

Biomass Heat and Power for Rural Alaska



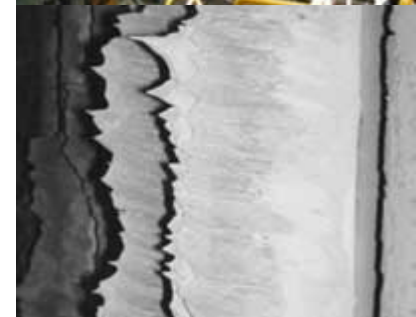
**Tom Miles
T. R. Miles, Technical Consultants, Inc.
Portland, OR**

**Living Building Challenge
December 16, 2014**



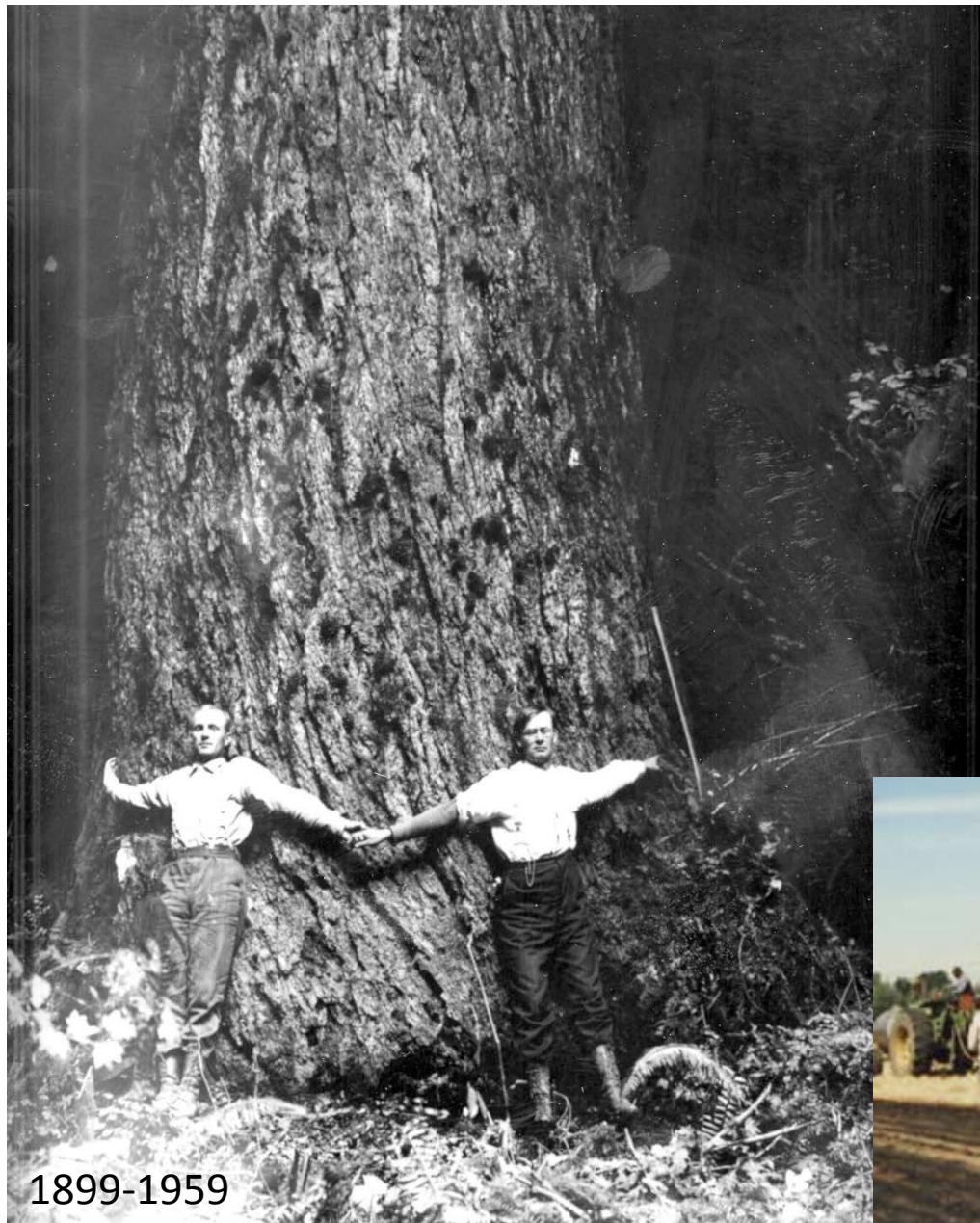
T R Miles Technical Consultants, Inc.

- Design and develop energy and environmental processes.
- Industries
 - Biomass energy
 - Pollution control
 - Materials handling
 - Feed, Food, and Fuels



FOUR GENERATIONS IN BIOMASS AND ENERGY

1870-2014



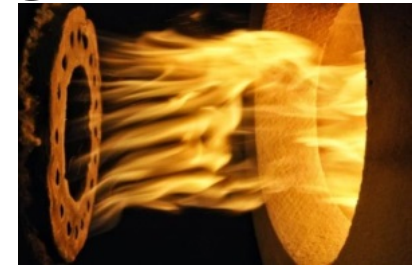
LBC Assumptions for Rural Alaska

- Building(s) have been optimized for energy consumption, efficiency and use;
- Wind and Solar options are exhausted; and
- Decisions are made about sources of energy to satisfy the building/community (scale jumping) demand.
- Choices: fossil fuels (natural gas, cng, propane, diesel) vs. local, renewable, and potentially carbon negative (e.g. biochar) biomass.
- Living communities can provide energy from local renewable resources such as forests and crops.
- What are the technology options for locations with reliable and sustainable sources of biomass?

Biomass Technologies Are Increasingly Carbon Negative and Energy Positive

- **Heat**

- Buildings
- Processes



- **Food Security**

- Greenhouse Heat
- Soil fertility - Biochar for carbon smart farming and carbon sequestration



- **Power from renewable carbon**

- <100 kWe - village and small community
- >100 kWe – community and institutional



- **Waste Disposal**

- Non-recycleable wood and paper

- **Fuel**

- Syngas to low cost diesel-like fuels



High Efficiency Wood Boilers Heat Homes, Schools, Greenhouses, Community Buildings



Chips



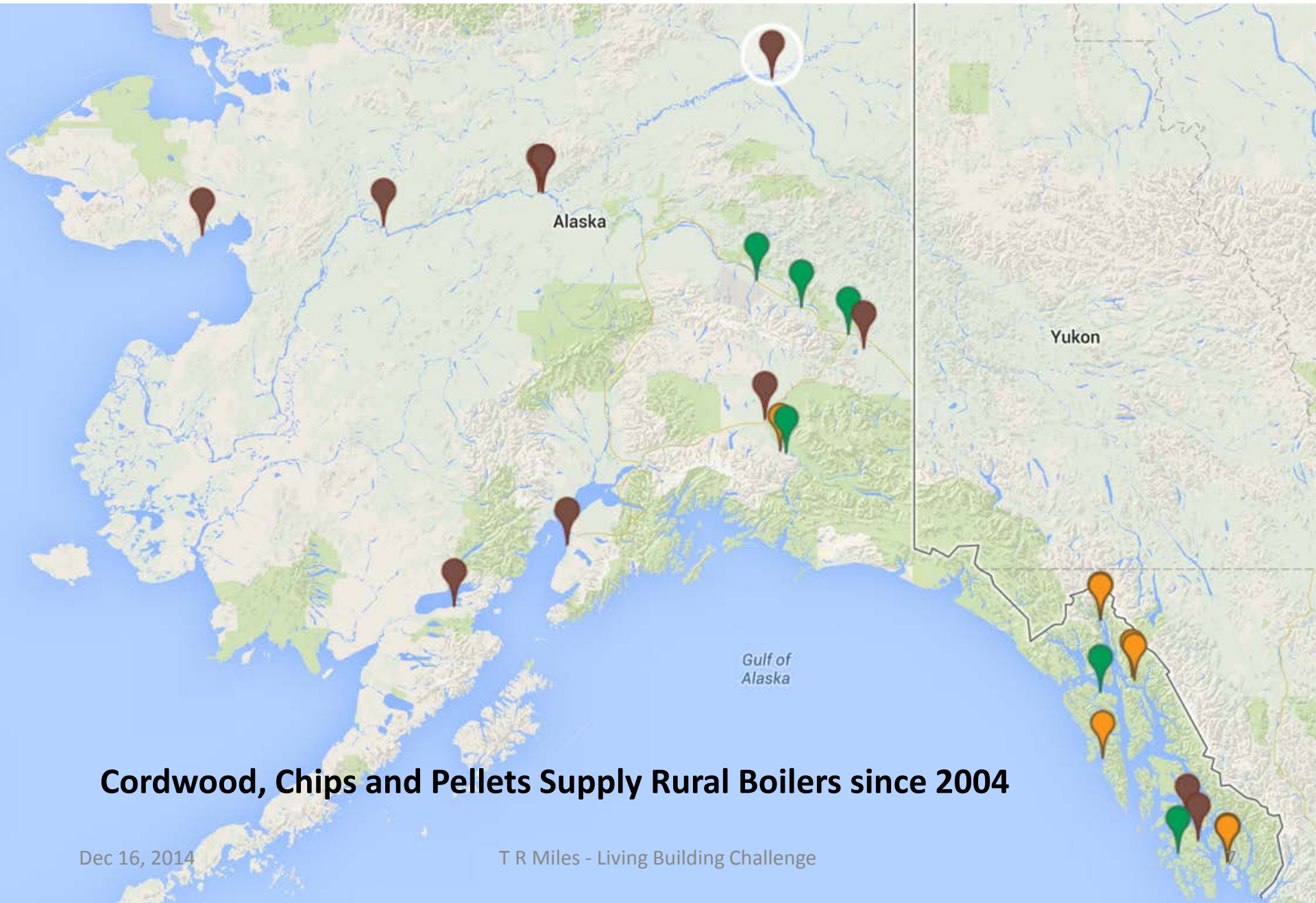
Pellets



Cordwood



Sustainable Fuels are Abundant in Rural Alaska



Cordwood, Chips and Pellets Supply Rural Boilers since 2004

Dec 16, 2014

T R Miles - Living Building Challenge

Wood Chips Heating Rural Schools in Alaskan Interior

-35 °F



Delta Greely School



Boiler + Fuel Storage



Local Fuel Chips



Automated Fuel Handling



Boiler

Clean, reliable heat. Local cost. Local fuel.

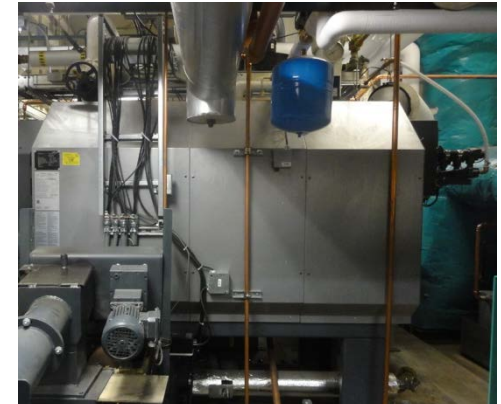
Wood Pellets Heat Sealaska Building, Juneau



Outside Fuel Storage



Ash -Boiler-Fuel Feed



Fuel-Boiler-Gas Out



Efficient Gas Cleaning



Heat Energy Storage

Improved Fuels for Efficient Conversion



CHIPS



PELLETS



**CARDBOARD + WOOD
BRICKS**



MICRO CHIPS



CARBONIZED



LIQUIDS

Improved Boilers: Bioburner

Moisture and Ash Tolerant Chip Boilers



High MC/Ash



Combustion Control



LEI BioBurner



Ash Removal

www.alaskanheattechnologies.com

Small Scale Heat and Power: Gasification

- Conversion of solid biomass to gas and char
- Onsite
 - Convert biomass to heat, electricity and char
 - Char used onsite or offsite to sequester carbon and improve soil fertility (and plant growth) on poor soils
- Offsite
 - Transport power to building
 - Char used to sequester carbon and improve soil fertility offsite for growing biomass.

Onsite Heat/Power + Biochar



Fluidyne Shasta II Gasifier Boiler with Logs and Chipper

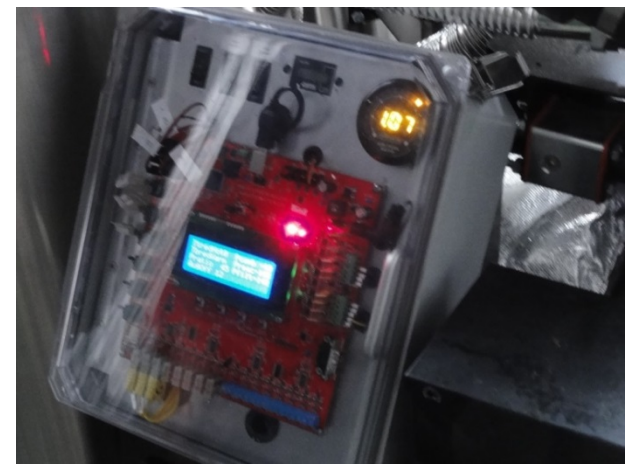
Chipping Onsite Gasifier Fuel Hoonah, Alaska 2012



Gasifier Fuel



All Power Lab Gasifier



Automated Control

20 kW Power Pallet at Alaskan Mill



Manual batch feed



www.gekgasifier.com

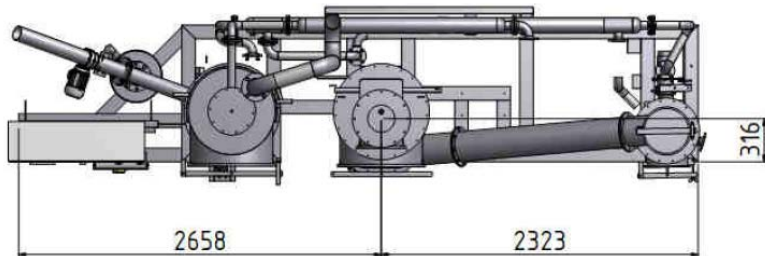
Generating 20 kW and Heat from Engine Cooling Water

All Power Labs – 25 kWe Power Pallet 2014



Germany Power From Fuel Chips- Spanner/Borealis

100KWth ~300,000 Btuh
45 kWe



www.borealiswoodpower.com

300+ installations
8000 hrs/yr



45 kWE SPANNER IN FABRICATION - >300 IN SERVICE 8,000 HRS/YR

Modular Heat and Power From Standard Chip Fuels



40kW electricity/ 100kWth

Volter, Finland volter.fi

2014

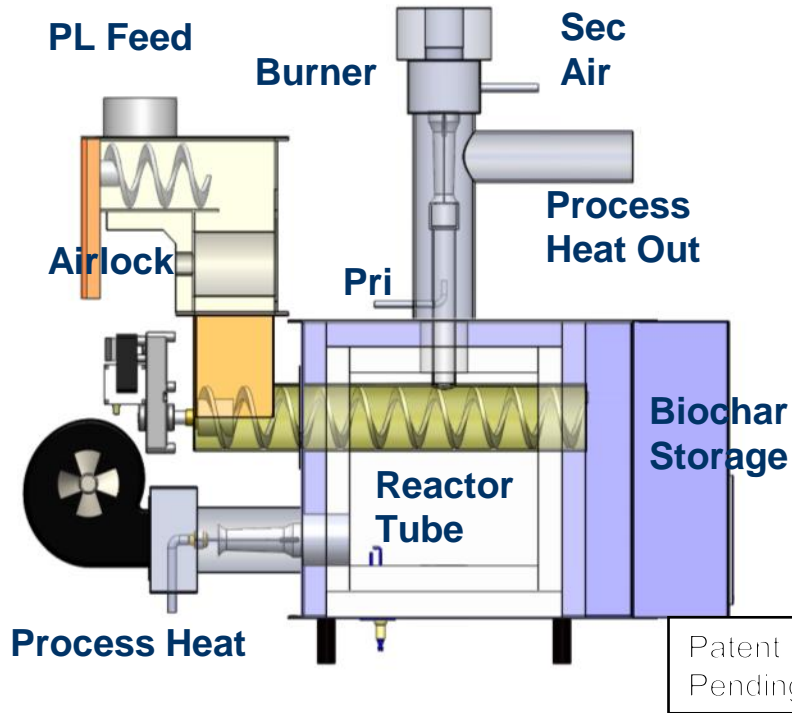


Thermal Conversions: Pyrolysis

- Convert solid biomass to gas, liquids and char
- Onsite
 - Convert biomass to liquid and solid char
 - Char used onsite or offsite as soil amendment and to sequester carbon
- Offsite
 - Transport renewable pyrolysis heating oil to building
 - Char used to sequester carbon and improve soil fertility offsite for growing biomass.



Onsite Reactor for Biochar + Heat



Commercial Scale Reactor

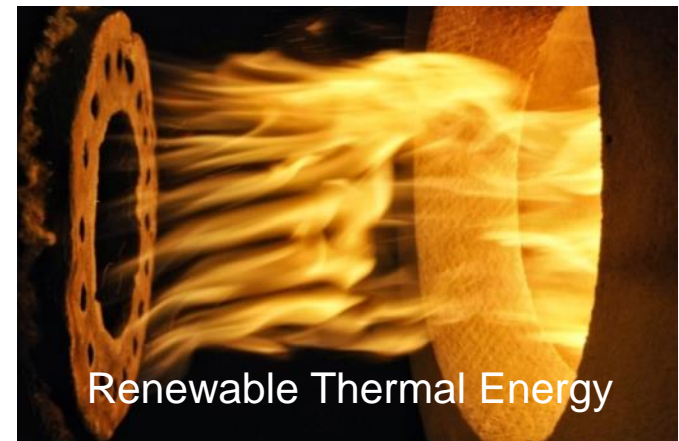
50 lb/hr biochar + 600,000 Btuh



Dryer-Feeder

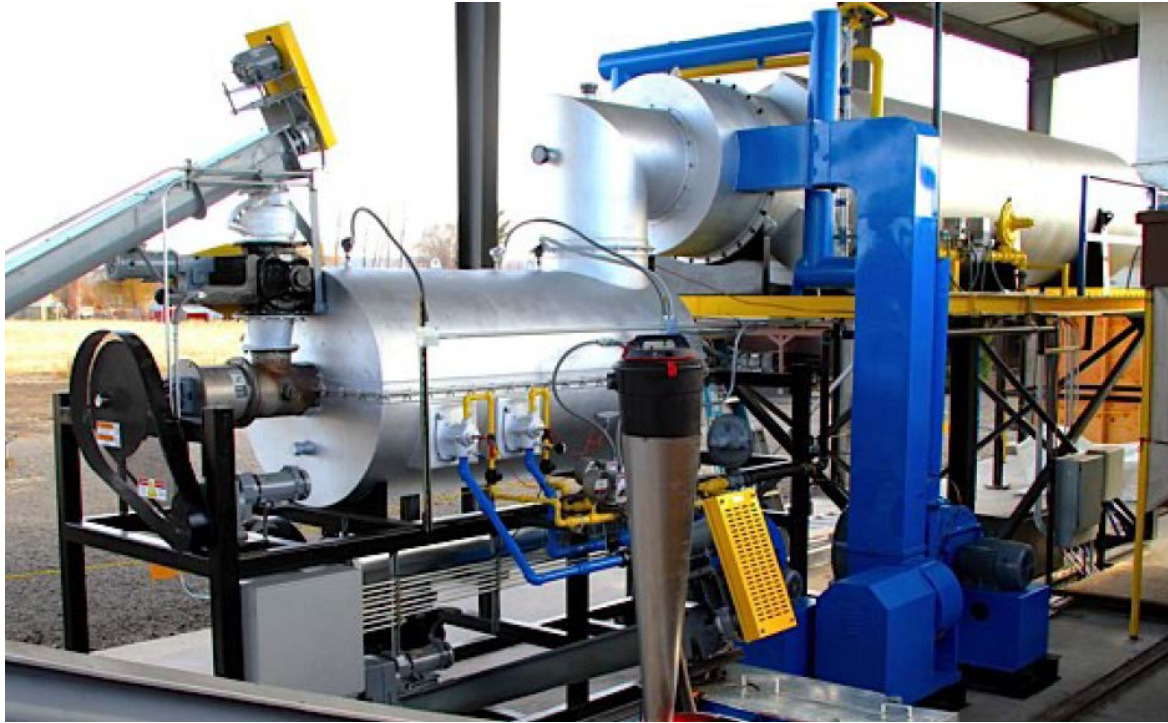


Biochar



Renewable Thermal Energy

Offsite Heat, Biochar and Gas



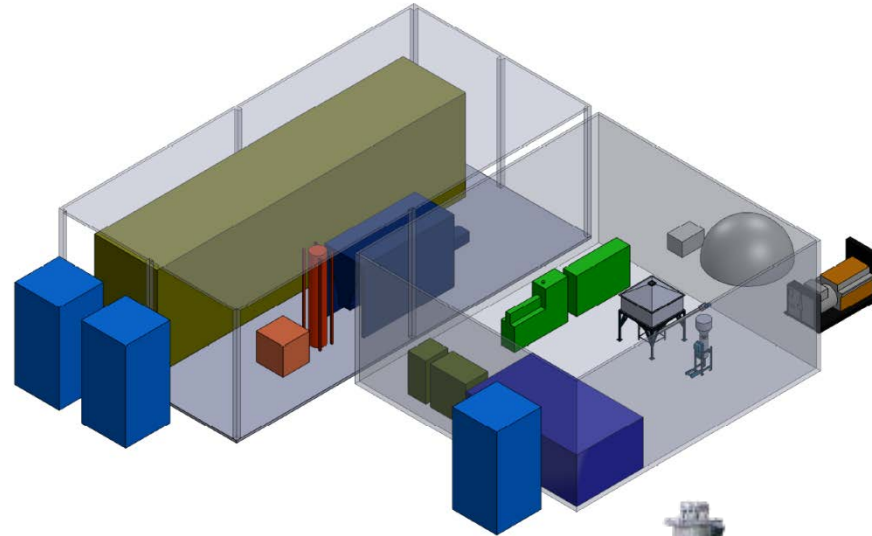
International Tech Corp, Prineville, Oregon

FIXED AND PORTABLE PLATFORMS

Integrated Heat, Power and Syngas

Proton Power

FEEDSTOCK
RECEIVING
AND
PROCESSING



SYNGAS

POWER
100-500 kWe

HEAT
Steam, HW

LIQUIDS
Oils, Vinegars

BIOCHAR



www.protonpower.com

Offsite Energy Services - Phoenix Energy

500 kWe, 1000 kWe, 2,000 kWe + Biochar



www.phoenixenergy.net

FUEL: Why Not Make Oil in Alaska?

- Proton Power - hydrogen
 - Hydrothermal Carbonization
 - Urban and Municipal Waste
 - PNNL Oil From Food waste
 - Cool Planet – slow pyrolysis
- Drop-in Gasoline, Diesel and Biochar



COOL PLANET ENERGY SYSTEM

CARBON NEGATIVE

Due to the company's patented technology and biochar product, Cool Planet's green fuels have the capability of being carbon negative, beating the carbon footprints of electric and natural gas alternatives.

BIOMASS Non-food plants capture CO2 from the atmosphere and serve as the feedstock for our process. The technology can utilize a variety of non-food biomass, from commercial pine trees to agricultural waste.

Biomass captures CO2 through photosynthesis



FACILITIES Our smaller, less-expensive facilities significantly lower scale-up risk for our technology, which combines a thermo-mechanical process and proprietary catalysts to produce both green fuels and biochar.

GREEN FUELS Our gasoline and diesel blendstocks are chemically identical to fossil fuels, requiring no sacrifices to the fuel infrastructure, performance, or price.

BIOCHAR Product sequesters carbon and delivers transformative benefits to industries as diverse as agriculture and pharmaceuticals.

Biochar sequesters CO2 in the soil

TRADITIONAL OIL

A nonrenewable fossil fuel, oil produces indispensable fuels that are also leading greenhouse gas contributors. While traditional gasoline and diesel release CO2 from underground into the air, Cool Planet's fuel cycle actually captures carbon underground in a process that is capable of being carbon negative.



www.coolplanet.com

Use Improved, New, and Emerging Carbon Negative, Energy Positive, Technologies for Sustainable Buildings and Communities.



www.gasifiers.bioenergylists.org
www.biochar.bioenergylists.org



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Design and development of energy and environmental processes

Industries

Biomass energy
Pollution control
Materials handling
Feed, Food and Fuels

