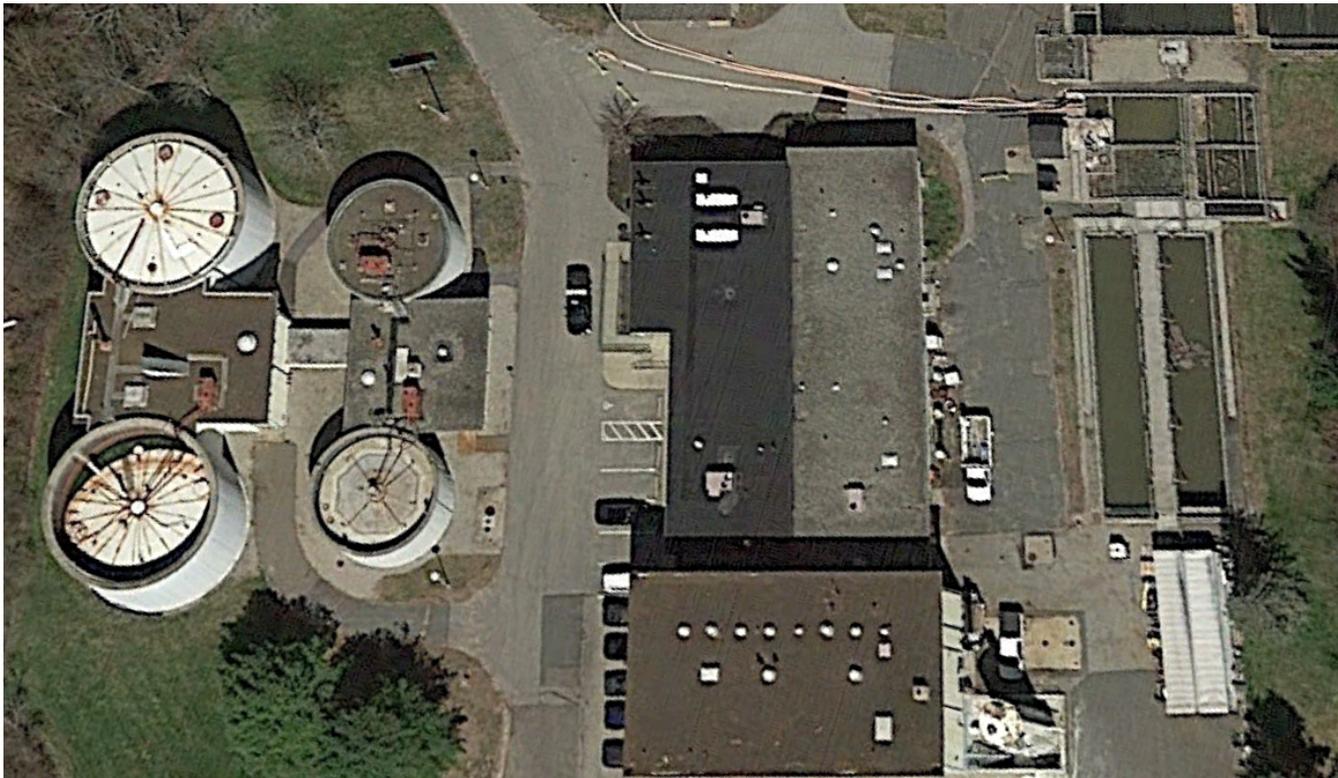
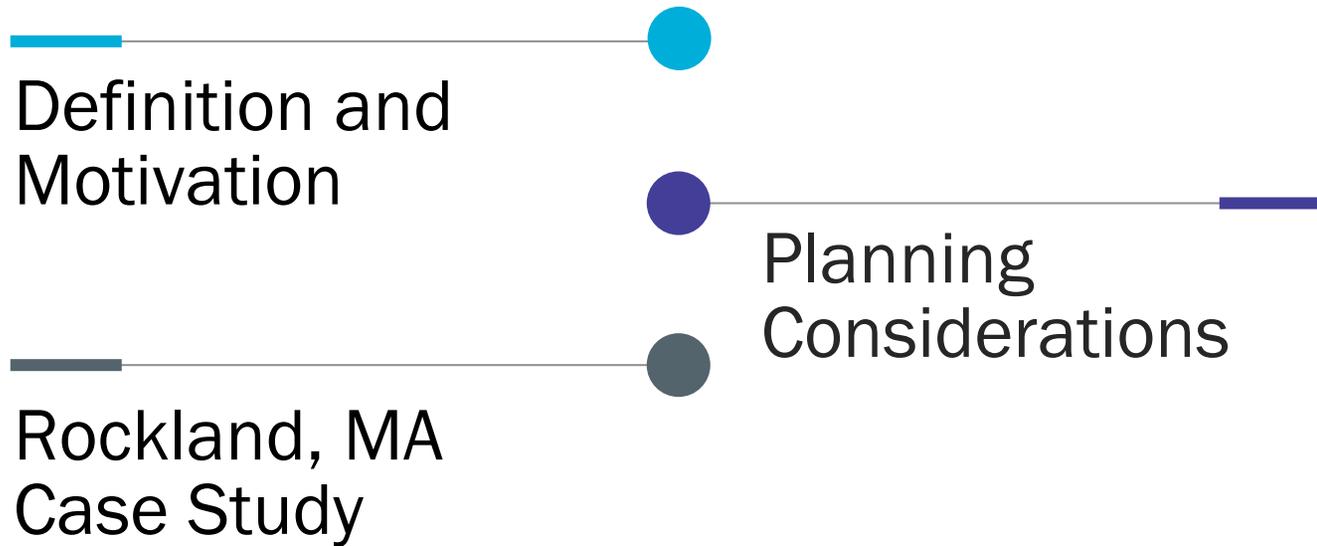


# Initial Co-Digestion Feasibility Study at the Rockland WWTP

October 17, 2019 – Springfield, MA

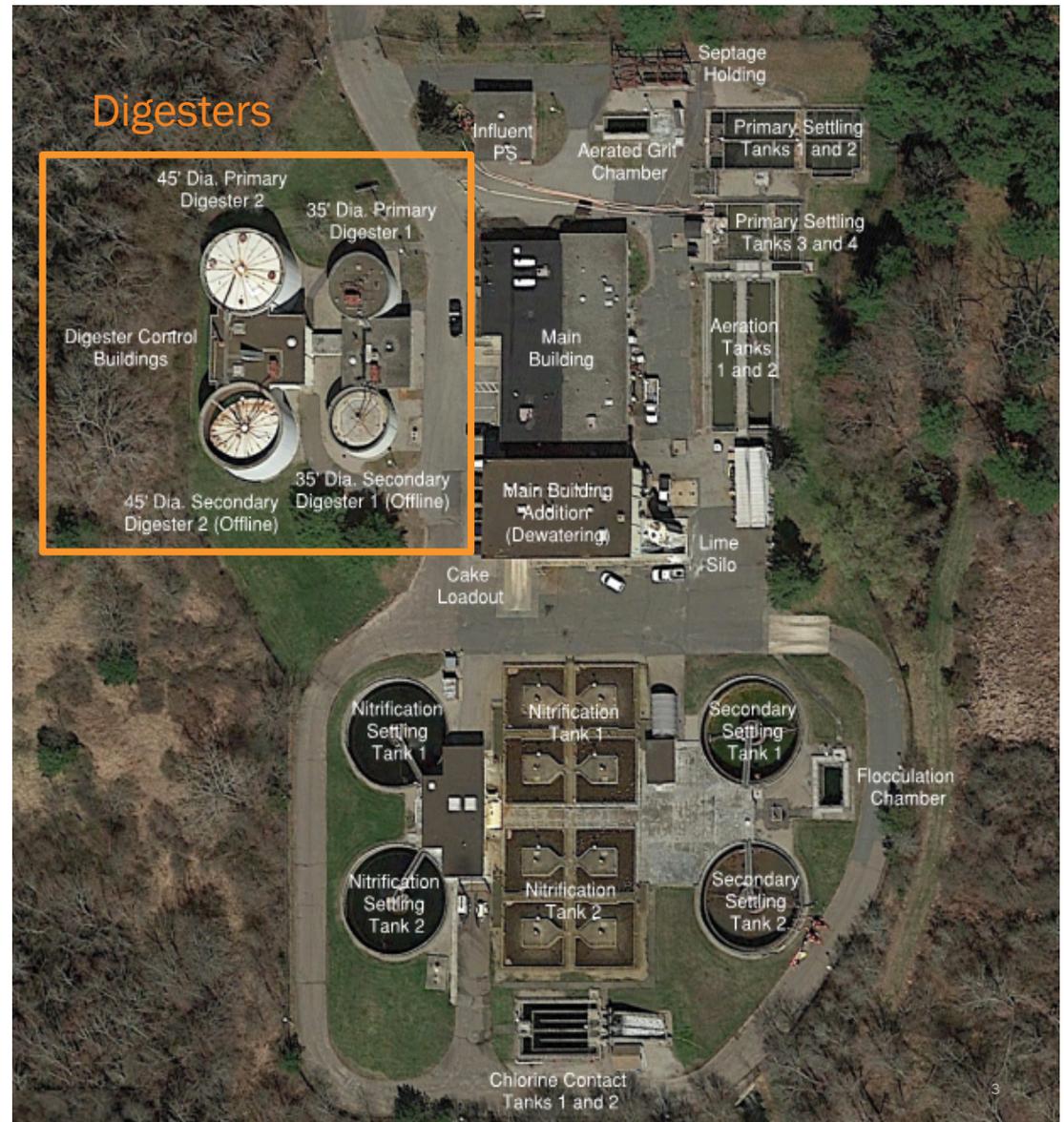


# Agenda



# Rockland, MA WRRF

- Managed by Town of Rockland Sewer Dept (SUEZ contract ops)
- Avg. Annual Flow: 2.5 MGD
- One of six WRRFs with AD in Mass



# MassCEC Organics-to-Energy Program

- Supports the development of facilities that convert source-separated organic materials and sewage sludge into heat, electricity and/or compressed natural gas
- Published >10 studies since program creation in 2012
- Three stages of funding
  - Feasibility Study Max Grant Level: \$60K
  - Technical Study
  - Implementation and Pilot Project



# Co-digestion opportunities at smaller WRRFs



WRRF Electricity Usage, kWh/MG	Remaining Electricity Demand (Annual Avg), kW	Trucks /d to achieve 100% Elec. Neutrality*
1,200	60	1
1,500	95	1.5
1,800	125	2

\* Assumes 6k gallon tanker truck, FOG liquid waste at 5% TS

# Co-digestion opportunities at smaller WRRFs

Electricity generation  
from WRRF sludge  
with MAD + ICE



2.5 MGD / 2.5 DTPD

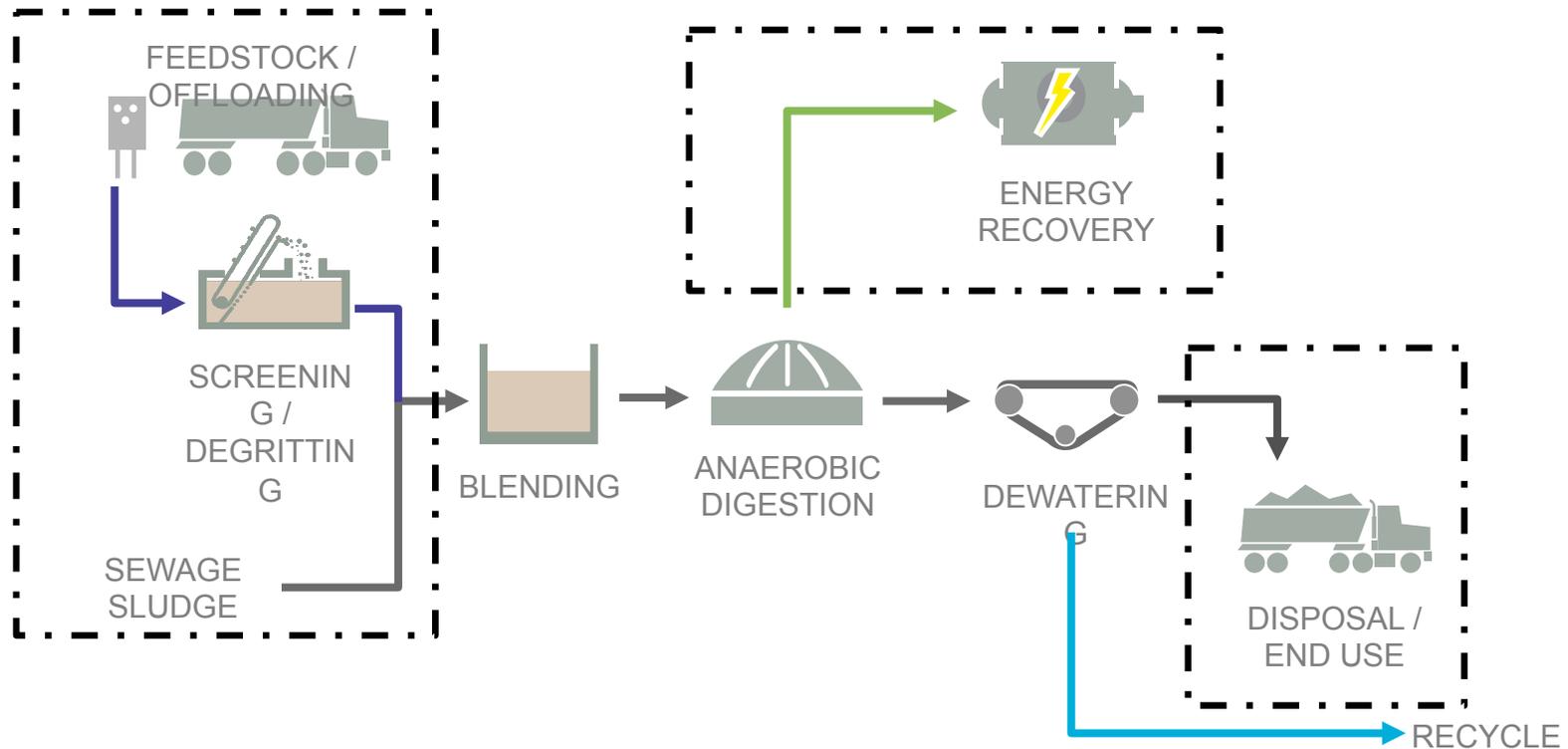
+65 kW

WRRF Electricity Usage, kWh/MG	Remaining Electricity Demand (Annual Avg), kW	Trucks /d to achieve 100% Elec. Neutrality*
1,200	60	1
1,500	95	1.5
<b>1,700</b>	<b>100</b>	<b>1-2</b>
1,800	125	2

Rockland

\* Assumes 6k gallon tanker truck, FOG liquid waste at 5% TS

# Looking past increased gas production



CAPITAL  
INVESTMENTS

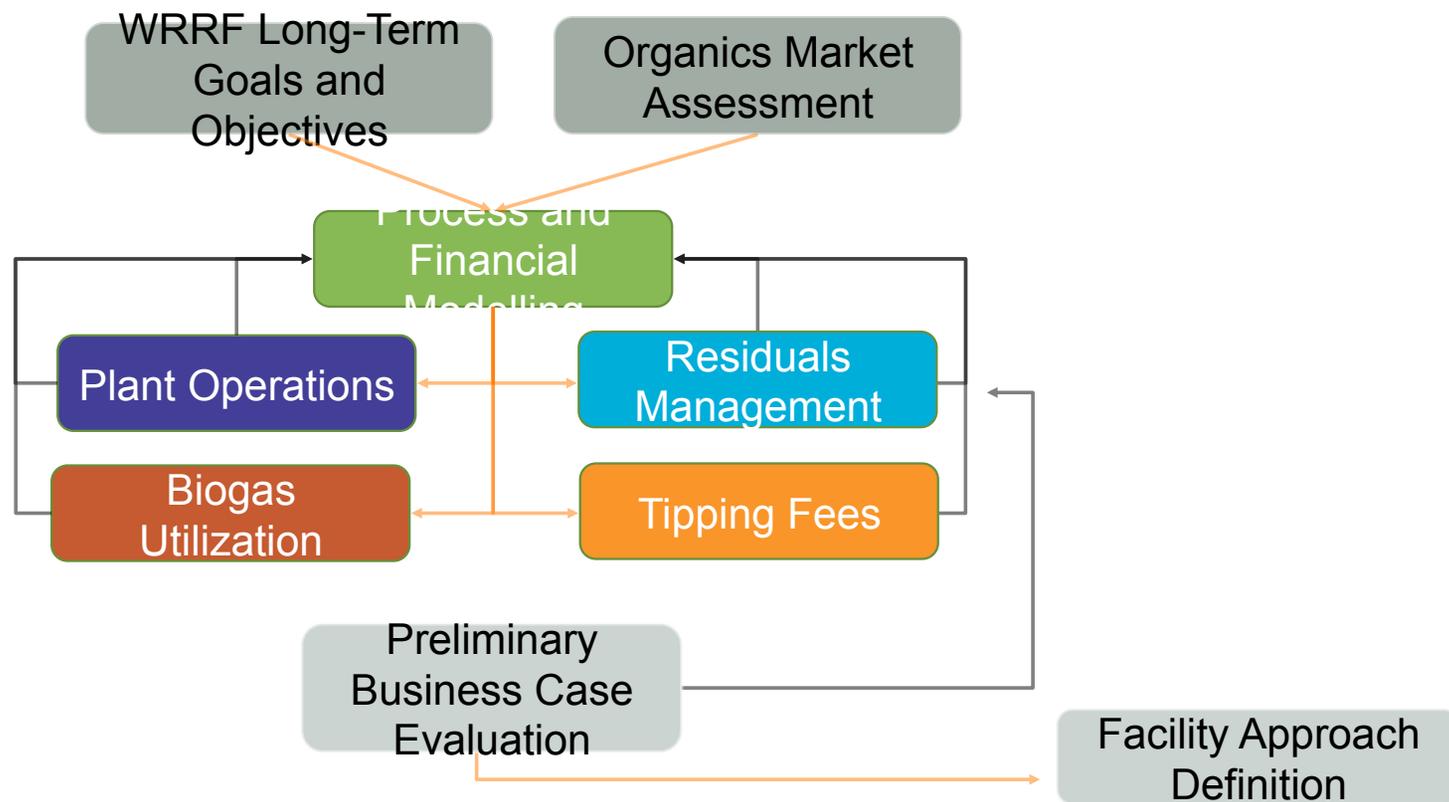


PROCESS  
IMPACT



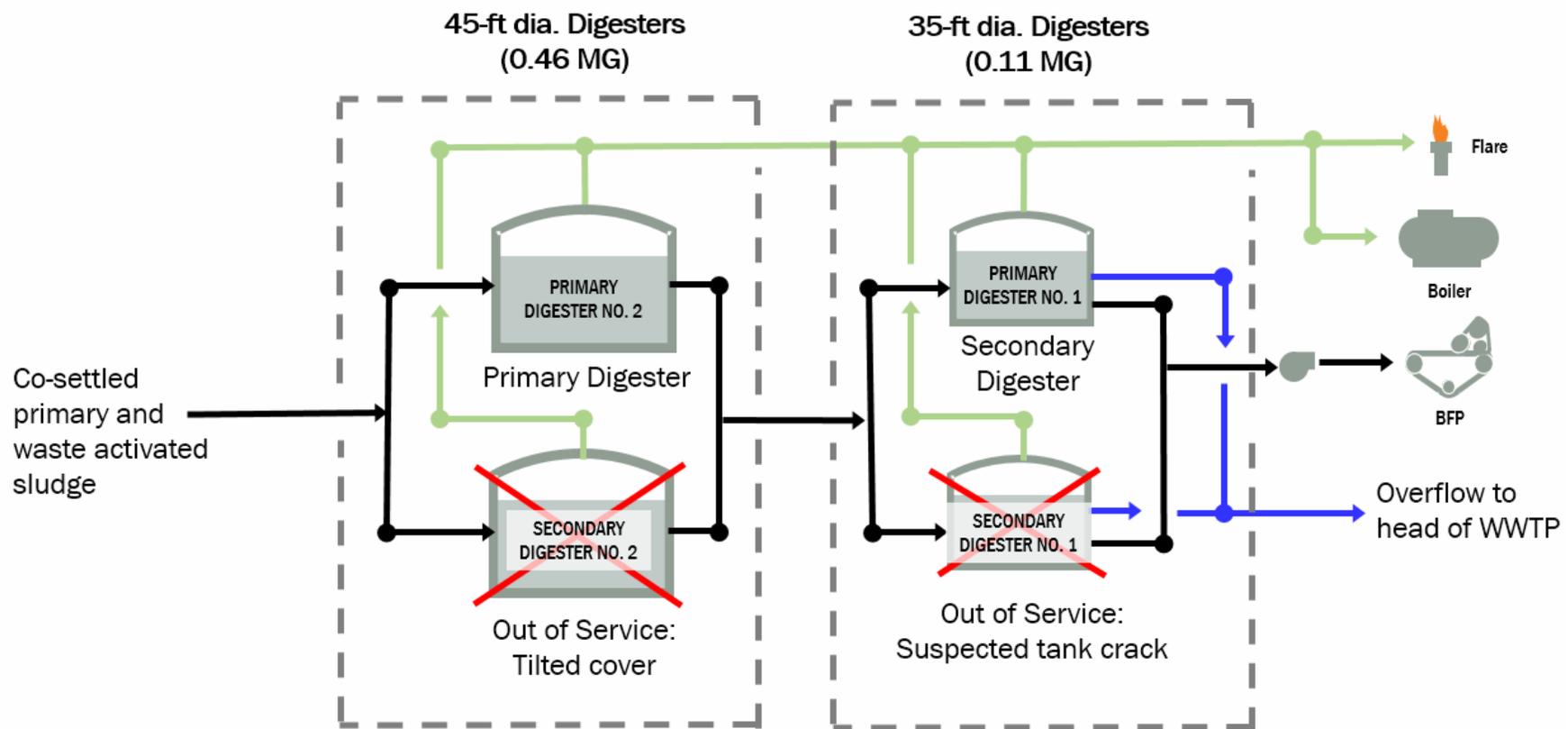
O&  
M

# Co-digestion feasibility study framework



# Plant Operations

## Current Conditions/Benchmarking



# Residuals Management

## Limited by existing state of equipment

- Current residuals generation: ~5 wtpd at 19%TS using belt filter press
- Difficult to maintain digestion temperatures required for Class B requirements
  - Co-settled PS and WAS feed is relatively thin (~2.4% TS) and variable given seasonal loading
- Hauled under long-term agreement to multiple disposal sites (incineration and landfill)
  - At time of study: \$100/ton, has since increased to \$111/ton

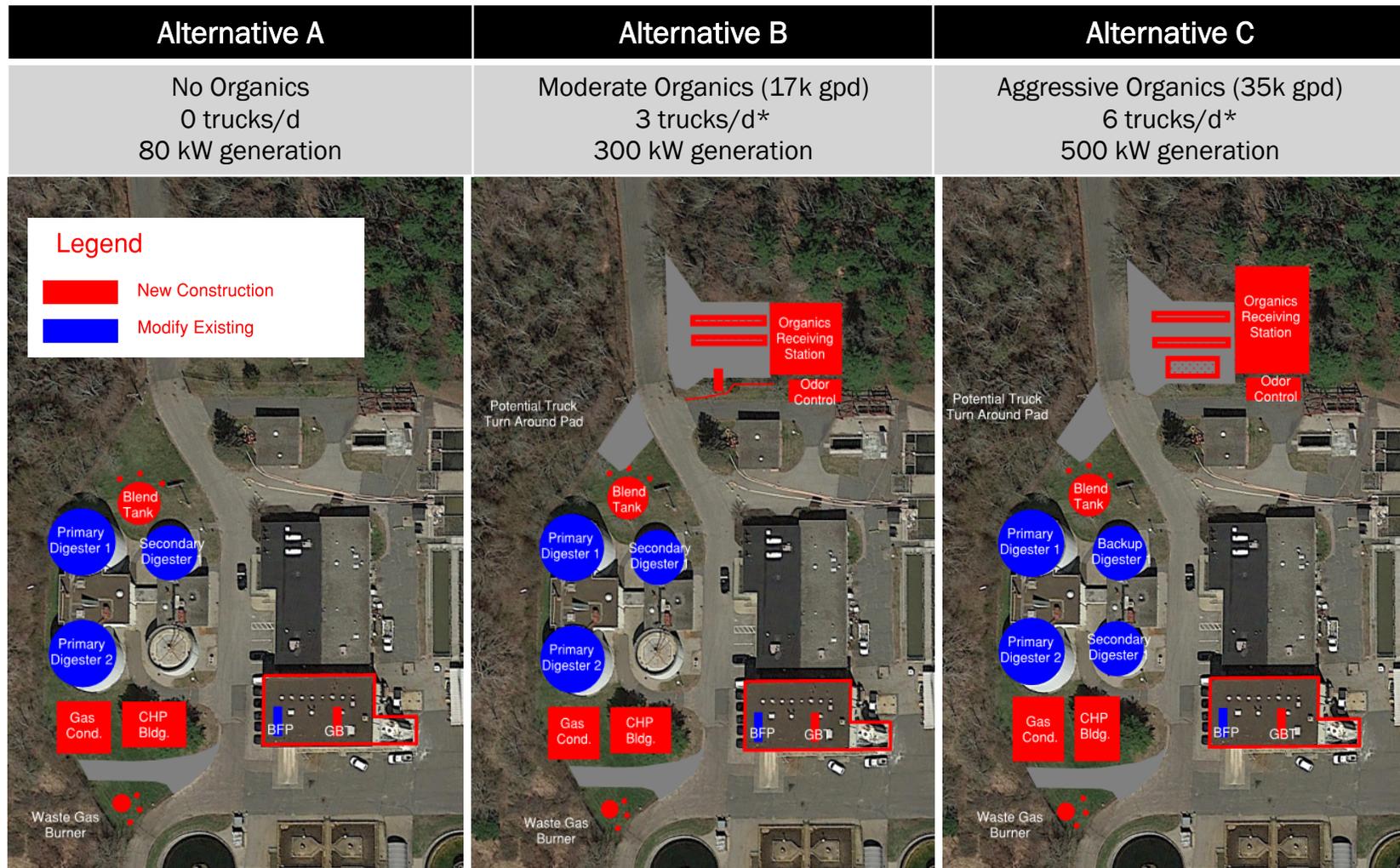
# Plant Operations

## State-of-good-repair projects required

- Mechanical WAS Thickening
  - Unlock digester capacity, control heat load
- Digester Rehabilitation
  - Covers, heat, mixing
- Digester Gas Management
  - Update to design codes and standards
  - Provide short-term storage
  - Change out all CS piping
- Blend tank
  - Homogenize loading to digester

# Plant Operations

## Project scope evaluated at varying scales



\* Assumes 6k gallon tanker truck, FOG liquid waste at 5% TS

# Tipping Fees

## Organics Market Assessment



- Targeted outreach to 16 potential, liquid HSW sources
  - **Primary Generators:** production/manufacturing facilities
  - **Indirect Sources:** hauling companies/brokers
- Typical Liquid HSW Sources
  - Hydrophilic – Non Oily
    - Expired soda, whey, food/beverage production
  - Hydrophobic – Oily
    - DAF waste, dairy/meat processing waste, FOG



# Tipping Fees

## Positive response from 16 potential sources

- Interest gauged on specific drivers
  - Cost reduction
  - Disposal reliability
  - Sustainability initiatives
- Results
  - Significant interest – current market for rate of disposal of organic wastes ranges from \$0.06 to \$0.10 per gallon, depending on waste type

# Biogas Utilization

## Universe of Alternatives



### Generate Power and Heat On-Site

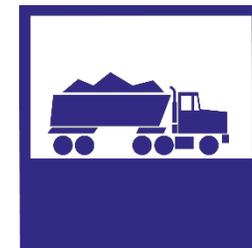
- Gas Turbine Generators
- IC Engine Generators
- Fuel Cells
- Microturbines
- Stirling Cycle Engines
- Organic Rankine Cycle



### Other On-Site Uses



- Boiler/Heat (hot water, steam)
- Product drying (via steam, hot air/oil/water)



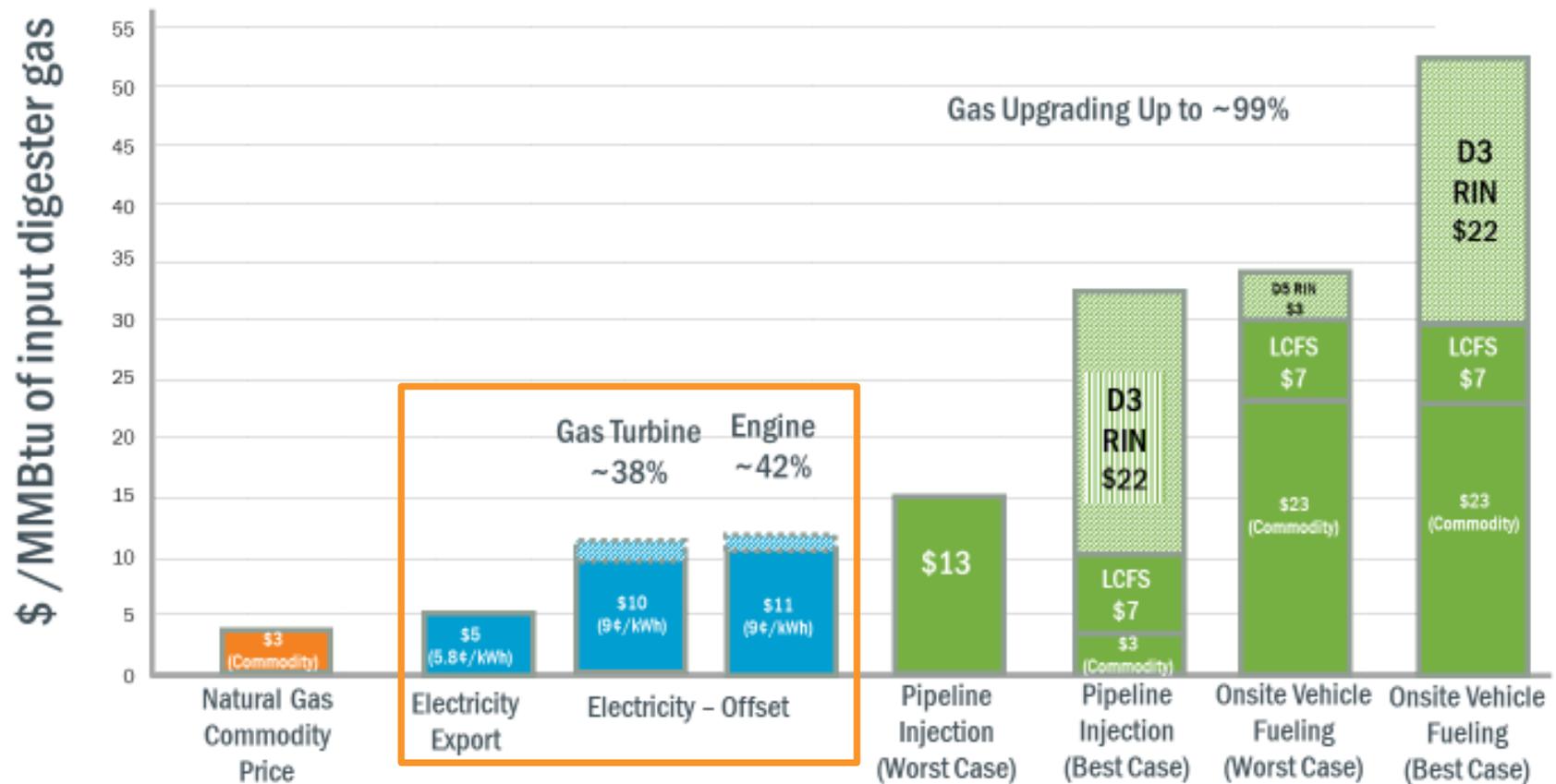
### Off-Site Sale/Use

- “As-Is” Unscrubbed
- Scrub CO<sub>2</sub>, biomethane pipeline injection
- Scrub CO<sub>2</sub>, Vehicle Fuel (rCNG)

# Biogas Utilization

Kilowatts, therms, gallons ... How do you compare value?

Relative value of energy (adjusted for conversion efficiency)



Rockland goal: onsite power generation

- Gas upgrading introduced too many variables at this stage

# Biogas Utilization

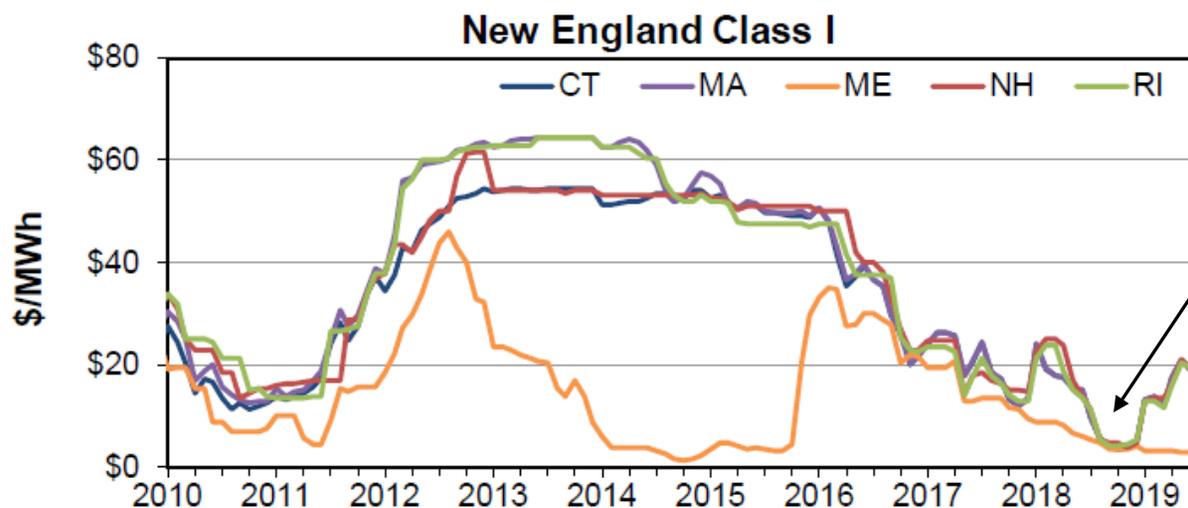
## Projecting value of onsite power generation

- Parse apart usage charge from power bill (\$0.14/kWh)
  - Disregard non-bypassable and standby charges
  - Potential to limit demand charge
- Calculate value from electricity export
  - National Grid has met net metering quota in area
  - Electricity sold back at wholesale rate of \$0.035/kWh
- Consider opportunities for regional and state incentives
  - National Grid Power Offset: \$0.075/kWh
  - REC value determined under Renewable Portfolio Standard

# Biogas Utilization

## Renewable Portfolio Standard

- Requirement on retail electric suppliers to provide a minimum percentage or amount of their retail load with eligible sources of renewable energy
- Renewable energy certificate (REC) program to facilitate compliance
  - NE states participate in a single power pool



REC value projected at all-time low at time of study (\$0.005/kWh). MA and ME have since increased RPS targets/demand.

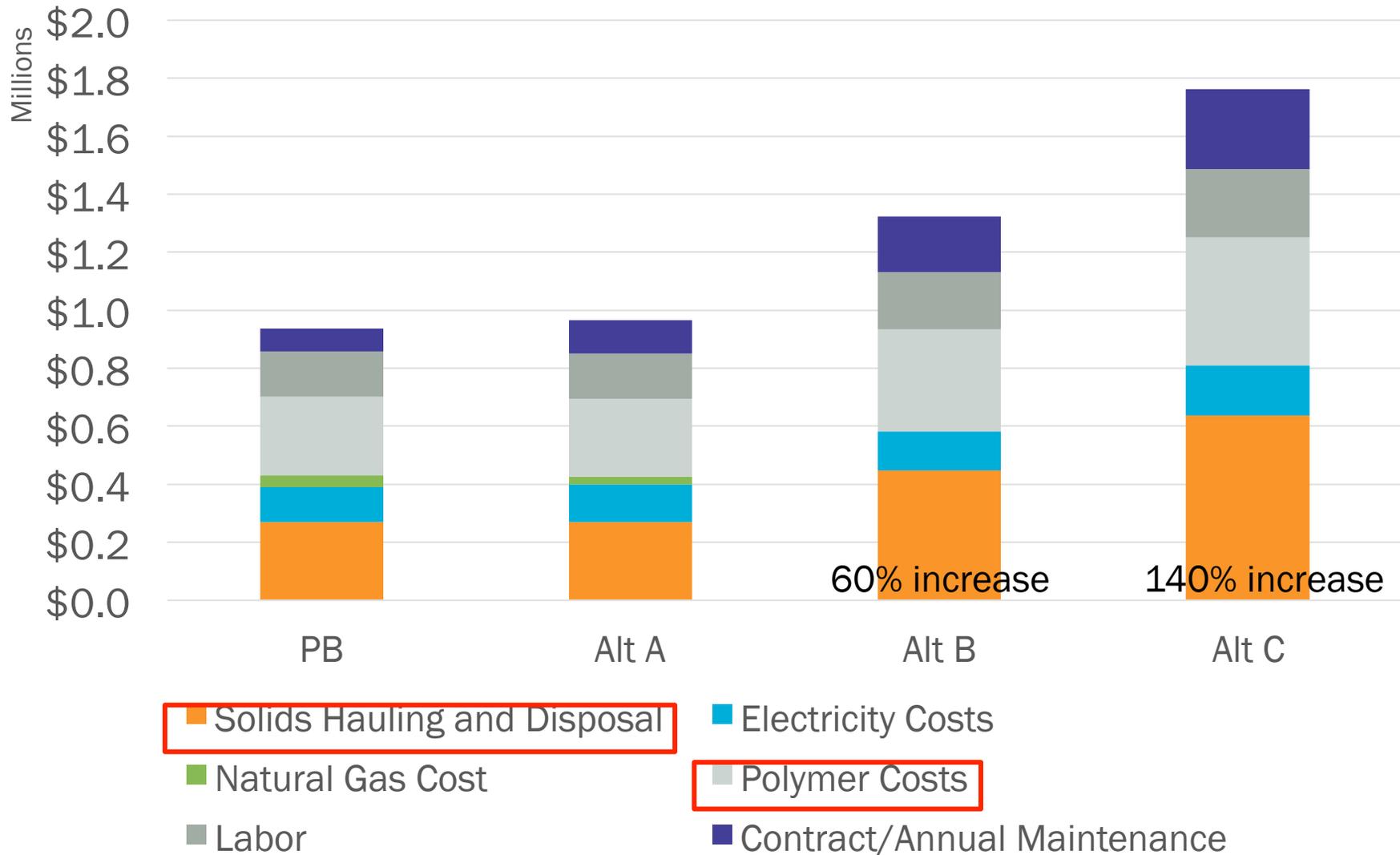
# First Cut Financial Evaluation

## 20-Yr NPV shows counter-intuitive results



# What's limiting O&M benefits?

## Residuals Management Costs increase

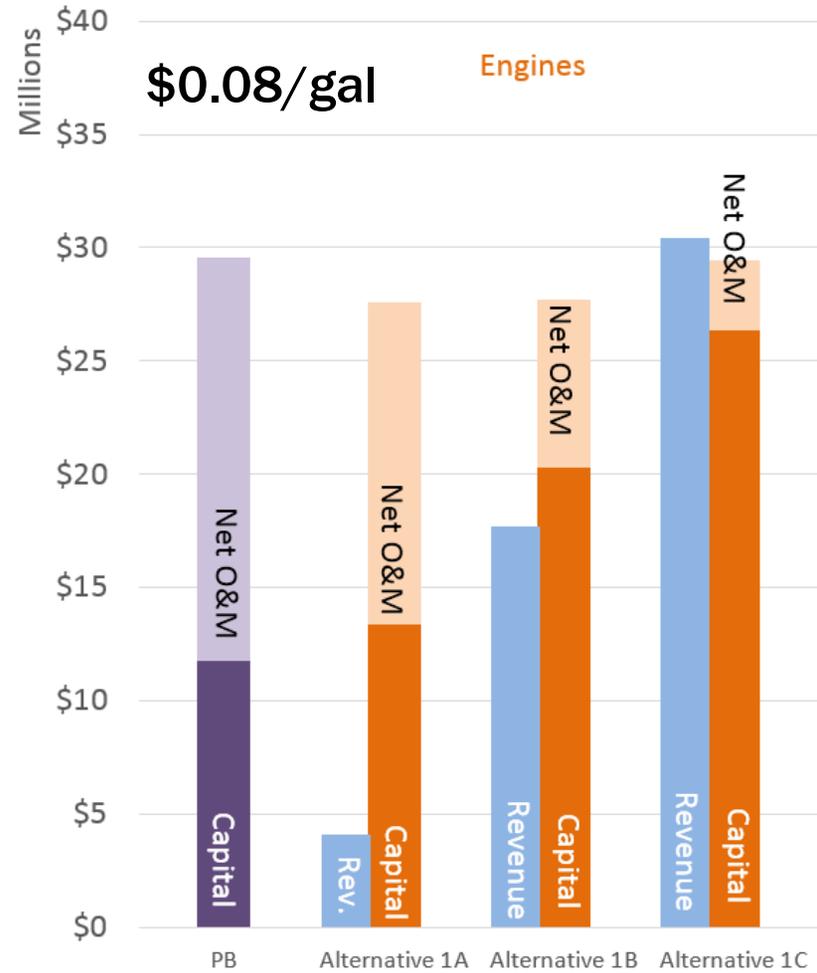
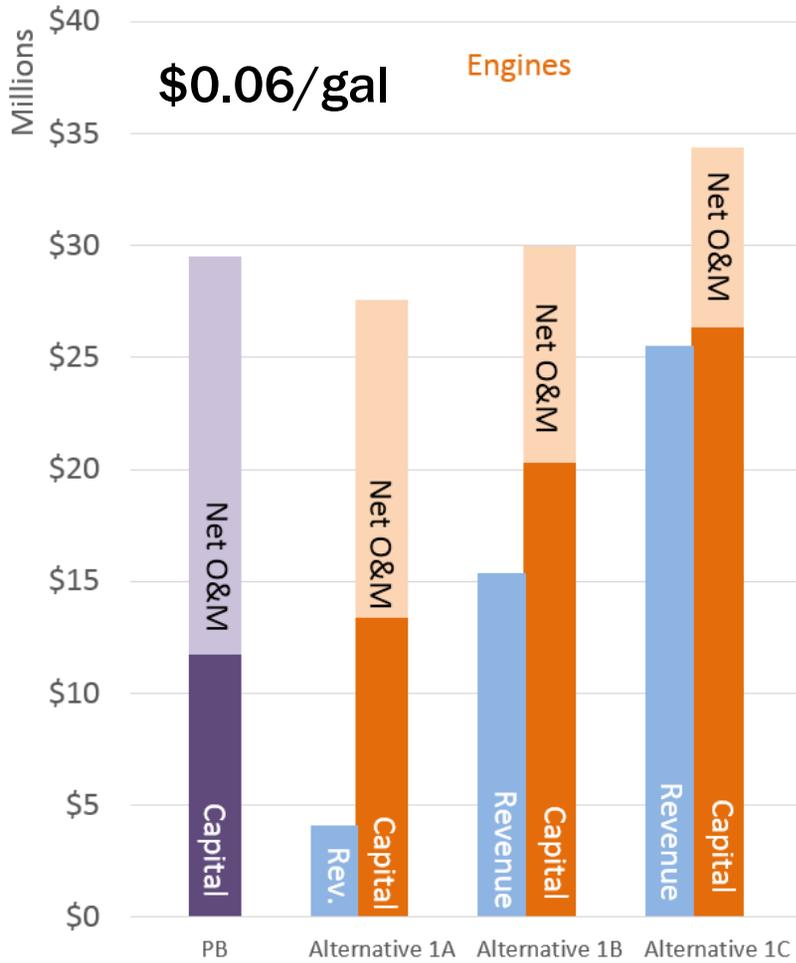


# Impact of Revenue Limited with electricity export

Revenue	Planning Baseline	Alt A: No Organics	Alt B: Moderate Organics	Alt C: Aggressive Organics
Annual Avg. Production	0	80 kW	300 kW	500 kW
Electricity Offset/ Sale	\$0	\$220,000	\$440,000	\$580,000
Organics Tipping Fees	\$0	\$0	\$370,000	\$770,000

*These are rough estimates based on experience. The ultimate values may vary a little or moderately depending on regulatory impacts, inflation or local impacts.*

# Tipping fee increases provide better alignment



# Substantial swing in economics available with improved residuals management costs

## Comparison of Alt C (30k gpd) to Do-Nothing



**Feedstock  
%VS / %VSR**



Residuals Management Cost (\$/wet ton)			
	\$100 (Raw disposal)	\$80 (Class B)	\$60 (Class B)
85% / 85%	+\$4.9M	+\$3.4M	+\$2.0M
90% / 90%	+\$1.6M	+\$0.6M	-\$0.3M
95% / 95%	-\$1.8M	-\$2.4M	-\$2.8M

# Conclusions

- Plant Operations
  - Co-digestion requires integration with state-of-good-repair projects
- Tipping Fees
  - Economics impacted by HSW disposal market; saw interest in project with some variability in pricing
- Biogas Utilization
  - With power generation, revenue limited with electricity export
- Residuals Management
  - Improved residuals management rate with readily degradable feedstocks required for favorable economics at increased HSW loading

# Acknowledgements



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**John Loughlin** Superintendent  
**Rick Kotouch** Plant Ops PM (SUEZ)  
**Ed Mcauliffe** Plant Ops (SUEZ)

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**Natalie Sierra** Senior Review  
**Tracy Chouinard** Process Model Lead  
**Alison Nojima** Energy Lead  
**Camilla Kuo-Dahab** Sidestream impacts



# Thank you

John Ross, PE

[jross@brwncald.com](mailto:jross@brwncald.com)

T 978.983.2030 | C 617.383.4962

**Brown** AND  
**Caldwell**