



USBI • [BIOCHARCONFERENCE.COM](https://biocharconference.com) • FEB. 12–15, 2024



KMW Combined Heat and Biochar Production Systems

New and retrofit opportunities for fuel flexible production of heat and biochar

Thomas Butler, P.Eng
General Manager
KMW Energy Group

KMW

Biomass and Biochar Energy Systems

KMW Combined Heat and Biochar Energy Systems



USBI • [BIOCHARCONFERENCE.COM](https://www.biocharconference.com) • FEB. 12-15, 2024

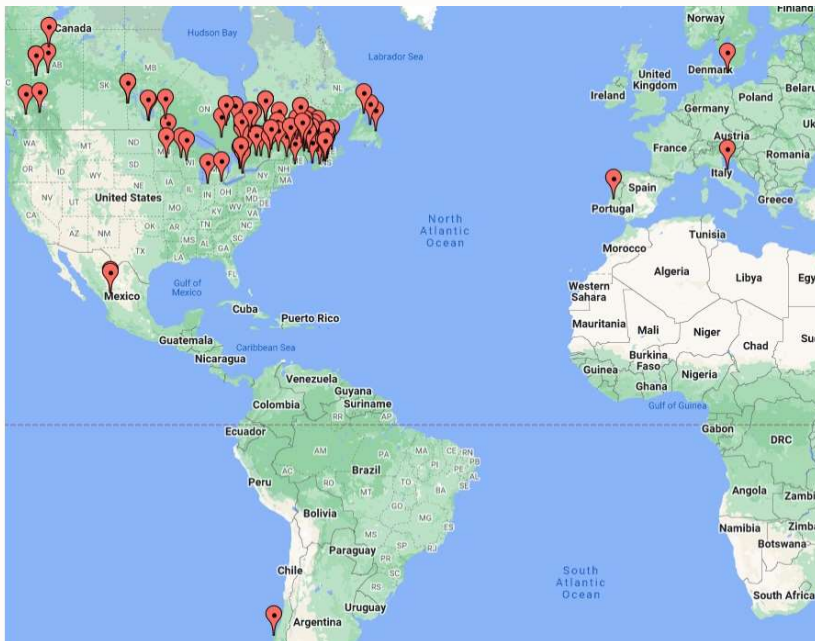


Who is KMW Energy Group?



KMW Energy Group. is a leading manufacturer of biomass combustion systems, gasifiers, boilers and heaters with over 70 years experience.

- Founding company started 1947 in Sweden
- Operated independently since 1987 in Canada
- 2020 KMW joined forces with steel fabricator Norarc/Normex for in house fabrication of KMW equipment
- 140 systems in operation



How It Works:



1. Define the required thermal and biochar outputs
2. Define the available feedstock quantity and quality
3. KMW Custom engineers a complete biochar energy system including:
 - Fuel Handling
 - Gasification/Combustion System
 - Energy Recovery
 - Emission Control
4. KMW fabricates the equipment at our shops in Ontario and Quebec Canada
5. KMW delivers the equipment to the customer site worldwide
6. KMW supports onsite the installation and commissioning of the system



Ultimate Fuel Flexibility

The KMW Grate Gasification System provides unmatched fuel flexibility and has proven capabilities operating with a wide variety of fuels. The list below is an example of fuels that have been utilized with the KMW Moving Grate System.

Wood Residues:

- Wet Bark up to 60% moisture.
- Sawdust
- Wood chips
- Wood shavings
- Sanding dust
- Filtercake from Pyrolysis
- OSB plant waste

Sludges:

- Primary sludge
- Secondary sludge

Biosolids:

- Municipal Biosolids

Agricultural Wastes:

- Orange peel pellets
- Cornstover
- Rice husks
- Oathulls

Waste Materials:

- Construction and Demolition waste
- Railway ties
- Waste tires
- Waste Oil Filters
- Refuse Derived Fuel

Our Equipment

Fuel Handling

KMW engineers and fabricates custom fuel receiving, storage and reclaim equipment customized to each projects specific fuel and layout requirements.

Typical projects include:

- Fuel receiving and unloading equipment
- Live bottom fuel storage systems between 1 hour storage up to 90 hours (live bottom screw or reclaim stokers)
- Fuel transfer with screw conveyors
- Fuel transfer with chain conveyors



Gasification/Combustion System

KMW's first moving grate system was put into commission in 1980 and has been perfected over the last 42 years.

KMW's patented grate system includes stainless steel alloy grates and individually controllable grate row movement.

The KMW grate system is shop built and delivered to your site fully tested.

Up to 15 tonne/hour input capacity per gasifier

Hot Water Systems

KMW Offers complete hot water systems for commercial, institutional and greenhouse heating.

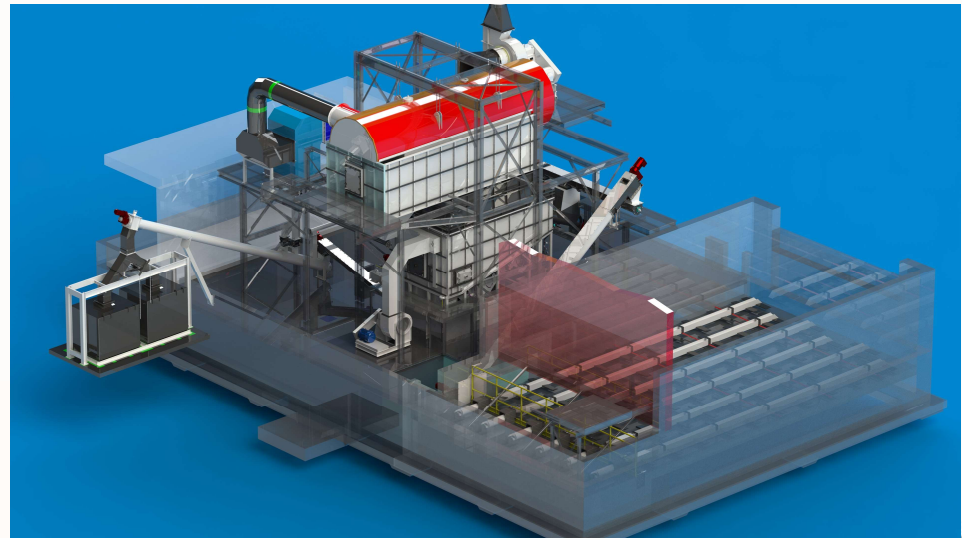
Hot Water Systems range in size from 100 - 1,500 BHP.



Steam Boiler Systems

KMW fabricates complete low pressure steam boiler plants for heating, kiln drying and process steam requirements.

Low pressure steam boilers are available from 200 - 2,500 BHP.



Our Equipment



High Pressure Steam Boiler Systems

KMW biomass steam boiler systems are available in the range of 5,000 lbs/hour up to 120,000 lbs/hour in a single boiler and multiple boiler configurations can supply up to 500,000 lbs/hr.

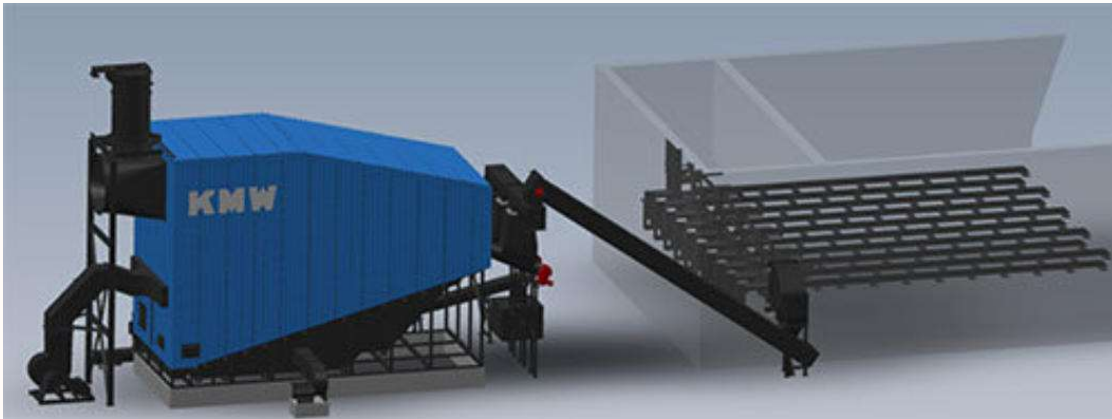
Steam pressure range is between 15 psig - 1350 psig and superheat is available up to 900 F.



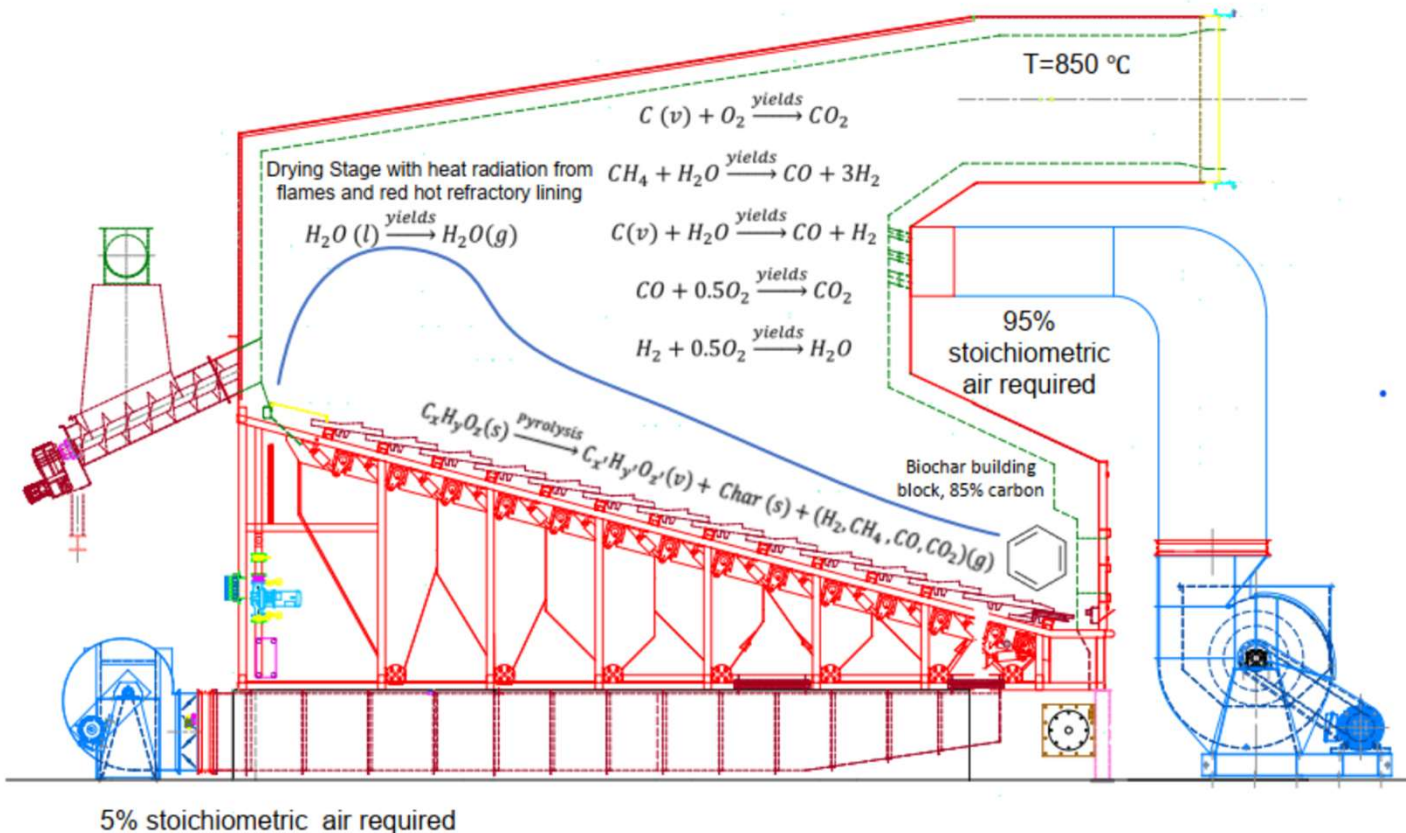
Dryer Systems



KMW combustion systems supplying hot flue gas to rotary dryer systems are available up to 100 Million BTU/hr in a single unit. KMW and its partners can supply complete rotary dryer systems for any pellet or board plant project.



KMW Combined Heat and Biochar Operation



- No Predrying
- Only two Outputs:
 - Inert, high temperature flue gas for heat recovery
 - High Quality Biochar

KMW Combined Heat and Biochar Systems



Benefits of the KMW Biochar Systems:

- Self sustaining production of biochar and heat
- Continuous 24/7 production of certifiable biochar
- No pre-drying required up to 60% moisture
- High carbon content >85% C
- High Temperature Gasification - 850C - 950C operating temperature
- Low Hydrogen/Carbon ratio.
- No condensed volatiles
- Very high energy efficiency with boiler and economizer resulting in low stack temperature.
- High BET Surface Area - 200 - 300 m²/g
- High Adsorption Average Pore Diameter

Durability: 0.96

Typical Net CO₂ removal/tonne of biochar = 2.7 - 3.0





KMW Biochar Lab Analysis

Forest Residue Chips:

Project: **WT2332131**

Date Received: **October 10, 2023**

Certificate of Analysis

Sample ID:	Sample Date and Time	Lab #:	Carbon, Total	Hydrogen, Total	Nitrogen, Total	Oxygen	Sulfur, Total	Heating Value	
			Moist. Free wt%	Moist. Free wt%	Moist. Free wt%	Calculated	Moist. Free wt%	As Received BTU/lb	Moist. Free BTU/lb
Skurup Biochar	10/4/23 0000	T2301750-001	89.67	<0.1	0.34	0.74	0.06	10,743	13,315

Waste Pallets: Proximate Analysis

	Dry Weight Basis
Moisture	0.0 %
Bulk Density	0.21 g/cc 12.8 lb/cu ft
Carbon (C)	85.7 %
Hydrogen (H)	2.2 %
Nitrogen (N)	0.9 %
Oxygen (O -calc.)	6.6 %
Ash	4.6 %
	100.0 Sum
Volatile Matter	14.3 %
Butane Activity	3.7 g/100 g
Surface Area Correlation	251 m ² /g
Organic Carbon	85.2 %
H/Corg.	0.31
Carbonates (as CaCO ₃)	4.3 %

Bark and LVL Beam Waste:

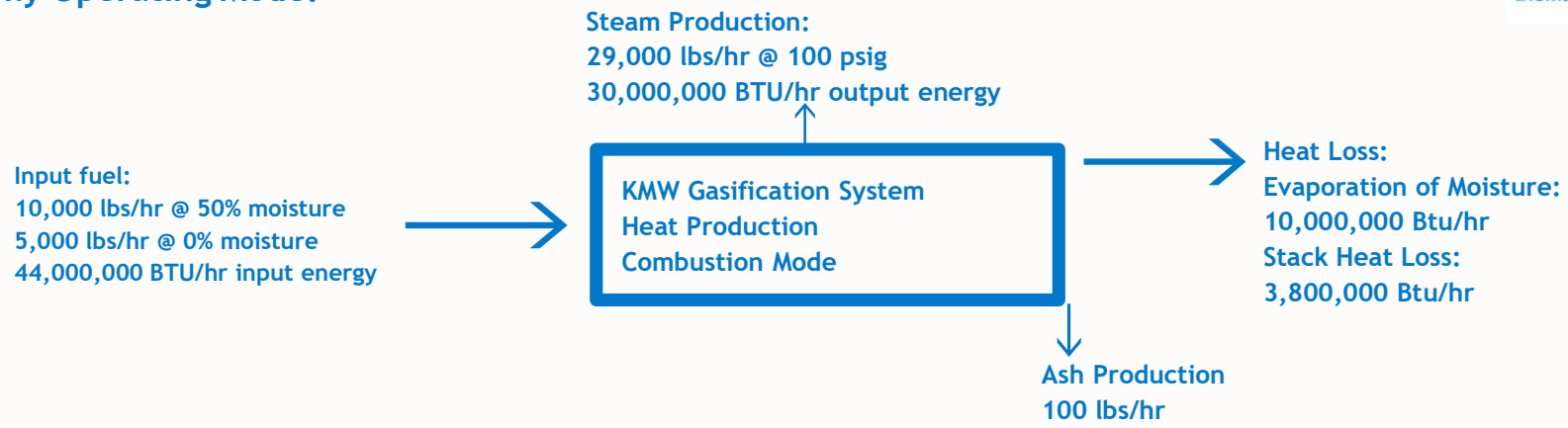
International BioChar Initiative (IBI) Laboratory
Dry Basis Unless Stated: Range

Moisture (time of analysis)	65.0
Bulk Density	12.6
Organic Carbon	76.7
Hydrogen/Carbon (H:C)	0.22 0.7 Max
Total Ash	11.7
Total Nitrogen	0.92
pH value	11.73
Electrical Conductivity (EC20 w/w)	1.42
Liming (neut. Value as-CaCO ₃)	14.4
Carbonates (as-CaCO ₃)	9.8
Butane Act.	2.2
Surface Area Correlation	202

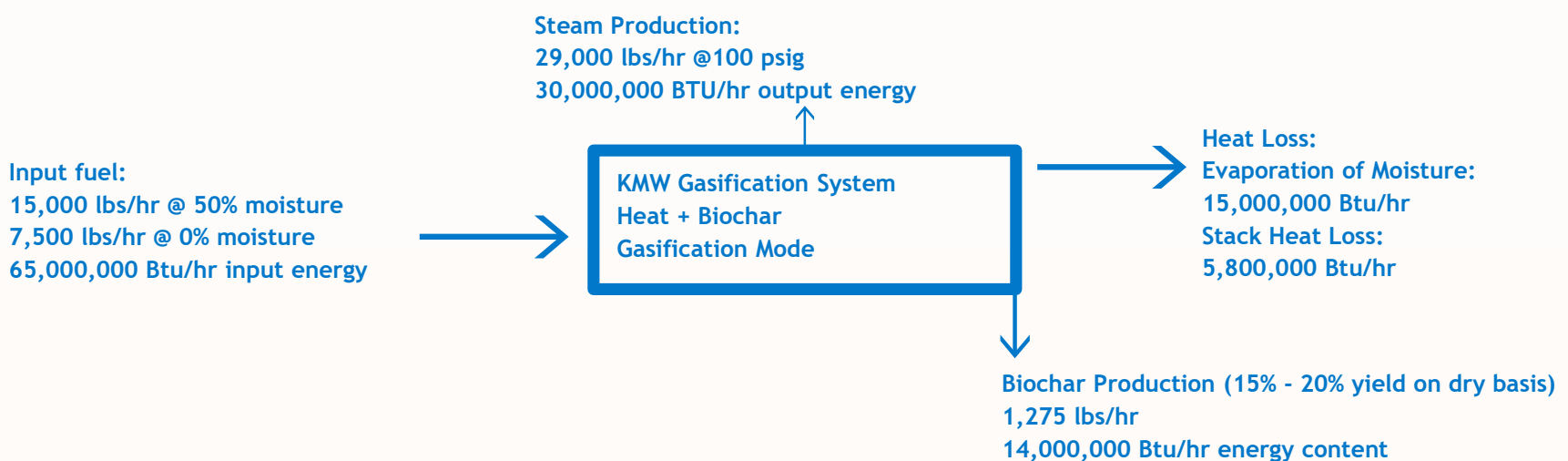


Biochar Systems - Heat and Mass Balance

Heating only Operating Mode:

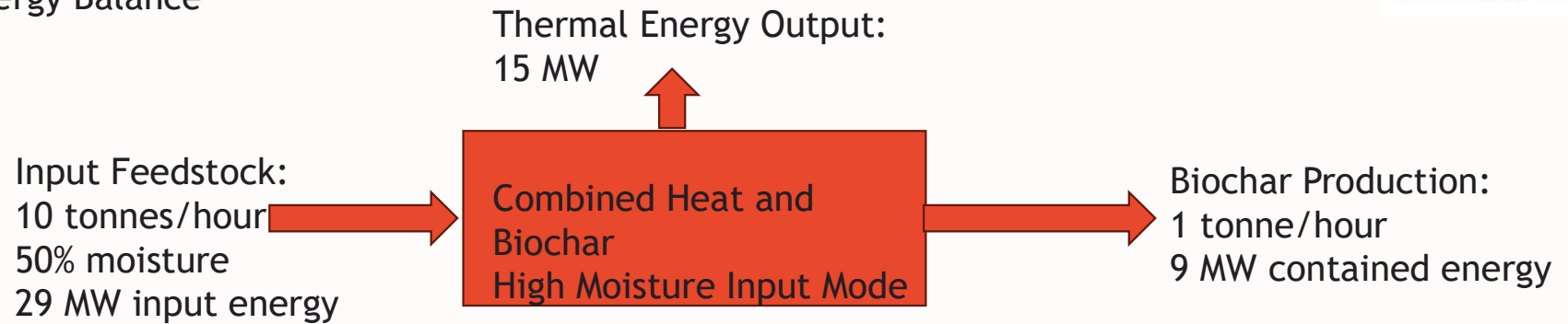


Combined Heat and Biochar Production Mode:

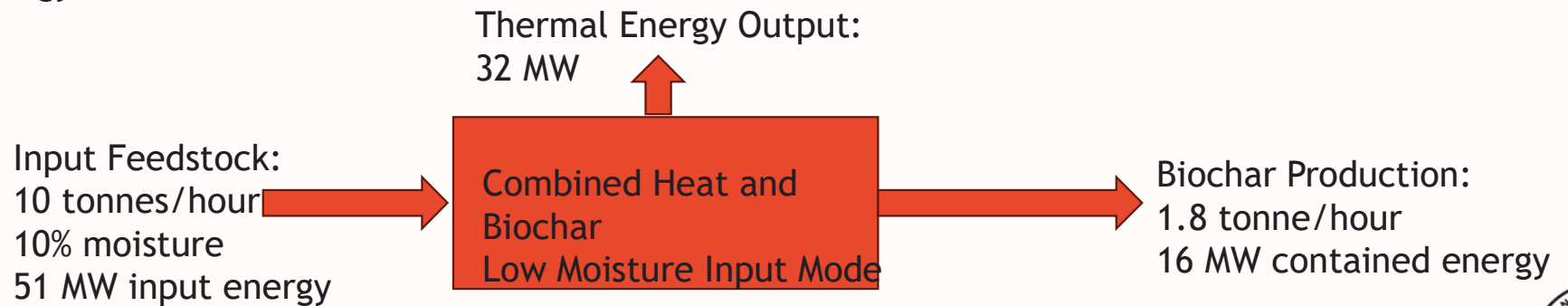


Combined Heat and Biochar - Energy balance

Wet Fuel Energy Balance



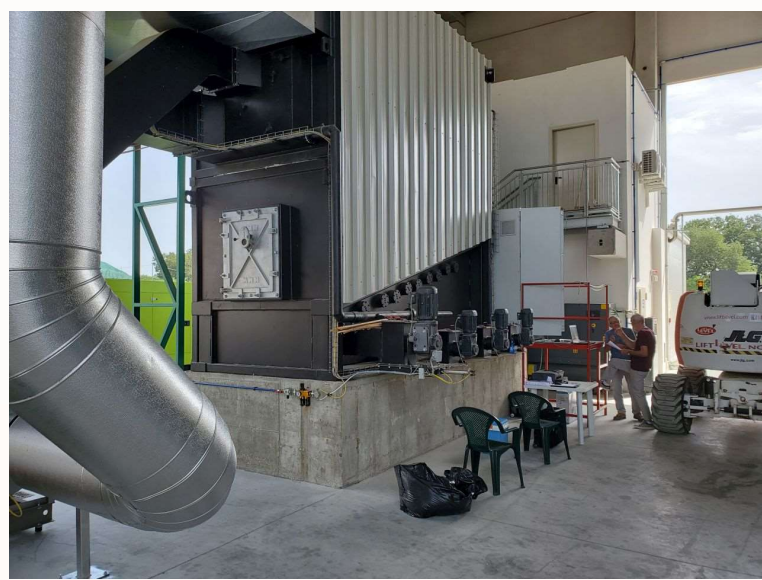
Dry Fuel Energy Balance



KMW Combined Heat and Biochar Production

Sample System - Combined heat and biochar - 400 tonnes/year biochar

Small size	Char + Heat
Fuel consumption (t/yr)	3,800
System net heat output (kW)	0.6
Char yield (wt.%)	20
Biochar production rate (mt/yr)	400



KMW XRF Gasifier Installed in 1 MWe ORC Plant



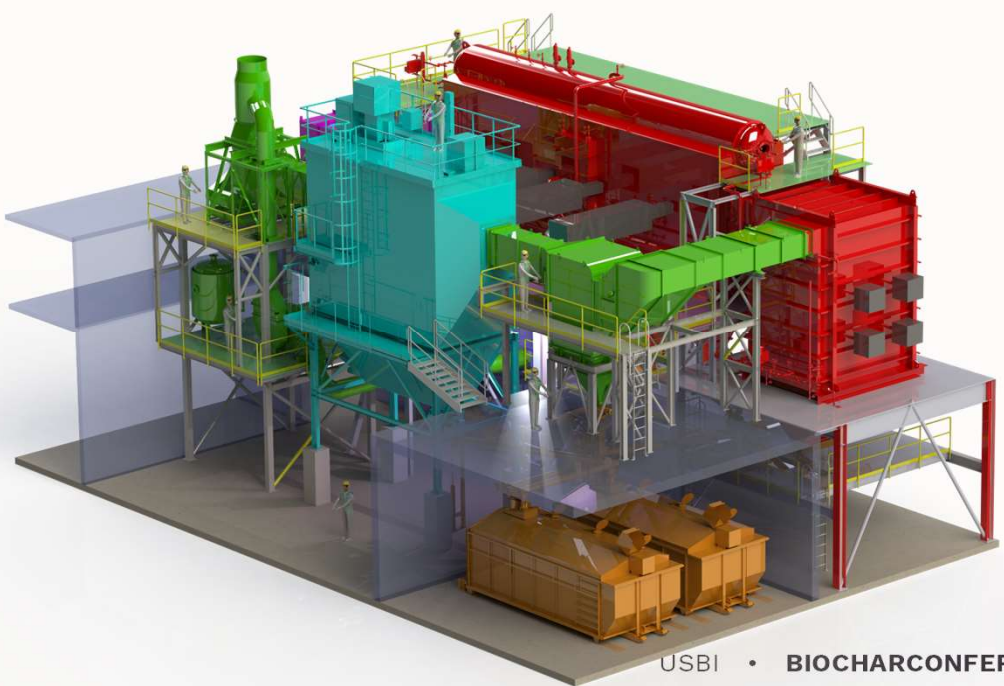
KMW XRF Gasifier - On truck for shipping



KMW Combined Heat and Biochar Production

Sample System - Combined heat and biochar - 8,500 tonnes/year biochar

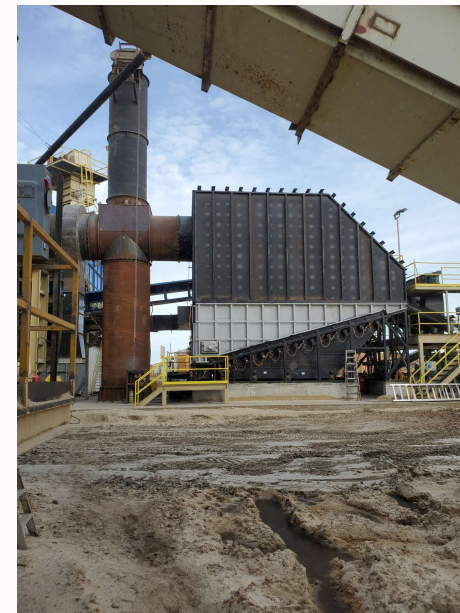
Medium size	Char + Heat
Fuel consumption (mt/yr)	86,500
System net heat output (MW)	13.4
Char yield (wt.%)	20
Biochar production rate (mt/yr)	8,500



KMW Combined Heat and Biochar Production



Large size	Char + Heat
Fuel consumption (mt/yr)	150,500
System net heat output (MW)	23.7
Char Yield (wt.%)	20
Biochar Production rate (mt/yr)	15,100



Biochar Production Thermal Energy Utilization



Thermal Energy Demand:

- Hot water - Typically 203F - 230F supply temp
 - Greenhouse
 - District heating
 - Building heating
 - Dry kilns
 - Belt dryers
- Steam - Low pressure: 15psig, medium pressure: 150 - 250 psig
 - Process steam
 - Dry kilns
- Hot gas for drying - 1900 F
 - Pellet manufacturing, sludge drying
- Power Generation
 - High pressure steam - 600 psig superheated or greater
 - Hot oil for ORC

• Every Project is unique in size and thermal demand, make sure your biochar system is as well



Combined Heat and Biochar Project Development



1. What does a combined heat and biochar system project need to be successful?

1. Feedstock:

- Quantity
- Energy
- Quality
- Availability - feedstock production must match thermal demand
- What Feedstock will you use? Clean, dry chips at \$100 - \$200/ton or residuals at \$15-\$30/ton?

2. Thermal Energy

- What is the NET thermal energy produced by the system?
- Thermal energy needed for pre drying of feedstock serves no net benefit to your operation

3. Biochar Quality and End Use

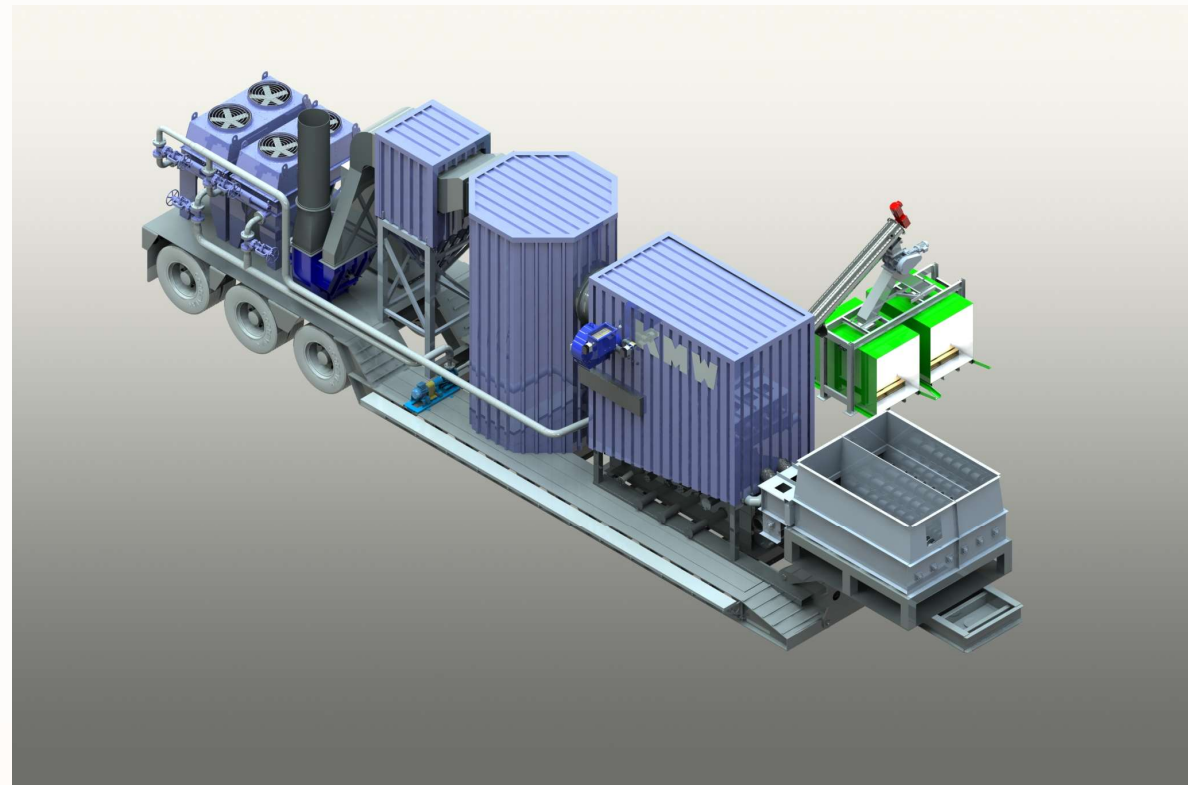
1. Is the system capable of producing the quality you require?
2. What is quality to you?



KMW Mobile Demonstration Unit



- 1,400 lbs/hr feedstock input
- 15 - 20% biochar yield on dry basis
- Fully self-contained R&D demonstration unit for demonstration and small scale production:
 - 1 or 2 feedstocks with automatic mixing
 - Hot water generation with energy monitoring
 - Propane preheat for sludge/biosolids use
 - Emissions Data Collection
 - Biochar production



For Rent Late 2024!





Contact KMW Energy Group today for your
Biomass and Biochar Energy Project



Thomas Butler

General Manager

Tel: (519) 494 - 0285

Email: thomas.butler@kmwenergy.com

Web: <https://www.kmwenergy.com>

USBI • [BIOCHARCONFERENCE.COM](https://www.biocharconference.com) • FEB. 12-15, 2024

