

## OFFICE OVERVIEW

July 2014

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Addressing our Nation's Energy Challenges

## **HOW BIOENERGY PLAYS A ROLE**

1

The need to reduce dependence on foreign oil and lower greenhouse gas (GHG) emissions has renewed the urgency for developing sustainable biofuels, bioproducts, and biopower.

2

The transportation sector accounts for approximately two-thirds of U.S. oil consumption and contributes to one-third of the nation's GHG emissions.

3

In the near term, biomass is the only renewable resource that can supplement petroleum-based liquid transportation fuels while reducing GHG emissions.



Biomass includes agricultural residues, forest resources, perennial grasses, woody energy crops, wastes (municipal solid waste, urban wood waste, and food waste), and algae, as well as other sources. Like other renewable energy resources, biomass is converted to power; however, unlike other resources, it can also be converted to fuels and chemicals.

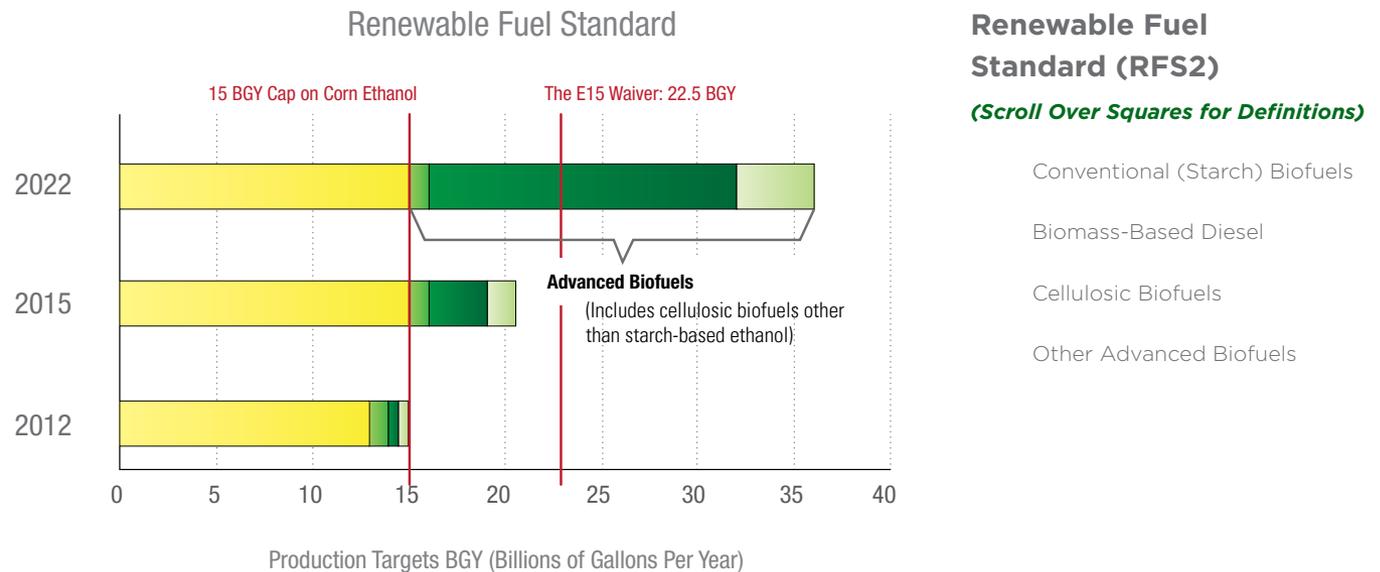


The [Energy Independence and Security Act \(EISA\)](#) of 2007 set aggressive goals to:

- Move renewable fuels into the marketplace
- Reduce the nation’s dependence on foreign sources of energy
- Reduce GHG emissions from the transportation sector.

EISA established production volumes for the [Renewable Fuel Standard Program \(RFS\)](#), since referred to as RFS2. RFS2 specifically defines categories of biofuels, sets minimum life cycle GHG reduction thresholds for these categories, and applies restrictions on the types of feedstocks and types of land that can be used to make qualifying renewable fuel.

EISA 2007 greatly expanded mandated biofuels production targets to 21 billion gallons of advanced biofuels and 36 billion total gallons of renewable fuels by 2022—a multifold increase from what the Energy Policy Act of 2005 originally set.



*The Bioenergy Technologies Office focuses on the development of all of the green items outlined in this bar chart.*

Utilizing biomass for fuels, products, and power is recognized as a critical component of the nation’s strategic plan to address our continued dependence on imported oil.

In President Obama’s 2013 State of the Union Address, and subsequent [Plan for a Strong Middle Class and a Strong America](#), he stated that “by investing in clean energy, we can continue to create good American jobs, reduce our reliance on foreign oil, and reduce the cost of energy for families and businesses.”

The President called on Congress to make the renewable energy Production Tax Credit permanent and refundable, as part of comprehensive corporate tax reform, providing incentives and certainty for investments in new clean energy.

The President also established an Energy Security Trust to support research into a range of cost-effective technologies such as advanced vehicles that run on electricity, home-grown biofuels, and vehicles that run on domestically-produced natural gas.

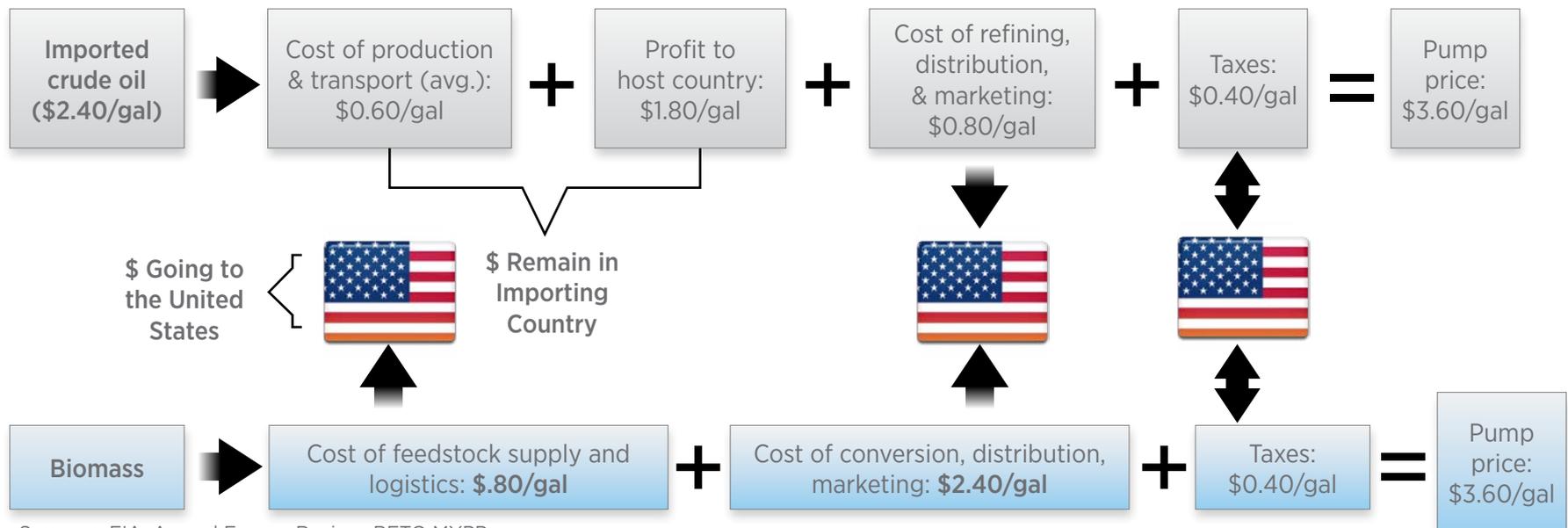


Photo courtesy of whitehouse.gov

“The path towards sustainable energy sources will be long and sometimes difficult. But America cannot resist this transition; we must lead it. We cannot cede to other nations the technology that will power new jobs and new industries—we must claim its promise.”

**–President Barack Obama**  
*2013 Inaugural Address*

- [Job Creation and Balance of Trade](#) – Displacing oil imports offers massive opportunity for domestic job creation, with virtually no consequent job destruction
- Climate Change Mitigation – Sustainable biomass production can provide >50% GHG reduction vs. petroleum-based fuels on a complete life-cycle basis
- Energy Security – Domestic production decreases vulnerability to short-term economic disruption due to war, civil unrest, OPEC action, speculation, etc.



Price differential between *imported* crude oil and *domestic* biomass:  
**\$101/barrel x 4.2 billion barrels/year = \$424 billion/year**



Addressing our Nation's Energy Challenges

## **THE U.S. DEPARTMENT OF ENERGY'S BIOENERGY TECHNOLOGIES OFFICE**

The [Bioenergy Technologies Office](#) supports the following national priorities:



Dramatically  
reduce  
dependence  
on foreign oil



Promote the  
use of diverse,  
domestic, and  
sustainable  
energy resources



Establish an  
advanced  
bioindustry  
and create jobs



Reduce carbon  
emissions  
from energy  
production and  
consumption

**For more information:**

[Bioenergy Technologies Office Multi-Year Program Plan](#)

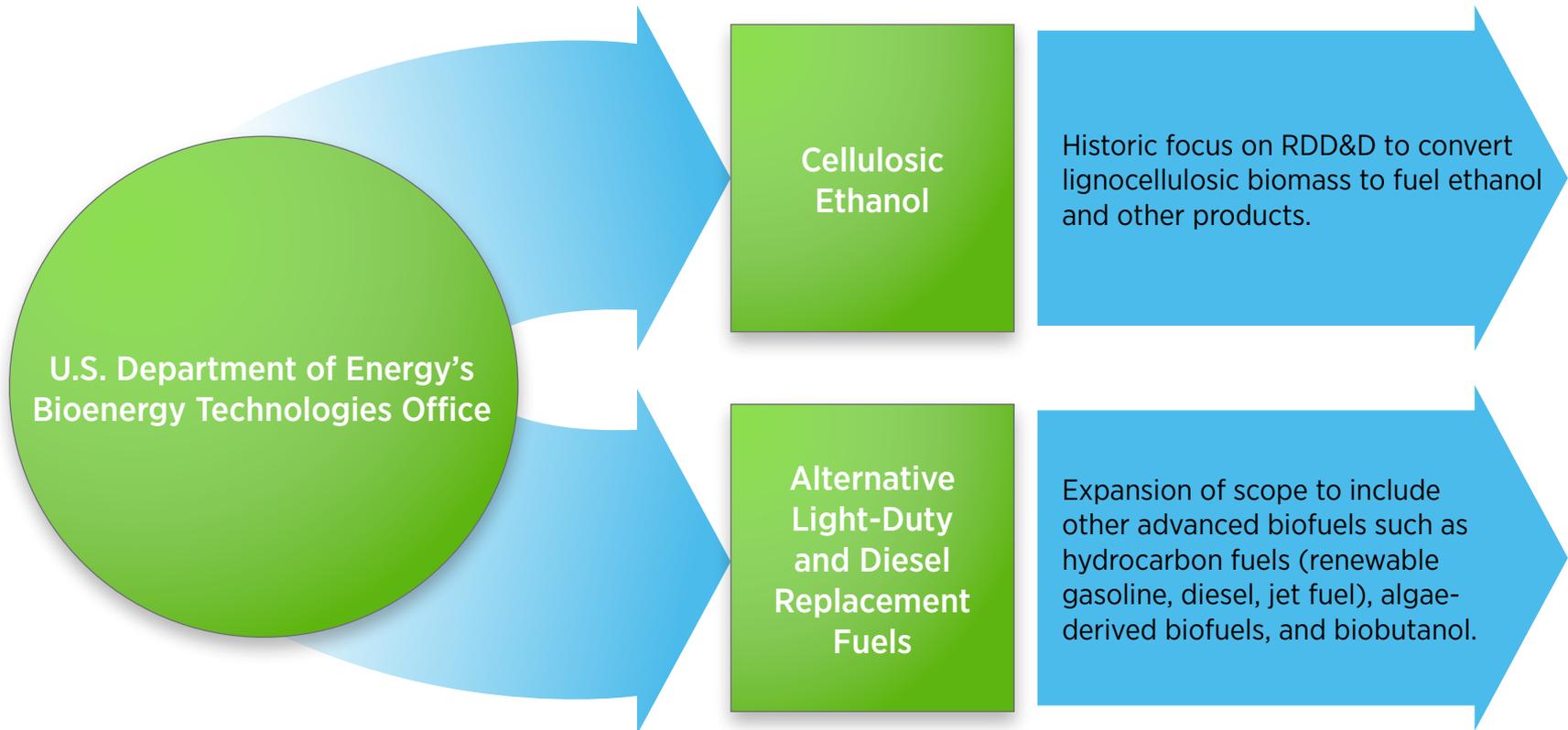
## MISSION

Develop and transform our renewable biomass resources into commercially viable, high-performance biofuels, bioproducts, and biopower through targeted research, development, demonstration, and deployment (RDD&D) supported through public and private partnerships.

## STRATEGIC GOAL

Develop commercially viable bioenergy and bioproduct technologies to enable sustainable, nationwide production of biofuels that are compatible with today's transportation infrastructure, can reduce greenhouse gas emissions relative to petroleum-derived fuels, and can displace a share of petroleum-derived fuels to reduce U.S. dependence on foreign oil and to encourage the creation of a new domestic bioenergy and bioproduct industry.

The Bioenergy Technologies Office forms cost-share partnerships with key stakeholders to research, develop, and demonstrate technologies for advanced biofuels, bioproducts, and biopower from lignocellulosic and algal biomass.



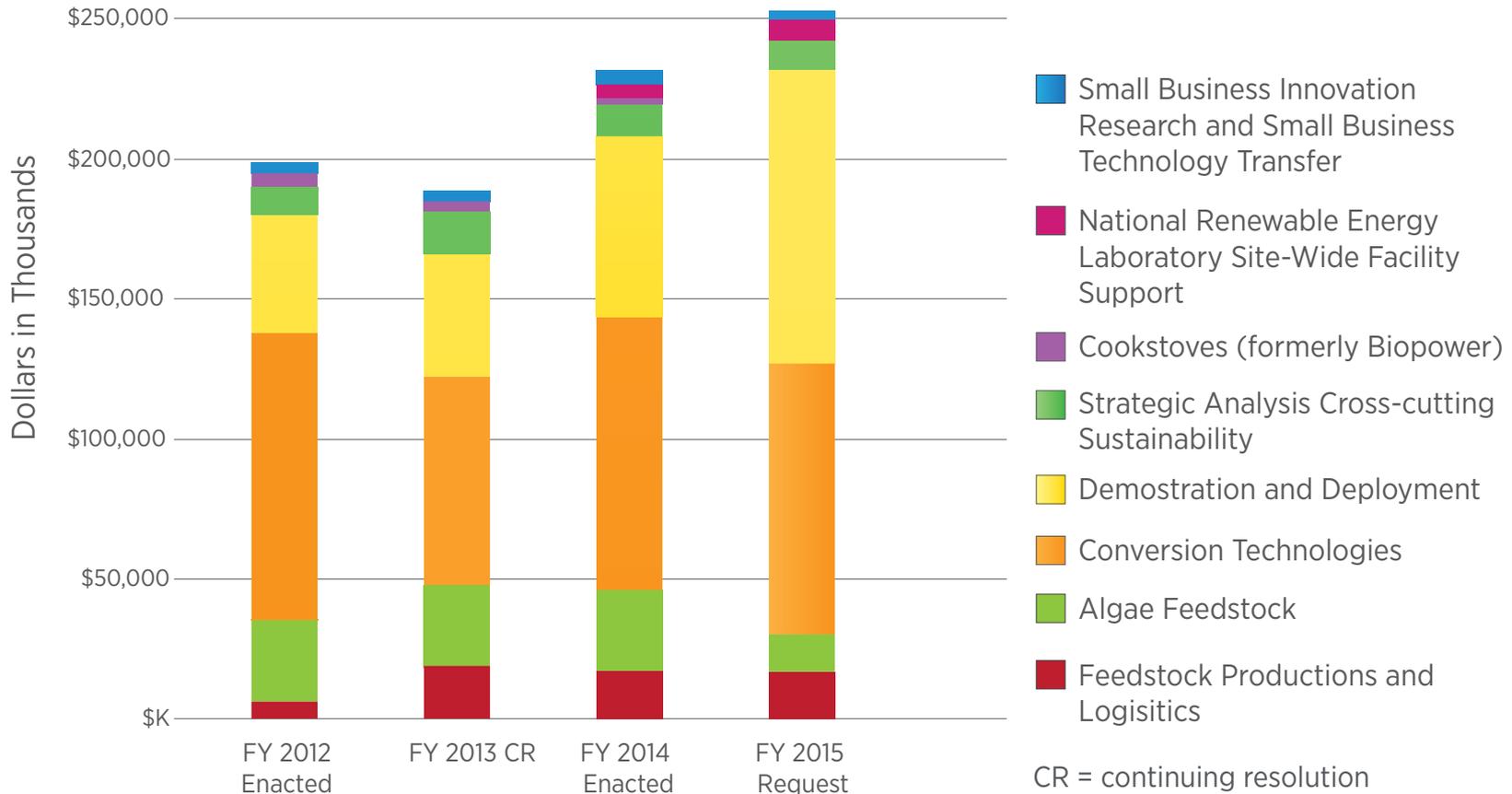


A Historical Perspective

## **BIOENERGY POLICIES, PRIORITIES, AND APPROPRIATIONS OVER TIME**

In recent years, several legislative, regulatory, and policy efforts have expanded and accelerated bioenergy-related RDD&D.

<p><u>Energy Policy Act of 2005</u>  <b>August 2005</b></p>	<p>Renewed and strengthened federal policies fostering ethanol production, including incentives for the production and purchase of biobased products; these diverse incentives range from authorization for demonstrations to tax credits and loan guarantees.</p>
<p><u>Energy Independence and Security Act (EISA) of 2007</u>  <b>December 2007</b></p>	<p>Supported the continued development and use of biofuels, including a significantly expanded <a href="#">Renewable Fuel Standard</a>, requiring 36 bgy renewable fuels by 2022 with annual requirements for advanced biofuels, cellulosic biofuels, and biomass-based diesel.</p>
<p><u>American Recovery and Reinvestment Act</u>  <b>February 2009</b></p>	<p>Provided grants, loans, and loan guarantees for developing and building demonstration- and commercial-scale biorefineries; established \$1.01 per gallon producer tax credit for cellulosic biofuels; provided authorization for the <a href="#">Biomass Crop Assistance Program</a> and for <a href="#">Biomass R&amp;D Initiative</a>, <a href="#">Biomass R&amp;D Board</a>, and <a href="#">Technical Advisory Committee</a> continuation.</p>
<p><u>Blueprint for a Secure Energy Future</u>  <b>March 2011</b></p>	<p>Outlines a comprehensive energy policy that cuts U.S. oil imports by one-third by 2025 through reducing the nation's dependence on oil with cleaner alternative fuels and greater efficiency. Promotes collaboration with international partners to increase bioenergy production. Includes research and incentives that aim to reduce barriers to increased biofuels use and the commercialization of new technologies.</p>
<p><u>President's Climate Action Plan</u>  <b>June 2013</b></p>	<p>Set goals to reduce carbon pollution in America by 17% by 2020 from 2005 levels. Outlined a strategy that focuses in part on Building a 21st Century Transportation Sector and Developing and Deploying Advanced Transportation Technologies. Promoted partnerships between the private and public sectors to deploy cleaner fuels.</p>



Through the American Recovery and Reinvestment Act, the Bioenergy Technologies Office was appropriated \$718 million in FY 2009. Learn more about the Office's [Recovery Act investments](#).

As biofuel technologies are developed and demonstrated, RD&D priorities adjust to bring more diverse biofuel pathways closer to commercialization.



Starch-based ethanol is a well-established commodity fuel with wide market acceptance through low-level blends in conventional vehicles and at higher blends in flex-fuel vehicles. Continued success of the ethanol industry helps pave the way for introducing cellulosic ethanol into the marketplace.

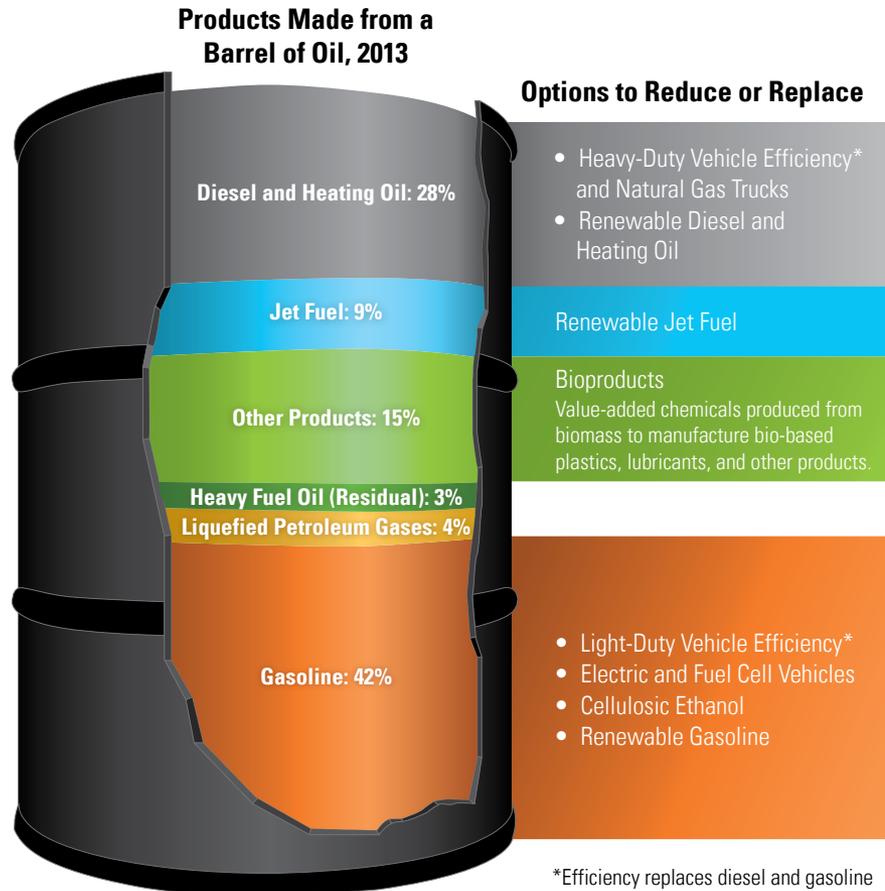
Over the last two decades, R&D has significantly lowered the cost of converting cellulosic biomass to fuel ethanol. DOE and the bioenergy community are leveraging cellulosic ethanol RD&D successes to accelerate algal and “drop-in” biofuel technologies for the production of hydrocarbon fuels, including renewable diesel, gasoline, and jet fuel.



The Bioenergy Technologies Office Today

## **REPLACING THE WHOLE BARREL**

## Products Made from a Barrel of Crude Oil (Gallons)



The United States spends approximately \$300 billion/year on imported oil; that's nearly **\$1 billion/day**.

- The U.S. transportation sector accounts for more than 70% of U.S. oil consumption.
- Only about 40% of a barrel of crude oil goes toward light-duty petroleum gasoline.
- Reducing dependence on oil requires developing technologies to replace gasoline, diesel, jet fuel, heavy distillates, and a range of biobased chemicals and products.

Source: <http://go.usa.gov/kYqV>

Note: A 42-U.S. gallon barrel of crude oil yields about 45 gallons of petroleum products.

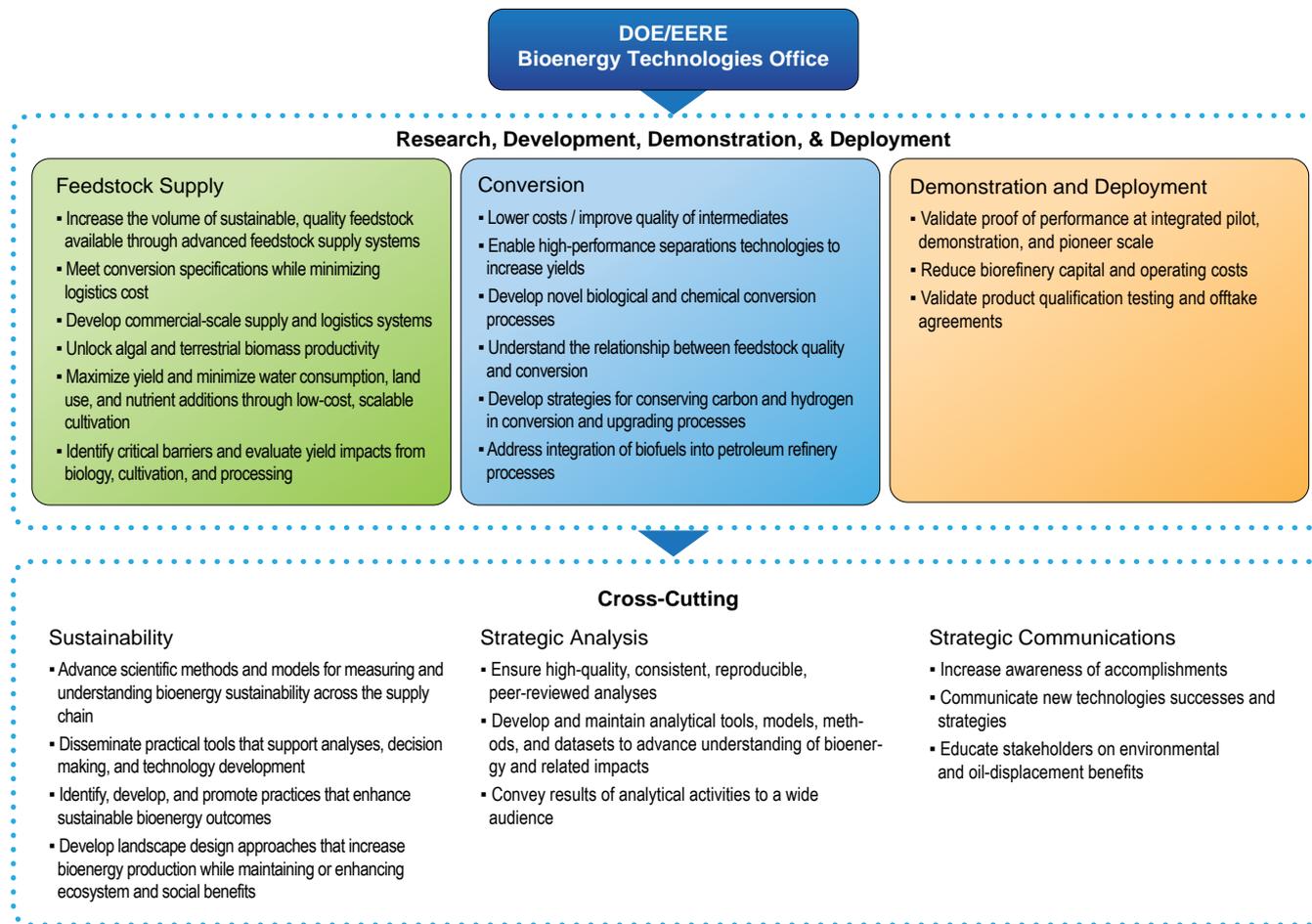
\*Efficiency replaces diesel and gasoline because it reduces demand, while providing the same service.



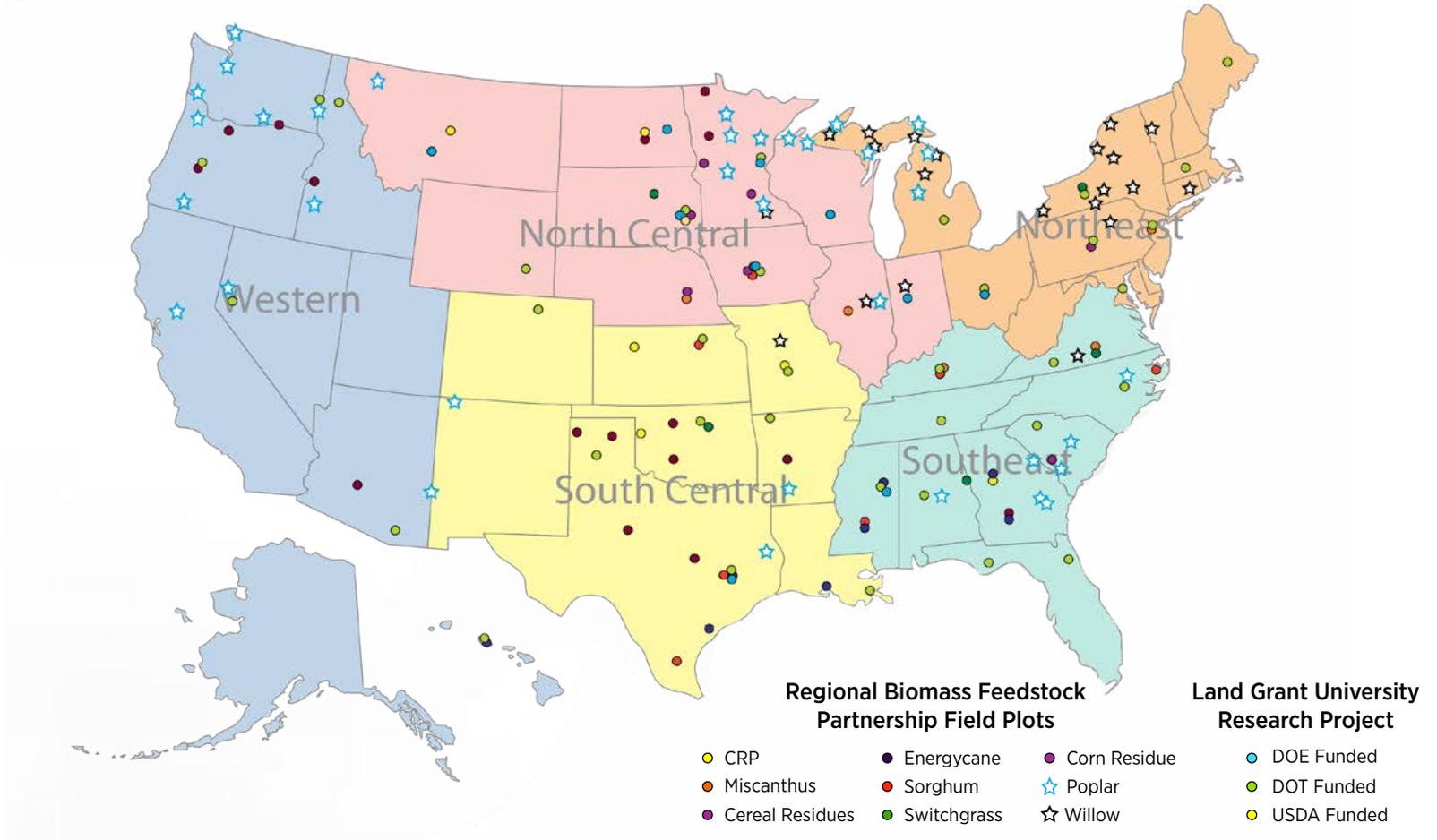
The Bioenergy Technologies Office Today

## **WORKING ACROSS THE SUPPLY CHAIN**

The Bioenergy Technologies Office forms cost-shared partnerships with key stakeholders to research, develop, and demonstrate technologies for advanced biofuels, bioproducts, and biopower from lignocellulosic and algal biomass across the supply chain.



Current activities involve R&D led by the [Sun Grant Initiative](#), a network of land-grant universities, in partnership with industry, national laboratories, and the U.S. Department of Agriculture (USDA), to establish biomass feedstock productivity baselines. The bioenergy crop trials are located across the nation.



*\* scroll over for description*

Current efforts focus on logistics RD&D to develop and optimize cost-effective, integrated systems for harvesting, collecting, storing, preprocessing, handling, and transporting a range of [sustainable feedstocks](#), including agricultural residues, forest resources, dedicated energy crops, and algae. Additionally, the findings of the [U.S. Billion-Ton Update](#) report that the United States should be able to sustainably produce 1 billion tons of domestic biomass per year.



Click to view a video from Idaho National Laboratory about transforming biomass into feedstock for bioenergy. Right click the video to view in full screen mode.

A new uniform format advanced supply system design will achieve these properties by improving the capacity and efficiency of each feedstock logistics unit operation.

Current activities deal with the major RD&D challenges associated with developing a logistics system that is capable of supplying biorefineries with high-density, aerobically stable, and high-quality biomass material.

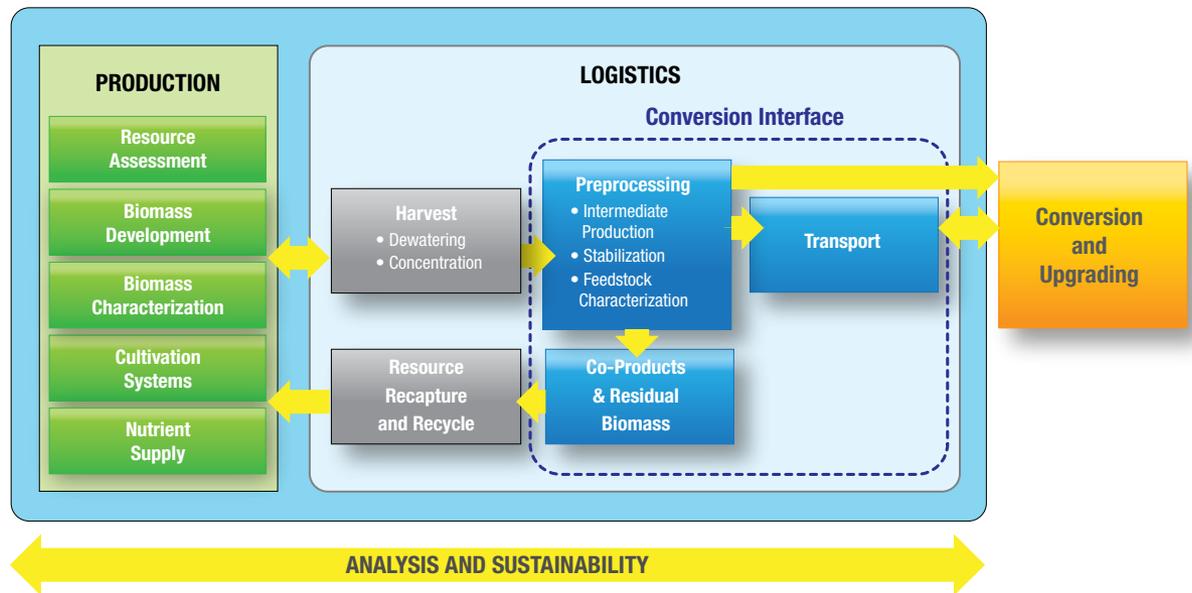
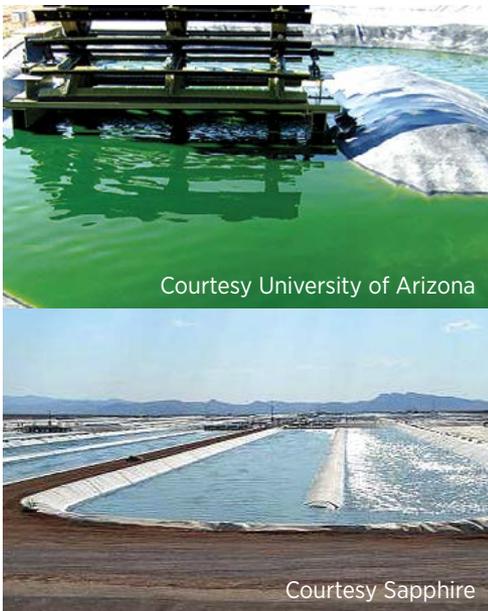
*Click on the buttons below to view the logistics system concept:*



Existing Supply Systems	Depot Supply Systems
Nearer-term focus	Longer-term focus
Access to a niche or limited feedstock resource	Access to a broader resource
Based on a dry supply system design (field-dried feedstocks)	Allows higher moisture feedstocks into supply systems
Designed for a specific feedstock type (dry corn stover)	Design addresses multiple feedstock types

Activities include R&D on [algal feedstocks](#) and issues related to the sustainable production of algae-derived biofuels.

Benefits	Challenges
High productivity expands domestic biomass potential	Affordable and scalable algal biomass production
Adds value to unproductive or marginal lands	Feedstock production and crop protection
Ability to use waste and salt water	Energy-efficient harvesting and drying
Potential recycling of carbon dioxide	Extraction, conversion, and product purification
Production of a range of biofuel feedstocks suitable for diesel and aviation fuels	Siting and sustainability of resources



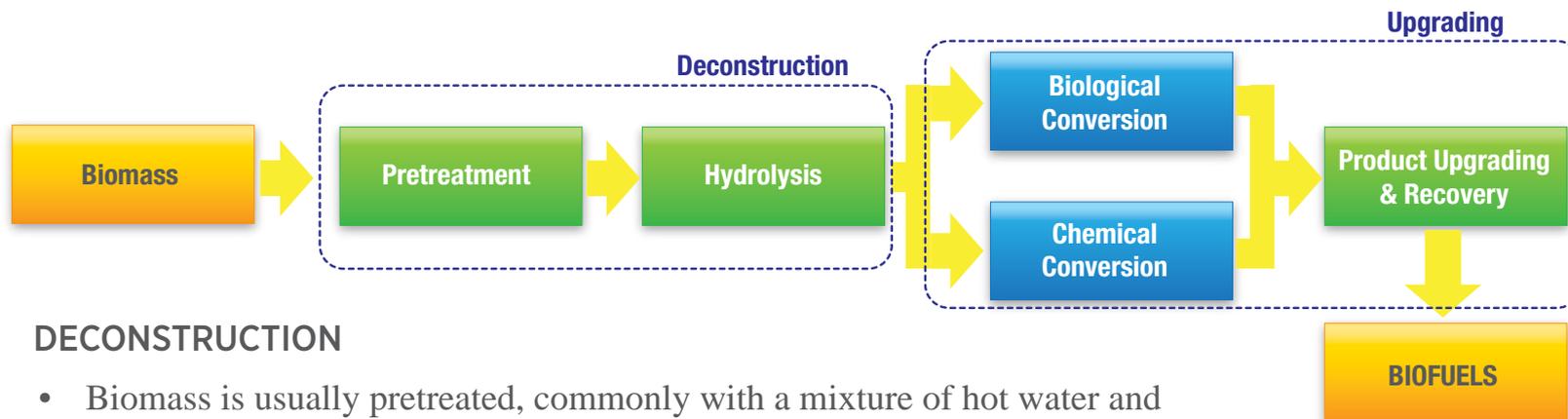
In 2012, the Algae Technology Area opened the Advancements in Sustainable Advancements in Algal Production funding opportunity and selected the ATP<sup>3</sup> to receive \$15 million in DOE funds to manage a regional network of algae testbeds.



AzCATI Facility at ASU

The ATP<sup>3</sup> project established a network of regional testbeds to empower knowledge creation and dissemination within the algal research community, accelerate innovation, and support growth of the nascent algal fuels industry. ATP<sup>3</sup> sites increase access to high-quality cultivation facilities, downstream process equipment, and analytical facilities, along with world renowned technical expertise and proactive management structure. ATP<sup>3</sup> personnel design, validate, and execute long-term cultivation trials to produce standardized data that will enable the comparison of promising production strains, algal culture systems, and processes at a meaningful scale across different regional, seasonal, environmental, and operational conditions.

RD&D projects are improving the [biochemical conversion](#) of cellulosic biomass to biofuels and chemicals. These processing routes entail breaking down biomass to make the carbohydrates available for conversion into sugars that microorganisms and other catalysts can use to create biofuels and bioproducts.

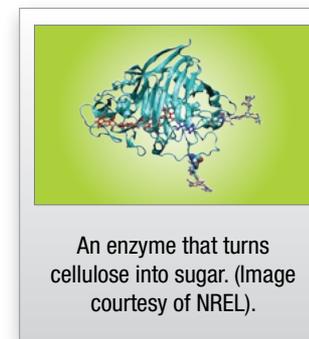


## DECONSTRUCTION

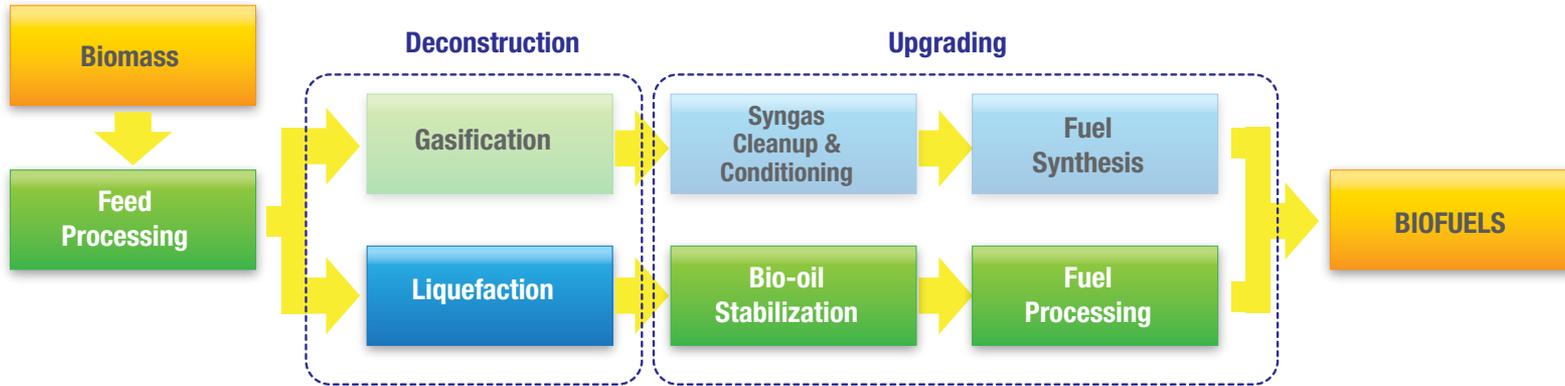
- Biomass is usually pretreated, commonly with a mixture of hot water and chemicals to make it amenable to hydrolysis.
- The pretreated biomass can be exposed to enzymes, which unlock and release (hydrolyze) the biomass sugars.
- Alternately, biomass can be completely deconstructed into sugar and carbohydrate streams using non-enzymatic processing technologies.

## UPGRADING

- The sugar-rich media is then fed to organisms, like yeast and E. Coli, which transform the sugars into biofuels and chemicals.
- Chemical catalysis can also be employed to transform the sugars into biofuels and chemicals.



RD&D projects are improving the thermochemical conversion of cellulosic and algal biomass. These processing routes use heat and chemistry to convert biomass into a liquid or gaseous intermediate, such as syngas or bio-oil. Customized processing of intermediates produces biopower or biofuels such as gasoline, diesel, and jet fuel.



## DECONSTRUCTION

- Ground and dried biomass is heated in reactors to produce gas, solid, and liquid intermediates.
- Gasification efforts are being de-emphasized after 2012 demonstration.

## UPGRADING

- Synthesis gas is cleaned (inorganics and CO<sub>2</sub> removal) and conditioned (tar reforming) and converted into biofuels and chemicals.
- Bio-oils are stabilized and upgraded (O<sub>2</sub> removal) to produce biofuels and chemicals.

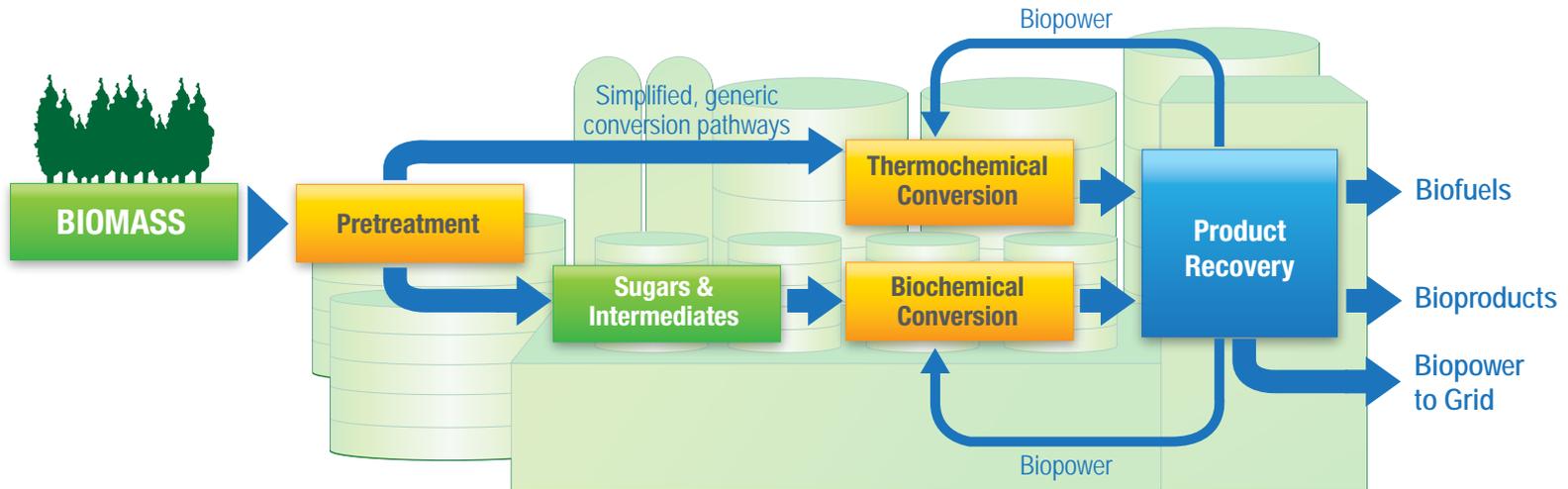


An F/A-18 Green Hornet Fighter plane operating on a 50/50 biofuels blend. (Photo courtesy of the U.S. Navy.)

Click the play arrows below to learn more about each bioenergy conversion route.



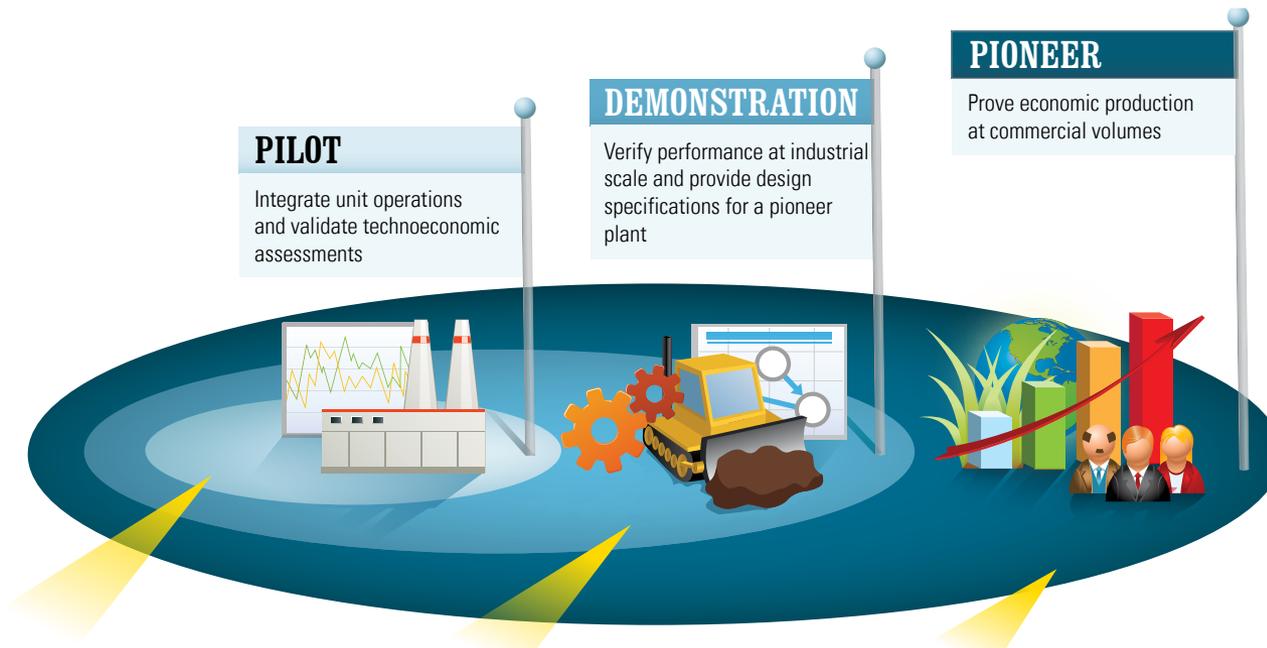
Current efforts include working through public-private, cost-sharing partnerships to address critical challenges of technology deployment for [integrated biorefineries](#) (IBRs). These biorefinery projects prove the viability of various feedstock and conversion pathways and reduce technical and financial risks by following a progression from pilot- to demonstration- to pioneer-scale.



Biomass Key Challenges	Pretreatment Key Challenges	Conversion Key Challenges	Product Key Challenges
<ul style="list-style-type: none"> <li>Reliable supply</li> <li>Consistent quality</li> <li>Affordable delivery</li> </ul>	<ul style="list-style-type: none"> <li>Biomass feeding</li> <li>Biomass sizing and moisture</li> <li>Solids handling</li> </ul>	<ul style="list-style-type: none"> <li>Products yields</li> <li>Construction materials</li> <li>Catalysts</li> <li>Fermentation organisms</li> </ul>	<ul style="list-style-type: none"> <li>Separations</li> <li>Catalytic upgrading</li> <li>Recycle loops</li> </ul>

*\* scroll over "Meeting the Challenges" for description*

The Bioenergy Technologies Office provides cost-shared funding to industry partners to demonstrate promising conversion technologies and systems at progressive scales. Each scale builds upon the results of the prior stage.



## PILOT OBJECTIVES

- Technical Performance
  - Prove conversion efficiencies
  - Confirm mass and energy balance
- Operations
  - Determine feedstock and product specifications
  - Integrate technology from feedstock in through product out
  - Evaluate process sustainability metrics
- Scale-Up to Demonstration
  - Develop robust economic model

## DEMONSTRATION OBJECTIVES

- Market Risk
  - Manufacture product for commercial acceptance testing
- Operations
  - Generate over 1000 hours of continuous operational data
  - Balance sustainability performance across environmental, social, and economic dimensions
- Scale-Up to Pioneer
  - Validate commercial equipment specifications and performance

## PIONEER OBJECTIVES

- Financial Risk
  - Prove technology is profitable to support robust replication of commercial facilities
- Feedstock Supply and Logistics
  - Demonstrate robust feedstock supply and offtake value chain
- Operations
  - Validate performance data and equipment design specifications
  - Verify sustainability performance across environmental, social, and economic dimensions

Current IBR project investments will accelerate U.S. bioindustry growth and ramp up production of a range of biofuels and bioproducts.

*Click image to view video of the groundbreaking*

- DOE investment has enabled equity investments, initial public offers, venture capital funding, joint ventures, and joint development agreements.

A groundbreaking in March 2012 at the POET-DSM commercial IBR, Project LIBERTY. (Photo courtesy of POET-DSM Advanced Biofuels.)

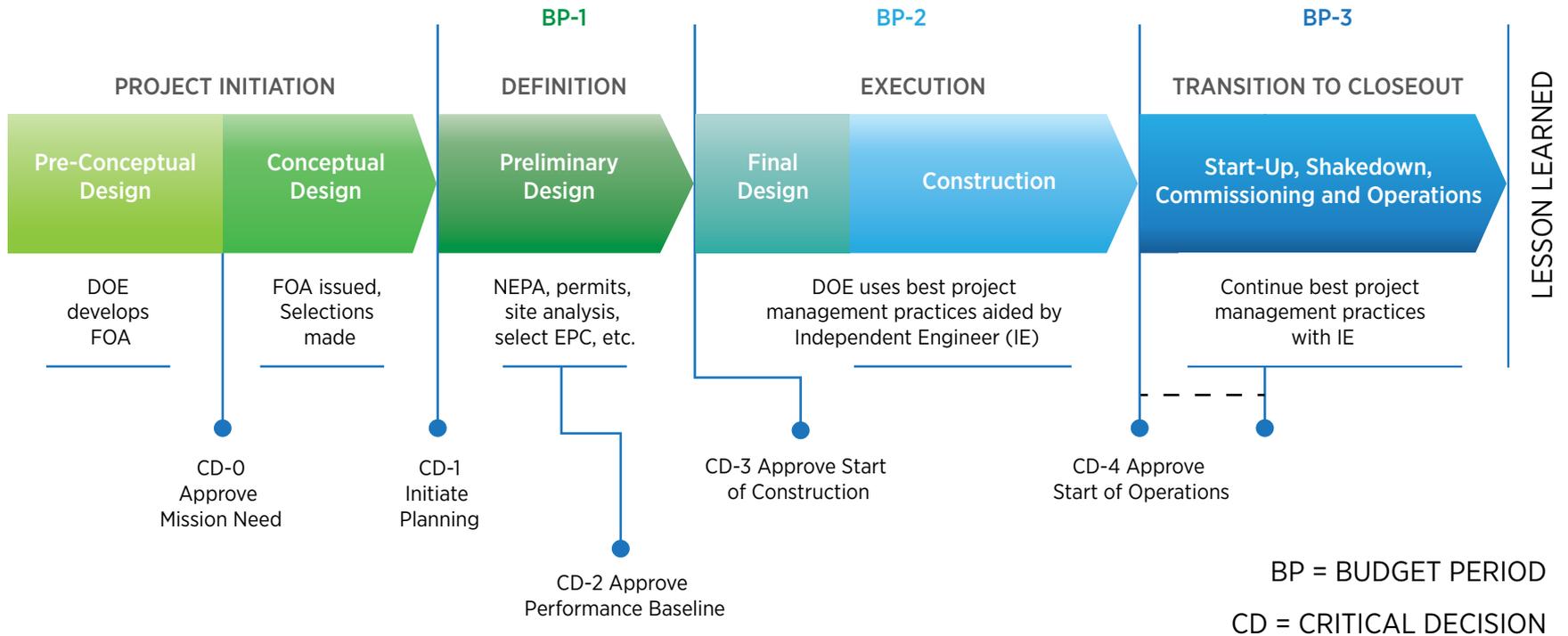
## Current Status of the IBR Portfolio (as of July 2014)

A total of 34 IBR projects have been awarded to date:

- |  |   |
|--|---|
| <ul style="list-style-type: none"><li>• 5 Complete (2 still filing final report)</li><li>• 24 Active</li><li>• 5 Mutually Terminated</li></ul> | <ul style="list-style-type: none"><li>• 16 produce Cellulosic Ethanol</li><li>• 12 produce Renewable Hydrocarbons</li><li>• 3 produce Algae Oil</li><li>• 2 produce Bioproducts</li></ul> |
|--|---|



DOE's Key Role: Reduce the risk of investment for first-of-a-kind technologies to attract private investors. The process of bringing an IBR on-line takes time and careful planning. This framework is divided into four main sections that correlate contractual Budget Periods (BP) to Critical Decision (CD) Points.





The image shows a map of the United States with various biorefinery projects marked by colored pins. The pins are color-coded by conversion technology: blue for Pilot, green for Demonstration, and red for Successfully Completed Projects. Some pins also feature a checkmark icon. The map includes a zoom control in the top left and an inset map of the Hawaiian Islands in the bottom left. Below the map are several filter panels:

- CONVERSION TECHNOLOGY:** A dropdown menu set to "ALL".
- PRIMARY FEEDSTOCK:** A list of feedstock types with checkboxes, all of which are checked: Agricultural Residues, Algae, Woody Biomass, Energy Crops, MSW, Vegetative and yard waste, and All.
- PRIMARY PRODUCT:** A dropdown menu set to "ALL".
- PROJECT SCALE:** A list of project scales with checkboxes, all of which are checked: Pioneer, Demonstration, Pilot, Successfully Completed Projects, and All.
- CHOOSE MAP VIEW:** Two radio button options: "BETO Biorefinery Investments by State" (selected) and "Display by Project".
- Show Map Labels:** A checkbox that is currently unchecked.

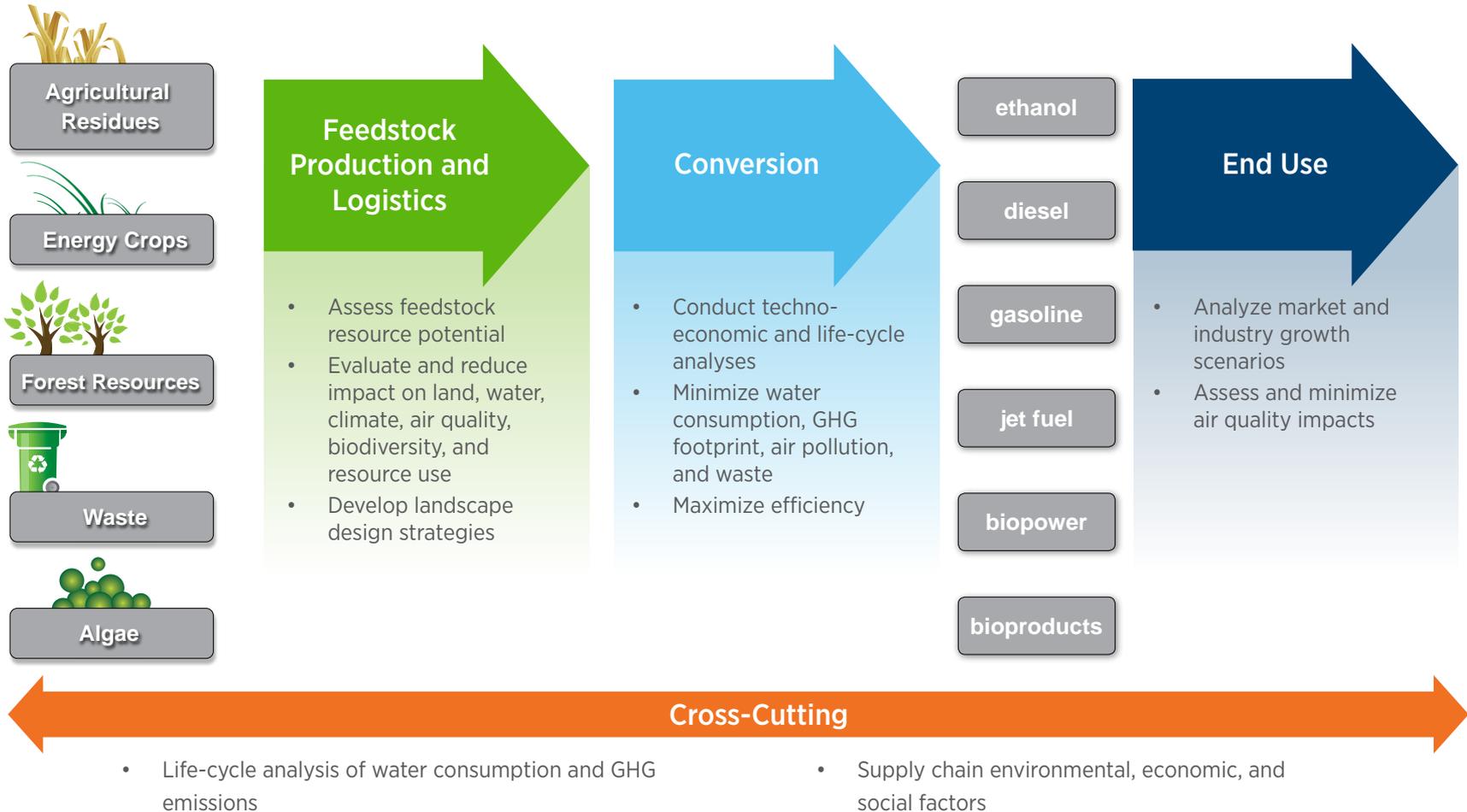
*Click on the map above to access the interactive IBR Map on the BETO website.*



The Bioenergy Technologies Office Today

## **PROMOTING SUSTAINABILITY, LEVERAGING STRATEGIC ANALYSIS**

Identifying and addressing the challenges for sustainable bioenergy production through field trials, applied research, capacity building, modeling, and analysis.



## Climate Changes and Air Quality



Analyzing biofuel pathways to quantify progress towards reducing [lifecycle greenhouse gases](#), [regulated emissions](#), and [fossil energy use](#).

## Soil Quality



[Developing strategies and tools](#) for producing biomass feedstocks while maintaining or enhancing soil quality.

## Land Use and Productivity



Advancing [landscape design approaches](#) that increase biomass production while maintaining or enhancing ecosystem services and food, feed, and fiber production.

## Water Quantity and Quality



Assessing the [water resource use and water quality](#) of bioenergy production, and investigating opportunities for bioenergy crops [to improve water quality](#).

## Biological Diversity



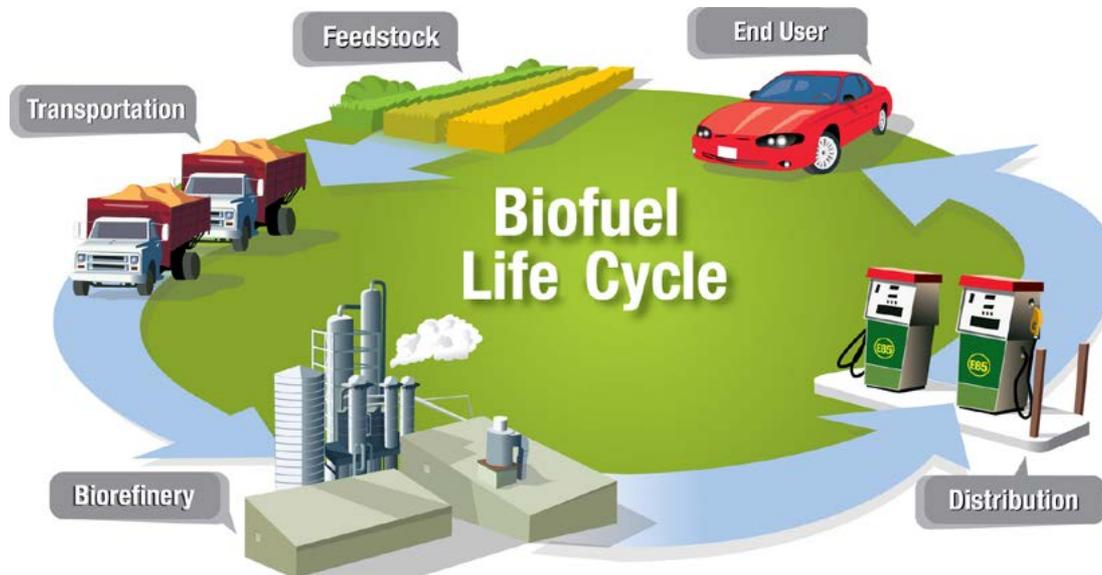
Investigating relationships between [bioenergy crops and biodiversity](#), and engaging with diverse experts to understand and promote practices that conserve wildlife and biodiversity.

Efforts also include evaluating [sustainability indicators](#) across the bioenergy supply chain, contributing to [global scientific dialogues](#) on bioenergy sustainability, and engaging with [international organizations](#) to understand and enhance more sustainable outcomes.

Current activities provide the analytical basis for Office planning and progress assessments, define and validate performance targets for biomass technologies and systems, review and evaluate external analyses and studies, and contribute engineering analyses.

State-of-technology assessments conducted by Idaho National Laboratory, National Renewable Energy Laboratory, Oak Ridge National Laboratory, Pacific Northwest National Laboratory, and Sandia National Laboratories

Land-use change analysis conducted by Argonne National Laboratory, National Renewable Energy Laboratory, Oak Ridge National Laboratory, Pacific Northwest National Laboratory, Purdue University, and the University of Minnesota



GIS-based assessment of algal resource potential conducted by Pacific Northwest National Laboratory

Well-to-wheels analysis and expansion of Greenhouse Gases Regulated Emissions and Energy Use in Transportation (GREET) model for emerging biofuels production pathways conducted by Argonne National Laboratory

Current efforts provide context and justification for decisions at all levels by establishing the basis of quantitative metrics, tracking progress towards goals, and informing portfolio planning management.



*\*Annual internal reviews of all IBR projects*

In 2012, eight [technology pathways](#) to hydrocarbon biofuels were selected based on the following criteria:

- Feasibility of achieving cost goal of \$3/gal
- Near/mid/long-term techno-economic potential
- Potential national impact
- Feedstock availability/flexibility
- Data availability across the full pathway
- Co-product economics
- Environmental sustainability.

## TECHNOLOGY PATHWAYS

[Biological Conversion of Sugars to Hydrocarbons](#)

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[Catalytic Upgrading of Sugars to Hydrocarbons](#)

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[Ex-Situ Catalytic Pyrolysis](#)

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[In-Situ Catalytic Pyrolysis](#)

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[Fast Pyrolysis and Upgrading](#)

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[Syngas to Mixed Alcohols to Hydrocarbons](#)

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[Whole Algae Hydrothermal Liquefaction](#)

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[Algal Lipid Extraction Upgrading to Hydrocarbons](#)

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**Current Next Steps:** Identify cost goals and technical targets and develop design case reports for each pathway. These design case reports can be found on the BETO [Key Publications page](#).

The [Bioenergy Knowledge Discovery Framework \(KDF\)](#) is an online collaboration and geospatial analysis toolkit that allows researchers, policymakers, and industry to explore and engage the latest bioenergy research. The KDF harnesses Web 2.0 and social networking technologies to build a collective knowledge system that facilitates collaborative production, integration, and analysis of bioenergy related information.



## BIOENERGY KNOWLEDGE DISCOVERY FRAMEWORK

U.S. DEPARTMENT OF ENERGY



CONTRIBUTE DATA



FIND DATA



VISUALIZE DATA



FIND TOOLS & APPS



LEGISLATORS



RELATED BILLS



COMMITTEES

The newest tool in the Bioenergy KDF is the [Legislative Library](#)—a database for tracking bioenergy activity in Congress. Visitors can use the library to look up what bioenergy policies their congressmen have introduced or to learn what the most recent bills on bioenergy include.



**BIOENERGY**  
KNOWLEDGE DISCOVERY FRAMEWORK  
U.S. DEPARTMENT OF ENERGY

Read more about how to navigate the Bioenergy KDF Legislative Library from the February 2014 [BETO blog post](#).



The Bioenergy Technologies Office Today

## **COORDINATING WITH A NETWORK OF STAKEHOLDERS**

- Share and learn from valuable insights and perspectives that can help identify the most critical challenges
- Better define and employ strategies with partners from industry, national labs, academia, and non-profit organizations to overcome challenges in effectively deploying biofuels, biopower, and bioproducts.

## Bioenergy Technologies Office



### PROJECT PERFORMERS

- National Laboratories
- Industry, Academia, and Nonprofit
- State and Local Entities

### DOE INTERNAL COLLABORATION

- Office of Advanced Research Projects-Energy (ARPA-E)
- Office of Science (SC)
- Other Energy Efficiency and Renewable Energy (EERE) Program Offices

### FEDERAL COLLABORATION

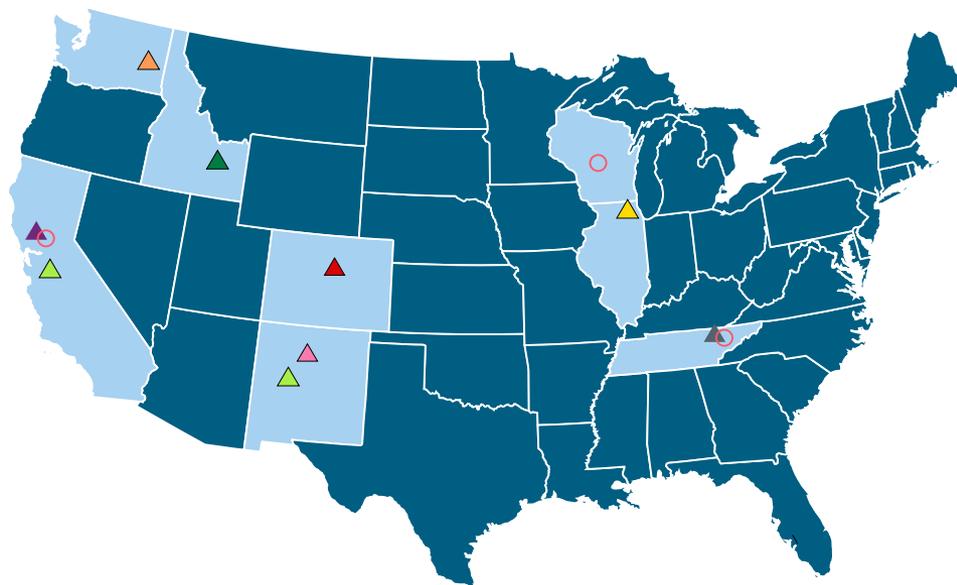
Biomass Research & Development Board, including offices and programs within the following:

- Department of Defense (DOD)
- Department of the Interior (DOI)
- Department of Transportation (DOT)
- Environmental Protection Agency (EPA)
- National Aeronautics and Space Administration (NASA)
- National Science Foundation (NSF)
- Office of Science and Technology Policy (OSTP)
- U.S. Department of Agriculture (USDA)

### NON-FEDERAL COORDINATION AND COLLABORATION

- Biomass R&D Technical Advisory Committee
- State, Local, and International Agencies and Research Institutions
- Trade and Professional Associations
- Non-governmental Organizations
- Investment and Financial Communities

## PROJECT PERFORMERS: DEPARTMENT OF ENERGY NATIONAL LABORATORIES AND RESEARCH CENTERS



- |   |  |
|---|--|
| ▲ Argonne National Laboratory             | ▲ Oak Ridge National Laboratory                |
| ▲ Idaho National Laboratory               | ○ Office of Science Bioenergy Centers          |
| ▲ Lawrence Berkeley National Laboratories | <i>Great Lakes, Madison, WI</i>                |
| ▲ Los Alamos National Laboratory          | <i>Joint BioEnergy Institute, Berkeley, CA</i> |
| ▲ National Renewable Energy Laboratory    | <i>Bioenergy Science Center, Oak Ridge, TN</i> |
|   | ▲ Pacific Northwest National Laboratory        |
|   | ▲ Sandia National Laboratories                 |

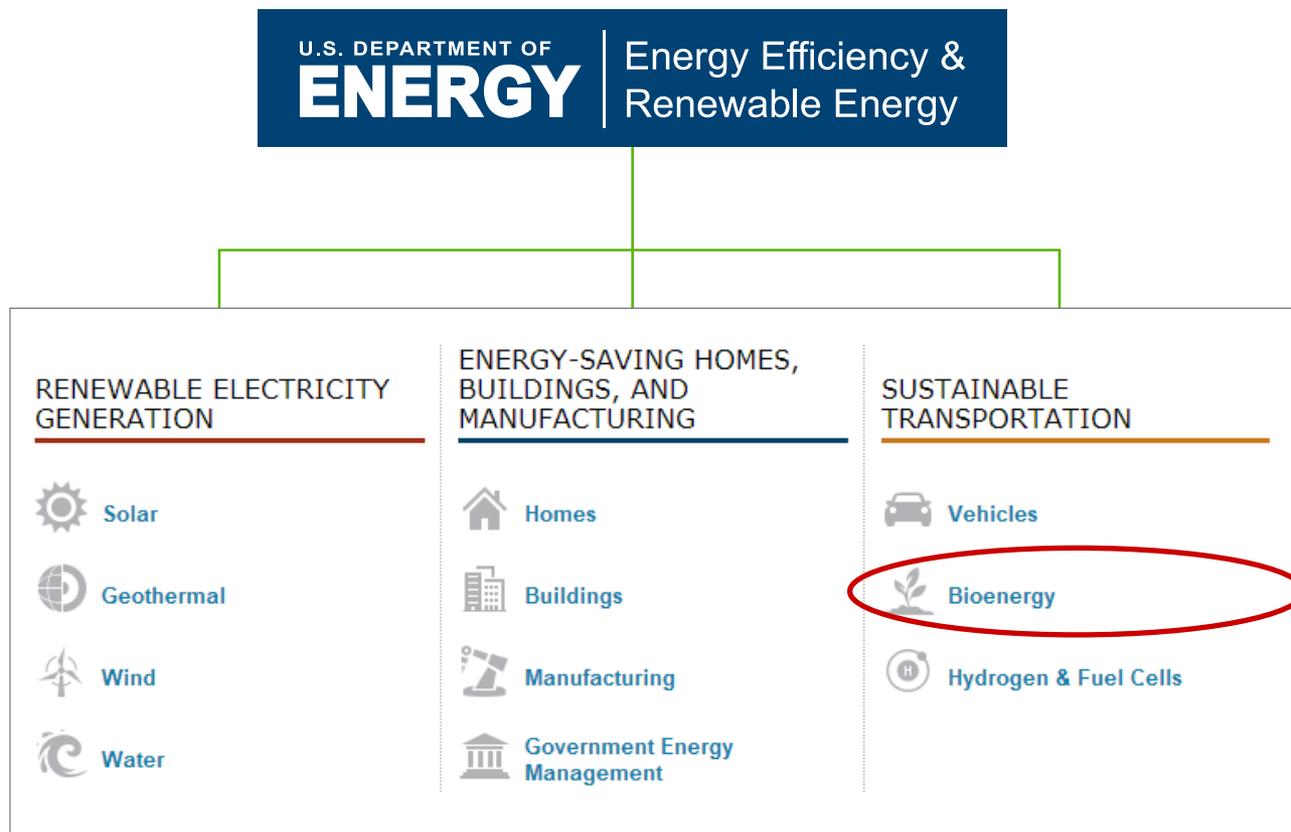
DOE national laboratories' RD&D activities are fully integrated in the Office portfolio.

The Bioenergy Technologies Office works with national laboratories and the Office of Science Bioenergy Research Centers to:

- Reduce common biofuels R&D barriers
- Complete techno-economic, life cycle, sustainability, and other analytical work
- Partner with industry and universities on bioenergy technology demonstrations.

While Bioenergy Research Centers' lead institutions are identified on the map, the centers work with numerous partner institutions across the United States.





The Vehicle Technologies Office partners with the Bioenergy Technologies Office to support fuel characterization and combustion testing for novel biofuels and biofuel blends, including work with [Clean Cities](#).

The Bioenergy Technologies Office also works with the Advanced Manufacturing Office on the [Clean Energy Manufacturing Initiative](#) in support of Carbon Fiber production from biomass.

## OFFICE OF SCIENCE

Office of Biological and Environmental Research (BER) and  
Office of Basic Energy Sciences (BES)

- Regularly coordinate on fundamental and applied biomass and biofuel research activities
- Partner in supporting Biomass R&D Board
- Share information about new partnerships, major research efforts at Bioenergy Research Centers, conversion- and feedstock-related activities and user facilities, and possible joint funding requests

## ADVANCED RESEARCH PROJECTS AGENCY-ENERGY (ARPA-E)

- Regularly coordinate by sharing information on relevant projects, especially those from ARPA-E's [PETRO](#) (Plants Engineered to Replace Oil) biomass-based fuels and [Electrofuels](#) Programs
- Complementary missions to fund projects that will:
  - Develop transformational technologies that reduce the nation's dependence on foreign energy imports
  - Reduce U.S. energy-related emissions, including GHGs
  - Ensure the United States maintains its leadership in developing and deploying advanced energy technologies



Engineered E. coli cells secreting hydrocarbons with similar fuel characteristics to gasoline. In this optical image, cells are shown naturally sequestering themselves from secreted “oils,” thereby facilitating fuel recovery. Image by Eric Steen, Joint BioEnergy Institute.



PETRO projects include research on Sorghum and Camelina crops to supply the transportation sector with cost-competitive biofuels that do not affect the U.S. food supply.

## PRIMARY INTERAGENCY PARTNERS

### [Biomass Research and Development Board](#)

Coordinates federal government biofuels and biobased products efforts

#### Biomass R&D Resources:

[TAC Library](#) | [Biomass R&D Timeline](#)



## NON-FEDERAL COORDINATION, COLLABORATION, AND PARTNERING

### [Biomass R&D Technical Advisory Committee \(TAC\)](#)

State, local, and international agencies and research institutions

Trade and professional associations

Nongovernmental organizations

The Office Communications Team conducts strategic outreach by promoting the benefits of sustainable biomass and biofuels to the public and key stakeholders and highlighting the role bioenergy plays in the creation of green jobs and energy security.

## OFFICE RECOGNITION



**Public Recognition** – The subscribers of *Biofuels Digest* selected the U.S. Department of Energy as number 5 of 40 in their list of “Hottest Partners in Bioenergy and Bio-Based Materials ” and 4 BETO staff members made Biofuels Digest’s “Top 100 People in Bioenergy.”



**Congressional Recognition** – The House Appropriations Committee declared that BETO’s research into next-generation biofuels has the potential to “dramatically” lower the impact of future high gas prices on Americans.

**Web Efforts**: Maintaining an easily accessible portal for sharing the most relevant and up-to-date materials

**New and Social Media**: Reaching out to new demographics and engaging in two-way conversations with audiences instantaneously.

**Publications**: Providing tangible and in-depth descriptions and accounts of technologies, activities, and accomplishments.

**Multimedia**: Creating dynamic and interactive communications products that make advanced research topics easily digestible and visually engaging.

**Press Releases**: Promoting high-level and timely information about important BETO topics to increase visibility.

**Webinar Series**: Enabling remote participants to take part in program discussions.

[Sign up for the BETO Newsletter!](#)



[Follow BioenergyKDF on Social Media!](#)



Visit the [BETO Blog](#) and the [EERE Blog](#) for articles about developments and events from BETO and within the bioenergy industry.

The screenshot shows the Energy.gov website header with the logo and navigation menu. Below the header, the 'EERE BLOG' section is visible, featuring a sidebar with links like 'News & Blog', 'Blog', 'D-Roll', etc. The main content area displays a post titled '4 Questions for a Better Buildings Case Competition' dated July 2, 2014, with a photo of a group of people. Below it, another post is partially visible, dated June 30, 2014, with a photo of a car.



[Subscribe](#) to the BETO blog for updates.

The screenshot shows the Bioenergy Technologies Office Blog page. The header includes the U.S. Department of Energy logo and navigation links: HOME, ARCHIVE, CONTACT, SUBSCRIBE. The main content area features a post titled 'Jump-Start Your Career with the Bioenergy Industry' dated June 25, 2014. The post includes two images: a line graph and a molecular structure diagram. The text of the post reads: 'Are you a recent college graduate looking to jump-start your career? Bioenergy is a dynamic and emerging field, and whether you majored in engineering or English, science or political science, business or biology, there are numerous possibilities to use your skills and education in the industry.'



The Bioenergy Technologies Office Today

## **PUBLICATIONS AND INNOVATIONS**

Project and Program Peer Review meetings are biennial reviews that provide DOE an opportunity to obtain meaningful feedback from stakeholders on current federally funded projects. The information is useful for the Bioenergy Technologies Office to consider future funding and portfolio balance decisions. This is also an opportunity for interested stakeholders to learn about state-of-the-art biomass energy technology development activities.

Full results of the BETO Project Peer Review and Program Management Review are available in the [Final Peer Review Report](#). Presentations from the BETO Project Peer Review are available under the individual Technology Area agenda tabs on the [Peer Review Portal](#) and by clicking on the titles to the right.



BETO develops a number of publications that outline, highlight, and report on its strategy for research, development, and demonstration of various biomass technologies.



[Bioenergy Technologies Office  
Multi-Year Program Plan](#)  
July 2014



[Integrated Biorefineries:  
Reducing Investment Risk in  
Novel Technology](#)  
April 2014



[Renewable, Low-Cost Carbon  
Fiber for Lightweight Vehicles:  
Summary Report](#)  
October 2013



[Replacing the Whole Barrel to  
Reduce U.S. Dependence on Oil](#)  
May 2013



[8 Technology Pathway  
One-Pagers](#)  
November 2012



[U.S. Billion-Ton  
Update](#)  
August 2011

Additional Office publications can be found at  
[Bioenergy Technologies Office Publication and Product Library.](#)

## [READ ABOUT EERE SUCCESSSES](#)

The EERE Successes page highlights the positive impact of its work with businesses, industry partners, universities, research labs, and other entities to increase the use and effectiveness of affordable renewable energy and energy efficiency technologies.

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Federal Energy Management

This collection of the Office of Energy Efficiency and Renewable Energy's (EERE) successes highlights the positive impact of its work with businesses, industry partners, universities, research labs, and other entities to increase the use and effectiveness of affordable renewable energy and energy efficiency technologies. EERE's successes are organized by category into milestones, community-focused successes, and research successes. Browse successes by topic below.

**EERE Milestones and Awards**

**Department of Energy Delivers on R&D Targets around Cellulosic Ethanol**  
EERE Bioenergy Technologies Office demonstrates a broad series of R&D advancements.  
[Read the full story](#)

**EERE in Your Communities**

**Alaska Gateway School District Adopts Combined Heat and Power**  
Tok School's use of a biomass combined heat and power system is helping the school to save on energy costs.  
[Read the full story](#)

## [READ ABOUT EERE WORK IN YOUR STATE](#)

The EERE State Summaries educate policymakers and the public about EERE investments and their positive impacts in individual states and across the country.

**Clean Energy in My State**

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**State Summaries: A Snapshot of Our Work in States**  
The EERE State Summaries educate policymakers and the public about EERE investments and their positive impacts in individual states and across the country. The EERE portfolio consists primarily of competitively selected projects with the largest potential to help achieve national economic, strategic, environmental, and energy goals. EERE helps create the United States' clean energy economy today, developing and delivering innovative, market-driven solutions for the following:  
• Sustainable transportation

**FEATURES**

**Learn about EERE's Successes**

**Quick Links to States**  
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Thank you for taking the time to learn about the Bioenergy Technologies Office! Please feel free to [contact](#) the Office with any remaining questions you may have.