2010 Annual Plan
Ultra-Deepwater and Unconventional Natural Gas and Other Petroleum Resources Research and Development Program

DOE/NETL-2009/1384

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

December 2009

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 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Title IX, Subtitle J according to the requirements of the law, and will continue to do so unless the law is repealed.

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Executive Summary

This document is the *2010 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.

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 conducted by the National Energy Technology Laboratory (NETL). NETL is also responsible for 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 selected[1]. The *2008 Annual Plan* resulted in the selection of 29 projects. Implementation of the *2009 Annual Plan* includes 7 solicitations issued by the Program Consortium in October 2009, with selections anticipated in early 2010.

As further required by Subtitle J, in September 2009, two Federal advisory committees, the Ultra-Deepwater Advisory Committee and the Unconventional Resources Technology Advisory Committee, began their respective reviews of the draft *2010 Annual Plan*. In October 2009, the two advisory committees provided their recommendations.

Section 999B(e)(3) of EPAct requires DOE to publish all written comments received regarding the annual plan. Accordingly, the Program Consortium's 2010 draft Annual Plan is included here as Appendix B,[2] and the comments and recommendations provided by the two Federal advisory committees are included here as Appendix C. No other written comments were received.

The *2010 Annual Plan* provides a comprehensive outline of the research activities planned for 2010. The primary focus of these activities is to fill in any technology gaps not adequately addressed by the projects and solicitations to date. A highlight of *2010 Annual Plan* is the attention that is being given to technology transfer.

[1] All projects 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 three program elements of Subtitle J that are administered by the Program Consortium.

Technology transfer is important to the success of this research program. Subtitle J[3] requires 2.5% of the amount of each award to be designated for technology transfer activities. The Federal advisory committees have recommended that more information on technology transfer be included in future annual plans. In response, the *2010 Annual Plan* describes the structure for the overall technology transfer program.

Subtitle J[4] 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 the three program elements. After allocations for contract 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 years' activities, all Program Consortium administered projects are 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's contract as part of its review and oversight function. Complementary research and development (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.

Subtitle J[5] contains a general sunset provision for Title IX, Subtitle J, of September 30, 2014.

[3] EPAct, Title IX, Subtitle J, Section 999C(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.
[4] EPAct, Title IX, Subtitle J, Section 999H(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)).
[5] EPAct, Title IX, Subtitle J, Section 999F. SUNSET. The authority provided by this subtitle shall terminate on 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 natural gas research and development (R&D). The complete text of Title IX, Subtitle J, is included as 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 Research 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 conducted by NETL, while all other research is administered by the Program 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 energy security, environmental protection, and economic growth.

1.2 Overall Implementation Scheme

NETL is responsible for managing implementation of the Ultra-Deepwater and Unconventional Natural Gas and Other Petroleum Resources Research Program (Program). Within NETL, the responsibility for overall program implementation, 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 Research Partnership to Secure Energy for America (RPSEA), a 501(c)(3) not-for-profit corporation consisting of over 145 member organizations, to administer the distribution of about $32 million per year in R&D contracts (Table 1.1.1) and to serve as the Program Consortium. The Federal Government maintains management oversight of the Program, and RPSEA's administration costs are limited to no more than 10 percent of the funds.

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

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

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. A complete list of consortium members is listed in Appendix B. The breadth of membership helps to ensure that consortium-administered R&D funds are directed towards key technology needs 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 research, development and demonstration (RD&D) recommendations to DOE in the form of a draft annual plan (DAP). The Secretary of Energy then prepares the annual plan for the cost-shared research program administered by the Program Consortium and transmits it to Congress which gives rise to the release of the solicitation of R&D proposals.

Prior to the Secretary submitting the annual plan to Congress, the legislation calls for DOE to solicit advice from two Federal advisory committees. The legislation allows for comments and recommendations 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. The comments and recommendations received from these advisory committees related to their review of the *2010 Annual Plan,* as submitted to the Secretary, are included in Appendix C.

Upon approval of the annual plan, EPAct section 999B(e)(3) directs the Secretary of Energy to transmit the annual plan to Congress, along with the written recommendations from the Program Consortium, the advisory committees, and any other experts from whom comments have been received.

Each annual plan must include details of ongoing activities, and a list of solicitations for awards to carry out research, development, demonstration, or commercial application activities. Also required are topics for such work, parties eligible to apply, selection criteria, duration of awards, and a description of the activities expected of the Program Consortium to fulfill its oversight responsibility. All of these topics are addressed in this plan.

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 receives 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 follows each project's progress, plans, and results and especially technology transfer. All projects are reviewed by the RAG annually.

While the RAG is 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.

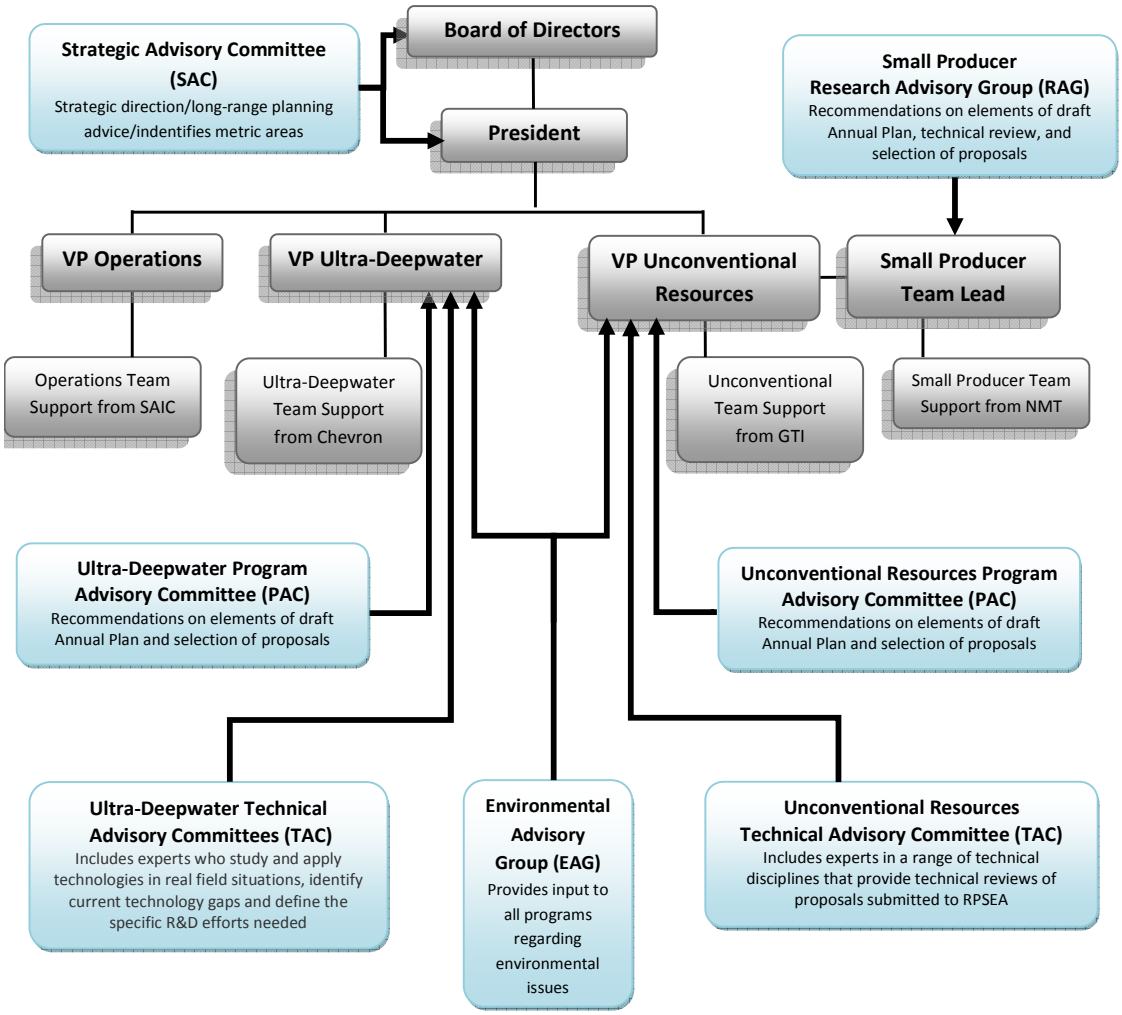

Figure 1.1.1: Organization of RPSEA and Advisory Committee Relationships

RPSEA has been operating as a consortium since 2002. Additionally, RPSEA has contracted with four organizations, the Chevron-administered *DeepStar* Consortium (*DeepStar*), the Gas Technology Institute (GTI), Science Applications International Corporation (SAIC), and the New Mexico Institute of Mining Technology (NMT), as parts 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:

- 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 have included 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 the Ultra-Deepwater Program (UDW), the primary inputs for UDW are the TAC meetings. Additional forums and meetings are frequently planned and delivered 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.

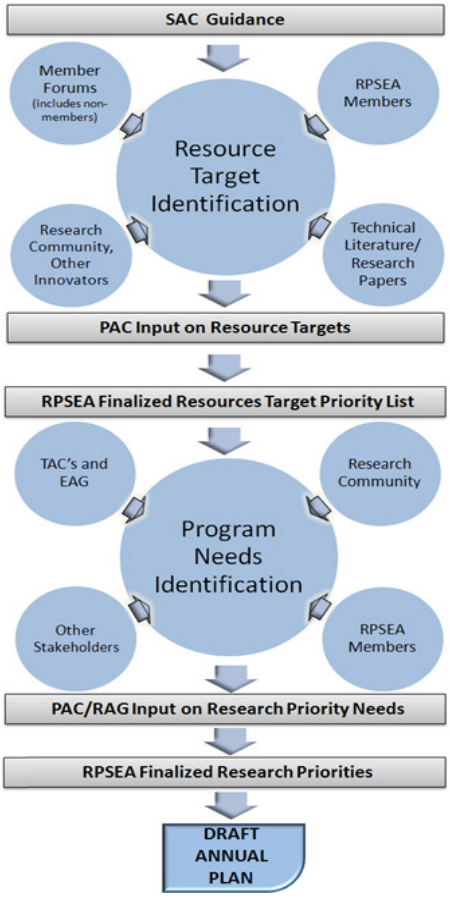

Figure 1.1.2: RPSEA Draft Annual Plan Process

2. Cost-Shared R&D (Consortium-Administered Program)

Subtitle J of EPAct specifies that the Program Consortium selected by DOE is to administer a program of research, development, demonstration, and commercialization in three technically challenged natural gas and petroleum resource areas:

- ***ultra-deepwater*** 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***.

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 exploration and production 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 technology transfer program will be planned and executed with the knowledge that for the desired impact to be achieved, significant technology transfer beyond the direct participants in funded projects is needed.

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

The three elements of the cost-shared program administered by the Program Consortium are discussed below. All projects require a minimum of 20% cost-share.

2.1 Ultra-Deepwater Program

A. Mission & Goals

The mission of the Ultra-Deepwater Program (UDW) is to identify and develop economically viable (full life cycle), acceptable risk technologies, architectures, and methods for exploration, drilling, and production of hydrocarbons in formations under ultra-deepwater and/or in the Outer Continental Shelf (OCS) in formations that are 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 that directly impact the design and reliable operation of a ultra-deepwater production system*
- *Developing "enabling" technologies that facilitate the development of additional technical advances*
- *Enhancing existing technologies to help lower overall cost and risks*

- *Pursuing "Grand Challenges"* (long-term, high-risk research, on applied science, and on key leveraging and transformational technologies capable of "leapfrogging" over conventional pathways)
- *Accomplishing ultra-deepwater resource development in a safe and environmentally responsible manner*

Relevant EPAct 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 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.

The goals of the UDW are to develop the ultra-deepwater resource base and to convert currently identified (discovered) resources into economic recoverable (proven) reserves, 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 volumes, production efficiency, and ultimate recovery of such resources.
4. Improving safety and environmental performance, by minimizing environmental impacts associated with exploration and production in ultra-deepwater.

B. Objectives

To meet the goals of converting the ultra-deepwater 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, reliable, and commercially viable. The UDW continues to build on the objectives first outlined in the *2007 Annual Plan*.

Near-Term

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

Objective #2: *Cost-Share Development* and *Awareness* –Network with academia, industry, and other key stakeholders to identify cost-share funding for development of new technologies, increase awareness of the UDW, and promote greater involvement.

Objective #3: *Ultra-Deepwater Technology Research & Development, and Applied Science* – Over the life of the Program, funding will be directed toward innovative and novel projects as well as graduate study projects that meet the technology needs of the ultra-deepwater and the goal of the UDW Program.

Longer-Term

Objective #4: *Ultra-Deepwater Technical Development and Field Development of Qualified Projects* - Through assessment of project results and additional solicitations (as needed), continue the development and maturation of the most promising technologies with a strong focus on field deployment of qualifying projects that carry the greatest potential. 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 and Safety Technology Development and Deployment* - Assess the environmental and safety impact of UDW projects. This effort may involve solicitations that target development and deployment of environmental and safety technology or may be represented by elements that are included in solicitations for more extensive projects.

Objective #6: *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 #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.

C. Implementation Plan

The UDW is being implemented by a third-party consortium that has a subcontract with the Program Consortium. The *DeepStar* Consortium is developing and administering solicitations for R&D projects in areas that address the objectives outlined above and meet the requirements of EPAct. Section 999B(d)(7)(A) of EPAct states that 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."* The following section outlines the major elements of the implementation plan.

DeepStar and Advisory Committee Roles in UDW

The Program Consortium has subcontracted management of the UDW Program to the Chevron-administered *DeepStar* Consortium. *DeepStar* is the world's largest ultra-deepwater stakeholder group and has a 19-year history of managing collaborative research. Through this arrangement, the UDW has 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 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 matching funds to further accelerate the development of ultra-deepwater technologies.

DeepStar is assisted in carrying out its subcontract by the UDW Program Advisory Committee (PAC) and nine Technical Advisory Committees (TACs) (see Appendix B for committee membership). The UDW PAC members represent asset owners that are currently operating in the ultra-deepwater 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 are 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 2.1.1). The role of the TACs, with representation from Subject Matter Experts who study and apply ultra-deepwater technologies in field settings, is to identify current technology gaps and define the specific research and development efforts to address these gaps. As such, the TACs provide a bottom-up end-user-driven program.

Table 2.1.1: UDW Technical Advisory Committees

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

Identification of Focus Areas for New Technology Development

The UDW focus areas for earlier solicitations were developed using a DeepStar Systems Engineering study that was based on industry experience and the needs of ultra-deepwater. Four base case field development scenarios were identified as representative of future Gulf of Mexico (GOM) ultra-deepwater developments with technical barriers that challenge their 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 their associated technology challenges. Four generic fields were created that were characterized by their inherent challenges to technical and economic development. The objectives of the 2007 and 2008 projects were developed based on these generic field types in response to the UDW goal to develop new technologies to help convert these resources to proven reserves.

Prioritization of Technology Development Needs

Each scenario is characterized by challenges currently hindering technical and economic development. The challenges have been revisited and revised each year of the program. The *2007 Annual Plan* identified the 33 technology themes required to bridge the technology challenges that were barriers to development for the four base fields. In 2008, the themes were reorganized into 4 major and 1 minor challenge. In 2009 the challenges were organized into a grouping of six technology "Needs", with various "Initiatives" identified to address each Need.

For 2010, the UDW will focus on the next phase of RD&D based on the project portfolio and specific project ideas that will fill identified technology gaps.

Table 2.1.2: UDW Program Structure Transition from 2007 Through 2009

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

The planning process used to prepare the initial plan for the UDW that was included in the 2007 Annual Plan, resulted in 33 priority research themes. These themes were summarized into "8 cross-cutting challenges" to be met by the UDW research. Based on implementation of the plan and feedback from stakeholders, including the Ultra-Deepwater Advisory Committee (UDAC) the UDW was restructured for the 2008 Annual Plan into "4 major challenges and 1 minor challenge". For the 2009 Annual Plan the UDW was restructured once again into 6 high-level "Need" categories. This current structure of the UDW more fully describes the existing project portfolio and allows for greater ease in filling in research gaps. It continues as the UDW structure for 2010.

Projects in the UDW portfolio are chosen based on their potential to address and satisfy the Needs and meet the Goal of converting ultra-deepwater resources to proven reserves as shown in the UDW flowchart in Figure 2.1.1 below.

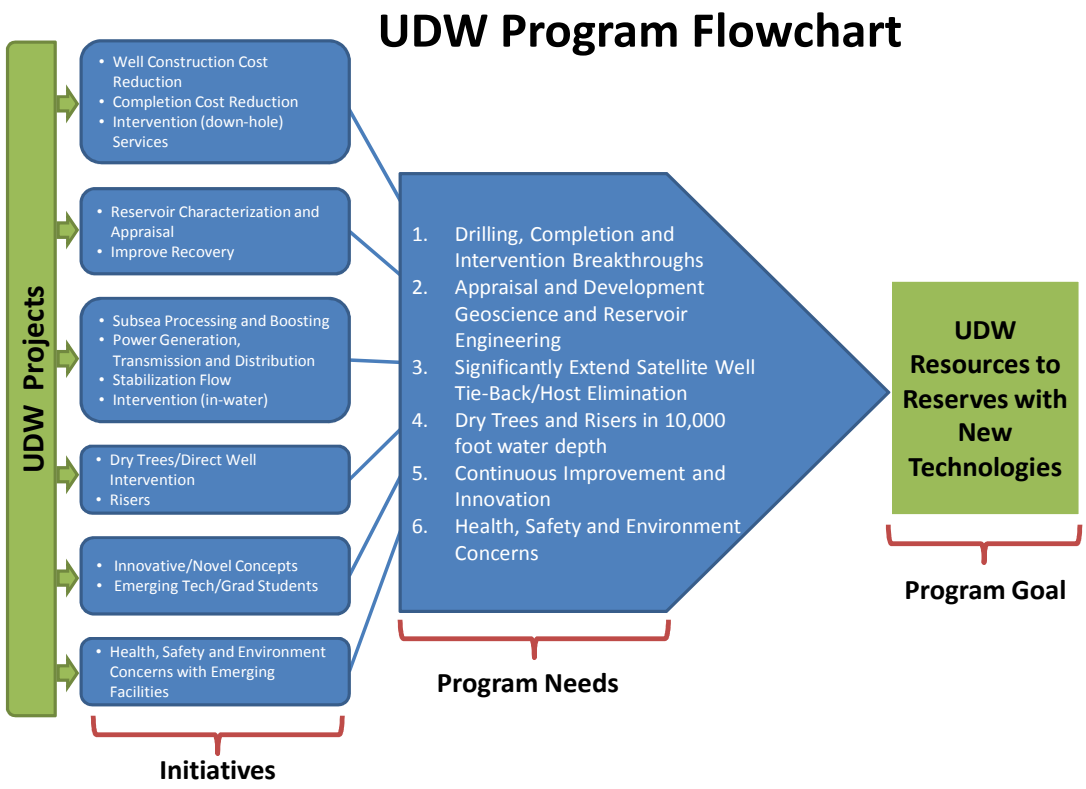

Figure 2.1.1: UDW Flowchart

The UDW Flowchart illustrates how the research projects support the overall Program goal for the UDW. Each project is part of a particular 'initiative' that directly addresses a particular research 'need'. When these 'needs' are satisfied by new technologies, the goal of converting resources found in formations that underlie ultra-deepwater and in formations that are deeper than 15,000 feet.

2010 Solicitations

Upon transmittal of the *2010 Annual Plan* to Congress, the 2010 requests for proposals (RFPs) will be developed and released. The primary focus of the five RFPs for 2010 is to fill-in technology gaps not addressed by the current portfolio of projects and outstanding solicitations. Solicitations for 2010 will be of three types:

- Next phase RD&D based on completed projects from the 2007 and 2008 Program
- Fill-in specific technical gaps
- Graduate Student and Innovative/Novel projects.

The direction of the 2010 UDW Portfolio is presented below within the context of the Six High Level Needs. The actual 2010 UDW Portfolio will be driven by guidance from the UDW PAC and the timing associated with the release of the 2010 solicitations.

Need 1: Drilling, Completion, and Intervention Breakthroughs
Proposals may be requested in 2010 that identify novel ideas to reduce well construction and completion costs, and funding follow-on recommendations from 2007 and 2008 projects.

Need 2: Appraisal and Development Geoscience and Reservoir Engineering
The 2010 solicitation will request proposals in the area of formation and reservoir characterization and/or 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 2010 addressing follow-on recommendations resulting from the 2007 and 2008 projects. Additional 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. Next Phase proposals may be requested addressing recommendations resulting from the 2007 and 2008 projects.

Need 5: Continuous Improvement and Innovation
Proposals solicited in 2010 in this need area may include:

- Advancing industry understanding of phenomena and science impacting ultra-deepwater operations
- Improvements in integrity management and reliability
- Additional graduate student and project funding
- Innovative technology high risk, high reward "long-shot "opportunities

Need 6: Associated Safety and Environmental Concerns
Will continue focus on technology development that minimizes environmental impact and safety. In accomplishing this, the Program Consortium will leverage ongoing research efforts and collaborate within existing forums and venues, and where possible, integrate with on-going UDW projects.

Areas of study may include:

- Discharge of produced water subsea – technology and regulatory aspects
- Environmental impacts associated with technologies addressed under other UDW Needs

Anticipated Awards for 2010
Each year, almost $15 million is available for project awards. Cost sharing beyond the required minimum is encouraged. In 2010, the UDW will target the award of three to five large projects with a value of $1 to $5 million per project. Additionally, a number of smaller awards averaging $150,000 - $300,000 each will be funded under Need #5 "Continuous Improvement and

Innovation." Each project will have duration of one to three years. In addition, project integration across multiple disciplines will be encouraged.

Under the Stage-Gate approach described in Section 2.5, all projects are 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 upcoming program year. In addition to releasing RFPS and awarding subcontracts, the Program Consortium is performing project management functions for the current contracts and for future awards during the year.

2007, 2008, and 2009 Activities

The Program Consortium has issued multiple solicitations for the UDW in each of the first three years. The number of solicitations released, the number of selections made and the number of awards made as of October 31, 2009 are shown in Table 2.1.2 below for 2007, 2008, and 2009.

Table 2.1.3: Ultra-Deepwater Program Solicitations, Selections & Awards

Funding Year	Solicitations	Selections	Awards
2007	13	17	16
2008	11	14	3
2009	5	TBD	TBD

Table 2.1.4 lists projects for years 2007 and 2008, and solicitations for 2009. The projects have been organized within the context of the "Initiatives" that address the Six High Level Needs. Additional data provided in the table includes the Lead Performer, the project end date for those projects under contract and the project duration anticipated for those project areas not yet under contract, the cost of the project, and funding portfolio year.

Additional project or solicitation details are provided in Appendix B. Abstracts and project information for each of the projects can be found on the DOE website at www.netl.doe.gov/technologies/oil-gas/EPAct2005 and on the Program Consortium website at www.rpsea.org. Note that project DW1402B (Need 4/ Initiative 1) is complete because the design that resulted from the execution of the project was not selected to move to Stage 2.

Table 2.1.4: 2007 - 2008 UDW Projects & 2009 Solicitations

PROJECT	LEAD PERFORMER	PROJECT END DATE/ DURATION	PROGRAM FUNDING	FUNDING PORTFOLIO YEAR
Need 1: Drilling, Completion, and Intervention Breakthroughs				
Initiative 1: Well Construction Cost Reduction				

DW2501: Early Reservoir Appraisal, Utilizing a Well Testing System	Nautilus International, LLC	November 2010	$820,000	2008
DW2502: Modeling and Simulation of Managed Pressure Drilling for Improved Design, Risk Assessment, Training and Operations	Stratamagnetic Software, LLC	April 2011	$360,000	2008
DW35XX: Drilling	TBD			2009
		Subtotal:	**$1,180,000**	
Initiative 2: Completion Cost Reduction				
DW35XX: Completions	TBD			2009
		Subtotal:		
Initiative 3: Intervention (Downhole Services)				
DW1502: Coil Tubing Drilling and Intervention System Using Cost Effective Vessels	Nautilus International, LLC	September 2010	$820,000	2008
DW2301: Deepwater Riserless Intervention System (RIS)	DTC International, LLC	24 Months	$3,411,500	2008
		Subtotal:	**$4,231,500**	
		Need 1 Total:	***$5,411,500***	
Need 2: Appraisal and Development Geoscience and Reservoir Engineering				
Initiative 1: Reservoir Characterization and Appraisal				
DW2001: Synthetic Benchmark Models of Complex Salt	SEAM	June 2011	$2,000,000	2007
DW2701: Resources to Reserves Development and Acceleration through Appraisal	University of Texas at Austin	18 Months	$200,332	2008
		Subtotal:	**$2,200,332**	
Initiative 2: Improved Recovery				
DW1701: Improved Recovery	Knowledge Reservoir	August 2011	$1,599,712	2007
DW37XX: Subsurface	TBD			2009
		Subtotal:	**$1,599,712**	
		Need 2 Total:	***$3,800,044***	
Need 3: Significantly Extend Satellite Well Tieback /Surface Host Elimination				
Initiative 1: Subsea Processing & Boosting				
DW1301: Improvements to Deepwater Subsea Measurements	Letton-Hall Group	April 2011	$3,600,126	2007
DW1901: Subsea Processing System Integration Engineering	GE Global Research	June 2010	$1,200,000	2007
DW33XX: Subsea Processing, Pressure Boosting, Instrumentation and Controls	TBD			2009
		Subtotal:	**$4,800,126**	
Initiative 2: Power Generation, Transmission & Distribution				
DW1902: Deep Sea Hybrid Power System	Houston Advanced	October 2010	$480,000	2007

	Research Center			
DW1302: Ultra-High Conductivity Umbilicals	NanoRidge Materials	December 2009	$448,000	2007
DW2901: Ultra-Reliable Deepwater Electrical Power Distribution System and Power Components	GE Global Research	36 Months	$5,000,000	2008
		Subtotal:	**$5,928,000**	
Initiative 3: Stabilized Flow				
DW1201: Wax Control	University of Utah	September 2010	$400,000	2007
DW1202: Equation of State Improvement for Extreme High Pressure and High Temperature Conditions (xHPHT)	NETL Complementary Program			
DW2201: Heavy Viscous Oil PVT	Schlumberger	24 Months	$460,000	2008
DW32XX: Stabilized Flow Assurance	TBD			2009
		Subtotal:	**$860,000**	
		Need 3 Total:	***$11,588,126***	
Need 4: Dry Trees and Risers in 10,000 Feet Water Depth				
Initiative 1: Dry Trees/Direct Well Intervention				
DW1402A: Ultra-Deepwater Dry Tree System for Drilling and Production (Stage 1 & 2)	FloaTec	Completed	$278,636	2007
DW1402B: Ultra-Deepwater Dry Tree System for Drilling and Production (Stage 1)	Houston Offshore Engineering	March 2010	$812,042	2007
		Subtotal:	**$1,090,678**	
Initiative 2: Risers				
DW1401: Carbon Fiber Wrapped High Pressure Drilling and Production Riser Qualification Program	Lincoln Composites	October 2010	$1,678,411	2007
DW1403: Fatigue Performance of High Strength Riser Materials	Southwest Research Institute	March 2010	$800,000	2007
		Subtotal:	**$2,478,411**	
		Need 4 Total:	***$3,569,089***	
Need 5: Continuous Improvement and Innovation				
Initiative 1: Improve Operating and Inspection Processes				
DW2101: New Safety Barrier Testing Methods	Southwest Research Institute	December 2010	$128,000	2008
		Subtotal:	**$128,000**	
Initiative 2: Graduate Student and Innovative Game-Changing Technologies				
DW1603-A: Graduate Student Design Project. Flow Phenomena in Jumpers	Tulsa University	January 2010	$120,000	2007
DW1603-B: Graduate Student Design Project. Hydrate Plug Characterization and Dissociation Strategies	Tulsa University	September 2010	$120,000	2007
DW1603-C: Graduate Student Design Project. Design of Extreme High Pressure and High Temperature	Rice University	October 2010	$120,000	2007

Subsurface Safety Valve				
DW1603-D: Graduate Student Design Project. Robotic MFL Sensor for Monitoring and Inspection of Deepwater Risers	Rice University	October 2010	$120,000	2007
DW2902-02: Technologies of the Future for Pipeline Monitoring and Inspection	The University of Tulsa	December 2011	$120,000	2008
DW2902-03:Wireless Subsea Communications Systems	GE Global Research	24 Months	$119,993	2008
DW2902-04: Replacing Chemical Biocides with Targeted Bacteriophages in Deepwater Pipelines and Reservoirs	Phage Biocontrol, LLC	24 Months	$120,000	2008
DW2902-06: Enumerating Bacteria in Deepwater Pipelines in Real-Time and at a Negligible Marginal Cost Per Analysis: A Proof of Concept Study	Livermore Instruments Inc.	24 Months	$119,730	2008
DW2902-07: Fiber Containing Sweep Fluids for Ultra Deepwater Drilling Applications	The University of Oklahoma	24 Months	$119,972	2008
DW39XX: Continuous Improvement and Innovation	TBD			2009
		Subtotal:	**$1,079,695**	
		Need 5 Total:	***$1,207,695***	
Need 6: HS&E Concerns (Safety and Environmental)				
Initiative 1: Met-ocean Needs That Impact Operations and Facility Design				
DW1801: Effect of Global Warming on Hurricane Activity	National Center for Atmospheric Research (NCAR)	February 2010	$544,085	2007
DW2801: Gulf 3-D Operational Current Model Pilot Project	Portland State University	24 Months	$1,248,000	2008
		Subtotal:	**$1,792,085**	
Initiative 2: HS&E Concerns with Emerging New Technologies				
DW33XX: Subsea Processing and Seabed Discharge of Produced Water	TBD			2009
		Subtotal:	**$1,792,085**	
		Need 6 Total:	***$1,792,085***	
	Total for 2007 and 2008		***27,368,539***	

This table illustrates how each project in the UDW 2007-2008 portfolio is grouped into various initiatives that address the 6 High Level Needs within the UDW structure. The table also indicates the research gaps to be filled by the 2009 solicitation process. Based on the projects selections resulting from the 2009 solicitation, the Program Consortium's Program Advisory and Technical Advisory Committees will structure the 2010 solicitation process to fill the next priority tranche of research gaps.

E. Program Consortium Administrative Activities

Overall administrative activities for the Program Consortium in general are discussed in Section 2.7. Shorter-term administrative activities specific to the UDW include the completion of annual milestones that show progress towards meeting objectives. As a minimum, short term administrative to be completed before the end of FY 2010 include:

- Issue 5 solicitations for 2010
- Finalize portfolio, prepare and issue 2010 RFPs

- Select and award 3 to 5 large projects for 2010
- Establish FY 2011 R&D priorities based on results of 2007-2010 portfolios and inputs from the TACs, PAC, and advice from the Secretary of Energy's Ultra-Deepwater Advisory Committee[6]
- Prepare the 2011 Draft Annual Plan

F. Milestones

The first solicitations for 2010 will be released after transmittal of the *2010 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.

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 2011. The administrative milestones for the 2010 UDW and all Program elements are listed in Table 2.4.1.

2.2 Unconventional Natural Gas and Other Petroleum Resources Program Element

A. Mission & Goal

The mission of the Unconventional Resources Program (UCR) 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 EPAct 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 UCR 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 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.

A goal of this program is to focus on and provide the technology to both increase the unconventional gas resource base and convert technical resources into economically recoverable gas production. 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 through new technology, the transfer of that technology to companies operating in the targeted resources will be an integral part of program planning and execution. Additionally, development of new

[6] The Ultra-Deepwater Advisory Committee is a Federal advisory committee to the Secretary of Energy

resources must be accomplished in an environmentally acceptable manner, so it is important that technologies developed under the UCR be applied in ways that minimize the impact of resource development on natural and cultural resources.

B. Objectives

Objectives for the UCR have been developed with input from the Program Consortium's unconventional onshore Program Advisory Committee (PAC). This input has been combined with information gathered during an ongoing series of efforts to identify and prioritize the technology challenges to development of unconventional resources.

Recent efforts include:

- A series of six forums on topics relevant to unconventional resources held in various producing basins beginning in late 2008 and continuing through June 2009
- Participation in industry meetings, addressing unconventional resources organized by professional societies, such as the Society of Petroleum Engineers and the American Association of Petroleum Geologists, as well as organizations such as Hart's Energy Publishing, Platts and Pennwell
- Input provided to the *2009 Annual Plan* by the Unconventional Resources Technology Advisory Committee[7] (URTAC)
- Input provided by PAC and TAC members associated with projects selected for the 2008 Program

All of these inputs were combined to arrive at the prioritized list of technology challenges that underlie both the objectives of the UCR and the list of solicitation topics described in the Implementation Plan section below.

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 the planning 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 additional reserves. The three development categories are:

- Existing - Active development drilling and production. (~45% of the projects in the UCR portfolio)
- Emerging - Formations, depth intervals, or geographic areas with limited commercial development activity and very large undeveloped areas remaining. (~45% of the projects in the UCR portfolio)
- Frontier Area - Formations, depth intervals, or geographic areas with no prior commercial development. (~10% of the projects in the UCR portfolio)

The intended relative balance of the Program's focus among these three categories from prior year annual plans is indicated above. In practice, however, the number of projects that apply to all three development categories has given the Frontier category a weight of approximately 15% in the 2007 and 2008 Portfolios. No significant change in emphasis is planned for 2010.

[7] The Unconventional Resources Technology Advisory Committee is a Federal advisory committee to the Secretary of Energy

In the near-term, the primary challenge is the rapid depletion rate of new wells and their relatively high cost. To address these concerns, R&D activities associated with the near term will have a significant field-based component with supporting analysis.

Methods and techniques developed in this phase will be tested through field work conducted in cooperation with industry. Near term projects will primarily focus on field testing, technology dissemination, and commercialization.

In the longer-term, the emphasis for the UCR will again be placed on industry cooperative field work in emerging areas with the development of at least one new emerging resource area to the point where a substantial portion of the technical resource base is converted to economic reserves.

Further out, in the longer-term, the UCR aims at identification and characterization of two or more resource-rich plays or basins that currently have limited activity.

The objectives of the UCR 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.

Longer-Term
Objective 4: Develop techniques and methods for exploration and production from high priority emerging gas shales, 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 the UCR 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 UCR is being implemented by developing and administering solicitations for R&D projects in areas that address the objectives outlined above. The objectives, technology targets, field projects and technology dissemination components utilize an approach illustrated by Figure 2.2.1 below. The Program components are prioritized for a particular resource target that has been identified as having significant potential. The highest ranking technology needs are identified and form the basis for the R&D solicitations. The projects are not implemented individually but are linked and coordinated one to another wherever possible. All projects are focused on a particular region(s) and coupled to program technology dissemination efforts. A coordinated program as opposed to individual projects is a primary implementation goal.

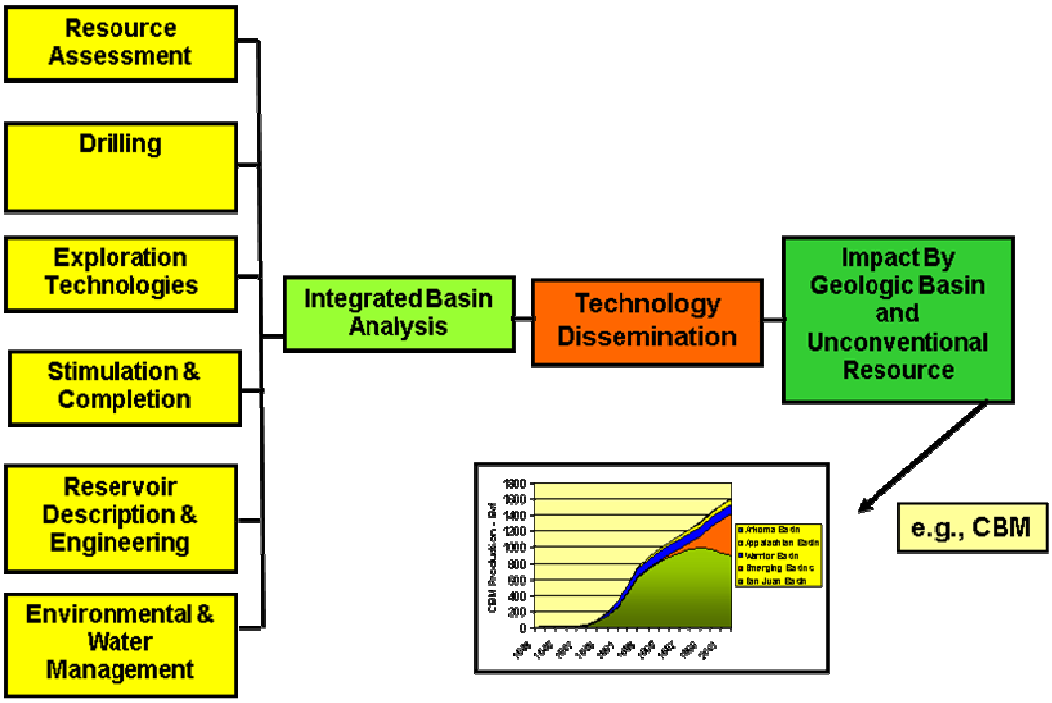

Figure 2.2.1: Program Development Component and Implementation Approach

The following section outlines the major steps in the implementation plan.

Prioritized Technology Challenges

The 2007 and 2008 solicitations were broad in scope in order to allow consideration of a broad range of technical solutions addressing key technical or resource gaps. The 2009 Program solicitation encourages the development of integrated programs targeting specific resources with a focus on technology or resource gaps that remain in the Program portfolio. The 2010 solicitation will be aligned with specific key resource targets that have emerged from the portfolio of projects as it exists for the 2007 through 2009 Program years.

Two Integrated Basin Analysis projects in the 2007 portfolio focus on the New Albany Shale in the Illinois Basin and tight sands in the Piceance Basin. Another Integrated Basin Analysis project targeting an additional shale resource is being sought through the 2009 solicitation. The PAC has recommended that these projects serve as anchor projects to focus program efforts on these specific resources.

While it is intended that the technologies developed through the Program will be applicable to a wide range of shale and tight sand resources, the recommended approach will allow individual researchers to develop coordinated efforts addressing the key challenges associated with specific targeted resources. In addition to the synergies that will arise from having teams of researchers work with common datasets on related problems, more effective workflows will result by combining the best practitioners and researchers from multiple disciplines in a coordinated approach to development of the targeted resources.

2010 Solicitations

At least one, but no more than three, solicitations are anticipated to be issued during 2010. As stated above, the solicitations issued during the 2010 Program year will be designed to build on the portfolio of projects developed during the 2007-2009 Program years. They will be designed to ensure a coordinated program addressing the technology challenges of resource development in at least three specific unconventional gas resource types. Thus, they will be generally aimed at filling program gaps remaining after the 2009 projects are chosen and building on the positive results of ongoing projects.

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 technologies that have reached the appropriate stage of development, field demonstrations will be encouraged. The areas of research shown below apply to each of the targeted unconventional resources, but the gap-filling areas will be defined by breadth of the UCR project portfolio at the time the 2010 solicitations are issued.

At least one, but no more than three, solicitations are anticipated to be issued during the 2010 Program year, depending upon the evolving needs of the Program. Some or all of the areas below may be covered by solicitations during the 2010 Program year.

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:
    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. Geosciences
        i. Characterize geological, geochemical, and geophysical framework of unconventional resource plays

ii. Develop surface-based and borehole-based technologies that identify drilling sweet spots

iii. Characterize fracture development and attributes (controls on development, orientation, intensity, openness, fluid saturation)

iv. Develop methods to understand and optimize the position and orientation of vertical and horizontal wellbores

v. Determine stress fields

vi. Apply geosciences to improve the design and implementation of hydraulic fracturing

c. Basin Analysis and Resource Exploitation

i. Characterize geological, geochemical, geophysical, and operational parameters that differentiate high-performing wells, areas and/or fields

ii. Develop and demonstrate techniques to analyze large volumes of data in real-time for application during unconventional resource development

d. Drilling

i. Develop 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. Develop multi-zone completion and stimulation methods

ii. Develop methods for effective zonal isolation

iii. Develop steerable hydraulic fractures

iv. Develop methods to identify candidate wells for re-stimulation and to predict the results of re-stimulation treatments

v. Develop "domain stimulation" methods that impact a larger volume of reservoir volume

vi. Develop suitable low-cost fracturing fluids and proppants, e.g. non-damaging fluids and/or high strength, low density proppants

vii. Develop stimulation methods that require less water and other fluids to be injected into the subsurface

viii. Develop stimulation methods that result in a lower volume of treatment fluids produced to the surface

ix. Develop approaches for improved treatment, handling, reuse and, disposal of fluids produced and/or used in field operations

x. Develop improved fracturing and stimulation techniques for gas shales

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, including methods for the re-use of recovered water and the use of non-potable water

iii. Develop methods for the treatment of produced water and fracturing fluids with intermediate and high total dissolved solids in order to minimize the potential impact on natural water resources

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. Develop petrophysical methods to accurately assess the potential for shale gas production, including techniques with the potential to be applied in real time

ii. Accurately delineate 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. Develop methods to manage production in order to maintain the permeability generated through stimulation operations and minimize formation damage over time

v. Develop methods to manage reservoirs to ensure maximum efficient recovery

vi. Develop methods for comprehensive characterization of shale gas reservoir quality from physical rock data (cores, etc.) using petrographic, physical, geochemical and other appropriate analyses

h. Reservoir Engineering

i. Develop methods to plan, model, and predict the results of gas production operations

ii. Develop real-time simulation and modeling of reservoirs

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 footprint and the impact of drilling and production operations

v. Develop surface mitigation methods applicable to all environments

vi. Develop technologies to recycle water

vii. Develop technologies for the detection and capture of emissions from unconventional oil and gas operations

2. Conduct early-stage research on novel concepts that may be applied to the development of unconventional gas resources. Such methods may include biological enhancement of gas production from unconventional 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.

The evaluation criteria described in the solicitations are designed to encourage the formation of partnerships between producers and researchers. Partnerships are encouraged in order to facilitate the transition from research to application. In addition, the 2010 solicitation will encourage oil and gas producers, with little experience in preparing proposals, to partner with universities, state geological surveys and similar entities, and service companies, who are familiar with this process.

Anticipated Awards for 2010

It is anticipated that there will be $13.7 million available for funding the UCR. Approximately 5 to 15 awards are anticipated to be awarded in 2010. 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 described in Section 2.5, all projects are 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, 2008, and 2009 Activities

Nineteen projects have been awarded based on selections from the 50 proposals submitted in response to the 2007 solicitation for the UCR. Nine projects were selected and awarded from the 69 proposals submitted in response to the 2008 solicitation. This information is summarized in Table 2.2.3. Information, such as project duration, program consortium funding, the primary project deliverable, and other participants for each of the 2007 and 2008 projects is provided in Tables 2.2.1 and 2.2.2.

PROJECT	AWARDEE	RPSEA FUNDING/ COMPLETION DATE	DELIVERABLE	PARTICIPANTS
A Self-Teaching Expert System for the Analysis, Design and Prediction of Gas Production from Shales	Lawrence Berkeley National Laboratory	$1,700,000 Oct 2010	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	$1,000,000 Sep 2011	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	$1,600,000 Mar 2011	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, Petroglyph Operating
Application of Natural Gas Composition to Modeling Communication Within and Filling of Large Tight-Gas-Sand Reservoirs, Rocky Mountains	Colorado School of Mines	$670,000 Aug 2010	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	$860,000 Sep 2010	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
Enhancing Appalachian Coalbed Methane Extraction by Microwave-Induced Fractures	The Pennsylvania State University	$79,000 Sep 2009	Fundamentals of efficacy of using microwaves as a CBM stimulation technique	Nottingham University
Gas Condensate Productivity in Tight Gas Sands	Stanford University	$520,000 Dec 2011	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	The University of Utah	$1,100,000 Sep 2011	Best Practices for development of Utah gas shales integrating natural and hydraulic fracture interaction	Utah Geological Survey, Golder Associates, Utah State University, HCItasca , Anadarko, Wind River Resources Corp

PROJECT	AWARDEE	RPSEA FUNDING/ COMPLETION DATE	DELIVERABLE	PARTICIPANTS
Geological Foundation for Production of Natural Gas from Diverse Shale Formations	Geologic Survey of Alabama	$500,000 Jul 2011	Geologic characterization of diverse shales in Alabama	
Improved Reservoir Access through Refracture Treatments in Tight Gas Sands and Gas Shales	The University of Texas at Austin	$950,000 Aug 2011	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	The University of Texas at Austin	$690,000 Apr 2011	Design and field test of lightweight proppants in the Barnett shale	Daneshy Consultants, BJ Services
New Albany Shale Gas	Gas Technology Institute	$3,400,000 Jul 2010	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	$91,680 COMPLETE	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	The University of Tulsa	$220,000 Sep 2011	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	The University of Tulsa	$440,000 Jan 2010	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	$310,000 Aug 2010	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	$430,000 Aug 2011	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	$1,100,000 Oct 2011	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	$2,900,000 Sep 2010	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 2.2.1: UCR 2007 Project Porfolio

PROJECT	AWARDEE	RPSEA FUNDING/ COMPLETION DATE	DELIVERABLE	PARTICIPANTS
Barnett and Appalachian Shale Water Management and Reuse Technologies	Gas Technology Institute	$2,500,000 Aug 2011	Water management methods and technologies that reduce demands for freshwater, reduce environmental impact of brine disposal, and ensure supplies of water for well drilling and completion for shale gas development	The University of Texas at Austin, The Bureau of Economic Geology, Texerra, Geopure Water Technologies/Texas A&M University, Texas Oil and Gas Association, Chesapeake Energy, ConocoPhillips, Devon Energy Corporation, EnCana, EOG, Pitts Oil Company, Quicksilver, , Range Resources, XTO, Barnett Shale Water Conservation and Management Committee, Appalachian Shale Water Conservation and Management Committee
Novel Gas Isotope Interpretation Tools to Optimize Gas Shale Production	California Institute of Technology	$1,190,000 Aug 2012	Novel diagnostic tools for predicting, monitoring and optimizing shale gas production	Devon Energy Corporation, BJ Services Company, GeoIsoChem Inc.

PROJECT	AWARDEE	RPSEA FUNDING/ COMPLETION DATE	DELIVERABLE	PARTICIPANTS
The Environmentally Friendly Drilling Systems Program	Houston Advanced Research Center	$2,199,895 July 2012	Identification and evaluation of critical technologies for low-impact drilling, transfer of technology to industry, and tools for selecting low-impact technologies appropriate for a given site	BP, CSI Technologies, Devon Energy Corporation, Gulf Coast Green Energy, Halliburton, Huisman, Jacarilla Apache Nation, KatchKan U.S.A., M-I SWACO, Newpark Mats & Integrated Services, Weatherford, TerraPlatforms, LLC, Texas A&M University, Sam Houston State University, University of Arkansas, University of Colorado, Utah State University, University of Wyoming, West Virginia University, Argonne National Laboratory, Los Alamos National Laboratory, TerraPlatforms, LLC, Environmentally Friendly Drilling Joint Industry Partnership, The Nature Conservancy, Natural Resources Defense Council, New York State Energy Research and Development Authority
Pretreatment and Water Management for Frac Water Reuse and Salt Production	GE Global Research	$1,105,000 Aug 2011	Technology that enables recycle of nearly all frac flowback water as well as production of a salable salt by-product	STW Resources, Inc.
Stratigraphic Controls on Higher-Than-Average Permeability Zones in Tight-Gas Sands in the Piceance Basin	Colorado School of Mines	$111,216 July 2011	Evaluation of the stratigraphic controls on the distribution and quality of tight-gas reservoirs in the Piceance Basin	
Coupled Flow-Geomechanical-Geophysical-Geochemical (F3G) Analysis of Tight Gas Production	Lawrence Berkeley National Laboratory	$2,900,000 Jan 2013	Knowledge regarding long-term behavior of fractured tight gas reservoirs	Texas A&M University, Stanford University, Baker Hughes Inc., Unconventional Gas Resources, Inc.
Sustaining Fracture Area and Conductivity of Gas Shale Reservoirs for Enhancing Long-Term Production and Recovery	Texas A & M University	$1,615,000 Sep 2012	A methodology for reservoir typing and selection of fracture stimulations for preventing loss of productive fracture area and loss of fracture conductivity	TerraTek a Schlumberger Company, Devon Energy Corporation, EnCana Oil & Gas USA, Pennsylvania General Energy Co.
Multiazimuth Seismic Diffraction Imaging for Fracture Characterization in Low-Permeability Gas Formations	Bureau of Economic Geology, The University of Texas at Austin	$1,105,000 Oct 2012	Techniques for predicting fracture occurrence and attributes by combining seismic tools, fracture modeling, and fracture characterization based on wireline sampling techniques	The University of Texas at Austin, Bill Barrett Corporation
Evaluation of Fracture Systems and Stress Fields Within the Marcellus Shale and Utica Shale and Characterization of Associated Water-Disposal Reservoirs: Appalachian Basin	Bureau of Economic Geology, The University of Texas at Austin	$1,020,000 Sep 2012	Demonstration of how multicomponent seismic data can be used to evaluate fracture systems that control production of shale gas systems, quantify stress fields and elastic moduli that influence hydrofrac performance in shale reservoirs, and measure the capacity of porous sandstone units to accept flow-back water produced during hydrofrac operations.	University of Pittsburgh, Chesapeake Energy Corporation, Jeter Field Service, RARE Technology, AscendGeo, AOA Geophysics, Inc., Austin Powder Company, Seismic Source

Table 2.2.2: UCR 2008 Project Portfolio

Additional information on all projects can be found at www.rpsea.org and on the NETL/Strategic Center for Natural Gas and Oil webpage at www.netl.doe.gov/technologies/oil-gas/EPAct2005.

Funding Year	2007	2008	2009	2010
# Solicitations	1	1	Proposals due December 2009	$13.8125 million for 5 to 15 awards
# Selections	19	9		
# Awards	19	9		

Table 2.2.3: UCR Solicitations, Selections, and Awards

Table 2.2.4 below illustrates the distribution of the 2007 and 2008 projects by technology area and primary resource target and also illustrates the priorities set by the PAC during the 2008 project selection cycle. It illustrates the way in which the projects selected for the 2008 program addressed some of the technology gaps left in the program after the 2007 selections. In some cases, such as the drilling topic, the PAC felt that the needs in this area for the targeted resources were not as critical as needs in other areas. Similarly, the 2009 solicitation is designed to strengthen the integrated approach to the technology challenges associated with specific unconventional gas resources and identify a third Integrated Basin Analysis project to serve as an anchor project for the program.

Table 2.2.4: 2007 and 2008 Project Selections Classified by Primary Resource Target and Technology Area

	CBM 10%	Gas Shales 45%	Tight Sands 45%	
Integrated Basin Analysis		New Albany (GTI) $3.4	Piceance (CSM) $2.9	$6.3
Drilling				$0.0
Stimulation and Completion	Microwave CBM (Penn) $.08	Cutters (Carter) $.09 Frac (UT Austin) $.69 Refrac (UT Austin) $.95 Frac Cond (TEES) $1.6	Gel Damage (TEES) $1.05 Frac Damage (Tulsa) $.22	$4.7
Water Management	Integrated Treatment Framework (CSM) $1.56	Barnett & Appalachian (GTI) $2.5	Frac Water Reuse (GE) $1.1	$5.2
Environmental	*	Environmentally Friendly Drilling (HARC)* $2.2	*	$2.2
Reservoir Description & Management		Hi Res. Imag. (LBNL) $1.1 Gas Isotope (Caltech) $1.2 Marcellus Nat. Frac./Stress (BEG) $1.0	Tight Gas Exp. System (LBNL) $1.7 Strat. Controls on Perm. (CSM) $0.1	$5.1
Reservoir Engineering		Decision Model (TEES) $.31 Coupled Analysis (LBNL) $2.9	Wamsutter (Tulsa) $.44 Forecasting (Utah) $1.1 Condensate (Stanford) $.52	$5.3
Resource Assessment		Alabama Shales (AL GS) $.5 Manning Shales (UT GS) $.43	Rockies Gas Comp. (CSM) $.67	$1.6
Exploration Technologies	Coal & Bugs (CSM) $.86	Multi-Azimuth Seismic (BEG) $1.1		$2.0
	$2.5	$20.0	$9.8	$32.3
2008 Program Priorities (Dollar Amounts in Millions)	H M L	High Priority Medium Priority Low Priority	2007 Projects 2008 Projects	

The 2009 solicitation was released in October 2009 with selections expected in early 2010. As discussed previously, the 2009 UCR solicitation encourages the development of integrated programs targeting specific resources with a focus on technology or resource gaps that remain in the UCR portfolio.

E. Program Consortium Administrative Activities

Overall administrative activities for the Program Consortium in general are discussed in Section 2.7. Shorter-term administrative activities specific to the UCR include the completion of annual milestones that show progress towards meeting objectives. Short term administrative activities to be completed before the end of FY 2010 include:

- Issue and complete at least one solicitation.
- Engage technical advisory committees to review the solicitation to ensure that it reflects sufficient breadth and depth of industry experience
- Select and award 5 - 15 projects for 2010
- Establish FY2011 R&D priorities based on results of 2007-2010 solicitations and other inputs from stakeholders, including the Program Consortiums Advisory Committees, and advice from the Secretary of Energy's URTAC.

F. Milestones

The 2010 UCR solicitation will be released after transmittal of the *2010 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.

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 2011, and holding program level technology transfer workshops. The administrative milestones for 2010 for the UCR and all program elements are listed in Table 2.4.1.

2.3 Small Producer Program Element

A. Mission & Goals

The mission of the Small Producer Program (SP) 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 EPAct 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 SP 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 coal beds, 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 SP helps make leading edge exploration and production technology available to operators, helping them to increase their contribution to the nation's energy supply.

The approach to enhancing the impact of small producers on energy production involves two 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 SP 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 technical issues of Objectives 1-3.

C. Implementation Plan

The SP is being implemented by developing and administering annual 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 SP 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. 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 SP, the Unconventional Onshore PAC will remain responsible for oversight of the entire onshore program, which includes the SP as well as the UCR. The RAG will interact with the Unconventional Onshore PAC through the RPSEA Onshore Vice President 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 SP, 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 SP has been able to draw on the input from a number of the exercises and workshops conducted in coordination with the UCR as well as specific events aimed at small producers conducted by New Mexico Institute of Mining and Technology, The University of Kansas, 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 solicitations under the SP have 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 the SP are applied to increase production in a timely fashion, each performer 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 an award.

Small Producer Consortium
In compliance with section 999B(d)(7)(C) of EPAct, 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 effort is highly encouraged.

2010 Solicitations
The 2010 SP solicitation(s) will continue to focus on the theme of advancing technology for mature fields. However, opportunities will be sought to further focus the SP to complement the project selections in the 2007, 2008, and 2009 portfolios.

The 2010 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 footprints to maximize recovery of additional hydrocarbons.
- Addressing novel concepts that may be applied to increase production from mature fields.

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

Anticipated Awards for 2010
It is anticipated that $3.2 million will be available for the SP during FY 2010. Approximately 4 to 12 awards are anticipated to be awarded in 2010.

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 are 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, 2008, and 2009 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 and awarded.

The 2008 solicitation focus remained the same as that of the 2007 solicitation. Again, $3.2 million of funding was available for R&D awards under the SP in 2008. Six projects were selected under the 2008 solicitation, of which 4 have been awarded as of October 31, 2009 and

the remaining two are still in negotiations leading to an award. Several of the 2008 projects built upon the theme of improving recovery from mature reservoirs, while others expanded into new theme areas of improved reservoir characterization and utilization of waste industrial products.

The 2009 solicitation will have the same general focus as that for previous years and is anticipated to be released in August 2009 with selections expected in late 2009. Consultation with the RAG and information from participants in industry forums has indicated that the focus established by the initial solicitation is still the most important for small producers.

Table 2.3.1: Small Producer Program Solicitations, Selections, and Awards

Funding Year	2007	2008	2009	2010
# Solicitations	1	1	Proposals due December 2009	$3.1875 million for 4 to 12 awards
# Selections	7	6		
# Awards	7	6		

Table 2.3.2: Small Producer Program Project Portfolio

2007 PROJECTS	AWARDEE*	RPSEA FUNDING/ Completion Date	DELIVERABLE	PARTICIPANTS
Cost-Effective Treatment of Produced Water Using Co-Produced Energy Sources for Small Producers	New Mexico Institute of Mining and Technology	$457,253 Aug 2010	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	The University of Kansas	$248,385 Aug 2010	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	$284,839 Sep 2010	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	The University of Kansas	$274,171 May 2010	Define the potential for CO2 recovery or sequestration in near-miscible reservoirs	Carmen Schmitt
Preformed Particle Gel for Conformance Control	Missouri University of Science and Technology	$520,212 July 2010	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	$509,185 Aug 2011	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	$723,373 Aug 2010	Methodology to predict if a reservoir is amenable to seismic stimulation	U.S. Oil & Gas Corporation, Berkeley GeoImaging Resources
2008 PROJECTS	**AWARDEE***	**RPSEA FUNDING/ Completion Date**	**DELIVERABLE**	**PARTICIPANTS**
Commercial Exploitation and the Origin of Residual Oil Zones: Developing a Case History in the Permian Basin of New Mexico and West Texas	The University of Texas of the Permian Basin	$630,934 July 2011	Examination of regional data to clarify extents, locations, and origins of residual oil zones in Permian Basin	Chevron Corporation, Legado Resources, Yates Petroleum, Petroleum Technology Transfer Council, Midland College, Applied Petroleum Technology Academy
Evaluation and Modeling of Stratigraphic Control on the Distribution of Hydrothermal Dolomite Reservoir Away from Major Fault Planes	Western Michigan University	$393,369 Oct 2011	Study of lateral variability of reservoir quality hydrothermal dolomites to improve prediction of laterally persistent reservoir zones in the	Polaris Energy Company

			Albion-Scipio trend of southern Michigan.	
Development Strategies for Maximizing East Texas Oil Field Production	Bureau of Economic Geology, The University of Texas at Austin,	$700,000 Oct 2012	Exploration of short to midterm strategies for maximizing recovery from East Texas Oil Field.	Danmark Energy LP, John Linder Operating Co. LLC
Mini-Waterflood: A New Cost Effective Approach to Extend the Economic Life of Small, Mature Oil Reservoirs	New Mexico Institute of Mining and Technology	$313,751 Aug 2011	Demonstrate the feasibility of waterflooding small oil reservoirs that are not conducive to a fully-developed, patterned waterflood.	Armstrong Energy Corporation, Keltic Wall Services
Field Demonstration of Alkaline Surfactant Polymer Floods in Mature Oil Reservoirs Brookshire Dome, Texas	Layline Petroleum 1, LLC	$597,834 Nov 2011	Conduct a pilot study in Brookshire Dome field demonstrate applicability of alkaline surfactant polymer flooding to improve incremental oil production.	Tiorco LLC, The University of Texas at Austin
Electrical Power Generation from Produced Water: Field Demonstration of Ways to Reduce Operating Costs of Small Producers	Gulf Coast Green Energy	$229,796 April 2010	**Demonstrate the use of a modified waste heat generator that uses produced water to create "green" electricity usable on site or for transmission off site for field operations.**	Denbury Resources, ElectraTherm Inc., Dry Coolers Inc., Southern Methodist University, Texas A&M University

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

The project portfolio for both 2007 and 2008 are show in Figure 2.3.1. Information, such as project duration, funding, the primary project deliverable, and other participants for each of the 2007 and 2008 projects can be found at www.rpsea.org and on the NETL/Strategic Center for Natural Gas and Oil webpage at www.netl.doe.gov/technologies/oil-gas/EPAct2005.

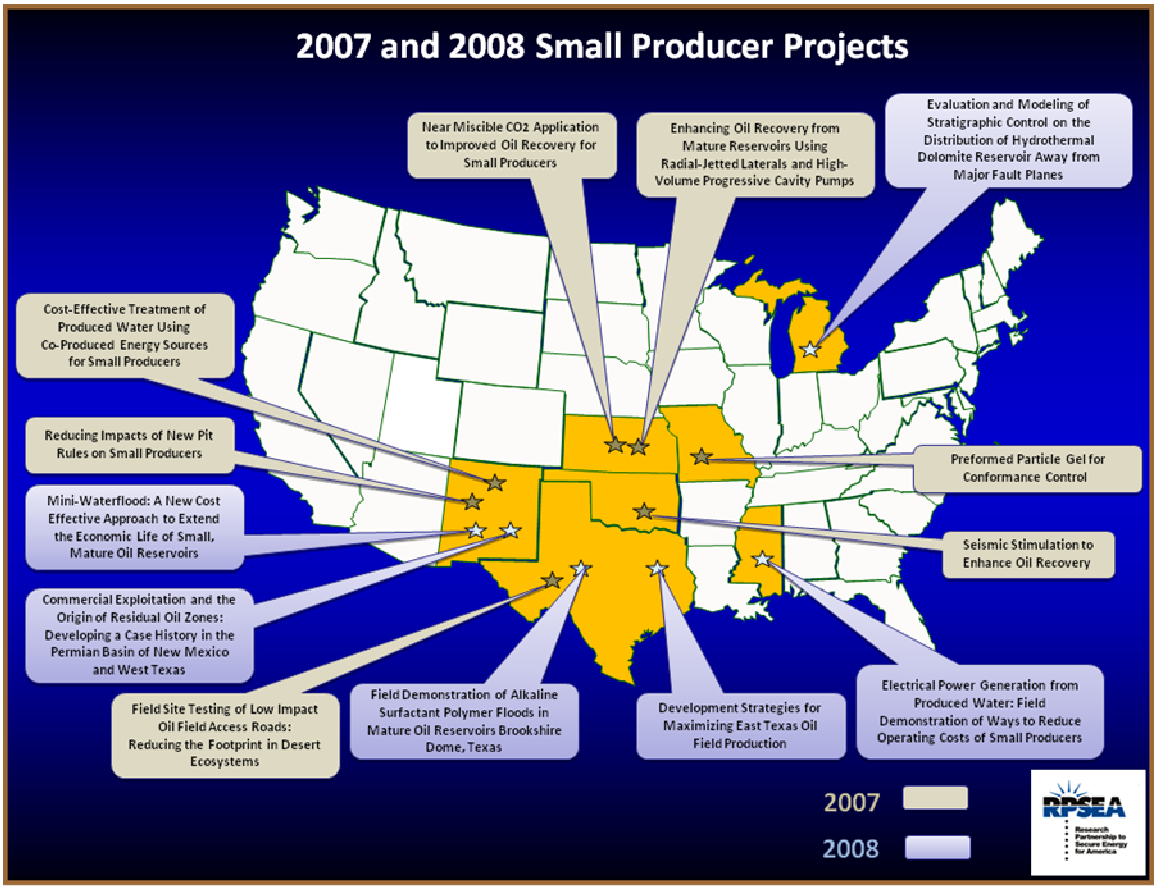

Figure 2.3.1: Small Producer Projects

E. Program Consortium Administrative Activities

Overall administrative activities for the Program Consortium in general are discussed in Section 2.7. Shorter-term administrative activities specific to the SP include the completion of annual milestones that show progress towards meeting the program element objectives. At a minimum, short term administrative activities to be completed before the end of FY 2010 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 4-12 projects
- Establishment of FY2011 R&D priorities based on results of 2007-10 solicitations and other inputs from stakeholders, including the Program Consortium's advisory committees and advice from the Secretary of Energy's URTAC.

F. Milestones

The 2010 Small Producer solicitation will be released after transmittal of the *2010 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

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 2011, and holding program level technology transfer workshops. The administrative milestones for 2010 for the SP and all program elements are listed in Table 2.4.1.

2.4 Solicitation Process

A. Eligibility

In accordance with Subtitle J of EPAct, 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 its 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. It remains in force as "active."

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. Beginning with the 2008 solicitation cycle, a two-step process was employed by the Program Consortium. This two-step process eliminates unnecessary detailed cost development for proposals that are not selected after step one. The two-step proposal process may be used where a technical volume and cost summary is submitted prior to submission of a full-cost proposal and other associated detailed information.

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.

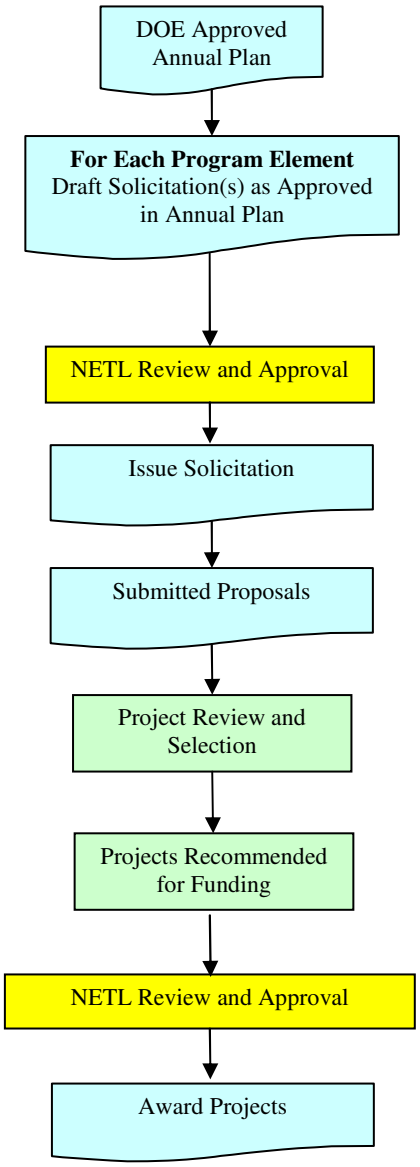

Figure 2.4.1: Project Solicitation Process

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 and the solicitation will direct applicants to respond to each, as appropriate:

- 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
- Justification that R&D would not be done without government funding

In the SP, 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.

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

E. Schedule and Timing

The schedule for the 2010 solicitations will be determined in consultation with NETL after the *2010 Annual Plan* has been submitted to Congress. After issuance, solicitations will remain open for a minimum of 60 days. The administrative milestones for 2010 for the SP and all program elements are listed in Table 2.4.1 below.

2010 Consortium Process Timeline

Month		*-2*	*-1*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
2010 Draft Plan Submitted (August 3, 2009)	♦														
Plan Published		♦													
Plan Approved					♦										
Obtain DOE Approval of Solicitation					♦										
Solicitation Open Period															
Proposal Evaluation and Selection															
DOE Approval										♦					
Contract Negotiation and Award															
Manage 2010 Awards															
Manage 2007, 2008 & 2009 Awards															
Report Program Deliverables															

2010 Consortium Process Timeline															
Conduct Technology Transfer Workshops & Activities															
Establish 2011 R&D Priorities & Annual Plan															

Table 2.4.1: Program Elements 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 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.
In addition, proposals will be required to assess whether industry would undertake the proposed R&D project in the near term in the absence of public funding.

G. Funding Estimates

It is anticipated that for fiscal year 2010, $14.8 million will be available for the UDW with approximately five to 10 awards, and $13.7 million for the UCR 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 $3.2 million will be available for the SP in fiscal year 2010. Approximately four to 12 awards are anticipated during fiscal year 2010. 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 and newsletters, e.g. *E&P Focus*
- 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)
- Petroleum Technology Transfer Council (PTTC) via NETL

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
- Coordinating 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 and applications, 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 has developed and implemented formal policies/procedures for the management of selected R&D awards which are consistent with the core principles of DOE Order 413.3A, *Program and Project Management for the Acquisition of Capital Assets*, as applied to R&D. Their policies/procedures address:

- Environmental considerations (NEPA considerations)
- Project negotiations
- Project funding decisions/factors
- Project reporting
- Assessments of individual project performance
- Project performance periods
- Project continuations (stage/gate)
- Project change/modification
- Project closeout and termination.

In addition, the Program Consortium will employ the 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.

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

An effective Technology Transfer Program is essential to the success of this Program. The goal is to engage participants all along the technology value chain, from conceptual development to commercial application. This will be accomplished through the coordinated effort between DOE/NETL and RPSEA outlined below.

The Technology Transfer Program

NETL has developed and is in the process of implementing a Technology Transfer Program that provides the internal process for integrating information from the traditional DOE Oil & Gas Program and the Ultra-Deepwater and Unconventional Natural Gas and Other Petroleum Resources Research Program.

The Technology Transfer Program has five primary elements and is 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.

With regard to technology transfer activities specifically related to the Program, there are various research products that will be delivered via differing technology transfer mechanisms, by each of four entities involved in the Program. Table 2.6.1 is a matrix that illustrates this concept and highlights the DOE/NETL role.

Table 2.6.1: Matrix Outlining Information Products and Delivery Vehicles for Section 999 Research Results

		RPSEA	NETL	Research Performers	DOE-HQ
Information to be Delivered	**Project Reports**		Complementary program	Interim and final reports	
	Project Data Sets		Complementary program	Spreadsheets, GIS, other	
	Project Software			Models and online tools	
	Presentations/papers	Program and project level	Program and project level	Project level	High Level Program
	Program Information	RFPs, deliverable, metrics, feedback	Program updates, benefits assessment		Program activity, FAC reports, mandated info.
Delivery Vehicle	**Project websites**			Selected projects have websites	
	Program websites	RPSEA site with links	Portal on NETL site with links (KMD)		Pages on DOE site
	Publications	Newsletter, articles in trade press	Newsletter, Techlines, articles in trade press	Technical papers, articles	Press releases, Techlines
	Forums/workshops	RPSEA forums and workshops	PTTC workshops		
	Public meetings	SPE papers, other technical meetings	SPE papers, other technical meetings	SPE papers, other technical meetings	SPE papers, other technical meetings

Active websites that are already sources of information related to the Program include the RPSEA website, the NETL website, and several individual project websites. Both the RPSEA newsletter and the SCNGO quarterly newsletter, *E&P Focus*, have feature articles highlighting individual projects and overall Program activities. As work on individual projects accelerates, all of the various technology transfer mechanisms will be engaged to deliver results and data products identified in Table 2.6.1.

A cornerstone of the NETL Technology Transfer Program is the development and implementation of a Knowledge Management Database (KMD) which will bring archived project information to the forefront. The KMD will include projects in the cost-shared program portfolio as well as information from DOE's traditional programs, both current and past. Opportunities to include additional data from other organizations are also being explored. NETL and the Program Consortium will coordinate to ensure that all relevant non-confidential and non-privileged project information will be made available to the public in a timely manner.

Reports, data, and results from the cost-shared program projects will be added as they become available. The KMD is accessible to the public via the Internet at www.netl.doe.gov/kmd.

The Cost-Shared Program
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. While only 2.5% of the amount of each contract is specifically set aside for funding technology transfer, the entire technology transfer program will be planned and executed with knowledge that for the desired impact to be achieved, significant technology transfer is needed.

At the project level, technology transfer activities include:

- Project reviews at quarterly UDW TAC meetings
- Press releases on significant project results
- Articles published in technical journals/publications
- Technical papers presented at conferences/workshops
- Specific project websites

Program-level technology transfer activities include:

- Posting of project information (abstracts, technical status assessments, results, accomplishments, reports, and key personnel contact information) on the Program Consortium's public website
- Periodic project reviews conducted as part of the Program management process
- Website enhancement to support interactive technology transfer
- Leveraging via participation and coordination with existing conferences, forums, and workshops
- Resurrection of ***GasTips*** publication[8]
- Select, focused, Workshops and Forums
- Program Consortium Technical Conferences held at a national or large regional scale
- Webcasts/Podcasts

The schedule for the Program Consortium technology transfer events is dynamic, driven by progress on individual projects and coordination with industry activities. A Calendar of Events on the RPSEA website lists upcoming, as well as past events. As new events are scheduled, they will be added to the Calendar of Events.

2.7 Program Consortium Administrative Activities

NETL will monitor and report on shorter-term administrative activities, program management performance and budget activities.

A. Monitoring Short-Term Program Consortium Administrative Activities

The Program Consortium developed quantitative, short-term performance metrics. The degree to which project milestones are completed on time, papers are delivered, patents are filed,

[8] *GasTips*, no longer in publication, was published by NETL to focus on new technology developments with application to natural gas resources.

companies contribute cost-share funds, and new technologies are determined to be successful and become commercialized are important indicators of the Program's success. Some specific short-term metrics include:

- Number of solicitations issued
- Number of compliant proposals received
- Number of selections made
- Percent of selections resulting in contracts
- Time from selection to contracting
- Research award adherence to budget and schedule
- Amount of cost share in excess of the minimum requirement
- Milestone performance

The specifics for each program element are presented under each Program section.

B. Monitoring and Reporting Program Consortium Oversight and Budget Activities Metrics

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 established a database to track obligated funding as well as uncosted amounts for the total Program (including administration), as well as for each project. Funds are tracked by year appropriated, in order to determine the age of all funds in all categories.

2. **Research Project Performance Data Collection** - The Program Consortium utilizes research project monthly reports to efficiently collect project performance data. Each research project is required to submit a monthly report containing the following information:

    - Actual Expenditures by Month
    - Performance Against Milestones
    - Highlights and Accomplishments
    - Issues or Concerns
    - Corrective Actions

In addition to the above, the Program Consortium developed 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

C. Program Benefits Assessment

A methodology for determining benefits related to the Subtitle J program was jointly developed by DOE/NETL and the Program Consortium. The report "*Benefits Assessment Methodology for the Ultra-Deepwater and Unconventional Natural Gas and Other Petroleum Resources Research Program"* provides a summary of the methodology to estimate the potential benefits of the cost-shared program administered by the Program Consortium. This report can be found at http://www.netl.doe.gov/technologies/oil-gas/EPAct2005/Index.html.

Acronyms

AAPG	American Association of Petroleum Geologists
BOD	Board of Directors
BOEPD	Barrels Oil Equivalent Per Day
CBNG	coal bed natural gas
DAP	Draft Annual Plan
DEA	Drilling Engineering Association
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
MMS	Minerals Management Service
MMV	measuring, monitoring, and verification
NEMS	National Energy Modeling System
NETL	National Energy Technology Laboratory
NMT	New Mexico Institute of Mining and Technology
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
RD&D	Research, Development and Demonstration
RFP	Request for Proposal
ROP	rate of penetration
RPSEA	Research Partnership to Secure Energy for America
SAC	Strategic Advisory Committee
SAIC	Science Applications International Corporation
SCNGO	Strategic Center for Natural Gas and Oil
TAC	Technical Advisory Committee
TCF	trillion cubic feet
UDAC	Ultra-Deepwater Advisory Committee
UDW	Ultra-Deepwater
URTAC	Unconventional Resources Technology Advisory Committee
XHPHT	Extreme High Pressure and High Temperature

Appendix A: Title IX, Subtitle J of EPAct 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 ultradeepwater 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 2010 Draft Annual Plan

The following 99 pages encompass the original RPSEA 2010 Draft Annual Plan submission.

RPSEA

2010 Draft Annual Plan

July 2009

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Executive Summary

This document is the Research Partnership to Secure Energy for America (RPSEA) 2010 Draft Annual Plan (DAP) for the Ultra-Deepwater and Unconventional Natural Gas and Other Petroleum Resources Research and Development Program (Program) established pursuant to Title IX, Subtitle J, Section 999 (Section 999), of the Energy Policy Act of 2005 (EPAct). RPSEA administers three of the four program elements 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. Previously, RPSEA submitted DAPs for 2007, 2008, and 2009, and gathered extensive input through industry workshops, road mapping sessions, and expert opinion in their development, including input from two Federal Advisory Committees (FACA).

The 2010 DAP is an evolutionary document building upon the foundation of the 2007 through 2009 approved Annual Plans, all of which the DOE has submitted to Congress and all of which incorporated RPSEA's 2007, 2008, and 2009 DAPs. The vision and plan laid out in these three previous DAPs remains solidly in place. At this stage of the Program, RPSEA's objectives are: the continued aggressive engagement of the private sector and research communities to enhance the value of the public/private partnership; a focus on building, maintaining, and managing the optimal portfolio contemplated by the original DAPs; and, the transition from planning to execution. Focus is the operative word regarding portfolio composition, and RPSEA remains keenly focused on the objectives more fully described in the following chapters. Each of the three RPSEA program portfolios, ultra-deepwater, unconventional resources and small producer, have developed according to plan, and the 2010 DAP continues that evolution to build the foundation required for optimal portfolio composition.

RPSEA's Mission is to provide a stewardship role in ensuring the focused research, development and deployment of safe and environmentally sensitive technology that can effectively deliver hydrocarbons from domestic resources to the citizens of the United States.

RPSEA Programs

The 2007 Program 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 were selected for award. The project selections were approved by NETL and are described in their respective program chapters, (4, 5 and 6). Of the 43 selections, 42 have been awarded and are actively in research.

2007 Program Selections				
	Small Producer	Unconventional Resources	Ultra-Deepwater	Total
Universities	6	13	5	24
For Profits	0	1	8	9
Non-Profits	0	1	4	5
National Labs	1	2	0	3
State Agencies	0	2	0	2
Total Selected	7	19	17	43

The 2008 program year solicitations were released by RPSEA beginning in mid-November 2008 for the Small Producer Program and the Unconventional Resources Program. The number of proposals received for 2008 increased by 40% over 2007. Solicitations for the Ultra-Deepwater Program were released in December 2008 and February 2009. Proposals from the Small Producer Program and the Unconventional Resources Program were received in mid-January 2009. The proposal reviews were completed in early March 2009 and submitted to the PACs for project selections. Six projects were selected for award under the Small Producer Program, and nine projects were selected for award under the Unconventional Resources Program. In the UDW, eight projects have been selected for award with an additional seven under review. The project selections were approved by NETL and are described in their respective program chapters (4, 5, and 6). RPSEA plans to issue its 2009 solicitations in late summer 2009.

RPSEA Activities

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. They include: a private Fellowship/Scholarship Program participating and exhibiting at 93 industry functions in two and half years, sponsoring innovative initiatives such as the Young Professionals in Energy and the Oil & Gas

Innovation Center, and sponsoring awards for the Science and Engineering Fair of Houston, and the Rice Alliance Best Energy Award Business Plan.

Stakeholder Participation

An extensive advisory network has provided input and direction for the DAP and for operational activities. In the overall process, there have been 75 meetings with 1,738 participants, who have volunteered almost 6,800 hours of time and effort since inception. As an example, the UDW advisory committees met 52 times with 1,325 participants involving over 4,000 hours of time and effort. In addition, RPSEA broadly reached out to involve the oil and gas community through an outreach program of member forums, in which topics ranged from unconventional resources, environmental, CO_2, small producer and offshore. Twenty-five member forums were hosted by member organizations in which 1,335 people participated over the last three years (not including RPSEA or the DOE personnel). This participation amounts to over 11,800 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.

RPSEA membership continues to grow, more than doubling since January 2007 from 66 members to the current membership of 145 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, nonprofits, and consumer and civic organizations. These members represent 27 states, the District of Columbia, and the Province of Newfoundland, Canada. Thirty-eight percent of members are comprised of U.S. small businesses. From information gathered from their public websites, RPSEA has found that its members collectively represent more than 600,000 employees worldwide and more than 50 percent of U.S. natural gas and oil production. (See Figure 3.2: RPSEA Membership by Industry.)

2009 and 2010 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 defined 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 focus for UDW in 2010 remains to address the themes articulated for the four generic field types by addressing the six previously described needs areas. These six needs address the higher-level goal of accelerating the development of resources into reserves. In 2009, RPSEA began an emphasis on more open solicitation topics. This was a natural transition from the more specific needs solicitations of the 2007 and 2008 program years, which were based on previous UDW needs assessments. The 2010 DAP continues this evolution to more open solicitations as described in Chapter 4. Also, the UDW program will move generally to a lesser number of larger projects, emphasizing cross cutting projects where possible.

The **Unconventional Resources Program** for 2007 through 2009 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 the NETL R&D portfolio and will continue to be addressed by NETL. The 2009 program will see the continued population of the portfolio set forth in the early foundational years. For 2010, the focus on unconventional natural gas remains essentially unchanged, with gas shales as the highest priority. The 2010 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 through 2009 awards. This is accomplished through the matrix in Chapter 5 (Table 5.1) describing technical areas versus resource types, used by the Unconventional Resources Program PAC to determine research focus. In addition, the 2010 DAP contemplates an emphasis on two or three geographic areas to broadly incorporate the components of the existing portfolio and begin the transition to field scale demonstration projects. Whereas UDW is moving to slightly more open solicitations, the Unconventional Resources Program will move to slightly more specific solicitations in order to fill the critical-path gaps of specific resource targets in the portfolio.

The **Small Producer Program** for 2007 through 2009 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 solicitations under this program were 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. The 2009 solicitation will continue this building process. For 2010, 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 through 2009 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 (EPAct), Title IX, Subtitle J, Section 999 (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 nonfederal lands, which although not directly providing federal royalties 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 needed technology is the 2008 Unconventional Resources Program selection on *Coupled Flow-Geomechanical-Geophysical-Geochemical Analysis of Tight Gas Production* led by Lawrence Berkeley National Laboratory. The emergence of extraordinary unconventional natural gas resources has in a very short time frame completely changed the domestic energy outlook. But the flow mechanism for these huge resources is still not well understood, and this critically important project seeks to advance the understanding of how all the factors are coupled in characterizing and optimizing gas flow from these relatively impermeable formations. While industry has done a remarkable job of iteratively advancing its operational processes to enable economic production, much still remains to be learned to further advance production with lower costs and lesser environmental footprint. Overlaying the science from this work onto existing field operations is not something that market forces would incentivize and is the appropriate application for advancement through a public/private partnership.

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 in general have little or no internal technology development capability. (www.ipaa.org/issues/testimony/IPAATestimony-HouseOversiteGovtReform10-31-2007.pdf).

Each program has specific examples of such collaboration. An example in the 2008 Unconventional Resources Program is the project selection of the *Environmentally Friendly Drilling Systems Program*. While the potential for unconventional natural gas is now clearly demonstrated by investment and production increases, it still requires drilling wells to access the resource. This project seeks to optimize the drilling process to assess trade-offs and establish balance among various interests using the land. This is especially relevant to both public lands in the West and to urban areas in the East. This project has more than 15 diverse participants bringing a variety of perspectives and expertise to address this critical issue. Another example is the 2008 UDW selection on *Coil Tubing Drilling and Intervention System Using Cost Effective Vessels* project. Recovery factors in the ultra-deepwater of the Gulf of Mexico (GOM) are directly related to intervention costs, and federal royalties are a function of recovery factors. By lowering the cost of intervention, producing fields can produce more at less cost from existing environmental footprints, thereby increasing federal royalties and enhancing domestic energy security. Yet another example is the 2008 Small Producer selection on *Electrical Power Generation from Produced Water* project. This project advances the technology to capture thermal energy from existing waste streams and converting it to generate electricity, thereby lowering costs which prolongs well life and increases recovery. And, since the electrical energy is geothermally generated, it produces no greenhouse gas emissions.

A. Consortium Selection

NETL contracted with RPSEA, a 501(c)(3) nonprofit corporation, to administer the distribution of approximately $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	1,750,000	14,875,000
Unconventional Resources	32.5%	16,250,000	812,500	1,625,000	13,812,500
Small Producer	7.5%	3,750,000	187,500	375,000	3,187,500
Consortium Total		37,500,000	1,875,000	3,750,000	**31,875,000**
Complementary	25%	12,500,000	0	0	12,500,000
Section 999 Total	100%	50,000,000	1,875,000	3,750,000	44,375,000

Table 1.1: Distribution of Section 999 Funds ($)

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 18,600 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, nonprofits, 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 and the Defense Advanced Research Projects Agency 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 competitively selected by the Department of Energy (DOE) to administer three programs of Section 999. Information on RPSEA and its members can be found at this link, RPSEA Members, 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.

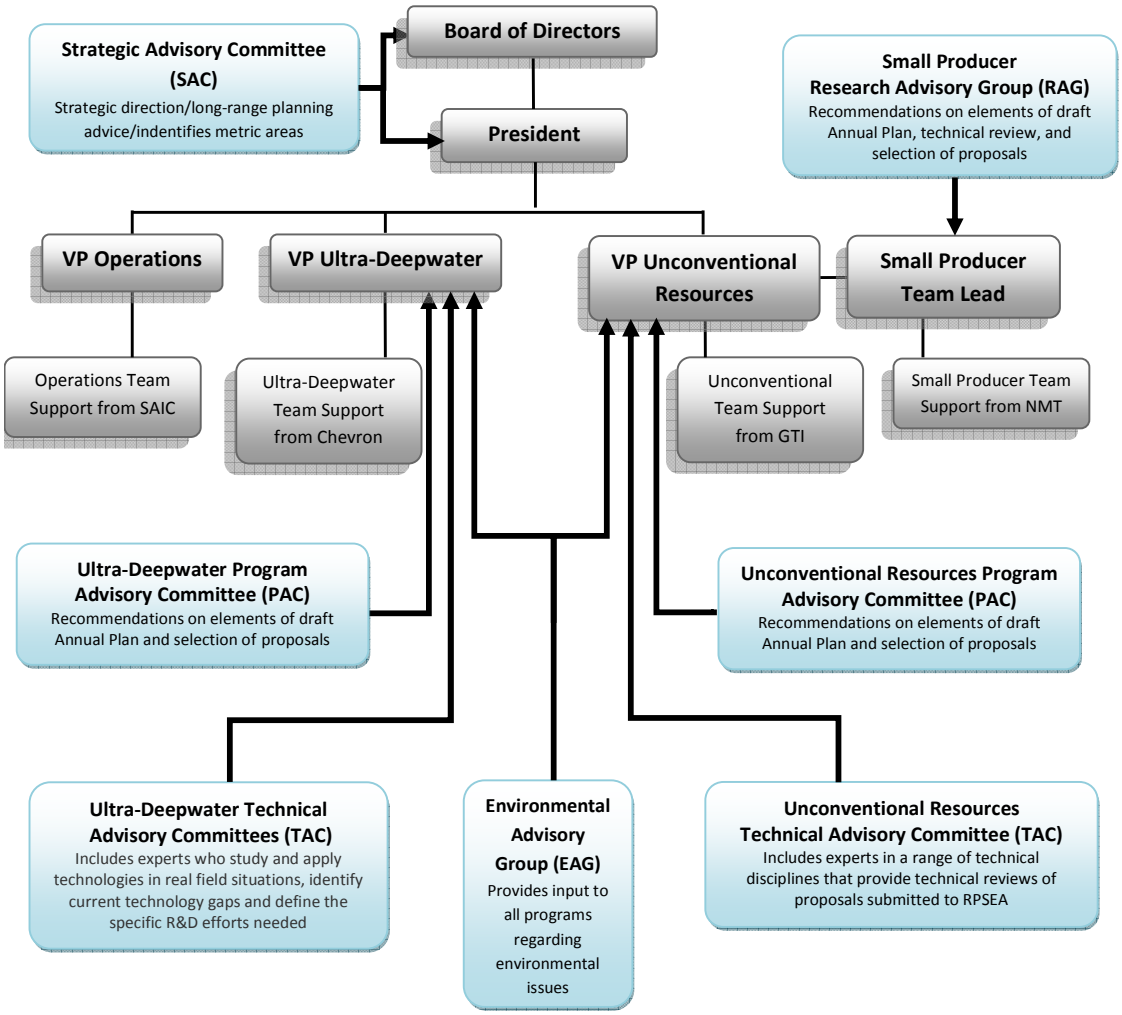


Figure 1.1: Organization of RPSEA and Advisory Committee Relationships

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 bylaws 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 nonmembers. 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, nongovernmental organizations, and industry for road mapping exercises to identify key regulatory barriers/issues. As requested, the EAG reviews programs, projects, and plans to ensure that environmental issues are appropriately addressed. The EAG also serves in a liaison capacity with various environmental programs and organizations across the United States.

Program Advisory (PAC) and Technical Advisory (TAC) Committees - The roles of the PACs and TACs within each program are further defined in Chapters 4 through 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 Producer 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. In August 2008, RPSEA provided recommendations for the 2009 Annual Plan and will in subsequent years provide Annual Plan input each July on a regular cycle.

Each year, the Annual Plan for the Program 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:

- Twenty-five 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 1,335 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 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 the 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.

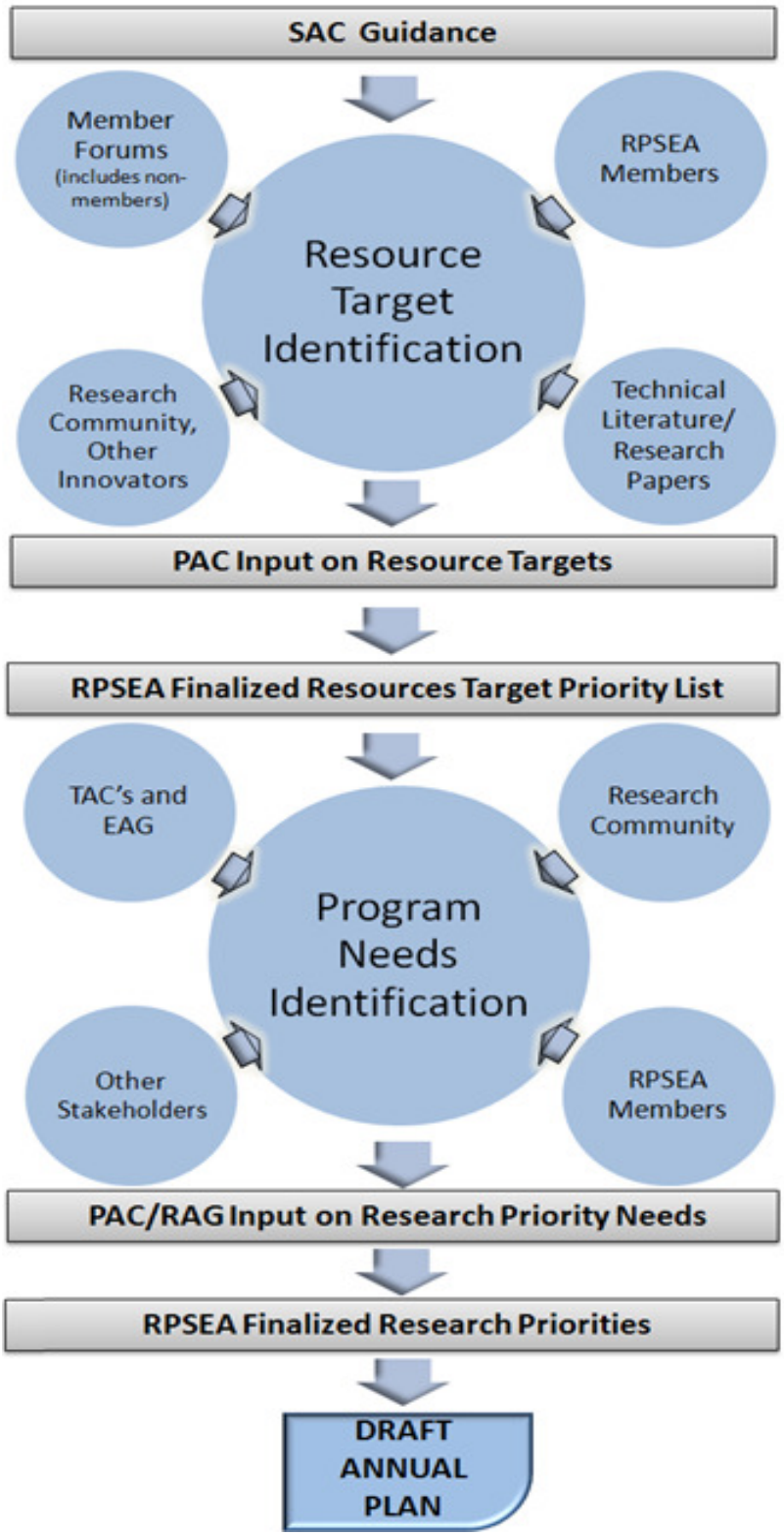


Figure 1.2: RPSEA DAP Development Process

Chapter 2 Strategic Overview

RPSEA Mission, Goals and Objectives

The primary mission of RPSEA with regard to Section 999 of EPAct 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 fourth year plan is RPSEA's continuing effort towards meeting the more specific goal in EPAct 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 the 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 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 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.

RPSEA 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:

- Works with industry to enhance technology transfer and deployment, demonstrating technology

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.

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 critical also to acknowledge the importance of collaborative partnership with industry to the success of the mission; 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. This is particularly true 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 the 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 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 technology transfer, as well as commercialization.

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 leapfrog the conventional development cycle.

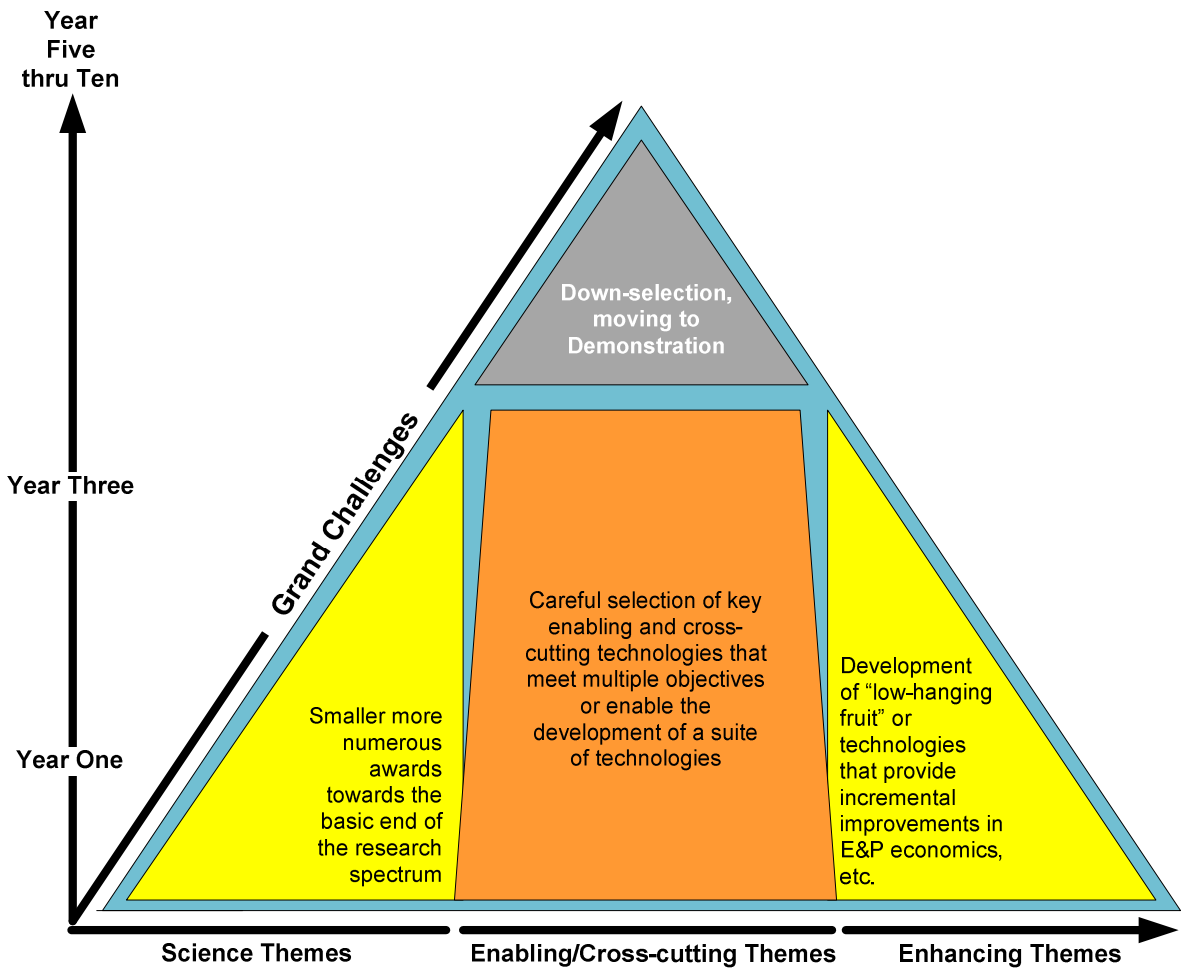


Figure 2.1: SAC Research Portfolio Guidance

Draft Annual Plan Organization

Following the structure of the strategic triangle in Figure 2.1, this fourth-year DAP builds upon the foundation laid by the 2007 through 2009 Annual Plans 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 years 2007 through 2009 Annual Plans as follows:

- Four ultra-deepwater field types have evolved to six industry needs
- Three unconventional 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. Table 2.1 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	• Relatively small number of industry players • Significant capital requirements • Consistent regulatory environment • Some internal research capability • Very high-cost, high-risk working environment • Industry players operating in major UDW basins worldwide	• Focus on infrastructure/harsh environnemental 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 • Opportunity for synergy with other UDW research programs (DEMO, PROCAP etc)
Unconventional Resources Program	• 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	• 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	The number of small producers is more than 10,000 in diverse regions and resources with: • Limited access to capital • Multiple regulatory jurisdictions • No internal research capability • Limited or no capability to internalize new technology • Threats from technical, environmental, and market challenges	• 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

Table 2.1: 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 chapters that follow.

Chapter 3 RPSEA Accomplishments

RPSEA has made significant progress towards the overall, high-level goals of the Program. These accomplishments are listed below.

- Commenced a new, fully-functional management structure and developed compliant policies and procedures specifically for administering Section 999 for the Program
- Developed a federally compliant set of policies and procedures for a new revolutionary Program, including management and operating plans
- Obtained federal certification of RPSEA's Procurement System, thereby expediting the approval process for research awards
- Successfully completed independent third party and federal accounting system audits with no material weaknesses
- Launched a new, content-rich website to support strategic communications, technology transfer, and the solicitation process
- Established a comprehensive advisory committee network
- Built support among oil and gas research and industry constituencies
- Increased membership within the different oil and gas community stakeholder groups. RPSEA currently has 145 members.
- Promoted links to other associations and members and has utilized the RPSEA website as a "network of networks"
- Initiated discussions and continued a series of meetings on technology collaboration with Norway's Demo 2000, United Kingdom's Industry Technology Facilitator (ITF) and Canada's Petroleum Research Atlantic Canada (PRAC). The objective of this collaboration is the identification and commencement of joint leveraged research opportunities.
- Developed the 2007, 2008, and 2009 Draft Annual Plans, which were the bases for the approved Program Annual Plans transmitted to Congress.
- Developed and issued research solicitations for the 2007 Program
    - Received and reviewed 99 research proposals and made 43 project selections
- Successfully negotiated and awarded 42 of the 43 project selections in 2007
- Developed and issued research solicitations for the 2008 Program
    - Received and reviewed 120 research proposals and made 23 project selections (additional selections most likely will be made before July 30, 2009)

- 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
- Held the first, full-scale RPSEA Unconventional Gas Project Review meeting for the Unconventional Resources Program in April 2009
- Held 25 nationwide member technology input forums
- Established RPSEA Lunch and Learn talks at member organizations
- Participated/exhibited and/or sponsored/supported multiple industry functions
- Chosen as the 2009 Offshore Technology Conference (OTC) Invited Organization
    - This recognition was based on RPSEA's outstanding contributions to the offshore industry and included a full afternoon panel of RPSEA members and researchers and provided a highlighted booth space to showcase research projects underway.
- Sponsored the Young Professionals in Energy (YPE) website
- Sponsored the development of the Oil & Gas Innovation Center
- Sponsored Oil & Gas Innovation Center Showcase
- 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 for 2008 and 2009

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 more than doubled since January 2007, growing from 66 members to the current membership of 145 members (Figure 3.1). These members represent 27 states, the District of Columbia and the Province of Newfoundland, Canada. As previously stated, these members collectively have more than 600,000 employees worldwide and represent more than 50 percent of U.S. natural gas and oil production. Thirty-eight percent of RPSEA membership is U.S. small businesses.

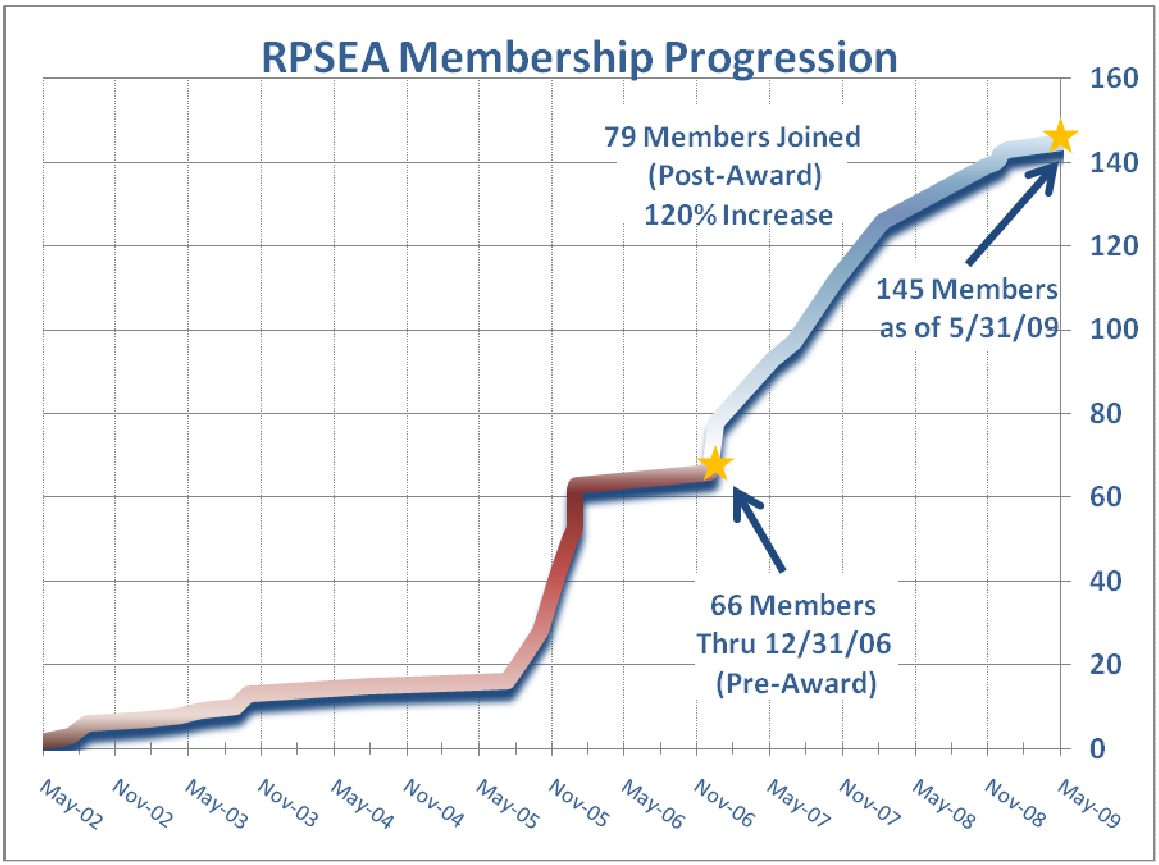


Figure 3.1: RPSEA Membership Progression

The overall RPSEA membership represents the diverse stakeholders in the oil and gas industry. The following graphic (Figure 3.2) depicts a percentage breakdown of these industries:

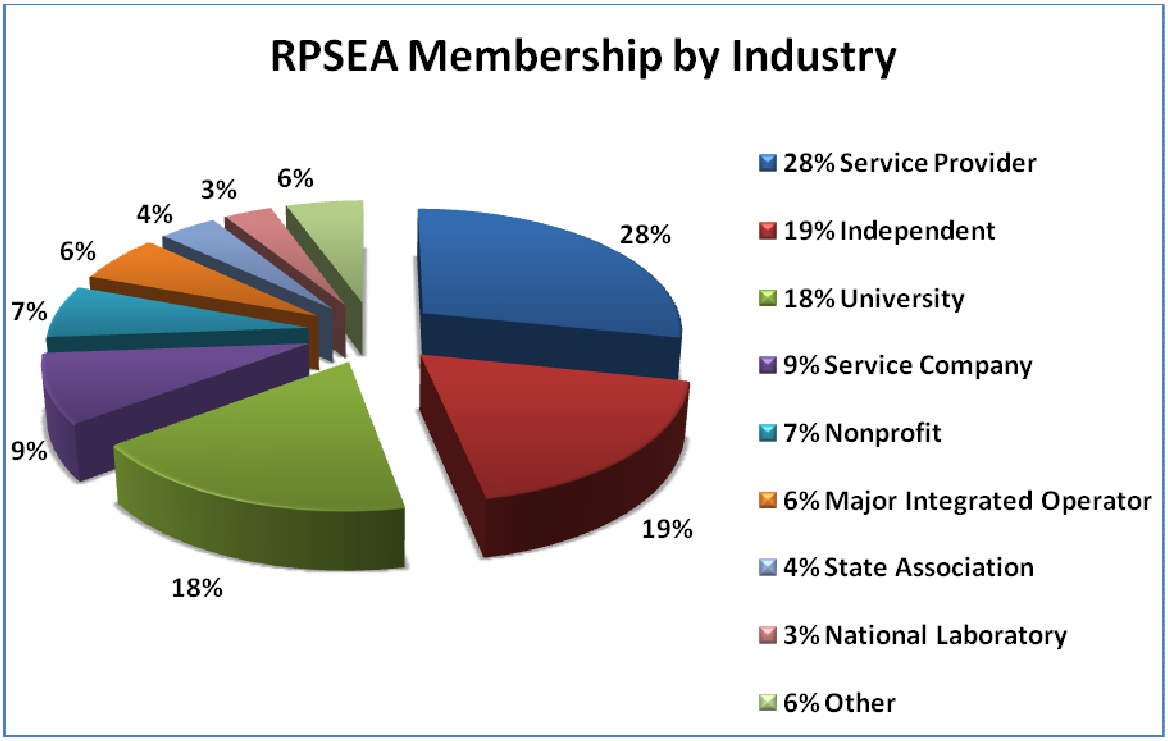


Figure 3.2: RPSEA Membership by Industry

Advisory Structure

RPSEA has developed a comprehensive advisory committee infrastructure from its diverse natural gas and oil constituency 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 meet multiple times a year 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 75 meetings with 1,738 participants who have volunteered approximately 6,800 hours of time and effort. As an example, the Ultra-Deepwater (UDW) PAC and TACs, combined, have met 52 times with 1,325 participants involving over 4,000 hours of time and effort. 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 25 forums hosted by member organizations (Table 3.1), in which 1,335 people participated (not including RPSEA, NETL or the DOE personnel). This participation amounts to over 11,800 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 grouped by general themes is as follows:

MEMBER FORUM	HOST
Ultra-Deepwater	
Autonomous Intervention for Deepwater O&G Operations Forum 10/31/06	Massachusetts Institute of Technology
Flow Assurance Forum 2/8/07	The University of Tulsa
Long-Term Environmental Vision for Ultra-Deepwater Exploration and Production Research Forum 11/20/08	Houston Advanced Research Center
Seafloor Engineering Forum 3/9/07	Texas A&M University
Seismic E&P Forum 10/10/06	University of Houston
Vortex Induced Vibrations Forum 1/11/07	Massachusetts Institute of Technology
Unconventional Resources - General	
Alaskan Unconventional Gas Resource Forum 4/7/08	The University of Alaska Fairbanks at the BP Energy Center
Produced Water Forum 12/14/06	New Mexico Institute of Mining and Technology
Unconventional Gas Development in the Western Energy Corridor 5/12/09	Idaho National Laboratory
Unconventional Resources - Shales	
Bakken Shale Forum 11/06/07	North Dakota Energy & Environmental Research Center
Coalbed & Shale Gas Forum 2008 (in	University of Alabama

MEMBER FORUM	HOST
conjunction with the International Coalbed & Shale Gas Symposium) 5/21/08	
Coalbed & Shale Gas Forum 2009 (in conjunction with the International Coalbed & Shale Gas Symposium) 5/18/09	University of Alabama
Fracture in Devonian Black Shale of the Appalachian Basin Workshop 1/8/08	West Virginia University
Mid-Continent Gas Shales Forum 6/3/09	Gas Technology Institute
Shale Gas Forum 12/5/06	The University of Oklahoma
Shale Plays Technology and Permian Basin Trends Symposium 11/29/07	Midland College
Tight Gas Shale Gas & Coalbed Methane Forum 11/14/06	Colorado School of Mines
Environmental	
Low Impact O&G Operations in Environmentally Sensitive Areas Forum 5/30/08	Texas A&M University
Technologies for Mitigation of Environmental Impact of Rocky Mountain Unconventional O&G Operations Forum 5/12/08	Colorado School of Mines
CO_2	
CO_2 EOR & Carbon Sequestration Forum 4/23/08	The CO_2 Conference
CO_2 Operations and Opportunities to Advance Technology for Mature Fields Forum 2/2/09	The University of Texas at Austin
Small Producer	
Mid-Continent Small Producer Forum 5/30/09	Kansas Geological Survey (University of Kansas)
Problem Identification Forum 11/29/06	University of Southern California
Small Producer Forum 12/15/06	New Mexico Institute of Mining and Technology

MEMBER FORUM	HOST
Unconventional Plays & Research UDW needs for Appalachian Basin Small Producers Forum 2/15/07	West Virginia University

Table 3.1: RPSEA Forums

One of the unique aspects of the Program is a focusing of the specific challenges and technology needs for resource themes. RPSEA, in conjunction with other organizations or alone with our member institutions, has held these various forums 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 forum 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.

In addition to the theme-based member forums listed above which focus on the Unconventional Resources and Small Producer Programs, the UDW uses a series of quarterly, TAC meetings that identify technology gaps and, eventually, define specific project themes which will serve as the basis for solicitations. These quarterly meetings allow RPSEA to take advantage of the extensive technical expertise of RPSEA members at critical stages during program development and execution.

Technology Transfer and Outreach

The RPSEA technology transfer plan 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:

Alliance Expo and Annual Meeting 2008 and 2009

American Association of Petroleum Geologists (AAPG) Annual Convention 2008 and 2009

American Institute of Chemical Engineers (South Texas Section) 2008

American Rock Mechanics Association Workshop 2007

Annual Convention of the Gulf Coast Association of Geological Societies 2007

Annual Gas Shale Summit 2008

Barnett Shale Produced Water Conference 2007

BOMA Optimizing Mature Assets 2007

Center for International Energy and Environmental Policy 2009
Clean Technology Conference and Expo 2009
Colorado Oil & Gas Association (COGA) Conference 2006 through 2009
CO_2 Flooding Conference 2007 and 2008
Deep Offshore Technology (DOT) and Demo2000 Conference 2007
Developing Unconventional Gas (DUG) 2007, 2008 and 2009
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
Gas Shales Summit 2008
Global New Energy Summit 2009
Global Technology Summit 2008
Greater Houston Partnership Energy Summit 2009
Hart's Research and Development in Exploration 2008
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 & 2009
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 and 2009
INTSOK 2007, 2008 and 2009
Interstate Oil and Gas Compact Commission (IOGCC) Annual Meeting 2008
Interstate Oil and Gas Compact Commission (IOGCC) Mid-Year Conference 2007
Louisiana Oil and Gas Association (LOGA) 2009
Marine Technical Society 2008
Massachusetts Institute of Technology Natural Gas Advisory Committee 2008 and 2009
Mid-America Regulatory Conference (MARK) 2008
More Bytes & More Barrels –Digital Energy Conference & Exhibition 2008 and 2009
New Mexico Oil and Gas Day 2009
North American Prospect Expo (NAPE) 2007, 2008 and 2009
Offshore Technology Conference (OTC) 2007, 2008 and 2009
Oil & Gas Innovation Center organizational sponsor

Oklahoma Independent Petroleum Association (OIPA) Annual Meeting 2008 and 2009

Rice Alliance Business Plan Competition 2008 and 2009

Rice Alliance Energy and Clean Technology Venture Forum 2007, 2008, and 2009

Rice Nanotechnology Venture Forum 2008 and 2009

Rice University Congressional Field Hearing 2008

Rocky Mountain Energy Technology Conference 2008

Science Engineering Fair of Houston 2008

Society of Exploration Geophysicists (SEG) Annual Meeting 2007 and 2008

Society of Petroleum Engineers (SPE) Workshop on Delivering and Using Emerging Technology in the E&P Business 2009

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 2007 and 2008

SW Petroleum Show 2008

Texas Renewable Energy Industries Association 2008

The Making of Energy Policy: Where Are We Going? Conference 2008

The University of Tulsa Energy Management Program 2008 and 2009

Washington Post Energy Conference 2007

Young Professionals in Energy (YPE) website sponsor 2008 and 2009

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 Company, 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, The University of Oklahoma, and West Virginia University.

Chapter 4 Ultra-Deepwater (UDW) Program

The EPAct 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 EPAct 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, drill, and produce hydrocarbons from ultra-deepwater including formations in the OCS deeper than 15,000 feet.

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

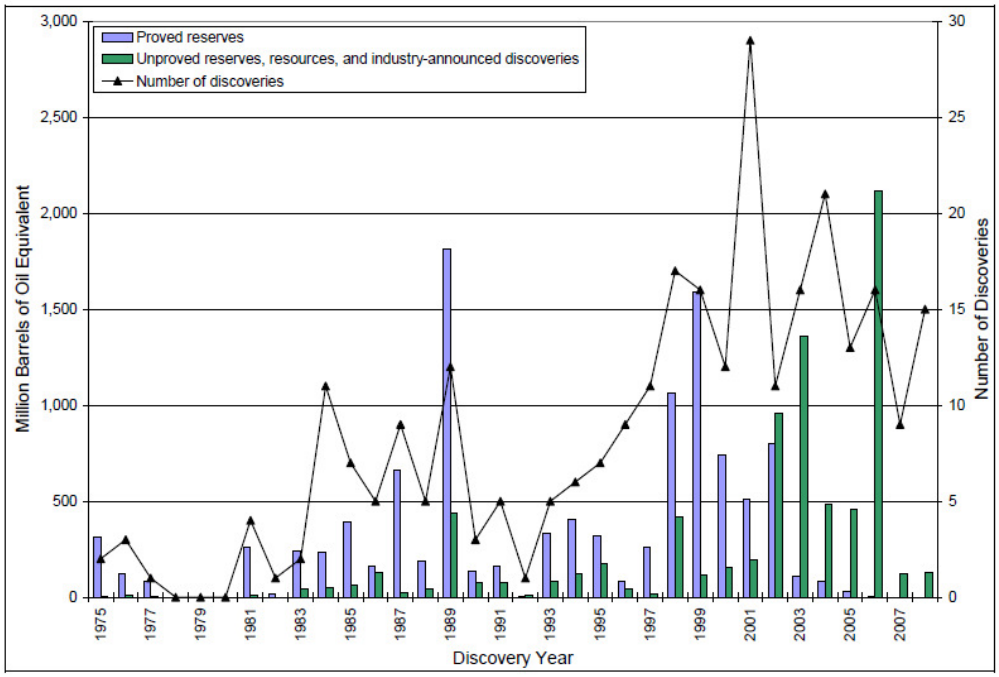
- Extending basic scientific understanding of the various processes and phenomena directly impacting the design and reliable operation of a ultra-deepwater production system
- Developing "enabling" technologies
- Enhancing existing technologies to help lower overall cost and risks
- Pursuing new technologies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

B. Goal

The goal of the UDW is 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. This goal will be achieved by:

1. Increasing the production of ultra-deepwater oil and gas resources
2. Reducing the costs to find, develop, and produce such resources
3. Increasing the efficiency of exploitation of such resources
4. Increasing production efficiency and ultimate recovery of such resources
5. Improving safety and environmental performance by minimizing environmental impacts associated with ultra-deepwater exploration and production

The significant importance of this goal 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.

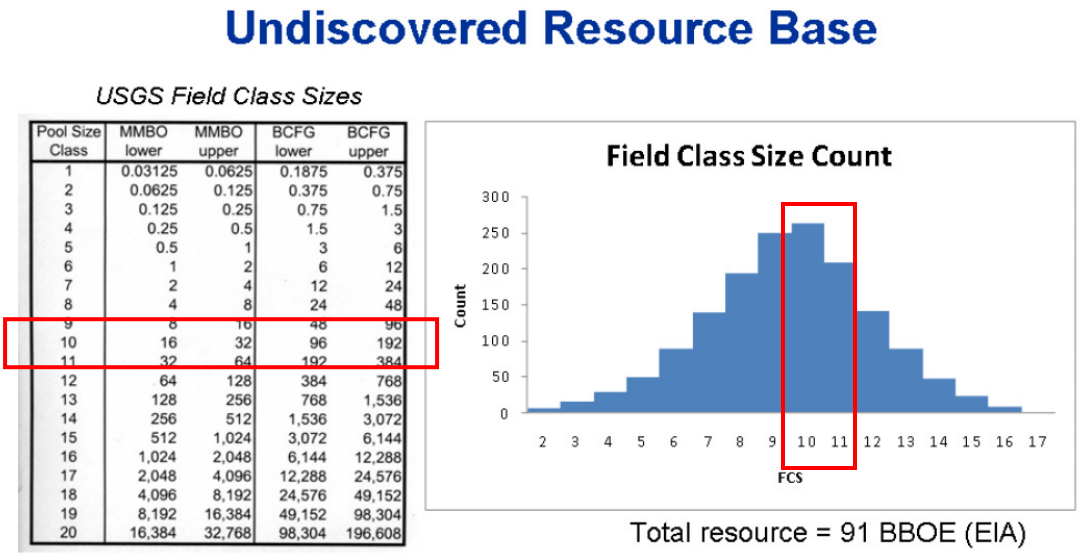


Latest Minerals Management Service (MMS) report 2009-016 shows an increasing lag between discovery and production in deepwater Gulf of Mexico – demonstrating the need to focus on development related technology development

Figure 4.1: Proven Reserves Add Value

Further evidence supporting UDW's goal to reduce cost can be found in Figure 4.2. Data from the DOE's Energy Information Agency (EIA) vividly shows that while 'small' fields are by definition small, the large number of the small fields can contribute significantly to the overall resource base if they can be economically developed. Similar opportunities for reserve growth also exist in the compartmentalized sections of larger fields. The majority of UDW future fields are likely to be developed with extended subsea tie backs utilizing a 'hub and spoke' methodology with multiple small fields tied

back to single surface hosts. RPSEA is focused on reducing overall development costs so that this resource base can be economically developed and resources produced for America's energy consumers.



Data from the DOE's EIA vividly shows that large numbers of small fields can contribute significantly to the overall resource base if they can be economically developed.

Figure 4.2: Undiscovered Resource Base by Field Class Size

C. Objectives

To meet the goal 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. The UDW established a series of objectives first outlined in the 2007 Annual Plan on which it continues to build.

Near Term

Objective 1: Ongoing Identification of Technology UDW Needs – The 2007 and 2008 Annual Plans capitalized on DeepStar Systems Engineering Studies, which identified the specific technology gaps that hinder ultra-deepwater development. Proposals were solicited to address the identified gaps. These gaps have been and will continue to be periodically revisited throughout the program duration, utilizing UDW TAC input.

Objective 2: Technology Research & Development, and Applied Science – The early years of the UDW will form the base of the technology development triangle (Figure 4.3). Subsequent years will fund additional technical development, demonstration, and potential commercialization of promising technologies. UDW has administered multiple rounds of solicitations for R&D contracts designed to meet the stated goal and identified UDW needs. While many of these projects will be of interest and would no doubt

generate value for the program and the American consumer, current limits on funding will dictate the need to prioritize and select only those that are deemed likely to result in the most significant increases in value through cost reduction, efficiency improvement, and effectiveness. Concurrently over the life of the Program, funding will be directed to innovative and novel projects as well as graduate study proposals that meet the needs and goal of the UDW.

Objective 3: 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.

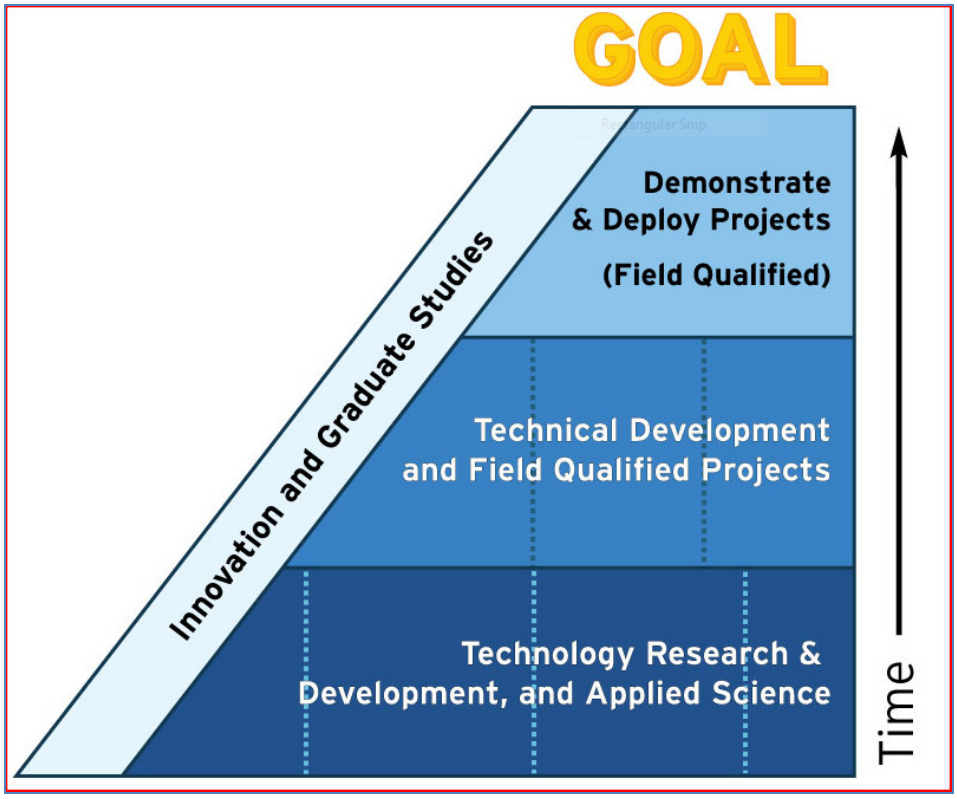


Figure 4.3: UDW Development Triangle

Longer Term

Objective 4: Technical Development and Field Qualified Projects – Through assessment of project results and additional solicitations (as needed), the UDW will continue the development and maturation of the most promising technologies with a strong focus on field qualifying projects 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 subcontract with RPSEA, utilizing the Chevron administered DeepStar consortium. DeepStar, with nine deepwater operating companies and 52 contributing member companies, is the world's largest ultra-deepwater stakeholder group and has a 19-year history of managing collaborative research. Through this arrangement, the UDW accesses 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 TAC in an advisory role. The 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.

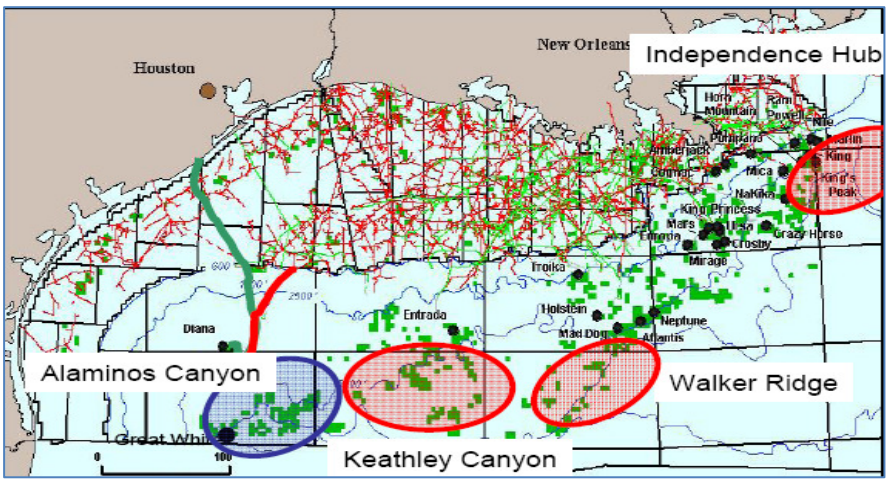
Supporting the PAC are nine TACs, each of which is focused on a particular ultra-deepwater technology area (see Table 4.1). The role of the TACs, with representation from subject matter experts who study and apply ultra-deepwater technologies in real field situations, is to identify current technology 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 Engineering	Subsea Facilities	Systems Engineering

Table 4.1: UDW TACs

Identification of Focus Areas for New Technology Development

Initially 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 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 4.4). Collectively these areas of activity represent a very large resource base as portrayed earlier in Figure 4.1. The initial 2007 and 2008 project selections and portfolio were developed based on these generic field types, with the UDW goal to develop new technologies to help convert these resources to proven reserves.



Walker Ridge/Keathley Canyon
- subsalt
- deeper wells
- tight formations

Alaminos Canyon
- viscous crude
- lacking infrastructure

Eastern Gulf – Gas Independence Hub
- higher pressure & temperature
- CO_2/H_2S

Overall
- higher drilling costs
- challenging economics

Figure 4.4: Technical Challenges for Identified Basins

Each of the above areas is characterized by challenges currently hindering technical and economic development which have been organized into a grouping of six technology UDW needs. Within each area of UDW need, various initiatives have been identified.

UDW projects are chosen based on their potential to address and satisfy the UDW needs and therefore meet the goal of converting UDW resources to proven reserves as shown in Figure 4.5.

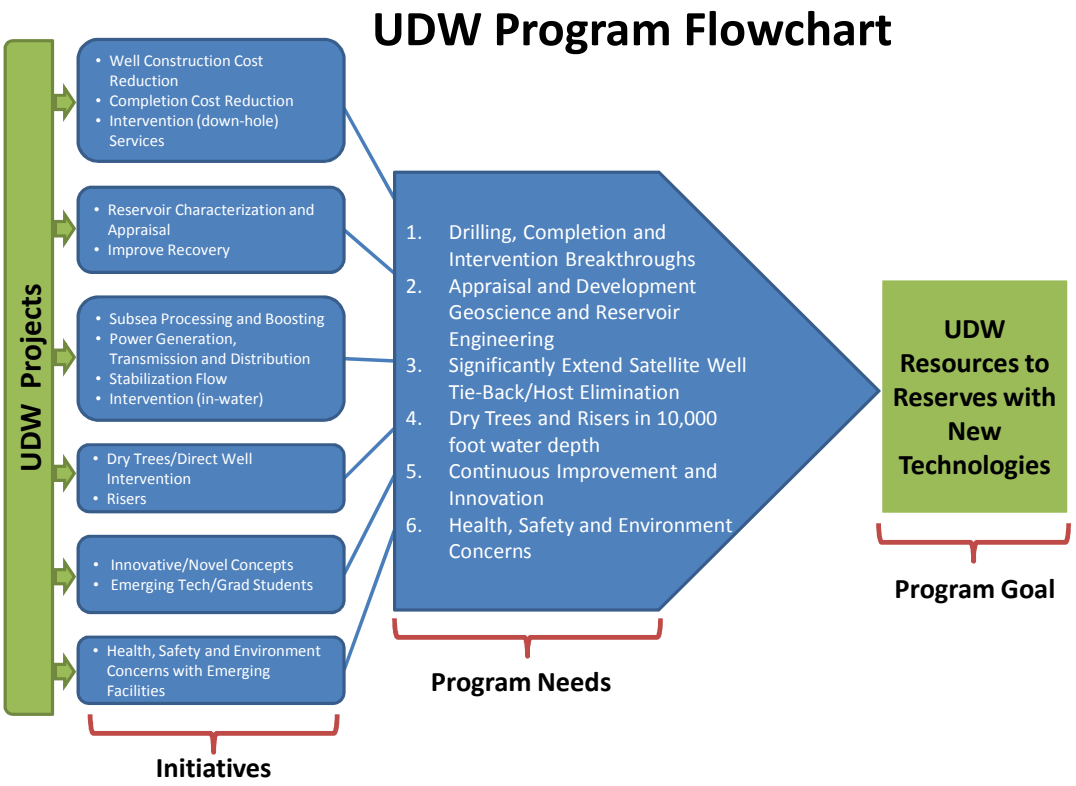


Figure 4.5: UDW Flowchart

E. UDW Program Status

2007 and 2008 Project Summary and Status

Each 2007 and 2008 project is summarized below in the context of how it fits into UDW needs and subcategory initiative. Table 4.2 provides an overview of project awardees, participants, and dollar value, with much more detailed information on the RPSEA website, www.rpsea.org.

2009 Project Summary and Status

While the 2007 and 2008 UDW projects are likely to show good promise and require additional phases of work to further mature the technologies, RPSEA will not be able to pursue all follow-on work. As the technologies are matured and move towards eventual demonstration, the funding requirements will increase quite rapidly. Due to limited Program funds, the opportunities will need to be prioritized and many will fall outside the RPSEA program. Efforts will be made to encourage the private sector to continue the maturation and commercialization process.

Solicitations approved in the 2009 Annual Plan have been developed and are expected to be posted on the RPSEA website late summer 2009. It will be noted when issued that the

2009 Request for Proposals (RFPs) are less prescriptive regarding Statements of Work and Deliverables than were most of the 2007 and 2008 RFPs. This is due to several factors. DeepStar had done a great deal of preparatory work in developing the 2007 and 2008 RFPs which enabled the UDW to leap ahead with a quick start. Due to extraordinarily complex and challenging contracting terms and conditions, none of the 2007 and 2008 projects were far enough along to provide any significant detailed results that might have helped guide 2009 work. As a result, the 2009 RFPs call for proposals directed to the identified UDW needs and initiatives in a very general way, leaving the proposer considerable latitude regarding methods and processes of accomplishment. It is hoped that this approach may generate some truly novel proposals from a broader community of experts. A summary of the 2009 RFPs is included below under the respective UDW need, along with the 2007 and 2008 projects.

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 spread cost exceeding $1 million per day, significant cost reduction is required for UDW project viability.

Initiative 1: Well Construction Cost Reduction

Target: Reduce ultra-deepwater drilling 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 at end of life 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 (Note: This project also supports Need #2, Initiative 1: Reservoir Characterization and Appraisal)

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 ensure 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, multiphase flow, and transient effects. New drilling systems with tools utilizing MPD have proven in wells on shore and in shallower water depths to reduce formation damage while drilling faster and at a lower overall risk.

DW35xx (2009): Drilling
Proposals under this drilling initiative are expected to have the potential to significantly reduce the cost of UDW well drilling operations. Concepts addressed may include:

- To reduce the single MODU spread cost by segregating the well construction operation into phases, where cost effective, fit-for-purpose vessels may be used. For example, a workboat may be used to construct the top-hole or open-hole section of the well. The more expensive MODU then would drill to total depth and be followed by a lower cost completion/workover rig to complete the well. It is expected that individual fit-for-purpose vessels would feature an effective lower daily spread cost. Potential added environmental benefits from this approach could be reducing pump and dump, reducing casing strings, etc.
- To reduce the total well count into a given reservoir to save drilling costs. Access to the reservoir targets may be accomplished with a "mother-bore" and various multi-laterals using Smart Well completion technologies to access the various reservoir targets.
- A longer-term approach may be to develop a seafloor based drilling rig featuring minimal surface support requirement. Several seafloor drill rig concepts have been studied over the years and a current project is being sponsored by DEMO 2000 in Norway. Any proposed concept would need to feature some unique advantages over current work in this area.

Initiative 2: Completion Cost Reduction

Target: Reduce ultra-deepwater completions costs by 30 percent.

DW35xx (2009) Completions
UDW Completions are an area where significant economic impact may be achieved either through process or through architecture of the well. Innovation will be needed to achieve significant cost savings relative to conventional technology. Potential studies may include:

- Modification of the completion architecture to enable downhole artificial lift system maintenance without having to mobilize major rigs MODUs; for example, locating well master valves downhole, or developing another method of deepwell artificial lift that is easier to service or maintain.
- Development of unique completion strategies where downhole equipment installation is highly optimized – perhaps single trip completions.

- Improvement of well stimulation techniques aiming at cost reduction – open-hole FracPack, for example – and/or to improve well drainage volume.

Initiative 3: 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.

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: Reservoir Characterization and Appraisal

Target: Delineation of the reservoir including fluid and rock properties, reservoir complexity and continuity, drive mechanism, and full field development planning while minimizing cost and risk to obtain such information will lead to quicker determination of commerciality.

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 uncertainty is one of, if not, the single biggest challenges facing offshore operators today. 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 well log data and small samples collected 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 three to four fold without understanding reservoir continuity. The result is a potential loss of resources in undeveloped deepwater and ultra-deepwater discoveries, or improper design of production facilities. Phase 1 of this multiphase project focuses on the technical gap assessment and concepts identification to help accelerate reserve development through more effective appraisal.

Initiative 2: Improved Recovery

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 historically produced 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 project 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.

DW37xx (2009): Subsurface

Proposals are being requested that will lead to accomplishment of the following ultimate goals:

- Better understanding of reservoir continuity, complexity, thickness, fluid type and commerciality for GOM at large well spacing before drilling
- Ability to produce reservoirs to near-zero residual hydrocarbon with near-zero operating expenses
- Reduced costs and time to delineate field commerciality
- Optimization of development well locations and reduction of number of development wells for economically robust field development

Need 3: Significantly Extend Satellite Well Tieback /Surface Host Elimination

Benefit: Frequently, many reserves reside in a collection of small fields as illustrated in Figure 4.2. Depending upon a number of factors, fields as large as 100 million barrels oil equivalent or greater will not support stand alone 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: Subsea Processing & Boosting

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 remote operating vehicles, 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.

DW33xx (2009): Subsea Processing, Pressure Boosting, Instrumentation and Controls
Proposals will be sought addressing modules that may be needed in a subsea production system including:

- Subsea separation system
- Pressure boosting systems
- Power supply, distribution and control systems
- Produced water management system
- Sensors and process control systems
- Chemical delivery and injection systems
- Produced solids management methods
- Seawater injection system
- Inspection, maintenance, and repair capabilities

A major consideration in selecting proposals for this RFP will be the cumulative impact the above technologies will have upon providing a complete field qualified subsea processing strategy and system.

Initiative 2: Power Generation, Transmission & Distribution

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 will 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: 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 theses 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.

DW32xx (2009): Stabilized Flow Assurance
Flow Assurance (FA) predicts and establishes management strategies for the behavior of production as it enters the wellbore and moves through the production system to the market point. For small UDW satellite field tie-back developments, cost effective FA management methods are required. Usually this FA cost effectiveness will be achieved by reducing the capital expenditures and/or operational expenditures of the field development facilities.

Two promising FA strategies with potential to achieve this objective are cold flow and subsea processing. Subsea processing removes bulk water from the production stream to the extent subsequent FA problems are reliably managed.

Cold flow is a strategy where production is reduced to seafloor temperature forcing formation of thermally dependent solids. Ideally, these solids are formed without pipe wall adhesion and the solids move with the production flow through the system. This strategy and its associated facilities have application limits and boundaries which need to be well understood.

This FA initiative seeks projects which will enable satellite field FA strategies to be matured to a project ready (TRL 6) status.

Initiative 4: Intervention (In-Water)

DW33xx (2009): Autonomous Underwater Vehicles (AUV)
Autonomous Underwater Vehicles (AUVs) are becoming more capable and reliable as their technology improves. Several demonstration and deployment tasks with increasing complexity are envisioned to introduce new capabilities to the offshore industry. Proposals will be sought to develop and, then, perform demonstration of:

- A simulated pre-hurricane and a post-hurricane facility inspection service
- Reliable operation of a subsea valve

These demonstrations are intended to demonstrate AUV capability and increase operator confidence of these capabilities in a deepwater field environment.

Need 4: Dry Trees 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

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

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.

Initiative 2: Risers

Target: Review materials and design to reduce cost, reduce weight, improve performance, and insure integrity.

DW1401 (2007): Carbon Fiber Wrapped High Pressure Drilling and Production Riser Qualification Program
Develop and qualify 14 inch to 19 inch inside diameter 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 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 with a rigorous materials

testing program that will also contribute to the goals in the drilling and completions area.

Need 5: Continuous Improvement and Innovation

Benefit: This addresses two areas: improving existing operations and focusing longer-term research and development on innovation in new field applications. 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. Longer-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 Innovative Game-Changing Technologies

Target: Provide practical project opportunities for graduate students to promote careers in the offshore oil and gas industry. Identify potentially viable novel and innovative technologies from entrepreneurs and others that might offer game-changing solutions for deepwater oil and gas. Provide seed money to the entities offering 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

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

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

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

DW2902-02 (2008): Technologies of the Future for Pipeline Monitoring and Inspection

DW2902-03 (2008): Wireless Subsea Communications Systems

DW2902-04 (2008): Replacing Chemical Biocides with Targeted Bacteriophages in Deepwater Pipelines and Reservoirs

DW2902-06 (2008): Enumerating Bacteria in Deepwater Pipelines in Real-Time and at a Negligible Marginal Cost Per Analysis: A Proof of Concept Study

DW2902-07 (2008): Fiber Containing Sweep Fluids for Ultra Deepwater Drilling Applications

DW39xx (2009): Continuous Improvement and Innovation
Continued 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. Awards under this RFP will provide practical project opportunities for graduate students to promote careers in the offshore oil and gas industry. Also requested are proposals from entrepreneurs and others for potentially viable novel technologies that might offer game-changing solutions for deepwater oil and gas. Awards will provide seed money to the entities offering these technologies for a period of approximately two years.

Need 6: HS&E Concerns (Safety and Environmental)

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

Initiative 1: Metocean Needs That Impact Operations and Facility Design

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 knowledgeable users.

Initiative 2: HS&E Concerns with Emerging New Technologies

DW33xx (2009): Subsea Processing and Seabed Discharge of Produced Water
Proposals addressing review and evaluation of existing regulations, standards and HS&E requirements that may govern deepwater surface and/or seabed direct discharge of produced water, define relative seabed conditions, environment, and marine toxicology will be of interest. Cost/benefit/impact assessments and conceptual design(s) of subsea processing systems(s) that incorporate discharge of solids and produced water at the seafloor and proposals on other related topics will also be requested.

PROJECT	AWARDEE	DURATION/ RPSEA FUNDING	DESCRIPTION	PARTICIPANTS
DW1201: Wax Control	The 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 Axept, Intertek, BP, Southwest Research Institute, ENI, Anadarko, Devon, Schlumberger, Weatherford
DW1302: Ultra-High Conductivity Umbilicals	NanoRidge Materials	12 months $448,000	Engineering prototype of a working ultra-high conductivity 'wire' (conductor) utilizing nanotube technology and test and analytical data	Technip, Rice University, Duco
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 feet	Stress Engineering
DW1402A: 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
DW1402B: Ultra-Deepwater Dry Tree System for Drilling and Production	Houston Offshore Engineering	Stage1 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
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 Research & Engineering	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. Flow Phenomena in Jumpers	The University of Tulsa	24 months $150,000	Project will contribute to the goals of the stabilized flow initiative	Chevron
DW1603-B: Graduate Student Design Project. Hydrate Plug Characterization and Dissociation Strategies	The University of Tulsa	24 months $150,000	Project will contribute to the goals of the stabilized flow initiative	BP
DW1603-C: 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-D: 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
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, Enl, 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 4.2: 2007 UDW Selections

F. 2010 UDW

The 2010 UDW will have approximately $15 million available for project awards. The 2010 UDW will target funding of three to five large projects, with a value of $1 million to $5 million per project. Additionally, a number of smaller awards averaging $150 thousand to $300 thousand each will be funded under Need 5: Continuous Improvement and Innovation. Each project will have a 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).

Proposed UDW 2010 RFPs can be categorized into three types:

- Next phase projects based on completed projects from the 2007 and 2008 program
- Specific project ideas to fill-in identified technical gaps
- Graduate student and innovative /novel projects

Anticipated 2010 UDW initiatives and/or projects are listed below in the context of each UDW need. The actual 2010 UDW may differ from the anticipated portfolio listed below and will be driven by further guidance from the UDW PAC and the timing associated with 2010 Program funding.

Need 1: Drilling, Completion, and Intervention Breakthroughs

Proposals may be requested identifying novel ideas to reduce well construction and completion costs and funding follow-on recommendations from 2007 and 2008 projects.

Need 2: Appraisal and Development Geoscience and Reservoir Engineering

Proposals will be requested in the area of formation and reservoir characterization and/or 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 addressing follow-on recommendations from 2007 and 2008 projects. New 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
- AUV and intervention
- Subsea processing/produced water treatment

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

This need area was addressed in the 2007 and 2008 UDW. Next phase proposals may be requested addressing recommendations from the 2007 and 2008 projects

Need 5: Continuous Improvement and Innovation

Proposals in this need area may include:

- Advancing industry understanding of phenomena and science impacting ultra-deepwater operations
- Improvements in integrity management and reliability
- Additional graduate student and project funding
- Innovative technology high risk, high reward "long-shot" opportunities

Need 6: Associated Safety and Environmental Concerns

There is a tremendous amount of environmental research funded by the federal and state governments as well as private foundations. RPSEA will reach out to the environmental researchers and safety professionals, enabling them to understand the importance of their efforts with respect to U.S. domestic energy production. RPSEA's focus is on technology development and, as such, RPSEA will be focusing efforts to ensure new technology developed within the program takes environmental impact and safety considerations into account. In accomplishing this, RPSEA will be seeking to leverage ongoing research efforts, and collaborate within existing forums and venues, and where possible integrate with ongoing UDW projects.

Areas of study may include:

- Discharge of produced water subsea – technology and regulatory aspects
- Environmental impacts associated with technologies addressed under other UDW needs

G. Metrics

Overall metrics for the Program in general are discussed in Chapter 7. Shorter-term metrics specific to the UDW include the completion of annual milestones that show progress towards meeting the UDW objectives. Short-term metrics to be completed before the end of FY 2010 include:

- Issue and complete at least one solicitation
- Engage TACs and PACs to review that the solicitation reflects sufficient breadth and depth of industry experience
- Select and award three to five large projects, with a value of $1 million to $5 million per project, with additional awards averaging $150 thousand - $300 thousand each, under Need 5: Continuous Improvement and Innovation
- Establish FY2011 program priorities based on results of 2007-10 solicitations and other inputs from stakeholders, including the program advisory committees and the UDAC

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 EPAct 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 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 (TCF). A 2008 report prepared by ICF International for the INGAA Foundation estimates these gas resources to be 624 TCF. Unconventional gas is clearly an important component of the U.S. energy portfolio and a valuable U.S. endowment. It is a goal of this program to provide the technology to both grow the resource base and convert technical resource into economic gas production. The primary beneficiary is the U.S. gas consumer who will have a more secure and fairly priced gas supply.

Due to their potential 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 NETL complementary research program and the DOE traditional oil and gas research program.

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 developed with input from the Unconventional Resources PAC. This input has been combined with information gathered during an ongoing series of efforts to identify and prioritize the technology challenges associated with the development of unconventional resources.

Recent efforts include: (1) a series of six forums on topics relevant to unconventional resources held in various producing basins by RPSEA members beginning in late 2008 and continuing through June 2009, (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 2009 Annual Plan by the URTAC, and (4) input provided by PAC and TAC members associated with projects selected for the 2008 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 2009 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 (~45%)
- Emerging - Formations, depth intervals, or geographic areas from which there has been limited commercial development activity and very large areas remain undeveloped (~45%)
- Frontier Area - Formations, depth intervals, or geographic areas from which there has been no prior commercial development (~10%)

The intended relative balance of the program's focus among these three categories from prior year Annual Plans is indicated above. In practice, the number of projects that apply

to all three development categories has given the Frontier category a weight of approximately 15% in the 2007 and 2008 programs. No significant change in emphasis is planned for 2010.

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.

In order to accomplish this integration, projects will continue to be focused on two or three specific unconventional gas development areas. While the results of the program will be applicable across a wide range of resources and basins, synergy among individual projects will best be achieved when there is an opportunity for individual projects to share common datasets and coordinate their efforts to apply a range of technologies to the solution of common problems.

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 objectives, technology targets, field projects and technology dissemination components utilize an approach illustrated within Figure 5.1. The program components are prioritized for a particular resource target that has been identified as having significant potential. The highest ranking technology needs are identified and form the basis for the R&D solicitations. The projects are not implemented individually but are linked and coordinated one to another wherever possible. All projects are focused on a particular region(s) and coupled to program technology dissemination efforts. A coordinated program as opposed to individual projects is a primary implementation goal.

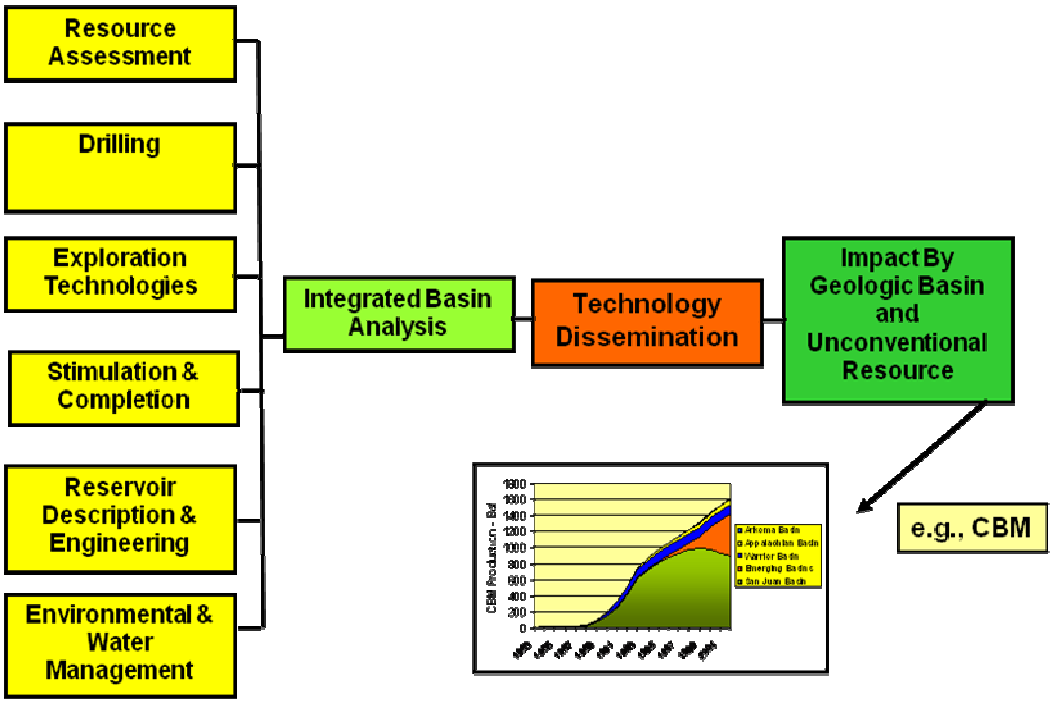


Figure 5.1: Program Development Component and Implementation Approach

The following section outlines the major steps in the implementation plan.

Development of Solicitations to Address Prioritized Technology Challenges
The 2007 and 2008 solicitations were broad in scope in order to allow consideration of 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 encourage the development of integrated programs targeting specific resources with a focus on technology or resource gaps that remain in the program after the 2007 and 2008 selections. The 2010 solicitation will be aligned with specific key resource targets that have emerged from the portfolio of projects chosen for the 2007 through 2009 program years.

Two Integrated Basin Analysis projects were funded during the 2007 program year, focusing on the New Albany Shale in the Illinois Basin and tight sands in the Piceance

Basin. Another Integrated Basin Analysis project targeting an additional shale resource is being sought through the 2009 program year solicitation. The PAC has recommended that these projects serve as anchor projects to focus program efforts on these specific resources. While it is intended that the technologies developed through the program will be applicable to a wide range of shale and tight sand resources, the recommended approach will allow individual researchers to develop coordinated efforts addressing the key challenges associated with specific targeted resources. In addition to the synergies that will arise from having teams of researchers work with common datasets on related problems, more effective workflows will be developed as a result of combining the best practitioners and researchers from multiple disciplines in a coordinated approach to development of the targeted resources.

Description of Planned Solicitations

The solicitations issued during the 2010 program year will be designed to build on the portfolio of projects developed during the 2007-2009 program years. They will be designed to ensure a coordinated program addressing the technology challenges of resource development in at least three specific unconventional gas resources. Thus, they will be generally aimed at filling program gaps remaining after the 2009 projects are chosen and building on the positive results of ongoing projects. At least one, but no more than three, solicitation is anticipated to be issued during the 2010 program year, depending upon the evolving needs of the program. Some or all of the areas below may be covered by solicitations during the 2010 program year.

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 technologies that have reached the appropriate stage of development, field demonstrations may be encouraged. 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 2010 solicitations are issued.

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. Geosciences

i. Characterize geological, geochemical, and geophysical framework of unconventional resource plays

ii. Develop surface-based and borehole-based technologies that identify drilling sweet spots

iii. Characterize fracture attributes (orientation, intensity, openness, fluid saturation)

iv. Develop methods to optimize the position and orientation of vertical and horizontal wellbores

v. Determine stress fields

vi. Apply geosciences to improve the design and implementation of hydraulic fracturing

c. Basin Analysis and Resource Exploitation

i. Characterize geological, geochemical, geophysical, and operational parameters that differentiate high-performing wells, areas and/or fields

ii. Develop and demonstrate techniques to analyze large volumes of data in real-time for application during unconventional resource development

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 "domain stimulation" methods that impact a larger volume of reservoir volume

iv. Development of suitable low-cost fracturing fluids and proppants, e.g. non-damaging fluids and/or high strength, low density proppants

v. Develop stimulation methods that require less water and other fluids to be injected into the subsurface

vi. Develop stimulation methods that result in a lower volume of treatment fluids produced to the surface

vii. Develop approaches for improved treatment, handling, reuse and, disposal of fluids produced and/or used in field operations

viii. Develop improved fracturing and stimulation techniques for gas shales

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 and fracturing fluids with intermediate and high total dissolved solids in order to minimize the potential impact on natural water resources

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 production in order to maintain the permeability generated through stimulation operations and minimize formation damage over time

v. 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

ii. Develop real-time simulation and modeling of reservoirs

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 footprint and the impact of drilling and production operations

v. Develop surface mitigation methods applicable to all environments

vi. Develop technologies to recycle water

vii. Develop technologies for detection and capture of emissions from unconventional oil and gas operations

2. Conduct early-stage research on novel concepts that may be applied to the development of unconventional gas resources. Such methods may include biological enhancement of gas production from unconventional 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 $13.7 million available for funding the Unconventional Resources Program during each fiscal year. Approximately five to 15 awards are anticipated to be awarded in 2010.

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 been awarded based on selections from the 50 proposals submitted in response to the 2007 solicitation for the Unconventional Resources Program. Nine projects have been selected for award from the 69 proposals submitted in response

to the 2008 solicitation. Figure 5.2 below illustrates the breakdown of the 2007 and 2008 projects by technology area and primary resource target.

	CBM 10%	Gas Shales 45%	Tight Sands 45%
Integrated Basin Analysis		New Albany (GTI) $3.4	Piceance (CSM) $2.9
Drilling			
Stimulation and Completion	Microwave CBM (Penn) $.08	Cutters (Carter) $.09 Frac (UT Austin) $.69 Refrac (UT Austin) $.95 *Frac Cond (TEES) $1.6*	Gel Damage (TEES) $1.05 Frac Damage (Tulsa) $.22
Water Management	Integrated Treatment Framework (CSM) $1.56	*Barnett & Appalachian (GTI) $2.5*	*Frac Water Reuse (GE) $1.1*
Environmental	*	*Environmentally Friendly Drilling (HARC) * $2.2*	*
Reservoir Description & Management		Hi Res. Imag. (LBNL) $1.1 *Gas Isotope (Caltech) $1.2* *Marcellus Nat. Frac./Stress (BEG) $1.0*	Tight Gas Exp. System (LBNL) $1.7 *Strat. Controls on Perm. (CSM) $0.1*
Reservoir Engineering		Decision Model (TEES) $.31 *Coupled Analysis (LBNL) $2.9*	Wamsutter (Tulsa) $.44 Forecasting (Utah) $1.1 Condensate (Stanford) $.52
Resource Assessment		Alabama Shales (AL GS) $.5 Manning Shales (UT GS) $.43	Rockies Gas Comp. (CSM) $.67
Exploration Technologies	Coal & Bugs (CSM) $.86	*Multi-Azimuth Seismic (BEG) $1.1*	

(Dollar Amounts in Millions) **2007 Projects** *2008 Projects*

Table 5.1: 2007 and 2008 Project Selections Classified by Primary Resource Target and Technology Area

Table 5.1 illustrates the way in which the projects selected for the 2008 program addressed some of the technology gaps left in the program after the 2007 selections. In some cases, such as the Drilling topic, the PAC felt that the needs in this area for the targeted resources were not as critical as needs in other areas. Similarly, the 2009 solicitation was designed to strengthen the integrated approach to the technology challenges associated with specific unconventional gas resources and identify a third Integrated Basin Analysis project to serve as an anchor project for the program.

Figure 5.2 shows how the 2007 and 2008 projects are beginning to achieve a program focus on two specific resource areas anchored by two Integrated Basin Analysis projects and supported by projects with a regional focus and projects that cross-cut the various geographic areas. The 2009 solicitation is designed to strengthen the program focus so that the maximum value is derived from the coordination and interaction of the funded projects.

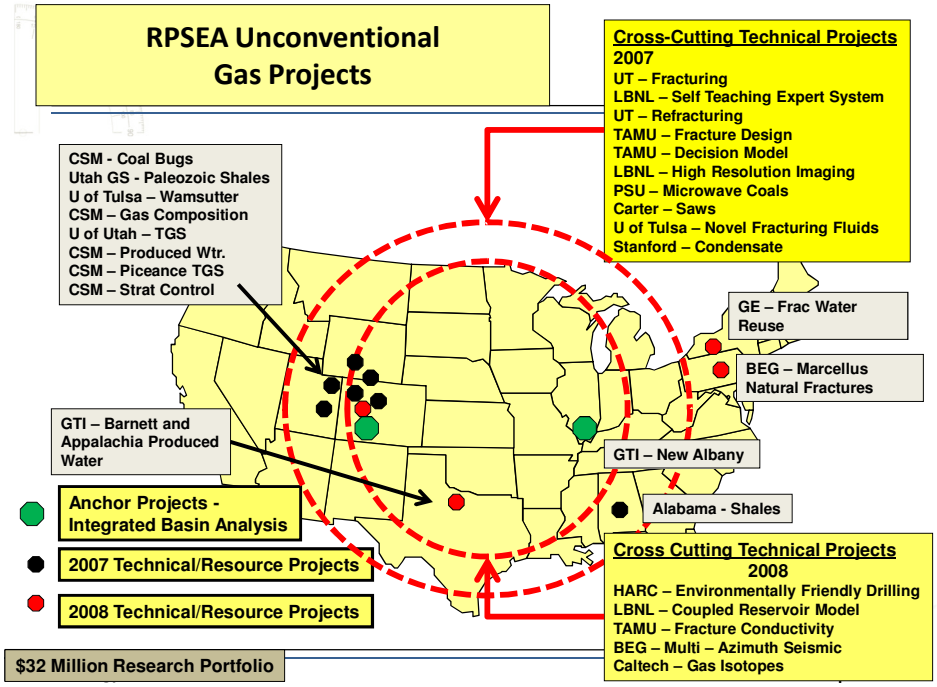


Figure 5.2: 2007 and 2008 Project Focuses

Table 5.2 provides a listing of the ongoing projects. Table 5.3 lists the projects that have been selected for the 2008 program year and are currently in the contracting process. Included for each award are the project title, the awardee, project duration, the primary project deliverable, and other participants. Additional information can be found at www.rpsea.org and on the NETL/Strategic Center for Natural Gas and Oil webpage at www.netl.doe.gov/technologies/oil-gas/EPAct2005.

PROJECT	AWARDEE	RPSEA FUNDING/ COMPLETION DATE	DELIVERABLE	PARTICIPANTS
A Self-Teaching Expert System for the Analysis, Design and Prediction of Gas Production from Shales	Lawrence Berkeley National Laboratory	$1,700,000 Oct 2010	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	$1,000,000 Sep 2011	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	$1,600,000 Mar 2011	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, Petroglyph Operating

PROJECT	AWARDEE	RPSEA FUNDING/ COMPLETION DATE	DELIVERABLE	PARTICIPANTS
Application of Natural Gas Composition to Modeling Communication Within and Filling of Large Tight-Gas-Sand Reservoirs, Rocky Mountains	Colorado School of Mines	$670,000 Aug 2010	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	$860,000 Sep 2010	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
Enhancing Appalachian Coalbed Methane Extraction by Microwave-Induced Fractures	The Pennsylvania State University	$79,000 Sep 2009	Fundamentals of efficacy of using microwaves as a CBM stimulation technique	Nottingham University
Gas Condensate Productivity in Tight Gas Sands	Stanford University	$520,000 Dec 2011	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	The University of Utah	$1,100,000 Sep 2011	Best Practices for development of Utah gas shales integrating natural and hydraulic fracture interaction	Utah Geological Survey, Golder Associates, Utah State University, HCItasca , Anadarko, Wind River Resources Corp
Geological Foundation for Production of Natural Gas from Diverse Shale Formations	Geologic Survey of Alabama	$500,000 Jul 2011	Geologic characterization of diverse shales in Alabama	
Improved Reservoir Access through Refracture Treatments in Tight Gas Sands and Gas Shales	The University of Texas at Austin	$950,000 Aug 2011	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	The University of Texas at Austin	$690,000 Apr 2011	Design and field test of lightweight proppants in the Barnett shale	Daneshy Consultants, BJ Services
New Albany Shale Gas	Gas Technology Institute	$3,400,000 Jul 2010	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	$91,680 COMPLETE	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	The University of Tulsa	$220,000 Sep 2011	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	The University of Tulsa	$440,000 Jan 2010	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	$310,000 Aug 2010	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	$430,000 Aug 2011	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	$1,100,000 Oct 2011	Development of recovery strategies mitigating condensate precipitation based on high resolution rock imaging	Schlumberger, BP, Chevron

PROJECT	AWARDEE	RPSEA FUNDING/ COMPLETION DATE	DELIVERABLE	PARTICIPANTS
Reservoir Connectivity and Stimulated Gas Flow in Tight Sands	Colorado School of Mines	$2,900,000 Sep 2010	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

PROJECT	AWARDEE	DURATION/ RPSEA FUNDING	DELIVERABLE	PARTICIPANTS
Barnett and Appalachian Shale Water Management and Reuse Technologies	Gas Technology Institute	24 months $2,500,000	Water management methods and technologies that reduce demands for freshwater, reduce environmental impact of brine disposal, and ensure supplies of water for well drilling and completion for shale gas development	The University of Texas at Austin, The Bureau of Economic Geology, Texerra, Geopure Water Technologies/Texas A&M University, Texas Oil and Gas Association, Chesapeake Energy, ConocoPhillips, Devon Energy Corporation, EnCana, EOG, Pitts Oil Company, Quicksilver, , Range Resources, XTO, Barnett Shale Water Conservation and Management Committee, Appalachian Shale Water Conservation and Management Committee
Novel Gas Isotope Interpretation Tools to Optimize Gas Shale Production	California Institute of Technology	36 months $1,190,000	Novel diagnostic tools for predicting, monitoring and optimizing shale gas production	Devon Energy Corporation, BJ Services Company, GeoIsoChem Inc.
The Environmentally Friendly Drilling Systems Program	Houston Advanced Research Center	36 months $2,200,000	Identification and evaluation of critical technologies for low-impact drilling, transfer of technology to industry, and tools for selecting low-impact technologies appropriate for a given site	BP, CSI Technologies, Devon Energy Corporation, Gulf Coast Green Energy, Halliburton, Huisman, Jacarilla Apache Nation, KatchKan U.S.A., M-I SWACO, Newpark Mats & Integrated Services, Weatherford, TerraPlatforms, LLC, Texas A&M University, Sam Houston State University, University of Arkansas, University of Colorado, Utah State University, University of Wyoming, West Virginia University, Argonne National Laboratory, Los Alamos National Laboratory, TerraPlatforms, LLC, Environmentally Friendly Drilling Joint Industry Partnership, The Nature Conservancy, Natural Resources Defense Council, New York State Energy Research and Development Authority
Pretreatment and Water Management for Frac Water Reuse and Salt Production	GE Global Research	24 months $1,105,000	Technology that enables recycle of nearly all frac flowback water as well as production of a salable salt by-product	STW Resources, Inc.
Stratigraphic Controls on Higher-Than-Average Permeability Zones in Tight-Gas Sands in the Piceance Basin	Colorado School of Mines	24 months $111,216	Evaluation of the stratigraphic controls on the distribution and quality of tight-gas reservoirs in the Piceance Basin	
Coupled Flow-Geomechanical-Geophysical-Geochemical (F3G) Analysis of Tight Gas Production	Lawrence Berkeley National Laboratory	36 months $2,900,000	Knowledge regarding long-term behavior of fractured tight gas reservoirs	Texas A&M University, Stanford University, Baker Hughes Inc., Unconventional Gas Resources, Inc.
Sustaining Fracture Area and Conductivity of Gas Shale Reservoirs for Enhancing Long-Term Production and Recovery	Texas A & M University	36 months $1,615,000	A methodology for reservoir typing and selection of fracture stimulations for preventing loss of productive fracture area and loss of fracture conductivity	TerraTek a Schlumberger Company, Devon Energy Corporation, EnCana Oil & Gas USA, Pennsylvania General Energy Co.
Multiazimuth Seismic Diffraction Imaging for Fracture Characterization in Low-Permeability Gas Formations	Bureau of Economic Geology, The University of Texas at Austin	36 months $1,105,000	Techniques for predicting fracture occurrence and attributes by combining seismic tools, fracture modeling, and fracture characterization based on wireline sampling techniques	The University of Texas at Austin, Bill Barrett Corporation

PROJECT	AWARDEE	DURATION/ RPSEA FUNDING	DELIVERABLE	PARTICIPANTS
Evaluation of Fracture Systems and Stress Fields Within the Marcellus Shale and Utica Shale and Characterization of Associated Water-Disposal Reservoirs: Appalachian Basin	Bureau of Economic Geology, The University of Texas at Austin	36 months $1,020,000	Demonstration of how multicomponent seismic data can be used to evaluate fracture systems that control production of shale gas systems, quantify stress fields and elastic moduli that influence hydrofrac performance in shale reservoirs, and measure the capacity of porous sandstone units to accept flow-back water produced during hydrofrac operations.	University of Pittsburgh, Chesapeake Energy Corporation, Jeter Field Service, RARE Technology, AscendGeo, AOA Geophysics, Inc., Austin Powder Company, Seismic Source

Table 5.3: Status Update on 2008 R&D Projects

F. Metrics

Overall metrics for the Program in general are discussed in Chapter 7. Shorter-term metrics specific to the Unconventional Resources Program include the completion of annual milestones that show progress towards meeting the program objectives. Short-term metrics to be completed before the end of FY 2010 include:

- Issue and complete at least one solicitation
- Engage the PAC to review that the solicitation reflects sufficient breadth and depth of industry experience
- Select and award 5 - 15 projects
- Establish FY2011 R&D priorities based on results of 2007-10 solicitations and other inputs from stakeholders, including the program advisory committees and the URTAC

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 EPAct 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 2007, the EIA reported that these 13,121 operators produced 186 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 PAC through the RPSEA unconventional resources vice president and through its chairman, who will hold a seat on the Unconventional Resources 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, The University of Kansas, 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, solicitations under this program are 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 2010 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, 2008, and 2009 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 EPAct, 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.

The 2010 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 of existing wellbores and surface footprint to maximize recovery of additional hydrocarbons (Objective 2)
- Addressing novel concepts that may be applied to increase production from mature fields (Objective 4)

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 $3.17 million will be available for the Small Producer Program during fiscal year 2010. Approximately four to 12 awards are anticipated to be awarded under solicitations in 2010.

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. 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 seven projects selected from the 2007 solicitation are listed in Table 6.1. The 2008 solicitation was released November 11, 2008 and closed January 12, 2009. This solicitation had the same general focus as that for the 2007 program year. Project selections were made in March of 2009 and the six new projects are listed in Table 6.1. Several projects built upon the theme of improving recovery from mature reservoirs, while others expanded into new theme areas of improved reservoir characterization and utilization of waste industrial products. 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 2009 solicitation, which is planned for release in late summer 2009, has the same general focus as that for previous years. Consultation with advisory group members and information from participants in industry forums has indicated that the focus established by the initial solicitation is still the most important for small producers.

Figure 6.1 provides a summary of the type and a general geographic location of the projects awarded under the 2007 solicitation and selected for award in the 2008 program. 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 2008 projects are listed below, categorized into three theme areas:

Oil and Gas Recovery

Field Demonstration of Alkaline Surfactant Polymer Floods in Mature Oil Reservoirs, Brookshire Dome, Texas

The goal of this project is to demonstrate through a field pilot implementation that the use of alkaline surfactant polymer flooding in appropriately selected reservoirs can result in improved oil recovery from shallow mature fields at a cost that is not excessive for the expected return. If successful, this technology could be applied to a number of mature fields that are currently non-productive.

Mini-Waterflood: A New Cost Effective Approach to Extend the Economic Life of Small, Mature Oil Reservoirs

The goal of this project is to demonstrate the feasibility of successfully waterflooding small oil reservoirs that are not conducive to a fully-developed, patterned waterflood. A non-traditional design water injection program is proposed to provide pressure maintenance and improve sweep efficiency. In general, the reservoirs of interest are small and thin in extent, shallow, at low pressure and temperature, and have unfavorable mobility ratios. Initial primary energy was not sufficient to produce the

oil; however, significant mobile oil remains to be recovered. Small waterfloods may improve oil recovery and extend the reservoir life under these poor conditions

Reservoir Characterization

Commercial Exploitation and the Origin of Residual Oil Zones: Developing a Case History in the Permian Basin of New Mexico and West Texas
This project will examine residual oil zones in the Permian Basin and develop a model for their origins, development, and distribution. Improved understanding of these zones should add targets for enhanced recovery in mature fields in this region, and the technique may be extended to other areas.

Evaluation and Modeling of Stratigraphic Control on the Distribution of Hydrothermal Dolomite Reservoir away from Major Fault Planes
This project will study the lateral variability of fractured hydrothermal dolomite reservoirs away from fault zones that are thought to control reservoir quality. Results of this integrated project should lead to reduced exploration risk and increased production from similar mature plays by providing small operators with viable models for predicting and interpreting the stratigraphic control of hydrothermal dolomite reservoirs away from main fault trends. Results should help operators in this basin and other similar plays throughout the United States.

Development Strategies for Maximizing East Texas Oil Field Production
The objectives of this proposed three-year study are to explore short-term and midterm-strategies for maximizing recovery from the East Texas Oil Field. Goals of the short-term demonstration project are to demonstrate the technology of strategically targeted deepenings and optimized waterfloods guided by depositional trends and to identify 100 deepening targets and 10 waterflood sites. Benefits will increase production in this field, but will also provide techniques and methodologies that can be applied to other similarly mature and marginal fields throughout the country.

Utilizing Waste Industrial Products

Electrical Power Generation from Produced Water: Field Demonstration of Ways to Reduce Operating Costs of Small Producers
This project proposes to demonstrate a modified waste heat generator that uses produced water to create “green” electricity usable onsite or for transmission offsite for field operations. The benefits are the potential of reducing field operating costs, reducing operator exposure to fluctuating electrical rates, and minimizing the environmental impact of oil and gas operations.

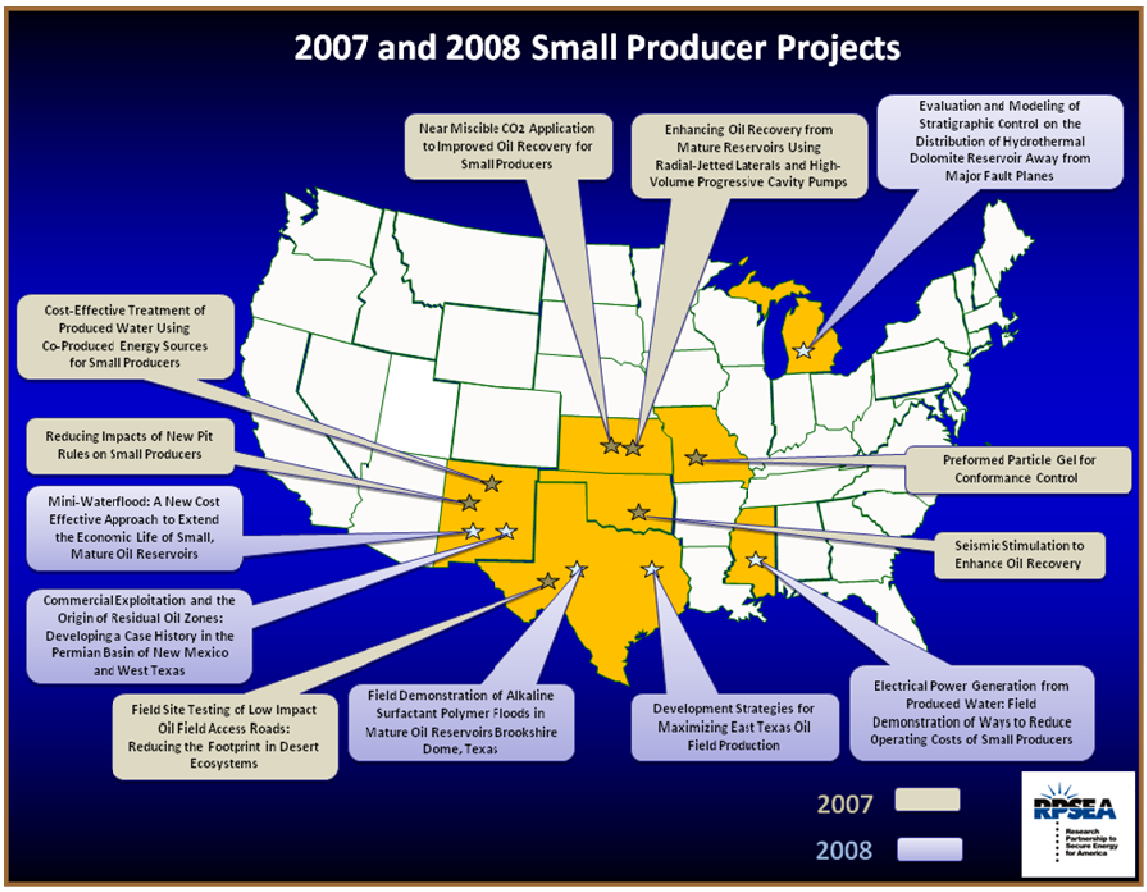


Figure 6.1: Small Producer Project Selections

2007 PROJECTS	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 $457,253	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	The University of Kansas	12 months $248,385	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 $284,839	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	The University of Kansas	24 months $274,171	Define the potential for CO2 recovery or sequestration in near-miscible reservoirs	Carmen Schmitt
Preformed Particle Gel for Conformance Control	Missouri University of Science and Technology	24 months $520,212	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	24 months $509,185	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 GeoImaging Resources
2008 PROJECTS	**AWARDEE***	**DURATION/ RPSEA FUNDING****	**DELIVERABLE**	**PARTICIPANTS**
Commercial Exploitation and the Origin of Residual Oil Zones: Developing a Case History in the Permian Basin of New Mexico and West Texas	The University of Texas of the Permian Basin	24 months $631,001	Examination of regional data to clarify extents, locations, and origins of residual oil zones in Permian Basin	Chevron Corporation, Legado Resources, Yates Petroleum, Petroleum Technology Transfer Council, Midland College, Applied Petroleum Technology Academy
Evaluation and Modeling of Stratigraphic Control on the Distribution of Hydrothermal Dolomite Reservoir Away from Major Fault Planes	Western Michigan University	24 montha $393,369	Study of lateral variability of reservoir quality hydrothermal dolomites to improve prediction of laterally persistent reservoir zones in the Albion-Scipio trend of southern Michigan.	Polaris Energy Company
Development Strategies for Maximizing East Texas Oil Field Production	Bureau of Economic Geology, The University of Texas at Austin,	36 months $984,985	Exploration of short to midterm strategies for maximizing recovery from East Texas Oil Field.	Danmark Energy LP, John Linder Operating Co. LLC
Mini-Waterflood: A New Cost Effective Approach to Extend the Economic Life of Small, Mature Oil Reservoirs	New Mexico Institute of Mining and Technology	24 months $318,943	Demonstrate the feasibility of waterflooding small oil reservoirs that are not conducive to a fully-developed, patterned waterflood.	Armstrong Energy Corporation, Keltic Wall Services
Field Demonstration of Alkaline Surfactant Polymer Floods in Mature Oil Reservoirs Brookshire Dome, Texas	Layline Petroleum 1, LLC	24 months $597,936	Conduct a pilot study in Brookshire Dome field demonstrate applicability of alkaline surfactant polymer flooding to improve incremental oil production.	Tiorco LLC, The University of Texas at Austin
Electrical Power Genergation from Produced Water: Field Demonstration of Ways to Reduce Operating Costs of Small Producers	Gulf Coast Green Energy			Denbury Resources, ElectraTherm Inc., Dry Coolers Inc., Southern Methodist University, Texas A&M University

* All awards made to consortia with prime listed as awardee and other members listed as participants
** Note that award amounts on 2008 projects are still under negotiation at this time

Table 6.1: Small Producer Program Selected Projects

F. Metrics

Overall metrics for the Program in general are discussed in Chapter 7. Shorter-term metrics specific to the Small Producer Program include the completion of annual milestones that show progress towards meeting the program objectives. Short-term metrics to be completed before the end of FY 2010 include:

- Issue and complete at least one solicitation
- Engage the RAG to review that the solicitation reflects sufficient breadth and depth of industry experience
- Select and award 4 - 12 projects
- Establish FY2011 R&D priorities based on results of 2007-10 solicitations and other inputs from stakeholders, including the program advisory committees and the URTAC

Chapter 7 Program Benefits and Performance Benchmarking

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. 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. Some specific short-term metrics include:

- Number of solicitations issued
- Number of compliant proposals received
- Number of selections made
- Percent of selections resulting in contracts
- Time from selection to contracting
- Research award adherence to budget and schedule

- Amount of cost share in excess of the minimum requirement
- Milestone performance

B. Monitoring and Reporting Program Management Performance and Budget Metrics

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** – 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.

2. **Research Project Performance Data Collection** - RPSEA utilizes research project monthly reports to efficiently collect project performance data. Each research project is required to submit a monthly report containing the following information:
    - Actual Expenditures by Month
    - Performance Against Milestones
    - Highlights and Accomplishments
    - Issues or Concerns
    - Corrective Actions

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 (OCI) Plan will govern all potential conflicts associated with the solicitation and award process.

RPSEA was required to submit an OCI Plan, which in accordance with Section 999B(c)(3) of EPAct addressed the procedures, by which RPSEA will (1) ensure its 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 Plan was reviewed by the DOE. After the DOE's comments and questions were addressed, a final OCI Plan 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 two-step proposal process may be used where a technical volume and cost summary is submitted prior to submission of a full-cost proposal and other associated detailed information. This two-step process eliminates unnecessary detailed cost development for proposals that are not selected after step one. 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.

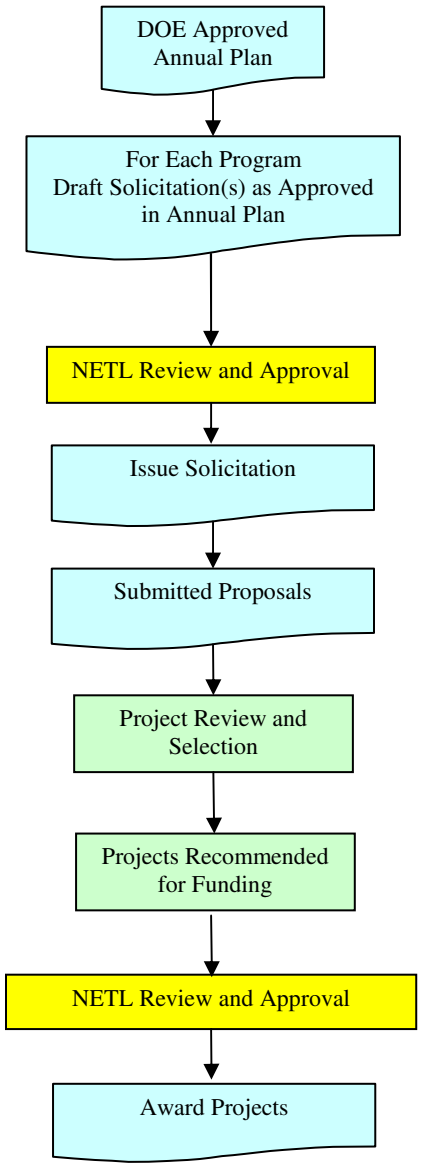


Figure 8.1: Project Solicitation Process

D. Selection Criteria

The following general criteria (which will be more defined in the individual solicitations) will be used, as applicable, 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 2010 solicitation(s) will be conducted after approval and posting of the 2010 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 2011, and holding program-level technology transfer workshops.

2010 RPSEA Program Timeline		Aug 09	Sept 09	Oct 09	Nov 09	Dec 09	Jan 10	Feb 10	Mar 10	Apr 10	May 10	Jun 10	Jul 10	Aug 10	Sept 10
Month		*-2*	*-1*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
2010 Draft Plan Submitted (July 15, 2009)	♦														
Plan Published		♦													
Plan Approved						♦									
Obtain DOE Approval of Solicitation							♦								
Solicitation Open Period															
Proposal Evaluation and Selection															
DOE Approval												♦			
Contract Negotiation and Award															
Administer 2010 Awards															
Administer 2007, 2008, & 2009 Awards															
Report Program Deliverables															
Conduct Technology Transfer Workshops & Activities															
Establish 2011 R&D Priorities & Annual Plan															

Table 8.1: 2010 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 2010, $14.79 million per year will be available for the UDW, with approximately five to 10 awards, and $13.73 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 $3.17 million per year will be available for the Small Producer Program. Approximately four to 12 awards are anticipated during fiscal year 2010. The typical award is expected to have 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 the 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 Engineer, American Oil and Gas Reporter*, *World Oil*, *JPT*, etc.)
- Presentations at industry meetings by both RPSEA and NETL representatives, as appropriate given the timing of the solicitations
- 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. RPSEA and NETL will coordinate to ensure an effective technology transfer function.

Specific technology transfer approaches incorporated in the Program include:

4. The engagement of 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. Operators and service companies represented on these committees represent the likely "early adopters" of Program technologies, who will lead the way for wider industry adoption and provide the real-world examples that will facilitate meaningful technology transfer. While the law requires that 2.5 percent of the project funding be set aside for technology transfer, this industry engagement reflects a component of the technology transfer approach beyond the effort funded by the set-aside.
5. Active communication and coordination between RPSEA and NETL on a Knowledge Management Database (KMD) that will serve as a publically available archive of data and results associated with RPSEA projects.
6. Continuing commitment to enhance the functionality and value of the RPSEA website by adding relevant, value-add data and information regarding RPSEA's individual projects as well as overall Program direction and impact.
7. Provisions in the project awards that require a minimum of 2.5 percent of the funding for each project to technology transfer activities. The solicitations 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. The model contract provides for the coordination of technology transfer across multiple related projects using the funding approach described above. Some of the activities to be funded at the program level are described below.

The approach to technology transfer is designed to address program-level goals through ongoing industry engagement, documentation of results on the RPSEA website and in a KMD, and 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.

The R&D contracts awarded will include requirements for the expenditure of funds allocated to technology transfer in accordance with the program-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.

Project-Level Activities

Project-level technology transfer activities are a key part of the project selection and management approach used by RPSEA in each of the programs.

- In the UDW, ongoing projects are regularly reviewed at quarterly TAC meetings, which are open to all interested parties. The relatively small size and regional concentration of the offshore community ensures good representation among potential technology adopters at the TAC meetings during which projects are reviewed. These meetings serve as an effective forum for introducing developing technology, ensuring that the resulting products are well aligned with industry requirements, and identifying potential participants in field trials. While TAC events form a key part of project-level technology transfer, they are supplemented by presentations, publications, and other activities outlined in the technology transfer plans developed jointly by the contractors and RPSEA project management staff.
- While the Unconventional Resources community is similarly involved in the selection and review of projects, this numerically larger and geographically more dispersed community requires additional emphasis on approaches designed to reach the widest possible cross-section of potential adopters of program technology. In addition to providing funds for contractors to engage in project-level technology dissemination, RPSEA is organizing program-level activities to provide opportunities for additional dissemination of program results.
- The Small Producer Program faces the challenge of connecting with the thousands of small producers operating across the nation. While engagement of service providers and others in the operation of the program will help ensure that new technologies are available to these small producers, a particular emphasis on program-level activities will be required to ensure that information on program results reaches potential adopters in all applicable regions.
- The degree to which industry engagement by RPSEA results in awareness of technologies developed under the Program is illustrated by the appearance of articles such as the one in the June 1, 2009 issue of *Oil and Gas Journal*, discussing the improvement of deepwater production measurements. A number

of other articles have been published, and links will be posted on the RPSEA website. This type of coverage in widely read trade publications is a direct result of active industry participation in the planning, management and execution of the Program, and provides an effective context for the directed technology transfer efforts that are funded by the 2.5 percent set-aside.

Program-Level Activities

RPSEA will conduct the following program-level technology transfer activities as an intrinsic part of the program-management approach.

- RPSEA will post on its public website a list of projects and related information, such as abstracts, technical status assessments, results, accomplishments, reports, and key personnel contact information. The information on the RPSEA website will be coordinated with the KMD being developed by NETL under the Section 999 complementary program, and appropriate links to information in the KMD will be provided on the RPSEA website.
- Periodic project reviews with the PACs, TACs and the RAG (as appropriate) that are conducted as part of the RPSEA program-management process are 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, thereby enhancing the effectiveness of the entire technology transfer effort.

In addition, RPSEA has implemented the following approach to maximize the impact of the 2.5 percent allocated to technology transfer:

- Each solicitation includes the requirement for a plan for technology transfer. The solicitation instructs offerors to propose an approach for technology transfer for their project, understanding that up to 40 percent of the 2.5 percent (or 1 percent of total project funding) designated for technology transfer may be designated by RPSEA for use in program-level technology transfer activities.
- RPSEA and the selected awardee will jointly develop a project-level technology transfer approach to be coordinated with program-level efforts.

Examples of program-level technology transfer activities include the following:

Website Enhancement

The RPSEA website will be enhanced to assist technology transfer beyond the simple availability of reports. Developing suitable materials to support such an effort and providing a website with the required functionality to support interactive technology transfer will come from the programmatic funding through a designated portion of the 2.5% technology transfer allocation. Additional website capability will also be required

to interface the RPSEA website with the KMD being developed by NETL in order to provide an effective tool for current and archival access to data and information generated through the program.

Leveraging Via Participation and Coordination with Existing Conferences, Forums, and Workshops

There are an abundance of industry conferences, forums, and workshops. These events are produced and sponsored by a variety of entities ranging from for-profits, governmental/regulatory agencies, professional societies, and other NGOs. Event objectives may range from simply making money to tech transfer to influencing policy; event quality and effectiveness at meeting desired goals can vary significantly. RPSEA on a regular basis will review existing industry events and on a prioritized basis work with the organizers to incorporate a RPSEA technology transfer component. Factors to be considered include:

- Quality and reputation of event
- Alignment between the event's existing delegate base and RPSEA's target audience for the technology to be disseminated
- Level and visibility of RPSEA's participation
- Cost - both in terms of actual out-of-pocket registration/exhibit fees, transportation and logistics, as well as indirect costs such as staff's time and effort

RPSEA has an established working relationship with OTC, PTTC, SPE, AAPG, SEG, Hart's, Pennwell, and others and will work with these groups by participating as session chairs, on planning and program committees, and other roles so as to leverage RPSEA's scarce resources. The objective of this participation will be the timely and cost effective dissemination of RPSEA-sponsored project results into targeted existing events with audiences that have specific needs for the technologies being presented.

RPSEA *GasTips*

The now-dormant *GasTips* publication was an excellent vehicle for providing wide exposure to research results. The relatively short articles and wide distribution list generated a lot of interest in new technology, which could be further pursued through in-depth references or discussions with subcontractors. RPSEA has initiated discussions with Hart's and potential industry sponsors regarding re-starting this publication as a vehicle for highlighting the results of the Section 999 R&D Program. Even though *GasTips* has had a recent hiatus from publication, it is a recognized communications vehicle with established credibility in the industry.

Select/Focused RPSEA Workshops and Forums

In some technical areas, several contractors will be working on different aspects of a single key challenge. The most effective technology transfer will occur when these

contractors each present their own results, but present them in a way that emphasizes their contribution to the solution of the larger problem. RPSEA will first investigate leveraging on existing conferences and forums, however, there will be situations where the volume of technology and the focus of the technology may best be accomplished as a standalone event. In these cases, RPSEA will organize focused workshops targeted on a particular technology or closely-related suite of technologies. RPSEA will carefully target the delegates to ensure key stakeholders and technology adopters are in attendance. These workshops would be designed to be interactive, involving a relatively small number of participants (target less than 50), along with experts from the technology developer or the operator participating in the initial field trials. The workshops would be presented multiple times in regions that would benefit from the application of the subject technology. Depending on the nature of the technology, the workshop could involve simulations, training based on case studies, or exposure to the actual application of the technology in a field setting. The desired result would be operator/staff capable of making appropriate decisions regarding the application of new, commercially available technology developed through the program. Program-level technology transfer funding will be required to support a third-party organization capable of organizing, conducting, and securing appropriate participation in regional workshops.

RPSEA has sponsored a series of forums hosted by various RPSEA members across the country. These forums have served as excellent vehicles for identifying technical needs and obtaining input for research program content. As the RPSEA Program develops research results, these forums will shift to greater emphasis on program results and the transfer of information, while maintaining a technical input component.

RPSEA Technical Conferences

Technical conferences held at a national or large regional scale can highlight a range of technologies applicable to a particular resource type or geographic area. Presentations will be made by RPSEA R&D contractors, as well as operators that have experience in the testing or application of new technologies. The primary audience will be the operator community positioned to apply the results of the program to the development of new resources. R&D contractors and organizations offering commercial services based on Program technology or otherwise relevant to the conference topic may secure booth space. Such conferences can be very effective in creating visibility and credibility for the results of the program, but significant program-level technology transfer funding will be required to organize, publicize, and conduct thoroughly professional national-scale technical conferences. Some expenses may be recovered by charging for attendance, but a low cost of attendance would be one way to distinguish RPSEA conferences from other topical meetings for which revenue generation for the sponsor is a primary goal.

Webcasts/Podcasts

Webcasts and podcasts have become a popular and effective medium for communication. Presentations by researchers and discussions among researchers, service companies and

producers regarding potential applications are among the types of material that would be appropriate for this medium. The majority of these are expected to be at the project level.

Follow on Projects and/or Unfunded Projects

Future phases of projects from 2007 through 2009 that may not be funded, or project ideas not selected in the rigorous project development process that show promise and are aligned with program needs, are important to retain. Finding funding or a continuation vehicle for these projects to ensure that the research initiated by RPSEA is not lost is an activity worthy of emphasis in the technology transfer effort.

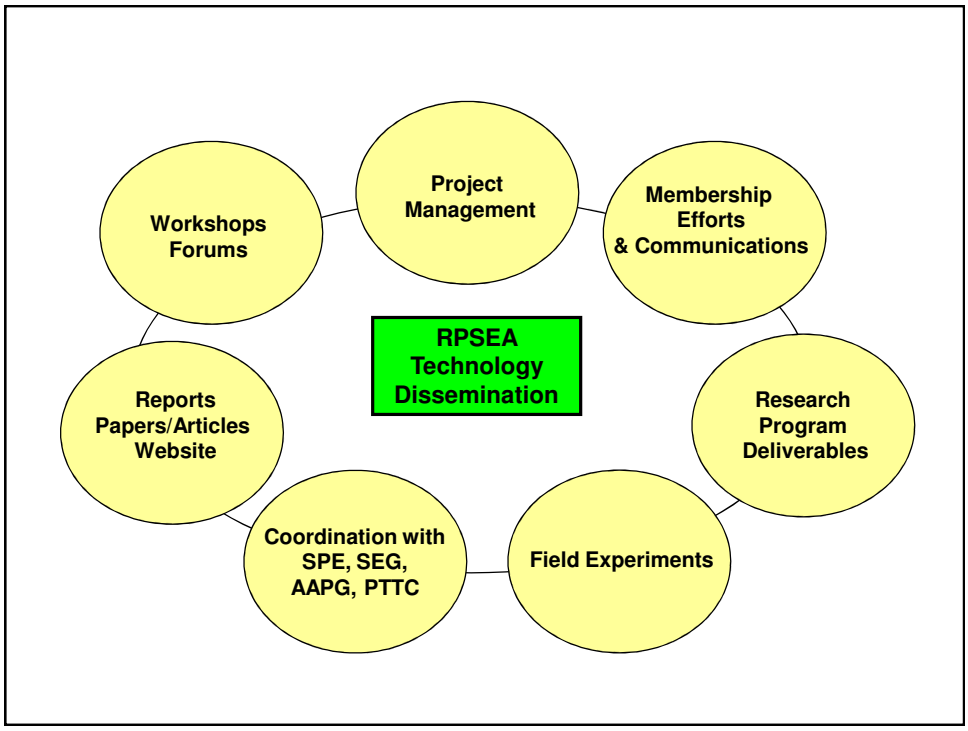


Figure 9.1: RPSEA Technology Dissemination Efforts

The schedule for RPSEA technology transfer events is dynamic, driven by progress on individual projects and coordination with industry activities. The RPSEA Calendar of Events lists upcoming, as well as past events. Recent events include participation as an Invited Organization at OTC, where several offshore technologies being developed under the UDW were highlighted, and the Mid-Continent Gas Shales Forum held in Chicago, where researchers and mid-continent shale gas operators gathered to discuss the challenges and opportunities in the New Albany Shale Gas resource, as impacted by technology being developed under the Program. As new events are scheduled, they will be included on the RPSEA Calendar of Events.

Appendix A: RPSEA Membership and Committee Lists

RPSEA Members

Acute Technological Services, LLC
Advanced Resources International, Inc.
AeroVironment, Inc.
Altira Group LLC
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.
Brownstein Hyatt Farber Schreck, LLP
Cameron/Curtiss-Wright EMD
Campbell Applied Physics
Capstone Turbine Corporation
CARBO Ceramics, Inc.
Centre For Marine CNG, Inc.
Chesapeake Energy Corporation
Chevron Corporation
City of Sugar Land
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
Deepwater Structures, Inc.
Deepwater XLP Technology, LLP
Delco Oheb Energy, LLC
Det Norske Veritas (USA)
Devon Energy Corporation
Drilling & Production Company
EnCana Corporation
EnerCrest, Inc.
Energy Corporation of America
Energy Valley, Inc.

ExxonMobil Corporation
Florida International University
Gas Technology Institute
GE/VetcoGray
Granherne, Inc.
Greater Fort Bend Economic Development Council
GSI Environmental, Inc.
Gunnison Energy Corporation
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
Independent Petroleum Association of New Mexico
Integrated Ocean Drilling Program
Intelligent Agent Corporation
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
Merrick Systems, Inc.
Mississippi State University
Nalco Company
Nance Resources
NanoRidge Materials, Inc.
National Oilwell Varco, 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
Oklahoma Independent Petroleum Association
OTM Consulting Ltd.
Oxane Materials, Inc.
Petris Technology, Inc.
Petrobras America Inc.
Petroleum Technology Transfer Council
Pioneer Natural Resources Company
QO, Inc.
Quanelle, LLC
Quest Integrated, Inc.
Rice University
Robert L. Bayless, Producer LLC
Rock Solid Images
RTI Texas
Sandia National Laboratories
Schlumberger Limited
Shell International Exploration & Production
Simmons & Company International
SiteLark, LLC
Southern Methodist University
Southwest Research Institute
Spatial Energy
Stanford University
StatoilHydro
Strata Production Company
Stress Engineering Services Inc.
Technip
Technology International
Tejas Research & Engineering, LP
Tenaris
Texas Energy Center
Texas A&M University
Texas Independent Producers and Royalty Owners Association
Texas Tech University
The Discovery Group, Inc.
The Fleischaker Companies
The Ohio State University
The Pennsylvania State University
The University of Kansas
The University of Oklahoma

The University of Texas at Austin
The University of Tulsa
The University of Utah
Titanium Engineers, Inc.
TOTAL Exploration Production USA
University of Alaska Fairbanks
University of Colorado at Boulder
University of Houston
University of Michigan
University of South Carolina
University of Southern California
VersaMarine Engineering, LLC
Watt Mineral Holdings, LLC
Weatherford International Ltd.
WellDog, Inc.
Western Standard Energy Corp.
West Virginia University
Williams
Woods Hole Oceanographic Institution
Wright State University

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Dr. Ernest J. Moniz	Massachusetts Institute of Technology
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Mr. Tony D. Vaughn	Devon Energy Corporation
Mr. Michael Wallen	NGAS Resources, Inc.
Mr. Thomas E. Williams	Nautilus International, LLC

RPSEA Strategic Advisory Committee (SAC)

NAME	AFFILIATION
Dr. Stephen Holditch – Chair	Texas A&M University
Ralph Cavanagh	Natural Resources Defense Council
Peter Dea	Cirque Resource Associates Ltd.
Paul Doucette	GE/VetcoGray
David Fleischaker	The Fleischaker Companies
Melanie Kenderdine	Representing Gas Technology Institute
Vello Kuuskraa	Advanced Resources International, Inc.
Guy Lewis	Gas Technology Institute
Dirk McDermott	Altira Group LLC
C. Michael Ming	Research Partnership to Secure Energy for America
Dr. Ernest Moniz	Massachusetts Institute of Technology
Mark Murphy (Ex-Officio)	Strata Production Company
Dr. 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)

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Gail Baxter	Marathon Oil Corporation
Himanshu Gupta	BP America, Inc.
Dr. Oliver Onyewuenyi	Shell Exploration & Production
James Pappas	Devon Energy Corporation
Rune Mode Ramberg	StatoilHydro
Philippe Remacle	TOTAL Exploration Production USA
Hani Sadek	Chevron Corporation
Luiz Fernando Souza	Petrobras America Inc.
Jenifer Tule-Gaulden	Anadarko Petroleum Corporation
Maurizio Zecchin	Eni SpA
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	AFFILIATION
John Hallman	Weatherford International Ltd.
Dr. Valerie Jochen	Schlumberger Limited
Randy LaFollette	BJ Services
Dr. John Lee	Texas A&M University
Mark Malinowsky	Rosewood Resources, Inc.
David Martineau	Pitts Oil Company, LLC
Steve McKetta	Southwestern Energy Company
Dr. Dag Nummedal	Colorado School of Mines
Brook Phifer	NiCo Resources, LLC
Darrell Pierce	DCP Midstream, LLC
Dr. Jose Rueda	BP America, Inc.
Richard Sullivan	Anadarko Petroleum Corporation
Dr. Nafi Toksoz	Massachusetts Institute of Technology
Dr. William 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	AFFILIATION
Jeff Harvard, Chair	Harvard Petroleum Company, LLC
Chuck Boyer	Schlumberger Limited
Dr. Iraj Ershaghi	University of Southern California
Bob Kiker	Petroleum Technology Transfer Council
Ken Oglesby	Impact Technologies LLC
Dr. Douglas Patchen	West Virginia University
Brook Phifer	NiCo Resources, LLC
Don Solanas	Arrowhead Exploration Co.
Dr. W. Lynn Watney	Kansas Geological Survey
Roy Long	National Energy Technology Laboratory (Ex-Officio)
Chandra Nautiyal	National Energy Technology Laboratory (Ex-Officio)

Environmental Advisory Group (EAG)

NAME	AFFILIATION
Dr. Richard Haut, Chair	Houston Advanced Research Center
Dr. Steve Bryant	The University of Texas at Austin
Sharon Buccino	Natural Resources Defense Council
David Burnett	Texas A&M University
Dr. Russ Johns	The University of Texas at Austin
Dr. Joe Kiesecker	The Nature Conservancy
Roy Long	National Energy Technology Laboratory
Dr. Pam Matson	Stanford University
Dr. Charles Newell	Groundwater Services, Inc.
Øyvind Strøm	StatoilHydro
Dr. Mason Tomson	Rice University

Acronyms

AAPG	American Association of Petroleum Geologists
AUV	Autonomous Underwater Vehicles
BOD	Board of Directors
BOEPD	Barrels Oil Equivalent Per Day
COGA	Colorado Oil & Gas Association
DAP	Draft Annual Plan
DEA	Drilling Engineering Association
DEEPSTAR	DeepStar Consortium
DOE	Department of Energy
DOT	Deep Offshore Technology
DUG	Developing Unconventional Gas
E&P	Exploration and Production
EAG	Environmental Advisory Group
EIA	Energy Information Administration
EOS	Equations of State
EPAct	Energy Policy Act 2005
FA	Flow Assurance
FACA	Federal Advisory Committees
FLIPPA	Florida Independent Petroleum Producers Association
GOM	Gulf of Mexico
GTI	Gas Technology Institute
HPHT	High Pressure/High Temperature
HTC	Houston Technology Center
IADC	International Association of Drilling Contractors
IOGCC	Interstate Oil and Gas Compact Commission
IPAA	Independent Petroleum Association of America
IPAMS	Independent Petroleum Association of Mountain States
INGAA	Interstate Natural Gas Association of America
ITF	United Kingdom's Industry Technology Facilitator
KMD	Knowledge Management Database
LOGA	Louisiana Oil & Gas Association
MARK	Mid-America Regulatory Conference
MMBOE	Million Barrels Oil Equivalent
MMS	Minerals Management Service
MODU	Mobile Offshore Drilling Unit
MPD	Managed Pressure Drilling
NAPE	North American Prospect Expo
NETL	National Energy Technology Laboratory

NMT	New Mexico Institute of Mining and Technology
NPC	National Petroleum Council
O&G	Oil and Gas
OCI	Organizational Conflict of Interest
OCS	Outer Continental Shelf
OTC	Offshore Technology Conference
OIPA	Oklahoma Independent Petroleum Association
PAC	Program Advisory Committee
PRAC	Canada's Petroleum Research Atlantic Canada
PTTC	Petroleum Technology Transfer Council
PVT	Pressure, Volume and Temperature
R&D	Research and Development
RAG	Research Advisory Group
RFP	Request for Proposal
RPSEA	Research Partnership to Secure Energy for America
SAC	Strategic Advisory Committee
SAIC	Science Applications International Corporation
SCNGO	Strategic Center for Natural Gas and Oil
SEG	Society of Exploration Geophysicists
SOE	Secretary of Energy
SPE	Society of Petroleum Engineers
TAC	Technical Advisory Committee
TCF	Trillion Cubic Feet
TRL6	Technology Readiness Level 6
UDAC	Ultra-Deepwater Advisory Committee
UDW	Ultra-Deepwater Program
URTAC	Unconventional Resources Technology Advisory Committee
xHPHT	Extreme High Pressure/High Temperature
YPE	Young Professionals in Energy

Appendix C: Federal Advisory Committee Comments

The following 39 pages encompass the final reports from the two Federal Advisory Committees charged with reviewing the 2010 Draft Annual Plan.

Unconventional Resources Technology Advisory Committee

Advisory Committee to The Secretary of Energy

October 22, 2009

The Honorable Dr. Steven Chu
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 *2010 Annual Plan* for the Ultra-Deepwater and Unconventional Natural Gas and Other Petroleum Resources Research Program.

The Committee finds that:

The program is an important part of the overall effort to develop a diverse portfolio of domestic energy sources which will provide for greater natural security and economic benefits. Significant progress has been made in the implementation of the Plan by both the Department of Energy (DOE) and the Research Partnership to Secure Energy for America (RPSEA).

The Advisory Committee also commends DOE and RPSEA for the actions taken in implementing prior Committee recommendations, especially in the critical areas of program implementation, technology transfer and the establishing of a Knowledge Management Database.

It is clearly evident that the program is striving to incorporate the environmental elements outlined in Subtitle J of the Energy Policy Act of 2005 legislation. Of note are the numbers of projects that focus on the reduction of environmental impacts and/or the increased production of natural gas (which will play such a vital role in a carbon constrained world).

The URTAC provides the following key recommendations:

- The program needs to be continued with adequate funding that is not affected by cutbacks or threat of elimination.
- The existing industry tax incentives must be retained for all producers in order to fully realize the benefit of the technologies developed through the program.

- The portfolio of projects and technology transfer aspects of the program should be extended to reach all producing regions of the country to the maximum extent possible.
- The Department should hold an annual industry symposium to showcase the program, thereby maximizing the exposure to end users and beneficiaries.
- The metrics and benefits assessment being undertaken by the Department is a significant accomplishment; recommendations are made on additional metrics that should be considered for implementation.

These key recommendations are addressed in the report along with other observations made by the Committee members. As experts and professionals in our areas of expertise, we believe that they are worthy of consideration and implementation.

The URTAC recommends proceeding with the continued implementation of the *2010 Annual 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 2010 Annual Plan

OCTOBER 2009

TABLE OF CONTENTS

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 of Energy 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 2010 Annual Plan on August 5, 2009.

- Committee members met on September 15th and 16th, 2009 in San Antonio, Texas. The agenda included a brief status update and overview of the "Draft 2010 Annual Plan". Committee members provided initial comments regarding the plan at this meeting. The Chair appointed sub-groups to work on sections of the plan.

- During the period from September 16th through October 14th, the appointed sub-group members conducted several meetings by teleconference and E-mail to develop and consolidate recommendations regarding the draft annual plan.

- The Committee met on October 15, 2009 in Los Angeles, California to receive sub-group reports and to draft the final recommendations of the Committee.

- The Committee met via teleconference on October 22, 2009 in Washington, D.C. to complete final approval of the Committee report in accordance with the deadline set by the Secretary and conveyed through the Designated Federal Officer.

EPACT Subtitle J "Section 999" sets the funding for the overall program at a level of $50-million-per-year over 8 years, provided from Federal lease royalties, rents, and bonuses paid by oil and gas companies. Of this, $37.5 million is awarded for the consortium research and development program administered by RPSEA and $12.5 million for the Complementary Program administered by NETL. The RPSEA program is broken into the Ultra-Deepwater ($14.493 million), the Unconventional Gas ($13.854 million), the Small Producer Program ($3.562 million) and funding for administration and oversight ($5.437 million).

The URTAC Committee focused on the Unconventional Gas and the Small Producer Programs of the Consortium Program and the applicable portions of the NETL Complementary Program.

2.0 EXECUTIVE SUMMARY AND RECOMMENDATION HIGHLIGHTS

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 and discussed the Draft 2010 Plan and identified major areas of concern. Sub-groups were formed to analyze and submit comments and recommendations for these areas. Sub-group 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.

The Committee also reviewed the recommendations of the previous URTAC Committee Reports (for the 2007, 2008 and 2009 Annual Plans) and concurs with those recommendations. Where it was useful, portions of those recommendations have been incorporated into this report.

The Committee wishes to note that steps have been taken by both NETL and RPSEA to implement many of the past recommendations of the URTAC, specifically in the areas of program, technology transfer, knowledge management database as well as metrics and benefit assessment.

For the Draft 2010 Annual Plan, the Committee has the following recommendations:

POLICY:
The Program has demonstrated significant value; it needs to be continued with adequate funding that is not affected by cutbacks or elimination.

To fully realize the benefit of the technologies developed through the program, existing industry tax incentives (including expensing of intangible drilling costs and percentage depletion) must be retained for all producers.

PROGRAM:
Research must be continued on the critical technologies such as improved use of water resources, techniques for evaluation of source potential, zonal isolation, re-stimulation and effective technologies for production of oil from shales.

The Committee again recommends the program expand its regional focus so that all producing regions of the country benefit from the program; this can be done by soliciting requests for proposals and dissemination of technology results to regions not yet benefitting from the program.

The Committee strongly recommends that an annual industry symposium sponsored by the DOE/NETL be held to showcase the program.

The Committee recommends that issues regarding Environmental Policy identified in APPENDIX A of their 2009 Annual Plan recommendations continue to be considered and implemented.

KNOWLEDGE MANAGEMENT AND TECHNOLOGY TRANSFER:
The DOE should take steps to widely publicize the recently developed Knowledge Management Database (KMD) website to all stakeholders, thereby increasing the awareness of the program and accelerating the transfer of technology as much as possible.

Likewise, the Committee recommends that the programs technology transfer efforts should continue to evolve over time, should include the dissemination of "Best Practices" to the producing community, should include producer problem identification workshops to catalogue issues of consequence for potential program research, and that the carrying out of all aspects of the technology transfer components of the program should be included as a measure of the success of the program.

METRICS AND BENEFITS ASSESSMENT:
The Benefits Assessment of the program needs to be expanded to include other methods and measures outlined in this report other than additional oil and gas production, including benefits to the overall economy, jobs, tax revenues, and reductions in petroleum imports to name a few.

3.0 TOPICAL REPORTS

The Advisory Committee developed their analysis of the Draft 2010 Annual Plan through a series of meetings and sub-groups (as outlined in Section 5.0: Sub-Group Topics and Member Assignments). There are four areas of findings and recommendations:

- Executive Summary and Policy
- Program
- Knowledge Management and Technology Transfer
- Metrics and Benefits Assessment

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 FINDINGS AND RECOMMENDATIONS

Energy independence is unlikely in the near-term; our increasing reliance on imported oil poses a real threat to the welfare of our country. The development of a diverse portfolio of domestic energy sources will provide national security and economic benefits. Domestic petroleum resources need to be part of this energy mix; furthermore, research specific to unconventional resources can help provide a more robust and stable energy portfolio. Much of the technology necessary to develop this energy supply has been enabled by research funded from the Energy Policy Act of 2005 (EPACT).

The Committee believes that there has been substantial return on research investment on the program currently being carried out. However, progress is often hampered by the failure of government to administer policies that are complimentary to the objectives of this program. For example, additional return on research funding could be realized if the federal regulatory process were more responsive to development of resources on public lands.

Finding #1:
It is the expert and professional opinion of the URTAC that the program as implemented has a measurable return on investment; it is well implemented and worth the nominal investment.

Secure funding of the Section 999 program continues to be a significant concern. The Administration's proposal to repeal funding is detrimental to the effectiveness of the program, the development of additional petroleum resources, and the energy security of the Nation.

The Committee recognizes President Obama's statement at a public meeting in New Orleans on October 15, 2009 regarding the need for additional domestic energy production:

"I am in favor of finding environmentally safe ways to tap our oil and our natural gas."

This suggests that there is an opportunity to reconsider the Administration's current position to eliminate funding for the program.

Recommendation #1:
Annual funding should be increased to a minimum of $150 million from royalties as provided for in EPACT Section 999 program and should be amended to extend the funding and "sunset" provisions to 2030.

Finding #2:
Successful implementation of the results and technologies developed from EPACT research requires the continuation of tax incentives such as expensing intangible drilling costs to all domestic producers and percentage depletion for small independent producers.

Recommendation #2:
Existing tax incentives must be retained for all producers.

Finding #3:
It is the opinion of the Committee that the program is carrying out its mandate to research and develop environmentally responsible technologies; examples include responsible and safe use of water resources and the minimization of the impact of drilling and production operations. At the same time, other government agencies are seeking elimination of some of these same technologies (such as hydraulic fracturing) which are critical to the development of unconventional resources. EPACT research has addressed improving the environmental impact of hydraulic fracturing technology with a number of program projects; the recent perception that hydraulic fracturing threatens drinking water supplies is unfounded, in light of 60 years of safe implementation of the technology.

Recommendation #3:
Research must be continued on these critical technologies to secure a robust and diverse domestic energy supply.

3.2 THE PROGRAM FINDINGS AND RECOMMENDATIONS

There has been significant effort by all parties (DOE/NETL and RPSEA) to implement many of the recommendations made by the URTAC reports for the previous draft annual plans (2007, 2008 and 2009). Thus the cumulative effect of the URTAC over the last few years is evident and has led to significant improvements in the plan. Specifically:

- The importance of Technology Transfer (TT) has been addressed by both RPSEA and DOE/NETL. DOE is to be commended for providing the additional program funding needed for an effective TT program through the Complimentary Program.

- NETL has implemented a Knowledge Management Database that is being rolled out to industry and is being exceptionally well received.

Finding #1:
The Committee finds that its previous recommendations have been addressed with responsive changes and incorporated into the plan. It is the opinion of the Committee that the program as implemented has a measureable returns, is well implemented, leveraged and will provide significant value for the nominal investment. The Committee does recommend some additional adjustments to the Program portfolio.

Recommendation #1:
The plan portfolio should be expanded to include: development of techniques for zonal isolation, re-stimulation, utilization of non-potable water for fracture stimulation, reuse of recovered waters, real-time downhole techniques for evaluation of source potential of oil and gas bearing shales, effective technologies for production of oil from shales and "other petroleum" resources.

Finding #2:
The research effort thus far appears to have has been focused primarily in the Rocky Mountain and Appalachian producing regions of the country.

Recommendation #2:
The Committee recommends the program expand its regional focus by soliciting requests for proposals and disseminating results to a more geographically diverse cross section of the petroleum producing regions of the country.

Finding #3:

The committee recognizes the need to conduct an annual review of the portfolio of projects as part of its responsibilities. There also needs to be better awareness of the program elements to the producing community and other potential beneficiaries.

Recommendation #3:
The Committee strongly recommends that an annual industry symposium sponsored by the DOE/NETL be held to showcase the program; this would provide greater exposure of the elements of the program to the producing community and other interested parties, serve as a technology transfer event of the knowledge learned from the program, as well as serve as a venue for the Advisory Committee to independently conduct its annual review of the large portfolio of projects and provide guidance as warranted.

The Committee should receive adequate notification and the invitation to all DOE/NETL activities related to the Section 999 program that pertains to their oversight so that they can attend and observe events. Past events that Committee members have been able to attend provided valuable insight into the program's operations.

Finding #4:
The EPACT statute requires addressing the technology challenges for independent producers' safe operations and environmental mitigation, specifically in the areas of reductions of greenhouse gas emissions and the sequestration of carbon. However, there are already significant research efforts supported by the federal government focused in these areas. The Committee recognizes that this program should not utilize already limited program funds to duplicate these efforts.

Recommendation 4:
The program should identify and facilitate communication of these other research efforts as they apply to the technological problems facing producers; where it is beneficial and not duplicative, research specific to oil and gas exploration and production should be considered.

Finding #5:
The Program has made considerable progress on taking action on environmentally related recommendations made by the Committee its previous reports.

Recommendation #5:
In its current review of program activities, the Committee recommends the following environmental topics for additional focus:

- Research on regulatory (Federal, state and local) barriers and/or issues to in order catalogue (identify, compile, and compare) impediments to unconventional hydrocarbon development in order to resolve how these resources can be developed with minimal environmental impact.

- Special emphasis should be placed on identifying "Best Practices" in critical areas such as environmental protection (including minimizing footprint and conserving or mitigating for biodiversity impacts) and reduction of wastes. These should be incorporated in the Knowledge Management Database and disseminated as key elements of the program as part of the Technology Transfer effort to producers.

Finding #6
The current portfolio has made good progress in addressing research to identify technologies, methods or applications to minimize environmental impact in areas such as water sources and reuse, surface use and surface reclamation. Additional work remains to be done in addressing other areas of mutual interest.

Recommendation #6
The Committee recommends that issues regarding Environmental Policy identified in "Appendix A" of the URTAC Recommendations on the 2009 Annual Plan continue to be considered, which focused on areas of overlapping interest for good environmental stewardship and resource development.

3.3 KNOWLEDGE MANAGEMENT AND TECHNOLOGY TRANSFER FINDINGS AND RECOMMENDATIONS

In previous reports, the Unconventional Resources Technical Advisory Committee recommendations addressed the need for a more modern and accessible knowledge management database and a robust Technology Transfer program as being critical to the success of the Unconventional Resources and Small Producer programs.

In the 2007 URTAC Committees' report, a web based system was identified as needed to disseminate research and development activities, lessons learned and knowledge management around Unconventional Resources and Small Producer Programs (Section 999) to those communities. The vision was such that after such a database was completed it could be extended to other oil and gas research programs. Such a knowledge repository has an almost limitless potential to the oil and gas and environmental interests around not only Unconventional Resources but other Department of Energy programs. Considering the savings and benefits realized by similar private industry databases, the payback could exceed the annual cost of the Unconventional Resources, Small Producer and Deepwater programs in 3-5 years.

Since the original recommendation was made in the 2007 plan, NETL has taken the responsibility to develop such a system called the Knowledge Management Database (KMD). All the committee's requirements have not only been met but exceeded by this new web enabled database. The KMD system is scheduled for public launch in October of 2009. By the time this report is submitted to the Secretary of Energy this database will be available at **www.netl.doe.gov/KMD**. The components of this new KMD are outlined in the appendix of this document.

Likewise, significant progress has been made in the Technology Transfer effort.

Finding #1:
The committee recognizes the effort involved in the development of the Knowledge Management Database. This undertaking not only involved a tremendous amount effort and commitment by DOE/NETL, but was achieved with very little budget allocation.

Recommendation #1:
The committee recommends that DOE to take steps to widely publicize the KMD website to all stakeholders so as to maximize the exposure of the producing community to the valuable information contained therein.

Finding #2: Technology Transfer
The committee recognizes the substantial progress made in the implementation of technology transfer recommendations made in the last three committee reports.

Recommendation #2:

The full success of the program can never be fully realized without a successful technology transfer effort, which should include the following additional elements:

- The committee recommends that the expeditious transfer of technology serve as a metric of the benefits of the program. Without the successful execution of this very critical element of the program, the full benefits of the program can never be fully realized.

- The program's tech transfer efforts should continue to evolve over time and include producer problem identification workshops to catalogue issues of consequence for potential program research.

3.4 METRICS AND BENEFITS ASSESSMENT FINDINGS AND RECOMMENDATIONS

The ultimate value of the DOE research is its significant contribution to the economic well being and the energy security of the nation. While the past and proposed research focuses are compelling and appropriate to advance these benefits, the metrics used to assess the projects essential to evaluating the benefits of the program need to be clearly identified. Significant effort has been undertaken by DOE/NETL to update and improve the methods used for program metrics and benefits assessment.

Finding #1:
In addition to providing incremental hydrocarbon production, the program also provides many resulting tangible economic benefits (tax revenue, royalties, jobs) as well as intangible benefits (including technical workforce enhancement, spin-off use of developed technologies, environmental footprint reduction, future impacts from contributions to the "body of knowledge").

Recommendation #1:
All of these tangible and intangible benefits should be recognized as part of the benefits assessment being conducted in conjunction with the program. Additional assessment methods that warrant consideration include:

- Construct a "backward-looking" model to assess how past technology successes using data from previous projects funded by DOE have resulted in increased reserves and/or production. This data can be used to help evaluate the expect benefits of the current program.
- Utilize Fuzzy Set Theory: the science of calculating with words, to turn words into numbers so that vague or uncertain concepts may be quantified.
- Benefits calculation should include risk and uncertainty components to the extent that they help provide better understanding and evaluation of the data being presented.
- Publish the NETL Benefits Analysis methods being developed in an archival peer-reviewed paper to add credibility to the analysis and to obtain feedback to improve the methodology.

Finding #2:
The committee recognizes that technology transfer is vital to the success of the Program as outlined in the Knowledge Management section of this document.

4.0 COMMITTEE MEMBERS

Title	Last Name	First Name	Employer	City	State
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
Mr.	Daugherty	William S.	NGAS Resources, Inc	Lexington	KY
Mr.	Dwyer	James P.	Baker Hughes	Houston	TX
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 SUB-GROUP TOPICS AND MEMBER ASSIGNMENTS

At the September 15th and 16th, 2009 meeting in San Antonio, Texas the following Subgroups and Schedule were established for developing the Subgroup analyses and reports. At the Committee meeting in Los Angeles on October 15th, the "2010 Program", "2007, 2008, 2009 Portfolio Assessment" and "Environmental" sub-group topics were incorporated into the "Program" section of the report.

Schedule
9/16 – Recommendations to leaders
9/28-10/7 – Subgroup conference calls and E-mail correspondence
10/7- Subgroup reports to Chair
10/13- Subgroup reports distributed to Committee
10/15 – Meeting in Los Angeles
10/22- Teleconference and formal vote on final URTAC Report

Six Sub-Group Areas of Analysis and Member Assignments:

Executive Summary, Policy, Past Report Review
Lead – C. Hall
Members - J. Hall, Julander, Marks, Sparks

2010 Program:
Lead – J. Hall
Members - Cavens, Dwyer, Hardage, Sparks, Tew

2007, 2008, 2009 Portfolio Assessment:
Lead – Zinke
Members – Brown, Dwyer, C. Hall, Mohaghegh, Sparks, Weiss

Knowledge Management and Technology Transfer
Lead – Dwyer
Members – Daugherty, C. Hall, Hardage

Metrics and Benefit Assessment:
Lead – Mark
Members – Brown, Daugherty, C. Hall, Levey, Mohaghegh

Environmental:
Lead – Brown
Members- Anderson, Brown, C. Hall, Julander, Levey, Weiss

APPENDIX

Description of Information About the New DOE Knowledge Management Database (KMD)

- Program Status
  - A list of projects goals, objectives, status, accomplishments, reports and key personnel contact information
- The RPSEA Consortium R&D Program
  - 57 project summaries currently available on the NETL Internet
- NETL Complimentary R&D Program
  - Drilling under extreme conditions
  - Environmental impacts of oil and natural gas development
  - Enhanced and unconventional oil recovery
  - Resource assessment
- Ongoing DOE Oil And Gas Programs
- Other Related Research Products Generated by the Traditional Oil and Gas Research Program At The NETL SCNGO (e.g. Gas Shale Research)

In addition to these requested attributes. The system will also include:

- Search Tools for NETL's CD/DVD document and "historical archive" database
- GIS and ArcGIS functionality – mapping of US O&G information and geographical databases.
- Xcelsius models providing visualization of O&G information and more importantly access to Outer Continental Shelf Models that provide information on water resources and environmental data pertaining to drilling in the Allegheny National Forest.

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

October 22, 2009

The Honorable Steven Chu
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 (UDW Program) element of the Draft 2010 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 EPAct (the Program) to date. The network of industry experts represents:

- 145 organizations,
- 27 states, the District of Columbia, and the Province of Newfoundland, Canada,
- collectively more than 600,000 employees world-wide; and
- more than 50% of U.S. natural gas and oil production

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 UDW 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 while being environmentally responsible. Domestic oil and gas supply will provide a critical bridge for America's transition to renewable energy sources in the future. Moreover, such domestic energy supplies provide America with a viable alternative to reduce environmental impact of CO_2 emissions associated with the importation of vast quantities of oil and gas. In addition, fewer imports translate into less fuel consumed with the transfer or transportation of energy.

New technology developed through this Plan promotes access to 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. From our Plan review, the UDAC is pleased to report a meaningful shift in private sector interest illustrated by cost sharing participation (50% industry and 50% nonprofit and universities to 67% industry 33% nonprofit and universities).

Industry has recently announced a significant discovery in ultra-deepwater Gulf of Mexico that reportedly could approach three billion barrels (i.e. Tiber). Conversion of this discovered resource into commercially proven reserves will require development of new technology and will become a substantive new federal, state and local revenue source. The UDW Program offers a unique collaborative environment for pioneering technology applicable to the ultra-deepwater arena. Technology developed through the UDW Program is publicly available, transferable, and would not otherwise be pursued in a timely manner.

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. DOE should commit fully toward reaching the objectives of the Program, through adequate funding for its full duration. It is important to acknowledge that the full value of the Program could be lost by premature cessation of funding.

Respectfully Submitted,

Kent F. Abadie
Chair – UDAC

Ultra-Deepwater Advisory Committee

2010 Annual Plan

Comments and Recommendations

October, 2009

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1. INTRODUCTION

The Ultra-Deepwater 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; or the Consortium).

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 2010 Annual Plan (the Plan) Review at the Eleventh Meeting of UDAC in San Antonio, TX on September 16-17, 2009.

The schedule of work for the review of the 2010 Plan included the following key milestones:

12-19-08 9th UDAC Meeting, Washington, DC: vote to establish 2 Standing Subcommittees: the UDAC R&D Portfolio Subcommittee, and the UDAC R&D Process Subcommittee

1-22-09 Meeting of the UDAC R&D Portfolio Subcommittee: reviews charter; determines strategy to use questionnaire to sort information on the portfolio of projects

2-6-09 Meeting of the UDAC R&D Portfolio Subcommittee: begins development of questions for use in sorting information on the project portfolio

3-24-09 Meeting of the UDAC R&D Process Subcommittee: reviews charter; discusses with NETL and RPSEA the process used by NETL and RPSEA from solicitation of proposals through award of subcontracts

4-15-09 Meeting of the UDAC R&D Portfolio Subcommittee: reviews RPSEA response to the questionnaire for the 2007 R&D Portfolio; discusses same with NETL and RPSEA; adjustments are made to the questionnaire

7-1-09 Meeting of the UDAC R&D Portfolio Subcommittee: reviews the additional information; discusses completed questionnaire with NETL and RPSEA

7-15-09 10th UDAC Meeting, Washington, DC: status update on the UDW Program and the NETL Complementary Research Program; reviews preliminary reports from the Portfolio Subcommittee and the Process Subcommittee

9-15/16-09 11th UDAC Meeting, San Antonio, TX: overview of the *2010 Annual Plan*

9-21-09 Meeting of the UDAC R&D Portfolio Subcommittee: reviews the 2010 Portfolio and requests the 'questionnaire' be applied to the 2008 Portfolio and the 2009 R&D Portfolio.

9-25-09 Meeting of the UDAC R&D Portfolio Subcommittee: discusses first draft of Subcommittee report; receives questionnaire response for the 2008 Portfolio; discusses the RPSEA Environmental Advisory Group function and project selection criteria with NETL and RPSEA;

9-28-09 UDAC R&D Portfolio Subcommittee members submit comments on draft Subcommittee report

9-28-09 UDAC R&D Process Subcommittee submits final draft report of findings and recommendations

10-5-09 Meeting of the UDAC R&D Portfolio Subcommittee: completes final Subcommittee report of recommendations

10-14-09 12th UDAC Meeting, Los Angeles, CA: review Subcommittee reports; develop final recommendations

10-15-09 Meeting of the UDAC Editing Subcommittee: develops first draft of final UDAC report on the *2010 Annual Plan*

10-16-09 UDAC Editing Subcommittee delivers draft for comment

10-19-09 UDAC members comment on first draft of final UDAC report

10-20-09 UDAC Editing Subcommittee delivers second draft of final UDAC report

10-21-09 UDAC members comment on second draft; final draft available for members

10-22-09 13th UDAC Meeting, Washington, DC: members vote to accept final UDAC report of comments and recommendations on the *2010 Annual Plan*

2.0 EXECUTIVE SUMMARY AND RECOMMENDATION HIGHLIGHTS

The UDAC recognizes the experience and expertise and wishes to thank the teams responsible for planning and executing the Ultra-Deepwater (UDW) Program: the DOE, National Energy Technology Laboratory (NETL) and Research Partnership to Secure Energy for America (RPSEA; or the Consortium).

Program metrics for the Plan are supported by the Committee. The Plan program metrics are as follows:

- *Issue and complete at least one solicitation;*
- *Select and award three to five large projects, with a value of $1 million to $5 million per project, with additional awards averaging $150 thousand - $300 thousand each; and*
- *Establish FY2011 program priorities based on results of 2007-10 solicitations and other inputs from stakeholders, including the program advisory committees and the UDAC.*

The UDAC authorized formation of two standing subcommittees (R&D Program Portfolio and Program Process) to further review focus areas of the 2010 Draft Plan. Details of the subcommittee findings are contained in this report. The following are highlights the Committee wishes to report.

Current Status and Program

In the 2009 Plan review, the Committee registered concern regarding the low number of contracts awarded for selected R&D projects. As a follow up, subcommittees identified and recommended actions associated with Program process improvement and communications. The results of these efforts are:

- Awards have reached the following levels: 17 for 2007 and 12 potentially for the 2008 funding.
- The mix of participants has expanded and altered from being almost evenly split 50% industry and 50% nonprofit and universities to being about 67% industry 33% nonprofit and universities. This shift illustrates genuine interest in the R&D program by private sector.
- The average of the individual awards has increased from approximately $850,000 to about $1,200,000. The increase in the size of the awards (or potential awards) is appropriate for the breakthrough technology.

Along with larger number of awards, cycle time for solicitation to award is also shortened from 12 months to less than 8 months with a desire to improve to a target cycle time of 7 months or less. Specific efforts to improve communication, education and standardization of the contracting process are key elements supporting this improvement.

Recommendation Highlights

- Greater attention should be devoted to environmental issues as they affect the industry infrastructure as well as natural environment. All projects are required to address specific environmental impacts. Consequently, the Committee suggests thorough review and assessment of the environmental content of the UDW program as well as enhanced transparency.
- Benefits assessment is an area critical to establishing the value and sustainability of the Program. Accordingly, this task should be assigned high priority to achieve implementation prior to the delivery of the 2011 Draft Annual Plan. Subsequently, benefit assessment methodologies should undergo continuous improvement.
- The Committee suggests external benchmarking be implemented to obtain a more comprehensive evaluation of Program performance. Internal benchmarking measures indicate satisfactory performance levels and DOE reports federally mandated audits revealed no material weaknesses.
- The R&D portfolio appears to be robust; however the EP industry operates in a dynamic environment. This operating environment requires flexibility in the R&D portfolio. Two significant areas requiring portfolio focus are well completions and low permeability reservoirs.

UDW Program Direction

Due to Program funding levels, the 2010 Plan reveals a significant narrowing of the R&D technology funnel. 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. Either additional funding sources need to be developed or the number of R&D projects reduced.

The Plan contributes 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. A critical success factor in the Program is to define “end game” strategies for each of the R&D projects and how they contribute and align with our national interests of energy security and independence.

The Committee feels EPAct Subtitle J delivers a compelling direction in support of UDW exploration and development critical to America's quest for domestic energy supply and federal, state and local revenue for the foreseeable future. The importance of domestic energy supply is underscored by its environmental advantage of reduced CO_2 emissions, contributions to the domestic job market, and enhancement of U.S. technical capabilities for competing in the global marketplace.

3.0 SUBCOMMITTEE REPORTS

At the September 16-17 meeting, the UDAC agreed to divide the UDW Program element of the Draft 2010 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 Portfolio
- Program Process

Subcommittees were formed to assess the Plan for each of the two (2) focus areas and provided the review and recommendations to the Secretary.

3.1 R&D PORTFOLIO FINDINGS AND RECOMMENDATIONS

Overview

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

1. Drilling, Completions, and Intervention Breakthroughs
2. Appraisal & Development Geoscience and Reservoir Engineering
3. Significantly Extend Satellite Well Tieback/Surface Host Elimination
4. Dry Trees and Risers in 10,000 Feet Water Depth
5. Continuous Improvement and Innovation
6. HS&E Concerns (Health, Safety and Environmental)

The Portfolio Subcommittee analyzed the Ultra-Deepwater Portfolio of Projects (2007 and 2008 portfolios, and 2009 solicitations), largely based on a survey instrument developed by the subcommittee. The survey results were compiled and evaluated based upon the following criteria:

- Balance
- Barriers and Opportunities
- Diversity
- Value

Finding #1: Environmental Content

In general, the Committee finds the R&D project portfolio balanced after review of the 2007 and 2008 portfolios, and 2009 solicitations, noting that only two R&D projects in 2007 and 2008 are represented in the "environmental" category. Nonetheless, all projects are required to address environmental issues and concerns. The Committee recognizes the role of the RPSEA Environmental Advisory Group (EAG) in advising RPSEA on how UDW technology fits into the broader environmental research effort and where RPSEA can undertake work to fill research gaps. However, environmental aspects of each project have not been communicated effectively at the project level. Therefore, the adequacy of the overall environmental content of the entire portfolio cannot be determined.

It should also be recognized that there are two aspects of "environmental" considerations:

1. How the environment affects industry infrastructure.

2. How the infrastructure and associated deepwater activities affect the natural environment.

For example, the Ultra-Deepwater Program must be sensitive to issues of climate change while searching for technology that minimizes:

- How climate change could affect the industry (e.g. sea level rise, increasing storm intensity)
- How industry could affect climate change (e.g. green house gases, ocean acidification, global warming)

Understanding of environmental and ecosystem dynamics is critical to designing and operating the surface and subsurface infrastructure of the oil and gas industry. Understanding of the ecosystem dynamics, ecology, habitats, and living resources of the areas of activity is critical to protecting the natural environment and living resources and sustaining the ecological services provided.

Recommendation # 1a:

The Committee recommends that an overall assessment be conducted to ensure that the environmental content of the R&D portfolio is adequate, that the results of this assessment be communicated, and adjustments be made in the portfolio if appropriate.

Recommendation # 1b:

Both environmental aspects need to be considered and addressed in the R&D portfolio:

1. How the environment affects industry infrastructure
2. How the infrastructure and associated deepwater activities affect the natural environment.

Finding #2: Converting Discovered Resources into Proven Reserves

The portfolio is weighted toward conversion of discovered resources into economically recoverable proven reserves. The survey of the projects shows that only one research project (DW2001) is aimed at increasing the resource base, while most other projects are aimed at conversion of resources into proven reserves.

Comment #2:

The main UDW Program objective is to increase production and convert resources to reserves. Given the main goal of the Program is to increase production and royalties this seems reasonable.

Finding #3: Project Strategy Considerations

The Plan recommends a decrease in the number of projects to be funded with a corresponding increase in the funding level for each project. The Committee expects that this trend will continue as the UDW Program matures and demonstration projects become more common. Maturation of the R&D portfolio will naturally lead to a greater demand for funding and/or optimization of the portfolio through collaborations and leveraging.

Recommendation # 3a:

Determine "end game" strategies for each project in the R&D portfolio. These strategies should be defined in terms of:

- Research, development, demonstration, and commercial application of technologies for ultra-deepwater [Section 999A(a)]
- 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. [Section 999B(a)]

Recommendation # 3b:

Identify additional sources of funding to sustain Program progress ensuring that development of technologies meet "end game" strategies. As the R&D portfolio matures and as projects remain in the Program, funding will need to be increased or the number of projects reduced.

Recommendation # 3c:

Identify ultra-deepwater related activities that other agencies (e.g. USGS, EPA, MMS, etc.) are sponsoring to look for opportunities for collaboration and to avoid redundancy.

Finding #4: Benefits Assessment

NETL is developing benefits assessment methodologies by which the value of the UDW Program can be measured and evaluated.

Recommendation # 4:

Ensure this deliverable is operational and available for public view prior to issuance of the 2011 Draft Plan.

Finding #5: Well Completion R&D

The Committee recognizes that completions operations are essential to successful development of ultra-deepwater resources and represent a major cost element. Inadequate focus has been given to well completion projects.

Recommendation # 5:

Develop and maintain a robust presence of completions projects in the portfolio.

Finding # 6: Low Permeability Reservoir R&D

There is a lack of projects addressing discoveries in ultra-deepwater reported to have low permeability reservoir rock (e.g. stimulation). R&D projects are primarily focused on cost-reduction rather than reservoir productivity.

Recommendation # 6:

Consideration should be given to pursuing R&D projects which would enable reservoir characterization and stimulation techniques such as hydraulic fracturing and acidization in ultra-deepwater to improve expected reservoir productivity in low permeability reservoirs.

3.2 PROGRAM PROCESS

Overview

The Committee feels that the overall process of solicitations and awards is maturing and showing great improvement. The variety of project awards and the increase in the number of participants demonstrates the efficacy of the process. The projects included in the Complementary Research Program demonstrate good communication pathways between the NETL and RPSEA. The electronic reporting of solicitations, awards, and projects, including technology transfer assist in making the UDW Program transparent to industry and the public.

From the number of companies involved in currently awarded projects and those selected for awards, it is possible that the future funding may be made available through greater private sector cost sharing; driven by successful demonstration that minimizes risk and offers commercial viability.

Finding #1: Speed of Awards

The speed at which projects are reviewed and awards given is critical to the overall success of the effort. The time period from solicitation to award has decreased from over one year to less than 8 months during the last three years. This improvement has been achieved through application of "standard contracts" and review process enhancements made by NETL and RPSEA. Formal/informal training and support efforts of both organizations help potential proposers understand the solicitation and award process. The award cycle time is expected to decrease even further as follow-up projects or new projects proposed by groups with former UDW Program experience are solicited and approved for award.

Recommendation #1:

The Committee recommends the DOE **continue** the following practices:

- Utilize standard contracts.
- Engage with stakeholders.
- Catalog successes and failures and share "learnings" with stakeholders.
- Identify new opportunities for improvements in the award process and communicate to stakeholders.

Finding #2: Health, Safety, & Environment (HS&E) Communication

General awareness of Health, Safety, and Environmental issues will continue to be a major driver in the vetting process for new technologies as they emerge and are commercially developed. Associated Safety and Environmental Concerns (Need 6 of the Plan) are under communicated in the information available to the industry and public about the HS&E content of proposals and awards.

Recommendation #2:

The Committee recommends project progress reports include considerations/findings related to HS&E, and improved communication to the public and industry of the Associated Safety and Environmental Concerns addressed by the projects awarded or selected for award.

Finding #3: Benchmarking

A review of the Program process demonstrates progress as indicated by the following internal benchmarking findings:

- The number of awards has increased from previous Plan review: 17 for 2007 and 12 potentially for the 2008 funding.
- The mix of participants has expanded and altered from being almost evenly split 50% industry and 50% nonprofit and universities to being about 67% industry 33% nonprofit and universities.
- The average of the individual awards has increased from approximately $850,000 to about $1,200,000. The increase in the size of the awards (or potential awards) is appropriate for the breakthrough technology.
- DOE reported that RPSEA completed both federally mandated third party audits with no material weaknesses.

There is a lack of comparison of Program process performance with other similar programs, domestic and international, with similar goals and frameworks of funding.

Recommendation #3a:

Continue internal benchmarking (i.e., within the UDW Program).

Recommendation #3b:

Assess Program process performance by evaluating/conducting external benchmarking with other R&D programs (e.g., Unconventional Resources Program, Small Producers Program, DEMO 2000).

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. Paul N. Cicio President Industrial Energy Consumers of America	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. Daniel J. Daulton U.S. Technical Marketing Manager BJ Services Company	Dr. Arnis Judzis Vice President TerraTek Schlumberger	Mr. Paul M. Wiencke Director Research Council of Norway
Dr. Quenton R. Dokken Executive Director Gulf of Mexico Foundation	Mr. Daniel T. Seamount, Jr., Chair Alaska Oil & Gas Conservation Commission	Ms. Mary Jane Wilson* President and CEO WZI Inc.

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5.0 SUBCOMMITTEE TOPICS AND MEMBERS

The Plan review and preparation of the final Committee Report involved the following:

R&D Program Portfolio

Lead – Quenton Dokken
Members – Joe Fowler, Stephen Sears, Arnis Judzis, Paul Cicio, Morten Wiencke, Rick Mitchell* & Ray Charles*

**Former UDAC/Subcommittee Members*

Program Process

Lead – Mary Jane Wilson
Members – Kent Abadie, Luc Ikelle, Dan Seamount & Paul Tranter

Editing Subcommittee

Lead – Kent Abadie
Members – Dan Daulton, Arnis Judzis & Quenton Dokken