

Energy Solutions... Delivered

IH²[®] Technology

A COST-EFFECTIVE ROUTE FOR CONVERTING BIOMASS INTO LIQUID TRANSPORTATION FUELS

Biomass is the primary renewable resource for the production of alternative transportation fuels. Conversion solutions that can use lignocellulosic and algal biomass avoid competition with food resources. Production of fuels that are direct replacements to the conventional hydrocarbon fuels (gasoline, jet, and diesel) avoid infrastructure replacement or modifications. Efficient conversion routes for these renewable feedstocks allow for production of fuels with greatly reduced greenhouse gas footprints. These conditions are incorporated in the U.S. Renewable Fuel Standard (RFS) mandate for production of advanced biofuels.



Gas Technology Institute has invented patents for a technology, IH²[®], which meets all of these conditions and will help to meet the RFS obligation. The technology produces clean transportation fuels from a wide variety of biomass resources. That versatility allows for regional production using local resources—good for regional

economies, the environment, and global energy security. It will increase the supply of economical, renewable, and sustainable transportation fuels in the marketplace and lower the greenhouse gas emissions from the transportation sector.

IH² converts virtually any type of non-food biomass feedstock—such as wood, agricultural residues,



algae, aquatic plants, and municipal waste—directly into gasoline, diesel and jet fuels. The process is unique in that it directly produces either blending stocks or finished liquid hydrocarbon fuels, unlike many other biofuels technologies that produce a crude intermediate that requires substantial further upgrading.

The IH² technology uses low-pressure hydrogen together with a proprietary catalyst to remove virtually all of the oxygen present in the starting biomass and produce finished hydrocarbon fuel products.

IH² is designed to have low environmental impact. Since the process produces its own hydrogen and a surplus of water to be self-sufficient, it can operate in a stand-alone configuration anywhere there is sufficient biomass feed for conversion.

A broad range of non-food source feedstocks can be used with the process, which mitigates concerns about seasonality, regionality, availability, and cost and does not interfere with the food chain.

The process is based on mature components that are integrated and operated in the IH² mode. It combines existing process equipment that is already commercially available for fast implementation, high reliability and low cost.

The scale-up requirements are well understood. The technology is highly flexible and is economical for both small- and large-scale applications.

GTI added a new pilot-scale IH² plant in 2012. It has demonstrated biomass handling for multiple feedstocks and will produce product in sufficient quantities for fuels certification and engine testing. The pilot plant's ability to operate continuously makes it an ideal platform for process optimization and detailed characterization.

GTI has licensed IH² to CRI Catalyst Company (CRI), an international company headquartered in Houston, TX, for worldwide



deployment. The timeline to market is short, and commercial introduction is expected in 2015. CRI provided much of the funding for the new pilot plant.

CRI has analyzed the produced fuels. First generation products have had excellent traits: the oxygen content is below detection limits, the fuel contains the same molecules as refined petroleum products, and the gasoline octane number is around 85. Second generation products using improved catalysts have demonstrated that product quality can be managed effectively.

Yields of product fuels have ranged from 26% to 46% depending on feedstock. This is over 70% efficient energy conversion, and the production of exportable steam can raise the overall process efficiency even higher.

Techno-economic and life-cycle analysis results illustrate that the technology can convert wood and agricultural residue biomass to gasoline and diesel blending components for less than \$2.00/gallon with greater than 90% reduction in greenhouse gas emissions.

GTI received funding support for R&D and preliminary engineering for this novel process from the U.S.

Department of Energy (EERE Bioenergy Technology Office) under the integrated biorefinery initiative. Participants in GTI's project include Cargill, CRI, Johnson Timber, Aquaflo, Blue Marble Energy, National Renewable Energy Laboratory and Michigan Technological University.

Preliminary engineering designs for 1 and 5 ton/day demonstration units and a 500 ton/day commercial unit have been completed, as have cost estimates for a commercial-scale 2,000 ton/day unit.

In addition to standalone units, in late 2012 DOE awarded GTI a project to evaluate the IH² process in a configuration to maximize integration with existing crude oil refineries with project partners CRI and Valero.

For More Information

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