



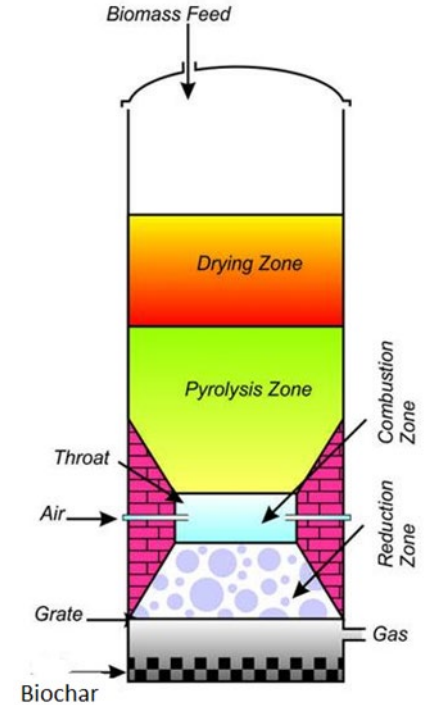
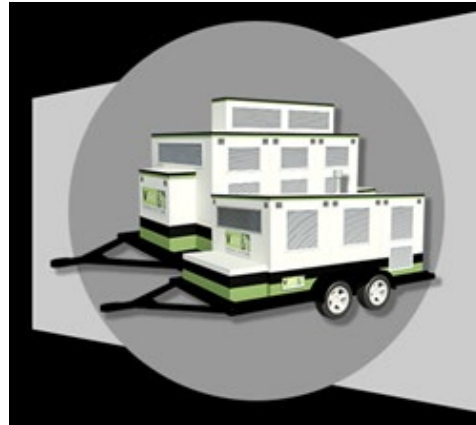
V-Grid Energy Systems, Inc.

© Copyright 2019 V-GRID Energy Systems, Inc. *All rights reserved*

V-Grid BioServers

James Dodsworth

- Why Are We Here?
- Benefits of V-Grid to Address Forest Biomass
- Soil Enrichment and Forest Health with Biochar
- Emissions Testing
- Discussion



3 MAJOR CONTRIBUTORS OF CLIMATE CHANGE IN CALIFORNIA

Natural Gas Power Plant – Manmade



The US Energy Information Agency now projects that most new electricity generator plants will be natural gas powered for at least the next 20 years. (EACH) 100MW NG-Power Plant emits 350,000 tons CO₂ per year (90% uptime).

Using V-GRID's 100MW Bioenergy servers
We can create 790,000MWh of clean electricity using biomass as a source and reduce 1.45M tons of CO₂

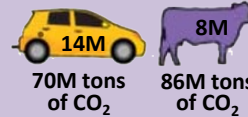
Live Stock – Manmade/Natural



Methane is 23 times worse at trapping greenhouse gases. There are approximately 8M cows producing the equivalent of 86M tons of CO₂ from manure each year.

PERSPECTIVE:

Comparing the CO₂ eq. of cars & cows in CA



Using V-GRID's 100MW Bioenergy servers
We can create 790,000MWh of clean electricity using cow manure as a source and reduce 3.8M tons of CO₂

Beetle Kill Trees – Natural Disaster



As of 2013, beetles have killed more than 88 million acres of pine in BC and the US. Without intervention, these trees will burn or decompose, and emit over 18 Gigatons of CO₂ back into the atmosphere.

Using V-GRID's 100MW Bioenergy servers
We can create 790,000MWh of clean electricity using beetle kill trees as source and reduce 1.45M tons of CO₂

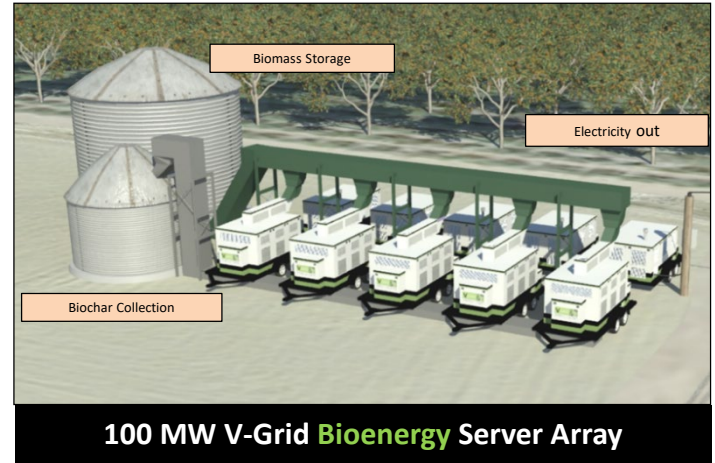
V-Grid technology can create 2,370,000 MWh of renewable clean electricity while reducing 6.7 Million tons of California's CO₂ emissions!!

Comparing Yearly CO₂ Emissions for 100MW Natural Gas Power Plant & V-Grid 100MW Bioenergy Server Array



90% uptime /yr

$100\text{MW} * 24 * 365 * .9 = 790,000 \text{ MWh}$
Assume footprint of 0.5 ton CO₂/MWh,
350,000 tons CO₂ produced/year



90% uptime /yr

**Using V-GRID Technology will create:
790,000 MWh of renewable clean energy
and
prevent/sequester 1.45M tons of CO₂**



CA – 50% → 2030

KEY CONSIDERATION: → California mandate – 50% of all energy from renewable sources by 2030

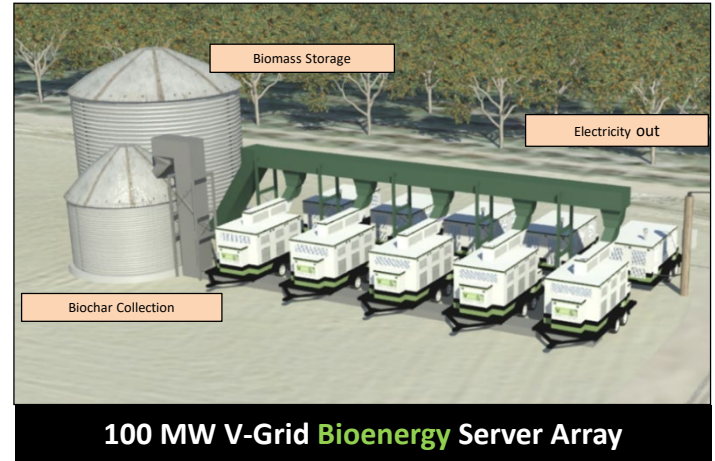
Using V-Grid Bioenergy Server Technology could prevent more than half the release of atmospheric CO₂ from dead or dying beetle kill trees

Beetle Kill Trees – Natural Disaster



IF NOTHING IS DONE...
By either fire or decay:

ZERO Electricity Generated
&
18 Gigatons of CO₂
goes into atmosphere



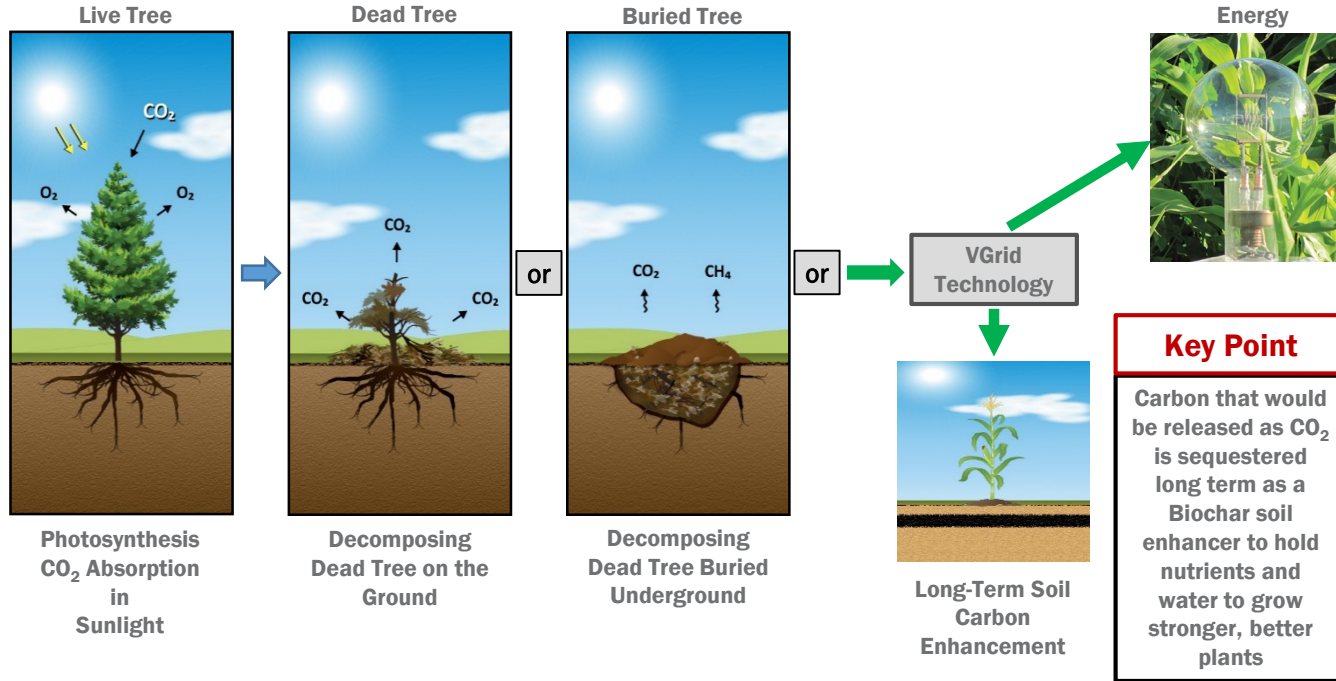
Using V-GRID Technology will create:
790,000 MWh of renewable clean energy
and
prevent/sequester **1.45M tons** of CO₂

Forest Management – The Problem



Plants capture CO_2 as they grow, but all CO_2 is released when they die

VGrid can sequester most of this carbon while cost effectively recharging forest soil for better tree health



Gasification for Forest Improvement

Mobile, Scalable, Self Contained Gasification



The V-Grid Benefit

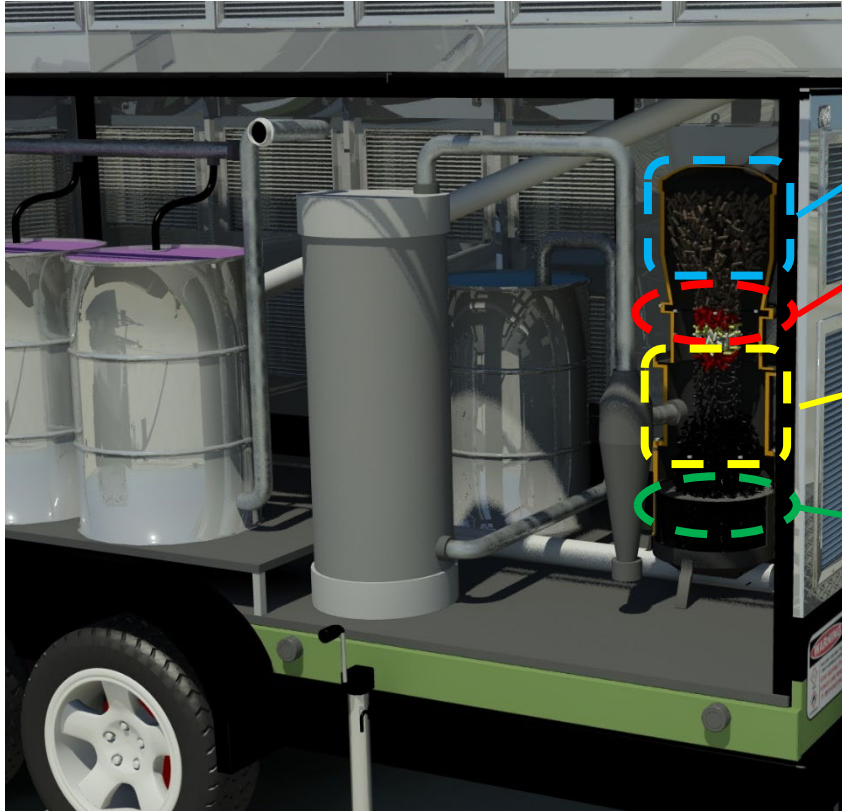
- Avoids burning of forest products and release of hydrocarbons
- Gasification provides *higher quality* biochar for soil improvement in the forests – better carbon sequestration than simple pyrolysis
- Provided as a mobile source for relocation after addressing damaged areas minimizing *transportation costs*
- Modular and “scalable” to *improve efficiency* of the feed system
- Can use electricity output to run feed systems required – chippers, conveyor, etc. further reducing carbon footprint!
- Output biochar can be distributed in the damaged areas for soil/forest health improvement
- Helps community by hiring and training locally

Array Operations

- Arrays consist of 5+ 100 kW Bioservers which can EACH produce up to 2.4 MWh over 24 hrs of operation.
- 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**

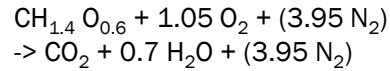


The V-Grid Process

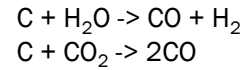


Pyrolysis

Combustion Zone

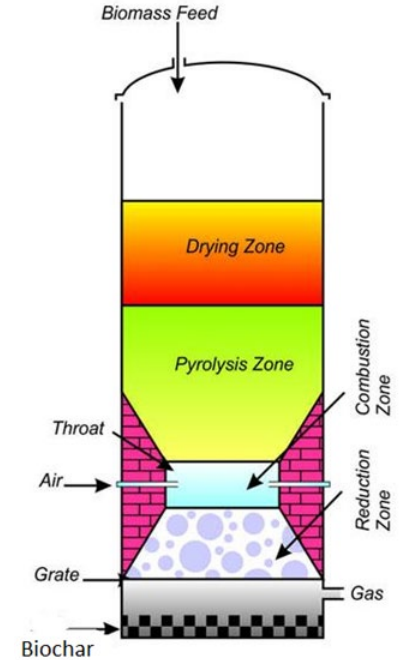


Reduction Zone



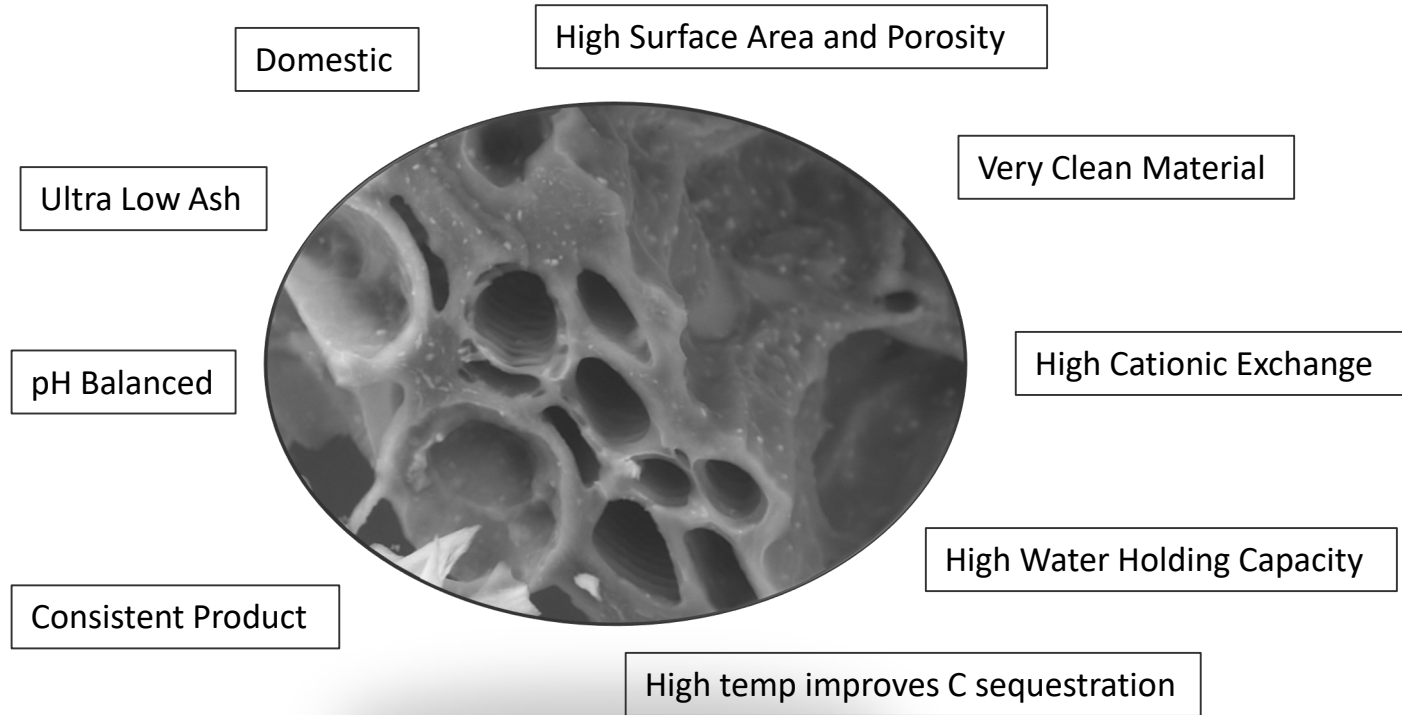
Active Carbon

High Purity
Porosity = 300 m²/g

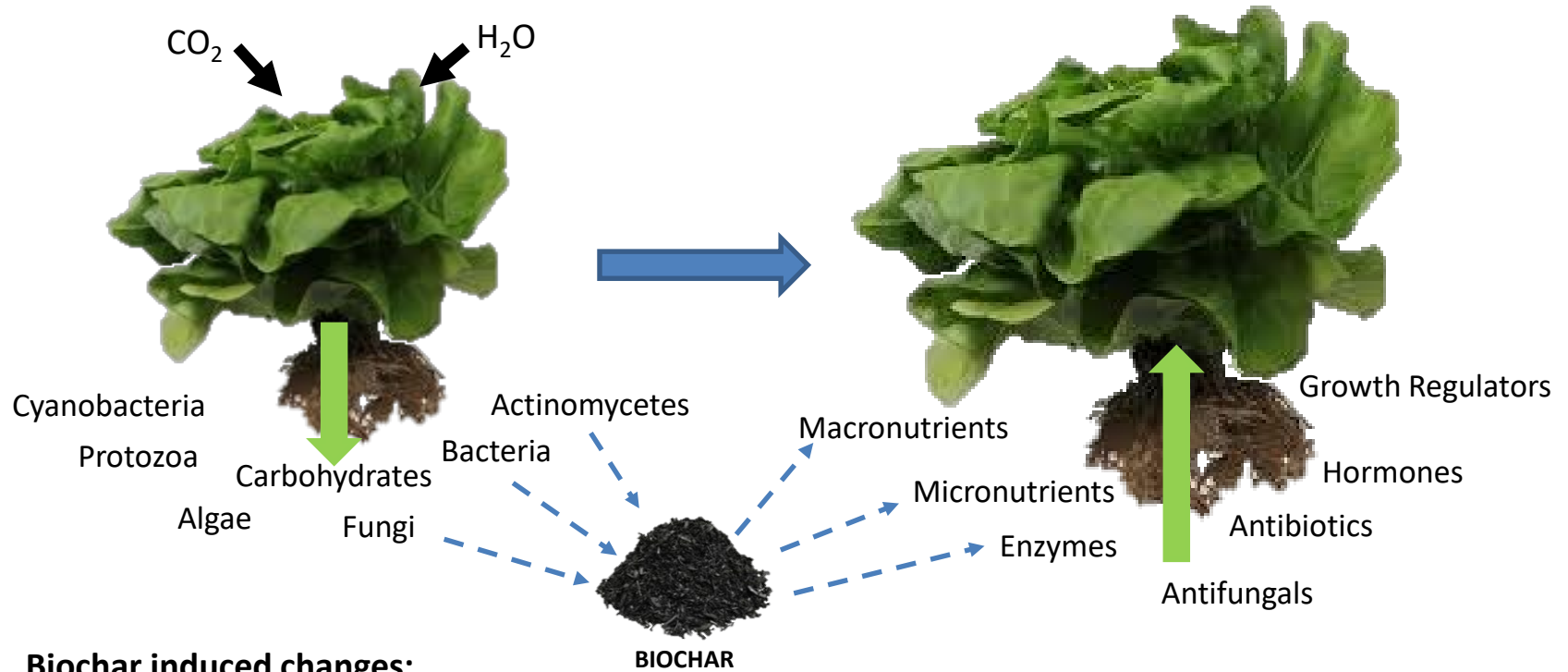


Providing the flexibility to meet multiple output requirements!

The Benefits of V-Grid Biochar



Biochar's Role in the Plant-Microbe Symbiosis



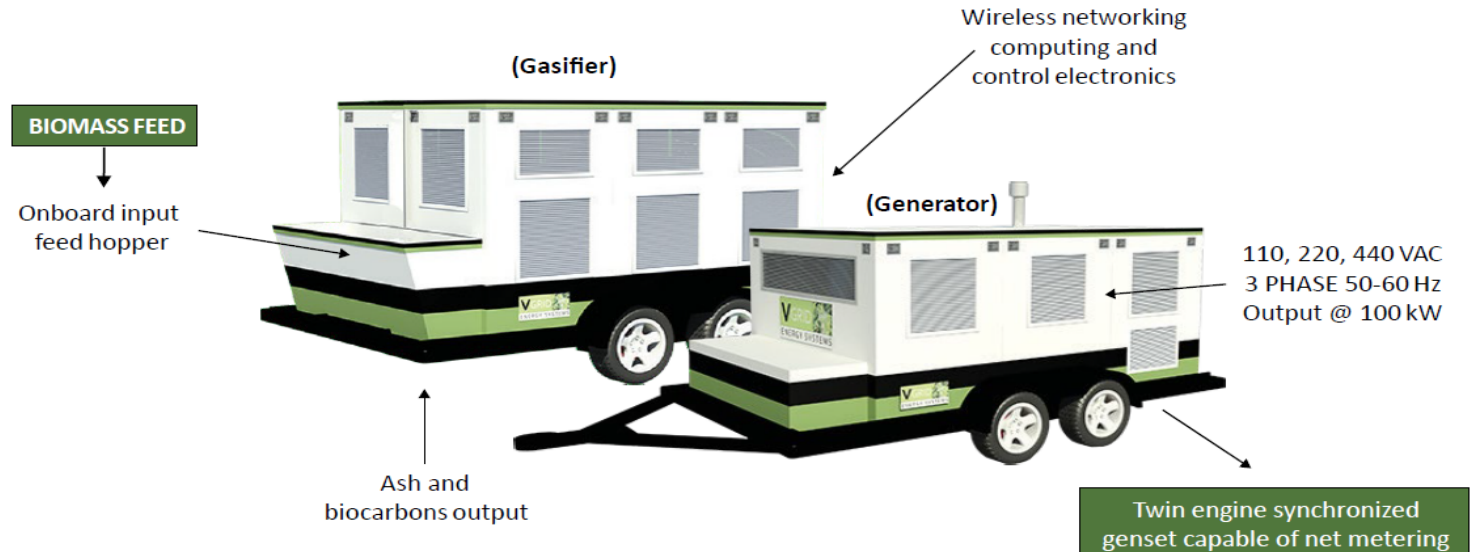
Biochar induced changes:

- Δ Local pH
- \uparrow CEC
- \uparrow WHC
- Refuge for bacteria which help fungi
- Increased nutrient availability
- Increased plant-fungi signaling
- Sorption of inhibitory compounds
- Induced systemic resistance
- Promotes biofilm formation

V-Grid Bioserver Emissions Testing



- Biomass Feedstock Loading
- Feedstock Gasifier to Produce Syngas to the Thermal Oxidizer
- Internal Combustion Engine for Power Generation
- Biochar Loadout



Criteria Pollutant	Daily Emissions (pounds/day)	Annual Emissions (tons/year)
NOx	11.5	2.1
SOx	12.5	2.3
CO	45.3	8.3
VOC	7.8	1.4
PM10	6.2	1.1
PM2.5	6.2	1.1

Total Emissions for 3 V-Grid BioServers

SJVAPCD New Source Review Compliance

- Each unit's emissions are below the SJVAPCD Best Available Control Technology (BACT) thresholds (e.g., 2 pounds/day for NO_x, SO_x, VOC, PM₁₀, and PM_{2.5}) 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_x, 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

Discussion