Biofuels
for Advancing America

Developing cost-competitive, sustainable biofuels for today's transportation infrastructure.

National Advanced Biofuels Consortium

"Advanced biofuels are crucial to building a clean energy economy. By harnessing the power of science and technology, we can bring new biofuels to the market and develop a cleaner and more sustainable transportation sector. This investment will help spur the creation of the domestic bio-industry, while creating jobs and reducing our dependence on foreign oil."

- U.S. Department of Energy Secretary, Steven Chu

Biofuels that are compatible with existing refineries, distribution networks, and vehicle fleets have great potential to rapidly meet national objectives of increased energy security, reduced greenhouse gas emissions, and new economic opportunities.

The National Advanced Biofuels Consortium (NABC) will develop cost-effective processes to supplement petroleum-derived fuels with advanced "drop-in" biofuels that are compatible with today's transportation infrastructure and that are produced in a sustainable manner.

Led by the National Renewable Energy Laboratory and Pacific Northwest National Laboratory, NABC includes 17 partners from industry, universities, and national laboratories (see sidebar). These partners possess world-class expertise, facilities, and licensed technologies for producing advanced biofuels.

With $35 million of American Recovery and Reinvestment Act funding from the U.S. Department of Energy and more than $12 million of partner funds, NABC will develop one or more biofuel technologies that address the fundamental challenges of converting lignocellulosic biomass feedstocks to drop-in biofuels. These new technologies will take full advantage of the cost savings that are possible by using existing refineries, distribution networks, and vehicle fleets.

What are Advanced Drop-In Biofuels?

Infrastructure-Compatible

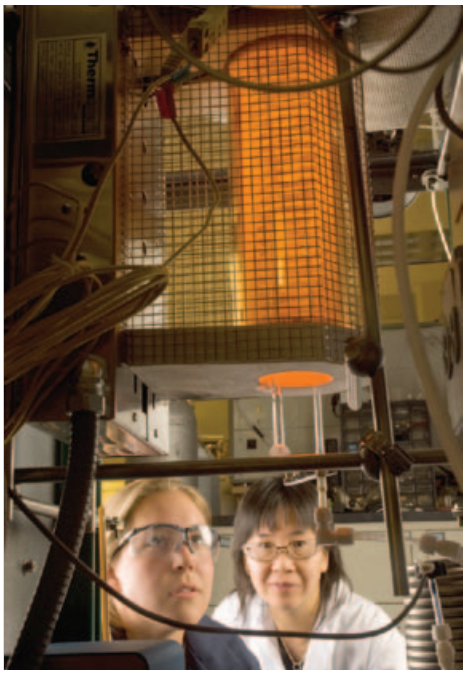
NABC will develop processes to produce biomass-derived gasoline, diesel, and jet fuel. These fuels can be blended with their petroleum-derived counterparts or used directly in gasoline, diesel, or jet engines. Drop-in biofuels are currently viable within all major fuel markets, and by developing processes to produce these fuels directly from biomass, NABC will expedite the path to market. To ensure integration with existing petroleum refining and vehicle infrastructure, NABC's advanced biofuel technologies will produce fuels that meet current regulatory requirements, such as EPA fuel regulations and ASTM specifications.

Sustainable

The technologies developed by NABC will be able to meet or exceed environmental and sustainability goals for biofuels production, such as reducing greenhouse gas emissions by 50% or more over conventional petroleum fuels, part of the definition for advanced biofuels in the Energy Independence and Security Act of 2007 (EISA). NABC will develop technologies for drop-in biofuels and biofuels precursors that can be sustainably produced, distributed, and utilized in EISA-mandated quantities in existing refineries, pipelines, and vehicles. Sophisticated life cycle assessments will be performed to evaluate specific environmental and sustainability impacts for each technology. By combining rigorous technoeconomic, environmental, and sustainability impact analysis with research, NABC will maximize the efficiencies of biofuels processes and increase the economic and environmental benefits.

Cost-Competitive

Favorable production economics are required for advanced biofuels to enter the marketplace. The cost of producing and distributing advanced biofuels must be comparable with that of conventional petroleum-derived gasoline, diesel, or jet fuel. NABC has determined that the fastest, most cost-effective route to advanced biofuels is to process biomass to gasoline, diesel, or jet fuel synergistically with petroleum using existing petroleum refineries to the maximum extent possible. This will avoid the costs of new infrastructure and accelerate broad utilization of biofuels by the existing transportation fleet.



Pat Corkery/PIX15698

NABC will accelerate the deployment of advanced biofuel technologies from laboratory to industrial scale.

NABC
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Process Strategies

NABC has chosen to investigate six process strategies that have the highest potential to meet the project goals. All six processes involve new and innovative approaches that

can dramatically advance the commercialization and adoption of advanced biofuels.

- Fermentation of sugars
- Catalytic conversion of sugars
- Catalytic fast pyrolysis
- Hydropyrolysis
- Hydrothermal liquefaction
- Syngas to distillates.

In addition, NABC will perform cross-cutting research on feedstock logistics, pretreatments, separations, upgrading, engineering and sustainability analysis, and refinery integration.

Refinery Insertion Points

The chemical and physical complexity of lignocellulosic biomass makes it difficult to use as a refinery feedstock. The primary barriers to introducing biomass into a refinery are that it is solid, heterogeneous, and has high oxygen content. A successful biomass-derived refinery feed must have low oxygen content, be miscible with petroleum, and contain minimal contaminants that can poison refinery catalysts and degrade fuel streams.

NABC will investigate three proposed insertion points for advanced biofuels in a petroleum refinery.

1) Biomass is converted into a bio-crude that can be co-processed with conventional crude oil.

2) Biomass is upgraded into refinery-ready intermediates that are compatible with refinery streams that must go through further processing at the refinery.

3) Biomass is upgraded to a near-finished fuel or blendstock that will be minimally processed at the refinery.

By researching a technically diverse set of technologies that are flexible with respect to refinery insertion points, NABC will develop processes that maximize the production of biofuels from the physically and chemically diverse range of lignocellulosic biomass feedstocks that are projected to be available on a sustainable basis in the future.

NABC Strategy

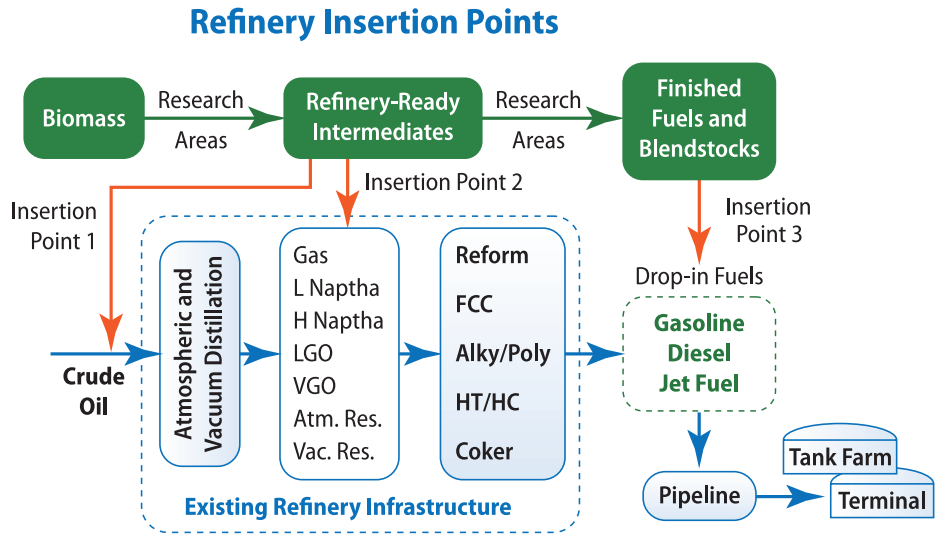
During stage one of the project, NABC will perform research on all six technologies to determine whether key technical and economic barriers can be overcome to develop a pilot-ready process in a three-year period.

Sustainability and technoeconomic analyses will guide the research programs. After one year, NABC will complete a feasibility study and publish the results. Based on these results, one to three "most likely to succeed" process strategies will be selected and moved toward the pilot scale in stage two. NABC will develop technologies and processes to be integrated with current petroleum refining infrastructure. At the end of the three-year project, NABC will deliver a technology package that includes a pilot plant-ready process, a detailed design and engineering report, and a life cycle analysis.

NABC's overarching goal is to expedite transfer of the resulting biofuel technologies to industrial practice, in order to contribute as rapidly as possible to meet national environmental and economic goals.

Follow NABC Progress

For NABC news, publications, and partner information, please visit *www.nabcprojects.org*.



This diagram shows the three insertion points NABC is evaluating that take advantage of existing infrastructure to produce and distribute biofuels.

NABC Partners

Albemarle Corporation
Amyris Biotechnologies
Argonne National Laboratory
BP Products North America Inc.
Catchlight Energy LLC
Colorado School of Mines
Iowa State University
Los Alamos National Laboratory
National Renewable Energy Laboratory
Pacific Northwest National Laboratory
Pall Corporation
RTI International
Tesoro Companies Inc.
University of California, Davis
UOP LLC
Virent Energy Systems
Washington State University

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