

Power Load Profiling & Energy Dashboard



Sidharta(Sid) Arora, P.E.

*Acknowledgements: MMSD Engineering Coops/Interns
Peter Anderson, Amelia Retrum and Katie French*



Presentation Outline

- Jones Island (JI) General Overview
- JI Electric Meter Monitoring & Process Data Collection
- Power Load Distribution at Jones Island
- Factors Affecting The Power use
- Opportunities of Savings
- Energy Performance Indicators
- Energy Dashboards

JONES ISLAND (JI) General Overview

- **330 MGD Full Treatment Capacity**
 - 95 MGD Annual Average
- **Inline Storage System (ISS)**
- **Liquid Treatment Processes**
 - Preliminary/Primary/Secondary/Disinfection
- **Solids Handling & Disposal**
 - Interplant pumping of solids
 - Thickening, Dewatering & Drying
 - MILORGANITE Fertilizer Production



JONES ISLAND Power Demand & Supply

Power Demand

Operating Condition	Plant Demand, MW
Dry Weather	10.5
Dry Weather +Deep Tunnel Infiltration Dewatering	14
Wet Weather	18-22

Power Supply

Source	Supply Capacity
Solar Turbines (LFG/NG)	3 x 4.5 MW
GE Frame 5 (NG/Fuel Oil)	1 x 15 MW
We Energies (Dewey)	25 MW
We Energies (Harbor)	15 MW



MMSD 2035 VISION ENERGY EFFICIENCY AND CLIMATE CHANGE

MMSD's energy related efforts are focused on achieving the year **2035 Vision** to:

- Meet Net 100% of MMSD's energy needs with renewable energy sources.
- Meet 80% of MMSD's energy needs with internal, renewable sources
- Reduce MMSD's CFP by 90% from its 2005 baseline

POWER LOAD PROFILING GOALS

- Power distribution in Jones Island Amongst various Unit processes
- Process impacting the power use
- Opportunity to save power

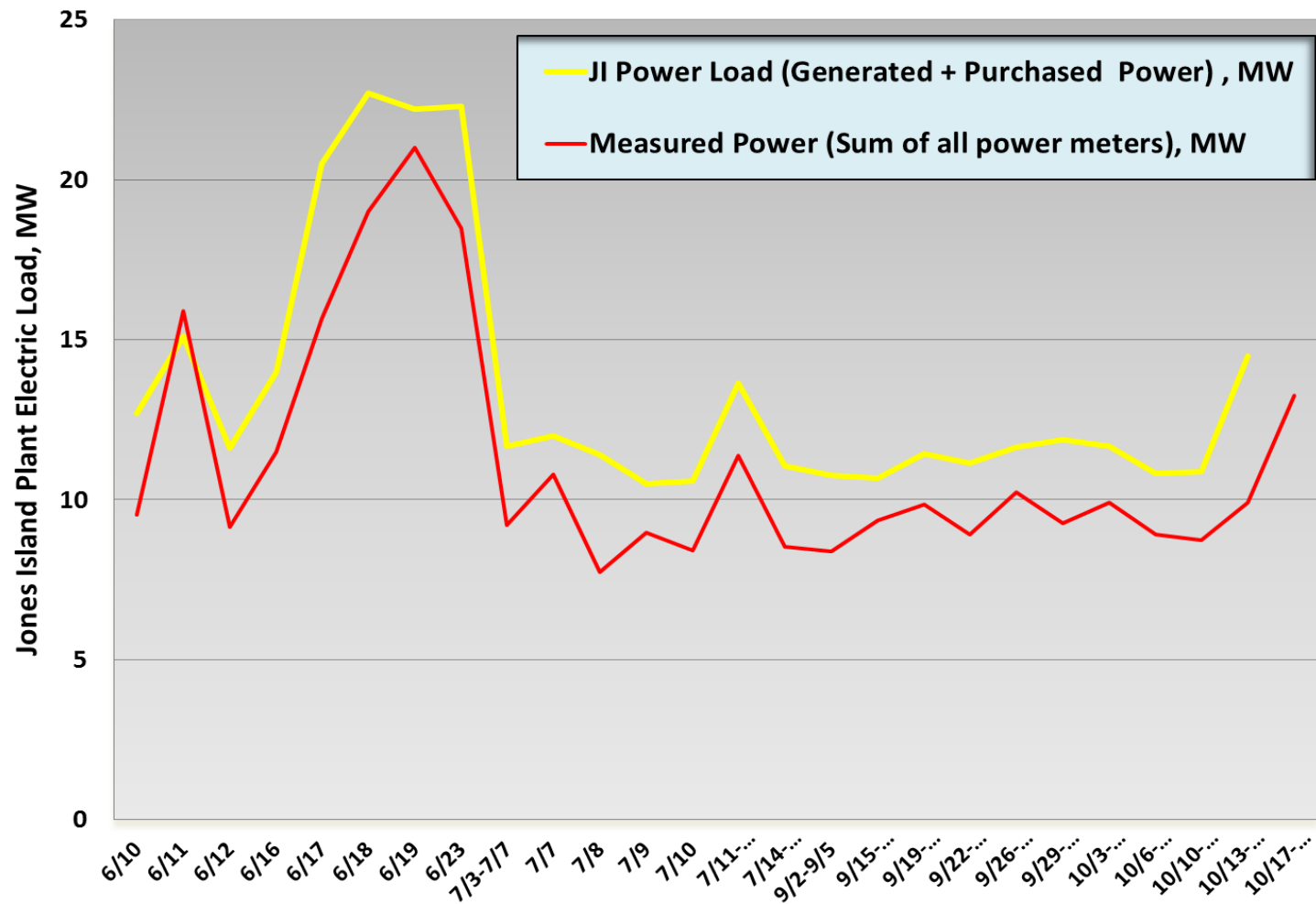
JI Electric Meter Monitoring & Process Data Collection

June 10th to October 20th

- **40 power meters** at various locations in Jones Island
 - 1 reading per day at 10 AM for each meter
- Monitoring Period Includes
 - Dewatering & Drying Facility Shutdown
 - Wet Weather Events
- Process data collected:
Flows, Sludge Mass, Blower Air Flows



DATA QUALITY CHECK



DATA CATEGORIZATION

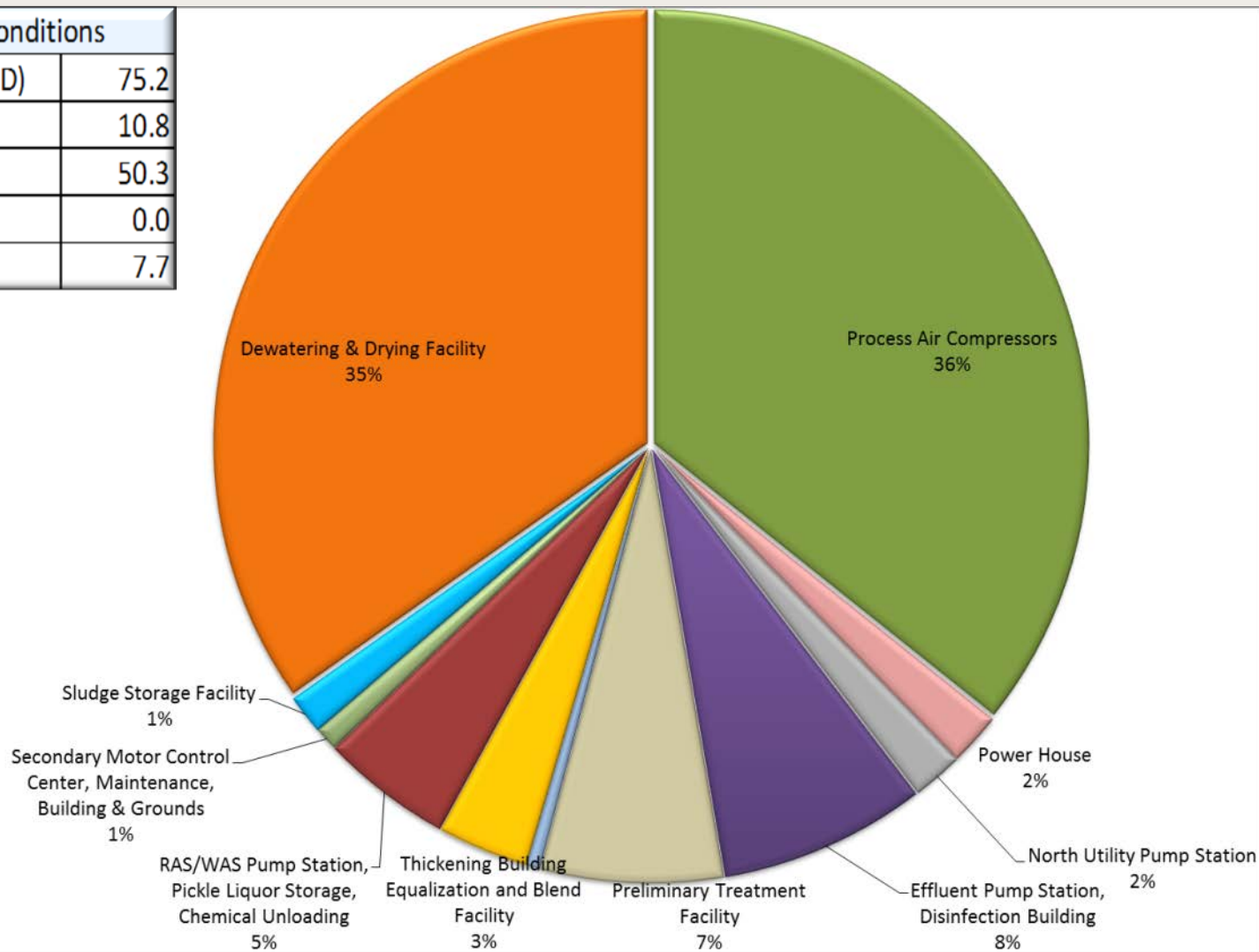
Power Load Data collected was categorized in following operating conditions:

- Dry Weather
- Dry Weather + Deep Tunnel Infiltration Dewatering (1 ISS pump)
- Wet Weather (2 or 3 ISS Pumps)
- With or Without D&D Shutdown

JONES ISLAND POWER DISTRIBUTION

DRY WEATHER

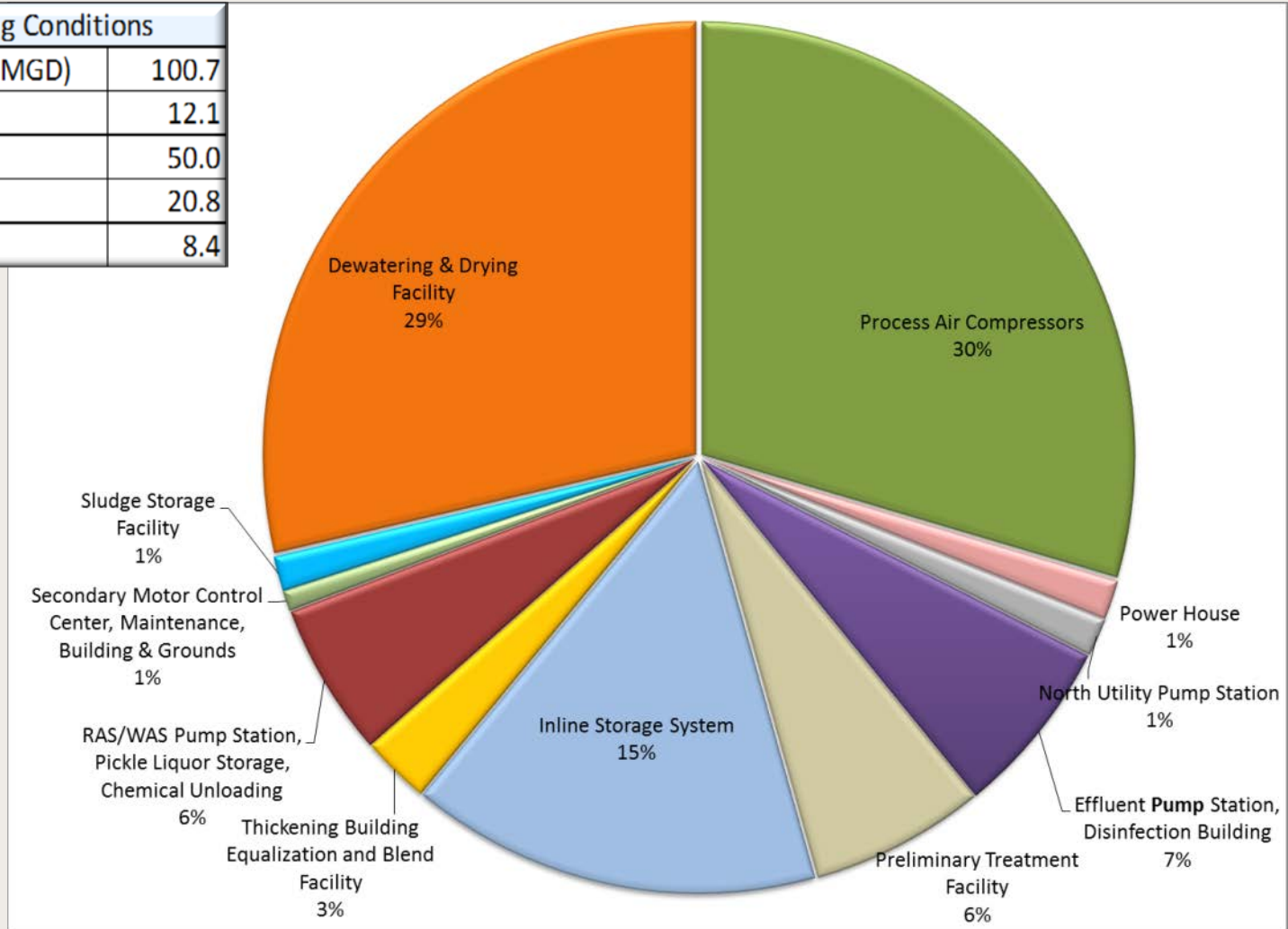
Average Operating Conditions	
Primary Influent Flow (MGD)	75.2
Plant Load, MW	10.8
Total RAS flow	50.3
Total ISS Flow	0.0
Dryers in Service	7.7



JONES ISLAND POWER DISTRIBUTION

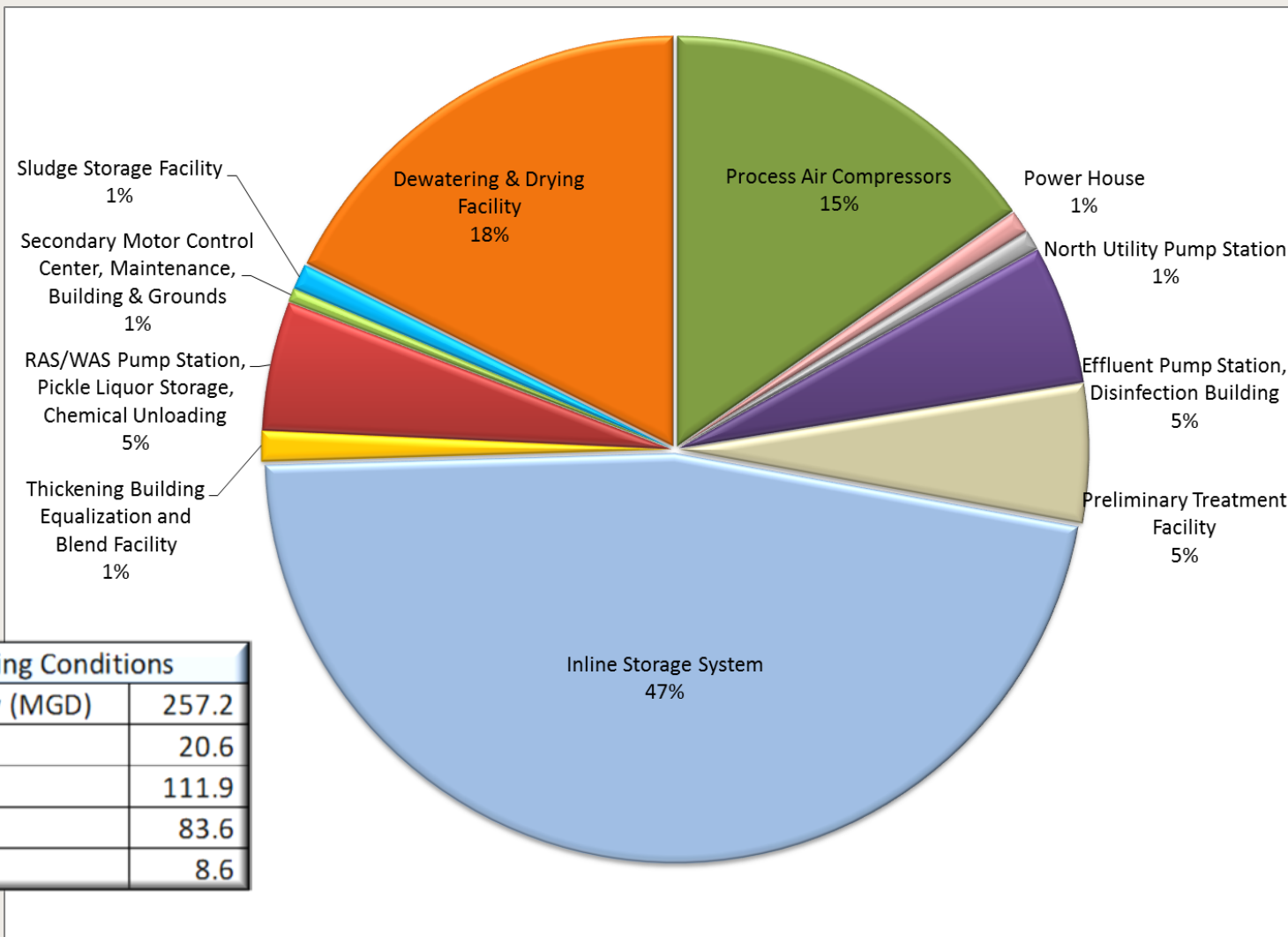
DRY WEATHER +1 ISS PUMP

Average Operating Conditions	
Primary Influent Flow (MGD)	100.7
Plant Load, MW	12.1
Total RAS flow	50.0
Total ISS Flow	20.8
Dryers in Service	8.4



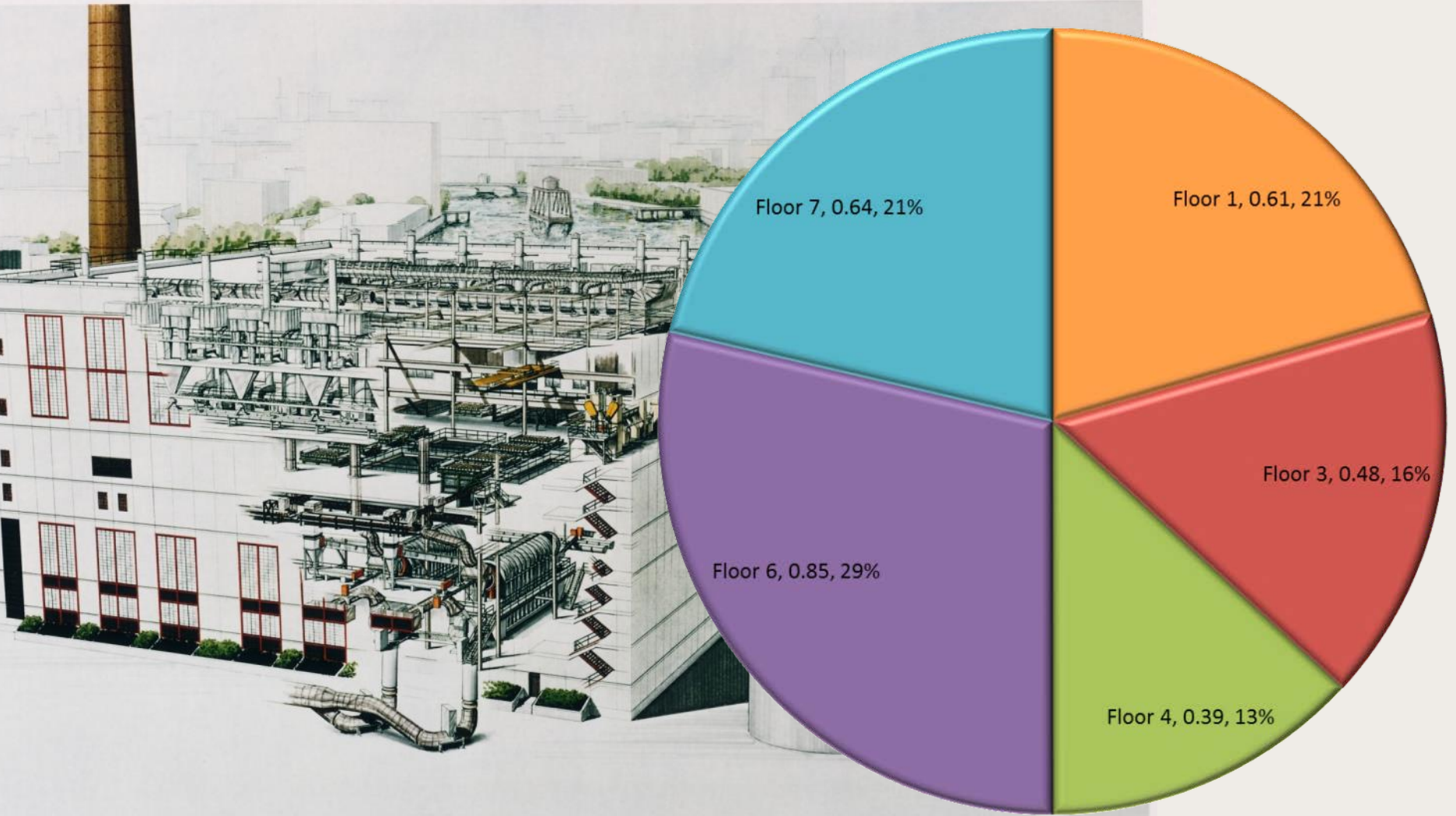
JONES ISLAND POWER DISTRIBUTION

WET WEATHER



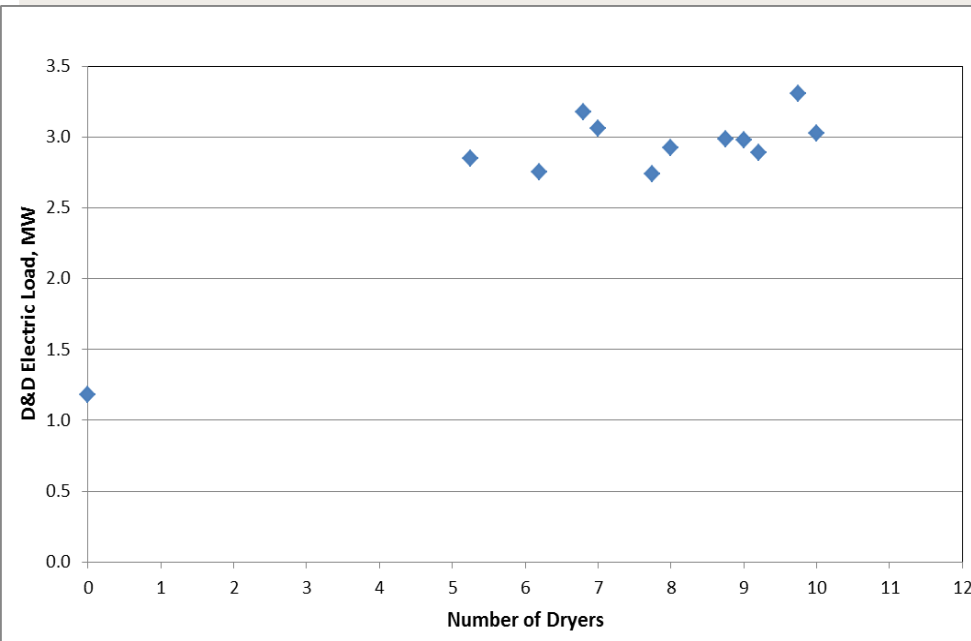
Average Operating Conditions	
Primary Influent Flow (MGD)	257.2
Plant Load, MW	20.6
Total RAS flow	111.9
Total ISS Flow	83.6
Dryers in Service	8.6

ZOOMING IN THE POWER LOAD OF DEWATERING AND DRYING FACILITY

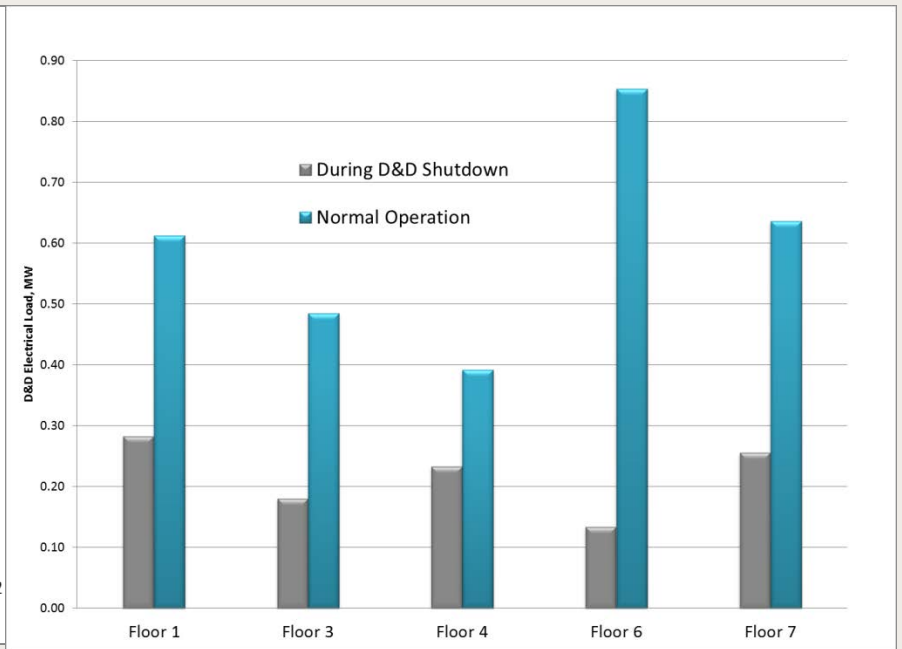


D&D POWER LOAD WITH NUMBER OF DRYERS IN SERVICE

D&D Power Load With # Dryers in Service



Variation of Floor Load with Annual D&D Shutdown



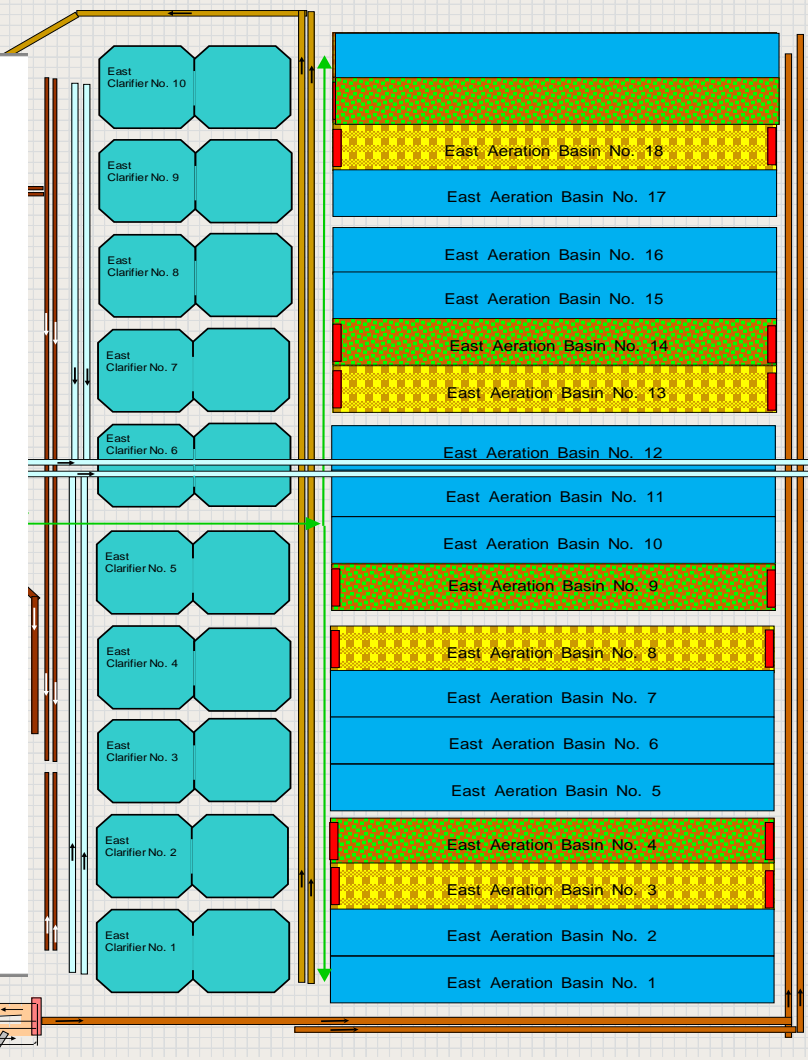
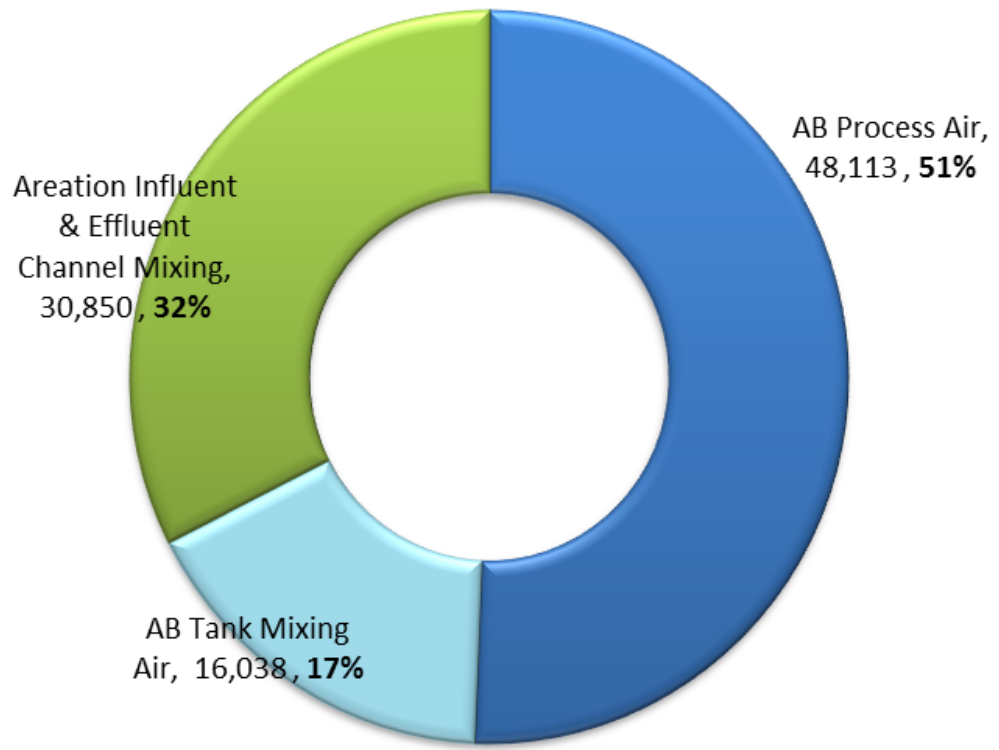
OPPORTUNITIES OF ENERGY SAVING DEWATERING AND DRYING FACILITY

- 50% of the D&D Electric power is used by Air Pollution Control Equipment on 5th and 6th Floor
- **Alternates of Wet Electrostatic Precipitators**
- D&D building utilizes only 1 MW power during annual maintenance shutdown
- **Shutdown D&D during low solids loading**

PROCESS AIR COMPRESSOR(PAC) POWER LOAD

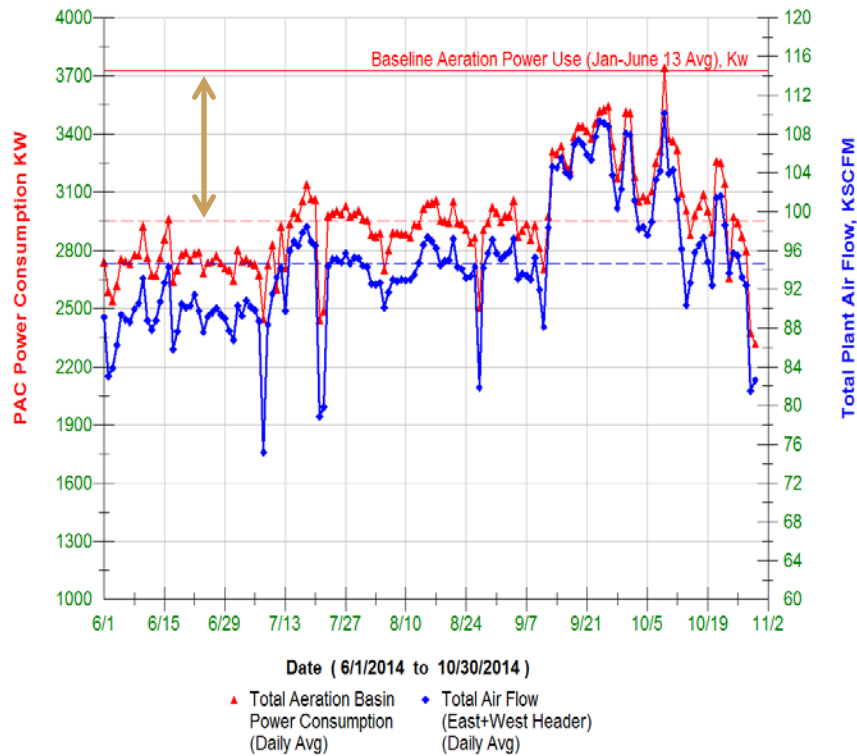
Total PAC Air 95,000scfm

Aeration Basin Air Utilization, scfm



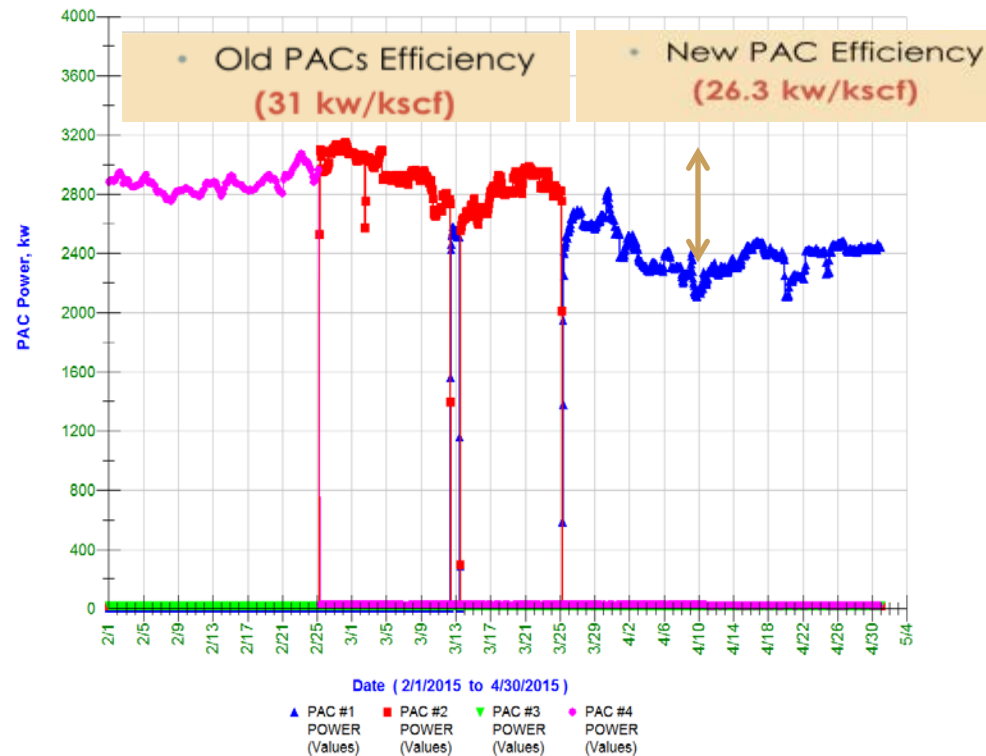
NEW PROCESS AIR COMPRESSOR(PAC)

Operation with DO Control



WMS (Veolia - Jones Island)
 JJ Air Reduction

Operation with New Blower

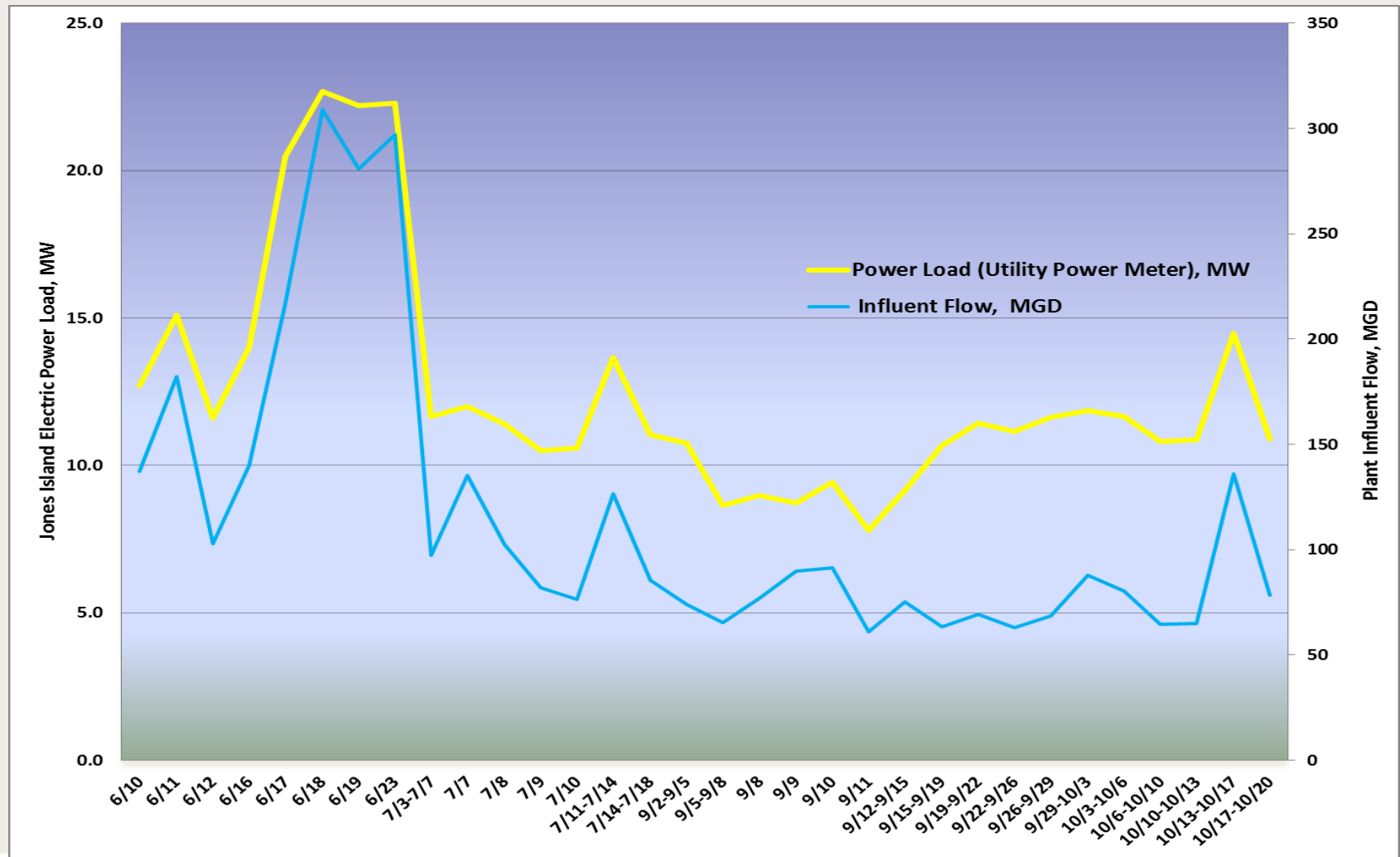


WMS (Veolia - Jones Island)
 PAC Power Consumption

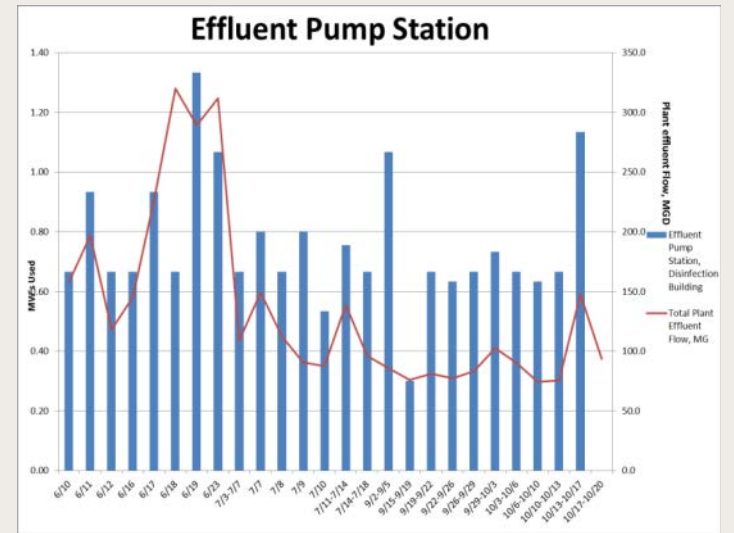
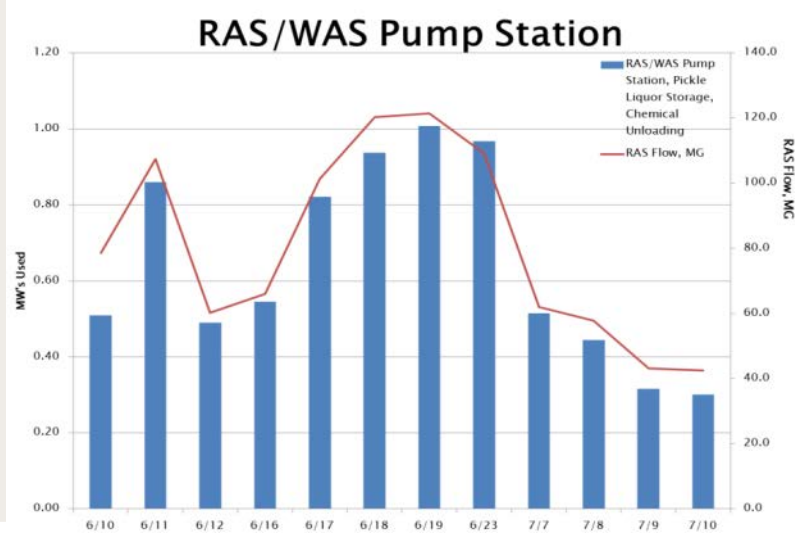
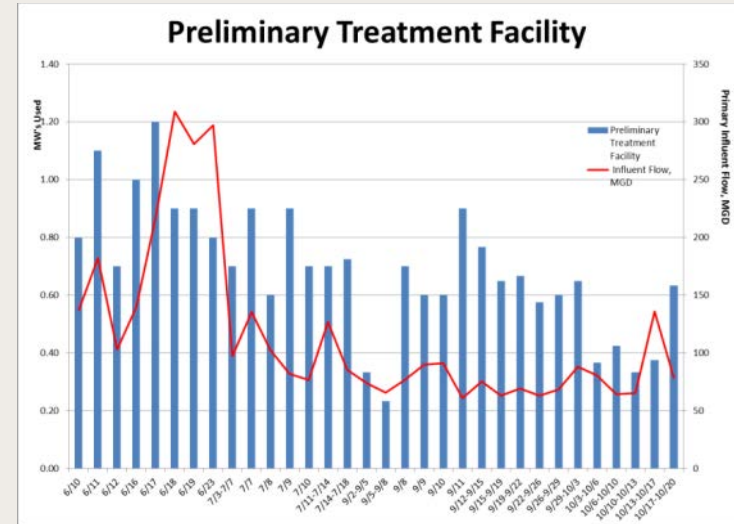
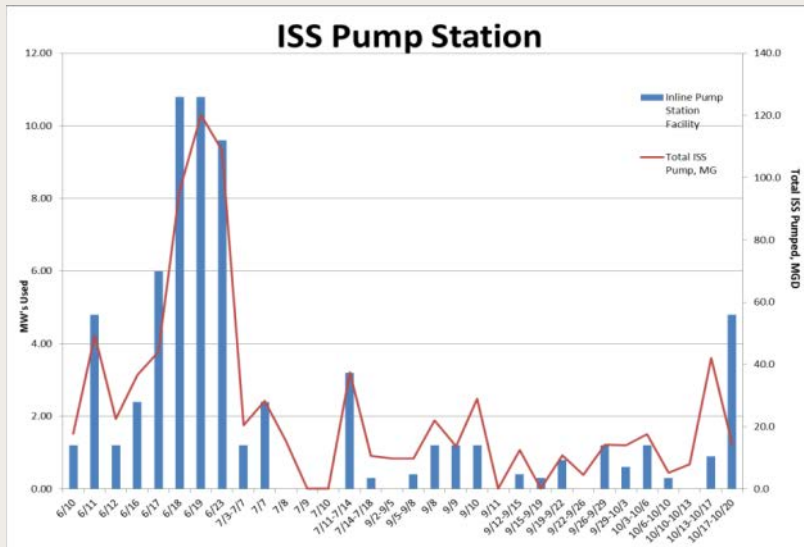
OPPORTUNITIES OF ENERGY SAVING PROCESS AIR COMPRESSOR

Air Utilization	Energy Reduction Considerations
Process Air (51%)	<ul style="list-style-type: none">• DO Control,• Ammonia Control• Energy Efficient Blower with Better Turn Down
Channel Air (32%)	<ul style="list-style-type: none">• Mechanical Mixer• Large Bubble Mixer
Tank Mixing (17%)	<ul style="list-style-type: none">• Basin Idling to reduce the Mixing Air by utilizing full length of the Aeration basins

DEPENDENCY OF POWER LOAD ON INFLUENT FLOW



OTHER UNIT PROCESS DEPENDENCY ON POWER





PERFORMANCE INDICATORS FOR DIFFERENT UNIT PROCESSES

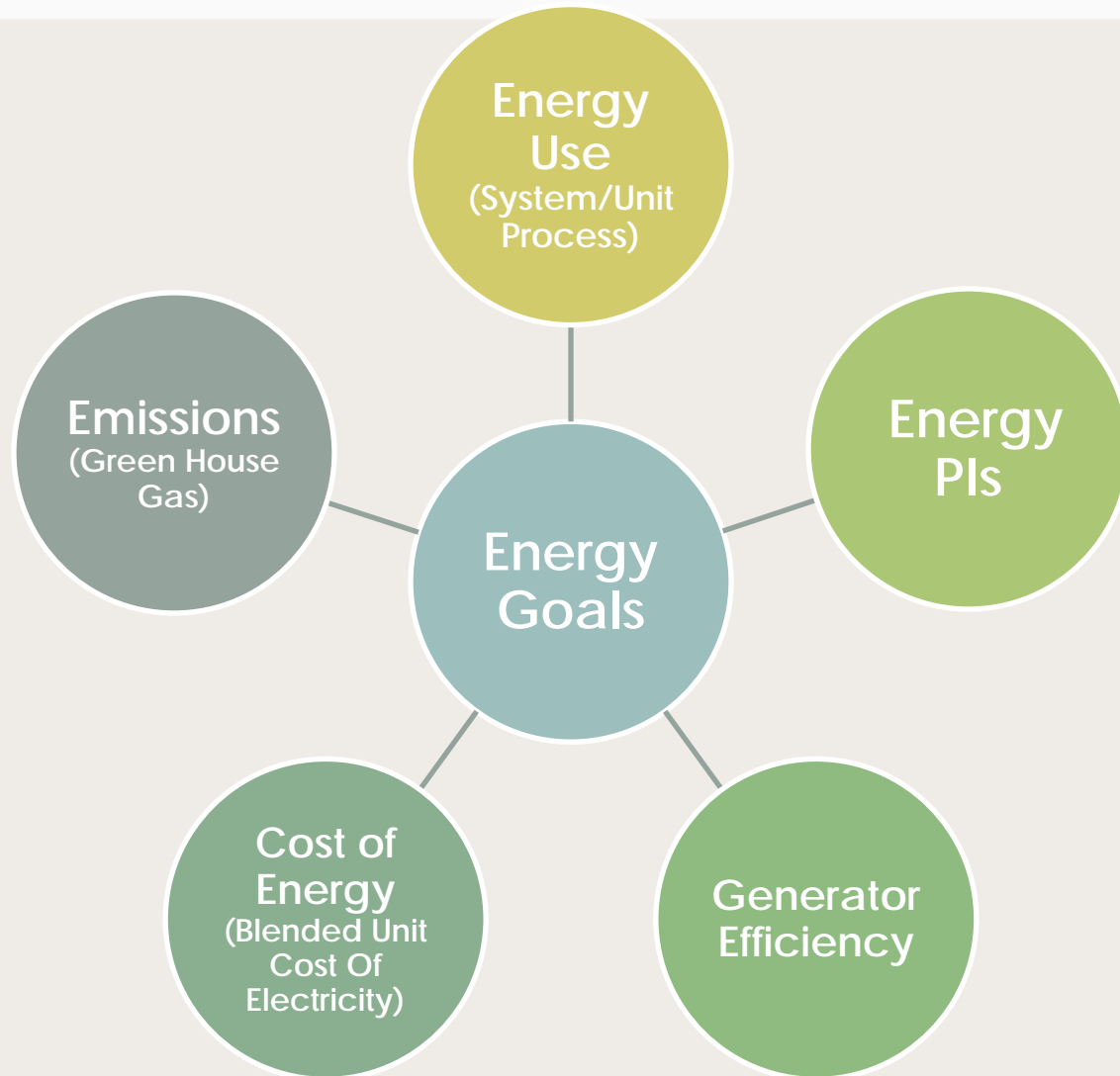
Performance Indicators for different unit processes

- KW/MG , for the unit process
- KW/ ton of sludge processed
- Process Air Compressors
 - KW/scfm
 - KW/LB PE BOD
- Turbines or Engine Generators
 - Kwh produced/Dth of fuel used
 - Rate of fuel used Dth/Hr

PERFORMANCE INDICATORS

- Statistically analyze the PIs data for last few years
- Assign a normal range based on the data analysis (High-Low-Average)
- Track Weekly/Monthly against the normal operating range

ENERGY DASHBOARD



JONES ISLAND ENERGY DASHBOARD

EMISSIONS

	<i>CO2 -non-biogenic</i> metric tons	<i>CO2 -biogenic</i> metric tons
Jan	6,380	1,250
Feb	5,600	1,260
Mar	6,800	1,300

ENERGY USE

	Generated Power <i>Mwh</i>	Purchased Power <i>Mwh</i>	Total Power Use <i>Mwh</i>	NG Purchased <i>Dth</i>	LFG Purchased <i>Dth</i>
Jan	7,534	364	7,891	106,469	30,691
Feb	6,868	542	7,391	128,173	25,561
Mar	7,491	563	8,048	124,561	19,758

ENERGY PERFORMANCE INDICATORS

		Jan	Feb	Mar
Plant Wide	<i>MWH/MG</i>	3.7	4	3.4
ISS Pumps	<i>MWH/MG</i>	1.92	1.86	1.88
RAS Pumps	<i>MWH/MG</i>	0.5	0.56	0.54
PACS	<i>KWh/PE BOD</i>	0.62	0.7	0.69
Dryers	<i>BTU/ lb water Evap</i>	1850	1900	1800
Dryers	<i>% WH Used</i>	30	35	25

ENERGY COST

	Purch. Electric <i>\$K</i>	Purch. NG <i>\$K</i>	Purch. LFG <i>\$K</i>	Blended Unit Cost <i>\$/Kwh</i>
Jan	\$48	\$543	\$74	\$0.05
Feb	\$57	\$631	\$61	\$0.05
Mar	\$57	\$612	\$47	\$0.05

ENERGY GOALS TRACKING

		Actual	Goal
Electricity Generated	%	87	100
Generated by Renewal Resources	%	37	80
CFP Reduction	%	10	90

GENERATION EFFICIENCY

	Solar 1		Solar 2		Solar 3		GE	
	<i>btu/kwh</i>	<i>Dth/ Hr</i>	<i>btu/kwh</i>	<i>Dth/ Hr</i>	<i>btu/kwh</i>	<i>Dth/ Hr</i>	<i>btu/kwh</i>	<i>Dth/ Hr</i>
Jan	9,039	31	9,039	31	9,039	31		
Feb	8,908	31.6	8,908	31.6	8,908	31.6		
Mar	8,843	30.8	8,843	30.8	8,843	30.8		

SUMMARY

- Identify areas of significant Electricity Use in a plant
(Find your Heavy Hitters)
- Prioritizing the energy conservation efforts
(Find Biggest Bang for your buck)
- Recognizing the dependency of a unit process on Power
- Identify opportunities in electricity consumption savings
- Develop Energy KPIs for different unit processes
- Track them monthly on a Energy Dashboard



THANKS

QUESTIONS?