

# **Gas Storage Technology Consortium**

Technical Quarterly Progress Report for  
October 1, 2006 – December 31, 2006

By

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## **ABSTRACT**

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Gas storage is a critical element in the natural gas industry. Producers, transmission and distribution companies, marketers, and end users all benefit directly from the load balancing function of storage. The unbundling process has fundamentally changed the way storage is used and valued. As an unbundled service, the value of storage is being recovered at rates that reflect its value. Moreover, the marketplace has differentiated between various types of storage services and has increasingly rewarded flexibility, safety, and reliability. The size of the natural gas market has increased and is projected to continue to increase towards 30 trillion cubic feet (TCF) over the next 10 to 15 years. Much of this increase is projected to come from electric generation, particularly peaking units. Gas storage, particularly the flexible services that are most suited to electric loads, is crucial in meeting the needs of these new markets.

To address the gas storage needs of the natural gas industry, an industry-driven consortium was created – the Gas Storage Technology Consortium (GSTC). The objective of the GSTC is to provide a means to accomplish industry-driven research and development designed to enhance the operational flexibility and deliverability of the nation’s gas storage system, and provide a cost-effective, safe, and reliable supply of natural gas to meet domestic demand.

This report addresses the activities for the quarterly period of October 1, 2006 through December 31, 2006. Key activities during this time period included:

- Technology transfer meetings:
  - Participating in the American Gas Association Fall Underground Storage Committee/GSTC Technology Transfer Workshop in San Francisco, CA, on October 4, 2006;
  - Organizing and hosting the Fall GSTC Technology Transfer Workshop in Pittsburgh, PA, on November 8, 2006;
- Scheduling and participating in three (3) project mentoring conference calls;
- Soliciting nominations for four Executive Council seats;
- Recruiting and invoicing membership for FY 2007;
- Outreach and communications.

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## **INTRODUCTION**

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Gas storage is a critical element in the natural gas industry. Producers, transmission and distribution companies, marketers, and end users all benefit directly from the load balancing function of storage. The unbundling process has fundamentally changed the way storage is used and valued. As an unbundled service, the value of storage is being recovered at rates that reflect its value. Moreover, the marketplace has differentiated between various types of storage services and has increasingly rewarded flexibility, safety, and reliability. The size of the natural gas market has increased and is projected to continue to increase toward 30 trillion cubic feet (TCF) over the next 10 to 15 years. Much of this increase is projected to come from electric generation, particularly peaking units. Gas storage, particularly the flexible services that are most suited to electric loads, is crucial in meeting the needs of these new markets.

To address the gas storage needs of the natural gas industry, an industry-driven consortium was created – the Gas Storage Technology Consortium (GSTC). The objective of the GSTC is to provide a means to accomplish industry-driven research and development designed to enhance the operational flexibility and deliverability of the nation’s gas storage system, and provide a cost-effective, safe, and reliable supply of natural gas to meet domestic demand. Consortium technology development is conducted in the general areas of well-bore and reservoirs, operations, mechanical, and salt caverns. Consortium members elect an executive council that is charged with reviewing projects for consortium co-funding. Proposals must address improving the production performance of gas storage and provide significant cost sharing. The process of having industry members develop, review, and select projects for funding ensures that the GSTC conducts research that is relevant and timely to the industry. Co-funding of projects using external sources of funding is sought to ensure that GSTC funds are highly leveraged.

## **EXECUTIVE SUMMARY**

This report summarizes the important accomplishments during the period of October 1, 2006 through December 31, 2006. The GSTC was established under contract to The Pennsylvania State University from the U.S. Department of Energy (DOE), National Energy Technology Laboratory (NETL), in June 2004. The agreement provides the Pennsylvania State University with the overarching management responsibilities for the GSTC.

Key activities for this reporting period included the following:

### *Technology Transfer Meetings*

As part of the American Gas Association Fall Underground Storage Committee Meeting, the GSTC organized and participated in a GSTC Technology Transfer Workshop in San Francisco, CA, on October 4, 2006. This meeting offered technology transfer for the southwestern regions of the U.S. Six projects presented technical findings during the one-day meeting.

The GSTC organized and hosted the Fall GSTC Technology Transfer Workshop in conjunction with Pipeline Research Council International (PRCI) and the Stripper Well Consortium (SWC) in Pittsburgh, PA, on November 8, 2006. This meeting offered technology transfer for the northeastern regions of the U.S. Full presentations were given for eight projects, and seven of the new 2006 projects participated in a roundtable discussion.

### *Project Mentoring Conference Calls*

A mentoring team procedure was established during the last quarter. Three conference calls were scheduled and conducted in this quarter, as follows:

- Predicting and Mitigating Salt Precipitation (Correlations Company), October 20, 2006;
- State-of-the-Art Assessment of Alternative Casing Repair Methods (Edison Welding Institute), October 31, 2006, and
- New Comprehensive Inventory Analysis Tool (Schlumberger Consulting Services), November 22, 2006.

### *Executive Council Candidate Solicitation*

The GSTC solicited the nominations for candidates to serve on the Executive Council for 2007-2008. During next quarter the Technical Advisory Committee will vote to elect four (4) representatives to replace the outgoing representatives.

### *Membership Invoicing for 2007*

Invoices for 2007 membership renewals were sent in December 2006 to current members and potential members.

### *Outreach and Communications*

The GSTC assisted with the article entitled “Updating the Roadmap for Natural Gas Storage Research,” Michael Whelan of the PRCI, and Ramon Harris of the National Fuel Supply Corp., on underground natural gas storage which appeared in *GasTIPS*, volume 12, no. 4, pp. 8-10, 2006.

A second GSTC project article, “Management of Produced Waters from Underground Gas Storage,” by James Castle, E.H. Cross, and L.E.Kanagy, appeared in *GasTIPS*, volume 12, No. 4, pp. 11-13, 2006. This project is funded by the GSTC to demonstrate a low-cost and readily implemented method for treating produced water as part of a system integrated with the surface facilities of a gas storage field.

## **EXPERIMENTAL**

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A description of experimental methods is required by the DOE for all quarterly technical progress reports. In this program, Penn State is responsible for establishing and managing an industry-driven underground gas storage consortium. Technology development research awards are made on a competitive basis. Technical reports from the individual researchers are required to contain experimental discussion sections and are submitted to consortium members and the DOE for review. Therefore, this section is not applicable to the Penn State contracted activities.

## **RESULTS & DISCUSSION**

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This report addresses the activities for the reporting period from October 1, 2006 through December 31, 2006. Key activities during this time period included:

- Technology Transfer Meetings:
  - Participating in the American Gas Association Fall Underground Storage Committee/GSTC Technology Transfer Workshop in San Francisco, CA, on October 4, 2006;
  - Organizing and hosting the Fall GSTC Technology Transfer Workshop in Pittsburgh, PA, on November 8, 2006;
- Scheduling and participating in formal project mentoring conference calls for three projects;
- Soliciting nominations for four Executive Council seats;

- Recruiting and invoicing membership for FY 2007; and
- Outreach and communications.

### **Technology Transfer Meetings**

#### **GSTC Technology Transfer Workshop, San Francisco, CA**

The Fall GSTC Technology Transfer Workshop for the southwestern U.S. was held at the Serrano Hotel in San Francisco, CA, in conjunction with the American Gas Association (AGA) Underground Storage Committee Meeting, on October 4, 2006. Presentations were given for six projects as part technology transfer process. Forty-one people attended this meeting. The agenda is attached as Appendix A. Following the meeting, the GSTC administration joined the AGA officials in a tour of the Pacific Gas and Energy underground gas storage fields on McDonald Island, approximately 10 miles west of Stockton, CA.

#### **GSTC Technology Transfer Workshop, Pittsburgh, PA**

The GSTC Technology Transfer Workshop for the northeastern U.S. was held at the Embassy Suites Pittsburgh International Airport Hotel in Pittsburgh, PA, on November 8, 2006. Technology findings were delivered for eight projects and a roundtable discussion of seven of the new 2006 projects was conducted. The meeting was held in conjunction with the Pipeline Research Council International (PRCI's) Underground Storage Technical Planning Committee Meeting and the Stripper Well Consortium (SWC) Technology Transfer Meetings. Forty-two people attended this session. The agenda is attached as Appendix B. The GSTC hosted a joint GSTC/PRCI reception following the close of the formal PRCI meeting. A SWC/GSTC joint reception, exhibit, and poster session was also held on November 8, 2006, following the close of the formal GSTC meeting. Technology was showcased from ten projects from the GSTC and the SWC during the exhibit session.

### **Project Mentoring Conference Calls**

During the last quarter, a formal mentoring team protocol was established whereby the quarterly reports submitted by the PI are posted to the GSTC website; the mentors are



notified and given two weeks to view the reports. At the end of the two weeks, a conference call is arranged among the mentoring team, the GSTC Director, and the PI for the project. Following the call, a record of the key discussion points are drafted by the GSTC administration and distributed for review and comment.

Members of three projects participated in the conference call mentoring sessions during this quarter. For each conference call, anywhere from six to eleven people participated.

The three projects and the date of each conference call were:

- Predicting and Mitigating Salt Precipitation (Correlations Company), October 20, 2006;
- State-of-the-Art Assessment of Alternative Casing Repair Methods (Edison Welding Institute), October 31, 2006, and
- New Comprehensive Inventory Analysis Tool (Schlumberger Consulting Services), November 22, 2006.

### **Executive Council Candidate Solicitation**

The GSTC solicited nominations for four (4) candidates to serve on the Executive Council for 2007-2008. The outgoing representatives are:

- James Philo, Consumers Energy
- Stephen Bergin, ONEOK Gas Storage, LLC
- Ramon Harris, National Fuel Gas Supply Corp.
- Sharri Dunn-Norman, University of Missouri-Rolla

The Executive Council members who will continue to serve until the end of 2007 are:

- Allen Bues, AMEREN Corp.
- Douglas Elenbaas, El Paso Corp.
- Timothy Habovick, Equitrans, LP
- David Burnett, Texas A&M University
- Richard Stocke, Texas Gas Transmission, LLC

### **Membership Invoicing for 2007**

Invoices for 2007 membership renewals were sent in December to current members and potential members. The GSTC will continue to grow and broaden in diversity by recruiting additional members throughout 2007.

## **Outreach and Communications**

The GSTC administration identified and assisted with the preparation of two articles for *GasTIPS*. An article entitled “Updating the Roadmap for Natural Gas Storage Research” on underground natural gas storage, by Michael Whelan of PRCI and Ramon Harris of the National Fuel Gas Supply Corp., appeared in *GasTIPS*, volume 12, no. 4, pp. 8-10, 2006. This article highlights some of the projects the PRCI and the GSTC are funding to assist with the nation’s underground natural gas/hydrocarbon storage facilities.

A second article, “Management of Produced Waters from Underground Gas Storage”, by James Castle, E.H. Cross, and L.E. Kanagy, appeared in *GasTIPS*, volume 12, no. 4, pp. 11-13, 2006. This project is funded by the GSTC to demonstrate a low-cost and readily implemented method for treating produced water as part of a system integrated with the surface facilities of a gas storage field.

## **Planned Activities for Next Reporting Period**

During the next quarter the GSTC will:

- Draft and release the request for proposals (RFP) for 2007;
- Identify the location and meeting date, and secure the facility, for the 2007 Spring Proposal Meeting;
- Announce election results for the four (4) Executive Council seats for 2007-2008;
- Schedule and continue mentoring team conference calls for 2006 projects;
- Continue new member recruitment;
- Draft and release another online newsletter; and
- Continue to update and improve the GSTC web site.

## **CONCLUSIONS**

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During this reporting period, the GSTC held two regional technology transfer meetings, one in the southwest (California region) and one in the northeast (Pennsylvania region) in the October/November time frame. The project mentoring team conference call process began, and three projects participated. The GSTC invoiced current members and potential members for 2007. The GSTC also solicited candidates to serve on the

Executive Council for 2007-2008. Additionally, two articles on GSTC research activities appeared in *GasTIPS*, volume 12, no. 4, 2006. Through these efforts, the GSTC has laid a solid foundation for continued membership growth and industry-relevant technology transfer.

## **REFERENCES**

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A listing of referenced materials is required by the DOE for each quarterly technical progress report. However, this technical progress report for the GSTC did not utilize any reference materials during this reporting period.

**APPENDICES**



### ***GSTC TECHNOLOGY TRANSFER WORKSHOP AGENDA***

#### **Serrano Hotel**

Golden Gate Room  
405 Taylor Street  
San Francisco, CA 94102

<b><i>October 4, 2006</i></b>	
	AGA Underground Storage Committee meeting (open only to AGA Underground Storage Committee Members)
<b>11:00</b>	<b>GSTC Meeting Begins, Opening Comments, Project Presentations</b>
11:15	Demonstration-Scale Constructed Wetland System for Treatment of Produced Waters from Underground Gas Storage <i>Presenter: Clemson University</i>
<b>12:00 – 1:00</b>	<b>Lunch</b>
1:00 – 1:30pm	California Energy Commission Program Overview, Strategic Analysis for Upcoming Year Working with GSTC <i>Presenter: CA Energy Commission</i>
1:35 – 2:20pm	Temperature Effects of Threaded Couplings in Caverns <i>Presenter: RESPEC</i>
2:25 – 2:55pm	State-of-the-Art Assessment of Alternative Casing Repair Methods <i>Presenter: Edison Welding Institute</i>
<b>2:55 –</b>	<b>Break</b>

<b>3:20pm</b>	
3:20 – 4:05pm	Cement Evaluation in Gas Filled Borehole <i>Presenter: Baker Hughes</i>
4:10 – 4:55pm	New Comprehensive Inventory Analysis Tool <i>Presenter: Schlumberger</i>
5:00 – 5:45pm	Gas Storage Field Deliverability Enhancement and Maintenance: An Intelligent Portfolio Management Approach <i>Presenter: West Virginia University</i>
<b>5:45 – 5:55pm</b>	<b>Closing Comments/Meeting Adjourned</b>
6:15pm	Evening reception begins



## ***GSTC TECHNOLOGY TRANSFER WORKSHOP AGENDA***

**Embassy Suites Pittsburgh International Airport Hotel**

550 Cherrington Parkway

Coraopolis, PA 15108

<b>November 7, 2006</b>	
<b>6:15-8:00 pm</b>	<b>PRCI / GSTC Evening Reception and Buffet Dinner</b>
<b>November 8, 2006</b>	
<b>7:15 am</b>	<b>Continental Breakfast and Registration</b>
8:00 – 8:35	Opening comments
8:35 – 9:10	New Comprehensive Inventory Analysis Tool <i>Presenter: Schlumberger Consulting Services</i>
9:10 – 9:45	Smart Gas: Using Chemicals to Improve Gas Deliverability <i>Presenter: Correlations Company</i>
9:45 – 10:20	Wellbore Cement Bond Integrity <i>Presenter: UTX Austin</i>
<b>10:20 – 10:50</b>	<b>Break</b>
10:50 – 11:25	Demonstration-Scale Constructed Wetland System for Treatment of Produced Waters from Underground Gas Storage <i>Presenter: Clemson University</i>
11:25 – 12:00	Temperature Effects of Threaded Couplings in Caverns <i>Presenter: RESPEC</i>
<b>12:00 – 1:00</b>	<b>Lunch</b>

<b>1:00 – 2:30</b>	<b>Roundtable</b>
	<p><i>Roundtable Discussion for projects funded for 2006 (~15 minutes each)</i></p> <p>Brine String Integrity-Case History Survey and Model Evaluation <i>PB Energy Storage Services, Inc.</i></p> <p>Predicting and Mitigating Salt Precipitation <i>Correlations Company</i></p> <p>Technology Feasibility Evaluation of Non-Intrusive Optical Detection, Monitoring and Preliminary Characterization of Casing Cement Leaks for Gas Wells <i>URS Group, Inc.</i></p> <p>Effects of Tensile Loading on the Remaining Strength of Corroded Casing <i>Kiefner and Associates, Inc.</i></p> <p>State-of-the-Art Assessment of Alternative Casing Repair Methods <i>Edison Welding Institute</i></p> <p>Storage Field Wellbore Flow Data Containing Water and Hydrates <i>Colorado Engineering Experiment Station, Inc.</i></p>
<b>2:30 – 3:00</b>	<b>Break</b>
3:00 – 3:35	Scale Remediation Using Sonication: Pre-Commercial Test Project <i>Presenter: TechSavants</i>
3:35 – 4:10	Cement Evaluation in Gas Filled Borehole <i>Presenter: Baker Hughes</i>
4:10 – 4:45	Gas Storage Field Deliverability Enhancement and Maintenance: An Intelligent Portfolio Management Approach <i>Presenter: West Virginia University</i>
<b>4:45 - 5:00</b>	<b>Closing Comments/Technical Meeting Adjourned</b>
6:15	SWC / GSTC Exhibits and Buffet Dinner