ADMINISTRATIVE INFORMATION

1. **Project Name:** Development/Demonstration of an Advanced Oxy-Fuel Fired Front End System

2. **Lead Organization:** Owens Corning
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4. **Project Partners:**
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5. **Date Project Initiated:** August 2003

6. **Expected Completion Date:** August 2005

PROJECT RATIONALE AND STRATEGY

7. **Project Objective:** The goal of this project is to develop and demonstrate an oxy-fuel combustion system for a glass furnace front end that will reduce gas consumption by approximately 70%, creating an operating savings of approximately 40 %, and significantly reduce NOx and CO2 emissions.

8. **Technical Barrier(s) Being Addressed:** Glass melters have successfully used oxy/fuel burners with outputs of 2-5 MM Btu/hr. These burners have correspondingly high gas and oxygen flows that provide cooling to the burner. Development of a front end oxy-fuel burner is an exercise in scaling down the technology while preventing overheating and degradation of the burner or burner block at much lower burner outputs of 0.04 – 0.1 MM Btu/hr. Due to the number of burners required to distribute heat in a front end, an additional barrier is the capital cost of flow ratio zone control skid equipment. To justify conversion of existing air/gas systems, capital cost must be minimized through the use of low cost gas/oxygen ratio control equipment and an alternate burner position: top firing as opposed to traditional side firing with burners on 4 ½" centers on forehearths and channels.

9. **Project Pathway:** A combination of burner modeling and bench trials were used to develop a burner and block that will generate the appropriate size and shape of flame for optimal heat transfer distribution while minimizing impingement of burner gases on the burner or block to avoid high temperature degradation. Scale up to an ongoing small scale production trial has been an essential part of the process to gain enough operating time to assess the equipment prior to a full scale installation planned for Owens Corning's Jackson, Tennessee plant.

10. **Critical Technical Metrics:** The primary metric will be gas consumption after conversion to oxy/gas burners compared to a sister melter at the facility that has the same front end layout, a similar glass throughput and the same glass formulation.

    Baseline Metric: Melter "A" front end gas consumption

    Project Metric: Melter "B" gas consumption target =35% x "A" Front End Gas consumption

PROJECT PLANS AND PROGRESS

11. **Past Accomplishments:**
    Phase 1 activities including preliminary modeling and burner design have been completed. Modelling to assess the impact of the top fire burner configuration on thermal homogeneity over an entire forehearth indicated favorable results in that the thermal gradient predicted was smaller than with conventional side fire burners. Bench tests of the several burner block and burner designs yielded a burner and block configuration that did not create any immediate degradation of the burner or block as it ran sufficiently cool. Phase II activities consisted of ongoing field trials. A 3 burner installation started in September /02. A small production scale installation started in June /03. These trials provided the initial burner run time required to prove the technology was robust enough for the full scale installation planned for Stage 3. Combined, the two combustion trials have resulted in 4 burner blocks failures with special causes assigned to 3 of the failures. Issues with minor degradation of burner gas tube tips over several months have been addressed with improvements in burner design to improve gas tube cooling and material selection to increase high temperature resistance to scaling.

12. **Future Plans:** Stage 3 activities include:
    - Full scale installation in which the entire front end for a melter in Owens Corning's Jackson Tennessee plant will be heated exclusively with oxy/gas top fire burners. Commissioning and debugging is scheduled to commence August /04.
    - Demonstration of the technology and data collection are scheduled to commence in Feb. /05 Measurement of post start up gas consumption, with the new burner configuration is planned for September /04.
    - Future modeling efforts are planned to commence on 4^{th} Q /04 to assess the potential to improve the fiber manufacturing process by profiling the heat input to provide reduced thermal gradient in the glass being delivered to individual bushings.
    - Gas analysis to quantify/confirm NOx and CO2 reductions.

13. **Project Changes:** The technical contribution of consortium member, Eclipse Combustion will be to modify their existing side fire burner technology to a top fire configuration to compare with the Owens Corning burner for robustness of the burners, specifically lack of gas tube scaling. The original project plan called for Eclipse to develop the combustion control equipment. This was completed prior to officially starting the DOE project. Consortium member Thompson, has withdrawn due to cessation of manufacturing in the U.S.

14. **Commercialization Potential, Plans, and Activities**: Upon completion of the demonstration period the results of the full scale installation, if successful, will be presented in a workshop for GMIC members and the glass industry covering technical, economic and environmental benefits of the technology. Other glass industry sectors that are seen to be most likely to benefit from this technology are sectors that also have long front end systems, specifically the TV and lighting sectors.

15. **Patents, Publications, Presentations:**

OXYGEN-FIRED FRONT END FOR GLASS FORMING OPERATION
US application published October 9, 2003 as 2003/0188554
PCT application published October 16, 2003 as PCT/2003/084885

LOW HEAT CAPACITY GAS OXY FIRED BURNER
US application is pending