

**FACT SHEET**

**I. PROJECT PARTICIPANTS**

**A. Prime Participant:**

General Electric Company, GE Energy

**B. Sub-Award Participant:**

General Electric Company, Global Research Center

**II. PROJECT DESCRIPTION**

**A. Objective(s):**

The objective of this project is to design and develop a fuel flexible (coal derived hydrogen or syngas) gas turbine for IGCC and FutureGen type applications that meets DOE turbine performance goals. The overall DOE Advanced Power System goal is to conduct, by 2010, the research and development (R&D) necessary to produce coal-based IGCC power systems with high efficiency (45-50% (HHV)), near-zero emissions (less than 3 ppm<sub>v</sub> NO<sub>x</sub> @ 15% O<sub>2</sub>) and competitive capital cost (< \$1000/kW).

**B. Relevancy**

This program directly addresses the DOE goals, and thereby supports the use of US domestic coal reserves for power generation with high efficiency, near-zero emissions, and the capture or elimination of CO<sub>2</sub> emissions. This program contains technology advancements needed to overcome the limitations in existing IGCC gas turbines and support FutureGen type plants with high-hydrogen fuel powering the gas turbine. Technology advances, combined with application of technologies currently in use on GE's 7FB natural gas fired gas turbine, and with technologies being developed for near-term upgrades, will enable GE to support the DOE goals.

**C. Project Summary:**

This program is broken into two phases. In Phase I, a conceptual design of the turbines that will achieve DOE goals for 2010, FutureGen (2012), and 2015 will be developed. R&D efforts in Phase I will position the program to perform detailed design work of components and systems in Phase II.

**D. Period of Performance**

Phase I – October 1, 2005 to September 30, 2007 (2 years)

Phase II – October 1, 2007 to September 30, 2011 (4 years)

**III. PROJECT COSTS**

<b><u>Phase I</u></b>	\$11,154,000	<b><u>Phase II*</u></b>	\$54,237,999
<b>A. DOE Costs</b>	\$7,807,800	<b>A. DOE Costs</b>	\$37,966,599
<b>B. Prime Cost Sharing</b>	\$3,346,200	<b>B. Prime Cost Sharing</b>	\$16,271,400
<b>C. Partner Cost Sharing</b>	NA	<b>C. Partner Cost Sharing</b>	NA

\* Note: This is an estimate only – a more detailed budget for Phase II will be provided before the end of Phase I.

#### **IV. MAJOR ACCOMPLISHMENTS SINCE THE BEGINNING OF THE PROJECT**

<b><u>Date</u></b>	<b><u>Accomplishment</u></b>
12/2005	First round of NO <sub>x</sub> entitlement testing and flameholding experiments completed at GE Global Research Center using high hydrogen fuels. <i>[Completed Quarterly Progress Indicator of 4Q2005: Conduct preliminary NO<sub>x</sub> entitlement tests and preliminary flame holding tests using current hardware.]</i>
2/2006	Syngas fuel sampling was performed at an operating IGCC powerplant to help characterize the IGCC environment. This test was conducted while the turbine was running under steady state conditions and complements earlier fuel sampling work done under a DOE program during start-up conditions.
3/2006	IGCC plant and turbine performance simulation models for the 2010, 2012 and 2015 turbines were constructed. <i>[Completed Quarterly Progress Indicator of 1Q2006: Prepare IGCC Syngas and Hydrogen fueled Gas Turbine System Performance Models.]</i>
3/2006	<b>Submitted the Research and Development Implementation Plan (RDI Plan)</b> – This major Phase I deliverable outlines the specific approach GE will pursue to achieve DOE's goals for the program. This RDI Plan provides activity level descriptions of planned work including specifically how each activity will contribute to the program goals, what concepts and configurations will be evaluated, the proposed research approach and how it will be validated, technical barriers, and estimated cost for each activity.
6/2006	A suite of candidate materials and coatings was identified and material samples were ordered for future testing. <i>[Completed Quarterly Progress Indicator of 2Q2006: Prepare specimens for material testing.]</i>
6/2006	A study on the impact of carbon sequestration on plant performance was completed. The study looked at IGCC performance of the gas turbine cycle design cases with 90% carbon removal.
9/2006	Testing was successfully performed on an advanced combustion concept over a range of conditions. Results showed strong operability and NO <sub>x</sub> levels significantly lower than obtained with previous diffusion combustion technology. <i>[Completed Quarterly Progress Indicator of 3Q2006: Test first subscale combustion concept.]</i>
12/2006	The first full head end test for this program on high hydrogen fuels was completed at the GTTL in Greenville.
12/2006	At this point, 25 invention disclosures have been filed as part of this program. This demonstrates the level of novel approaches being considered to solve the challenging goals of the DOE program.

## V. MAJOR ACTIVITIES PLANNED DURING THE NEXT 18 MONTHS

### Planned Activity

#### Combustion

- Experimental evaluation of axial staging, flame visualization, exhaust gas recirculation, steam injection will continue at the Global Research Center through the end of Phase I.
- Modeling efforts to improve dynamics and flameholding will continue.
- Full scale testing at the GTTL in Greenville will commence shortly and will continue through the end of Phase I.
- Downselect to two combustion concepts most likely to achieve DOE goals at end of Phase I.

#### Turbine/Aero

- Sealing testing fixture to evaluate baseline leakage and investigate design improvements will be utilized.
- Continue to leverage internal technology development efforts for larger last stage buckets, including an aero rig test in 2007 and planning for a Phase II wheelbox test.
- A conceptual flowpath for the turbine will be evaluated in the near term.

#### Materials

- Testing on candidate materials and coating systems will begin shortly and continue through the end of Phase I.
- Development and validation of impact and erosion test for EBCs.
- Development of improved CMC/EBC systems in preparation for future engine test opportunities.

#### Systems

- Continue to evaluate performance impact CO2 compression & sequestration at IGCC Plant Level
- Continue plant level analysis of exhaust gas recirculation for a variety of cases.
- Continue iteration on plant level models for 2010, 2012, and 2015 turbines based on interaction with combustion and turbine teams.
- Evaluate additional technology improvements and new ideas as needed.

## VI. ISSUES

No issues have been identified.