ALL POWER LABS

Carbon Negative Power & Products

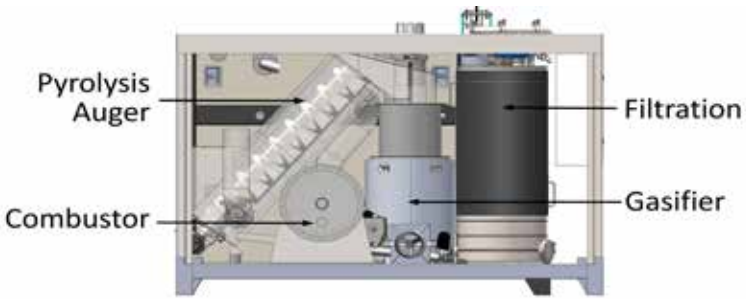
ALL POWER LABS GAS-MAKING TECHNOLOGY

SMALL-SCALE BIOMASS REACTOR

The ALL Power Gas-Making Technology features a compact, Combined Heat and Biochar (CHAB) gasifier system designed to convert waste woody biomass into clean high-quality producer gas, high-temperature biochar as well thermal energy. It is based on our PP30 v3.0 Power Pallet development using APL's newest Swirl Hearth architecture, which includes design innovations expected to widen the range of acceptable feedstocks, reduce feedstock preparation requirements, and improve emissions.

This standalone gas-making system is capable of being optimized for either gas or biochar production and sized for community farms and gardens as well as research institutions. It makes an ideal test platform for R&D and demonstration activities such as validation of various feedstocks, gasification, and other renewable energy research.

In addition to the Producer Gas Heat Exchanger (PGHx) designed for the PP30 and the ability to produce more than 60 m^3/hour of high quality syn-gas, this system also includes a gas combustor able to add 50 kWth of heat to a customer-supplied hydronic system.



Gas-Maker Cross Section

CORE PERFORMANCE SPECIFICATIONS

GAS MAKING SYSTEM	
Maximum Feedstock Conversion Rate	25 kg/hr
Maximum Syn Gas Flow Rate	60 m^3/hr
Biochar Yield (fraction of input biomass by weight)	up to 20%

PRODUCER GAS OUTPUT COMPOSITION	
Tar (aromatic hydrocarbons)	<50 mg/m^3
Hydrogen - H_2	20%
Carbon Monoxide - CO	20%
Carbon Dioxide - CO_2	5%
Nitrogen - N_2	55%

INFRASTRUCTURE REQUIREMENTS

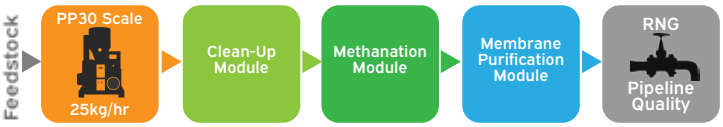
SPECIFICATIONS	
Form Factor	Half Skid
Footprint	3 feet x 6 feet (1 meter x 2 meters)
Clearance: for external components and material loading/unloading	4 feet all sides (125 centimeters)
Shore Power	120/240 Vac 1800 W
Fuel Drying (dry weight)	15% ± 3% moisture
Fuel Loading	Conveyor or Manually
Biochar Handling	Manual or Conveyor
Instrumentation and Controls	Interactive automation & monitoring/logging

AUTOMATION SYSTEM

FEATURES	
Full Temperature and Pressure Instrumentation	Standard
Smart Grate, Fuel, and Charash Auger Control	Standard
Diagnostic Messages for Error Recovery	Standard
User-Configurable Setpoints for All Critical Systems	Standard
Automatic Safety Shutdown	Standard
Remote Monitoring and Datalogging via wifi	Available

The specifications provided herein are working values based on standard operation with qualified feedstock & are subject to change without notice

SYNTHETIC FUEL PATHWAY



RNG Gas-Making Flow Chart

ALL Power Labs Gas-Making Technology is an ideal reactor to convert ligno-cellulistic biomass into syngas for the purpose of generating Renewable Natural Gas (RNG). This is accomplished by the addition of a sequence of modules to process the gas maker's output allowing the generation of pipeline-quality methane. The first processing module treats the syngas to remove the remaining trace hydrocarbons and nitrogen. This is followed by a methanation process module which converts the hydrogen (H_2) and carbon monoxide (CO) of the syngas into methane (CH_4) via the use of catalysts. Finally, the gas output is purified using membranes to remove residual carbon dioxide (CO_2) and any remaining contaminates.

APL's gas making technology meets the demands of a changing energy landscape in need of fossil-fuel-free hydrocarbons and synthetic fuels. Creation of renewable methane suitable for injection into the extensive existing natural gas distribution and consumption system represents an excellent ongoing value proposition for APL technology.

REACTOR PRODUCTS

GAS MAKING SYSTEM	
Renewable Natural Gas Flow Rate	~4 m^3/hr
Biochar Yield (fraction of input biomass by weight)	up to 20%
Thermal Output	50 kWth

BIOCHAR

COMPOSITION	
Carbon Content	>90%
H:C Ratio	<0.2
Polycyclic Aromatic Hydrocarbons (EPA 16 PAH)	<50 mg/kg

BIOMASS FEEDSTOCK

SPECIFICATIONS	
Particle Size	1/8 in. - 1.5 in. (3 mm - 65mm)
Nut Shells (e.g. walnut, palm kernel, hazelnut)	Compatible
Hardwood Chips (e.g. oak, ash, beech)	Compatible
Softwood Chips (e.g. pine, fir, cedar)	Compatible
Fines Fraction: less than 1/8 inch	<12% by weight
Main Fraction: 1/8 inch to less than 2.5 inches	>75% by weight
Coarse Fraction: greater than 1.5 inches and all must be less than 2.5 inches	<3% by weight
Moisture Content (Dry Basis)	<15% External Drying Required

All specifications are subject to change without notice

ALL Power Labs

ALL Power Labs is the global leader in small-scale gasification technology. We make biomass-fueled power generators that are ready for everyday work, to serve real-world, distributed-energy needs. Our compact gasifiers are now at work in over thirty countries, and support research at more than fifty universities around the world.

Our team is an unusual combination of hands-on fabricators and university-trained scientists and engineers. The result is a powerful combination of technical ability and physical know-how for developing innovative energy solutions.

ALL Power Labs makes machines that transform organic waste into useful Power and Products, for work at the intersection of industry, agriculture, and climate. APL intends to make a consequential impact on global energy poverty and greenhouse gas drawdown, through mass delivery of its carbon-negative energy devices.

Our facility is in Berkeley, California. Please contact us to arrange a visit the next time you are in the Bay Area. We would love to show you around.

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