

**Unconventional Resources Technology
Advisory Committee (URTAC) Meeting
Crowne Plaza Hotel, Houston, Texas
July 25, 2007**

Welcome

Sally Zinke, Chair of the Unconventional Resources Technology Advisory Committee (Committee), convened the meeting at 8:30 a.m. on July 25 in Houston, Texas. She introduced Bill Hochheiser, the Committee Management Officer, who presented a "Safety Moment" focusing on the emergency procedures for exiting the conference room and reminding people of the importance of wearing seat belts. Appendix 1 contains the Committee sign-in sheet for the meeting.

Jim Mosher's resignation from the Committee due to his recent appointment to the Department of Interior was announced. For the record, his resignation letter is included in these minutes as Appendix 2.

At 8:40 a.m. the Designated Federal Officer (DFO) Jim Slutz welcomed the group. The underlying urgency of the Committee's task was reinforced. Mr. Slutz explained that in order to finance the 2007 research and development (R&D) projects the Committee recommendations and the Annual Plan must be published. He thanked the Committee for their hard work and dedication as demonstrated by the output of the subcommittees, and encouraged them to work diligently to prepare the Committee's recommendations by the day's end. Due to schedule conflicts, Mr. Slutz pre-appointed Bill Hochheiser to act as the DFO.

The Chair outlined the agenda for the day as shown in Appendix 3:

- The first session was designed to give the Committee an overview of the overall scope of all the subcommittee recommendations so that potential duplication or inconsistencies could be avoided or at least identified early on in the process. It was specifically requested that discussion be held to a minimum during this session.
- During the second session, a typist recorder was assigned to transcribe Committee recommendations for display on large overhead screen. This live, continually-updated wording of specific recommendations in real time facilitated the ongoing development of the final statement of Committee recommendations.

SUBCOMMITTEE RECOMMENDATIONS INTRODUCED

Interim subcommittee activities, resulting from subcommittee group discussions, documented prior to the meeting, are detailed in Appendix 3. These proposed recommendations were used as the starting point for the detailed discussions. These subcommittee-proposed recommendations resulted from various e-mail exchanges and

teleconferences involving the members that volunteered to participate in the separate subcommittee discussions. These subcommittee activities took place after the first meeting of the Committee on June 22nd in Arlington, Virginia, and concluded the week before the second meeting on July 25th in Houston, Texas.

At 8:45 a.m. the Committee tuned its attention to the brief introductory presentations by the each of the subcommittee leaders.

Technology Transfer Subcommittee Opening Brief

[See Appendix 4 for detailed Subcommittee report]

Chris Hall explained that in general “technology transfer” is an R&D activity that is usually left as the last task in most programs, and is not usually given very high priority. Most subcommittee members felt the need to increase the visibility of the technology transfer process in order to ensure the success of the overall program. It was noted that R&D projects are of limited value if not communicated in a clear, concise, and useful manner to the oil and gas community.

Other issues addressed by the subcommittee included the adequacy of the level of funding, possible use of the Petroleum Technology Transfer Council (PTTC) to assist in the process, and a better definition of the R&D program for small producers. The recommendation that a Knowledge Management (KM) Database be developed to capture the results of the entire R&D effort was introduced. It was noted that although the proposed KM database can be an expensive proposition, member experience has shown that it is well worth the cost.

Regulations Subcommittee Opening Brief

[See Appendix 4 for detailed Subcommittee report]

Victor Carrillo introduced this topic by noting that industry and government agencies need to establish better working relationships to address and resolve barriers to oil and gas exploration and production and to avoid delays in program development and implementation. These barriers can be significant, and the subcommittee felt that R&D targeted for this area could help streamline the processes and ensure that an effective and efficient conclusion could be reached that would meet the needs of all parties.

Of note, the subcommittee suggested that a focused, joint workshop involving federal, state, and local representatives and industry could be a useful mechanism for identifying the root issues and developing an action plan which would likely involve some focused R&D to resolve. These issues are all the more important for unconventional resources because this area is not as well understood as conventional oil and gas resources. It was also suggested that the Interstate Oil and Gas Compact Commission (IOGCC) would be an important participant in this endeavor.

Water and Environmental Management Subcommittee Opening Brief

[See Appendix 4 for detailed Subcommittee report]

This topic was introduced by Juliette Faulkner who was acting on behalf of Vik Rao, the subcommittee leader who was not able to attend the meeting. She briefly reviewed the conclusions of the subcommittee which stressed the importance of produced water management in conjunction with unconventional resources but also noted that mitigating factors are also becoming critically important in developing unconventional resources.

Water management has become an increasingly important element in the production of unconventional gas resources, and it was noted that there are many challenges to resolve. First and foremost, recognizing that there are multiple parallel efforts underway dealing with water management, many independents feel that there is a real opportunity in better managing the available information in an organized and user-friendly manner, which would go a long way towards providing useful information to the industry.

Production Research Subcommittee Opening Brief

[See Appendix 4 for detailed Subcommittee report]

Jessica Cavens presented the work of the Production Research subcommittee, and noted that the reason for this group was the Committee's opinion that production-related issues were not adequately addressed in the annual plan. They believed that the high investment and operating costs associated with production dictate that this topic be given higher priority in the R&D program. Additionally, other related issues to be dealt with including CO₂ sequestration, extending life of existing wellbores, advanced cementing practices, and efforts to better categorize unconventional resource geologies.

Exploration Research Subcommittee Opening Brief

[See Appendix 4 for detailed Subcommittee report]

Fred Julander represented the Exploration Research Subcommittee which recommended that a grass roots effort was required to better understand the nature and characteristics of unconventional gas resources. The subcommittee felt that this is becoming more important, particularly in light of the fact that these resources have the potential to become significant factors in overall domestic gas supplies, if successfully developed. For example, the geology of unconventional gas resources that are emerging in the Green River Basin and new areas in Alabama are less well understood compared to conventional resources.

Plan Metrics and Funding Subcommittee Opening Brief

[See Appendix 4 for detailed Subcommittee report]

Sally Zinke presented an overview of the Metrics Subcommittee's work which focused on the importance of broadening the characterization and measurement of program efforts and results to better quantify the benefits associated with the Section 999 program. It was felt that a better job of explaining and quantifying the impact of the R&D program is needed to ensure that policy makers understand the breadth of the program.

Besides the oil and gas community, decision makers responsible for funding the program need factual information about the benefits of the that go well beyond quantifying improved royalty income collections. Members of the subcommittee felt strongly that the results of the program have to be translated into metrics with higher visibility including reserves additions, increased tax revenues, balance of trade improvements, employment gains, improved global energy security, and reduced environmental impacts.

Committee “Consensus” Considerations

At 9:10 a.m. the subcommittee briefs were concluded and in preparing for the detailed discussion session, the facilitator reviewed the ground rules suggested for the discussion including:

- 1) Members were reminded of their agreement not to raise topics that had not been previously discussed in prior advisory committee or subcommittee meetings;
- 2) A consensus opinion by the Committee was assumed on discussion topics unless issues were raised at the time that an item was being discussed; and
- 3) Considering the tight schedule for activities during the day and the large number of items to be discussed, members were reminded to keep their comments brief.
- 4) Also it was agreed that there would be three categories of consensus:
 - *consensus* is where all members agreed to the recommendations unanimously;
 - a *majority agreement* is where more than half of the members agreed on a position;
 - a *minority opinion* is where less than half of the members agreed on a position.

Detailed Discussions and Development of Final Recommendations

The final Committee recommendations are presented in Appendix 5. It is intended that these meeting minutes will serve to provide additional background on the final recommendations and the rationale for the modifications to the subcommittee recommendations. The minutes also communicate the sense of the Committee that may not be clear when reading the recommendations alone.

At 9:15 a.m. the detailed discussions on subcommittee recommendations was begun.

Technology Transfer

In general, the comments relating to the technology transfer section amplified the importance of the topic, and, based on the collective experience of the members, it was felt that this section needed to be strengthened beyond the recommendation in the annual plan.

Regarding formalization of the process, the Committee adopted the recommendations of the subcommittee. These included suggestions on conducting technical forums and publishing results on a nationwide basis, ensure that the technology transfer process is an ongoing process and not a one time effort, and, finally, insuring that appropriate metrics are developed to measure the performance of the technology transfer process.

On the subject of a "Knowledge Management (KM) Database," the Section 999 legislation requires that 2.5 percent of the R&D funds be devoted to technology transfer, and it obligates the individual project to perform that task using the awarded funds.

Bill Hochheiser noted that one of the complicating factors associated with funding was the legal interpretation that 2.5 percent of project funds awarded have to be spent as part of the project budget. Specifically excluded from this consideration was the possibility of reallocating the technology transfer funds to a pool administered by the program consortium for the benefit of all projects. Therefore, any new program-wide initiatives for developing systems solutions required additional funding beyond the mandated 2.5 percent.

Further, the Committee felt strongly that funds need to be utilized to set up a database to act as a repository for knowledge created by the program. Because such an effort extends beyond that of any individual project, the Committee requested that the Department of Energy (DOE) identify the funding required for such an effort. Members felt that the cost involved in setting up a database would be on the order of several hundred thousand dollars. But, before investing those funds, the Committee also suggested that the Petroleum Technology Transfer Council (PTTC) be contacted to see whether they had a low cost alternative for resolving this issue.

Members also stressed the importance of designing this KM database to be open to the public, although it was acknowledged that a registration process may be necessary to handle user logistics.

Regarding the Small Producer element of the technology transfer program, it was suggested that the most beneficial use of any funds dedicated to small producers is in promoting technology transfer. The Committee could not distinguish any substantive difference between the operational R&D needs for small producers compared to those of larger companies. However, the technology transfer needs of small producers are unique due to their large number, their limited internal infrastructure/staffs, and limited funding.

The Committee took a break at 10:20 a.m. and reconvened at 10:40 a.m.

Regulations

These recommendations were adopted by the Committee with only minor modifications. The subcommittee proposed that DOE arrange for a one-day brainstorming session of all stakeholders to address barriers to timely development of exploration and production resources. This was strongly endorsed by the Committee. Ideally, this workshop could produce model regulatory procedures for handling permitting issues. The Committee also suggested adding non-governmental organizations (NGOs) to the list of agencies participating in the proposed one-day brainstorming session.

The IOGCC was viewed as key participants in this endeavor as they could help adopt a generic model for permitting procedures as compared to the wide range of procedures that currently exist from state to state. In addition to the obvious environmental implications of new resource development, the scope of the regulatory model should also include consideration for historical and recreational impacts of any proposed exploration or production venture.

The Committee also suggested that the recommendation dealing with timely release of research results should be moved to the Technology Transfer section.

A Committee vote was utilized to determine the most effective location for the discussion on the recommendation involving synergies among state and federal agencies. It was decided to form a new section entitled "Inter-agency and Other Stakeholder Coordination" in light of the perceived importance of that topic, and to give it a higher visibility in the document.

This was considered an important aspect of the program as it focused attention on the desirability of coordination among the various governmental organizations and the oil and gas community. It was noted that in the past, with careful planning, these joint activities have resulted in synergistic benefits. One specific case was noted involving a coordinated effort in California to resolve barriers in the development of large unconventional resources. This represented an excellent example of how the various agencies can work effectively with industry to ensure that all concerns are addressed appropriately with minimal delay.

Water and Environmental Management

At 11:25 a.m. the Committee turned its attention to the next subcommittee presentation on the subject of Water and Environmental Management led by Juliette Faulkner. The subcommittee recommendations were largely accepted by the Committee; however, there was significant discussion focused on a few items.

Generally, there was a concern on the part of the subcommittee that reuse of produced water was evolving into a major issue in the development of unconventional gas resources and that a proactive plan was necessary to ensure the most effective and efficient development of the resource. The Committee agreed with the recommendation to catalog the broad range of separate programs, technologies, applications, and water reuse options to facilitate an adequate level of technology transfer. This initiative involved not only the states and local authorities but also the Department of Agriculture (as many of the water reuse options focus on agricultural requirements) and the DOE (as regards the CO₂ sequestration program).

It was also felt that the term “fit for use” was sufficient to acknowledge that there are multiple potential reuses of water depending on the costs, technologies, local requirements, and environmental issues involved. Therefore, it was not necessary to expand on environmental mitigating factors. An important point is that there is no requirement for all produced waters to be treated to a quality level that makes it fit for human consumption, but that there are various end uses that can readily accommodate lower quality waters. The challenge for the independent producers of unconventional natural gas is to have a full understanding of all the options so that they can make the most economic decisions in the development of their resources.

It was decided to leave it to DOE to address this produced water issue in the ongoing management of the R&D program. This is a complicated issue and it was felt that the Committee should avoid making overly prescriptive recommendations in this area but rather identify their concerns and obligate the DOE to take appropriate steps to manage the process. This included a suggested requirement to include these considerations in the solicitation process. In the case of tight gas and shale gas, there are differing criteria that stipulate the level of water quality required for reuse of water for fracturing operations that are not generally well understood by state and local authorities.

The Committee stressed the importance of cataloging the current and previous R&D projects related to water quality in order to avoid duplication. At the same time, the Committee did not want to delay progress on any promising produced water R&D projects. Also, there was discussion that analysis of previous water quality-related R&D projects should also take into account mitigation activities and impacts on other environmental parameters.

However, it was agreed that coordinating all of these complicating issues simultaneously could have a detrimental impact on the progress of the R&D program. It

was concluded that the decisions made now can and should be revisited in one year, and that a reassessment of these concerns could be undertaken at that time.

At 12:10 p.m. the Committee broke for lunch and reconvened at 1:10 p.m.

Production Research

The recommendations of the Production Research Subcommittee were adopted with minor changes and, more importantly, supplemented with a discussion about “other petroleum.” The Committee’s underlying concern was that production issues are a significant factor in calculating the economics of oil and gas operations, and, therefore, important to include this area in the R&D program.

The Committee did not feel that the annual plan had given this topic sufficiently high priority. Therefore, the subcommittee suggested several areas of R&D including: extending the life of existing wellbores, developing advanced cementing technology, identifying the synergies with CO₂ sequestration activities, and focusing efforts aimed at better characterizing the geological, geochemical, and geophysical framework of unconventional resources.

The Committee understood and agreed that the initial focus of the plan is on unconventional gas. However, a recommendation was added affecting the scope of future unconventional program solicitations to include a category on “other petroleum resources”. This is in line with the original legislation which clearly identifies unconventional gas and other petroleum as having the same priority. For example, the Committee believed that R&D should be used to explore novel applications of enhanced oil recovery programs which may become increasingly important as CO₂ capture and sequestration technologies become more prevalent.

Also to further detail the importance of “other petroleum,” the Committee agreed to add a separate section in the appendix of the Committee’s final report to elaborate on the impact of the emerging Williston Basin and Bakken crude oil resources which are producing on the order of 60,000 barrels of oil per day (50,000 in Montana and 10,000 in North Dakota). Also, it was pointed out that underscoring the growing importance of “other petroleum”, the Energy Information Agency (EIA) has recently increased the reserves associated with the Bakken (3.6 billion barrels of oil [BBO] and additional CO₂ enhanced oil recovery (EOR) derived crude oil reserves (amounting to 16 BBO). All of these developments lend further support to the growing importance of the “other petroleum” resources which should retain a priority position within the Section 999 program.

As a final additional comment, the subcommittee recommended that RPSEA (as an unbiased, non-governmental entity) examine how best to ensure that research results produced by federal agencies are released in a timely manner. It was suggested that perhaps the Federal Laboratory Consortium (which includes representation from many government agencies that deal with oil and gas issues including the DOE, U.S. Geological Survey [USGS], Minerals Management Service [MMS] EIA, Department of Agriculture and Department of Defense, for example) was an important source of data for addressing this issue.

The Committee also felt that this recommendation was better suited for including in the “Technology Transfer” section. Therefore, it was appended to that recommendation in that section as an additional comment instead of being included in the section on Production Research.

Exploration Research

At 2:00 p.m. the Committee turned to Exploration. The subcommittee’s recommendations were largely adopted by the Committee with some editorial changes to better clarify the recommendations.

The primary focus of this subcommittee was that although emerging and/or frontier basins involving unconventional gas resources have significant potential to add to our nation’s reserves, little effort is expended in understanding the underlying fundamental geology. For example, today industry has a limited understanding of what distinguishes a successful and producible unconventional gas resource.

The Committee recommended R&D efforts aimed at addressing these fundamental issues in a systematic and scientific manner. It was the opinion of the subcommittee that this area has significant potential to dramatically increase domestic reserves. Key challenges include understanding the geological framework and predicting the characteristics of reservoirs, traps, and seals.

Additionally, the Committee endorsed recommendations to develop workshops and additional surveys of resource areas to complement existing strategic plans.

Finally R&D was recommended to develop novel ways of reducing the environmental footprint, minimizing surface disturbances and infrastructure development for unconventional gas resources. It was noted that developing some of the most promising basins in the Rocky Mountain region will involve drilling of thousands of wells. It was suggested that through appropriate R&D initiatives, the drilling footprint could be reduced to allow the resource to be produced in both an economical and environmentally benign manner.

Plan Metrics and Funding

At 2:25 p.m. the discussion on this topic was led by Sally Zinke.

The Committee accepted the subcommittee recommendations and supplemented it with a discussion of the importance of funding Section 999. Specifically, the Committee felt that it was important to state that funding is critically important, and that the funds originally authorized should not be reduced or diverted to other activities. Further, the Committee felt that the authorized funding level of \$50 million per year is lower than what is needed for maximum success. Many of the projects involved in the R&D program are multi- year in term, and in order to ensure continuity and the most effective use of tax dollars, the annual funding should be protected. Additionally, the Committee requested that in subsequent annual plans, a specific section be added that addresses the foregone opportunities due to funding limitations, in order to provide justification for expanding the funding level allocated to the Section 999 program.

The Committee also felt that increasing domestic oil and gas reserves and production is not only good for the U.S. economy and energy security as has been noted earlier but that, also, there are environmental benefits. There is little doubt that the environmental regulatory process in the United States is significantly more robust than that of most countries, and, therefore, from a global environmental perspective increasing reserves and production in the United States actually avoids negative environmental impacts elsewhere.

Additionally, it should be noted that in the area of onshore unconventional resources, the industry's track record for protecting the environment is excellent. Government-sponsored R&D programs have developed enhanced oil recovery technologies and unconventional gas production techniques, which are now significant contributors to the overall domestic supplies. Coupled with an effective technology transfer program and willing independent producers, these R&D programs have turned into extremely successful field applications. Coal bed methane, tight gas and shale gas are excellent examples. The onshore independent producers rely heavily on government sponsored R&D programs. Furthermore, the Committee believes that if the government does not invest in these programs then the R&D will not be conducted.

It was suggested that a committee of independent observers, coupled with industry representatives, be assigned to identify and evaluate various alternative metric assessment systems for communicating the benefits resulting from the investment in Section 999 activities. Several Committee members objected that sufficient time was not allowed for a subcommittee to take on such a sizeable task and make useful recommendations in a timely manner. Therefore, it was suggested that DOE begin to conduct such an assessment now. However, the Committee concluded that the metrics

be developed by unbiased authorities to avoid having DOE seen as mirroring industry positions.

Before the Committee concluded this discussion, it was agreed that the original subcommittee title of “Metrics” would be re-titled “Plan Metrics and Funding” to reinforce and draw more attention to the funding issues.

Final Recommendations and Report

The Committee took a short break at 3:00 p.m. and reconvened at 3:05 p.m. The latest version of the recommendations was printed and distributed, and time was set aside for members to review the recommendations in final form and to propose any last changes. Also, the recommendations were reformatted to ensure that they were integrated as smoothly as possible into one consistent format. Numerous editorial changes were recommended to achieve that end.

At 4:00 p.m. the Committee took a break and reconvened at 4:15 p.m. with the purpose of reviewing the executive summary and the cover letter to the Secretary of Energy.

Some members wanted time after the meeting to edit the executive summary, and asked whether that could be accommodated. Bill Hochheiser responded that although he understood and was sympathetic to the desire to spend more time in editing the document, federal law requires that all meetings of the Committee must be held in a public forum; it may not meet in private. Therefore, the Committee was required to conclude its work today.

The Committee decided its top priority was to ensure that all of the important concepts and recommendations be articulated in the report, and the report agreed to by the members. It was proposed that the Chair be given the authority to make small editorial and format changes at the conclusion of the meeting on the condition that no substantive content changes be included. The Committee members agreed.

The Committee decided that the executive summary would contain excerpts from the individual subcommittee recommendations, and, therefore, each subcommittee leader was asked to summarize an appropriately high-level statement of recommendation from their group for inclusion in the executive summary. This process took place from 4:25 p.m. until 5:00 p.m. The cover letter to the Secretary was a summation of the executive summary.

Carryover Issues

At 5:00 p.m. Bill Hochheiser solicited feedback from the Committee on suggestions for improvements for next year's meeting and, in light of the time constraints, invited members to send him feedback by e-mail.

Public Comment

At 5:05 p.m. the Committee concluded its deliberation and Bill Hochheiser called for public comment, and, as none were offered, the meeting was adjourned.

Committee Report Complete – Adjourn

At the conclusion of the meeting a final record was made available to all members, and the letter transmitting the recommendations from the Committee to the Department of Energy was signed by the Chair.

Appendix 1

Attendee List

Unconventional Resources Technology Advisory Committee Attendees July 25, 2007

Unconventional Resources Technology Advisory Committee Meeting
Sign-In Sheet - July 25, 2007

Last Name	First Name	Organization	Sign
Ames	Eugene L.	Nordan Trust	
Aminzadeh	Fred	Society of Exploration and Geophysicists	
Ancell*	Kenneth	Ancell Energy Consulting, Inc.	
Anderson	Scott	Environmental Defense Fund	
Bardin*	David J.	Arent Fox LLP	
Carrillo	Commissioner Victor G.	Railroad Commission of Texas	
Cavens	Jessica J.	EnCana Oil & Gas (USA)	
Conser	Russell J.	Shell International E&P Inc.	
Daugherty	William S.	NGAS Resources, Inc.	
Dwyer	James P.	Baker Hughes INTEQ	
Falkner	Julliette A.	The Nature Conservancy	
Frantz	Joe	Unbridled Energy Company	
Hall	Jeffrey D.	Devon Energy Corporation	
Hall	J. Chris	Drilling Production Co.	
Julander	Fred C.	Julander Energy Company	
Lewis	Fletcher S.	Fletcher Lewis Engineering, Inc.	
Levey*	Raymond	College of Engineering University of Utah	
Master	James A.	North American Grouse Partnership	
O'Bryan	Patrick L.	BP America, Inc.	
Rao	Vikram	Halliburton	
Sparks	Don L.	Discovery Operating, Inc.	
Tew	Berry H. "Nick"	State Oil and Gas Board of Alabama	
Zinke	Sally G.	Ultra Petroleum	

* Special Government Employee

Appendix 2

*James A. Mosher, Ph.D.
16222 River Bend Ct
Williamsport, MD
21795*

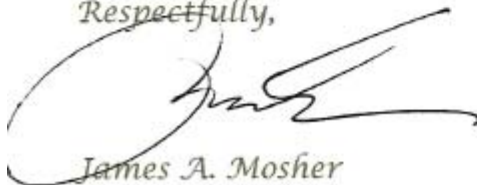
July 16, 2007

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

Dear Mr. Secretary,

I am very appreciative of the appointment to Unconventional Resources Technology Advisory Committee, and the opportunity to provide another perspective to its mission. The work of the Council is relevant and important to a range of other natural resources issues. Unfortunately, I must tender my resignation as of the date of this letter. I have accepted an appointment to federal employment at the Department of Interior as Deputy Assistant Secretary for Fish, Wildlife & Parks. I will, of course, have a continuing interest in the work of the Committee.

Respectfully,



James A. Mosher

Cc: James A. Slutz, Deputy Asst. Secretary

Appendix 3

Agenda

Unconventional Resources Technology Advisory Committee

Crowne Plaza Houston North Greenspoint, 425 N. Sam Houston Parkway East, Houston, TX, 77060

July 25, 2007

- 7:30 Continental Breakfast
- 8:00 Registration
- 8:30 **Welcome** [Sally Zinke, Chair]
- 'Safety Minute'
 - Acknowledge Members who did not attend June meeting
- 8:45 **Opening Remarks** [Jim Slutz, DFO]
- Review Committee Responsibilities and Expected Outcomes
- 9:00 **Recommendations Introduced** [Sally Zinke, Chair]
- Subgroup leaders introduce recommendations and discuss consolidation process
 - Chair introduces draft report and discusses process for uniting recommendations and preparing executive summary
- 10:15 Break
- 10:30 **Fine Tune/Organize Committee Comments for Technology Transfer, Regulations, and Water/Environmental Management Subgroups** [Sally Zinke, Chair]
- Discuss content and wording of recommendations and other comments
 - Consensus on recommendations (Consensus vs. Majority Agreement vs. Minority Opinion)
- 12:15 Lunch
- 1:15 **Fine Tune/Organize Committee Comments for Production, Exploration Research Theme Content, and Metrics Subgroups** [Sally Zinke, Chair]
- Discuss content and wording of recommendations and other comments
 - Consensus on recommendations (Consensus vs. Majority Agreement vs. Minority Opinion)
- 2:45 **Finalize Report** [Sally Zinke, Chair]
- Final document layout
 - Discuss and finalize Executive Summary
 - Print final Committee Report
- 3:30 Break
- 3:45 **Carryover Issues** [Sabine Brueske, Facilitator]
- Lessons learned, considerations for future advisory meetings
- 4:30 **Public Comment**
- 5:00 **Committee Report Complete, Adjourn**

Appendix 4

Initial Subcommittee Recommendations

At the June 22nd meeting, the following Subgroups were established for developing analyses and reports on behalf of the full Committee.

Six Recommendation Areas and Subgroup Members:

Technology Transfer (includes: Small Producer Response to Solicitation, and Uptake)

Lead – C. Hall

Members – Lewis, Dwyer, Ancell, Frantz

Regulations

Lead – Carrillo

Members – Tew, Mosher, Bardin

Water Management

Lead – Rao

Members – Falkner, Carrillo, Ancell, O'Bryan, J. Hall

Production Research Theme Content

Lead – Cavens

Members – Sparks, Anderson, Conser, Bardin, Tew

Exploration Research Theme Content

Lead – Julander

Members – Levey, Aminzadeh, Ames

Metrics (includes: Funding)

Lead – Zinke

Members – Ames, C. Hall, Daugherty, Bardin, Aminzadeh

Technology Transfer Recommendations

Technology Transfer (TT) is one of the most important aspects of Research and Development (R&D) because without it the benefits of the program never get disseminated to the widest possible audience. The RPSEA program provides few specifics or even guidelines on how TT would be accomplished. It cannot be left for later development.

1) The Technology Transfer (TT) Component of the Program Need to be Better Formalized:

The Committee believes that the following should be included in the Technology Transfer aspects of the program:

- Program should consist of both technical forums with published proceedings and web based Knowledge Management database.
- Technical forums should provide information of interest to the widest audience of producers possible for maximum dissemination (national coverage).
- All TT should be part of an on-going program so that access to the widest audience is assured. Isolated TT efforts for individual R&D projects has proven to not be as effective as those done as part of an on-going coordinated effort.
- The TT component of the program should be satisfy the “metric of measurement of success” of extending the program to all petroleum producing regions of the United States.

2) Knowledge Management (KM) Database Resource:

The preservation of data from the R&D projects and Technology Transfer program must be retained in a database for maximum dissemination (both near and long term) to the end users. Elements of a successful database resource should include:

- Projects requirements should specify that part of the TT funding component (2.5%) be in the form of information to be input into a web-based Knowledge Management database.
- The RPSEA program should be required to ensure that R&D results be put into a Knowledge Management database to serve as a resource of technology for producers.
- KM should have following aspects:
 1. Be web-based.
 2. User sign-in and password.
 3. Standard Template format for input.
 4. Subject matter review process.
 5. A knowledge push and/or community notification system to stimulate and maintain interest.
 6. Expected criteria for success.
- Existing petroleum technology transfer databases such as the one already developed by the Petroleum Technology Transfer Council (PTTC) should be used to the maximum extent possible to reduce development and maintenance costs.

3) RPSEA Technology Transfer Funding Is Inadequate to Accomplish What Needs to be Done:

Given the very limited funding available, the RPSEA program needs to efficiently leverage all aspects of the program to ensure a maximum return on benefit:

- Augment funding from other sources such as the Ultra Deep Program, NETL, other DOE funding, membership programs, attendance receipts.
- Concentrate funding to serve specific purposes such as requiring grant awardees to invest their TT funding (2.5% of grant amount) in specifically structured ways,

such as: (a) Development of TT workshop materials; (b) development of material for web-based Knowledge Management database; (c) participation in specified workshops.

- Leverage Funding by use existing programs for the TT component of the RPSEA program whenever possible, such as PTTC. Fewer dollars would have to be spent than that required maintain separate program. There would also e a wider dissemination of information.

4) The Small Producer Component of the Program Needs to be Modified:

The Small Producer Component of the Program provides the opportunity to extend the program to a much larger audience whose needs are vastly different than those of larger producers. However, with the limited resources available, significant changes need to be made to the proposed program:

- R&D projects shouldn't be developed with just "small producers" in mind; R&D benefits all producers. Therefore, R&D shouldn't be a focus of this component of the program.
- The Small Producer funding should be focused on on-going regional problem identification and technology transfer to solve existing problems with following requirements:
 1. Development of structured materials/proceedings for workshops.
 2. Input of material into web-based Knowledge Management database.
- It is best to use existing programs such as Petroleum Technology Transfer Council (PTTC) which already have the industry acceptance and structure to carry out such a program. The RPSEA program was written makes no mention of utilizing these valuable resources.

Regulation Recommendations

The Committee agrees with the RPSEA Draft Plan (p. 140): ***Regulatory barriers must be identified and understood early in the program development process as they have direct impact on technology solutions***, but regulatory barriers themselves should also be a subject for research.

Background: Unconventional resource development (including gas shales, CBM, tight sands) is sometimes unnecessarily impeded / negatively impacted by governmental regulatory barriers (federal, state, local) such as rules for well spacing/density, and field development patterns originally developed for conventional reservoir development. For example: state regulatory rules applied to traditional vertical wells may be wholly inappropriate for horizontal wells into unconventional reservoirs.

The Committee recommends that RPSEA –

1. Organize and bring together key individuals from academia, regulatory entities, and industry, for one-day brainstorming session(s) to identify key regulatory

barriers to Unconventional Gas (gas shales, CBM, tight sands) development and propose suggested solutions and/or research opportunities; and based on such sessions,

2. Solicit research from appropriate entities (such as IOGCC) to:
 - a. Identify, compile, and compare regulatory barriers (federal, state, or local) to Unconventional Gas development; and
 - b. Identify and recommend regulatory **best practices** that can serve as flexible models for other governmental bodies to develop rules that allow Unconventional Gas resources to be produced effectively and efficiently, while protecting correlative rights, preventing waste and the drilling of unnecessary wells, and protecting the environment.
 - c. Suggest additional research to address key regulatory barriers, including barriers to development of unconventional **petroleum** resources in future plan years.

Timely release of research results by federal agencies (including DOE, EIA, and USGS) to the oil and gas exploration and development community can advance understanding of Unconventional resources. We further recommend that RPSEA:

1. Examine whether agency regulations or policies may so impede such release as to merit a "best practices" research solicitation, and
2. Seek to enhance regulatory/research synergies by improving state and federal agency coordination and communication.

Research and resource management efforts by other state and federal natural resource agencies that address wildlife and wildlife habitat concerns are of potential value in planning energy research and demonstration projects. We encourage coordination between DOE/RPSEA and resource entities such as the U.S. Fish & Wildlife Service, Bureau of Land Management, and U.S. Forest Service.

Water/ Environmental Management Recommendations

Recognizing that Unconventional Gas development is critical to the nation and that such operations are the province of small independent players and that they require fresh water, in generally water scarce areas, the Committee endorses the RPSEA/NETL Plan, with the following recommendations and prioritization in the area of fresh water conservation and sustainable development:

Guiding Principles for RPSEA Decisions:

- The improvements to development opportunities comprising the thrust of the Plan should be with an explicit view to minimizing impacts to natural and cultural resources and sustaining biodiversity, and these considerations will be used in the ratings.
- Minimize fresh water usage and encourage use of recycled fluids

Tight Gas and Shale Gas

The Committee strongly endorses the RPSEA proposal to make water management a focus of the intended development. This is in recognition of the facts that these areas are going to be the major source of natural gas in the US within five years, and that small independent operators play heavily in this arena and that the reservoirs tend to be in water scarce areas. While the plan is well conceived, we recommend the following prioritization:

- Develop means to treat and reuse produced water in an economical and *fit for purpose* manner. These purposes, in order: fracturing fluid, drilling fluid and cementing.
- Develop fracturing and drilling fluids (in that order) capable of tolerating treated produced water and recycled fracturing fluid based water.

Coal Bed Methane

The Committee strongly endorses the specific objectives in this area, in particular recognition of the fact that, unlike other petroleum resources, the associated water is produced before the gas, and so reservoir development requires a viable water management plan. We offer the following guiding statement:

- Develop means for treating produced water in a *fit for purpose* manner. The purposes, not in order, and recognizing the relative purity of this water, include: agriculture, industrial processes, petroleum operations and human consumption.

Production Recommendations

Add the following points to annual plan

- Extending life of existing wellbores
 - Through fluid loss additives, behind pipe pay identification etc
- Advance cementing practices and technology
 - Reduce microannulus development
- CO₂ Sequestration/Enhanced Recovery

- The program incorporate one or more elements regarding the sequestration of carbon dioxide along with enhanced recovery efforts
- Program managers should consult with NETL to determine how best to integrate RPSEA activities regarding sequestration with the larger DOE program
- Future plans should include both oil & gas taking into account current reserves, potential increase in recovery, activity, and production

Emphasize the following as a focus area in the solicitation for proposals under shale gas and tight sands

- Comprehensive characterization of the geological, geochemical, and geophysical framework of unconventional resource plays, particularly emerging plays

In Houston, we would like to discuss

- Attempt to draw on potential technologies from sources not previously available or researched
 - No effort has been made to query all the Federal Labs for R&D potential and known technologies from other industries
 - Only labs previously associated with oil & gas projects are considered.
 - Federal Laboratory Consortium (FLC) could help
 - Example is work done by Leigh Price (USGS)
 - RBDMS data base (Risk based data management system) from the Ground Water Protection Council.

Exploration Recommendations

- 1) **Exploration in Emerging and/or Frontier basins.** Exploration Technology R&D for Unconventional Gas resources must include initiatives to improve cost effectiveness, modify and boost the efficiency of existing technologies, and expedite the market availability of promising new technologies that will increase the comprehension and cataloging of the geological framework and petroleum systems within emerging and frontier basins.
- 2) **Improve Strategic Planning Process for Exploration R&D.** The committee encourages RPSEA to undertake additional investigative efforts, including workshops and surveys to complement the existing strategic plan. More specifically, this process should focus on Exploration technologies deemed critical by representatives from industry.
- 3) **Characterization of Shale Gas Reservoir Systems.** Expanded data collection, improved database and software functionality should be undertaken to facilitate the evaluation of the shale gas resource potential (and other resources such as coal bed methane and tight sandstones) and help predict the characteristics of reservoirs, traps, and seals. We recommend the research considered include first and secondary principles of unconventional

systems. These may include (but not restricted by) original characteristics such as depositional settings, mineralogy, organic matter type and secondary imprints of the basin setting and tectonic regime overprinted on the system. We prefer those research topics that have transferrable learnings for a broad geographic area.

- 4) **Minimizing the Exploration Footprint.** The committee believes that increased R&D spending in the area of exploration technology research will reduce surface disturbance and infrastructure development, prioritize and reduce the number of drilling locations and promote greater drainage efficiency and strive to reduce water impacts for unconventional resources.

Metrics Recommendations

1) The Committee recommends that RPSEA develop metrics by which to measure the success of the program that go beyond those that are required by statute (e.g., impact on federal royalty revenues) to include others that may be of concern to various governmental agencies and the petroleum industry. Metrics of program success must serve purposes of both internal assessment and outside review:

- Increased reserves (both in place and increased economic reserves due to application of new technologies and reduced operating costs).
- Jobs retention and/or growth in the industry
- Increased recovery factor of oil in place due to application of new technologies.
- Increased revenues to operators and royalty owners and, consequently, income tax revenues to the local, state and federal government.
- Oil and gas production contribution to Gross Domestic Product.
- Off-setting of imports of oil and gas and, consequently, on improved Balance of Payments.
- Technology exposure consisting of number of case studies developed, technology transfer events held and number of producers exposed to technologies that will result in production of additional reserves.
- Environmental: reduced footprint and reduced emissions.

2) The Committee strongly recommends that in the development and implementation of the program, RPSEA should be tasked with ensuring that the program extends to all oil and gas producing regions of the United States. While individual grant projects in the first year may be situated in one region, plans should be announced early in the program to place projects in other regions. The technology transfer component must extend to all regions of the country starting with the first year.

3) The development of suitable metrics has proven to be difficult for past R&D and technology transfer projects because different groups and oversight agencies evaluate results differently. For this reason, it is strongly recommended that an industry group outside of RPSEA be appointed by DOE to develop, recommend and evaluate suitable metrics to be used in conjunction with the DOE R&D programs such as this.

Appendix 5

Unconventional Resources Technology Advisory Committee Recommendations

Technology Transfer Recommendations

Technology Transfer (TT) is one of the most important aspects of R&D and it needs to be carried out in a manner such that the results are disseminated to the widest possible audience. The Annual Plan provides insufficient specifics or even guidelines on how TT would be accomplished. It cannot be left for later development.

The Committee recommends the following:

1) The Technology Transfer (TT) Component of the Program Needs to be Better Formalized:

The Committee believes that the following should be included in the Technology Transfer aspects of the program:

- Program should consist of both technical forums with published proceedings and web based Knowledge Management database.
- Technical forums should provide information of interest to the widest audience of producers possible for maximum dissemination (national coverage).
- All TT should be part of an on-going program, as isolated TT efforts for individual R&D projects have proven to not be as effective as those done as part of an on-going coordinated effort.
- The TT component of the program should be to satisfy the “metric of measurement of success” of extending the program to all petroleum producing regions of the United States.

2) Knowledge Management (KM) Database Resource:

The preservation of data from the R&D projects and Technology Transfer program must be retained in a database for maximum dissemination (both near and long term) to the end users. Elements of a successful database resource should include:

- DOE should identify funding for the creation of a database or customization of an existing database as a repository for the information created.
- Project requirements should specify that a portion of the 2.5% TT funding component be used to create information to be input into a web-based Knowledge Management database.
- The RPSEA should be required to ensure that R&D results be put into a Knowledge Management database to serve as a resource of technology for

producers.

- KM should have the following aspects: be web-based; user sign-in and password (requires registration but open to public); standard template format for input; subject matter review process; a knowledge push and/or community notification system to stimulate and maintain interest; and expected criteria for success.
- Existing petroleum technology transfer databases such as the one already developed by the Petroleum Technology Transfer Council (PTTC) should be used to the maximum extent possible to reduce development and maintenance costs.

3) Technology Transfer Funding To Accomplish What Needs to be Done:

Technology Transfer funding is inadequate to accomplish what needs to be done. Given the very limited funding available, the DOE needs to efficiently leverage all aspects of the program to ensure a maximum return:

- Augment funding from other sources such as the Ultra-Deepwater Program, NETL, other DOE funding, membership programs, and attendance receipts.
- Concentrate funding to serve specific purposes such as requiring grant awardees to invest their TT funding (2.5% of grant amount) in specifically structured ways, such as: (a) development of TT workshop materials; (b) development of material for web-based Knowledge Management database; (c) participation in specified workshops.
- Leverage funding by use of existing programs for the TT component of the DOE program whenever possible, such as PTTC. Fewer dollars would have to be spent than that required to maintain separate program. There would also be a wider dissemination of information.

4) Use of Funds for the Small Producer Program for Technology Transfer:

The most beneficial use of funds for the Small Producer Program is for technology transfer. The Small Producer component of the Program provides the opportunity to extend the program to a much larger audience whose needs are vastly different than those of larger producers. However, with the limited resources available, significant changes need to be made to the proposed program:

- The funding for the Small Producer Component should concentrate on producer education, and be focused on on-going regional problem identification and technology transfer to solve existing problems with following requirements:
 3. Development of structured materials/proceedings for workshops.
 4. Input of material into web-based Knowledge Management database.
- It is best to use existing programs such as PTTC which already have the industry acceptance and structure to carry out such a program. The Annual Plan, as written, makes no mention of utilizing these valuable resources.
- Given the limited resources available, R&D shouldn't be a focus of this component of the program. R&D projects shouldn't be developed with just "small producers" in mind; R&D benefits all producers.

Additional Comment: Timely release of research results by Federal agencies (including DOE, EIA, and USGS) to the oil and gas exploration and development

community, can advance understanding of unconventional resources. We recommend an examination of whether agency regulations or policies may so impede such releases as to merit a “best practices” research solicitation.

Regulations Recommendations

The Committee agrees with the Annual Plan (p. 140): *Regulatory barriers must be identified and understood early in the program development process as they have direct impact on technology solutions*, but regulatory barriers themselves should also be a subject for research.

Unconventional resource development (including gas shales, CBM, tight sands) is sometimes unnecessarily impeded / negatively impacted by governmental regulatory barriers (Federal, state, local) such as rules for well spacing/density, and field development patterns originally developed for conventional reservoir development. For example: state regulatory rules applied to traditional vertical wells may be wholly inappropriate for horizontal wells into unconventional reservoirs.

The Committee recommends the following:

3. Organize and bring together key individuals from academia, regulatory entities, non-governmental organizations and industry, for one-day brainstorming session(s) to identify key regulatory barriers/issues relating to unconventional gas (gas shales, CBM, tight sands) development and propose suggested solutions and/or research opportunities; and based on such sessions,
4. Solicit research from appropriate entities (such as IOGCC ¹) to:
 - a. Catalogue (identify, compile, and compare) regulatory barriers/issues (Federal, state, or local) relating to unconventional gas development; and
 - b. Identify and recommend regulatory best practices that can serve as flexible models for other governmental bodies to develop rules that allow unconventional gas resources to be produced effectively and efficiently, while protecting correlative rights, preventing waste and the drilling of unnecessary wells, and protecting natural resources and the environment.
 - c. Suggest additional research to address key regulatory barriers, including barriers/issues relating to development of unconventional petroleum resources in future plan years.

¹ Interstate Oil and Gas Compact Commission

Water and Environmental Management Recommendations

Recognizing that unconventional gas development is critical to the nation and that such operations are primarily the province of independent producers and that they require fresh water, generally in water-scarce areas, the Committee endorses the Water Management portion of the Annual Plan, with the following recommendations and prioritization in the area of fresh water conservation and sustainable development:

Guiding Principles:

- The improvements to development opportunities comprising the thrust of the Plan should be with an explicit view to minimizing impacts to natural and cultural resources and sustaining biodiversity, and these considerations will be used in the criteria for project selection.
- Minimize fresh water usage and encourage use of recycled fluids

Tight Gas and Shale Gas

The Committee strongly endorses the RPSEA proposal to make water management a focus of the intended development. This is in recognition of the facts that these areas are going to be the major source of natural gas in the US within five years, and that independents operate heavily in this arena and that the reservoirs tend to be in water scarce areas. While the plan is well conceived, we recommend the following:

- Catalogue (identify, compile, and compare) existing technology and solutions for treating produced waters.
- Develop new or improve on existing technologies to treat and reuse produced water in an economical and *fit for purpose* manner. The purposes, not in order, include: petroleum operations (e.g., fracturing and drilling fluids and cementing), agriculture, industrial processes, or other potentially beneficial uses.
- Develop fracturing and drilling fluids (in that order) capable of tolerating treated produced water and recycled fracturing fluid based water.

Coal Bed Methane

The Committee strongly endorses the specific objectives in this area, in particular recognition of the fact that, unlike other petroleum resources, the associated water is produced before the gas, and so reservoir development requires a viable water management plan. We offer the following guiding statement:

- Develop new or improve on existing technologies to treat and reuse produced water in an economical and *fit for purpose* manner. The purposes, not in order, and recognizing the relative purity of this water, include: petroleum operations (e.g., fracturing and drilling fluids and cementing), agriculture, industrial processes, or other potentially beneficial uses.

Production Research Recommendations

The Committee recommends the following:

- Extending life of existing wellbores
 - Through fluid loss additives, behind pipe pay identification etc.
- Advance cementing practices and technology
 - Reduce microannulus development
- CO2 Sequestration/Enhanced Recovery
 - The program incorporate one or more elements regarding the sequestration of carbon dioxide along with enhanced recovery efforts
 - Program managers should consult with national laboratories and other industry experts to determine how best to integrate R&D activities regarding sequestration with the larger DOE program.
- Future plans should include both oil and gas, taking into account current reserves, potential increase in recovery, activity, and production.
 - Amend the first year plan to have the Consortium perform a preliminary examination of “other petroleum” opportunities, using Consortium program administration funds.
 - Thoughtfully identify “other petroleum” R&D opportunities and consider the demarcations between Consortium and Complementary programs in future years (2-10) of the EPACT 999 program in light of available funding.²
- The Committee recommends the following be emphasized as a focus area in the solicitation for proposals under shale gas and tight sands
 - Comprehensive characterization of the geological, geochemical, and geophysical framework of unconventional resource plays, particularly emerging plays

Supporting Comments:

RPSEA’s earlier, thoughtful process for identifying the three *natural gas* theme areas that comprise the plan’s Unconventional Resources program element relied heavily on a 2003 National Petroleum Council (NPC) study that considered only natural gas.³

The NPC’s new global report (approved July 18, 2007)⁴ adds information about onshore oil resources, data that RPSEA and its advisers have obviously not had time to digest.

² NETL’s complementary program element in the draft lists “enhanced and unconventional oil recovery” as a focus.

³ NATURAL GAS POLICY – FUELING THE DEMANDS OF A GROWING ECONOMY. (NPC 2003).

⁴ FACING THE HARD TRUTHS ABOUT ENERGY. (NPC 2007) 422 pages.

For example, NPC 2007 reports estimates of potential payoff from promoting enhanced oil recovery (EOR) from existing reservoirs at an additional 90 to 200 billion barrels of recoverable oil in the United States alone. (EPACT would classify part as “unconventional” because they are uneconomic resources, even though NPC’s concept might classify them as “conventional”.⁵) These new estimates did not exist in 2003 when NPC produced its natural gas policy study.

Section 999 of the Energy Policy Act (EPACT) of 2005 speaks of two Unconventional onshore resource categories: natural gas resources *and* “other petroleum” resources. The Executive Summary in the draft of a first Annual Plan may seem to exclude “other petroleum” resources as a topic to be addressed by the RPSEA Consortium, reserving it to be addressed to some extent by the NETL complementary Program. However, although the draft plan contemplates no R&D *awards* by the Consortium for “other petroleum” during the first year, the President of the RPSEA Consortium laudably advises that they will undertake *program administration* examination of “other petroleum” opportunities.

Exploration Research Recommendations

- 5) **Exploration in Emerging and/or Frontier Basins with an Emphasis on the Characterization of Shale Gas Reservoir Systems.** Exploration Technology R&D for unconventional gas resources must include initiatives to use promising new technologies that will increase the comprehension and cataloging of the geological framework and petroleum systems within emerging and frontier basins. Expanded data collection, improved database and software functionality should be undertaken to facilitate the evaluation of the shale gas resource potential (and other resources such as coal bed methane and tight sandstones) and help predict the characteristics of reservoirs, traps, and seals. We recommend the research considered include first and secondary principles of unconventional systems. These may include (but not restricted by) original characteristics such as depositional settings, mineralogy, organic matter type and secondary imprints of the basin setting and tectonic regime overprinted on the system. We prefer those research topics that have transferrable learnings for a broad geographic area.
- 6) **Improve Strategic Planning Process for Exploration R&D.** The Committee encourages additional investigative efforts, including workshops and surveys with an emphasis on shale gas to complement the existing strategic plan. More specifically, this process should focus on Exploration technologies deemed critical by representatives from industry.

⁵ For example, NPC 2007 classifies all CO₂-EOR R&D as “conventional” in Chapter 3: Technology (page 19 of 62) even as it describes various Existing, Emerging, and Frontier CO₂-EOR technologies (pages 20-22 of 62).

- 7) **Minimize the Exploration Footprint.** The Committee recommends soliciting proposals in the area of exploration technology research that will reduce surface disturbance and infrastructure development, prioritize and reduce the number of drilling locations and promote greater drainage efficiency and strive to reduce water impacts for unconventional resources. Take the lessons learned from developed fields and apply them to the exploration phase of new plays. The results of greater understanding and better characterization of developing plays will be a more orderly development process and ultimately a minimal footprint.

Plan Metrics and Funding Recommendations

Metrics

The Committee recommends development of metrics by which to measure the success of the program that go beyond those that are required by statute (e.g., impact on Federal royalty revenues) to include others that may be of concern to various stakeholders. Metrics of program success must serve purposes of both internal assessment and outside review, such as:

- Increased identified resource endowment in areas where they are not well quantified and reduced uncertainty of the resource volume.
- Increased resources and reserves (both technically recoverable resources and increased economic reserves due to application of new technologies and reduced operating costs).
- USA jobs retention and/or growth.
- Increased recovery factor of oil in place due to application of new technologies.
- Increased revenues to operators and royalty owners and, consequently, increased revenues to the local, state and Federal government.
- Oil and gas production contribution to Gross Domestic Product.
- Off-setting of imports of oil and gas and, consequently, on improved Balance of Payments.
- Technology exposure consisting of number of case studies developed, technology transfer events held and number of producers exposed to technologies that will result in production of additional reserves.
- Environmental: reduced footprint and reduced emissions.

The Committee strongly recommends extending the program to all oil and gas producing regions of the United States. While individual grant projects in the first year may be situated in one region, plans should be announced early in the program to place projects in other regions. The technology transfer component should extend to various regions of the country starting with the first year.

The development of suitable metrics has proven to be difficult for past R&D and technology transfer projects because different groups and oversight agencies evaluate

results differently. For this reason, it is strongly recommended that a committee of industry and other stakeholders outside of RPSEA be appointed by DOE to develop, recommend and evaluate suitable metrics to be used in conjunction with the DOE R&D programs such as this.

Funding

The Advisory Committee regards most positively Congress's dedication of \$50 million a year out of Federal royalties for 10 years, starting in this FY2007, toward Federal contributions for domestic oil and gas R&D. This money funds the onshore unconventional resources and small producer programs, the ultra-deepwater program and the NETL complementary program.

The Committee believes that the deposit of no-year non-appropriated funds into the *Ultra-Deepwater and Unconventional Resources Fund* must continue (in addition to annual Congressional appropriations for DOE's traditional or "core" oil and gas R&D programs) and must be used solely for the purposes of this research program as provided under EPACT. This certainty of funding is required in order to implement an efficient and effective long-term R&D program, which the Committee strongly believes is in the national interest.

Furthermore, the Committee questions the adequacy of the current EPACT Section 999 level of \$50 million per year plus appropriations at recent levels, especially regarding onshore opportunities and vital national interests. The Committee, therefore, recommends:

- Attention to multiple Federal funding sources and raised funding levels in order to assure that our national government makes requisite efforts to unlock and use the oil and gas endowment right here at home, and
- That the second and subsequent annual plans indicate the potential benefits that could be realized through increased funding, for example, by reviewing meritorious opportunities recently foregone due to spending limits.

Supporting Comments:

The USA is blessed with large onshore resources of natural gas and oil that are not economically accessible today but could become accessible, on meaningful timetables, if government and industry make requisite investments in R&D and technology transfer.

Proving up USA onshore resources and bringing them into production more rapidly could yield enormous public benefits – worth hundreds of billions of dollars a year – in terms of national security, reduced imports and more favorable balance of payments, less dependence on foreign nationally-owned oil companies, high-quality science and technology jobs in the U.S. and research opportunities for faculty and students at American universities, income to workers and royalty owners (private, state and local as well as Federal royalty owners), and consequently tax revenues.

Developing reserves in the USA will be environmentally more benign than development in many other countries. Also, national oil companies are committing more of their

national resources to their own development plans rather than export, the U.S. needs to develop its own resources.

Industry, in the case of onshore resources, means primarily independent oil and gas firms. Independents traditionally invest their cash flow into development of onshore reserves, and will leverage government-sponsored research and technology. The dramatic growth of coalbed methane production over the past 20 years illustrates how the independents leverage good long-term R&D.

The Committee believes that if the Federal government does not sponsor research like this, it will not happen.

Inter-agency and Other Stakeholder Coordination Recommendations

Research and resource management efforts by other state and Federal natural resource agencies that address wildlife and wildlife habitat concerns are of potential value in planning energy research and demonstration projects. We recommend coordination with Federal and State resource entities such as the U.S. Fish & Wildlife Service, Bureau of Land Management, U.S. Forest Service, State Environmental Agencies and State Resource Agencies.

Appendix 6

SUPPORTING DETAIL FOR SECTION 3.4 – PRODUCTION RESEARCH

Emerging Williston Basin Bakken crude oil resources illustrate roles of independents of varying sizes and of technology transfer work of the PTTC for realizing onshore potentials in the USA (particularly since major oil companies shifted attention to prolific foreign and deep GOM resources). The current play, started by an independent in Montana (named AAPG's "Explorer of the Year") and sustained by independents⁶ – with PTTC forums driving technology transfer – accounts for the largest onshore discovery since Prudhoe Bay (MT's Elm Coulee Field, discovered in 2000, now produces over 50,000 BOD; ND Bakken almost 10,000 BOD).

- Estimates of generated oil (mostly remaining in place) range up to 500 BBO, with a most probable range of 200-300 BBO according to the ND Geological Survey.⁷
- An extensive Bakken Report left by USGS petroleum geochemist Leigh C. Price who died in 2000 is available.⁸ Bakken hydrogen index data are available in the USGS organic geochemistry database (online at <http://energy.cr.usgs.gov/prov/og/>)

(Bakken, a light, sweet, liquid crude oil sourced from upper and lower Bakken shales, is produced from the source rock itself or, now more likely, from immediately adjacent rocks to which this oil was expelled without undergoing migration. Bakken oil is often deemed "unconventional" in the sense of being in a continuous-type formation. Challenges are to understand what makes for success in some oil wells and not others, and to raise recovery factors by several percentage points – issues paralleling those for continuous-type Barnett Shale gas.)

Changing unconventional oil appraisals by the Energy Information Administration (EIA) in DOE:

- New, long-term projections in EIA's Annual Energy Outlook 2007 (AEO, a February publication) reflect for the first time an additional 20 BBO of onshore, lower-48 crude oil as part of the technically recoverable crude oil resource base – an increase of more than 20 percent (3.6 BBO for Bakken crude oil of the Williston Basin and 16 BBO for additional CO₂-EOR).
- That increase drives up projected onshore production, notably in the Rockies.⁹

⁶ *Wildcat Producer Sparks Oil Boom on Montana Plains; Size of Find Still Unclear*, Wall Street Journal, Apr. 5, 2006, page A1.

⁷ LeFever, J. and Helms, L. *Bakken Formation Reserve Estimates* [https://www.dmr.nd.gov/ndgs/bakken/newpostings/07272006_BakkenReserveEstimates.pdf]; Grape, S. *Technology-Based Oil and Natural Gas Plays: Shale Shock! Could There Be Billions in the Bakken?* [<http://tonto.eia.doe.gov/FTPROOT/features/ngshock.pdf>].

Also, other articles at <https://www.dmr.nd.gov/ndgs/bakken/bakken.asp>

⁸ See <http://www.undeerc.org/Price> which is linked on the PTTC Rocky Mountain web site.

⁹ NPC 2007 summarizes: "... The United States produced 5.2 MB/D of conventional crude oil in 2005, but its domestic production is at best rising slightly in absolute terms while declining as a share of domestic demand. Existing fields ... are generally not seen as having the potential to reverse existing declines. The EIA AEO2007 includes cases showing U.S. conventional crude oil production ranging between 5.25 MB/D and 6.04 MB/D in 2030." [Chapter 2: Supply, Part III: Analysis of Energy Outlooks, Page 12 of 28; .pdf 163 of 422]