



ALL POWER LABS

Carbon Negative Power & Products



Transforming California Forestry Residues into Carbon Negative Energy, Food and Water

EPIC Forum, February 2020

“APL is the global leader in small-scale gasification”

APL engineers and manufactures next generation biomass gasification systems in Berkeley, CA. Since 2008 we've delivered hundreds of our products to dozens of countries around the world.



Product

20 - 200 kW biomass
gasifiers, engineered and
built in Berkeley, CA.

People

40 FTE (20 eng, 8 production,
6 sales & support, 5 mgmt)

Funding

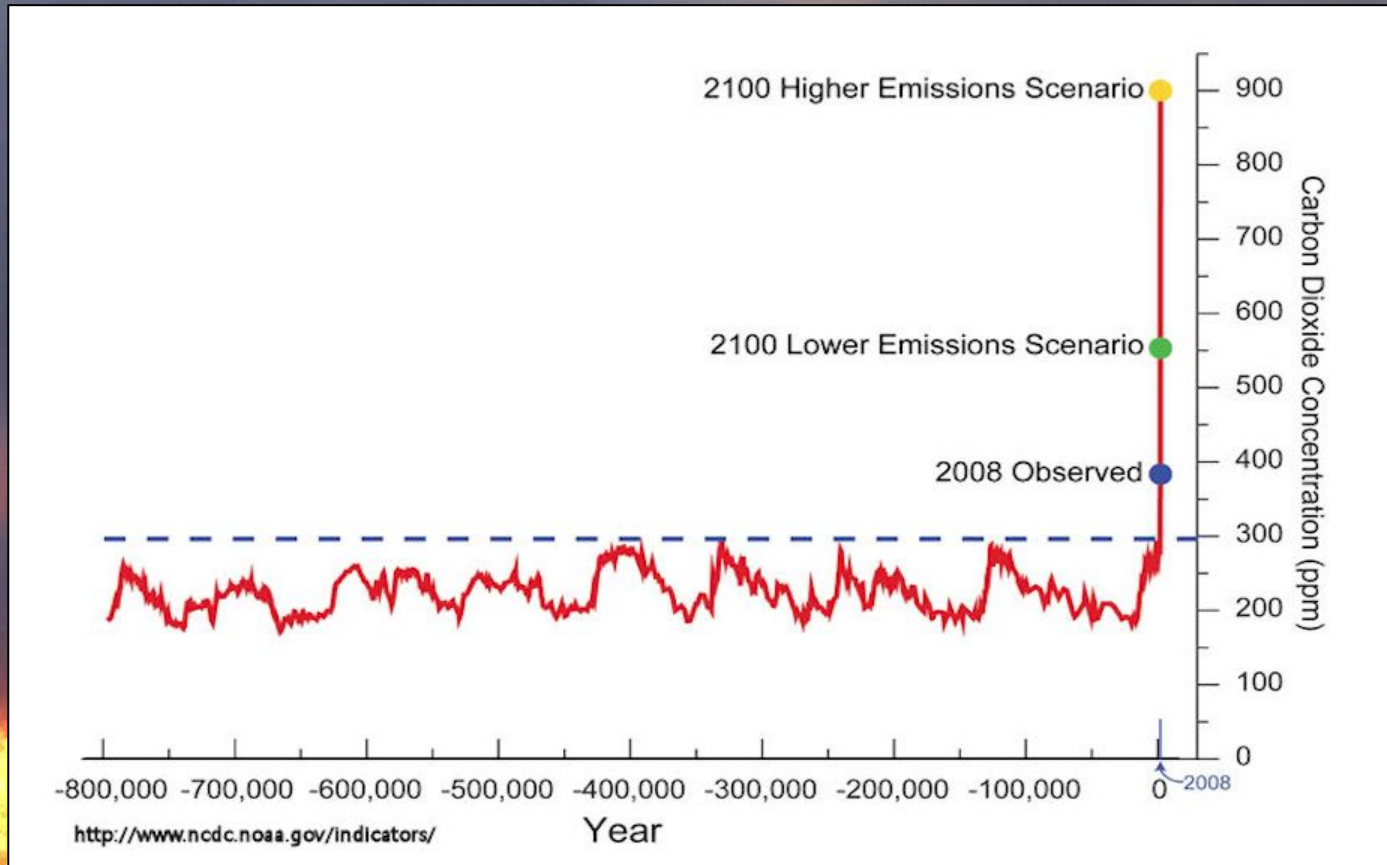
Self-funded by sales,
founder equity & grants

Intellectual Property

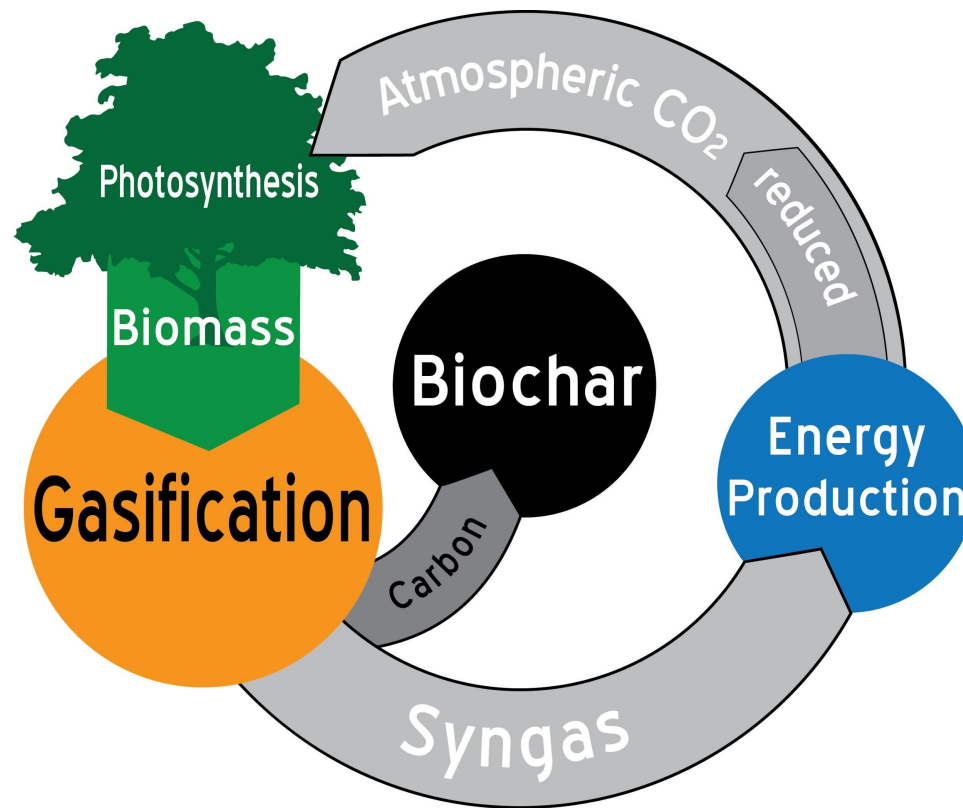
11 international patent applications (3 US issued)

Our Biggest Problem

We're cooking the planet with our fossil carbon emissions!



Carbon Negative Power & Products via Biomass Gasification + Biochar



How we refossilize carbon back underground with power, plants & agriculture

The All Power Labs Solution



Biomass Fuel
(agriculture & forestry
byproducts)

**Organic Waste to useful
Power & Products**



Electricity & Heat



**Carbon
Sequestration
(Biochar)**

**Drought & Water
Management**



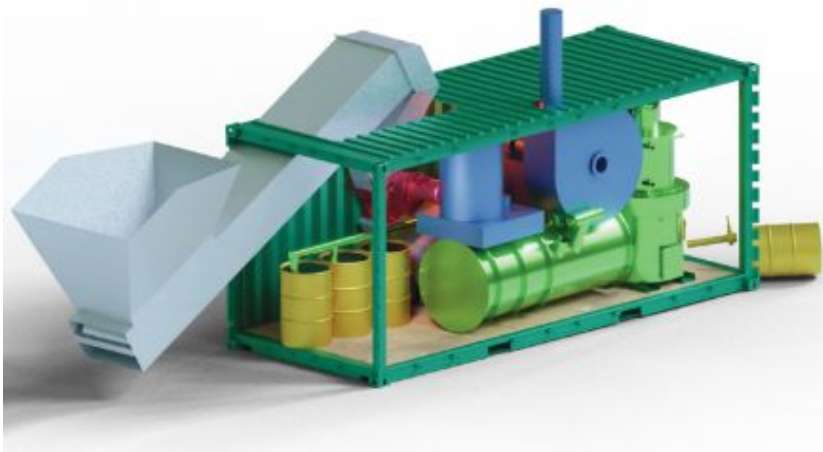
APL Product Platforms



Power Pallet- Biomass to electricity, heat & biochar



Watertainer- Biomass powered atmospheric water generator with biochar and heat

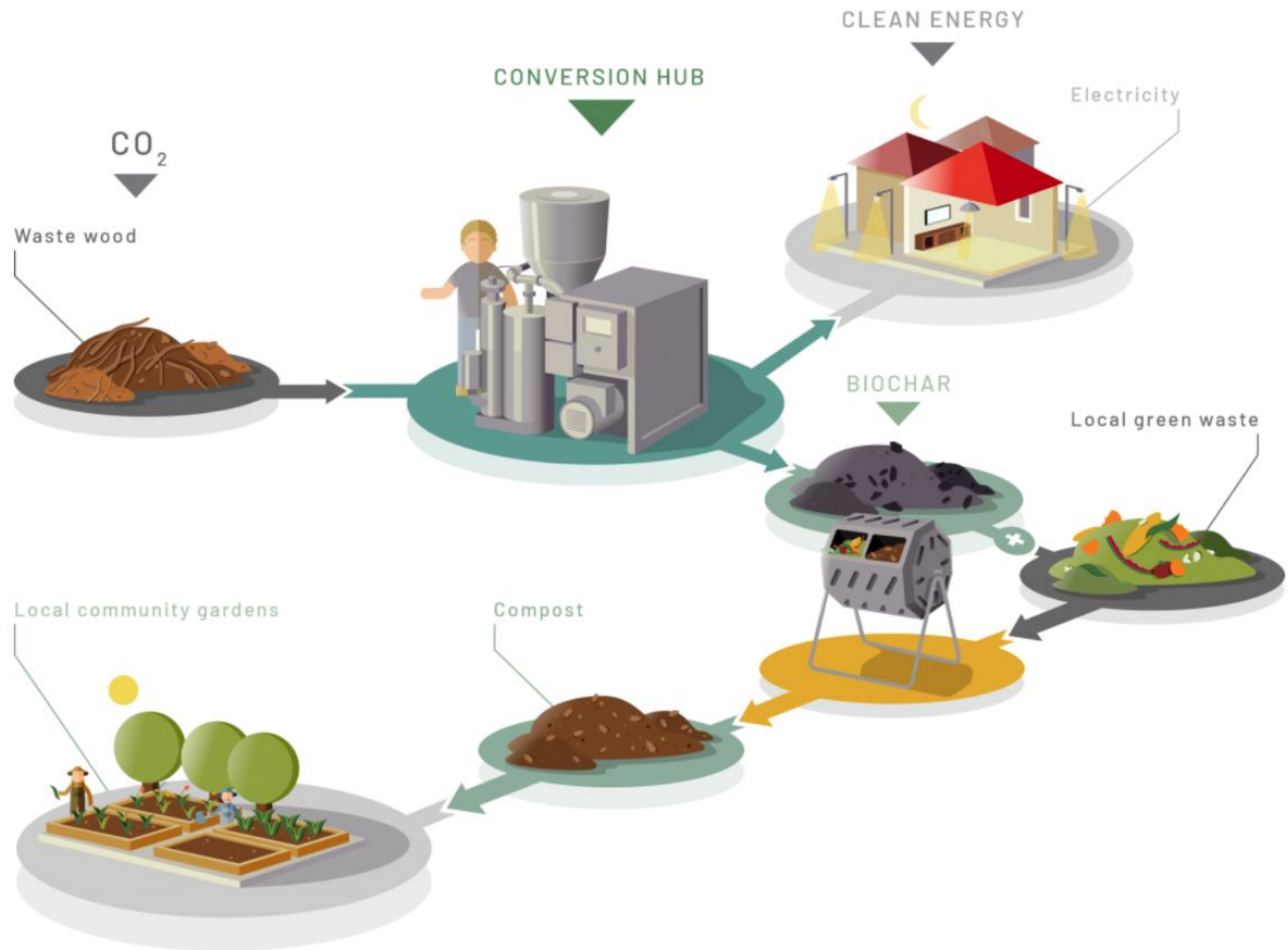


Chartainer - biomass to gas biochar & heat



Powertainer- Biomass to electricity

Wet and Dry Wastes: Co-Composting with Biochar



Pumpkin Plant

Grown at Gill tract Community Farm in Albany, California.

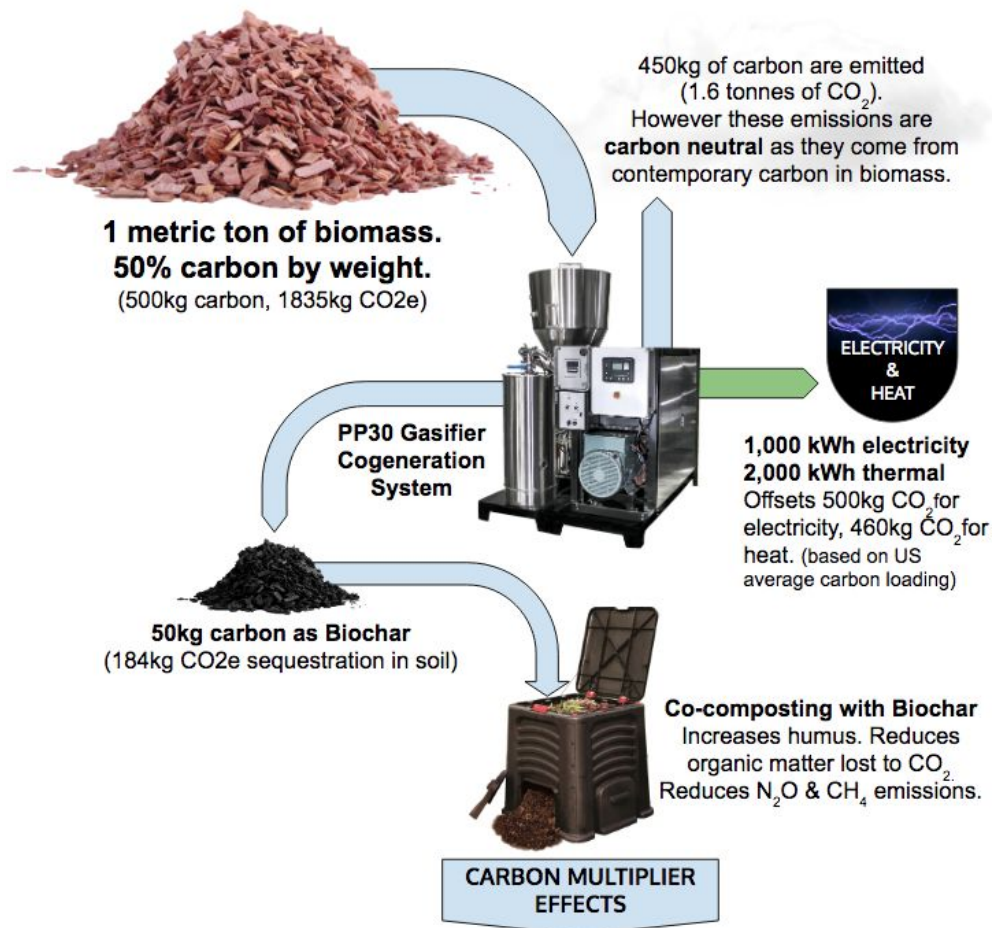
Plain compost



Co-composted
biochar



Total carbon flows and CO₂e impacts



50kg direct carbon sequestration
(184kg CO₂e)



Standing biomass
increase ~250kg
(458kg CO₂e)



Soil Organic Matter
~1 tonne increase in humus, plant exudates, fungal mycelium, glomalin, microbes, etc (1835kg CO₂e)



N₂O & CH₄ emission reduction 10-90%
(CO₂e varies w/ soil)



The Model: Optimizing for Impact Ratio

Calculating "All-in" Impact Ratios per unit green-waste input

1.0 kg biomass green-waste produces:

2.2 lbs

CO2e Impacts by Type (in kg)

Offset Avoided Captured Sequestered

1.0 kWh Electricity

grid

0.500

off-grid diesel

0.880

2.0 kW th Heat via CHP

grid natural gas

0.200

6,824 BTU

heating fuel

0.270

0.05 kg Biochar to soil

Biochar yield rate from raw biomass= 5%

0.184

Increased Plant Productivity

Growth acceleration from biochar = 25%

0.459

Reduced GHG emissions from soil (CH4, NO2)

Emission reduction from biochar = x%

0.050

Water Reduction / Conservation

Water reduction from biochar = x%

0.046

Land Restoration, Reforestation, New landscaping

New planting on unproductive land

0.184

Other CO2e Impact Adders

Prevention of biomass anaerobic decomposition

0.150

Post engine CO2 capture and sequestration

0.000

Misc adder #1

Misc adder #2

Total CO2e Impact (in kg)

1.771

0.746

0.200

0.642

0.184

on-grid

2.22

1.196

0.200

0.642

0.184

off-grid

Average of on-grid and off-grid total impact

2.00

(at entered biomass input amount)

"All-in" Impact Ratio per unit green-waste input

1kg Green-waste input produces

2.00

kg CO2e Total Impact

1kg Biochar represents

39.93

kgCO2e Total Impact



Local Carbon Network

Community based carbon sequestration.
Moving carbon “sky-to-soil” to reverse climate change.

OR

*How to reduce atmospheric CO₂e levels 10-40ppm over 1 century
through a collaboration of People, Plants and Machines.*

The carbon capture sky funnel already exists!

A massive carbon capture system waits for smart climate engagement in green-waste piles all around the world!



Urban tree & yard waste



Agricultural byproducts



Forestry management



LCN connects the sky carbon funnel to local soil



- UC Gill Tract Community Garden (UC Berkeley)
- Spiral Garden Community Food Security Project, Berkeley
- California Habitats Indigenous Activists, Berkeley
- Ashby Community Gardens, Berkeley
- Peralta Community Garden, Berkeley
- Transition Berkeley, Berkeley
- Planting Justice, Berkeley
- Norcal Community Resilience Network, Berkeley
- Malcom X School Garden, Berkeley
- Northside Garden, Berkeley
- Good Shepherd Church Garden, Berkeley
- California Habitats Indigenous Activists, Berkeley
- Emeryville Community Garden, Emeryville
- Big Daddy's Complete Rejuvenating Community Garden, Emeryville
- PLACE for Sustainable Living, Oakland



Local Carbon Clusters

Local Carbon Cluster: East Bay Area



Green Waste Recycle Yard

Biomass Source



Acapulco Rock & Soil

Biomass Source



All Power Labs

Conversion Hub



Peralta Community Garden



UC Berkeley

Berkeley



Spiral Gardens Community Food Security Project



Malcom X School Garden



Ashby Community Garden



PLACE for Sustainable Living



Emeryville Community Organic Garden



Bee Green Recycling & Supply
Biomass Source

Piedmont

Local Carbon Clusters

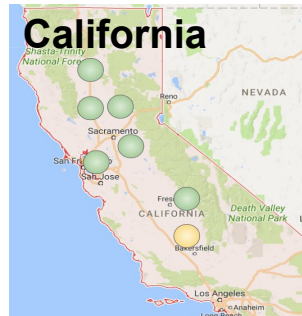
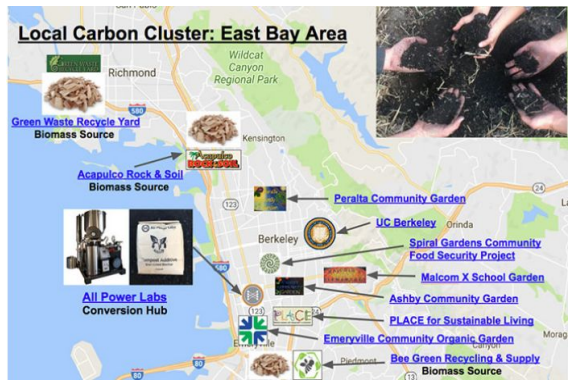


13 nodes
284.90 kg biochar deployed
8,547 kg CO₂e

Oakland

Scaled Carbon Clusters

East Bay, CA



Global Network



The world's biggest problems.
The world's biggest opportunities.

Join us.



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Press

“THE MOST IMPORTANT AND TRANSFORMATIVE ENERGY PRODUCT THAT NO ONE HAS HEARD OF”

“You take the waste of photosynthesis, which is abundant and free, and convert it to a form compatible with internal combustion engines, which are abundant and very cheap.... In terms of lean manufacturing and design, we’ve figured out how to do this as a Zen fasting retreat.”

FAST COMPANY

“CARBON-NEGATIVE ENERGY, A REALITY AT LAST -- AND CHEAP, TOO”

“In Berkeley, Calif., All Power Labs is turning out machines that convert cheap and abundant biomass into clean energy and rich, efficient charcoal fertilizer.”



“CAN ENDING ENERGY POVERTY ABROAD CREATE JOBS AT HOME?”

“...All Power Labs has... turned existing ideas about development aid and manufacturing jobs on their head... there’s one thing we know for sure: it’s companies like these that can and will help lift hundreds of millions out of energy poverty -- if they receive investment”



San Francisco Chronicle
SAN FRANCISCO CHRONICLE AND SFCHRONICLE.COM | Monday, November 30, 2015 | Section D
All Power Labs has a green-hot idea



“THIS BERKELEY STARTUP & ITS ENERGY MACHINES ARE ABOUT TO TAKE OFF”

“...they have the enthusiasm, momentum, & innovative thinking rarely seen in such an organically-emerging startup. And if their gasifiers are ever able to reach any substantial scale, they could have a profound effect on the emergence of off-grid power in the places that need it most.”

GIGAOM