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

Distributed Reforming of Biomass Pyrolysis Oils

Cooperative Research and Development Final Report

CRADA Number: CRD-06-00192

NREL Technical Contact: Stefan Czernik

CRADA Report
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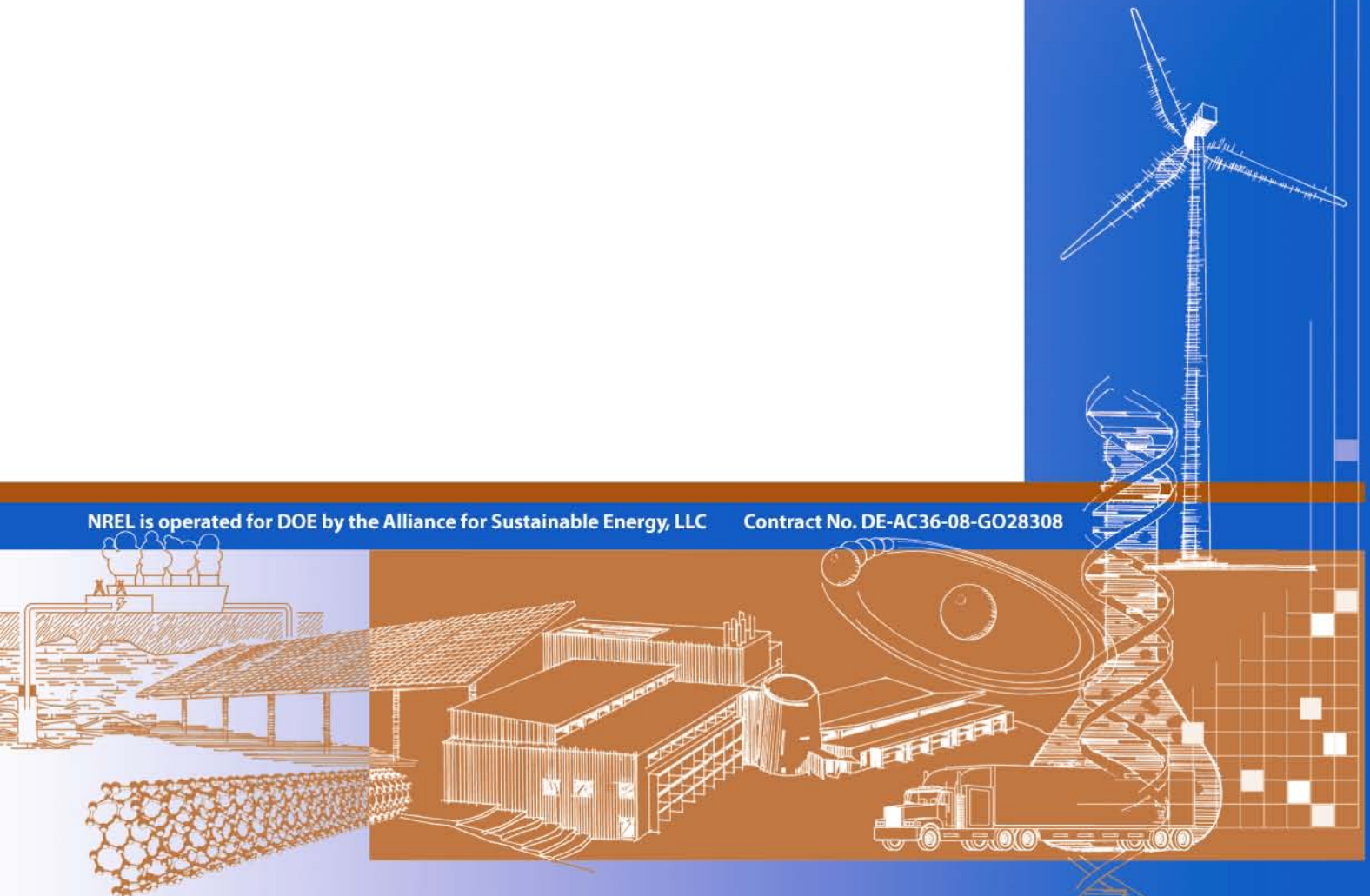

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Cooperative Research and Development Final Report

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-06-00192

CRADA Title: Distributed Reforming of Biomass Pyrolysis Oils

Parties to the Agreement: Chevron Technology Ventures + NREL + Colorado School of Mines

Abstract of CRADA work:

The objective of this project is for Chevron and NREL to collaborate in determining the effect of bio-oil composition variability on autothermal reforming performance including bio-oil volatilization, homogeneous oxidative cracking, and catalytic reforming. NREL is currently working on a DOE-funded low temperature catalytic bio-oil reforming process. This proposed work will expedite the development of a feed-flexible, distributed-reforming process for near-term production of hydrogen. The area to be tested is the impact of bio-oil composition variability due to biomass source or the pyrolysis process and to test methods of bio-oil stabilization and upgrading to improve performance.

Summary of Research Results:

The catalytic POX/steam reforming tests performed on the selection of bio-oils showed a high conversion of cellulose and wood bio-oils producing hydrogen with the yields reaching 80% of the stoichiometric potential. Despite the oxygen addition, up to 5% bio-oil carbon formed solid deposits that slowly deactivated the catalyst. Most likely anhydrosugars and oligomeric lignin are the main sources of these solid deposits. For bio-oils produced from herbaceous feedstocks the hydrogen yields were significantly lower and catalyst deactivated much faster during the process. This is most likely due to the higher amounts of nitrogen, sulfur, and other minor components (phosphorus, metals) present in bio-oils produced from grasses and agricultural residues, corn stover in particular that promote the formation of carbonaceous deposits and are known as strong poisons of catalysts (H_2S).

Subject Inventions listing:

None

Report Date: 3/1/10 Responsible Technical Contact at Alliance/NREL: Czernik, Stefan

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