

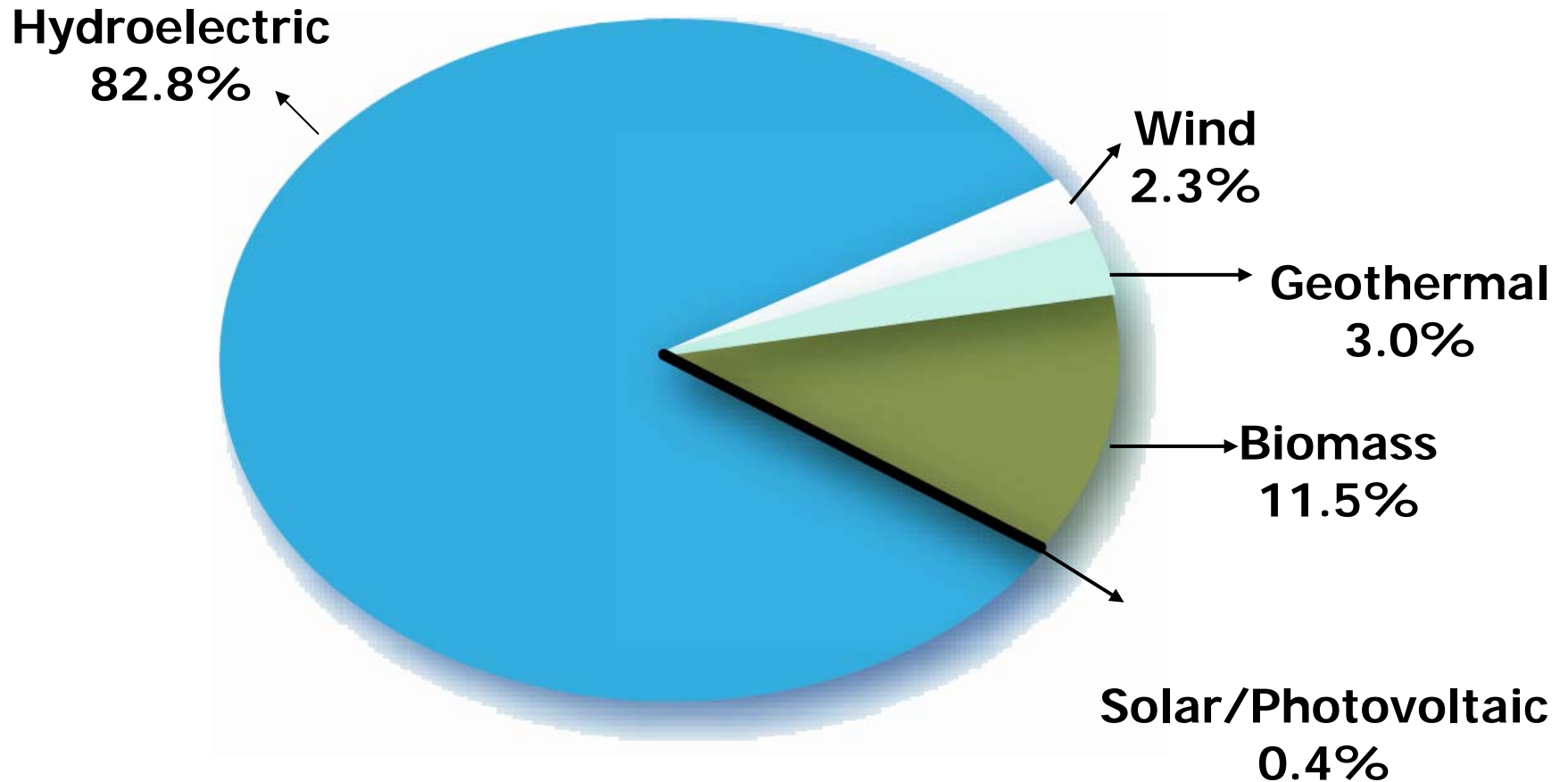
# 미국의 바이오전력 현황

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# Agenda for Today's Presentation

- ◆ **Status of Biopower in the U.S.**
- ◆ **DOE Biopower R&D and Program Highlights**
- ◆ **Potential for Collaborative Efforts**

# U.S. Renewable Generating Capacity



# Status of Biopower in U.S.

## ◆ Currently Installed:

- U.S. Biomass Power: 7,000 MW (mostly pulp and paper, does not include MSW and landfill gas)
- Over 500 facilities in U.S. generate electricity from wood or wood waste

# Program Mission and Vision

- ◆ The mission of the Biopower Program is, in partnership with industry, to encourage the development and utilization of biopower technologies that are competitive with conventional power systems.

# Program Goal

## Goal

By 2010, develop biopower technology to enable the addition of approximately 11,000 MWe of **new biopower capacity**.

Technology	MW-On Line	Energy Displaced (Quads/Yr)
Cofiring	8,000	0.5
Small Modular	700	0.1
Gasification/Biorefinery	2,300	0.1
<b>Totals</b>	<b>11,000</b>	<b>0.7</b>

Based on Government Performance Results Act (GPRA)

# Program Strategy

**Technologies**



**Success in  
Biomass**

**Policies**

**Markets**

# Technologies

- ◆ The Technology Strategy is to:
  - develop integrated biopower systems in partnership with industry
  - provide technical assistance and information on biopower's potential as sustainable power
  - Develop reliable, low cost, high yield feedstocks that provide environmental benefits.
- ◆ Committed to a portfolio of near-, mid-, and long-term R&D.



# Policies

- ◆ Expand current tax credit to include Ag and Farm residues
- ◆ Renew tax credit for biomass to include cofiring and open-loop
- ◆ Expand number of states with Renewable Portfolios Standard
- ◆ Establish Cofiring as a viable emissions reduction scheme

# Markets

- ◆ Establish Cofiring as a viable emissions reduction scheme
- ◆ Utilize biopower technologies to address animal waste issues
- ◆ Provide incentives to lower the costs of new plants
- ◆ RD&D partnerships with energy producers and supplier companies
- ◆ Partner with deregulated power industry to promote Biopower
- ◆ Provide data and analysis for Environmental groups

# Major Program Elements

- ◆ The US DOE Biopower Technology R&D Program consists of 5 Program Elements:
  - **Feedstock Production**
  - **Systems Development**
  - **Thermochemical Conversion**
  - **Regional Biomass Energy Programs**
  - **Bioenergy**

# Biomass Feedstocks

Resource is Prevalent and Widespread



## Wood Residues

- Sawdust
- Wood chips
- Wood waste
  - pallets
  - crate discards
  - wood yard trimmings



## Agricultural Residues

- Corn stover
- Rice hulls
- Sugarcane bagasse
- Animal waste



## Energy Crops

- Hybrid poplar
- Switchgrass
- Willow

# Feedstock Development Program

Collaboration between OPT, OTT, USDA  
performed by  
Oak Ridge National Laboratory

- Screened over 150 woody and herbaceous species as potential energy crops
- Validating the technical and economic viability of integrated supply systems
- More than 100,000 acres of short-rotation woody crops established by industry to date

# Systems Development

- ◆ **Near Term**

- Cofiring  
(Rural Development)

- ◆ **Mid Term**

- Modular Systems

- ◆ **Long Term**

- Integrated Gasification Combined Cycle

# CoFiring

- ◆ Commercialize and promote biomass cofiring using the least cost approach
- ◆ Broaden the base of utilities employing biomass in existing generating units
- ◆ Increase the number and type of technologies used in cofiring



# Cofiring – FY 2002 Highlights

- ◆ Continuing Rural Development Projects in New York and Iowa:
  - New York Salix (Willow)
  - Dunkirk Power Plant
    - **10-15 MWe from biomass**
  - Iowa Switchgrass
  - Ottumwa Generating Station
    - **Up to 35 MWe from biomass**
  
- ◆ Expanding cofiring techniques by exploring advanced technologies that will enhance system reliability, including work with municipalities and electric cooperatives.



# Small Modular Biopower Systems

- ◆ Working with industry to develop small, modular biopower systems
- ◆ Power range from 5 kW to 5 MW
- ◆ Cost-shared contracts awarded in gasification and combustion technologies



# Small Modular Biopower- FY 2002 Highlights

- ◆ Phase III of the Small Modular Biopower effort will be started to demonstrate modular system prototypes and will expand to include other feedstock areas. System configurations will encourage the use of advanced power generating components such as microturbines and fuel cells.
- ◆ Initiating collaborative activities with U.S. Forest Service utilizing SMS systems in conjunction with forest health/fire mitigation projects by using the thinning and brush as fuel for power production.

# Gasification

**Developing gasification technologies for the conversion of biomass into clean, sustainable energy and other products**

## **Elements:**

- Build on successful and existing technology platforms
- Plan and implement a robust R&D program
- Establish supportive infrastructure

# Gasification - FY2002 Highlights

- ◆ **Phase I awards made September-2001 for five new advanced biomass gasification projects.**

**Emery  
Recycling**

➔ Salt Lake City, UT: IGCC and IGFC concepts based on Emery gasifier using segregated MSW and animal wastes, agricultural residues

**Sebesta  
Blomberg**

➔ Roseville, MN: Atmospheric gasification with gas turbine and SI engines at malting facility using barley residues and corn stover

**Alliant  
Energy**

➔ Lansing, IA: Combined cycle concept using fluid bed pyrolizer using Corn Stover

**UTRC**

➔ East Hartford, CT: Biomass gasifier coupled to aero-derivative turbine with fuel cell and steam turbine options utilizing Clean wood residues and NG

**CP&L**

➔ Raleigh, NC: Biomass gasification to produce a reburning fuel stream for utility boilers utilizing clean wood residues

# Thermochemical Conversion R&D

## NREL Thermochemical Users Facility

- ◆ Develop and demonstrate integrated biomass gasification-power generation systems (diesel, Stirling, fuel cell)
- ◆ Emphasis on developing appropriate gas cleanup and conditioning operations as a function of gasifier type, feedstock, and power generation device fuel requirements



# Regional Biomass Energy Program

## Technology Transfer Network

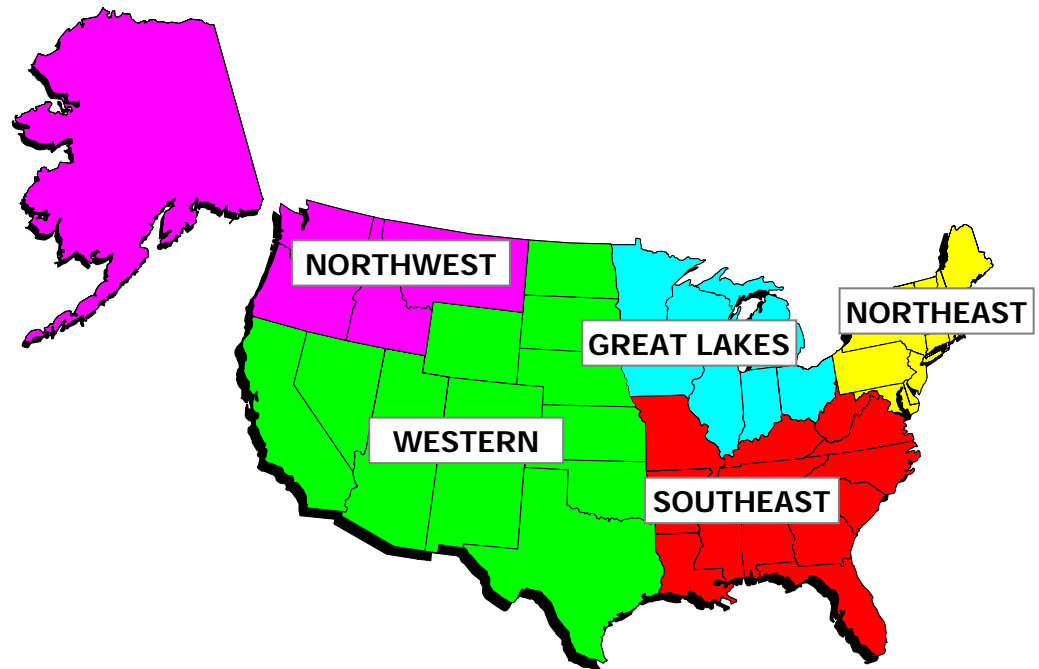
Northeast - 11 States

Southeast - 13 States

Great Lakes - 7 States

Western - 13 States

Northwest - 5 States



# Bioenergy Integration R&D

- ◆ **The Biopower Program, while managed separately, fully coordinates with the Biofuels and Bioproducts Programs within the Department.**
- ◆ **Each of these three programs provide funding for an annual Bioenergy Integration Effort and a Bioenergy Solicitation.**
- ◆ **The solicitation specifically seeks research projects that develop technology to produce a combination of power, fuels, or products.**

# FY 2002 Program Snapshot

	FY2001 Enacted	FY2002 Requested	Change
<b>Program Total</b>	<b>\$39.7M</b>	<b>\$37.8M</b>	<b>- \$1.9M</b>
• Thermochemical Conversion	3.4	4.0	+ 0.6
• Systems Development (Co-firing, Gasification, Small Modular Systems, Rural Development)	25.7	26.6	+ 0.9
• Feedstock Development	3.3	3.5	+ 0.2
• Regional Biomass Energy Program	1.3	1.2	- 0.1
• Bioenergy	6.0	2.5	- 3.5

## FY 2002 Highlights

- **Gasification R&D will include examination of gas conditioning and gas clean up technologies**
- **Phase I awards for five new advanced biomass gasification projects**
- **Rural Development Projects continue in NY and IA**
- **Collaboration with US Forest Service on SMB systems in forest management schemes**
- **Bioenergy broad-based solicitation examining innovative concepts for application in the gasification process**



# Bush Administration's National Energy Policy

- ◆ **The policy makes several recommendations in support of biopower efforts:**
  - Chapter 6.7: "...recommends...to extend and expand tax credits for electricity produced using wind and biomass."
  - Chapter 6.1: "...recommends...to re-evaluate access limitations to federal lands in order to increase renewable energy production, such as biomass..."
  - Chapter 7.11: Review New Source Review regulations