


Sustainable Bioenergy Production
A U.S. Department of Energy Perspective

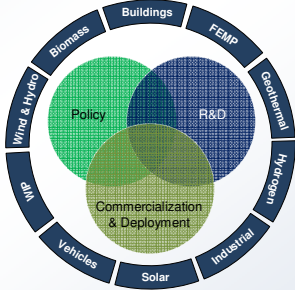
Alison Goss Eng
Office of the Biomass Program, US Department of Energy

March 10, 2009


DOE-Energy Efficiency and Renewable Energy Strategy



- **Advanced Fuels & Vehicles**
 - Biomass/Biofuels
 - Hydrogen
 - Vehicle Technologies
 - Batteries
- **Renewable Power**
 - Solar
 - Wind
 - Hydropower
 - Geothermal
- **Energy Efficiency**
 - Buildings Technologies
 - Industrial Technologies
 - Weatherization
 - Federal Energy Management


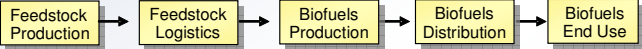



Department of Energy Biomass Program

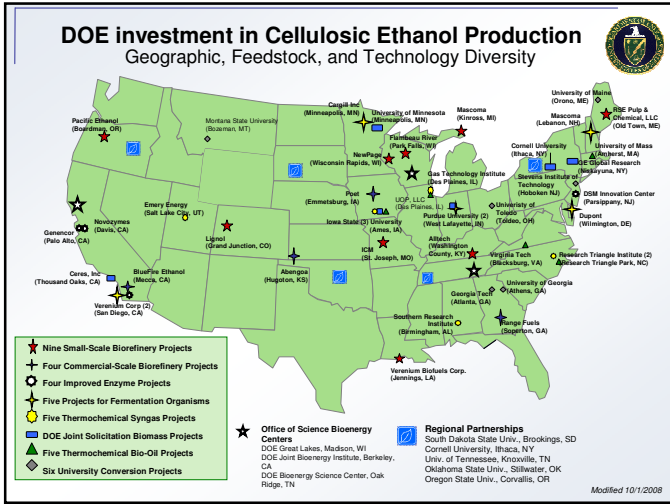


- **The Biomass Program (OBP) at the Department of Energy works closely with industry, university, and other non-profit partners to remove the barriers to cellulosic ethanol production**
 - Over \$1 billion announced within the last year for multi-year biofuels research and development projects
 - Technology deployment (small and commercial scale biorefinery construction) and core R&D (ethanologen) support
- **Sustainability part of our core mission as a program**
 - Essential to process and distribute biomass on the scale needed to support dramatically larger volumes of biofuels production over the long term
 - Support R&D aimed at assessing the impacts of biofuels on the environment

Strategic Focus: Biofuels

- **Cellulosic Ethanol:** Primary focus of the program.
- **Alternative Light-Duty and Diesel Replacement Fuels:** Major scoping activities are underway to help prioritize future work on additional advanced alternate fuels



Successive Generations of Biofuels

Corn Ethanol

- Commercially available (no DOE research ongoing)
- Reduced GHG emissions
- Capacity constrained

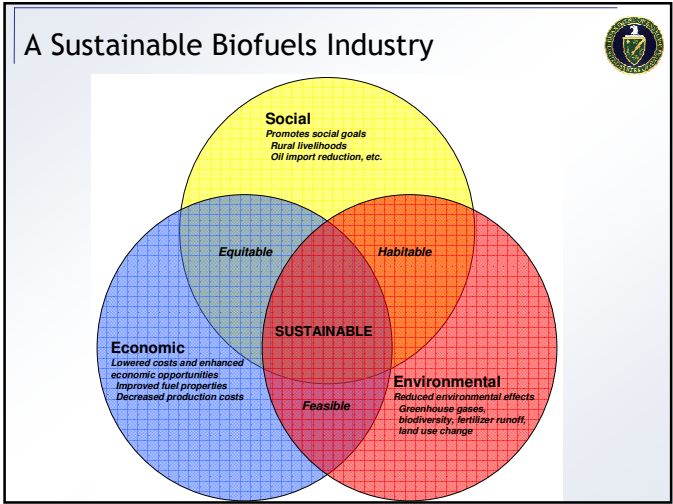
Cellulosic Ethanol

- Focus of current DOE research
- Potential to lower GHG emissions >85%
- Uses biomass from waste and non-agricultural land

Advanced Biofuels

- DOE scoping studies in progress
- Potential to displace diesel
- Energy content and fuel economy similar to petroleum-based fuels

Biomass Program's Sustainability Efforts



Our Commitment to Sustainability



The U.S. DOE Biomass Program is committed to developing the resources, technologies, and systems needed for biofuels to grow in a way that enhances the health of our environment and protects our planet. To that end, we are working to...

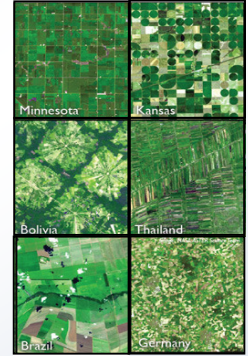
- Develop diverse, non-food feedstocks that require little water, fertilizer, or new land
- Foster sustainable forestry practices
- Harvest biomass components selectively, leaving adequate soil nutrients
- Assess life-cycle impacts of major scale-up in biofuels production, from feedstocks to vehicles, addressing:
 - land use and soil health
 - water use
 - air quality issues
 - impacts on greenhouse gas (GHG) emissions



DOE-OBP Research: Land use change



- \$1.8 million in FY08/09
- Refining models to help study international land use change issues due to growth of biofuels.
- Lack of evidence for conventional wisdom on 'indirect land use change impacts'
- "Conventional wisdom" - if an acre is taken out of food production in one place, it must be replaced somewhere else
- "Indirect impact" argument assumes that land is not available for expansion without clearing new forests or grasslands. It also tends to assume that deforestation is caused (at least to some degree) by market prices for commodities, and would not otherwise occur



DOE-OBP Research: Water use

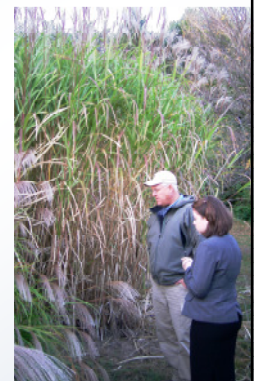


- \$1.3 million in FY08/09
- Conducting LCA of water demand for biofuel production (compares corn ethanol, sugar cane ethanol, and competing petroleum fuels).
- Significant regional variations in consumptive water use for corn ethanol production
 - Due to irrigation requirements in different climate zones and soil types
- Water consumption in ethanol production plants is decreasing.
- Cellulosic ethanol (switchgrass) produced with state-of-the-art technology consumes less water — at the low end of the range for corn ethanol.
- Water consumption in oil production is highly sensitive to the recovery technology used and the water recycling programs employed.

DOE-OBP Research: Sustainable Feedstock production



- \$6.5 million in FY08/09
- **Regional Biomass Energy Feedstock Partnerships** conducting in-field studies to determine best location for dedicated energy crops
 - Considering climatic conditions, soil types, water quality, and land use
- **Series of trials focused on validation of "stover removal tool"**—decision support to help farmers to ensure soil health while utilizing agricultural waste for bioenergy

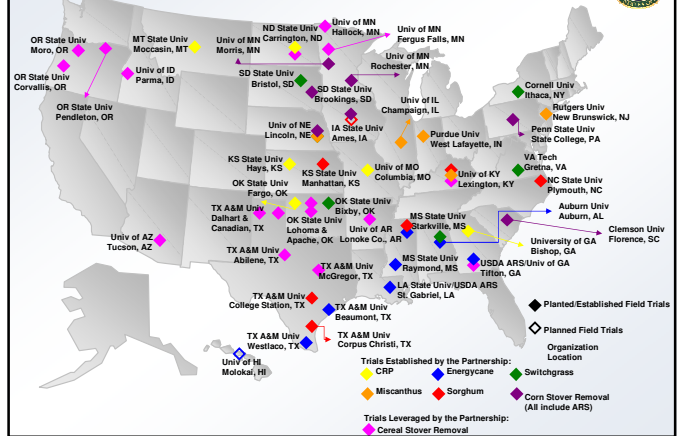


Sustainable Feedstock production, cont.

- The Sun Grant Initiative, as a part of the ongoing energy crop field trials carried out through the Regional Partnerships, is collecting and analyzing data on
 - Soil Carbon
 - Hydrology and Water Quality
 - Nutrient cycling—carbon, nitrogen, phosphorous, and potassium
 - Direct Green House Gas (GHG) Emissions



Regional Biomass Energy Feedstock Partnership Bioenergy Crop Trials



Climate Change: The GREET Model

Greenhouse gases, Regulated Emissions, and Energy use in Transportation (GREET) Model

- Developed by Argonne National Laboratory to assess Well-to-Wheels Energy and Greenhouse Gas Emissions of Vehicle/Fuel Systems
 - More than 100 fuel production pathways from various feedstocks
 - More than 75 vehicle/fuel systems
- GREET and its documents are available at Argonne's website at <http://www.transportation.anl.gov/software/GREET/>



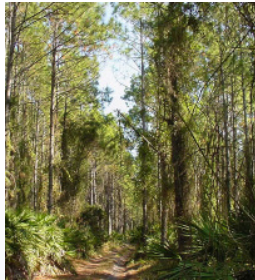
Cross-cutting efforts: The Great Lakes Bioenergy Research Center

- GLBRC one of three Office of Science-funded centers
 - Only one focused on sustainability issues
- DOE-OBP leveraging existing GLBRC sustainability efforts through authorization through the American Economic Recovery Act
 - Novel production systems for perennial, native grassland systems, and integrated systems.
 - Biogeochemical, biodiversity, and socioeconomic responses to expansion and intensification of agriculture and silvicultural practices
 - Spatially explicit land use change forecast on crop area changes

Cross-cutting efforts: The Great Lakes Bioenergy Research Center



- U.S. Forest Service at the Department of Energy's Savannah River Site
 - Planning to conduct a watershed study evaluating different silvicultural options that are likely scenarios for biofuels feedstocks
 - Evaluation of different management options involving level of fertilization and weed control



Cross-cutting efforts: Bioenergy Knowledge Discovery Framework (KDF)



- Cross cutting -- \$2.2 million in FY08/09
- ORNL, ANL, INL, UC-Davis and others are developing a national scale GIS-based framework that
 - Assists in analyzing economic and environmental impacts of feedstock, biorefinery, and infrastructure development options
 - Supports collaboration between federal agencies, national labs, and other partners by providing easy access to best available data and models.
- Key features include Web-enabled and interactive access and role-based user levels to allow access to most relevant content and promote data sharing



Working with Partners Globally



Biodiversity

- Working with **Conservation International** (\$1.1 million in FY08/09) to:
 - Identify land that should not be developed into biofuel crops
 - Conduct pilot studies to identify best places for biofuel crops
 - Implement standards for biofuel crop production.

Standards development

- Participating in **Council for Sustainable Biomass Production** to develop principles and standards for bioenergy feedstocks. Draft by Spring 2008
- Providing data and analysis to inform a variety of international and domestic discussions on sustainability standards (e.g. **Roundtable on Sustainable Biofuels, Global Bioenergy Partnership**)

International Biofuels Forum

- Brazil, China, India, South Africa, the USA, and the European Commission have joined the forum to discuss ways to promote the sustained use and production of biofuels around the globe.

IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation



Biomass Program staff will be a part of the lead author team on a chapter of the report and will contribute expertise on:

- climate mitigation potential of renewable energy sources;
- linkages between renewable energy growth and co-benefits in achieving sustainable development by region;
- impacts on global, regional and national energy security;
- policy options, outcomes and conditions for effectiveness; and
- How accelerated deployment could be achieved in a sustainable manner.

Balanced Analysis, Constructive Dialogue, and Smart Policies



- *Energy Independence and Security Act of 2007* mandates that DOE focus on sustainable biofuels.
 - EISA requires GHG reductions and periodic reevaluation.
- The US and all nations must adopt and enforce land use policies that prohibit development of ecologically sensitive lands.
- DOE and the State Department are working to address global sustainability issues with international partners, including environmental organizations, industry, and others.
 - Sustainability requires careful assessment of all impacts on water, land use, GHG, fertilizer use, and socio-economic issues.
 - Global standards for sustainable development would promote adherence to best practices in developing biofuels industries.
- We welcome open discourse on all topics of concern and encourage broad dissemination of plans and ideas.



Contact Information



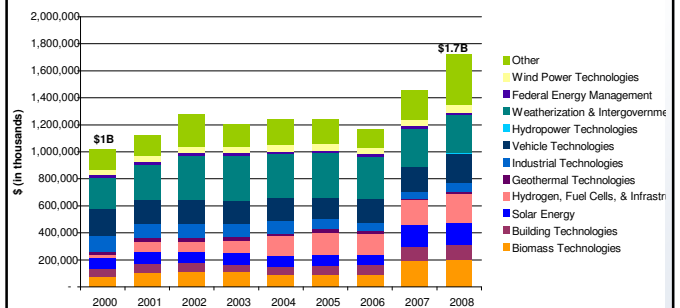
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THANK YOU

Extra Slides



Office of Energy Efficiency and Renewable Energy Renewable Energy Budget (Fiscal Years 2000-2008)



Information Resources



- **Office of Biomass Program, Valri Lightner**
Tel: 202-586-0937.
Web Site: <http://www1.eere.energy.gov/biomass/>
 - **EERE Info Center - www1.eere.energy.gov/informationcenter**
 - **Alternative Fuels Data Center - <http://www.eere.energy.gov/afdc/fuels/ethanol.html>**
 - **Bioenergy Feedstock Information Network - <http://bioenergy.ornl.gov/>**
- Biomass R&D Initiative – www.biomass.govtools.us**
- **Grant Solicitations - www.grants.gov**
 - **Office of Science - <http://www.er.doe.gov/>**
 - **Loan Guarantee Program Office - <http://www.lgprogram.energy.gov>**
 - **Loan Guarantee Final Rule - <http://www.lgprogram.energy.gov/lgfinalrule.pdf>**

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