



Biomass and Fuel Flexible CHP/District Energy Systems

District Energy System Applications

- **Colleges & Universities**
- **States & Municipalities**
- **Healthcare**
- **Federal Government**

Middlebury College

Middlebury, VT

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- **Steam Production: 23,500 per hour @ 240 psig**
- **50% reduction in in #6 fuel oil annually (1,000,000 gallons plus)**
- **CO2 reduction: 12,500 plus metric tons per year.**
- **40% reduction in carbon foot print**
- **Annual wood chip consumption: 20,000 tons per year**
- **Electricity produced: 15-20% of the campuses need (3-5 million kilowatt-hours of electric per year)**
- **Particulate emissions: 0.017 lbs/MMBTU, average**



Images Courtesy of Chiptec

Colby College

Waterville, ME

- (2) 400 hp high pressure boilers
- Combined steam production: 26,000 lbs per hour @ 300psig
- Consumes 22,000 tons of locally sourced woodchips annually
- Fuel sourced within a 50 mile radius from Sustainable forest operations
- 90% reduction in #6 fuel oil annually (1 million gallons)
- Entire plant LEED Gold Certified
- CO emissions: less than 0.1 lbs/MMBTU, average Particulate emissions: 0.01 lbs/MMBTU, average



University of British Columbia

- Key component to commitment to reduce GHG's by 100%
- Syngas fuels a 2MW generator, eliminates new electrical transmission line
- Created a Living Laboratory



State of Vermont District Heating

- New biomass fueled facility for serving the current and anticipated State heating requirements as well as the initial phase of the City's municipal thermal utility.
- Reduce reliance on oil
- Two (2) new 600 BHP wood fueled boiler systems and (1) new #2 oil emergency backup boiler



Enwave Seattle



- Utilized waste wood, avoiding landfill
- Serves approximately 200 buildings downtown
- Reduces CO2 output by 55,000 tons/year
- Cuts carbon footprint by 50-60%
- Supports LEED for customers



Gundersen Lutheran Medical Center, Inc.

La Crosse, WI

Boiler and Wood Metering

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800 horsepower biomass boiler making steam at 400psi

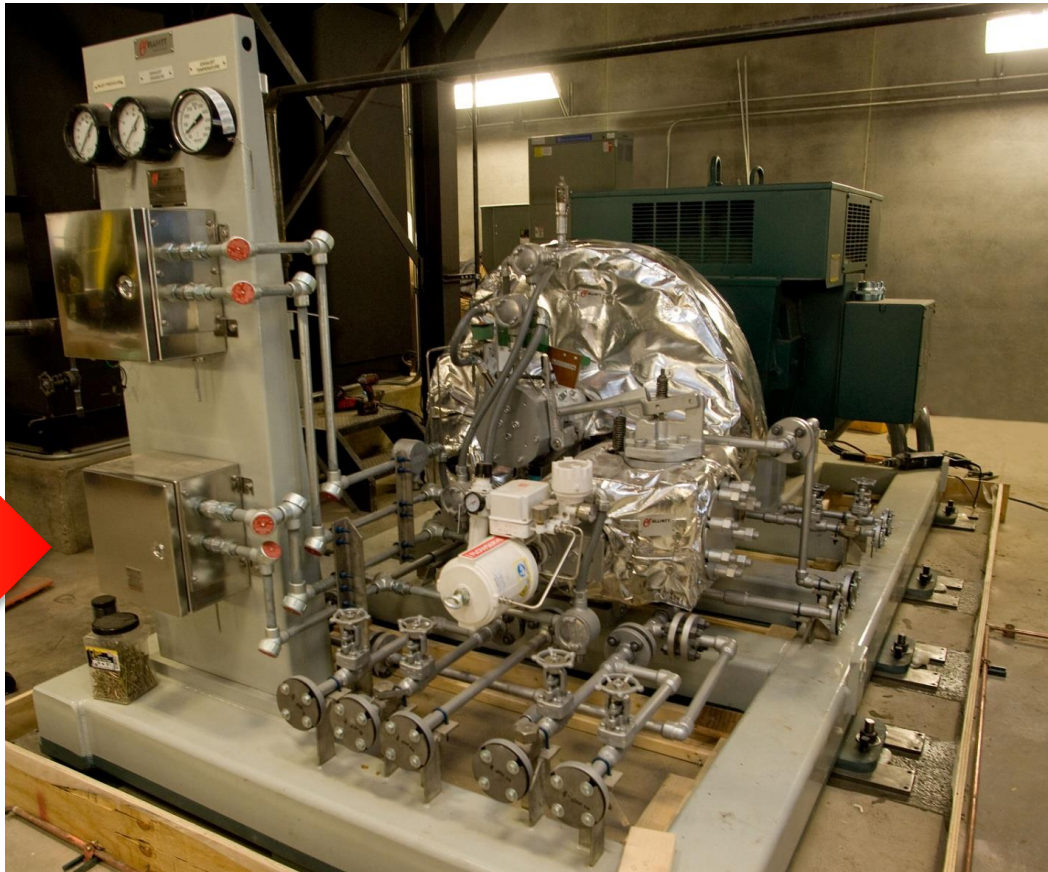


Gundersen Lutheran Medical Center, Inc.

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Steam Turbine Generator

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400 psi

Electricity to
Clinic (400kW)

2,200,000 kW-hrs.

Steam to
Facility

100 psi

CHP Tri Generation System

Veterans Affairs Battle Creek, MI

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- **EO 13514: Reduce GHGs by 28% by 2020**
- **VA Goal: 7.5% of energy from renewable sources by 2020**
- **2 MWe and 4.4 MWth for heat & power**
- **GHG Reduction: 14,000 tonnes/yr**
- **Produces 10,400,000 kWh- 84% of yearly electricity load**

Images Courtesy of Nexterra

VA Medical Center

Chillicothe, OH

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- 600HP wood fired boiler, 450 psig
- Supplies steam to a 350kW steam turbine generator
- Capable of burning a multitude of wood residues
- Fully automatic ash extraction system

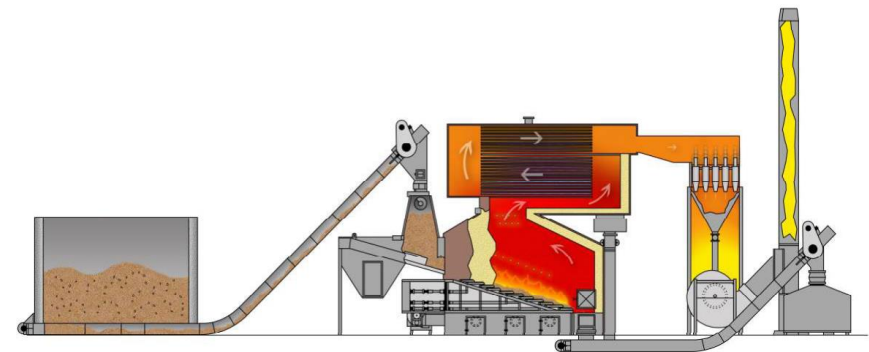
VA Medical Center

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- 8 Rake moving floor storage bin with fuel handling
- Stepped grate combustion system with automatic ash extraction
- Electrostatic Precipitator Emissions Control
- Test results on particulate emissions less than half of what is normally produced by a natural gas burner



Marine Corps Logistics Base

Albany, GA

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- First “Net Zero” Marine Corps Installation
- Uses woody biomass such as tree trimmings, scrap wood, crop residues, and methane gas from landfills for power generation
- 2.1 MW Combined Heat and Power landfill generator
- 8.5 MW steam turbine to generate 44 MWh per year

