Biomass for Energy & Conservation: Can We Do Both?

Sustainability of Woody Biomass: From Slash to Hybrid Plantations

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U.S. Energy Consumption Overview 2008

Energy Consumption = 99.304 Quadrillion Btu
Renewable Energy Total = 7.30 Quadrillion Btu

- Petroleum 37.4%
- Natural Gas 24.0%
- Coal 22.6%
- Nuclear Electric 8.5%
- All Imports 33.0%
- Renewable Energy 7.3%

- 7.0% Wind
- 33.6% Hydroelectric
- 4.9% Geothermal
- 53.2% Biomass
- 1.2% Solar

★ 70% of biomass is wood based

www.eia.doe.gov/aer
The Biomass Feedstock Resource Base

- About one-half of the land in the contiguous U.S.
  - Forestland resources -- 504 million acres of timberland, 168 million acres of other forestland
  - Agricultural resources -- 342 million acres cropland, 39 million acres idle cropland, 68 million acres cropland pasture

Forest resources
- Logging residues and other removals
  - Traditional logging activities
  - Cultural operations on timberlands
- Forest thinnings (fuel treatments)
  - Timberland
  - Other forestland
- Industry processing residues
  - Primary wood processing mill wastes
  - Secondary wood processing mill wastes
- Urban wood wastes
- Fuelwood
- Pulping liquors (black liquor)
- Conventional Forestry
- Short Rotation Woody Crops

Land use in the United States

Source: DOE/USDA Billion Ton Report. 2005
Percent Total US GHG Annual Emissions by Sector (2005)

Note: Negative numbers denote sequestration; forests, trees and wood products sequester 11% US GHG emissions annually
Source: http://www.epa.gov/climatechange/emissions/downloads06/07ES.pdf
Forests
A Strategic Asset

- Energy security
- Environmental quality
- Economic opportunity
Natural Resource Management

Environment
- Climate Change
- Stand Function
- Sustainability

Energy
- Renewable
- Secure
- Sustainable

Biomass Management and Use

Economy
- Costs
- Rural Development
- Global Competition

Water
Land
Air
Infrastructure
Working Lands
Conservation & Utilization
Points to Ponder

• Large volumes of biomass
  ❖ Fire risks
  ❖ Declining health
  ❖ Reduction of services
  ❖ Many forms and shapes
  ❖ Can produce even more

• Declining infrastructure
  ❖ Industry decline
  ❖ Offshore investments and imports
  ❖ Worker (capacity) shortage
  ❖ Reduced investments

• Markets and barriers
  ❖ Cyclic booms and busts
  ❖ No markets
  ❖ Higher costs
  ❖ Very distributive
From Slash to hybrid plantations
Opportunity and Potential

**Feedstock**
- Forest Residues
- Hazardous Fuel Treatments
- Short Rotation Woody Crops
- Wood Waste
- Conventional Forestry
- Mill Wastes & Residues

**Conversion**
- Manufacturing
- Co-firing
- Combustion
- Gasification
- Hydrolysis
- Digestion
- Pyrolysis
- Extraction
- Separation

**Uses**
**Fuels:**
- Ethanol
- Other Liquid Fuels
- Hydrogen

**Electricity and Heat**

**Biobased Products**
- Composites
- Specialty Products
- New Products
- Chemicals
- Traditional Products
Desired Resource Outcome

- Forest systems
  - Healthy
  - Productive
  - Supply goods, services, and values
We will expect forests to produce

- Wood
- Water
- Non-wood products
- Recreational opportunities
- Habitats
- Wildlife and Fish
- Climate change mitigation
- Energy
So we must

- Manage through changing conditions
  - Environmental
  - Economic
  - Supply and demand
  - Global economy
- Continue to supply goods, services, and values
- Including energy
Our challenge

• NOT merely
  ▶ Sustaining existing systems
  ▶ Restoring selected systems

• IS ALSO
  ▶ Enhance capacity of systems to meet future resource needs
  ▶ Managing systems to provide for increasing levels of a variety of benefits
Woody Biomass

- Derived from any and all parts of trees
  - Bole, limbs, tops, roots, foliage
- Insect-, disease-, or fire- damaged or killed
- Purpose-grown wood for energy
- Conventional forestry
- Pre- and post consumer paper and wood products
- Pulping liquors
Considerations

• Resource availability, sources, production and management, feedstock supply components

• Harvesting and operations technologies, in-forest pre-processing technologies, transportation

• Conversion technologies, feedstock characteristic needs, conversion efficiencies, costs

• Integrated management systems

• Information, data, decision tools

• Development/deployment of biomass energy facilities
Challenges

• Provide quantities of wood needed for energy
  ✓ Increase the supply of renewable and alternative fuels to 35 billion gallons by 2017\(^1\)
  ✓ Renewable Fuels Standard 36 Bgal biofuels/year by 2022 with 20 Bgal non-corn\(^2\)
  ✓ President Obama\(^3\) called for doubling renewable energy production (2009). The President also created the Biofuels Interagency Working Group (Biofuels 2009), which is charged with:
    ➢ Developing the Nation’s first comprehensive biofuel market development program;
    ➢ Coordinating infrastructure policies affecting the supply, secure transport, and distribution of biofuels; and
    ➢ Identifying new policy options to promote the environmental sustainability of biofuels feedstock production

• Maintain & enhance forest health and productivity
  ✓ Ensure conservation & sustainable delivery of wood products and other benefits
  ✓ Avoid/mitigate potential negative impacts
  ✓ Capitalize on benefits working forests provide in the landscape

• Reduce Costs & increase efficiency
  ✓ Feedstock production & management
  ✓ Harvest, collection & delivery
  ✓ Conversion processes

• Reduce Investor Risk

\(^1\) 2007 State of the Union Address
\(^2\) EISA 2007 (Energy Independence and Security Act of 2007)
Some Critical Information In Hand

• Resource Assessments
  ◆ Billion Ton Report
  ◆ Resources Planning Act Assessments
  ◆ Regional Assessments
  ◆ FIA

• Life Cycle Analyses
  ◆ CORRIM

• Soil Productivity
  ◆ National Long Term Soil Productivity Study
  ◆ Soil carbon syntheses
  ◆ Whole-tree logging and harvest impact studies

• Water quality
  ◆ Best Management Practices (42 states)

• Habitat and biodiversity studies

• Forest Certification Programs

* Items listed as examples – not exhaustive
Integrated Biobased Products And Bioenergy Approach

- Research & Development
- Synthesis
- Development of
  - options
  - strategies
  - systems
  - practices
For sustainable goods, services, & values
Critical Research

- Management and utilization systems for forest biomass and residues, forest health and fuels reduction treatments, and production forests
- Science and technology for woody cropping systems at multiple operational scales
- Management and land use systems for specific functions (designed forest systems)
Critical Research (cont)

- More efficient, light-on-the-land harvest, collection, and transportation systems
- Highly productive feedstocks with improved water- and nutrient-use efficiencies
- Efficient technologies for wood conversion to biofuels and bioproducts
- Life cycle analysis of integrated systems

... Sustainability
IEA BIOENERGY

- TASK 31: Biomass Production for Energy from Sustainable Forestry
  - 8 Countries: USA, Canada, United Kingdom, Finland, Sweden, Denmark, Norway, Germany, Netherlands
  - Two State-of-the Science books from Tasks A6 and 31

**TASK 31**

**TASK A6**
Dyck et al. 1994. Impacts of Forest Harvesting on Long-Term Site Productivity.

http://www.ieabioenergytask31.org/
IEA BIOENERGY

• TASK 30: Short Rotation Crops for Bioenergy Systems

- 5 Countries: Brazil, Canada, Australia, New Zealand, Sweden, United Kingdom, USA

http://www.shortrotationcrops.org/
Science You Can Use

Questions?

USDA Forest Service Research & Development