"BIOMASSS GASIFICATION FOR THERMIC AND ELECTRIC ENERGY GENERATION"

Desarrollos Energeticos and Ambiente
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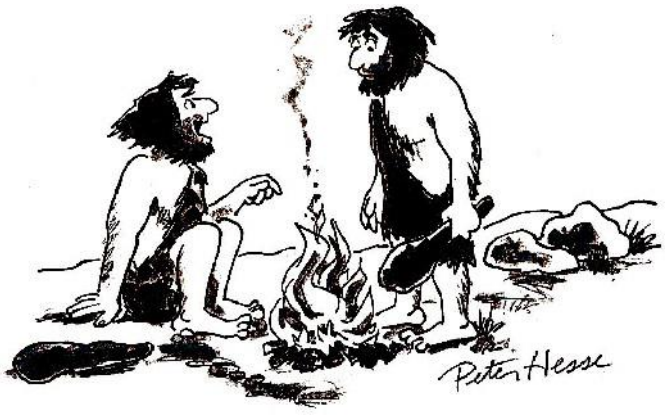
Biomass in Primitive Times



"They call it fire!...it's a way to recycle Biomass"

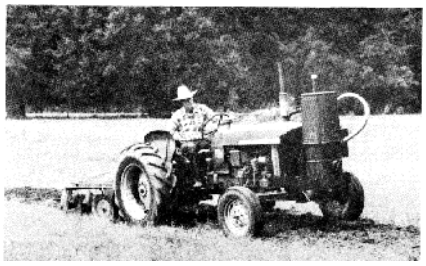
Gasification

- It is the release of volatile compounds in the fuel at temperatures between 600-800 C and in the presence of limited amounts of oxygen.
- Biomass, 80% Volatile Material
- Carbon, 30% Volatile Material
- CO, H_2 y CH4 is usually generated as combustible gasses
- A heating value of 135.4 BTU/scf.
- Nitrogen 50.9%
- CO 27.0%
- Hydrogen 14.0%
- Methane 3.0%
- Oxygen 0.6

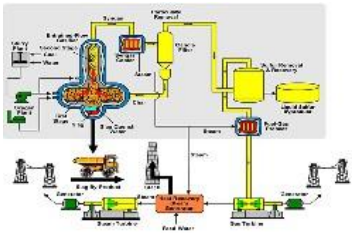
History of Gasification

- The Gasification process was originally developed in the 1800s when producing TownGas for public lighting and cooking in England.
- Gasification processes have been used since 1920 to produce synthetic chemicals and fuels.
- During World War II it was used to power various vehicles.

History of Gasification

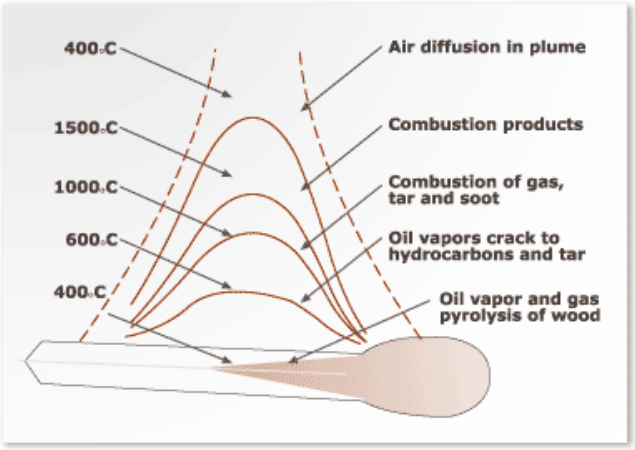


Electrical Energy Generation Plant using Gasification



Simple Example of Gasification

Gasification Principle, Pyrolysis



Gasification Principle

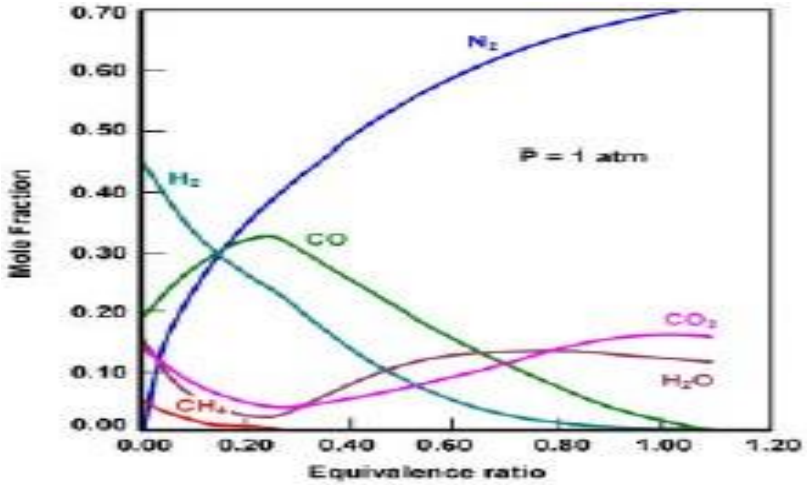
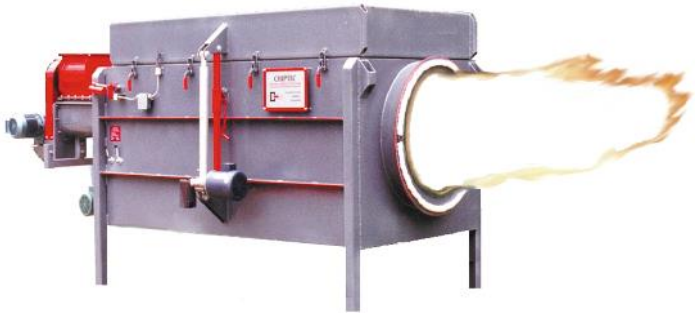


Figure 4: Equivalence ratio

Biomass Gasification

Gasifier Generating Full Flame



Commercial Applications

CHIPTEC®
WOOD ENERGY SYSTEMS

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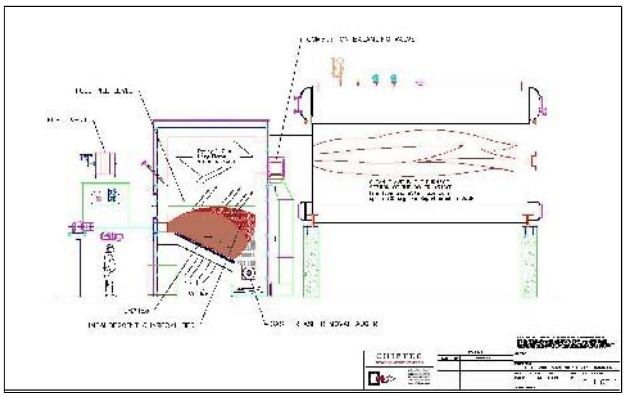
TECHNOLOGY

Chiptec state of the art biomass gasifier



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Technological Differences

Why Use Gasification vs Conventional Biomass Technology?

- **Ability to use a wide range of biomass fuels.**
- **Low Emissions of Particles and Gases.**
- **Better Combustion Efficiency**

(2.2 conventional vs 3.1 gasification Lbv/Lbm 600 psig)

- **High levels of proportionality 10:1**
- **Reduction of Operational Maintenance Costs.**

Industrial Applications

Biomass Burner Adaptation

Phoenix Series Capacities

- Generation of 1.5 to 20 MMBTU/H
- Can Replace Fossil Fuel Burners
- Proportionality of 1:20 (Modulation Versatility from Low to High Fire)
- Fuel Humidities from 6 to 60%
- Complete Automation of Controls
- Continuous Ash Removal
- Integrated Particle Control System
- High Combustion efficiency
- High Pressure Steam Generation (600 psig).
- Integrated Fire Extinguishing System

Industrial Applications

B Series Gasifier

B Series Industrial Applications

- Generation of 20 to 60 MMBTU/H
- Proportionality of 1:10 (Modulation versatility from Low to High Fire automatically)
- Fuel Humidities from 6 to 60%
- Control Automation. (Touch screen)
- Integrated Oxygen and Particle Control
- Automatic ash removal (fertilizer)
- Built-in Pre Heater and Economizer.
- Complete removal of Tars
- Fire Hazard Protection

Fuels to Use:

- Bagasse
- Forest Residues
- Rice Husk
- Coffee Husk
- African palm residues
- Coconut Fiber
- Wood Chips
- Agricultural Waste

Pollutant Emission Reduction

Pollutants	Chiptec Emission Rates (Wet & Dry Fuel) lb./MMBtu	USA Federal Government AP-42 Emission Factors(Wet & Dry Fuel) lb./MMBtu
Total Particulates*	0.1 -0.2	0.22-0.3
Oxides of Nitrogen:	0.2	0.22 -0.49
Carbon Monoxide:	0.2	0.6
* Emission factors for systems utilizing mechanical particulate collection devices		

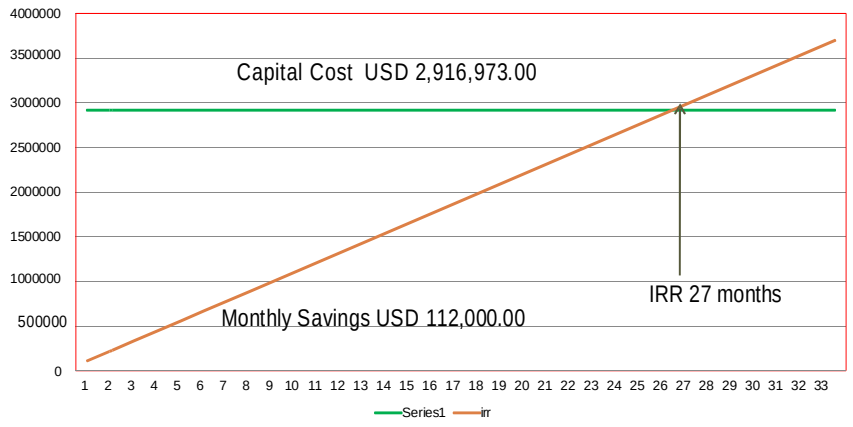
Operating Costs

"Replacement of the Fuel Oil Burner to Biomass"

- Steam Fuel Oil Generation Cost
  = 0.0148 $/Lb. ($1.70/gal)
- Biomass Steam Generation Cost
  = 0.00436 $/Lb. ($30/TM)
- **Net Difference due to Biomass Use**
  = 0.01044 $/Lb.

Boiler 300 BHP (150 psig, 100 F, EFF=86.1)
- **8,902 Lb./H**
- **Savings of $92.93/hour ($ 66,909.60/month)**

Simple Return



Operating Costs

"Gasification vs Conventional Biomass"

- Conventional Systems with the presence of: Carbon, Methane and Carbon Monoxide equivalent to a loss of **3,042,021 BTU/H (fuel)**
- Equivalent to generating 2,600 Lb/H of steam.
- With an "Avoided and Not Generated" Operating Cost
- of **$8,300/month. (for 20 MT boilers)**

Capital Costs

"Gasification vs Conventional Biomass"

- Biomass for Steam

  Conventional Method= 0.043 $/BTU/h

- Gasification for Steam

Boiler and Gasifier= 0.055 $/BTU/h 100psig,10k Lb/h

0.060 $/BTU/h 600psig,44k Lb/h

Thank you for your time!

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