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Woody biomass energy solutions

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2008 RENEWABLE ENERGY SYMPOSIUM



Woody Biomass Energy Solutions



August 20, 2008

by

*Scott Bell, USDA Forest Services;
Jason Perock, Nevada Division of Forestry
and Rich Minetto, RM Engineering*

Agenda

- Need For Woody Biomass Utilization
- Advantages and Opportunities of Bio-Energy
- National Policies
- Nevada Biomass Projects
- Nevada Project Development Considerations
- What Constitutes a Good Opportunity
- Biomass Case Histories

Need for Woody Biomass Utilization

- Improve forest health
- Reduce threat & impacts to communities from wildfires
- Improve air quality through reduced wildfires and prescribed fire emissions
- Lower treatment costs
- Economic benefits



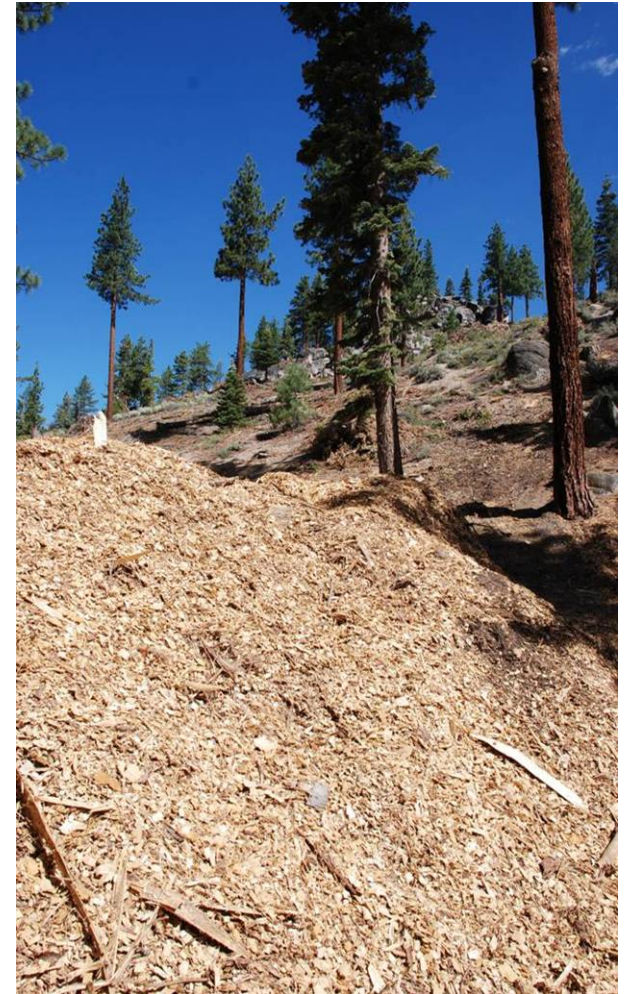
Advantages of Wood Biomass

- Renewable
- Low Carbon Emissions
- Minimal Metals and Sulfur
- Minimal Ash
- Low Fuel Cost



Billion Ton Report (April 2005)

"Looking at just forestland and agricultural land, the two largest potential biomass sources, this study found over 1.3 billion dry tons per year of biomass potential – enough to produce biofuels to meet more than one-third of the current demand for transportation fuels."



WGA: Clean & Diversified Energy Initiative

Biomass Task Force Report – Jan 2006

“Biomass as an energy resource has the potential to supply 15,000 MW of electricity to the Western States by the year 2015.... Feedstocks include forest resources, agricultural residues and products and resources from the municipal waste stream including solid wastes, biosolids, sewage and waste buried in landfills.”



National Biomass Legislation

- Healthy Forest Restoration Act of 2003
- Energy Policy Act of 2005
- Farm Bill of 2008



Biomass Boilers are found in Hundreds of Facilities

- A 1993 study by the Biomass Energy Resource Center in Montpelier, Vermont found biomass boilers in 43 schools, 26 hospitals, 17 colleges, 22 greenhouses, 6 correctional institutions and 20 commercial/industrial facilities; with another 20 operating at an urban art center, government buildings, library complex, luxury resort hotel, low income housing and 2 downtown district heating systems
 - In Vermont, a 50 MW biomass power plant has been operating in a town of 35,000 since 1986
- Fuel for School and Beyond Program
 - Six State Program in Intermountain West
 - Nevada, Idaho, Montana, Wyoming, Utah, North Dakota

WPCSD: David E. Norman Elementary School (August 2005)

- ➔ Output: 3 MMBtu/hr low pressure steam boiler heats 3 main buildings
- ➔ Fuel Supply: 150 tons/year
- ➔ Fuel: Wood chipped to two inches or smaller, clean and dry (7-20% moisture content)



WPCSD: David E. Norman Elementary School

Biomass Thermal Heating 2005

Funding

- \$340,000 Nevada Division of Forestry Fuels For Schools Grant
- \$13,344 Nevada Division of Forestry Fuels For Schools and Beyond pass through Grant to assist in securing the first 6 years of biomass fuel
- \$250,000 Department of Energy Grant earmarked by Senator Harry Reid
- Performance contracting measures as allowed by NRS332 - Biomass boiler part of a larger district wide energy savings project

Fuels Supply

- Country Construction
- Bureau of Land Management Stewardship Contracting



NNCC Renewable Energy Center (REC)

(May 2008)

Biomass Combined Heat & Power Plant (Operational 2008)

- ➔ Electric: Elliott steam turbine/generator sized at approximately 1,000 kW
- ➔ Thermal: Hurst, 900 horsepower (38 MMBtu/hr) steam boiler to power steam turbine and offset existing main boilers
- ➔ Fuel: Approximately 10,400 tons/year wood chips
- ➔ Pollution Control: Pulse-jet baghouse system
- ➔ Metal Building: Pre-engineered, 83 ft x 80 ft overall dimensions with control room, restroom and tool storage area



Solar (Photovoltaic) Power

- ➔ Electric: 30 kW output approximately



NNCC Renewable Energy Center (REC)

(May 2008)

Biomass Combined Heat & Power Plant

Funding

- ➔ \$8.4 million financing through performance contracting NRS333a
- ➔ \$250,000 USDA Forest Service National Woody Biomass Grant
- ➔ \$80,000 Nevada Division of Forestry Fuels For Schools & Beyond pass through Grant

Fuel Supply

- ➔ Approximately 10,400 bone dry tons annually
- ➔ Multiple Fuel Suppliers: Urban Wood Waste through Landfill Diversion, Forest Management Activities
- ➔ Fuel Supply Infrastructure: \$250,000 USDA Forest Service National Woody Biomass Grant



Nevada Biomass Market Condition

- ➔ Biomass fuel supply infrastructure in its infancy
- ➔ Need to educate public on benefits of biomass plants
- ➔ Southern NV Urban Wood to Energy Quantification Project
 - ➔ UNLV Contract to quantify urban wood waste (paid for by First Choice Tree Service, DK Landscaping, BEC Environmental, NV Energy Office, Highland Soil and Water)
 - ➔ Urban Tree Services
 - ➔ Wood Products Industry waste
 - ➔ C&D Waste
 - ➔ Results:
 - ➔ Tree Services: 96,000 – 121,000+ gt/yr
 - ➔ Wood Products Waste: 18,000 – 23,000 gt/yr
 - ➔ C&D: Still being compiled
 - ➔ Wildland Biomass: 26,000+ gtons
 - ➔ 2008-2010



Nevada Project Development Considerations

- Investment community and plant owner/operators require predictable fuel pricing 10-20 years
 - Market needs to develop multiple fuel suppliers
- Biomass plants must comply with city and state building and air permitting requirements
 - Air permits must comply with NDEP/BAPC regulations
 - UEPA permit required from PUC if electric generation

Nevada Project Development Considerations

- Public Utility Commission Utility Environmental Protection Act Permit (UEPA)
- Class II Operating Permit from Nevada Bureau of Air Pollution Control
- City Community Development Department Special Use Permit with conditions:
 - UEPA Permit to be obtained prior to operation
 - Bi-annual report to the City Planning Department (performance, fuel testing and Air Quality Permit)
- City Building Department Construction Permit
- City or State Public Works Board Design Review

Ideal Opportunities for Woody Biomass Energy Solutions

- Building/campus hot water heating systems
- District heating systems
- Combined heat and power plants
- Gasification to convert material into a pyrolysis gas

What Constitutes a Good Opportunity?

- ➔ Location, location, location - close proximity to:
 - ➔ Fuel supply – forest waste, urban wood waste, landfill wood waste and construction waste materials
 - ➔ Fuel processing and storage
 - ➔ Host site – consistent heat and electrical loads
 - ➔ 1 MW system requires appx. 10,000 tons/year
- ➔ Public sector client
 - ➔ 24/7 operation with electric and large sustainable heat load
 - ➔ Savings offset commercial rates not wholesale rates
 - ➔ Sell Renewable Energy Credits and Offsets
- ➔ Funding
 - ➔ Clean Renewable Energy Bonds (CREBS)
 - ➔ Tax exempt financing (lease purchase agreement)
 - ➔ Grants, rebates, Renewable Energy Credits, Offsets
 - ➔ Power Purchase Agreement (PPA)



Loyalton Biomass Plant: Susanville, CA

Loyalton Co-generation Biomass Plant, the plant was built in 1989 to burn wood chips to heat water to steam in an 850-degree boiler that generates steam to spins a turbine at 3,600 revolutions per minute, producing enough electricity to power approximately 7,000 homes. Capable of producing 20 megawatts of energy, the co-generation plant is currently running at about half capacity.

Environmental Benefits: Today, much of the Basin's forest slash and yard waste is burnt in piles. The energy goes up in smoke, clouding the air and eventually Lake Tahoe and other alpine lakes.

The biomass initiative in Tahoe has several different upsides: green energy, improved air quality, improved water quality, and more efficient forest thinning.

Air Pollution Control: The plant emits carbon monoxide, carbon dioxide and nitrogen oxides — but much of it is captured within the plant by various air-cleaning machinery. The emissions are strictly monitored by the U.S.

Environmental Protection Agency

Fuel:

- 280 tons: Average amount of fuel burned each day.
- The fuel comes from as far as Carson City, Redding, Klamath Falls and Stockton. A few truckloads roll in from Truckee and Tahoe each day. Much of the wood comes from forest thinning operations and logging and some wood is diverted from City landfills.
- 23,000 un-thinned forest acres in the Tahoe Basin can be reached by thinning machinery



By David Bunker

Sierra Sun, dbunker@sierrasun.com

June 15, 2007

Cadillac Renewable Energy Center, Cadillac, MI



This 38 megawatt, \$58,500,000 wood-fueled project was placed in commercial operation in July 1993. It sells electricity to Consumers Energy Company under a 35-year contract.

- **Fuel:** The facility burns about 400,000 tons per year of waste wood, which consists of residues (tops and limbs) from logging operations for area paper mills, mill waste and recycled wood.
- **Employment:** The project employs 20 workers who are cross-trained to perform O&M functions.
- **Equipment:**
 - **Boiler:** A single stoker-type boiler manufactured by Zurn Industries.
 - **Generator:** The steam turbine/generator was supplied by General Electric.
 - **Air Pollution:** To meet strict state and federal environmental standards, the air pollution control equipment includes an electrostatic precipitator for flyash and a selective non-catalytic reduction system for nitrogen oxides.

Grayling Generating Station, Grayling Township, MI



This 37.2 megawatt, \$70,000,000 wood-fueled project was placed in commercial operation in August 1992.

- ➔ **Fuel :** Approximately 400,000 tons per year of wood. Wood sources include sawdust and other mill waste from AJD and other area sawmills, residue (tops and limbs) from logging operations, wood chips, and clean wood waste recovered from area landfills.
- ➔ **Equipment:**
 - ➔ Boiler: A single stoker-type boiler manufactured by Zurn Industries, which produces steam at 1280 psig and 950 F.
 - ➔ Generator: The steam turbine/generator was supplied by ABB.
 - ➔ Air Pollution: The air pollution control equipment includes an electrostatic precipitator to control particulate matter and a nitrogen oxides reduction system from Nalco FuelTech.
- ➔ **Staff:** GES directly employs 26 workers in power plant operation and maintenance, as well as dozens more in wood fuel processing and trucking.
- ➔ **Community Benefits:** The facility provides an economical outlet for disposal of waste materials from local sawmills and forest products industry.
- ➔ **Awards:** In 1993 the Grayling Generating Station received the prestigious [Power Magazine Powerplant Award](#) and in May 2001 the [Clean Corporate Citizen Award](#) from the Michigan Department of Environmental Quality.

Questions



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