

## FACTS SHEET

### Fuel Flexible Combustion for Coproduction Plant Applications

I.) Project Participants:

Prime Participant: General Electric

Sub-award Participant: Georgia Tec

II.) Project Description:

A. Objective: Develop a multi-fuel low emission combustor for Vision 21 plant and gas turbine system applications. Combustion system development includes the development of combustion modeling tools for low Btu fuel compositions. The combustion system is targeted at Vision 21 coproduction plant operating conditions & fuels. A system model of the proposed Vision 21 plant design will be constructed to predict overall plant efficiencies.

B. Background/Relevancy: A primary goal of the Vision 21 program is the development of high-efficiency, low-emission energy plants (Vision 21 plants) that produce electric power, transportation fuels, and / or chemicals from fossil fuel feedstocks. Achieving the goals of the Vision 21 program will require significant advances in underlying technologies, including fuel-flexible combustion systems that must overcome significant challenges posed by variable composition, multi-stream fuels.

Market leading combustion systems produce low emissions through lean premixing of the fuel with air and through the addition of diluents. Existing premixing systems are restricted by their premixing times and fuel autoignition temperatures. They are also restricted by their susceptibility to combustion dynamics with changes in heating value. Diluent enhanced diffusion flames can operate with fuels not acceptable for premixed systems but currently produce higher emissions and are also inflexible to changes in heating value.

C. Period of Performance: June, 2003 – June, 2006

D. Project Summary: The aim of this program is the demonstration of a combustion technology which will overcome the limitations of current syngas gas turbine combustion systems and enable improved Vision 21 plant designs. The ability to handle low-heating value syngas, better use fossil fuels, reduce process waste, and produce clean and efficient power are the benefits of this type of system.

The program will first characterize existing processes and resulting offgas stream compositions to define fuel specifications from existing processes. Forecast improvements in plant design and their impact on fuel stream compositions will then be modeled. A system model of a Vision 21 plan incorporating a fuel-flexible combustor concept will be produced at the end of the program.

Combustor development will begin with a characterization of the limitations of existing combustor design approaches. Flame extinction limits as a function of fuel composition will also be measured to develop improved combustion models. Reduced order sub-models for CFD design tools will then be generated. Two combustor prototypes incorporating appropriate emerging technologies will be developed and tested for extended fuel performance range. The leading design will be refined and evaluated against the needs of a fuel-flexible Vision 21 production plant.

III.) Project Costs:

- A. DOE Costs: The DOE is providing funds for this project to cover 71% of the costs.  
Total: \$1,542,908
- B. Prime Contractor Cost Sharing: The General Electric Company, as prime contractor, is providing a 28% cost share for this project.  
Total: \$600,000
- C. Partner Cost Sharing: Georgia Tec, a project partner, is providing 1.7% of the costs.  
Total: \$36,032

IV.) Major Accomplishments Since the Beginning of the Project:

- Documented fuel compositions and injection requirements of existing processes, September 2003.  
Reviewed existing syngas station fuel specifications, results of conceptual studies, and business inquiries. Compiled syngas composition and properties database with gas turbine operating condition database. Completed statistical analysis of properties.

V.) Major Accomplishments Planned in the next 6 Months:

- Define fuel characterization process, September 2003 - March 2004.  
Measurement of extinction limits of flames as a function of fuel composition can be accomplished in a variety of ways. The experimental process for performing these characterizations will be defined and validated experimentally.

VI.) Major Accomplishments Planned in the next 6 to 18 Months:

- Complete first characterization of low Btu fuel, June 2004.  
Using the flame extinction measurement facility, the characteristics of the first low Btu fuel stream will be measured. This milestone will initiate the construction of a library of flame characteristics and their dependence on fuel composition.
- Complete definition of combustor performance design space, September 2004.  
An evaluation of available technologies and their capabilities will be rated against the requirements of the fuel flexible combustor. An optimal combustor design space will be defined for the proposed fuel-flexible combustor.

VII.) Major Milestones For Entire Project:

- Define preliminary combustor design requirements. 6/2003 -12/2003

- Construct product quality scorecard. 10/2003 – 9/2004
- Define detailed combustor requirements. 1/2004 – 12/2004
- Downselect to leading combustor concept. 7/2004 – 6/2005
- Make final performance estimates for Vision 21 Plant. 7/2005 -6/2006
- Validated conceptual design. 7/2005 -6/2006

VIII.) Issues:

IX.) Attachments:

- A. Schematic: None at this time.
- B. Project Schedule:

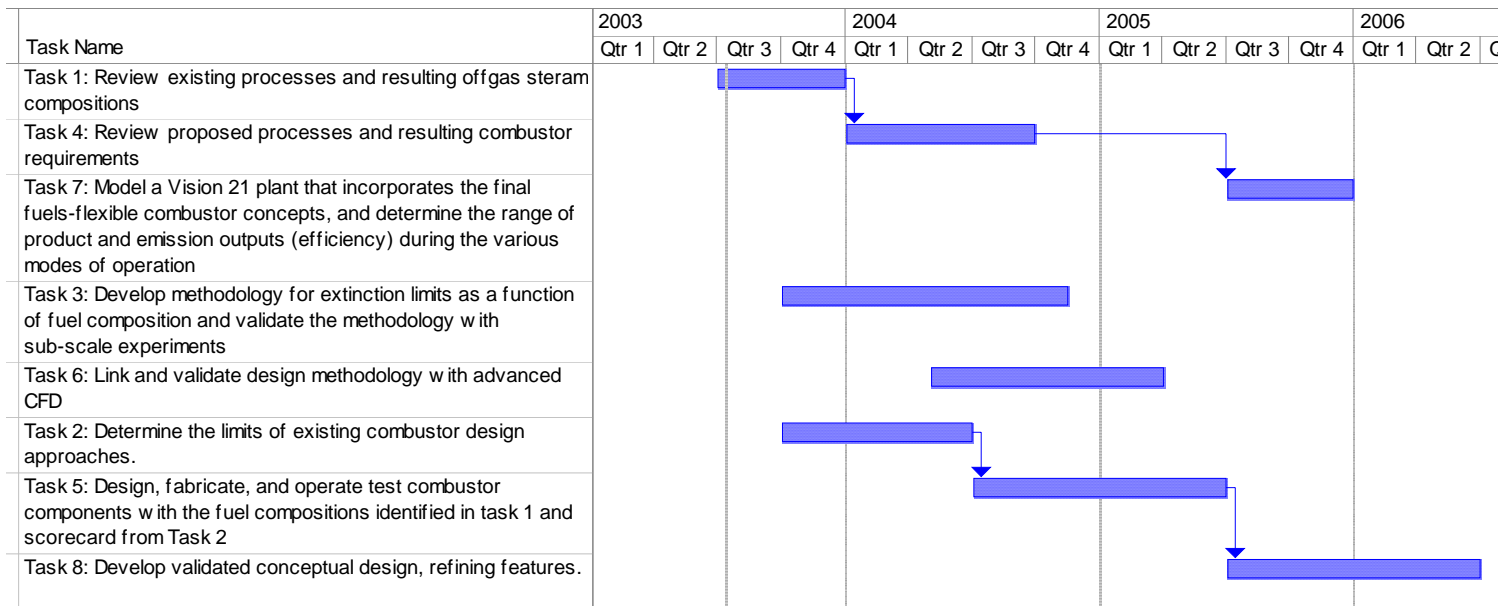


Figure 1: Project Schedule