

# **Bioenergy Applications in the USA**

EGNRET 47

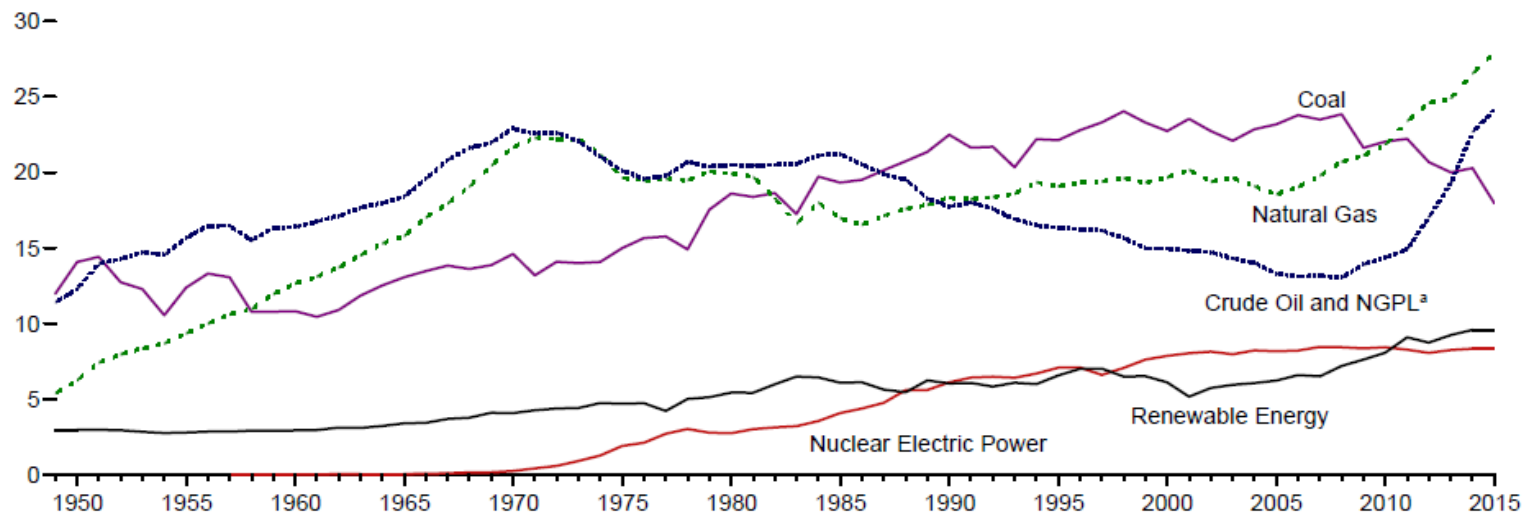
Jakarta, Indonesia

October 10-13, 2016

# Renewable energy and total U.S. energy use

**Figure 1.2 Primary Energy Production**  
(Quadrillion Btu)

By Source, 1949–2015

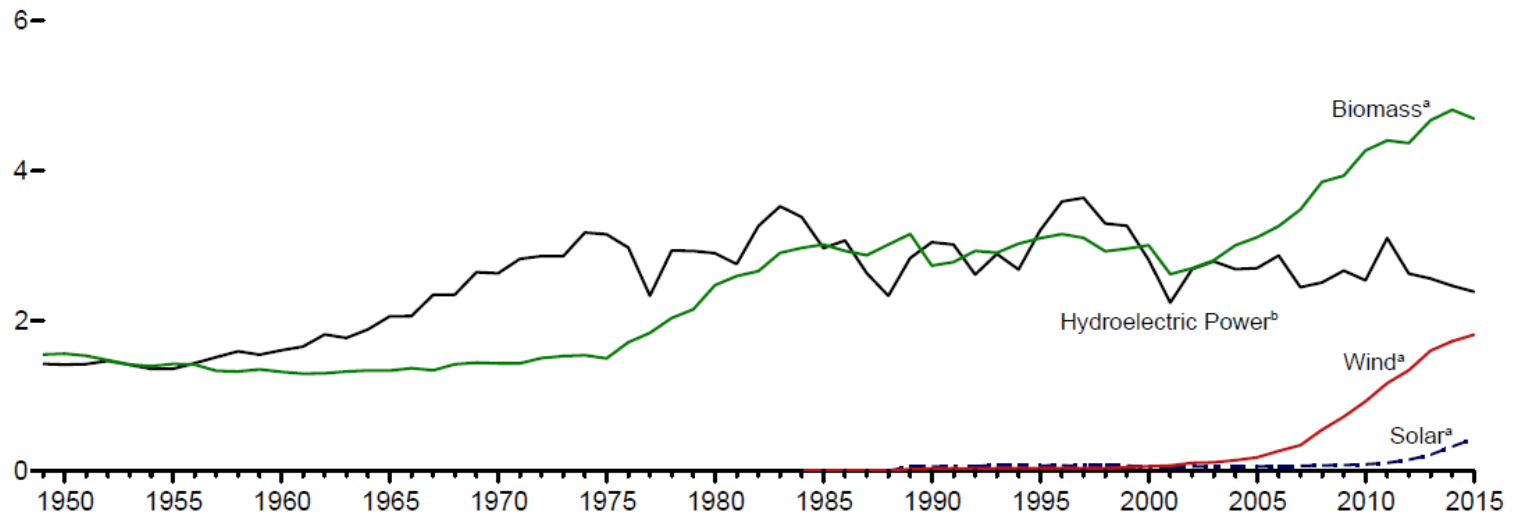


Source: US DOE EIA Monthly Energy Review, page 4  
September, 2016  
<http://www.eia.gov/totalenergy/data/monthly/>

# Renewable energy consumption

**Figure 10.1 Renewable Energy Consumption**  
(Quadrillion Btu)

Major Sources, 1949–2015



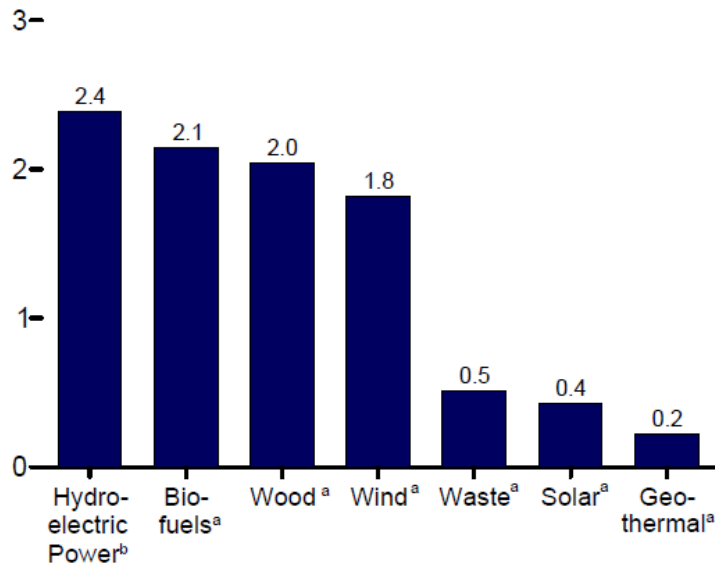
By Source, 2015

By Sector, 2015

Source: US DOE EIA Monthly Energy Review, page 150  
September, 2016  
<http://www.eia.gov/totalenergy/data/monthly/>

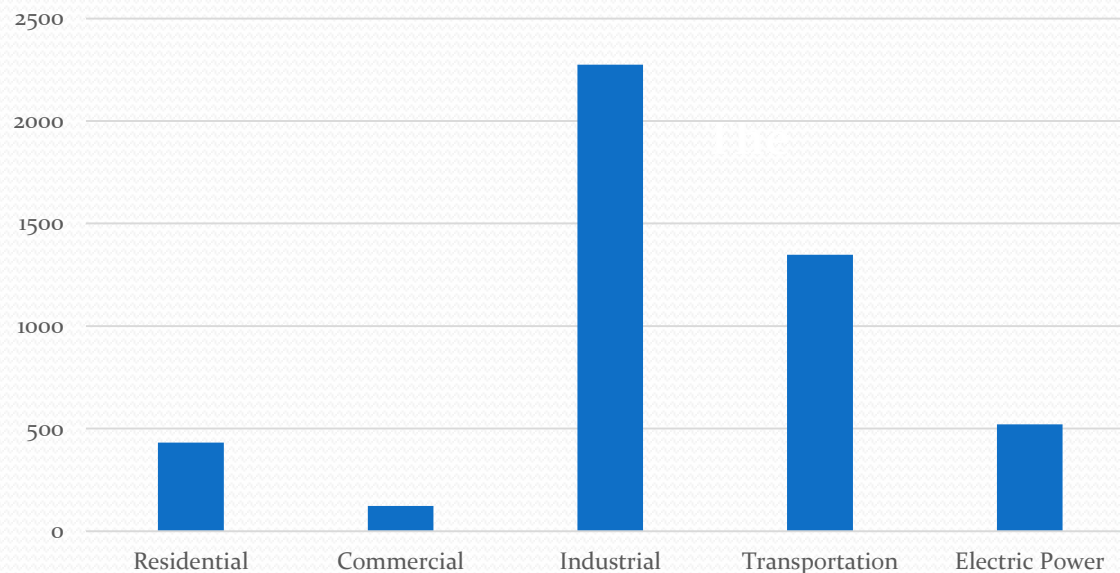
# Renewable energy by source

By Source, 2015



Source: US DOE EIA Monthly Energy Review, page 150  
September, 2016  
<http://www.eia.gov/totalenergy/data/monthly/>

# Biomass use by sector (2015, Trillion Btu)



Source: US DOE EIA Monthly Energy Review, page 151-154  
September, 2016  
<http://www.eia.gov/totalenergy/data/monthly/>

# Bioenergy at U.S. DOE

- The U.S. Department of Energy's Bioenergy Technologies Office (BETO)\* establishes partnerships with key public and private stakeholders to develop and demonstrate technologies for producing cost-competitive advanced biofuels from non-food biomass resources, including cellulosic biomass, algae, and wet waste (e.g. biosolids).
  - **Promoting national security through developing domestic sources of energy**
  - **Growing a sustainable future with renewable biomass resources**
  - **Generating green jobs by stimulating a bioenergy economy**

\*<http://energy.gov/eere/bioenergy/downloads/bioenergy-technologies-office-multi-year-program-plan-march-2016>

# What is biomass?

- Biomass is an energy resource derived from plant- and algae-based material that includes agricultural residues, forest resources, perennial grasses, woody energy crops, algae, wet waste (e.g., biosolids), municipal solid waste, urban wood waste, and food waste. It is unique among renewable energy resources in that it can be converted to carbon-based fuels, chemicals, or power.

\*<http://energy.gov/eere/bioenergy/downloads/bioenergy-technologies-office-multi-year-program-plan-march-2016>

# BETO has a multi-year program plan: March 2016\*

- The BETO technology portfolio is organized according to the biomass-to-bioenergy supply chain—



FEEDSTOCK SUPPLY



BIOMASS CONVERSION



BIOENERGY DISTRIBUTION



BIOENERGY END USE

\*<http://energy.gov/eere/bioenergy/downloads/bioenergy-technologies-office-multi-year-program-plan-march-2016>



# There are five key components of the BETO portfolio\*

- R&D on productive and competitive advanced algal systems
- R&D on sustainable, high-quality feedstock supply systems
- R&D on biomass conversion technologies
- Demonstration and validation of integrated biorefinery technologies up to industrial scale
- Crosscutting sustainability, analysis, and strategic communications activities.

\*<http://energy.gov/eere/bioenergy/downloads/bioenergy-technologies-office-multi-year-program-plan-march-2016>

# U.S. DOE/BETO Budget\*

(Dollars in Thousands)	FY 2015 Enacted	FY 2016 Enacted	FY 2017 Requested
Feedstocks	\$32,000	\$46,500	\$0
Feedstock Supply and Logistics	\$0	\$0	\$22,000
Advanced Algal Systems	\$0	\$0	\$30,000
Conversion Technologies	\$95,800	\$85,500	\$140,900
Demonstration and Market Transformation	\$79,700	\$75,100	\$75,000
Strategic Analysis and Cross-Cutting Sustainability	\$11,000	\$11,000	\$11,000
NREL Site-Wide Facility Support	\$6,500	\$6,900	\$0
<b>Total, Bioenergy Technologies</b>	<b>\$225,000</b>	<b>\$225,000</b>	<b>\$278,900</b>

\*<http://energy.gov/eere/downloads/bioenergy-technologies-office-fy-2017-budget-glance>

## Other Federal Agencies



The U.S. Department of Agriculture focuses on feedstock production and rural development, co-chairs the Biomass R&D Board with DOE, and partners with BETO on interagency efforts to support the bioeconomy.



BETO provides technical expertise on the Farm-to-Fly 2.0 initiative to produce renewable jet fuel.



EPA administers the Renewable Fuel Standard and works with BETO on life-cycle analysis for different fuel pathways.



DOT invests in national infrastructure and works with BETO on challenges related to bioenergy transportation and logistics.



Under the Defense Production Act, DOD partners with USDA and DOE to produce drop-in fuels for the military.



The National Science Foundation supports innovative chemical, environmental, and bio-engineering analysis that informs BETO research.

## Key Partnerships of the Bioenergy Technologies Office



### Department of Energy

#### Office of Energy Efficiency & Renewable Energy

##### Vehicle Technologies Office (VTO)



VTO partners with BETO on fuel and infrastructure characterization and new work on the co-optimization of fuels and engines.

##### Advanced Manufacturing Office (AMO)



AMO works with BETO to research and develop renewable, low-cost carbon fiber for lightweight vehicles.

##### Fuel Cell Technologies Office (FCTO)



FCTO and BETO coordinate on reformation and gasification, biomass availability, renewable hydrogen production, and the use of algae to produce biofuels and hydrogen.

#### Bioenergy Technologies Office (BETO)



BETO's mission is to accelerate the commercialization of advanced biofuels and bioproducts through targeted RD&D supported by public and private partnerships.

## The White House Office of Science and Technology Policy



BETO contributes to White House goals for the reduction of GHG emissions and oil imports under the Climate Action Plan.



BETO collaborates with the Office of Fossil Energy to utilize biomass for carbon capture.



The Office of Science focuses on early stage basic science with eventual commercial applications for bioenergy.



ARPA-E invests in innovative technologies including electro-fuels and the PETRO program for direct biofuel production.



The Loan Programs Office provides loan guarantees for commercial biorefinery projects.



Energy Information Administration

BETO contributes data to the EIA to support their accurate energy forecasting for consumption and production.

## National Laboratories



**BETO partners with other DOE offices, other federal agencies, and the national laboratories to achieve U.S. bioenergy goals**

Source: <http://energy.gov/eere/bioenergy/downloads/bioenergy-technologies-office-multi-year-program-plan-march-2016>



Questions  
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