Webcast

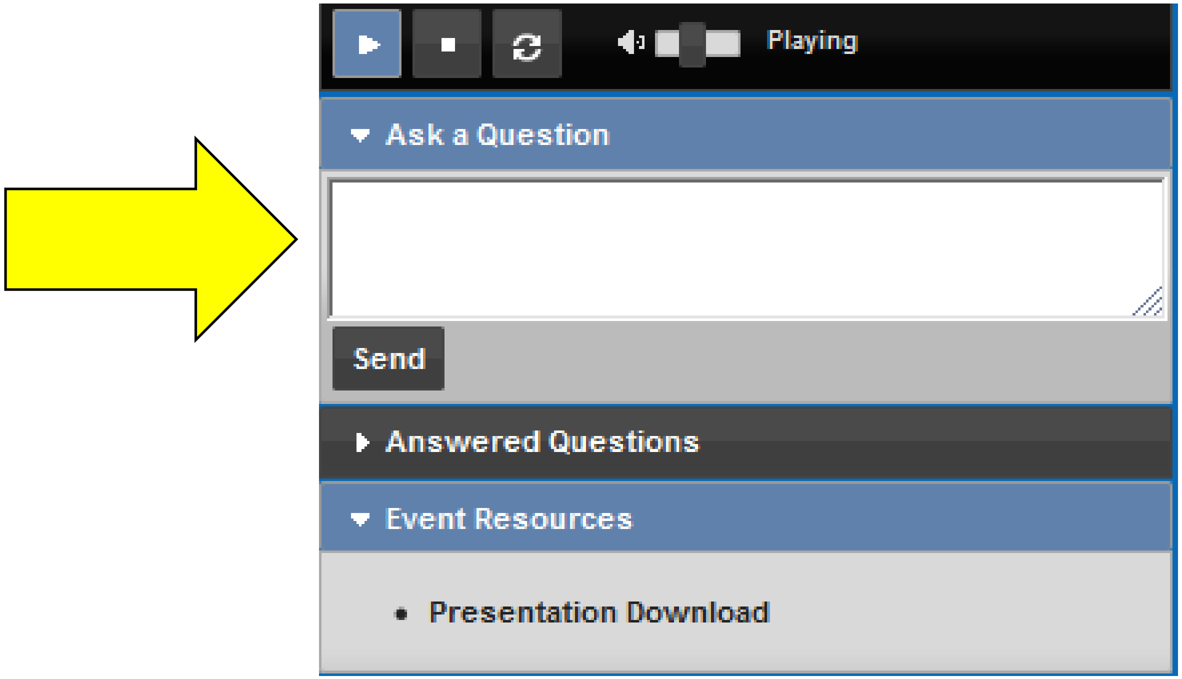
Business Cases for Co-Digestion of Food Waste: Lessons Learned

April 30, 2020

Housekeeping Items

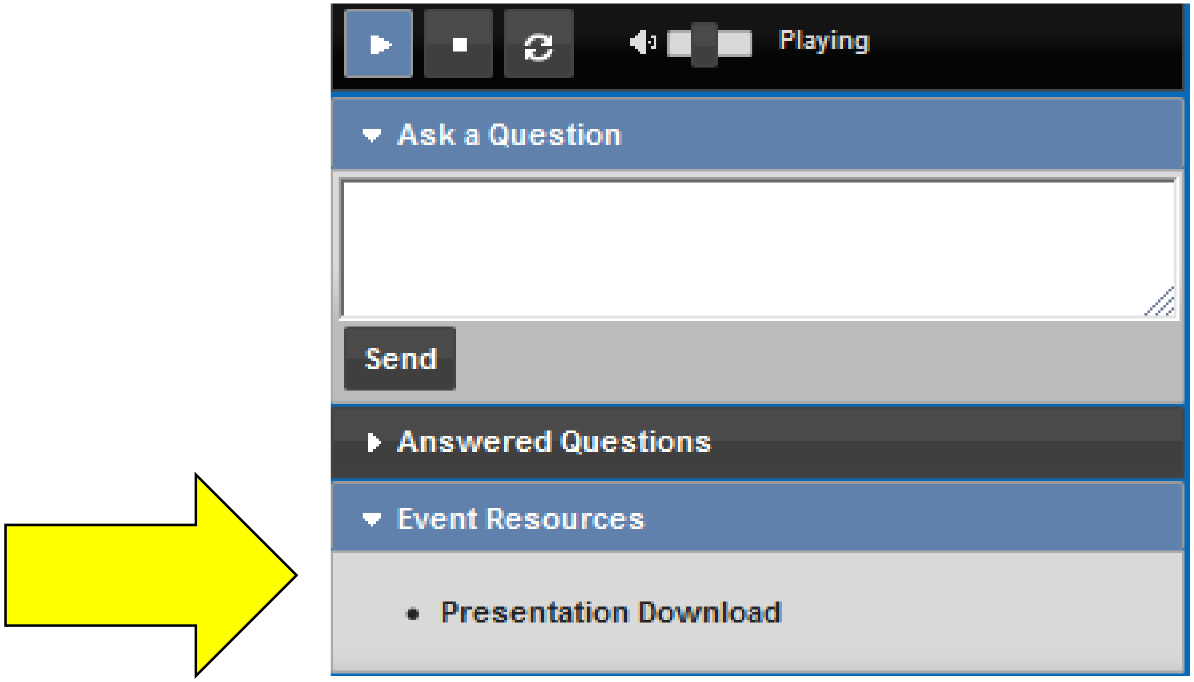
- Submit questions through the question box at any time! We will do a Q&A near the end of the webcast.
- Slides and a recording of the webcast will be available at www.waterrf.org.
- Survey at the end of the webcast.

Input your webcast questions here



Q&A at end of webcast

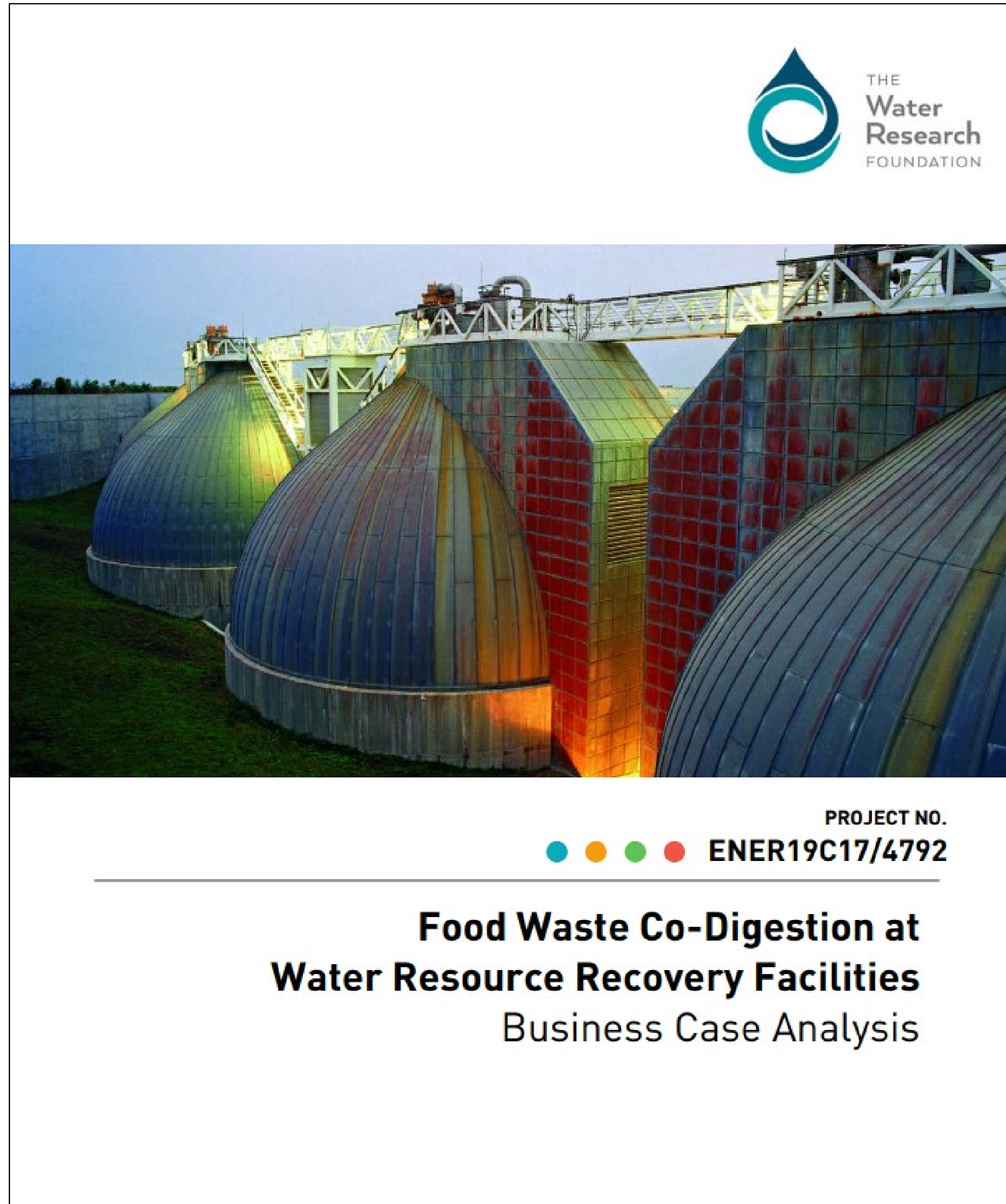
Download presentation



Slides and recording will be available within 24 hours after the webcast

Resources

- Report for WRF 4792 is now available for download on our website.
- You can access it here.


THE Water Research FOUNDATION

PROJECT NO.
ENER19C17/4792

Food Waste Co-Digestion at Water Resource Recovery Facilities
Business Case Analysis

Webcast Agenda

- Introduction
- Overview of Report
- Case Study : Sanitation Districts of LA County (CA)
- Case Study : Derry Township Municipal Authority (PA)
- Q & A

Business Cases for Co-Digestion of Food Waste: *Lessons Learned*

Carol Adaire Jones
Environmental Law Institute

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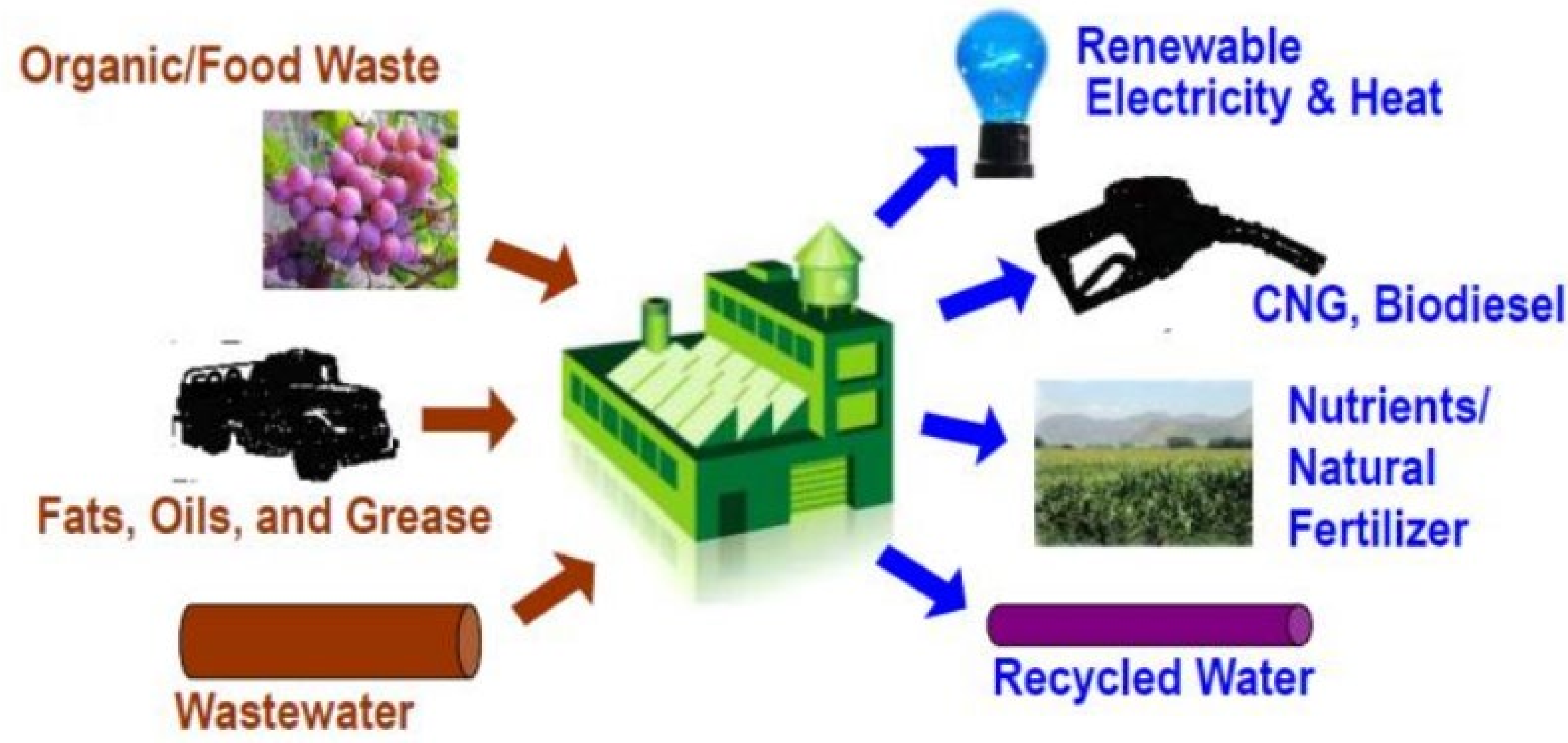
The Water Research Foundation Webcast
April 30, 2020

Food Waste Co-digestion at WRRFs: Business Case Analysis

- Authors
  - Carol Adaire Jones, Environmental Law Institute (ELI)
  - Craig Coker, Coker Composting and Consulting, Co-PI
  - Ken Kirk, Former Executive Director, NACWA, Co-PI
  - Lovinia Reynolds, ELI

Utility of the Future (UoTF): Resource recovery at wastewater facilities (WRRF)

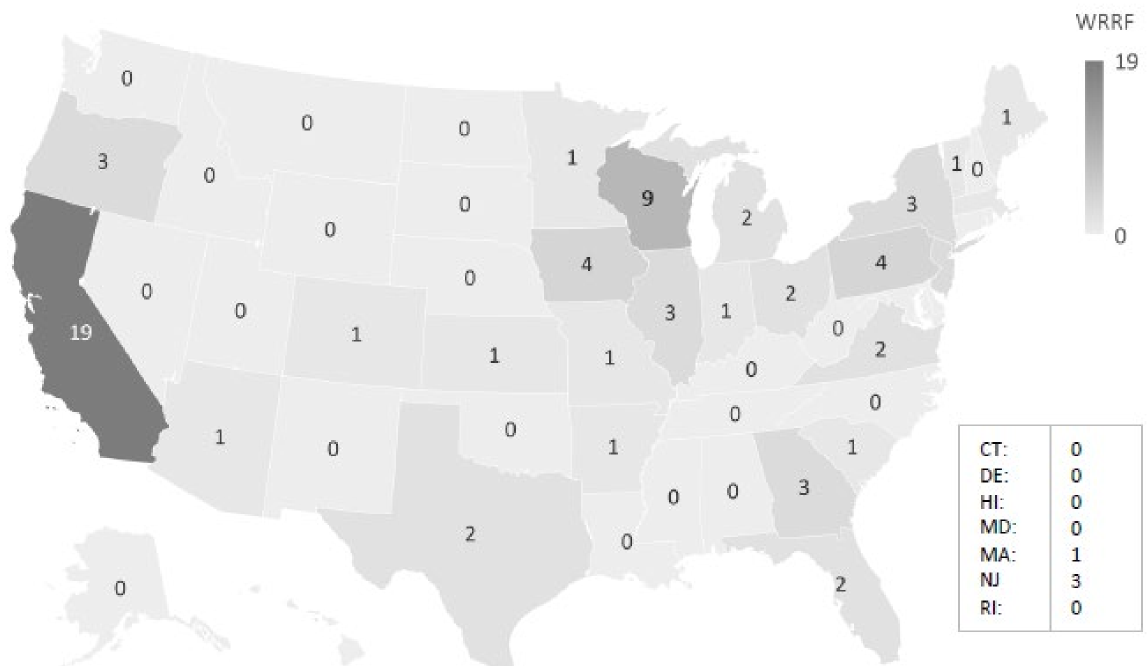


Co-digestion of food waste: Creating *Triple Bottom-Line* value

- Start with the operational gains…
  - Leveraging unused digester and energy production capacity
  - Recycling waste products causing problems in current disposal
  - Increasing biogas production for renewable energy
- To create WRRF financial benefits,
  - Tipping fee revenues from new feedstocks
  - Energy cost savings and/or market revenues and green payment revenues, increased grid resilience
  - Lower wastewater operating and collection costs
- Environmental benefits,
  - Reducing GHG, other air, water emissions; recycling resources
- Community benefits
  - Reducing odors
  - Providing a service to industry waste generators, enabling economic development

Co-digestion of food waste: Unrealized potential

- About **1 in 10 of 14,000 WRRFs have AD** (though about half of ww flows covered)
- **Fewer than 1 in 10 with AD co-digest food waste** (USEPA)
  - Less than 1/3 of those co-digest food scraps
- …though more than 1 in 10 with AD co-digest all HSOW, including glycerin, biofuel wastes



Operating WRRF Food Waste Co-digestion Systems by State, 2016

Source: USEPA 2019.

Impediments and risks of co-digestion

Risk-averse wastewater sector culture meets various risks:

- Operations/regulatory compliance
  - Operational upsets and additional costs for O&M
  - Added nutrients, contaminants may affect effluents, biosolids
  - Increased energy production may risk Clean Air compliance in non-attainment areas (energy production)
- Economics and financing
  - Uncertainties in feedstock availability, price uncertainty for feedstock, energy
  - Competing against core mission (WW) projects for scarce capital
- Stakeholder/political: odors, rate increases

Research approach

- *Question*: Can we identify alternative business models for co-digestion at WW treatment plants, suited for different contexts?
  - *Answer*: NO! WRRFs need to tailor strategy to utility mission, and resources, scale; and market and policy context
- The report offers general principles and case study examples of how to create value, manage risks
  - Lessons learned about successful business strategies
  - Solutions to address financial impediments and manage financial risks
  - Lessons learned about the role of public policy
- *Plus* a diagnostic framework for utility self-assessment of opportunities and business case for co-digestion

Methods and products

- Conducted structured interviews with more than 65 organizations (WRRFs; *plus* energy, solid waste, finance, technology, engineering & consulting sectors)
- Report six major case studies, 25 thumbnail sketches, which represent full range of WRRFs by
  - Characteristics: size, regional location
  - Policy and market environments
  - Strategic choices: food waste feedstocks, energy uses, biosolids uses, contracting and financing options
- *Plus* examples of co-digestion no-goes, suspensions, and cutbacks

Business case diagnostics

Strategic focus:
Can we create value and manage risks?

1. Is co-digestion consistent with the mission of the WRRF? Its goals?
2. What opportunities to create value and achieve mission goals can co-digestion unlock over time?
3. What strategies can we deploy to mitigate potential risks?

Elements to evaluate

- **Production:**
  - AD processing (excess capacity, or new investment? what technology?): *Implications for feedstock suitability*
  - AD feedstocks: which ones; acceptance criteria, receiving station, pre-processing: *Available? Implications for quality, quantity, price over time?*
  - Energy: products, technology, internal use or external sales: *Do I have current capacity to realize value from more biogas? New options?*
  - Biosolids and bioliquids: *will they increase? Enable new product to sell?*
- **Financing and contractual**: what role for private sector?
  - Contracting: *risk-sharing options?*
  - Financing: *access to SRF? Private options through PPP?*

Understand and leverage potential drivers that create value

- More stringent regulations of WRRF biosolids, plus FOG, industrial processing wastes, and food scraps
  - Create WRRF incentives to produce more value from biosolids (adopt AD, use biogas for thermal dryers to produce Class A)
  - Create supplies of food waste feedstocks for WRRFs
- Financial drivers
  - Energy savings and/or revenue
  - Financial incentives for greenhouse gas reduction, energy efficiency, and renewable energy (RECs, RINS, LCFS)
  - Financial incentives for landfill diversion of food scraps
- Utility commitments to environmental stewardship, and community service

Assess risks and develop risk mitigation strategies

- **Operations**: What strategies to address any impacts on:
  - Potential for digester upsets and downtime
  - Regulatory compliance (air emissions, water quality of effluent),
  - Biogas production (level and variability)
  - Biosolids and liquids production (quantity, nutrient content)
- **Financial value and risks**: How do I mitigate risks?
  - Costs for plant equipment repair and O&M, regulatory compliance; opportunity costs of equipment downtime
  - Feedstock revenues (how predictable are market supply & tipping fees?)
  - Energy cost savings and/or product revenues from created markets, green payment programs (how predictable are they over time?)
- **Stakeholders**: What strategy to gain support?

Lessons learned

To create a successful co-digestion program requires the right context

- A co-digestion champion in the utility or municipal government.
- Enough site space for vehicles to deliver feedstocks and for other equipment needs
- A business mindset to resource recovery
- Visionary utility board or municipal decision-makers who will support projects beyond the core wastewater mission that make economic sense for ratepayers
- Location with access to a sufficient supply of feedstock at a good price

Successful business strategies generally evolve over time

- ..as WRRFs learn from past successes and failures to improve economic performance
- With learning and growth, strategic questions evolve:
  - For example, for AD capacity, the focus evolves from identifying excess capacity, to rationing capacity to the highest value sources, and finally to examining the potential for co-digestion to support expansion in AD capacity.
  - For energy, the focus evolves from achieving onsite energy neutrality, to breaking down barriers to accessing the power grid, to exploring the potential for supplying RNG to the market

Why: No-goes, suspensions & cutbacks?

- **No-goes:** lack of sufficient ROI is main reason
  - Low energy purchase prices (low savings), low sales tariffs
  - Uncertain/low feedstock supply and revenues
  - Lack of financial incentive programs
  - Small size with resulting limited economies of scale
  - *Also*: NIMBY, no co-digestion champion, no political support
- **Suspensions of co-digestion**
  - Market changes: energy, feedstock markets
  - Major problems with feedstock quality (shut down digester)
  - Unanticipated capital investments (e.g., for pre-processing food wastes), unfavorable timing for accessing capital
- **Cutbacks in scale of co-digestion**
  - Loss of major supplier (with limited effort for feedstock development)
  - Equipment or other failures: No longer able to recycle biogas (loss of capacity to produce energy) or biosolids (lack of storage, suitable land for application)

Solutions exist for impediments and risks

Challenges	Solutions
Operational risks of new feedstocks (upsets, regulatory compliance)	• Research identifies best technologies/practices • Conduct initial feasibility/risk studies • Added maintenance, staffing may be required
Stakeholder concerns	Extensive public meetings and consultations, backed up with facts and figures
Feedstock economic risks: feedstock supply; tip fees	• Conduct market analysis • Develop contracts for feedstock supply with haulers
Energy economic risks: equipment hard/ expensive to maintain, not WRRF expertise; energy prices uncertain	Public-private partnerships: • Private energy developers can acquire and operate equipment, provide expertise WRRFs do not have • Power-purchase agreements set long-term prices
Scarce financial capital	• Various incentive program grants • Public-private partnerships can provide financing

Best practices

A successful business strategy…

Will not compromise plant environmental compliance

- The wastewater sector has important responsibilities for public health and environmental quality, which are central to its mission.
- Violation of those responsibilities can result in substantial financial penalties.

Calculates the financial analysis over the full investment life-cycle

- Can the utility establish the operational and financial capacity to support the program over the life-cycle of the investment?
- Need to identify revenues and costs from initial investments thru replacement, apply a ROI criterion
  - Full sequence of investments: AD, energy generation, and biosolids management capacity.
  - Full capital investment life-cycle, including maintenance and upgrades

Leverages available drivers in sync with WRRF mission

Important drivers creating value include:

- Regulatory policies requiring renewable energy, regulating wastes and biosolids
- Market-based opportunities to generate revenues and cost savings,
- Policies providing green payments to support investments in sustainability,
- Utility and community commitments to environmental quality, community service, including support for waste haulers

Incorporates strategies to address financial risks

Risk management strategies include:

- Diversifying sources and product outlets, establishing long-term contracts
- Building in equipment redundancies to allow for scheduled or unscheduled maintenance requirements
- Using public-private partnerships/contracts to share construction ***and operating*** risks with the private sector.

Thank you!

Report publications link:

https://www.eli.org/food-waste-initiative/publications

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Case Studies

- Sanitation Districts of LA County (CA)
  - *Speaker*: Mark McDannel, Manager of the Solid Waste Energy Recovery Section
- Derry Township Municipal Authority (PA)
  - *Speaker*: Bill Rehkop, Facilities Manager

SANITATION DISTRICTS OF LOS ANGELES COUNTY

Food Waste Recycling from Lab Scale to Commercial Program

Water Research Foundation Webcast

Mark McDannel

Manager, Energy Recovery Section

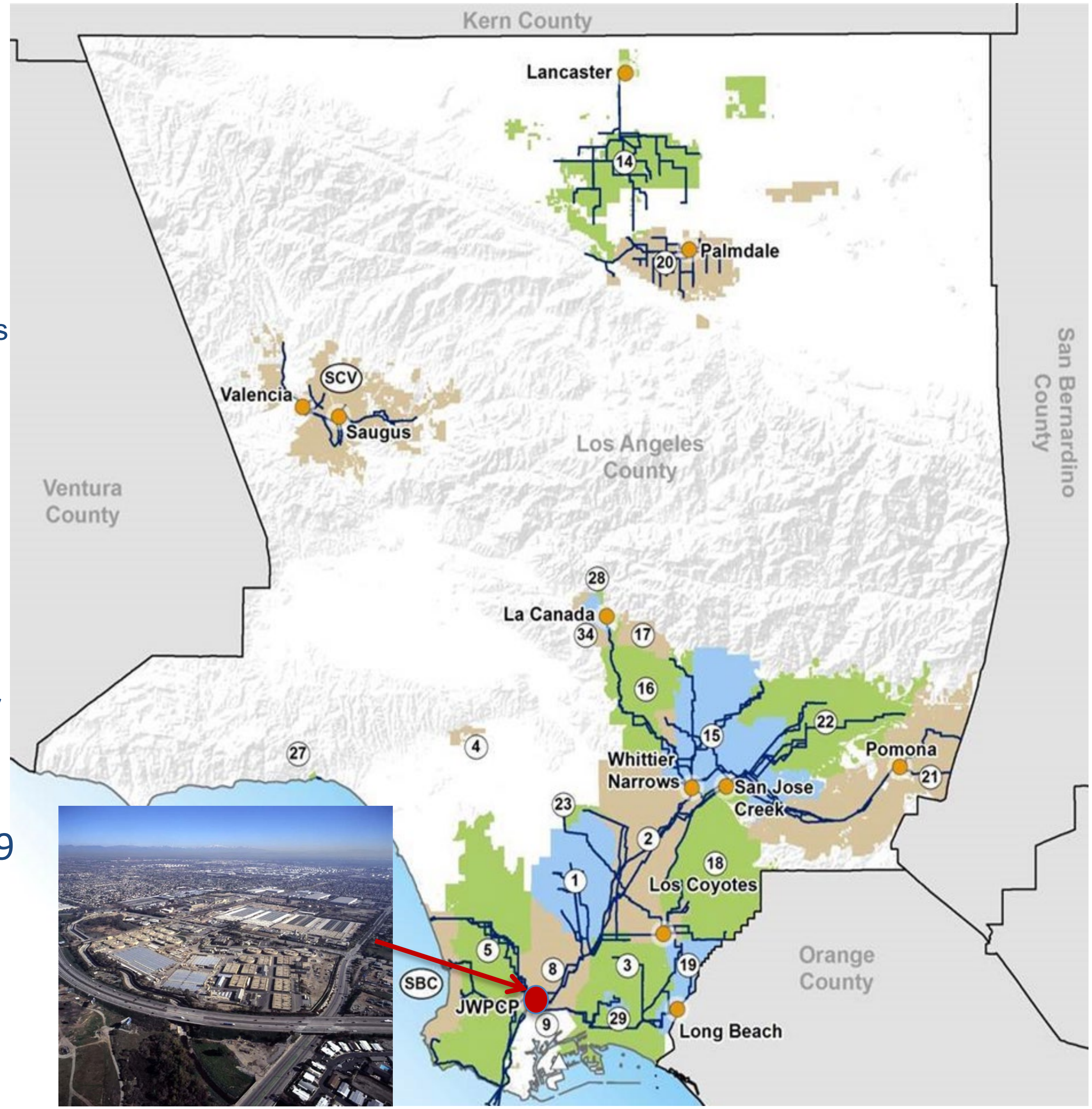
April 30, 2020

Why Food Waste Recycling?

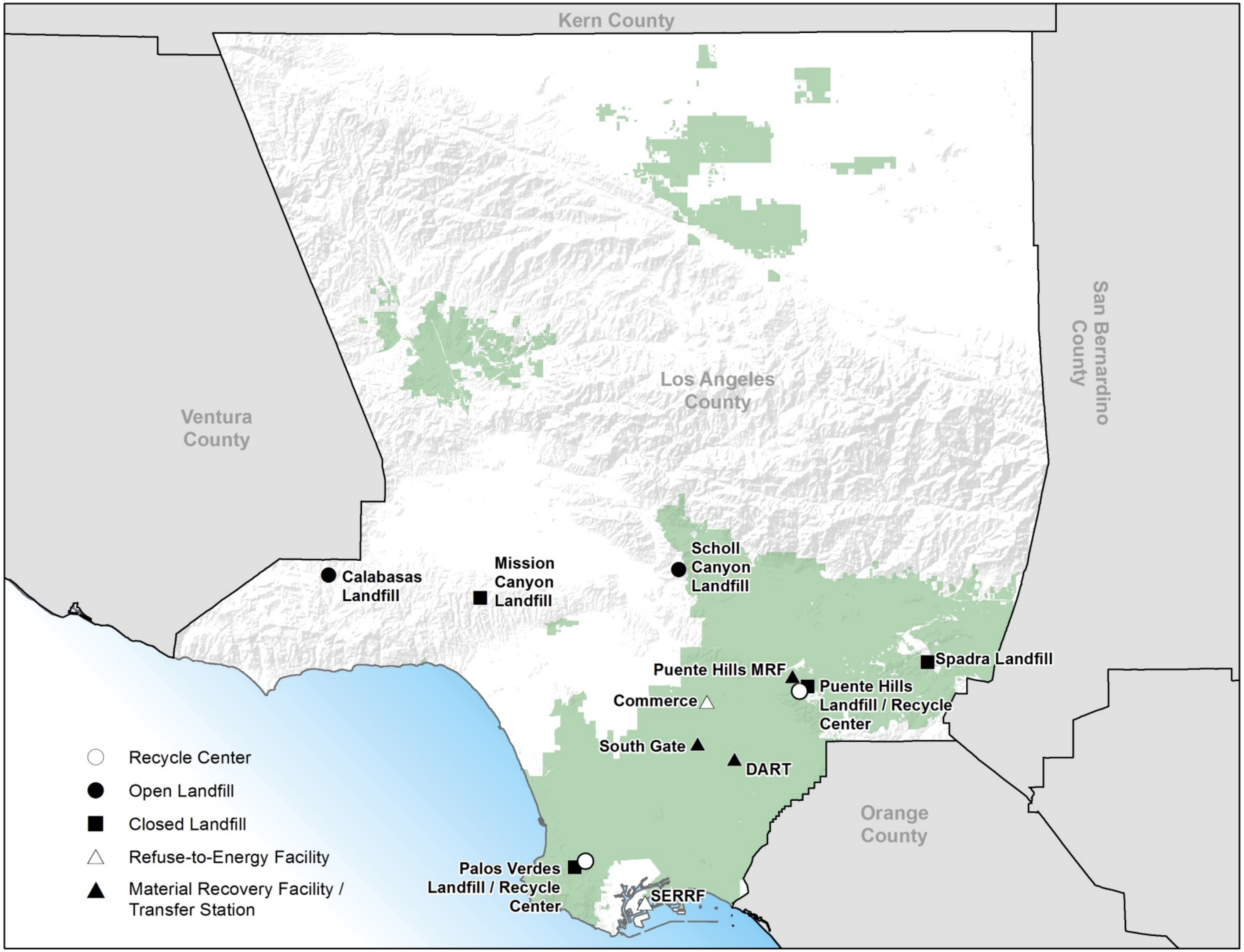
- Districts provide solid waste and wastewater services for 5 million people in Los Angeles County
- Natural technical and operational fit
- Help member cities meet landfill diversion goals
- “Converting Waste Into Resources” is in our logo

Districts' Wastewater Facilities

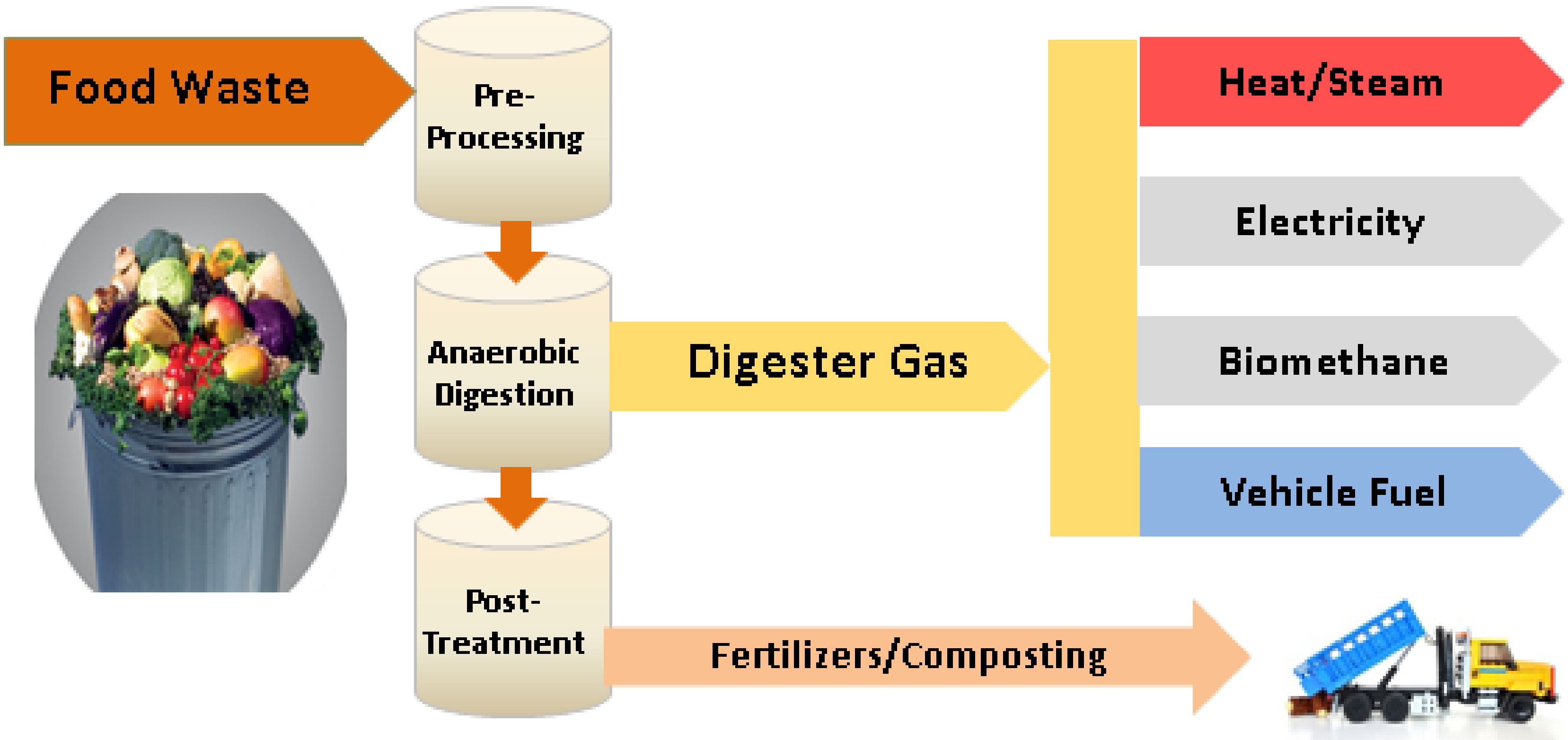
- Joint Water Pollution Control Plant…
  - 280 mgd treated
  - 24 active digesters
- Ten water reclamation plants
- Approximately 1,445 miles of main trunk sewer lines
- Districts operate 49 active pumping plants



Districts' Solid Waste Facilities



The Districts' Comprehensive Solution to Food Waste



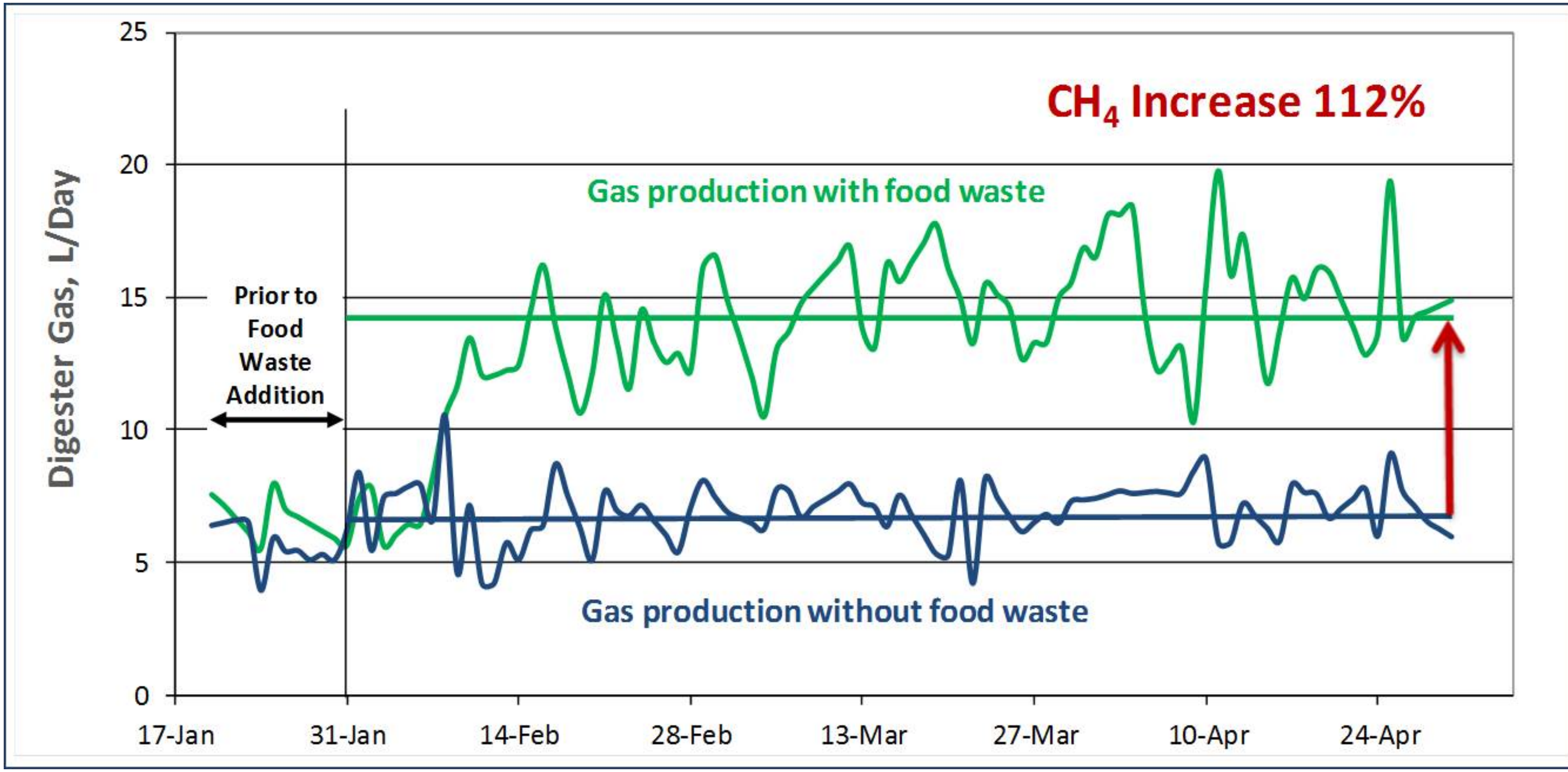
What Food Waste Do We Accept?

- Number one rule-addition of food waste cannot negatively impact treatment plant operations
- Food waste must be processed to be pumpable, have low contaminant levels
- Food waste must be digestible and not significantly increase biosolids production
  - No green waste

Pre-Processing: You Can't Take Trash to a Treatment Plant

Bioseparator Cleaning Is Labor Intensive

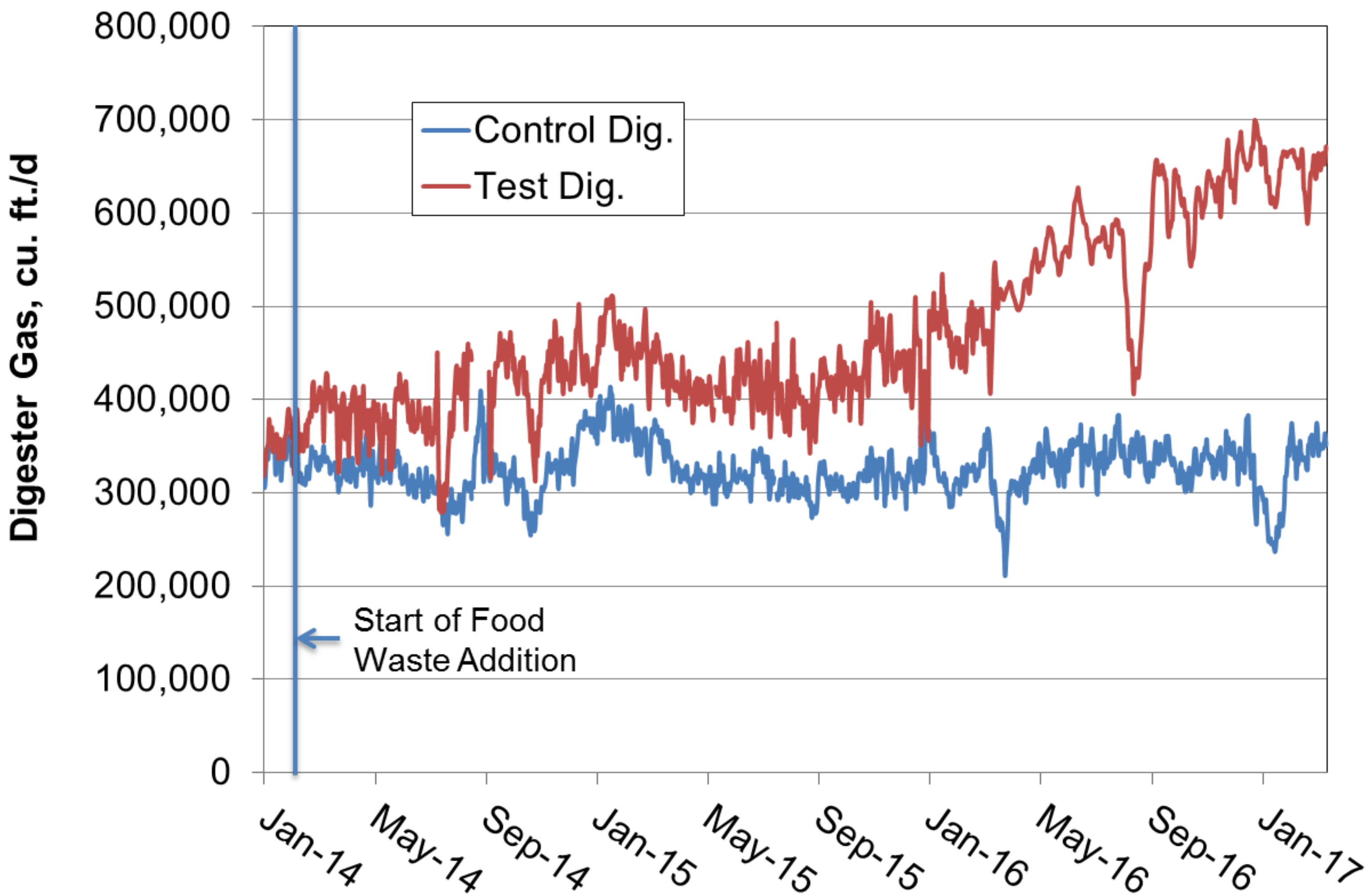
Food Waste Bench Scale Testing Biogas Production



Lesson: Adding 10-12% (v/v) food waste slurry to sludge doubles biogas production

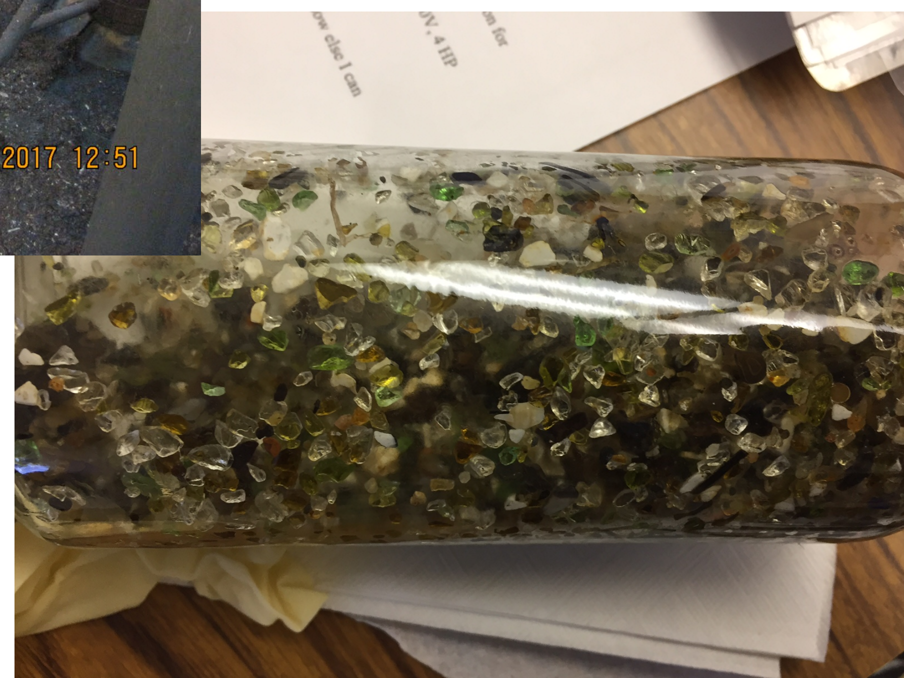
Food Waste Slurry characteristics: Total Solids ~ 14% by wt., Volatile Solids ~ 92% by wt., COD ~ 222,000 mg/L

What Did We Learn at Full Scale? Gas Production Matched Lab Tests



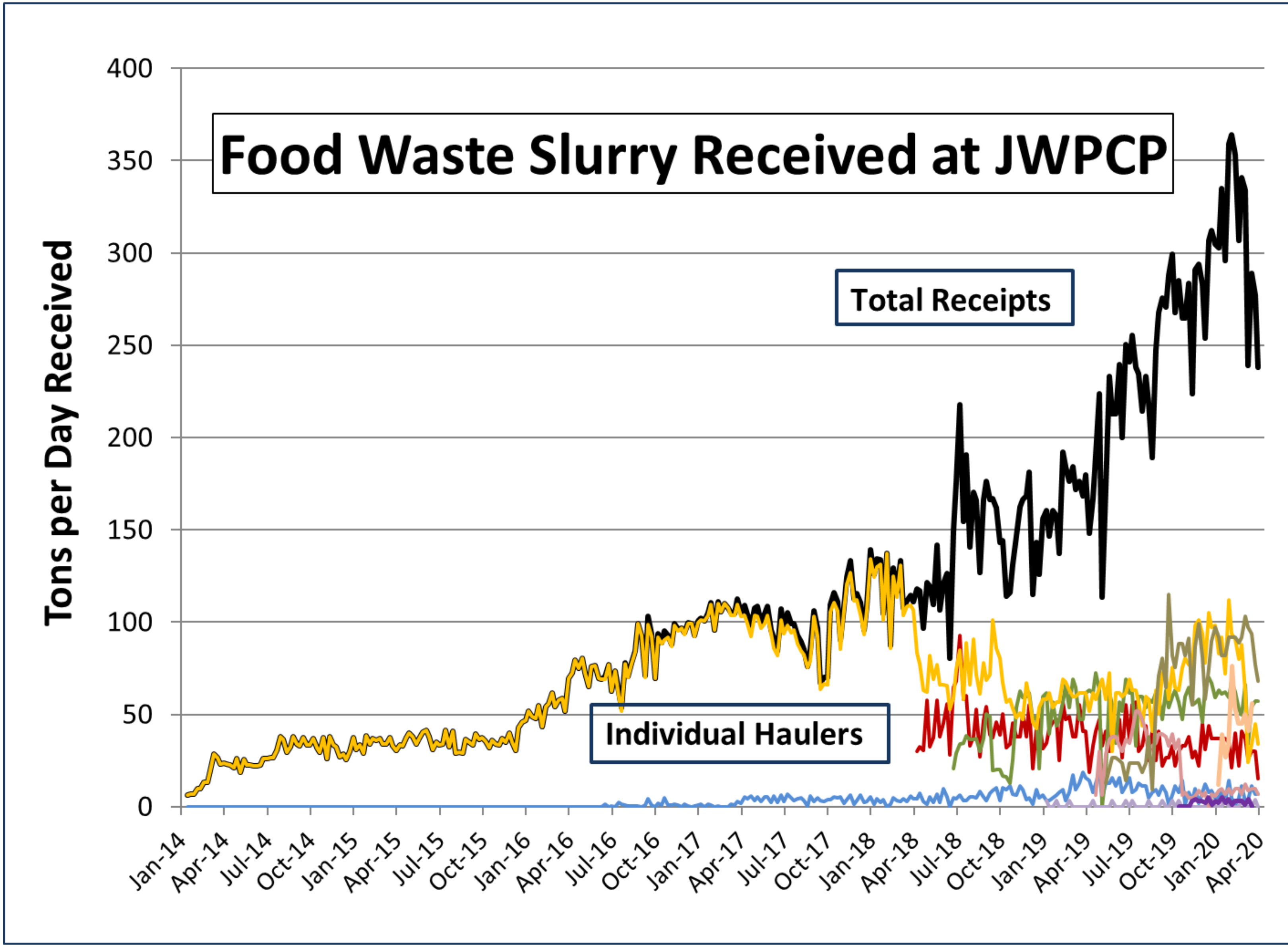
Odor Control Is Critical but Can Be Simple

Digester Cleaning: Contamination Increases Downtime and Expense



Individual Projects Required for Commercial Program

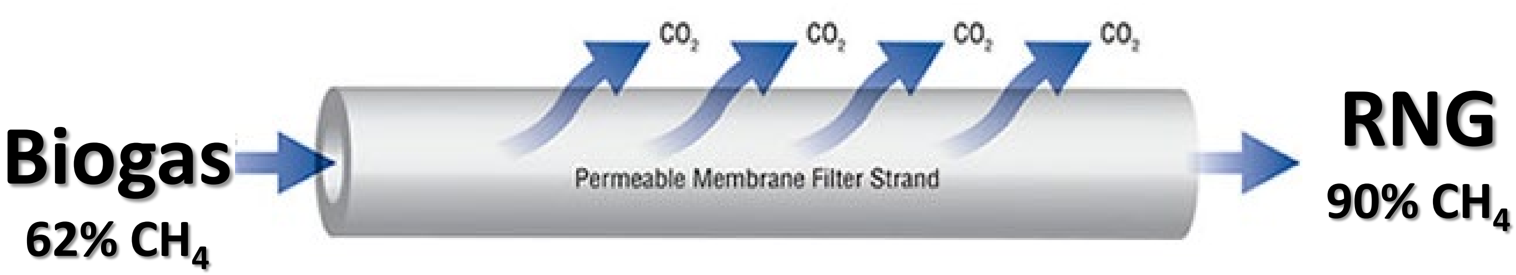
Project	Budget
Food Waste Processing at MRF	$1,900,000
Food Waste Receiving Stations	$2,800,000
Phase I Biogas Conditioning System	$3,100,000
Electricity Feed to BCS	$160,000
Gas Pipeline from Treatment Plant to BCS	$3,100,000
Flares to Handle Additional Gas	$6,400,000
Total	$15,600,000
Grant Funding	$4,500,000



Food Waste Slurry Received at JWPCP
Total Receipts
Individual Haulers
Tons per Day Received
400
350
300
250
200
150
100
50
0
Jan-14
Apr-14
Jul-14
Oct-14
Jan-15
Apr-15
Jul-15
Oct-15
Jan-16
Apr-16
Jul-16
Oct-16
Jan-17
Apr-17
Jul-17
Oct-17
Jan-18
Apr-18
Jul-18
Oct-18
Jan-19
Apr-19
Jul-19
Oct-19
Jan-20
Apr-20

JWPCP Food Waste Phase I Energy Project

- We have an existing CNG station with 1500 gge/day demand
- No need to interconnect to pipeline
- Higher income, lower costs than pipeline
- 400 cfm digester gas converted to 2,000 gge/day vehicle CNG
- Under construction, startup mid 2020



Location of Biogas Conditioning System

Delivery of Gas Treatment Skid

Thank You

Mark McDannel
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SUSTAINABILITY INTO THE FUTURE: Energy Savings and Energy & Materials Recovery

Presented by:

William G. Rehkop III, P.E.

Facilities Director

Derry Township Municipal Authority

The Water Research Foundation

Webcast: April 30, 2020

DTMA

Derry Township Municipal Authority

PRESENTATION OVERVIEW

- DTMA Organization
- Net Position Over the Years
- Energy Savings and Energy & Material Recovery
    - Sludge Processing and Biosolids Beneficial Reuse
    - “Business” Ventures: Co-Digestion of High Strength Organic Waste (HSOW) / FOG / Septage
    - CHP Cogeneration
- *Sustainability into the Future* – Future Plans for Acceptance of Additional HSOW and Driving Net-Zero Energy
- “Lessons” Learned

ORGANIZATION & FACILITIES

- Operating Authority formed in 1972
- Current Staff of 40
- Service Area: Six (6) Municipalities
- Two Wastewater Treatment Facilities
    - Clearwater Road WWTF – 5.02 MGD
        - Operational since 1978
        - Serves the Townships of Derry, Conewago, South Hanover, and a portion of Hummelstown Borough
    - Southwest WWTF – 0.6 MGD (“Unmanned” Satellite WWTF)
        - Operational since 1993
        - Serves Southwest corner of Township of Derry, Northwest corner of Londonderry Township, and Lower Swatara Township
- Fourteen Pumping Stations
- 150+ Miles of Sanitary Sewer (6” to 48” DIA)

“Providing a cost effective public service to protect and enhance the water, environment, and quality of life for our local and regional community.” ***– DTMA Mission Statement***

CLEARWATER WWTP - AERIAL

CONTRIBUTING FACTORS TO POSITIVE NET POSITION

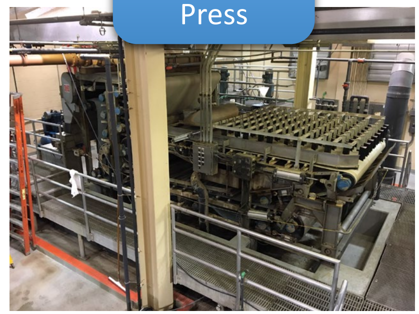
- Dedicated, highly skilled and trained staff
- Strong Customer Base and Steady Growth
- Diversified Assets
  - Regionalization / bulk municipal customers
  - Stormwater Assets Fund (est. 2017) to support MS4 Permit and Derry Township storm water system improvements
- Strategic Sewer Rate Increases and 5-Year Capital Improvement Interval Planning
- Flood Recovery and Long-term Resiliency
- Sludge Processing and Biosolids Beneficial Reuse
- Business Venture – HSOW/FOG/Septage Receiving Revenue on an Annual Basis (>$1 MM)

CLEARWATER FACILITY IMPROVEMENTS TIMELINE

1977
CwR WWTP
Commissioned

1993
SW WWTP
Commissioned

1997
Belt Filter
Press



2001
Egg-shaped Digester
Headworks / Septage Off-Loading Station

2005
FOG Receiving
Station and
Pretreatment Tank

2005
BNR Upgrade
A_2/O Kruger Process

2007
Thermal Dryer

CLEARWATER
STEADIGRO
FOR LONG TERM GROWTH

2008
Centrifuge

2010
CHP Cogeneration

FLOODING PERSPECTIVE

SLUDGE PROCESSING & BIOSOLIDS BENEFICAL REUSE

CLEARWATER
STEADIGRO
FOR LONG TERM GROWTH

SLUDGE DISPOSAL & BENEFICIAL REUSE METHODS

March 1977 through February 1994

Vacuum Filters (Winter Months Only)	Incineration – Ash to Landfill	Sub-surface injection at MHS Farms (Summer Months Only)

February 1994 through March 1997

Lime stabilized sub-surface injection (LSSSI) at MHS Farms = **30% of Total DT**	Landfill = **70% of Total DT**

March 1997 through July 2001

Belt Filter Press and Lime Post Treatment (LPT), Disposal at MHS Farms = **38% of Total DT**	Landfill = **62% of Total DT**

July 2001 through April 2008

Anaerobic Digestion (ESD) – Decreased Total DT for Disposal by 58%	Class B Biosolids Disposal = **58% of Total DT**	LPT = **42% of Total DT**

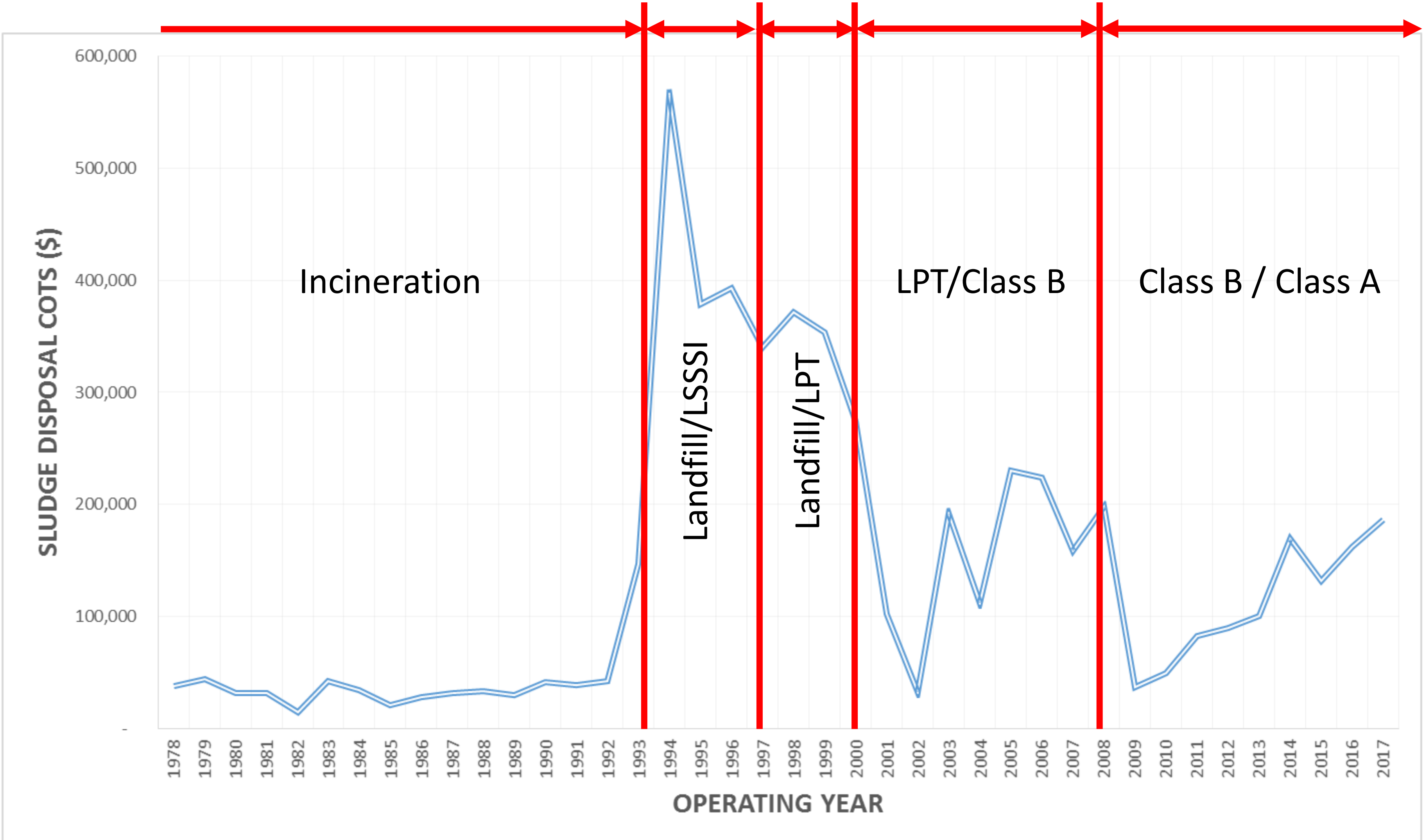
April 2008 to July 2018

Thermal Dryer – Class A Biosolids = **29% of Total DT**	Class B Biosolids = **71% of Total DT**

August 2018 to Present

Class B Biosolids **= 100%** *(Thermal Dryer OOS due to July 2018 Flood)*

SLUDGE DISPOSAL & BIOSOLIDS COST HISTORY



"BUSINESS" VENTURES

25 Jan 2018

HISTORY OF HAULED-IN WASTE PROGRAM

- Septage Receiving – Since 1991
  - Two Lane Receiving Station Constructed in 2000
  - Screening / Grit Removal via Headworks Facility
- FOG Acceptance – Since 1995
  - Aerobic Grease Pretreatment Since February 2005

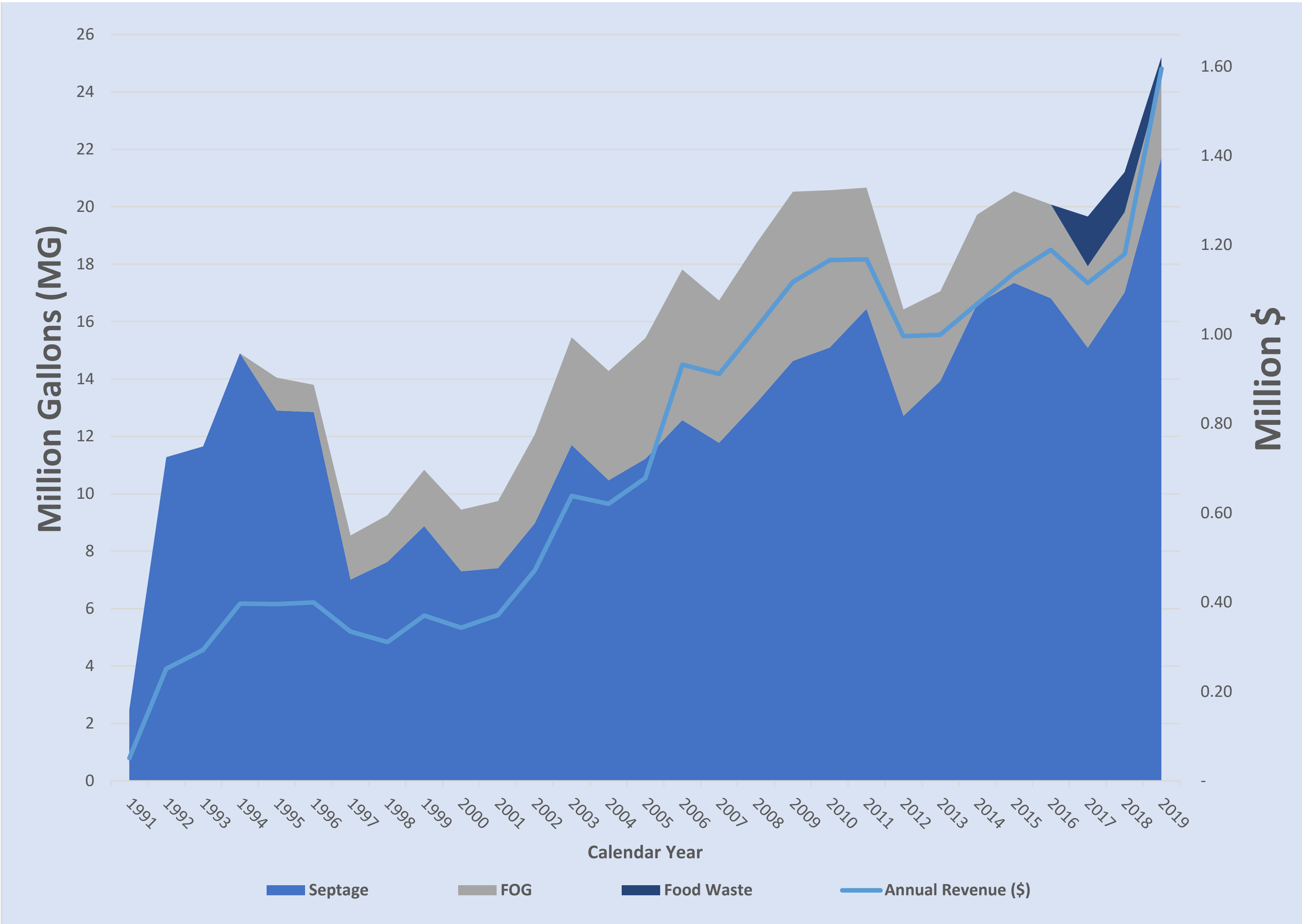
CO-DIGESTION: FOG & HSOW FEEDSTOCK

- Utilize Existing Infrastructure and Optimize Existing Anaerobic Digestion Capacity
  - Minimal upfront CapEx to initially accept HSOW at an existing off-loading station
  - Blended with municipal sludge(s) and fed directly to ESD

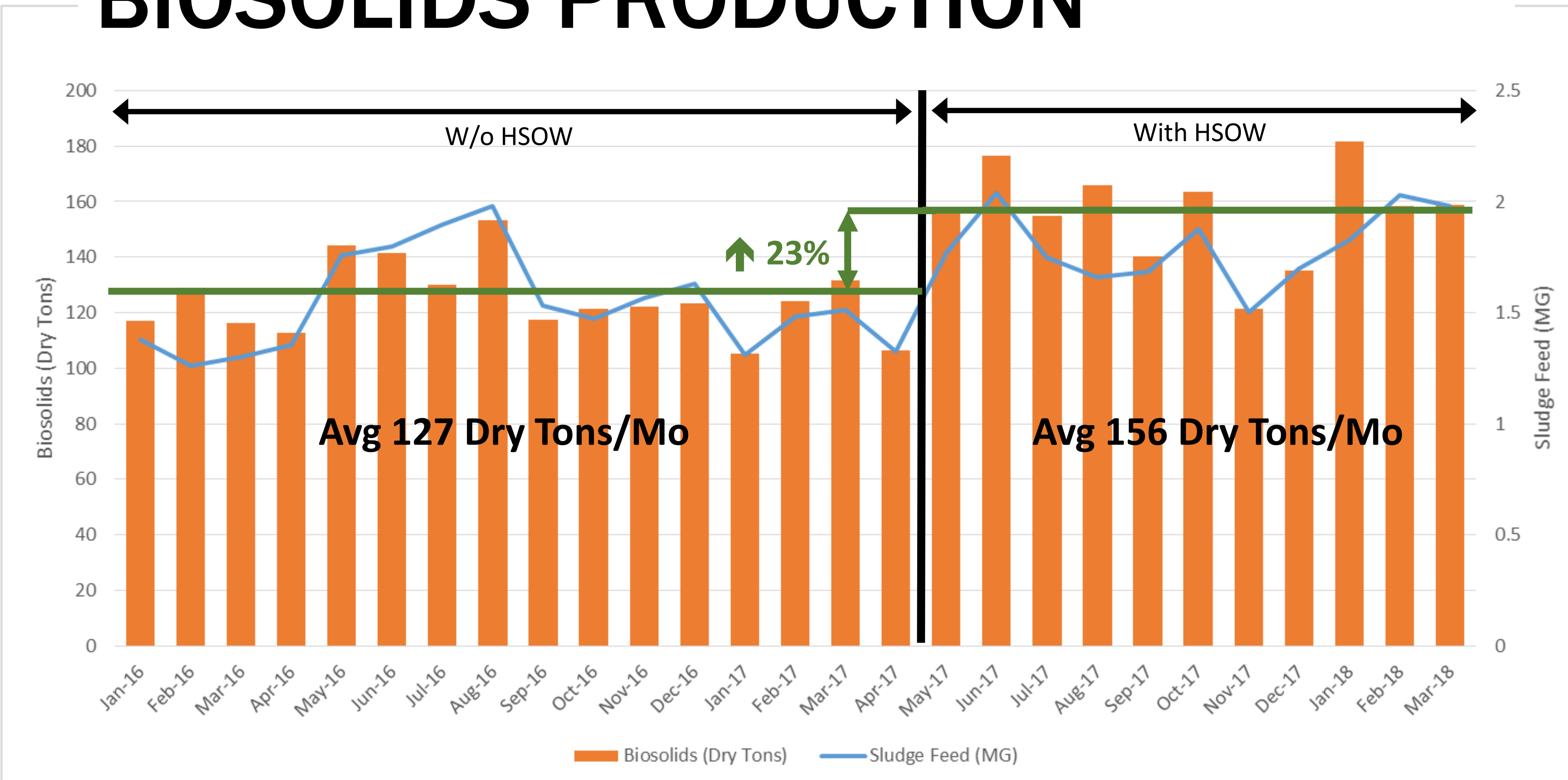
CO-DIGESTION (cont.)

- Hershey Chocolate Co. Waste Sludge
  - Direct connection from Hershey's PTP to Clearwater WWTP since 1970's
  - Prior to new PTP constructed in Jan. 2019, Avg. 115k Gallons/Month, 5% TS, 88% VS
- FOG Waste
  - Avg. 10,900 GPD
  - Settles out as Primary Sludge, Blended with Sludge Feed to ESD
- HSOW – Beginning January 2017
  - Redner's Food Market (Grind2Energy)
    - 5k to 10k Gallons/Month
    - 10-14% TS, 92-95% VS
  - Corn Syrup Processing Waste
    - 10k to 15k Gallons/Month
    - 16% TS, 290,000 mg/L as COD
  - Local Grocery Store and Supermarket Unsold Food (Divert)
    - 1-2 Loads/Day (M-F), 120k to 200k Gallons/Month
    - 15% TS, 92% VS, 200,000 mg/L as COD
  - Brewery Yeast Waste
    - 100k Gallons/Month
    - 10% TS, 90% VS

HSOW / FOG / SEPTAGE ACCEPTANCE ANNUAL TOTALS

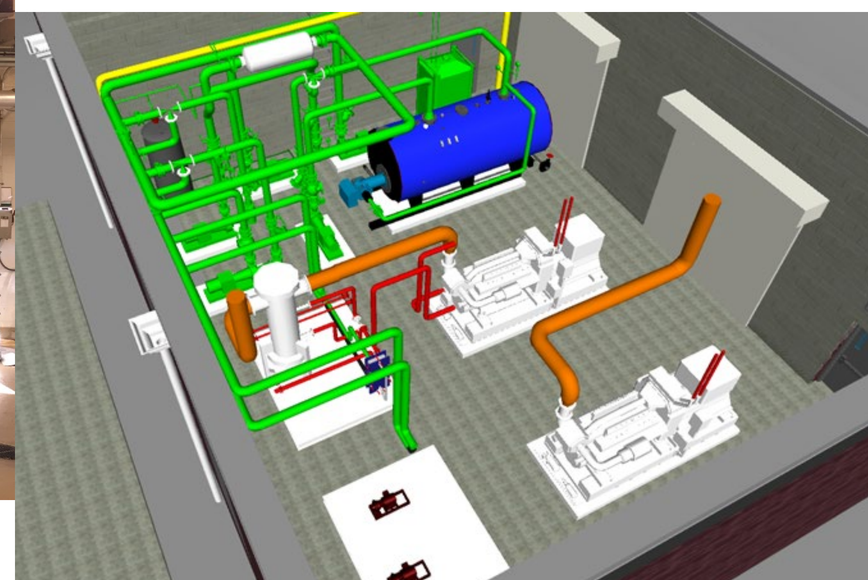


HSOW ACCEPTANCE & IMPACTS TO BIOSOLIDS PRODUCTION

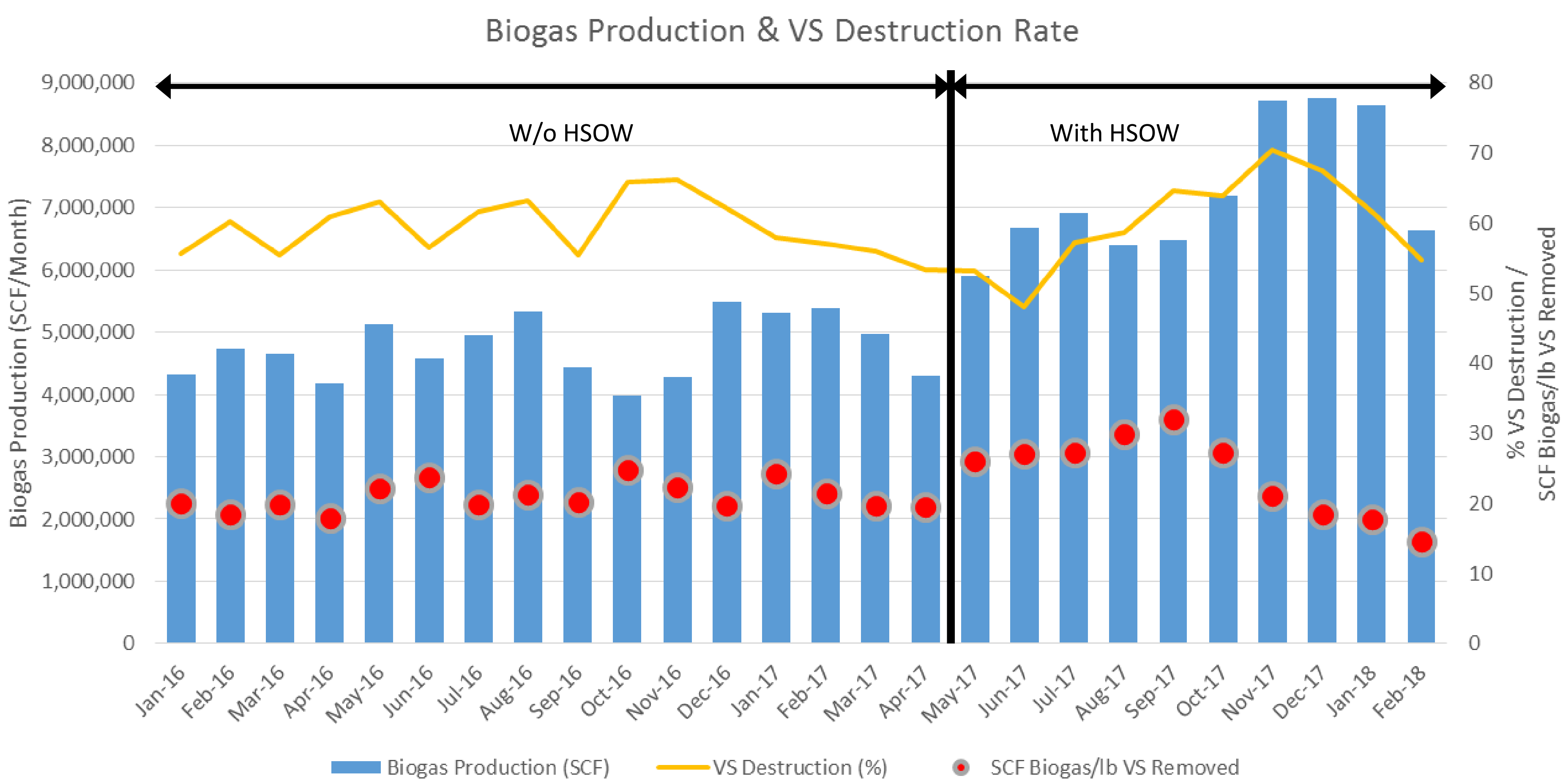


- 23% increase in Biosolids, of which:
  - 8% (or 9.5 Dry Tons) was contributed by an increase in Primary Sludge and WAS solids loading for same period
  - 15% (or 19.5 Dry Tons) was contributed by HSOW

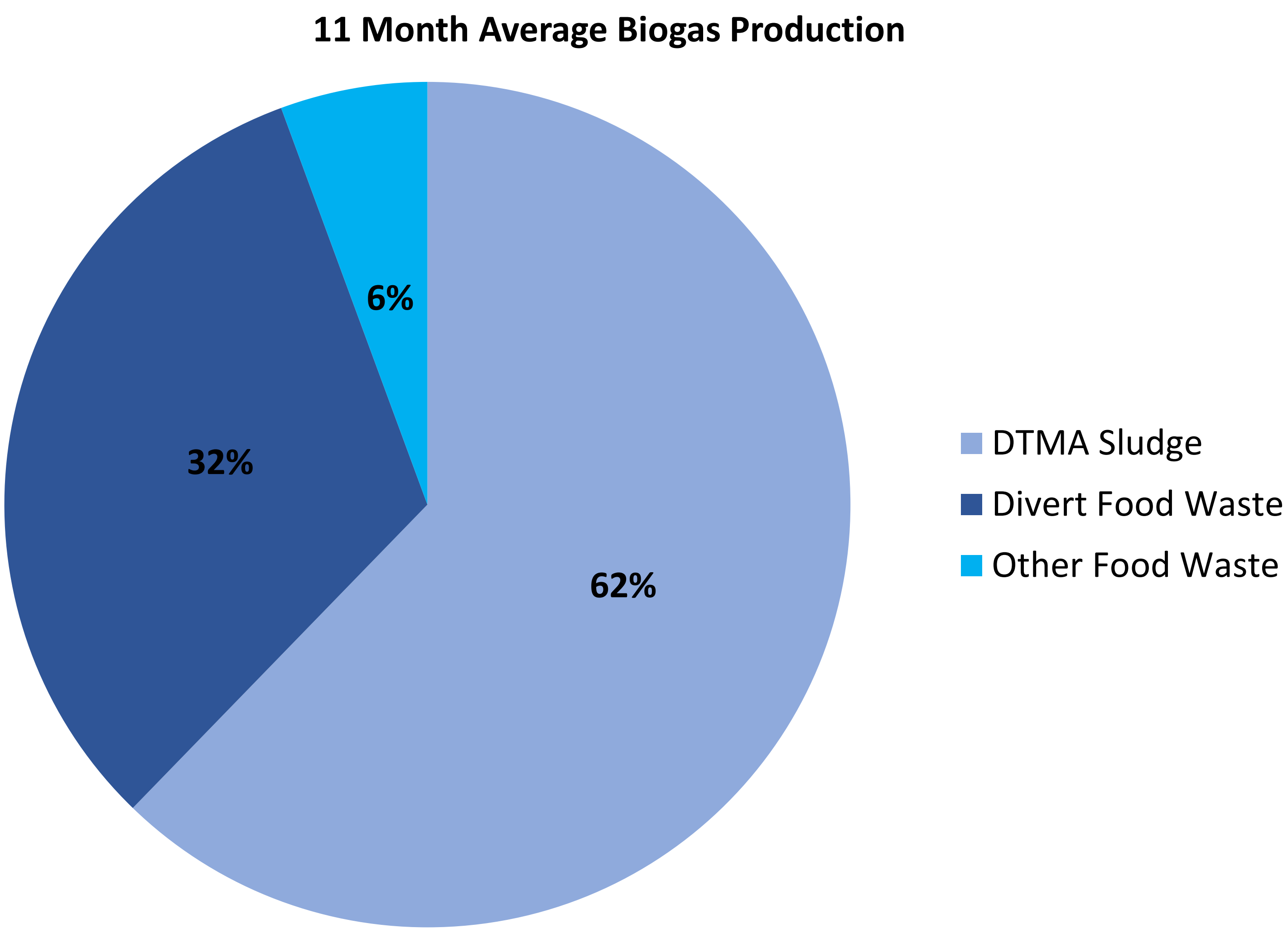
ENERGY RECOVERY & REUSE



BIOGAS PRODUCTION



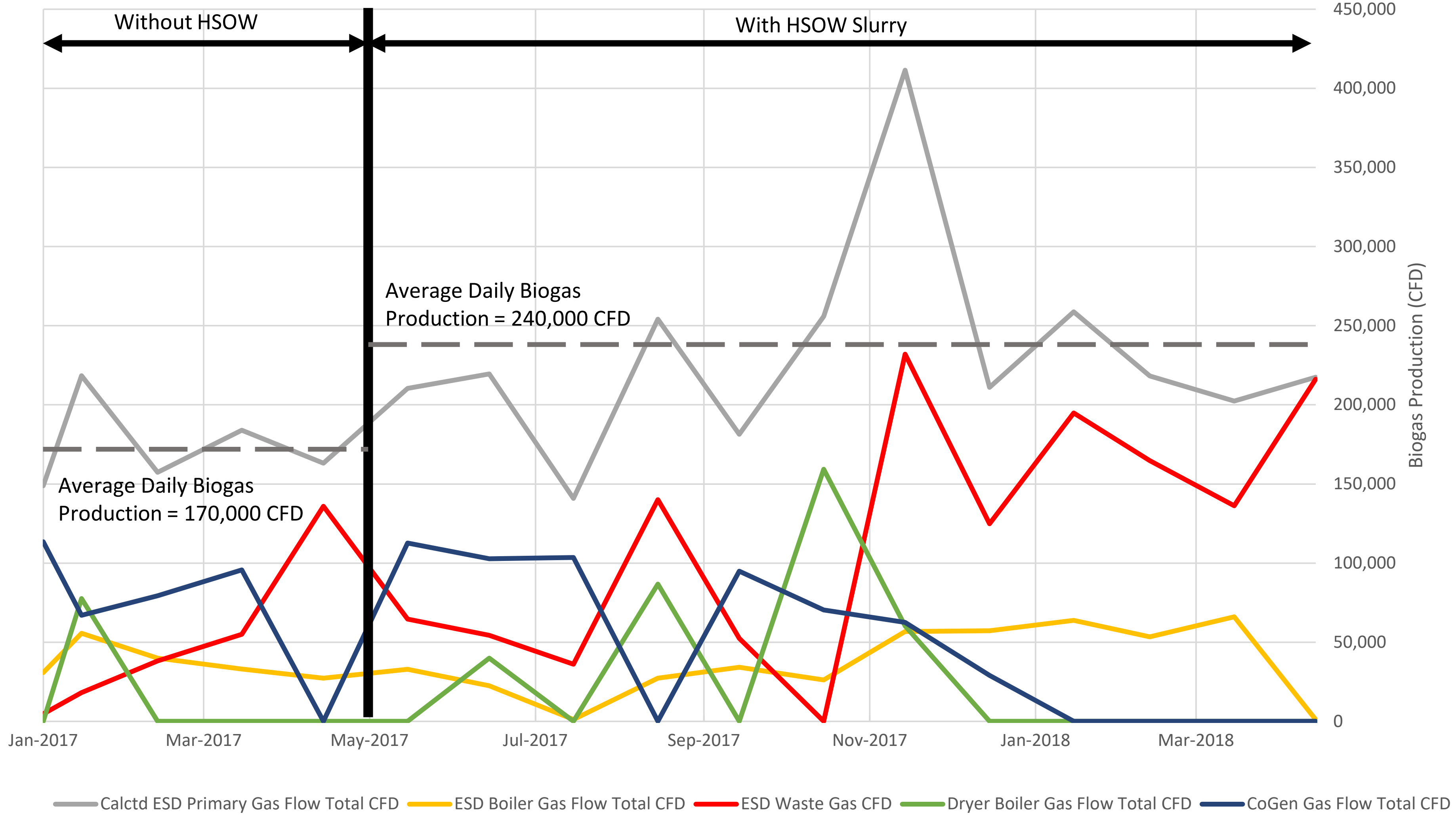
BIOGAS PRODUCTION (cont.)



CURRENT ON-SITE BIOGAS UTILIZATION

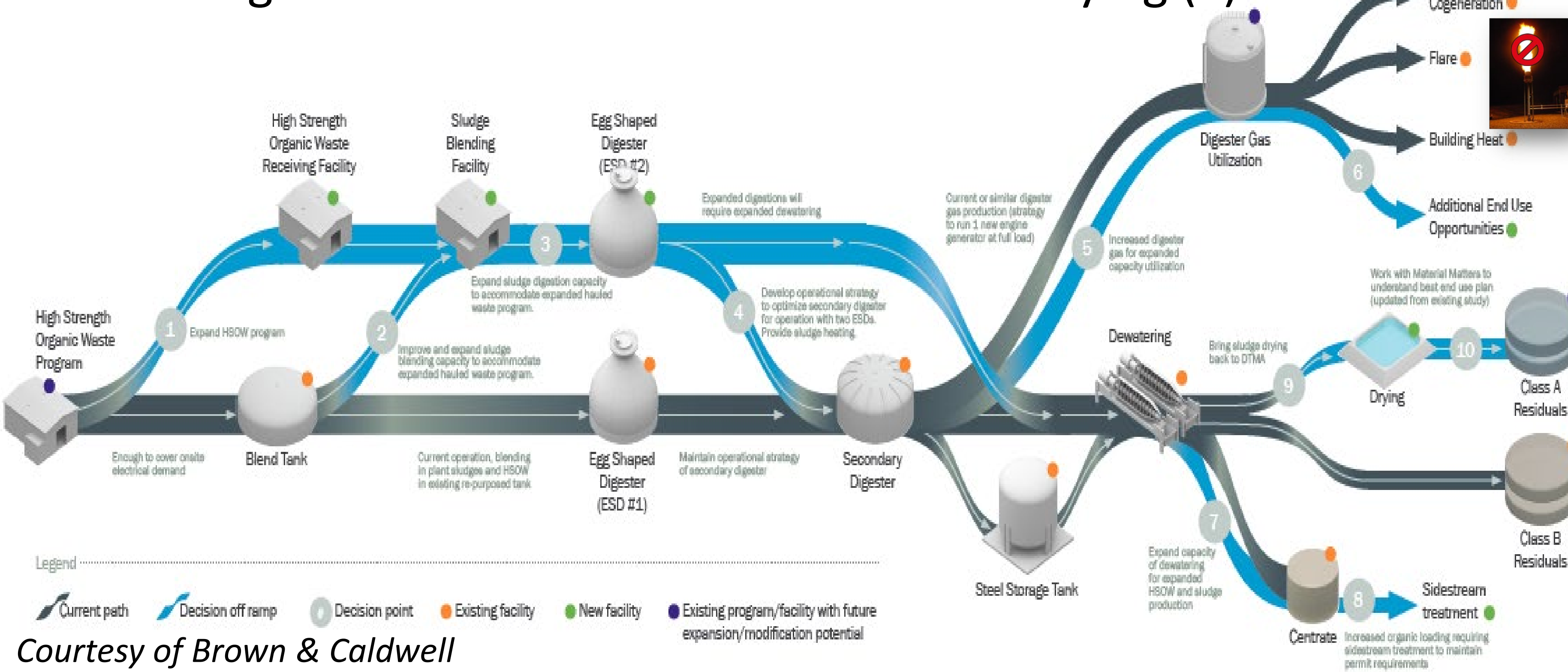
- ESD Heating (est. 2001)
  - Fuel hot water boiler for heating digester contents
- Thermal Dryer (est. 2008)
  - Steam boiler fueled by biogas, heat source to dry biosolids
  - Decommissioned as of July 2018
- 280 kW Cogen & Gas Conditioning (est. 2010)
  - Annual Electric Savings – Offsets an average of 21% of total WWTP electric consumption per year
  - Engine Heat Recovery: Heat three (3) WWTP buildings during cold weather season

BIOGAS ON-SITE UTILIZATION



SUSTAINABILITY INTO THE FUTURE

- Upgrade & Expansion of Facilities to Accept Additional HSOW
  - ESD #2, Secondary Digester Improvements, HSOW Offloading Station, Dewatering Equipment, Sidestream Treatment
- Two (2) 1 megawatt CHPs and Biogas Conditioning System Upgrade
  - *GOAL:* Achieve Net-Zero Energy
- Looking into the Future: Class A Biosolids Drying (?)



Courtesy of Brown & Caldwell

LESSONS LEARNED: CO-DIGESTION

- Upfront “buy-in” from regulatory agencies
- Monetize / Optimize existing AD Capacity & Feed Rates
- Perform short-term acclimation period for new HSOW waste streams
- Monitor key biological metrics on digester health:
  - Organic (VSS) loading / destruction
  - Volatile Acids / Alkalinity Ratio (VA/ALK) – Buffering Capacity (Ideal: Ratio <0.4)
  - Biogas Production: 12 to 18 Cu.Ft/lb VSS Destroyed (Metcalf & Eddy)
  - Biosolids Dewaterability and Centrate Quality
- Mixed liquor analysis and elemental analysis for potential struvite formation
- Implement fine screening and/or sludge cleaning to minimize debris in biosolids contributed by HSOW
- Improved on-line analyzers (VFA, alkalinity, COD) for trending digester loadings and reliable biogas predictability
- Continuing the Advancement of WRRF Co-Digestion w/HSOW

Thank You!

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DTMA

Derry Township Municipal Authority

RELIABLY RESPONSIVELY PROFESSIONALLY

Questions?

Thank You

Comments or questions, please contact:

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For more information, visit

www.waterrf.org