

Woody Biomass Utilization



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CSU Biomass Short Course
Fort Collins, CO – January 2008



Overview



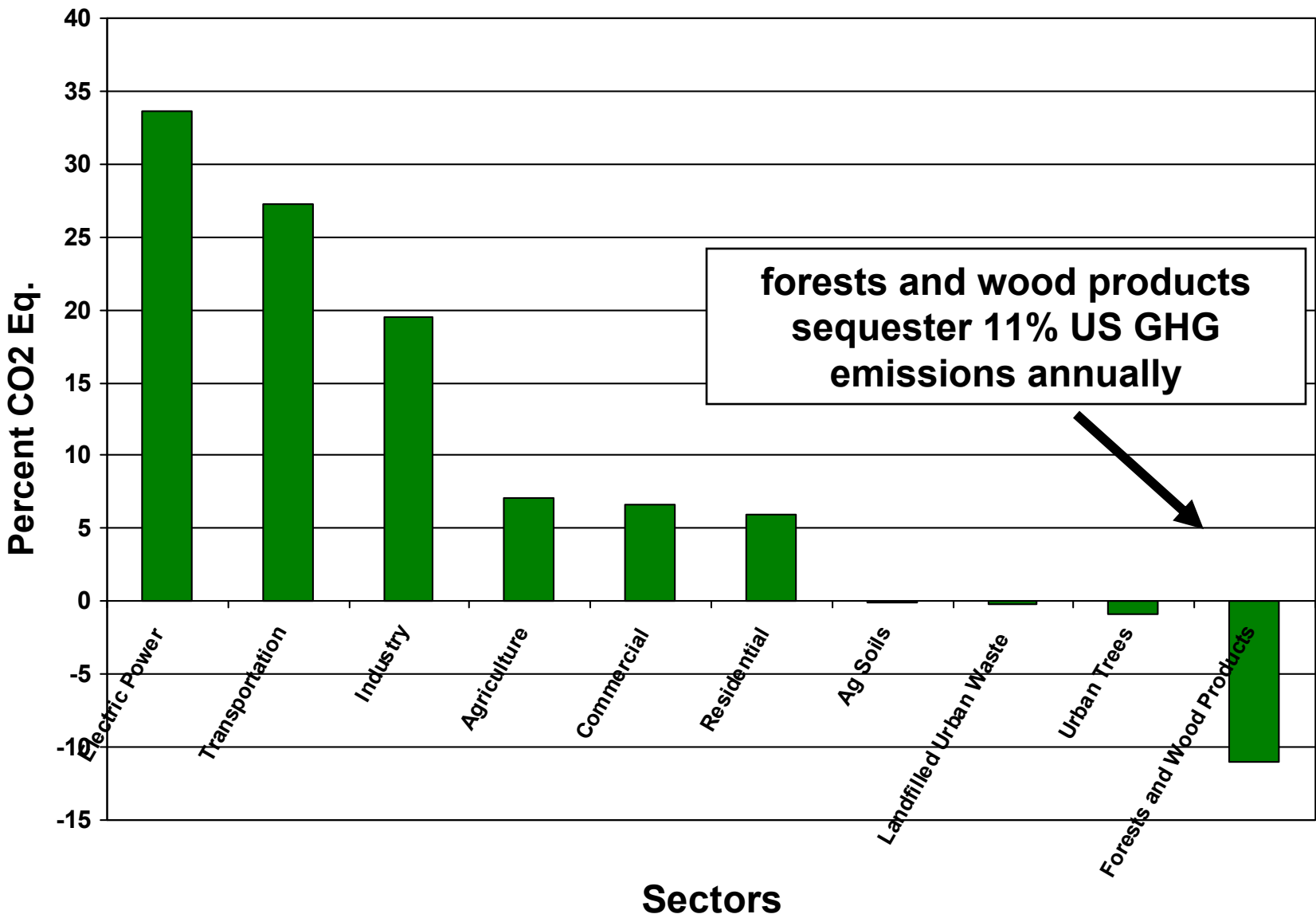
- Forest Resources, Climate Change and Biomass
- Bioenergy
- Biobased Products
- Sustainability



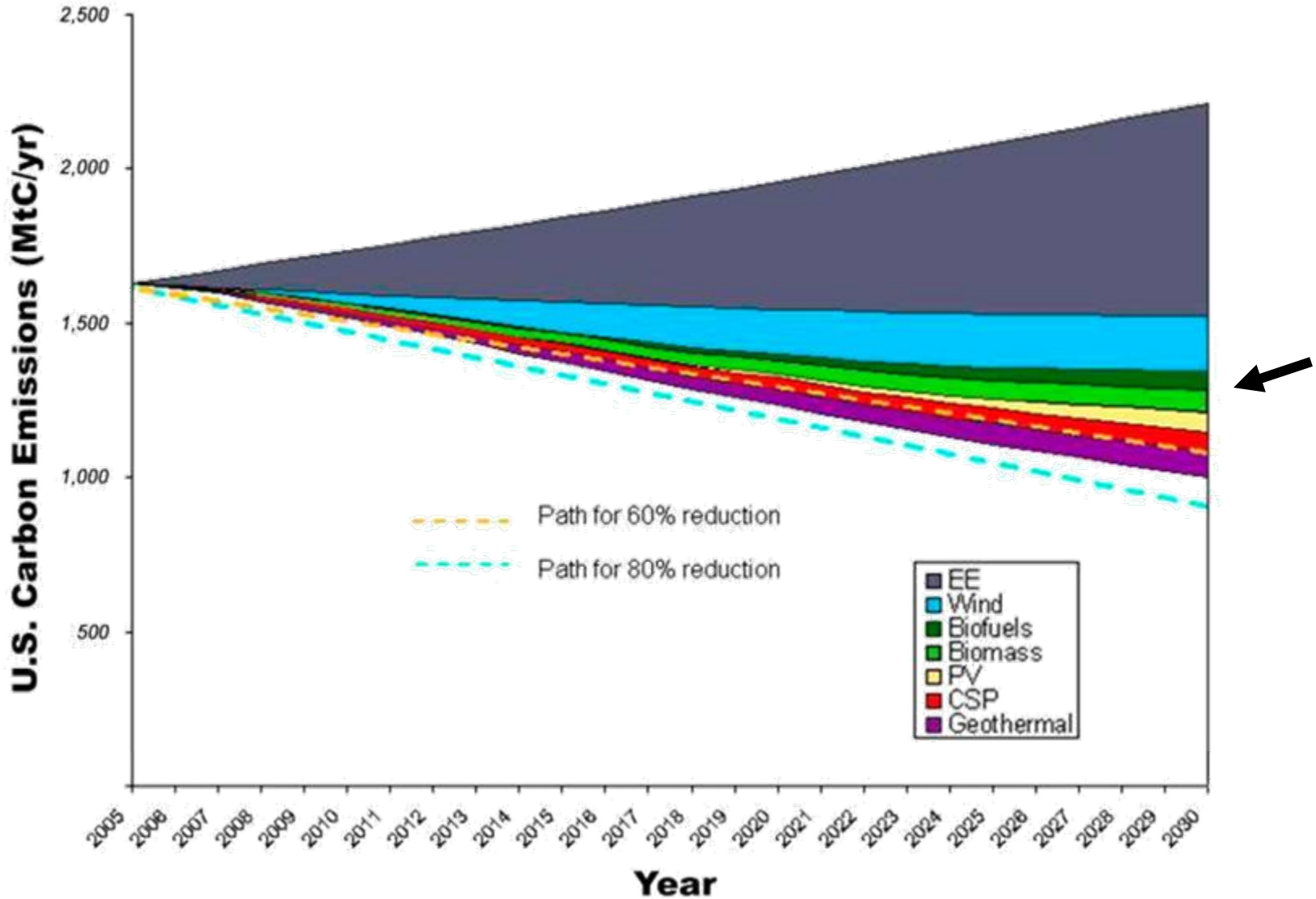
Managing our lands for energy, food and fiber



Total US Green House Gas Annual Emissions by Sector (EPA, 2003)



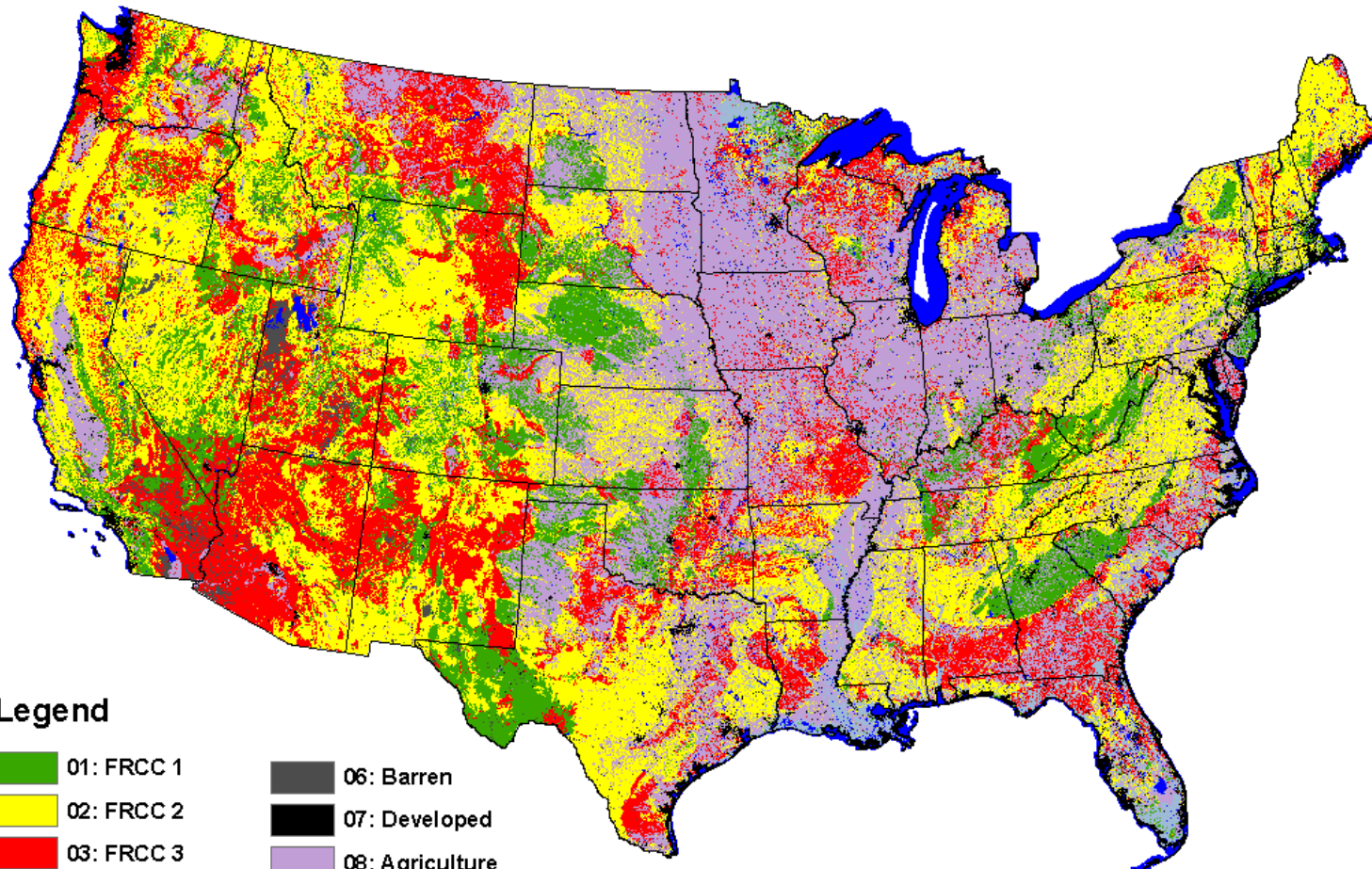
U.S. Carbon Emissions Displacement Potential from Energy Efficiency and Renewable Energy by 2030



Restoring Fire Adapted Forest Ecosystems



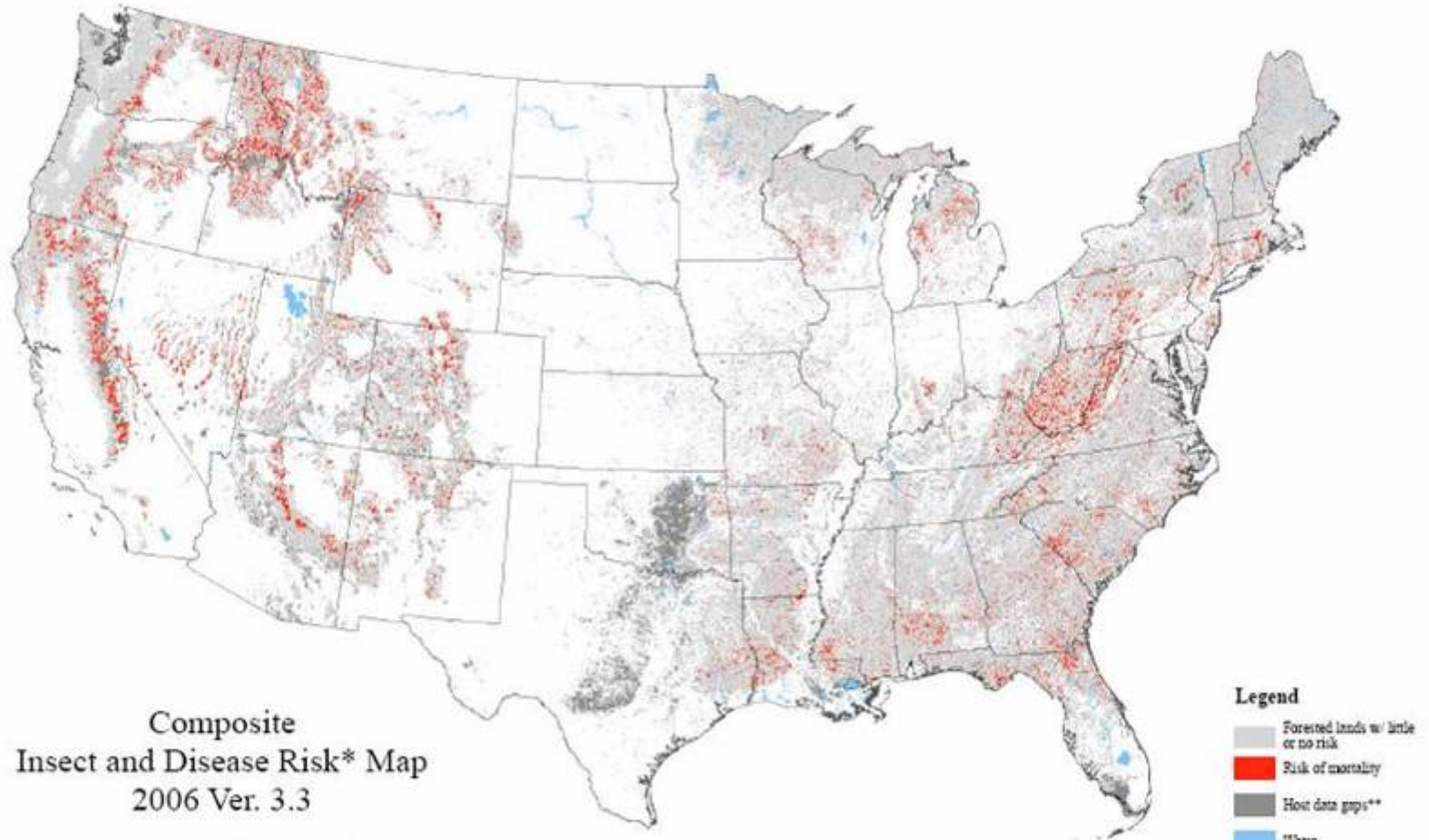
LANDFIRE Rapid Assessment Fire Regime Condition Class



Legend

 01: FRCC 1	 06: Barren
 02: FRCC 2	 07: Developed
 03: FRCC 3	 08: Agriculture
 04: Water	 09: Non-Classified V
 05: Snow/Ice	 10: Unclassified

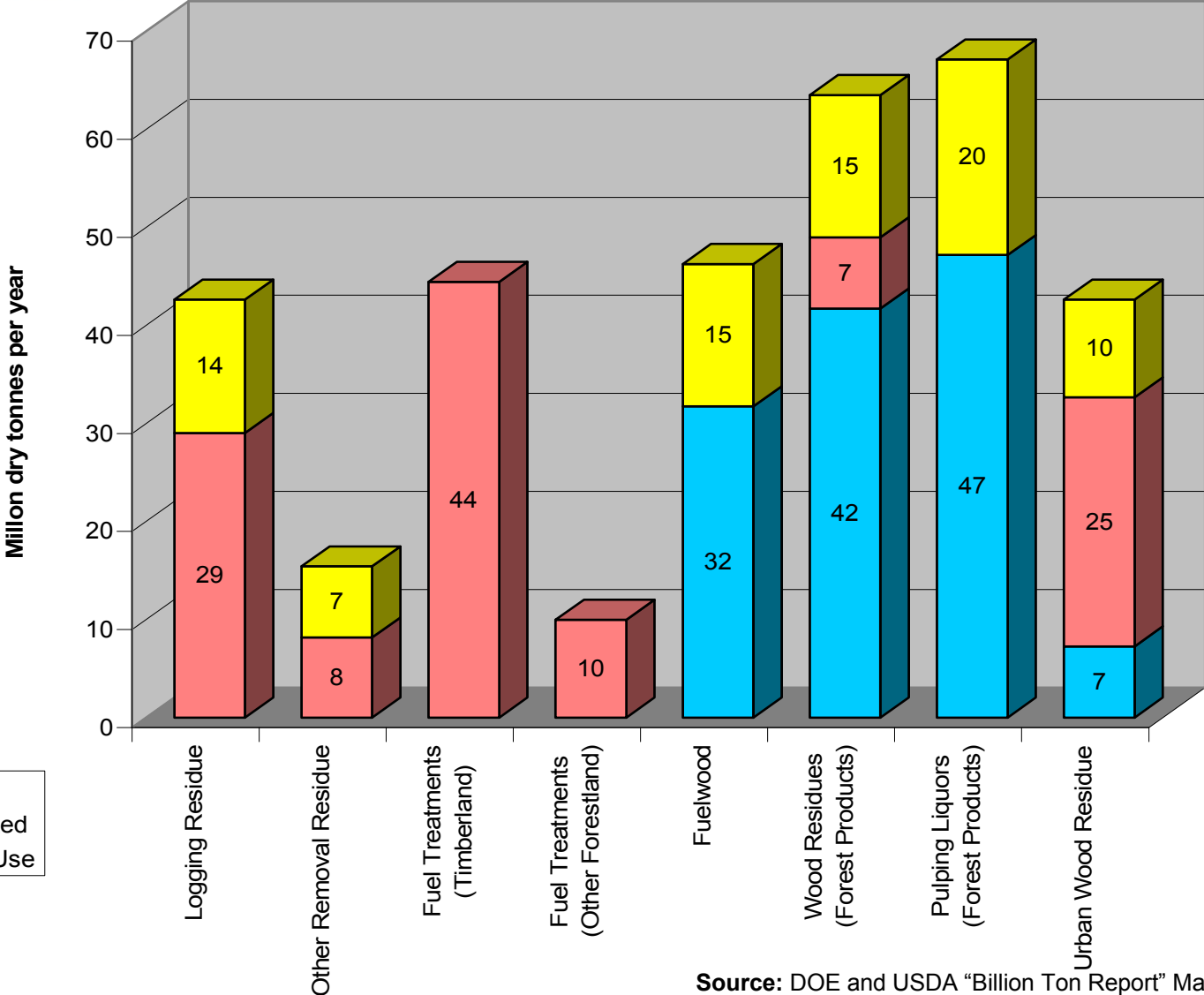
Forest Insect and Disease Risk



*The expectation that 25% or more of the standing live volume of trees greater than 1" in diameter will die over the next 15 years, including background mortality.

Printing Date: September 22, 2006

Potentially Available Forest Resource



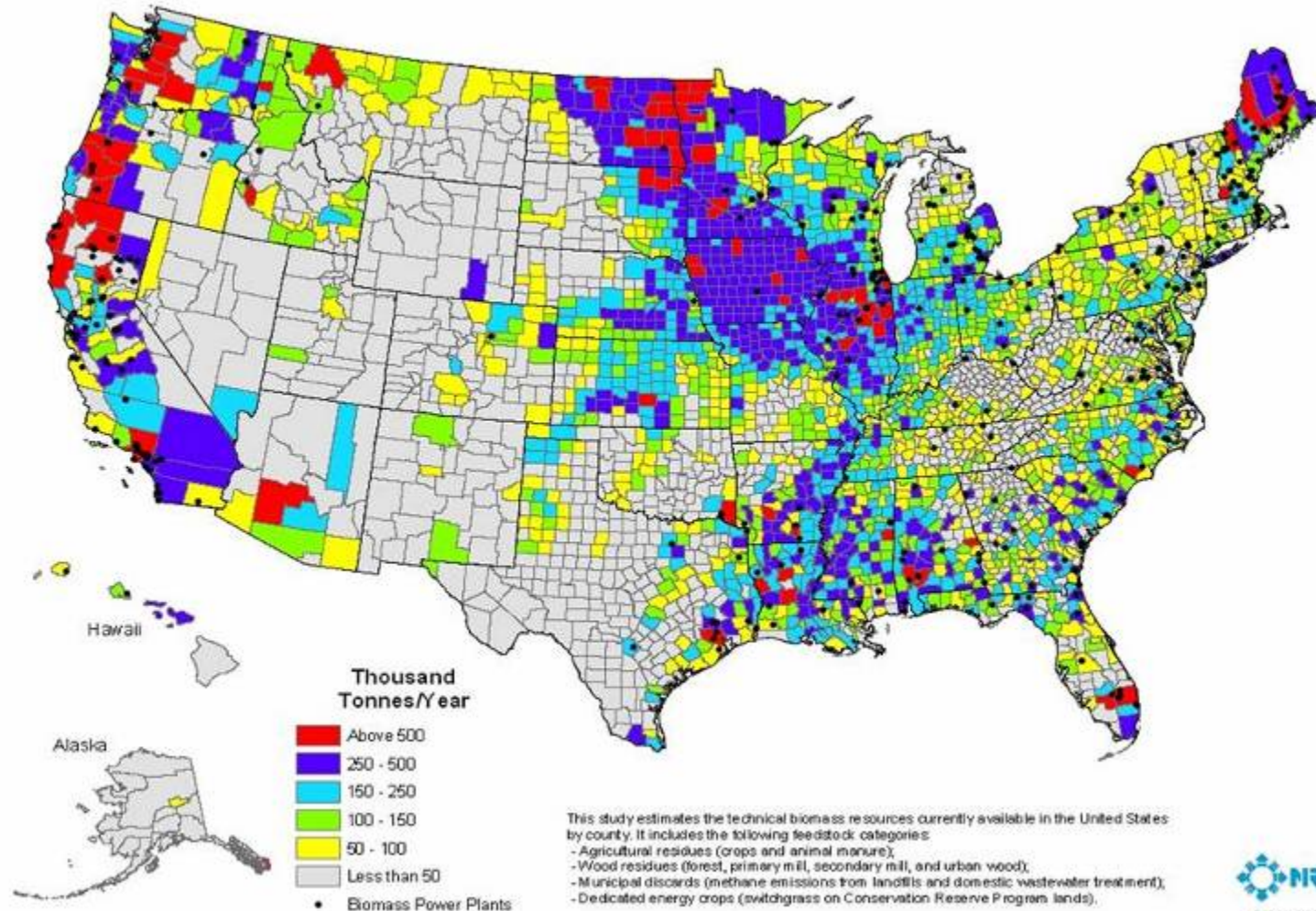
■ Growth
■ Unexploited
■ Existing Use

Source: DOE and USDA "Billion Ton Report" May 2005
<http://www1.eere.energy.gov/biomass/publications.html>

Agricultural and Wood Residues



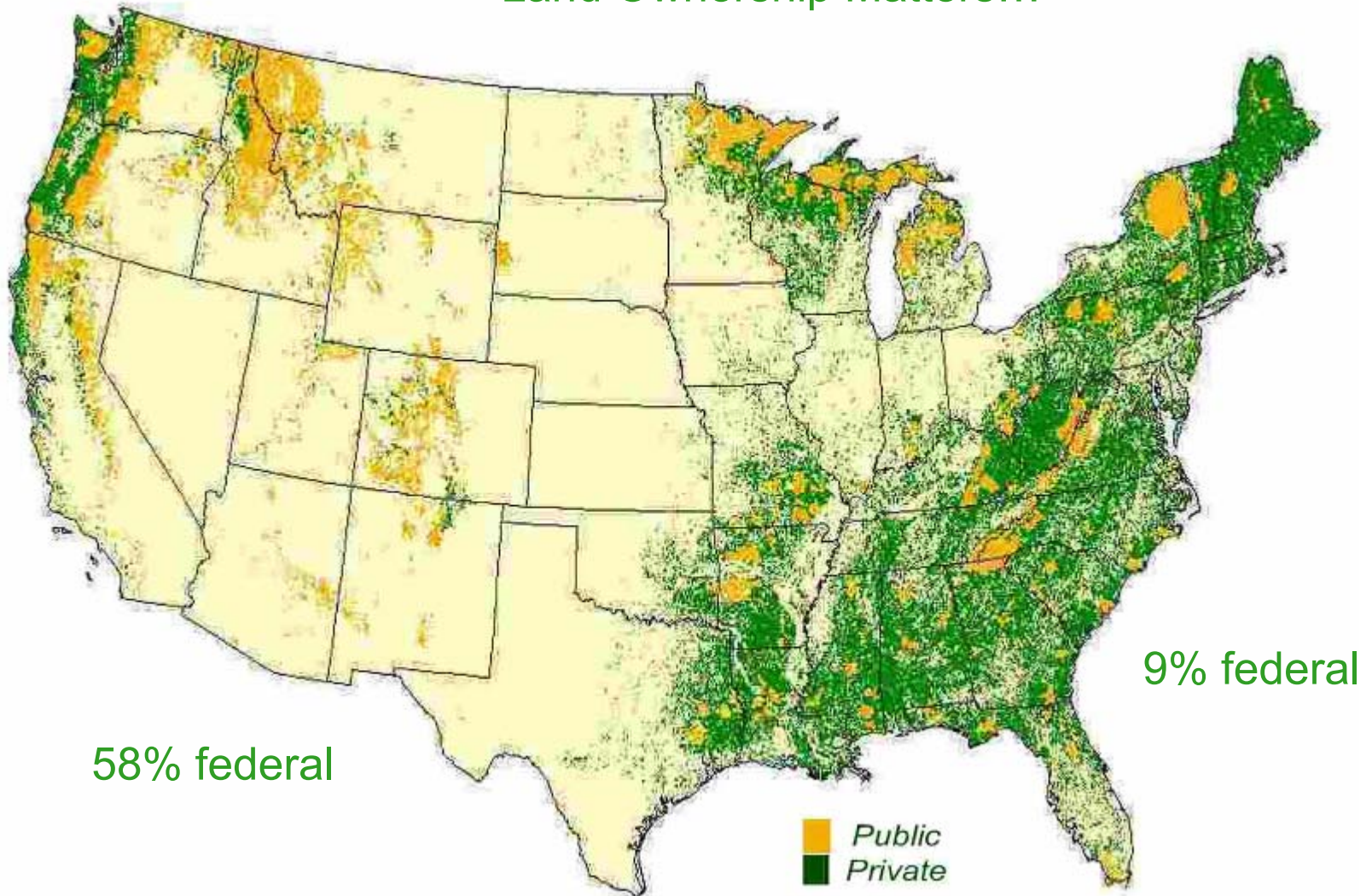
Biomass Resources Available in the United States



Public vs Private Forests



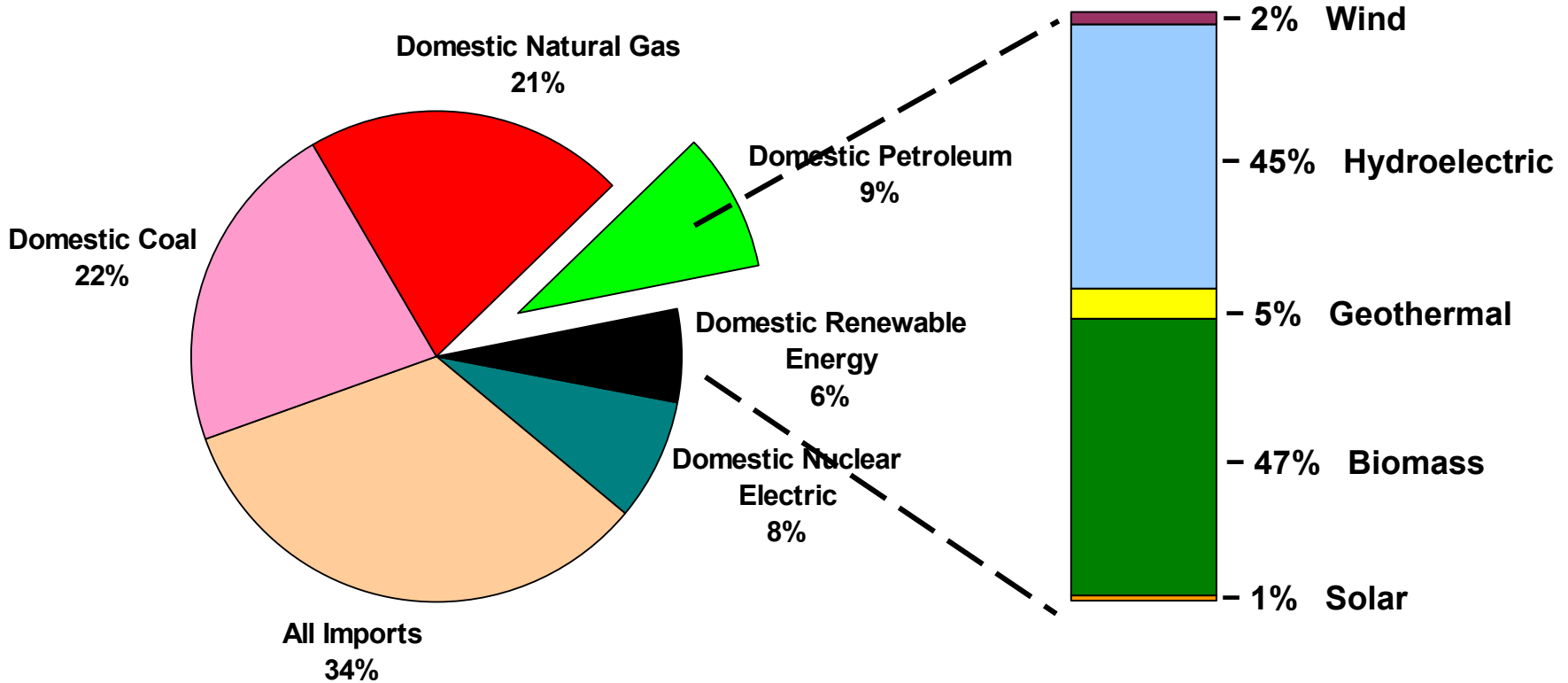
Land Ownership Matters...



U.S. Energy Consumption



Total = 6.2 Quadrillion Btu



★ 72% of biomass is wood based

Bioenergy: What is it?



- Thermal Energy
 - Heat
 - Steam
- Power
 - Electricity
 - Combined heat and power
- Biofuels
 - Liquid transportation fuels
 - Fermentation
 - Gasification
 - Methane (digesters)





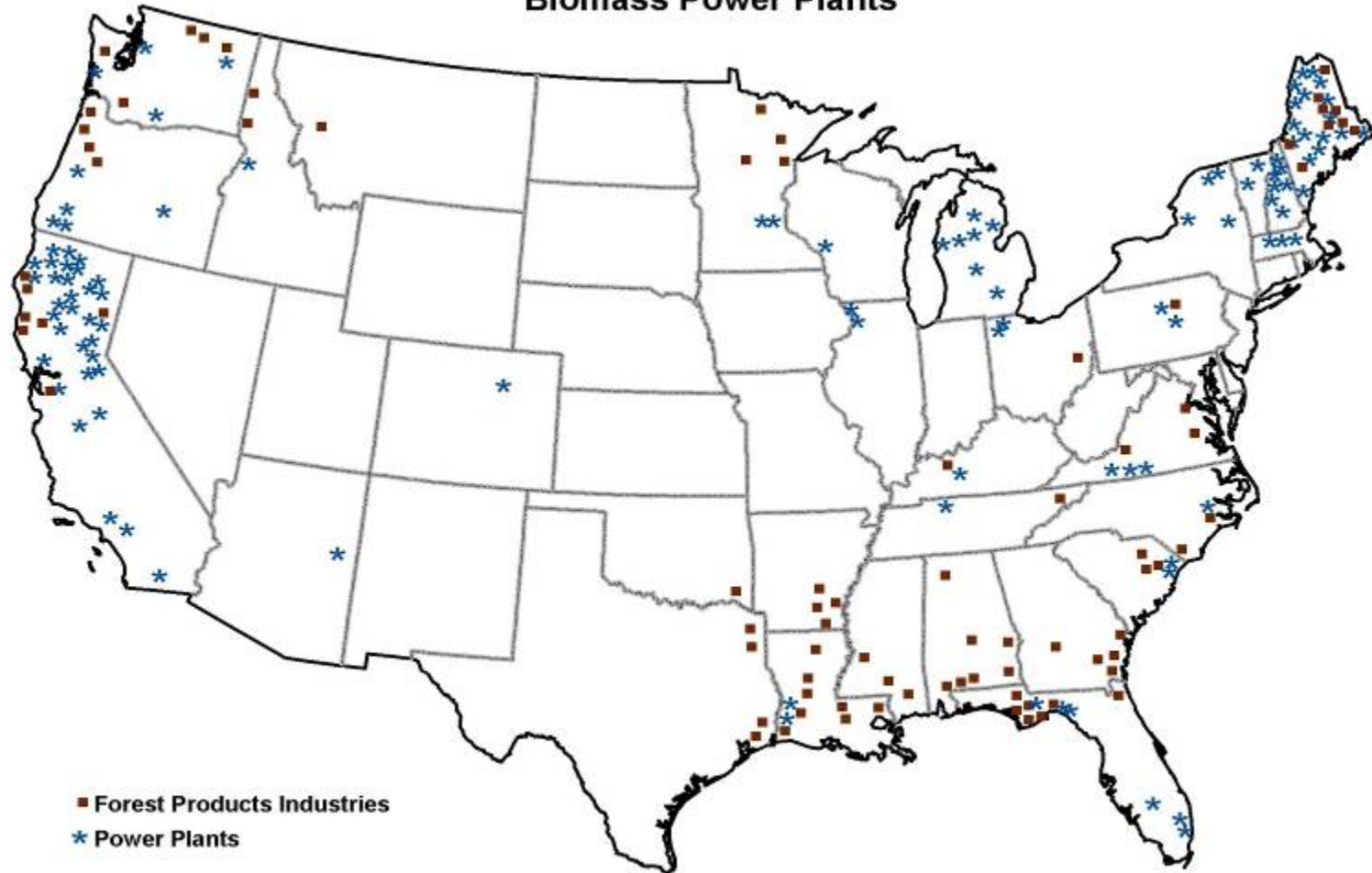
Biomass Heat and Power



Biomass Power Plants



Biomass Power Plants



Sources: National Electric Energy System (NEEDS) Database for IPM 2004

U.S. Environmental Protection Agency, Clean Energy eGRID2006 Version 1.0 Plant File (Year 2004 Data)

Example facility

biomass sources

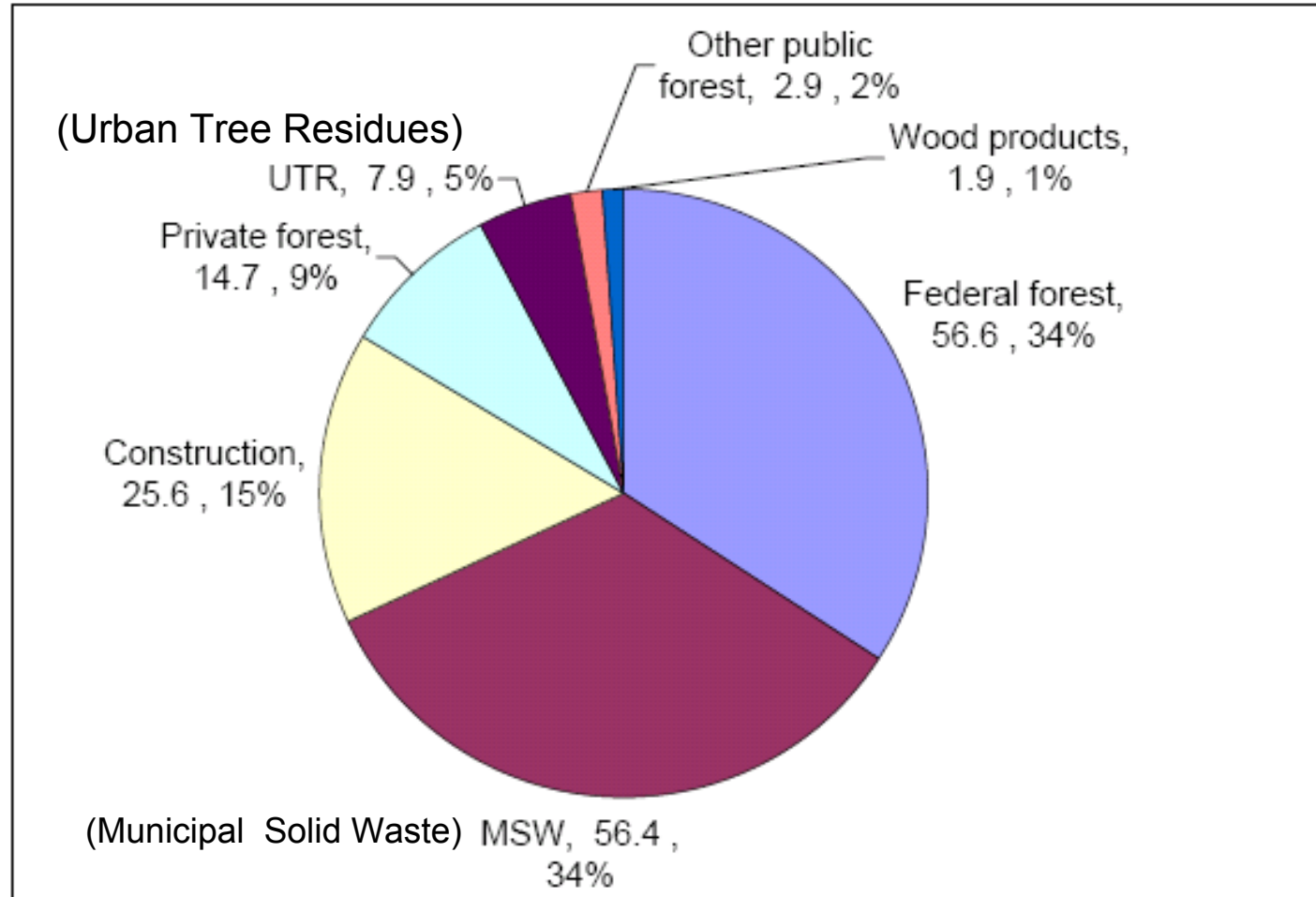
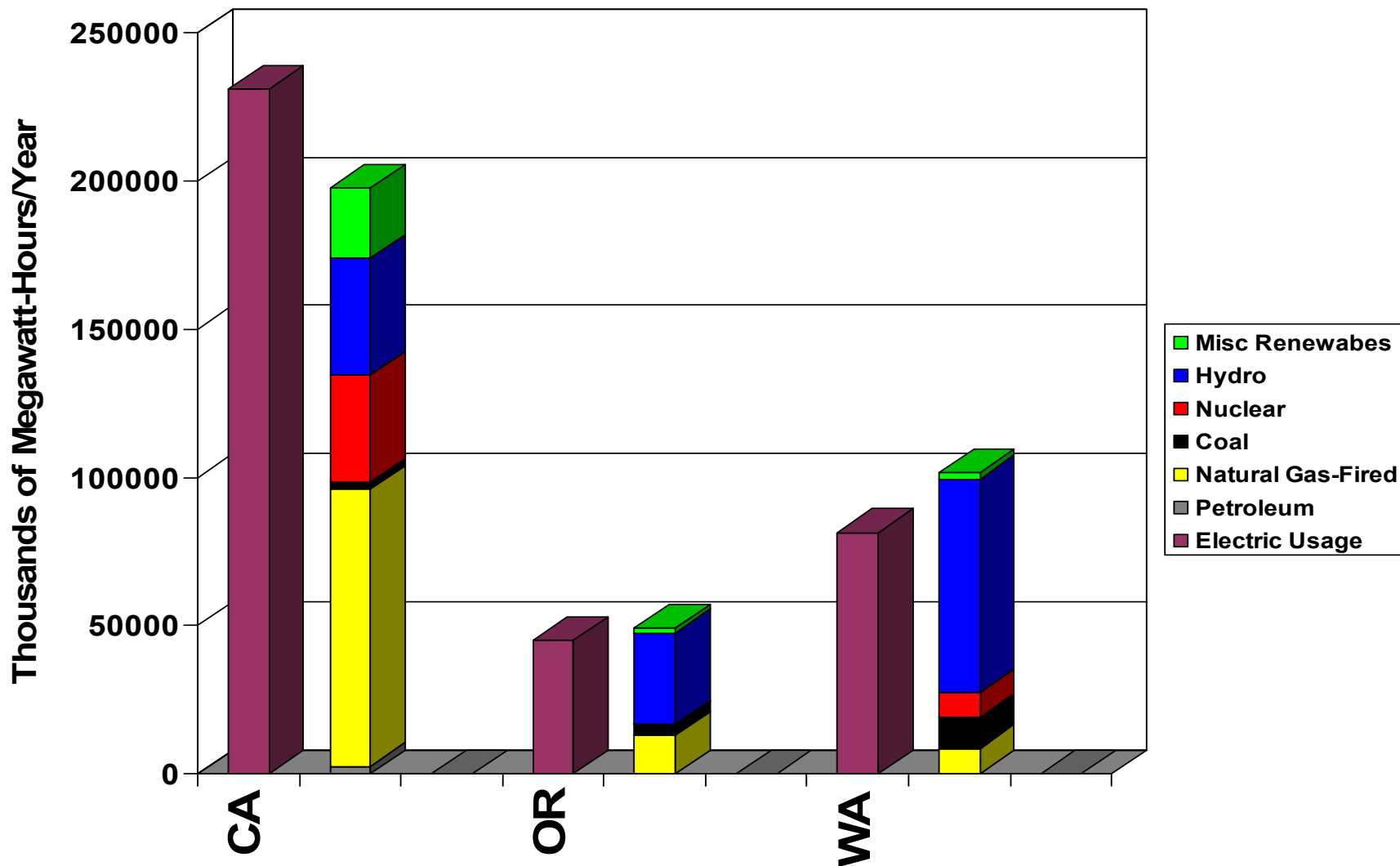


Figure 4-3. Breakdown of Biomass Availability by Source (Thousand bdt/year)

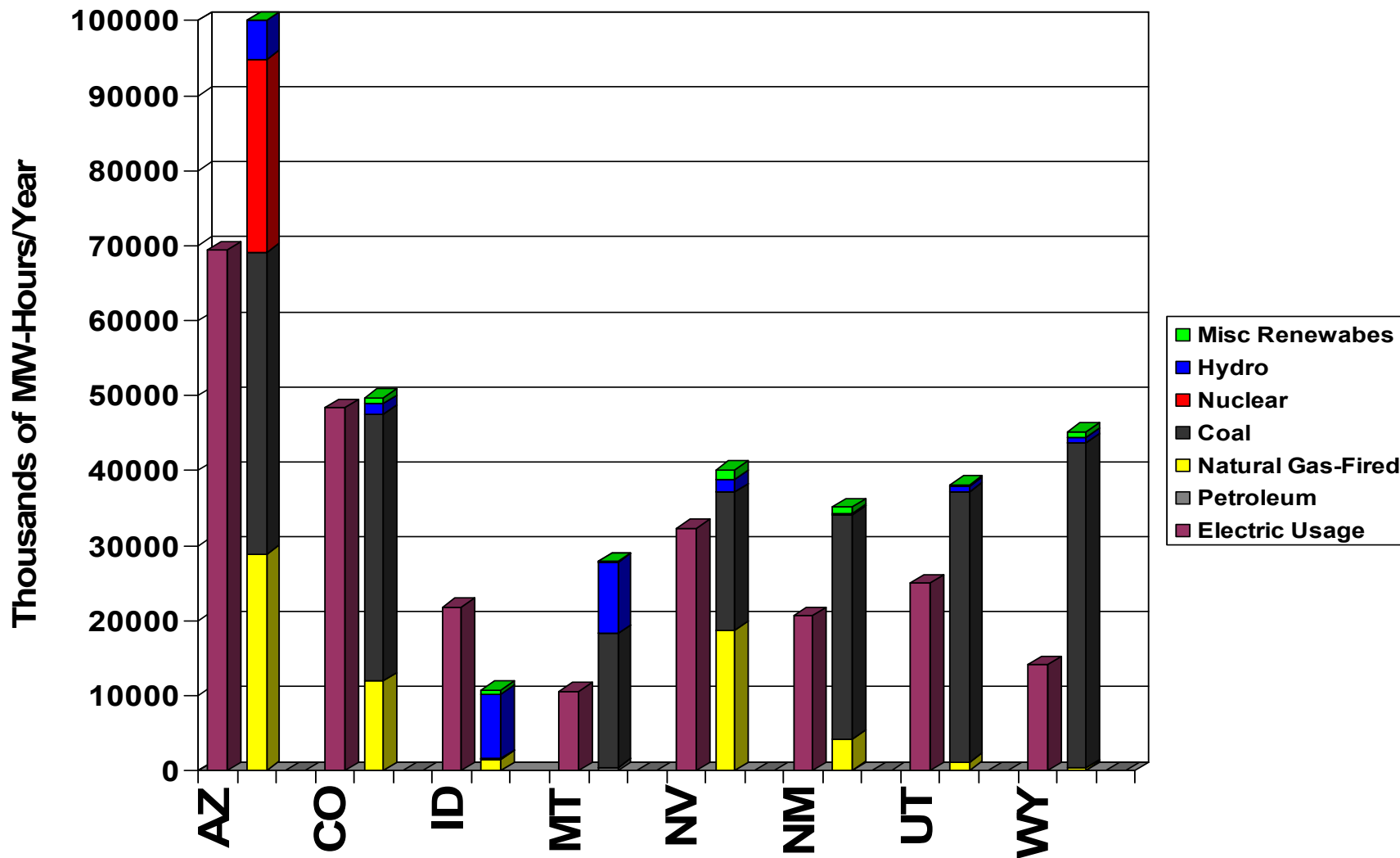
Electricity Use and Generation

Coastal States



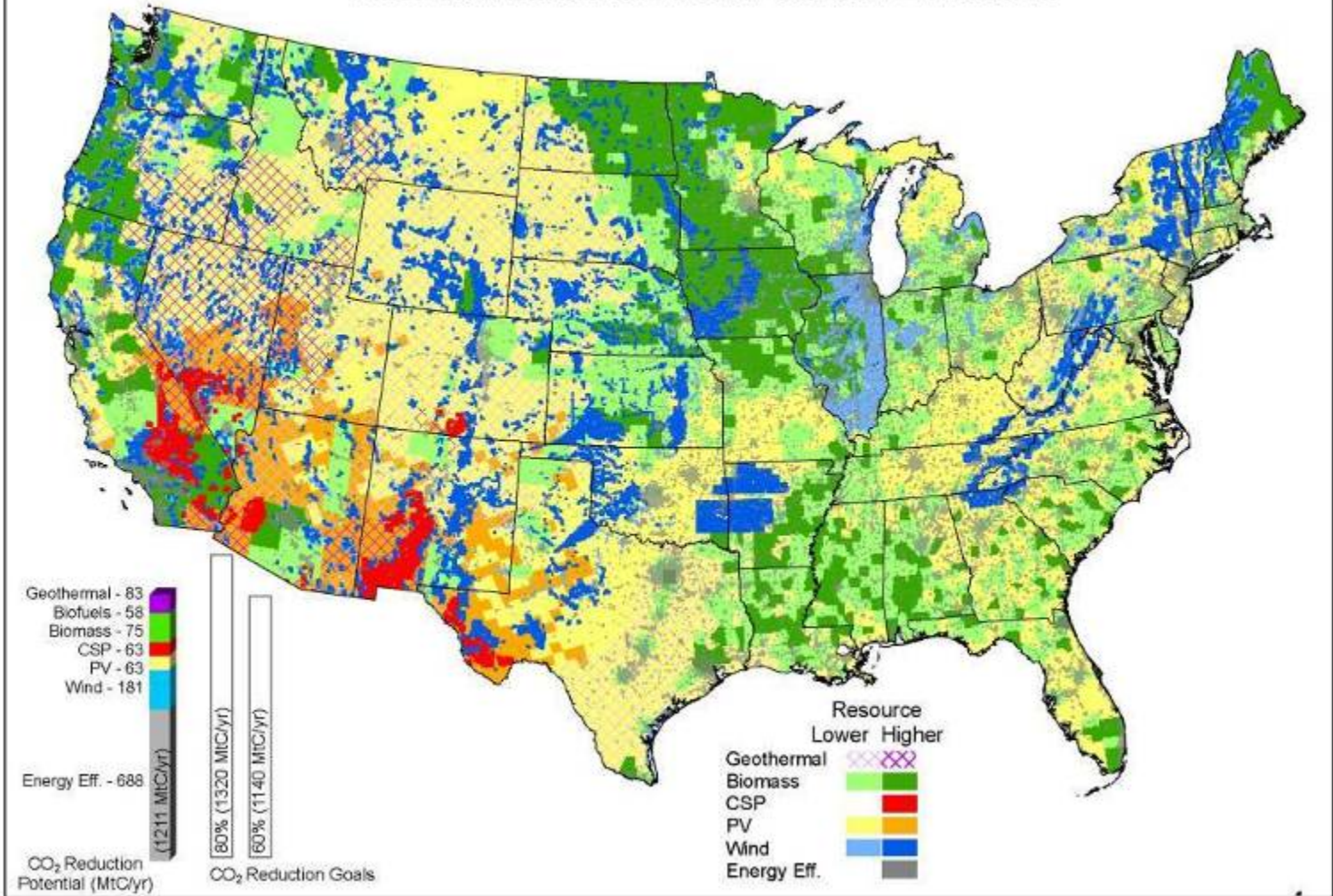
Electricity Use and Generation

Interior West



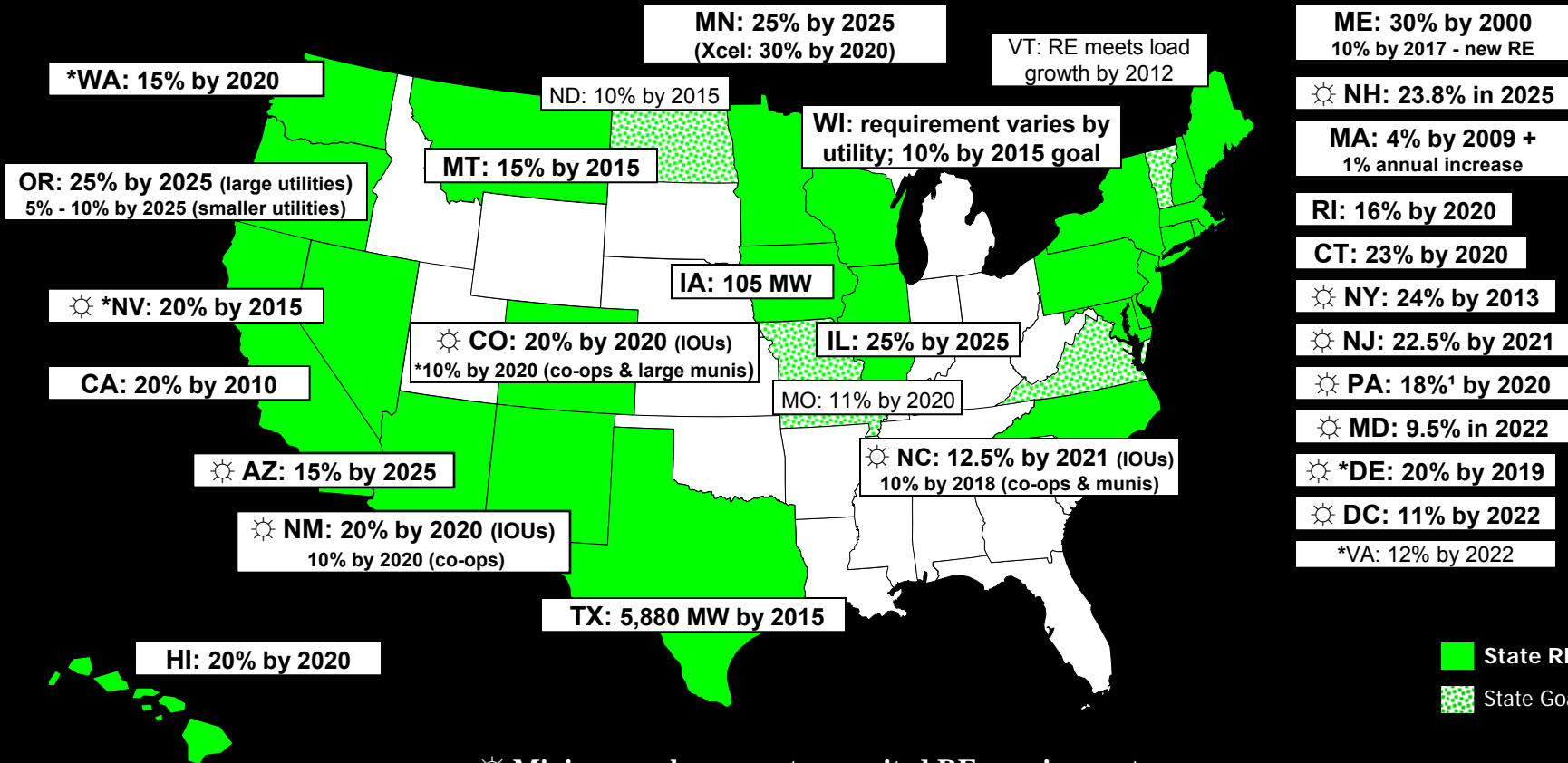


Potential Reduction in U.S. Carbon Emissions



Source: American Solar Energy Society. 2007. http://www.ases.org/climatechange/climate_change.pdf

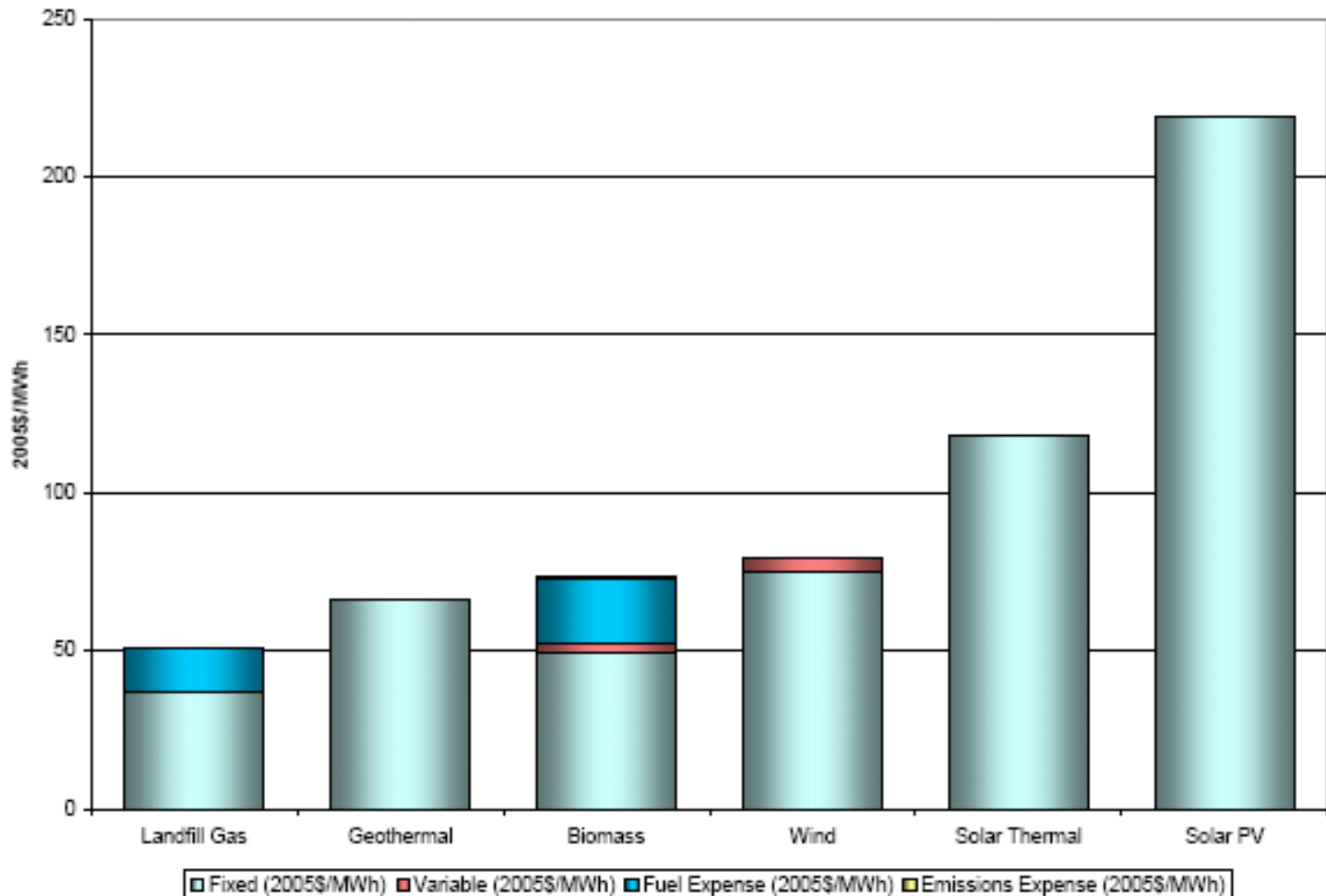
Renewable Portfolio Standards



☀ Minimum solar or customer-sited RE requirement
 * Increased credit for solar or customer-sited RE
¹PA: 8% Tier I / 10% Tier II (includes non-renewables)

(Source: Database of State Incentives for Renewable Energy. 2007. "Renewables Portfolio Standards." NC State University. NC Solar Center. Available online at: http://www.dsireusa.org/documents/summarymaps/RPS_Map.ppt)

Levelized Cost of Renewables

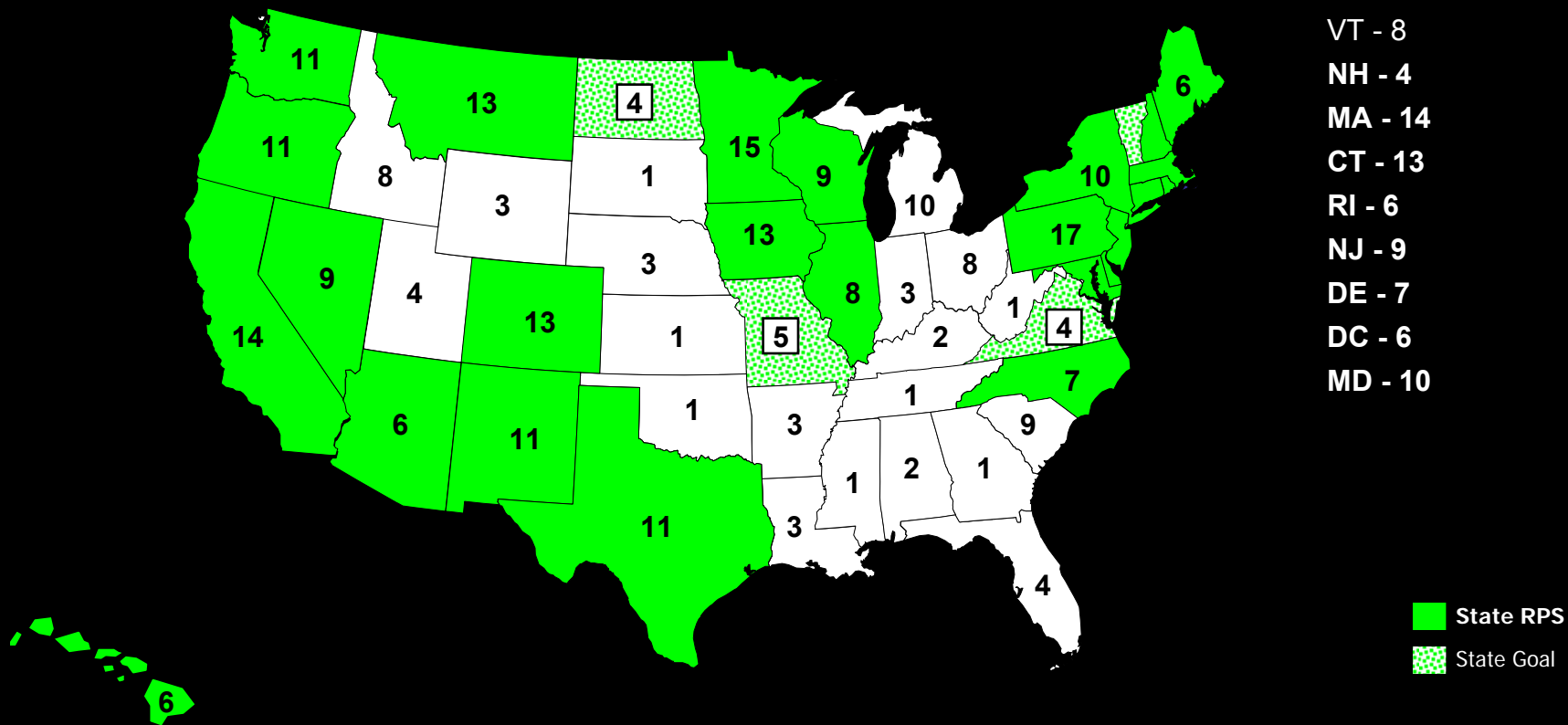


Biomass Incentives



AK - 2 (AK not shown)

Federal – 8 Programs



Numbers of Incentives (State and Local)

(Source: Database of State Incentives for Renewable Energy. 2007. "Renewables Portfolio Standards." NC State University. NC Solar Center. Available online at: http://www.dsireusa.org/documents/summarymaps/RPS_Map.ppt)



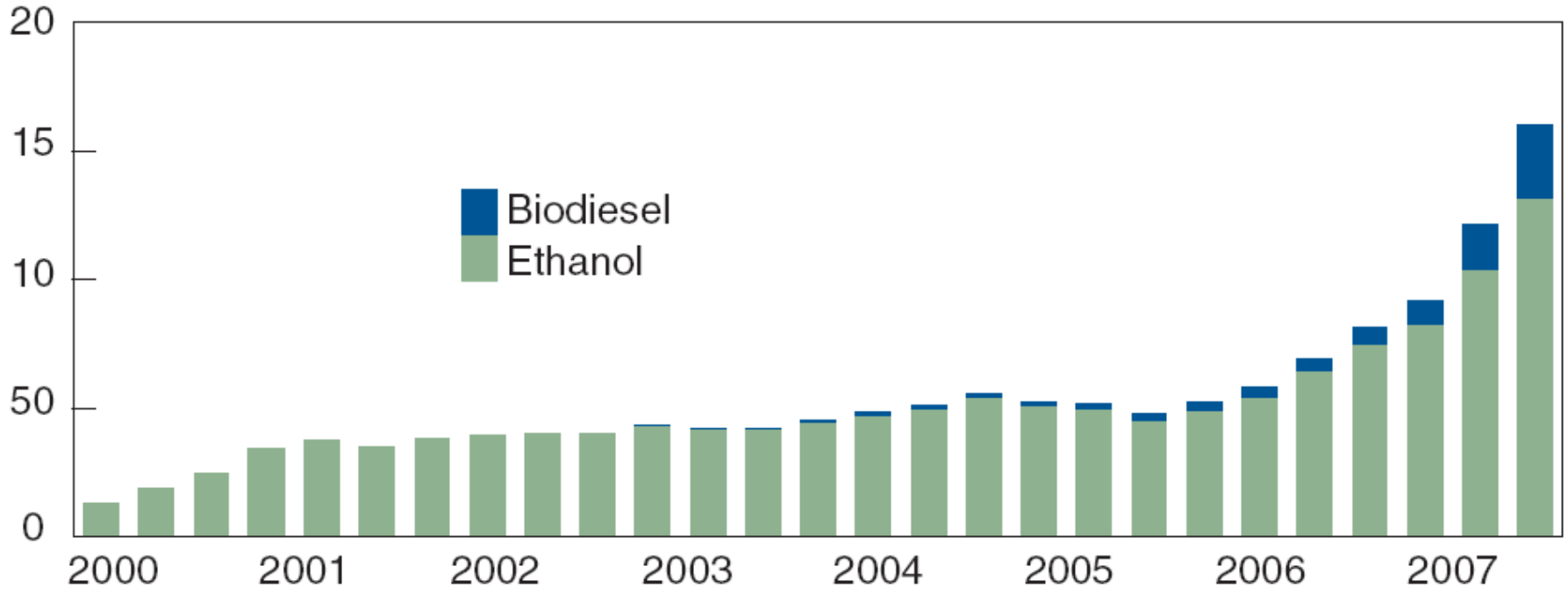
Biofuels





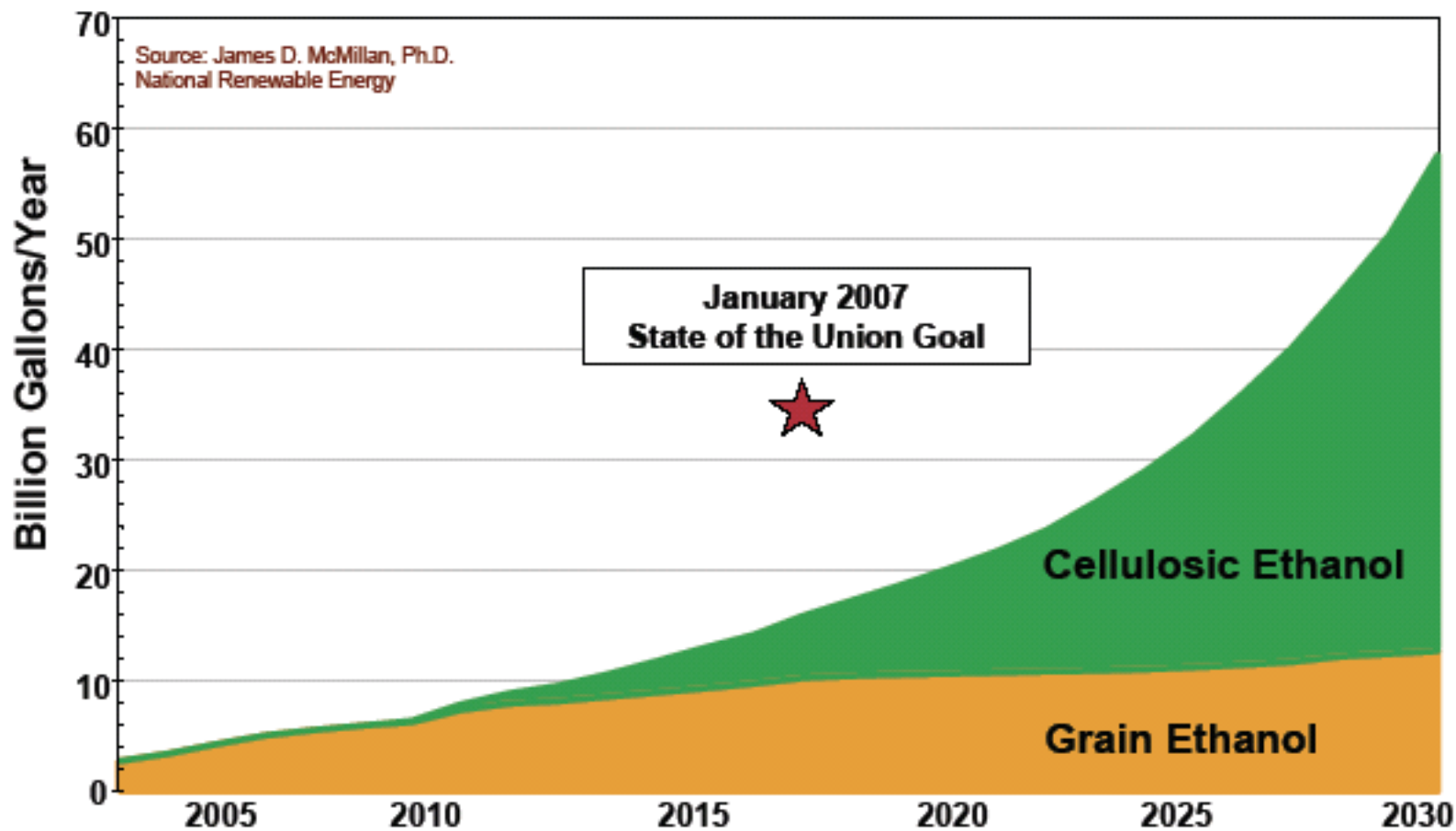
Global biofuel production tripled between 2000 and 2007

Billion gallons



Source: International Energy Agency; FO Licht.

U.S. Biofuels Growth Accelerating



2006 DuPont Participation: >\$300 million, growing 20+%/year



The miracles of science™

Source: NREL Projection

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Net Energy and Net GHG Emissions



Units of biofuel produced from 1 unit of fossil fuel	Reduction in GHG emissions to make ethanol compared to gasoline made from fossil fuel
1.3 Corn to ethanol	22%
8 Sugar Cane to ethanol	56%
2.5 Soybean to biodiesel	69%
Up to 36 Wood/Grass to ethanol	91%

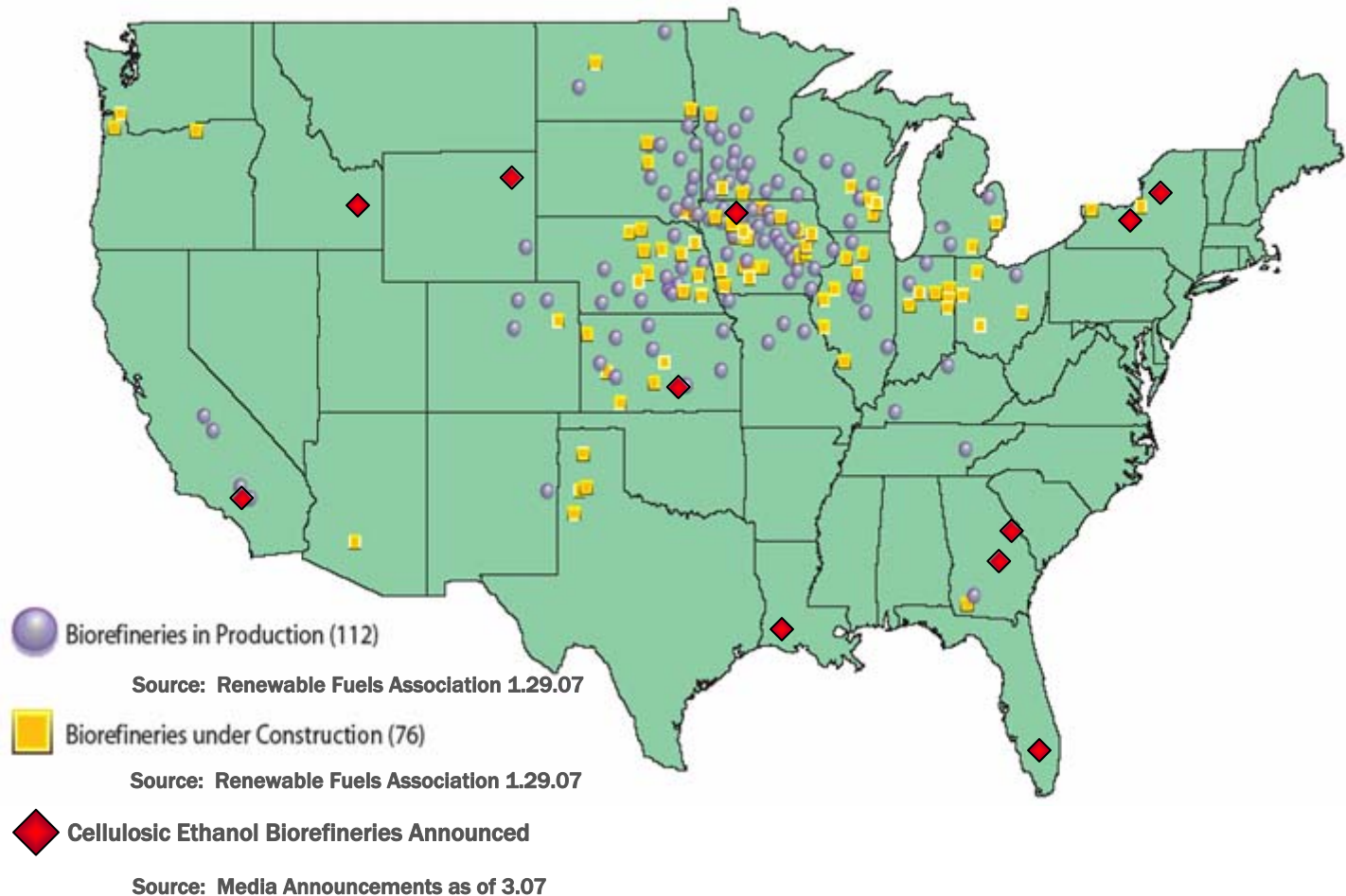
Data Sources (adapted from C.Mater, Mater Engineering)

- Corn to ethanol data: US DOE; EPS; Renewable Fuel's Association; Energy Future Coalition; Worldwatch Institute
- Cane to ethanol data: USDOE; Worldwatch Institute; Iowa State University
- Soy to biodiesel data: USDOE; EPA; Worldwatch Institute;
- Woody/grass biomass to ethanol: USDOE; EPA; WorldWatch Institute

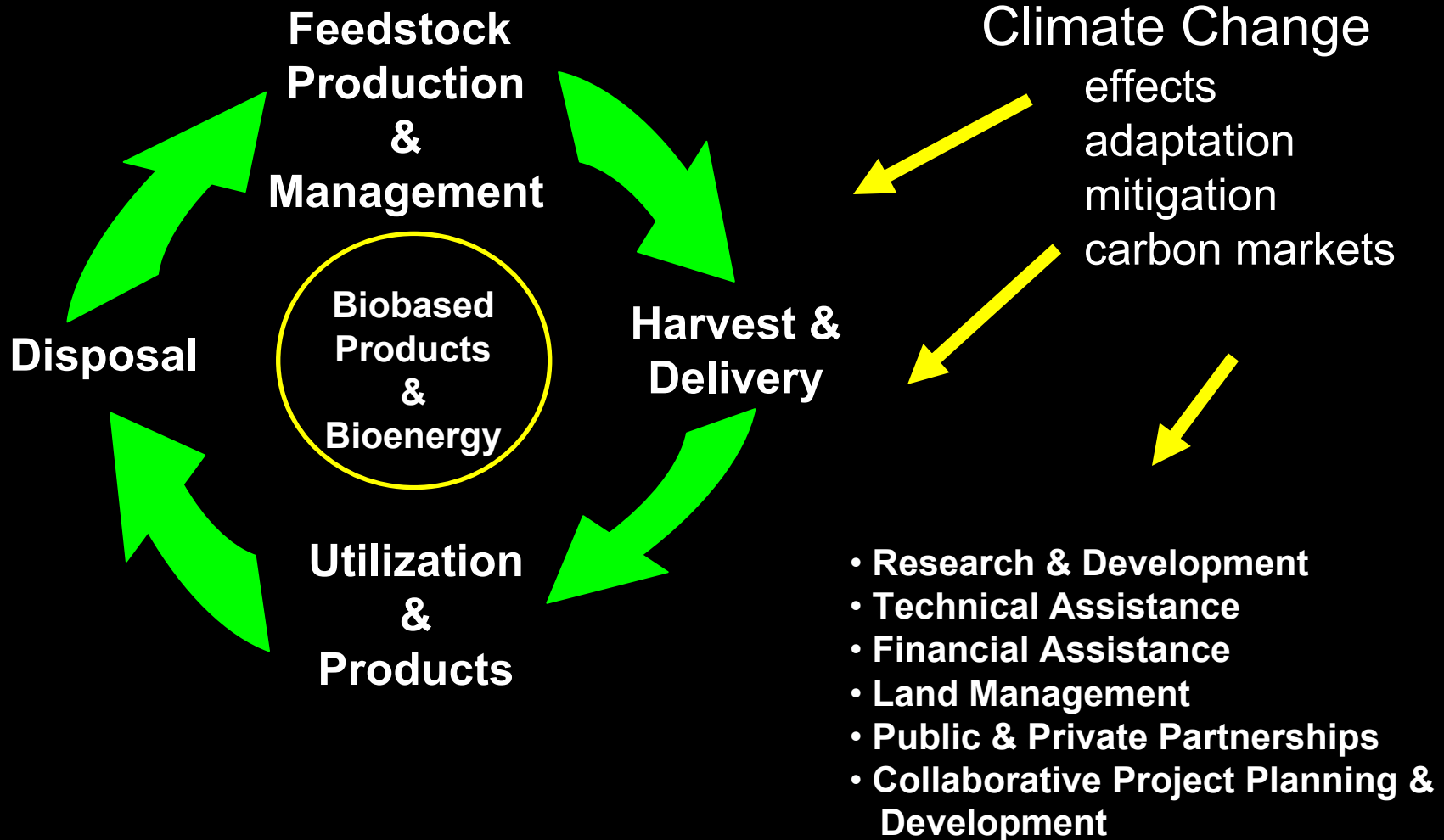
U.S. Biorefinery Locations



U.S. Biorefinery Locations Corn and Cellulosic Feedstocks



Integrated Biobased Products and Bioenergy Approach



Forest Service

Woody Biomass Utilization Strategy

- Identify and build partnerships through collaboration
- Develop and deploy the needed science and technology
- Help develop new and expand markets for bioenergy and biobased products
- Facilitate a reliable and predictable supply of biomass

Draft National Strategy- September 2007



Sustainability and Bioenergy



- Forest Resource Issues
- National Policy
- State Policy
- Public Interest



- Sustainability- Energy, Environment, Economy

Effective biomass policy is essential to achieving sustainable forests in the United States

Thank you!



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For more information, please visit:
<http://www.fs.fed.us/woodybiomass>