

# V-Grid Bioserver

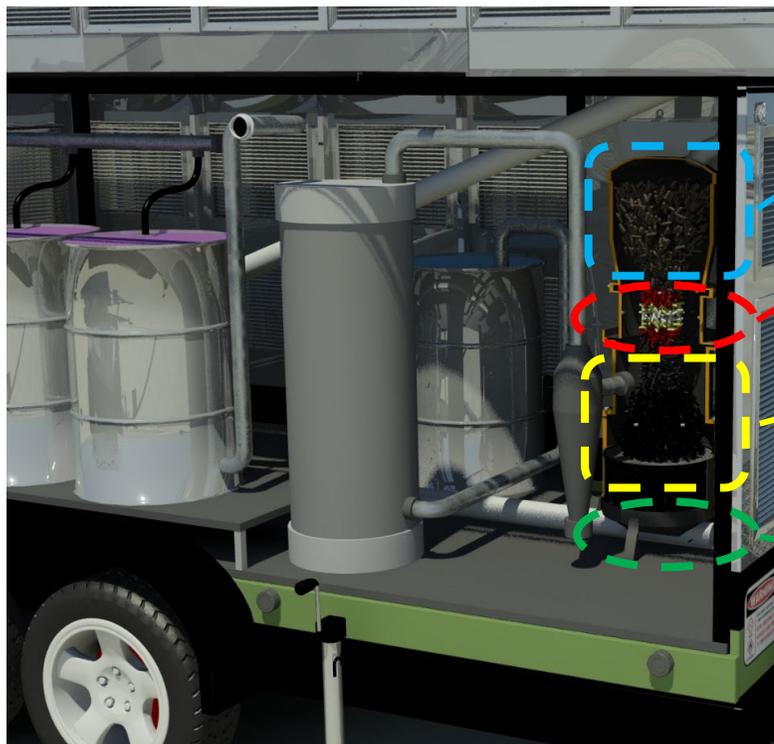
The mobile, scalable solution for converting biomass to biochar and electricity





- Supplier of mobile, scalable gasifiers called BIOSERVERS used for the conversion of biomass into electricity and biochar
- The choice of this conversion of biomass has serious implications in terms of cost, benefit, and efficiency of conversion making the V-grid Bioserver *the* choice for improving the health of our environment
- Discover the benefits of the V-Grid Bioserver and serve the world a better future

- What is a gasifier?
- Gasification versus other technologies
- Benefits of the V-Grid Bioserver
- V-Grid Bioserver inputs and outputs
- Air quality
- Monetizing V-Grid Bioserver outputs
- Biochar Proven Applications
- Wrap Up

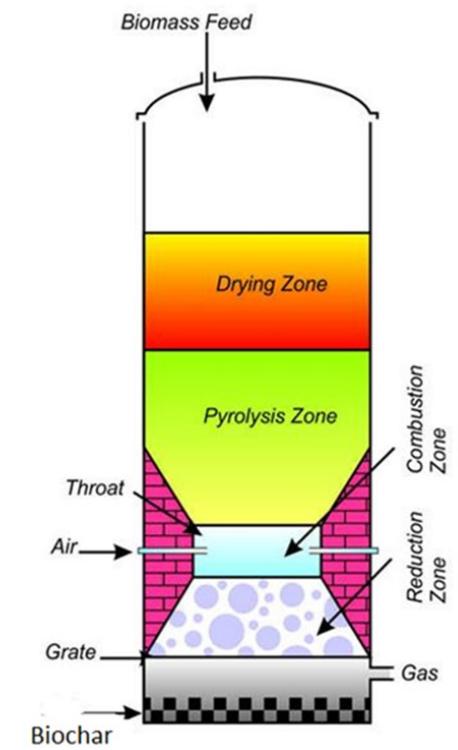


**Pyrolysis**

**Combustion Zone**  
 $CH_{1.4} O_{0.6} + 1.05 O_2 + (3.95 N_2)$   
 $\rightarrow CO_2 + 0.7 H_2O + (3.95 N_2)$

**Reduction Zone**  
 $C + H_2O \rightarrow CO + H_2$   
 $C + CO_2 \rightarrow 2CO$

**Active Carbon**  
High Purity  
Porosity =  $300 m^2/g$

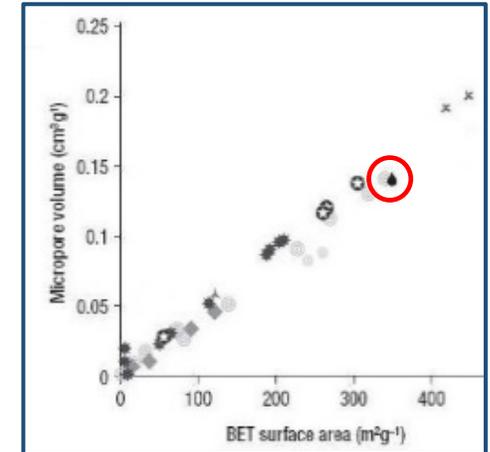
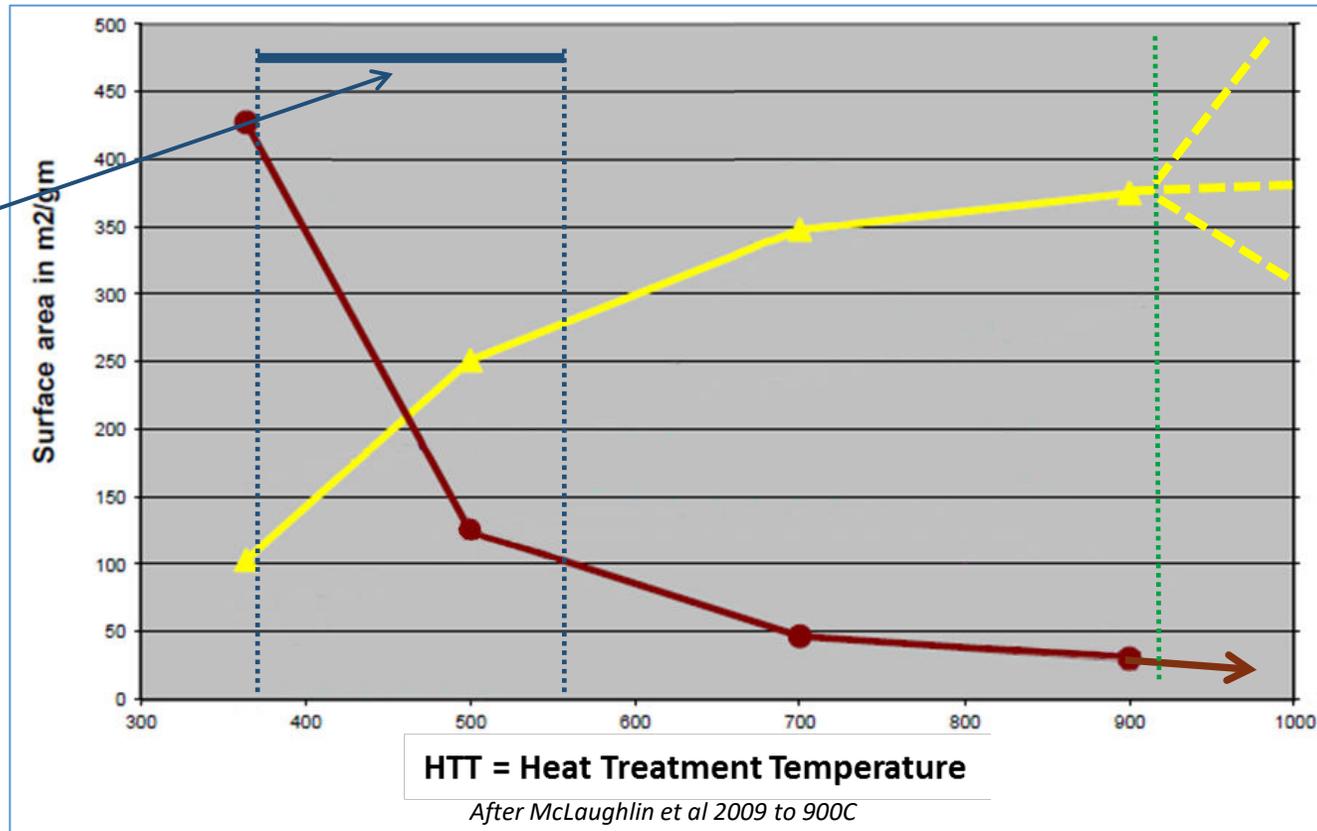


Gasification provides for the best volatile removal from biomass and highest temperature resulting in biochar with extremely high surface area making it usable for multiple applications including animal feed!

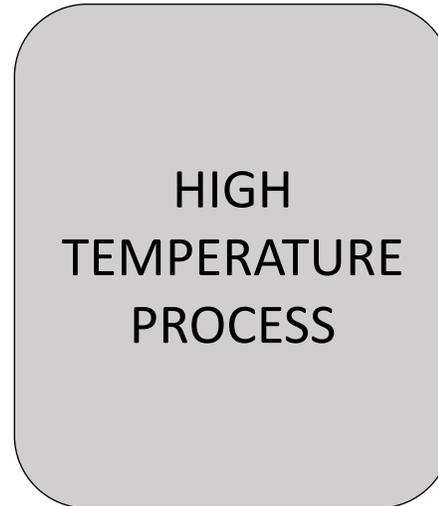
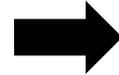
# Why Gasify? V-Grid Biochar Compared to Pyrolysis Char

Low Temperature (350-600°C) results in low SA, non-uniform porosity, and material has significant residual organic compounds (PAHs etc) > 1200°C increases ash content, pH, fuses pores and also lowers surface area.

Typical  
pyrolysis char  
350 to 550°C



VGrid's Bioserver will process most dense, small form factor materials like nutshells and wood pellets, chipped trees, etc.



Biochar

High temperature process ensures uniformity & consistency of biochar with high/uniform porosity, high carbon content and very low residuals and ash.

## The V-Grid Benefit

- Gasification provides *higher quality* biochar compared to pyrolysis
- Can be provided as a mobile source for relocation after addressing damaged areas minimizing *transportation costs*
- Modular and “scalable” to *improve efficiency* of the feed system, can be operated as an array
- Generated electricity can be net metered back to PG&E or used to run peripheral equipment further reducing carbon footprint
- High quality output biochar can be monetized through various applications – soil amendment, animal feed supplement
- V-Grid **today** has 7 units in operation at a dairy in Visalia, going to 10 soon with automation!

## Array Operations

- Arrays consist of five plus (5+) 100 kW Bioservers running 24 hours/day in a controlled environment.
- Can set up chippers and conveyors to feed multiple Bioservers
- Each Bioserver unit capable of processing ~ **2.4 tons per day in biomass producing ~ 1/3 ton of biochar in addition to 100 kwh of electricity**



- Operational Model Assumptions
  - Two shift operation, 16 hours per day, 5 days per week
  - 85% uptime unit running on average, operational time estimated at 70%
  - 3 people required to run up to five units per shift
  - Each unit will process approximately 250 lbs per hour
- Electricity
  - Max output 100 kW per bioserver
  - Can run engines with propane when systems off-line for electricity
- Carbon
  - Output - 500 lbs per 16 hr day, 5 tons per month, 60 tons per year (per unit, 21 days per mos, 16 hr/day)
- Liquids
  - Condensate which is comprised of water, light tars and acetic acid ~ 8 gal/hr,

- Each unit's emissions are below the SJVAPCD Best Available Control Technology (BACT) thresholds (e.g., 2 pounds/day for NO<sub>x</sub>, SO<sub>x</sub>, VOC, PM<sub>10</sub>, and PM<sub>2.5</sub>) per device
- Total facility emissions are also below the SJVAPCD BACT thresholds
- Even though below the BACT thresholds, engines will include a 3-way catalyst to control NO<sub>x</sub>, CO, and VOC emissions and will meet the SJVAPCD BACT Guideline for syngas fueled engines
- Total facility emissions are below 10 tons/year for all pollutants, so no offsets, air quality modeling, or health risk assessment are required
- Facility is a minor source and able to comply with all applicable rules

- All outputs of the Bioserver can be monetized!
- Electricity – generates 100kW per unit producing \$13-\$18/hr dependent on local electricity rates, *Net Metering Approved!*
- Biochar – value of char varying from \$1-\$5 per lbs pending application which is \$30-\$150/hr
- Condensate/tar can be monetized for spraying for dust/asphalt and sells for \$0.40-\$1.00 per gallon or \$3-\$7/hr
- Each V-Grid Bioserver can generate income of \$50-175/hr while removing waste biomass and helping the environment!!!

# V-Grid Biochar Uses - Animal Feed



## BIOCHAR LIVESTOCK APPLICATIONS

Biochar used in the livestock/animal industry is primarily used to bind toxins in the gastrointestinal tract of animals. Can also be used to absorb ammonia, volatiles in animal feces, bedding thereby reducing greenhouse gases and odor.



APPLICATION	IN USE TODAY	IN TRIALS	IN DEVELOPMENT	FUTURE
Dairy Calf Powder for SCOURS	XX			
Rough powder for toxin outbreaks	XX			
Dairy Calf transition		XX		
Adult cow methane reduction, feed efficiency		XX		
Poultry Bedding			XX	
Goats, pigs, sheep				XX

**BIOCHAR  
SOIL SUPPLEMENT  
APPLICATIONS**

Biochar used as a soil supplement provides carbon sequestering resulting in water retention, as well as a harbor for bacteria improving plant growth. Provided as is or in mixes and can be charged with bacteria for severely depleted soils



APPLICATION	IN USE TODAY	IN DEVELOPMENT	FUTURE
Soil restoration	X		
Organic farming	X		
Manure treatment for ammonia, methane, return to soil		X	
Indoor cannabis grow medium		X	
Outdoor grow medium		X	

- Proven technology
- Mobile technology allows for the easy placement and relocation of the units from site to site without high brick and mortar costs
- Scalability can be utilized to drive down the output costs and address higher rates of biomass conversion
- V-Grid Bioservers provide gasification technology on the go to generate electricity and produce proven, high-quality biochar

**Questions?**