

Hazen

Biogas Utilization for Small Utilities - “Small Utilities Can Dream Big Too”

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2020 Annual
Conference
and Exhibit

Bioenergy Recovery Industry Trends

- Developing bioenergy markets and pathways
- New bioenergy recovery technologies
- Growing interest in bioenergy recovery from smaller utilities
- Integrated bioenergy recovery planning

Small Utilities Have Unique Challenges

- Economies of Scale and Funding
- Staffing and Operations Impacts
- Sensitivity to Risk
- Accounting for Unknowns and Uncertainty
- Making Informed Decisions

Biosolids and Energy Strategic Plan Goals and Drivers

- Digester rehabilitation needs
- Achieve plant wide energy neutrality
- Diversify biosolids sustainable use outlets and market options.
- Maximize the use of high strength waste (HSW)
- Minimize exposure to regulatory and market uncertainty/risks.

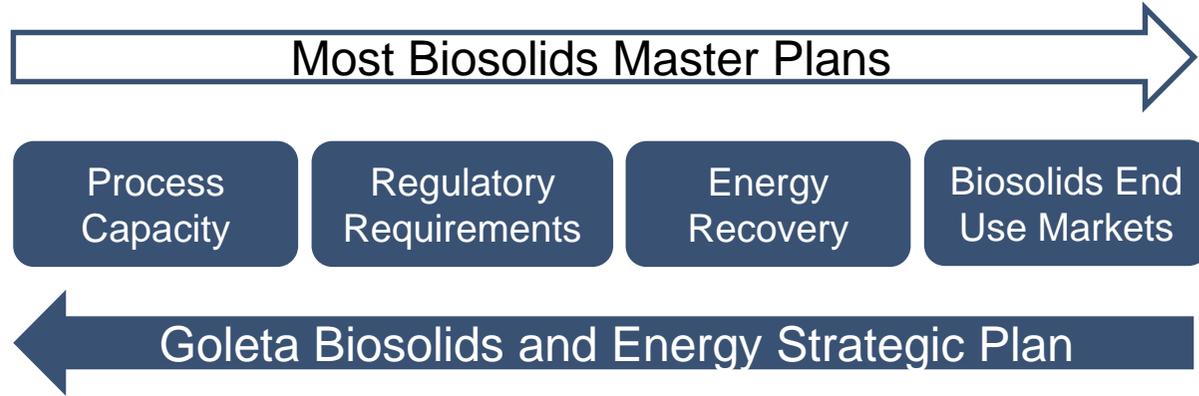
Goleta Sanitary District... Working to be
your Utility of the Future

Vision →

Innovation →

Strategy →

“Starting with the end use in mind”

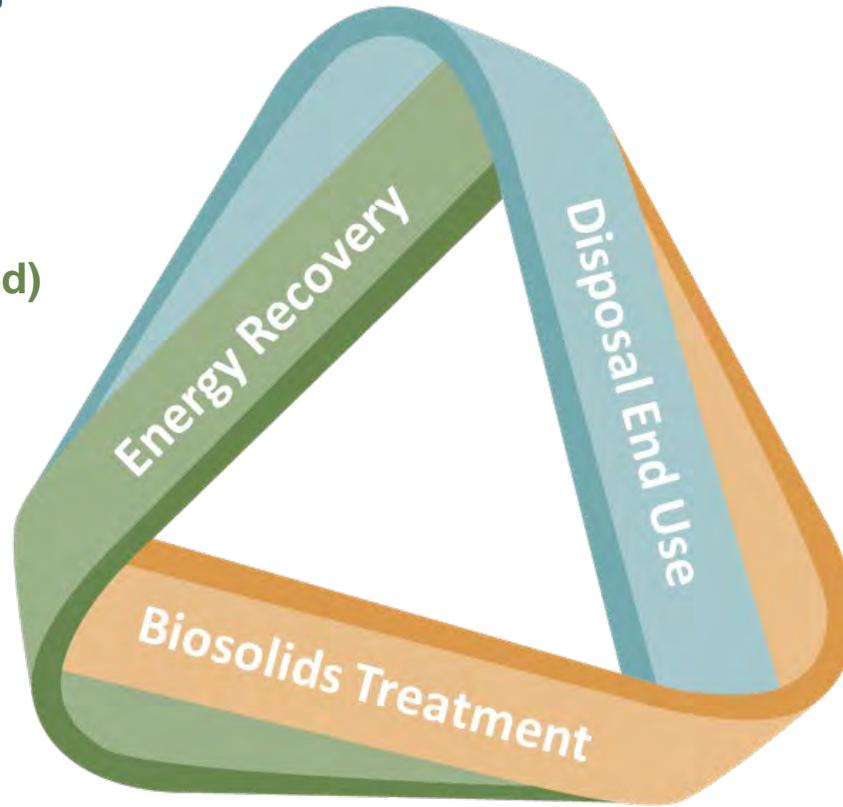


Understand how energy and biosolids end use markets influences long term biosolids management strategies and practices

Integrated Evaluations

Increase biogas production

- Post treatment (Lystek re-feed)
- WAS Pretreatment (Pondus)
- Codigestion HSW/FOG



Class A Technologies

- Sludge Drying
- Composting
- Solar Drying
- Lystimize

- Recuperative Thickening
- New Digester

GSD Energy Neutrality Strategy

- Beneficially utilize biogas
 - CHP, RNG or Fuel Biosolids Dryer
- Enhance biogas production
 - Codigesting FOG and food waste from UCSB
 - WAS pretreatment (PONDUS)
 - Sludge post treatment (Lystek Refeed)
- Explore Solar and Energy Storage

“Leave no stone unturned”

-GSD Board



Bioenergy Recovery Key Challenges

1. Making informed bioenergy recovery decisions in an uncertain environment
2. Right balance of risk and benefit
3. Developing a comprehensive long term path forward



Challenge - Accounting for Unknowns and Managing Risk

- Biogas Production
- Energy Costs
- Equipment Costs
- Plant Energy demands

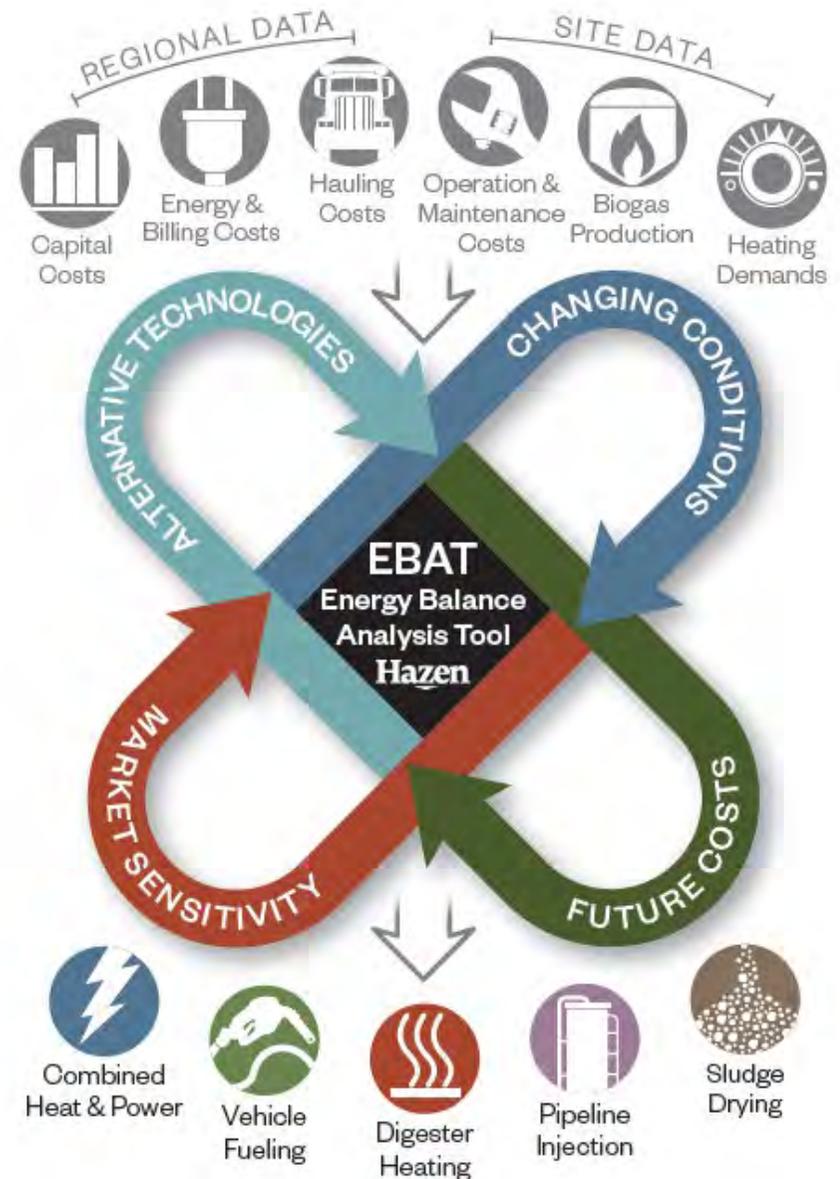
Known and Predictable

- Energy Market Conditions (RIN market)
- FOG/HSW availability
- FOG/HSW tip revenue
- Class A regulations (Dryer)
- Hauling Costs
- Funding and incentives

Unknown and Uncertain

Energy Balance and Analysis Tool (EBAT)

- Energy, GHG and Financial balance tool
- Account for variable market, plant, and process alternatives
- Understand conditions that make each biosolids and bioenergy recovery alternative feasible (“triggers”)
- Interactive online interface



Bioenergy Technology Alternatives

Electricity and Heat production (CHP)



- Offset purchased electric energy
- Recover heat from engine to heat digesters

Renewable Natural Gas Production (RNG)



- Produce RNG to be sold as a transportation fuel via pipeline injection
- Generate renewable fuel commodities (D3 RINs, LCFS Credits)

Sludge Drying & Sludge Drying + CHP



- Offset purchased natural gas
- OR
- Generate electric energy and use excess heat to supplement dryer heat

Process Alternatives

- Select all
- Base Case
- Lystek Refeed + New Digester + Lystek Class A
- Lystek Refeed + RT
- Lystek Refeed + RT + Lystek Class A
- New Digester
- PONDUS + RT
- RT

Codigestion

\$0.11	HSW Tip Rev (\$/gal)	\$0.11
\$0.07	FOG Tip Rev (\$/gal)	\$0.07
6,200	HSW (gal/day)	6,200
10,000	FOG (gal/day)	10,000

Biogas Utilization Capital Costs

\$2,500	CHP Construct Cost ...	\$3,250,000
\$11,500,000	Dryer Construct Cos...	\$11,500M
\$6,000,000	RNG Construct Cost ...	\$6.00M

Other

0.0%	RIN/LCFS Credit	\$20.00
\$58.00	Hauling Costs (\$/ton)	\$58.00
-3,600,000	Annual Elec Consum...	-3.60M

Payback Period

Lystek Refeed + RT	>20
New Digester	>20
PONDUS + RT	>20
RT	15

Payback Period

Lystek Refeed + RT	15
New Digester	16
PONDUS + RT	16
RT	13

Payback Period

Lystek Refeed + RT	>20
New Digester	>20
PONDUS + RT	>20
RT	>20

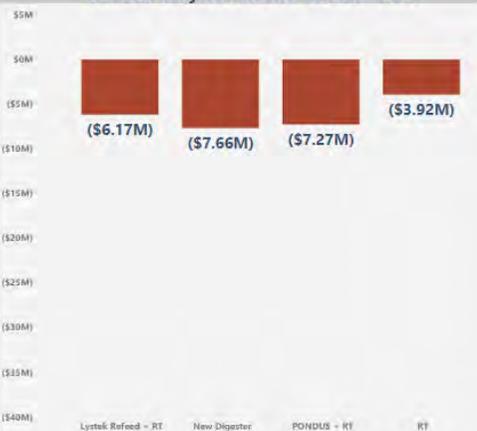
Payback Period

Lystek Refeed + RT	>20
New Digester	>20
PONDUS + RT	>20
RT	>20

20-Year Project Present Worth - CHP



20-Year Project Present Worth - RNG



20-Year Project Present Worth - Dryer

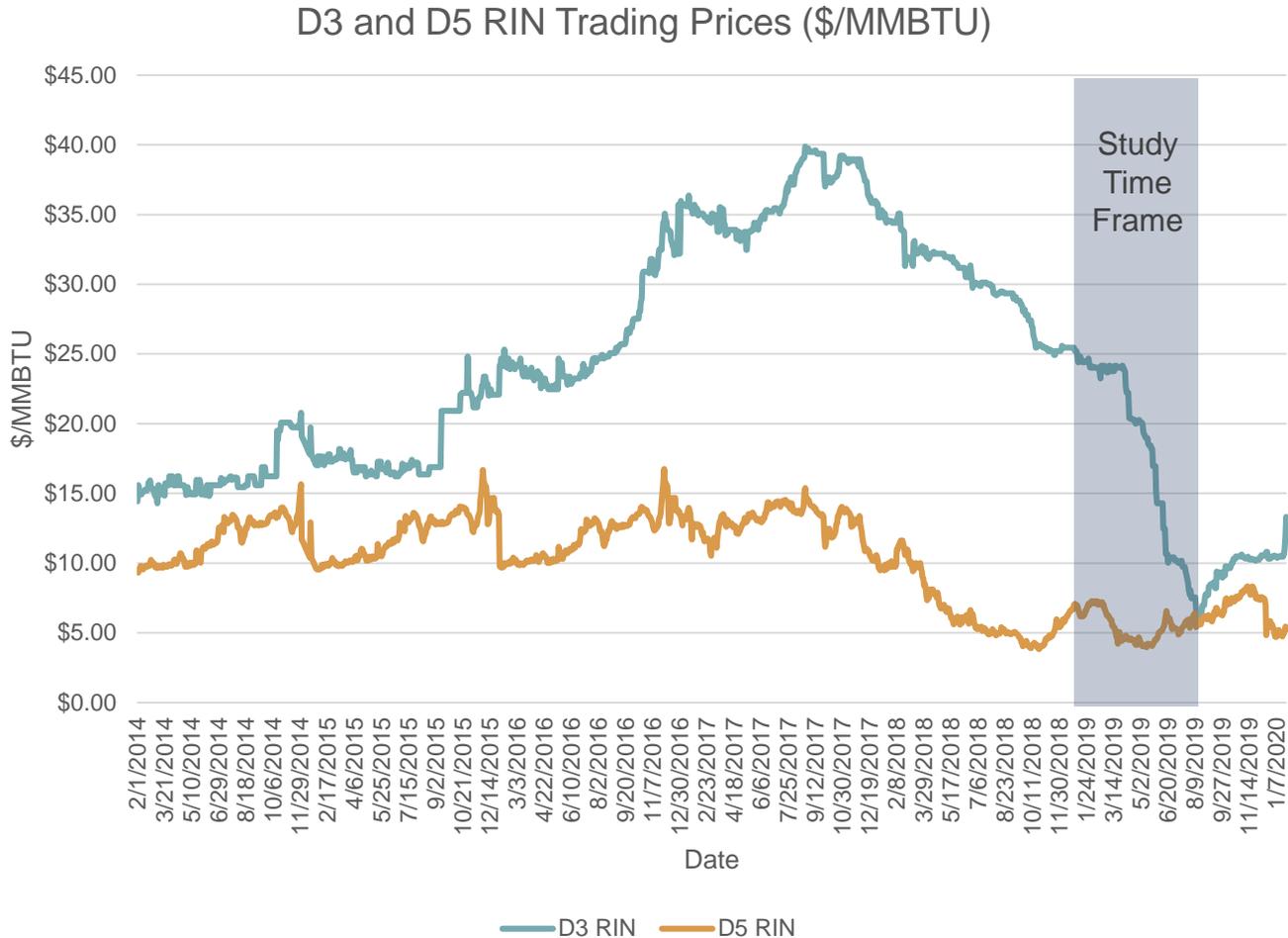


20-Year Project Present Worth - Dryer + CHP



Exploring the “What If’s” (RIN Market Example)

- RNG revenue highly dependent on the value of D3 RINs.
- D3 RINs were trading at ~\$25/MMBTU when project started. Lost over 60% of its value by the time the study ended.



Key Finding 1 – Biogas to RNG was sensitive to RIN market stability

- GSD decided RNG production was too risky.
- Electric energy market is much more stable than renewable fuels commodity markets.
- ***GSD is focused on moving forward with electric energy production (CHP).***



Key Finding 2 – Codigestion was needed to achieve energy neutrality however....

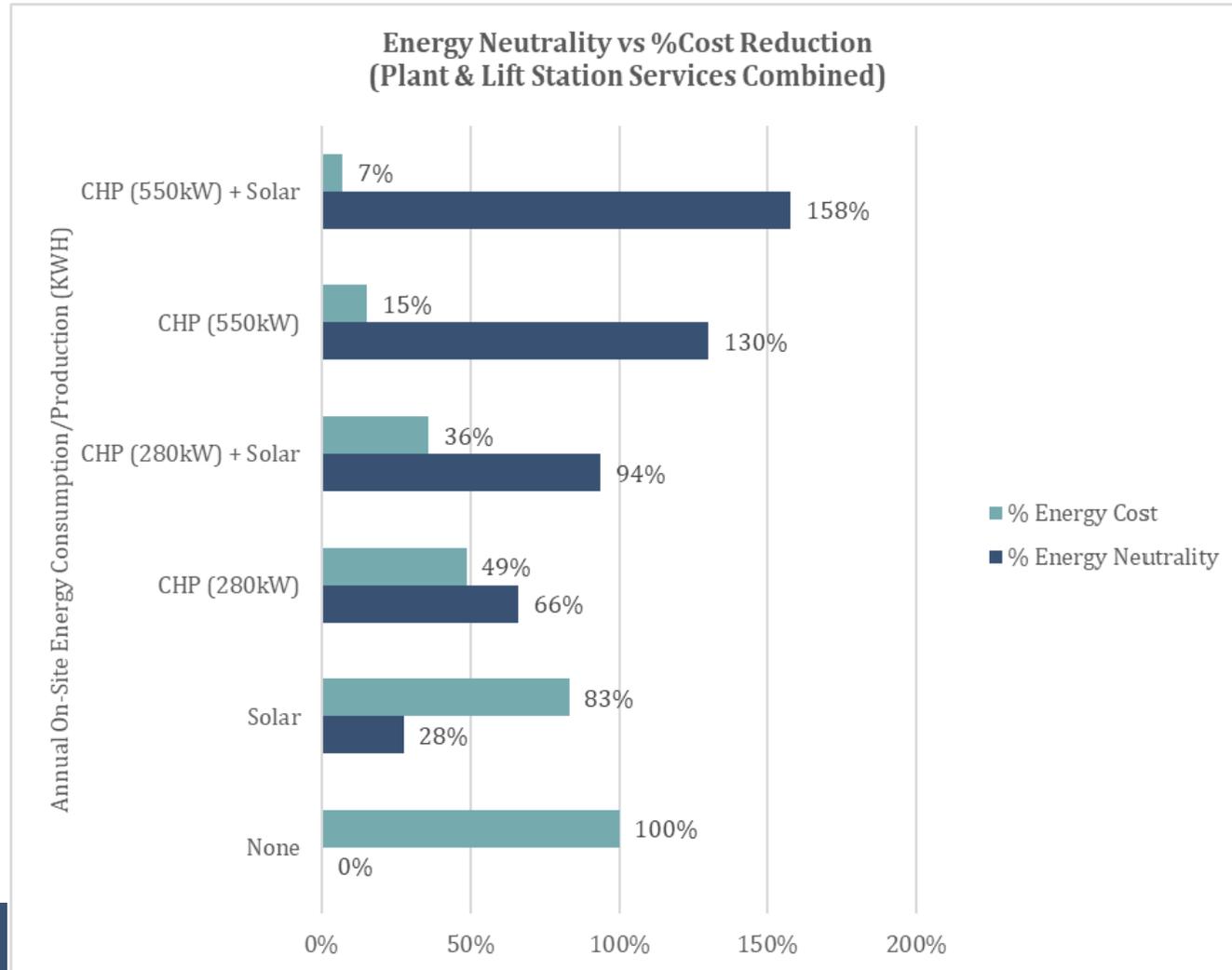
- ...GSD did not have firm capacity to accept FOG/HSW
- Recuperative thickening or new digester would provide firm capacity
- ***GSD decided to add a new digester***



Max month conditions when Digester 3 is offline

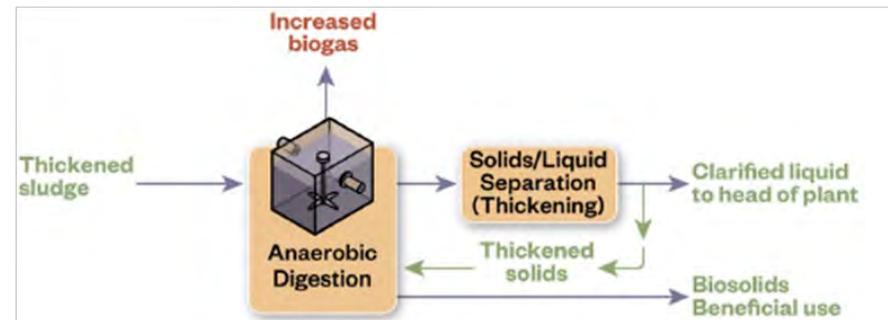
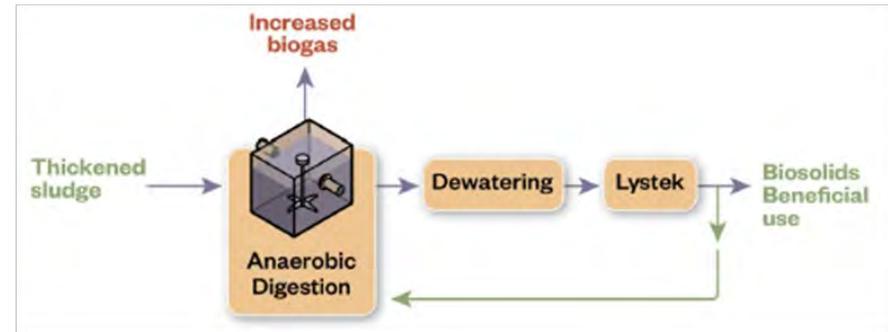
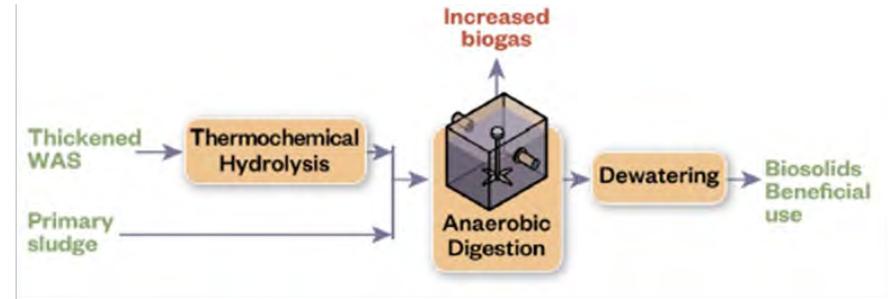
Key Finding 3 - Energy Neutrality ≠ Zero Energy Costs

- 100% energy neutrality reduced energy costs by 65%.
- Net metering agreement aggregated each month.
- Surplus energy sold back at the surplus rate (~\$0.025/KWH)
- ~Returns began to diminish after 70% energy neutrality
- ***GSD decided to pursue the best financial case alternative***



Key Finding 4 – WAS pretreatment and Lystek Refeed did not provide a high level of value

- Biogas production increase - 25-30%
- On-site energy production with co-digestion could exceed 70% (diminishing returns)
- Cost of PONDUS and Lystek refeed did not justify the energy production costs with evaluated with CHP
- ***Reconsider these technologies if RNG is pursued in the future***



Key Finding 5 – Codigestion tipping fees were ~ 62% of the overall revenue profile

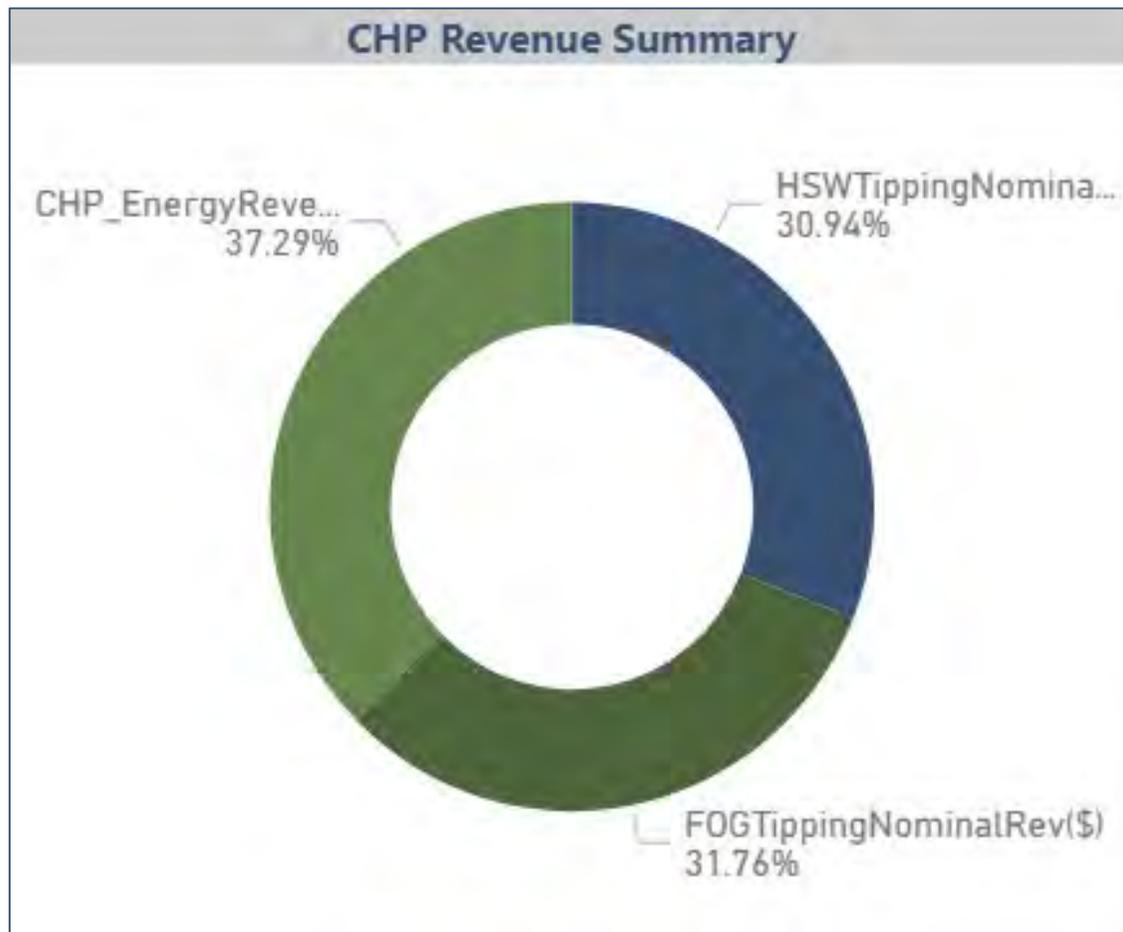
Food waste (HSW) from UCSB

- \$0.11/Gallon
- ~6200 Gallons/Day

Fats Oils and Grease (FOG)

- \$0.07/Gallon
- ~10,000 Gallons/Day

Currently evaluating and negotiating long term agreements with UCSB and FOG haulers

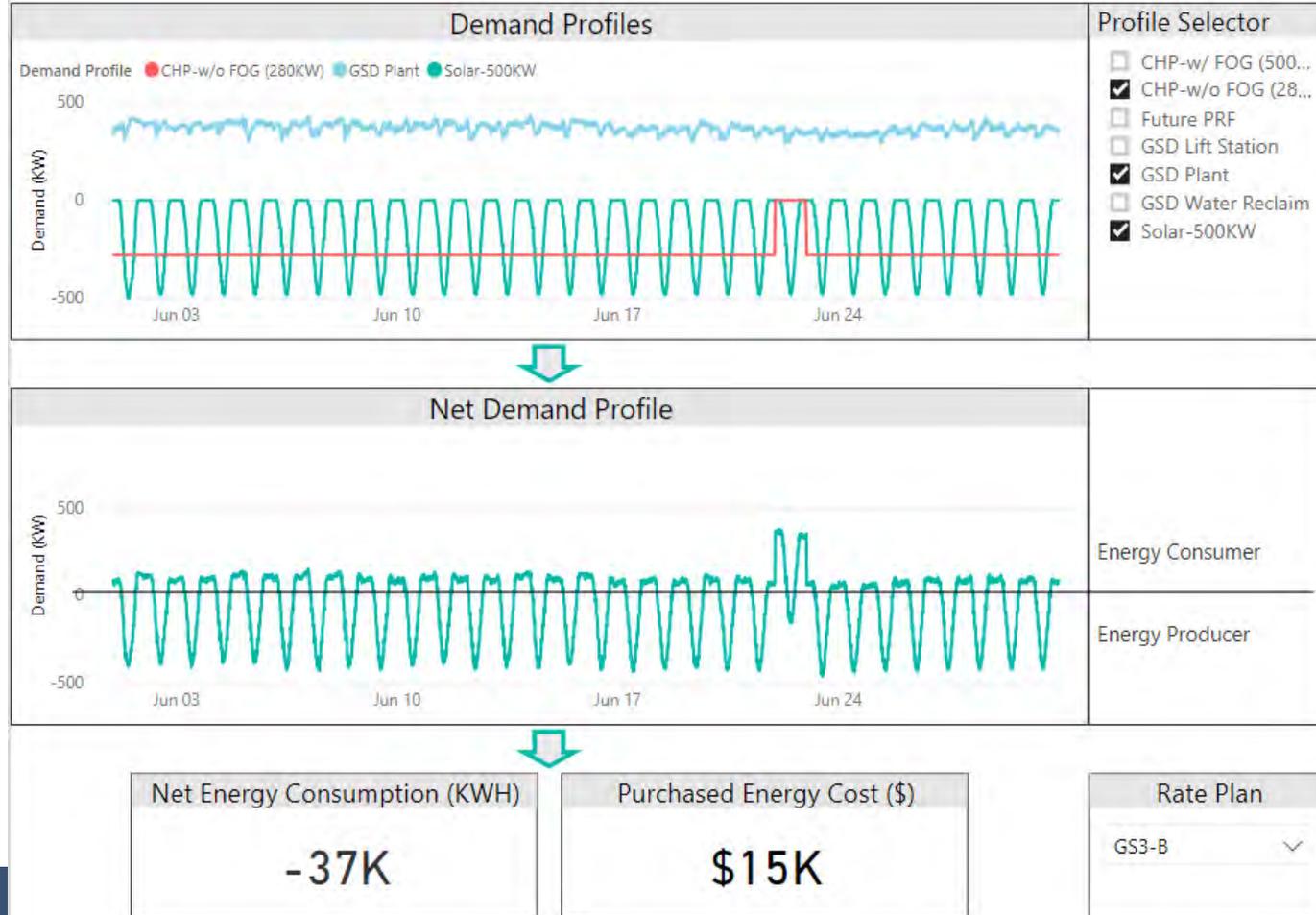


Key Finding 6 – Solar and Energy Storage Not Economically Feasible

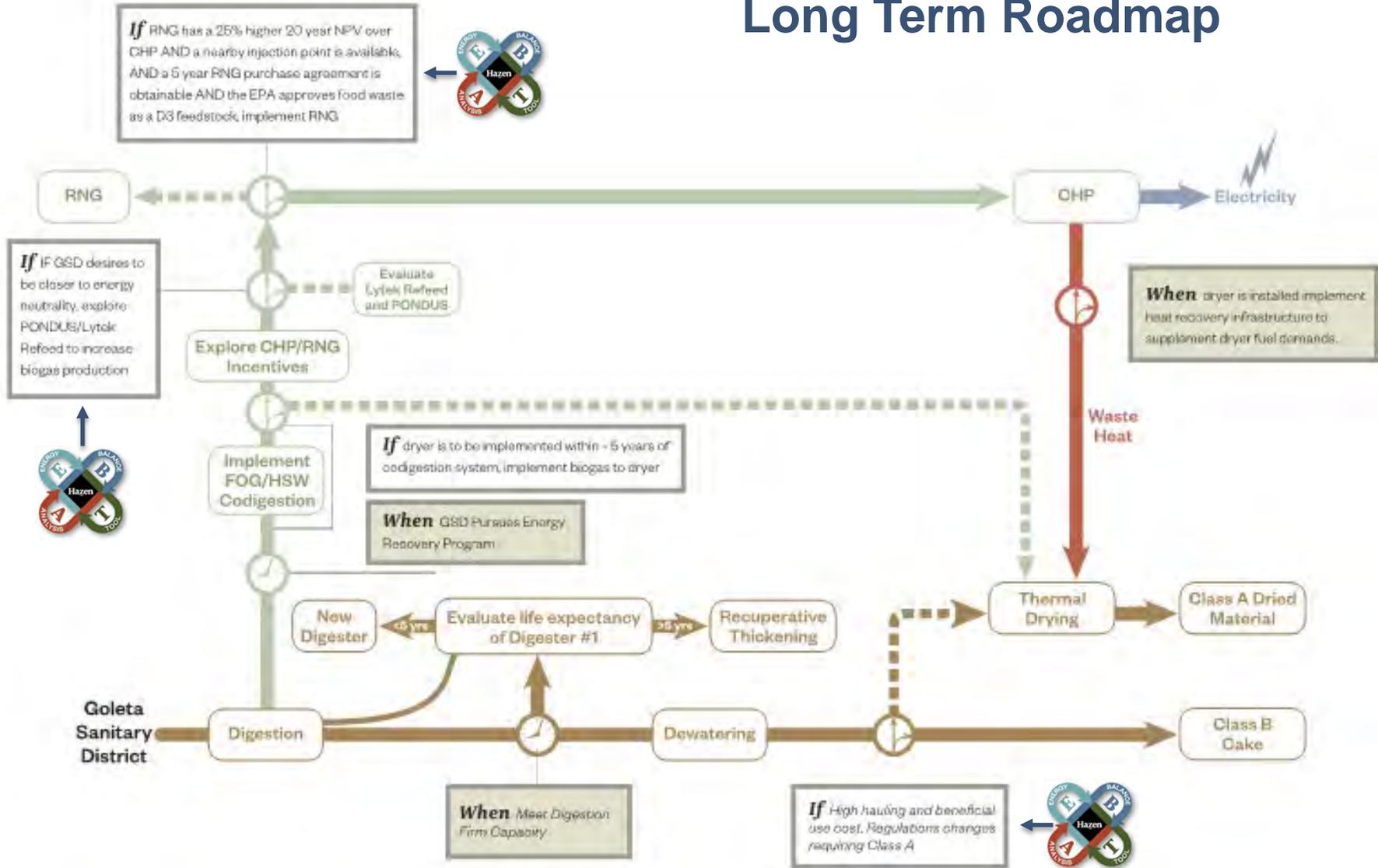
- Energy storage costs exceeded energy cost benefits
- Solar costs exceed benefit due to time of use shift.
- Battery system costs \$500/KWH (Short duration)

Billing Rate Model Description

This model is used to evaluate the net energy costs for onsite power generation and energy storage alternatives.



Long Term Roadmap



Lessons Learned

- Integrated energy and biosolids evaluations provided a deeper understanding of the bioenergy recovery opportunities.
- Energy neutrality may not be the most cost-effective target
- Accounting for unknowns and uncertainty using energy modeling (EBAT) gave the board confidence that “no stones were left unturned”.

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Thank You

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