



# Bio-fueled Combined Heat & Power



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# Presentation Overview

- Introduction
- Considerations for Combined Heat & Power
- CHP Systems for Biofuels
- CHP Project Factors
- CHP Benefits
- Conclusion





# Introduction

- Cogeneration, Production of Heat & Power from same fuel source
- Reliable & Proven Technology
- Growing demand for renewable energy
- Close to 8 gigawatts of Biomass fueled system used CHP process



# Why Consider CHP.....

- Increase in System Efficiency
- Surges & Volatile Cost for Fossil Fuels  
CHP Equipment for Biomass
- Financial Incentives (QF Rates, RECs)
- Environmental Considerations



# Biomass Fueled CHP

- Fuel Sources
  - Forest Residue
  - Waste Wood from Process
  - Saw Dust
- CHP Systems
  - Biomass Boilers with steam turbine process
  - Biomass Gasifiers with IC engine



# Biomass Boilers & Steam Turbines

- Boiler Types (70-80% Efficiency)
  - Small Fixed Grate Boiler
  - Stoker Spreader Boiler
  - Fluidized Bed Combustion
- Turbine
  - Condensing Turbine
  - Back Pressure Turbine



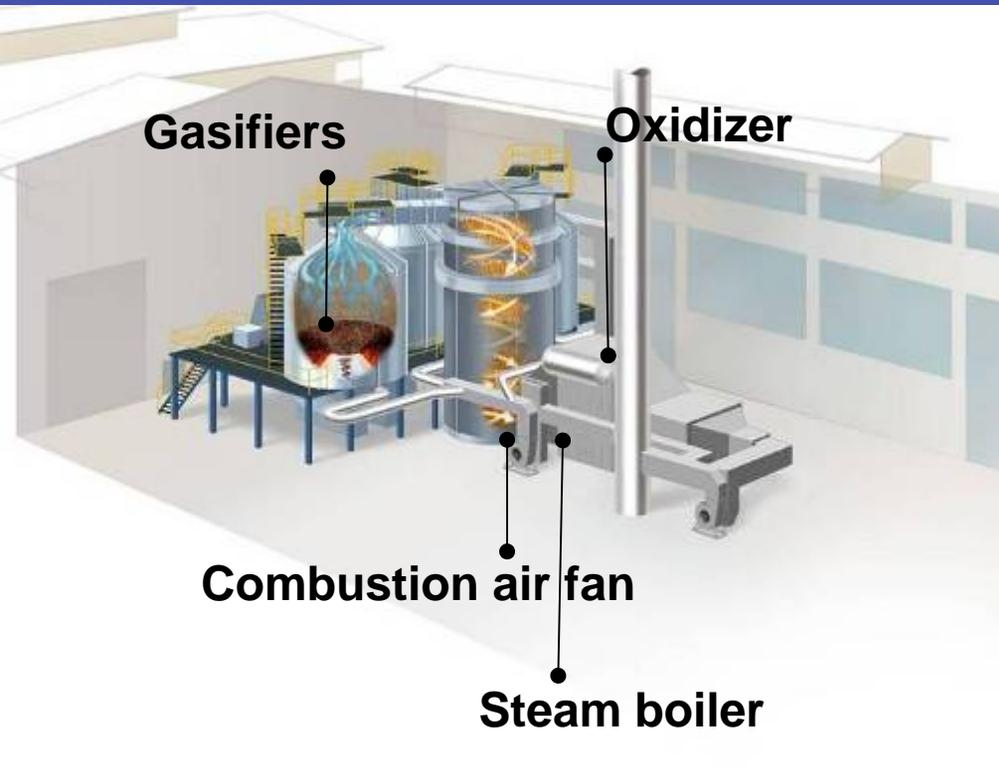
# Biomass Gasification Technology

- Nexterra Power Systems
- Community Power Corporation





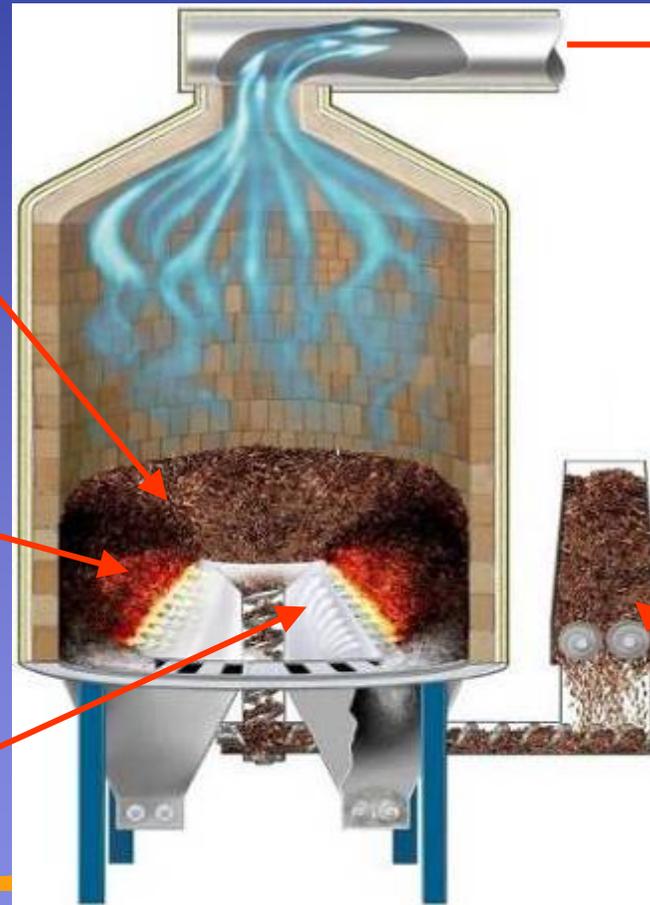
# Biomass Gasification for CHP



## Nexterra's Advantages For CHP

- Potential to fire syngas into reciprocating engines and gas
- Ability direct flue gas into existing boilers
- Low PM & NOx Emissions for urban operations
- Operates on clean wood waste (10-60% moisture and 3" minus)
- Simple design: low maintenance cost & minimal operator
- Rapid load response
- High turn down ratio 5:1

# Nexterra's Gasification Technology



- Syngas exits at 500 – 700°F
- Syngas 100 – 300 btu/ft<sup>3</sup>
- Clean burning fuel comprised of CO, H<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>, H<sub>2</sub>O, CO<sub>2</sub>
- PM emissions less than .10 lbs/MMBtu gross input without gas cleanup

Partial oxidation at 1500 – 1800 °F and fuel is converted into “syngas”

Ash migrates to base, removed by automatic ash grate

Primary Air (30% of stoichoimetric)

Hog fuel  
3-inch minus  
10 – 60% moisture



# Dockside Green District Heating System



- Located adjacent to downtown Victoria
- Turnkey 2-3 MWth thermal gasification system supplied and installed by Nexterra
- Fuel is green “urban” wood waste supplied locally – e.g. tree trimmings, etc.
- Expected PM levels <.01 lbs/MMBtu input





# Community Power Corporation



## System Specifications

- 5-50 kw units available with 50k-500k btu/hr of thermal energy
- Low PM & NOx Emissions
- Trailer or Skid mounted for simple installation
- Cold start up in 15 minutes
- High turn down ratio > 10:1





# Community Power

## Biomax Power System

### Features:

- Combined Heat & Power using variety of biomass sources
- Automated Process for startup, operation and shutdown
- Dry Gas Cleanup, so no liquid waste streams
- Dryer available for add on for higher moisture fuels



# Biogas Fueled CHP

- Fuel Sources
  - Landfill gas
  - Digester gas
- CHP Systems
  - IC engine with Heat Recovery Boiler
  - Gas Turbine with Heat Recovery Boiler



# Biogas IC Engine

- Biogas generators, designed for this application
  - Caterpillar 3520
  - Jenbacher 320, 620 series
  - Waukesha APG1000
  - Solar Gas Turbine
- Low NOx emission (0.5 grams/bhp)



# Heat Recovery

- Increase Total Efficiency from 30% to 60-80% by Utilizing:
- Waste Exhaust Heat for Steam or Hot Water Production
- Heated Turbine Exhaust with Duct Burner
- Jacket Heat for Hot Water or Power Generation



# CHP Project Factors

- Biofuel Exhaust Gas, specific pollution control design requirements
- Multiple Entity Participation, longer timeline
- Initial Capital Investment Costs & Funding
- Life Cycle costs for O&M



# Overview of Benefits

- Energy Savings, helping to meet federal energy reduction mandates
- Positive Impact on Air Quality
- Energy Cost Savings
- Other Financial Incentives
- Other Positives





# Conclusions

- Biofueled CHP system:
  - Continuing Requirement for Renewable Fuel use for Energy from Federal Mandates, Utility Portfolio Requirements and More Stringent Air Quality Regulations
  - Continuing Desire to Decrease Utility Consumption and Cost



# For More Information

- Would you like to know more about this session?
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Don't forget to fill out and drop off your session evaluations!



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