



Technical Education and Analysis for Community Hauling and Anaerobic Digesters (TEACH AD)

TEACH AD Webinar Series - July 28, 2022

Lessons in biosolids management: Successful biosolids programs at the City of St. Cloud Nutrient, Energy and Water (NEW) Recovery Facility and at the District of Columbia Water and Sewer Authority

Technical Education and Analysis for Community Hauling and Anaerobic Digesters – **TEACH AD**

The goal of this program is to help communities and water resource recovery facilities in the Midwest region divert food waste from landfills by providing education and no-cost technical assistance to explore the increased adoption of anaerobic digestion and renewable energy biogas technologies.

- Educational Assistance
- Technical Assistance

Marcello Pibiri

Program Manager

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Webinar Speakers



Marcello Pibiri

Senior Research Engineer
UIC Energy Resources Center



Elijah Stuber

Environmental Compliance Specialist
City of St. Cloud



April Thompson

Director of Marketing and Sales
Bloom, DC Water

Thanks to
our sponsor!



Q&A

Submit your questions to the host using the Q&A box in the upper right-hand corner

Survey

After the presentation you will receive a brief survey. We appreciate your feedback

Presentations

A recording of today's webinar will be posted on the TEACH AD webpage and you will be emailed a link by early next week

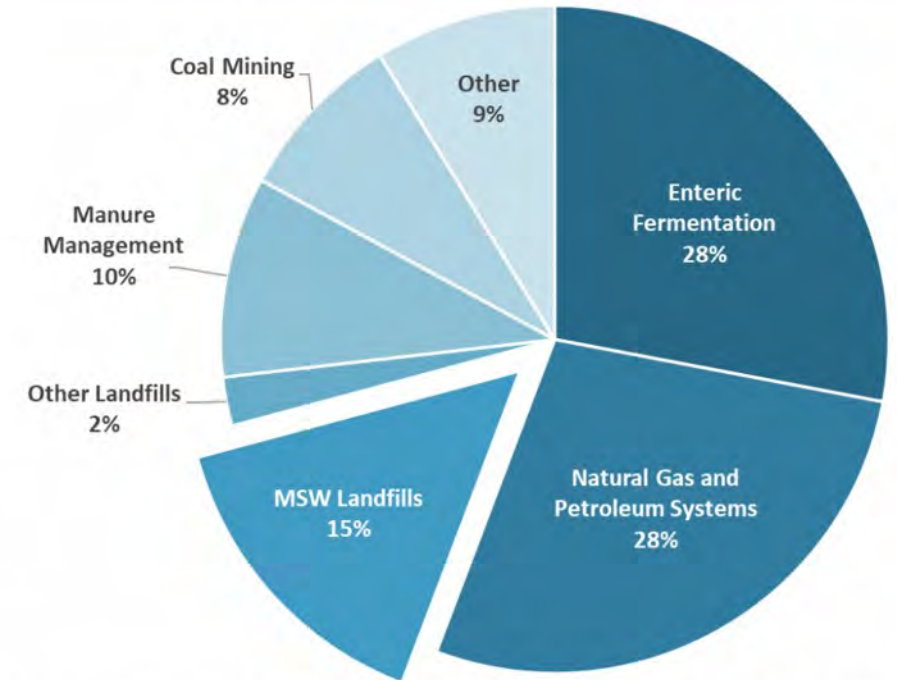
Technical Issues

Contact Sam Rinaldi at: samr@uic.edu or 312-996-2554 for assistance

Importance of diverting food waste from landfills

- Municipal solid waste (MSW) landfills are the third-largest source of human-related methane emissions in the United States
- By reducing the amount of food waste landfilled, we reduce methane emissions

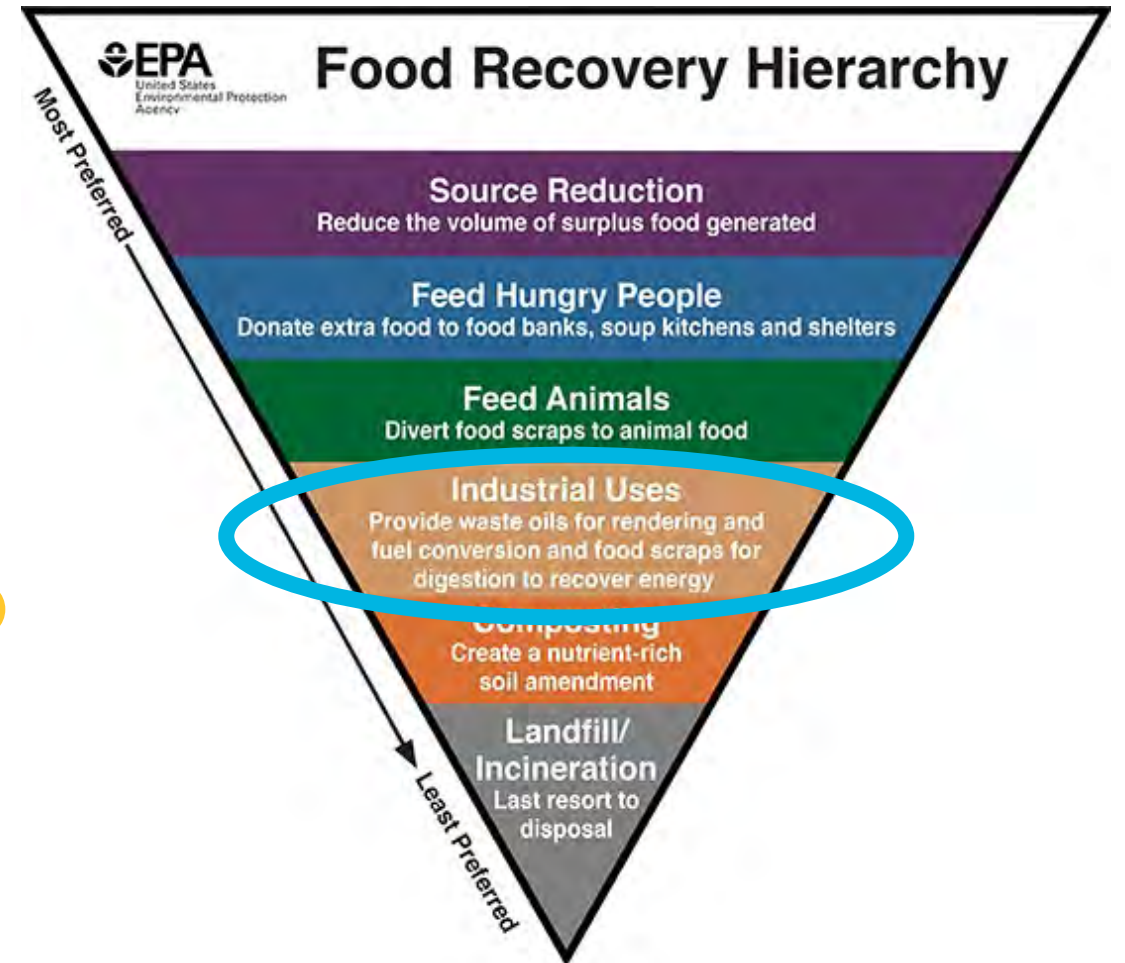
2018 U.S. Methane Emissions, By Source



Note: All emission estimates from the *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2018*. U.S. EPA. 2020.

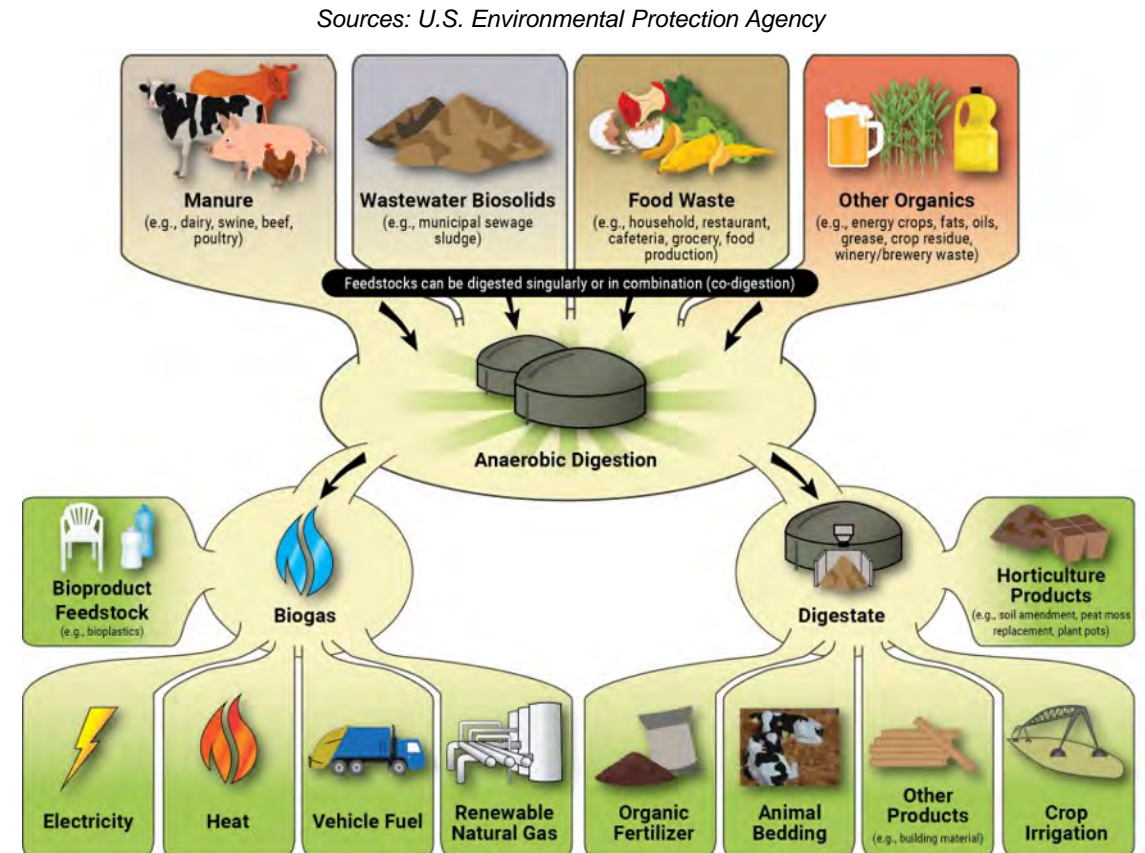
Importance of diverting food waste from landfills

- One-third of all food produced for human consumption worldwide is lost or wasted
- Source Reduction
- Feed People, Not Landfills
- Industrial Uses
 - **Anaerobic digestion**



Overview of anaerobic digesters

- Anaerobic digestion is the natural process in which microorganisms break down organic materials in the absence of oxygen.
- Two valuable outputs
 - Biogas
 - Digestate





Bloom: Marketing Anaerobically Digested Biosolids

April Thompson

Director of Marketing and Sales, Bloom

Washington, DC

There is no such thing as waste, only
wasted resources.

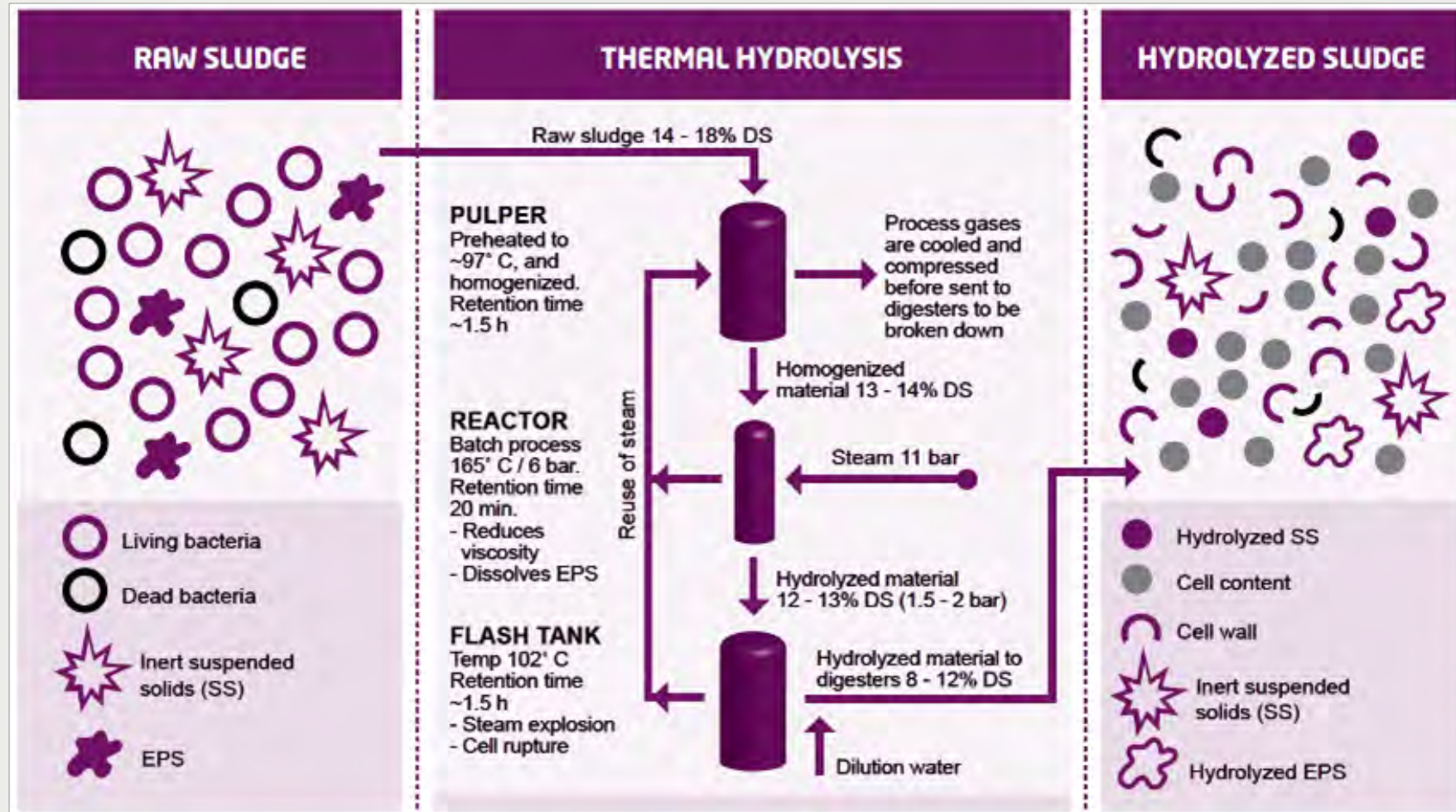


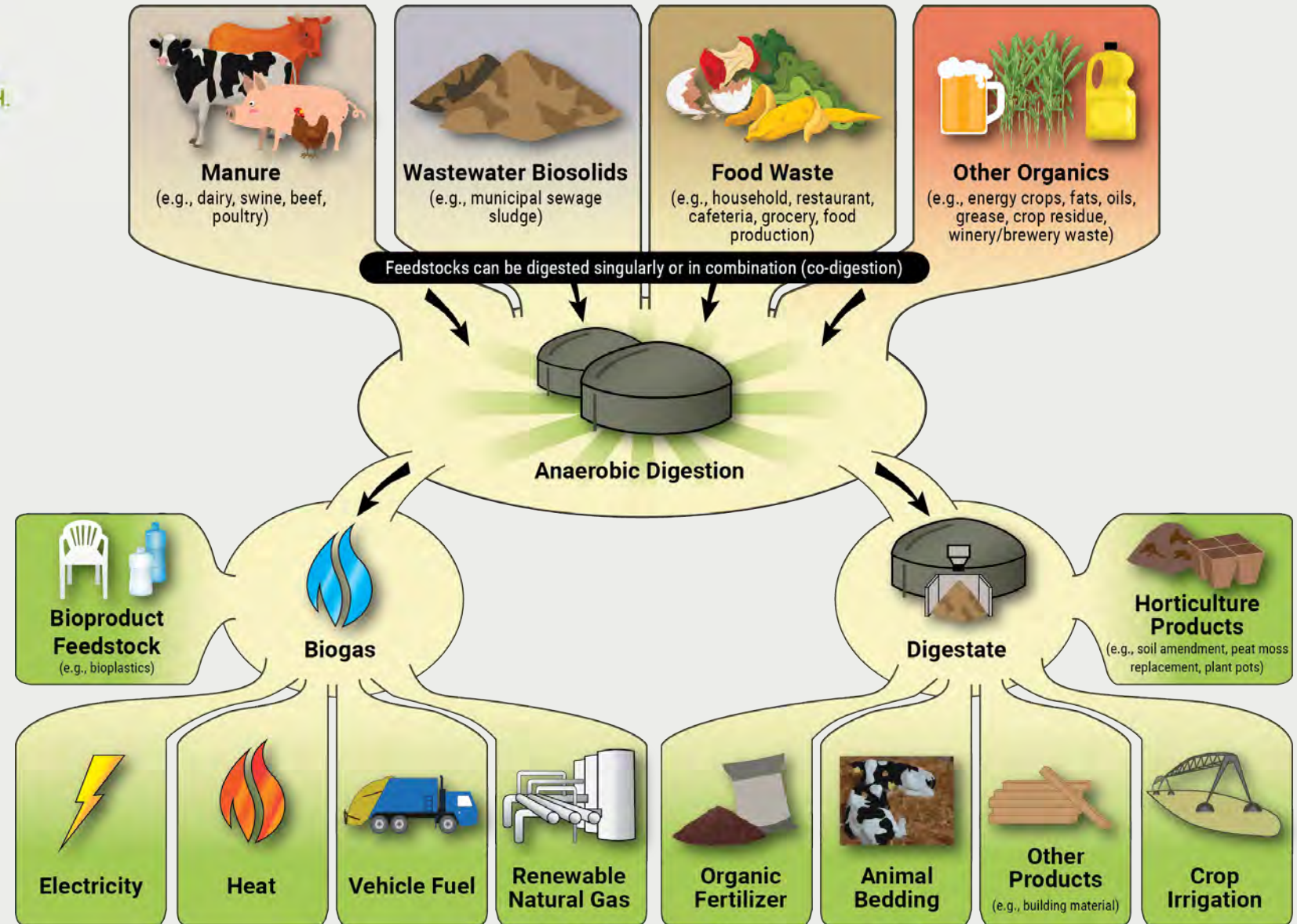
**DC Water's Blue Plains: 370 million gallons/day capacity
Largest advanced Water Resource Recovery Facility in the world**

Anaerobic Digestion / Thermal Hydrolysis

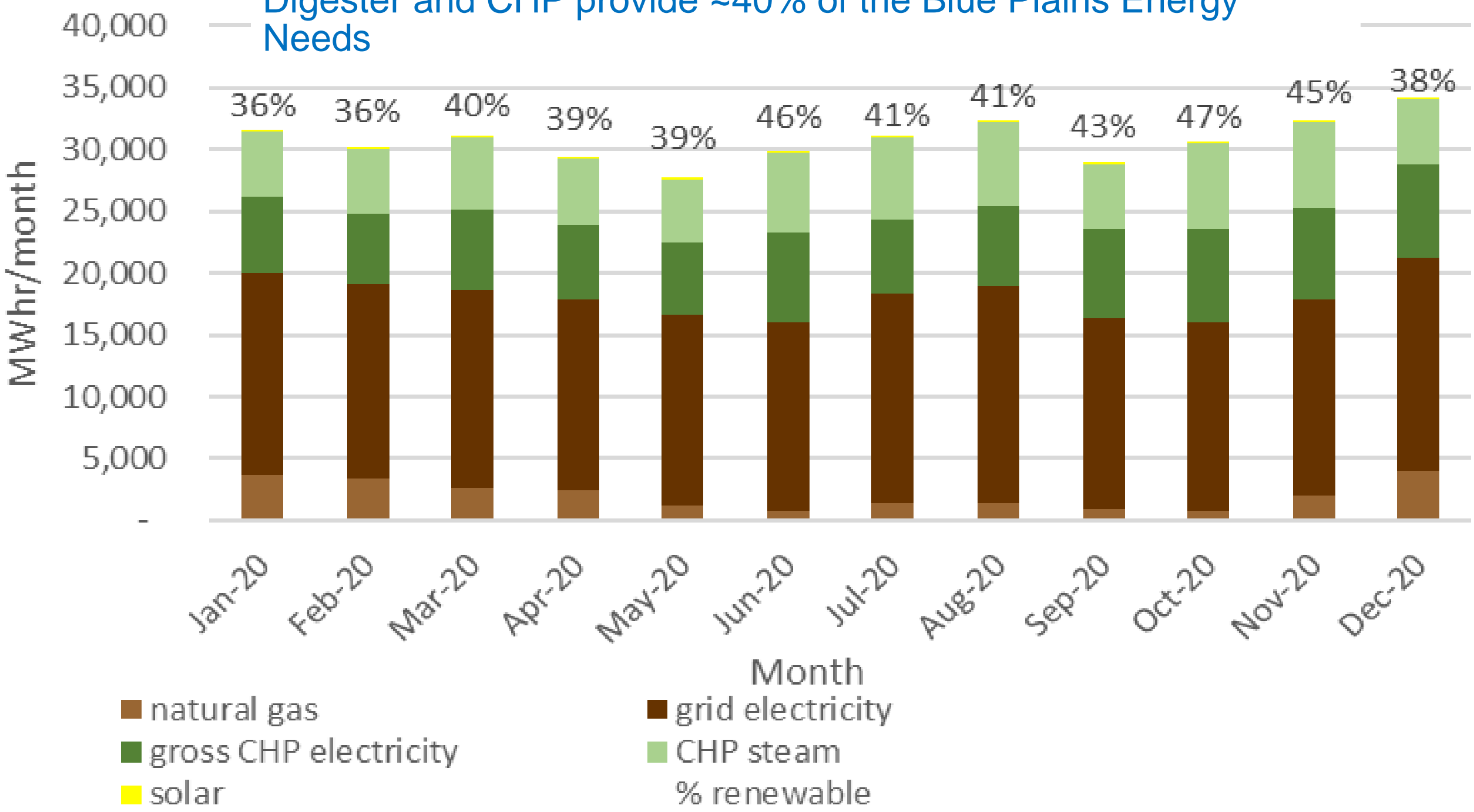


Thermal Hydrolysis Process





Digester and CHP provide ~40% of the Blue Plains Energy Needs



Accelerating Nature's Processes



Program Benefits



Reduce biosolids quantities by more than 50%



Improve product quality (Class A and more)



Generate 8 MW of clean, renewable power

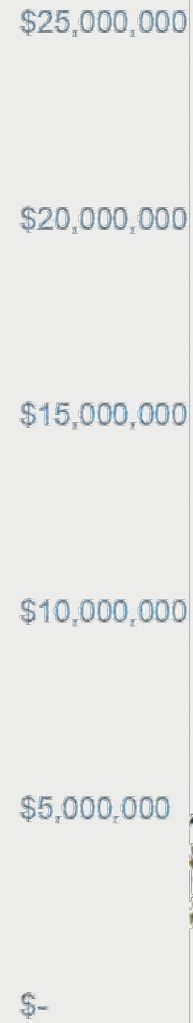
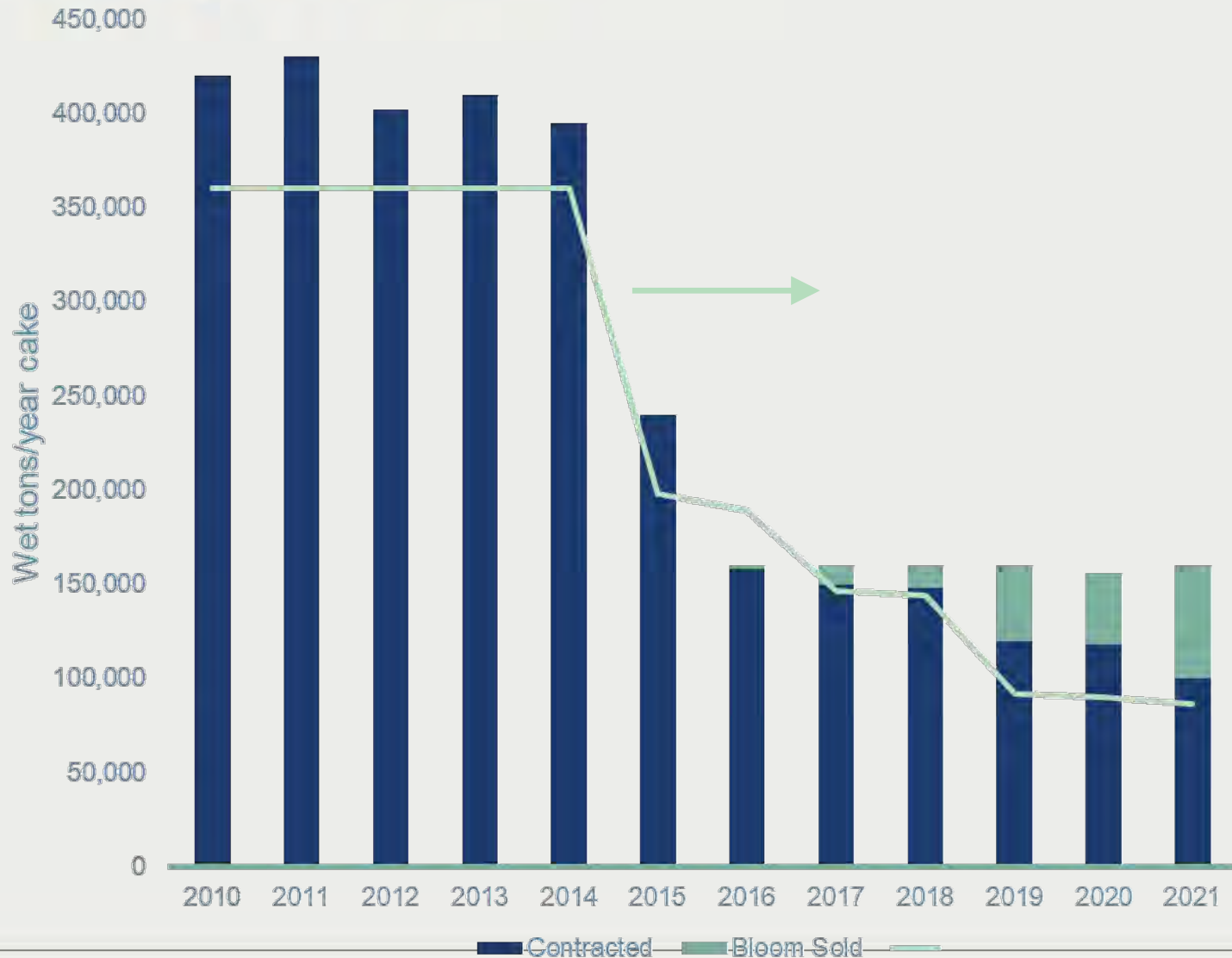


Cut GHG emissions dramatically - by 1/3 or 50,000 MT CO₂e annually



Save millions of dollars annually

Costs reduced from \$19M to \$4.8M annually



Class B vs. Class A Product



The Value in Biosolids

Nutrients

Macro-Nutrients

- Nitrogen (~1.5%)
- Phosphorus (~2%)
- Calcium

Micro-Nutrients

- Zinc
- Copper
- Molybdenum

Organic Matter

- Food for soil microbes
- Builds soil tilth
- Erosion resistance
- Water-holding capacity
- Ability to retain nutrients

Drought resistance

- More root & shoot growth
- Improved yields

Energy

For Energy Recovery

- Energy in the chemical bonds of organic matter
- 9,300,000 Btu/metric ton of biosolids available through anaerobic digestion

Beneficial microbes

- Improved nutrient uptake
- Disease resistance

Research Projects

Virginia Tech

- Drought resistance study
- Greenhouse gas balance
- Wintertime N uptake
- P land base analysis
- Blended soil products development



University of Maryland

- Beneficial soil microbes
- Wye poplar plantation surface application
- Mine reclamation with poplars



USDA + University of Maryland

- Triclosan, trichlorocarbon
- PBDEs



+



Bloom Timeline



- First product from digesters: November 2014
- First Distribution (free sample): November 2015
- First product sale: August 2016
- First Distribution & Marketing permits: November 2016
- Bloom trademark registered: January 2017
- First daily production sell-out: April 2018 (450 wt)
- First bagged product in stores: May 2018
- First month sellout: April 2019
- Sales team expansion: November 2019
- Broke \$1M in savings and revenue and 40k tons sold: 2020

Bloom Products

- Fresh Bloom:
 - Biosolids straight from process
 - Good for farming, construction, blending application
 - Product slickiness, limits use in home gardening.
- Cured Bloom (100% Bloom):
 - Dried/windrowed material
 - Granular, easy to use
 - Higher nutrient content
 - Requires space and labor to produce
 - Lawn, landscape, home gardens etc
- Blended Products
 - Woody Blend (compost substitute)
 - Sandy Blend (preferred topdress)
 - Same end users as Cured Bloom



Cured Bloom

- Similar to windrow composting
- (biosolids cake air dried to ~60% solids)
- Short piles in long rows, turned regularly and covered during rain
- Private partners curing and bagging; receive royalty on bag sales



On-Site Blending Facility



Our Customers

BLOOM GOOD SOIL,[®] BETTER EARTH.

You're in Good Company When You Choose Bloom

AMERICAN HORTICULTURAL SOCIETY

TUDOR PLACE

Mulch & Stone THE HOME OF FREE DELIVERY

NAVY FEDERAL Credit Union

DENISON

CHM@L

THE CATHOLIC UNIVERSITY OF AMERICA

DISTRICT OF COLUMBIA PUBLIC SCHOOLS

SMITH MEADOWS Sustainable Farm

LANE

URBAN ZINK CONTRACTOR, INC.

W.S. JENKS & SON

SHORB LANDSCAPING

Annie's ACE Hardware

Friends of Soldiers Home

EDRICH LUMBER, INC. Since 1952

d. District Department of Transportation

GEORGE WASHINGTON'S MOUNT VERNON

GARNER EXTERIORS

HOMESTEAD GARDENS

MAGSTONE

Ten Oaks Nursery & Oasis Landscaping

MAPLE HILL LAWN & GARDEN

ROCK GROVE LANDSCAPE RSSY



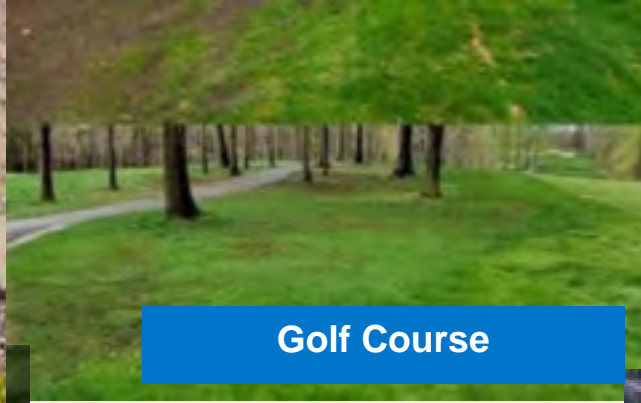
What's Grown in Bloom



Hay Farm



Horticultural Society



Golf Course



Hobbyist Vintner/Grape Grower



Cut Flower Farm



Street Tree Plantings



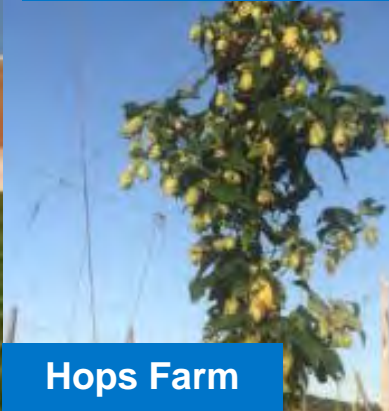
Elementary School Garden



Wetlands Restoration



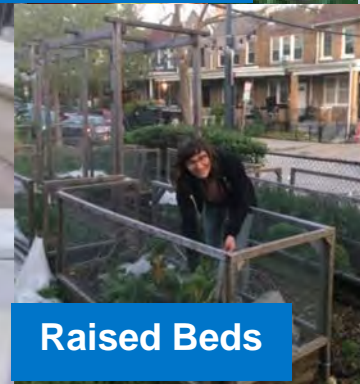
School Landscaping



Hops Farm



Home Veg Gardens



Raised Beds



Commercial Corn

Construction/Blending & Agriculture, Ideal Applications for Fresh Bloom



Commercial soybeans



Maryland State Highway project



Blends Ideal for Commercial and Residential Landscaping



Great for lawns!



“This was our first job with Bloom and we got better results than I think we’ve ever seen, and certainly never so quickly! We did core aeration and overseeding of an existing lawn with poor, claylike soil and within seven days the tall fescue grass was jumping. Anyone trying to establish grass should consider using Bloom.”

– *Bobby White, Owner, Maple Hill Lawn & Garden*

Kane Landscape project using sandy blend, Leesburg VA

School Athletic Field Rehab





bloomsoil.com

april@bloomsoil.com

Facebook: [@bloomsoil](https://www.facebook.com/bloomsoil)

Instagram: [@bloom.soil](https://www.instagram.com/bloom.soil)

bloomsoil.com

July 28, 2022



City of St. Cloud Public Utilities





History

Pre 1954

- No Treatment in St. Cloud Area





History

1954

- Treatment Facility By SCSU





History

1976

- Treatment Facility Relocated





History

2013

- Treatment Updates

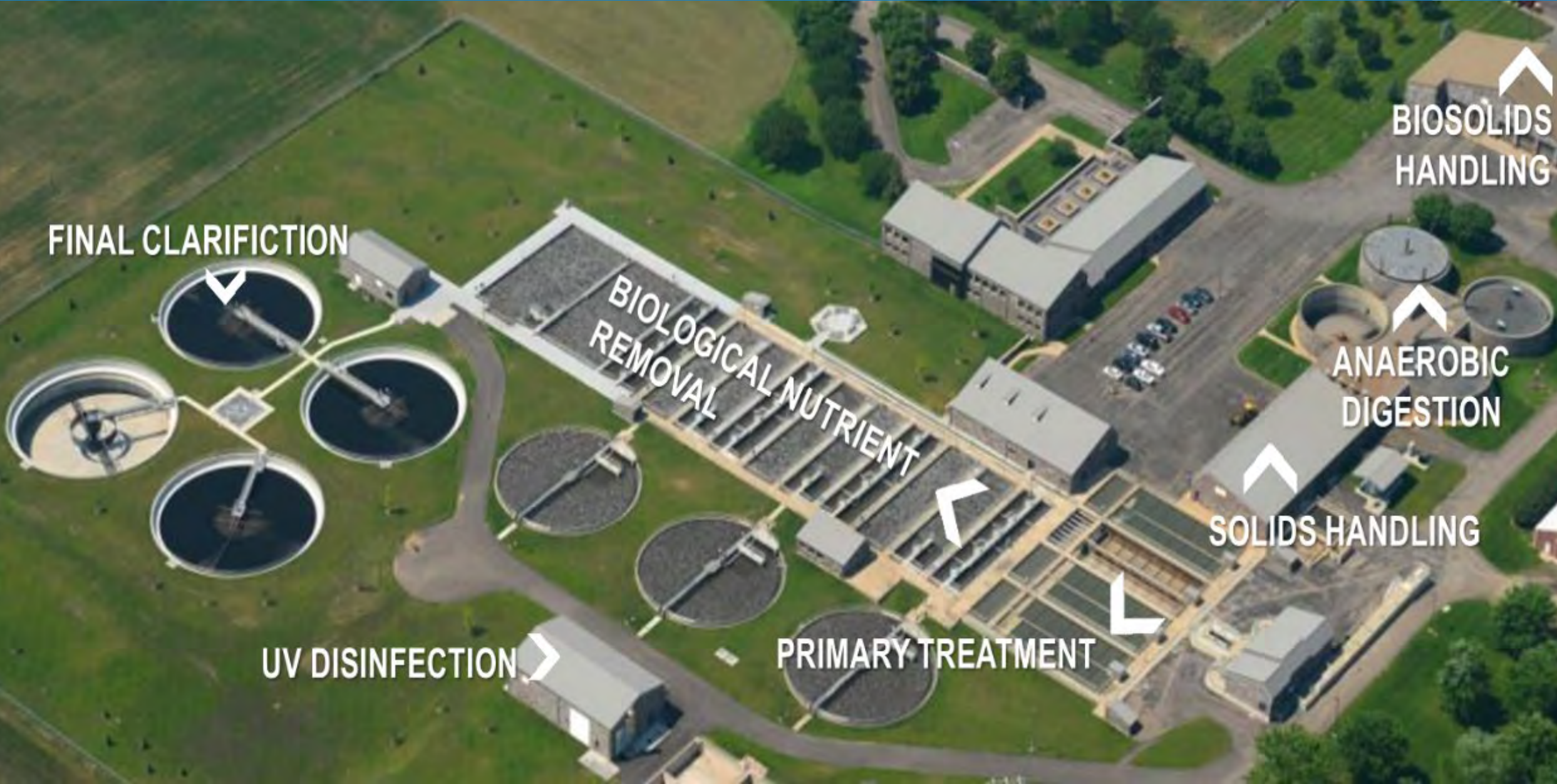


ST. CLOUD NEW RECOVERY FACILITY

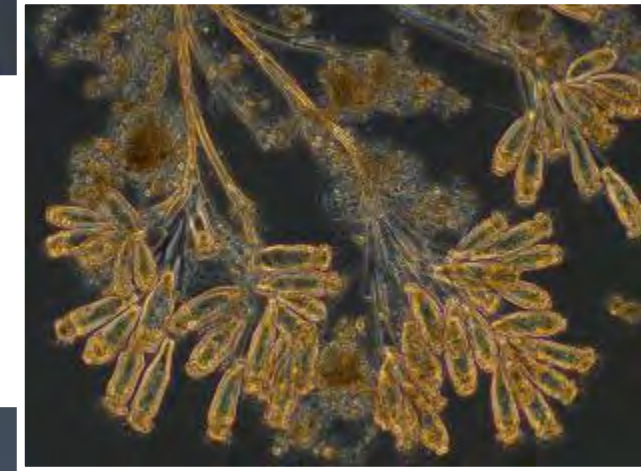
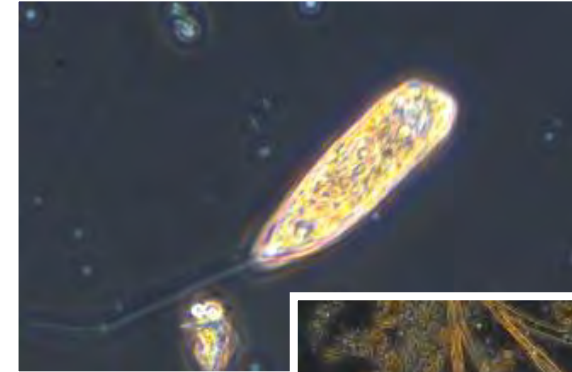
- Wastewater from **5** cities
- Total population of **120,000** people
- **10-11** million gallons/day
- Staffed **24** hours/day, **365** days/year



TREATMENT OVERVIEW



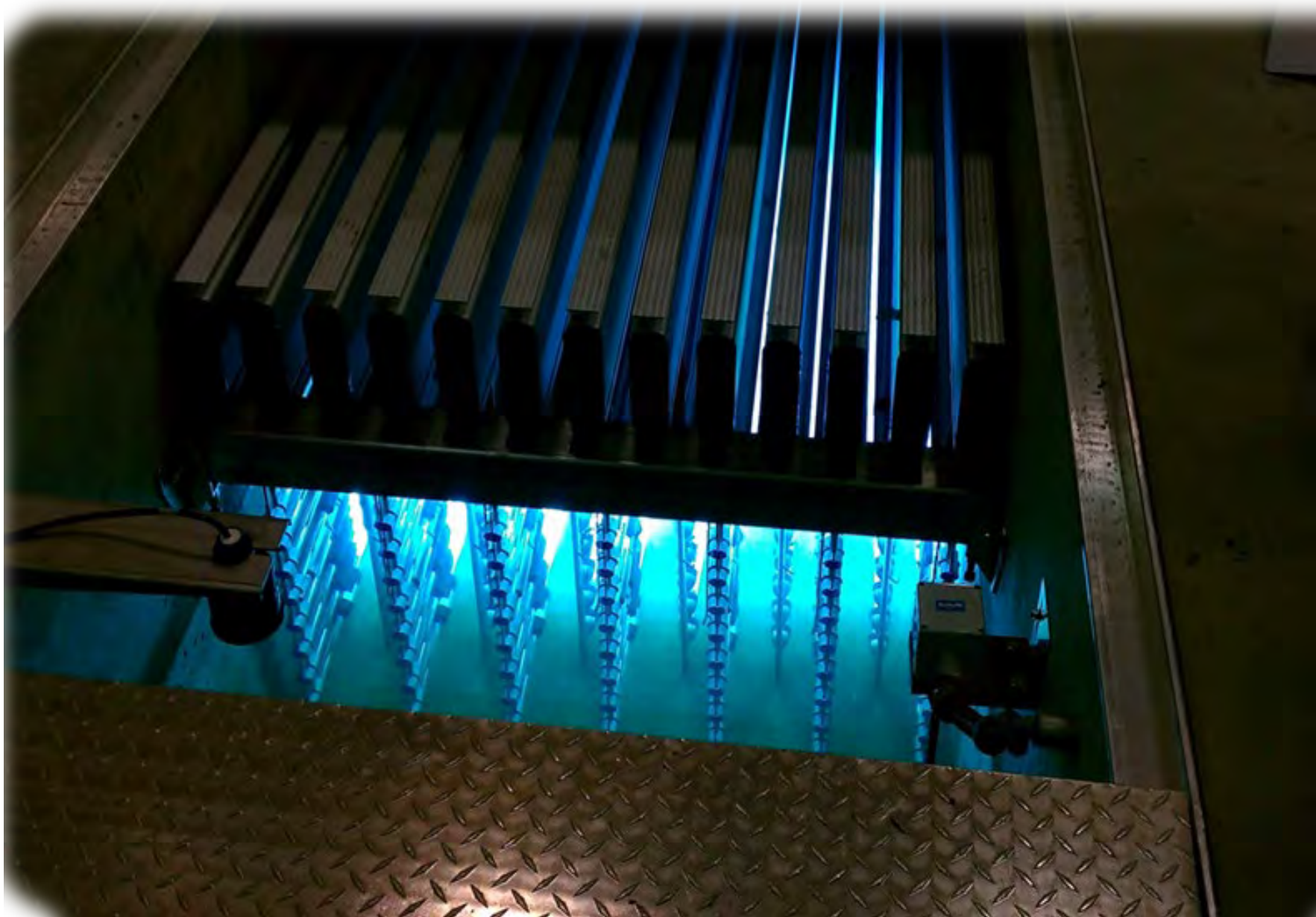
FULL BIOLOGICAL NUTRIENT REMOVAL



FINAL CLARIFICATION



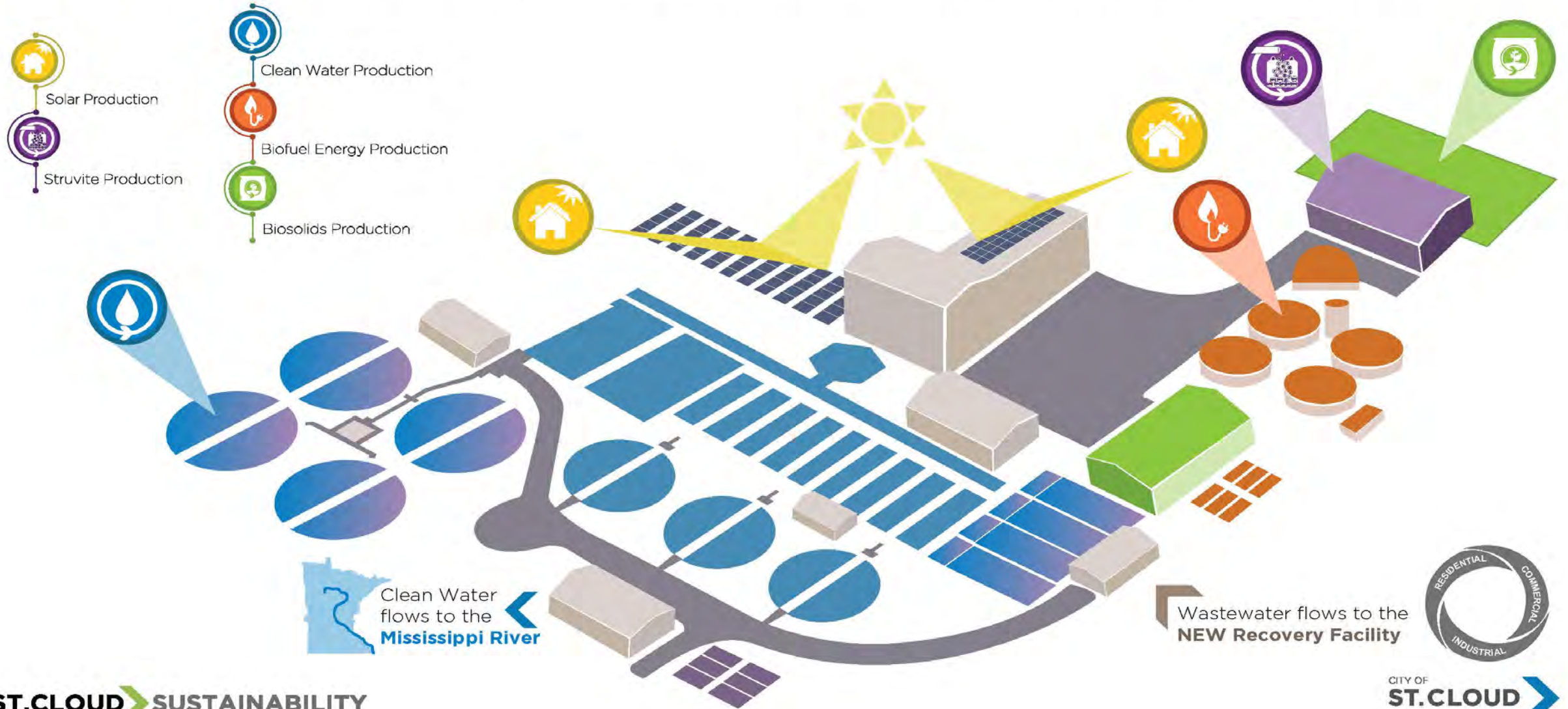
UV DISINFECTION



St. Cloud Nutrient, Energy & Water Recovery Facility

Producing Clean Water, Renewable Energy, and Recovering Nutrients

The St. Cloud NEW Recovery Facility is a leader in innovative, cost-effective, and sustainable practices, producing renewable energy, recovering nutrients, and sending clean water back to the environment. The NEW Recovery Facility makes the City of St. Cloud GREATER, converting waste products to renewable resources.





**Biofuel
Recovery**



**Biosolids
Reuse**



**Nutrient
Recovery**

SOLIDS • THICKENING



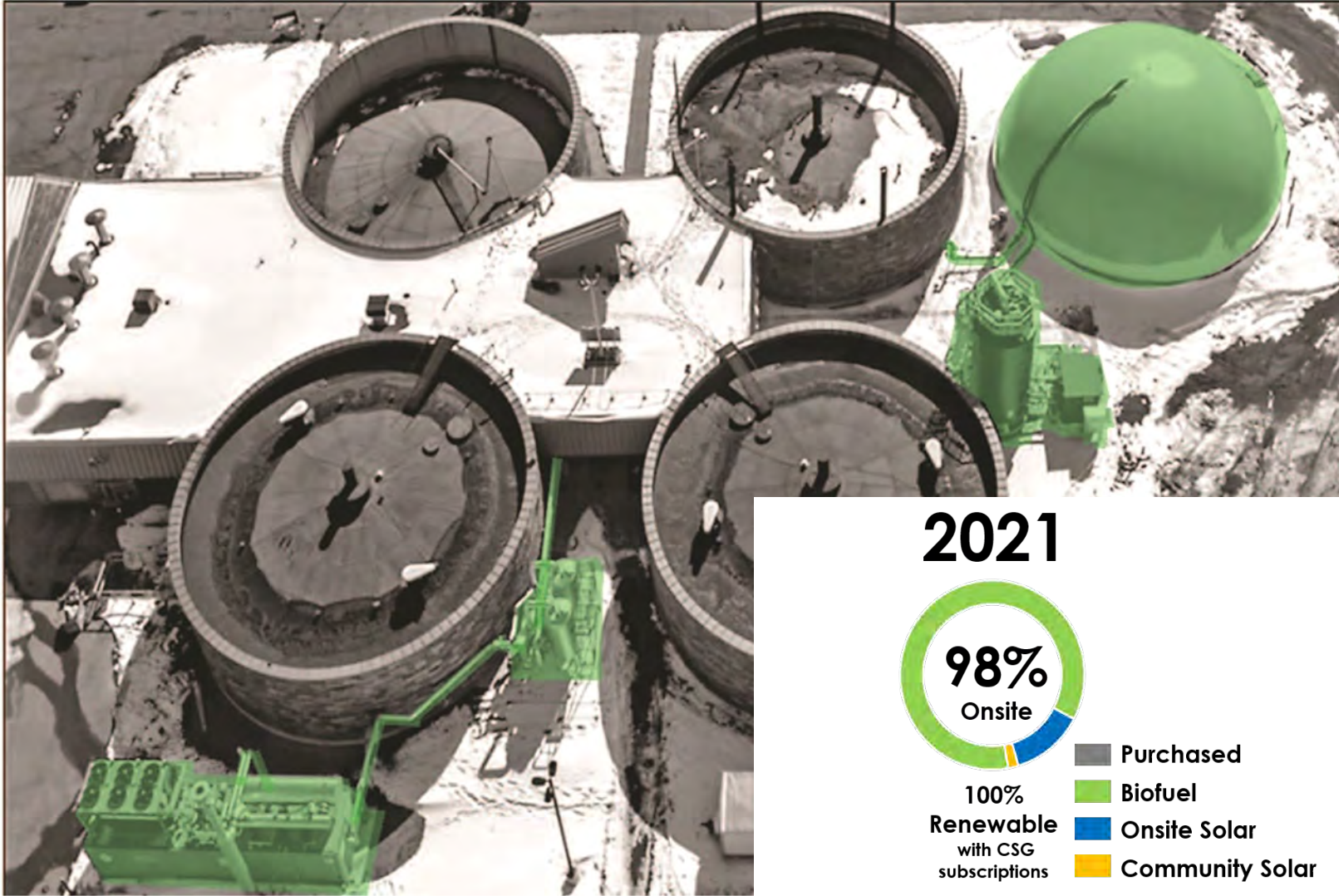
HIGH STRENGTH WASTE PROGRAM



ANAEROBIC DIGESTION



BIOFUEL & HEAT RECOVERY



DIGESTION OVERVIEW

35,000 Municipal Solids + 20,000 gallons High Strength Waste

Thickened to 9% solids by the Gravity Belt Table

Digested for >15 days

TVS Reduction 60%

EPA Class B Liquid Biosolids, ~ 4% solids



DEWATERING



	Class B Biosolids (gallons)	Class A Biosolids (gallons)	Volume Reduction
2018	4,321,000	1,516,580	64.90%
2019	17,365,000	4,872,120	71.94%
2020	17,515,000	5,278,980	69.86%
2021	16,301,000	4,656,210	71.44%
2022	9,463,000	2,416,170	74.47%

LYSTEK • KEY COMPONENTS



BOILER

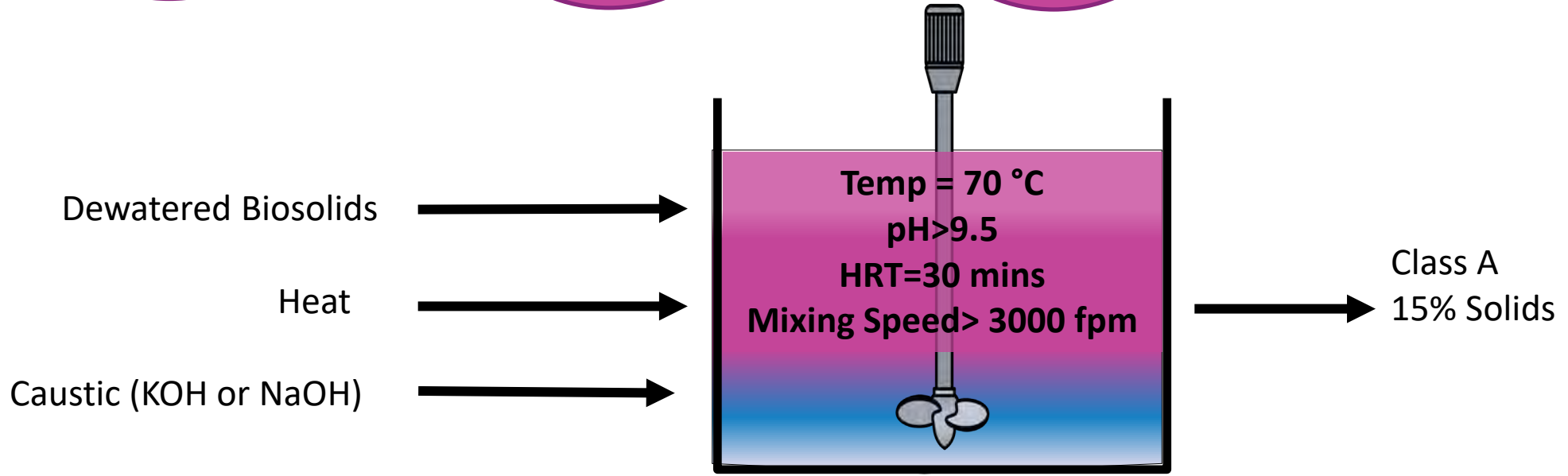


CAKE HOPPER



REACTOR

LYSTEK • PROCESS OVERVIEW



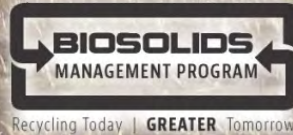
RECENT APPLICATION



	Spring 2018	Spring 2022	Difference
Gallons applied:	6,630,695	2,392,870	-64%
Acres applied to:	716.3	590.7	-18%
Miles driven:	11,294	3,021	-73%
Gallons of fuel used:	4,393.9	1,654.1	-62%
Days of recycling:	29	25	-14%
Total Dry Tons applied:	1,049.7	943.3	-10%
Total Pounds of Nitrogen:	143,164.4	98,684.7	-31%
Total Pounds of Phosphorus:	75,045.9	72,828.4	-3%

PROGRAM MANAGEMENT

CITY OF
ST.CLOUD  **BIOSOLIDS PROGRAM**
MINNESOTA

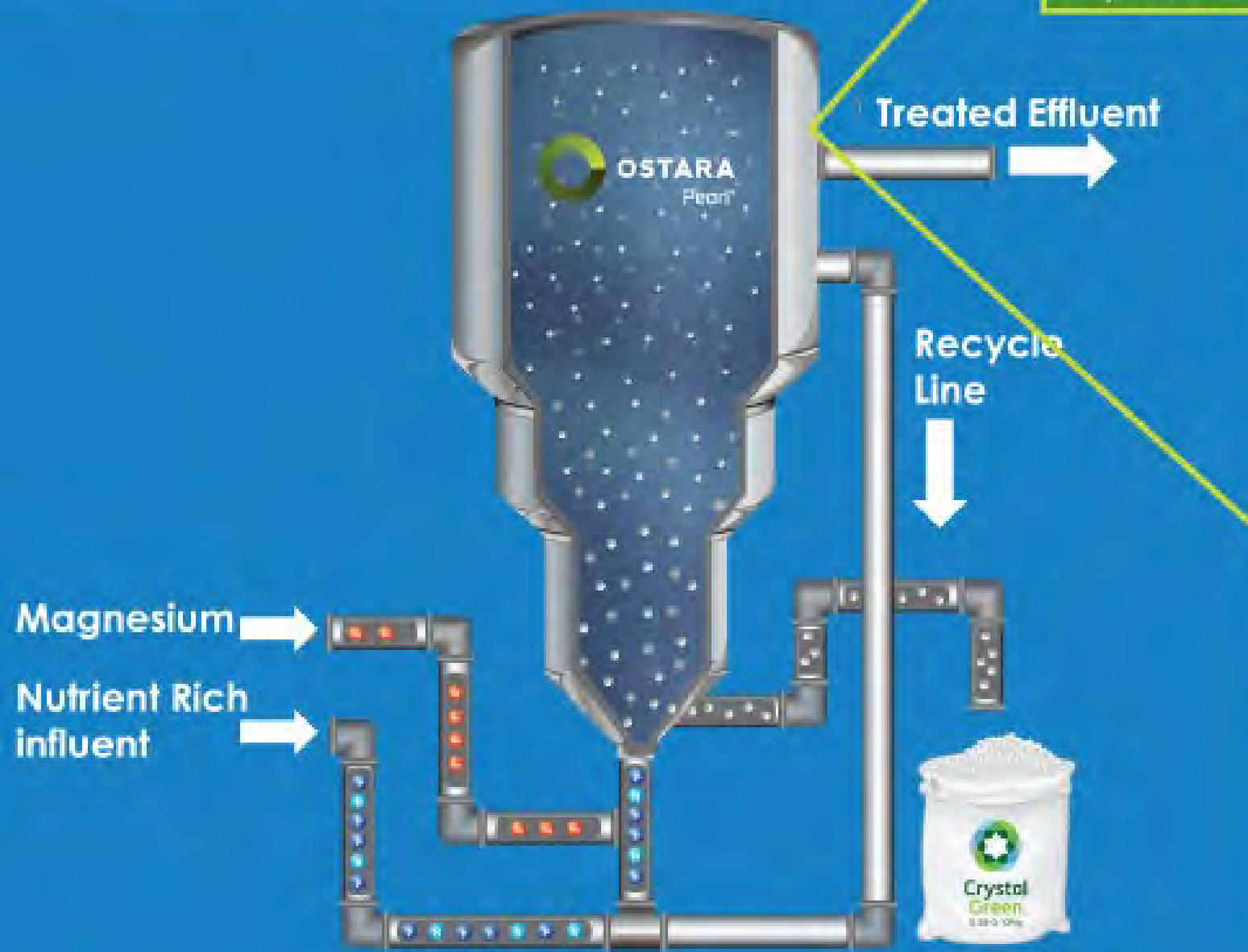


Providing a highly valued agricultural product that is produced in a professional, cost-effective, and sustainable manner.

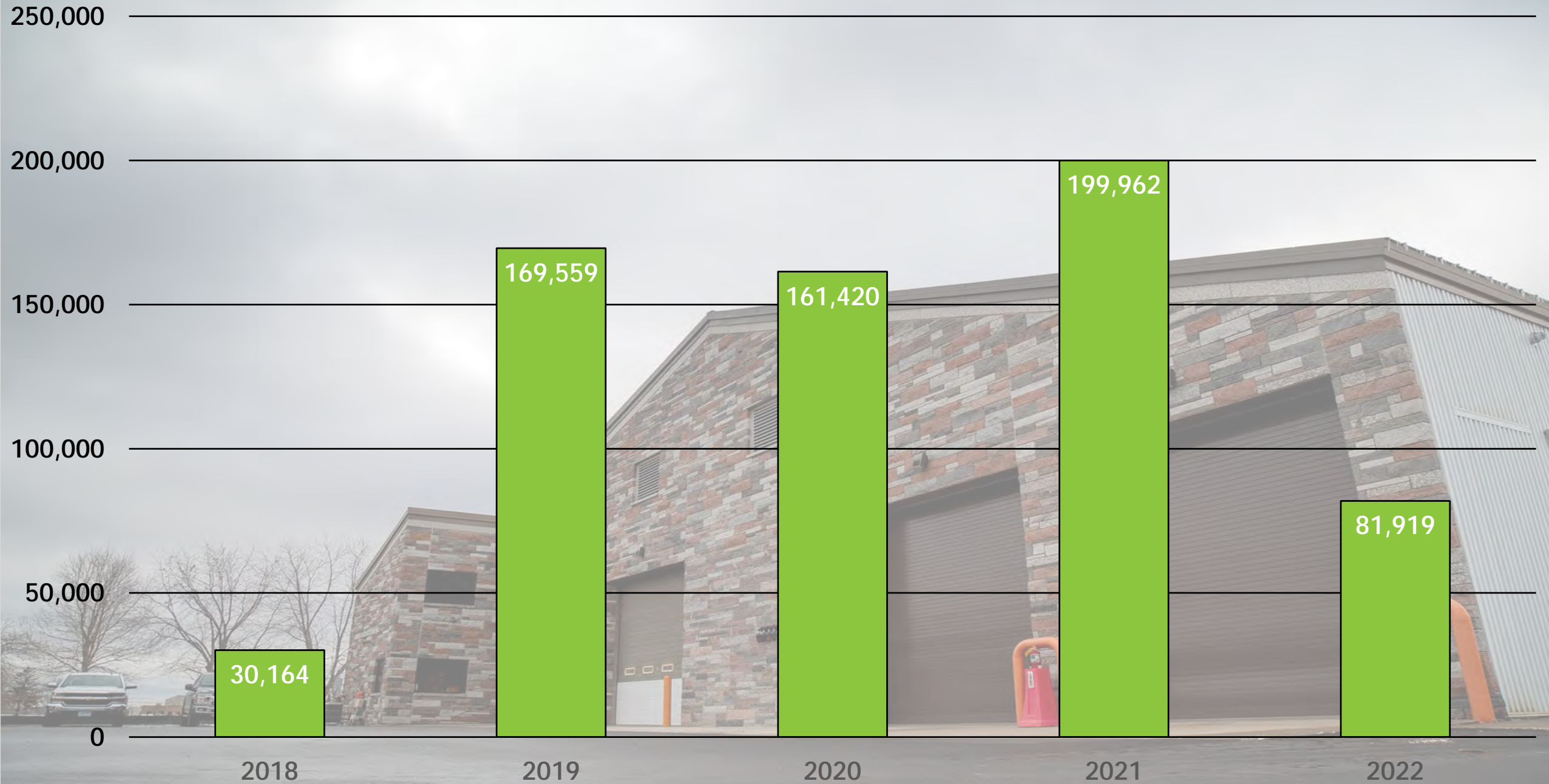
A certificate from the National Biosolids Partnership. The certificate is framed with a decorative green border. At the top left is the logo for the National Biosolids Partnership, which consists of a stylized swirl in orange, green, and blue. To the right of the logo, the text reads "NATIONAL biosolids PARTNERSHIP". Below this, it says "TIER 4" in large letters, with a gold ribbon award containing the number "4" next to it. To the right of "TIER 4" is the text "PLATINUM LEVEL AWARD". Below this, it says "REPRESENTING ACHIEVEMENT IN BIOSOLIDS MANAGEMENT AND ENVIRONMENT STEWARDSHIP". The main body of the certificate contains the following text: "This organization, St. Cloud Public Utilities St. Cloud, MN has successfully met the Platinum Level requirements for the National Biosolids Partnership Biosolids Management Program that supports excellence in biosolids management practices, augments regulatory compliance obligations, environmental performance and provides meaningful opportunities for public participation." At the bottom left is a smaller version of the National Biosolids Partnership logo with the text "Certified Management Program" below it. At the bottom right, the year "2021" is printed.

BIOFERTILIZER

Since 2018, the facility produces this crystalline biofertilizer product which contains slow-release phosphorus for crop production = reuse & revenue source



PHOSPHORUS RECOVERY (lbs.)



Food Waste Pilot Study

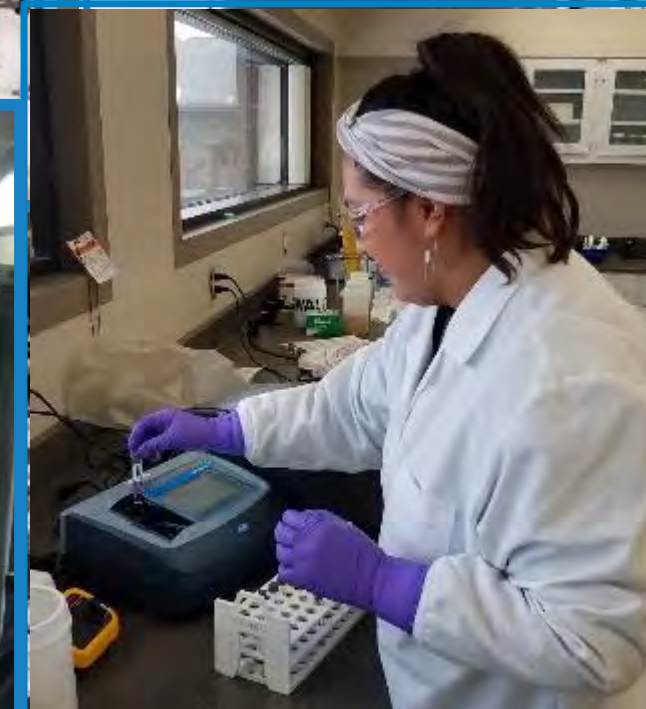
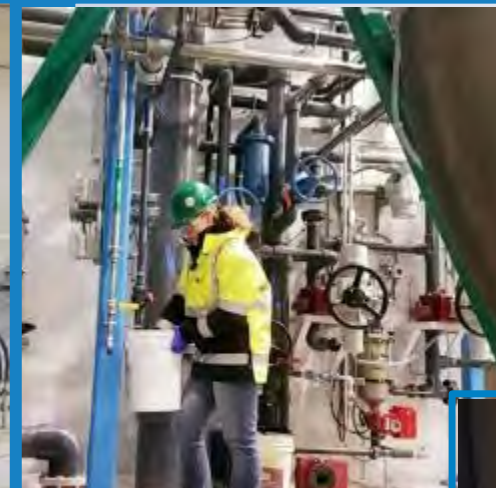


Key Takeaways

- Co-digestion Impacts
 - Biosolids product:
 - Nutrient value and volume
 - Application rates
 - Financial:
 - Revenue source from tipping fees
 - Decreased energy costs
 - Beneficial partnerships with local industries
 - Environmentally friendly disposal option
- Why Lystek
 - Volume reduction
 - Cost to haul reduction
 - Class A liquid biosolids product



TEAM ST. CLOUD • PEOPLE



Passion for Clean Water & Resource Recovery

ST.CLOUD  **GREATER**

> INNOVATION > IMPROVEMENT > EXCELLENCE

Thank you!

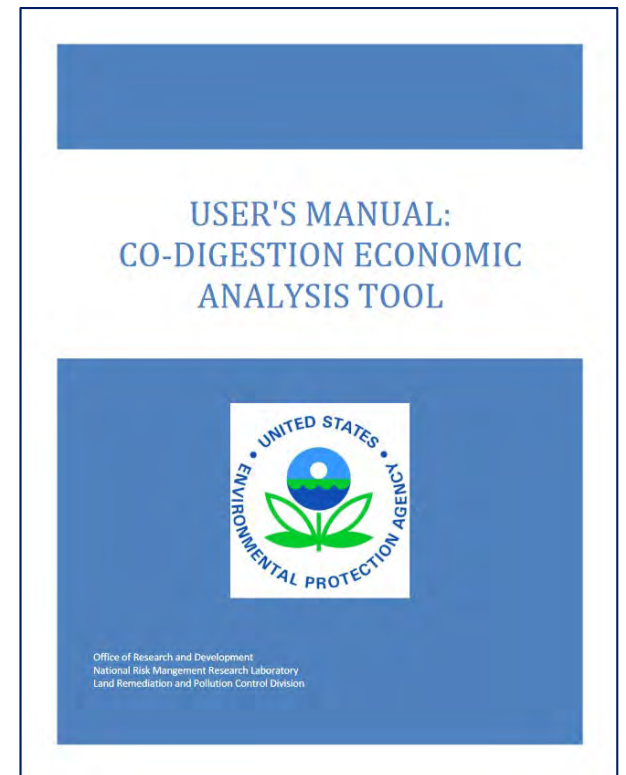


TEACH AD – Educational Assistance

- In person workshops (2)
 - Onsite events
 - Tour of the site
 - **April 2022: Kishwaukee Water Reclamation District for**
 - **Visit erc.uic.edu/bioenergy/teachad/in-person-workshops/**
- Webinars (10)
 - Will cover different aspects of an anaerobic digestion project
 - **Join us again in September for our 7th Webinar**
 - **Visit erc.uic.edu/bioenergy/teachad/teach-ad-webinars/**
- Project profiles (8)
 - Will highlight successful AD projects
 - **First two project profiles covering UW Oshkosh and Urbana Champaign Sanitary District**
 - **Visit <https://erc.uic.edu/bioenergy/teachad/project-profiles/>**

TEACH AD – Technical Assistance

- Anaerobic Digestion Technical Assessments
 - Tailored technical assistance to each client
 - Initial economic and physical feasibility assessment for (co)digestion of organic wastes
 - Assess opportunity for using U.S. EPA’s Co-Digestion Economic Analysis Tool (CoEAT)
 - Report presentation and follow up with next steps



Visit erc.uic.edu/bioenergy/teachad/technical-assessments/

TEACH AD – CoEat Analysis

	Current	Future A	Future B	Future C	Future D	
Biogas Produced (cf/yr)	13,862,185	26,169,378	26,169,378	26,169,378	26,169,378	37,978.59 cfd
Total Biogas Heating Energy (MBTU/yr)	6,307	11,906	7,620	11,906	0	71,696.92 cfd
Total Energy Needed for Heating (MBTU/yr)	3,853	4,421	4,421	4,421	4,421	49.7895311 cfm
Max Capacity of Digester (gal)	1,115,000	1,115,000	1,115,000	1,115,000	1,115,000	
Feedstock Feed Rate (gal/day)	13,215	16,907	16,907	16,907	16,907	
% Solids of Feedstock Fed to Digester (%)	3.8%	5.2%	5.2%	5.2%	5.2%	
Percent Volatile Solids Reduction (%)	57%	57%	57%	57%	57%	
Actual Hydraulic Retention Time (days)	67.8	53.0	53.0	53.0	53.0	
Target Hydraulic Retention Time (days)	15.0	15.0	15.0	15.0	15.0	
Available Capacity (Gal/day)	46,519	42,827	42,827	42,827	42,827	
Additional Volume Needed to Treat Feedstock (gal)	0	0	0	0	0	
Mass of Biosolids (Tons/yr)	450	704	704	704	704	
Biosolids Cost (\$/yr)	(\$58,608.55)	(\$88,792.80)	(\$88,792.80)	(\$88,792.80)	(\$88,792.80)	
Biosolids Revenue (\$/yr)	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	
Tipping Fees (\$/yr)	\$0.00	\$127,622.25	\$127,622.25	\$127,622.25	\$127,622.25	
Avoided Natural Gas Costs (\$/yr)	\$33,995	\$66,038	\$28,222	\$0	(\$39,006)	
Avoided Electricity Costs (\$/yr)	\$0	\$0	\$129,613	\$0	\$0	
Avoided Vehicle Fuel (\$/yr)	\$0	\$0	\$0	\$305,983	\$486,629	
Annualized Cost of Plant Upgrades (\$/yr)	\$0	(\$36,833)	(\$113,230)	(\$134,973)	(\$149,467)	
Annual Operations and Maintenance (\$/yr)	(\$5,000)	(\$5,000)	(\$67,566)	(\$87,632)	(\$121,673)	
Net Annualized Value (\$/yr)	(\$29,614)	\$63,035	\$15,869	\$122,208	\$215,312	
Simple Payback (yr)	NA	NA	7.7	5.8	4.9	

Return to Inputs/ GUI

Restore Default Formulas

Print Input Values

TEACH AD – CoEat Analysis

Current: Use biogas to heat digester and incoming feedstock. Value is given to excess heat. If digester heating demand is not met, expense for natural gas will incur.

Future A: Use biogas to heat digester and incoming feedstock. Value is given to excess heat. If digester heating demand is not met, expense for natural gas will incur. This scenario is not achievable as the plant does not have enough heat demand.

Future B: Use biogas in CHP to heat digester and incoming feedstock and generate electricity. Value is given to the electricity generated and excess heat. If digester heating demand is not met, expense for natural gas will incur.

Future C: Use biogas to heat the digester and convert the rest to vehicle fuel. If digester heating demand is not met, no biogas will be available for CNG and an expense for natural gas will incur.

Future D: All biogas is converted into vehicle fuel. Cost of natural gas to meet the heating demand of the digester and incoming feedstock will incur.

For a detailed review of the calculations and assumptions, please observe the "4. Biogas Use" worksheet.

Analysis

Percent increase in heating demand =

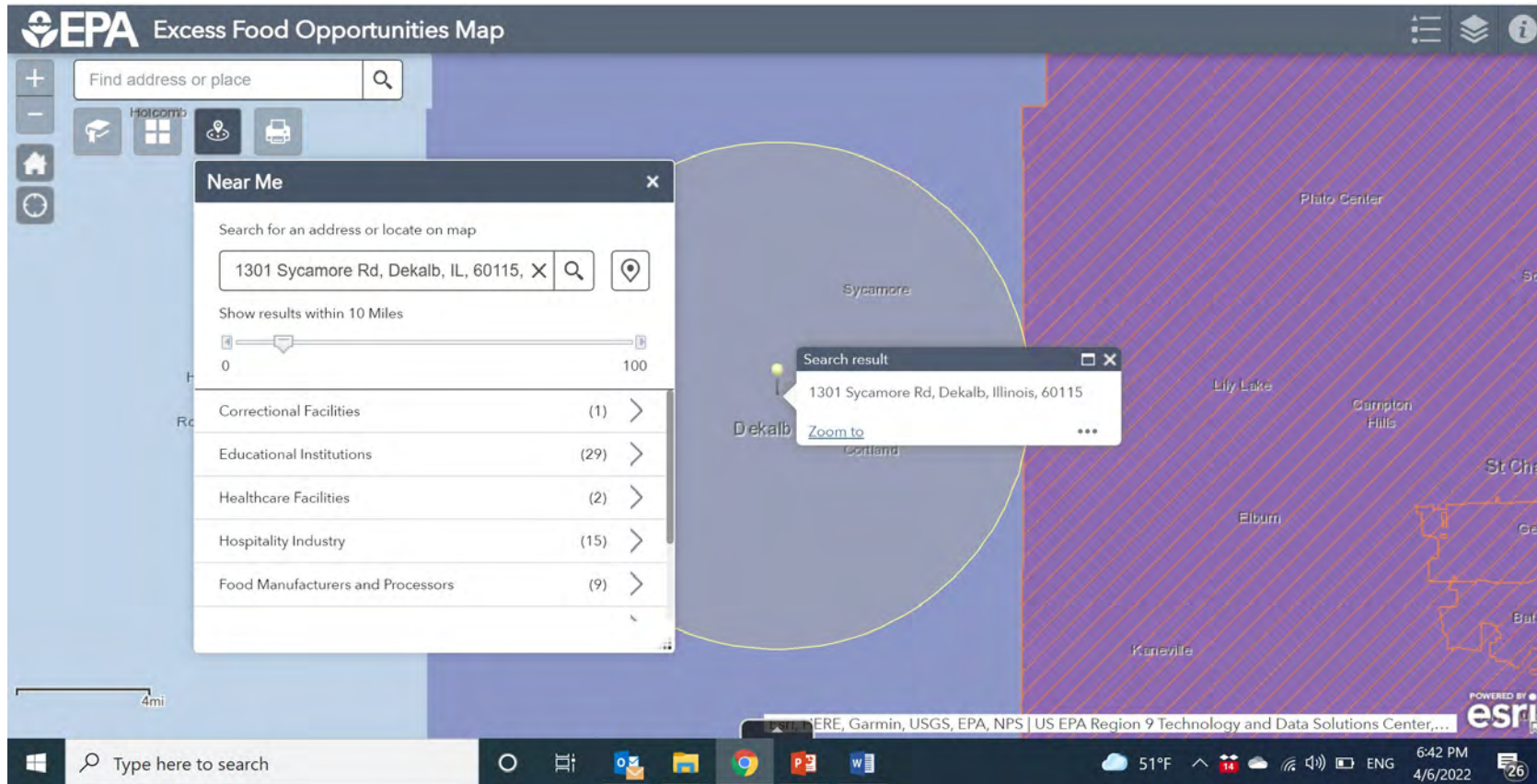
Percent increase in biogas production =

Percent increase in biosolids =

Additional volume needed to treat feedstock = [gal]

Size of CHP = kW

TEACH AD – EPA Food Waste Map



TEACH AD - Contact

Marcello Pibiri

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PROGRAM OFFERINGS

Technical Assessments

In-person Workshops

On-line Webinars

Project profiles

ELIGIBLE FACILITIES AND PROJECTS

Water Resource Recovery Facilities

Municipal Food Waste Digesters

Community - Based Digesters

Food Processing, On-Farm Digesters

Questions & Answers



Marcello Pibiri

Senior Research Engineer
UIC Energy Resources Center



Elijah Stuber

Environmental Compliance Specialist
City of St. Cloud



April Thompson

Director of Marketing and Sales
Bloom, DC Water

TEACH AD Webinar Series

Join us again in **September** for our **7th Webinar!**

Thank You

Please fill out our survey.

A recording of today's webinar will be posted, and you will be emailed a link by early next week.



Thank You