CAMBI

NWWC 2023

Small-scale thermal hydrolysis to optimise biosolids management Case studies from North America

Dr Bill Barber

13 November 2023

NWWC 2023

Development of Modularized thermal hydrolysis

1998

2019

CAMBI

Clinton River Water Resource Recovery Facility

20 t DS/d

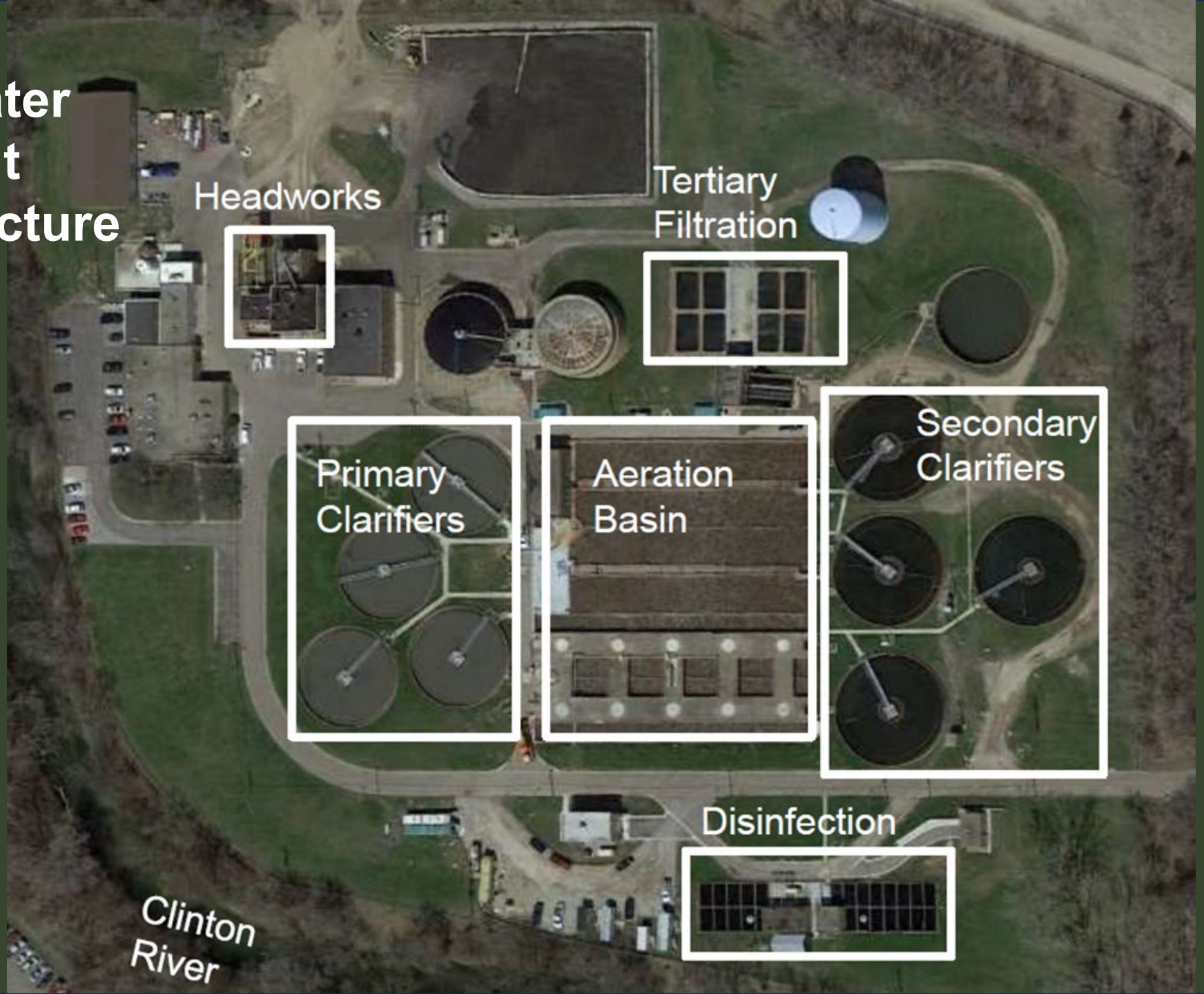
Auburn Hills
Charter Township of Independence
Lake Angelus
Lake Orion
Oakland Township
Orion Township
Oxford Township
the village of Oxford
Pontiac
Rochester
Rochester Hills
Waterford Township
West Bloomfield Township

155 N Opdyke Rd, Pontiac, MI 48342

OAKLAND COUNTY MICHIGAN


Riverside St
Phillips St
59
Michigan Ave
N Astor St
Peach St
Eastway Dr N
Pike St
© 2013 Google
Google earth

Wastewater treatment infrastructure



Biosolids management infrastructure

- Primary with secondary digestion
- Dewatering
- Open storage area

Mass Balance (Biosolids Processing)

HRT 22d but < 15

50%

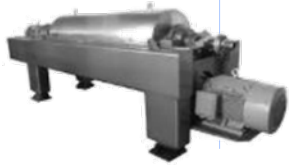
DS = 18%

Class B to land application	
Tons/d	7.8
%DS	18
%VS	67
Wet tons/d	45.8

Sludge Input	
Tons/d	25
%DS	5
%VS	75
Wet tons/d	250

Digestion	
Number	2
Total vol. (m^3)	5,300
%VSR	32
Biogas (m^3/d)	2,400

DS = 23%



50%

Raw to landfill	
Tons/d	12
%DS	23
%VS	75
Wet tons/d	44.5

Drivers

- Insufficient digestion capacity
- Raw cake storage creates strong odours
- Reliance on landfill
- Preference for state-of-the-art facility
- Class A bonus but not necessity

Optioneering study

- Additional digestion capacity
- Different digestion configurations
- Liming based systems

New Infrastructure

- Septage Receiving facility
- Biosolids storage
- Biosolids processing building
- Biogas storage dome

Total Cost approx. $42,000,000

Project received $2.5 million principal forgiveness from Michigan's Green Project Reserve, funded by the Clean Water State Revolving Fund program.

New biosolids handling building

- 2-story building of 15,880 ft^2 with processing capacity of 550 kl/d concentrated sludge
- 2 x sludge blending tanks
- Hydro sludge screens receiving sludge at 3% DS
- 2 x Andritz centrifuge pre-thickening
- Cambi Thermal hydrolysis
- 2 x Andritz dewatering centrifuges

Thickening and dewatering

Source: Water and Wastes Digest Magazine, December 2021

Thermal Hydrolysis

Boiler plant

Biogas storage dome

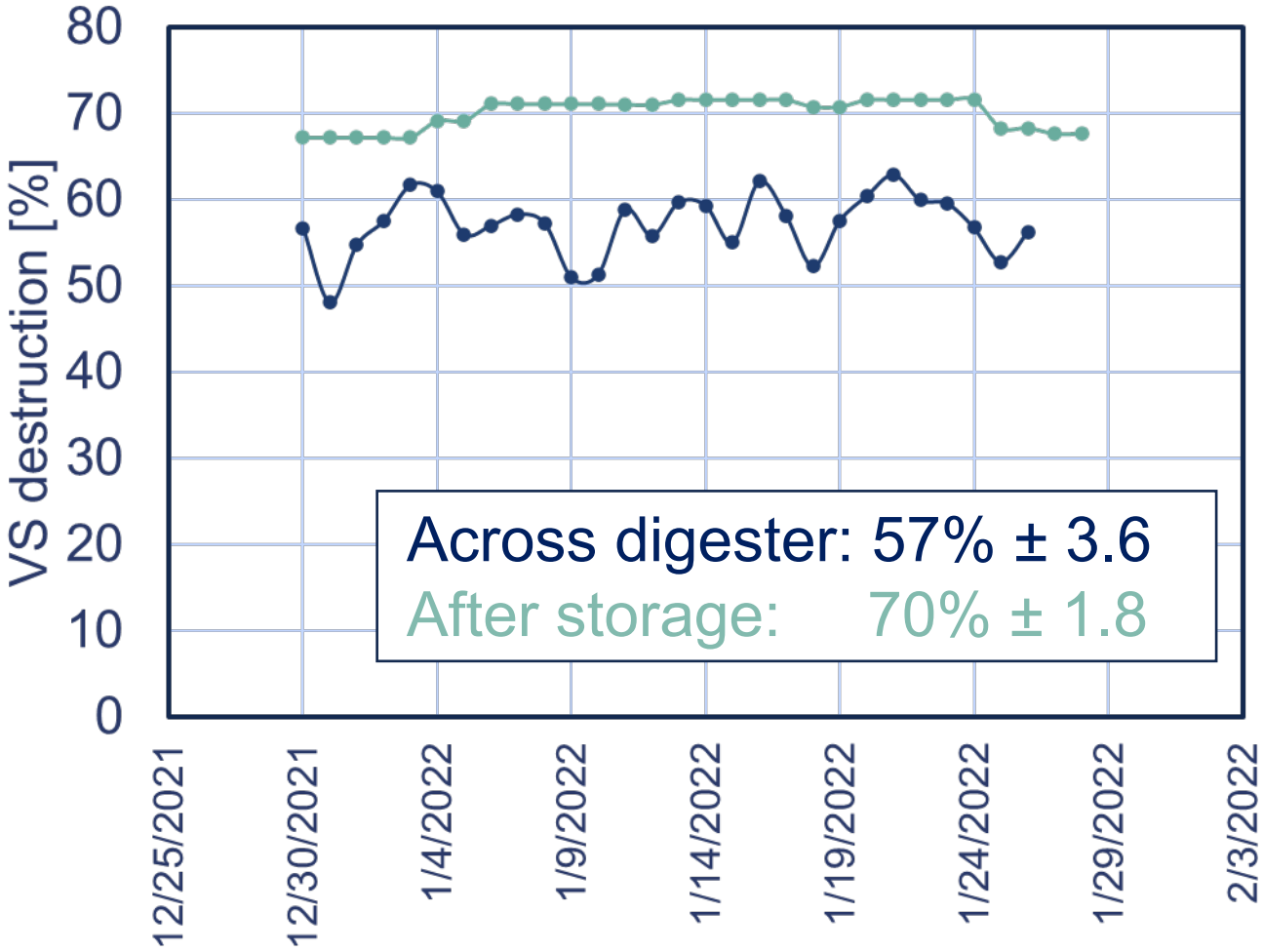
- Duosphere
- 2,300 m^3 storage capacity
- 6 hours

- 4 biosolids storage holding bays
- 20,000 sq ft storage area
- Can storge 7000 cu. yards of biosolids
- Approx. 180 days

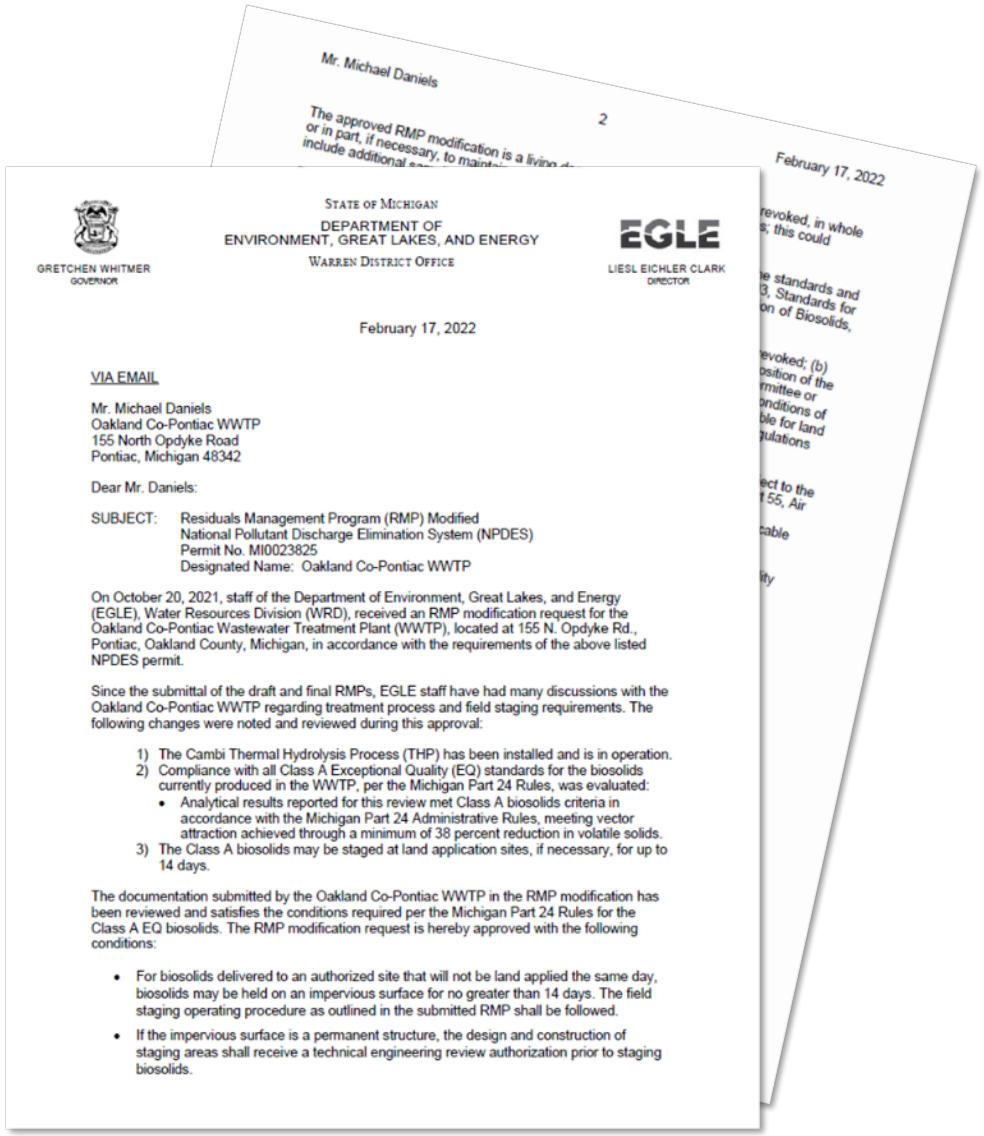
Covered biosolids storage area

Anaerobic Digestion Performance

pH	8.0 ± 0
Alkalinity [mg CaCO3/l]	8,712 ± 458
Total VFA [mg/l]	732 ± 259
Ammonia-N [mg/]]	2,238 ± 484
VFA/Alkalinity ratio	0.08 ± 0.03



Class A accreditation



STATE OF MICHIGAN
DEPARTMENT OF
ENVIRONMENT, GREAT LAKES, AND ENERGY
WARREN DISTRICT OFFICE

GRETCHEN WHITMER
GOVERNOR

EGLE

LIESL EICHLER CLARK
DIRECTOR

February 17, 2022

VIA EMAIL

Mr. Michael Daniels
Oakland Co-Pontiac WWTP
155 North Opdyke Road
Pontiac, Michigan 48342

Dear Mr. Daniels:

SUBJECT: Residuals Management Program (RMP) Modified
National Pollutant Discharge Elimination System (NPDES)
Permit No. MI0023825
Designated Name: Oakland Co-Pontiac WWTP

On October 20, 2021, staff of the Department of Environment, Great Lakes, and Energy (EGLE), Water Resources Division (WRD), received an RMP modification request for the Oakland Co-Pontiac Wastewater Treatment Plant (WWTP), located at 155 N. Opdyke Rd., Pontiac, Oakland County, Michigan, in accordance with the requirements of the above listed NPDES permit.

Since the submittal of the draft and final RMPs, EGLE staff have had many discussions with the Oakland Co-Pontiac WWTP regarding treatment process and field staging requirements. The following changes were noted and reviewed during this approval:

1) The Cambi Thermal Hydrolysis Process (THP) has been installed and is in operation.
2) Compliance with all Class A Exceptional Quality (EQ) standards for the biosolids currently produced in the WWTP, per the Michigan Part 24 Rules, was evaluated:
   - Analytical results reported for this review met Class A biosolids criteria in accordance with the Michigan Part 24 Administrative Rules, meeting vector attraction achieved through a minimum of 38 percent reduction in volatile solids.
3) The Class A biosolids may be staged at land application sites, if necessary, for up to 14 days.

The documentation submitted by the Oakland Co-Pontiac WWTP in the RMP modification has been reviewed and satisfies the conditions required per the Michigan Part 24 Rules for the Class A EQ biosolids. The RMP modification request is hereby approved with the following conditions:

- For biosolids delivered to an authorized site that will not be land applied the same day, biosolids may be held on an impervious surface for no greater than 14 days. The field staging operating procedure as outlined in the submitted RMP shall be followed.
- If the impervious surface is a permanent structure, the design and construction of staging areas shall receive a technical engineering review authorization prior to staging biosolids.

- EPA and State Regulations
- Communications
- New technology in Michigan
- Benefits of Class A
  - Potential for other outlets

Mass Balance (After THP)

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Sludge Input	
Tons/d	25
%DS	5
%VS	75
Wet tons/d	250

100%

HRT < 30 d

DS% = 32%

Digestion	
Number	2
Total vol. (m^3)	5,300
%VSR	57
Biogas (m^3/)	8,700

DS% = 37%

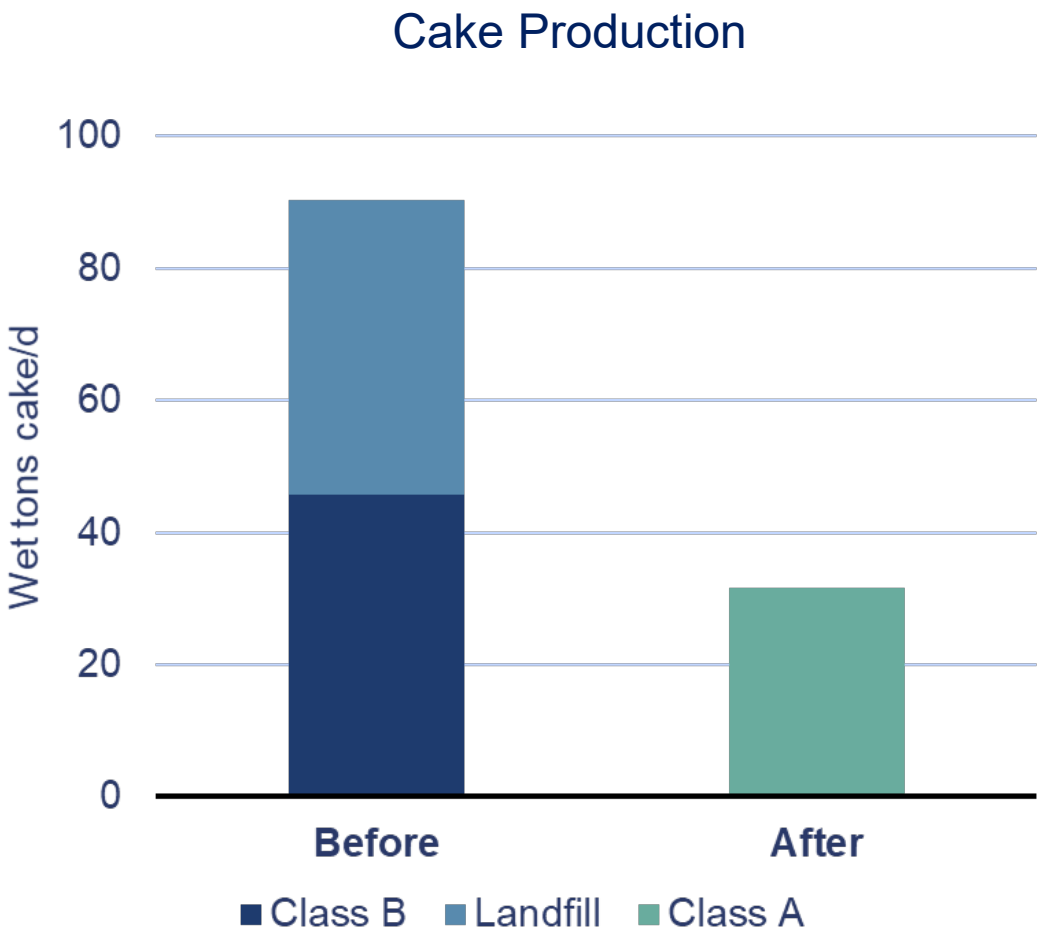
Storage	
Time	Weeks to months
Additional VSR%	25
Total VSR%	68 - 74

Class A to land application	
Tons/d	12.9
%DS	37
%VS	49
Wet tons/d	31.7

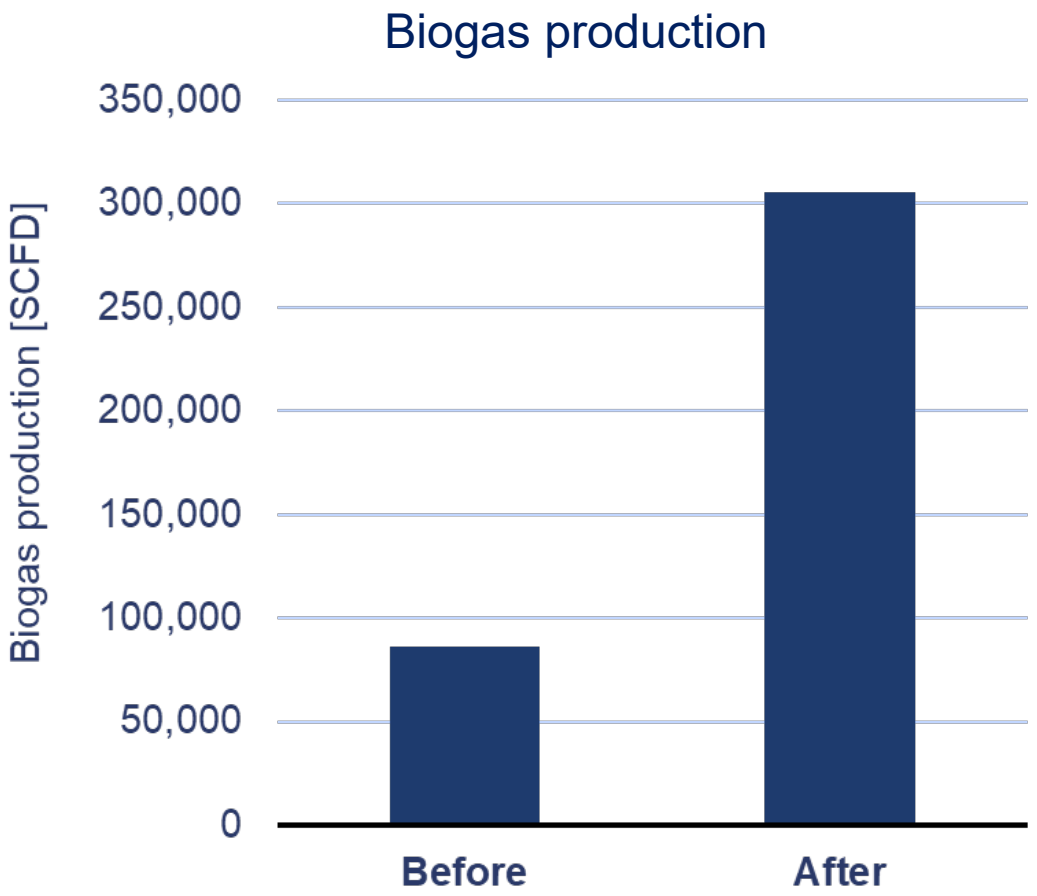
0%

Raw to landfill	
Tons/d	0
%DS	N/A
%VS	N/A
Wet tons/d	0

Performance

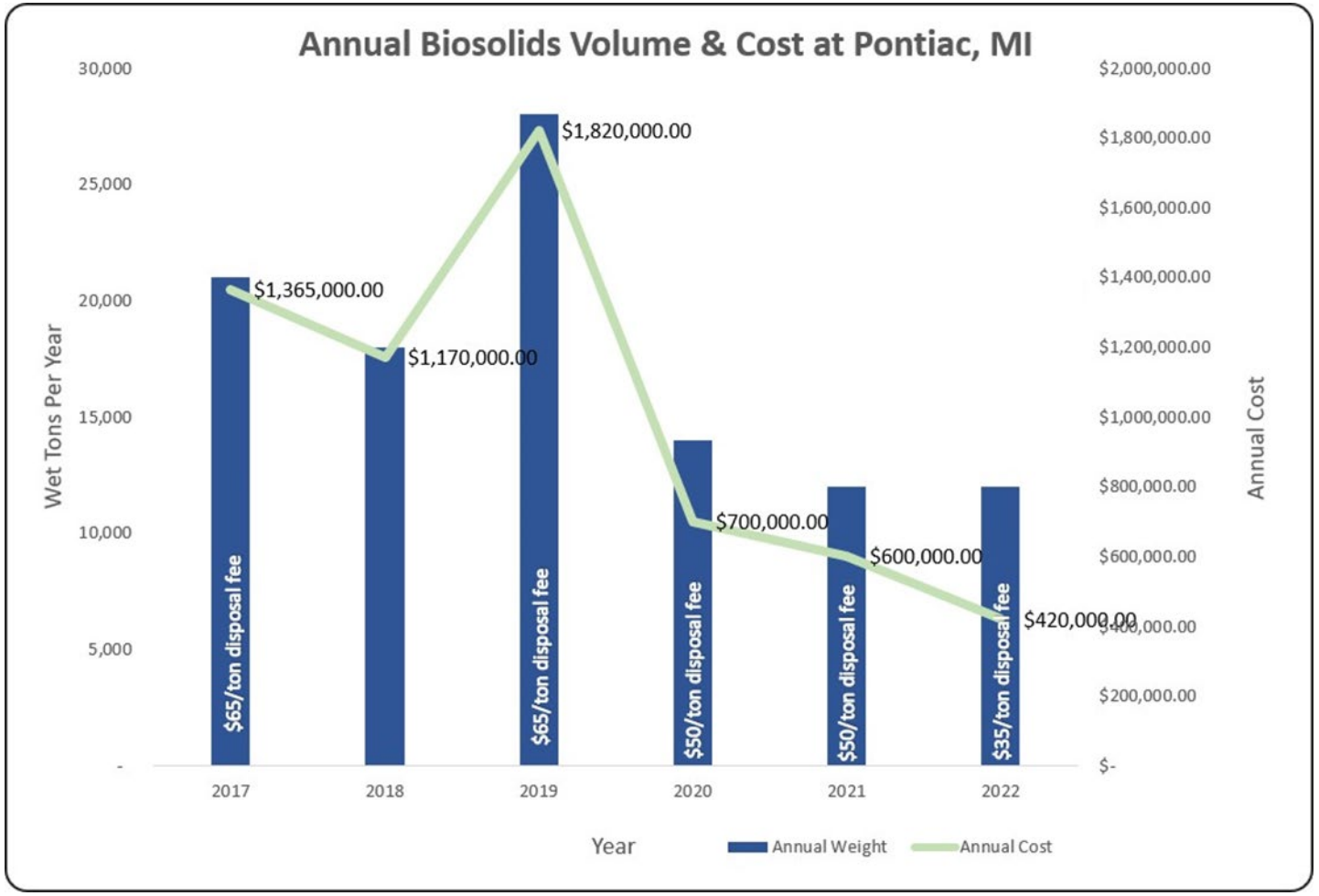


- 65% less cake
- Class A
- No landfill



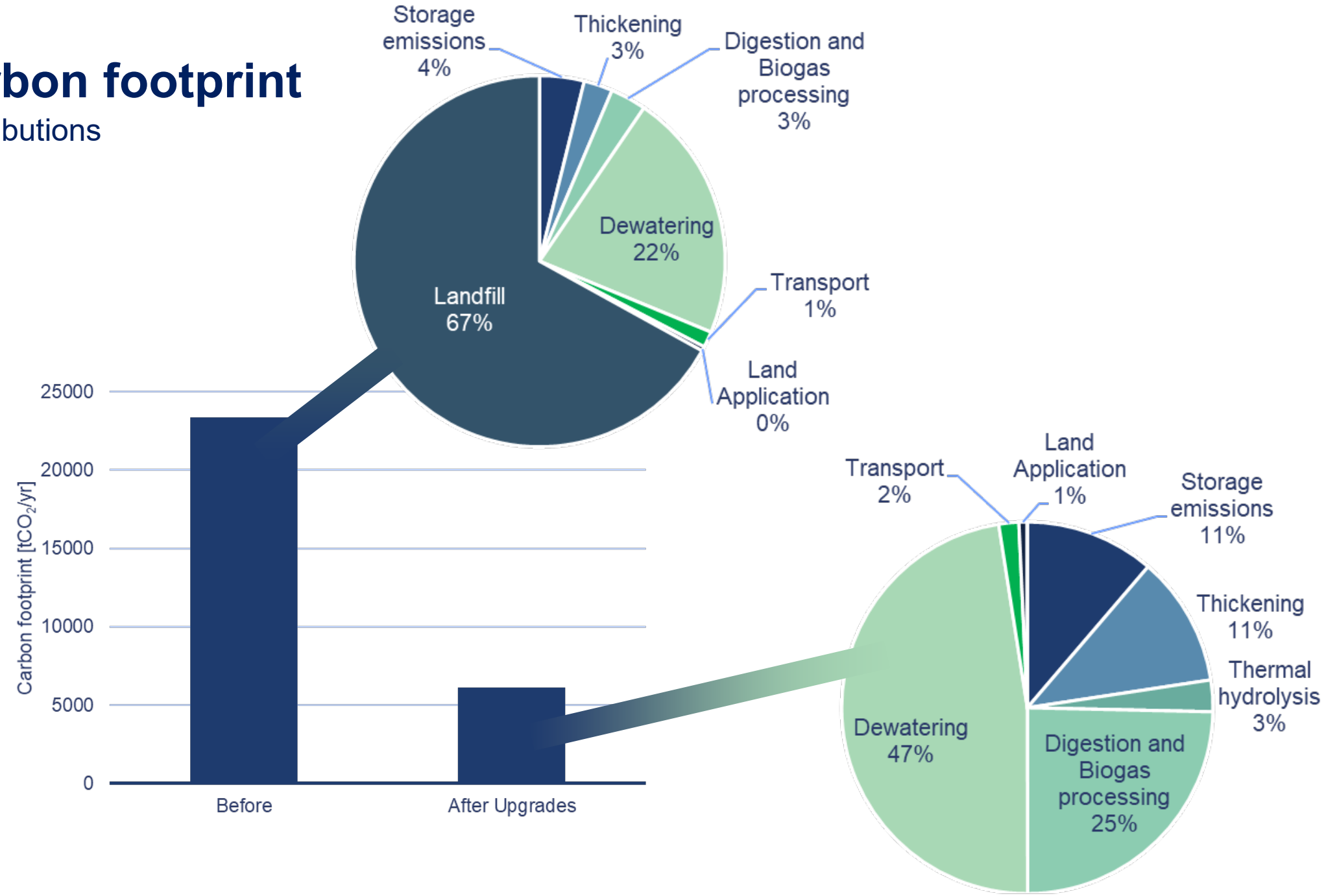
- 350% more biogas
- Some biogas used for boiler
- Excess for plant use
- Some used for aeration

Impact on operations



Carbon footprint

Contributions



Planned Maintenance Shutdown

Sept 13 – 17th 2021

- First Planned shutdown delayed after 2 years partly due to COVID-19
- Approx. 1 week for THP plus 1 week for boiler plant – (typically <1 week for both)
- Despite COVID-19 delay key items in good condition
- Needed to landfill during shut-down

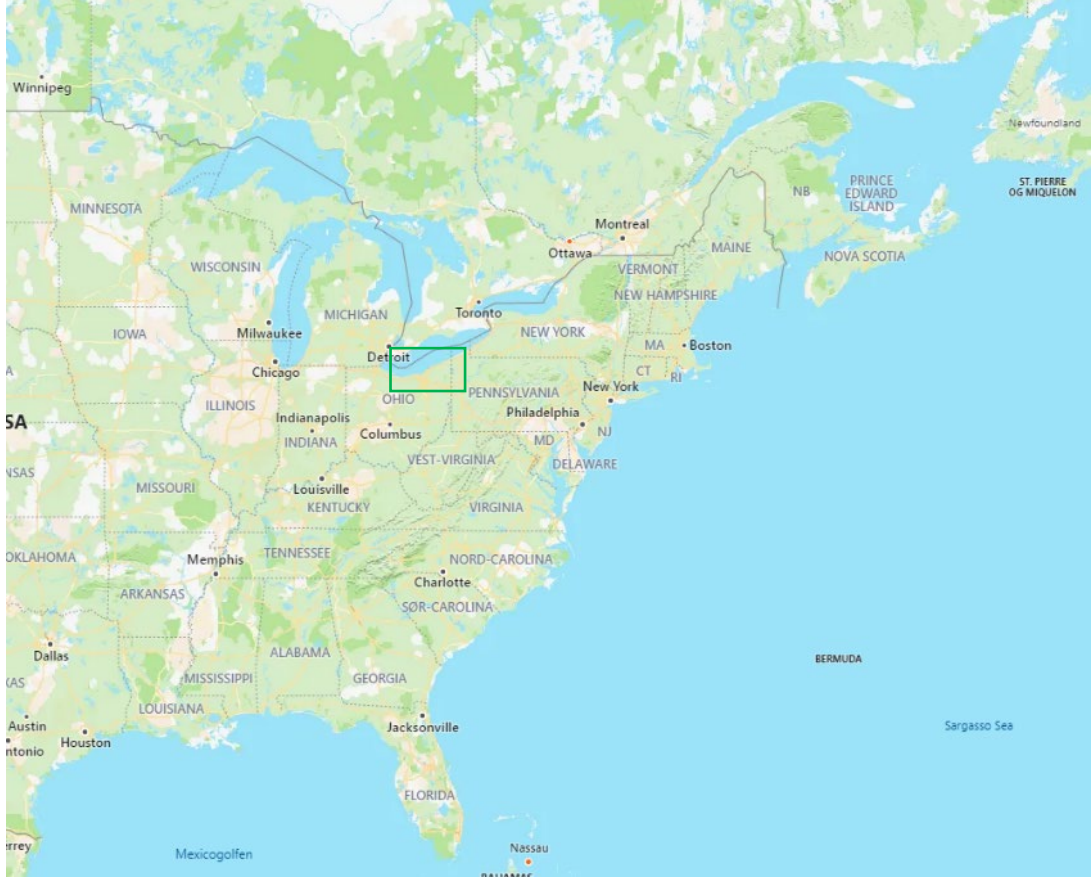
- Pre-dewatered cake hopper
- Single stage PC pump
- 4” stainless pipe to THP inlet
- 4” pipe changed to 8” HDPE pipe
- Mixing could be improved with the pump
- Recommend 4 stage pump, spend a little more money and eliminate any risk

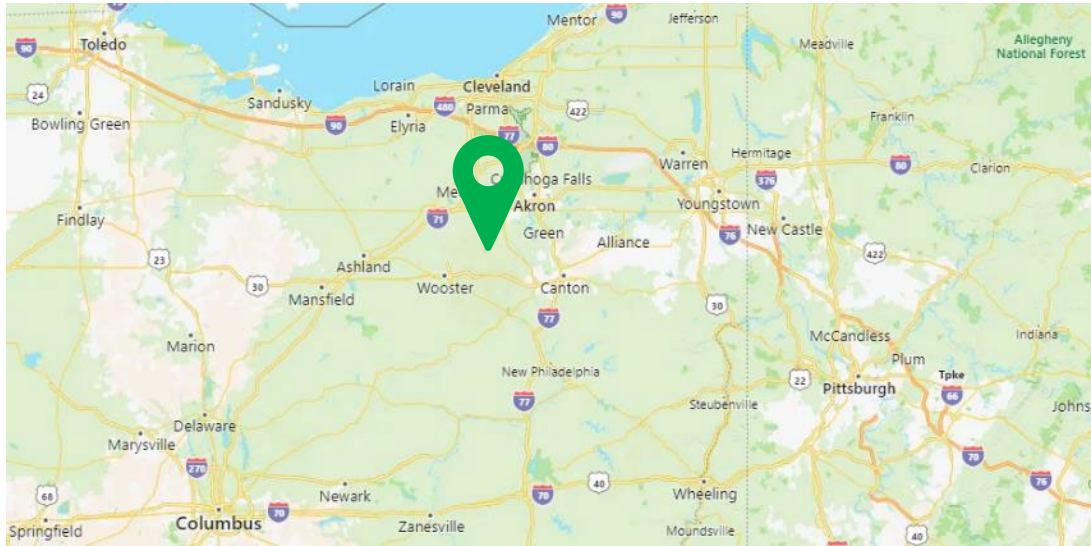
Observations

- Perception
  - Perceived complexity for new technology
  - THP was the easiest part of the plant to operate
- Ease of operation and maintenance
- High availability and reliable
- Excellent service and customer support

Location

- Medina County, Ohio
- Approximately 35,000 homes and businesses
- Serves the cities of Brunswick and Medina, and several townships
- Located in the Lake Erie Drainage Basin



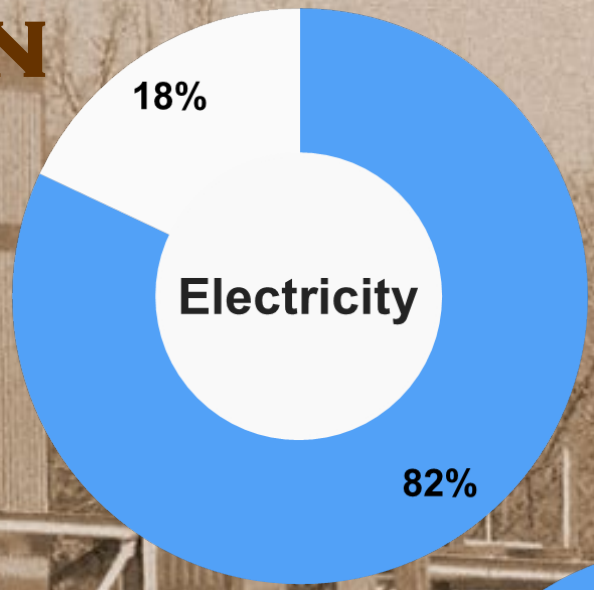


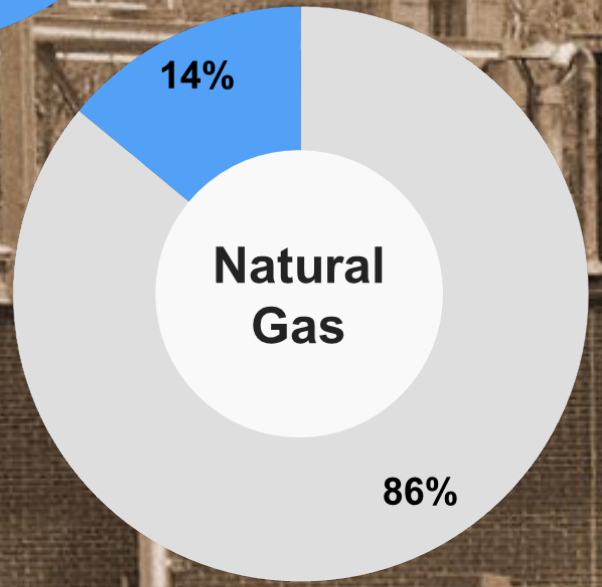
- 55,500 m^3/d (15 t DS/d) Design flow
- Activated Sludge with EBNR
- Class A or Exception Quality Sludge
- 6 Primary Clarifiers
- 9 Aeration Basins
- 3 Final Clarifiers
- 3 Sand Filters

- TP < 1 mg/l
- Ammonia-N < 1.15 (summer) 4.5 (winter)

Zimpro Wet Air Oxidation

- Oxidized sludge at high temperature and pressure
- Produced EQ Biosolids
- Extensive training process for operators
- Energy Inefficient
- Difficult and Expensive to maintain
- 40 + years old
- $17 M to refurbish





2015 Assessment of Plant Capacity – Investment Grade Audit (IGA)

- Increasing COD Loading in the Influent
- Increasing problems with recirculation of refractories
- High Energy and maintenance costs with Zimpro

Results of the IGA

- Replace aging sludge processing infrastructure
- Reduce Operational Costs
- Expand capability to process External Waste Sources as part of Sludge Stream
  - Currently discharged into sewers – large load on main treatment process
  - Combined Heat and Power System
  - Estimated electricity savings of $1.7M/year

Key Compor

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Two Anaerc
Digester

Strength Waste
Receiving

Centrifuges
dewaterin

F at Marks Road Lift
Station

Energy Savings Performance Contract

- Performance contract that guarantees the energy savings to a client.
- The savings in energy costs can be used to pay back the capital investment of the project over the useful life expectancy of the equipment.
- The contract may include energy validation requirements. These energy usage is verified after the system is commissioned and may require third party involvement.

Project Timeline

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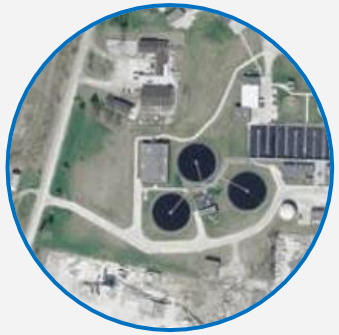
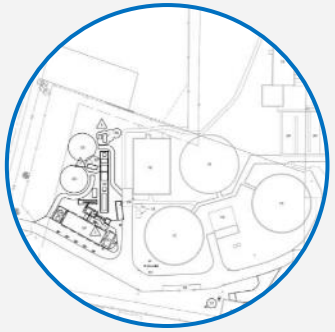


2015

Analysis of Plant Capacity



December 2016

Investment Grade Audit Completed

May 2017

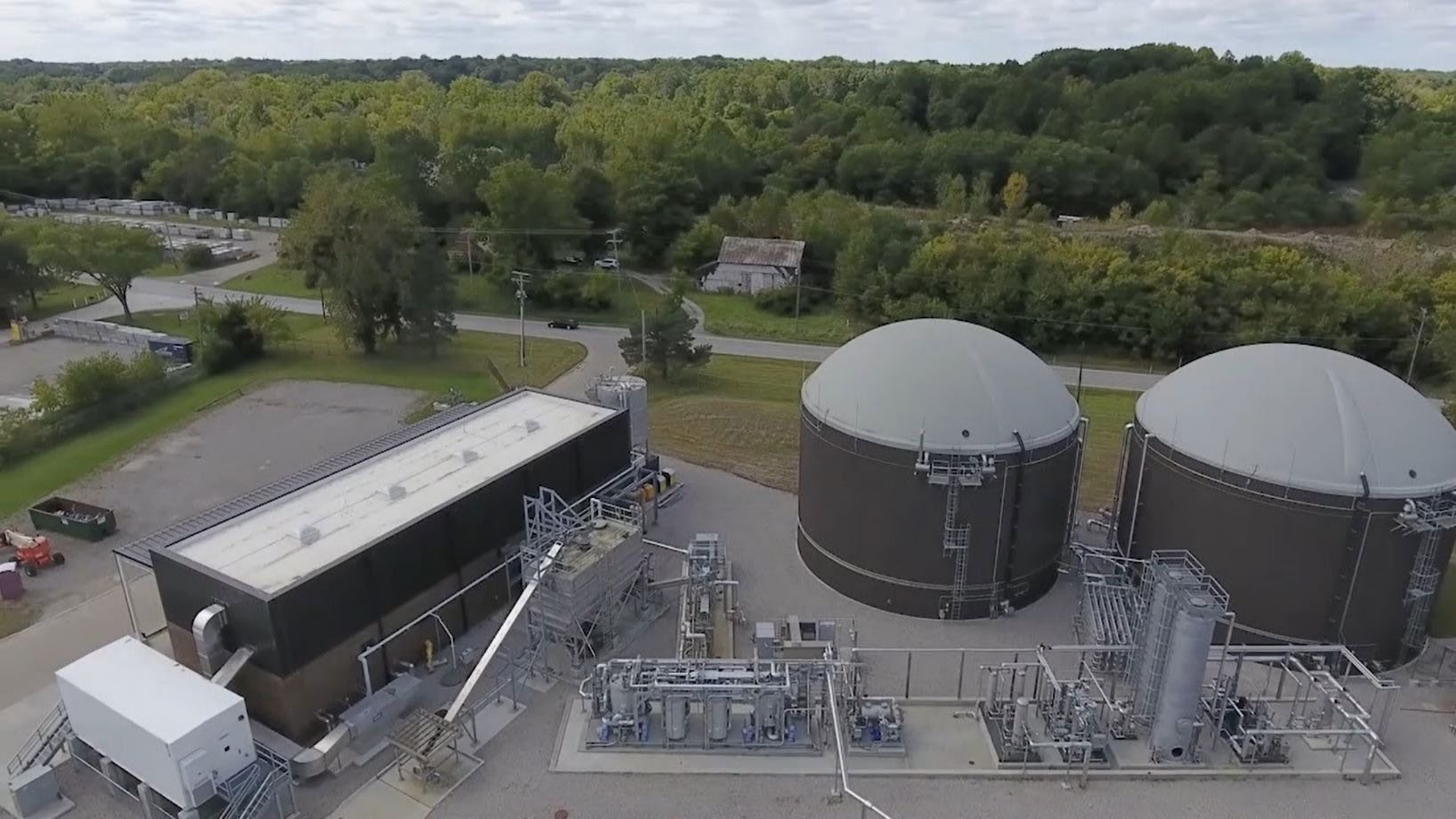
Construction began

December 2018

Digester Seeding

January 2019

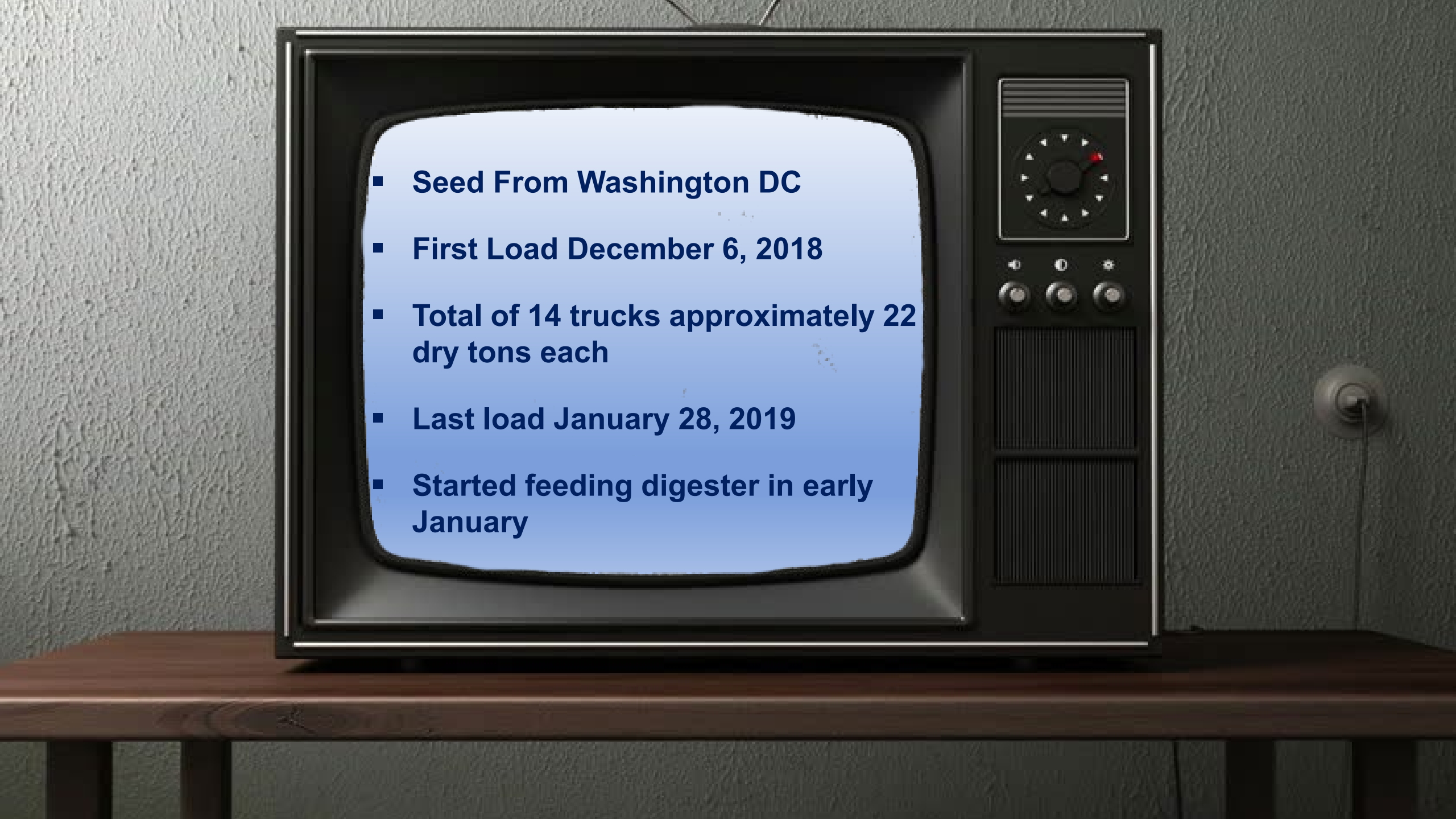
Start-up



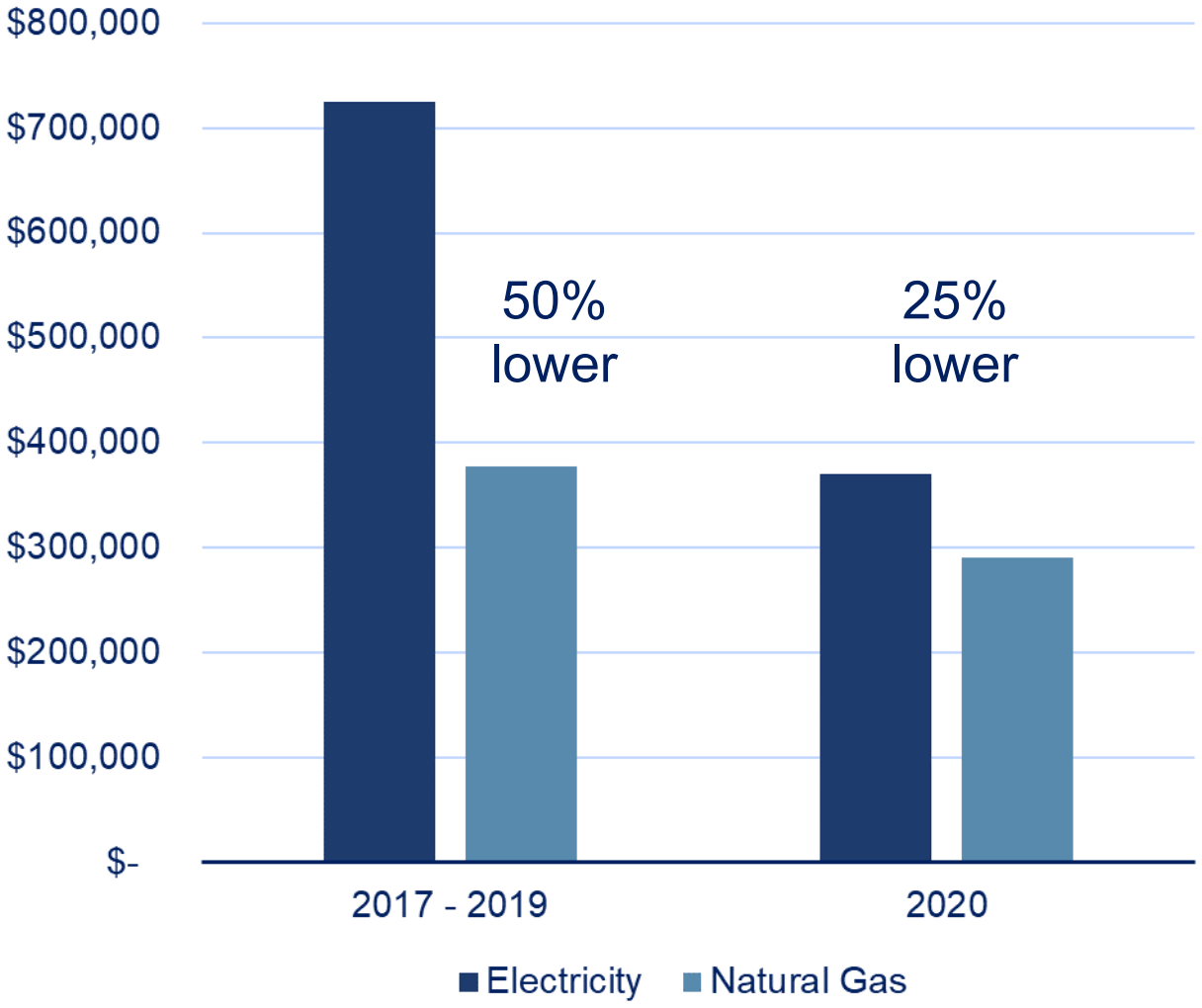

THP FEED
STEAM

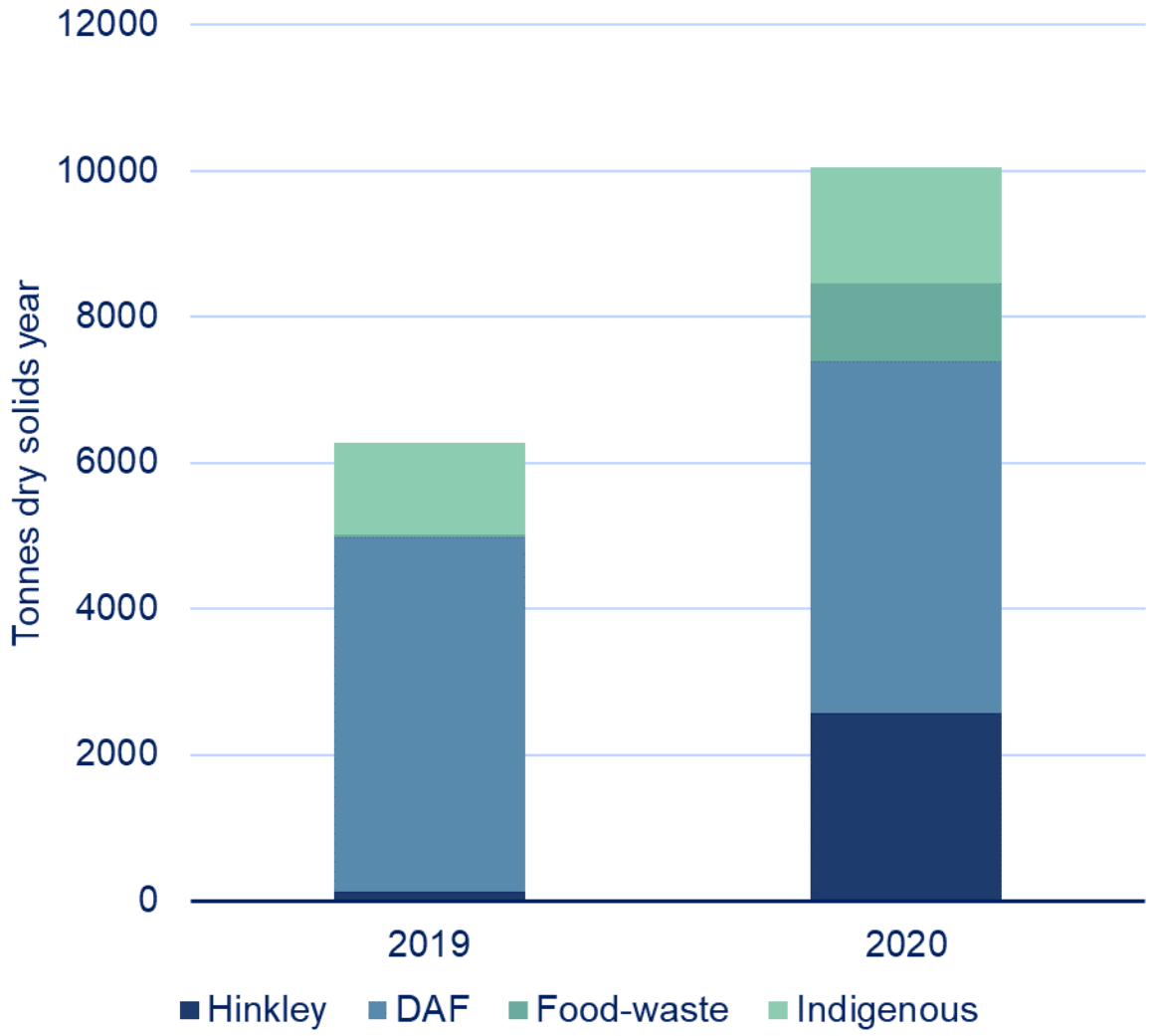
Co-digestion

- Accepts FOG and DAF Solids and local food waste
- Preheated from Generator Cooling Loop
- Used for Dilution of THP Feed


Seed From Washington DC
First Load December 6, 2018
Total of 14 trucks approximately 22 dry tons each
Last load January 28, 2019
Started feeding digester in early January

Since Installation





Lessons learnt

- It gets cold in Ohio
- Feed solids to THP needed to be increased
- Access to plant
- Proximity of spare parts
  - Stators for pumps

Acknowledgements

Dawn Taylor
Superintendent at Medina County
Sanitary Engineer

Mike Daniels
Chief WRC Water Resource Recovery at
Oakland County Water

Dr Bill Barber
Technical Director Cambi. Inc.
Bill.barber@cambi.com

Thank you

Contact us