



ARBOR

BIOBASED CARBON-NEGATIVE ENERGY

Commercial Pilot Project (Auburn, CA)

TARGET ONLINE DATE: Sep 2027

PROJECT DEFINED

Power: 3 MWe

Carbon Removal: 60-75,000 tons/yr (CO₂)

Feedstock: 45-55,000 BDT/yr (forest waste)

PARTNERS ESTABLISHED

Host: PCWA (Placer County Water Agency)

Feedstock: Chipped waste forest biomass

CO₂ Storage: Trucked to nearby EPA Class VI well

Technology Partner: GTI Energy

MAJOR MILESTONES

Site Selection: COMPLETE

Design Basis: COMPLETE

Feedstock Assessment: COMPLETE

Power Offtake: MOU (PCWA)

Carbon Removal Offtake: MOU (Carbon Direct + Frontier)



Location: 38°53'06.4"N 121°06'24.6"W

The Problem

Many, many sources iterate the same problem and underlying challenges:

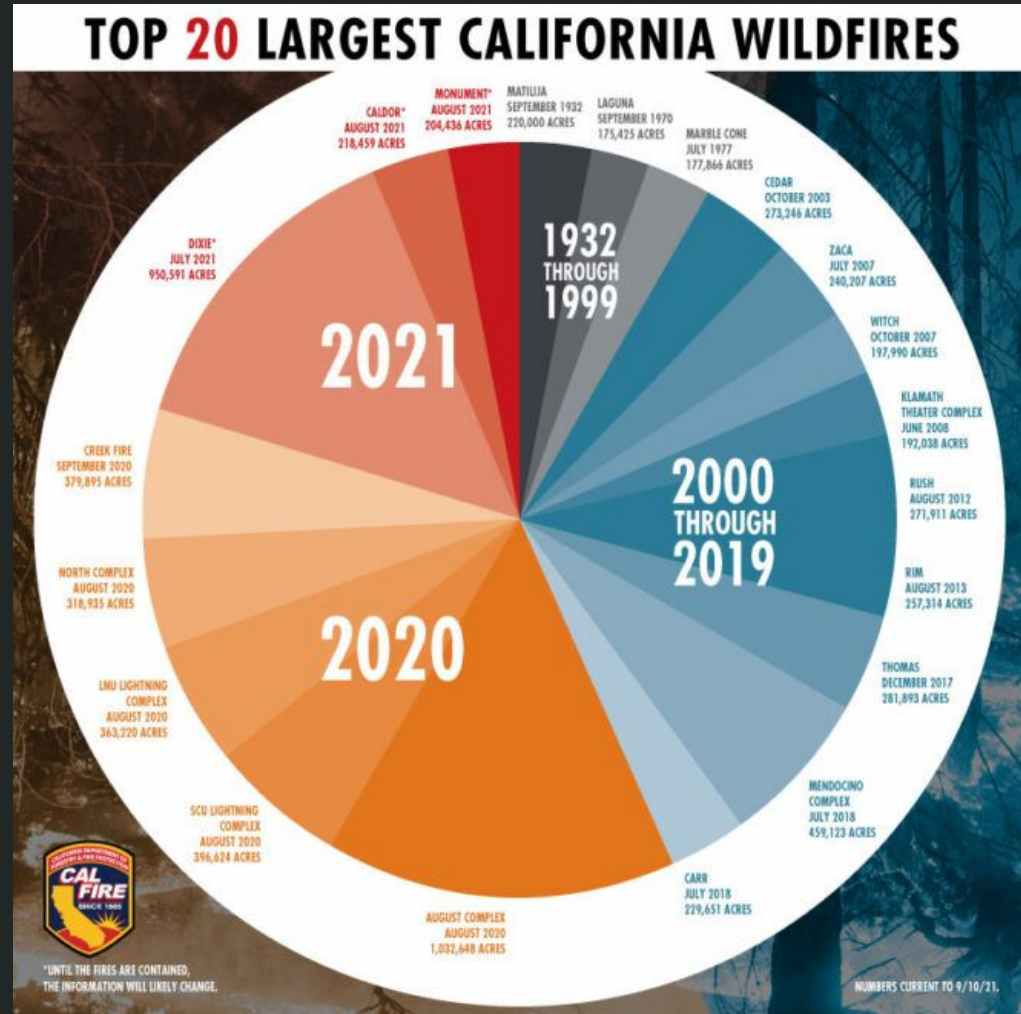
- California has a huge and growing wildfire problem that threatens public health, economic growth, climate goals, and the livelihood of millions of Californians
- A huge driver for this: **too much biomass in the forest** to handle under current conditions

From *Getting To Neutral* by Lawrence Livermore National Laboratory:

“The goal of managing one million acres per year will either require large amounts of dedicated funding, **or more profitable approaches to fuel reduction treatment.**”

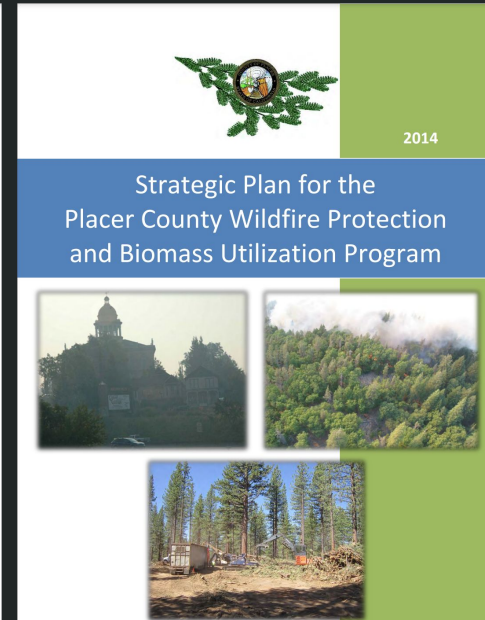
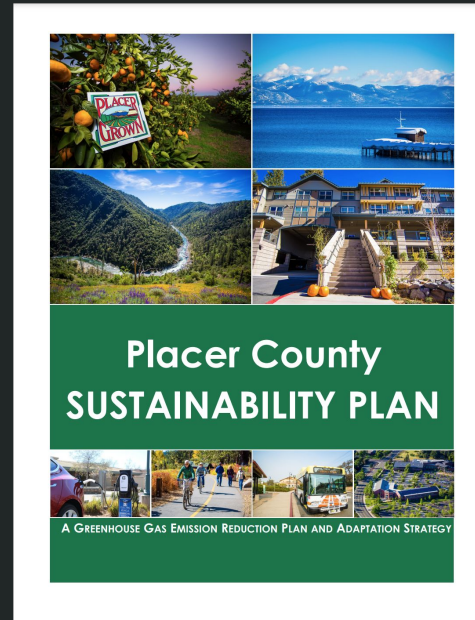
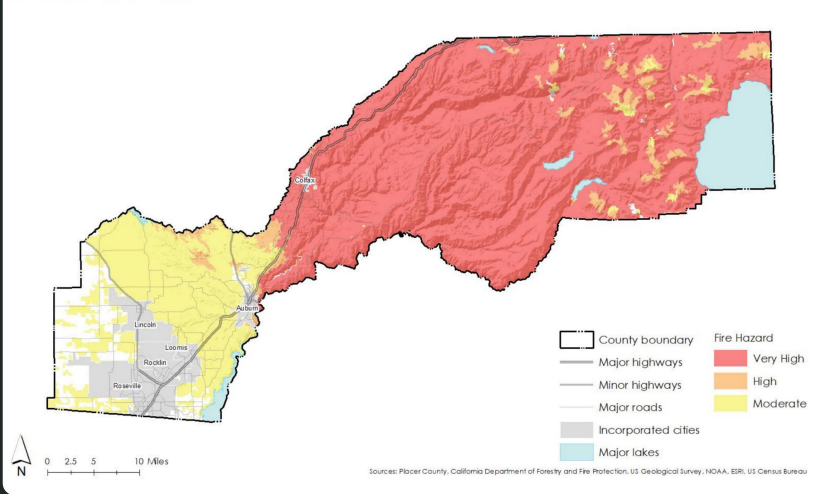
...

“This is a complex task in California forests, which fall under different ownerships with varying goals.”



Placer County Context

Current Wildfire Risk



*“For Placer County to be successful in the biomass utilization sector it will need to continue to attract and promote **leading technical partners** that can help determine the County’s best opportunities for **biomass utilization**. In particular, it is absolutely critical that the County cultivates **private interest in the biomass utilization** component of the Program” - Strategic Plan for Placer County Wildfire Protection*

Challenges and Solutions



Transportation and Processing Costs
Generation of valuable co-products



Poor feedstock power density
Unique business case for facility



Inconsistent feed quality
Feedstock agnostic design

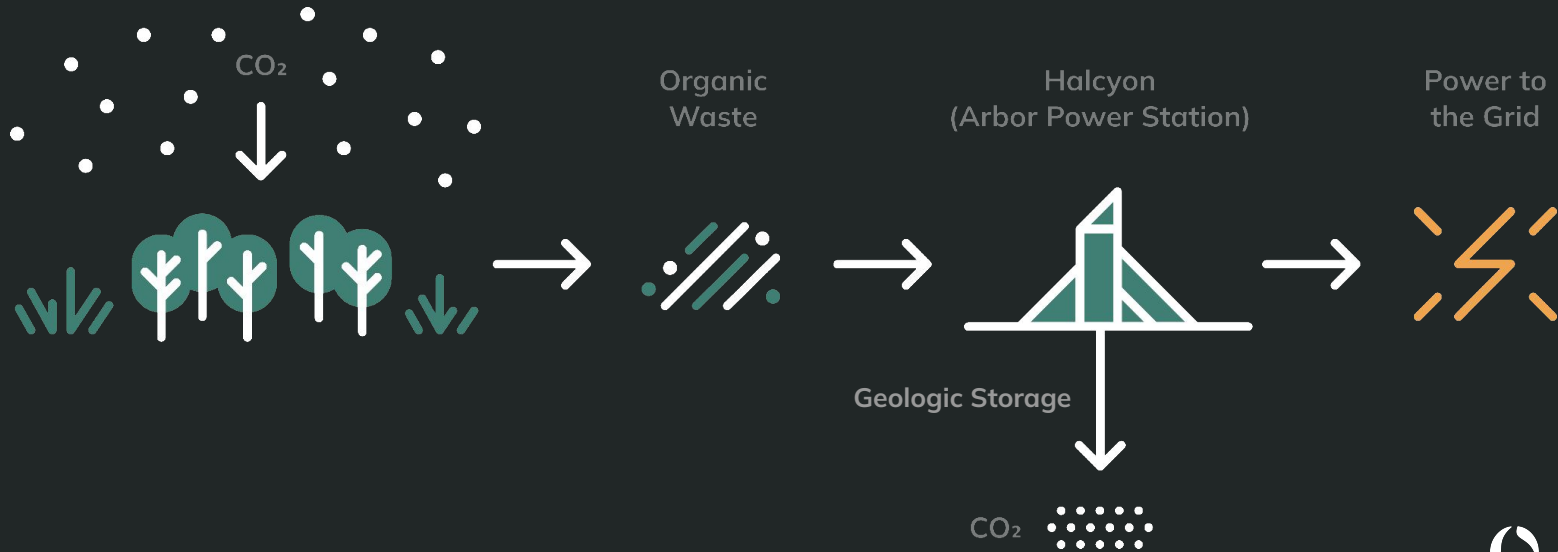


Local air quality concerns
Pollutant capture central to process

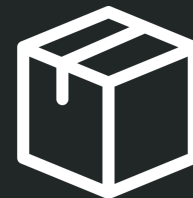
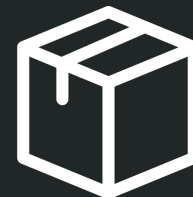
2. The Arbor Approach

Carbon-Negative Power

WE ARE USING ROCKET TECHNOLOGY TO TURN ORGANIC WASTE INTO ENERGY WITH NEGATIVE EMISSIONS. BIOENERGY WITH CARBON CAPTURE & PERMANENT STORAGE.



Business Case



1 BDT Biomass + Air

.6-1.2 MWh
(\$80-160 w/ BIORAM)

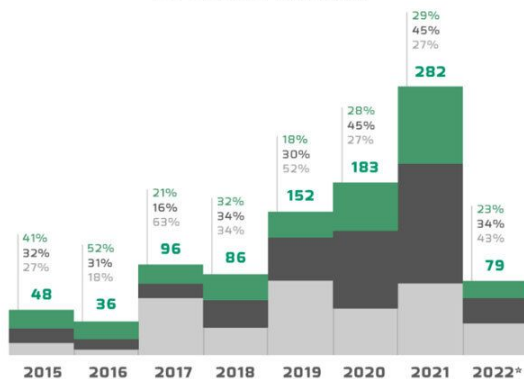
2 tons CO2
(\$170 federal credits
+ \$500 voluntary)

Higher value products = More money into the forestry ecosystem = More land treated = More waste biomass

Business Case

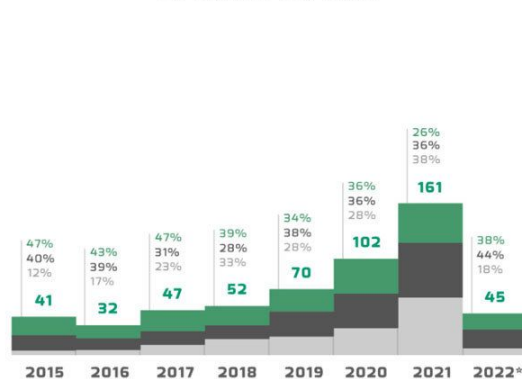
ALL ISSUANCES

BY CREDIT TYPE, Mt



ALL RETIREMENTS

BY CREDIT TYPE, Mt



KEY

REDD+

RE

ALL ELSE

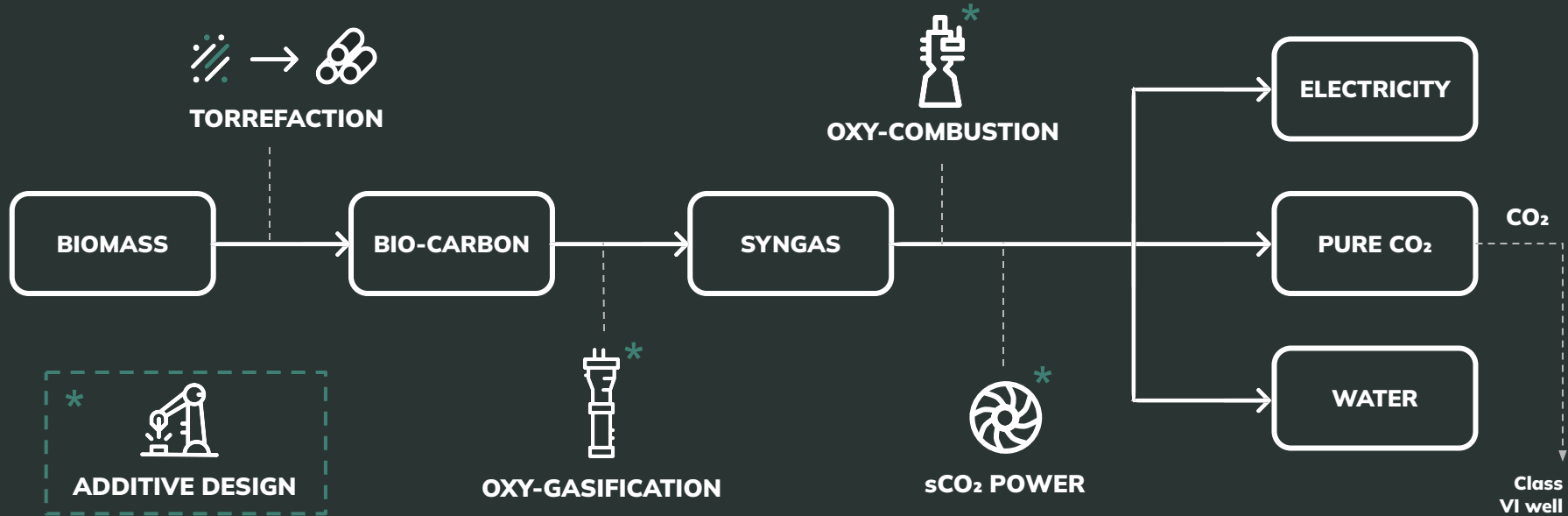


Carbon Direct

Frontier

System Overview

DESIGNED FROM A CLEAN SHEET - ROCKET ENGINE TECHNOLOGY REPURPOSED FOR A CLEAN FUTURE.



Technology Development

COMMERCIALY PROVEN

Torrefaction



TRL 9

Demonstrated commercially by multiple companies that Arbor plans to engage

Gasification



TRL 8

Novel Gasification System (R-Gas):
Demonstrated by GTI with coal

Oxy-Fuel Combustion



TRL 8

Demonstrated by Parametric Solutions Inc (PSI) & GTI

sCO2 Power



TRL 8

Demonstrated by NET Power, Echogen, Peregrine Turbines, GTI w/ STEP



TRL 5

Demonstrated ultra-dense phase flow of torrefied biomass - the key hurdle for using R-Gas with biomass. **A world first!**

ACHIEVED: Q3 2022



TRL 5

Demonstrated supercritical oxy-fuel combustion of syngas with complete flame stability. **A world first!**

ACHIEVED: Q2 2023



TRL 5

Demonstrate integrated sCO2 power system at plant scale

TARGET: Q3 2024

TRL 5
Partial-Scale
Validation



First-of-a-Kind Manufacturing



sCO₂ Heater



Oxycombustors

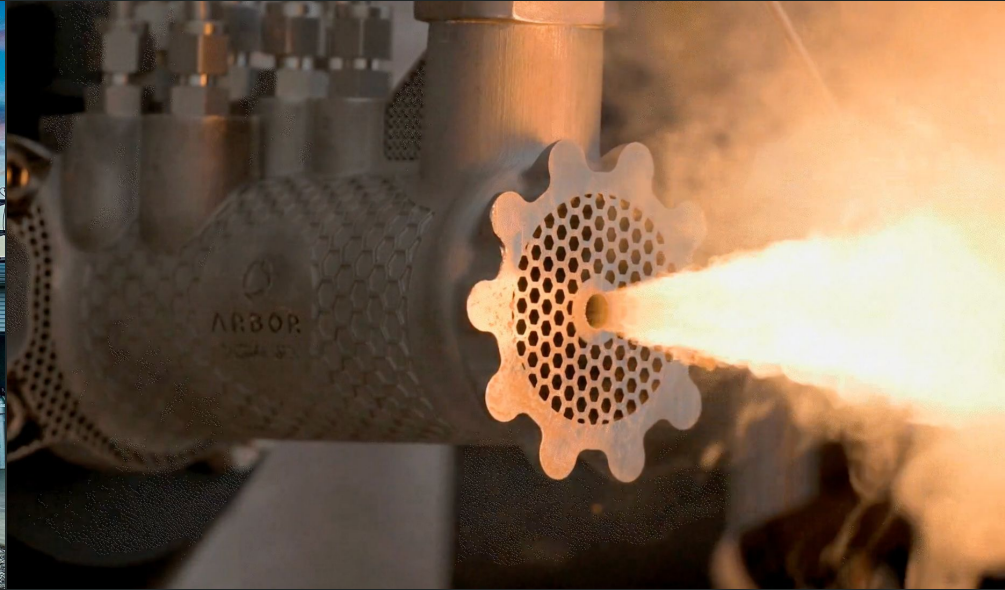


Combustion Stand

Testing a Vegetarian Rocket Engine



Mojave Test Site



Ignition Testing

3. Pilot Project and Path Forward

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Project Partners & Support

\$2.8M

Grant Funding

7

Project Partners

16

Letters of Support



Stakeholder Engagement

CONDUCTED OVER THE COURSE OF 9-12 MONTHS IN 2022 AND 2023

Meetings were held with representatives of ~50 organizations and agencies including:

- **Federal, State, and Local Government**
 - **Federal:** USFS, US Dpt. of Energy
 - **State:** CA DOC, CA Energy Commission, Governor's Office of Planning and Research, CalFire, Sierra Nevada Conservancy, California Air Resources Board
 - **Local:** Placer County Air Pollution Control District, Placer Community Development Resource Agency, Sustain Auburn, Newcastle-Ophir MAC
- **Community-Based, Non-Governmental, or Advocacy Organizations**
 - Placer County Fire Safe Alliance, Placer County RCD, The Nature Conservancy, Sierra Institute, Sierra Business Council, National Forest Foundation, Climate Transformation Alliance
- **Workforce Development and Community Colleges**
 - ADVANCE Center, Sacramento Sierra Building & Construction Trades Council, People Working Together, Sierra College, Placer County Office of Economic Development, Golden Sierra Workforce Development Board
- **Traditionally excluded groups and organizations representing them**

The Leadership Team



Brad Hartwig

CEO | [LinkedIn](#)

Former Rocket Propulsion Engineer at SpaceX, Previous Flight Test Engineer & Test Pilot at Kitty Hawk.



Miho Beal

Head of Operations | [LinkedIn](#)

Former Sr. Manager Purchasing & New Product Introduction at Rivian. Previously Gas Turbine Application Engineer at GE



**Andrés
Garcia-Clark**

CTO | [LinkedIn](#)

Former Principal Turbomachinery Engineer at SpaceX, Previously Sr. Design Engineer for Gas Turbines at GE



Sutton Guldner

Head of Business Development | [LinkedIn](#)

Former Project Engineer at Shell, Harvard MBA (Energy and Sustainability focus), M.S. Mechanical Engineering, Cornell.

The Business & Project Development Team



Dr. Farrah Powell

Community Engagement, Science, & Policy | [LinkedIn](#)

PhD Environmental Studies & Climate Change Policy from UCSB. Expert in life cycle assessment, environmental & social justice, grant writing & data analytics



Estéban Arreguin

Project Development | [LinkedIn](#)

30 years experience developing and operating power plants and bioenergy projects. EHS/regulatory compliance expert. 10 years experience leading hypersonic vehicle development



Josh Raycroft

Director of Strategy & Partnerships | [LinkedIn](#)

Former Head of Business Development at Embark Truck and VP Strategy & Partnerships at Virgin Hyperloop. Previously multiple Design and Systems Engineering roles at GE Aviation