Energy and Chemical Savings Options

Presentation Purpose

NapaSan Strategic Plan 2019

3B. *Evaluate and recommend ways to reduce energy and chemistry consumption in treatment process and collection system.*

Chemistry and energy are the largest "consumables" in the operating budget, making up about 34% of the total Services and Supplies budget and 12% of the overall operating budget.
Timeframe:

This evaluation will be completed by NapaSan staff. Update the Board on efforts made to date and provide options for future reductions by December 31, 2019.

6E. *Evaluate energy self-generation with the primary goal of decreasing overall energy costs and reliance on the energy grid, and recommend policy options for consideration.*

Explore the expansion of the FOG receiving and the internal combustion combined heat and power (Cogen) system, linear electromagnetic induction, fuel cell, expanded solar, or other ideas to increase NapaSan's generation of electrical power, as long as there is both immediate and long-term cost savings.

Timeframe:
Initial framework of alternatives will be provided to the Board for consideration by June 30, 2020.

Energy and Chemical Savings Options - February 2018

Continue to Evaluate

Category	ECM	ECM Name	kWh Saved ($0.14/kWh)	kW Saved	Utility $ Savings	O&M/Other $ Savings	Total $ Savings	Investment	SPBP, yrs
Chemical	9	Evaluation Study of Alternate Treatment Chemicals				TBD		$ 135,000	TBD
	10	Peracetic Acid Pilot Study							
Load Reduction	11	Jockey blower	108,000	12	$ 14,000	$ 20,000	$ 34,000	$ 525,000	15.4
	12	Aeration basin internal recycle pumping	513,000	58	$ 66,000	$ (1,000)	$ 65,000	$ 211,000	3.3
Cogen Optimization		Continue to Monitor FOG Import							
	14	CEPT - Chemically Enhanced Primary Treatment (In-house pilot study)	747,000	85	$ 103,833		$ 103,833	$ 335,000	3.2
	15	Algae to Energy Study (Complete)				TBD		$ 35,600	TBD
Generation	16	Fuel Cell	4,098,585		$ 680,000	$ (260,000)	$ 420,000	$ 3,754,739	8.9
Other	18	Pond Surface Lease (Floating Solar)				$ 220,000	$250,000		

Chemical Alternatives Evaluation

Brown & Caldwell, June 28, 2019

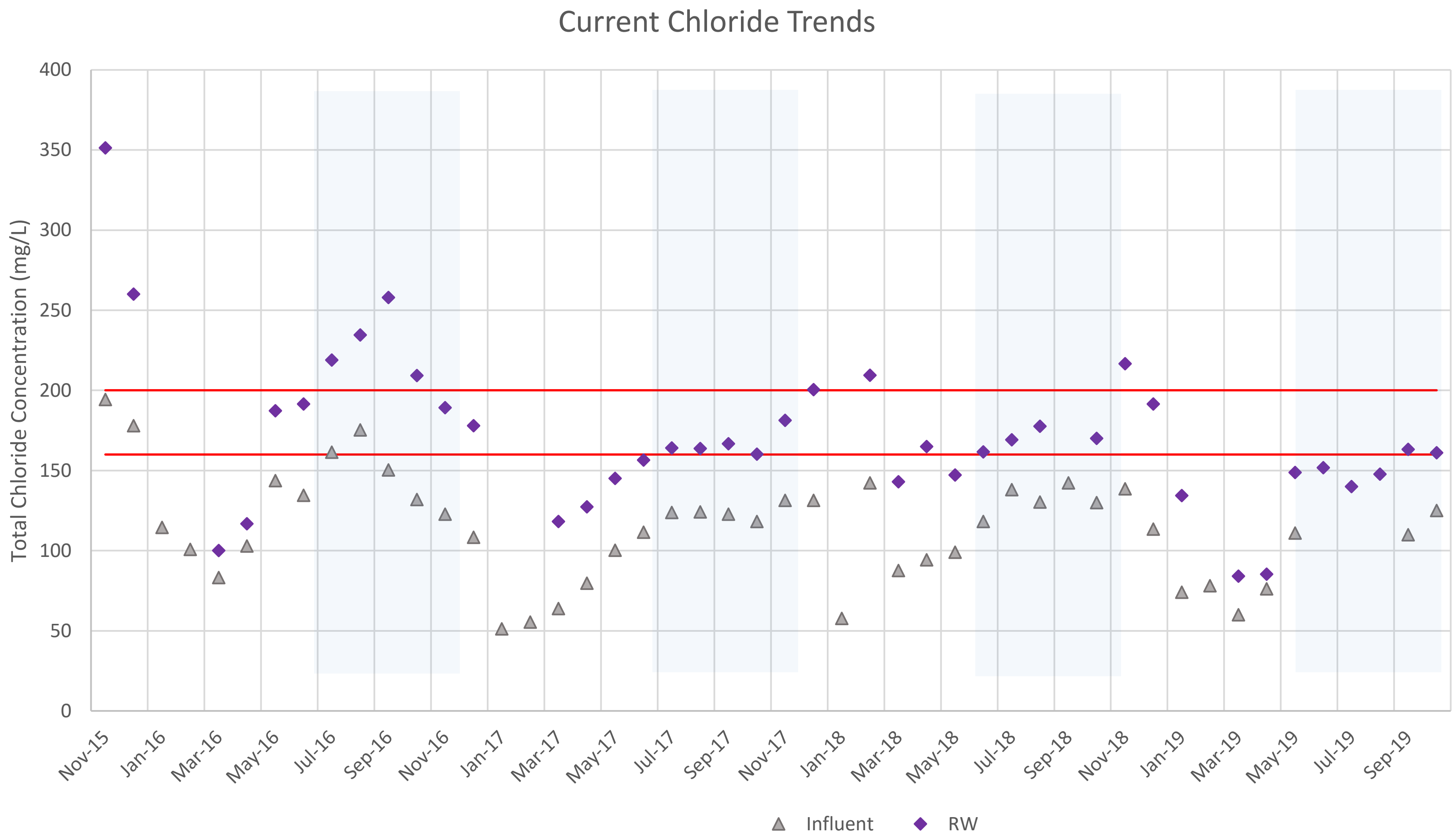
Focused on NapaSan goals;

1) Increased recycled water production from 2,200 to 3,700 acre-feet per year.
2) Maintaining water quality at a peak day chloride concentration of 160 mg/L.

Study Considerations:

- Replacement of poly aluminum chloride (PACl)coagulant with non-chloride based polymer used in the production of recycled water.
- Repair of the 66-inch trunk.
- Replacement of ferric chloride with ferric sulfate.
- Replacement of sodium hypochlorite disinfection with ultraviolet irradiation disinfection.
- Installation of membrane filtration and reverse osmosis.

Chemical Alternatives Evaluation



Chemical Alternatives Evaluation

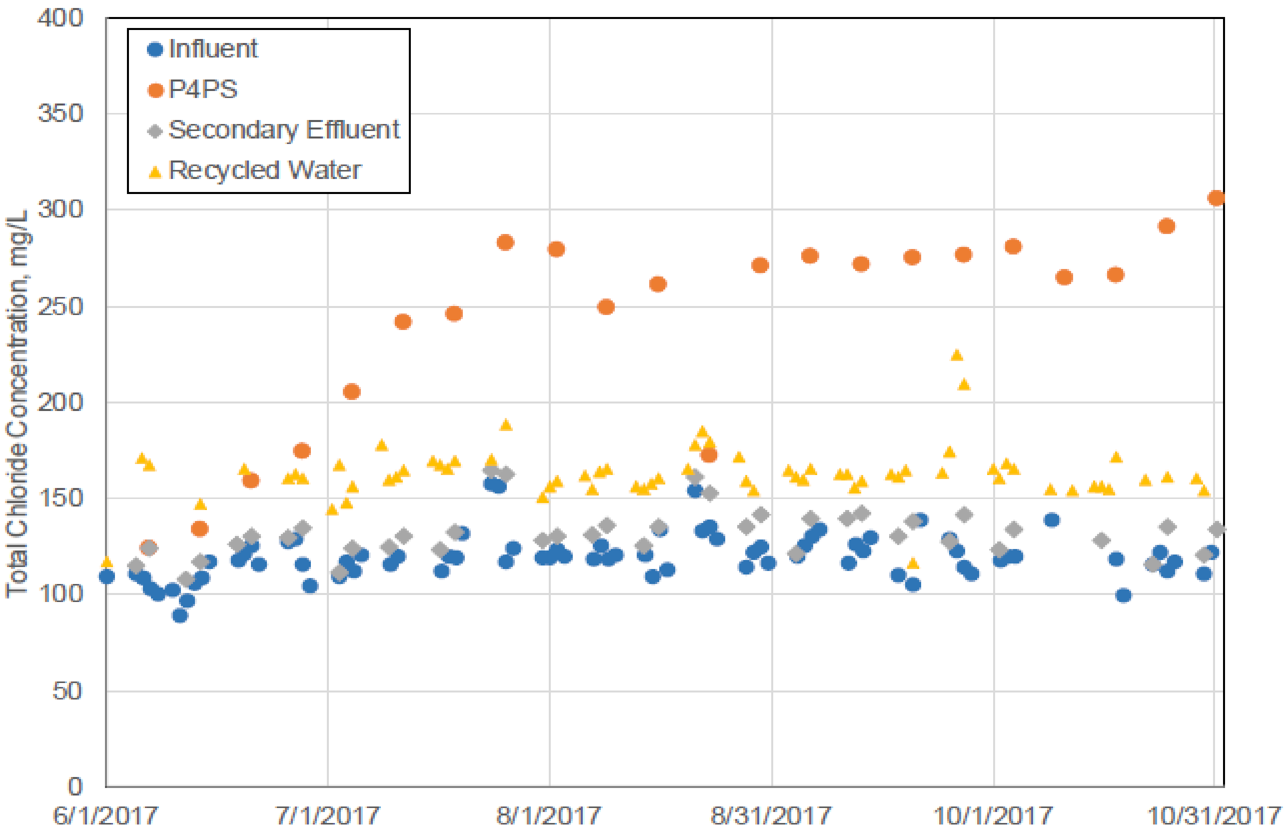


Figure 3-2. Historical total chloride concentrations from select locations

Chemical Alternatives Evaluation

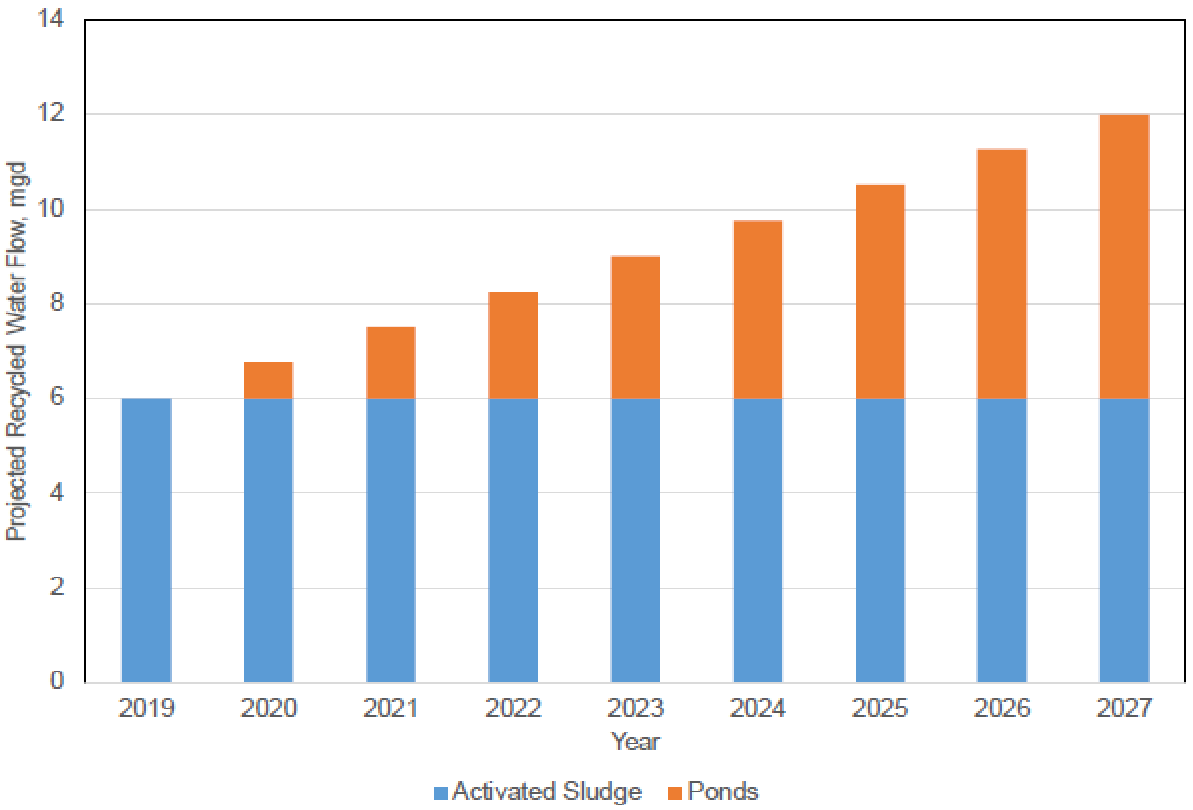


Figure 2-2. Projected changes in recycled water source by year showing that future demand will be met with water stored in the ponds

Chemical Alternatives Evaluation

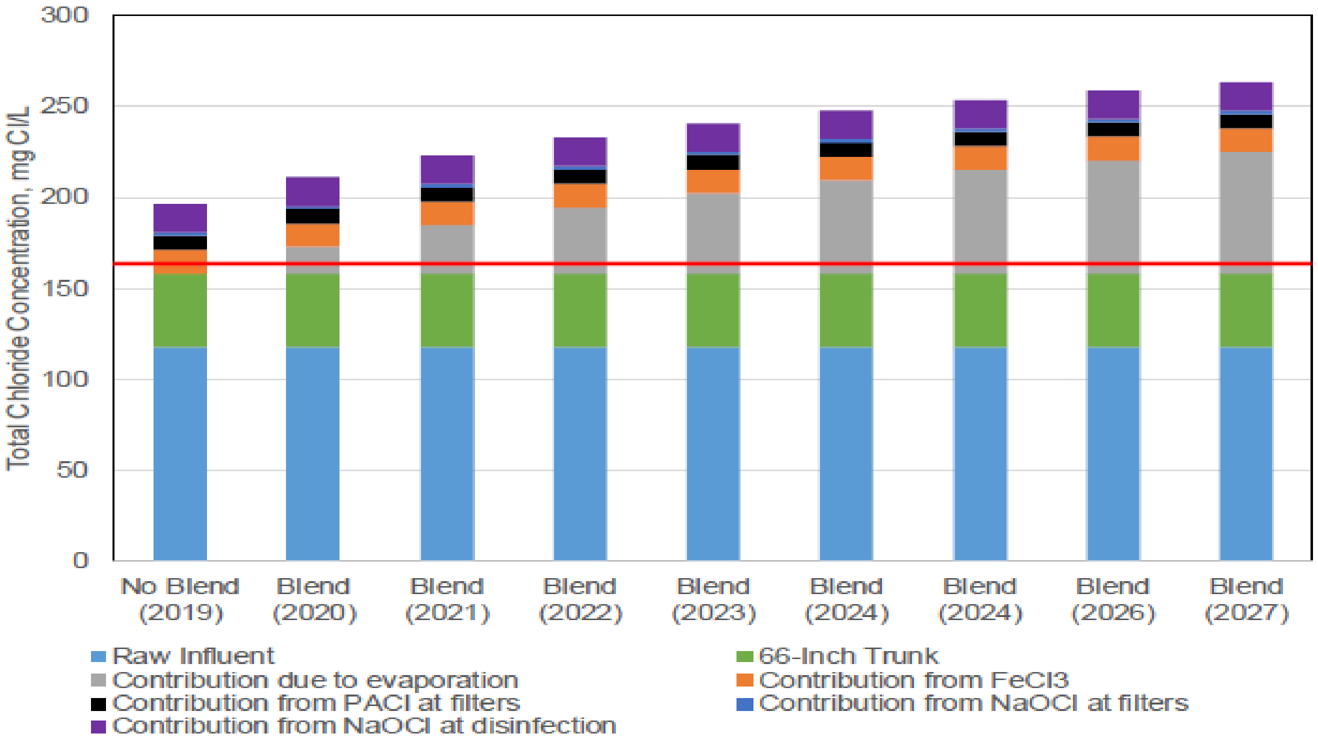


Figure 3-4. Stacked column plot showing the increasing projected chloride concentrations over time from 2019 through buildout recycled water flows in 2029

The red line shows the peak day chloride concentration goal of 160 mg/L.

Chemical Alternatives Evaluation

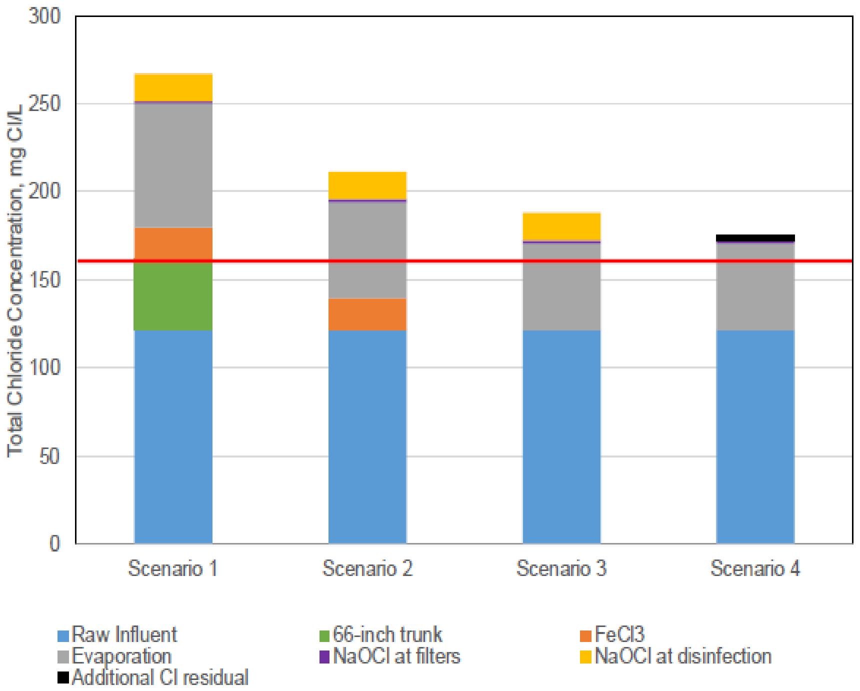
Table 6-3. Summary of Scenarios Evaluated						
Scenario	Replace PACl	Repair 66-inch Trunk	Replace $FeCl_3$ with $Fe_3(SO_4)_3$	MF influent flow, mgd	RO permeate flow, mgd	UV peak flow, mgd
1	✓	-	-	4.5	3.8	-
2	✓	✓	-	2.3	2.0	-
3	✓	✓	✓	1.4	1.2	-
4a	✓	✓	✓	0.8	0.7	12 (RW Only)
4b	✓	✓	✓	0.8	0.7	24 (All flow)

MF – Membrane Filtration
RO – Reverse Osmosis
UV – Ultraviolet light disinfection
PACl – Chloride containing coagulant
$FeCl_3$ – Ferric Chloride
$Fe_3(SO_4)$ – Ferric Sulfate

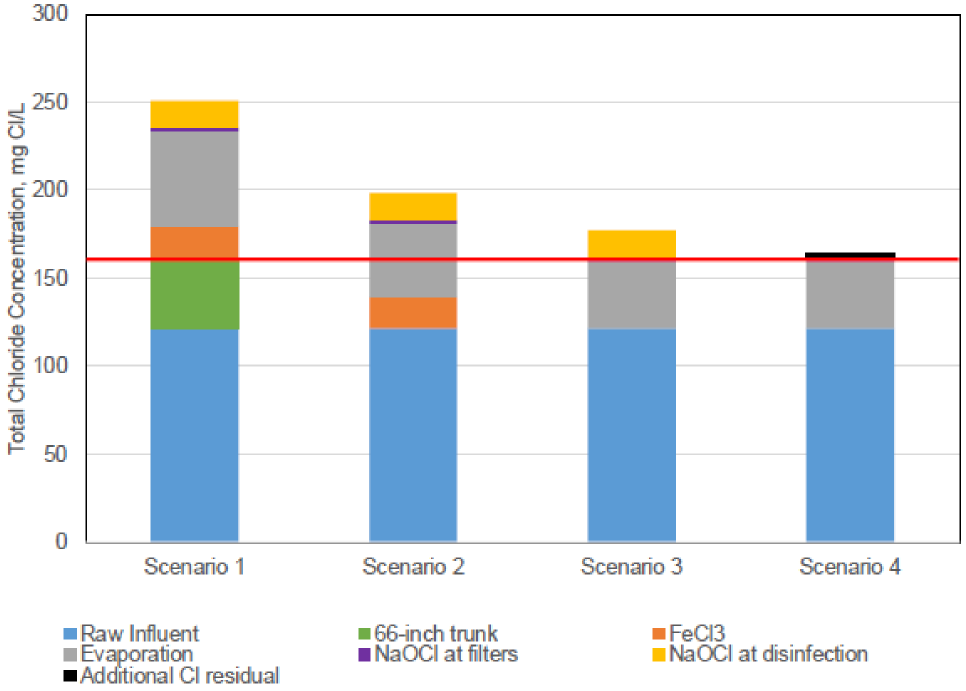
NapaSan

Chemical Alternatives Evaluation

Source of Chloride from each scenario when all ponds are on-line.



Source of Chloride from each scenario when pond 3 is isolated for concentrate management.



Determines MF/RO Capacity

Chemical Alternatives Evaluation

Summary of Costs ($M)					
Item	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4a**	**Scenario 4b**
Flow (MGD)	MF 4.5	MF 2.3	MF 1.4	MF 0.8 / UV 12	MF 0.8 / UV 24
UF	4.5	3.2	2.4	1.6	1.6
RO	5.5	3.5	2.6	1.7	1.7
UV				1.8	3.4
Install	18.1	12.2	9.2	9.4	12.3
Total	28.0	18.8	14.2	14.6	19.1

MF – Membrane Filtration (consists of UF & RO)
UF – Ultra Filtration
RO – Reverse Osmosis
UV – Ultraviolet light disinfection

Chemical Alternatives Evaluation

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2	✓	✓	-	2.3	2.0	-
3	✓	✓	✓	1.4	1.2	-
4a	✓	✓	✓	0.8	0.7	12 (RW Only)
4b	✓	✓	✓	0.8	0.7	24 (All flow)

Table 6-4. Summary of Costs					
Item	Scenario 1	Scenario 2 [a]	Scenario 3 [a]	Scenario 4a [a]	Scenario 4b [a]
Total capital cost [b]	28,000,000	18,900,000	14,300,000	14,600,000	19,100,000
O&M cost, $/yr	870,000	720,000	740,000	710,000	660,000
30-year NPV[c]	53,900,000	40,300,000	36,200,000	35,700,000	36,600,000

a. *The chloride reduction from the repair of the 66-inch trunk is included in this scenario, but the cost is not included in this cost estimate.*

b. *Capital costs are presented in 2019 dollars.*

c. *Net present value calculated over 30-years at a discount rate of 3 percent.*

Chemical Alternatives Evaluation

Recommendations

- Repair the 66-inch trunk.
- Install an Ultraviolet Transmittance (UVT) sensor.
- Confirm the hydraulic capacity through existing contact basins.
- Test ferric sulfate for H_2S removal at the headworks.
- Engage MF manufacturers to test chloride-free polymer on membranes.
- Conduct MF/RO pilot testing.

Peracetic Acid Pilot Study

1. Gaining acceptance as a wastewater disinfectant prior to discharge.

2. Not listed as an approved disinfectant by the Clean Water Act.

3. Further off from being accepted as a recycled water disinfectant.

4. Continue to monitor acceptance.

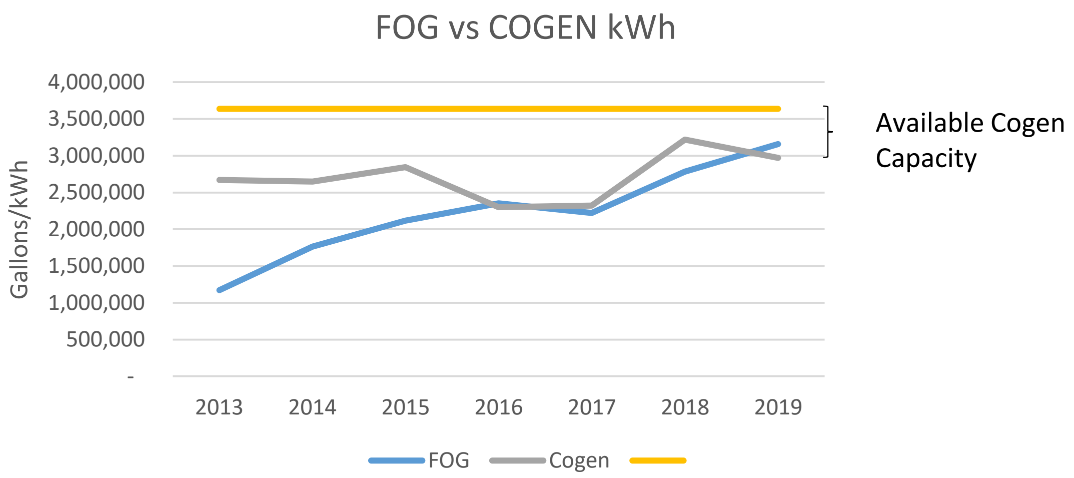
Load Reduction

Jockey Blower – Replace the constant speed blower with smaller capacity high efficiency blower. Working with Neuros to identify cost. WEFTEC 2019 Neuros rolled out a natural gas turbo blower that may have improved economic performance.
Competition for capital funding.

Aeration Basin Internal Recycle Pumping – Relatively short payback. Competition for capital funding and lack of regulatory pressure has reduced prioritization.

Cogen Optimization

FOG Import



CEPT – Continue with an in-house pilot study using ferric chloride and ferric sulfate and polymer to determine cost balance around this mode of operation.

Algae to Energy Study

- Entered into a desk study and biomethane potential testing with Microbio Engineering, (San Luis Obispo) to identify seasonal species of pond algae and their beneficial digestibility.
- Experimenting with existing infrastructure co-thickening the algae sludge and WAS sludge and feeding this stream into the anaerobic digester.

Generation

Fuel Cell

Bloom energy smallest fuel cell is larger than our minimum base load.
Fuel cell requires clean fuel, i.e. natural gas quality.
Unable to load follow.

Linear Induction Generator (EtaGen)

Modular design and in capacities below our minimal base load.
Flexible fuel i.e. biomethane or mixture of biomethane and natural gas.
Able to load follow.

Currently working with NextEra Energy Resources on a PPA proposal.

Other

Pond Surface Lease – Floating Solar

Ciel & Terre - *a French pioneer in the photovoltaic market, is specialized in floating solar panels for commercial, government and non-profit institutions.*

NapaSan Board approved lease option for a portion of pond 4 and pond 3 surface to Ciel & Terre's 20 MW floating solar array. Energy generated by the solar array would be purchased by Marin Clean Energy. The project requires construction of a power transmission service to PG&E's nearest substation. Cal ISO expressed interest in partnering on the construction of the transmission service.

Emerging interest

Iwatani Corporation - *As an integral part of one of the leading global Japanese conglomerates, Iwatani Corporation of America has been steadily broadening its' horizons to new markets throughout The Americas in the fields of cooking products, industrial gases, ceramics, electronics, plastics, chemicals, metals, and agri-bio for the past 30 years.*

Propose utilizing the solar array to generate hydrogen for use in the hydrogen sector.

Questions