

7<sup>th</sup> Quarterly Technical Progress Report for the  
Gas Storage Technology Consortium

Quarterly Report for the Period  
04/01/2005 – 06/30/2005

By

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Co-Investigator

Work Performed Under DOE Cooperative Agreement  
DE-FC26-03NT41779

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Submitting Organization  
The Pennsylvania State University  
The Energy Institute  
C211 Coal Utilization Lab  
University Park, PA 16802

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## **ABSTRACT**

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 critical in meeting the needs of these new markets.

In order 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 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 April 1, 2005 through June 30, 2005. During this time period efforts were directed toward 1) GSTC administration changes, 2) participating in the American Gas Association Operations Conference and Biennial Exhibition, 3) issuing a Request for Proposals (RFP) for proposal solicitation for funding, and 4) organizing the proposal selection meeting.

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## **EXECUTIVE SUMMARY**

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 critical in meeting the needs of these new markets.

In order 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 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.

## **EXPERIMENTAL**

This project is a consortium between industries, academia, and the U.S. Department of Energy. As a consortium, there are no experimental results to report.

## **RESULTS and DISCUSSION**

This report addresses the activities for the quarterly period of April 1, 2005 through June 30, 2005. During this time period efforts were directed toward 1) GSTC administration changes, 2) issuing a Request for Proposals (RFP) for proposal solicitation for funding, 3) participating in the American Gas Association Operations Conference and Biennial Exhibition, and 4) organizing the proposal selection meeting.

On March 29, 2005, The Pennsylvania State University announced administration changes to the GSTC. In an effort to improve the administrative functions of the Gas Storage Technology Consortium (GSTC), The Pennsylvania State University has reorganized and expanded its management team. The new administrative team will provide additional opportunities for growth and development while assisting the GSTC Membership fulfill its primary goal: to provide a means to accomplish industry-driven, research and development designed to enhance 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.

Mr. Joel Morrison was appointed Consortium Director, and he will oversee the day-to-day operations of the GSTC. Dr. Alan Scaroni, Associate Dean for Graduate Education and Research for the College of Earth and Mineral Sciences will serve as Principal Investigator (PI) on the federal cooperative agreement. Ms. Susan Lavan will continue to serve as the primary contact on contractual matters (official announcement on Appendix A).

On April 18, 2005, the GSTC released a 2005 Request for Proposals (RFP), with a submission deadline of July 20, 2005. The proposals received in response to this RFP will be reviewed at the upcoming proposal selection meeting (official RFP on Appendix B).

The GSTC participated in the American Gas Association Operations Conference & Biennial Exhibition on April 28, 2005. The GSTC took this opportunity to increase name-awareness, present a general overview of the Consortium and to announce upcoming events. The conference drew approximately 1300 attendees.

The GSTC is organizing the next proposal meeting, which is scheduled to take place on August 30-31, 2005 at the Embassy Suites Pittsburgh International Airport. The Principal Investigators of the proposed projects will provide the membership with a 20-minute presentation, followed by a 5-minute question and answer session. Additionally, the audience will hear technology updates from the Principal Investigators whose projects were selected for funding in 2004 and 2005.

## **CONCLUSIONS**

In order to address the gas storage needs of the natural gas industry, an industry-driven consortium has been 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 operational flexibility and deliverability of the Nation's gas storage system, and to provide a cost effective, safe, and reliable supply of natural gas to meet domestic demand. To accomplish this objective, the project is divided into three phases that are managed and directed by the GSTC Coordinator. Base funding for the consortium is provided by the U.S. Department of Energy (DOE).

During this time period efforts were focused on participating in the American Gas Association Operations Conference and Biennial Exhibition, issuing a Request for Proposals (RFP) for proposal solicitation for funding, and organization of the proposal selection meeting.

## **REFERENCES**

There are no references to include with this report.

## **APPENDICES**



**To: Gas Storage Technology Consortium Membership**

**From: Joel L. Morrison**

**Re: GSTC Administration Changes**

**Date: March 29, 2005**

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In an effort to improve the administrative functions of the Gas Storage Technology Consortium (GSTC), The Pennsylvania State University has reorganized and expanded its management team. The new administrative team will provide additional opportunities for growth and development while assisting the GSTC Membership fulfill its primary goal: to provide a means to accomplish industry-driven, research and development designed to enhance 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.

As the newly appointed Consortium Director, I will oversee the day-to-day operations of the GSTC. Dr. Alan Scaroni, Associate Dean for Graduate Education and Research for the College of Earth and Mineral Sciences will serve as Principal Investigator (PI) on the federal cooperative agreement. Ms. Susan Lavan will continue to serve as the primary contact on contractual matters. We are working with our program sponsor, the Department of Energy's National Energy Technology Laboratory (NETL), to improve the GSTC proposal solicitation/ evaluation process, to improve and expedite the process on getting the GSTC subcontracts in place once projects are approved for funding, and to improve the GSTC communications. With that in mind, I am pleased to inform you of some of the activities which we are currently working on:

- 1) The end date of the four projects awarded in 2004 will be extended to December 31, 2005 to permit these initial projects to be completed if requested by the PI.
- 2) The GSTC By-Laws will be modified to assure that the Consortium governance in place is similar to other NETL sponsored industrial consortia.
- 3) The newly funded 2005 project awards are now in processing and the start date will be moved up to May 1 rather than the previously targeted date of September 2005. The end date for these proposals will be December 31, 2006.
- 4) NETL has approved, and is in the process of releasing, all of the anticipated GSTC program monies to allow for an additional round of funding in 2005. We expect to have approximately

\$750,000 to co-fund additional projects. In future years, the GSTC will consolidate its funding cycle to one per year that will occur in the Spring.

- 5) Penn State will be releasing the GSTC request-for-proposal no later than April 18 with a proposal close date of August 18, 2005.
- 6) We are currently organizing a fall meeting in which we will review some of the existing GSTC projects (most likely the 2004 projects) and review new proposals seeking funding. We are anticipating this will be a two-day meeting in mid- to late-September.

I look forward to working with the GSTC membership in the upcoming weeks as these changes and activities are implemented. If you have any specific ideas on how to make the GSTC more responsive to industry needs, I encourage you to contact me at (814-865-4802 or by email [gstc@ems.psu.edu](mailto:gstc@ems.psu.edu)). I assure you that your comments will be discussed with the new administrative team, that each member voice will be counted equally, and that we value your input.

Sincerely,

**Joel L. Morrison**

Cc:

Dr. Alan Scaroni, Associate Dean for Graduate Education and Research, College of EMS  
Mr. Robert Killoren, Associate Vice President For Research, Penn State University  
Dr. Daniel Discoll, Contracting Officer Representative, NETL  
Ms. Susan Lavan, Associate Director for Grants and Contracts, College of EMS  
Dr. Harold Schobert, Director, The Energy Institute  
Ms. Natalie Novak, Communications, The Energy Institute

**THE  
GAS STORAGE TECHNOLOGY  
CONSORTIUM**

**Request for Proposals  
For 2005**

**Submission Deadline:  
July 20, 2005 (4:00 pm EST)**

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# 2005 REQUEST FOR PROPOSALS FOR THE GAS STORAGE TECHNOLOGY CONSORTIUM

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## APPLICANT ELIGIBILITY

Competition is open to all current Full and University Members of the Gas Storage Technology Consortium (GSTC). The GSTC Executive Council will not review proposals without a fully executed membership agreement in place. New memberships are accepted throughout the year. Membership information and applications can be found on the GSTC website at <http://www.energy.psu.edu/gstc>. Proposals received from members whose dues are not current, or whose membership agreement is not fully executed will be returned without review.

University employees eligible to serve as principal investigators for proposals submitted to the consortium are:

- Full-time regular tenure-track or regular faculty, and;
- Persons with the title of Research Assistant, Associate, Scientist or Senior Scientist.

## INSTITUTION COMMITMENT

Each proposal must be signed by an official of the company or university who is authorized to commit the company/institutional resources to the project. The name of the Applicant's authorized official shall be entered in the appropriate space shown on the cover page (Attachment B).

## RESEARCH FOCUS AREAS

The mission of the GSTC is to assist in the development, demonstration and commercialization of technologies to improve the integrity, flexibility, deliverability, and cost-effectiveness of the nation's underground natural gas/hydrocarbon storage facilities. Projects selected for funding will be based on those that best accomplish the Consortium goals. Proposals in this funding cycle are being solicited from GSTC Full and University Members in the following focus areas:

### ***Mechanical***

Examples include, but are not limited to, investigations that address pipe and well casing integrity, the improvement of downhole leak detection, the development of new casing evaluation tools, the development/ evaluation of advanced metallurgy/ materials for use in well casing and casing repairs, cement bonding, delta-temperature effects on casing, use of "smart pipe" concepts for well casing, corrosion mitigation and quantification, removal techniques for scales, fines, salts, asphalts, and techniques to remediate damage through stimulation/ recompletion/ workover of existing wells.

### ***Well-bore and Reservoir***

Examples include, but are not limited to, investigations that address reservoir characterization, consider new approaches to modeling of gas cycling and inventory verification, develop techniques to maintain and improve injectivity and deliverability, and expand existing aquifers and reservoirs.

### ***Operations***

Examples include, but are not limited to, investigations that address handling of produced water, techniques to minimize/mitigate water encroachment, cost effective multiphase wellhead measurement systems, design criteria for facility sizing to meet variable demand, and best practices associated with product quality shipped/delivered. In addition, applied research into the development/ evaluation of low-cost salt inhibitors to mitigate salt precipitation within the reservoir, well, and pipeline systems are being sought.

### ***Salt Cavern***

Examples include, but are not limited to, investigations that address salt cavern stability and growth rates, interconnectivity and best practices techniques for management of caverns.

## **AWARDS**

Awards will be made on an annual basis. Subcontracts will be issued from The Pennsylvania State University to the successful applicant. The period of performance for the 2005 funding cycle will be from October 1, 2005 to September 30, 2006. Members will be permitted to submit future proposals to extend the proposed work; however, this must be performed on a year-to-year basis.

If additional documentation is required prior to issuance of a subcontract, a delay in submission of the October 1 start date may occur.

## **SUBMISSION**

The deadline for receipt of SWC proposals is **July 20, 2005 by 4 PM (Eastern Standard Time)**. Proposals received after the deadline will be returned to the applicant. Two signed paper copies are required plus one electronic copy in PDF format. The full proposal and a separate copy of the public abstract should be saved in PDF format on a CD or ZIP disk and submitted with the paper copies.

In addition to the proposal, each applicant is required to provide the GSTC Membership a nominal 20-minute presentation at the GSTC Fall Meeting. The GSTC will hold its 2005 Fall Meeting on August 30-31, 2005 in Pittsburgh, Pennsylvania. The 20-minute presentation will consist of a 15-minute presentation focused on the technical and budget aspects of the proposed project and 5-minute question and answer session. **The presentation is due at the time of the proposal submission.** The presentation format should be either in the form of an electronic PowerPoint presentation or in the form of overhead transparencies. The proposal packet should be submitted to the following address:

Mr. Joel L. Morrison  
Director, Gas Storage Technology Consortium  
The Pennsylvania State University  
C-211 Coal Utilization Laboratory  
University Park, PA 16802-2323

## **PROPOSAL FORMAT**

Proposals should be formatted to fit standard 8 x 11" letter size paper with 1" margins, single-spaced, using 12 point font and be consecutively numbered at the bottom on each page.

## **SECTIONS OF THE PROPOSAL**

The proposal shall consist of the following sections in order.

***Proposal Checklist***                      See Attachment A

The proposal checklist is required to ensure the proposal submittal is complete and that the applicant is eligible for Consortium funding consideration.

***Public Cover Page***                      See Attachment B

The cover sheet along with the public Executive Summary will be distributed to the GSTC membership as part of the proposal evaluation process.

***Table of Contents***                      One (1) page maximum

***Public Executive Summary***                      One (1) page maximum

Provide a one-page summary of the proposed research. The executive summary should not contain any propriety or business sensitive data because summary will be distributed to the GSTC membership along with the proposal cover sheet. An electronic copy of the executive summary is required. The summary will be posted to the GSTC and/or program sponsor websites if the Consortium funds the proposal. The summary should be written in the third person and include a statement of objectives and methods to be employed. It should be informative to other persons working in related fields and understandable to a scientifically or technically literate lay reader.

***Technology Overview***            One (1) page maximum

The technology overview section of the proposal enables the applicant to discuss how their proposed technology is different from existing technology that may be available within the industry. At a minimum the following should be discussed:

- Is the technology covered by existing patents, and if so, what are they; and
- How does the proposed technology differ from existing technology?

***Project Description***            Five (5) page maximum

The main body of the proposal should outline the plan of work, including the broad design of activities to be undertaken. At a minimum, the following should be discussed:

- Statement of the problem;
- Has the proposed work, or a portion of the proposed work, been funded elsewhere;
- Objectives and expected significance of the research;
- Statement of the work plan;
- Relation of the proposed work to comparable work in progress;
- Description of available facilities and major items of equipment available for the work; and reference citations.

***Project Schedule***            One (1) page maximum

A plan which establishes the time schedule for accomplishing the work. The plan should include major milestones of the project in bar chart format and should cover the complete period of performance.

***Anticipated Results***            Two (2) page maximum

Discuss how the project will improve the integrity, flexibility, deliverability, and cost-effectiveness of the nation's underground natural gas/hydrocarbon storage facilities. Discuss the commercial viability of the proposed project. Identify specific groups in the commercial sector that may use the project results.

***Budget***            See Attachment C

The submission of a reasonable budget is an important part of the proposal. Your budget may request funds under any of the categories listed on Attachment C, as long as the item and amount are considered necessary to perform the work. Proposed equipment expenditures are permitted; but their purchase must be justified. Ownership of the equipment vests with the Pennsylvania State University and is reported to DOE on an annual basis. It is expected that the participants will already have most of the necessary permanent equipment to conduct the research. The majority of the funding is intended to support research activities. Permanent equipment purchases are discouraged and will be considered during the proposal evaluation. After approval by the Executive Council, but prior to purchase, written approval must be obtained by the Department of Energy for purchase of equipment items that have a life of 2-years or more and a cost of \$5,000 or more.

### ***Cost-Share Commitments***

A minimum of 40% cost-share is required for each project that is selected by the GSTC for funding. The 40% cost-share is calculated as 40% of the proposed project (i.e. the sum of the recipient's allowable cost-share and the GSTC share equals the total allowable costs of the project). Cost-share, which may be in the form of cash and third party in-kind, is acceptable as part of the match provided it meets the following criteria:

- Are verifiable, necessary and reasonable for proper and efficient accomplishment of the project;
- Are incurred within the project performance period. Previously expended research development, or exploration costs are unallowable.
- Are not included as contributions for any other federal project, are not paid by the Federal Government under another award, and otherwise allowable in accordance with Federal cost principles and DOE regulations governing cost sharing.
- The value of patents and data contributed to the project is unallowable as cost sharing.
- The value of salaries or wages of 1<sup>st</sup> party personnel directly involved in the project are allowed as cost share.

All cost-share commitments must be supported by appropriate documentation. Third parties proposing to provide all or part of the required cost share must include a letter from the third party stating its commitment to provide a specific minimum dollar amount of cost-share. The letter should also identify the type of proposed cost share (e.g., cash, services) to be contributed. Letters must be signed by the person authorized to commit the expenditure of funds and be provided in PDF format. Failure to provide appropriate documentation can result in the proposal being returned without review.

### ***Biographical Sketches***

One (1) page per person maximum

Vitae of key personnel involved in the project must be included and should include educational background, professional experience, research interest, honors, professional activities and relevant publications.

### ***Collaborative Work***

All collaborations with individuals not included in the budget should be described and documented with a letter from each collaborator.

### ***Other***

Letters of support from outside sources are encouraged, but not mandatory.

## **TREATMENT OF PROPRIETARY INFORMATION**

Privileged or confidential commercial or financial information that the applicant does not want disclosed to the public or used by the Government for any purpose other than application evaluation, should be specifically identified by page on the proposal cover sheet.

## **PROPOSAL EVALUATION PROCESS**

The GSTC Executive Council will review and recommend projects for GSTC funding. The GSTC Director will notify all applicants within thirty (30) days of the GSTC Executive Council meeting, by letter, of the final decision regarding their proposals. The decision of the GSTC is final and not subject to reconsideration or appeal.

## **ADDITIONAL INFORMATION**

Additional questions should be forwarded to the GSTC Director. Questions should be submitted via e-mail to [gstc@ems.psu.edu](mailto:gstc@ems.psu.edu) or contact Mr. Joel Morrison at (814) 865-4802.

## **ATTACHMENT A – PROPOSAL PACKET CHECKLIST**

I certify that:

- I am a current Full member of the GSTC
- I am a current University member of the GSTC

Project Title: \_\_\_\_\_

Principal Investigator (PI): \_\_\_\_\_

To assure that your application is complete, please complete and paper clip (one copy only) the proposal packet checklist to the cover sheet of the original (signed) copy of the proposal. Be sure the following items are included in the following order.

- \_\_\_\_\_ Public Cover page completed and signed by PI and authorized representative
- \_\_\_\_\_ Public Executive Summary (one page maximum)
- \_\_\_\_\_ Technology Overview (one page maximum)
- \_\_\_\_\_ Project Description (five page maximum)
- \_\_\_\_\_ Project Schedule (one page maximum)
- \_\_\_\_\_ Anticipated Results (two page maximum)
- \_\_\_\_\_ Budget (Using Attachment C budget template)
- \_\_\_\_\_ Cost-Share Commitments
- \_\_\_\_\_ Biographical Sketches (one page/ person maximum)
- \_\_\_\_\_ Project Team (one page maximum)
- \_\_\_\_\_ Letters of Support
- \_\_\_\_\_ Two signed originals and one electronic copy of the proposal in PDF Format are due to the GSTC Consortium no later than 4:00 PM (EST) on July 18, 2005
- \_\_\_\_\_ One electronic copy of the Public Executive Summary in PDF Format
- \_\_\_\_\_ Proposal presentation (15 minute presentation, PowerPoint encouraged)

**ATTACHMENT B – PROPOSAL COVER SHEET**

Proposal Submitted to: Mr. Joel Morrison  
Director, Stripper Well Consortium  
The Pennsylvania State University  
C-211 Coal Utilization Laboratory  
University Park, PA 16802-2308

Proposal Deadline: July 20, 2005 (4:00 PM EST)

Date of Submission \_\_\_\_\_

Title of Proposal: \_\_\_\_\_  
\_\_\_\_\_

Company Name: \_\_\_\_\_

Principal Investigator: \_\_\_\_\_

Address: \_\_\_\_\_  
\_\_\_\_\_

Other Participants: \_\_\_\_\_

Amount Requested from SWC \$ \_\_\_\_\_

Cost Share Commitments Cash \$ \_\_\_\_\_  
(Minimum 30% Required)

In-Kind \$ \_\_\_\_\_

Total Project Costs \$ \_\_\_\_\_

PROPRIETARY INFORMATION: Does this proposal contain Proprietary or Confidential Information?

\_\_\_\_\_ NO                      \_\_\_\_\_ YES (if yes, complete box below)

***Notice of Restrictions on Disclosure and Use of Data***

The data contained on pages \_\_\_\_\_ of this proposal are submitted in confidence and contain privileged or confidential commercial and/or financial information. Such data may be used or disclosed only for evaluation purposes. If funded, the Government would have the right to use or disclose data from this project to the extent provided the DOE/PSU Cooperative Agreement. This restriction does not limit the Government's right to use or disclose data obtained without restrictions from any source, including the proposer.

Submitted by:

Approved by:

\_\_\_\_\_  
Signature of PI

\_\_\_\_\_  
Authorized Representative

# **ATTACHMENT C – BUDGET**

Name of PI: \_\_\_\_\_

**Salaries and Wages**

List individually all personnel identified in the proposal.

Include title and percent of effort

NOTE: The use of undergraduate and graduate students is encouraged, and appropriate.

The basis for proposed percent of effort or labor hours should be identified (historical hours, engineering estimates).

**REQUESTED GSTC** \_\_\_\_\_

**COST-SHARE**

\$ \_\_\_\_\_

\$ \_\_\_\_\_

**Fringe Benefits**

\$ \_\_\_\_\_

\$ \_\_\_\_\_

**Materials and Supplies**

List types required and estimated costs.

NOTE: State whether amounts proposed are based on catalog prices or other cost estimating.

\$ \_\_\_\_\_

\$ \_\_\_\_\_

**Equipment**

Items exceeding \$5,000 and 1 year's useful life are defined as permanent equipment. List item and dollar amount for each amount. Justify and/or provide quotation.

\$ \_\_\_\_\_

\$ \_\_\_\_\_

**Travel (see Note 4)**

State the type and extent of travel and its relation to the project. Itemize by destination and estimated costs.

\$ \_\_\_\_\_

\$ \_\_\_\_\_

**Publication/Information Dissemination**

Estimate costs of documenting, preparing, publishing and sharing research findings. Show estimates.

\$ \_\_\_\_\_

\$ \_\_\_\_\_

**Other Direct Costs**

Itemize and justify. (\*See note below)

\_\_\_\_\_

\$ \_\_\_\_\_

\$ \_\_\_\_\_

\_\_\_\_\_

\$ \_\_\_\_\_

**Facilities and Administration (F&A)**

Specify current rate(s) and base.

Note: A copy of the negotiated agreement should be included with the proposal. If none exists, a disclosure of the contents of the rate should be made.

\$ \_\_\_\_\_

\$ \_\_\_\_\_

TOTALS

\$ \_\_\_\_\_

\$ \_\_\_\_\_

**Attach up to two additional pages of justification covering all items.**

**\*NOTES:**

- 1) If more than 5% of project cost is from SWC funding the contracting organization must be a Full or University Member of the GSTC.
- 2) Subcontracts included in proposal (third party agreements) to current consortium members must be less than 50% of the requested GSTC funding. Budgets and work statements from each subcontractor, in the format above, must be included in proposal.
- 3) Fees or profits will not be paid on any award resulting from this solicitation. Nor can fee or profit be considered as cost-sharing.
- 4) The GSTC will host two technology transfer workshops. Recipients of GSTC funding are required to provide a presentation on the status of their project at these meetings. The costs of attending these GSTC technology transfer meeting are to be included in the travel budget.