National Renewable Energy Laboratory
A national laboratory of the U.S. Department of Energy
Office of Energy Efficiency & Renewable Energy
Innovation for Our Energy Future

Incorporation of Renewable Energy Technologies at Anheuser-Busch

Cooperative Research and Development Final Report

CRADA Number: CRD-07-00225

NREL Technical Contact: Kevin Walkowicz

CRADA Report
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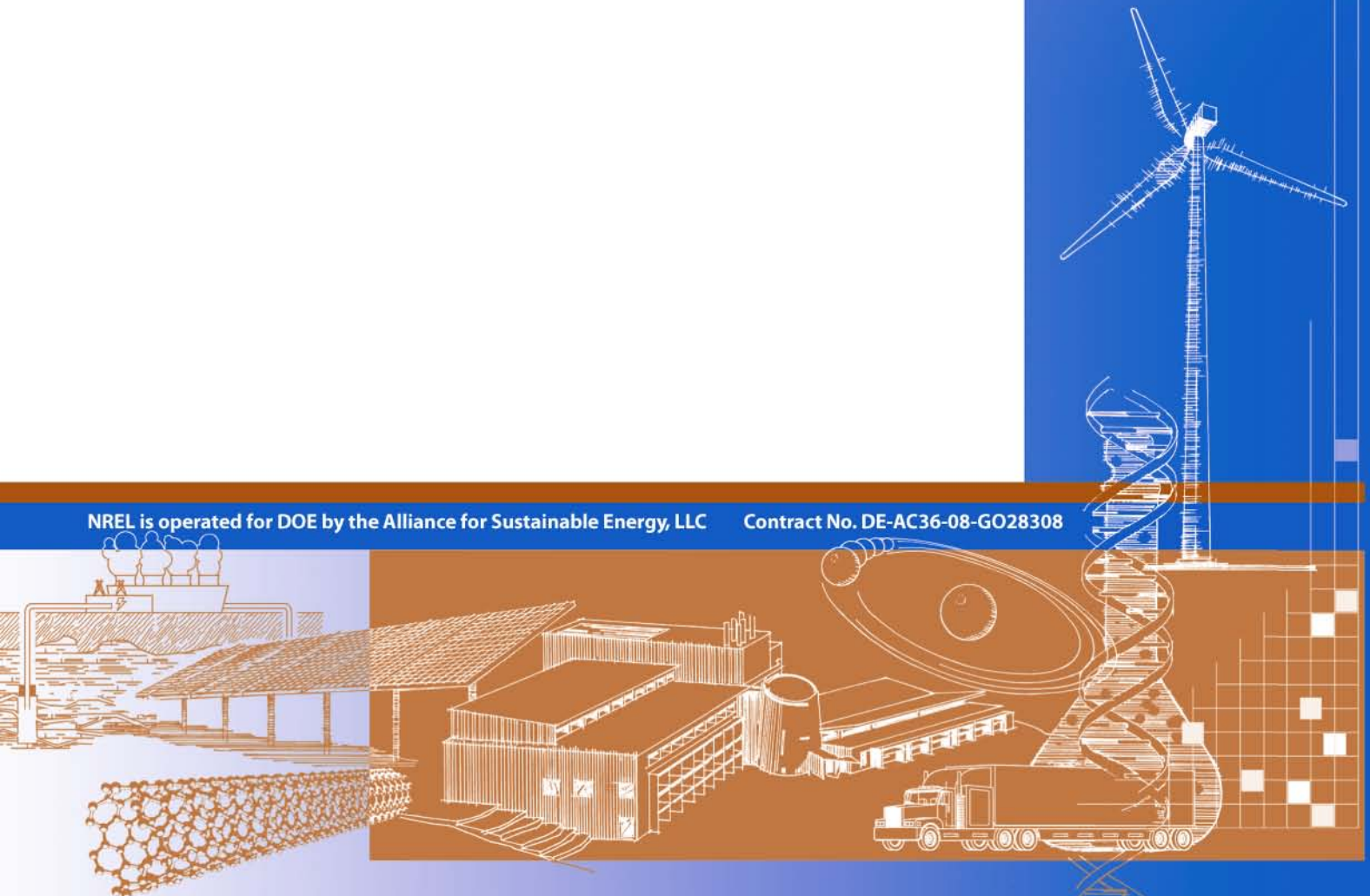

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Cooperative Research and Development Final Report

In accordance with Requirements set forth in Article XI.A(3) of the CRADA document, this document is the final CRADA report, including a list of Subject Inventions, to be forwarded to the Office of Science and Technical Information as part of the commitment to the public to demonstrate results of federally funded research.

CRADA number: CRD-07-00225

CRADA Title: Incorporation of Renewable Energy Technologies at Anheuser-Busch

Parties to the Agreement: Anheuser-Busch Companies, Inc. + NREL

Abstract of CRADA work:

There are several areas of interest with regard to advancing renewable energy technology and increasing Anheuser-Busch's use of renewable energy, such as higher-value uses for biomass streams, fuels utilization, transportation, building systems and renewable energy technologies. Anheuser-Busch would like to collectively work with the National Renewable Energy Laboratory on a variety of projects as outlined in the statement of work below.

Anheuser-Busch and the U.S. Department of Energy's National Renewable Energy Laboratory collaborated to identify alternative fuels and other efficiency-improving technologies for their distribution center fleet located in Denver, Colorado. Specifically, NREL will investigate technologies that will improve fuel economy while maintaining or improving emissions in comparison to those associated with currently implemented vehicle technology.

Summary of Research Results:

Vehicles were instrumented with GPS data loggers, and route/duty cycle analysis of three vehicle groups of interest resulted in 8 valid days of data for the Navistar 4400s, 12 valid days of data fpr the 4900's, and 9 valid days of data for the T-800's. The average speeds for the data set were obtained and analyzed. This data set and analysis also provided data to create three representative test cycles for each vehicle group for the Denver Distribution Center fleet—a filtered, shortened cycle representing the low, average, and high usage characteristics for each truck type. For future analysis and testing, these cycles, which are representative of the sample set, could be used as the most appropriate average cycles for the Denver Distribution Center.

Task 2 of the project utilized the data collected in Task 1 and analyzed various technology options to understand how they would perform in this specific fleet. Specific technology areas of interest included (1) full hybridization, (2) mild hybridization, (3) tire options, (4) aerodynamic improvements, (5) manual versus automatic transmissions, (6) mass reduction, and (7) engine selection/power.

The largest improvement in fuel economy on a percentage basis was the implementation of a full hybrid system, which yielded a maximum 37% improvement in fuel economy: $1,863 per truck per year in

savings at a fuel cost of $3.00 per gallon. Mild hybridization to eliminate unnecessary idling of the trucks resulted in potential maximum savings of $1,506 per truck per year. A 20% reduction in rolling resistance has the potential to improve fuel economy by 4.0% ($315 per truck per year). A 20% reduction in aerodynamic drive has the potential to improve fuel economy by 5.7% ($261 per truck per year). Elimination of the automatic transmission torque converter losses resulted in a maximum 13.9% improvement in fuel economy ($594 per truck per year). A 20% reduction in mass resulted in a potential 12.8% improvement in fuel economy ($783 per truck per year). Engine downsizing (reducing the size of the engine by 20%) resulted in a maximum potential improvement of 14.8% in fuel economy ($1,050 per truck per year).

Overall, it is evident that the duty cycle must be understood and characterized, and each technology must be assessed for the intended duty cycle(s) in order to fully maximize the ROI. A range of improvements is documented for the same technology on different trucks and duty cycles. This information can be combined with the company's business-specific goals with respect to ROI for the technology options discussed here. Technologies that most closely meet the payback period requirements of the company should be investigated further.

Subject Inventions listing:

None.

Report Date: 3/1/10 Responsible Technical Contact at Alliance/NREL: Walkowicz, Kevin

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