

**Biomass Gasification** 

# We are a great fit because...

- Proven gasifier technology for biomass management
- Meets Engineered Municipal Solid Waste Facility Definitions
- Experienced team
- Reduce GHG emissions
- Renewable Energy
- Flexibility





# Outline

- Introductions
- Installations
- Gasification Overview
- Process Flow
- Implementation





# Who is Aries Clean Energy?



Originally funded by Thompson Machinery, Aries closed additional corporate financing with Spring Lane Capital solidifying equity financing.

Aries acquired downdraft technology from APA, and fluidized bed technology from MaxWest environmental. Both are commercially proven systems.



# Installations



Downdraft gasification system in Lebanon, TN.

i loven lechnology.	Proven <sup>-</sup>	Technol	logy:
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Client/Location	Date	Equipment	Output
Boral Brick - Phenix City, AL	2003 (3) PHG-08 Gasifiers		12 mmbtu/h
Boral Brick - Augusta, GA	2005 (3) PHG-08 Gasifiers		12 mmbtu/hr
Boral Brick - Gleason, TN	2008	(6) PHG-08 Gasifiers	36 mmbtu/hr
Boral Brick - Gleason, TN )	Our	gasifiers alone have	1 MW
PHG Energy - Greenwood, MS	logg	ed more than 75,000	32 mmbtu/hr
City of Covington, TN	h	ours of commercial	125 kW
City of Lebanon, TN		Oxiaizer, OKC System	420 kW
City of Sanford, FL	2012	Gen 2 Fluidized Bed- biosolids gasification	NA





# What is Gasification?

*The clean, efficient <u>conversion</u> of biomass into a synthetic gas in an <u>oxygen-starved</u> environment* 

- <u>NOT</u> Incineration.
- More oxygen than Pyrolysis
- Less oxygen than Incineration
- 10% remains as charcoal biochar



## Aries Downdraft Gasifier



- Feedstocks:
  - Woody biomass
  - Biosolids
- Outputs:
  - **Biochar** (high carbon content)
  - Syngas (~100-130Btu/CF, CO + H2)
- 85-90% mass + volumetric reduction
- 60TPD modules
- CO2 reduction



### Aries Fluidized Bed Gasifier



- Feedstocks:
  - Biosolids
  - Refuse derived fuel
  - Woody biomass
  - Food waste (diversion)
- Outputs:
  - Biochar (high carbon content)
  - Syngas (~100-130Btu/CF, CO + H2)
- 90-95% mass + volumetric reduction
- Scaleabale
- CO2 reduction



### **Process Flow Diagram**







**Gasification Plant Tour** 

www.ariescleanenergy.com

# System Overview – Lebanon Downdraft Gasifier



![](_page_10_Picture_2.jpeg)

## System Overview – Sanford Fluidized Bed Gasifier

![](_page_11_Figure_1.jpeg)

![](_page_11_Picture_2.jpeg)

# Output

#### **BioChar**

- Soil Amendment
  - Increased agronomic activity
  - Less irrigation
  - Less fertilizer
- Carbon Sequestration
- Filter media
- High carbon content
- Aries has two letters of intent in place with W. Coast distributors

![](_page_12_Picture_10.jpeg)

![](_page_12_Picture_11.jpeg)

#### Emissions

- Positive Feedback from BAAQMD
  - EPA letter helpful
- Aesthetics quiet, totally enclosed
- Available 365d/yr (not weather dependent)
- Significantly lower CO2 emissions
- Can reduce traffic

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Jeff Snyder Chief Marketing Officer Mar West Environmental Systems Incorporated 1485 International Parkway 30 Lake Mary, Florida <i>the gastifier is not a gastifier is not a</i> <i>the gastifier is not a g</i>
According to the McGuire Woods <sup>*</sup> request, MaxWest constructed a fixed bed downdraft gasifier for processing biosolida <sup>†</sup> in late 2008. Operation began during September 2009. The original fixed bed downdraft gasifier was replaced with a fluidized bed design; construction on this unit began September 26, 2011 <sup>2</sup> . According to information provided in your letter, the current process involves a continuous feed of dried biosolida into the gasifier. The gasifier is operated in an oxygen-starved environment at a temperature of approximately 704 dogrees celcius (°C). No flame is applied to the sewage sludge in the gasifier, nor is a flame propogated as a result of the heating. The gasifier produces what is called a synthetic gas or "syngas." Once the syngas exits the gasifier, it is routed through a particulate matter cyclone and then to a process heater and beat exchanger for heat recovery. The

![](_page_13_Picture_8.jpeg)

# Air Permitting – 3MW woody biomass system

	Gasifier Emissions (Ton/yr)	BAAQMD Threshold <sup>1</sup> (Ton/yr)
ROG	<1	<10
NOx	<8	<10
PM10	<1	<15
PM2.5	<1	<10

1. BAAQMD CEQA Air quality guidelines 5/2017 Table 2-2 "Threshold of Significance"

![](_page_14_Picture_3.jpeg)

# Schedule

#### Approximately 2 years from start to close-out

- 9 month development
- 12 month construction
- 6 month close-out

![](_page_15_Picture_5.jpeg)

![](_page_15_Picture_6.jpeg)

# Air Permitting

	Gasifier Emissions (Ton/yr)	BAAQMD Threshold <sup>1</sup> (Ton/yr)
ROG	<1	<10
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PM10	<1	<15
PM2.5	<1	<10

1. BAAQMD CEQA Air quality guidelines 5/2017 Table 2-2 "Threshold of Significance"

![](_page_16_Picture_3.jpeg)

## **BAAQMD** Feedback to Date

- Positive Feedback from BAAQMD
  - EPA Letter helpful
- Reduces Bay Area traffic impacts on busy roads
- Available 365d/yr (not weather dependent)
- Significantly lowers CO2 emissions
  - Could be used for food waste conversion to

energy

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY WASHINGTON, D.C. 20480
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exitizer process heater are subject to the SSI EG Rule.
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<sup>1</sup> MaxWest provides that the biosolid feed to the gasifier is savage aludge. <sup>2</sup> In determining applicability to Subpart MMMM, the EPA used the "commenced construction" dates as provided by MaxWest. In other words, we did not determine if the applicability of Subpart LLLL at Section 60.4775 applies instead.
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![](_page_17_Picture_9.jpeg)

#### CO<sub>2</sub> Impact – Ex Central San

- Ex facility: Central San could reduce operational CO<sub>2</sub> by 70%+ by gasifying biosolids and generating power
- Additional savings by reducing vehicle trips

![](_page_18_Figure_3.jpeg)

![](_page_18_Picture_4.jpeg)

# CO<sub>2</sub> Impact – Ex Delta Diablo

Project: Gasify imported wood waste + Delta Diablo biosolids to generate electricity

- Benefits include:
  - 467kW renewable electricity
  - Reduce transportation emissions
  - Reduce Delta Diablo overall CO2 emissions 85%
  - Take Delta Diablo 'off grid'

![](_page_19_Figure_7.jpeg)

Delta Diablo: Proposed CO2 Savings from Gasification

Current Gasifier

Source: CH2M Technical Memorandum: "Assessment of Conceptual Gasification-to-Power Facility for Delta Diablo Wastewater Treatment Plant" April 26, 2016

![](_page_19_Picture_11.jpeg)

### **Diversion Discussion**

"The bill [AB1126] would additionally exclude EMSW conversion from the definition of transformation"

**Definition:** 

**Waste Diversion**--As defined in California statute, the combined efforts of waste prevention, reuse, and recycling practices

**Transformation**--Transformation refers to incineration, pyrolysis, distillation, or biological conversion other than composting. The statutory definition of transformation does not include composting, gasification, or biomass conversion.

![](_page_20_Picture_5.jpeg)

# Questions?

![](_page_21_Picture_1.jpeg)

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www.ariescleanenergy.com

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