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RETTEW SM

Synthica Energy, LLC
St. Bernard Organics to Energy Facility

Presentation Outline

BCI

- Introductions
- Overview of Synthica and St. Bernard Project
- Project timeline
- Contracting Method
- Construction Considerations

~~Rettew~~ BCI

- General AD/RNG info and overview
- Synthica St. Bernard Process Design
- Operations

- Questions

Introductions

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- Jason Wert - Market Leader - Water, Renewables and Energy Production - RETTEW Associates, Inc.

Biogas vs RNG (Renewable Natural Gas)

- **What is biogas?** When organic wastes decompose in an oxygen-free environment they release biogas. This process is called *anaerobic digestion* and it is common for organic wastes like food scraps and uneaten food, animal manures and sewage.

- Biogas is a mixture primarily of carbon dioxide (CO_2) [generally 44%-24%] and methane (CH_4) [generally 55%-75%], with smaller amounts of nitrogen (N_2) and trace amounts of hydrogen sulfide (H_2S), ammonia (NH_3) and hydrogen (H_2). Moisture (H_2O) is also a significant component of biogas.

- Because biogas comes from materials that are the product of the current carbon cycle, the CO_2 produced when it is used as fuel is considered biogenic—meaning it comes from natural sources—and therefore carbon neutral. It is can be upgraded to become "**Renewable Natural Gas**."

RNG
RENEWABLE NATURAL GAS

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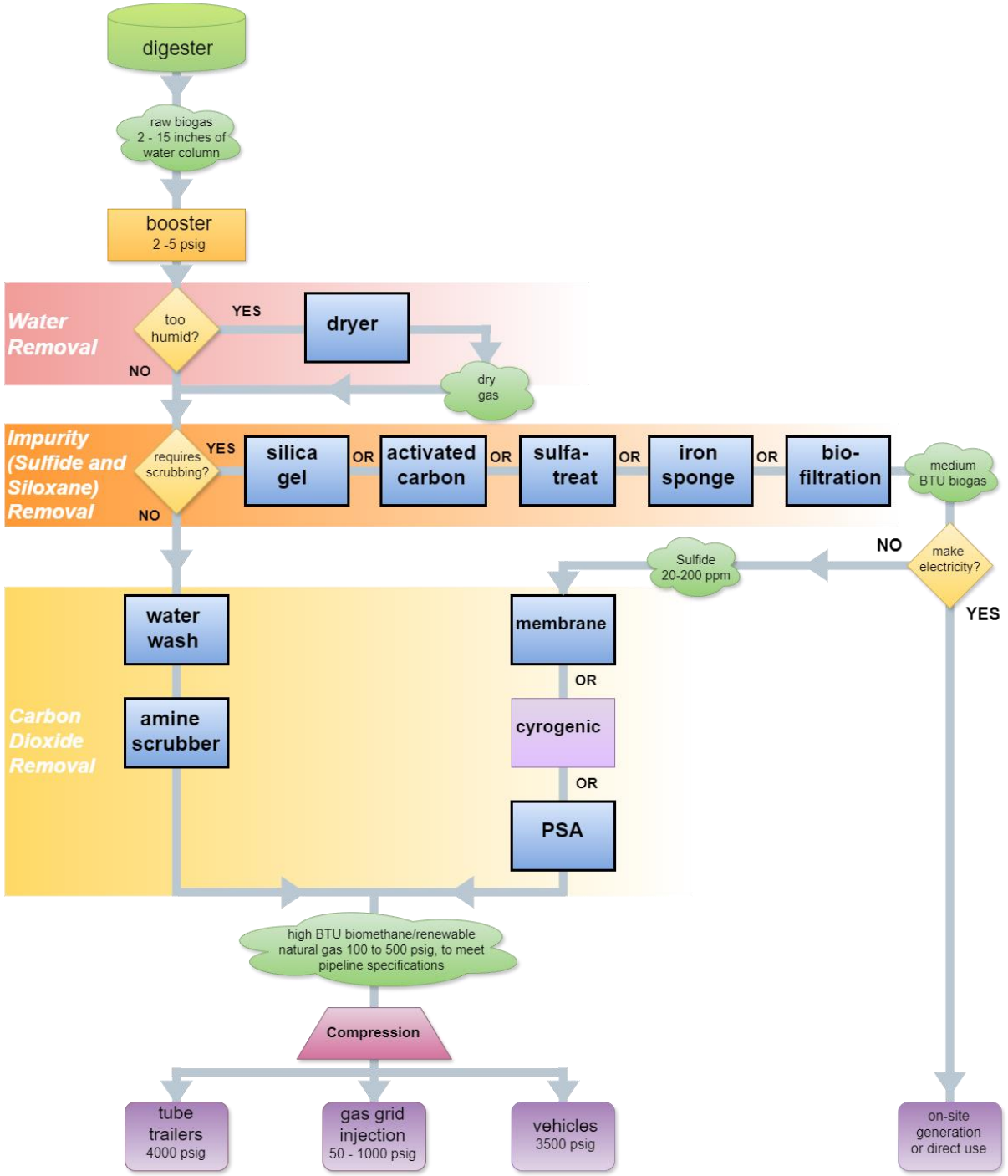
Biogas to RNG

- Because biogas includes significant amounts of methane it is important to prevent it from escaping into the environment. Methane traps over 80x more heat in the atmosphere than CO2. Since biogas often contains enough methane to be flammable, a key strategy for mitigating this potent greenhouse gas (GHG) is capturing it and using as an energy source.

- Biogas can be upgraded to produce RNG. This is done by processing biogas using one (or a combination) of various filtration technologies, which removes the CO2, H2S and other impurities. The remaining gas is 95% or more methane, and suitable for injection into pipelines; it can also be stored or transported by virtual pipeline (tanker trucks).

- Chemically identical to geologic natural gas, RNG can be used in all the same ways. Like biogas, RNG is biogenic and carbon neutral. Depending on the feedstock and other factors, RNG can even be significantly carbon negative



Synthica Energy, LLC

- Synthica is a startup company created by two friends from the Cincinnati area, Sam Schutte and Grant Gibson. They're headquartered in Blue Ash.

- Synthica's mission is to site and build anaerobic digestion facilities in the U.S. heartland to produce biogas for commercial power plants and pipeline injection.

- Their facilities will receive industrial food wastes, organic by-products, brewery washout, and many other wastes, at a competitive price that makes sense when compared to landfills, incineration, or sewer disposal.

- The business model revolves around landing and maintaining feedstock contracts.
  - Business factors: tip fee costs, natural gas prices, environmental Corporate Social Responsibility (CI scores), political

SSB - Major Players and Involvement

- **Synthica Energy, LLC**
  - Owner
- **Private Investors**
  - Early financing
- **Rettew Associates, Inc.**
  - Design Engineer
- **UGIES** – UGI Energy Services (Utility Provider in Northeast)
  - Co-owner and Financing
  - Managed Construction
- **Building Crafts, Inc.**
  - General Contractor
- **Goldman Sachs**
  - Private Equity Partner

Synthica

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UGI Energy Services

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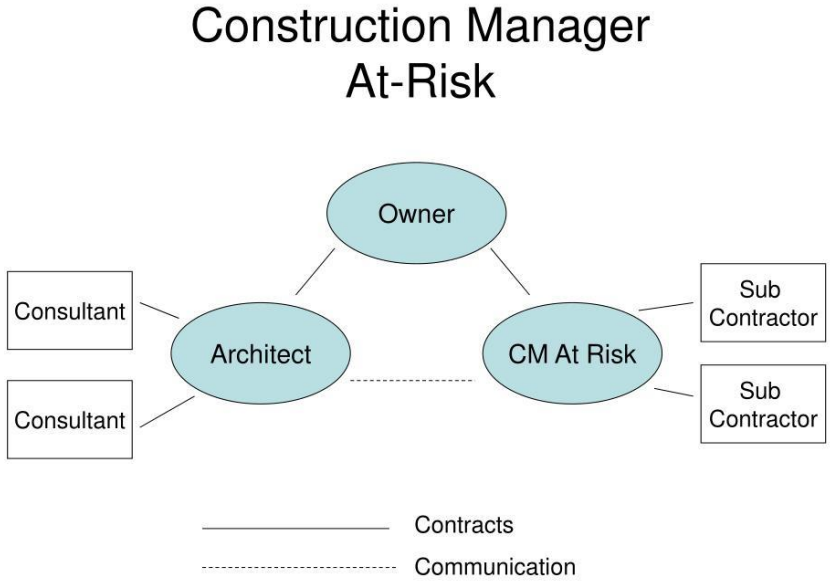
Goldman Sachs

Synthica St. Bernard Contracting

- Synthica contracted Rettew Associates, Inc. for engineering and design services.
- Wanted to bring a contractor in early to help with planning and design.
- Decided on **CMAR (Construction Manager at Risk)** for construction schedule and cost planning purposes.
- Building Crafts was brought on board around 30% - 60% design
  - Cost Control: Estimating/Value Engineering
  - Constructability
  - Early construction packages for schedule (and marketing)
- We had two separate contracts
  - Pre-construction Services Agreement (T&M)
  - Construction Services – Negotiated a GMP around 90%



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Synthica St. Bernard
Organics to Energy Digester Facility

- St. Bernard is Synthica's first facility. Construction is basically completed.
- Joint venture of Synthica Energy, LLC and UGI Energy Services
- Located along Vine Street/Spring Grove Ave. near lots of industrial activity (Claims to be the first Anaerobic Digestion Plant within 50 miles of Cincinnati, OH)
- $60+ million capital investment
- Facility will be rated to handle 190,000 tons per year of pre-consumer food and industrial organic waste.
  - 25 truckloads/day
- Capable of 260,000 MMBtu pipe-line quality Renewable Natural Gas (RNG) per year: approx. 4,000 homes/yr

Synthica St. Bernard – Development Schedule

- **2015** – Sam & Grant have concept to build an anerobic digestor in Cincinnati.
- **2017** - Rettew retained by Synthica
- **2019** – St. Bernard site identified and purchase agreement issued.
- **March 2023** – Preliminary Construction Services Contract (DBIA 520) executed with Building Crafts
    - BCI joined design meetings giving contractor input and developing an estimate/GMP
    - Completed early work packages on T&M agreed upon rates
- **Aug 2023** – DBIA 530/535 Agreements Executed: Cost plus fee with a guaranteed max price (GMP)
- **Aug 2023** – Construction started under GMP contract
- **Feb 2024** – Bldg structures completed
- **March 2024** – Tanks Completed
- * **May 2025** – Facility accepts first delivery of Food Waste *
- **July 2025** – Dewatering Bldg started up: MSD compliant
- * Biogas Upgrading and RNG delivered to pipeline – **2026**

IRA – ITC's

UGIES and Synthica utilized **Section 48 ITC's** (investment tax credits) under the IRA (Inflation Reduction Act)

- Apprenticeship requirements
- Prevailing Wage
- "Buy American" was NOT utilized for SSB

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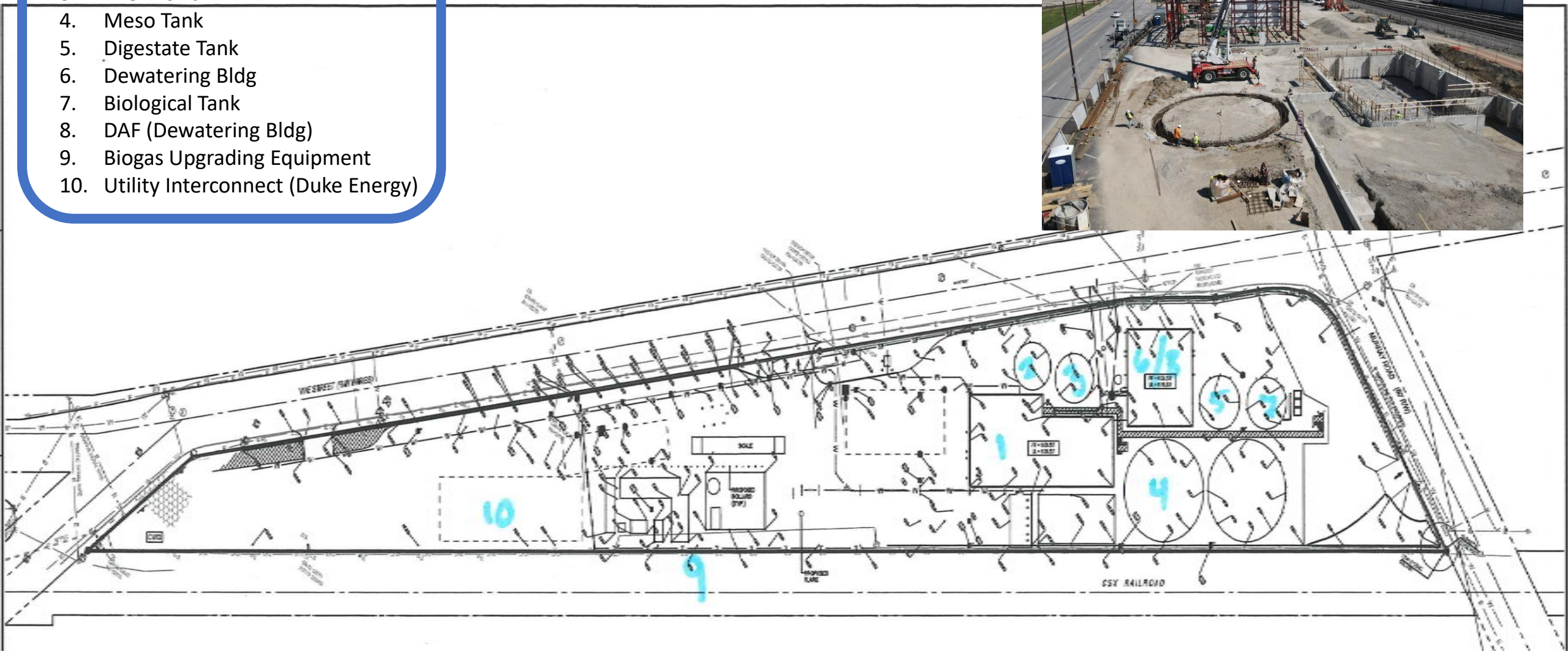
Synthica St. Bernard

Site Layout

1. Waste Receiving Bldg
2. Combined Waste Tank
3. Thermo Tank
4. Meso Tank
5. Digestate Tank
6. Dewatering Bldg
7. Biological Tank
8. DAF (Dewatering Bldg)
9. Biogas Upgrading Equipment
10. Utility Interconnect (Duke Energy)



Synthica St. Bernard – Site Selection

Site Selection:

- The site was a school bus lot (First Student)
- Thin/long pizza shaped

Challenges:

- How to fit all of the structures on site?
- Make sure there is room for trucks to maneuver.

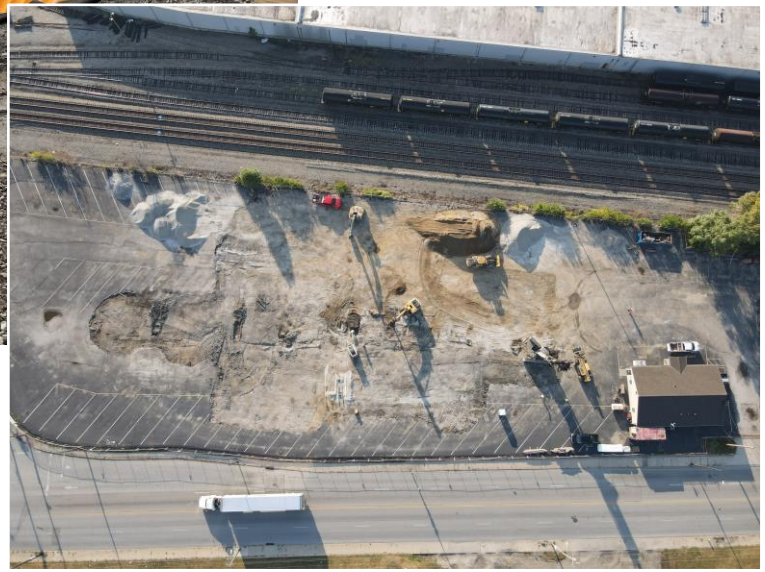
Solutions:

- Structures had to be built taller and deeper to achieve size and capacity requirements
- Tighter together saved some costs but made the construction schedule linear “longer”

Synthica St. Bernard - Soils

Soils:

- Historically industrial part of Cincinnati (P&G, St. Bernard Soap, ect.
- Asphalted over previous site(s)
- Buried railroad tracks and previous unknown foundations were hit during excavation

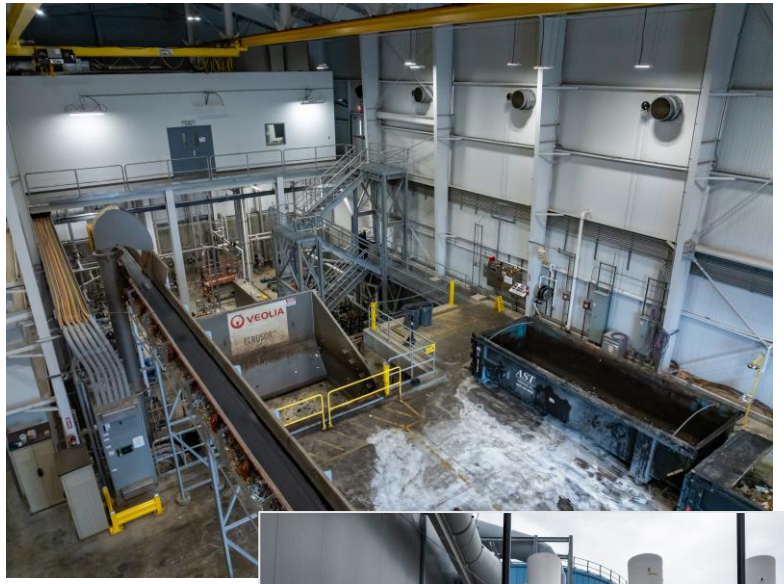


Solutions:

- All structures were built on rammed aggregate piers (apprx 450 – 500 geopiers)
- Meso Tank was much heavier and required Auger Cast Piles
- Underground water retention systems were also installed

Synthica St. Bernard – Design/Const.

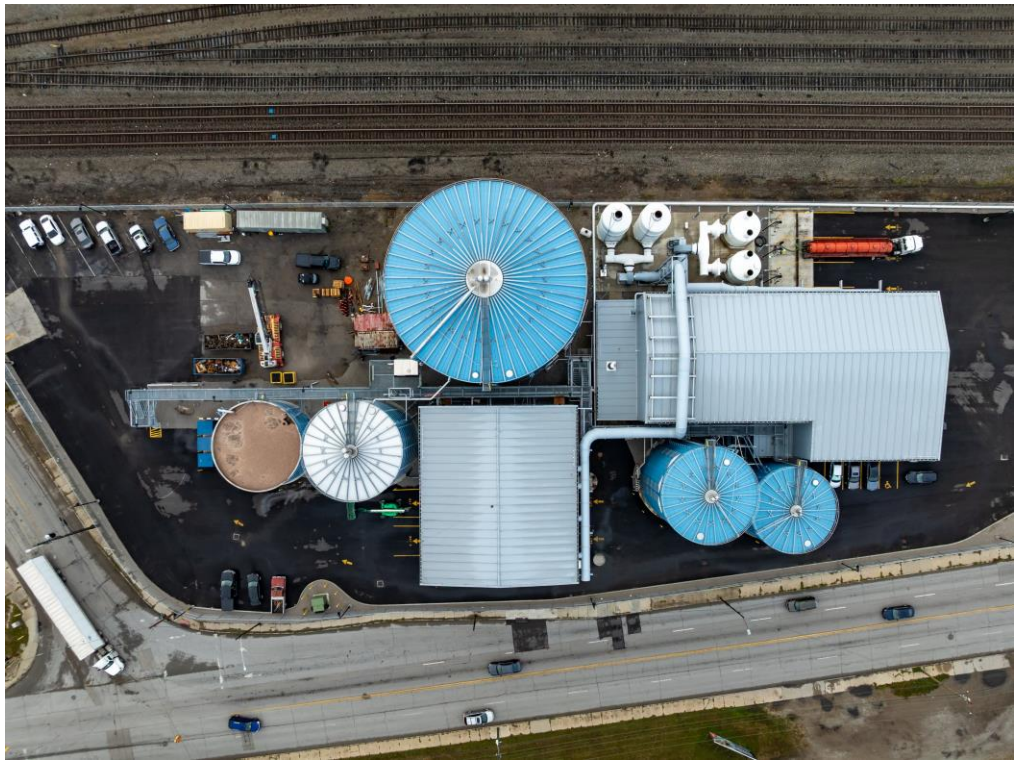
1. **Waste Receiving Building**:
   - Depackaging Unit
     - Packaged food waste in boxes or plastic can be dumped in without removing packaging.
     - Rated for 50 cy/hr (varies)
     - Organics get separated and sent to the Combined Waste Tank
     - Inorganic Material goes through screw & belt conveyors to the dumpster



1. **Waste Receiving Building**:
   - Pump Room
     - Liquid Unloading Pumps
     - Recycle Pumps
     - Digester Feed Pumps
     - Hot water/Booster pump (From Boiler)
     - Heat Exchanger
   - Boiler and gas compressors
   - Facility will use apprx 250,000 – 300,000 gallons of H20/day

Synthica St. Bernard - Design

- The main design of the facility is based around a two-phase anaerobic digester process:
  - Thermophilic Hydrolysis Acidification Reactor (**Thermo Tank**): High temperature and high-pressure hydrolysis for acidification
    - Methanogens - microorganisms
  - Mesophilic Methane Generation Digester (**Meso Tank**): Acetogenesis and methanogensis
    - Mesophiles – microorganisms (methane production)
- *My* understanding of the reason for this two-phase system is for versatility in the feedstock while still trying to maximize methane output.
- Biogas is still collected at each stage



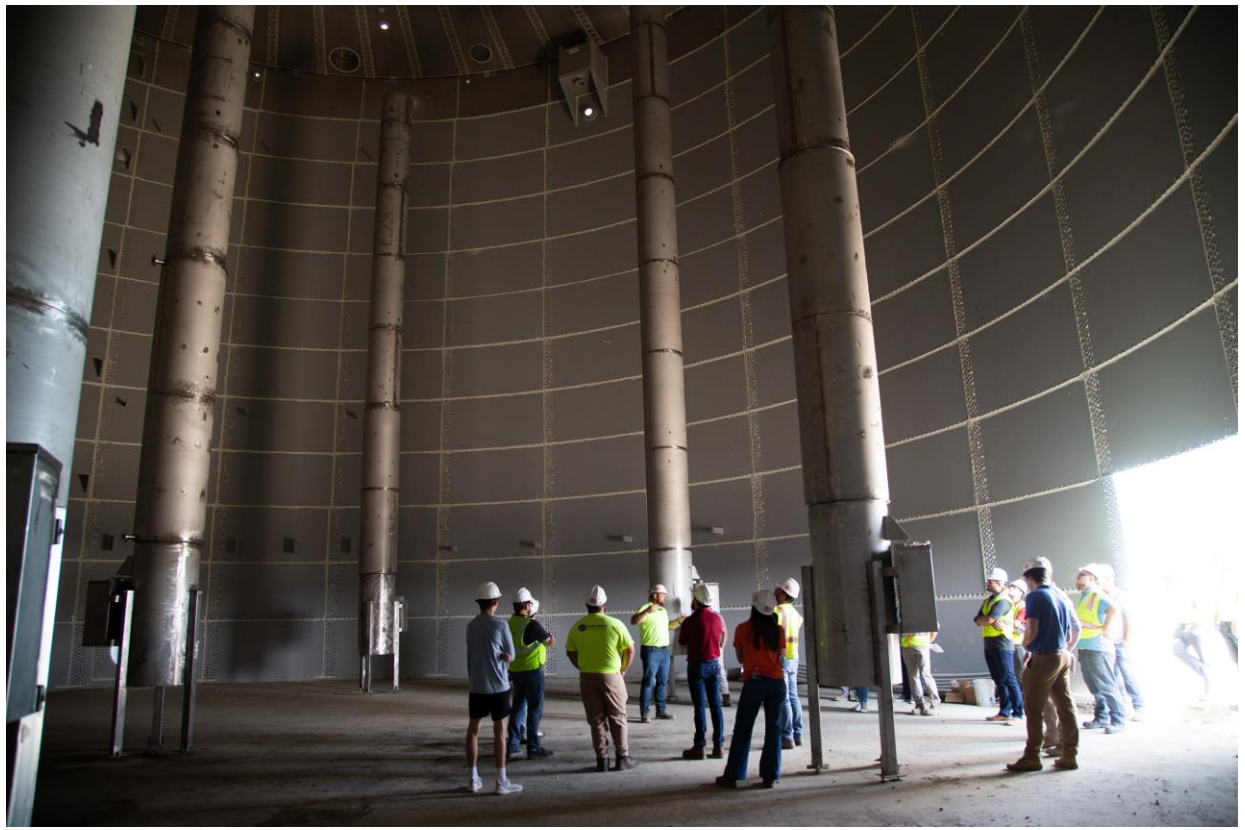
Synthica St. Bernard – Design/Const.

2. **Combined Waste Tank**:
   - 260,000 Gallons
   - Various products coming in with varying pH and chemistry
   - Helps homogenize and can hold product until suitable for AD
   - Chopper pumps circulate flow and mix using 3 nozzles

3. **Thermophilic Hydrolysis Acidifcation Reactor**:
   (Thermo Tank)
   - 470,000 gallons
   - 130-140 degrees
   - Produces biogas at a higher rate
   - Typical retention time: 3-days
   - 6 turbo mixers (42’ tall)

Synthica St. Bernard – Design/Const.

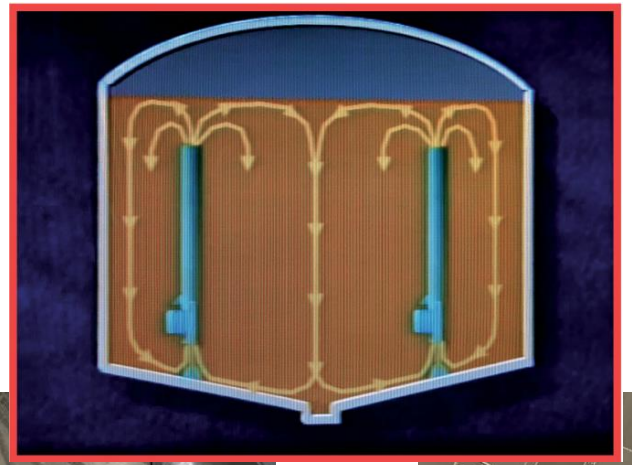
4. **Mesophilic Methane Gneration Digester** (Meso Tank):
   - 80’ dia, 58’ tall, 2.1 million gallons
   - 90 – 100 degrees
   - More stable biogas production
   - Typical retention time: 19-days
   - 8 turbo mixers (46’ tall)



Synthica St. Bernard – Tube Mixers

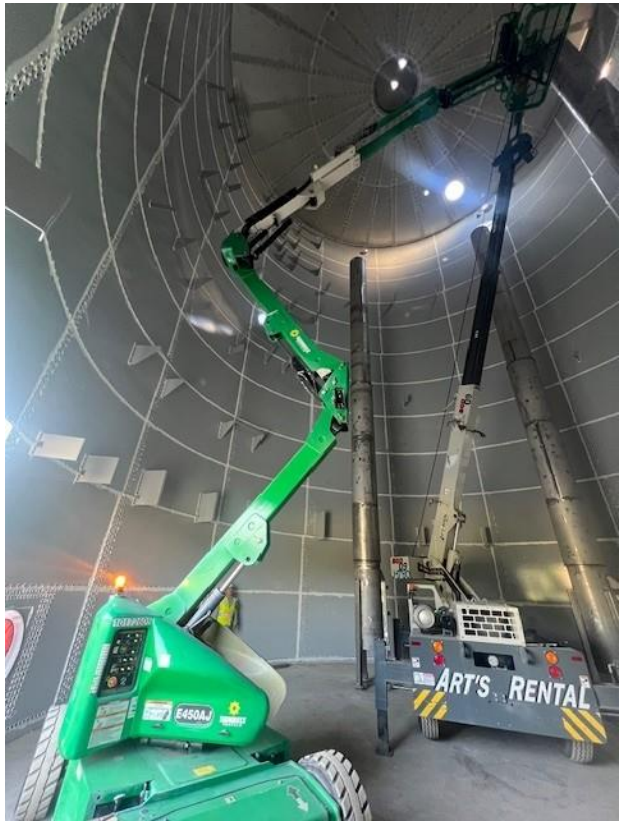
Thermophilic Hydrolysis Acidification Reactor:
(Thermo Tank)

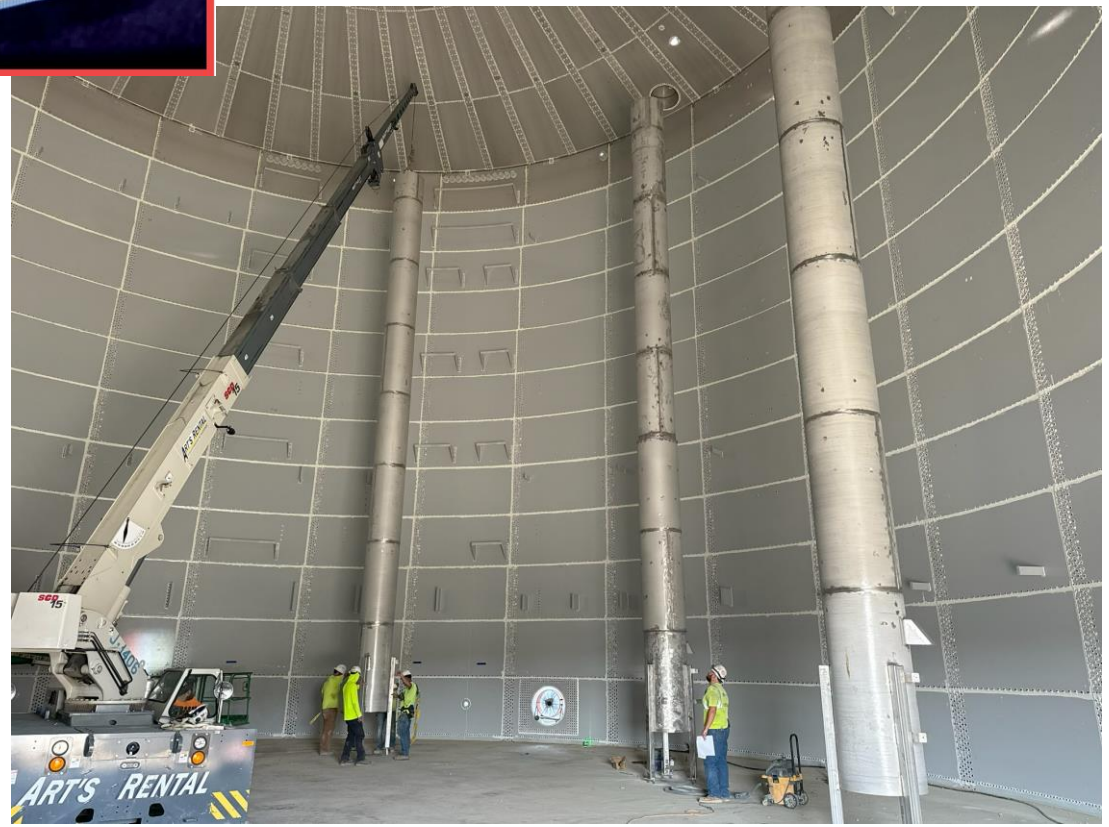
- 38’ dia, 56’ tall
- 470,000 gallons
- 6 turbo mixers (42’ tall)



Mesophilic Methane Generation Digester
(Meso Tank):

- 80’ dia, 59’ tall
- 2.1 million gallons
- 8 turbo mixers (46’ tall)





Synthica St. Bernard – Design/Const.

5. **Digestate Tank**:
   - Most of the gas has been collected, wastewater begins being treated
   - Byproduct of AD is digestate

7. **Biological Tank**: (open top with Aeration)
   - Wastewater treatment before discharge to MSD
   - Diffusers and Blowers for aeration
   - 200 HP Blowers with fine bubble diffusers

Synthica St. Bernard – Design/Const.

8. **Dewatering Building**:
    - Dissolved Air Flotation Tank (DAF)
        - Removes remaining solids, oils, and greases.
        - Uses air bubbles to float particles to the surface .
        - Solids sent back to combined waste or bio tanks
        - Effluent water goes through metering manhole then to MSDGC Mill Creek

8. **Dewatering Building**:
    - Dewatering
        - Polymer Feed Equipment
        - Centrifuge
        - Screw conveyors move sludge to dumpster (possible resell)
        - Water goes to Biological Tank

Synthica St. Bernard – Design/Const.

9. **Biogas Upgrading Equipment**: (Gas Purification)
    - Removes bulk carbon dioxide and Hydrogen Sulfide to get a product that is 97%-98% Methane
    - Rated to process 1,100 scfm of gas
    - Bulk H2S spray down system protects equipment down stream
    - Raw Gas Blower – Gas is cooled and pressurized
    - H2S Polishing – Gas passes through granular porous media
    - Results in three processes: Biogas, Water, Stripping Air
    - Compression Skid for processing
    - Scrubbing, Flashing, Stripping Vessels: Gas enters bottom of vessel and flows up through media and water (gas is then dried and sent to interconnect)
    - Gas Analyzers – For quality (Duke analyzes again)
    - Flare – Only used if equipment malfunctions or poor quality of methane

10. Duke Energy Interconnect

- RNG injected into the utility system (and off to California)

Synthica St. Bernard – Design/Const.

Odor Control System

- Two Systems (One unique to each bldg.)

1. Activated Carbon for Waste Receiving Bldg
   - Blowers pull air through reactor vessels filled with carbon
   - This system is better for an environment with a variety of odor compounds
2. Bio trickling Filter System for Dewatering Bldg
   - Synthetic media mixed with liquid nutrient solution and water creates microorganisms that break down odor
   - Cost effective and efficient for removing H2S in the wastewater

<u>Design Issues:</u>

- You can see supports on roof for 54” ductwork.
- Needed for site constraints: equipment location

Synthica St. Bernard – Operations

Operation of the Facility:

- Operation of the plant was bid out competitively through and RFQ/RFP
- UGIES as the majority owner of the Synthica St. Bernard Facility did the evaluation and selection.
- Synthica Energy, LLC bid for the operation package
- Ultimately, Veolia was selected to operate the plant with oversight from both UGIES and Synthica

Synthica St. Benard Facility

https://youtu.be/aV1A0WXQQ8c

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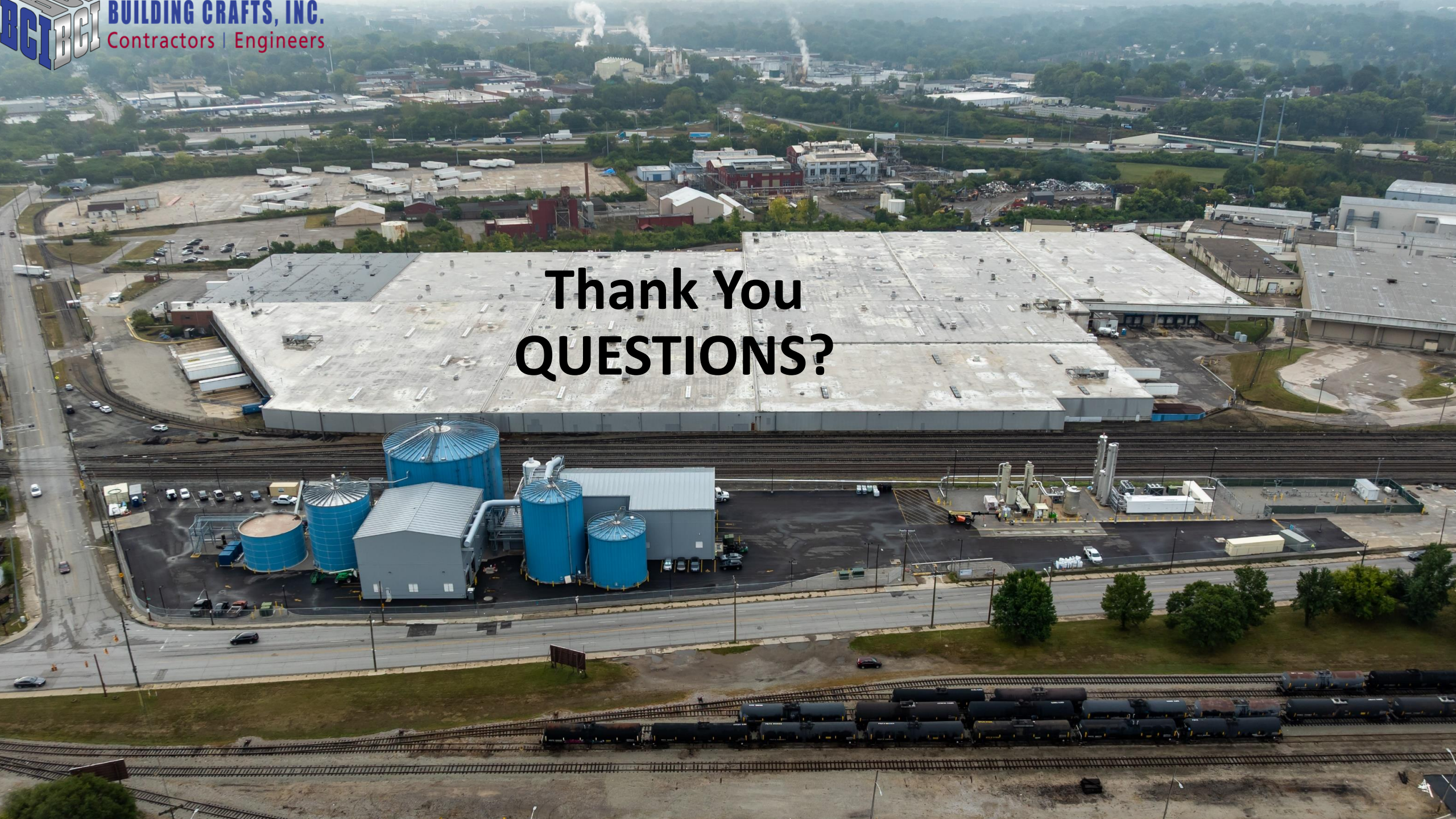

Thank You
QUESTIONS?