

U.S. Bioenergy Programs: An Overview

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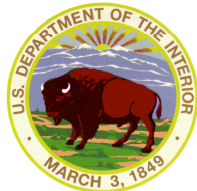
Preparatory Meeting: International Partnership on Bioenergy

Rome, Italy

6 September 2005

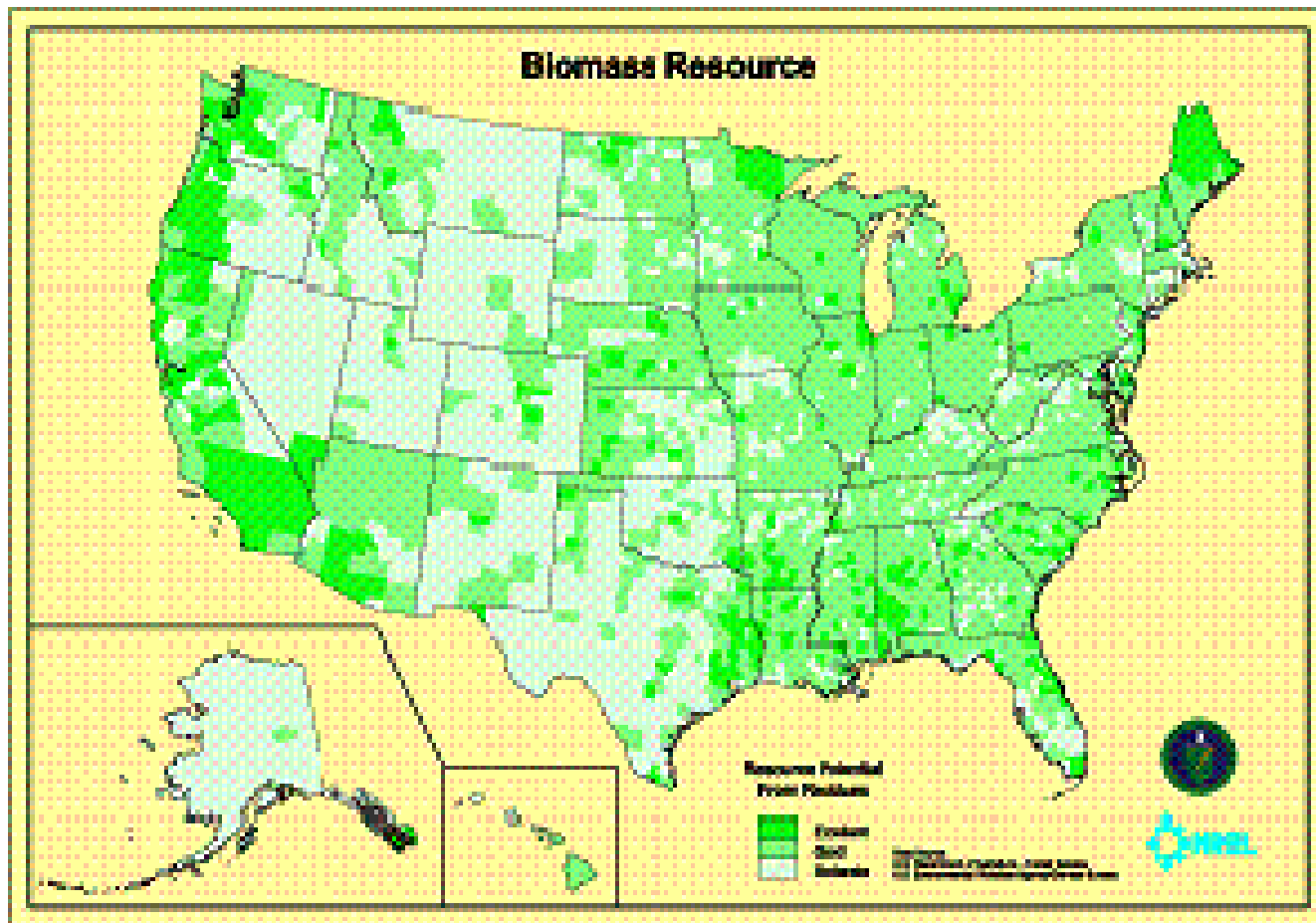
Key Legislation & Federal Biomass Agency Collaborations

- **Healthy Forest Restoration Act of 2003, Title II**
- **Memorandum of Understanding (MOU) for Woody Biomass Utilization (DOE/USDA/DOI)**
- **Biomass Research and Development Act of 2000**
 - Biomass R&D Technical Advisory Committee
 - Interagency Biomass R&D Board
- **Farm Bill 2002, Title IX**
 - Federal Procurement of Biobased Products (Section 9002)
 - Renewable Energy Systems and Energy Efficiency Improvements (Section 9006)
 - Biomass Research and Development (Section 9008)
 - Continuation of the Bioenergy Program (Section 9010)
- **Energy Tax Act of 1978** – Created excise tax exemption (5.2¢/gallon) for gasohol
- **Joint Projects**
 - Joint USDA/DOE Feedstock Stage Gate Review
 - Billion Ton Feedstock Study (USDA/DOE)
 - USDA/DOE Hydrogen MOU



Biomass Resources in the U.S.

Significant biomass resources are available throughout many parts of the United States.



The Potential of Biomass Future Use

USDA/DOE “Billion Ton” Study

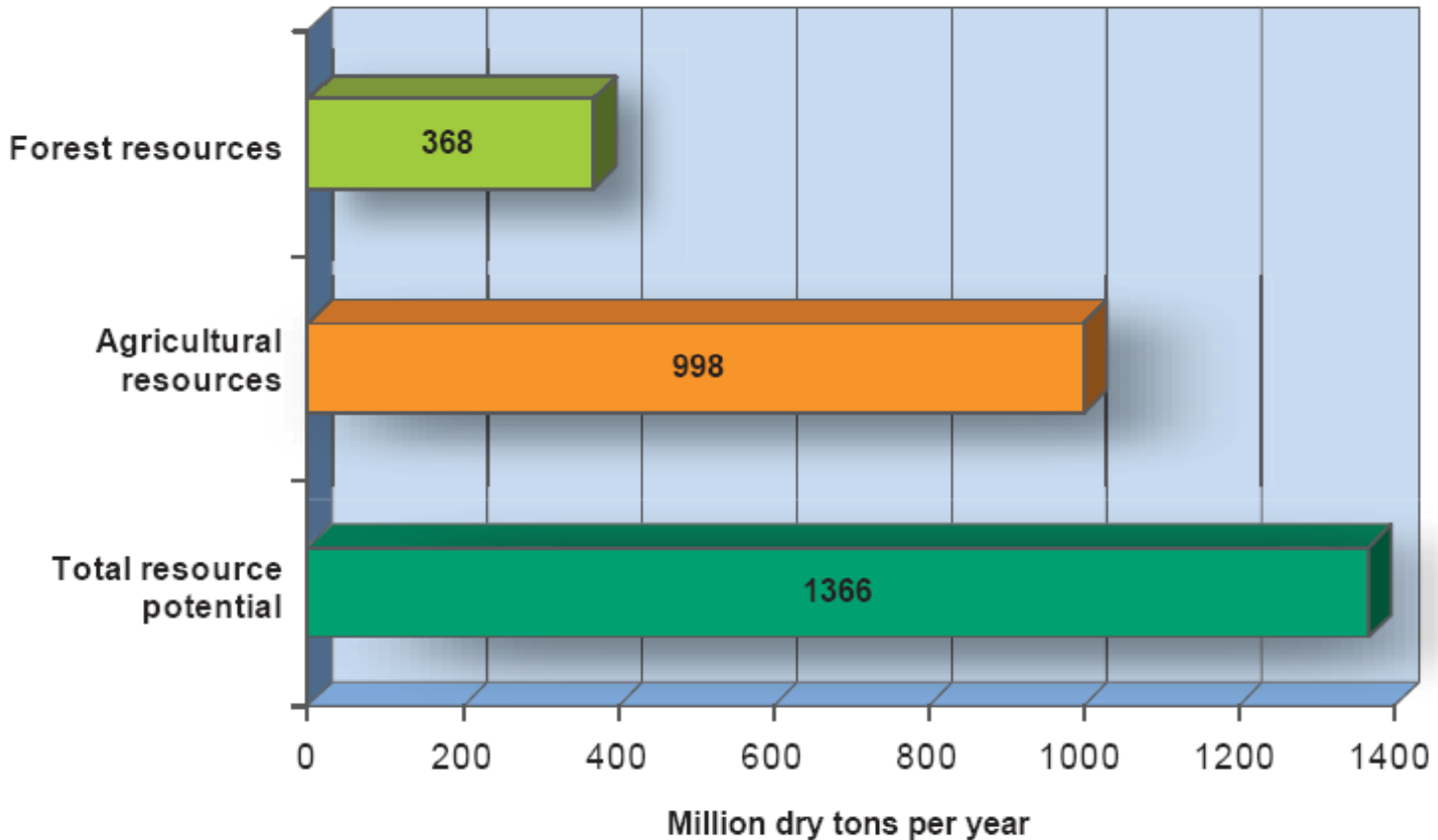
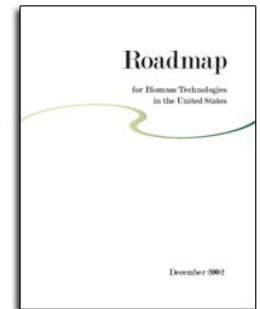
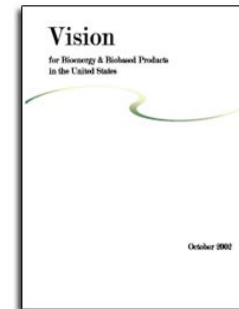


Figure 1: Annual biomass resource potential from forest and agricultural resources

http://feedstockreview.ornl.gov/pdf/billion_ton_vision.pdf

Biomass R&D Technical Advisory Committee

Biomass R&D Technical Advisory Committee targets for biomass



	2001	2010	2020	2030	Actual for 2004
BioPower Biomass share of electricity & heat demand in utilities and industry	2.1% (2.0 quads)	4% (3.3 quads)	5% (4.0 quads)	5% (5.0 quads)	2.1% (2.1 quads)
BioFuels (ethanol & biodiesel) Biomass share of demand for transportation fuels.	0.5% (0.15 quads)	4% (1.3 quads)	10% (4.0 quads)	20% (9.5 quads)	1.1% (0.30 quads)
BioProducts Share of target chemicals that are biobased.	5%	12%	18%	25%	5%

DOE Office of Biomass Program Mission

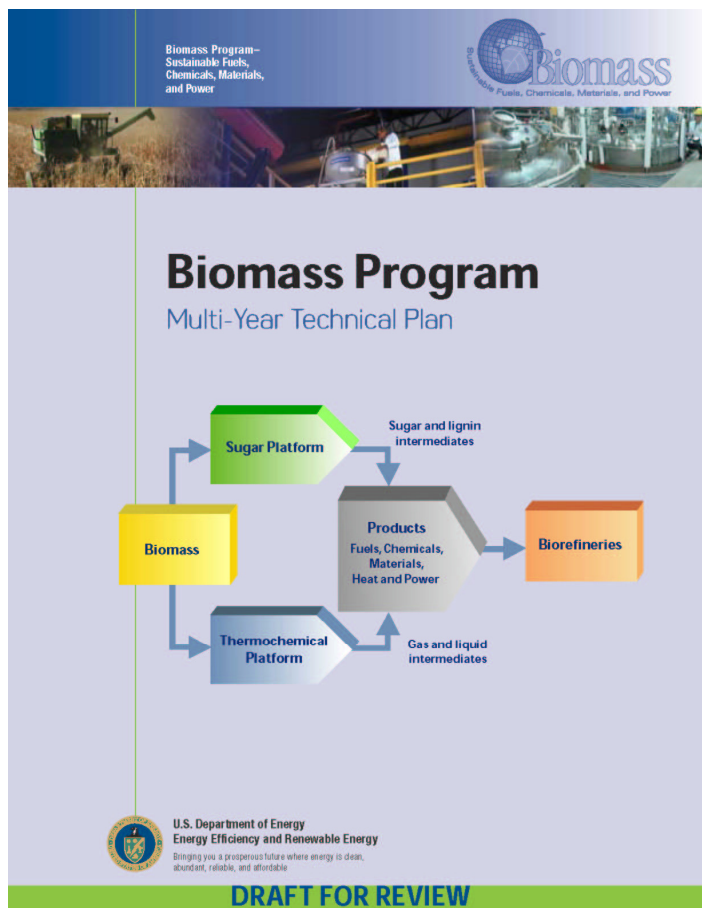
“The mission of Biomass Program is to partner with U.S. industry to foster research and development on advanced technologies that will transform our abundant biomass resources into clean, affordable, and domestically-produced biofuels, biopower and high-value products. The result will be improved economic development, expanded energy supply options, and increased energy security”

Fiscal Year 2005 funding for biomass R&D:

- DOE - \$80.8 million
- USDA - \$14.4 million



DOE Office of Biomass Program Multi-year Technical Plan

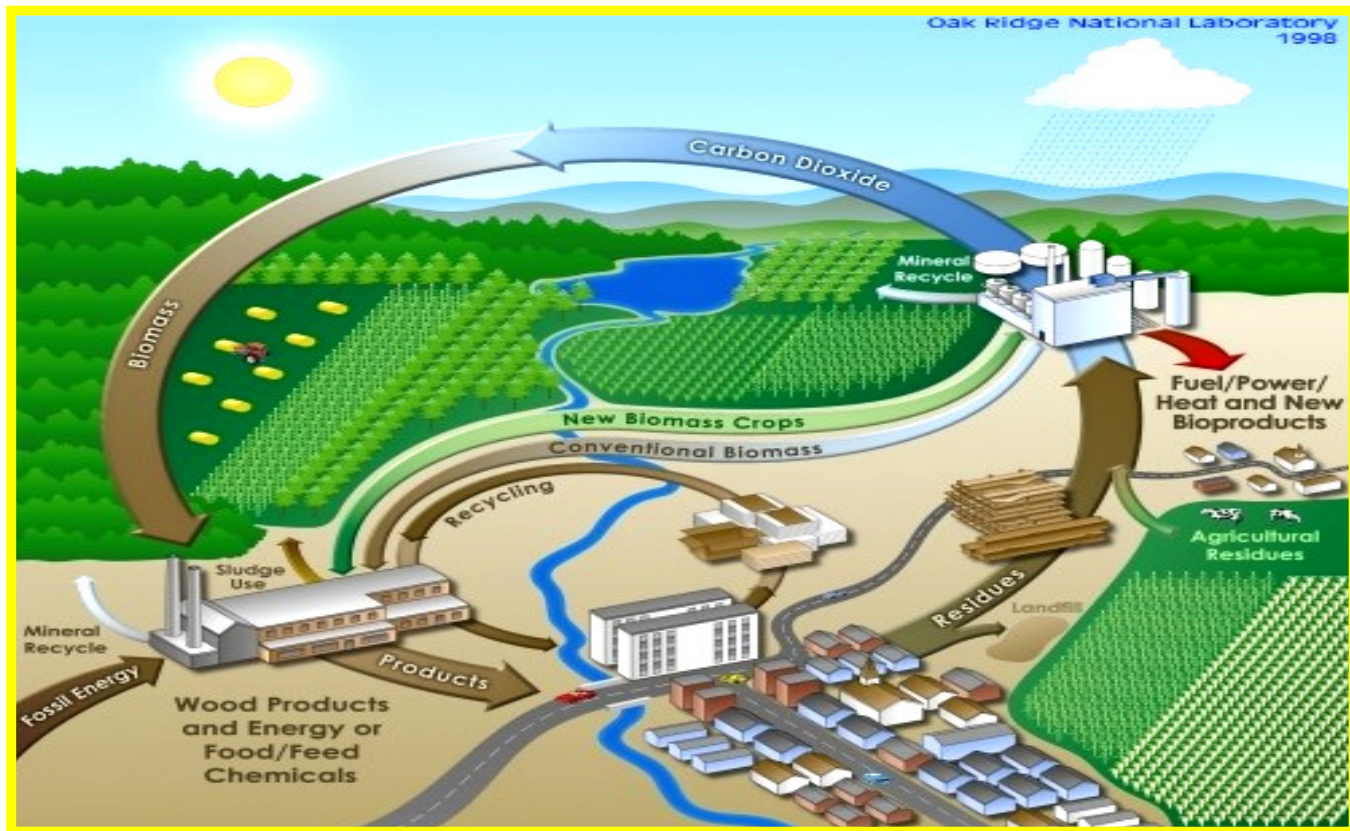


- Comprehensive work breakdown structure
- Unprecedented scope and collaboration
- Merged 3 former Programs
 - Biofuels
 - Biopower
 - Office of Industrial Technologies – biomass
- Milestones, cost, schedule
- Every project is linked to program goals, objectives & technical barriers

http://devafdc.nrel.gov/biogeneral/Program_Review/MYTP.pdf

Vision: Next Generation Biorefineries

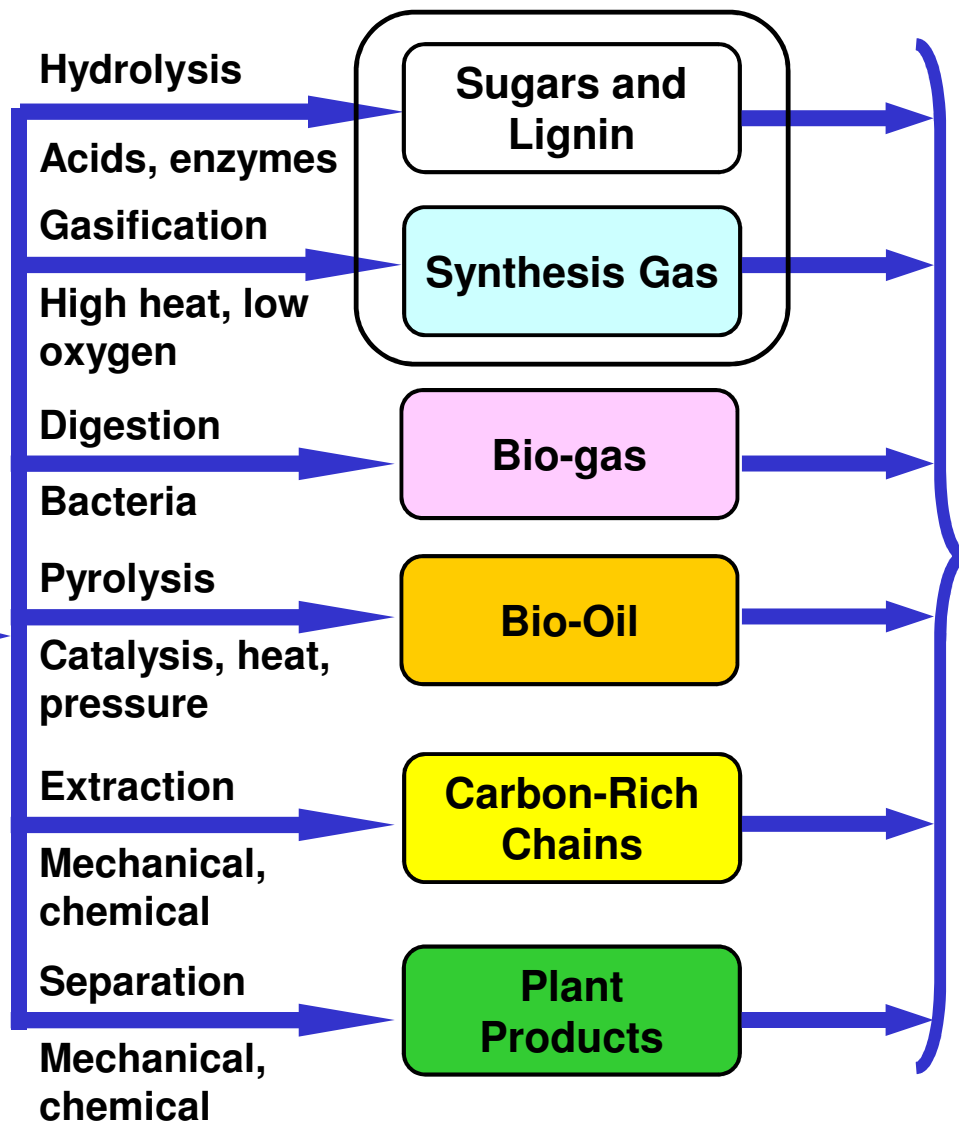
Will be fully integrated facilities that can process grain or biomass crops into a full range of commodity and consumer products



Biorefinery Concept



Feedstock production, collection, handling & preparation



USES

Fuels:

Ethanol
Renewable Diesel
Hydrogen

Power:

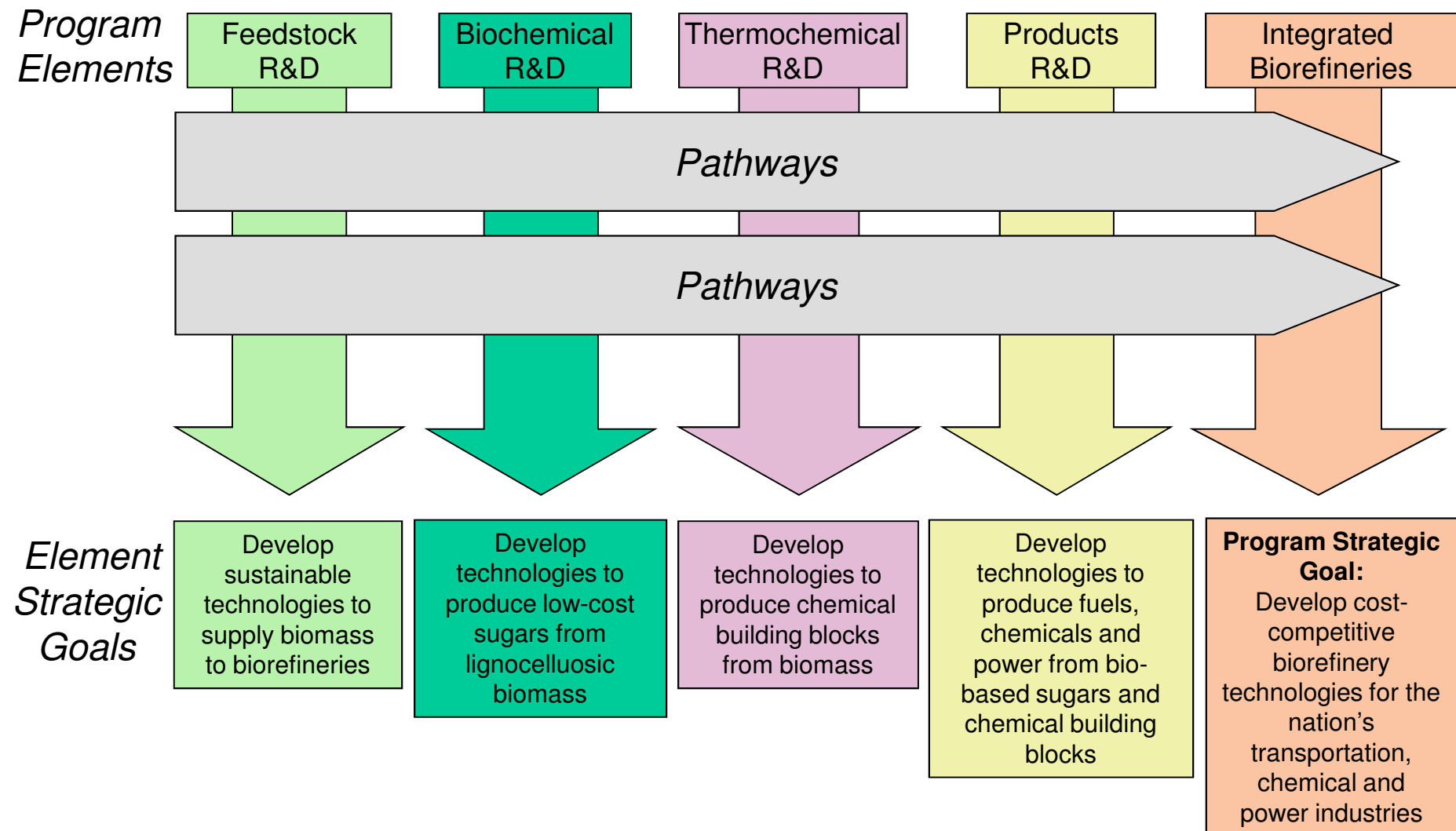
Electricity
Heat

Chemicals

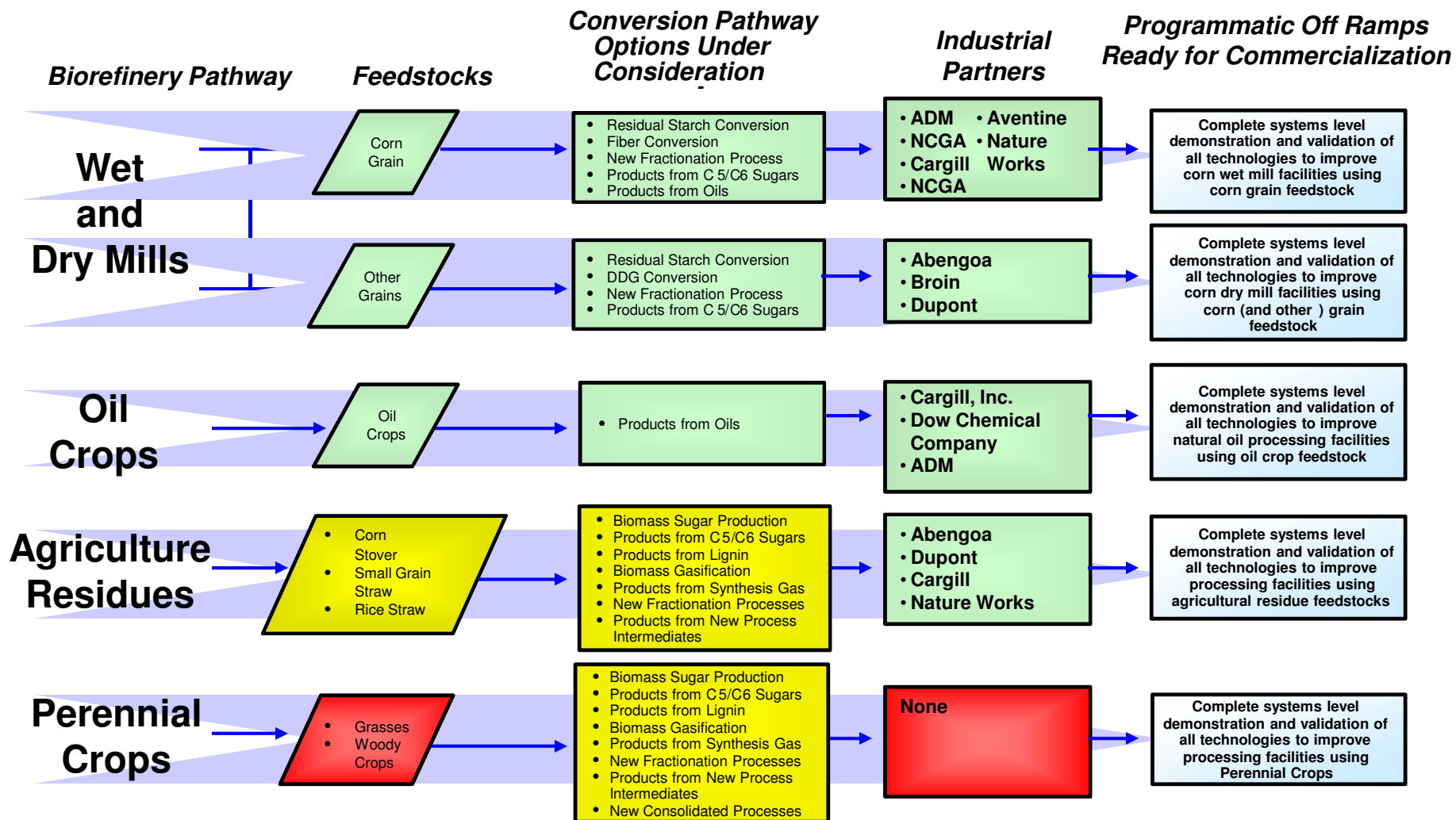
Plastics
Solvents
Chemical Intermediates
Phenolics
Adhesives
Furfural
Fatty acids
Acetic Acid
Carbon black
Paints
Dyes, Pigments, and Ink
Detergents
Etc.

Food and Feed

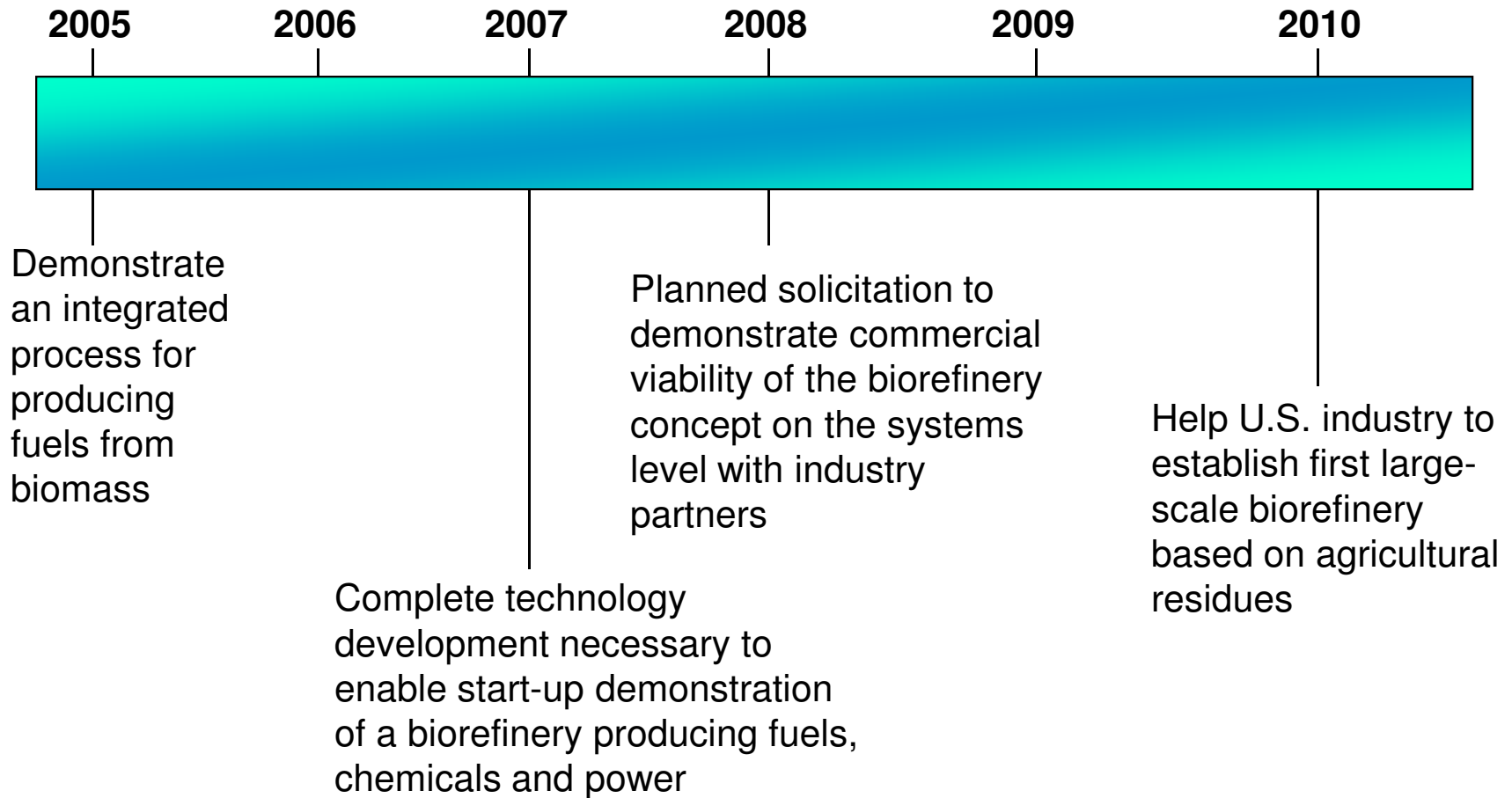
Office of the Biomass Program: Strategy & Pathways



Agricultural Sector Biorefinery Pathways



Program Goals and Key Targets for the Biorefinery



USDA Biomass Energy and Biobased Products Programs

Opportunities for Agriculture in Sustainable Energy Production



Creating Supply

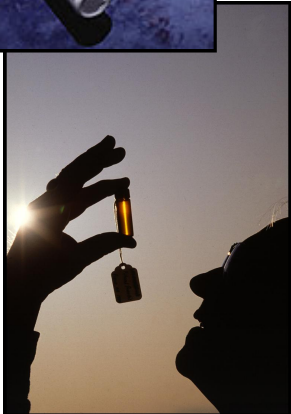
- Bio-refinery grants
- Renewable energy loan guarantees and grants
- Incentives for new production of ethanol and biodiesel

Generating Demand

- Federal procurement of biobased products
- Education and outreach

Developing Technologies

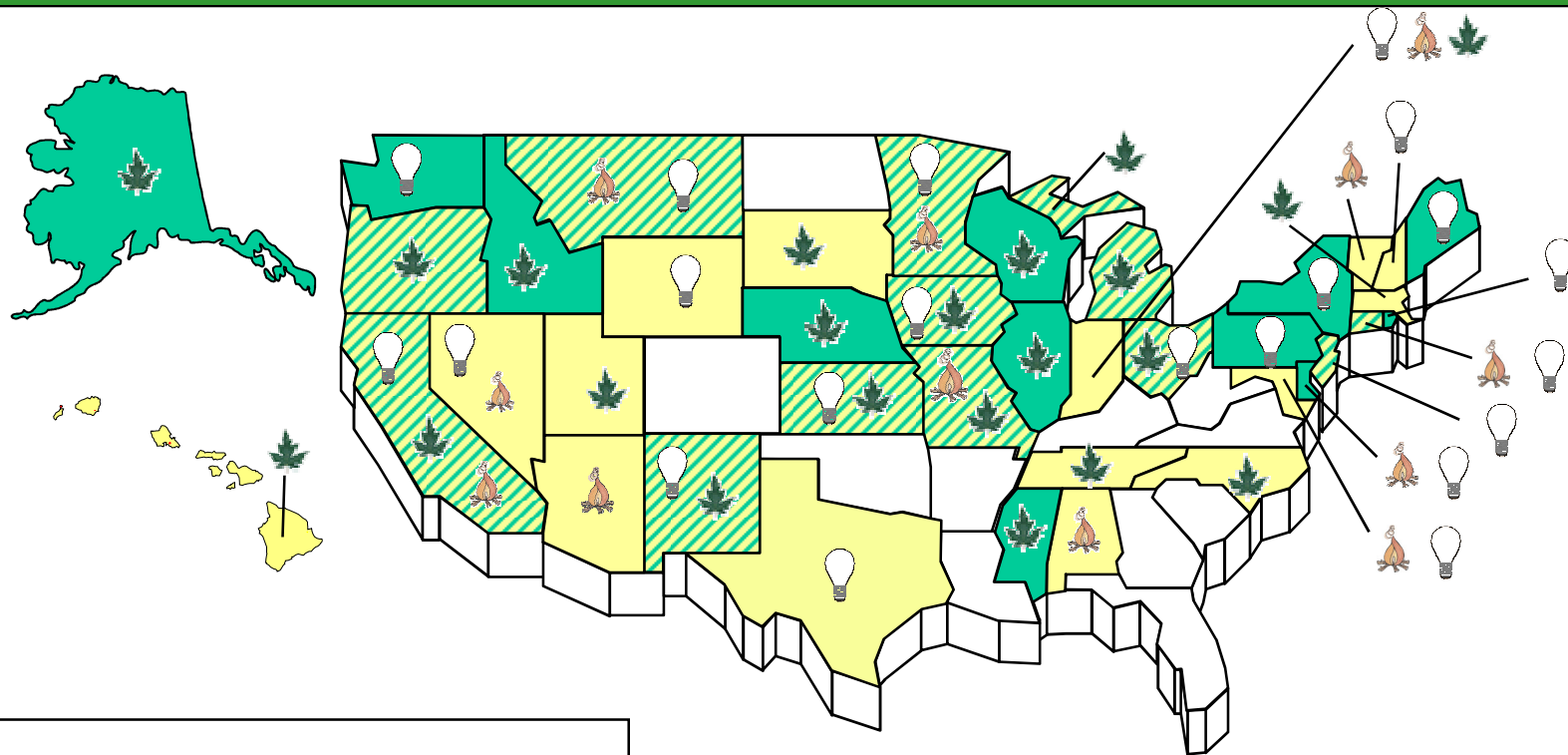
- Hydrogen fuel cell technology development
- Biomass research and development grants



Incentives for Commercial Deployment of Bioenergy

- Federal government incentives address market barriers
- Key legislative and administrative actions
 - A portfolio of legislative and administrative actions covering energy, environment, agriculture, and financial incentives including:
 - direct investment
 - production tax credits
 - accelerated capital depreciation
 - partial exemption of excise taxes for alcohol fuels
 - loans
- State governments provided additional incentives for initiatives aligned with those of the federal government.

State Biomass Incentives



Incentives Available

Credit/Exemptions
/Rebates



Grants/Loans



Both Incentives



Biomass Applications

Electricity



Heating



Multiple Biomass
Applications



Integrated Biorefinery – Barriers

- Most technical barriers are aimed at reducing costs and are addressed through R&D in the Sugar and Thermochemical Platforms.
- However, barriers exist that are specific to the goal of successful demonstration and deployment:
 - Challenge of end-to-end, feed-to-product, process integration
 - Risk of pioneer technology – “First Mover” penalties
 - Attracting investors
- DOE/PI conducting risk framework analysis to identify key business risks that could deter commercial deployment of integrated biorefining technologies

EPAct 2005: Bioenergy Highlights

Title XV – Ethanol and Motor Fuels

- Sec. 1501: Increases the amount of the renewable content of gasoline from 4.0 billion gallons in 2006 to 7.5 billion gallons in 2012.
- Sec. 1510: Establishes in DOE a loan guarantee program for the construction of biorefining facilities converting MSW and cellulosic biomass into ethanol and other products

Title XIII – Energy Policy Tax Incentives

- Sec. 1301: Extends renewable energy production tax credit for two years (\$2.7 billion over 2005-2015)
- Sec. 1303: Provides up to \$800 million in bonds to finance clean renewable energy projects
- Subtitle D: Alternative Motor Vehicles and Fuels Incentives - Contains a variety of tax credits to promote ethanol and biodiesel production and fueling stations, and alternative cars and light trucks.

The Role of Biomass in the Hydrogen Economy

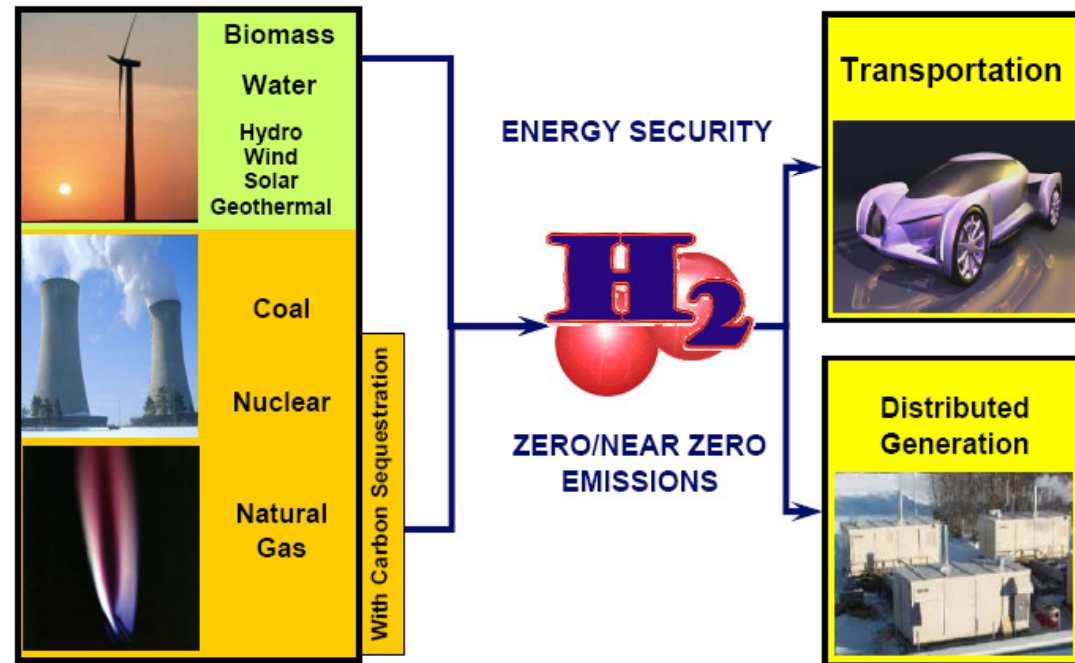
Distributed Production

- Natural Gas: Reforming
- Electrolysis
- Liquids Reforming: ethanol; other sugar derived alcohols; bio-oil; F-T liquids derived from biomass or coal

Central Production

- Coal gasification with carbon sequestration
- Biomass gasification
- Biomass fermentation: aerobic & anaerobic
- Wind/solar based electrolysis
- Photolytic: photobiological & photolytic
- HT thermochemical cycles: nuclear, solar, or other

Many pathways to hydrogen



USDA/DOE Biomass to Hydrogen MOU



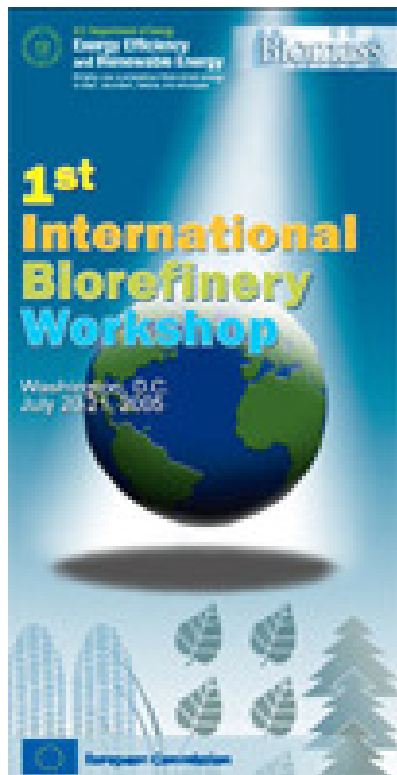
Goals



- Further President Bush's vision for a hydrogen economy to reduce dependence on foreign energy sources and greenhouse gas emissions
- Develop the cost-effective production of hydrogen from biomass resources
- Speed the deployment of emerging technologies
- Facilitate regular meetings of USDA and DOE experts to share information on technologies and activities of mutual interest relating to the reduction of costs associated with converting biomass to hydrogen
- Transition to hydrogen technologies in the agriculture industry and in rural communities
- Strengthen the relationship between USDA and DOE regarding their work through the Hydrogen and Fuel Cell R&D Interagency Task Force

International Efforts: First International Biorefinery Workshop

- The Workshop was held in July 2005 in Washington, D.C.
- Participants included U.S. and EC representatives from agriculture, forestry, academia, finance, government, and the fuels, chemicals, automotive, and biorefinery development industries. Over 20 countries were represented.



➤ Workshop Objectives:

- Provide a forum for a technical review of state-of-the-art research leading to the development of biorefinery technologies.
- Evaluate biorefinery markets and opportunities.
- Foster domestic and international partnerships for the development and deployment of biorefineries.
- Disseminate information on successful research and demonstration occurring in the U.S. and internationally.

International Efforts: International Energy Agency

- The Department of Energy's Office of the Biomass Program participates in the IEA International Bioenergy Collaboration Implementing Agreement, known as IEA Bioenergy.
- IEA Bioenergy is Currently Engaged in the Following Tasks:
 - Socio-Economic Drivers in Implementing Bioenergy Projects
 - Short Rotation Crops for Bioenergy Systems
 - Biomass Production for Energy from Sustainable Forestry
 - Biomass Combustion and Co-firing
 - Thermal Gasification of Biomass
 - Pyrolysis of Biomass
 - Energy Recovery from Municipal Solid Waste
 - Energy from Biogas and Landfill Gas
 - Greenhouse Gas Balances of Biomass and Bioenergy Systems
 - Liquid Biofuels from Biomass
 - Bioenergy Systems Analysis

Summary

- U.S has significant biomass resources that could significantly contribute to U.S. energy security, economic development, and environmental goals
- DOE, USDA, and other agencies work cooperatively on biomass R&D and deployment
- DOE R&D programs focus on the integrated biorefinery to produce a range of products, including clean fuels, chemicals, and power
- Federal and state programs and incentives encourage increased market penetration of biofuels
- EPCA 2005 provisions aim at enhancing R&D and accelerating deployment through tax credits, bonds, loan guarantees, &c
- Work with the private sector and internationally to advance technology development and foster partnerships