

Not Your Typical Turbo Blower

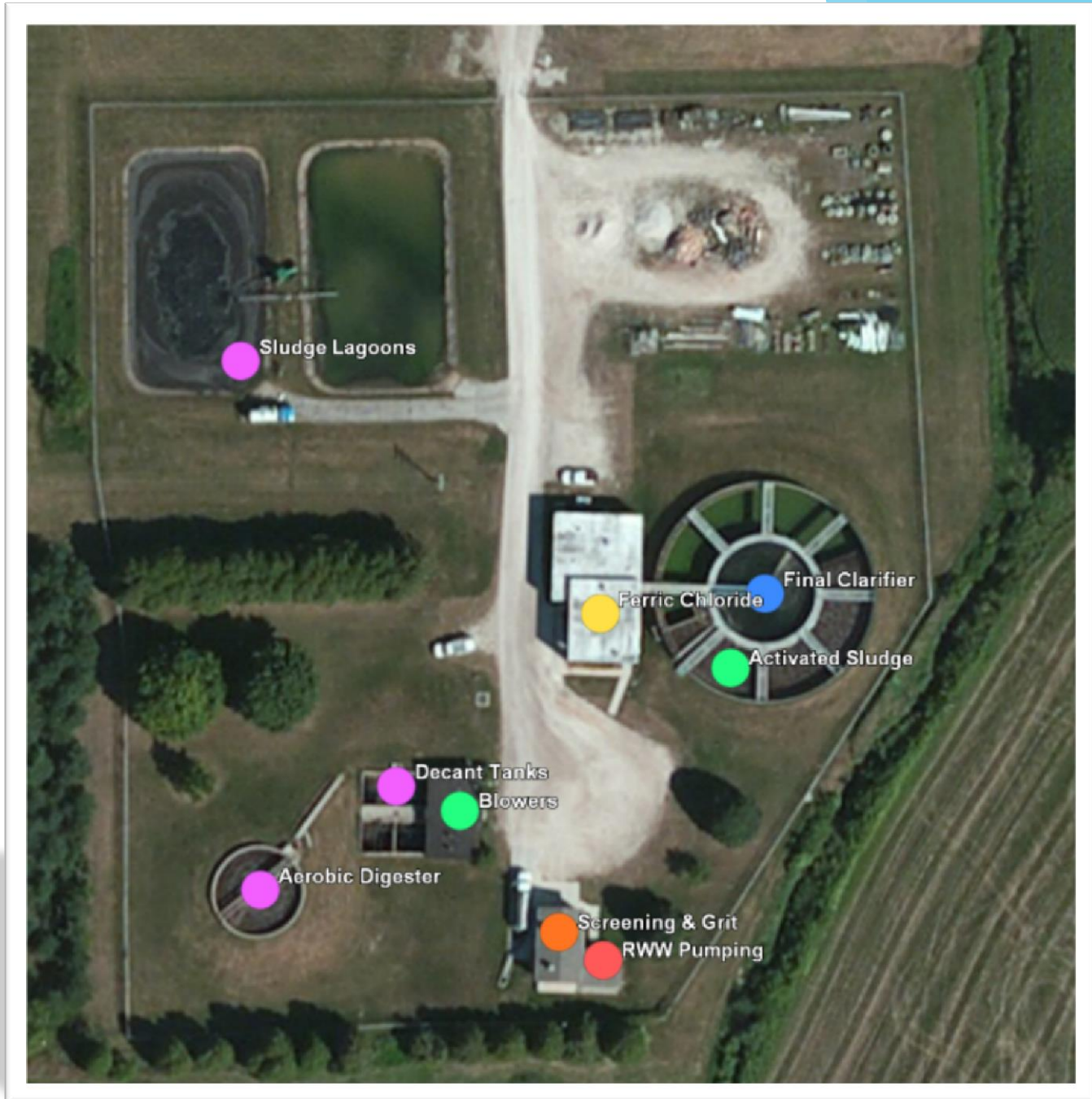
New Holstein Utilities' Blower Improvements

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Background

- ▶ New Holstein Utilities
 - ▶ Population (~3200)
 - ▶ Design
 - ▶ Flow (1.33 mgd)
 - ▶ Load (1600 ppd BOD)
 - ▶ Current
 - ▶ Flow (0.5 mgd)
 - ▶ Load (680 ppd BOD)



Background

▶ Permit Requirements

- ▶ BOD (20/30 mg/L)
- ▶ TSS (20/30 mg/L)
- ▶ TP (1.0 mg/L)
- ▶ No disinfection

▶ Operational Practices

- ▶ Extended Air (Nitrification)
- ▶ Septage Receiving (Slugs)



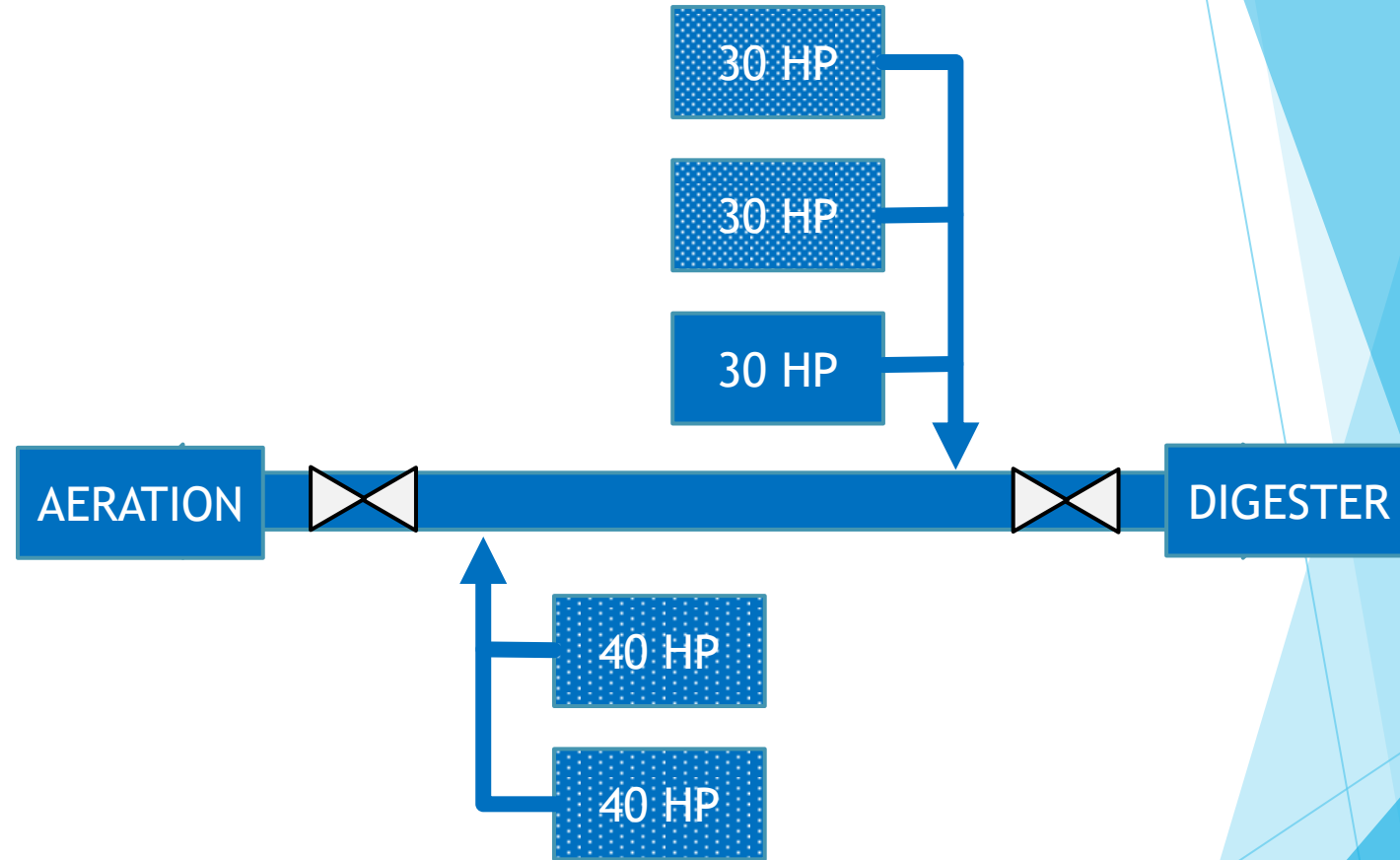
Background

- ▶ Aeration Blowers
 - ▶ Type - Rotary Lobe
 - ▶ Function - Aeration and Digester
 - ▶ Condition - End of Useful Life
 - ▶ Reliability Concerns
 - ▶ Inefficient



Background

- ▶ Aeration Blowers
 - ▶ Operational Limitations
 - ▶ Constant Speed
 - ▶ 40HP / 30HP
 - ▶ Age
 - ▶ 2 Failed
 - ▶ 2 Used Units



Typically run 70 / 100 HP
for 1600 scfm / 2300 scfm
(mixing limited)

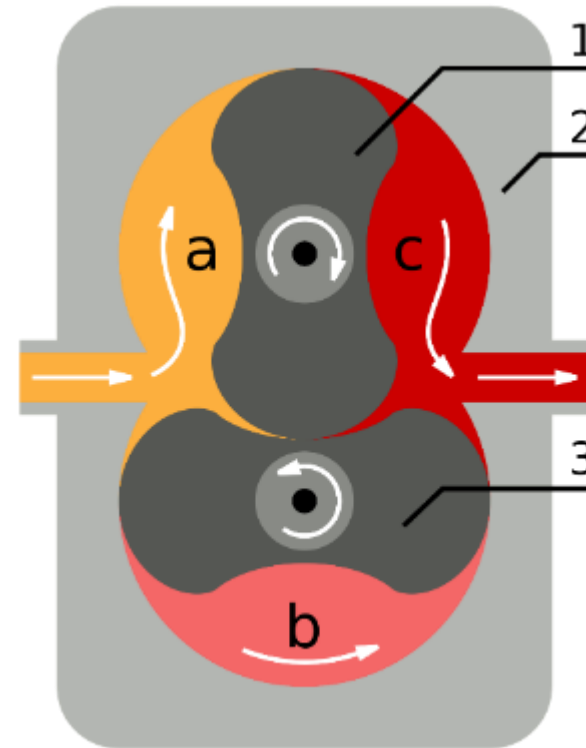
Facilities Plan

- ▶ Blower Replacement
- ▶ Ancillary Systems
 - ▶ Building
 - ▶ Decant Tanks
 - ▶ WAS Control
 - ▶ Sludge Pumps
 - ▶ Standby Generator
 - ▶ DO Control
 - ▶ Lab Temperature
 - ▶ Workshop/Garage Bay



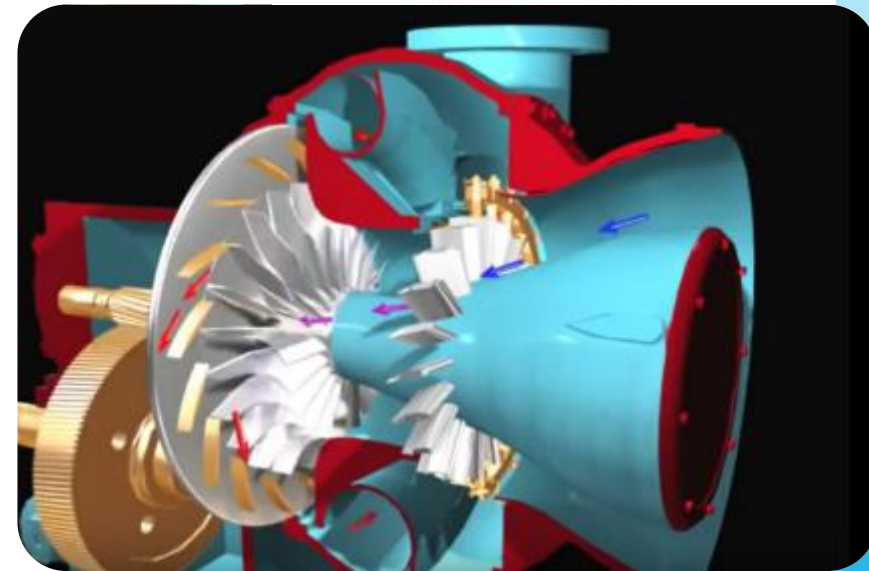
Facilities Plan

- ▶ Blower Replacement Alternatives
 - ▶ Replace In-Kind - Rotary Lobe Blowers
 - ▶ Single Stage Centrifugal (Turbo) Blowers
- ▶ Efficiency
 - ▶ Life Cycle Cost Evaluation
- ▶ Upgrade Electrical Service
 - ▶ 230V vs. 480V Power
- ▶ Recommended Further Consideration



Facilities Plan / Preliminary Design

- ▶ Single Stage Centrifugal Blowers
 - ▶ High Speed Turbo (Sulzer/APG-Neuros)
 - ▶ Specialized Electronics
 - ▶ Cost
 - ▶ Integrally Geared with Sliding Vane (Turblex)
 - ▶ High Capacity / Cost
 - ▶ Integrally Geared with VFD (Inovair)
 - ▶ New



Inovair Blower

- ▶ Concept
- ▶ Advantages
 - ▶ Moderate Cost / Efficiency
 - ▶ Basic Components
- ▶ Disadvantages
 - ▶ Not Best Efficiency
 - ▶ Limited Installations and Experience
 - ▶ Milwaukee Industrial Application
 - ▶ Rib Mountain (eternally almost complete)
 - ▶ Unclear lifespan



Design Concepts

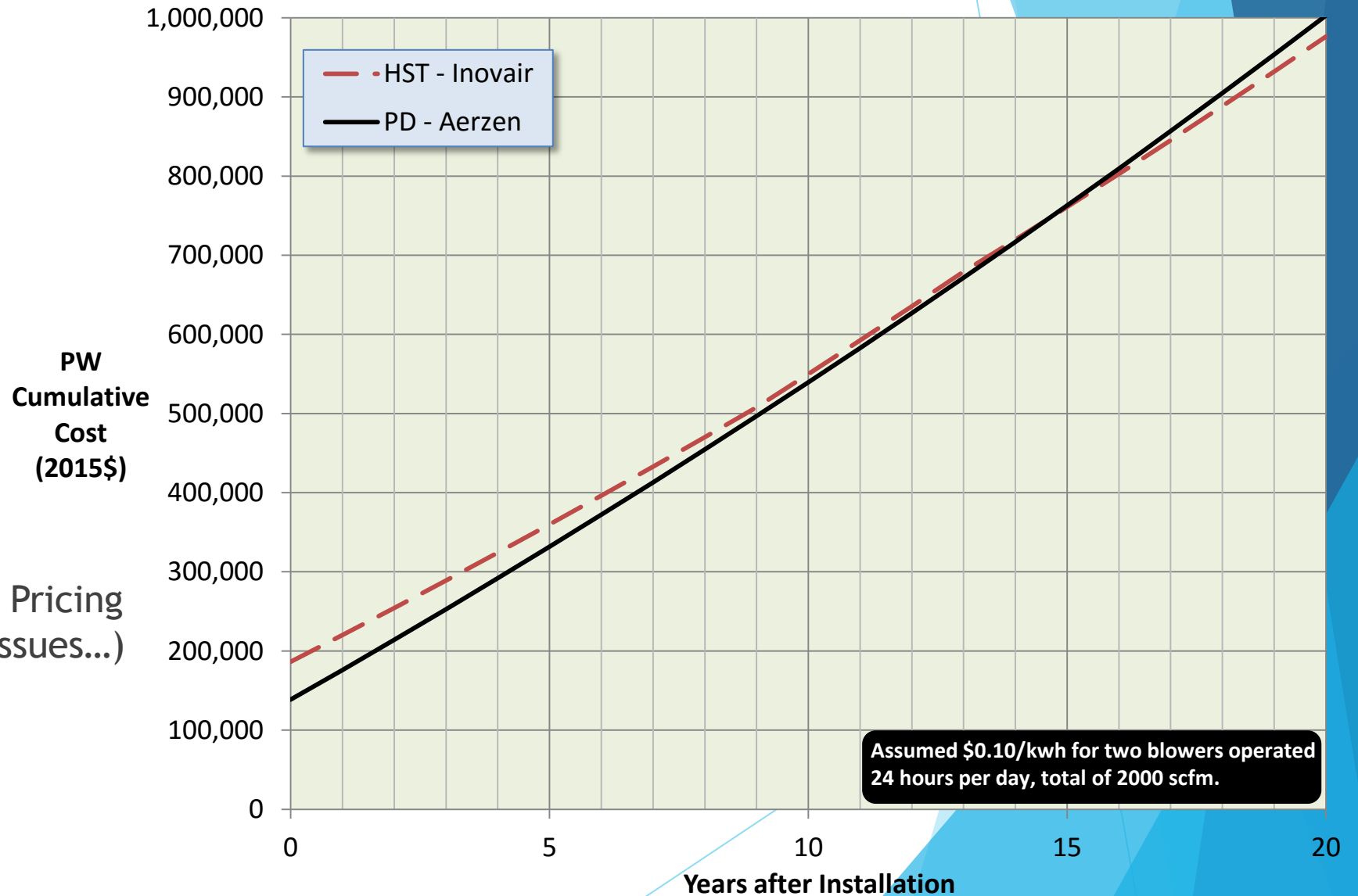
▶ Design:

- A. Evaluated Blower Bid
- B. D.O. Control
- C. Modulating Valve
- D. 3-D Model

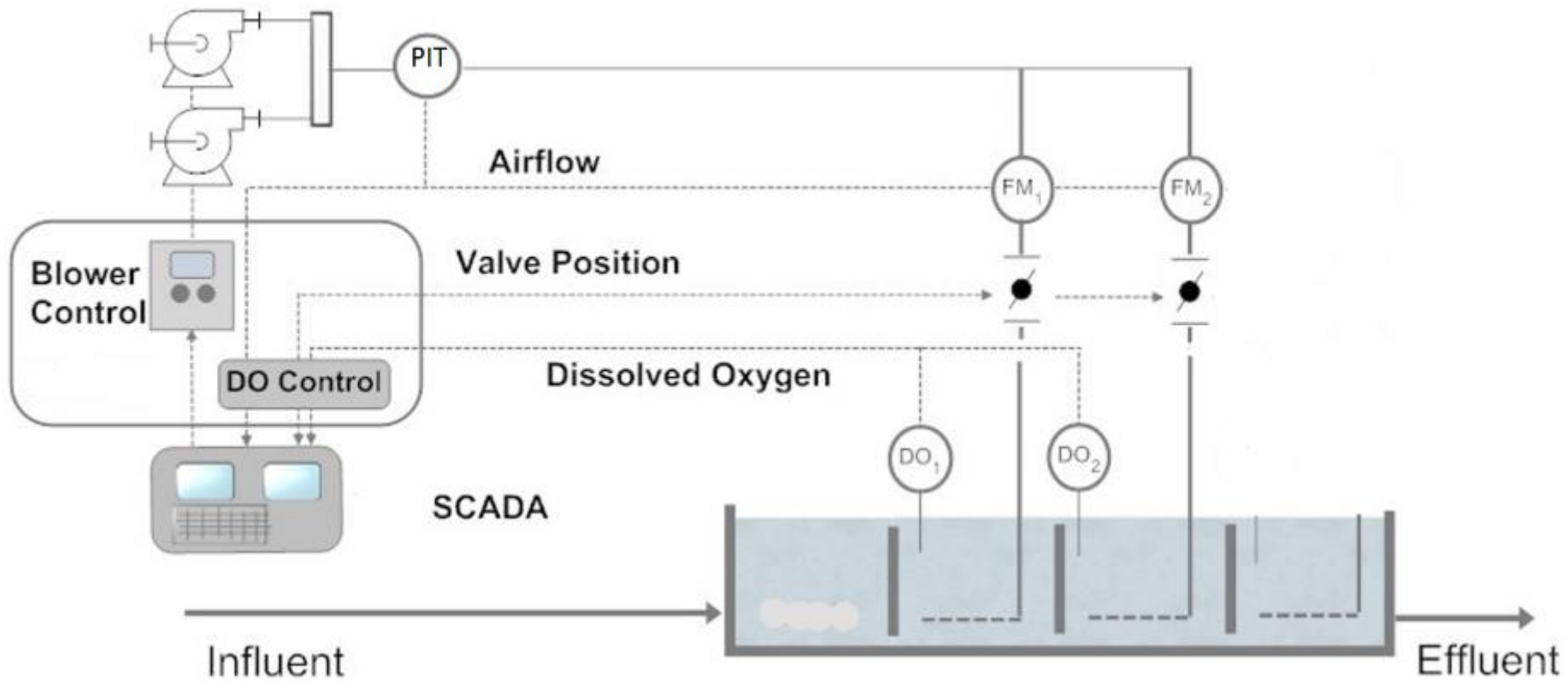
A) Blower Evaluation

- ▶ Evaluated Bid:
 - ▶ Rotary Lobe Blowers
 - ▶ Inovair

- ▶ Early Adopter=Attractive Pricing
(and random issues...)



B) Dissolved Oxygen Control

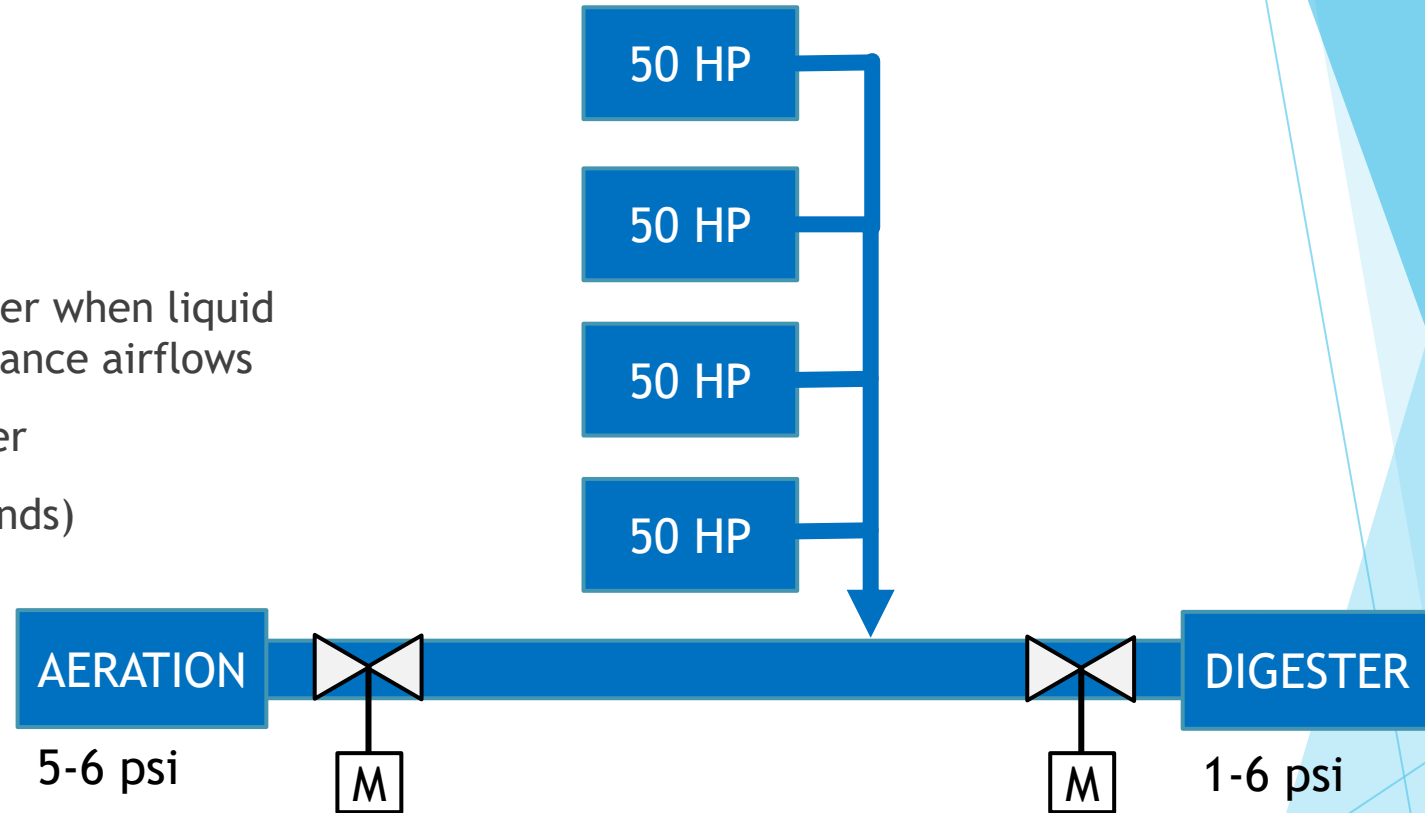


C) Modulating Digester Valve

▶ Concept

- ▶ Throttle digester header when liquid levels are lower to balance airflows
- ▶ Less overall horsepower

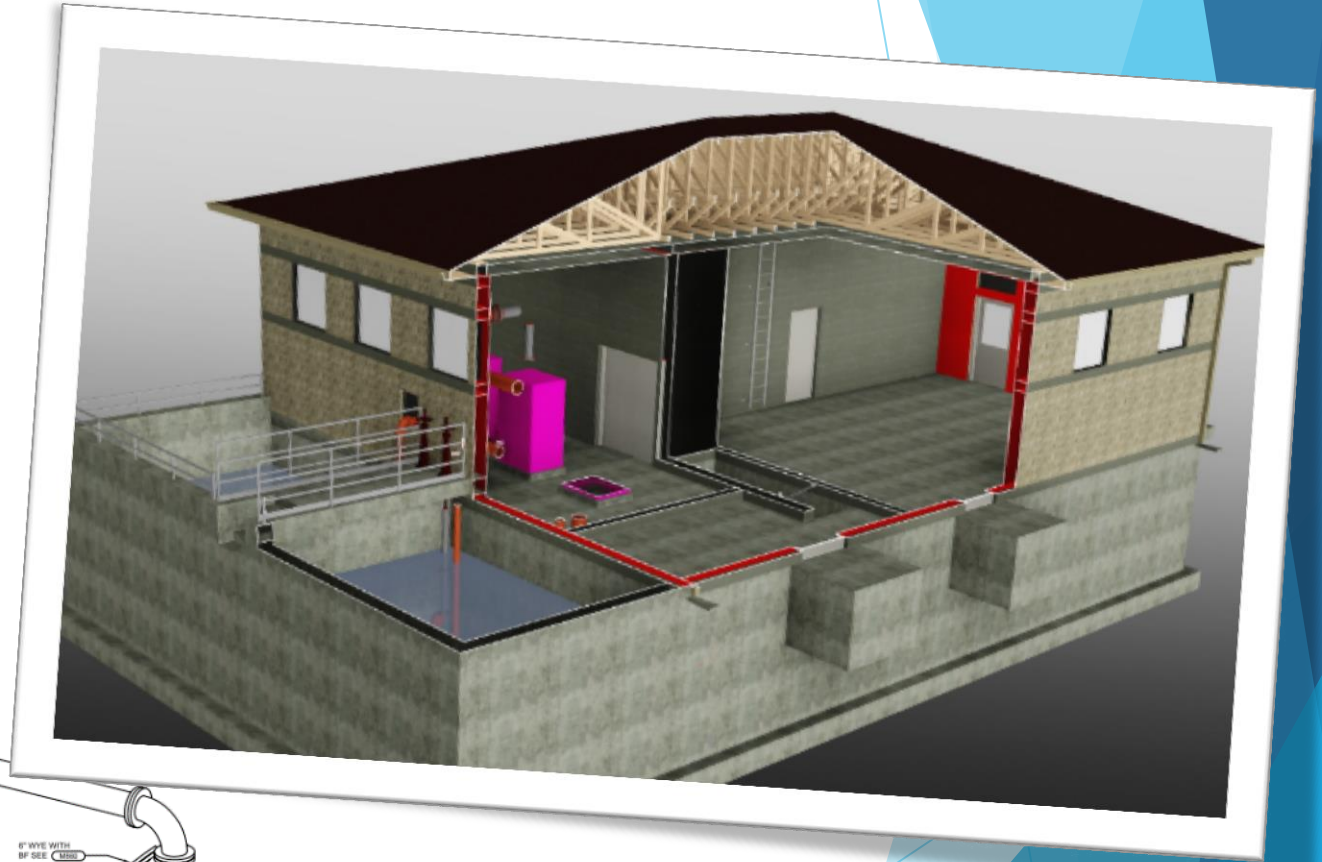
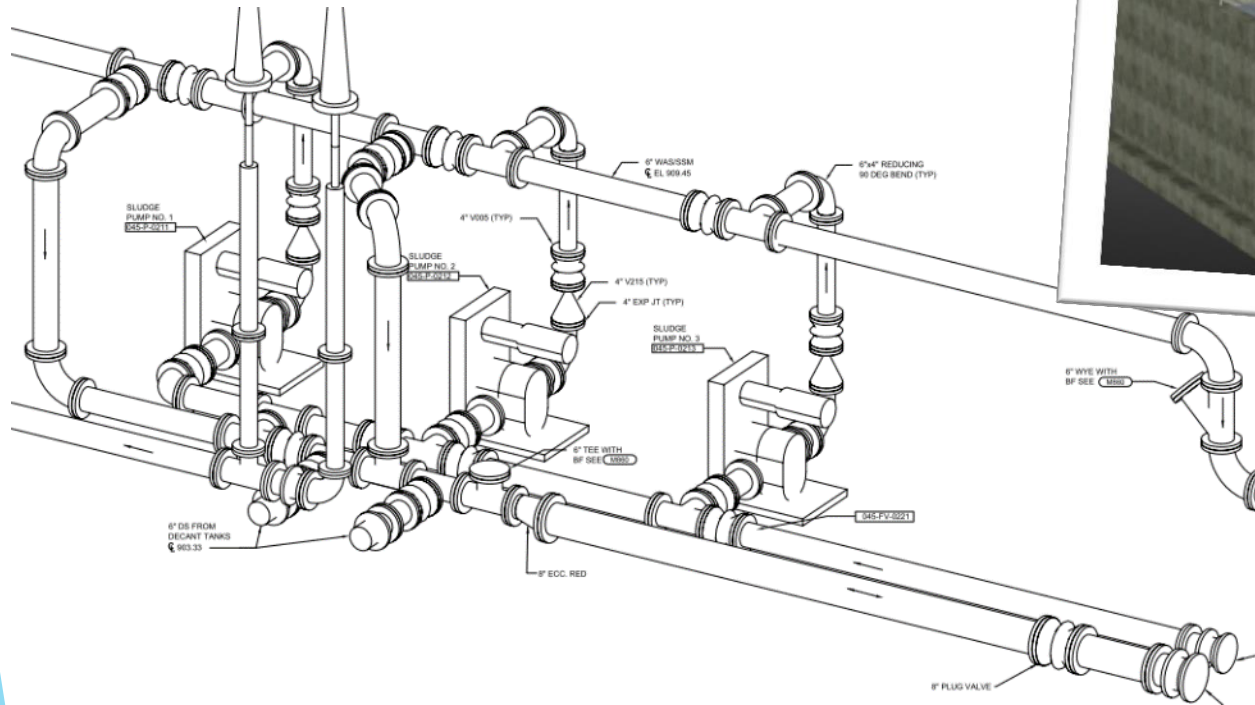
(Note: can't pinch both ends)



- ▶ Allow flexibility to run a dedicated blower(s) to each side

D) 3-D Models

- ▶ Design:
 - ▶ 3-D Model
 - ▶ Pump Gallery - Operator Input allowed ability to pull/push flow every direction



Funding

BIDS

Low Bidder:

- ▶ \$2,149,000

GRANTS

Aeration Blower:

- ▶ Projected Energy Savings (\$16,500) |

Building Heat:

- ▶ Electric Heat → Gas Heat Savings (\$7,500) |

Grant Value

- ▶ \$ 33,976 WPPI
- ▶ \$ 68,165 Focus on Energy
- ▶ \$364,382 CWF Principal Forgiveness
- ▶ \$466,523 Total (22%) | ▶ \$1,682,477 (net cost)



Construction and Startup Photos



Construction and Startup Photos



Construction and Startup Photos



Construction and Startup Photos



Construction and Startup Photos





Construction and Startup Photos

Construction and Startup Photos



(No trees were harmed on this portion of the project)

Construction and Startup Photos





CAUTION
043-MC-0211
PUMP NO. 1

CAUTION
043-MC-0211
PUMP NO. 1

BORGER

BORGER

BORGER

Valved Flexibility

- ▶ Design:
 - ▶ Eliminated 1 pump
 - ▶ Some flowpaths can flow by gravity or pump
 - ▶ Rotary lobe pumps allow multi-use
 - ▶ All three can really move some sludge
 - ▶ Sacrificed Automation





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Turbo Blowers

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Turbo Blowers

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Turbo Blowers

CAUTION
HOT SURFACES
DO NOT TOUCH

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Operation

- ▶ Startup Plan
 - ▶ How to sequence blower demo/startup to prove new units are fully functional?
(...Very Carefully)



Operation

- ▶ The Blowers Work!*
- ▶ Designed to typically need 2 blowers
- ▶ Now to Optimize
 - ▶ Reduce DO
 - ▶ Reduce Mixing Limited
 - ▶ Reduce Digester Airflow
- ▶ Limitations:
 - ▶ Blower Turndown (Range 70-100%)
 - ▶ Inovair now offers wider-range units, consider varying sizes (or rpms?)



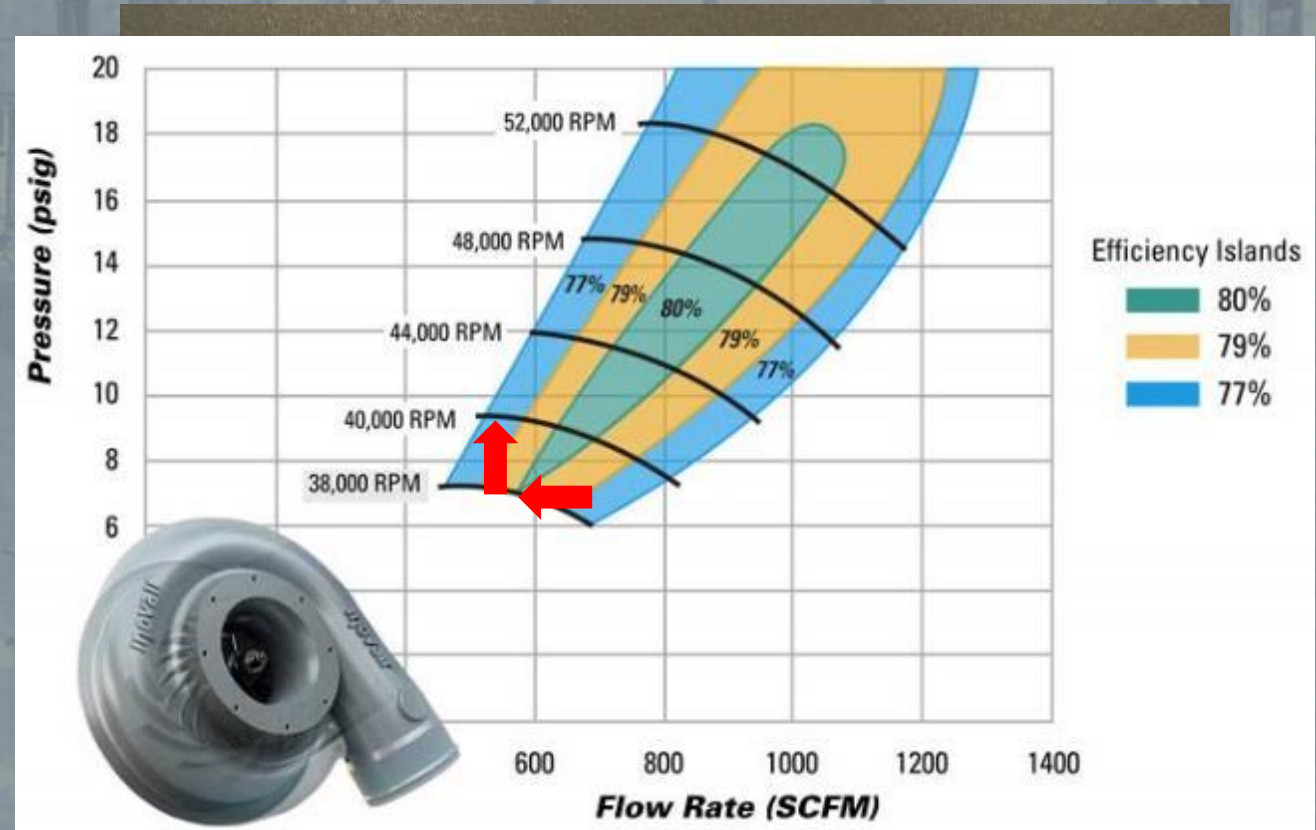
The image shows a control panel screen with a table titled 'Starts'. The table lists the number of starts for various pieces of equipment over different time periods. The equipment includes Blower 1, Blower 2, Blower 3, Blower 4, Sludge Pump 1, Sludge Pump 2, and Sludge Pump 3. The time periods are This Hour, Today, Yesterday, This Month, and Total. A mouse cursor is visible over the 'Today' column for Blower 4.

	This Hour	Today	Yesterday	This Month	Total
Blower 1	1	57	39	118	196
Blower 2	2	60	37	122	168
Blower 3	2	58	36	114	193
Blower 4	0	0	2	5	47
Sludge Pump 1	0	0	0	0	4
Sludge Pump 2	0	0	0	0	4
Sludge Pump 3	0	0	11	38	142

Control

Operation

- ▶ Blower PLC Programming
 - ▶ Surge Protection Feature
 - ▶ Manual reset
 - ▶ Head rise to surge worse at VFDmin
 - ▶ Ramps up VFD, fights valve PID



Operation

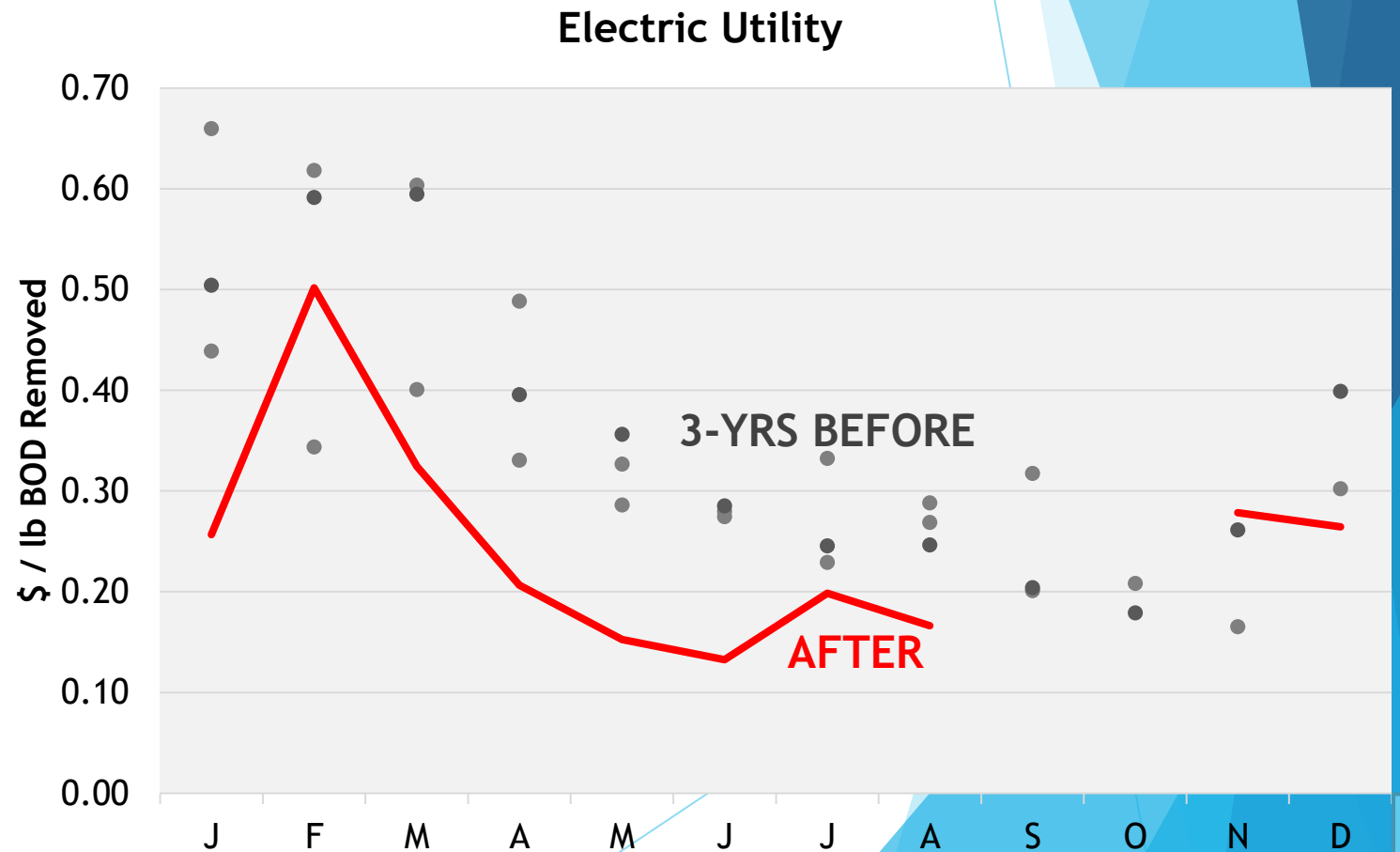


- ▶ Blower PLC Programming
 - ▶ Mass Airflow - Winter Operation
 - ▶ Adjusted PLC Temp Setting

Operation

▶ Current

- ▶ Operating smooth now
- ▶ Maintenance Items:
 - ▶ Expensive Oil
 - ▶ Belt Tensioning
 - ▶ Air Filter
- ▶ Observed Energy Savings
 - ▶ Average
 - ▶ Peak



Operation

► Benchmarking

See Focus at Booth #136

Download Guide @

www.focusonenergy.com/guidebooks



ENERGY BEST PRACTICES GUIDE:
**WATER &
 WASTEWATER
 INDUSTRY**



Table 4 Best Practice Benchmarks and Top Performance Quartiles for Wisconsin Wastewater Facilities

Facility Type	Flow Range (MGD)	Average Energy Use (kWh/MG)	Top Performance Quartile (kWh/MG)	Best Practice Benchmark (kWh/MG)	Average Potential Savings
Activated Sludge**	0 -1	5,440	< 3,280	3,060	44%
	1 - 5	2,503	< 1,510	1,650	34%
	> 5	2,288	< 1,350	1,760	23%
Aerated Lagoon	< 1	7,288	< 4,000	3,540	51%
Oxidation Ditch	< 1.2	6,895	< 4,000	4,320	37%

Operation

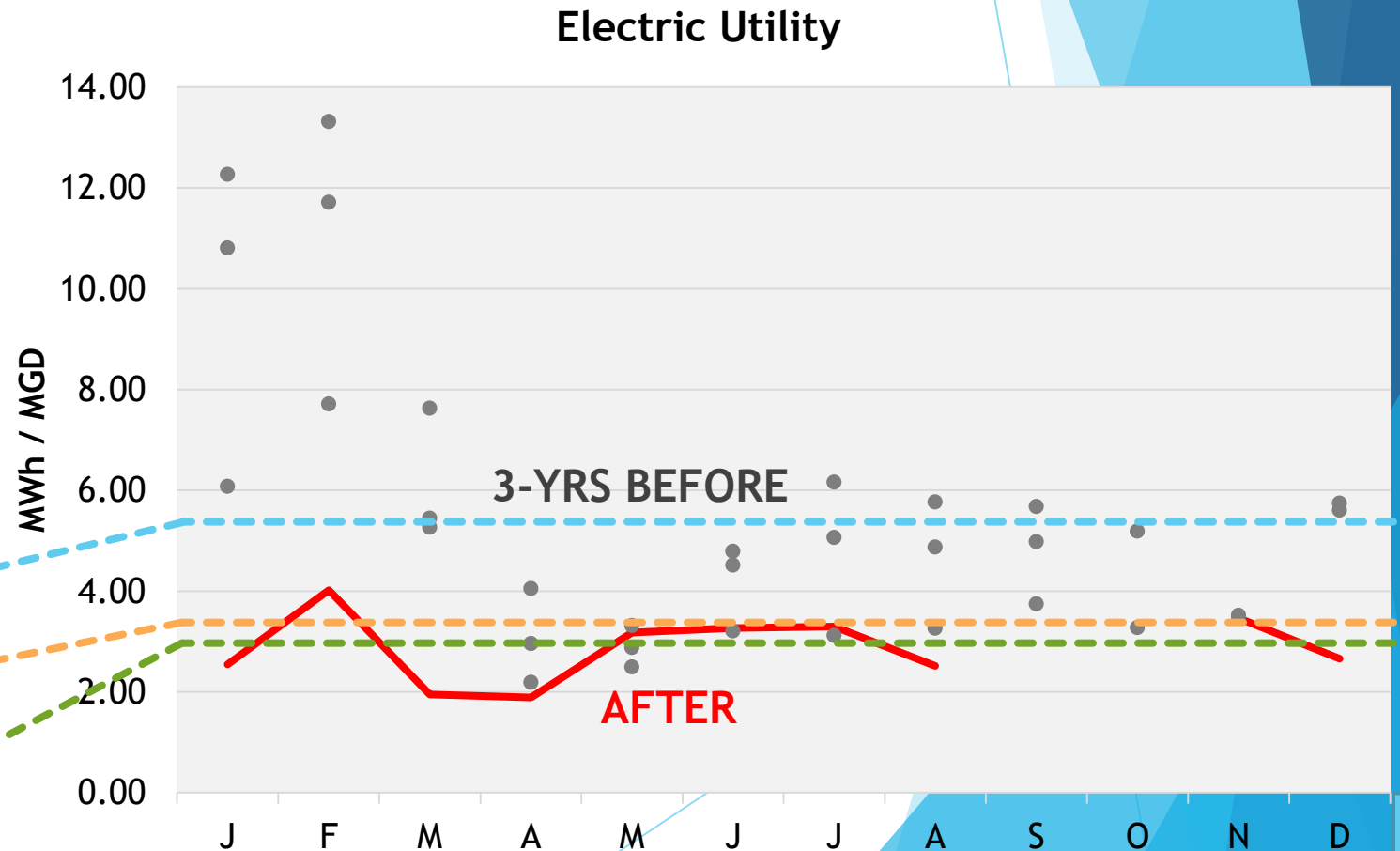
- ▶ Benchmarking
 - ▶ How does it compare?
 - ▶ Data Crunch
 - ▶ Keep Updated

- ▶ Benchmark - Activated Sludge

5.4 MWh/MGD (average)

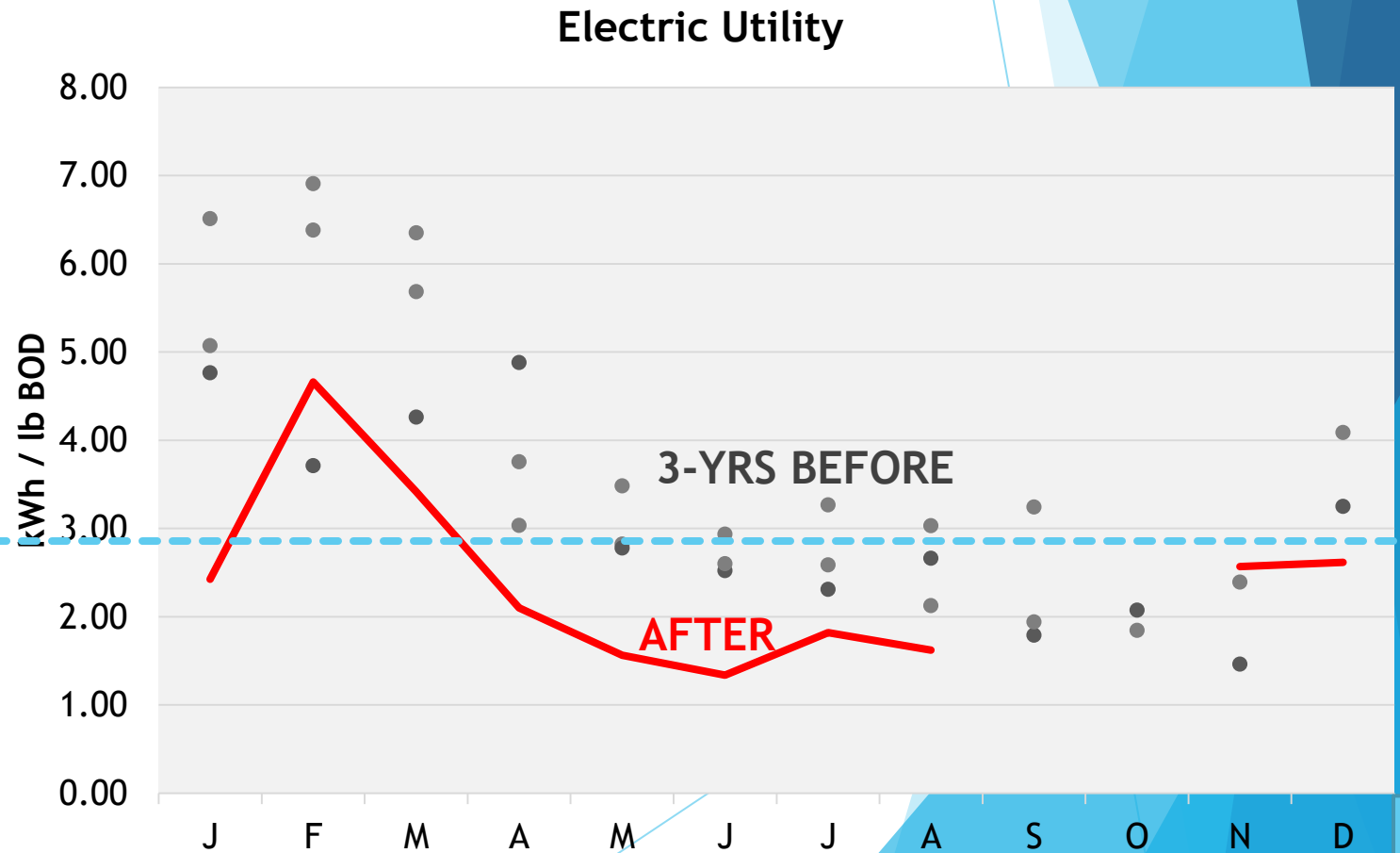
3.3 MWh/MGD (Top 25%)

3.0 MWh/MGD (Best Practice)



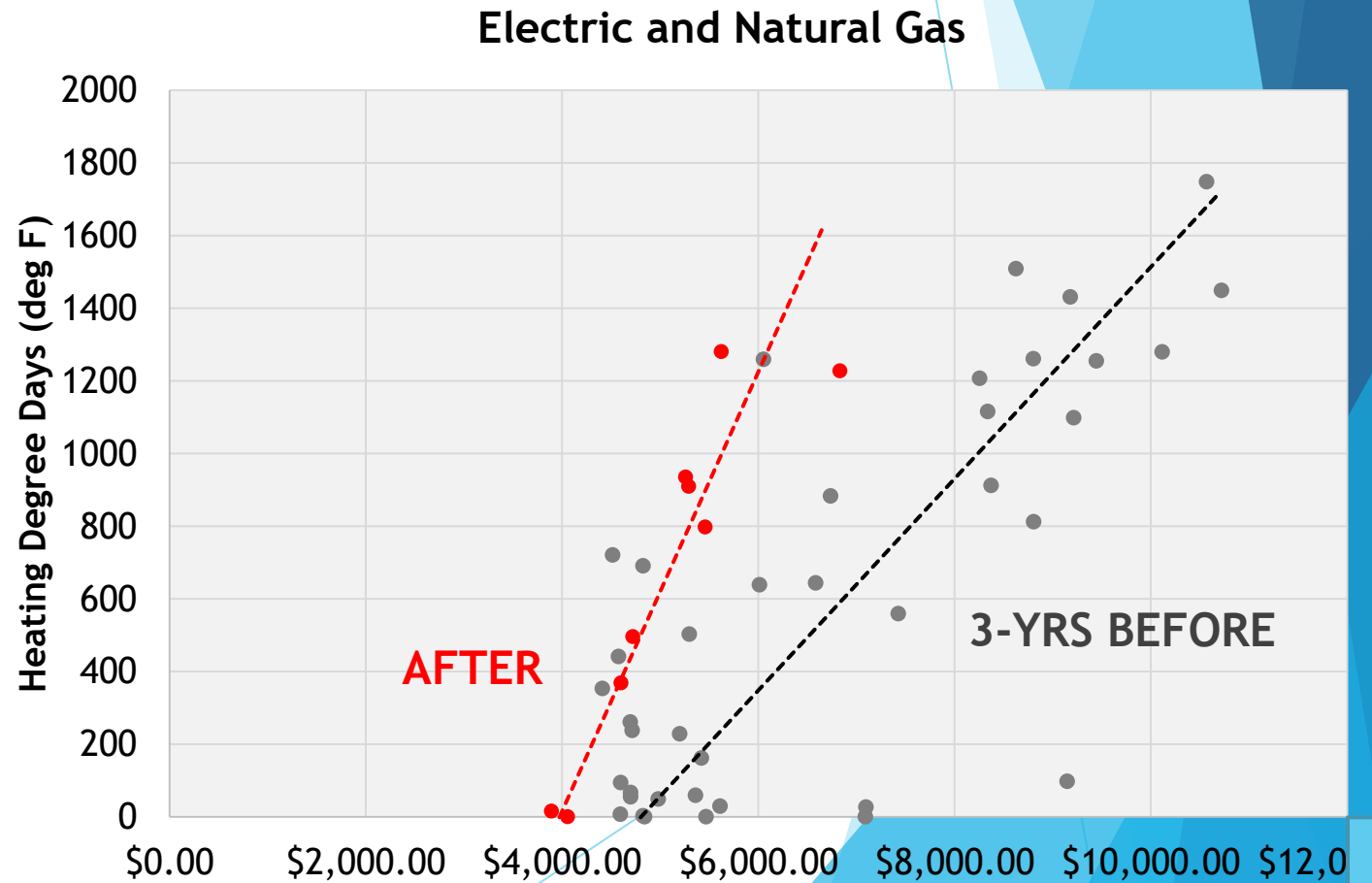
Operation

- ▶ Normalized for Loading
- ▶ Heating Impact
 - ▶ Summer
 - vs
 - ▶ Winter
- ▶ Benchmark - Extended Air
2.9 MWh/MGD



Operation

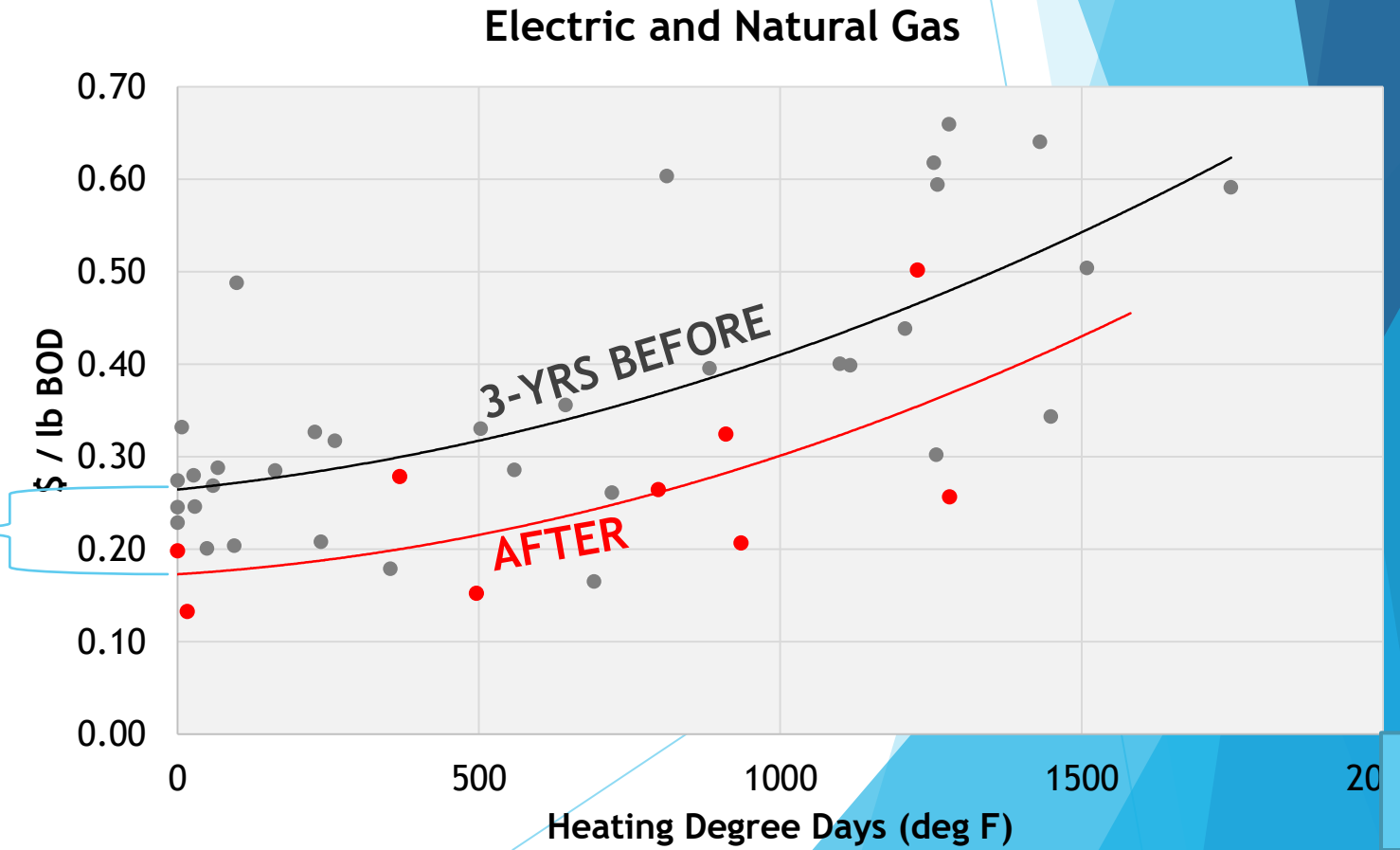
- ▶ Heating Improvements
 - ▶ Cost:
 - ▶ \$40,000
 - ▶ Benefit:
 - ▶ Reduced OPEX
 - ▶ Lab temp control
 - ▶ 2-10 year payback without grants
 - ▶ Demand charge reductions



Operation

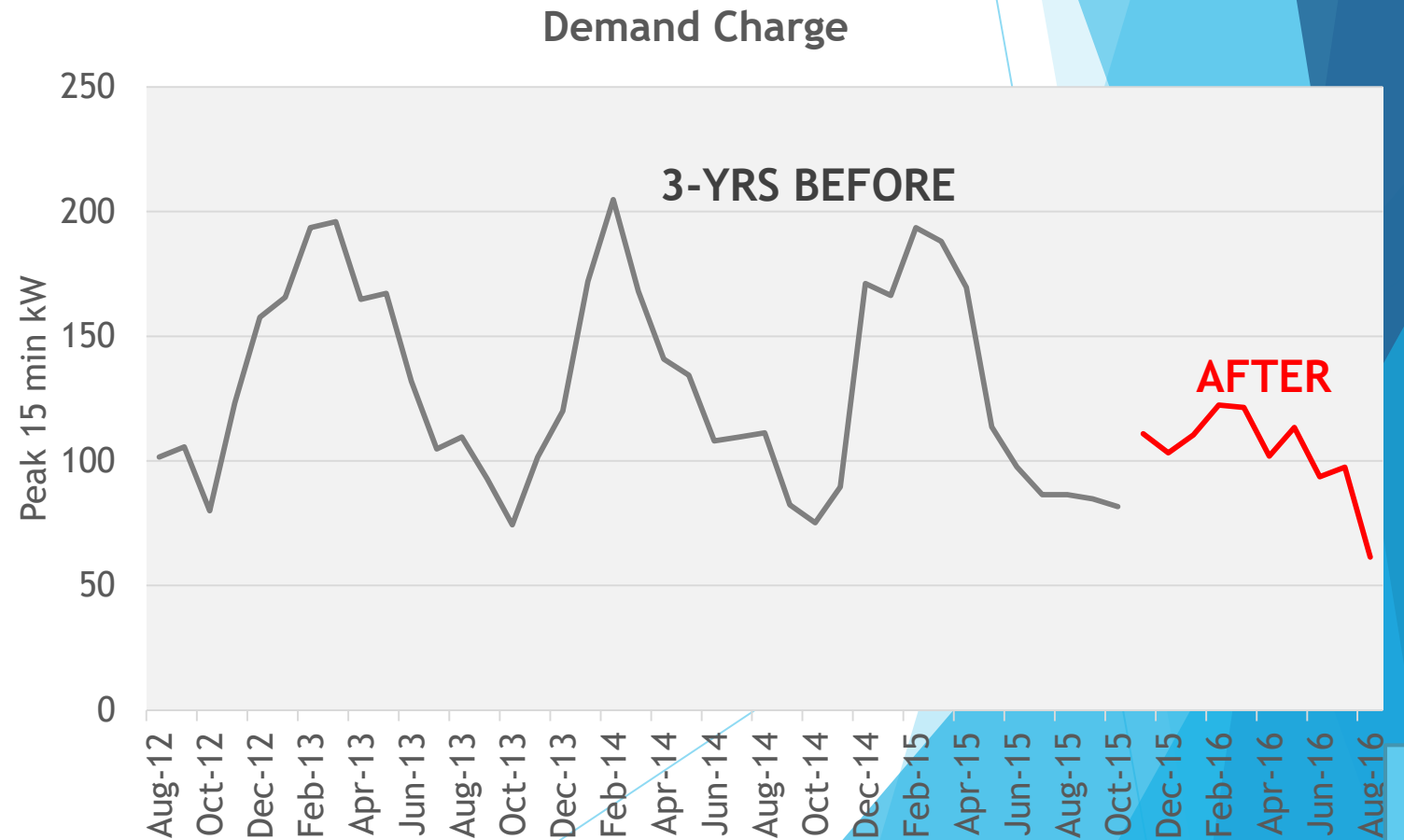
- ▶ Normalize for BOD and Heating

Blower System Efficiency
34.6 % Reduction



Operation

- ▶ Minimized Electric Heat
(some areas still have electric heat)





Summary

- ▶ More than Just a Blower Replacement Project
 - ▶ Blowers
 - ▶ Continued Optimization
 - ▶ Control System
 - ▶ Heating System

- Come Visit!