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Southeastern Perspectives on Bioenergy Sustainability

USDOE's Biomass 2010

March 30, 2010

SACE Biomass Endeavors

- **Increasing Awareness**
- **GOAL: One Broader Definition with Sustainability Provisions**
- **Strong Renewable Electricity Standards (RES) 25% x 2025**
- **Helpful State Level Policies**
  (Net Metering, Intercon. Standards, Fair Payment)

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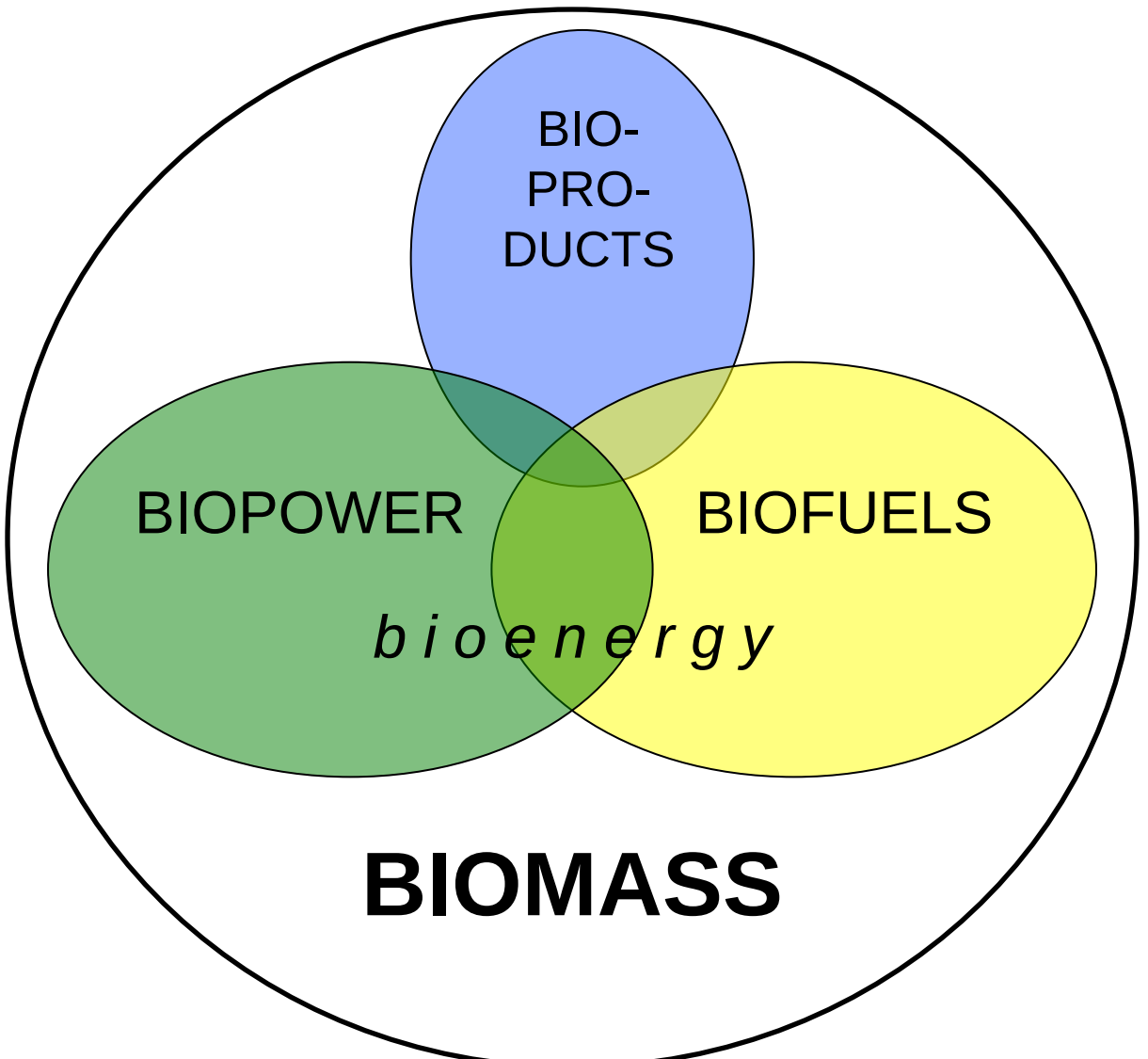
What is Bioenergy?



MADE FROM BIOMASS:

- bioproducts
- biofuels
- biopower

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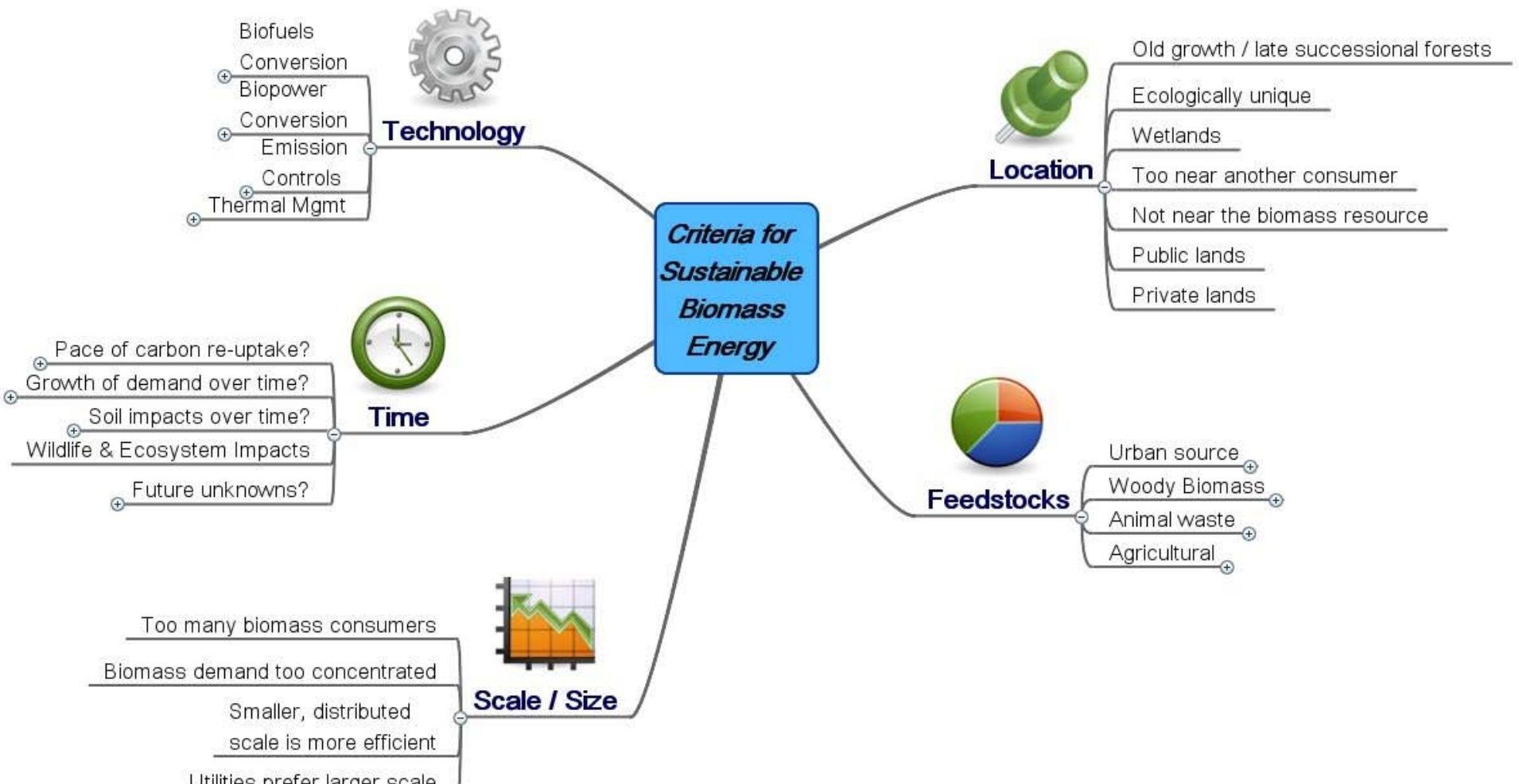
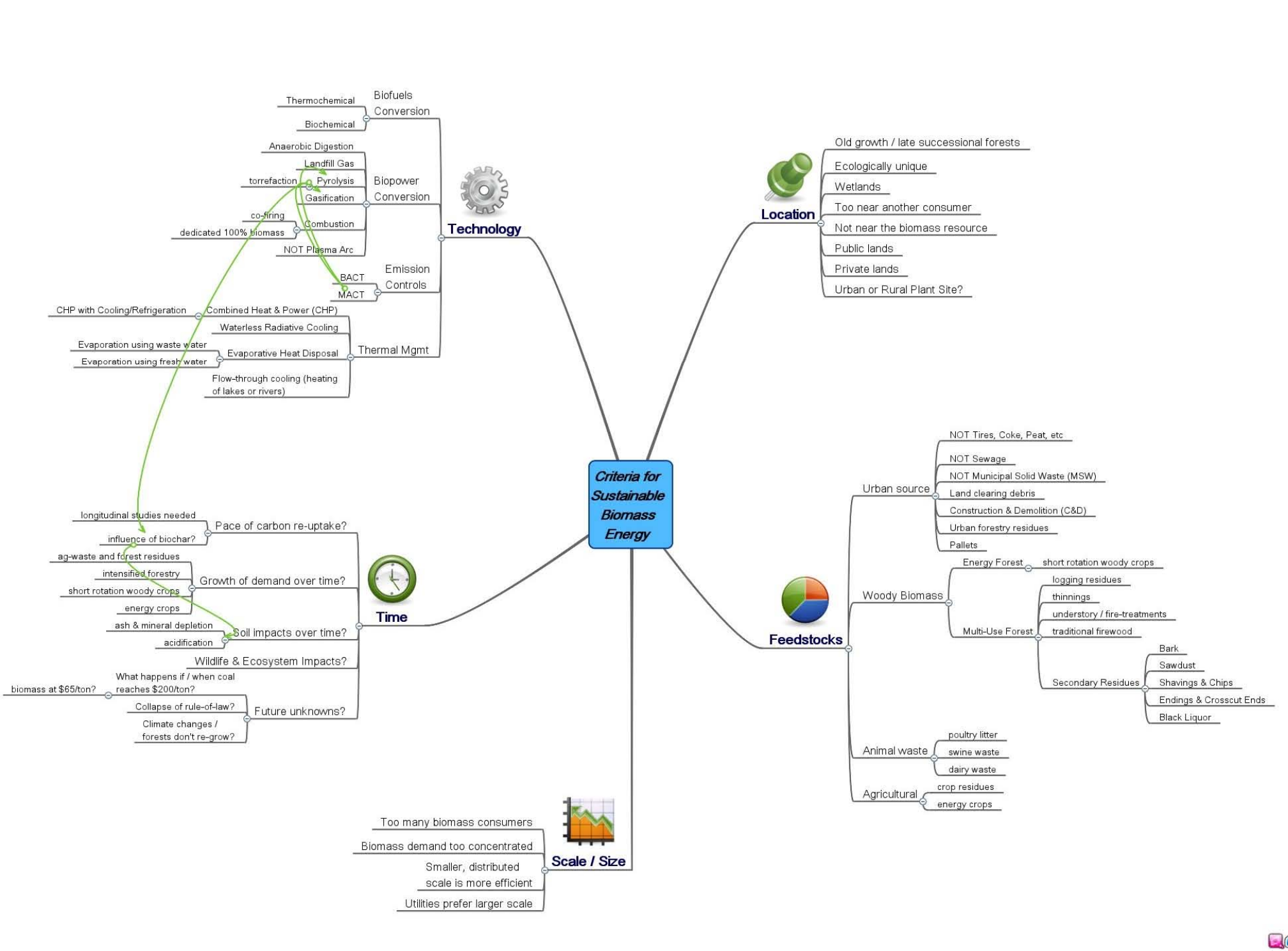
Sustainability




Criteria for Sustainable Biomass Energy
Technology
Biofuels Conversion
Thermochemical
Biochemical
Biopower Conversion
Anaerobic Digestion
Landfill Gas
Pyrolysis
torrefaction
Gasification
Combustion
co-firing
dedicated 100% biomass
NOT Plasma Arc
Emission Controls
BACT
MACT
Thermal Mgmt
Combined Heat & Power (CHP)
CHP with Cooling/Refrigeration
Waterless Radiative Cooling
Evaporative Heat Disposal
Evaporation using waste water
Evaporation using fresh water
Flow-through cooling (heating of lakes or rivers)
Location
Old growth / late successional forests
Ecologically unique
Wetlands
Too near another consumer
Not near the biomass resource
Public lands
Private lands
Urban or Rural Plant Site?
Feedstocks
Urban source
NOT Tires, Coke, Peat, etc
NOT Sewage
NOT Municipal Solid Waste (MSW)
Land clearing debris
Construction & Demolition (C&D)
Urban forestry residues
Pallets
Woody Biomass
Energy Forest
short rotation woody crops
Multi-Use Forest
logging residues
thinnings
understory / fire-treatments
traditional firewood
Secondary Residues
Bark
Sawdust
Shavings & Chips
Endings & Crosscut Ends
Black Liquor
Animal waste
poultry litter
swine waste
dairy waste
Agricultural
crop residues
energy crops
Time
Pace of carbon re-uptake?
longitudinal studies needed
influence of biochar?
Growth of demand over time?
ag-waste and forest residues
intensified forestry
short rotation woody crops
energy crops
Soil impacts over time?
ash & mineral depletion
acidification
Wildlife & Ecosystem Impacts?
Future unknowns?
What happens if / when coal reaches $200/ton?
biomass at $65/ton?
Collapse of rule-of-law?
Climate changes / forests don't re-grow?
Scale / Size
Too many biomass consumers
Biomass demand too concentrated
Smaller, distributed scale is more efficient
Utilities prefer larger scale

SE States Updates

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What can DOE do to help?

- Help clarify the priorities.
- Encourage better interdisciplinary analysis of resources.
- Encourage EPA: MACT & AP-42.
- Economics of biomass tri-gen?
- Get creative with USDA about soil.

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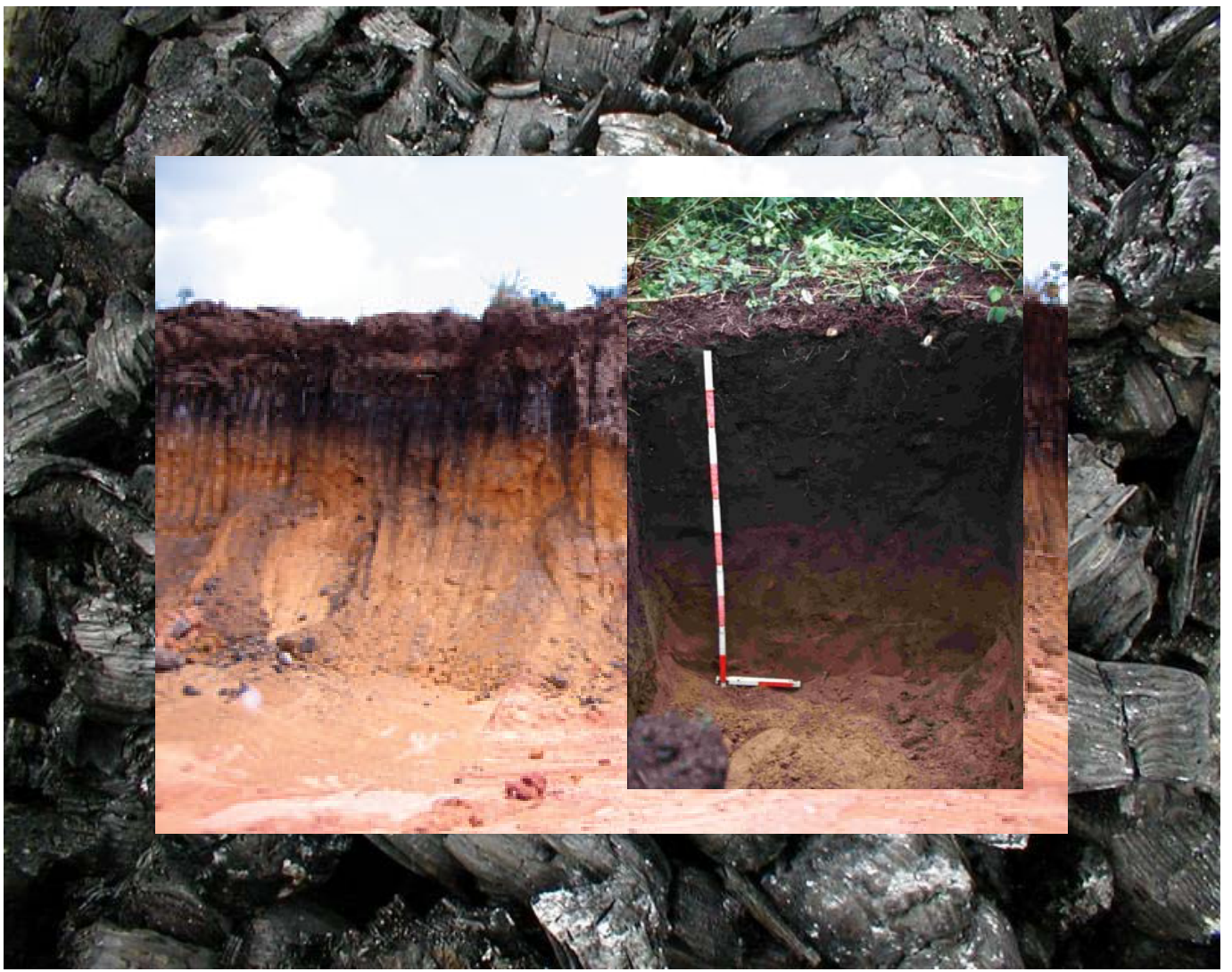
Carbon Negative Bioenergy!
Charcoal = Biochar = Terra Preta



- Pyrolysis or Gasification
- Incomplete Combustion
- Starved of O2, 400 to 1000°F
- >4,000 years old & very stable
- Beneficial to soil, plants & climate

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Questions?

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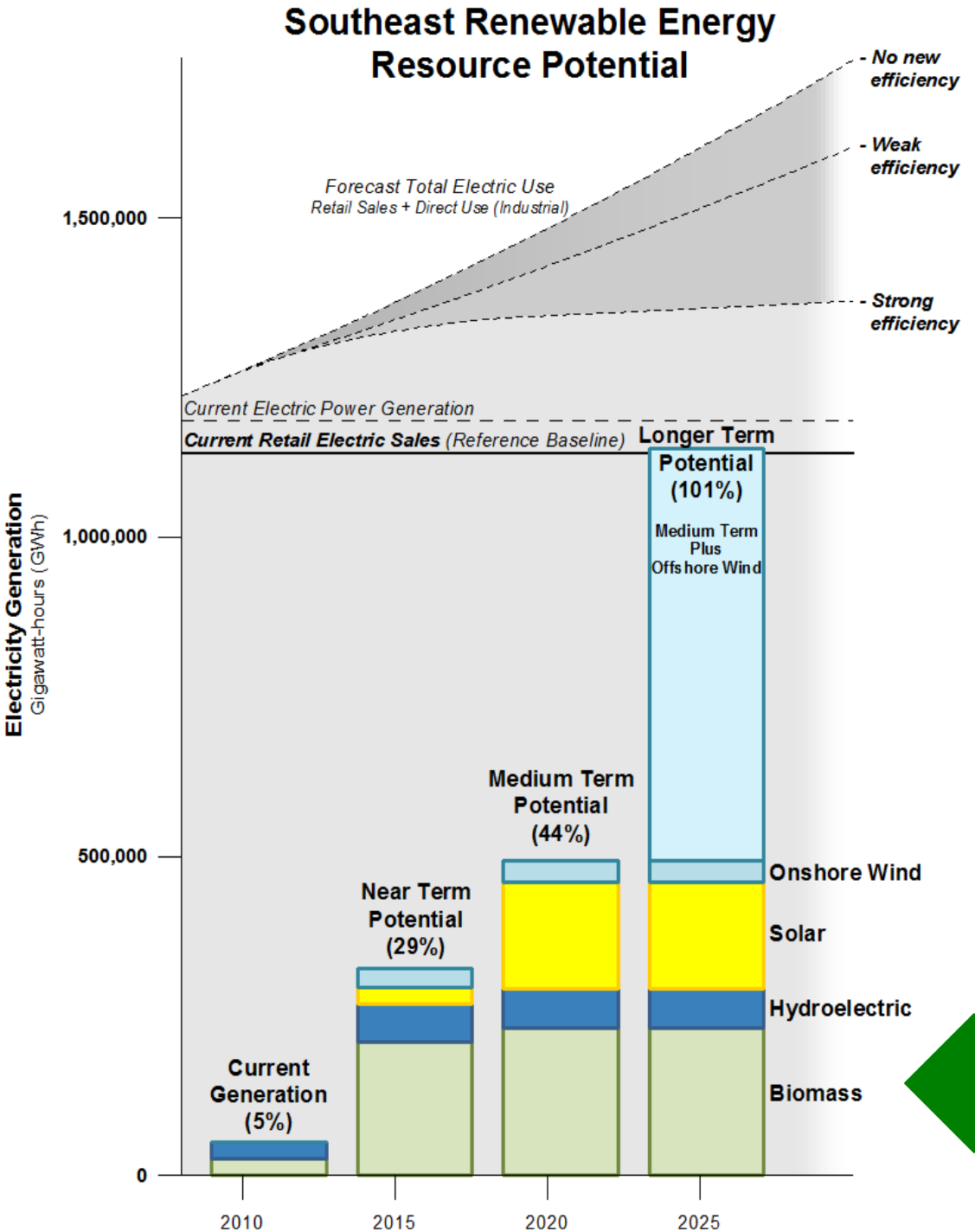

25% x '25

- Baseload = Reliable
- Cost-competitive
- Rapidly Deployed
- Early Workhorse
- 205,000 GWh Proj. Feasible Generation
- 2/3^{rds} near-term potential in RE.

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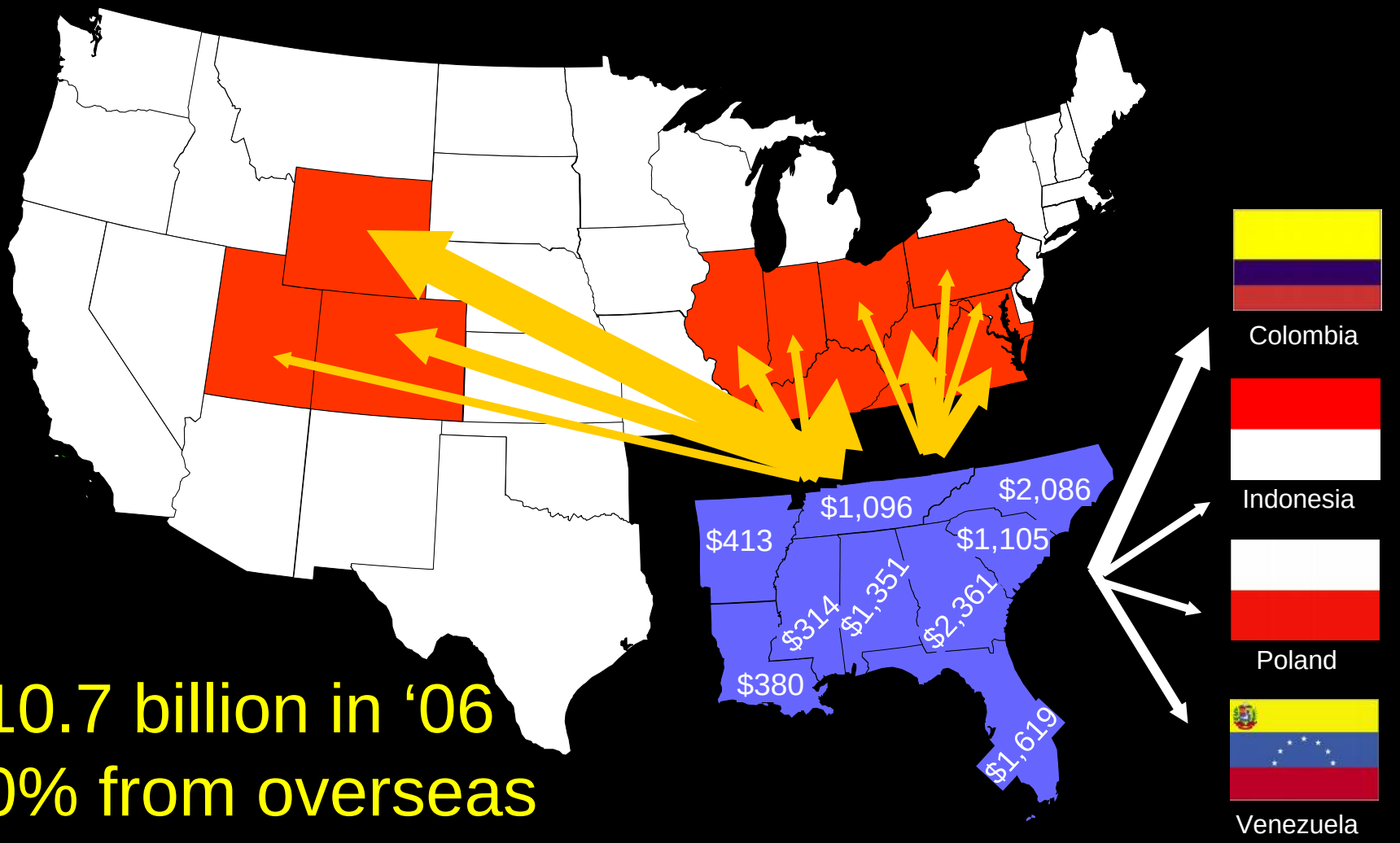
Coal is a Wealth Transfer

Annual Coal Import Expenditures, 2006 (million $)



- $10.7 billion in ‘06
- 10% from overseas

SOURCE: Map prepared by Jeff Deyette (Union of Concerned Scientists) using public data on coal purchases from the Federal Energy Regulatory Commission (FERC) and the USDOE Energy Information Administration (EIA).

Sustainability Overview

- Carbon Lifecycle
- Concentration of Demand
- Pollution Emissions
- Soil Productivity
- Water Quality & Quantity
- Biodiversity & Wildlife
- Indirect Effects
- Land Use Impacts

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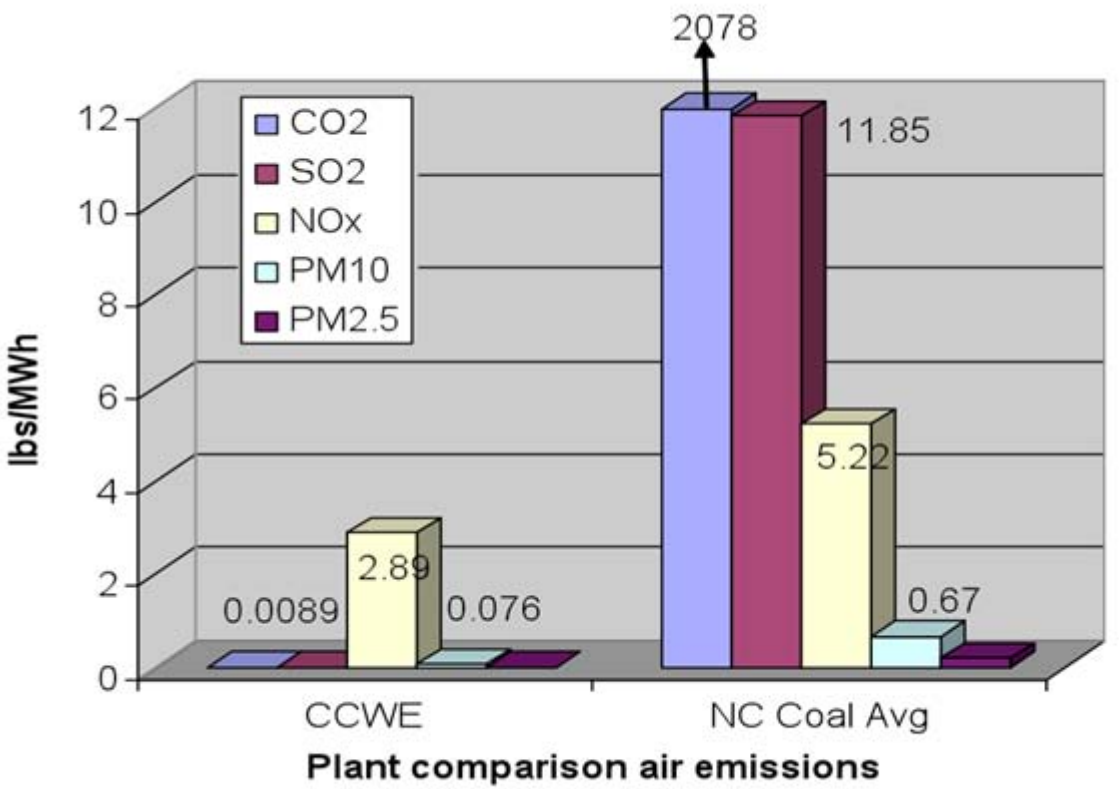
Pollution Emissions

Emissions: Wood vs. Coal



- Craven County Wood Energy (CCWE) is clearly superior to average coal plants
- Lower NOX, SO2, PM
- *No mercury!*
- Nevertheless, SACE does not support biopower with less than BACT

Graph courtesy of NCSU Solar Center.
Data: NC Division of Air Quality.

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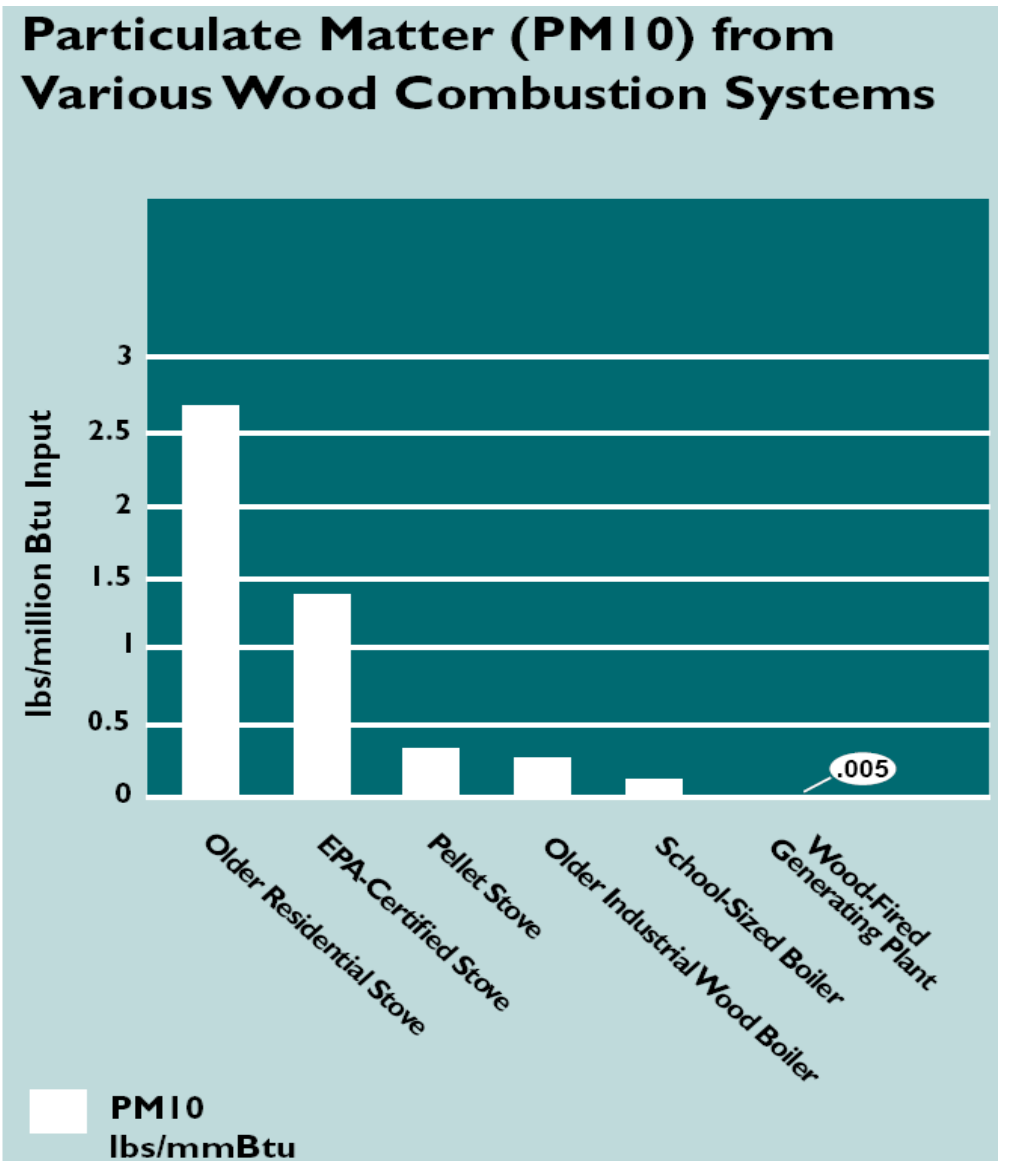
Particulate Emissions



Biopower is not your father's wood stove.

300 times less than EPA certified wood stoves.

Still, we do not support anything less than BACT.

Source: Biomass Energy Research Center (BERC), Montpelier, VT

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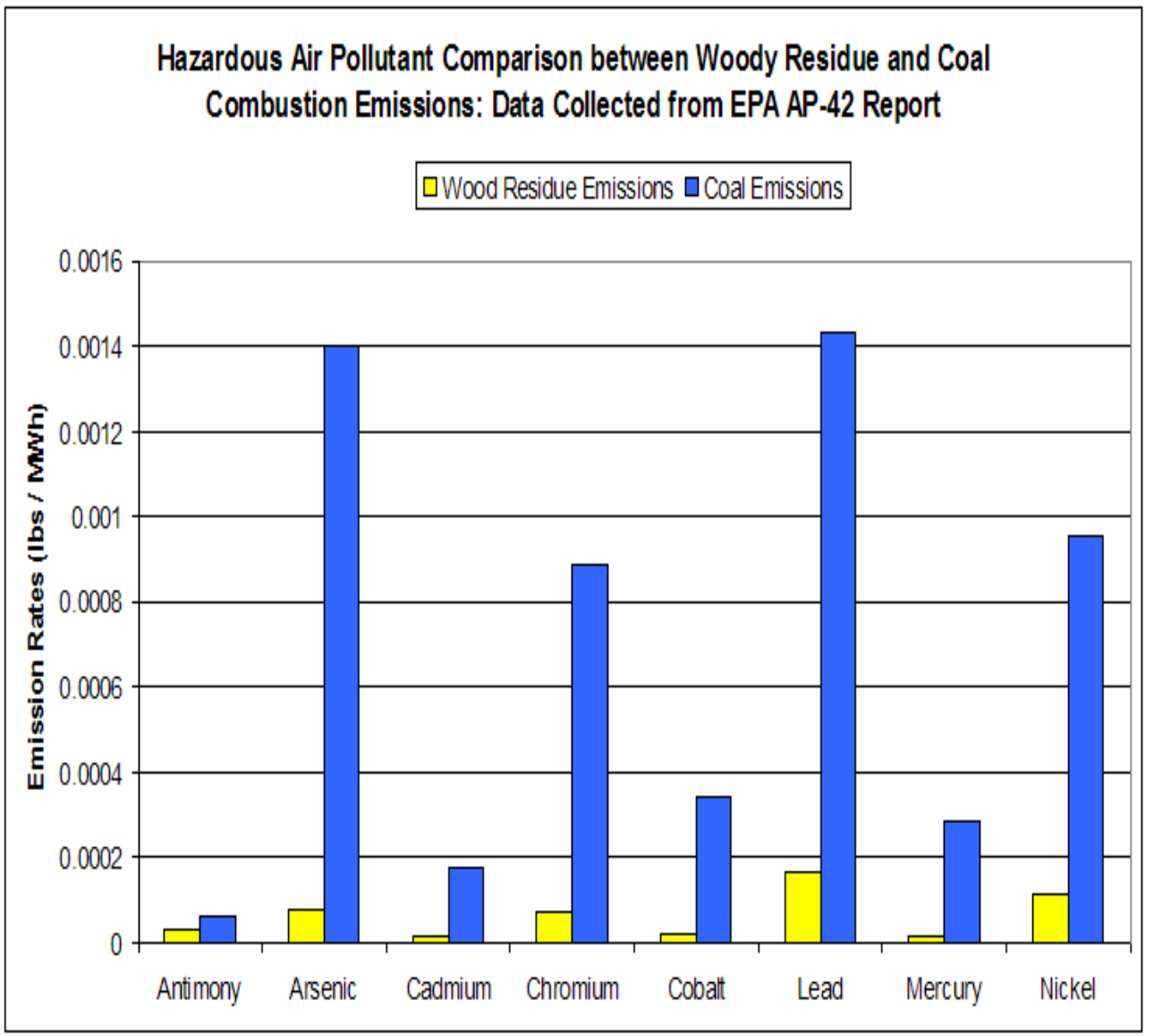
Air Toxics Emissions



Biopower is superior in HAP emissions, too.

Source: EPA's "AP-42 Report," analyzed by SACE intern Byron Kominek.

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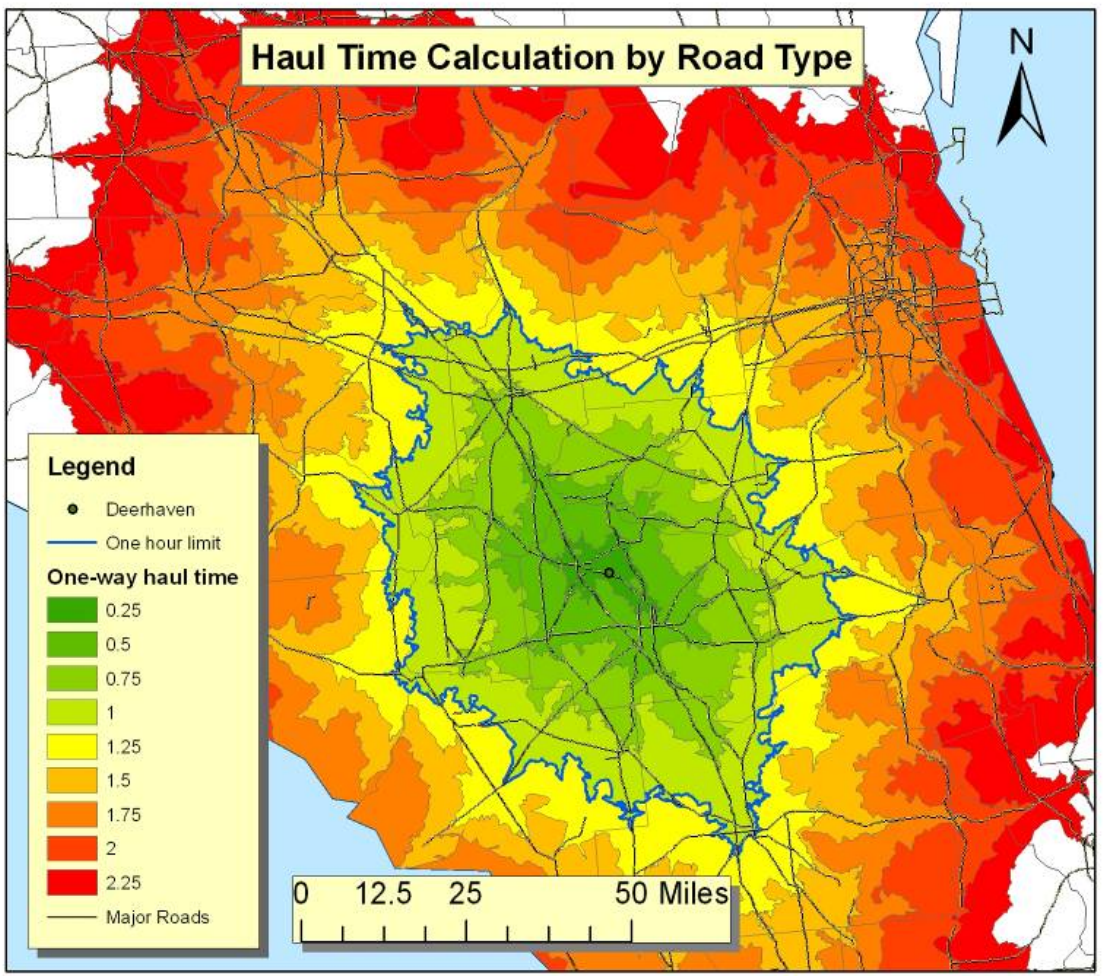
Sustainability Policies



Matthew Langholtz, November 2006

- Soil & Water BMPs
- State Biomass Harvest Guidelines
- Enhanced Forest Management Plans
- Improved Forest Certif. Programs
- Look-Back Provisions?

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Is Biopower Worth the Effort?

ATTACHMENT A.

September 22, 2000

These default scores represent high impact applications allowed by regulation or law. The default scores are used when other information is not available from the service provider or facility managers. Lower impact scores will be assigned when information demonstrating lower impacts is provided.

TECHNOLOGY (default for general fuel types in bold)	Score	CO2	SOx	NOx	Mercury	Water Use	Water Quality	On-Site Land Use	Off-Site Land Use
Solar Distributed PV	0.0	0	0	0	0	0	0	0	0
Wind Turbine Plant; low land impact	0.1	0	0	0	0	0	0	1	0
Wind Turbine Plant: Poorly Sited	**1.1**	**0**	**0**	**0**	**0**	**0**	**0**	**10**	**0**
Geothermal; Binary Technology	1.4	0	0	0	0	1	6	3	1
Landfill Gas (IC Engine, high NOX rate)	1.6	0	1	7	1	1	0	3	1
Low Impact Hydro	1.8	0	0	0	0	4	4	4	4
Geothermal; Flash Technology	**2.0**	**1**	**1**	**1**	**0**	**2**	**6**	**3**	**3**
Biomass: Certified Sustainable Fuel, NOx Controls	2.1	0	1	5	1	1	6	2.5	2
Biomass: Certified Sustainable Fuel High NOx	2.2	0	1	6	1	1	6	2	2.5
Solar Central Station PV	**2.6**	**0**	**0**	**0**	**0**	**1**	**6**	**14**	**0**
Biomass: Some CC Benefit "clean supply", NOx Controls	3.0	2	1	5	1	1	6	5	4
Hydro Plant; Private, Post-1986 Relicense	3.6	0	0	0	0	8	8	8	8
Biomass: High NOx, Some CC Benefit, mixed supply	3.7	2	1	6	6	1	6	5	4
Natural Gas Combined Cycle (w/NOx controls)	3.9	5	1	5	1	4	6	3	5
Natural Gas Combined Cycle	4.0	5	1	6	1	4	6	3	5
Biomass: Wood Fueled, High NOx, Biomass not replaced	4.1	4	1	6	6	1	6	5	4
Gas Fired Steam Electric (w/SCR and SWI)	4.3	6	1	5	1	5	6	4	5
Gas Fired Steam Electric	**4.4**	**6**	**1**	**6**	**1**	**5**	**6**	**4**	**5**
Natural Gas Combustion Turbine	5.2	9	1	8	1	1	6	6	5
Biomass: Wood Fuel, High NOx, No CC Benefit, has waste	**5.4**	**10**	**1**	**6**	**6**	**1**	**6**	**5**	**4**
Hydro Plant; default	5.6	0	0	0	0	10	10	15	15
Oil-Fired Steam Electric (0.5% sulfur content)	5.9	8	3	7	4	6	6	4	7
Oil Fired Combustion Turbine	6.0	9	4	8	5	1	6	5	6
Oil-Fired Steam Electric (1.0% sulfur content)	6.1	8	4	7	4	6	6	4	7
Oil Fired Steam Electric	**6.2**	**8**	**6**	**7**	**4**	**6**	**6**	**4**	**7**
Coal With FGD (low mercury content)	8.1	10	4	10	6	9	6	5	13
Coal With FGD (high mercury content)	8.4	10	4	10	9	9	6	5	13
Coal Fired Steam Electric	**8.8**	**10**	**10**	**10**	**10**	**9**	**6**	**5**	**9**
Nuclear	**11.8**	**0**	**0**	**0**	**0**	**10**	**6**	**55**	**34**
Mass Burn Municipal Waste	**Under**	**Review**	**--**	**To**	**Be**	**Added**	**Soon**	**--**	**--**

SOURCE: http://powerscorecard.org/scorecard.cfm