

LISTEN.
THINK.
SOLVE.®

Energy Management and the Installation of Intelligent Motor Controls Lowell Regional Wastewater Utility

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Woodard and Curran



Rockwell
Automation

 **Allen-Bradley** • *Rockwell Software*

Who We Are

- Founded 1979 – have grown to a 600-person, integrated engineering, science, and operations company
- Provide consulting, engineering and operations expertise
- Diverse clientele: municipalities, energy industry, food & beverage manufacturers, colleges & universities, real estate
- Operate 10 offices throughout New England, NY, NJ, GA

What We Do

- Serve public and private clients locally and nationwide
 - Industrial Engineering
 - Civil & Environmental Engineering
 - Environmental Management Consulting
 - Corrective Action
 - Real Estate
 - Operations & Management

LRWWU: Background

- 32 MGD activated sludge facility
- Wet weather capacity of 112 MGD
- Facility serves more than 180,000 users Lowell, Chelmsford, Dracut, Tewksbury & Tyngsboro
- System includes:
 - 230 miles of sewer lines
 - 5000 catch basins
 - 9 combined sewer overflow (CSO) diversion stations
 - 16 wastewater pumping and metering stations



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Lowell Regional Wastewater Utility Duck Island Wastewater Treatment Plant



A – Influent Building (Screw Pumps) and Generator	E – Effluent Building	I – Administration Building
B – Primary Clarifiers	F – Maintenance Buildings	J – Sludge Dewatering Building
C – Aeration Blowers	G – Odor Control/Scrubber System	K – Solids and Septage Handling System
D – Secondary Clarifiers	H – Sludge Loading Garage	



Problem / Challenge

- LRWWU had been operating for 30+ years
 - Aging equipment, piecemeal repairs, inefficient operation resulted in high energy usage
- Continuous Operation





GENERAL  ELECTRIC
Motor Control Center

THICKNER DRIVE

THICKNER DRIVE

DANGER



THICKNER DRIVE

THICKNER DRIVE

DEFER IT!



**Do more
with less!**



LRWWU Energy Management

- 1990s - LRWWU began focusing on energy efficiency, tracking energy costs and implementing cost effective process improvements. Key areas of focus included:
 - Working closely with the electric utility to qualify for incentives
 - Creation of an energy management program
 - Participating in the ISO demand response program
 - Adopting the EPA Plan-Do-Check-Act Approach
 - Benchmarking energy use and costs for the WWTF & Pump Stations
 - Conducting energy evaluations



POWER MONITORING

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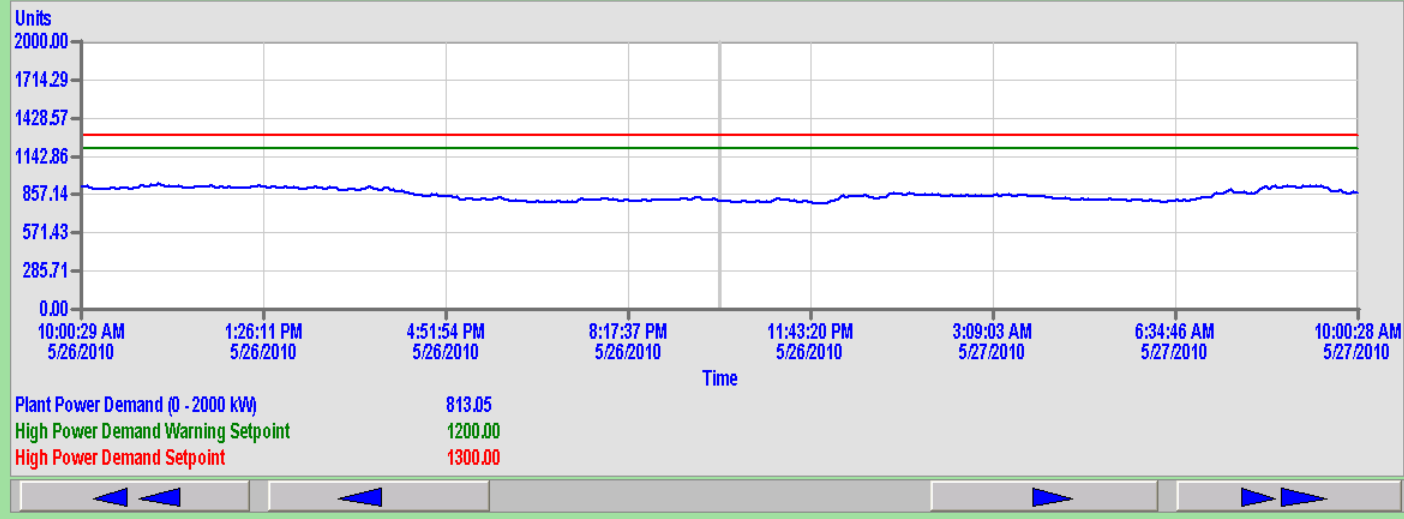
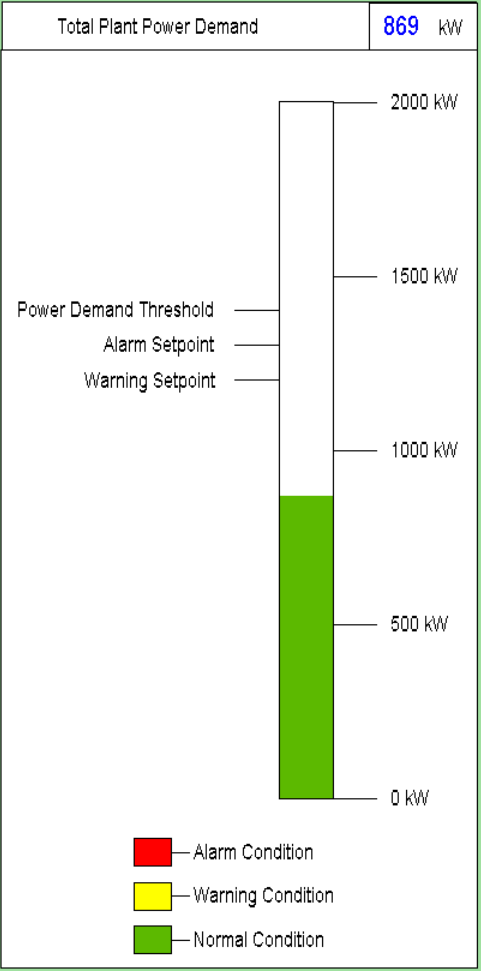
Power Monitor Influent Building SW1		
Power Demand	538	kVA
Average Current	696	amps
Average Voltage	491	Volts
Real Power	535	kW
Power Factor	-91	

ALARM	STATUS	ENABLE / DISABLE	Setpoint
Plant Power Demand Threshold			1400 kW
Plant High Power Demand Alarm	NORMAL	ENABLE DISABL	1300 kW
Plant High Power Demand Warning	NORMAL	ENABLE DISABL	1200 kW

Power Monitor Chemical Room SW2		
Power Demand	331	kVA
Average Current	394	amps
Average Voltage	494	Volts
Real Power	332	kW
Power Factor	-98	

Estimated Process Power Usage

	\$ Per kW	0.10 cents
Switchboard No.1	293.7 kW	787.8 kW Total Power / Cost
	7.05 \$/Day	
Switchboard No.2	494.1 kW	18.91 \$/Day
	11.86 \$/Day	



POWER MONITOR NO.1

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Wetwell	Influent Flow	Effluent Flow
4.2 ft	33.7 mgd	27.3 mgd

- Screw No.1 **RUN** 238.4 kW
- Screw No.2 **OFF**
- Screw No.3 **OFF**
- Screw No.4 **OFF**
- Bar Rack No.1 **OFF**
- Bar Rack No.2 **OFF**
- Grit & Screenings Belt **RUN** 2.2 kW
- Screenings Conveyor **OFF**
- Grit Classifier No.1 **OFF**
- Grit Classifier No.2 **RUN** 0.8 kW
- Primary Clarifier No.1 **RUN** 0.75 kW
- Primary Clarifier No.2 **OFF**
- Primary Clarifier No.3 **RUN** 0.75 kW
- Primary Clarifier No.4 **RUN** 0.75 kW
- Primary Clarifier No.5 **RUN** 0.75 kW
- Primary Clarifier No.6 **RUN** 0.75 kW

33.7 mgd
238.4 kW
5.72 \$/Day

3.1 kW
0.07 \$/Day

3.7 kW
0.09 \$/Day

- PS&G Pump No.1 **RUN** 17.0 kW
- PS&G Pump No.2 **OFF**
- PS&G Pump No.3 **RUN** 17.0 kW
- PS&G Pump No.4 **OFF**
- PS&G Pump No.5 **RUN** 17.0 kW
- PS&G Pump No.6 **OFF**

Estimated Process Power

296.2 kW
7.11 \$/Day

32.0 mgd
51.0 kW
1.22 \$/Day

Power Monitor		
Switchboard No.1		
Influent Building		
Power Demand	530	KVA
Average Current	689	amps
Average Voltage	491	Volts
Real Power	531	KW
Power Factor	-91	

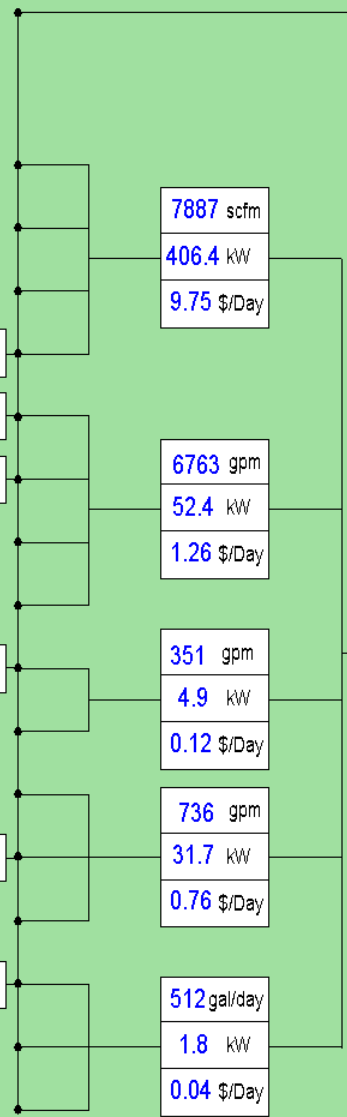
Total Plant Power Demand	864	KW
Plant High Power Demand Warning SP	1200	KW
Plant High Power Demand Alarm SP	1300	KW

POWER MONITOR NO.2

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Wetwell	Influent Flow	Effluent Flow
4.2 ft	34.3 mgd	27.3 mgd

- Blower No.1 OFF 0 %
- Blower No.2 OFF 0 %
- Blower No.3 OFF 0 %
- Blower No.4 RUN 88 % 406.4 kW
- RAS Pump No.1 RUN 63 % 27.4 kW
- RAS Pump No.2 RUN 61 % 25.0 kW
- RAS Pump No.3 OFF 0 %
- RAS Pump No.4 OFF 0 %
- WAS Pump No.1 RUN 78 % 4.9 kW
- WAS Pump No.2 OFF 0 %
- Plant Water Pump No.1 OFF 0 %
- Plant Water Pump No.2 RUN 92 % 31.7 kW
- Plant Water Pump No.3 OFF 0 %
- Chlorine Pump No.1 RUN 19 % 1.8 kW
- Chlorine Pump No.2 OFF 0 %
- Chlorine Pump No.3 OFF 0 %



7887 scfm
406.4 kW
9.75 \$/Day

6763 gpm
52.4 kW
1.26 \$/Day

351 gpm
4.9 kW
0.12 \$/Day

736 gpm
31.7 kW
0.76 \$/Day

512 gal/day
1.8 kW
0.04 \$/Day

Estimated Process Power
497.2 kW
11.93 \$/Day

Power Monitor		
Switchboard No.2		
Chemical Room		
Power Demand	334	kVA
Average Current	384	amps
Average Voltage	494	Volts
Real Power	325	kW
Power Factor	-99	

Total Plant Power Demand	864	kW
Plant High Power Demand Warning SP	1200	kW
Plant High Power Demand Alarm SP	1300	kW

**So, what did
we do?**







One Stop Shopping



- Power monitoring
- Efficient Motor Controls
- Simple Design
- Ease of Installation
- Network Ready



Low Bid Wins!!!

Call For Help



Maintenance Manager

- Commonality of Spare Parts
- Common training programs for staff
- One software platform to learn and use
- Seamlessly integrates motor controls with SCADA to reduce process complexity
- Single point of contact for both motor controls and process



Operations Manager

- Power Monitoring and Tools for Energy Reduction



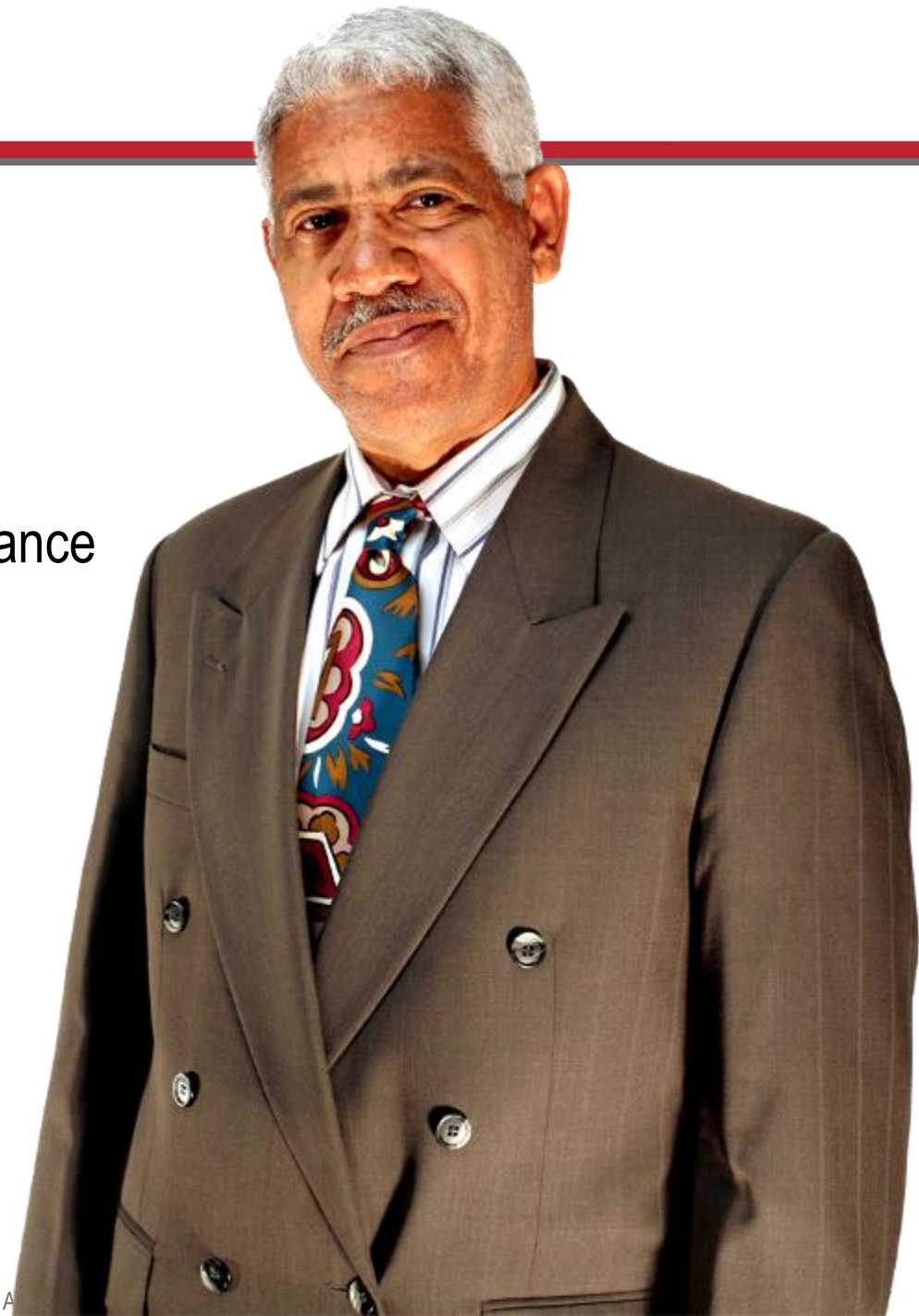
Head Operator

- Didn't change one bit
- Reduced his down time because he could tell why a pump failed now due to capabilities of the E3 overload



Director

- Plants productivity is up
 - Doing more with less!
- Spending less money on maintenance trouble calls



What Did It Take?

**What did
it take?**



Where Are We Now?



From This...



To This!

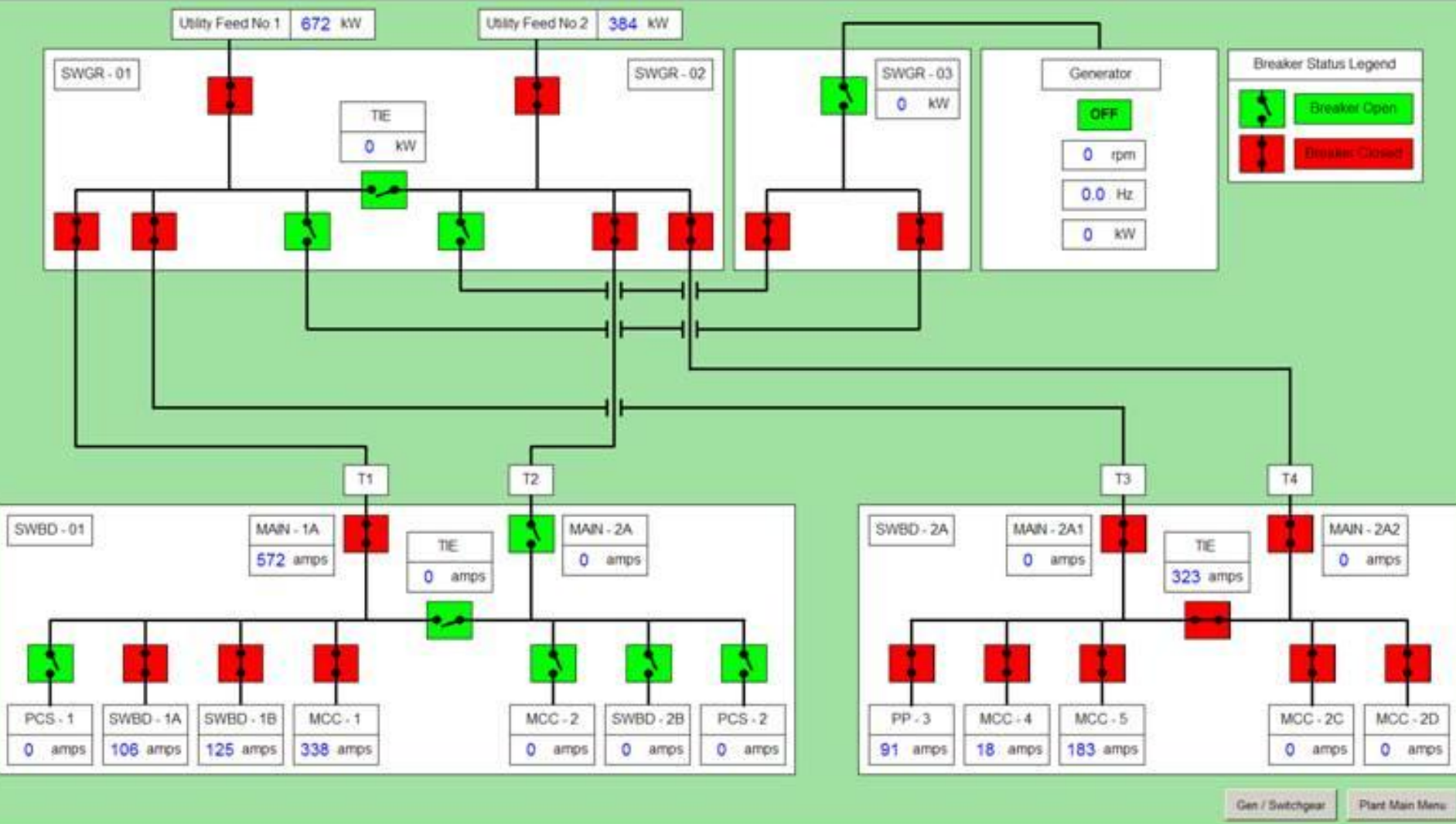


POWER OVERVIEW

PLANT ALARM

REMOTE STATION ALARM

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Gen / Switchgear Plant Main Menu

What Have We Learned?



Thank you!

Questions?



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