Not Your Typical Turbo Blower

New Holstein Utilities' Blower Improvements

Don Lintner (NHU)

Eric Lynne (Donohue)

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

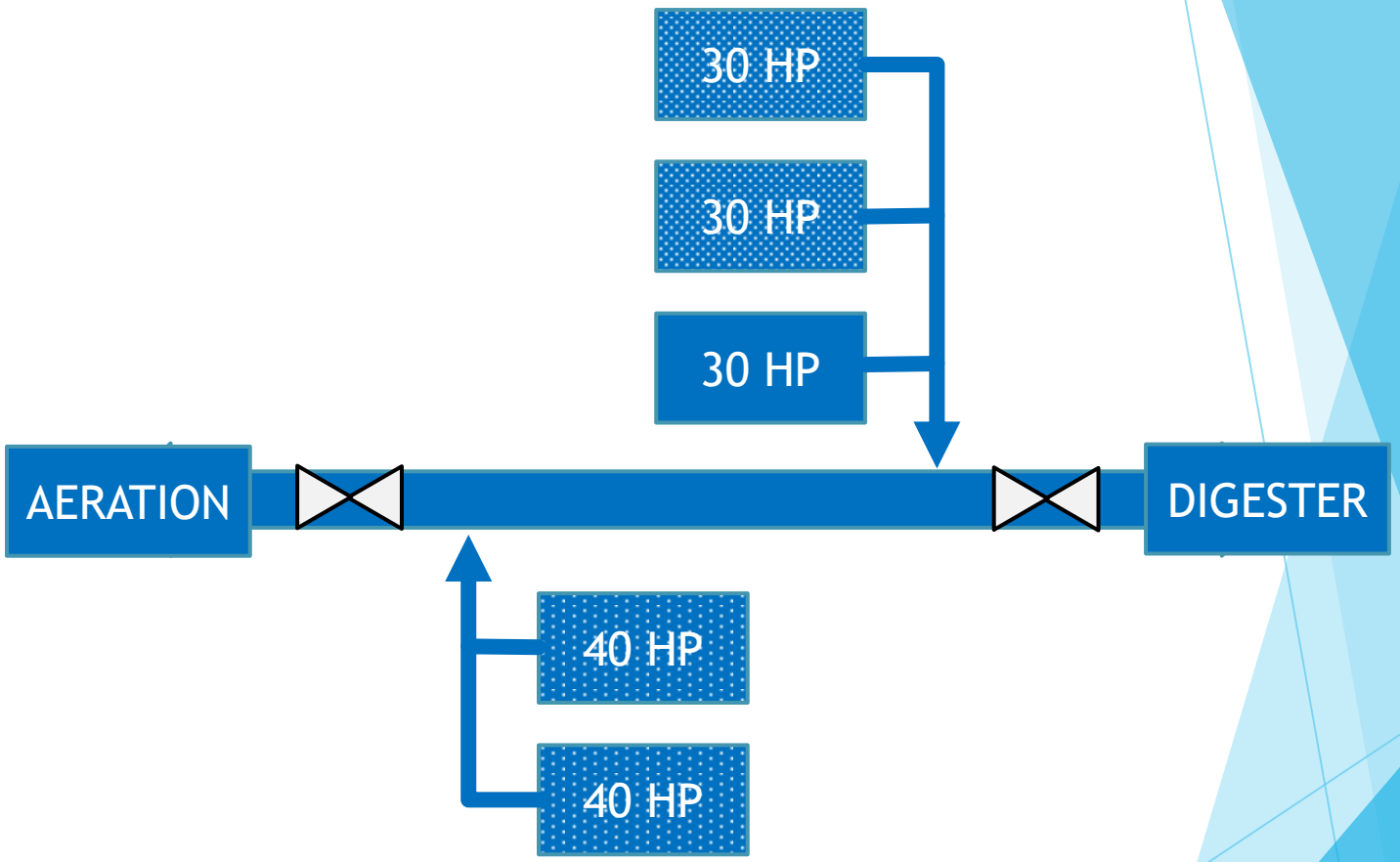
- Permit Requirements
  - BOD (20/30 mg/L)
  - TSS (20/30 mg/L)
  - TP (1.0 mg/L)
  - No disinfection
- Operational Practices
  - Extended Air (Nitrification)
  - Septage Receiving (Slugs)

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



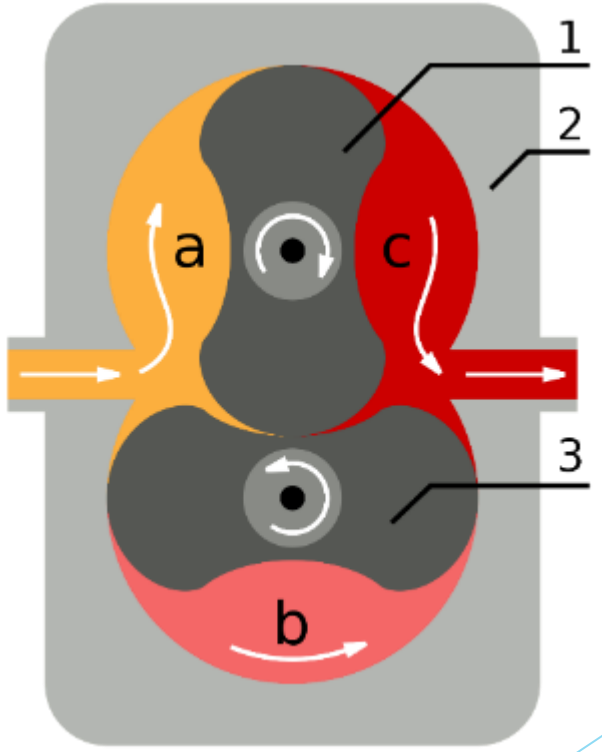
Typically run 70 / 100 HP
for 1600 scfm / 2300 scfm
(mixing limited)

Facilities Plan

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

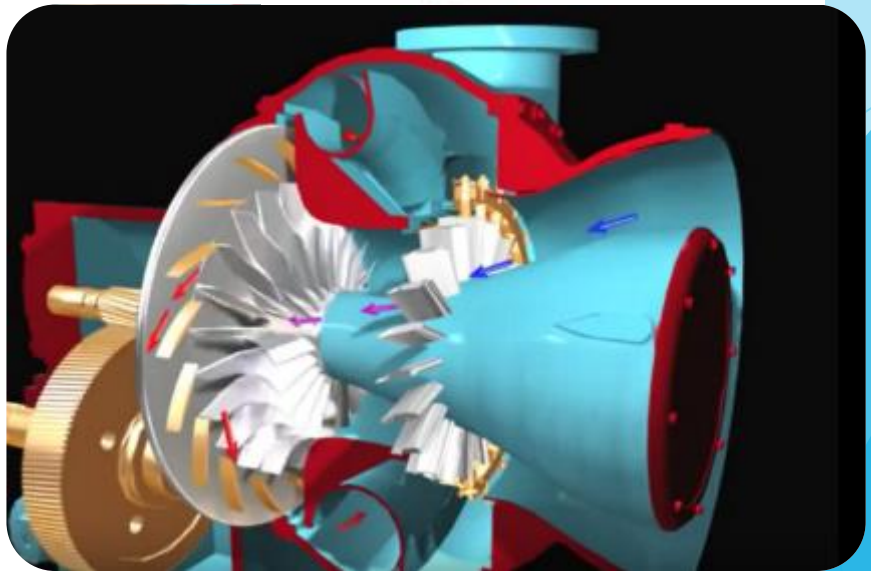
Facilities Plan

- 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 Desigr

- 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

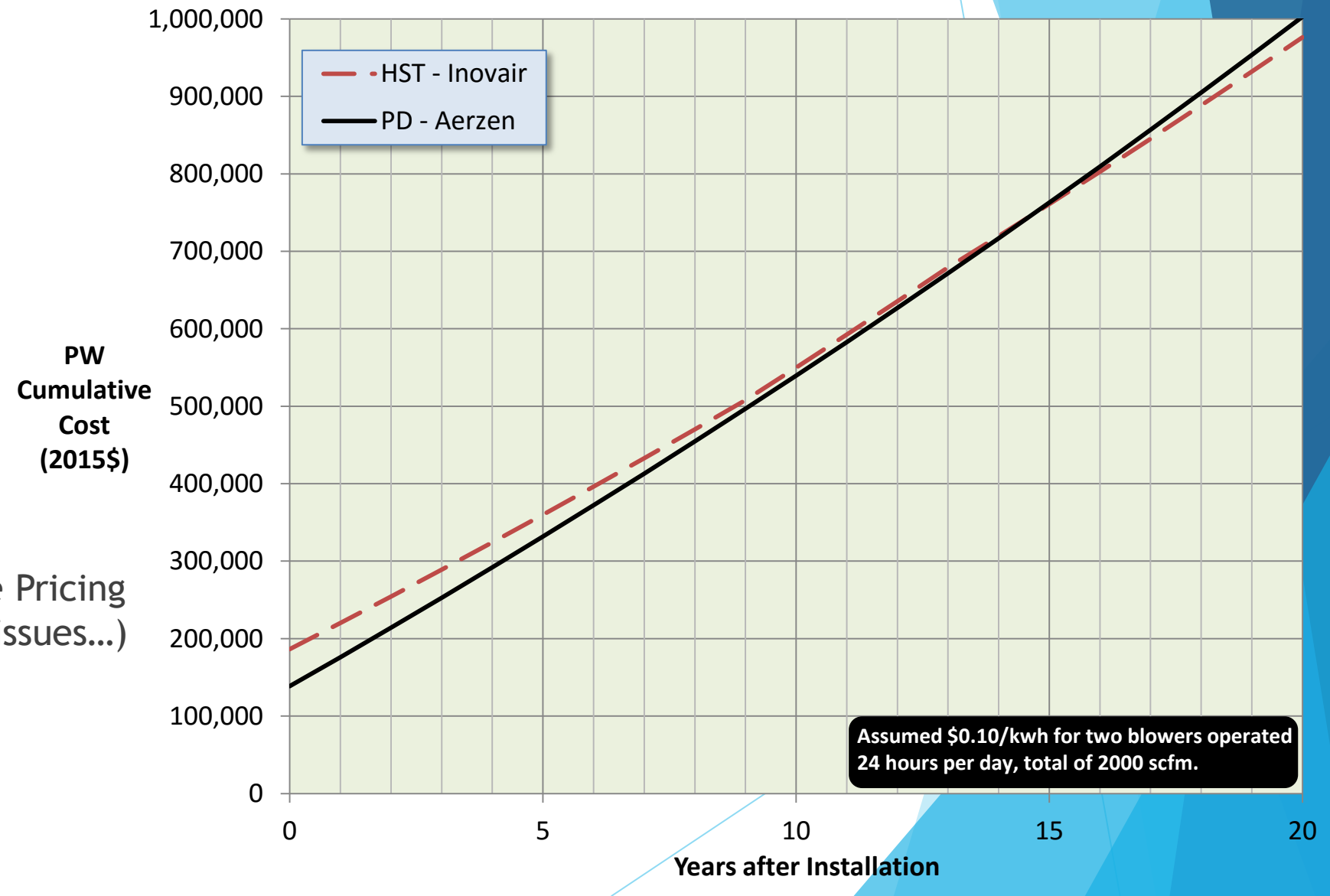


Design Concepts

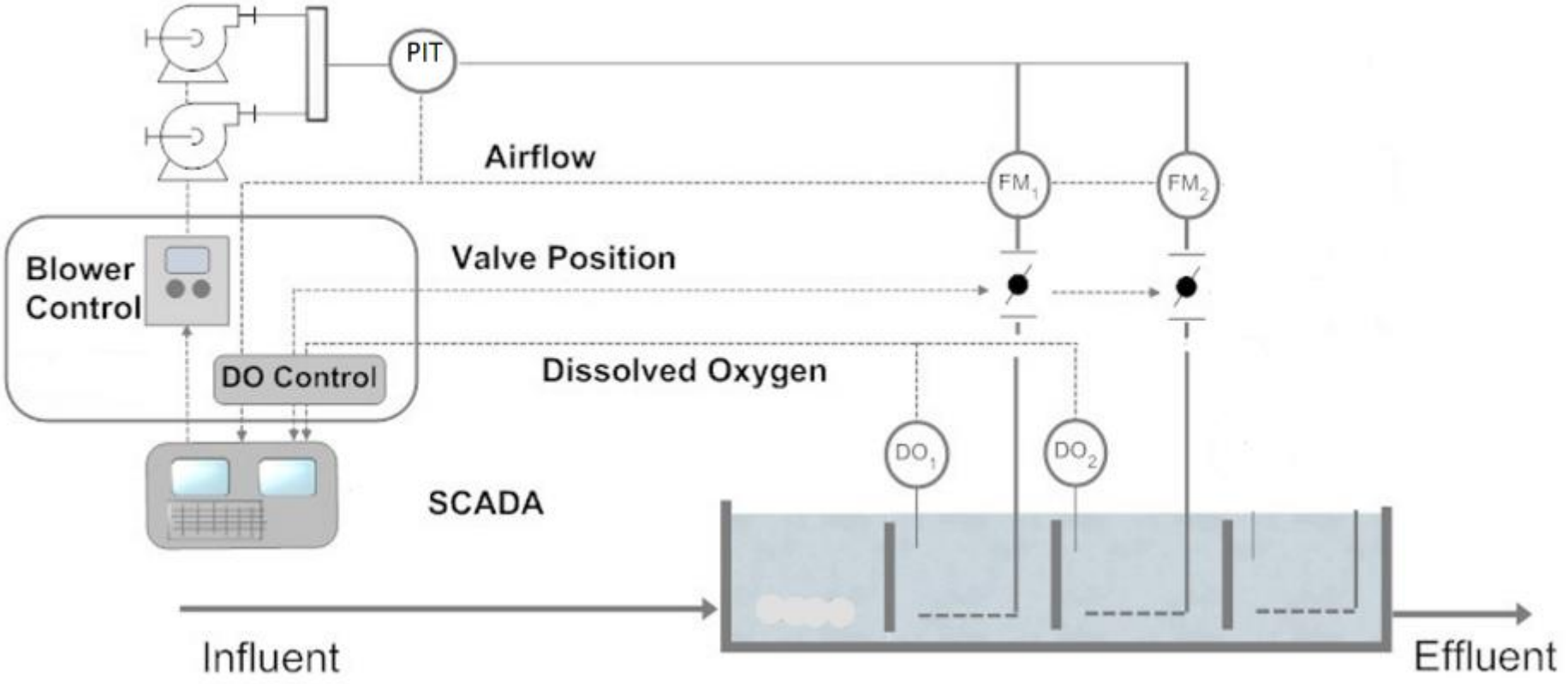
- Design:
  A. **Evaluated Blower Bid**
  B. **D.O. Control**
  C. **Modulating Valve**
  D. **3-D Model**

A) Blower Evaluation

- Evaluated Bid:
  - Rotary Lobe Blowers
  - Inovair
- Early Adopter=Attractive Pricing (and random issues…)



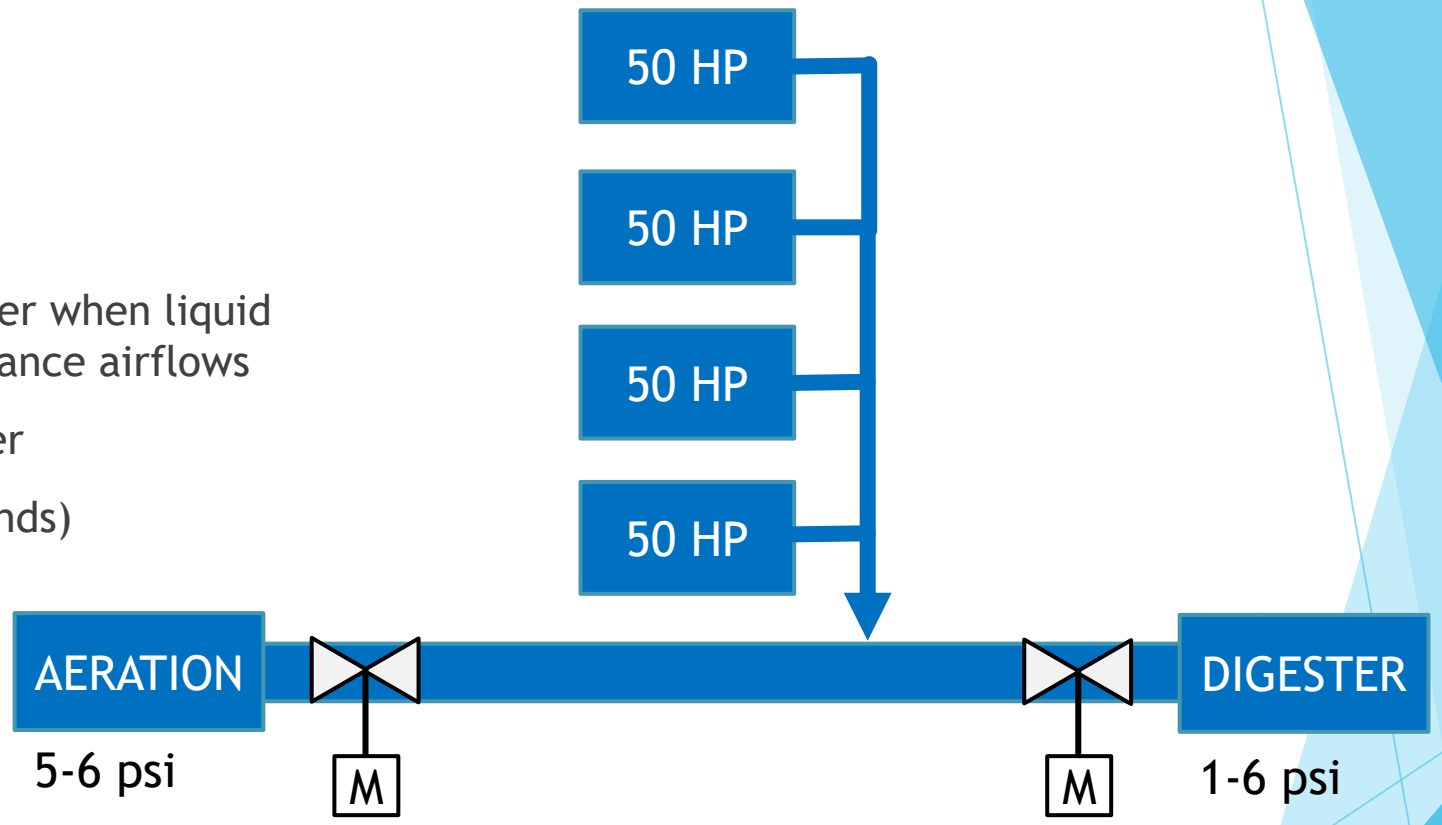
B) Dissolved Oxygen Control



C) Modulating Digester Valve

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

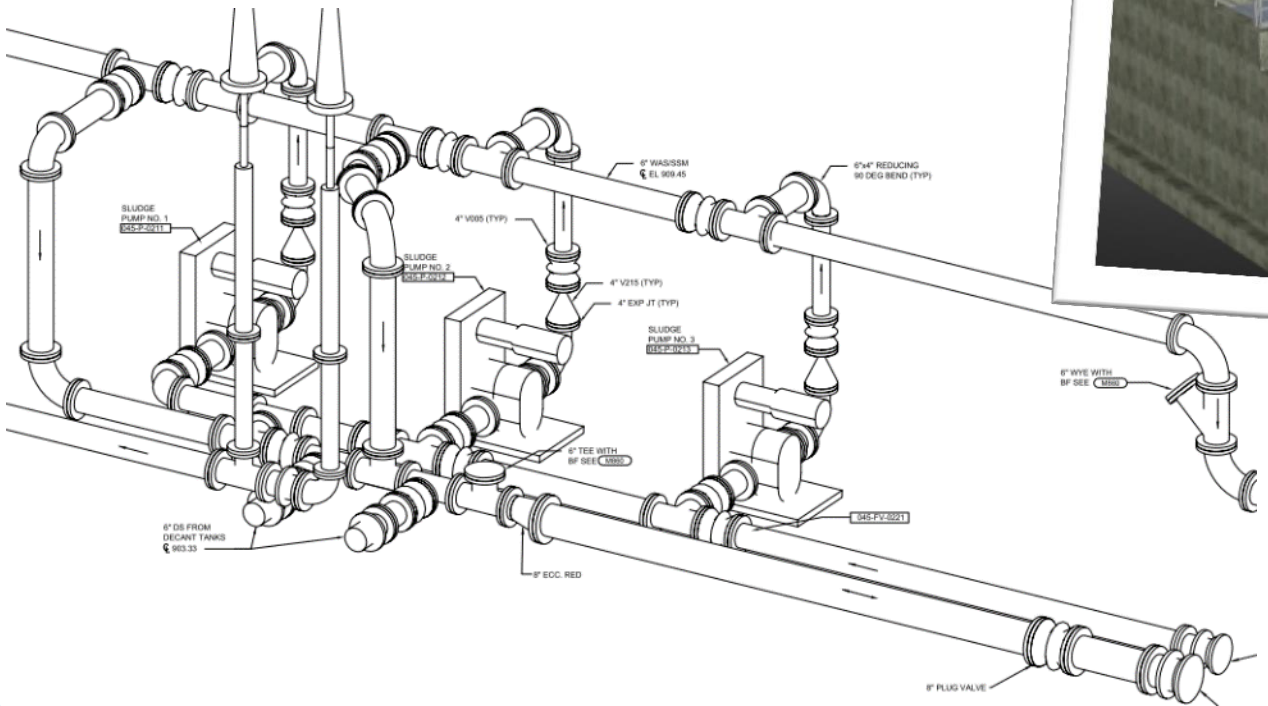
(Note: can't pinch both ends)

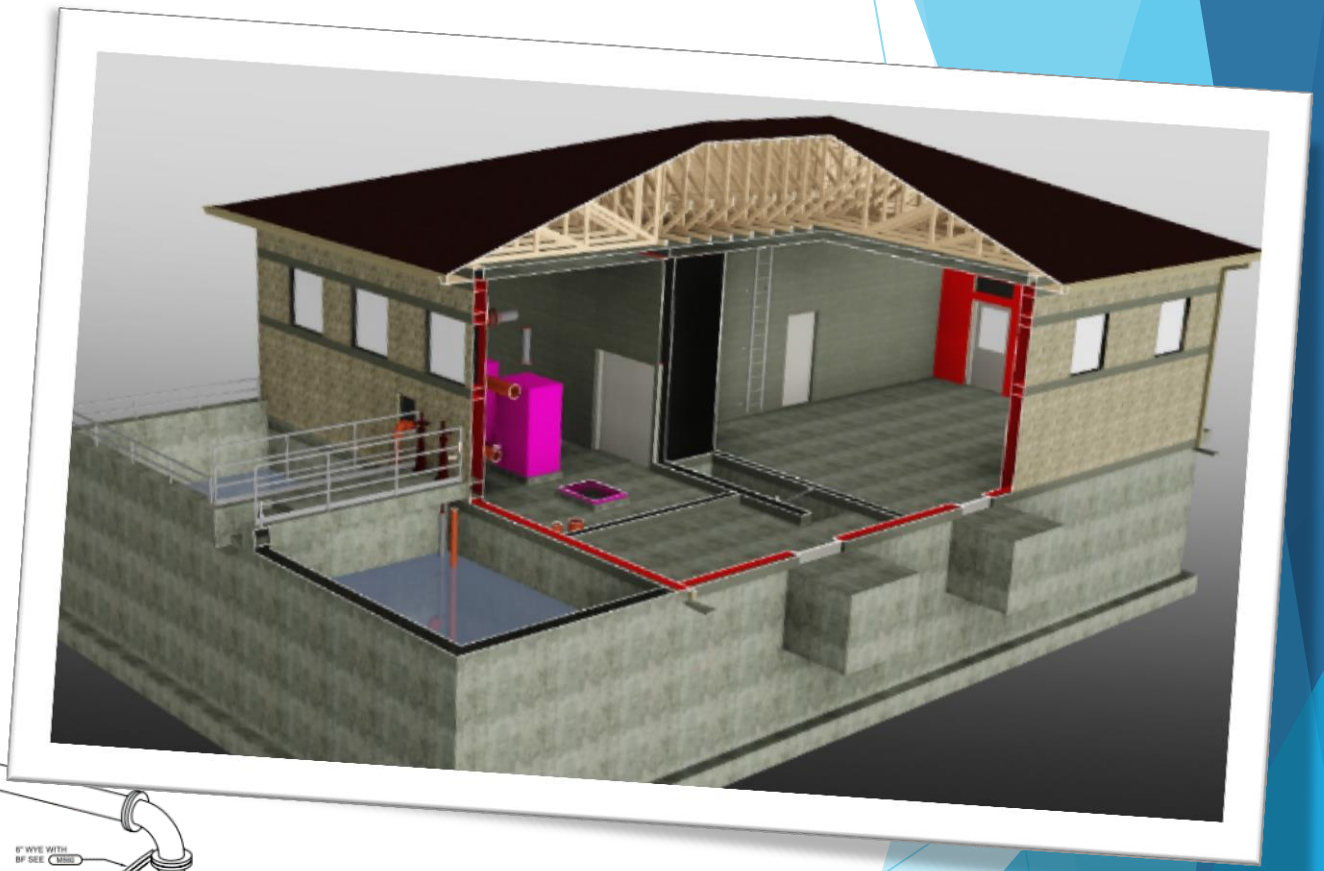


- Allow flexibility to run a dedicated blower(s) to each side

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

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

Construction and Startup Photos


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


inovair
Turbo Blowers

Operation

- Startup Plan
  - How to sequence blower demo/startup to prove new units are fully functional?

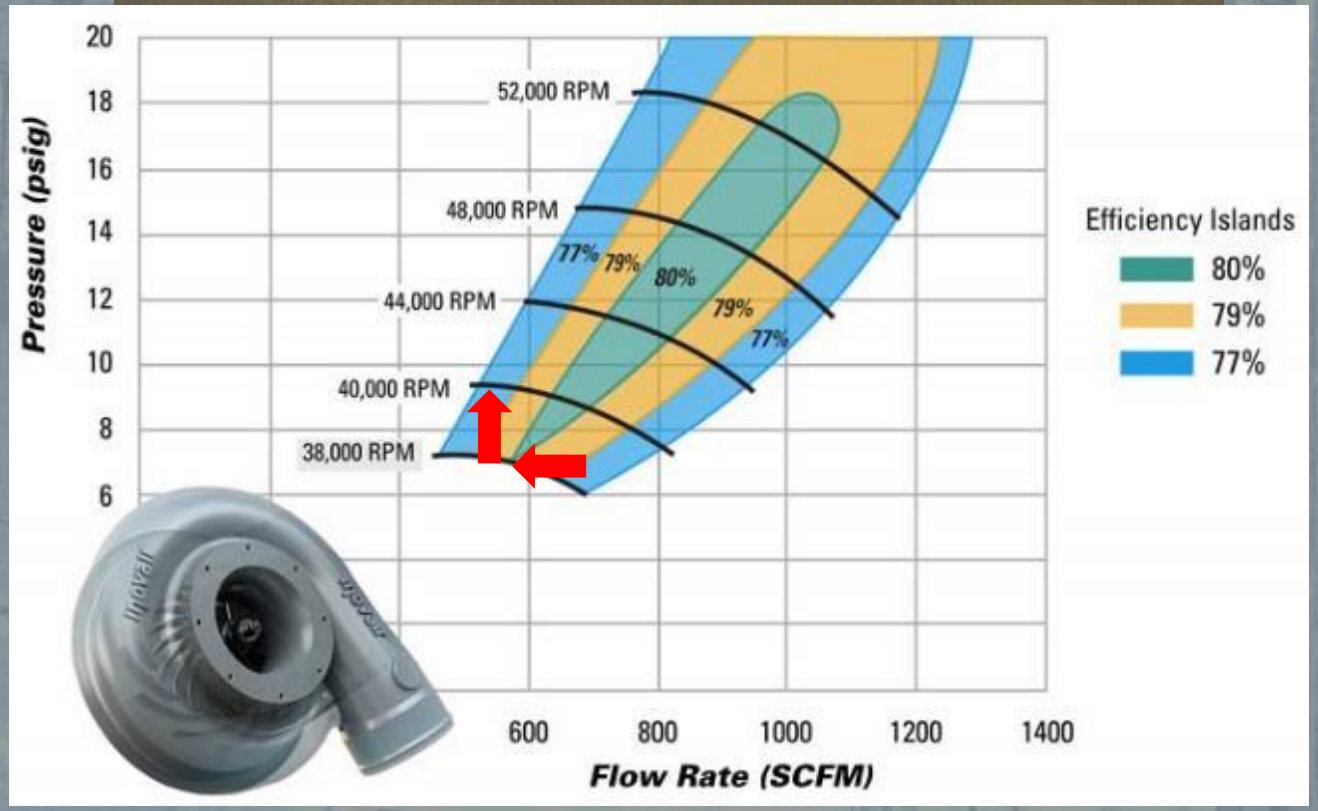
    (...Very Carefully)

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?)

Operation

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

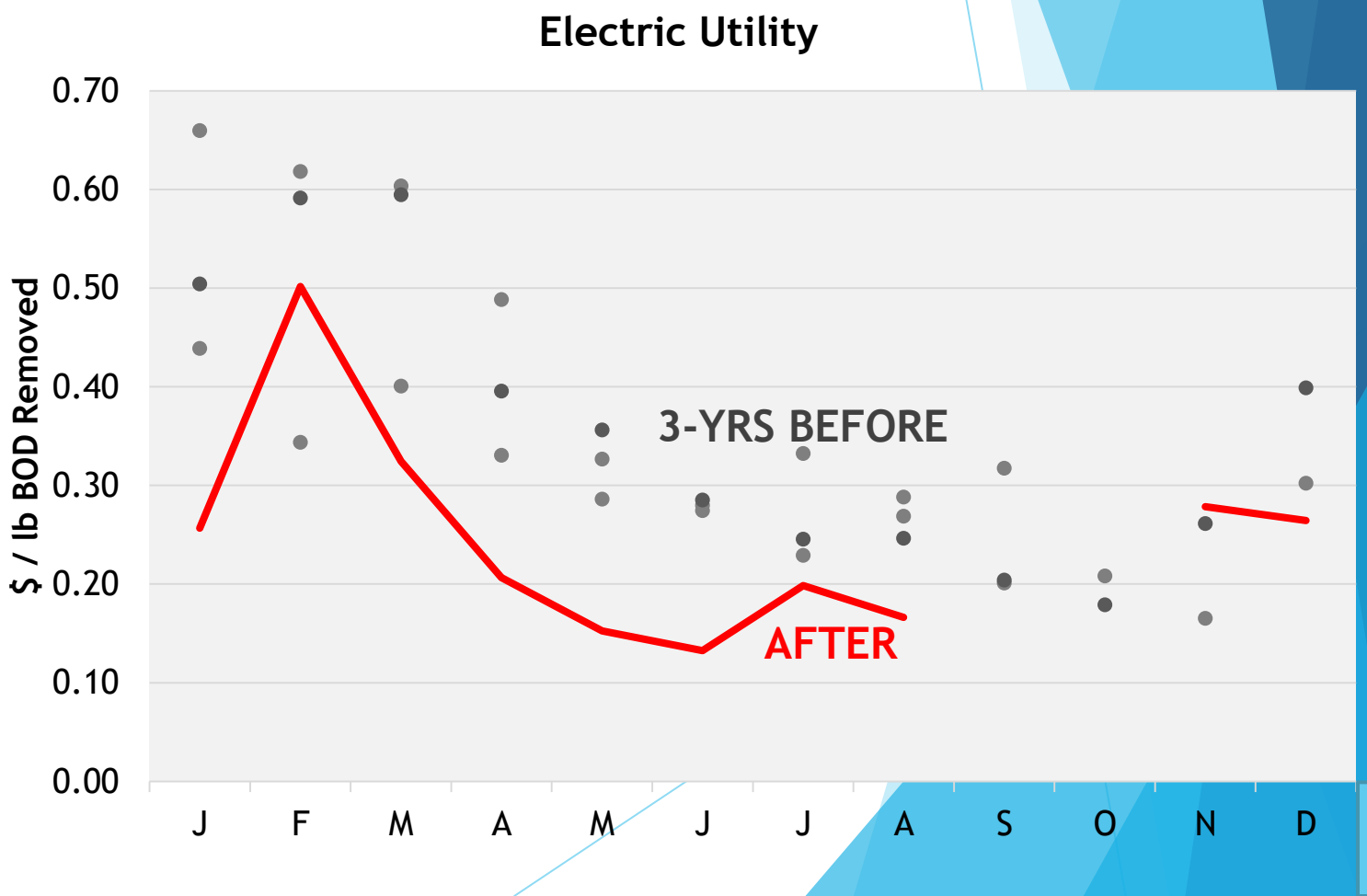


Operation

- 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

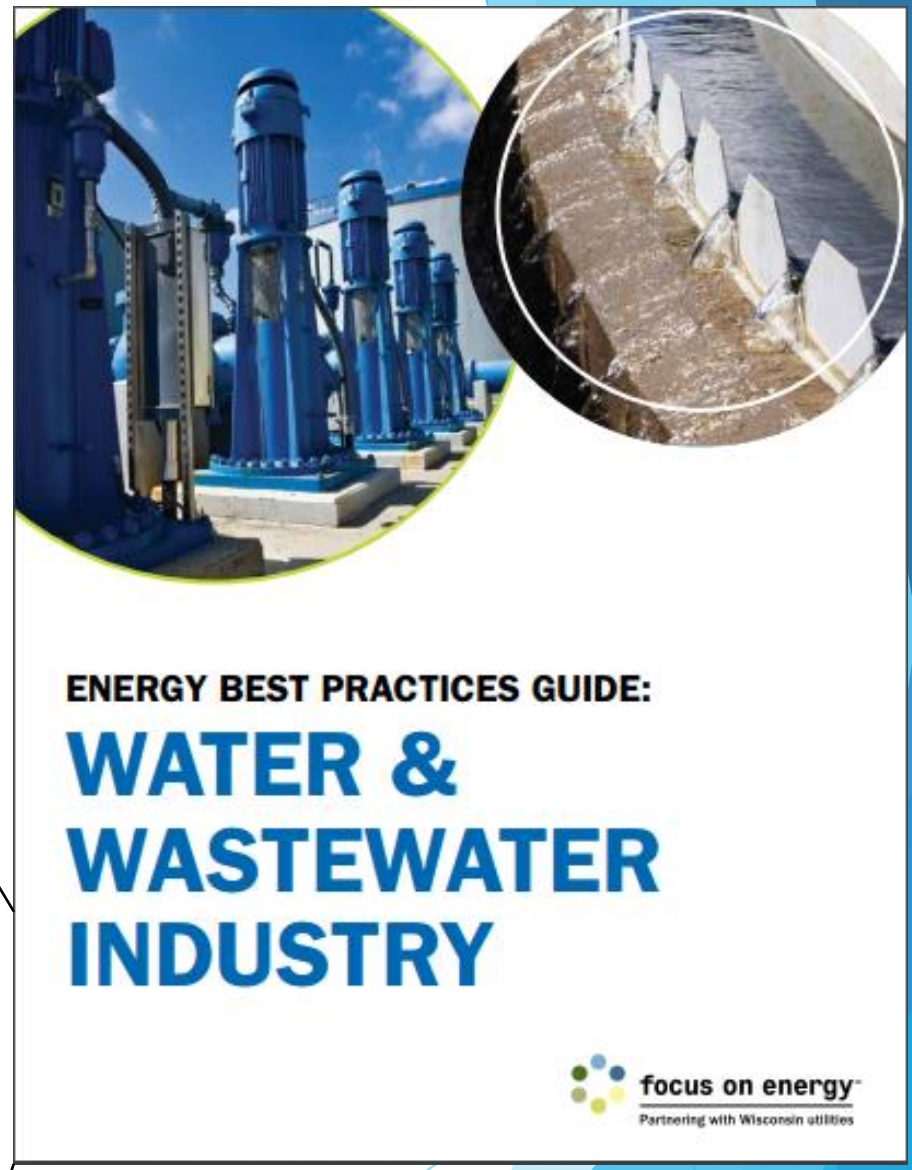
See Focus at Booth #136

Download Guide @

www.focusonenergy.com/guidebooks

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

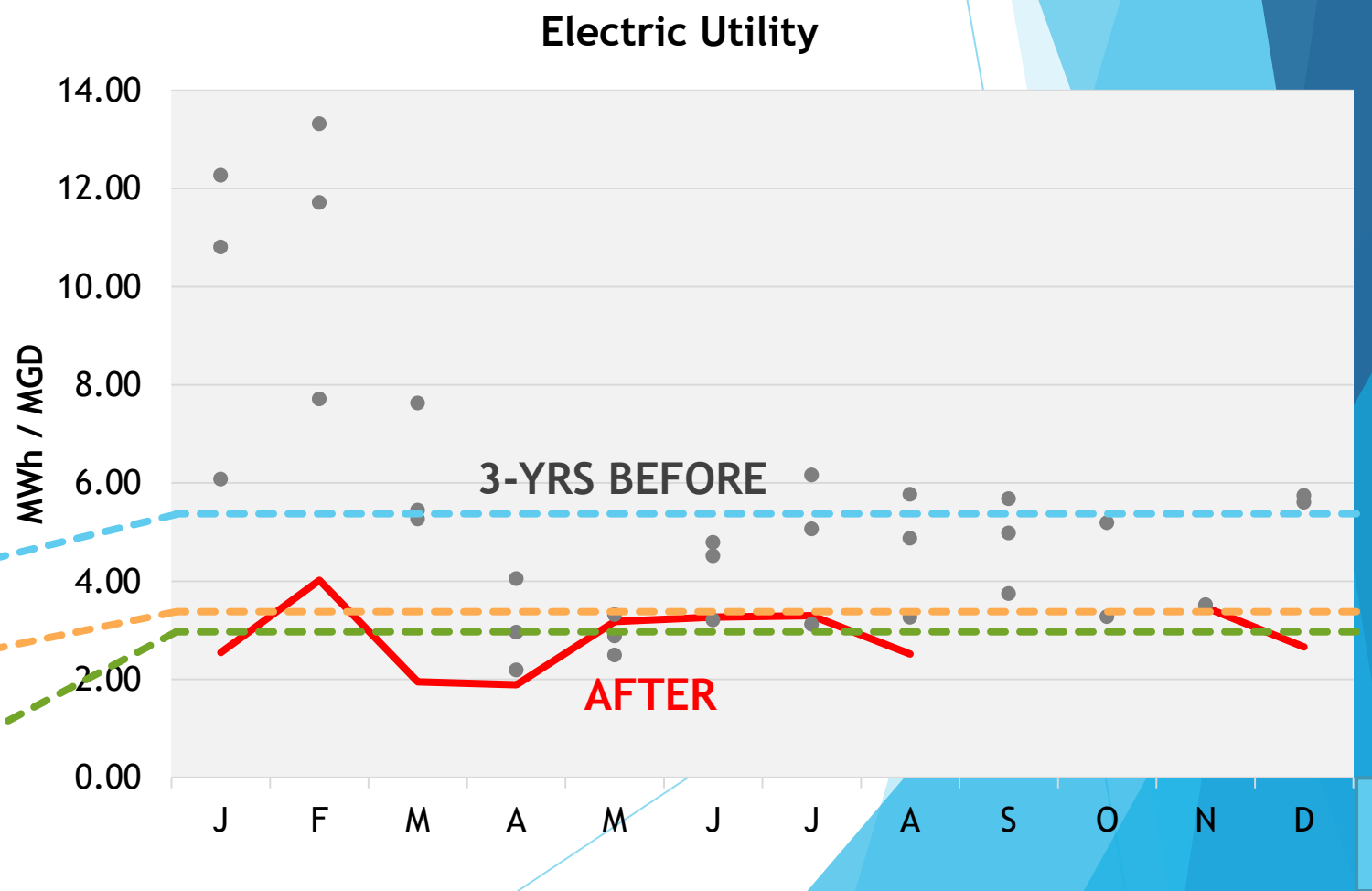
- Benchmarking
  - How does it compare?
  - Data Crunch
  - Keep Updated

- Benchmark – Activated Sludge

  5.4 MWh/MGD (average)

  3.3 MWh/MGD (Top 25%)

  3.0 MWh/MGD (Best Practice)



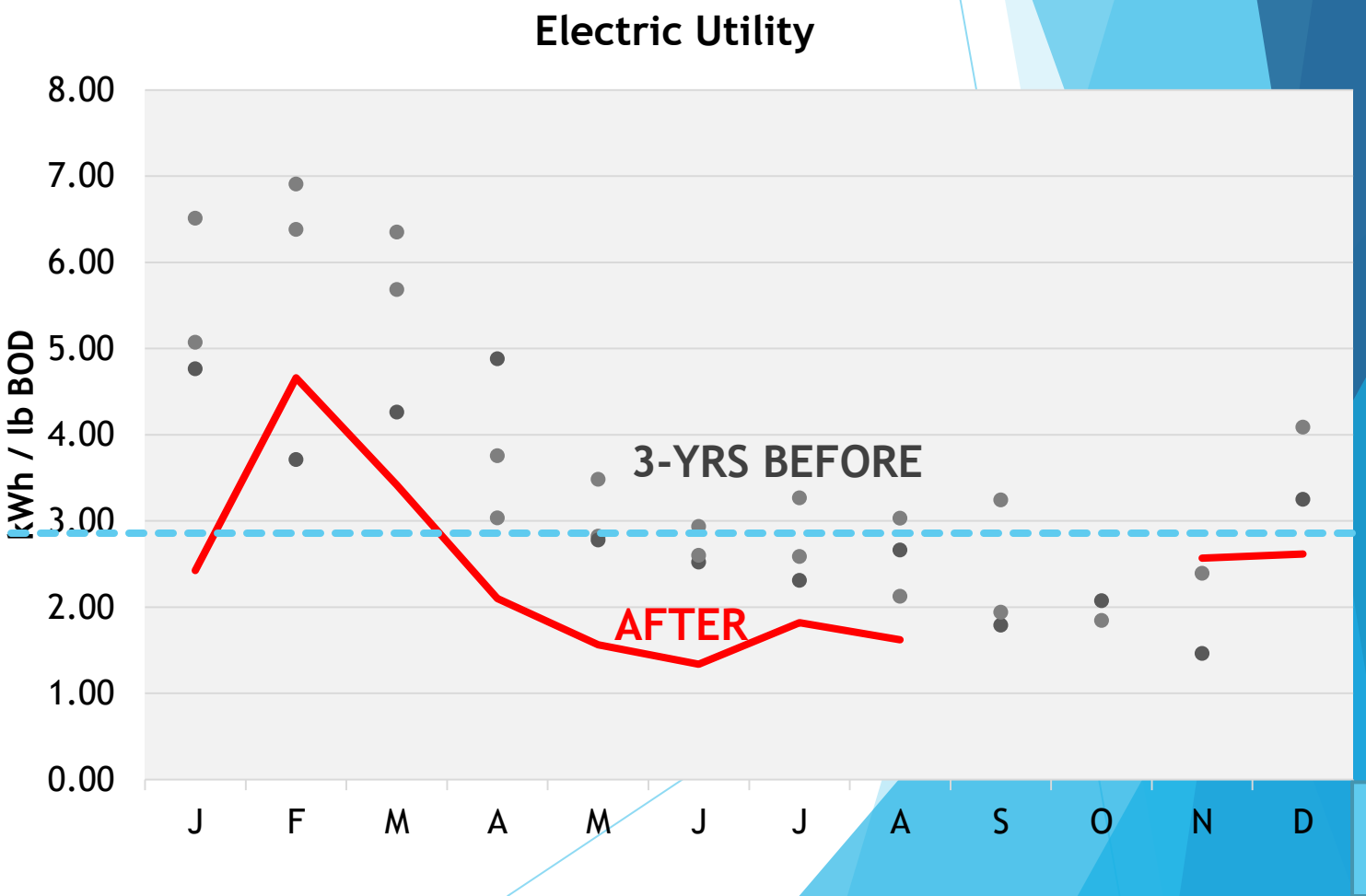
Operation

- Normalized for Loading
- Heating Impact
  - Summer

    vs
  - Winter

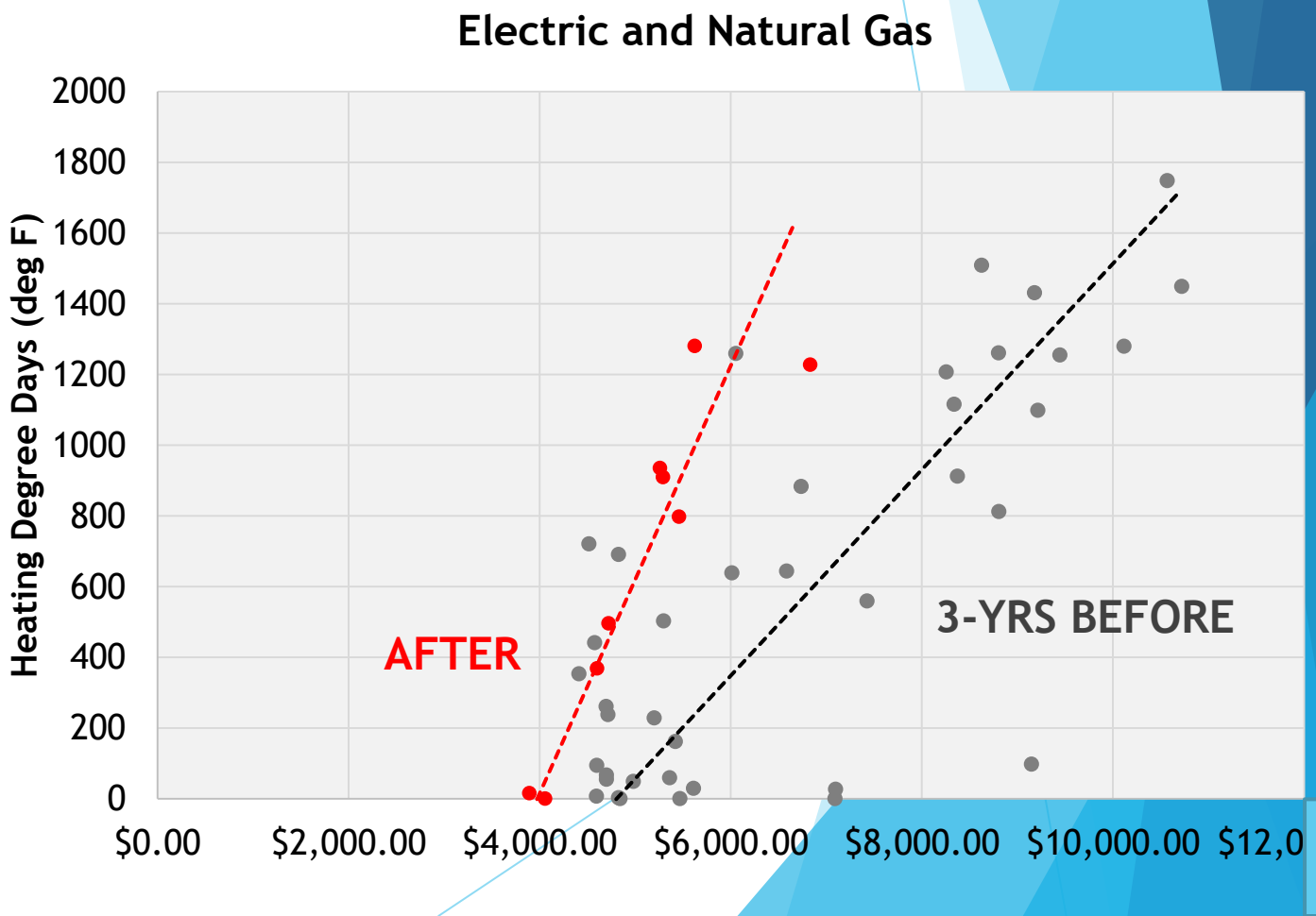
- Benchmark – Extended Air

  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

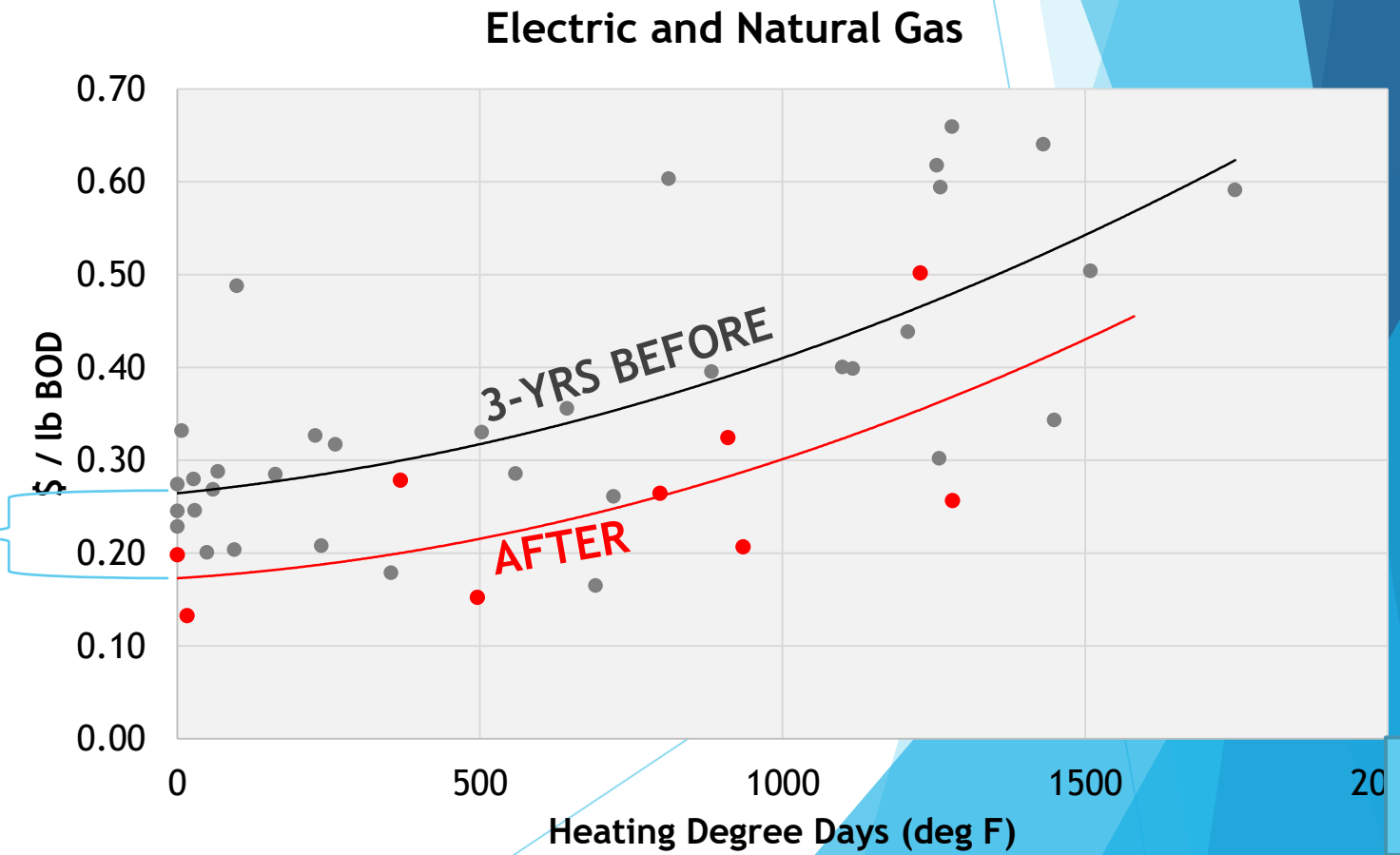


Operation

- Normalize for BOD and Heating

Blower System Efficiency

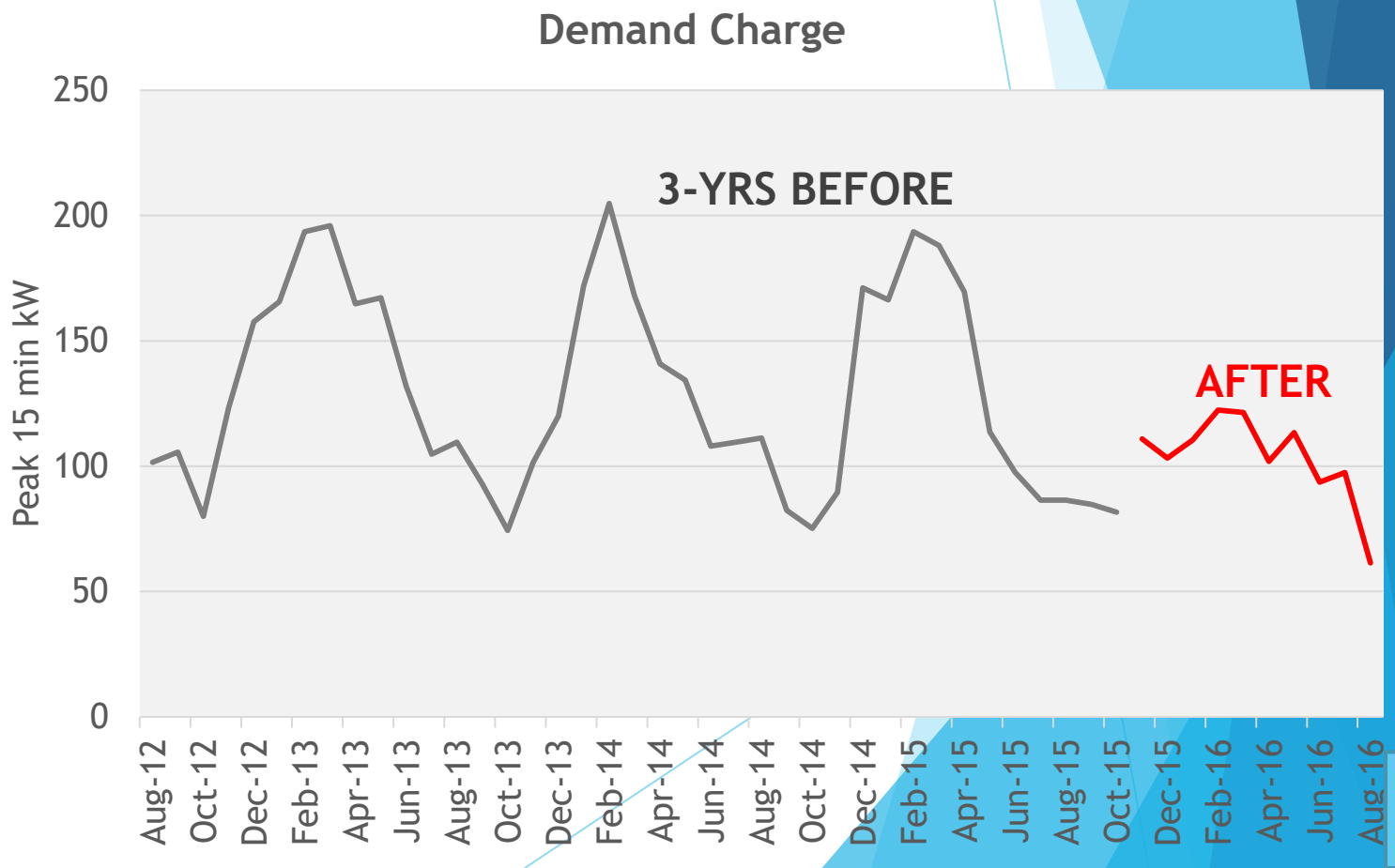
34.6 % Reduction



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!