

Ultra-Deepwater and Unconventional Natural Gas and Other Petroleum Resources Program Administration

A summary of the R&D program and lessons learned

The full report can be found at www.rpsea.org

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Founded in 2002, RPSEA is a unique 501(c)(3) non-profit, national consortium that provides focused research and development to deploy safe and environmentally sensitive technology that can deliver hydrocarbons from domestic resources to the citizens of the United States. Its membership consists of nine of the nation's premier research universities, five national laboratories, other major research institutions, large and small energy producers, and energy consumers.



INTRODUCTION

This is a summary of the Research Partnership to Secure Energy for America (RPSEA) Final Report 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 (EPAAct). The U.S. Department of Energy (DOE), through its National Energy Technology Laboratory (NETL), provided program oversight. This Final Report covers the period from 2007, when research began, through 2016, when the program ended, and builds a foundation for work that can be conducted in the future.

This Final Report describes each of the program elements and includes descriptions of specific projects that illustrate successful technology development efforts funded through the program. Section VI of the report provides conclusions and section VII are recommendations based on lessons learned describing ways to improve the process and efficiency in conducting a public private research consortium.

The report also includes a summary of technology transfer efforts, which have reached a worldwide audience, resulting in accelerated and highly successful implementations of newly developed technologies.

The report documents the most successful public private partnership for oil and gas R&D in the U.S. and lays the foundation for future research endeavors. The legislation in Section 999 provided investments in R&D from the Federal royalty trust vs annual appropriated funding through DOE R&D projects (not programs). This proved to be vastly superior, when coupled with the processes RPSEA developed. Future programs should follow these processes build upon the lessons learned described in the report. This increases success rates, shortens the cycle time from concept to application and maximizes the return on funds invested.

The success is also attributed to RPSEA members providing hundreds of subject matter experts who contributed thousands of hours in directing this program, as is evident by results described in the report.

In the three research areas, RPSEA working with the US Department of Energy NETL, successfully managed over 170 projects utilizing \$350 million including cost share. The projects, several of which are already commercial, have resulted in improved safety, reduced environmental risk and increased energy security. The research generated over \$150 billion in direct economic value from jobs, royalties and revenue. It yielded over \$40 billion in environmental damage mitigation. An enormously successful technology transfer program, over 5,000 articles have been published documenting its results.

REPORT EXECUTIVE SUMMARY

Technology developed through this program has led to safer and more efficient development of ultra-deepwater resources, more environmentally sensitive development of the tremendous shale gas resource within the U.S., and the responsible production of additional hydrocarbons from the mature fields that are operated primarily by small producers throughout the nation. The success of any research and development program is appropriately judged by the extent to which the results are applied and commercialized. This Final Report briefly describes each of the program elements and includes descriptions of specific projects that illustrate successful technology development efforts funded through the program.

It also includes a summary of technology transfer efforts, which have reached a worldwide audience, resulting in accelerated and highly successful implementations of newly developed technologies. Moreover, the results of the program are very apparent at any of the professional conferences at which research relevant to the oil and gas industry is discussed. We have documented over 5,000 reports, presentations, and publications detailing the work conducted through the program, which has significantly improved the safe and responsible development of oil and natural gas, our Nation's most prolific energy resources.

While the original intent of the Section 999 was to "maximize the value of natural gas and other petroleum resources of the United States" none of that value will be realized if the targeted resources cannot be developed in a safe and environmentally sensitive manner. The Deepwater Horizon incident caused the industry to reevaluate its approach to risk management as applied to all exploration and development operations. Issues related to onshore development, namely water usage and treatment, induced seismicity, wellbore integrity, and greenhouse gas emissions, added to the needs of this program. As a result, an important component of this program has been to ensure that risks associated with the development of ultra-deepwater and unconventional resources are fully understood, and that the means are available to fully mitigate those risks with respect to both prevention and recovery.

HISTORICAL PERSPECTIVE

The Ultra-Deepwater and Unconventional Natural Gas and Other Petroleum Resources Research and Development Program (Program) was established pursuant to Title IX, Subtitle J, Section 999 (Section 999), of the Energy Policy Act of 2005 (EPAAct). RPSEA was selected by the Department of Energy, Office of Fossil Energy to administer three of the four program elements identified in EPAAct, 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 period of performance was one of the most historical time in the US oil and gas industry. Domestic supplies were decreasing, while imports increased. This created a national security concern through US vulnerability to foreign imports. The Section 999 program played an important role in funding new technology to help meet these challenges. The US “shale revolution” became a reality. Research, new technology and technology transfer created jobs, provided energy security and a better-quality of life for American.

The BP Macondo incident also took place during this period. This was the worst event in the US offshore industry. The industry associations, RPSEA members and the offshore research program shifted their priorities to address safety concerns as better technology was applied to improve safety and the environment and gain public support the industry would never stand for another similar incident. RPSEA’s successful technology advisory committees (TACs) provided an excellent source of information exchange. Intellectual property of technology to improve safety and environmental performance took a back seat to the industry coming together.

RPSEA also made key investments in conventional production. While called the small producers program, the program addressed many of the challenges to marginal wells primarily produced by small and mid sized producers. The marginal wells provide access to more oil in the ground than we have ever produced in our history. Without maintaining access through better technology this valuable resource will be lost. One of the largest returns on the investments made was in this program investing is what is today called the ROZ or residual oil zones adding reserves and production in areas that were contemplating abandonment. Improvements in enhanced oil recovery were also made.

The program operated during some of the most historical times in the oil and gas industry. We saw a huge increase in the price of oil and then a devastating drop in commodity prices - RPSEA research provided technology to help operators me more efficient; RPSEA research program was at the beginning and technology developed as a contributor to the “shale revolution”; and the BP Macondo incident, the worst oil and gas event in the US – RPSEA program was able to shift research to focused on needed. safety technology.

THE RPSEA PROCESS

- Each year RPSEA was required to 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 prepared the Annual Plan for the cost-shared research program administered by the Program Consortium and transmitted it to Congress, which was followed by a release of the solicitation of R&D proposals based on the Plan.
- Prior to the Secretary submitting the Annual Plan to Congress each year, the legislation called for DOE to solicit advice from two Federal Advisory Committees: the Ultra-Deepwater Advisory Committee (UDAC) and the Unconventional Resources Technology Advisory Committee (URTAC). The legislation allowed for comments and recommendations from other industry experts as well. DOE's Office of Fossil Energy was responsible for organizing and managing both of these committees. The comments and recommendations received from these advisory committees related to their review of the Annual Plan were submitted to the Secretary.
- Upon approval of the Annual Plan each year, EPCAct section 999B(e)(3) directed the Secretary of Energy to transmit the Annual Plan to Congress, along with the written recommendations from the Program Consortium, the two Federal Advisory Committees, and any other experts from whom comments have been received.
- Each Annual Plan included details of ongoing activities, and a list of solicitations for awards to carry out research, development, demonstration, or commercial application activities. It also was required to include 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.

It was reasoned that the best efforts of the research community would be required to develop the technology necessary to safely deliver hydrocarbons from the targeted resources; however, the knowledge residing with producing companies and service and manufacturing companies would be crucial in providing effective direction for the needed research. The rapid application of new ideas and results would be facilitated by the continuing involvement of highly skilled representatives from the operating and service - manufacturing companies to help plan and execute the research program. Furthermore, the emphasis on safety and environmental sensitivity would require direct involvement and communication with the regulatory agencies and the environmental community.

The utilization of a small portion of Federal oil and natural gas royalties to partially fund the program, which would be co-funded by cost share contributions from research project recipients, would ensure that all involved parties had "skin in the game" and would be joint contributors to a successful public – private partnership.

TECHNOLOGY TRANSFER

Technology Transfer has been a cornerstone of the RPSEA program. Subcontractors were required to submit a technology transfer plan for at least 1.5% of the gross project costs as part of their proposals. As the projects were awarded, RPSEA worked with the subcontractors to assure that the research results would be transferred to a defined audience(s). In addition, each subcontract award normally provided that 1% of the gross awards would be held back by RPSEA to conduct a broader technology transfer effort. This was successfully accomplished through publications, the RPSEA website, meetings, trade shows, technical conferences, and regional and national workshops held throughout the contract period.

The RPSEA technology transfer process was adapted to the target audience in as much as the efforts for transferring program results to smaller independent operators requires a much different approach than that utilized to reach the ultra-deepwater community. The common and most successful element however involved the use of advisors, which included peers, members of academia, and end users (normally operators), to develop the program and progress the selected projects towards maturity. The RPSEA mechanism brought industry together to create a common understanding on technical issues impacting oil and gas exploration and production. RPSEA was highly regarded for its ability to bring various segments of industry and government together for discussion. This ability contributed to the success of the technology transfer effort.

RPSEA worked with a variety of organizations, including OTC, SPE, AGI, AAPG, IADC, API, IPAA, and others in facilitating technology transfer efforts. Those organizations' publications and conferences have been a major outlet for RPSEA program results.

The energy trade press also embraced RPSEA as a "go to" source for their readers to keep abreast of new technology. Not only did the press work with RPSEA and contractors to transfer information via their publications, but most also did so in digital media, social media, and through their own commercial conferences, normally focused on specific technology challenges.