Summary of Comments

Proposal 10-01-01T Natural Gas, Ranked # 2
Analysis of PowerSTAR^R Spark Plugs in CNG Engine Applications
Scott Applebaum, Multispark, LLC

PROJECT OBJECTIVE:

- Proposes to prove the feasibility of using Multispark's patented PowerSTAR^R spark plug design in a CNG engine and establishing the performance and emission reduction merits of its use by the end of a 9-month period. Tests will be conducted on vehicles powered by a CNG engine.

FUNDING RECOMMENDATION:

- Recommended for funding. Eligible for funding contingent upon a satisfactory response to request for clarification for minor modifications.

PUBLIC INTEREST BENEFITS:

- The proposed technology has the potential to save California ratepayers 10-15% in fuel costs in natural gas vehicles.

- The proposed technology has the potential to improve mileage that will conserve energy while producing more power by burning more of the fuel in the engine that in turn reduces harmful gases.

STRENGTHS:

- Strong letters of support from Southern California Gas Company, universities and industry.

WEAKNESSES:

- No significant weaknesses noted.

CLARIFICATIONS / CONDITIONS:

- Proposal needs quantifiable goals in the Statement of Work, especially regarding efficiency , emission, and fuel economy goals.
- Test vehicle being used must have a Cummins engine, as John Deere engines are no longer being used.
- Budget needs to be revised to include less welding equipment.

California Energy Commission Energy Innovations Small Grant (EISG) Transportation Program **GRANT APPLICATION COVER PAGE**	**FORM A**

a. Project Title: Analysis of PowerSTAR® Spark Plugs in CNG Engine Applications
(not to exceed 10 words)

b. Project Subject Area: (*Indicate the one that most applies*)

☒ Vehicle Technologies ☐ Transportation Systems

☐ Alternative Fuels

c. Applicant Category:

☐ Individual ☐ Academic Institution

☒ Small Business ☐ Non-Profit

d. Grant Funding Requested: $ $94,700 ☐ Hardware $95K ☐ Modeling $50K

e. Proposed Project Duration: 9 Months *(maximum duration 12 months)*

f. Principal Investigator/Project Manager: *(serves as single point of contact for all communications)*

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Organization:	Multispark, LLC	
Position/Title:	President CEO	

g. Proprietary/Confidential Information:

☐ NO – Proposal does not contain proprietary information, unrestricted distribution authorized.

☒ YES - Proposal contains proprietary information, restrict distribution and disclosure.
(clearly mark and label those sections that are proprietary on all copies)

h. Application Status *(include only prior submissions on same concept)*

☐ First Submission ☒ Second Submission ☐ Third Submission

Provide the proposal number(s) assigned to prior submission(s): 09-01G

i. Indicate the Solicitation Number Listed on the Solicitation Notice: 10-01T NG

j. Indicate the Solicitation Number Printed on the Application Manual Used: 10-01T NG
(the solicitation numbers listed in items i and j must match)

k. Principal Investigator/Project Manager Certification: To the best of my knowledge, I certify that the information contained in this grant application package is true, and discloses all requested information.

Principal Investigator/Project Manager Signature: _____ **Date:** March 19, 2010

Reserved for EISG Program Administrator Use		
Solicitation	Date Received	Proposal Number Assigned
10-01T NG		

Project Summary

Project Title: Analysis of PowerSTAR® Spark Plugs in CNG Engine Applications

Principle Investigator: Scott Applebaum, President CEO, Multispark, LLC.

Project Goal: The goal of this project is to establish the feasibility of using Multispark's patented PowerSTAR® spark plug design in a CNG engine application by demonstrating the performance and emission reduction merits of its use by the end of a 9-month period. Tests will be conducted on vehicles powered by a CNG engine.

State of the Art: Multispark, LLC has pioneered and patented a new generation of spark plugs (PowerSTAR®) for combustion engines that reduce emissions, fuel consumption and enhance performance.

Energy Problem Targeted: Increase fuel savings and performance (Torque/HP) while reducing emissions in CNG engine applications.

Primary Tasks/Objectives: Multispark has been able to achieve great success with gasoline engines and we are going to investigate whether similar results can be achieved in Compressed Natural Gas (CNG) applications namely in CNG buses which comprise about 80% of transit fleets in US cities.

Technical Feasibility Issues: The PowerSTAR® Spark plug can be retrofitted in most engines but CNG engines have not been addressed yet. Since CNG engines run hotter than gasoline engines therefore the heat range of our PowerSTAR® prototypes for CNG applications will have to be experimented with to achieve similar benefits as in gasoline engines.

Proposed Innovations: This innovative new concept of the PowerSTAR® spark plugs will be tested in CNG engines to improve combustion and to perform at its optimum. Our spark plugs increase the efficiency of the combustion engine and furthermore more horsepower and torque will be harnessed from the existing CNG engine.

Impact & Benefits: PowerSTAR® spark plug's multiple ignition events are in the same order of magnitude as having five or eight spark plugs in one cylinder creating an efficient burn of natural gases. An increase in horsepower and torque; decrease in fuel consumption and emissions by 30% will make a great impact for California's vehicles in the transit and general public applications.

Market Connection: If the result of this study in CNG engines is similar to gasoline engine results, the PowerSTAR® spark plug will benefit CNG vehicles in California and in the global marketplace.

Statement of Work
Analysis of PowerSTAR® Spark Plugs in CNG Engine Applications
Scott Applebaum, President CEO Multispark, LLC

Project Goal: The goal of this project is to establish the feasibility of using Multispark's patented PowerSTAR® spark plug design in a CNG engine and establishing the performance and emission reduction merits of its use by the end of a 9-month period. Tests will be conducted on vehicles powered by a CNG engine.

Project Tasks	Performance/Cost Objectives
1) Design Sub-assembly	Establish the correct heat range for a similar CNG PowerSTAR® spark plug by measuring the heat range of the OEM spark for the engine. Two different spark plugs will be designed so as to make a
2) Design Prototype STAR Electrode	The design will be based on our existing star design. Number of STAR points will be 5 or 8 points.
3) Build Sub-assembly	A contracted manufacturer will build 100 prototypes and the best quality prototypes will be selected for assembly.
4) Fabricate Prototype STAR	Evaluate quality of prototype measure the STARs are within the tolerances Make sure that the STARs lay flat and on a machined surface.
5) Final Assembly	Evaluate quality of prototype build. Run the final assembled spark plugs on our spark plug testing device. Evaluate the sparking of the STAR points. Make sure that all the points are sparking consistently.
6) Finishing product	Evaluate quality of prototype build. Re-Run the final assembled and finish spark plugs on an open-air tester. Evaluate the sparking of the STAR points. Make sure that all the points are sparking consistently. Run the spark plugs in a pressure chamber and run the pressure up to 20 PSI evaluate the spark consistency making sure that all the star points produce a spark.
7) Acquire Test Vehicle	Purchase or Lease a test vehicle.
8) Install prototype in test vehicle and street test prior to running on the test equipment.	Make sure the prototype performs satisfactorily in the engine. Run the vehicle on small trip of 50 -100 miles evaluate the performance making sure that there are no unusual noises coming from the engine.
9) Evaluate engine performance stock vs. PowerSTAR equivalent	Measure Torque, Horsepower, and air/fuel ratios versus RPM for both the stock OEM spark plug and PowerSTAR equivalent on a dynamometer. Different runs should be run at the same operational temperature to compare the results
10) Test emissions in a lab controlled environment.	Measure HC, CO, and NOx levels comparing to stock OEM spark plug Compare the results and compute percentages of differences.
11) Endurance testing	Run the vehicle for a month and take notes on the performance. Evaluate fuel economy for a 5 to 15% improvement and examine the spark plugs for wear.
12) Evaluate test results	Create a plot showing the differences between dynamometer runs as well as the differences between measured Hydrocarbon, Carbon Monoxide, and NOx levels with both standard and PowerSTAR® spark plugs.
13) Write Report	Report the test results from performance, emission and endurance tests. Submit progress reports in months 3, 6, 8 and final reports in month 9.

Reporting Requirements: Submit Progress reports and final report in accordance with the proposed Project Schedule/Deliverables Chart.