Comparative Fuels Combustion Pollutants Diminished by Hydrogen

Principal Investigator

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Prepared for

State of California Air Resources Board

Research Division

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Official Hydrogen Cleansing Fuel Results

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No Human Subjects

No Animal Subjects

SUPPORT FOR ADVANCED CLEAN CARS

Selected Research Area: Advances in vehicle technology.

Engineers, scientists, and inventors in the public and private sectors continue to explore new technologies or improve existing ones.

Synthesizing research is needed that identifies exotic technologies, such as new or substitute materials, chemistries, or processes, and evaluates and compares their potential for contributing to compliance with the standards.

DELIVERABLES:

 Quarterly progress reports

 Final report

 Additional deliverables to be determined in consultation with ARB staff.

TIMELINE:

It is anticipated that projects will be completed in 36 months from the start date. Note that this allows 30 months for completion of all work through delivery of a draft final report; the last 6 months are for ARB and RSC review of the draft final report and delivery of a revised final report and data files to the ARB.

Project:

Hydrogen as an additive in the fuel systems of internal combustion engines has been proposed, to decrease particulate matter and pollutants from exhaust.

I. Fuels undergoing testing with hydrogen additives:

A. Gasoline, tested at three octane levels.

B. Diesel, tested in automobile, small truck, and large truck.

C. Natural gas

D. Propane

II. Methods for introduction of Hydrogen into internal combustion engine:

A. Devices available commercially.

B. Custom devices

III. Exhaust pollution measurements

A. Smog check type equipment

B. Specialized equipment to monitor pollutants

IV. Operating Conditions

A. Idling

B. City driving.

C. Freeway driving

D. Hill climbing

PROJECT SCHEDULE:

Task 1: Purchase Equipment, Test Vehicles

Task 2: Install Equipment

Task 3: Perform Vehicle Fuel Tests

Task 4: Record Results of Tests Under Specified Conditions

Task 5: Draft Preliminary Report

Task 6: Draft Final Report

Task 7: Amend Final Report

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **MONTH** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** |
| **TASK** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **1** |  | **X** | **X** | **X** |  |  |  |  |  |  |  |  |  |  |  |
| **2** |  |  | **X** | **X** | **X** | **X** |  |  |  |  |  |  |  |  |  |
| **3** |  |  |  | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |  |  |  |
| **4** |  |  |  | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |  |  |  |
| **5** |  |  |  |  |  |  |  |  | **X** | **X** | **X** | **X** |  |  |  |
| **6** |  |  |  |  |  |  |  |  |  | **X** | **X** | **X** | **X** | **X** |  |
| **7** |  |  |  |  |  |  |  |  |  |  |  | **X** | **X** | **X** | **X** |

ESTIMATED COST BY TASK:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Task** | **Labor** | **Employee**  **Fringe**  **Benefits** | **Subs,**  **Consults** | **Equip** | **Travel**  **Subsist** | **Computers,**  **Interfaces,**  **Server** | **Copy**  **Print** | **Mail**  **Phone**  **Fax** | **Materials**  **and**  **Supplies** | **Analyses** | **Misc.** | **Overhead** | **Total** |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **1** | **$4,500** | **$1,500** | **$0** | **$155,000** | **$5,600** | **$12,500** | **$5** | **$42** | **$65** | **$0** | **$0** | **$1,200** | **$180,412** |
| **2** | **$7,500** | **$2,800** | **$7,800** | **$35,000** | **$2,300** | **$4,800** | **$15** | **$54** | **$148** | **$0** | **$0** | **$2,400** | **$62,817** |
| **3** | **$79,200** | **$9,900** | **$0** | **$0** | **$6,100** | **$450** | **$25** | **$76** | **$225** | **$18,000** | **$0** | **$5,600** | **$119,576** |
| **4** | **$36,000** | **$7,200** | **$0** | **$0** | **$1,400** | **$270** | **$45** | **$90** | **$245** | **$25,000** | **$0** | **$1,800** | **$72,050** |
| **5** | **$2,400** | **$1,300** | **$0** | **$0** | **$0** | **$120** | **$22** | **$15** | **$32** | **$3,200** | **$0** | **$2,400** | **$9,489** |
| **6** | **$5,800** | **$2,500** | **$0** | **$0** | **$0** | **$260** | **$42** | **$45** | **$58** | **$4,800** | **$0** | **$3,600** | **$17,105** |
| **7** | **$3,400** | **$1,500** | **$0** | **$0** | **$0** | **$90** | **$35** | **$33** | **$45** | **$2,400** | **$144** | **$2,600** | **$10,247** |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | **$138,800** | **$26,700** | **$7,800** | **$190,00** | **$15,400** | **$18,490** | **$189** | **$355** | **$818** | **$53,400** | **$144** | **$19,600** | **$471,696** |

CONCLUSIONS:

Results of tests involving introducing hydrogen into the combustion engine, inter-mixed with selected commercial fuels, under selected operating conditions will provide the data that will be useful for primary and secondary manufacturing goals in achieving decreased pollution of air resources.

A secondary result of the testing data will assess the viability of hydrogen as a carbon neutral fuel, relating to the equipment and methods utilized.

A tertiary result would be to assess the viability of hydrogen as a potential more economical "filler" gas involving internal combustion, to decrease greenhouse gasses while maintaining acceptable levels of power and performance under various operating conditions.

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Education:

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Bachelor’s Degree in Physics, 1971

Employment:

1971 - 1974 Datum, Inc., Anaheim, CA

Electronics Engineer

Design disk controllers for Data General mini-computers.

1974 - 1979 Marten-Decker Inc., Santa Ana, CA

Design Engineer

Design oil field instrumentation and process control equipment.

1979 - present

Industrial Data Systems, Inc., Anaheim, CA

Founder and Chief Engineer,

Design and manufacture industrial weighing instrumentation.