

UNIVERSITY OF MINNESOTA

EXTENSION

Trends in Energy Use: Renewable Energy Today and Tomorrow

Dean Current, Program Director, CINRAM

Fueling the Future:

The Role of Woody and Agriculture Biomass for Energy Workshop

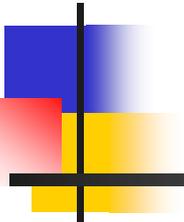
February 18, 2009

Roosevelt

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Trends in Energy Use: Renewable Energy Today and Tomorrow

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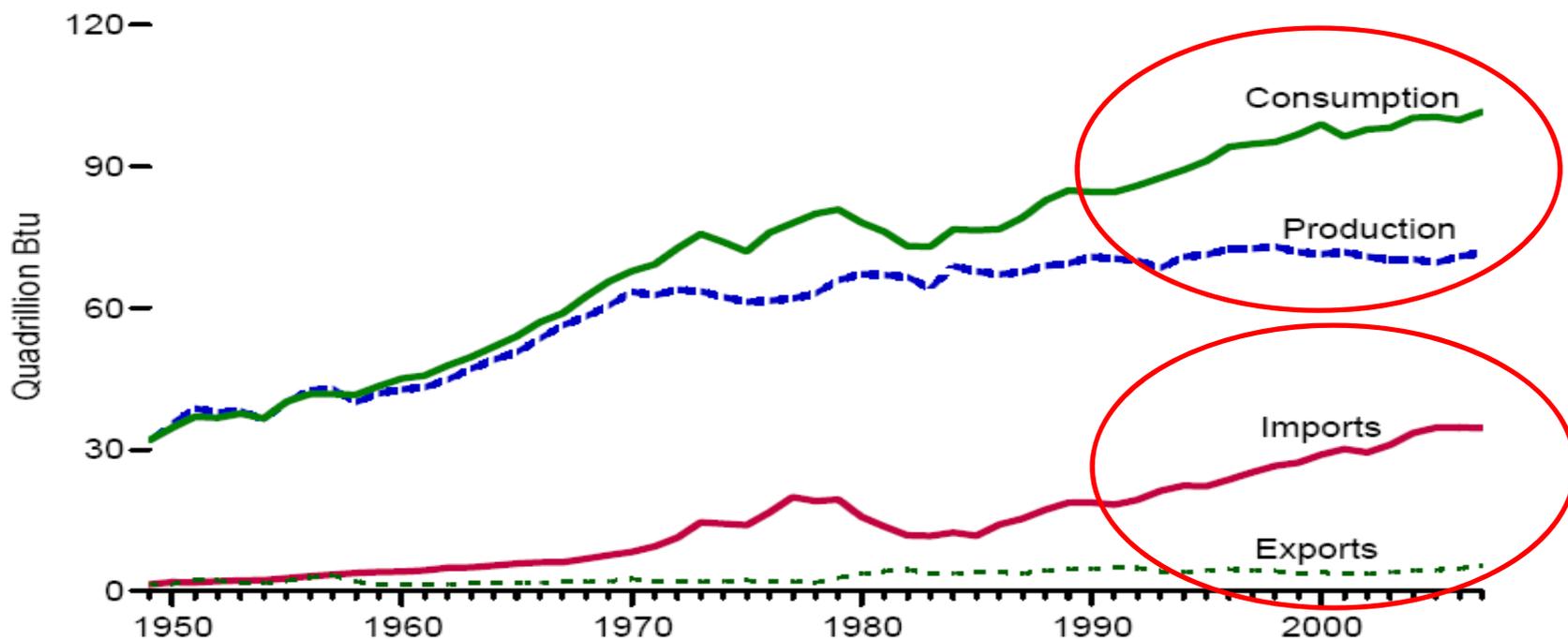
Fueling the Future:

**The role and use of woody and agriculture biomass for energy workshop
February 18, 2009 (Wednesday) - Nite Hawk Bar and Grill - Roosevelt, MN**

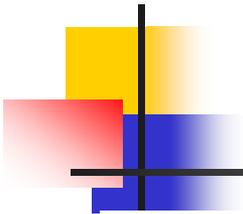
Energy Production and Consumption 1949-2007

Figure 1.1 Primary Energy Overview

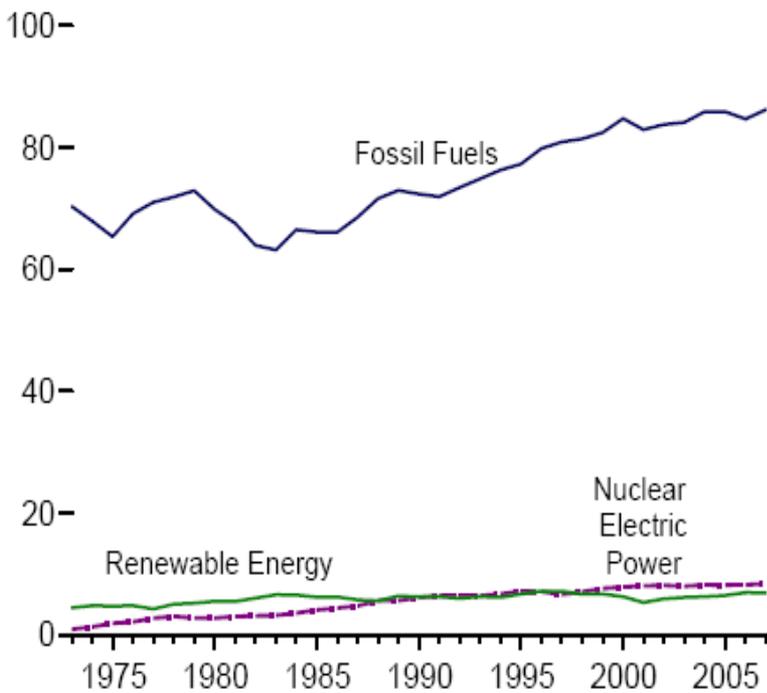
Overview, 1949-2007



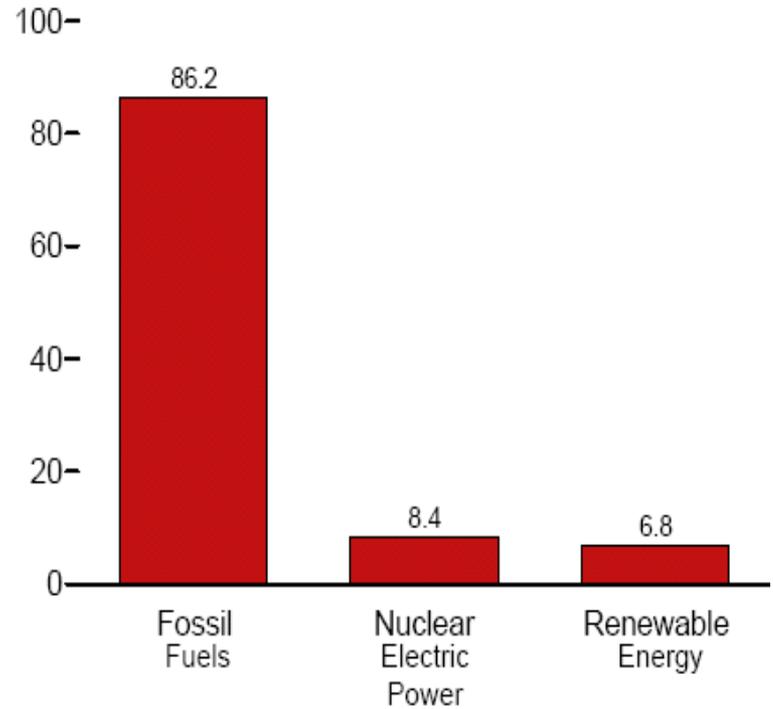
Source: Energy Information Administration – Annual Energy Review –2007



Compared With Other Resources, 1973-2007



Compared With Other Resources, 2007

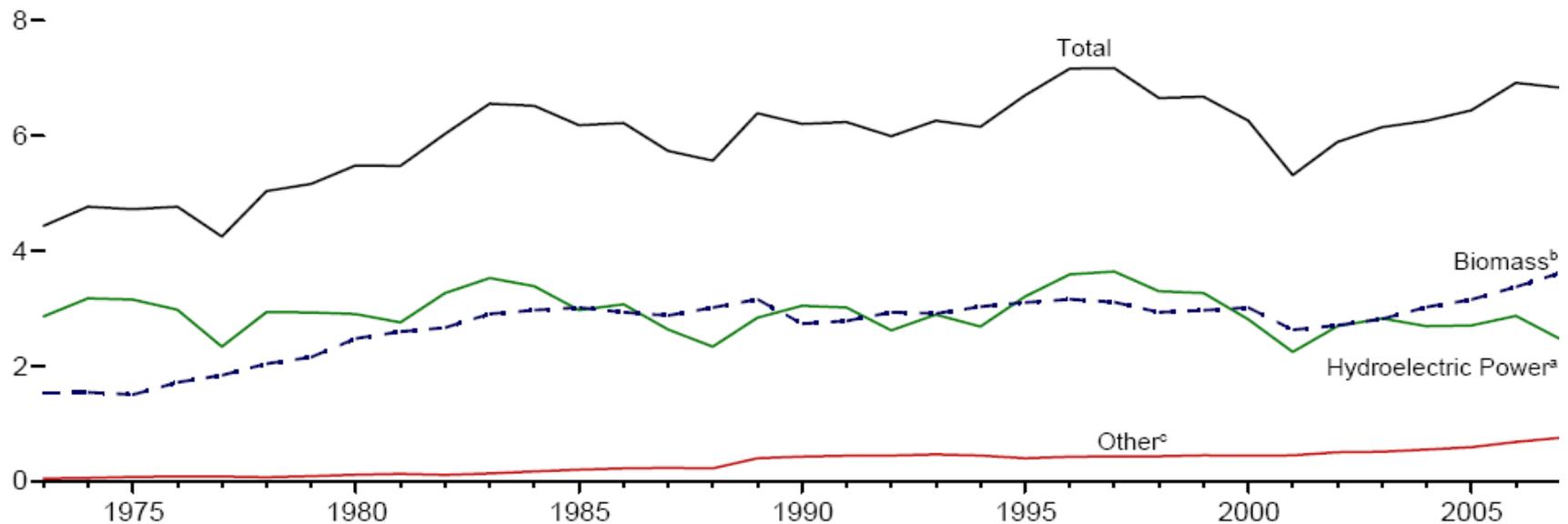


Source: Energy Information Administration – Monthly Energy Review – Jan. 2009

Renewable Energy Consumption 1973-2007

Figure 10.1 Renewable Energy Consumption
(Quadrillion Btu)

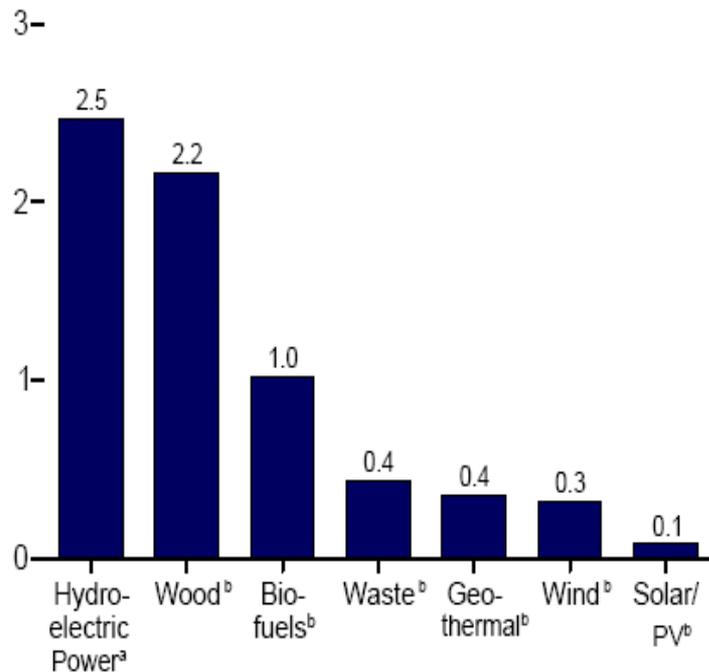
Total and Major Sources, 1973-2007



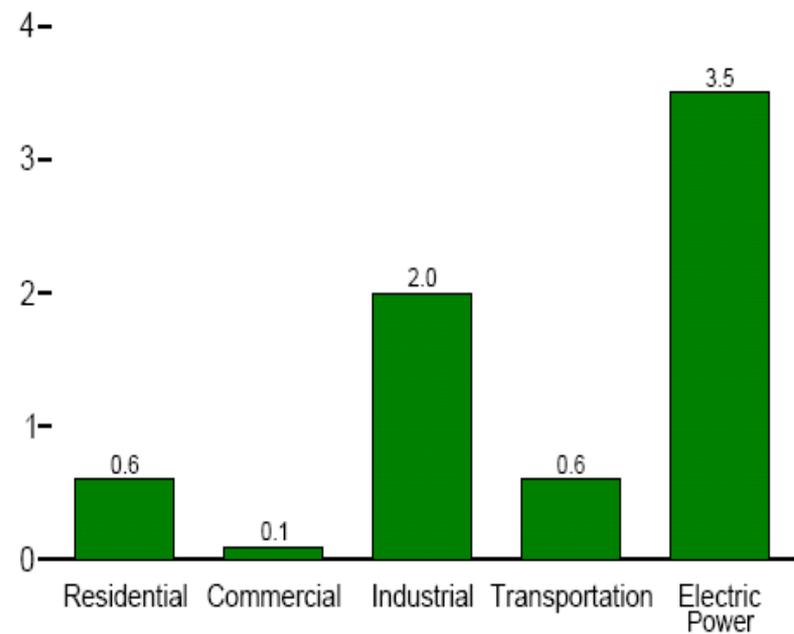
Source: Energy Information Administration – Monthly Energy Review – Jan. 2009

Renewable Energy-Source and Sector

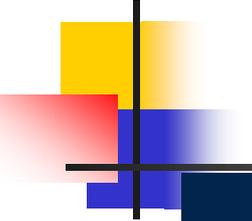
By Source, 2007



By Sector, 2007



Source: Energy Information Administration – Monthly Energy Review – Jan. 2009

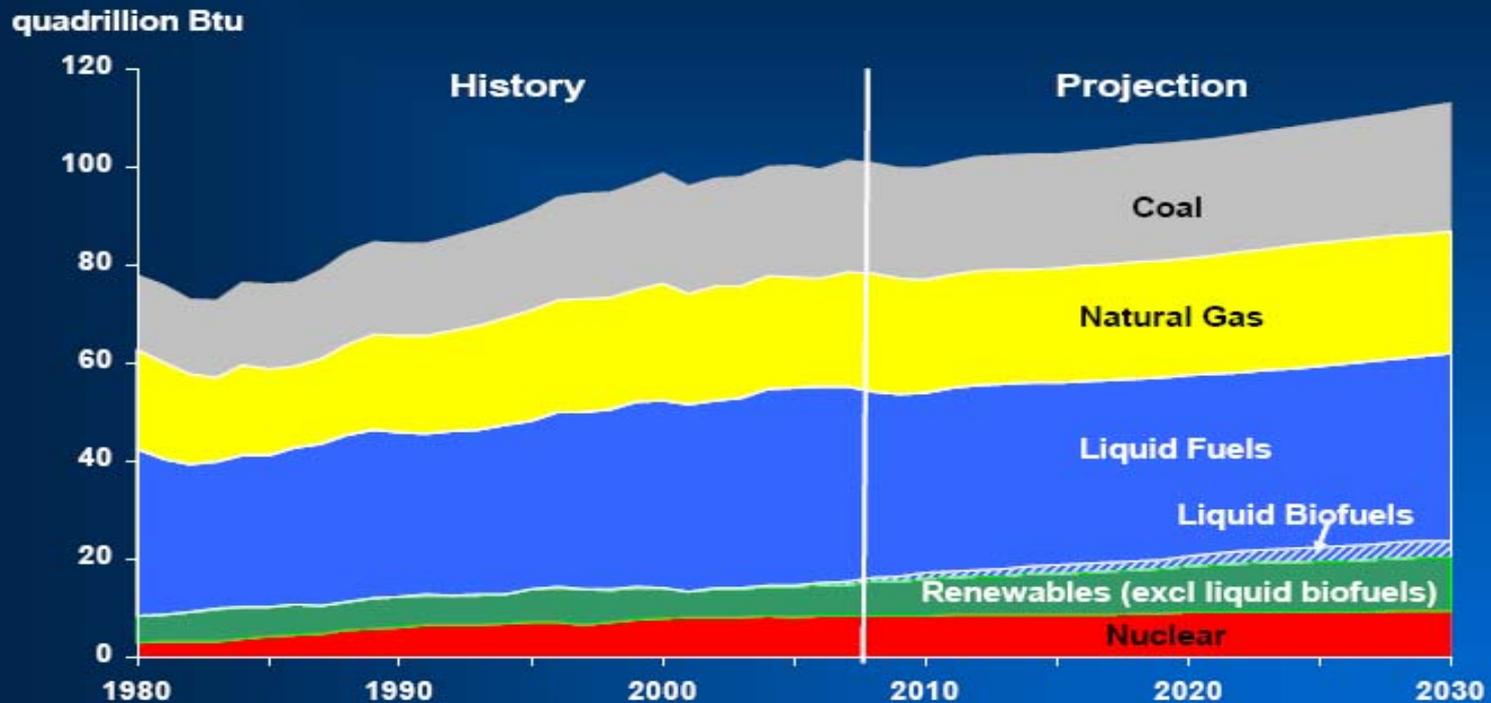


So what does the future hold? - Projections from EIA

- Long-term economic growth averages about 2.5 percent per year between 2007 and 2030
- World crude oil prices recover from a near-term decline and reach \$130 per barrel (in 2007 dollars) by 2030
- A robust domestic natural gas resource base allows for a steady expansion of production given projected growth in demand and prices
- Recently-enacted policies and concerns over greenhouse gas (GHG) emissions, combined with high energy prices, moderate projected growth in energy consumption and emissions

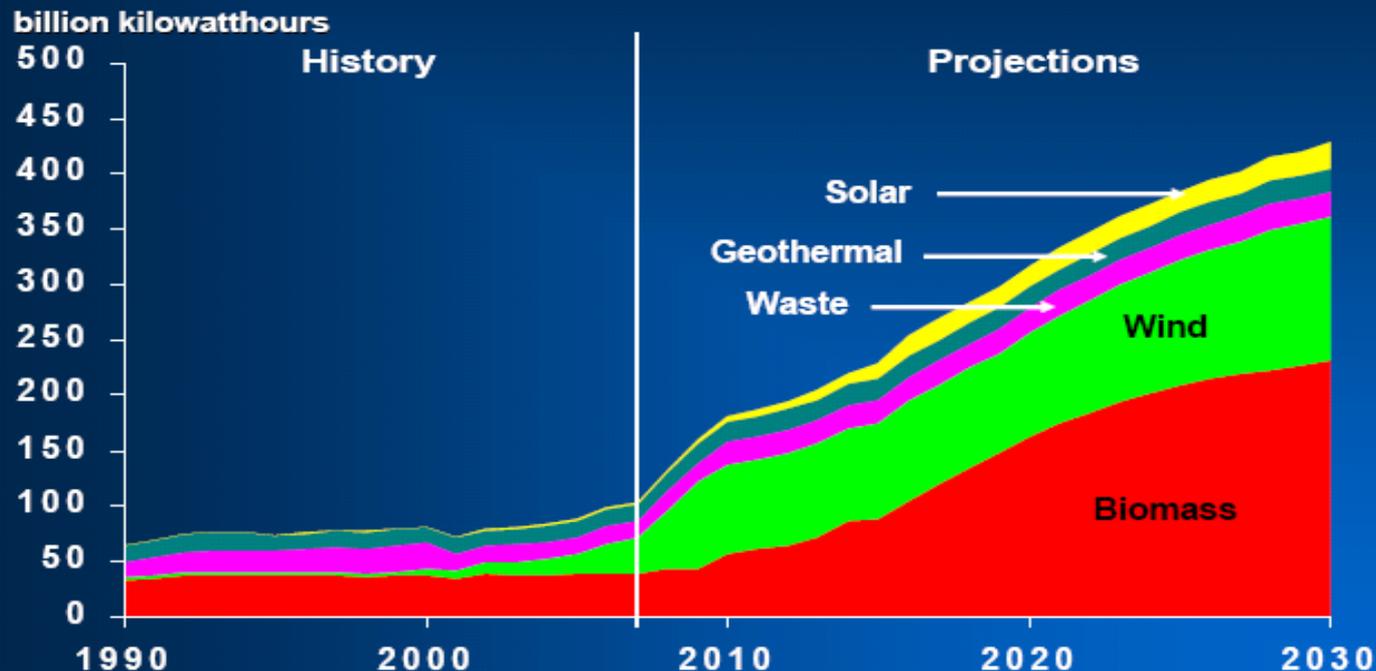
Use of Renewables will grow

Non-fossil energy use grows rapidly, but fossil fuels still provide 79 percent of total energy use in 2030

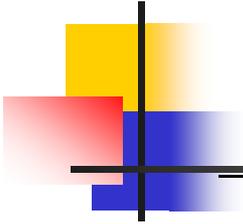


Biomass is an important component

Nonhydropower renewable power meets 33% of total generation growth between 2007 and 2030



Potential demand for biomass



Energy Facility

Location

Rock Tenn

Saint Paul, MN

Laurentian Energy Authority

Virginia, MN

Minnesota Power

Grand Rapids, MN

FibroMin (Ag residue and wood)

Benson, MN

District Energy

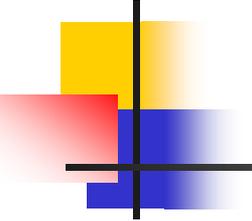
Saint Paul, MN

Little Falls Ethanol Cooperative

Little Falls, MN

Rahr Malting – KODA Energy

Shakopee, MN



Renewable Energy

- Biomass Opportunities

- Prairie grasses – various configurations
 - Switchgrass, Miscanthus, Native prairie
- Corn/cellulosic ethanol
- Woody harvest residues
- Dedicated woody crops
- Brushlands
- Fuel and fiber integrated forest management

Dedicated energy crops

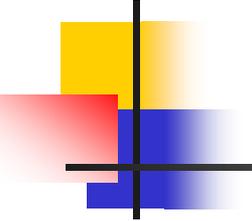
- Hybrid poplar or willow
- 3-6 year rotation
- Economics improving but still marginal
- Payments for environmental services could improve economics (CO₂, water)



Self-propelled forage harvester (Claas)

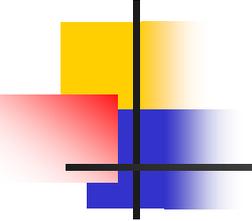
Photo: Forest Research





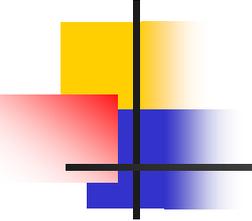
Thinning

- Due to costs of pre-commercial thinnings, thinning does not take place
- Thinning has the potential to increase productivity of stands 50% or more
- Thinning could provide important source of biomass and productivity enhancement
- Est. 4.5 dry tons/acre at age 10 and 23.5 at age 30 aspen (Demchik, 2006)



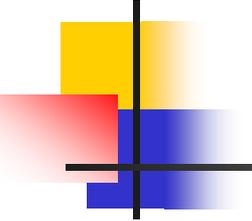
Logging Residue

- 10-19 Green tons/acre depending upon cover type (est. \$15-25/ton at plant)
- Would probably have to leave up to 30% on site



Integrated, intensive forest management

- Include biomass generation throughout management cycle
 - Optimize biomass and forest product production
 - Healthier, more resistant forest
 - Improved forest productivity for a number of benefits
 - Under guidelines that ensure environmental services
 - Increased employment opportunities



Hazardous fuel removal

- Forest Service pays up to \$575/acre currently for hazardous fuel removal
- 14,000 acres on the Superior National Forest in 2007
- 7-10 green tons/acre
- By harvesting hazardous fuel for biomass energy use, costs of treatment could be reduced
- Little work has been done on this

Brushland harvest

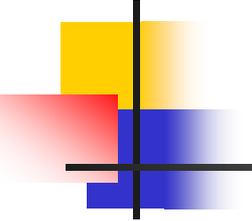
- Brush currently sheared, piled and often burned for wildlife habitat management
- Brush could be harvested and sold
- Density of brush important to economics
- Estimated 12-17 dry tons/acre on well stocked sites (Berguson, 1997)



Bio-baler

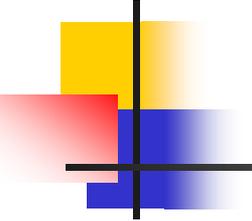


Photos courtesy of Philippe Savoie – Agriculture and Agri-Food Canada



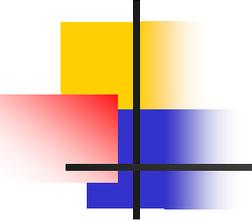
Concerns

- Food vs. fuel
- Deforestation in other parts of the world linked to renewable production
- Sustainable production
- Energy balance
- GHG emissions



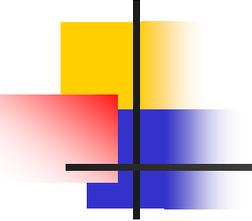
Environmental concerns

- Over harvest of forest lands
- Depletion of nutrients when removing greater amount of material
- Sustainable Biodiesel Alliance – BMP's
- Brushland and slash harvest principles
 - Research background provided by UMN
 - Guidelines prepared by DNR and MN Forest Resources Council



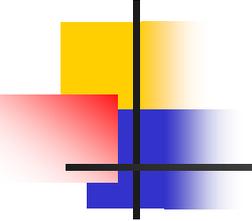
Environmental benefits

- Healthier, more productive forest
- More resilient ecosystems
- Carbon credits - Minnesota Terrestrial Carbon Project
 - Rules and inst. structure for CO₂ trading
 - Trading has started on the Chicago Climate Exchange
 - Carbon credits available for tree plantings



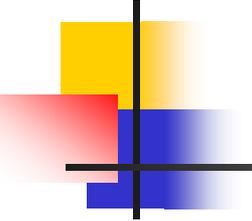
Issues:

- Many of the biomass related activities are new to land managers
- Production issues
 - How much biomass is available from ag lands and forests (thinnings and harvest residue)
 - How can we economically harvest and transport biomass as an energy source
 - What kind of productivity improvements are possible and what is their value



Issues:

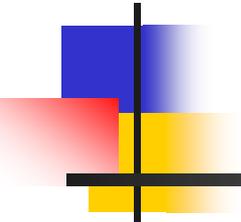
- Logistics:
 - New machinery needs
 - Transportation issues
 - Densification
 - Handling smaller material
- Products
 - Chemicals/Bio-oil
 - Chips
 - Pellets



Issues:

- Ecological services
 - Carbon payments
 - Sustainable management
 - Maintaining forest areas
- Economics
 - Profitability of different options
 - Initial investment needs for new activities
 - Economic/community development

Questions?



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