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Scrap to Profit

www.ariescleanenergy.com

Topics

- What is Gasification
- Facts about Lebanon TN
- Gasifier Technology for Lebanon TN
- The Lebanon Gasification System

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What is Gasification?

What is Gasification

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

- A thermo-chemical process. ***Not Incineration***.
- Result is a low emission, clean fuel called ***Producer Gas*** or ***Syngas***
- ***Feedstock flexible*** over the life of the equipment
- Ability to ***vary output*** to match the energy need
- About 95% of what goes in comes out as fuel gas. The other ***5% is a charcoal biochar*** with many uses.

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Feedstock Specifications

- Consistent feedstock = consistent gas
- Moisture content is key (< 30%)
- Feedstock size: ¼” to 4”
- Ash content < 10%
- Minimum bulk density: 14lbs/ft^3
- Low cost waste streams from other processes can greatly improve economics
- Feedstock “Blends” offer further flexibility

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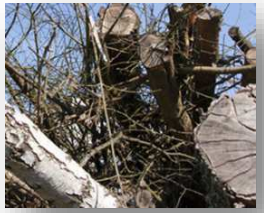
Potential Feedstock

- Woodchips
  - ✓ Urban yard waste, ROW trimmings
  - ✓ Bark or pulp operation waste wood
  - ✓ Manufacturing scrap
- WWWT Sludge
- Food processing residue and other manufacturing waste
- Scrap tires and rubber products
- Agricultural and animal waste
- Switchgrass, miscanthus and other purpose-grown energy crops



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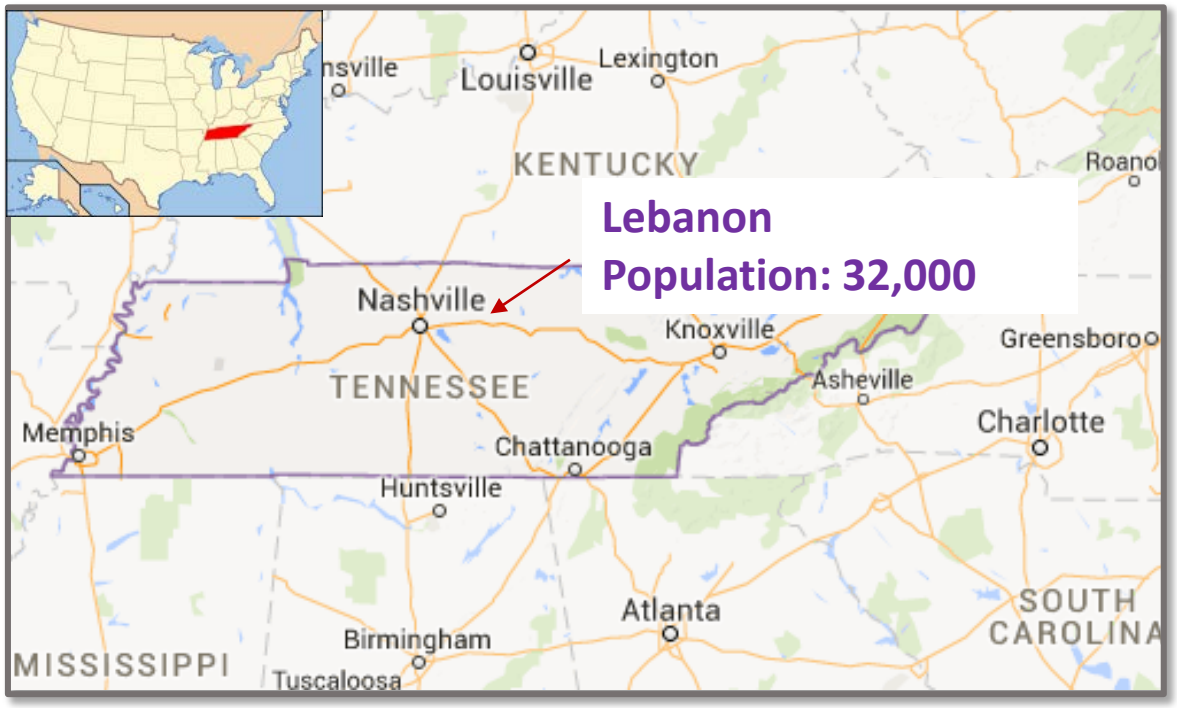
Facts about Lebanon Tennessee

City of Lebanon TN



Drivers

- Landfill reduction
- No Land Application
- Reduce O&M costs
- Create additional revenue

City of Lebanon Tennessee

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Before Gasification

- ATAD to Class A Biosolids
- Land application on farm land

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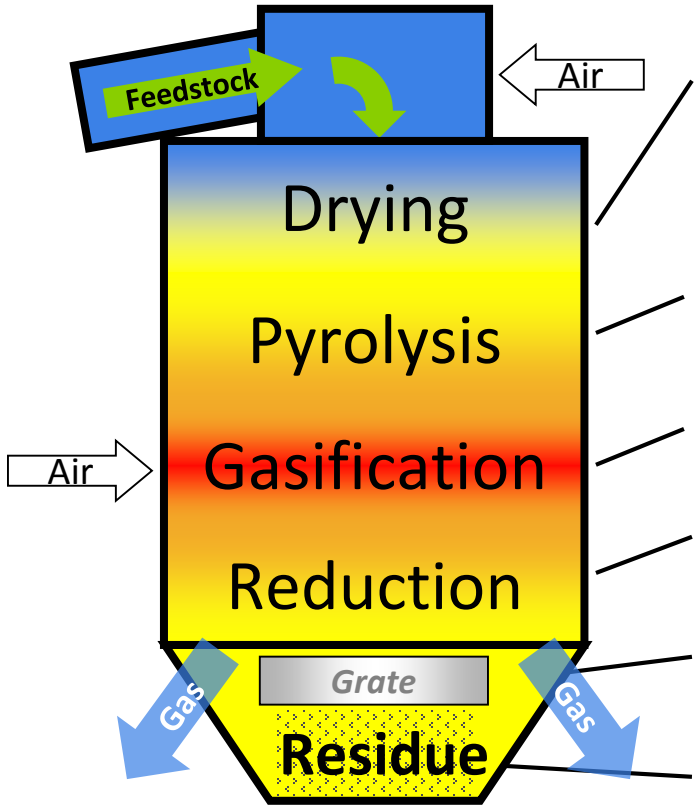
Gasifier Technology

Aries Downdraft Gasifier



Evaporate moisture from the feedstock

Feedstock breaks down to gas and tars

Partial oxidation layer

Carbon reforms with steam to create CO and H_2

Rotating Grate shaves biochar layer

Residue box for biochar removal

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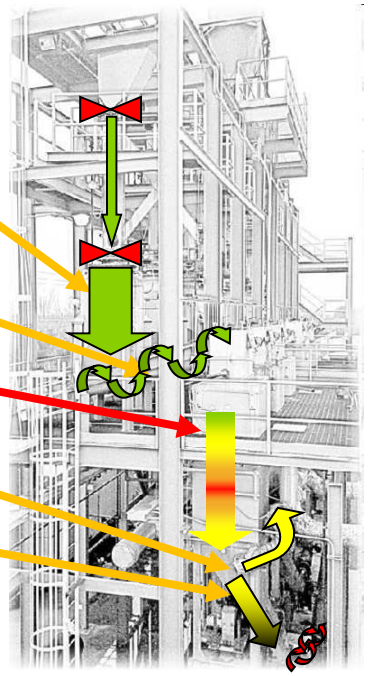
The Flow of Material to Gas



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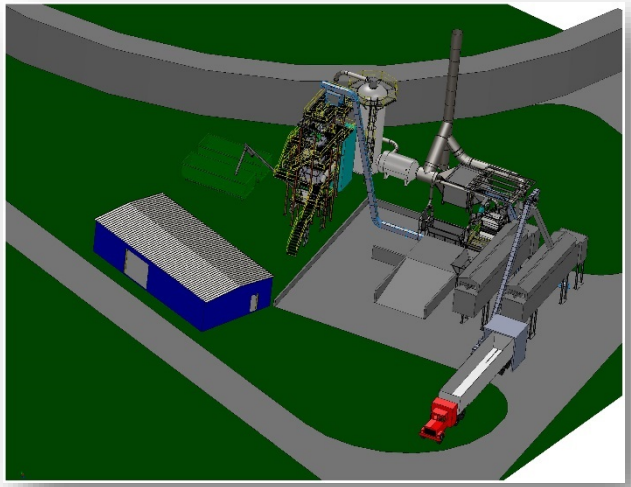
The Lebanon System

Lebanon Waste to Energy



From planning to the real thing

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Project Partners

City of Lebanon

Own and operate the facility

Aries Clean Energy

Technology provider

General contractor

Rockwood

Wood waste and tire processing

Who is Rockwood?

Rockwood

- Local presence
- Provides processing of wood waste & tires
- Logistics & collection of waste
- Public Partnership with City

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Lebanon Waste to Energy Project

Known Operating Elements:

- 32 TPD material processed (Up to 64TPD)
- 3 tons sludge, 3 tons tires, 26 tons wood waste
- Operating 24/5/52 or 6240/year

Variable Income Elements and <u>Cash Flow Drivers</u>:

- Tipping fee income to City from Industry and/or Wilson County
- Material hauling and pre-processing costs
- Taking existing ATAD offline and processing sludge in gasifier

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Feedstock Preparation

ROCKWOOD RECYCLING

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Mass & Energy Balance

FEED DATA

Dryer Inlet Feed

		Green Wood	Pallet Wood	TOTAL WOOD	Tires	Muni Sludge	Total
Moisture Content	------->	40%	10%	18%	5%	75%	**27%**
Wet Rate (lb/hr)	**------->**	**1,000**	**1,200**	**2,200**	**250**	**250**	**2,700**
Dry Rate (lb/hr)	------->	600	1,080	1,680	238	63	**1,980**
Water Rate (lb/hr)	------->	400	120	520	13	188	**720**
Tons/Day (24 hr)	------->	12	14	26	3	3	**32**
Tons/Year		12	14		3	3	
@							
6,000	hr/yr	3,000	3,600	6,600	750	750	**8,100**

Gasifier Inlet Feed

	Green Wood	Pallet Wood	TOTAL WOOD	Tires	Muni Sludge	Total
Average Total MC	20%	20%	20%	20%	20%	**20%**
Wet Rate	750	1,350	2,100	297	78	**2,475**
Dry Rate	600	1,080	1,680	238	63	**1,980**
Water Rate	150	270	420	59	16	**495**
					TPD @ 20% MC	29.70

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Time Lapse Construction

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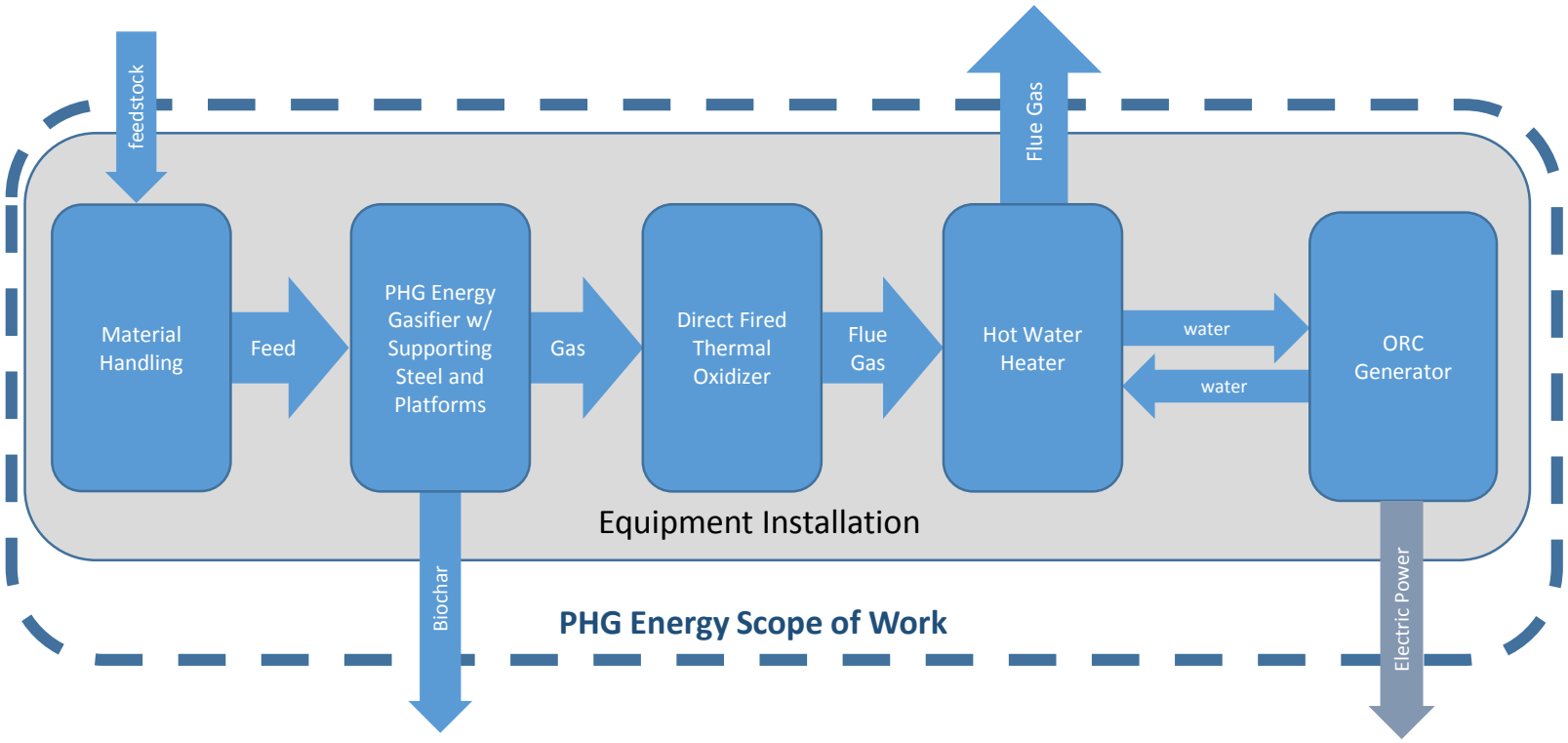
Lebanon PFD



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System Components

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Feed System

- Fully enclosed
- Walking floor
- 50 ton capacity

Material Dryer

- Dries green wood to 25% moisture
- Utilizes waste heat

Gasifier

- Downdraft Gasifier
- 64 ton/d
- Continuously feed
- 25MMBtu/hr. net

Thermal Oxidizer

Fuel Gas is Combusted in the thermal oxidizer to cleanly produce heat

Heat Drives an Organic Rankine Cycle Generator to make electricity through a hot water loop

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Heat Exchanger

Heat recovery for hot water loop to ORC's and material dryer

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GE ORCs

- 3X 140kW ORC's
- 300 degree F hot water

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Biochar Collection

- Fully enclosed system
- Indirect cooling
- Automated switch over

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Questions? -- And Thank You

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