3,562,500	32,062,500
Complementary	25%	12,500,000	0	0	12,500,000
Section 999 Total	100%	50,000,000	1,875,000	3,562,500	44,562,500

Table 1.1: Distribution of Section 999 Funds (US\$)

RPSEA is organized as a consortium and has a broad membership base that includes representatives from all levels and sectors of both the oil and gas exploration and production (E&P) and oil and gas R&D communities. For a complete list of RPSEA members, see Appendix A. RPSEA members represent virtually all critical elements of the natural gas and oil supply technology value chain. This breadth of membership helps ensure that consortium-administered R&D funds are directed towards key problems in ways that leverage existing industry efforts. A variety of advisory committees and meetings drawn from this membership are incorporated into RPSEA's planning process, as well as in the recommendation of R&D projects to be awarded and the review of project results. Collectively, this network has accounted for approximately 14,300 hours of volunteer participation, the value of which cannot be over emphasized and is not something that could otherwise be easily procured at any cost. This voluntary participation has occurred because industry recognizes the value to economically and efficiently find and produce natural gas and oil, which ultimately benefits American consumers and supports a program of wide ranging methods to increase energy supply.

The companies, universities, and other organizations that receive funds through this Program will provide cost-share contributions of at least 20 percent of total project costs. The involvement of industry partners in all phases of the oil and gas R&D process increases the likelihood that technologies developed by the Program will move into the marketplace.

RPSEA is a new model for public/private partnership that has never existed at this scale in the natural gas and oil industry and resembles the model recommended by the 1999 National Petroleum Council (NPC) study. Using a collaborative approach with industry, academia, and government to advance technology, RPSEA's membership includes E&P corporations, service companies, research organizations, universities, national labs, financial entities, non-governmental organizations, and consumer and civic organizations. This "network of networks" avoids "reinventing the wheel" by utilizing and leveraging the robust individual capabilities of the network components. The model, uniquely developed for the natural gas and oil sector, seeks to replicate the success of other models uniquely developed for other public and private sectors such as the National Aeronautical Space Administration, Defense Advanced Research Projects Agency, and others that employed flexible, innovative, and relevant methods to achieve their objectives by matching capabilities with needs and goals.

B. RPSEA Structure

Key features of RPSEA's organization are illustrated in Figure 1.1. RPSEA is the consortium selected by the Department of Energy (DOE) to administer three programs of Section 999. Information on RPSEA and its members can be found at <http://www.rpsea.org/en/cms/?38> and membership is depicted in Appendix A.

The key features of RPSEA's organization are illustrated below showing the broad process of engagement both internally and externally.

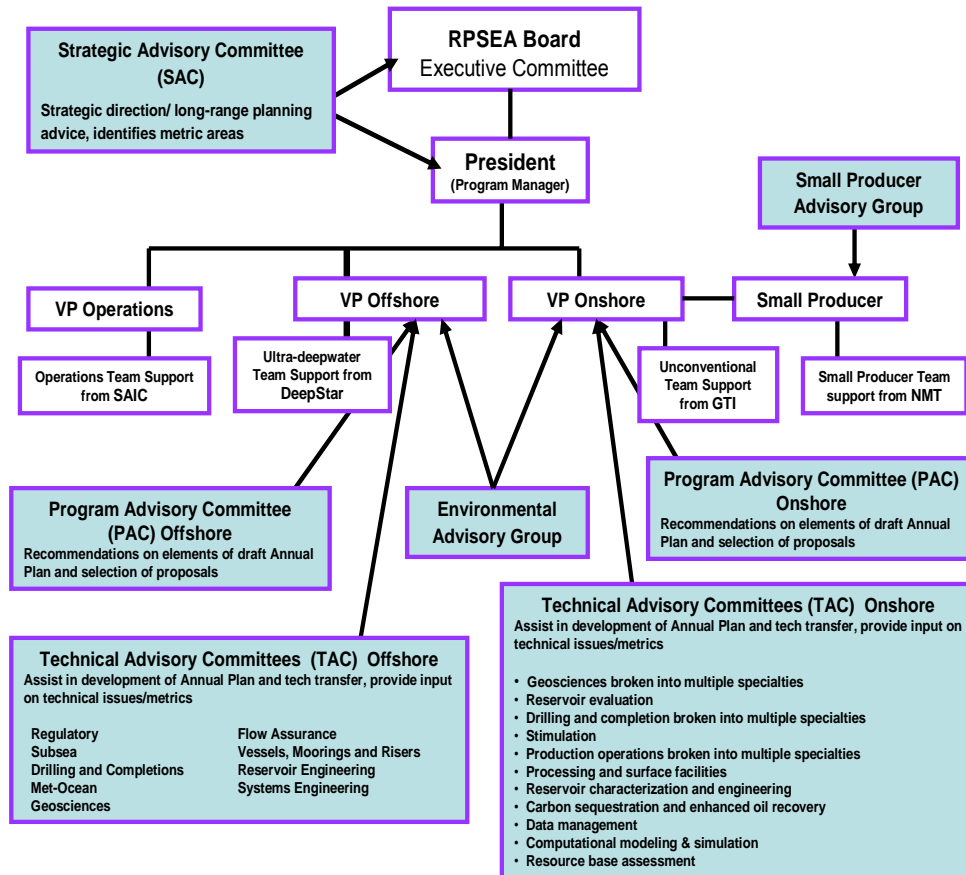


Figure 1.1: Organization of RPSEA and Advisory Committee Relationships

The makeup of the Board of Directors and the external advisory committees and groups are provided in Appendix A, and their respective roles are described below.

Board of Directors (BOD) - In addition to operational oversight, the BOD provides significant input and direction to the preparation of the RPSEA Draft Annual Plan (DAP). RPSEA has a diverse BOD, whose members are each renowned for their expertise and give RPSEA valuable guidance. RPSEA by-laws require a two-thirds super majority vote for approval of the DAP.

Strategic Advisory Committee (SAC) - RPSEA established the SAC to provide strategic direction, advice on the shape of the research portfolio, long-range planning recommendations, and metrics determination to the BOD and to the president. The SAC is comprised of a group of industry leaders in the energy field, including both RPSEA members and non-members. The SAC provides guidance regarding the process used to develop the RPSEA DAP, the proposed R&D portfolio, and the metrics to be used to track progress toward Program goals.

Environmental Advisory Group (EAG) - Environmental stewardship is at the core of all RPSEA activities. The EAG is designed to provide input to the Program regarding environmental issues. It organizes and brings together key experts and policy leaders from academia, regulatory entities, non-governmental organizations, and industry for road mapping exercises to identify key regulatory barriers/issues.

Program Advisory (PAC) and Technical Advisory (TAC) Committees - The roles of the PACs and TACs within each program are further defined in Chapters 4-6, as they are specific to each program. Generally, the PACs provide recommendations on elements of the proposed plan, but primarily make project selection recommendations from the pool of reviewed proposals into an integrated R&D portfolio. The TACs provide subject specific technical advice on the development of the proposed plan and conduct the quantitative proposal reviews at the direction of the PACs.

Small Producers Research Advisory Group (RAG) - The Small Producer Program receives guidance from the RAG consisting of industry and academic representatives that are closely tied to the national small producer community. The RAG reviews proposals, makes project selection recommendations, and follows each selected project's progress, plans, results, and especially, technology transfer. All projects will be reviewed by the RAG annually. While the RAG will be responsible for directing the Small Producer Program, the Unconventional Resources Program PAC will remain responsible for oversight of the entire onshore program, which includes the Small Producer Program.

In addition to the BOD and the advisory committees described above, RPSEA has contracted with four organizations: Chevron, through the Chevron administered DeepStar Consortium (DeepStar), Gas Technology Institute (GTI), Science Applications International Corporation (SAIC), and New Mexico Institute of Mining and Technology (NMT), as part of its management team.

RPSEA's Management Approach

RPSEA's approach to the administration of this critical and innovative Program is intended to provide substantial benefits to American consumers by meeting significant public policy objectives. Key features of this approach include:

- **Broad and deep stakeholder engagement** to accurately identify and expertly execute high-impact research
- **A rigorous technology portfolio management structure** to align programs, projects, technologies, and technology transfer with the high-level strategic objectives of the statute
- **Integration of diverse programs** into a cohesive and coherent program that maximizes programmatic impacts
- **Aggressive, informed, and effective technology transfer** focused on each step of the technology maturation process to ensure maximum technology penetration and diffusion in the marketplace

C. Planning Process

In late 2006, NETL contracted with RPSEA to begin its work with an effective date of January 4, 2007. RPSEA submitted its first DAP to the DOE on April 3, 2007. In November 2007, RPSEA provided recommendations for the 2008 Annual Plan.

Each year, the Annual Plan for RPSEA must be published by the Secretary of Energy (Secretary) before the solicitation of R&D project proposals can begin. Prior to submitting the Annual Plan to the Secretary, the legislation calls for the DOE to gather input on the Annual Plan from Federal Advisory Committees (FACA), as well as from other industry experts. These two committees are the Ultra-Deepwater Advisory Committee (UDAC) and the Unconventional Resources Technology Advisory Committee (URTAC). The DOE's Office of Fossil Energy is responsible for organizing both of these committees. This approach is designed to bring together a broad range of ideas to ensure that the Program returns the maximum benefit to the nation.

Upon publication, the Secretary must transmit the Annual Plan to Congress, along with the recommendations of RPSEA's DAP, the advisory committees, and any other experts from whom comments have been received. Each year's Annual Plan must include details of: ongoing activities; a list of solicitations for awards to carry out research, development, demonstration, or commercial application activities, including topics for such work; that would be eligible to apply; selection criteria; duration of awards; and, a description of the activities expected of RPSEA to fulfill its administrative responsibility.

Timely approval and implementation of each year's Annual Plan is critical to effective results. Achieving these results within the ten-year time specified by Section 999 requires that each year's plan build upon previous years as an integrated and evolving Program. Subsequent year solicitations and project selection are a function of proposals received in a given year, and gaps are identified and addressed as quickly as possible. Groundwork is laid within the research and producer community to assemble the teams to propose. Commitments are made to secure human and capital resources well in advance. Delays in plan approval and/or transmittal, research solicitations, or in project selection and award complicate and discourage participation. Unrelated schedule disruptions significantly impair Program effectiveness and undermine the efforts of all those involved. Committing personnel or budgetary resources and then not utilizing them effectively represents a lost opportunity cost, as it precludes an entity from employing its limited assets somewhere more productively. This is especially true in today's highly constrained workforce environment. It also pertains to universities who seek to recruit, incentivize, and schedule students to participate in projects.

RPSEA has received broad and diverse input from its member organizations, as well as from additional experts. Input was solicited and/or developed from:

- Nineteen RPSEA member forums held in various regions of the country; universities have served as hosts of the majority of the RPSEA member forums. While RPSEA members hosted the forums, participation was not limited to RPSEA members. Member forums included 940 individual participants representing multiple organizations with

interests in technologies to enhance domestic natural gas and oil production. Most of these forums have been oriented to the Unconventional Resources Program and the Small Producer Program. While a few of the forums have been oriented to UDW, the primary inputs for UDW are the TAC meetings. Additional forums and meetings are continually being planned in order to secure input to future plans and R&D solicitations.

- Multiple individual meetings and contacts with individual RPSEA members
- RPSEA’s offshore and onshore PACs and the RAG for general guidance and project selection, the various TACs, and the SAC for high level direction
- Multiple road-mapping exercises conducted by DOE, RPSEA, and others prior to 2007

The process of integrating these inputs is illustrated in the schematic shown in Figure 1.2, which describes detailed steps leading to the development of the DAP. It should be noted that this is an iterative process, both initially and over time, that is not precisely linear. The process itself lends strong transparency to how the DAP is developed, as no one interest can dominate. This holds true for project selection and portfolio development, where the open and robust process with multiple inputs overrides individual biases and provides invaluable credibility. This process is ongoing.

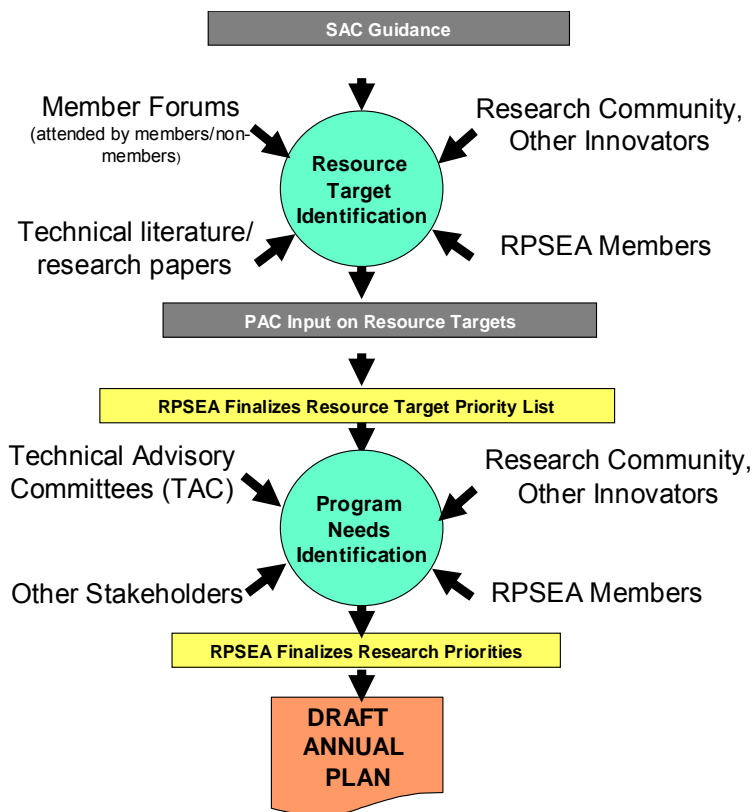


Figure 1.2: RPSEA DAP Development Process

Chapter 2 Strategic Overview

RPSEA Mission, Goals and Objectives

The primary mission of RPSEA with regard to Section 999 of EPLA is to administer a program of “*research, development, demonstration, and commercial application of technologies for ultra-deepwater and unconventional natural gas and other petroleum resource exploration and production, including addressing the technology challenges for small producers, safe operations, and environmental mitigation (including reduction of greenhouse gas emissions and sequestration of carbon).*”

All RPSEA activities contemplated in this DAP are focused on achieving this mission. This third year plan is RPSEA’s continuing effort towards meeting the more specific goal in EPLA of “[*maximizing*] the value of natural gas and other petroleum resources of the United States, by increasing the supply of such resources, through reducing the cost and increasing the efficiency of exploration for and production of such resources, while improving safety and minimizing environmental impacts.”

RPSEA, as the program consortium selected by DOE, is directed by statute to administer a program of research, development, demonstration, and commercialization in two of the nation’s most promising, but technically challenged natural gas and petroleum resource areas:

- Ultra-deepwater integrated system technologies and architectures for water depths in excess of 1,500 meters or drilled depths greater than 15,000 feet in the Outer Continental Shelf (OCS)
- Unconventional natural gas and other petroleum resource E&P technology, with unconventional being defined as economically inaccessible. This resource-based, prioritized research program focuses on converting technically recoverable tight gas sands, coalbed methane, and gas shales resources to economic gas production.

Further, RPSEA is required to specifically address the unique technology challenges of small producers through a consortia approach. This research component is focused on advancing technologies for mature oil and gas fields. Small producers are defined as those with production of less than 1,000 barrels oil equivalent per day (BOEPD).

Proactively embedded in the DAP and cross-cutting all elements of the Program is a focus on the environment, including projects that

The Environment

minimize or mitigate environmental impact or risk, mitigate water usage, reduce the “footprint,” and lower emissions. In addition, all projects in the Program will be evaluated for potential and ongoing environmental impacts as applicable, both positive and negative, to ensure that these impacts are fully understood during project selection and management.

Research Program Development Principles

It is the obligation of RPSEA and the goal of this DAP to appropriately balance the critical research needs of the Program with the capabilities of the research community and, in so doing, meet its responsibility to the American public - developing technologies to enhance domestic energy supplies in environmentally responsible ways.

In the United States, energy demand is growing at the same time the domestic natural gas and oil industry is transitioning from “harder to find and easier to produce conventional reservoirs, to easier to find and harder to produce unconventional reservoirs.” The United States, however, is not resource poor, but rather resource long and technology short. This technology dearth, in turn, places substantial new demand on the nation’s research infrastructure to meet the challenge of developing the portion of the resource base addressed in this DAP.

As recommended in the 1999 NPC Natural Gas Supply study, “*the government should continue investing in research and development through collaborations with industry, state organizations, national laboratories and universities.*” The research collaboration envisioned in this Program is critical; integrating these diverse but capable sectors in the energy research value chain represents one of the largest challenges for the Program, as well as one of its greatest potential rewards.

It is important that a fundamental point be understood prior to discussing other guiding principles for RPSEA’s portfolio development: the Program mission cannot be achieved without a vibrant and diverse technical workforce of scientists and engineers. This necessarily entails a strong organizational commitment to the academic and research community, and a Program structure that specifically enables their unique problem-solving and innovation capabilities. This robust R&D emphasis also supports the nation’s intellectual capital, helping to maintain America’s global technological leadership position, as the universities are the training ground and consequently the source for this skilled workforce.

Workforce

RPSEA also works to educate both the professionals in the oil and gas industry and the general public on the issues surrounding technology development and deployment and the corresponding public benefits. RPSEA:

RPSEA will be instrumental in advocating the advanced technology aspects of the natural gas and oil E&P industries sufficient to attract the best minds in the energy technology industry.

- Works with industry to enhance technology transfer and deployment, demonstrating technology utilization as technologies are developed

- Encourages public appreciation of the natural gas and oil industry as both an innovator and consumer of technology solutions through its communications efforts

It is also critical to acknowledge the importance of collaborative partnership with industry to the success of the mission, and academic research, while absolutely necessary, is clearly not sufficient. Along with other research institutions, industry, as the ultimate end user investing in the application of the technologies developed in this Program, must play a key, and in many instances, the lead role in technology development, particularly as projects move to the development and demonstration phase.

RPSEA’s research portfolio includes projects that focus on near-term and longer-term time scales. It will seek to mitigate research investment risks by building upon early successes and provide stringent mechanisms for interim continuation or termination decisions on individual projects. RPSEA’s portfolio of projects specifically seeks to:

- Create leverage wherever possible on funding, personnel, equipment, operations, and other resources
- Create synergies through integration or investments in cross-cutting and enabling technologies, allowing the whole to be greater than the sum of its parts
- Allow for investment in high risk, high reward activities and ensure that good project management derives maximum learning benefit from failures that are expected from a portfolio with an appropriate risk profile
- Avoid the funding of many disparate small and/or one time projects which generally minimize the potential for high impact results
- Conversely, focus on a relatively fewer number of larger and/or higher potential projects, which create legacy opportunities with appropriate provisions for follow on funding and resources
- Provide for coordination with the complementary program administered by NETL to maximize the federal investment in the Section 999 program
- Identify technologies outside of the natural gas and oil industry that may have application to help achieve the mission of the Program
- In concert with DOE/NETL strongly emphasize technology transfer to effectively disseminate the results of the R&D

Reliable and reasonably priced natural gas and oil supplies will be a critical component of a future energy mix that combines near term use of traditional sources and long term development of alternatives with conservation and energy efficiency. In order to achieve this mix, the Program must balance incremental technology developments with breakthrough technologies, such as grand challenges that will have

Consumer Benefits

fundamental and lasting impact for energy consumers. This necessarily entails multiple perspectives to identify problems, as well as solutions. This DAP must encourage and make provisions for “out of the box” approaches and applications to enable powerful entrepreneurial enterprise and innovation. Further, RPSEA must provide safeguards against “development by committee” and promote a commitment to commercialization, not just technology transfer.

Fostering research that is commercially viable that enables faster-than-average adoption will enhance the industry’s role as both a “high-tech” developer, as well as a consumer, and will help attract the best minds to the energy industry.

These attributes of portfolio construction are graphically depicted below in Figure 2.1. This strategic triangle developed by the SAC conveys Program timeframes against the spectrum of technology development levels from basic to applied. It also depicts a broad foundation of projects in early years migrating to fewer more focused field demonstration projects, which are outgrowths of the early foundation projects. Not all early projects will develop. Finally, grand challenges are superimposed as they can leap frog the conventional development cycle.

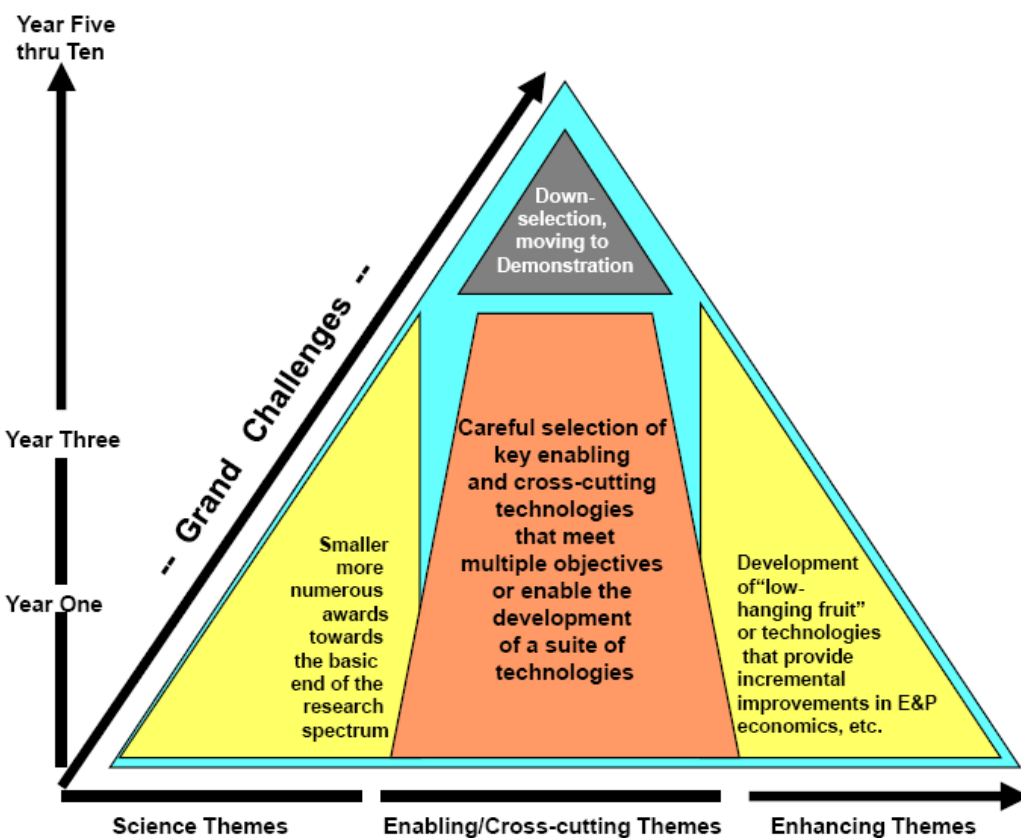


Figure 2.1: SAC Research Portfolio Guidance

Draft Annual Plan Organization

Following the structure of the strategic triangle in Figure 2.1, this third-year DAP builds upon the foundation laid by the 2007 and 2008 DAPs and incorporates lessons learned and evolving technology and resource needs. It seeks to transition the early-term research portfolio into a more specific later-term portfolio. It retains the fundamental components of the year 2007 and 2008 DAPs as follows:

- Four ultra-deepwater field types have evolved to six industry needs
- Three unconventional onshore resource types
- One small producer technology challenge

While RPSEA has established a generic process to identify resource targets, opportunities, barriers, research themes, and thrusts for the research plan, there are process differences across the Program. Figure 2.2 details these variations in industry structure and the ramifications for RPSEA management in the development of the DAP.

	Industry Structure	Research Management Implications
Ultra-Deepwater Program	<ul style="list-style-type: none"> • Relatively small number of industry players • Significant capital requirements • Consistent regulatory environment • Some internal research capability • Very high cost, high risk working environment 	<ul style="list-style-type: none"> • Focus on infrastructure/harsh environmental conditions • Setting priorities with industry input critical to success • Potential to provide significant cash matching funds • Demonstration is very expensive. High value on risk avoidance forces limited number of focus areas • Formal collaborative research model exists
Unconventional Onshore Program	<ul style="list-style-type: none"> • Large number of players, some very small in size • Somewhat limited access to capital • Multiple regulatory jurisdictions • Limited internal research capability • Ability to adopt new technology varies • Technology issues vary considerably with geographic/geologic area 	<ul style="list-style-type: none"> • Focus on production/geology/environmental issues • Need to identify and pursue specific resource targets • Less potential for cash matching funds, but history of in-kind contributions • Formal tech transfer mechanisms exist, but are challenging due to the high diversity of the users • Historical but no current formal collaborative research model • Research programs need to be designed with geographic area and technology user in mind
Small Producer Program	<p>Number of small producers is 7,400 and growing in diverse regions and resources (http://www.eia.doe.gov/emeu/perfpro/independ/pt1ch3.html)</p> <ul style="list-style-type: none"> • Limited access to capital • Multiple regulatory jurisdictions • No internal research capability • Most do not have capability to internalize new technology • Small producers are threatened by technical, environmental, and market challenges 	<ul style="list-style-type: none"> • Focus on geology, environmental, regulatory compliance, cost reduction • Must work with small producers to identify issues that impact small producers across and within regions • Little potential for cash matching funds but history of in-kind contributions • Formal tech transfer mechanisms exist, but are challenging due to the high diversity of the users • Some successful examples of collaborative research exist • Small producers may lack the staff to internalize complicated technology, so tech transfer must involve appropriate service providers

Figure 2.2: Variations by Programs

This DAP has been written by RPSEA in consultation with its BOD. In addition, input has been provided by NETL throughout the process. Each of these three programs is individually outlined in the sections that follow.

Chapter 3 RPSEA Accomplishments

Since the inception of the Program, significant progress has been made by RPSEA towards the overall, high-level goals of the Program. A list of these accomplishments is listed below.

- Commenced a new, fully-functional management structure and developed compliant policies and procedures specifically for administering the Program
- Developed a federally compliant set of policies and procedures for a new revolutionary Program, including management and operating plans
- Held 19 nationwide member technology input forums
- Established a comprehensive advisory committee network
- Developed and received approval for the 2007 Annual Plan
- Developed the 2008 DAP
- Built support among oil and gas research and industry constituencies
- Increased membership within the different oil and gas community stakeholder groups
- Issued research solicitations for the 2007 Program
- Received and reviewed 99 research proposals, plus 120 Ultra-Deepwater project ideas
- Made 43 project selections
- Developed research solicitations for the 2008 Program
- Established a Fellowship/Scholarship Program with private funding of \$255,000 for eight member universities providing much needed support for 16 students per year over three years
- Established a RPSEA summer internship
- Hosted multiple membership meetings
- Participated/exhibited and/or sponsored/supported multiple industry functions
- Launched new content-rich website to support strategic communications, technology transfer, and the solicitation process
- Promoted links to other associations and members and have utilized the RPSEA website as a “network of networks”
- Sponsored the Young Professionals in Energy (YPE) website
- Contributed to the development of the Oil & Gas Innovation Center
- Sponsored an award at the senior level for the Science Engineering Fair of Houston
- Sponsored an award for the best energy business plan at the Rice Alliance competition

In order for RPSEA to effectively meet the overall high level goals of this Program as described in EPAct and ensure that Program funds are used efficiently, RPSEA also set and met several goals which were considered important to the day-to-day operations within the organization.

Diverse Membership

To broadly increase RPSEA membership to include all stakeholder groups in the oil and gas community, RPSEA has made great strides in growing its membership base. Membership has doubled since January 2007, growing from 66 members to the current membership of 132 members. These members represent 28 states, the District of Columbia and the Province of Newfoundland, Canada. As previously stated, these members collectively have more than 500,000 employees worldwide and represent approximately 50 percent of U.S. natural gas and oil production.

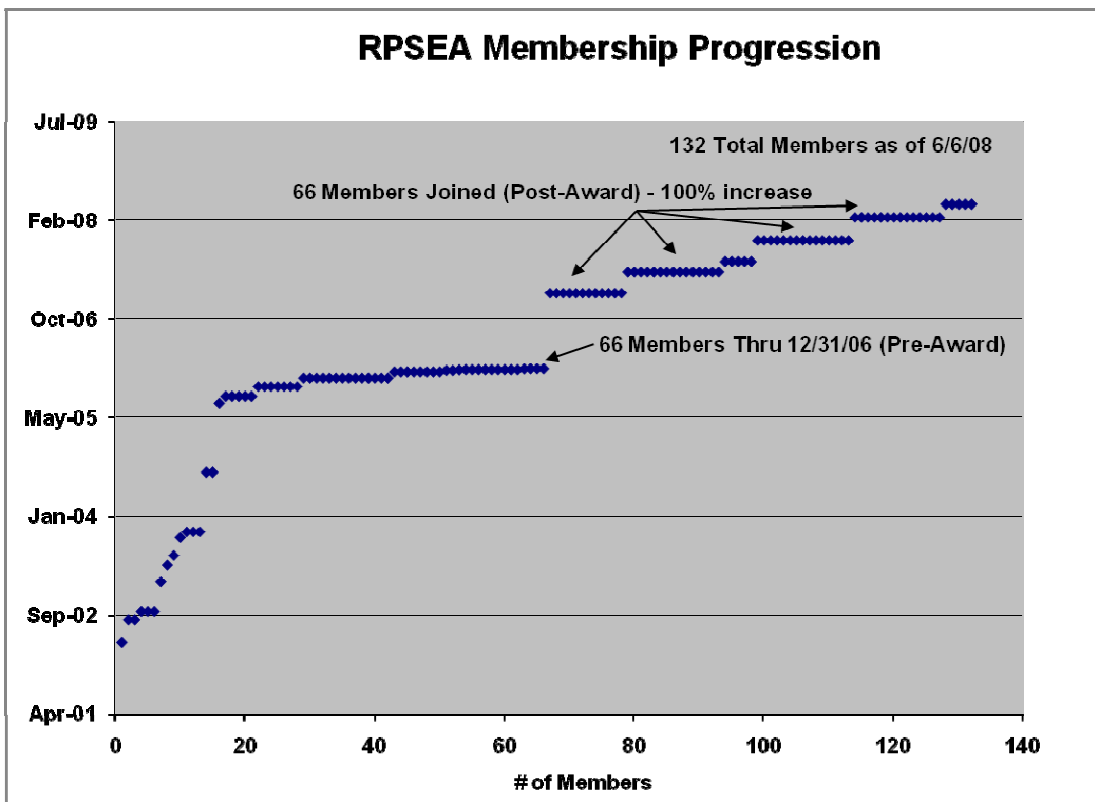


Figure 3.1: RPSEA Membership Progression

The overall RPSEA membership represents the diverse stakeholder communities in the oil and gas industry. The following graphic depicts a percentage breakdown of these communities:

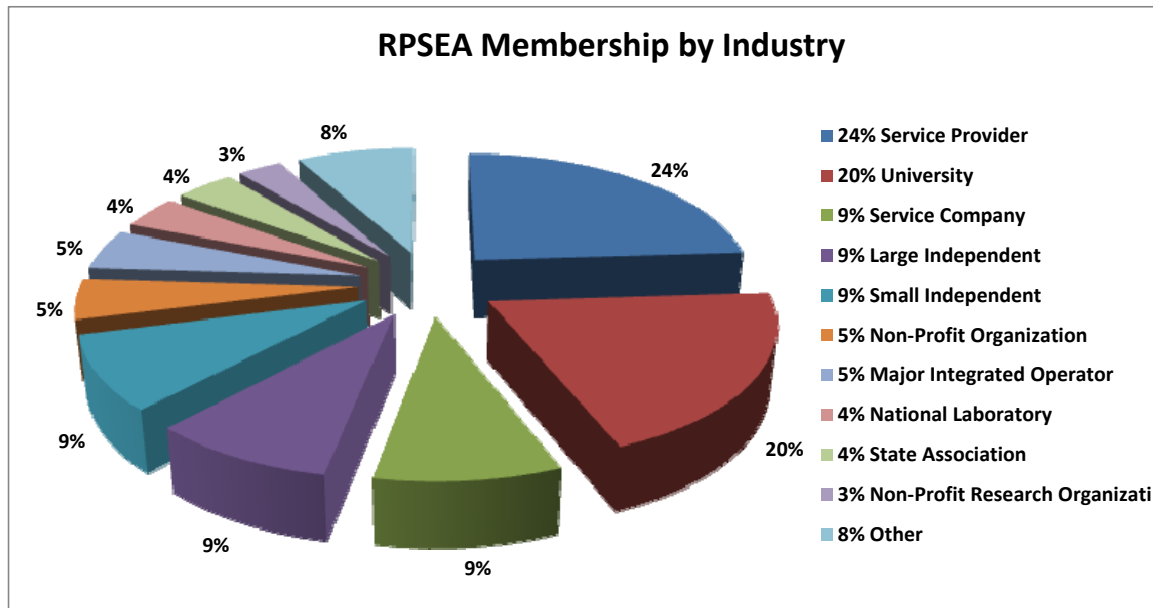


Figure 3.2: RPSEA Membership by Industry

Advisory Structure

From the diverse natural gas and oil constituency, RPSEA developed a comprehensive advisory committee infrastructure that efficiently and effectively provides input and direction to the overall Program goals, including development of high level, program level, and technical level advisory committees, and small producer and environmental advisory groups. These groups have met multiple times to review overall Program goals, project ideas, and review and select projects. The PACs, TACs, and RAG have been the workhorse committees, but in the overall process there have been 40 meetings with 840 participants who have volunteered approximately 3,800 hours of time and effort. As an example, the Ultra-Deepwater Program (UDW) PAC and TACs combined met 29 times with 591 participants involving over 2,800 hours of time and effort to focus the 120-plus project ideas for 2007 and 2008 down to 26 ideas representing approximately \$30 million dollars in R&D funds. Participation on the advisory committees is an opportunity for industry experts to broadly ensure that the most promising technological approaches and solutions are brought to bear on the technical challenges associated with developing domestic resources. These advisory committees/groups are crucial for the successful execution of the Program and to ensure that the Program is aligned with the interest and requirements of industry, so that results will be rapidly applied to impact the nation's energy supply.

Member Forums

RPSEA has broadly reached out to involve the oil and gas community through an outreach program of technology forums, holding 19 forums hosted by member organizations, in which 940 people participated (not including RPSEA, NETL or DOE personnel). This participation amounts to over 9,500 hours of participant commitment and does not include the hours of commitment from the host organization. The host commitment in terms of time, effort, and monetary support was substantial in all cases.

A list of the forums is as follows:

Member Forum	Host
Seismic E&P Forum	University of Houston
Autonomous Intervention for Deepwater O&G Operations Forum	Massachusetts Institute of Technology
Tight Gas Shale Gas & Coalbed Methane Forum	Colorado School of Mines
Problem Identification Forum	University of Southern California
Shale Gas Forum	University of Oklahoma
Produced Water Forum	New Mexico Institute of Mining and Technology
Small Producer Forum	New Mexico Institute of Mining and Technology
Vortex Induced Vibrations Forum	Massachusetts Institute of Technology
Flow Assurance Forum	University of Tulsa
Unconventional Plays & Research Needs for Appalachian Basin Small Producers Forum	West Virginia University
Seafloor Engineering Forum	Texas A&M University
Bakken Shale Forum	North Dakota Energy & Environmental Research Center
Shale Plays Technology and Permian Basin Trends Symposium	Midland College
Fracture in Devonian Black Shale of the Appalachian Basin Workshop	West Virginia University
Alaskan Unconventional Gas Resource Forum	The University of Alaska Fairbanks at the BP Energy Center
CO2 EOR & Carbon Sequestration Forum	The CO2 Conference
Technologies for Mitigation of Environmental Impact of Rocky Mountain Unconventional O&G Operations	Colorado School of Mines
Coalbed & Shale Gas Forum (in conjunction with the International Coalbed & Shale Gas Symposium)	University of Alabama
Low Impact O&G Operations in Environmentally Sensitive Areas Forum	Texas A&M University

One of the unique aspects of the Program is a focusing of the specific challenges and technology needs for resource theme. RPSEA, in conjunction with other organizations or alone with our member institutions, has held these various meetings across the United States where theme based technical experts from universities, service providers, producer/operators, and others within the oil and gas industry can present and discuss technical topics that address specific R&D perspectives. This broad based perspective is important as different oil and gas industry communities have different perspectives and needs requirements. The process allows the meeting participants to prioritize those ideas that they feel should be addressed through the Program. This process will continue to be utilized throughout the life of the Program.

Technology Transfer and Outreach

The RPSEA technology transfer plan, working in conjunction with DOE/NETL, is described in Chapter 9. Successful technology transfer and the uptake of technology within an organization can be enhanced by a familiarity with RPSEA's ongoing process and the projects funded under this Program. To this end, RPSEA seeks to participate or exhibit at multiple industry functions to engage with industry stakeholders and to disseminate information on RPSEA and the Program. RPSEA has participated, exhibited, sponsored, or otherwise supported the following industry functions:

Alabama Coalbed Methane and Shale Gas Conference 2008

Alliance Expo and Annual Meeting 2008

American Association of Petroleum Geologists (AAPG) Annual Convention 2008

American Rock Mechanics Association Workshop 2007

Barnett Shale Produced Water Conference 2007

BOMA Optimizing Mature Assets 2007

Colorado Oil & Gas Conference (COGA) 2007 & 2008

Deep Offshore Technology (DOT) and Demo2000 Conference 2007

Developing Unconventional Gas (DUG) 2007 and 2008

Energy and Environment Subcommittee Meeting 2008

Energy Technology Venture Capital Conference 2007 and 2008

Energy in Transition Houston Technology Center (HTC) 2008

Florida Independent Petroleum Producers Association (FLIPPA) Annual Meeting 2007

Hart's CO2 Conference 2007

Houston Small Business Administration 2007

Independent Oil and Gas Association of New York 2007

Independent Petroleum Association of America (IPAA) Crude Oil Committee Mid-Year Meeting 2007

Independent Petroleum Association of America (IPAA) Offshore Committee 2007
Independent Petroleum Association of Mountain States (IPAMS) Annual meeting 2007
Insight Gas Shales Summit 2008
International Association of Drilling Contractors (IADC)/Drilling Engineering Association (DEA) Forum 2007
International Coalbed & Shale Gas Symposium 2008
INTSOK 2007 and 2008
Interstate Oil and Gas Compact Commission (IOGCC) Mid-Year Conference 2007
Mid-America Regulatory Conference (MARK) 2008
More Bytes & More Barrels - 2008 Digital Energy Conference & Exhibition
North American Prospect Expo (NAPE) 2007 and 2008
Offshore Technology Conference (OTC) 2007 and 2008
Oil & Gas Innovation Center organizational sponsor
Oklahoma Independent Petroleum Association Annual Meeting (OIPA) 2008
Rice Alliance Business Plan Competition 2008
Rice Nanotechnology Venture Forum 2008
Rice University Congressional Field Hearing 2008
Science Engineering Fair of Houston 2008 Society of Exploration Geophysicists Annual Meeting 2007
Society of Petroleum Engineers (SPE) workshop on Life of Field Surveillance for Unconventional Gas 2007
Society of Petroleum Engineers (SPE) Seismic While Drilling Advanced Technology Workshop 2007
Society of Petroleum Engineers (SPE) Annual Technical Conference Exhibition (ATCE) 2007 and 2008
SW Petroleum Show 2008
The Making of Energy Policy: Where Are We Going? Conference 2008
University of Tulsa Energy Management Program 2008
Washington Post Energy Conference 2007
Young Professionals in Energy (YPE) website sponsor
5th Rice Alliance Energy and Clean Technology Venture Forum 2007
7th Annual Gas Shale Summit 2008
57th Annual Convention of the Gulf Coast Association of Geological Societies 2007

In addition to its responsibilities under EPAct, RPSEA has sought to leverage its efforts in ways that also provide broad public benefit, such as the creation of an industry/education partnership by establishing and managing a Fellowship/Scholarship Program. With designated financial resources supplied from RPSEA members Schlumberger and Strata Production, RPSEA has awarded multiple scholarships to date to the following member universities: Colorado School of Mines, Louisiana State University, New Mexico Institute of Mining and Technology, Stanford University, Texas A&M University, The University of Texas at Austin, University of Oklahoma, and West Virginia University.

Chapter 4 Ultra-Deepwater Program

The EAct states the UDW “*shall focus on the development and demonstration of individual exploration and production technologies as well as integrated systems technologies including new architectures for production in ultra-deepwater.*”

Relevant EAct definitions for the UDW include:

- **Deepwater** - a water depth that is greater than 200 meters but less than 1,500 meters
- **Ultra-Deepwater** - a water depth that is equal to or greater than 1,500 meters
- **Ultra-Deepwater architecture** - the integration of technologies for the exploration for, or production of, natural gas or other petroleum resources located at ultra-deepwater depths
- **Ultra-Deepwater technology** - a discrete technology that is specially suited to address one or more challenges associated with the exploration for, or production of, natural gas or other petroleum resources located at ultra-deepwater depths

A. Mission

The mission of the UDW is to identify and develop economically viable (full-life cycle), acceptable risk technologies, architectures, and methods to explore for, drill for, and produce hydrocarbons from ultra-deepwater and formations in the OCS deeper than 15,000 feet.

This mission of technology development encompasses (not in order of priority):

- Extending basic scientific understanding of the various processes and phenomena directly impacting the design and reliable operation of a ultra-deepwater production system
- Developing “enabling” technologies
- Enhancing existing technologies to help lower overall cost and risks
- Pursuing new technologies which, if successfully developed, are capable of “leapfrogging” over conventional pathways
- Accomplishing ultra-deepwater resource development in an environmentally responsible manner

B. Goals

The goals of the UDW are to exploit the ultra-deepwater resource base and to convert currently identified (discovered) resources into economic recoverable (proven) reserves, while protecting the environment, thereby providing the U.S. consumer with secure and affordable petroleum supplies. These goals will be achieved by:

6. Increasing the production of ultra-deepwater oil and gas resources
7. Reducing the costs to find, develop, and produce such resources

8. Increasing the efficiency of exploitation of such resources
9. Increasing production efficiency and ultimate recovery of such resources
10. Improving safety and environmental performance, by minimizing environmental impacts associated with ultra-deepwater E&P

The significant importance of these goals is illustrated by Figure 4.1, which shows the difficulty the oil and gas industry has had since 2002 converting discovered resources into proven reserves (producing developments). Proven reserves add value to royalty revenues, consumers, and the oil and gas industry. Identified non-producing resources do not contribute to the supply base or generate royalties.

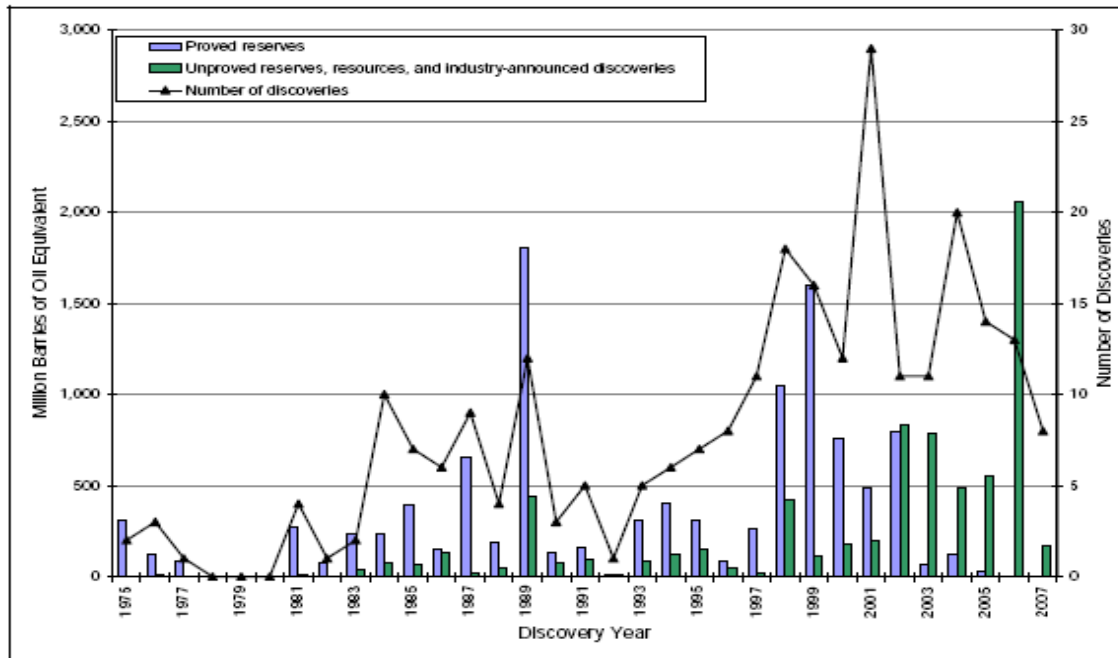


Figure 4.1: Proven Reserves Add Value

Latest Minerals Management Service (MMS) report (May, 2008) shows an increasing lag between discovery and production in deepwater Gulf of Mexico – demonstrating the need to focus on development related technology development

C. Objectives

To meet the goals of converting the ultra-deepwater resource base to economically recoverable reserves, new planning and analytical models must be built, new equipment must be designed and manufactured, and the equipment must then be demonstrated to be dependable and reliable, and ultimately manufactured and deployed in commercial quantities. This will be achieved by meeting the following near-term and longer-term objectives.

Near Term

Objective 1: Ongoing Identification of Technology Needs – Capitalize on the 2006

DeepStar Systems Engineering Study and Roadmap, which identified the specific technology gaps that hinder ultra-deepwater development. These gaps have been and will continue to be periodically revisited throughout the Program duration utilizing UDW TAC input and through UDW workshops. Identified gaps will be utilized to develop UDW theme areas and frame UDW solicitations during the first three years of the Program.

Objective 2: Ultra-Deepwater Technology Development – The early years of the UDW will form the base of the technology development triangle (Figure 2.1). Subsequent years will fund additional technical development, demonstration, and potential commercialization of promising technologies. During the first three years, the program will design and administer multiple rounds of solicitations for R&D contracts designed to meet the stated goals and needs of the UDW. The UDW will successfully administer a selection process resulting in a portfolio of R&D contracts that will best achieve this goal. Given the limited amount of funding, projects will be selected that are deemed likely to result in significant increases in value through cost reduction, efficiency improvement, and effectiveness.

Objective 3: Program Awareness and Cost-Share Development – The UDW will network with academia, industry, and other key stakeholders to increase its awareness, promote involvement, and identify cost-share funding for development of new technologies.

Longer Term

Objective 4: Ultra-Deepwater Technology Development and Deployment – Through assessment of R&D results and additional solicitations (as needed), the UDW will continue the development and maturation of the most promising technologies identified during the first three years of solicitations. It will maintain a strong focus on demonstration and industry deployment and will terminate weaker projects and focus budget and efforts on those technologies that carry the greatest potential for meeting the UDW goal.

Objective 5: Environmental and Safety Technology Development and Deployment –The UDW will assess the environmental and safety impact of UDW funded projects. This effort may take the form of individual solicitations or elements of more extensive project-based solicitations.

Objective 6: Technology Demonstration – The UDW will work with industry, appropriate regulatory agencies, and other key stakeholders to provide seed-level funding and other incentives for demonstration and validation of newly developed technologies.

Objective 7: Technology Commercialization and Industry Deployment – The UDW will work with industry, appropriate regulatory agencies, and other key stakeholders to provide seed-level funding and other incentives to ensure commercialization and industry deployment of emerging technologies.

D. Implementation Plan

DeepStar and Advisory Committee Roles in the UDW

The UDW is managed by Chevron, through a sub-contract with RPSEA, utilizing the Chevron administered DeepStar consortium. DeepStar, with eight deepwater operating companies and 52 contributing member companies, is the world's largest ultra-deepwater stakeholder group and has an 18-year history of managing collaborative research. Through this arrangement, the UDW will have access to 700+ technical and management committee volunteers, as well as a successful process for technology research, development, and commercialization. In addition to providing high-level input from oil and gas operating companies that are ultimately responsible for the production of deepwater energy resources, this highly developed process formally facilitates the direct input of universities, regulatory bodies, service companies, and other key stakeholder groups. This process of broad engagement through expansive and inclusive advisory committees provides the UDW with significant pro bono expertise, as well as potentially significant cost share funds to further accelerate the development of ultra-deepwater technologies.

The UDW utilizes a PAC and nine TACs in an advisory role. The UDW PAC provides high-level input on program priorities, field areas of interest, and technology dissemination, as well as a link to the producer and research communities, but its primary role is project selection. PAC engagement in the process is critical as these operators will be the organizations called upon to actually deploy and operate the new technologies developed under the program.

Supporting the PAC are nine TACs, each of which is focused on a particular ultra-deepwater technology area (see Table 4.1). The role of the TACs, with representation from subject matter experts who study and apply ultra-deepwater technologies in real field situations, is to identify current technology gaps and define the specific R&D efforts needed to address these gaps. As such, the TACs provide a bottom-up, end-user-driven program.

Drilling & Completion	Environmental, Safety & Regulatory	Floating Facilities
Flow Assurance	Geoscience	Met-ocean
Reservoir	Subsea Facilities	System Engineering & Architecture

Table 4.1: UDW TACs

Identification of Focus Areas for New Technology Development

In developing the UDW focus areas for solicitation, DeepStar provided a systems engineering study based on industry ultra-deepwater experience and needs. Four base case field development scenarios were identified as representative of future Gulf of Mexico (GOM) ultra-deepwater

developments with technical barriers, which challenge development. These scenarios are drawn from four key areas of activity in the deepwater GOM (Walker Ridge, Keathley Canyon, Alaminos Canyon, and the Eastern Gulf) and the associated technology challenges (Figure 4.2). Four generic fields were created (Canopy, Gumout, Coyote, and Diablo) based upon the areas of current activity. Each of the generic fields is characterized by unique design features currently hindering technical and economic development (Table 4.2). The field development scenarios have been matured into design bases and are being used as input for the UDW solicitations. The systems engineering study will be revisited periodically over the duration of the UDW to ensure relevance with ongoing industry exploration and development activities.

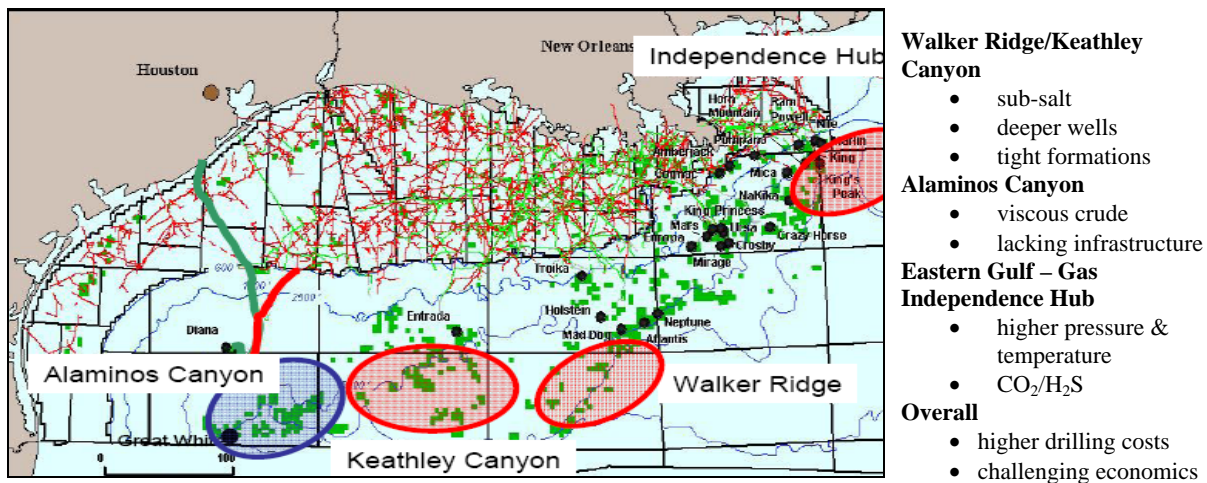


Figure 4.2: Technical Challenges for Identified Basins

Field Type	Technology Challenge	Development Options
Canopy Field	Low Permeability Reservoir	Semi with Wet Trees
		FPSO with Wet Trees
		FPSO EPS
Gumout Field	High Viscosity Oil	Produce to Beach
		Dry Tree Structure
Coyote Field	Small Reserve Fields	Satellite Tieback to Host
		Satellite Tieback to Host
Diablo Field	XHPHT (22.5 ksi x 350+°F)	Semi w/ Gas Sweetening
		Dry Tree Structure
		Produce to Beach thru Sour Gas Pipeline

Table 4.2: UDW Base Case Scenarios

E. 2007 and 2008 UDW Status

2007 and 2008 UDW Prioritization Methodology

The nine TACs provided systems engineering study input by reviewing the four base case scenarios and identifying the highest priority technology gaps required to bridge technology challenges and remove barriers to development. A number of the gaps identified are either multi-disciplinary or cut across several TAC discipline areas.

The UDW TACs further refined the gaps into specific project ideas which address one or multiple gaps. The process included the development of more than 120 project ideas, which were proposed by the TACs themselves or by any interested/knowledgeable entity involved in the process. All project ideas were compiled and reviewed by each TAC, which then refined and combined similar ideas, refined the scope of work, identified deliverables, and estimated the schedule and costs. Each TAC ranked the resulting respective list of project ideas and submitted the highest ranking project ideas to the PAC. The PAC evaluated and prioritized the projects from all TACs. The PAC prioritization was based upon projected project impact, available budget, and alignment with overall program goals. The prioritization process used by the PAC called for each of the 11 UDW operating companies in the PAC to select project ideas, which would do the most to bridge technology gaps of particular relevance to their operations and meet the goals of the UDW. Only those project ideas receiving a majority vote (6 of 11 companies) were considered. Figure 4.3 shows a schematic representation of the 2007/2008 UDW prioritization process. This effort entailed 29 meetings of the UDW TACs, with 591 participants representing over 2,800 hours of voluntary time and effort to focus the 120-plus project ideas to 26 high quality ideas needing approximately \$30 million in R&D funds. Few government or industry cooperative development programs have utilized such a comprehensive process of input and review to effectively vet its results.

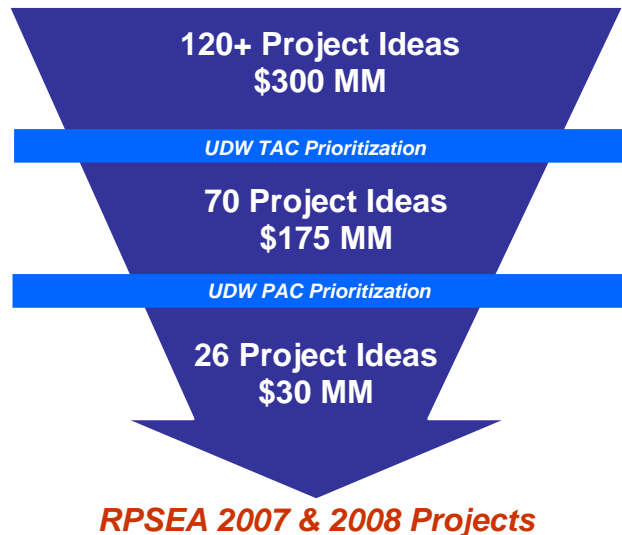


Figure 4.3: UDW Prioritization

2007 and 2008 Project Summary and Status

Selected projects can be categorized as addressing one of six major development and operation needs currently pursued by the worldwide ultra-deepwater community. In the 2008 Annual Plan, four industry needs were defined. These four needs have evolved into the six listed below based on UDW PAC, TACs, and UDAC feedback. These needs will continuously evolve over the Program duration to ensure continued relevance. Additional information can be found at the website www.rpsea.org regarding UDW abstracts, meeting minutes, request for proposal (RFPs), etc. Addressing each of these needs will enhance the commerciality and, in many cases, enable development of UDW base case fields shown in Table 4.2. These high-level industry needs are:

1. Drilling, Completion, and Intervention Breakthroughs
2. Appraisal and Development Geoscience and Reservoir Engineering
3. Significantly Extend Subsea Tieback Distances/Surface Host Elimination
4. Dry Trees/Direct Well Intervention and Risers in 10,000 Feet Water Depth
5. Continuous Improvement/Optimization of Field Development
6. Associated Safety and Environmental Concerns

All 2007 UDW projects have been selected and are in the process of being awarded, and the technical content for 2008 projects has been determined. Selected projects address key initiatives, which are expected to continue through the duration of the UDW. Each 2007 selected project and planned 2008 project is described below in the context of how it fits into the initiative and UDW need. Table 4.3 describes the 2007 projects and anticipated awards. Figure 4.4 shows the geographic distribution of 2007 anticipated awards.

Many of the UDW projects will require additional phases of work funded by subsequent years of the Program to further mature the technologies and pursue eventual demonstration.

Need 1: Drilling, Completion, and Intervention Breakthroughs

Benefit: Drilling, completion, and intervention costs now represent 50 to 70 percent of the total capital expenditures on UDW projects. With ultra-deepwater drilling rig day rates approaching \$1 million, significant cost reduction is required for UDW project viability.

Initiative 1: Drilling and Completions

Target: Reduce ultra-deepwater drilling and completions costs by 30 percent

DW1501 (2007): Extreme Reach Development

This project will conceptualize the tools and service capabilities required to safely drill, complete, produce, maintain, and abandon reservoirs located up to 20 miles away from the surface facilities and well access point.

DW2501 (2008): Early Reservoir Appraisal Utilizing a Low Cost Well Testing System

This project will evaluate cost-effective systems for testing deepwater reservoirs without the need of high-cost mobile offshore drilling units (MODUs) and related test equipment. The work includes: (1) evaluation of the various GOM deepwater reservoirs to identify what facility capabilities are required to achieve a successful test and (2) to evaluate alternative deepwater well testing system configurations and insure they adequately handle the range of reservoir conditions defined in (1), optimize the hardware and equipment configurations, identify their technology readiness levels and technical gaps, and define their well test economics to show such test programs are cost effective and justified.

DW2502 (2008): Modeling and Simulation of Managed Pressure Drilling (MPD)

This project will expand existing capabilities for analysis and simulation of MPD ultra-deepwater well design and operations. The objective is to create an integrated capability for the modeling of fluid circulation in MPD wells, including the effects of multiple flow paths, formation influx, lost returns, pressure and temperature effects, multi-phase flow, and transient effects.

Initiative 2: Intervention (Downhole Services)

Target: Enable ultra-deepwater subsea well intervention, utilizing low cost surface vessels or via subsea intervention equipment. Intervention is directly correlated to ultimate recovery factors. Cost reductions and/or efficiency improvements in well intervention will serve to increase overall hydrocarbon recovery.

DW2301 (2008): Deepwater Riserless Light Well Intervention

This project will develop a certified ready-to-fabricate riserless intervention system design for 10 ksi wireline and electric line service in up to 10,000 feet water depths.

DW1502 (2008): Coil Tubing Drilling and Intervention System Using Cost Effective Vessels

This project will establish the conceptual design, operational performance, and system feasibility for an ultra-deepwater coiled tubing subsea well intervention system. This project will also contribute to the goals of the drilling and completions initiative above.

Need 2: Appraisal and Development Geoscience and Reservoir Engineering

Benefit: The ultra-deepwater part of the GOM poses many geological and geophysical challenges to the exploitation of hydrocarbons. Many of these challenges are related to a combination of the ultra-deepwater environment and the presence of a regionally extensive, thick salt canopy which overlies the prospective subsalt section. The combination of a thick water column and thick salt layer pose a formidable challenge for acquiring data and accessing resources. The environmental conditions and costs associated with the ultra-deepwater setting and deep reservoirs also impact the type and amount of data that can be gathered to increase

reservoir understanding and reduce uncertainty. High drilling costs result in expensive exploration wells, sparse appraisal wells, limited sampling/production testing, and development decisions based on very limited data.

Initiative 1: Exploitation and Appraisal

Target: Delineation of the reservoir including fluid and rock properties, commerciality, internal architecture and continuity, and drive mechanism for full field development planning without additional drilling and additional time for reservoir characterization.

DW2001 (2007): Synthetic Benchmark Models of Complex Salt

This geophysical imaging technology project will generate realistic benchmark geological models, associated synthetic seismic and potential field data. Such information will allow industry to effectively and efficiently assess seismic (and other) acquisition and processing techniques to generate hydrocarbon reservoir images beneath massive, complex salt bodies.

DW2701 (2008): Resources to Reserves; Development and Acceleration Through Appraisal

Reservoir appraisal is required to provide information to reduce the range of uncertainty and, therefore, reduce the risk of the subsequent development phase. Currently, appraisal is mostly comprised of seismic interpretation and data from drilling wells. The vast majority of this data is static data and does not help define reservoir continuity. The high cost of drilling in deepwater limits the amount of data from wells to no more than a handful. The extreme costs and regulatory/environmental concerns all but eliminate early production testing for dynamic data on reservoir continuity. Therefore, operators are forced to make decisions on developments with ranges in in-place hydrocarbons of 3-4 fold without understanding reservoir continuity. The result is a potential loss of resources in undeveloped deepwater and ultra-deepwater discoveries. Phase 1 of this multi-phase project focuses on the technical gap assessment and concepts identification to help accelerate reserve development through more effective appraisal.

Initiative 2: Field Development

Target: Build and implement field and reservoir development plans that are flexible enough to meet changing physical conditions and achieve commerciality.

DW1701 (2007): Improved Recovery

Deepwater subsea wells have ultimate recovery factors lower than conventional platform dry tree wells. In addition recovery factors in the GOM are less than optimal. The oil remaining in these fields is significant and provides the incentive for the development of processes and methodologies to unlock these additional residual barrels. The purpose of this RFP is identification of improved recovery opportunities in the early stages of field development planning, such that the facility and well designs can be optimized to take advantage of those opportunities.

Need 3: Significantly Extend Subsea Tieback Distances/Surface Host Elimination

Benefit: Frequently, many reserves reside in a collection of small fields. Such small fields do not justify commercial development. However, such small fields provide excellent production opportunities for major facilities once they come off of peak production. Extending the reach of subsea tiebacks will enable existing production facilities to effectively and commercially produce these smaller fields over a larger geographical area.

As the offset between the well and the surface facility grows, it will become possible to produce larger unitized reserves (one large or several smaller fields) over long distances directly to onshore (beach) facilities eliminating the need for offshore production stabilization, their related surface facilities, and impact.

Initiative 1: Stabilized Flow

Target: Developing sufficient understanding of flow assurance concerns, including wax, asphaltenes, and hydrates, will enable subsea production that will eliminate expensive flow assurance risk mitigation measures currently employed to prevent blockages. Elimination of these mitigation measures, including insulation, pigging, chemical injection, etc., will significantly reduce project capital expenditures, operational expenditures, development times, increase ultimate recovery, and decrease production downtime.

DW1201 (2007): Wax Control

This project will evaluate current and new flow assurance technologies to develop options for flowline cold, stable flow without pipe insulation.

DW1202 (2008): Equation of State Improvement for Extreme High Pressure and High Temperature Conditions (xHPHT)

Current Equations of State (EOS) are known to give poor predictions for some deepwater reservoir fluids and conditions where pressures can exceed 20,000 psi, temperatures exceed 350°F, and the fluids are complex. This project will generate lab data at xHPHT conditions to validate, and if necessary, develop a new EOS to better predict pressure, volume, and temperature (PVT) information and transport properties.

DW2201 (2008): Viscous Oil PVT

Heavy viscous oils present new PVT relationships and technical challenges for deepwater conditions. This project will further our understanding of the fluid system's physical properties. It will develop new laboratory procedures to characterize such fluids and will validate the predictive models for such fluids.

Initiative 2: Subsea Power

Target: Encourage development of safe, cost effective, reliable electrical power delivery to subsea equipment. Significant power will be required for pumps and compressors used to pump production products through the export pipelines in ultra-deepwater. Such pressure boosting will aid in maximizing recovery of reserves from these reservoirs.

DW1902 (2007): Deep Sea Hybrid Power System

This project evaluates alternative methods for locally generating significant electrical power on the seafloor near large consumption points.

DW1302 (2007): Ultra-High Conductivity Umbilicals

This project will deliver an engineering prototype of a working ultra-high conductivity wire (conductor) utilizing nanotube technology and perform a sufficient suite of tests and analysis from both a technical and a commercial perspective to determine and qualify the strengths, weaknesses, and opportunities of further maturing the technology.

DW2901 (2008): Reliable Deepwater Power Distribution and Components

This project will leverage existing industry experience to improve subsea electrical power system reliability at a reduced cost. The project will first establish baseline power system designs and requirements. Analysis and trade-offs will be performed to optimize and improve over-all system reliability through identification of components which would benefit from redesign and component improvements.

Initiative 3: Subsea Processing

Target: Encourage deployment of subsea processing through development of technologies, which will reduce the deployment risk in the GOM. Subsea processing holds the possibility of significantly reducing overall facility cost, reducing topsides requirements, improving overall ultimate recovery, and minimizing surface impact.

DW1301 (2007): Subsea Metering

This project's objective is to address gaps in the deployment and use of multiphase and wet gas meter technology in deepwater production systems. Specifically, the project will develop and standardize deepwater well fluid sampling, develop the means to deploy clamp-on measurement systems to deepwater wells via ROV, understand the ways in which production alteration of meters affects their response and measurement, develop and qualify meter sensors for high pressure/high temperature (HP/HT) environments, evaluate the effectiveness of wellbore flow models, such as virtual flow meters, and develop uncertainty models for the complete multi-well production system from subsea meter to topside.

DW1901 (2007): Subsea Processing System Integration Engineering

This project will develop a process simulator for a subsea production system. The work includes: developing physical and chemical models of multiphase fluid behavior; developing a dynamic and static integrated separation simulator; developing methodologies to evaluate the operating envelope of process systems; and, starting a simulator validation program through a testing program.

Need 4: Dry Trees/Direct Well Intervention and Risers in 10,000 Feet Water Depth

Benefit: Some reservoirs are complex and will require frequent well intervention to effectively produce the reservoir's reserves. Currently, the most cost effective near-term well intervention technology is via dry tree systems. The deepest dry tree system is currently installed in 5,610 feet of water. Extending the water depth capability of dry tree risers to 8,000 foot to 10,000 foot water depths will be required to effectively develop many discoveries in the GOM.

Initiative 1: Dry Trees/Direct Well Intervention and Risers

Target: Enable dry trees/direct well intervention and risers in 10,000 feet water depths especially for xHPHT conditions.

DW1401 (2007): Carbon Fiber Wrapped High Pressure Drilling and Production Riser Qualification Program

Develop and qualify 14" to 19" ID composite reinforced metal tubulars for 15 ksi working pressure riser service in 10,000 feet water depth. This project will also contribute to the goals in the drilling and completions area.

DW 1402 (2007): Ultra-Deepwater Dry Tree System for Drilling and Production

Develop the feasibility design of a (low motion) semisubmersible qualified to support dry tree risers in the GOM which can be integrated with its topside quayside. This includes critical equipment specification and identification of any technology gaps. This project will also contribute to the goals in the drilling and completions area.

DW 1403 (2007): Fatigue Performance of High Strength Riser Materials

This testing and material qualification program will collect fatigue performance data for high strength materials sufficient that engineers may reliably use this data for critical service deepwater riser design. This project starts a rigorous materials testing program that will also contribute to the goals in the drilling and completions area.

Need 5: Continuous Improvement/Optimize Field Development

Benefit: This need area addresses two needs: improving existing operations and long term research and development. Ultra-deepwater fields installed just three years ago are now mature and experiencing reliability issues. Significant opportunity exists to address these reliability concerns and ensure hydrocarbons continue producing for the benefit of the American consumer. Long term research and development is necessary to ensure focus on the oil field of the future and the human capital which will keep future fields producing oil and gas.

Initiative 1: Improve Operating and Inspection Processes

Target: Improve the reliability and cost effectiveness for verifying the production system is qualified and ready for the next period of operations.

DW 2101 (2008): New Safety Barrier Testing Methods

This project will investigate alternative (subsea) methods for assessing the capability of a safety barrier (valve or possibly a blowout preventer) to hold pressure with only a

minimum (acceptable) leakage rate in the closed position. The most viable verification method(s) will be investigated in greater detail to develop a repeatable and reliable safety barrier, alternative, qualification test (if feasible).

Initiative 2: Graduate Student and Long Term Research and Development

Target: Provide practical project opportunities for graduate students to promote careers in the offshore oil and gas industry. Identify potentially viable novel technologies that might offer game-changing solutions for deepwater oil and gas. Provide seed money to the providers of these technologies for a period of approximately two years.

DW1603 - A (2007): Graduate Student Design Project - Design of Extreme High Pressure and High Temperature Subsurface Safety Valve

This project will also contribute to goals of the drilling and completions initiative.

DW1603 - B (2007): Graduate Student Design Project - Robotic MFL Sensor for Monitoring and Inspection of Deepwater Risers

This project will also contribute to the goals of the dry trees/direct well intervention and risers in 10,000 feet water depth initiative. If this project matures, then a follow-on project may occur in Need 5, Initiative 1 – for improved field inspection methods.

DW1603 - C (2007): Graduate Student Design Project - Hydrate Plug Characterization and Dissociation Strategies

This project will also contribute to the goals of the stabilized flow initiative.

DW1603 - D (2007): Graduate Student Design Project - Flow Phenomena in Jumpers

This project will also contribute to the goals of the stabilized flow initiative.

DW2601 (2008): Longer Term Research and Development

Identify potentially viable novel technologies that might offer game-changing solutions for deepwater oil and gas. Provide seed money to the providers of these technologies for a period of approximately one year. Provide longer-term funding to 1-2 technologies that show the best promise.

Need 6: Associated Safety and Environmental Concerns

Benefit: While the benefits in this area are challenging to quantify, there is good value in appropriate regulatory agencies, academia, industry, non-governmental organizations, and other key stakeholders working together to identify strategies to assess the impact of new technologies on deepwater development and subsequent operations.

DW1801 (2007): Effect of Global Warming on Hurricane Activity

The primary objective of this study is to assess the threat that global warming will substantially increase GOM hurricane activity (intensity and/or frequency). This assessment is to be based on simulations using a high resolution climate model capable of generating hurricanes without data assimilation. The subcontractor will make the

necessary model simulations and will also be responsible for analyzing the results. At the end of this study, the subcontractor will provide an estimate of how much the hurricane intensity and frequency is likely to change in the GOM over approximately the next 50 years. It is understood that many of the tools involved in such a study are immature and large gaps remain in the knowledge of critical processes. Nevertheless, the offshore industry is faced with major decisions concerning offshore structure design that must be made in the near term, and these need to be based on the best available science at this time.

DW2801 (2008): Gulf Three Dimensional Operational Current Model Pilot

The overarching goal of this pilot is to improve the ability of numerical models to forecast the loop current and its associated eddies. The vision of success at the end of the pilot is that there will be a well-validated operational model (or perhaps ensembles from multiple models) in place that produces timely, accurate forecasts, which are summarized by web-based products that provide substantial benefits to many well understood users.

PROJECT	AWARDEE	DURATION/ RPSEA FUNDING	DESCRIPTION	PARTICIPANTS
DW1201: Wax Control	University of Utah	24 months \$400,000	Evaluate current and new flow assurance technologies to develop options for flowline cold stable flow without pipe insulation	SINTEF Petroleum Research, BP, StatoilHydro, University of Tulsa
DW1301: Improvements to Deepwater Subsea Measurements	Letton-Hall Group	24 months \$3,654,000	Address gaps in the deployment and use of multiphase and we gas meter technology in deepwater production systems.	Chevron, Shell, Total, ConocoPhillips, BHP, StatoilHydro, Petrobras, Oceaneering, Multiphase Systems Integration Welker Engineering, Lake Charles Instruments/Neftemer Asept, Intertek, BP, Southwest Research Institute, ENI, Anadarko, Devon, Schlumberger, Weatherford
DW1302: Ultra-High Conductivity Umbilicals	Technip	12 months \$448,000	Engineering prototype of a working ultra-high conductivity 'wire' (conductor) utilizing nanotube technology and test and analytical data	Rice University, Duco, NanoRidge Materials
DW1401: Carbon Fiber Wrapped High Pressure Drilling and Production Riser Qualification Program	Lincoln Composites	24 months \$400,000	Develop and qualify composite reinforced metal tubulars for 15 ksi WP riser service in 10,000 fsw	Stress Engineering
DW1402A: Ultra-Deepwater Dry Tree System for Drilling and Production	Houston Offshore Engineering	Stage 1 3 months \$106,000 (Optional additional stages)	Feasibility design of a (low motion) semisubmersible qualified to support dry tree risers in the GOM which can be integrated with its topside quayside	Keppel Fels, Kiewit Offshore Services

PROJECT	AWARDEE	DURATION/ RPSEA FUNDING	DESCRIPTION	PARTICIPANTS
DW1402B: Ultra-Deepwater Dry Tree System for Drilling and Production	Floatech	Stage1 3 months \$234,000 (Optional additional stages)	Feasibility design of a (low motion) semisubmersible qualified to support dry tree risers in the GOM which can be integrated with its topside quayside	Seadrill Americas, Inc., GE/VetcoGray, 2H Offshore
DW1403: Fatigue Performance of High Strength Riser Materials	Southwest Research Institute	18 months \$800,000	Testing and material qualification program will collect fatigue performance data for high strength materials for riser design	
DW1501: Extreme Reach Development	Tejas	9 months \$200,000	Study, conceptualize tools and service capabilities required to safely drill, complete, produce, maintain, and abandon reservoirs located up to 20 miles away from the surface facilities	Total, Chevron
DW1603-A: Graduate Student Design Project. Design of Extreme High Pressure and High Temperature Subsurface Safety Valve	Rice University	24 months \$150,000	Project will contribute to goals of the drilling and completions initiative	
DW1603-B: Graduate Student Design Project. Robotic MFL Sensor for Monitoring and Inspection of Deepwater Risers	Rice University	24 months \$150,000	Project will contribute to the goals of the dry trees/direct well intervention and risers in 10,000' water depth	itRobotics
DW1603-C: Graduate Student Design Project. Hydrate Plug Characterization and Dissociation Strategies	Tulsa University	24 months \$150,000	Project will contribute to the goals of the stabilized flow initiative	BP
DW1603-D: Graduate Student Design Project. Flow Phenomena in Jumpers	Tulsa University	24 months \$150,000	Project will contribute to the goals of the stabilized flow initiative	Chevron
DW1701: Improved Recovery	Knowledge Reservoir	18 months \$1,600,000	Identification of improved recovery opportunities in the early stages of field development planning	Anadarko
DW1801: Effect of Global Warming on Hurricane Activity	National Center for Atmospheric Research (UCAR)	12 months \$560,000	Study to assess the threat that global on Gulf of Mexico hurricane activity (intensity and/or frequency)	Georgia Institute of Technology
DW1901: Subsea Processing System Integration Engineering	GE Global Research	12 months \$1,200,000	Process simulator for a subsea production system	GE/VetcoGray
DW1902: Deep Sea Hybrid Power System	Houston Advanced Research Center	12 months \$480,000	Evaluate alternative methods for locally generating significant electrical power on the seafloor near large consumption points	Lawrence Livermore National Laboratory, Naval Facilities Engineering Service Center, Yardney Lithion, GE, Shell, Chevron
DW2001: Synthetic Benchmark Models of Complex Salt	SEAM	24 months \$2,000,000	Project will generate realistic benchmark geological models, associated synthetic seismic and potential field data	3DGeo Development, Anadarko, BHP Billiton, CGGV Veritas, Chevron, Conoco Phillips, Devon, EMGS ASA, EnI, Exxon Mobil, Geotrace Technologies, Hess Corporation, ION, Landmark Graphics, Maersk Oil, Marathon Oil, Petrobras, PGS Americas, Repsol Services, Rock Solid Images, StatoilHydro, Total, WesternGeco

Table 4.3: UDW 2007 Project Selections

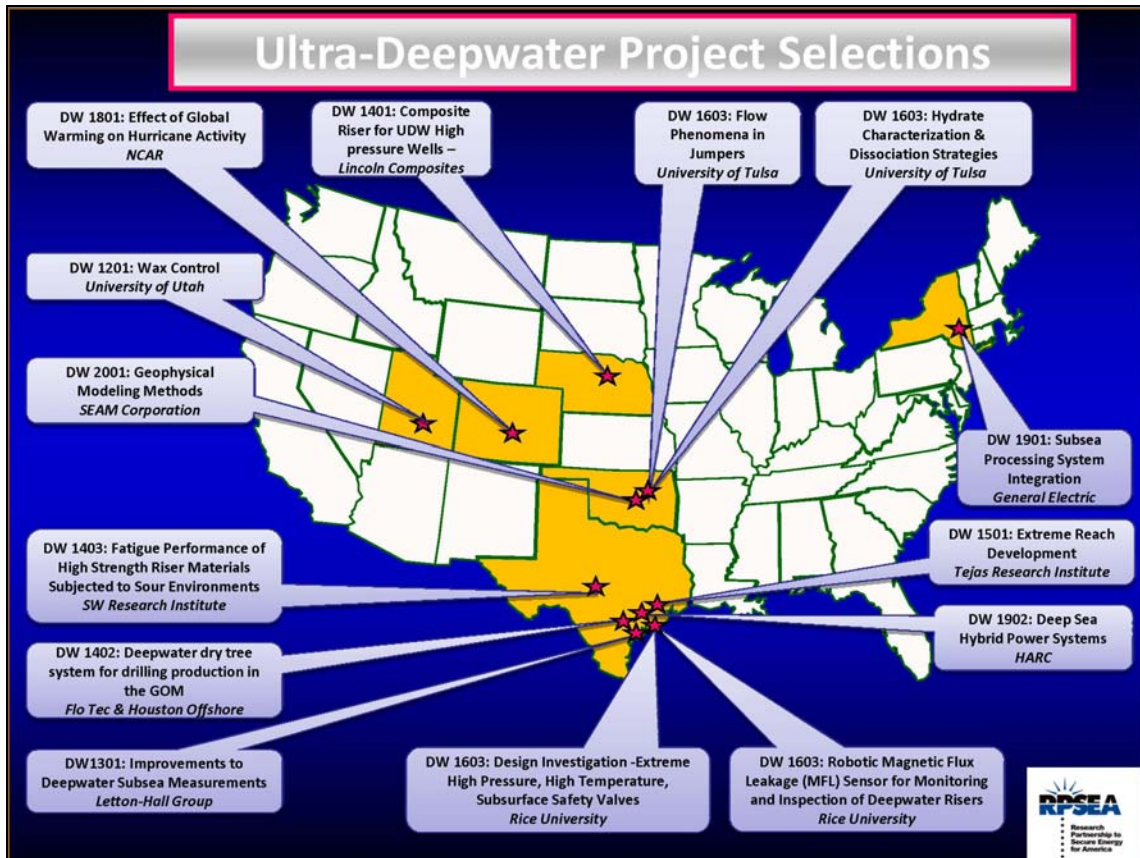


Figure 4.4: UDW 2007 Project Selection Geographic Distribution

F. 2009 UDW

The 2009 UDW will have \$14.96 million available for project awards. The 2009 UDW will target funding of five to ten projects, with a value of \$1 to \$5 million per project. Each project will have duration of one to three years. Projects will be aligned with the six UDW needs. Project integration across multiple disciplines will be encouraged (e.g. geoscience, reservoir and drilling, or flow assurance and subsea).

A methodology similar to the 2007 and 2008 project selection process will be utilized by the UDW TACs and PAC to assist in prioritizing, rating, and selecting 2009 proposals for funding. The 2009 process is different than the process used in 2007 and 2008, in that the UDW TACs prioritized project ideas by initiatives instead of developing and voting for specific individual projects. The TAC input for 2009 was submitted to the PAC and will be evaluated and prioritized by the PAC prior to September 1, 2008 to develop the appropriate balance for the 2009 UDW program. Figure 4.5 describes the 2009 project selection process.

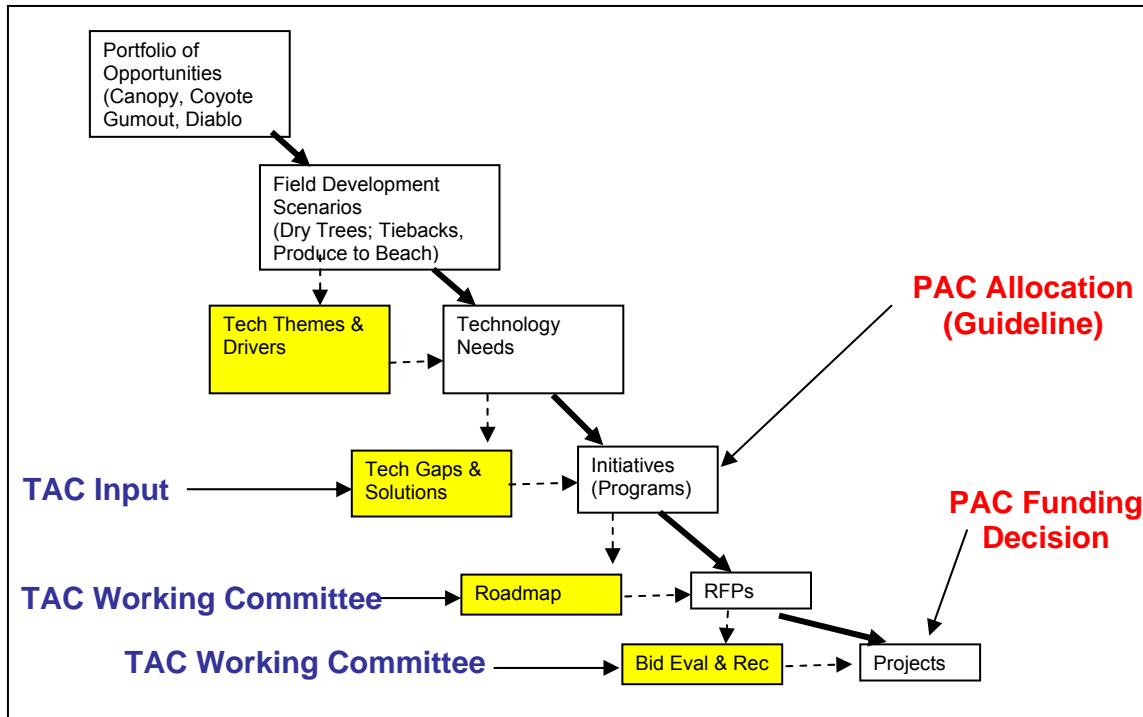


Figure 4.5: 2009 UDW Project Selection Process

UDW 2009 RFPs will consist of both specific project ideas and broader initiative-based requests. Anticipated 2009 UDW initiatives and/or projects are listed below in the context of each UDW need. The actual 2009 UDW may differ from the anticipated portfolio listed below. The actual 2009 UDW portfolio will be driven by further guidance from the UDW PAC and the timing associated with 2009 program funding.

Need 1: Drilling, Completion, and Intervention Breakthroughs

Proposals will be requested identifying novel ideas to reduce well construction and completion costs.

Need 2: Appraisal and Development Geoscience and Reservoir Engineering

Proposals will be requested in the area of production and reservoir surveillance. The goal of this effort is to reduce the amount of unproduced hydrocarbons upon well or field abandonment, contributing to increased recovery.

Need 3: Significantly Extend Subsea Tieback Distances/Surface Host Elimination

Proposals may be requested in one or more of the following areas:

- Ultra-deepwater flow assurance especially for the areas of solids (asphaltenes, hydrates, waxes, and scale) deposition and plug formation management
- Pressure boosting
- Autonomous underwater vehicles and intervention
- Subsea processing/produced water treatment

Need 4: Dry Trees/Direct Well Intervention and Risers in 10,000' Water Depth

This need area was addressed in the 2007 and 2008 UDW program. Additional follow-on activities may be funded in subsequent years.

Need 5: Continuous Improvement/Optimize Field Development

Proposals in this need area may include:

- Advancing industry understanding of phenomena impacting ultra-deepwater operations such as vortex-induced vibration
- Improvements in integrity management and reliability
- Additional graduate student project funding
- High risk, high reward “long-shot” R&D opportunities

Need 6: Associated Safety and Environmental Concerns

Ultra-deepwater efforts in this need area will involve the assessment of environmental and safety impact of UDW funded technology development projects. This effort may take the form of individual solicitations or elements of more extensive project based solicitations. Areas of study may include:

- Improved Met-ocean understanding
- Discharge of produced water subsea – technology and regulatory aspects

Chapter 5 Unconventional Natural Gas and Other Petroleum Resources Program

A. Mission

The mission of the Unconventional Natural Gas and Other Petroleum Resources Program (Unconventional Resources Program) is to identify and develop economically viable technologies to locate, characterize, and produce unconventional natural gas and other petroleum resources in an environmentally acceptable manner.

Unconventional natural gas and other petroleum resource is defined in Section 999G of EPLA as “*natural gas and other petroleum resource[s] located onshore in an economically inaccessible geological formation, including resources of small producers.*”

B. Goal

The overall goal of the Unconventional Resources Program is to increase the supply of domestic natural gas and other petroleum resources through the development, demonstration, and commercialization of technologies that reduce the cost and increase the efficiency of exploration for and production of such resources, while improving safety and minimizing environmental impact.

The contribution of natural gas to the nation’s gas supply from three specific unconventional resources, gas shales, coal seams, and tight sands, has grown significantly during the past 20 years. These resources have been highlighted by the Energy Information Administration (EIA) and others as important supply sources during the next 20 years. According to the latest estimate by the National Petroleum Council 2003 Natural Gas Study (NPC 2003), the volume of technically recoverable gas from these three resources in the lower 48 states is in excess of 293 trillion cubic feet. In view of the significant additional work accomplished since the NPC 2003 study on the development of gas shales and other unconventional gas resources, it is likely that this resource number is very conservative. Due to their potential and significance and in view of the limited resources available to the research program, gas shales, tight gas sands, and coalbed methane were determined to be the unconventional resources to be specifically addressed in the initial years of the program. Opportunities to leverage developed technologies through application to other unconventional natural gas and petroleum resources will be sought, and other petroleum resources may be specifically targeted in subsequent years. Oil shale and unconventional oil resources are addressed by the EPLA Section 999 complementary program and the traditional DOE R&D program, both implemented by NETL.

In order for the program to be successful by maximizing the value of natural gas and other petroleum resources of the United States through new technology, the transfer of that technology to companies operating in the targeted resources will need to be an integral part of the program planning and execution. Additionally, any development of new resources must be accomplished

in an environmentally acceptable manner, so it will be important that technologies developed under the program be applied in ways that minimize the impact of resource development on the environment.

C. Objectives

Objectives for the Unconventional Resources Program were initially developed with input from RPSEA's unconventional onshore PAC, along with the results of a series of workshops and forums held from 2003 through early 2007. The objectives have been updated as additional information has been gathered through ongoing efforts to identify and prioritize the technology challenges to development of unconventional resources. These recent efforts include: (1) a series of eight forums on topics relevant to unconventional resources held in various producing basins by RPSEA members beginning in late 2007 and continuing through May 2008, (2) participation by RPSEA staff in industry meetings, addressing unconventional resources organized by professional societies such as SPE and AAPG, as well as organizations such as Hart's Energy Publishing, Platts and Pennwell, (3) input provided to the 2007 and 2008 Annual Plans by the URTAC, and (4) input provided by PAC and TAC members associated with projects selected for the 2007 program. All of these inputs were combined to arrive at the prioritized list of technology challenges that underlie both the objectives of this program and the list of solicitation topics found in the implementation plan. The issued solicitations will likely be further focused as a result of the selections made for the 2008 program.

The objectives are defined in terms of the resource (shales, coal, tight sands) and the level of field development category (existing, emerging, frontier). All three resources are important but gas shales, the most difficult and least developed, was identified during this process as the top priority. It was the consensus of the advisory groups that gas shales promised the greatest potential return on investment in terms of reserves additions. The three development categories are:

- Existing - Active development drilling and production
- Emerging - Formations, depth intervals, or geographic areas from which there has been limited commercial development activity and very large areas remain undeveloped
- Frontier Area - Formations, depth intervals, or geographic areas from which there has been no prior commercial development

The relative balance of the program's focus among these three categories, as well as the priority basins identified within each of the three resource areas, are illustrated within Table 5.1. The basins noted are representative based on expressed industry interest and not meant to exclude opportunities in other basins within the three resource types.

Level of Field Development	Program Balance	Priority Gas Shales	Priority Coalbed Methane	Priority Tight Sands
Existing	45%	Ft Worth - Barnett	Appalachian	Green River/Uinta
		Appalachian	San Juan	South Texas
			Powder River	Appalachian
Emerging	45%	Appalachian	Uinta-Piceance	Appalachian
		Permian	Powder River	Piceance
		Arkoma/Ardmore/Anadarko		Uinta
Frontier Area	10%	Permian-Woodford	Illinois & Michigan	Western Oregon
		Green River	N. Mid-continent	Washington

Table 5.1: Resource Prioritization Matrix

Specifically, the objectives of the Unconventional Resources Program are:

Near Term

Objective 1: Develop tools, techniques, and methods that substantially increase in an environmentally sound manner commercial production and ultimate recovery from established unconventional gas formations and accelerate development of existing and emerging unconventional gas plays.

Objective 2: Develop tools, techniques, and methods that substantially decrease the environmental impact of unconventional gas development with particular emphasis on water management and operations footprint.

Objective 3: Integrate the results and deliverables of the existing portfolio of projects to ensure that new technologies are demonstrated to and applied by industry to enhance safe and environmentally responsible production of the domestic unconventional gas resource base. Successful technology transfer is an important component of this objective.

Longer Term

Objective 4: Develop techniques and methods for E&P from high priority emerging gas shale, coal, and tight sand fields, as well as frontier basins and formations, where these operations have been hindered by technical, economic, or environmental challenges.

Development of an Integrated Program

An important aspect of this program is encouragement of teaming efforts to address integrated production needs of a particular unconventional gas resource. To the extent possible, integration of geologic concepts with engineering principles to overcome production and environmental issues is encouraged. The intent is to develop a coordinated program as opposed to individual projects such that the whole has much greater value than the sum of the parts.

D. Implementation Plan

The Unconventional Resources Program is being implemented by developing and administering solicitations for R&D projects in areas that address the objectives outlined above. The following section outlines the major steps in the implementation plan.

Development of Solicitations to Address Prioritized Technology Challenges

The 2007 solicitation was broad in scope in order to allow consideration of a broad range of research topics addressing key issues. Solicitations for the 2008 program continue to seek a broad range of technical solutions, but placed particular emphasis on addressing key technical or resource gaps within the current portfolio of projects. The 2009 program solicitations will encourage the development of integrated programs targeting specific resources with a likely focus on technology or resource gaps that may remain in the program after the 2007 and 2008 selections. Areas that were identified as requiring additional emphasis include the development of unconventional gas in the Appalachian region, decreasing the environmental footprint of unconventional gas development, water management associated with unconventional gas development, and improved methods for complex multi-zone completions.

The topic areas planned to be included in solicitations during the 2009 program year are summarized below. In order to ensure that areas of particular interest and need in the portfolio are addressed, a small number of individual solicitations may be issued that emphasize a particular subset of the technology or resource focus areas described below. In particular, the resource focus of solicitations will depend on the needs necessary to achieve the desired program balance among gas shales, tight sands, and coalbed methane as the 2007 and 2008 projects are selected. At least one, but no more than three, solicitations are anticipated to be issued during the 2009 program year, depending upon the evolving needs of the program. Some or all of the areas below may be covered by solicitations during the 2009 program year.

Description of Planned Solicitations

The 2009 Unconventional Resources Program will seek to broaden the specific unconventional resources to be targeted, while supplementing active projects by addressing technology needs that have arisen during the execution of those projects. Solicitations issued during 2009 will continue to target gas shales, tight sands, and coalbed methane resources with priorities as shown in Table 5.1 and further driven by 2008 program selections when made. Solicitations will continue to be directed towards the development of tools, techniques, and methods that may be applied to substantially increase in an environmentally sound manner, commercial production, and ultimate recovery from established unconventional gas resources and accelerate the development of gas from emerging and frontier unconventional plays. The areas of research shown below apply to each of the targeted unconventional resources, but priorities will be defined by program needs at the time the 2009 solicitations are issued. For example, some specific areas of additional interest that emerged after the 2007 project selections include: the need for more research in water management; improved methods for complex multi-zone completions; reducing the environmental footprint of drilling operations in Rocky Mountain tight sands; and, additional emphasis on Appalachian shale gas resources.

Specific solicitations may be issued addressing the highest level goals below (1, 2, 3) or targeting specific technology areas (a, b, c...) as the program develops.

1. Develop an integrated program involving key technologies necessary to enable development of a specific unconventional gas resource in a particular geographic area. The program may include research in some or all of the areas a. through i. listed below, depending on the specific barriers to development of the targeted resource. Proposals for integrated programs are encouraged to incorporate and build upon the results of prior and currently active RPSEA projects. Concepts to be pursued within a given area of research may include, but are not limited to the areas listed as i, ii, iii, etc. below.
 - a. Resource Assessment
 - i. Evaluate the potential resources associated with new or underdeveloped unconventional gas plays and identify technical and economic barriers to their development
 - b. Exploration Geosciences
 - i. Characterize geological, geochemical, and geophysical framework of unconventional resource plays
 - c. Basin Analysis and Resource Exploitation
 - i. Characterize geological, geochemical, geophysical, and operational parameters that differentiate high-performing wells
 - d. Drilling
 - i. Development of extra-extended single and multi-lateral drilling techniques
 - ii. Develop improved drilling methods that lower cost, reduce time on location, use less materials, or otherwise increase the efficiency and effectiveness of well construction
 - e. Stimulation and Completion
 - i. Multi-zone completion and stimulation methods
 - ii. Development of steerable hydraulic fractures
 - iii. Development of suitable low-cost fracturing fluids and proppants, e.g. non-damaging fluids and/or high strength, low density proppants
 - iv. Develop stimulation methods that require less water and other fluids to be injected into the subsurface
 - v. Develop stimulation methods that result in a lower volume of treatment fluids produced to the surface
 - vi. Develop approaches for improved treatment, handling, re-use and, disposal of fluids produced and/or used in field operations

- f. Water Management
 - i. Develop comprehensive approaches for the conservation and management of water resources used and produced during all aspects of unconventional gas development
 - ii. Develop water management approaches that minimize the impact of drilling, completion, stimulation, and production operations on natural water resources
 - iii. Develop methods for the treatment of produced water
 - iv. Develop methods for the sustainable beneficial use of produced water
 - v. Develop methods to control fines production
 - vi. Develop techniques to minimize the volume of water produced to the surface
 - g. Reservoir Description and Management
 - i. Methods to accurately assess the potential for shale gas production from common industry petrophysical methods
 - ii. Accurate delineation of natural fracture systems
 - iii. Extend the commercial life of a well through reduction or elimination of workovers and recompletions, as well as reduction of production costs
 - iv. Methods to manage reservoirs to ensure maximum efficient recovery
 - h. Reservoir Engineering
 - i. Methods to plan, model, and predict the results of gas production operations
 - i. Environmental
 - i. Develop advanced drilling, completion and/or stimulation methods that allow a greater volume of reservoir to be accessed from a single surface location
 - ii. Develop advanced drilling approaches that minimize the surface impact of well construction associated with the targeted unconventional gas resource
 - iii. Develop advanced completion, stimulation and/or reservoir management approaches that minimize the environmental impact associated with the development of the targeted resource
 - iv. Develop methods for planning and site selection that minimize the surface impact of drilling and production operations
2. Conduct early-stage research on novel concepts that may be applied to the development of unconventional gas resources.
 3. Develop and execute innovative approaches to integrate the results of individual research projects to address key technical issues in the development of unconventional gas resources and develop such research into commercially available services.

For new technologies to have an impact on energy production, they must be applied by energy producers. Many producers active in the targeted resources lack the full array of resources or organizational experience to take new technology from the research stage to the point at which it can be applied in field operations. For this reason, the evaluation criteria will be designed to encourage work leading to field applications that will demonstrate the applicability of new technology and encourage its commercial availability. In many cases, however, the developers of innovative new technology lack the resources and the expertise to bring new products to the stage of field application and commercial availability. For this reason, number 3 in the description above is designed to support activities that will integrate the results of individual projects and lead to field demonstrations of new approaches to unconventional gas development using results selected from the entire portfolio of projects.

The evaluation criteria will also be designed to encourage partnerships between oil and gas producers and research organizations. Partnerships are encouraged in order to facilitate the transition from research to application. In addition, the solicitation will encourage oil and gas producers who are not familiar or have expertise in proposal submissions to partner with universities and service companies, who are familiar with this process.

Project Selection Process

Proposals submitted for the Unconventional Resources Program are divided into topic areas (e.g. Completion, Reservoir Engineering, Resource Assessment, etc.) for review in order to align the technical expertise and experience of reviewers with the content of the proposals. Three or more reviewers provide technical evaluations of the proposals within each topic area. To the greatest extent possible, all of the proposals within a topic area are evaluated by the same set of reviewers.

The PAC recommends proposals for funding based on the technical review scores and the priorities associated with the various topic areas and targeted resources. Prior to considering individual proposals, the PAC assigns priorities to each of the topic areas for each of the targeted resources (currently gas shales, tight sands, and coalbed methane). The highest priority resource/topic area combinations are given the most weight in project selection, although all proposals with competitive technical review scores are considered for funding. The PAC considers factors such as balance among the time scales associated with technology and resource development, diversity of technical approach, and the geographic distribution of targeted resources when developing a portfolio of projects intended to maximize the probability of meeting program goals.

Funds Available and Anticipated Awards

It is anticipated that there will be \$13.94 million available for funding the Unconventional Resources Program during each fiscal year. Approximately 5 to 15 awards are anticipated to be awarded in 2009.

The typical award is expected to have a duration of one to three years, although shorter or longer awards may be considered, if warranted, by the nature of the proposed project.

Under the stage/gate approach, all projects will be fully funded to the completion of the appropriate decision point identified in each contract, which may include multiple stages. If a decision is made to move to the next stage or decision point or to gather additional data, additional funding will be provided from available funds.

E. Ongoing Activities

Nineteen projects have either been awarded or are in the process of being awarded based on selections from the 50 proposals submitted in response to the 2007 solicitation for the Unconventional Resources Program. As many of these projects were planned for time frames of two or three years, 35% of the 2008 funds were allocated to the support of projects selected from the response to the 2007 solicitation. Figure 5.1 below provides a synopsis of the type and general geographic location of the projects.

Table 5.2 provides a listing of each of the projects selected. Included for each award is the project title, the awardee, other participants, project duration, the primary project deliverable, and other participants. Additional information can be found at www.rpsea.org and on the NETL/SCNGO webpage at www.netl.doe.gov/technologies/oil-gas/EPAct2005.



Figure 5.1: Unconventional Onshore Project Selections

PROJECT	AWARDEE	DURATION/ RPSEA FUNDING	DELIVERABLE	PARTICIPANTS
A Self-Teaching Expert System for the Analysis, Design and Prediction of Gas Production from Shales	Lawrence Berkeley National Laboratory	24 months \$1,700,000	User friendly software package for gas shale production prediction	Texas A&M University, University of Houston, University of California Berkeley, Anadarko, Southwestern Energy
Advanced Hydraulic Fracturing Technology for Unconventional Tight Gas Reservoirs	Texas A&M University	36 months \$1,000,000	Design methodology for hydraulic fracturing considering new conductivity model	Carbo Ceramics, Schlumberger, Halliburton Energy Services, BJ Services
An Integrated Framework for the Treatment and Management of Produced Water	Colorado School of Mines	36 months \$1,600,000	Best practices protocol for handling and processing produced water in the Rocky Mountains	Kennedy/Jenks Consultants, Argonne National Laboratory, Stratus Consulting, Eltron Research and Development, Chevron, Pioneer Natural Gas, Marathon, Triangle Petroleum, Anadarko, Awwa Research Foundation, Stewart Environmental, Southern Nevada Water Authority, Veolia Water, Hydration Technology, Petroglliph Operating
Application of Natural Gas Composition to Modeling Communication Within and Filling of Large Tight-Gas-Sand Reservoirs, Rocky Mountains	Colorado School of Mines	24 months \$670,000	Fundamental understanding of gas composition as vs. migration pathways	U.S. Geological Survey, University of Oklahoma, University of Manchester, Fluid Inclusion Technology Permedia Research Group, Williams Exploration and Production, ConocoPhillips, ExxonMobil, Newfield Exploration, BP, Anadarko, EnCana Oil & Gas, Bill Barrett Corporation
Comprehensive Investigation of the Biogeochemical Factors Enhancing Microbially Generated Methane in Coal Beds	Colorado School of Mines	24 months \$860,000	Identification of critical factors for generating gas microbially in coal formations	University of Wyoming, U.S. Geological Survey, Pioneer Natural Resources, Pinnacle Gas Resources, Coleman Oil and Gas, Ciris Energy

PROJECT	AWARDEE	DURATION/ RPSEA FUNDING	DELIVERABLE	PARTICIPANTS
Enhancing Appalachian Coalbed Methane Extraction by Microwave-Induced Fractures	Penn State University	12 months \$79,000	Fundamentals of efficacy of using microwaves as a CBM stimulation technique	Nottingham University
Gas Condensate Productivity in Tight Gas Sands	Stanford University	36 months \$520,000	Production protocols to minimize formation damage due to liquids precipitation near the wellbore	
Gas Production Forecasting From Tight Gas Reservoirs: Integrating Natural Fracture Networks and Hydraulic Fractures	University of Utah	36 months \$1,100,000	Best Practices for development of Utah gas shales integrating natural and hydraulic fracture interaction	Utah Geological Survey, Golder Associates, Utah State University, HClasca, Anadarko, Wind River Resources Corp
Geological Foundation for Production of Natural Gas from Diverse Shale Formations	Geologic Survey of Alabama	36 months \$500,000	Geologic characterization of diverse shales in Alabama	
Improved Reservoir Access through Refracture Treatments in Tight Gas Sands and Gas Shales	University of Texas	36 months \$950,000	Strategy for refracture of tight gas and gas shale wells. Define window of refracture opportunity	Noble Energy, BJ Services, Anadarko, Jones Energy, Pinnacle Technologies
Improvement of Fracturing for Gas Shales	University of Houston	36 months \$690,000	Design and field test of lightweight proppants in the Barnett shale	Daneshy Consultants, BJ Services
New Albany Shale Gas	Gas Technology Institute	24 months \$3,400,000	Well completion strategy for New Albany Shale wells focusing on well stimulation	Amherst College, University of Massachusetts, ResTech, Texas A&M University, Pinnacle Technologies, West Virginia University, Texas Bureau of Economic Geology, Aurora Oil and Gas, CNX Gas, Diversified Operating Corporation, Noble Energy, Trendwell Energy Corporation, BreitBurn Energy
Novel Concepts for Unconventional Gas Development in Shales, Tight Sands and Coalbeds	Carter Technologies	12 months \$91,680	Feasibility study for the utilization of cables for cutting rock formations in a wellbore for stimulation purposes	University of Oklahoma, University of Houston, M-I LLC
Novel Fluids for Gas Productivity Enhancement in Tight Formations	University of Tulsa	36 months \$220,000	Model for the mitigation of gel damage due to hydraulic fracturing in the near wellbore region	Williams Exploration & Production
Optimization of Infill Well Locations in Wamsutter Field	University of Tulsa	36 months \$440,000	Simulation technique for highgrading downsized spacing locations in a tight gas reservoir	Texas A&M University, Devon Energy
Optimizing Development Strategies to Increase Reserves in Unconventional Gas Reservoirs	Texas A&M University	24 months \$310,000	Reservoir and decision model incorporating uncertainties	Unconventional Gas Resources Canada Operating Inc., Pioneer Natural Resources
Paleozoic Shale-Gas Resources of the Colorado Plateau and Eastern Great Basin, Utah: Multiple Frontier Exploration Opportunities	Utah Geologic Survey	36 months \$430,000	Characterization of Paleozoic shales, identification of highest potential areas, best practices for drilling and completion	Bereskin and Associates, GeoX Consulting, Halliburton Energy Services, Shell, Sinclair O&G, EnCana Oil & Gas, Bill Barrett Corporation, CrownCrest Operation LLC
Petrophysical Studies of Unconventional Gas Reservoirs Using High-Resolution Rock Imaging	Lawrence Berkeley National Laboratory	36 months \$1,100,000	Development of recovery strategies mitigating condensate precipitation based on high resolution rock imaging	Schlumberger, BP, Chevron
Reservoir Connectivity and Stimulated Gas Flow in Tight Sands	Colorado School of Mines	24 months \$2,900,000	Mamm creek field characterization and productivity criteria for application to similar environments	University of Colorado, Mesa State University, iReservoir, Bill Barrett Corporation, Noble Energy, Whiting Petroleum Corporation, ConocoPhillips

Table 5.2: Status Update on 2007 R&D Projects

The 2008 program is focused on filling research gaps within the existing R&D portfolio including geographic focus. The 2008 solicitations are expected to be released in late summer 2008, with selections in December 2008. Advisory input has indicated a stronger presence in the Appalachian area of the country, emphasis on produced water technology issues and ongoing

environmental focus. Technology dissemination continues to be highlighted as an area that needs to be developed as the program continues to develop.

Chapter 6 Small Producer Program

A. Mission

The mission of the Small Producer Program is to increase the supply from mature domestic natural gas and other petroleum resources through reducing the cost and increasing the efficiency of production of such resources, while improving safety and minimizing environmental impact, with a specific focus on the technology challenges of small producers.

Small producer is defined in EPOA as “*an entity organized under the laws of the United States with production levels of less than 1,000 barrels per day of oil equivalent.*”

B. Goals

The goal of the Small Producer Program is to address the needs of small producers by focusing on areas including complex geology involving rapid changes in the type and quality of the oil and gas reservoirs across the reservoir; low reservoir pressure; unconventional natural gas reservoirs in coalbeds, deep reservoirs, tight sands, or shales; and, unconventional oil reservoirs in tar sands and oil shales.

C. Objectives

The small producer community is quick to adopt new technology that has been shown to have an economic benefit in their operating environment, but does not generally have the time or resources to provide a test bed for technology development efforts or the demonstration of new applications of existing technology. The Small Producer Program has a crucial role in ensuring that leading edge exploration and production technology is made available to small producers, allowing them to maximize their important contribution to the nation’s secure energy supply. The Section 999 small producer classification is roughly equivalent to the Category III operators as defined by the EIA. In 2006, the EIA reported that these 13,180 operators produced 181 million barrels of oil or 11% of U.S. oil production for that year.

The approach to enhancing the impact of small producers on energy production involves two related, but distinct activities. First, individual small producers facing representative challenges will be engaged to work with technology providers on the development and application of technology to enhance economic and environmentally responsible production and resource recovery. The support provided through the program will mitigate the economic risk normally associated with the application of new technologies. Second, the information acquired as a result of projects funded through the program will serve as the basis for technology transfer efforts that will promote appropriate novel technology applications throughout the small producer community.

The specific objectives of the Small Producer Program are:

Near Term

Objective 1: Apply technologies in new ways to enable improvements in water management and optimization of water use in mature fields.

Objective 2: Apply technologies in new ways to improve oil and gas recovery from mature fields, extending their economic life.

Objective 3: Apply technologies in new ways to reduce field operating costs.

Longer Term

Objective 4: Apply lessons from all near-term projects to new basins/areas and develop new technologies to address the problems of Objectives 1 through 3.

D. Implementation Plan

The Small Producer Program is being implemented by developing and administering solicitations for R&D projects in areas that address the objectives outlined above. The following section outlines the major steps in the implementation plan.

Small Producer Program Advisory Groups

The Small Producer Program receives guidance from the RAG, consisting of industry and academic representatives that are closely tied to the national small producer community. The RAG focuses on identifying, targeting, and prioritizing specific technology needs. This advisory group also provides a key communications focal point for encouraging the formation of the requisite research consortia (see next subsection for description of this requirement). After projects are initiated, the RAG follows each project's progress, plans, and results with particular attention to tech transfer. All projects are reviewed by the RAG annually.

While the RAG will be responsible for directing the Small Producer Program, the Unconventional Resources Program PAC will remain responsible for oversight of the entire onshore program, which includes the Small Producer Program, as well as the Unconventional Resources Program. The RAG will interact with the Unconventional Resources Program PAC through the RPSEA onshore vice president and through its chairman, who will hold a seat on the Unconventional Resources Program PAC.

Development of a Solicitation to Address Prioritized Technology Challenges

The Small Producer Program has been able to draw on the input from the exercises and workshops listed in the Unconventional Resources Program section of this DAP (see Chapter 5, part C), as well as specific events aimed at small producers conducted by NMT and West Virginia University. The overarching theme expressed by small producer representatives at

these events was the need for technology, which allows small producers to maximize the value of the assets they currently hold primarily in mature fields.

Accordingly, the initial solicitation under this program was aimed toward developing and proving the application of technologies, that will increase the value of mature fields by reducing operating costs, decreasing the cost and environmental impact of additional development, and improving oil and gas recovery. Reducing risk is seen as key to reducing costs and, thus, extending the well life and improving recovery. Improved field management, best practices, and lower cost tools (including software) are all within the scope of this effort.

The 2009 solicitation(s) will continue to focus on the theme of advancing technology for mature fields, however, opportunities will be sought to further focus the program to complement the project selections in the 2007 and 2008 programs.

In order to ensure that technologies developed under this program are applied to increase production in a timely fashion, each proposal has been required to outline a path and timeline to an initial application. A specific target field for an initial test of the proposed development must be identified, and ideally, the field operator will be a partner in the proposal.

In compliance with Section 999B(d)(7)(C) of EPOA, all awards resulting from this solicitation “shall be made to consortia consisting of small producers or organized primarily for the benefit of small producers.” For the purposes of the solicitation, a consortium shall consist of two or more entities participating in a proposal through prime contractor-subcontractor or other formalized relationship that ensures joint participation in the execution of the scope of work associated with an award. The participation in the consortium of the producer that operates the asset that is identified as the initial target for the proposed work will be highly encouraged.

2009 solicitation(s) may request proposals addressing the following technology challenges:

- Development of approaches and methods for water management, including produced water shutoff or minimization, treatment and disposal of produced water, fluid recovery, chemical treatments, and minimizing water use for drilling and stimulation operations (Objective 1)
- Development of methods for improving oil and gas recovery and/or extending the economic life of reservoirs (Objective 2)
- Development of methods to reduce field operating costs, including reducing production related costs, as well as costs associated with plugging and abandoning wells and well site remediation; consideration will be given to those efforts directed at minimizing the environmental impact of future development activities (Objective 3)
- Development of cost-effective, intelligent well monitoring and reservoir modeling methods that will provide operators with the information required for efficient field operations (Objectives 2 & 3)

- Development of improved methods for well completions and recompletions, including methods of identifying bypassed pay behind pipe, deepening existing wells, and innovative methods for enhancing the volume of reservoir drained per well through fracturing, cost-effective multilaterals, in-fill drilling, or other approaches (Objectives 2 & 3)
- Implementation and documentation of field tests of emerging technology, that will provide operators with the information required to make sound investment decisions regarding the application of that technology (Objective 3)
- Collection and organization of existing well and field data from multiple sources into a readily accessible and usable format that attracts additional investment (Objectives 1, 2, 3, & 4)
- Creative capture and reuse of industrial waste products (produced water, excess heat) to reduce operating costs or improve recovery (Objectives 1, 2, & 3)
- Leverage existing wellbores and surface footprint to maximize recovery of additional hydrocarbons (Objective 2)

The items in the above list are examples only and are not meant to exclude appropriate technologies and topics that may not be included therein. Additional solicitations may be issued based on assessment of proposals received and available funding.

For new technologies to have an impact on energy production, they must be applied by energy producers. Most small producers lack the full array of resources or organizational experience to take new technology from the research stage to the point at which it can be applied in field operations. For this reason, the evaluation criteria will be designed to encourage work leading to field applications that will demonstrate the applicability of new technology and encourage its commercial availability. In many cases, however, the developers of innovative new technology lack the resources and the expertise to bring new products to the stage of field application and commercial availability. For this reason, the solicitations will highly encourage the participation of at least one small producer in the consortium of two or more organizations required for each award under the Small Producer Program. In addition, the Small Producer Program intends to leverage other successful efforts such as the Petroleum Technology Transfer Council (PTTC) in order to reach the geographically dispersed small producer community.

Project Selection Process

Proposals submitted for the Small Producer Program are evaluated by the RAG consisting of representatives of small producers operating in various geographic areas, as well as academics and researchers with experience working with small producers on topics related to the program theme, currently advancing technology for mature fields. In addition to technical merit, alignment with program goals and capabilities of the proposer, the RAG considers factors such as balance among technology time scales, diversity of technical approach, and the geographic distribution of resources impacted when selecting projects intended to maximize the probability of meeting program goals.

Funds Available and Anticipated Awards

It is anticipated that \$3.21 million will be available for the Small Producer Program during fiscal year 2009. Approximately 4 to 12 awards are anticipated to be awarded under solicitations in 2009.

The typical award is expected to have a duration of one to three years, although shorter or longer awards may be considered if warranted by the nature of the proposed project.

Under the stage/gate approach, all projects will be fully funded to the completion of the appropriate decision point identified in each contract, which may include multiple stages. If a decision is made to move to the next stage or decision point or to gather additional data, additional funding will be provided from available funds.

E. Ongoing Activities

The 2007 solicitation focused on application of available technologies for oil and gas recovery, water management issues, and minimizing the environmental impact on the surface. The solicitation was released on October 17, 2007 and closed on December 3, 2007. The proposals were evaluated by members of the RAG, RPSEA, and NETL. Seven projects selected from the 2007 solicitation are listed in Table 6.1. The seven projects have either been awarded or are in the process of being awarded. All awards were made to consortia consistent with EPAct, with the prime contractor listed as the awardee and the other consortia members listed as participants. The 2008 solicitation, which is planned for release in late summer 2008, has the same general focus as that for the 2007 program year. Project selections for 2008 are expected in December 2008.

Figure 6.1 provides a summary of the type and a general geographic location of the projects awarded under the 2007 solicitation. Additional information can be found at www.rpsea.org and on the NETL/SCNGO webpage at www.netl.doe.gov/technologies/oil-gas/EPAct2005.

The projects can be categorized into three theme areas:

1. Oil and Gas Recovery

a. Enhancing Oil Recovery from Mature Reservoirs Using Radial-Jetted Laterals and High-Volume Progressive Cavity Pumps

This project will field test the addition of radial-jetted laterals as a means to increase the drainage area and, thus, the oil production in a well pumped by a high-volume, progressive cavity pump. Complementing this effort will be the addition of targeted jetted laterals in an injection well for the purpose of improving injectivity and, thus, economically disposing of the additional water production.

- b. **Near Miscible CO₂ Application to Improved Oil Recovery for Small Producers**
The goal of this feasibility study is to demonstrate that near miscible CO₂ applications can increase oil production with injection pressures below minimum miscibility pressure. The project will investigate the displacement of oil at near miscible conditions by coupling experimental work with reservoir simulation. The potential benefits are an increase in the resource base for CO₂ flooding and an expanded opportunity for small producers to apply CO₂ flooding.
- c. **Seismic Stimulation to Enhance Oil Recovery**
The goal of this project is to field test whether seismic waves sent into a mature oil reservoir can liberate immobile oil and, thus, enhance oil production. The benefit of this novel technique is the stimulation of a wider volume of the reservoir, not confined to only where fluids are injected and, thus, be an alternative to water flooding.

2. Water Management Issues

- a. **Cost-Effective Treatment of Produced Water Using Co-Produced Energy Sources for Small Producers**
This project will test a low temperature distillation unit to purify produced water at the wellhead and, subsequently, make this water usable for other oilfield operations. This work not only targets the development of the purification technology, but also will provide field demonstration of the unit at two sites operated by small producers.
- b. **Preformed Particle Gel for Conformance Control**
This project will establish methods to optimize particle gel treatments in fracture systems to increase oil recovery and reduce water production by improving waterflood sweep efficiency. Experimental work will update theoretical models to improve gel treatment design and predictions of oil recovery and potentially lead to widespread application.

3. Minimizing the Environmental Impact on the Surface

- a. **Field Site Testing of Low Impact Oil Field Access Roads: Reducing the Footprint in Desert Ecosystems**
This project will identify and test new techniques to reduce the environmental impact of oil field lease roads in desert-like ecosystems. A selected test site will include instrumentation to monitor the load on various road materials throughout a calendar year. The benefits are the potential of reducing field operating costs and minimizing the environmental impact of oil and gas operations.

b. **Reducing Impacts of New Pit Rules on Small Producers**

The objective of this project is to minimize the impact of pit rules on small producers in New Mexico by reducing the cost of compliance through streamlining the permitting process. This will be accomplished by developing a database of pertinent information and providing easy access to this information via the web and in formats that will allow quick review and decisions to be made.



Figure 6.1: Small Producer Project Selections

PROJECT	AWARDEE *	DURATION/ RPSEA FUNDING	DELIVERABLE	PARTICIPANTS
Cost-Effective Treatment of Produced Water Using Co-Produced Energy Sources for Small Producers	New Mexico Institute of Mining and Technology	24 months \$457,000	A process to purify produced water at the wellhead	Robert L. Bayless, Producer LLC, Harvard Petroleum Company
Enhancing Oil Recovery from Mature Reservoirs Using Radial-Jetted Laterals and High-Volume Progressive Cavity Pumps	University of Kansas	12 months \$248,000	Application of available technology to increase oil recovery while effectively disposing of water	Kansas Geological Survey, American Energies Corporation
Field Site Testing of Low Impact Oil Field Access Roads: Reducing the Footprint in Desert Ecosystems	Texas A&M University	24 months \$444,939	Identify materials and processes that will lessen the environmental impact of oilfield operations	Rio Vista Bluff Ranch, Halliburton
Near Miscible CO2 Application to Improved Oil Recovery for Small Producers	University of Kansas	24 months \$329,324	Define the potential for CO2 recovery or sequestration in near-miscible reservoirs	Carmen Schmitt
Performed Particle Gel for Conformance Control	University of Missouri, Rolla	24 months \$520,000	Assessing gel performance in mitigating water production in fractured systems	ChemEOR Company, BJ Services
Reducing Impacts of New Pit Rules on Small Producers	New Mexico Institute of Mining and Technology	36 months \$560,063	Access to online compliance data and automating permitting process	Independent Petroleum Association of New Mexico, New Mexico Oil Conservation Division
Seismic Stimulation to Enhance Oil Recovery	Lawrence Berkeley National Laboratory	24 months \$723,373	Methodology to predict if a reservoir is amenable to seismic stimulation	U.S. Oil & Gas Corporation, Berkeley Geolmaging Resources

* All awards made to consortia with prime listed as awardee and other members listed as participants

Table 6.1: Small Producer Program Selected Projects

Chapter 7 Program Benefits Assessment and Performance Metrics

The primary overall goal of Section 999 is to increase the supply of domestic natural gas and oil by increasing the supply through cost reduction and efficiency improvement. RPSEA and its SAC will provide support and advice to the NETL-led effort to develop a methodology for determining benefits related to the Program. In general, a comprehensive benefits analysis that evaluates a full range of impacts stemming from the Program is anticipated.

There are four primary objectives of the planned benefits assessment methodology:

- To accurately characterize the full suite of benefits to be assessed, as to both type and timing
- To define reasonably accurate methods for quantifying these benefits as they accrue or for estimating how they are likely to accrue in the future
- To produce benefits assessments considered valid and reasonable by a panel of knowledgeable experts
- To further develop the methodology needed to estimate increases in royalty receipts resulting from the Program

In addition to the benefits assessment, the Program will monitor and report on short-term performance metrics, as well as program management performance and budget metrics. The methodologies for measuring these metrics are provided below.

A. Monitoring Short-Term Performance Metrics

The Program will develop quantitative, short-term performance metrics. Some, but not all of the short-term metrics, will require that individual project metrics be established. The degree to which individual project objectives are met and the degree to which the roll-up of project objectives meet Program objectives must be quantified. However, quantification of project-specific metrics will require the Program to be implemented and underway. Accordingly, the following steps will be followed with regard to quantifying short-term Program impacts that are project dependent.

1. The first round of project proposals must be awarded before establishing project level objectives and metrics.
2. During this time, RPSEA will review and select the most appropriate methodology for quantifying and tracking short-term Program metrics.
3. After a methodology has been selected, a baseline will be established for all areas where short-term metrics will be measured.

4. With the above information in hand, a projection of Program short-term results based on a \$50 million R&D budget per year for a specified number of years will be modeled.
5. Based on the results of Step 4, more precise and quantifiable Program objectives will be established.
6. The results will be reviewed with RPSEA advisory groups before finalization.
7. The process will be repeated on a yearly basis to quantify incremental project/RPSEA administered Program results and cumulative impacts.

The degree to which project milestones are completed on time, papers are delivered, patents are filed, companies contribute cost-share funds, and new technologies are determined to be successful and become commercialized are important indicators of the Program's success. The long-term success of the Program will ultimately be determined by the degree to which these short-term achievements are translated into the benefits outlined earlier.

B. Monitoring and Reporting Program Management Performance and Budget Metrics

In addition, as detailed within the RPSEA Management Plan, a monitoring process has been implemented for tracking budgeted versus actual financial information and other project schedule parameters. This monitoring process includes measurements of:

5. **Obligated/Uncosted Funding in Relation to Total Funds** – RPSEA will establish a database to track obligated funding, as well as uncosted amounts for the total Program (including administration) and each project. Funds will be tracked by year appropriated in order to determine the age of all funds in all categories.
6. **Earned Value Assessment for Each Research Project Including Individual Project Cost and Schedule Variation** – Earned value management metrics will measure the cost and schedule performance of each research project. These metrics will be based on three essential variables:
 - **Budgeted Cost of Work Scheduled** is extracted from the initial project plan. This variable lays down the baseline of planned expenditures at any given time.
 - **Budgeted Cost of Work Performed** is extracted from the initial plan and computed based on the reported work completed.
 - **Actual Cost of Work Performed** is extracted from a project's periodic reports and is the actual expenditure to complete a given task.

From these three variables, the RPSEA administrator will determine the cost and schedule variance for each project.

Cost and schedule data will be collected from researchers on a schedule negotiated with the provider during the contract finalization process. The nature and characteristics of projects funded under the Program will vary widely. The reporting frequency established for each project will consider these differences and vary as appropriate for individual projects and will balance the need for information required to effectively monitor project execution against project schedules, milestones, and magnitude.

7. **Project Completion Targets (within budget and project period)** – RPSEA will utilize the three variables identified above to compute and report the estimated time at completion and estimated cost at completion for each project.

In addition to the above, RPSEA is developing procedures to capture, monitor, and analyze data related to:

- Minimization of the amount of time from invoice to payment
- Processing time for project change requests
- Project report quality and adherence to set standards
- The number of small business, minority owned, and other disadvantaged category Program participants

Chapter 8 Solicitation Process

A. Eligibility

In accordance with Section 999 of EPAct, in order to receive an award an entity must either be:

- c) a United States-owned entity organized under the laws of the United States or
- d) an entity organized under the laws of the United States that has a parent entity organized under the laws of a country that affords:
 - a. to United States-owned entities opportunities comparable to those afforded to any other entity to participate in any cooperative research venture similar to those authorized under this subtitle,
 - b. to United States-owned entities local investment opportunities comparable to those afforded to any other entity, and
 - c. adequate and effective protection for the intellectual property rights of United States-owned entities.

RPSEA is not eligible to apply for an award under this Program.

B. Organizational/Personal Conflict of Interest

The approved RPSEA Organizational Conflict of Interest Plan (OCI) will govern all potential conflicts associated with the solicitation and award process.

RPSEA was required to submit an OCI, which in accordance with Section 999B(c)(3) of EPAct addressed the procedures, by which RPSEA will (1) ensure it's board members, officers, and employees in a decision-making capacity disclose to the DOE any financial interests in or financial relationships with applicants for or recipients of awards under the Program, and (2) require board members, officers, or employees with disclosed financial relationships or interests to recuse themselves from any oversight of awards made under the Program. The OCI was reviewed by the DOE. After the DOE's comments and questions were addressed, a final OCI was approved.

In addition, the contract between the DOE and RPSEA includes the following OCI clauses: H.22 *Organizational Conflict of Interest (Nov 2005)*; H.23 *Organizational Conflict of Interest (OCI) Annual Disclosure*; and, H.24 *Limitation of Future Contracting and Employment*.

These contract clauses and the approved OCI will govern potential conflicts associated with the solicitation and award process.

C. Solicitation Approval and Project Selection Process

The overall structure of the solicitation approval and project selection process is illustrated in Figure 8.1. Project selection will be through a fully open and competitive process. A pre-proposal process may be used where a brief description of a research concept is submitted prior to submission of a full proposal in order that feedback may be given regarding the alignment of the proposed work with Program goals and the advisability of submitting a full proposal. Within the RPSEA project proposal review and selection process, advisory committees composed of subject matter experts and industry representatives will be responsible for providing technical reviews of proposals and for the selection of proposals to recommend to the RPSEA president for negotiation toward award. NETL will be responsible for the final review and approval of recommended projects.

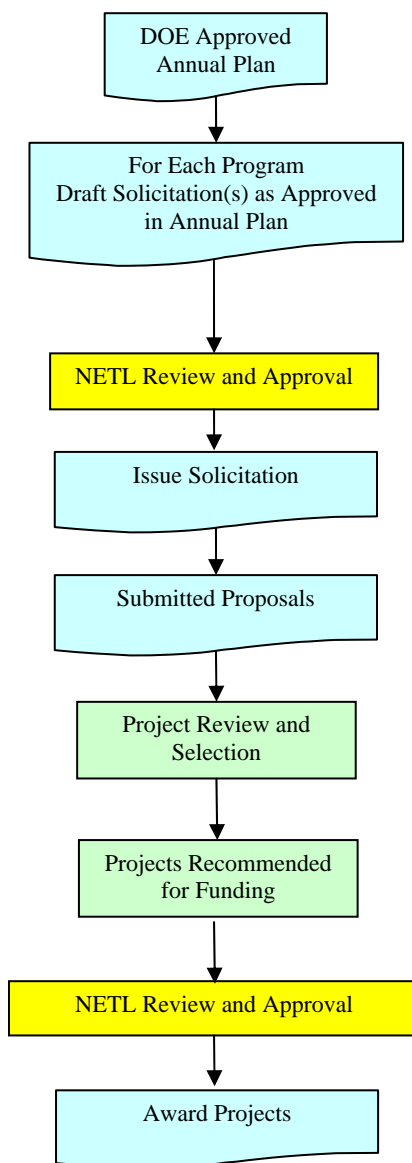


Figure 8.1: Project Solicitation Process

D. Selection Criteria

The following general criteria (which will be more defined in the individual solicitations) will be used to evaluate proposals submitted under the Program. The details of the selection criteria and the weighting factors will vary depending on the specific technology area and will be clearly identified in each solicitation.

- Technical merit and applicable production or reserve impact
- Statement of project objectives
- Personnel qualifications, project management capabilities, facilities and equipment, and readiness
- Technology transfer approach
- Cost for the proposed work
- Cost share
- Environmental impact (including an assessment of the impacts, both positive and negative, that would result from the application of a developed technology)
- Health and safety quality assurance/quality control

A bidder may be required to meet with the review committee to present their proposal and to answer any outstanding questions.

In the Small Producer Program, the following criteria will be used to evaluate proposals in addition to those stated above: approach to application of the results, involvement of small producers, and the overall strength of the Program.

E. Schedule and Timing

The 2009 solicitation(s) will be conducted after approval and posting of the 2009 Annual Plan and will remain open for a minimum of 60 days. Additional activities for RPSEA shown on the timeline below will be the active administration of all R&D awards, planning and development of the Program for 2010, and holding program level technology transfer workshops.

2009 RPSEA Program Timeline		<i>Aug 08</i>	<i>Sept 08</i>	<i>Oct 08</i>	<i>Nov 08</i>	<i>Dec 08</i>	<i>Jan 09</i>	<i>Feb 09</i>	<i>Mar 09</i>	<i>Apr 09</i>	<i>May 09</i>	<i>Jun 09</i>	<i>Jul 09</i>	<i>Aug 09</i>	<i>Sept 09</i>
<i>Month</i>		-2	-1	1	2	3	4	5	6	7	8	9	10	11	12
2009 Draft Plan Submitted (July 31, 2008)	◆														
Plan Published		◆													
Plan Approved						◆									
Obtain DOE Approval of Solicitation							◆								
Solicitation Open Period															
Proposal Evaluation and Selection															
DOE Approval															
Contract Negotiation and Award															
Administer 2009 Awards															
Administer 2007 & 2008 Awards															
Report Program Deliverables															
Conduct Technology Transfer Workshops & Activities															
Establish 2010 R&D Priorities & Annual Plan															

Table 8.1: 2009 RPSEA Program Timeline

F. Proposal Specifications

The structure and required elements of proposals submitted in response to each of the solicitations, as well as the specific details regarding format and delivery, will be developed in consultation with the DOE and will be provided in each solicitation.

G. Funding Estimates

It is anticipated that for fiscal year 2009, \$14.87 million per year will be available for the UDW with approximately five to 10 awards and \$13.81 million per year for the Unconventional Resources Program with approximately five to 15 awards. The typical award is expected to have duration of one to three years, although shorter or longer awards may be considered if warranted by the nature of the proposed project. Under the stage/gate approach, all projects will be fully funded to the completion of the appropriate decision point identified in each contract, which may include multiple stages. Once a decision is made to move to the next stage or decision point, additional funding will be provided from available funds.

It is anticipated that \$3.19 million per year will be available for the Small Producer Program. Approximately four to 12 awards are anticipated during fiscal year 2009. The typical award is

expected to have a duration of two years, although shorter or longer awards may be considered if warranted by the nature of the proposed project.

H. Advertising of Solicitations

Advertising of each solicitation will be implemented in a manner that insures wide distribution to the specific audience targeted by each solicitation.

The vehicles used will include but not be limited to:

- Publication on the NETL website, supported by DOE press releases
- Publication on the RPSEA website, supported by RPSEA press releases and newsletters
- Announcements distributed via e-mail to targeted lists (e.g., small producer solicitation to members of state producer organizations and IPAA)

Other vehicles that may be used include:

- Advertising in recognized industry publications (e.g., *Oil and Gas Journal*, *Hart's E&P*, *Offshore*, *American Oil and Gas Reporter*, etc.)
- Presentations at industry meetings by both RPSEA and NETL representatives, as appropriate given the timing of the solicitations
- Subscribing to funding-alert organizations that send e-mails once a week about funding opportunities to members in their specific areas of expertise
- Working with the various professional, industry, state, and national organizations to utilize their established networks

Chapter 9 Technology Transfer

In order to meet the Program goal of maximizing the value of the nation's natural gas and oil resources, as well as increasing federal royalty receipts, it is essential that technology developed under this Program be rapidly and effectively applied by operators exploring for and developing new resources. The goal for technology transfer under this Program is to assure the engagement of participants all along the technology value chain, from conceptual development to commercial application, in order to maximize the impact of Program technology. Technology transfer will be coordinated with NETL/DOE.

A proactive communication approach to technology transfer must include the initial articulation of technology needs by the ultimate users of the technology, involve the various stakeholders in the technology development continuum, and have continuous feedback loops from each stage in the process to either validate or calibrate research or technologies. The technology transfer objectives for the early years of the Program focus on developing and implementing a set of processes designed to ensure coordinated transfer of technology across the anticipated wide spectrum of technology investors, developers, deployers, and end users likely to be associated with the Program. Examples of technology transfer include workshops, conferences, websites, and flyers, along with newer techniques such as webcasting, podcasting, or online video conferencing.

The specific technology transfer objectives for the Program include:

1. Incorporate provisions in the solicitations that provide for the allocation of 2.5 percent of the funding for each project to technology transfer activities. Develop and incorporate language that requires each applicant for an award to propose a technology transfer approach, with the understanding that up to 40 percent of the 2.5 percent designated may be directed by RPSEA for program-level technology transfer. Develop and incorporate language in the model contract that provides for the coordination of technology transfer across multiple related projects, as specified above.
2. Engage the PAC and TAC members through involvement in needs assessment, project selection, and ongoing project review in order to promote ongoing interest in developing projects and facilitate field tests and demonstrations using operator wells, data, and facilities.
3. Each project will participate in at least one project review meeting for RPSEA members and the public.

The approach to technology transfer is designed to address program-level goals through a coordinated process that combines the technology transfer efforts associated with related projects, while honoring the contractual commitment to fund technology transfer through the allocation of 2.5 percent of Program funding for this purpose.

As part of the administration of the Program, RPSEA will conduct the following program-level technology transfer activities.

- RPSEA will post on its public website a list of projects, including goals, objectives, technical status assessments, results and accomplishments, reports, best practices, and key personnel contact information. This effort will be coordinated with the knowledge management database being developed by NETL under the Section 999 complementary program that will provide a repository for Program results.
- Periodic project reviews with the PACs and the RAG (and the TACs as required) will be designed to ensure that the results of related projects are presented in a way that highlights their interconnection and allows the advisory bodies to identify opportunities for the evaluation and application of project results.

In order to maximize the impact of the 2.5 percent allocated to technology transfer, RPSEA is implementing the following approach:

- Each solicitation included the requirement for a plan for technology transfer. The solicitation will instruct offerors to propose an approach for technology transfer for their project, understanding that up to 40 percent of the 2.5 percent designated for technology transfer may be designated by RPSEA for use in program-level technology transfer activities, such as third-party services to coordinate program-level technology transfer for a number of projects.
- RPSEA is developing a program-level technology transfer approach for the portfolio of projects to be funded. This plan will be based on maximizing the impact of the entire project portfolio, including new and ongoing projects, and will consider the input associated with the technology transfer plans submitted in successful proposals.
- RPSEA and the selected awardee will jointly develop a project-level technology transfer approach.

The R&D contracts awarded will include requirements for the expenditure of funds allocated to technology transfer in accordance with the portfolio level plan. In some cases, especially with large projects with few deliverables, the technology transfer may be handled entirely by the awardee in accordance with an approved plan. In other cases, especially smaller projects, technology transfer efforts may be more effective if coordinated with other projects.

A portion of the 2.5 percent funding will be allocated to support a knowledge management database. RPSEA database efforts will be coordinated with the knowledge management database being developed by NETL under the Section 999 complementary program. The preservation of data from the R&D projects and technology transfer program must be retained in

a database for maximum dissemination (both near and longer term) to the end users. Elements of a successful database resource should include:

- A knowledge management database populated with R&D results to serve as a resource of technology for industry
- A knowledge management database with the following aspects: require user registration, but be free of charge and open to the public; have a standard template format for input; allow for subject matter review process before information is published; and, incorporate a knowledge push and/or community notification system to stimulate and maintain interest
- Use of the existing petroleum technology transfer databases and databases that are under development by NETL to the maximum extent possible, to reduce development and maintenance costs

The objective of this approach is to ensure a coordinated technology transfer effort that maximizes the impact of the entire Program. Options will be explored for leveraging resources to ensure a most robust technology transfer program. The DOE will continue to engage RPSEA to develop a coordinated program. As a result of project commencements in 2008, it is expected that a combination of RPSEA member meetings, program specific meetings, joint efforts with professional associations, and/or other regional events will be held beginning in the last half of 2009. Notices of these meetings will be posted to the RPSEA and NETL websites as they are developed.

Appendix A: RPSEA Membership and Committee Lists

RPSEA Members

Acergy US Inc.
Acute Technological Services, LLC
Advanced Resources International, Inc.
AeroVironment, Inc.
Altira Group
American Gas Association
Anadarko Petroleum Corporation
Apache Corporation
Apex Spectral Technology
APS Technology, Inc.
Baker Hughes Incorporated
Bill Barrett Corporation
BJ Services
BP America, Inc.
BreitBurn Energy Partners L.P.
Bretagne, LLC
Brownstein Hyatt Farber Schreck, LLP
Cameron/Curtiss-Wright EMD
CARBO Ceramics, Inc.
Centre For Marine CNG, Inc.
Chesapeake Energy Corporation
Chevron Corporation
City of Sugar Land
Colorado Energy Research Institute/Colorado School of Mines
Colorado Oil & Gas Association
ConocoPhillips Company
Conservation Committee of California Oil & Gas Producers
Correlations Company
CSI Technologies, Inc.
DCP Midstream, LLC
Delco Oheb Energy, LLC
Det Norske Veritas (USA)
Devon Energy Corporation
The Discovery Group, Inc.
EnCana Corporation
EnerCrest, Inc.
Energy Corporation of America
Energy Valley, Inc.
The Fleischaker Companies
Florida International University
Gas Technology Institute

GE/VetcoGray
Greater Fort Bend Economic Development Council
GSI Environmental, Inc.
Halliburton
Harvard Petroleum Corporation
Houston Advanced Research Center
Houston Offshore Engineering, LLC
Houston Technology Center
HW Process Technologies, Inc.
Idaho National Laboratory
Independent Petroleum Association of America
Independent Petroleum Association of Mountain States
Integrated Ocean Drilling Program
Interstate Oil and Gas Compact Commission
Jackson State University
K. Stewart Energy Group
Knowledge Reservoir, LLC
Lawrence Berkeley National Laboratory
Lawrence Livermore National Laboratory
Leede Operating Company
Los Alamos National Laboratory
Louisiana State University
Marathon Oil Corporation
Massachusetts Institute of Technology
Maxwell Resources Corp.
Merrick Systems, Inc.
Mississippi State University
Nalco Company
Nance Resources
NanoRidge Materials, Inc.
Natural Carbon, LLC
Nautilus International, LLC
New England Research, Inc.
New Mexico Institute of Mining and Technology
New Mexico Oil & Gas Association
NGAS Resources, Inc.
NiCo Resources
Noble Energy, Inc.
Novatek, LLC
The Ohio State University
Oklahoma Independent Petroleum Association
Oxane Materials, Inc.
The Pennsylvania State University
Petris Technology, Inc.
Petrobras America Inc.

Petroleum Technology Transfer Council
Pioneer Natural Resources Company
Quanelle, LLC
Rice University
Robert L. Bayless, Producer LLC
Rock Solid Images
RTI Texas
Sandia National Laboratories
Schlumberger Limited
Shell Exploration & Production
Simmons & Company International
SiteLark, LLC
Southwest Research Institute
Stanford University
StatoilHydro
Strata Production Company
Stress Engineering Services Inc.
Technip
Technology International
Tejas Research & Engineering, LP
Tenaris
Texas Energy Center
Texas Engineering Experiment Station/Texas A&M University
Texas Independent Producers and Royalty Owners Association
Texas Tech University
Titanium Engineers, Inc.
TOTAL Exploration Production USA
The University of Alabama
University of Alaska Fairbanks
University of Houston
The University of Kansas
University of Michigan
The University of Oklahoma
University of South Carolina
University of Southern California
The University of Texas at Austin
The University of Tulsa
The University of Utah
VersaMarine Engineering, LLC
Watt Mineral Holdings, LLC
Weatherford International Ltd.
WellDog, Inc.
Western Standard Energy Corp.
West Virginia University
Williams, and Woods Hole Oceanographic Institution

RPSEA Board of Directors

Board Member	Affiliation
Mr. Mark B. Murphy – Board Chair	Strata Production Company
Dr. Richard A. Bajura	West Virginia University
Mr. Brian R. Cebull	Representing Independent Petroleum Association of America
Dr. Brian Clark	Schlumberger Limited
Mr. Daniel D. Gleitman	Halliburton
Dr. Richard C. Haut	Houston Advanced Research Center
Mr. Christopher Haver	Chevron Corporation
Mr. Lynn D. Helms	Representing Interstate Oil and Gas Compact Commission
Dr. Stephen A. Holditch	Texas A&M University
Dr. Brooks A. Keel	Louisiana State University
Ms. Melanie A. Kenderdine	Representing Gas Technology Institute
Dr. Roger L. King	Mississippi State University
Dr. Daniel H. Lopez	New Mexico Institute of Mining and Technology
Mr. Dirk McDermott	Altira Group
Mr. Christopher B. McGill	American Gas Association
Mr. C. Michael Ming	Research Partnership to Secure Energy for America
Dr. Ernest J. Moniz	Massachusetts Institute of Technology
Ms. Castlen E. Moore	Apache Corporation
Mr. Rob Perry	BP America, Inc.
Mr. Brook J. Phifer	NiCo Resources
Mr. Jim Schroeder	Representing Independent Petroleum Association of Mountain States
Dr. Scott W. Tinker	The University of Texas at Austin
Mr. Timothy N. Tipton	Marathon Oil Corporation
Mr. Tony D. Vaughn	Devon Energy Corporation
Mr. Michael Wallen	NGAS Resources, Inc.
Dr. Arthur B. Weglein	University of Houston
Mr. Thomas E. Williams	Nautilus International, LLC

RPSEA Strategic Advisory Committee (SAC)

Strategic Advisory Committee Member	Affiliation
Dr. Steven Holditch – Chair	Texas A&M University
John Allen	GE/VetcoGray
Ralph Cavanagh	Natural Resources Defense Council
Peter Dea	Cirque Resource Associates Ltd.
David Fleischaker	The Fleischaker Companies
Melanie Kenderdine	Representing Gas Technology Institute
Vello Kuuskraa	Advanced Resources International, Inc.
Dirk McDermott	Altira Group
C. Michael Ming	Research Partnership to Secure Energy for America
Dr. Ernest Moniz	Massachusetts Institute of Technology
Mark Murphy (Ex-Officio)	Strata Production Company
Donald Paul	Energy Technology Services, LLC
William Schneider	Newfield Exploration Company
Kyle Simpson	Brownstein Hyatt Farber Schreck, LLP

RPSEA Ultra-Deepwater Program Advisory Committee (PAC)

Name	Organization
Hugh Banon	BP America, Inc.
Gail Baxter	Marathon Oil Corporation
Jenifer Tule-Gaulden	Anadarko Petroleum Corporation
Christopher Haver	Chevron Corporation
Rick Mitchell	Devon Energy Corporation
Dr. Oliver Onyewuenyi	Shell Exploration & Production
Maurizio Zecchin	Eni SpA
Rune Mode Ramberg	StatoilHydro
Philippe Remacle	TOTAL Exploration Production USA
Luiz Fernando Souza	Petrobras America Inc.
Gary Covatch	National Energy Technology Laboratory (Ex-Officio)
Roy Long	National Energy Technology Laboratory (Ex-Officio)
Tom Williams (Ex-Officio)	Nautilus International, LLC

RPSEA Unconventional Resources Program Advisory Committee (PAC)

Name	Company
Dr. Julio Friedman	Lawrence Livermore National Laboratory
Mark Glover	BP America, Inc.
Dr. Valerie Jochen	Schlumberger Limited
Dr. John Lee	Texas A&M University
John Lewis	Noble Energy, Inc.
Mark Malinowski	Rosewood Resources, Inc.
David Martinueau	Pitts Energy Group
Steve McKetta	Southwestern Energy
Dr. Dag Nummedal	Colorado Energy Research Institute/ Colorado School of Mines
Brook Phifer	NiCo Resources
Darrell Pierce	DCP Midstream, LLC
Kurt Reinecke	Bill Barrett Corporation
Bob Stayton	Weatherford International Ltd.
Richard Sullivan	Anadarko Petroleum Corporation
Dr. Nafi Toksoz	Massachusetts Institute of Technology
Bill Van Wie	Devon Energy Corporation
Roy Long	National Energy Technology Laboratory (Ex-Officio)
Virginia Weyland	National Energy Technology Laboratory (Ex-Officio)

Small Producer Research Advisory Group (RAG)

Name	Organization
Brook Phifer, Chair	NiCo Resources
Chuck Boyer	Schlumberger Limited
Jeff Harvard	Harvard Petroleum Company, LLC
Dr. Iraj Irshaghi	University of Southern California
Bob Kiker	Petroleum Technology Transfer Council
Dr. Charles Mankin	University of Oklahoma
Dr. Douglas Patchen	West Virginia University
Don Solanas	Arrowhead Exploration Co.
Roy Long	National Energy Technology Laboratory (Ex-Officio)
Chandra Nautiyal	National Energy Technology Laboratory (Ex-Officio)

Environmental Advisory Group (EAG)

Name	Organization
Dr. Rich Haut, Chair	Houston Advanced Research Council
Scott Anderson	Environmental Defense Fund
Dr. Steve Bryant	The University of Texas at Austin
Sharon Buccino	Natural Resources Defense Council
Dr. David Burnett	Texas A&M University
Assheton Carter	Conservation International
Bob Gordan	Stress Engineering Services Inc.
Russ Johns	The University of Texas at Austin
Joe Kiesecker	The Nature Conservancy
Roy Long	National Energy Technology Laboratory
Pam Matson	Stanford University
Chuck Newell	GSI Environmental, Inc.
Scott Reeves	Advanced Resources International, Inc.
Øyvind Strøm	StatoilHydro
Mason Tomson	Rice University

Appendix D: Federal Advisory Committee Comments

The following 38 pages encompass the final reports from the two Federal Advisory Committees charged with reviewing the 2009 Draft Annual Plan.

The Ultra-Deepwater Advisory Committee
Advisory Committee to The Secretary of Energy Established Under EPOA 2005 Section 999D

October 23, 2008

The Honorable Samuel W. Bodman
Secretary of Energy
Washington, D.C. 20585

Dear Mr. Secretary:

On behalf of the Ultra-Deepwater Advisory Committee (UDAC), I am pleased to submit the results of our review of the Ultra-Deepwater Program element of the Draft 2009 Annual Plan for the Ultra-Deepwater and Unconventional Natural Gas and Other Petroleum Resources Research and Development Program (the Plan).

The Committee recognizes the accomplishments of the management team (DOE, NETL, and RPSEA) in creating the Plan and implementing EPOA (the Program) to date. The network of industry experts represents 132 organizations, 28 states, the District of Columbia, and the Province of Newfoundland, Canada, collectively more than 500,000 employees world-wide. This network has been particularly effective in identifying the research opportunities with the greatest potential to impact the development of new technology required to develop the oil and gas resources in the U.S. ultra-deepwater in a safe, cost effective and environmentally responsible manner.

There are multiple benefits of this research for consumers, the economy, and national security. The program supports industry efforts to increase and further develop the domestic resource base in the United States. This will help provide a robust, diverse, and affordable supply of energy in the United States that is not dependent on imports, and is essential to economic growth. All consumers regard affordable energy as a crucial component to their lives. This Program is key in providing affordable energy. Finding and developing new reserves is increasingly difficult and requires new technology. Accessing the ultra-deepwater reserves in U.S. territorial waters is one of the best opportunities for substantial new domestic energy resources.

New technology developed through this Plan will contribute to accessing these resources and will enable the development of a workforce capable of filling new jobs created by ultra-deepwater development. This includes research needed for safe infrastructure while protecting the environment. The cooperative nature of this government/industry/academia program, with cost sharing by industry partners to develop and test new technology, brings together the best minds to attack these complex problems. The ultra-deepwater program element is focused on the Gulf of Mexico, but results will be applicable to other areas in U.S. territorial waters such as the offshore Arctic. The

UDAC supports including the technology needs of these other areas, as authorized by EAct, in the scope of the Program.

The UDAC believes that DOE should work within the Administration to ensure that the Program is sustained, and that new technology is available when needed throughout the lifecycle of ultra-deepwater activity. Appropriations for the program will be required when projects mature to the field-testing stage and to achieve delivery of new technology.

The Plan includes breakthrough Grand Challenge projects, which are intended to leapfrog existing technologies and open access to new supplies of domestic oil and gas. UDAC believes these projects should receive high priority.

Respectfully Submitted,



Kent F. Abadie
Chair – UDAC

UDW Advisory Committee

2009 UDW Annual Plan

Comments and Recommendations

October, 2008

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1.0 INTRODUCTION

The UDW Advisory Committee (UDAC or Committee) was formed pursuant to the provisions of Title IX, Subtitle J, Section 999D(a) of the 2005 Energy Policy Act (EPAcT).

The Committee consists of:

- Individuals with extensive research experience or operational knowledge of offshore natural gas and other petroleum exploration and production; and
- Individuals broadly representative of the affected interests in ultra-deepwater natural gas and other petroleum production, including interests in environmental protection and safe operations.

The provisions of EPAcT excluded Federal employees and board members, officers or employees of the Program consortium, known as Research Partnership to Secure Energy for America (RPSEA).

The duties of the UDAC under EPAcT Title IX, Subtitle J, Section 999D(a) are to advise the Secretary of Energy (Secretary) on the development and implementation of programs under Title IX, Subtitle J, related to UDW natural gas and other petroleum resources and to carry out section 999B(e)(2)(B) which is to comment on the draft annual plan.

The Committee was chartered July 2008, and members received letters of appointment from the Secretary signed August 14, 2008. See Section 4.0 for a list of Committee members.

The Department of Energy (DOE) Designated Federal Officer provided additional guidance for the Draft 2009 Annual Plan Review at the Sixth Meeting of UDAC in Washington on September 9-10, 2008.

The schedule of work for the review of the 2009 Plan included the following key milestones:

- 8/14/2008 - DOE Notice to UDAC for Draft 2009 Annual Plan Review
- 9/9-10/2008 - 6th UDAC Meeting in Washington, DC
- 09-10/2008 - Subcommittee Inputs to Leaders
- 10/10/2008 - Leaders submit recommendations to Chair
- 10/14/2008 - Combined Recommendations Distributed by Chair
- 10/15/2008 - 7th UDAC Meeting in Houston, TX
- 10/16/2008 - Edit Subcommittee Compiles Subcommittee Reports into Draft Final Report
- 10/21/2008 - Edit Subcommittee Distributes Draft Final Report and Transmittal Letter to UDAC
- 10/23/2008 - 8th UDAC Meeting: Teleconference to Review & Vote on Final UDAC Report

2.0 EXECUTIVE SUMMARY AND RECOMMENDATIONS

The UDAC recognizes the experience and expertise of the team responsible for planning and executing the UDW Program element: the DOE, National Energy Technology Laboratory (NETL) and RPSEA (the Consortium). An extensive effort, supported by a large number of industry experts, has been successful in identifying research opportunities which are aligned with the Program goals.

The UDAC met September 9-10, 2008, and agreed to form five subcommittees to review the 2009 Draft Plan. These subcommittees focused on:

- R&D Program Focus
- Program Scope
- Process
- Program Progress & Value
- Societal Impact

The Plan, if successfully executed, will contribute to the primary Program goal of increasing the UDW resource base and converting discovered resources into proven reserves which can be safely and economically recovered while protecting the environment. However, this will require awarding the contracts to organizations selected to perform the research, and delivery of the expected results to the UDW industry. The UDAC notes that only three contracts had been awarded by mid-October 2008 since the beginning of the Program. The Committee recognizes that NETL and RPSEA are working to streamline the process and improve R&D project awards and anticipates that these efforts will be successful. The UDAC recommends that efforts be made to expedite the award process, and to establish a system of monitoring the status of the Program, including measures and scorecards.

In accordance with EAct, the UDAC believes the Program results are beneficial and should encompass areas beyond the Gulf of Mexico within U.S. territorial waters, including the Arctic. These other areas should not dilute the Program to the point where funds may be insufficient for executing Grand Challenge/breakthrough projects. The Committee recommends that more emphasis be given to projects representing Grand Challenges.

While safety and the environment are aspects of the Plan, efforts should be put forth to better define and address these elements. The Committee recommends that safety and environment aspects of the Plan should each be given greater emphasis.

Please be aware that funding levels should be closely monitored and appropriation authorization provided by EAct may need to be activated. As projects move toward the field demonstration stage, current funding provisions may be insufficient in view of the high costs of technology evaluation and implementation in the UDW operating environment. For example, R&D

programs of similar nature, such as DEMO 2000 sponsored by the Research Council of Norway, have been funded with a total cost-share of USD \$500 Million from 1999 – 2008. The Committee recommends looking for opportunities for international collaboration, and increased focus on cost sharing by industry.

Finally, the maturation timeline for UDW developments is in its early phases, and will extend over the next twenty years and longer. R&D technology development will be a key enabler throughout the entire lifecycle. EAct and programs of this nature will be vitally important in the next few decades to ensure our energy security.

3.0 SUBCOMMITTEE REPORTS

At the September 9-10 meeting, the UDAC agreed to divide the UDW Program element of the Draft 2009 Annual Plan for the UDW and Unconventional Natural Gas and Other Petroleum Resources Research and Development Program (the Plan) and review the following focus areas:

- R&D Program Focus
- Program Scope
- Process
- Program Progress & Value
- Societal Impacts

Subcommittees were formed to assess the Plan for each of the five (5) focus areas and provided the review and recommendations to the Secretary.

3.1 R&D PROGRAM FOCUS

Overview

The Committee is pleased that many of the recommendations from the previous UDAC have been implemented. The Ultra-Deepwater Program element concentrates on six major needs:

1. Drilling, Completions, and Interventions Breakthroughs
2. Appraisal & Development Geoscience and Reservoir Engineering
3. Significantly Extend Subsea Tieback Distances/Surface Host Elimination
4. Dry Trees/Direct Well Intervention and Risers in 10,000 Feet Water Depth
5. Continuous Improvement/Optimization of Field Development
6. Associated Safety and Environmental Concerns

Finding #1: Program Content

The UDAC is in general agreement with the first five needs that have been identified and the criteria that are being used to make selections (Note: Need 6 referenced above requires clarification relative to the definitions of “safety” and “environment”, which is addressed in Section 3.1 “R&D Program Focus” and Section 3.5 “Societal Impact” of this Report). We recognize that the project selections are what ultimately define the Program focus.

Recommendations:

- Safety and environmental projects should be considered as separate topics.
- Safety and environmental projects should be identified with specific phases of the exploration and production lifecycle (i.e., find, develop, produce and abandon).
- The project impact assessment utilized in the project selection process should be made public and available to the UDAC.

Finding #2: Safety and Environmental Impact

The Plan does not have clear definitions for the terms “safety” and “environmental”. The Plan recommends assessing the safety and environmental impact of UDW funded projects, but not the overall safety or environmental impact of ultra deepwater development.

Recommendations:

- Fund projects which address the overall safety impact of UDW activity.
- Fund projects which address the overall environmental impact of UDW activity.

Finding #3: Safety

Identified met-ocean projects address global warming effects on hurricanes and offshore current predictions. Wind and wave predictions are critical to safe, advanced structural design necessary to drill and develop UDW projects.

Recommendation:

The met-ocean program should be strengthened regarding wind and wave predictions.

Finding #4: Environmental

No environmentally based R&D projects have been solicited and selected that address biological and ecological impacts, both positive and negative, of UDW activity.

Recommendation:

Environmental studies should address the biological and ecological impacts, both positive and negative, of UDW activity.

Finding #5: Grand Challenges

The Plan does not contain sufficient R&D projects which constitute Grand Challenge technologies. "Grand Challenges" are defined as transformational technologies which, if successfully developed, are capable of leapfrogging conventional pathways.

Recommendation:

The UDW Program element should be primarily directed at R&D that drives step changes in the industry (i.e., Grand Challenges).

3.2 PROGRAM SCOPE

Overview

In reviewing the Plan, the overall Program scope for the UDW element is oriented toward the ultra-deep waters of the Gulf of Mexico. EPAct provides for the UDW Program elements to encompass U.S. territorial waters within specified water depths and subsurface formation depths, which are not limited to the Gulf of Mexico. Technology and experience from UDW arenas other than the Gulf of Mexico are valuable in securing energy for America.

Finding #1: Other Petroleum Provinces

Technology and the knowledge base needed to explore and exploit hydrocarbons in ultra-deep waters coincide to a large extent with those needed for developing other oil and gas provinces that will be of importance to the U.S. (e.g. offshore, harsh met-ocean conditions, Arctic and remote locations). In terms of domestic oil and gas supply, these regions will become strategically and economically important to the U.S. in the future.

Recommendation:

Expand the Plan's scope to petroleum provinces within the definition of EPAct (e.g., Arctic) and undertake technology development to maximize the supply of domestic oil and gas. Caution should be exercised to avoid diluting available funds in a way that impacts the total size of projects and promoting the most beneficial R&D technologies.

Finding #2: International Deepwater R&D Program Collaboration

UDW oil and gas operators and service industry in the U.S. work globally and do not limit their activity and technology base to U.S. territorial waters. DEMO 2000 in Norway (USD \$500 Million total funding from 1999 to 2008), Brazil, Industry Technology Facilitator (ITF) in the United Kingdom, and the consortium 'West Africa Deepwater Operators' (WADO) have shared their offshore technologies and experiences for many years.

Recommendation:

Seek cooperation and experience with similar programs internationally in order to gain leverage/synergy and avoid redundancy/duplication of effort.

3.3 PROCESS

Overview

The Program is well established and in the early stages of execution. The challenges to UDW R&D are broad, complex, requires innovation and capital intensive. Implementing a plan of this magnitude requires cooperation between entities involved in administering the Program and stakeholders. UDAC believes this endeavor has been successfully achieved thus far, however, improvements are required in certain areas.

Finding #1: Intellectual Property

No evidence has surfaced that contractual provisions governing intellectual property (IP) rights are a barrier to the selection and award process, however, it remains a critical success factor to the UDW Program element.

Recommendation:

Continue monitoring IP rights in the project selection/award process.

Finding #2: Request for Proposal (RFP)

Although progress has been made, RFP solicitations tend to be very specific and may curtail scientific creativity.

Recommendation:

The RFP solicitation process should be reviewed to allow a broader approach to problem identification and solving to promote “out of the box” thinking and a broader base of respondents.

Finding #3: Contract Award Process

Although streamlining has been implemented, contractual complexity with respect to research performers has resulted in protracted cycle times to achieve contract award, withdrawal of potential contractors, and qualified candidates not responding to RFPs.

Recommendations:

- Explore and implement ways to further streamline the contract award process. For example, examine the potential of linking cost share to the commercial structure of the contract by establishing cost-share tranches that correlate to procurement, cooperative research and grant commercial structures. Procurement contracts could be utilized for R&D cost share up to 50%. Cost-share proposals ranging from 50% to 75% may be considered to be collaborative R&D governed by cooperative research-type contracts. RFPs selected/awarded that exceed 75% of cost share could be delivered under a grant.
- Perform an after action review to identify the key success elements of the Unconventional Program and apply these learnings to the UDW Program element, as appropriate.
- Conduct a survey of the UDW research community to identify process changes which may yield increased response to UDW RFPs.

Finding #4: Private-Sector Funding

The Plan continues to promote minimum cost share of 20%. The Program may benefit from increased private sector funding, including cost sharing. Programs of similar nature, such as DEMO 2000 (Norway), provide for research performer cost shares starting at 75%.

Recommendations:

- Promote higher cost share proposals by increasing the weight allocated to the cost share element in the proposal evaluation and selection process
- Consider in-kind contributions in the cost share element of the proposal (e.g., rig time, vessel utilization, core samples, etc.)
- Encourage private funding sources to support the UDW Program element

Finding #5: Complementary Program

The UDW Program element could benefit from a more robust Complementary Program with greater focus on UDW technology needs identified in the Plan.

Recommendation:

The Complementary Program should identify and assign resources to UDW technology needs specified in the Plan that are unfunded and not redundant.

3.4 PROGRAM PROGRESS & VALUE

Overview

With limited project awards to date, it is difficult to identify the value and benefit of the Program from a quantitative prospective due to the lack of tangible data associated with project(s) progress.

Finding #1: Program Monitoring

The Plan provides for implementation of certain monitoring and measurement systems identified as:

- Monitoring and Reporting Program Management Performance and Budget Metrics
- Program Benefits Assessment

Recommendation:

The referenced status reports should be made available to the public through the “Technology Transfer” vehicles used by NETL and RPSEA (i.e., web sites, public mailers, etc).

Finding #2: Program Metrics

Metrics are being captured with respect to requirements of EPAct.

Recommendation:

Produce a quarterly executive summary document using a simple table format. An example of the data to be included follows:

- Reference year of funding allocation
- Number of projects solicited
- Number of projects awarded
- Contract award value
- Project name and affiliate (university, private sector company, etc.)
- Projected start and completion dates
- Value of the UDW Program element (estimated by Benefits Assessment)
- Projected additional federal royalty
- Potential jobs created

Finding #3: Program Value (Long Term)

The extreme conditions of UDW require cutting edge technologies that can take many years to develop and progress to commerciality and reliability. Technology demonstration in the UDW environment requires significant investment. The UDW provinces are in early stages of development and will continue to have technology needs for many decades spanning the entire E&P lifecycle (find, develop, produce, and abandon).

Recommendations:

- Funding levels should be closely monitored and appropriation authorization provided by EAct (section 999H[e]) may need to be activated in the future.
- Continue EAct and other programs of this nature to provide R&D for the required UDW technologies throughout the entire E&P lifecycle (find, develop, produce & abandon), which will take place over the next several decades.

3.5 SOCIETAL IMPACTS

Overview

The Plan insufficiently addresses the distinction between safety and environment and lacks clear executable projects in these areas. There is great opportunity to promote sustainable development and attract young professionals to the workforce through projects that are environmentally and safety focused.

Finding #1: Environmental Research Plan

The environmental aspects of the UDW Program element are not clearly understood within the context of other environmental federally funded programs (e.g., NOAA, NSF, etc.). Specific environmental programs relating to UDW activities are not identified in the Plan.

Recommendations:

- Fund projects on atmospheric or oceanic research that clearly demonstrate a benefit to UDW development, not merely augmenting research already funded by other government agencies. (See Section 3.1)
- Emphasis should be placed on environmental projects which study the impacts of UDW activity, both positive or negative. (See Section 3.1)

Finding #2: Environmental Impact Assessment

The Plan does not describe how environmental impact(s) of UDW projects will be evaluated.

Recommendation:

Define strategies for assessing and monitoring potential environmental impact, both positive and negative. Consider developing a detailed document describing what is known and not known about the ecology of UDW environments, and how oil/gas exploration, drilling, and production activities could potentially impact environmental quality, productivity, and sustainability.

Finding #3: Workforce Development

Private funding of fellowships/scholarships/internships supporting UDW R&D programs is an effective way to enhance future workforce and attract young professionals to the oil and gas industry. This enhances the U.S.'s ability to implement and follow through on UDW technology and be competitive on a global scale to secure our future energy independence.

Recommendation:

Encourage continuation of this practice.

4.0 ULTRA DEEPWATER ADVISORY COMMITTEE – 2008-2010

Mr. Kent F. Abadie Manager Development and Production Shell Exploration & Production Company	Dr. Joe R. Fowler* President Stress Engineering Services, Inc.	Mr. Stephen Sears* Department Chair Dept. of Petroleum Engineering Louisiana State University
Mr. Raymond G. Charles Area Exploration & Geoscience Manager ExxonMobil Exploration Company	Dr. Luc T. Ikelle* Robert R. Berg Professor Texas A&M University	Mr. Paul T. Tranter Vice President Asset Management, Floating Rigs Transocean, Inc.
Mr. Paul N. Cicio President Industrial Energy Consumers of America	Mr. Arnis Judzis Vice President TerraTek Schlumberger	Mr. Paul M. Wiencke Director Research Council of Norway
Mr. Daniel J. Daulton U.S. Technical Marketing Manager BJ Services Company	Mr. Richard K. Mitchell Vice President Worldwide Drilling & E&P Services Devon Energy Corporation	Ms. Mary Jane Wilson* President and CEO WZI Inc.
Dr. Quenton R. Dokken Executive Director Gulf of Mexico Foundation	Mr. Daniel T. Seamount, Jr., Chair Alaska Oil & Gas Conservation Commission	

*Special Government Employee

5.0 SUBCOMMITTEE TOPICS AND MEMBERS

The Plan review and preparation of the final Committee Report involved the following:

R&D Program Focus

Lead – Joe Fowler

Members – Ray Charles & Dan Daulton

Program Scope

Lead – Arnis Judzis

Members – Dan Seamount & Morten Weincke

Process

Lead – Luc Ikelle

Members – Kent Abadie, Joe Fowler & Paul Tranter

Program Progress & Value

Lead – Richard Mitchell

Members – Paul Cicio, Dan Daulton & Quenton Dokken

Societal Impacts

Lead – Quenton Dokken

Members – Paul Cicio, Stephen Sears & Mary Jane Wilson

Editing Subcommittee

Lead – Kent Abadie

Members – Dan Daulton, Arnis Judzis & Stephen Sears

Unconventional Resources Technology Advisory Committee

Advisory Committee to The Secretary of Energy

October 23, 2008

The Honorable Samuel W. Bodman
Secretary of Energy
Washington, DC 20585

Dear Mr. Secretary:

On behalf of the Unconventional Resources Technology Advisory Committee (URTAC), it is my pleasure to submit our findings and recommendations based on our review of the Unconventional Resources Technology and Small Producers' portion of the Draft Ultra-Deepwater & Unconventional Gas 2009 Research and Development Plan.

The Committee finds that:

The Federal Government oil and gas Research and Development (R&D) and Technology Transfer (TT) programs are extremely important for maximizing domestic production. That said, the Federal Government needs to become more actively involved as an advocate of domestic oil and gas production.

The Advisory Committee commends DOE, NETL and RPSEA for the actions taken in implementing prior Committee recommendations. Both the Consortium and Complementary Programs provided a very comprehensive response to the need to develop a robust technology transfer program and knowledge management system.

The URTAC provides the following key recommendations:

- A national goal of recovering an additional 30% of the existing domestic reserves is achievable and warranted.
 - The creation of a multi-department study (e.g. Energy, Commerce and Interior) to bring together existing information and to assess the potential of the domestic oil and gas industry to meet the nation's energy needs is warranted, so that oil and gas can make its full contribution.
 - DOE must work with various parties including industry, NGO's, state regulators, other federal agencies and others to explore mechanisms to balance environmental responsibility and resource development concerns.
 - That research focus be expanded in the areas of: geosciences; basin analysis and real-time resource exploitation; stimulation and completion; water management; environmental concerns; and other petroleum resources.
 - Technology transfer is an essential part of the program that must: outline the steps necessary to communicate the results of the research and technologies developed;
-

Unconventional Resources Technology Advisory Committee

Advisory Committee to The Secretary of Energy

develop a Knowledge Management System which should be linked to other knowledge management resources; establish metrics to evaluate and communicate successes; and the program should utilize outside established organizations and conferences to promote the knowledge management system and technology transfer process.

- An emphasis needs to be placed on evaluating funded projects to document “early success”. Those developments need to be rolled out to the industry as soon as possible (prior to completion of the research) so as to encourage industry support.

These key recommendations are addressed in the report along with other observations made by the Committee members.

The URTAC recommends proceeding with implementation of the R&D Plan consistent with the guidelines outlined in our report.

Respectfully submitted,



James C. (Chris) Hall, Chair
(310) 849-9726

**Unconventional Resources Technology
Advisory Committee**

**Comments and Recommendations
2009 Unconventional Gas
Research and Development Plan
(Including Small Producer Programs)**

OCTOBER 2008

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1.0 INTRODUCTION

The Unconventional Resources Technology Advisory Committee (URTAC) was formed in accordance with provisions of Section 999D(a) of the 2005 Energy Policy Act (EPACT)

The Committee consists of:

- A majority of members who are employees or representatives of Independent Producers of natural gas and other petroleum, including small producers;
- Individuals with extensive research experience, operational knowledge or unconventional natural gas and other petroleum resource exploration and production;
- Individuals broadly representative of the affected interests in unconventional natural gas and other petroleum resource exploration and production, including interests in environmental protection and safe operations;
- Individuals with expertise in the various geographic areas of potential supply of unconventional onshore natural gas and other petroleum in the United States.

The provisions of EPACT excluded from eligibility to participate in URTAC the following: Federal employees and board members, officers and employees of Research Partnership to Secure Energy for America (RPSEA).

The duties of the URTAC under EPACT Section 999 are to advise the Secretary on the development and implementation of programs related to unconventional natural gas and other petroleum resources and to review the draft annual research plan.

The Committee members were appointed by letters from the Secretary on August 19, 2008. Key milestones for the Committee included:

- Committee members received the draft annual plan on August 19, 2008.
- Committee members met on September 11th and 12th, 2008 in Washington DC. The agenda included a brief status update and overview of the “Draft 2009 Annual Plan”. Committee members provided initial comments regarding the plan at this meeting. The Chair appointed sub-committees to work on sections of the plan.
- During the period from September 15th through October 10th, the appointed sub-committee members conducted several teleconference calls to develop and consolidate recommendations regarding the draft annual plan.
- The Committee met on October 16, 2008 in Houston, Texas to receive sub-committee reports and to draft the final recommendations of the Committee.
- The Committee met via teleconference on October 23, 2008 in Washington, D.C. to complete final approval of the committee report in accordance with the deadline set by the Secretary and the Designated Federal Officer.

Section 999 sets the funding for the overall program at a level of \$50-million-per-year over 10 years, provided from Federal lease royalties, rents, and bonuses paid by oil and gas companies. After allocations for program management by NETL and consortium research and development (R &D) administration by RPSEA, the amounts to be distributed for R&D total \$42.56 million (\$32.06 million per year for the Consortium Program R&D and \$12.5 million per year for the Complementary Program R&D). It is anticipated that there will be \$13.89 million available for funding the Unconventional Resources program element during each fiscal year beginning with 2007 and \$3.21 million for funding the Small Producer Program.

2.0 EXECUTIVE SUMMARY AND RECOMMENDATIONS

These findings and recommendations are at a strategic level and address the overall quality of the plan and provide general guidance regarding setting priorities and execution of the plan through the projected 10 year horizon.

The Committee reviewed the recommendations provided by the previous URTAC regarding other petroleum resources that may have a significant future benefit to the U. S. domestic energy supply and, in general, concurs with those recommendations.

The Committee reviewed and discussed the Draft Plan and identified major areas of concern. Subgroups were formed to analyze and compose comments and recommendations for these areas. Subgroup reports were distributed to the entire Committee and each was discussed by the Committee as a whole. Following this discussion, the entire committee agreed on and drafted the comments and recommendations included in this report.

Recommendations:

The committee recommends:

- 1) Policy:
 - a) A national goal of recovering an additional 30% of the existing reserves is achievable and warranted.
 - b) The Federal Government oil and gas Research and Development (R&D) and Technology Transfer (TT) programs are extremely important for maximizing domestic production.
 - c) The creation of a multi-department study (e.g., Energy, Commerce, and Interior) to bring together existing information and to assess the potential of the oil and gas industry to meet the nation's energy needs under less restrictive scenarios, is warranted, so that oil and gas can make its contribution.
 - d) The Federal Government become actively involved as an advocate of domestic oil and gas production.
 - e) DOE work with various parties including industry, NGOs, state regulators, other federal agencies and others to explore mechanisms to balance environmental responsibility and resource development concerns.
- 2) Research focus be expanded in the following areas:
 - a) Geosciences as applied to exploration, drilling, stimulation and re-stimulation
 - b) Basin analysis and real-time resource exploitation
 - c) Stimulation and Completion
 - d) Water Management
 - e) Environmental
 - f) Other Petroleum Resources

3) Technology Transfer

- a) The plan should specifically outline the steps necessary to communicate the results of the research and technologies developed.
- b) The knowledge management system of the Unconventional Resources and Small Producer Program should be linked to other knowledge management resources.
- c) Once a knowledge management system has been developed, metrics are necessary to evaluate and communicate successes.
- d) The program should utilize organizations and conferences to promote the knowledge management system and technology transfer process.

4) Near Term Impacts:

- a) An emphasis needs to be placed on evaluating funded projects to document “early success”. Those developments need to be rolled out to the industry as soon as possible (prior to completion of the research) to encourage industry support. This will also allow for early assessment of the technology transfer process and identify areas for improvement.
- b) Encourage researchers to be knowledgeable of prior and on-going research within the industry, academia and national labs. This includes placing emphasis on solicitations which leverage technologies developed by other industries.
- c) The plan needs to ensure, that along with long term research, some short term projects with potential for early application are emphasized.

3.0 TOPICAL REPORTS

The Advisory Committee developed their analysis of the Draft Annual Plan through a series of meetings and sub-groups (as outlined in Section 5.0: Sub-Group Topics and Members). There are four areas of recommendations:

- Executive Summary and Policy
- Research Focus
- Technology Transfer
- Near Term Impacts (Process)

Also of note is that recommendations made by the Environmental Sub-Group were incorporated into the Policy and Technology Transfer reports.

Treatment of Non-Consensus

In situations where members were divided on agreement with specific recommendations or statements in the report, the following categorization was used:

- **Majority Agreement** – 50% or greater of Committee members were in agreement with the statement.
- **Minority Opinion** – fewer than 50% of Committee members were in agreement with the statement.

In this report, there are no instances of Minority Opinion.

3.1 POLICY

As an advisory committee, the URTAC's focus is on commenting on the Unconventional Natural Gas, Other Petroleum Resources and Small Producers Program 2009 Draft Annual Plan. Nevertheless, URTAC would like to identify outside influences and issues which could adversely impact domestic oil and gas production with the hope that they can be addressed by the Department of Energy or elsewhere in carrying out the elements of the Section 999 Program.

Oil and gas will continue to provide a significant amount of energy to the United States during the next 20 years, even with significant efforts to increase alternative and renewable resources. Therefore, every effort must be taken to ensure that petroleum resources are developed to the maximum extent possible. A national goal of recovering an additional 30% of the existing reserves is achievable and warranted.

The Federal Government oil and gas Research and Development (R&D) and Technology Transfer (TT) programs are extremely important for maximizing domestic production for many reasons: (1) Federal programs serve to develop and transfer technologies that are not proprietary and thus are available to all producers, both large and small; and (2) as a major landowner and tax recipient, the government should actively manage its minerals and revenue streams. Participating in R&D and ensuring the effectiveness of TT mechanisms is an important undertaking to fulfill this responsibility and to be an effective steward.

IMPORTANCE OF DOMESTIC PETROLEUM SUPPLIES:

Findings:

Domestic oil and gas production are major sources of energy supply to the United States with national strategic importance. With the now popular focus on renewable energy sources, petroleum supplies are often overlooked and discounted as being easily replaced; nothing could be farther from the truth. Considerable information is available from many sources both from within the Federal Government and the private sector on the state of the domestic oil & gas industry and its importance as an energy supplier during the next 20 years. There needs to be a balance. However, there is no mechanism to gather this information into a unified report that would have credible standing in the eyes of the public and in Washington DC.

Recommendation:

The Committee recommends:

- The creation of a multi-department study (e.g., Energy, Commerce, and Interior) to bring together existing information and to assess the potential of the domestic oil and gas industry to meet the nation's energy needs is warranted, so that oil and gas can make its contribution. Such a study could also be tasked to assess the impediments to resource development and the effects of changes in tax treatments.

DEPARTMENT OF ENERGY AVOCACY IN LOCAL ENERGY RESOURCE ISSUES:

Findings:

Many states are taking action to impose legislation and regulations that could adversely impact the ability to develop oil and gas natural resources. Furthermore, states are developing local regulatory frameworks for the development of unconventional resources that conflict with what has been developed elsewhere. These adversely impact the ultimate recovery of valuable oil and gas resources.

Recommendation:

- The Federal Government become actively involved as an advocate of domestic oil and gas production. This could be accomplished by the Department of Energy through their own outreach efforts or through entities (e.g. the Interstate Oil and Gas Compact Commission (IOGCC)). Failure to take action could result in the loss of access to reserves and production capability, off-setting any benefit provided by R&D and Technology Transfer efforts.

ENVIRONMENTAL CONCERNS

Findings:

Resource development and environmental responsibility are important objectives that should be addressed together; environmental responsibility is a fundamental aspect of resource development.

Normally, production has a negligible and easily mitigated impact on the environment. While the drilling and development phase early in the life of any field has a more visible impact, it lasts only for a short time. All too often, the impact of oil and gas projects is judged solely on the highly visible early phase development, without taking the overall life cycle into account. As a result, many projects are defeated on the local and/or state level, resulting in loss of potentially valuable reserves.

Recommendation:

The Committee recommends that:

- DOE with Department of Interior establish an entity of various parties including industry, NGOs, state regulators, other federal agencies and others to explore mechanisms to balance environmental responsibility and resource development concerns. (See Appendix A for additional detail.)

3.2 RESEARCH FOCUS

In order to be comprehensive, the Draft Annual Plan needs to include research related to shale gas and oil, coal gas, heavy oil, unconventional oil and environmental issues.

Findings:

The development of oil and gas from fractured shales continues to expand rapidly. Research related to optimum drilling, stimulation/restimulation and completion techniques, along with real time data evaluation, is needed to optimize hydrocarbon extraction from shales. Some shales are difficult to effectively fracture; fracturing water is a by product of the process which is very costly, may inhibit wellbore completion and needs to be better managed.

Coal gas development continues to increase. However, unlike other hydrocarbon sources, gas from soft coals can have a significant biogenic component. The potential exists for “regeneration” of additional gas during the producing life of a field thus making produced water management a key issue.

During the RPSEA solicitation process, the research proposals should identify technologies, methods or applications to minimize environmental impact in areas such as produced water and reuse, air quality and climate, and surface disturbance (including reclamation); how well the proposals cover this should be considered in the evaluation process.

Recommendations:

The Committee recommends that research areas be expanded to include:

- 1) Geosciences as applied to exploration, drilling, stimulation, and re-stimulation:
 - a) Developing surface-based and borehole-based technologies that identify drilling sweet spots
 - b) Characterizing fracture attributes (orientation, intensity, openness, and type of fluid)
 - c) Optimizing the position and orientation of vertical and horizontal well bores
 - d) Determining stress fields
 - e) Improving the design and implementation of hydraulic fracturing
- 2) Basin analysis and real-time resource exploitation:
 - a) Characterizing geological, geochemical, geophysical, and operational parameters that differentiate high-performing areas or fields
 - b) Developing and demonstrating techniques to analyze large volumes of data in real-time for application during unconventional resource development
 - c) Developing real-time simulation and modeling of reservoirs
- 3) Stimulation and Completion:
 - a) Developing stimulation methods that require less water and other fluids to be injected into the subsurface

- b) Developing stimulation methods that result in a lower volume of treatment fluids produced to the surface
 - c) Demonstrating approaches for improved treatment, handling, re-use and disposal of fluids produced and/or used in field operations
 - d) Improving fracturing and stimulation techniques in gas and oil shales
- 4) Water Management
- a) Developing methods for the treatment of produced water and fracturing fluids at intermediate and high total dissolved solids (TDS) in order to minimize the potential impact on natural water resources
 - b) Developing techniques to minimize the volume of water produced to the surface
- 5) Environmental:
- a) Developing site selection criteria that minimize the surface footprint and the impact of drilling and production operations
 - b) Developing surface mitigation methods applicable to all environments
 - c) Developing technologies to recycle water
 - d) Developing technologies for detection and capture of emissions from unconventional oil and gas operations
 - e) Assessing environmental impact and viability of oil shale production.
- 6) Novel concepts
- a) Enhancing coal gas production over time
 - b) Developing biological, reservoir engineering / hydrological methods.
- 7) Other Petroleum Resources
- a) Heavy oil, tar sands, tight oil sands and oil shales

3.3 TECHNOLOGY TRANSFER

The most significant benefits of an R&D Program are realized in the transfer of the technology. The mechanism of the technology transfer for this Program must be well defined, implemented early in the program and used often to leverage the benefit of the investment in this program.

Findings:

The Advisory Committee commends DOE, NETL and RPSEA for the actions taken in implementing prior committee recommendations. Both the Consortium and Complementary Programs provided a very comprehensive response to the need to develop a robust technology transfer program and knowledge management system.

A robust knowledge management system is not enough. We are concerned about the effectiveness of any knowledge management or technology transfer system which is adopted. It is imperative that technology be transferred effectively to all producers, especially small producers.

Recommendations:

- 1) The plan should specifically outline the steps necessary to communicate the results of the research and technologies developed. Specifics should include:
 - a) Communication to industry of the existence of a Knowledge Management System.
 - b) Organization of the communication plan such that it has the widest possible dissemination yet leverages the networking ability around basins.
 - c) Access protocol to the Knowledge Management System so as to provide the necessary metrics to monitor and evaluate the system.
 - d) Implementation of supply chain improvements to provide greater access and to minimize the costs for small producers.
- 2) The Knowledge Management System of the Unconventional Resources and Small Producer Program should be linked as soon as possible to other knowledge management resources, including other programs managed by DOE (such as the Ultra Deepwater Program). The databases should have a similar taxonomy look and feel.
- 3) The Section 999 Plan stipulates that a portion of every research project be dedicated to technology transfer. The Advisory Committee recommends that this effort not be done solely within the individual projects but through established knowledge management and technology transfer systems, thereby leveraging the funding by consolidating the efforts and maximizing the benefits to the end users.
- 4) When awards are made, RPSEA must clearly identify the expectations of researchers for the dissemination of information for use in the knowledge management system and technology transfer efforts, including implementation of the consolidated knowledge management and technology transfer systems.

- 5) Utilize the latest and most appropriate-to-task communication technologies to launch and promote the Knowledge Management System, including electronic resources such as web based seminars and computer based education systems. These are proven cost effective systems to deliver or push information to the communities that can best benefit.
- 6) Once a knowledge management system has been developed, metrics are necessary to evaluate and communicate successes. The program should consider:
 - a) Knowledge management entries
 - b) Readership or subscription trends and totals
 - c) Multiple user or access trends and totals
 - d) Transfer successes, case studies, and testimonials
 - e) Peer review functionality
- 7) The program should utilize organizations and conferences to promote the knowledge management system and technology transfer process. The program should focus on early knowledge application and transfer successes by communicating these successes through the consortium system itself as well as outside organizations, industry publications and conferences. The database cannot replace the effectiveness of regionally focused workshops organized through local producers and small producer organizations. These must be worked in tandem.

3.4 NEAR TERM IMPACTS

Finding:

An emphasis needs to be placed on building credibility, demonstrating value and enhancing projects through feedback. Exposing early results will provide both an opportunity for feedback to current projects and stimulate ideas for further research.

Recommendations:

- 1) An emphasis needs to be placed on evaluating funded projects to document “early success”. Those developments need to be rolled out to the industry as soon as possible (prior to completion of the research) to encourage industry support. This will also allow for early assessment of the technology transfer process and identify areas for improvement.
- 2) Encourage researchers to be knowledgeable of prior or on going research within the industry, academia and national labs. This includes placing emphasis on solicitations which leverage technologies developed by other industries.
- 3) The plan needs to ensure, that along with long term research, some short term projects with potential for early application are emphasized.

4.0 COMMITTEE MEMBERS

<u>Title</u>	<u>Last Name</u>	<u>First Name</u>	<u>Employer</u>	<u>City</u>	<u>State</u>
Mr.	Anderson	A. Scott	Environmental Defense Fund	Austin	TX
Dr.	Brown	Nancy J.	Lawrence Berkeley National Laboratory	Berkeley	CA
Ms.	Cavens	Jessica J.	EnCana Oil & Gas (USA)	Denver	CO
Dr.	Cline	Jeffrey T.	Cline Energy Consulting	Houston	TX
Mr.	Daugherty	William S.	NGAS Resources, Inc	Lexington	KY
Mr.	Dwyer	James P.	Baker Hughes INTEQ	Houston	TX
Ms.	Falkner	Juliette A.	The Nature Conservancy	Arlington	VA
Mr.	Hall	Jeffrey D.	Devon Energy Corporation	Oklahoma City	OK
Mr.	Hall	J. Chris	Drilling & Production Co.	Torrance	CA
Dr.	Hardage	Bob	University of Texas at Austin	Austin	TX
Mr.	Julander	Fred C.	Julander Energy Company	Englewood	CO
Dr.	Levey	Raymond A.	University of Utah	Salt Lake City	UT
Dr.	Mark	Sandra D.	Black Hills Exploration and Production	Evergreen	CO
Dr.	Mohaghegh	Shahab D.	West Virginia University	Morgantown	WV
Mr.	Sparks	Don L.	Discovery Operating, Inc.	Midland	TX
Dr.	Tew	Berry H. (Nick)	State Oil and Gas Board of Alabama	Tuscaloosa	AL
Ms.	Weiss	Janet	BP America, Inc.	Houston	TX
Ms.	Zinke	Sally G.	Ultra Petroleum	Englewood	CO

5.0 SUBGROUP TOPICS AND MEMBERS

At the September 12, 2008 meeting in Washington DC the following Subgroups and Schedule were established for developing the Subgroup analyses and reports. Following the Subgroup conference calls, the Environmental subgroup recommended that its recommendations be incorporated into the Technology Transfer and Policy sections of the reports.

Five Sub-Group Areas of Analysis and Reports:

- Executive Summary and Policy
- Research Focus
- Technology Transfer
- Near Term Impacts (Process)
- Environmental (incorporated into Policy and Technology Transfer topics)

Schedule

9/19 – Recommendations to leaders
9/22-10/10 – Subgroup conference calls
10/10- Subgroup reports to Chair
10/13- Subgroup reports distributed to Committee
10/16 – Meeting in Houston
10/23- Teleconference and formal vote on final URTAC Report

Sub-Group Members for the Five Recommendation Areas:

Executive Summary and Policy

Lead – C. Hall

Members-Anderson, Cavens, Falkner, Julander, Mark, Tew

Research Focus:

Lead – Cline

Members – Anderson, Brown, Dwyer, Levey, Hardage, Julander, Mohaghegh, Sparks, Tew

Technology Transfer

Lead – James Dwyer

Members – Cline, Daugherty, C. Hall, Hardage, Weiss

Near Term Impacts (Process):

Lead – Cavens

Members- Dwyer, J. Hall, Julander, Zinke

Environment:

Lead – Weiss

Members- Anderson, Brown, Cline, Falkner, Julander

APPENDIX A

ENVIRONMENTAL POLICY RECOMMENDATION

Issue

Access to oil and gas resources on public lands and federal waters is typically impeded for years by land use decisions made outside of the DOE, and a process for permitting that allows special interests to greatly influence outcomes. In addition, acquiring access to unconventional resources on public lands is an inefficient process that can stop development all together or make access/development too costly to pursue. Competing land use initiatives are on the rise. Development delays are a key energy security issue. Unconventional resources can be developed on public lands by application of appropriate technology in an environmentally responsible manner as evident by responsible development on private lands. The temporal footprint impacts based on well-founded science should feature more in multiple use decision making. While this dilemma directly affects the energy security of the US, the Committee recognizes that a solution is larger than the mandate of the DOE.

Proposal

With the variety and demand of uses increasing on our public lands, new mechanisms are needed to create a framework that will optimize development and other uses, including conservation. Addressing the issues around multiple land use requires a reasoned and sound scientific approach that integrates the views of the various users and governing bodies. Conservation of scarce or sensitive biological resources can occur in conjunction with land-use activities that meet the energy, social, and economic needs of people.

The Committee recommends that the DOE work with various parties including other federal agencies (this Committee recommends the inclusion of the Department of the Interior), industry, NGOs, state regulators, and others to explore/develop mechanisms to resolve these conflicts. These mechanisms should more fully incorporate the industry's ability to effectively develop in an environmentally responsible manner founded on sound science.