



MONTGOMERY

C O U N T Y

To improve the quality of life through our environmental services



MONTGOMERY
C O U N T Y

ENVIRONMENTAL SERVICES

Energy Purchasing, Capacity Charges & Energy Usage Reductions

October 22, 2015 – Kevin Krejny



MCES Energy Goal

*To use the **minimum** amount of energy to perform core functions and to procure energy in a predictable, **cost efficient** manner*



MCES Core Functions

1. Transport drinking water to customers
2. Transport wastewater away from customers
3. Treat wastewaters and manage Biosolids
4. Return clean water to Great Miami River and Little Miami River
5. Transfer Solid Waste and Recycle

Six Major Facilities

1. Western Regional WRF - WW
2. Eastern Regional WRF - WW
3. Dryden Road Lift Station - WW
4. Transfer Station - SW
5. M2- Booster Station - DW
6. M4- Booster Station - DW

Mix of Wastewater-Drinking Water-Solid Waste



Western Regional WRF 2015 Budget

	2015 Budget	% of Budget
Salaries	\$ 1,249,168	23.0%
Public Utilities	\$ 1,147,550	21.2%
Biosolids/screening/trash	\$ 1,095,000	20.2%
Benefits	\$ 462,048	8.5%
Debt Service	\$ 443,660	8.2%
Operating Supplies/Rentals/Misc	\$ 436,750	8.1%
Contract Professionals	\$ 293,500	5.4%
Maintenance and Repair	\$ 221,000	4.1%
Capital Outlay	\$ 56,000	1.0%
Training/Travel/Communication	\$ 20,425	0.4%
Total Budget	\$ 5,425,101	

How much can you control?



Manager Controlled Budget

Western Regional Budget (MANAGER CONTROL)		
	2015 Budget	% of Budget
Public Utilities	\$ 1,147,550	21.2%
Biosolids/screening/trash	\$ 1,095,000	20.2%
Operating Supplies/Rentals/Misc.	\$ 436,750	8.1%
Maintenance and Repair	\$ 221,000	4.1%
Capital Outlay	\$ 56,000	1.0%
Training/Travel/Communication	\$ 20,425	0.4%
Manager Controlled Budget	\$ 2,976,725	55%

A little more than half.



Electric Bill Components

Two Separate Bills

- Generation Charge (GDF SUEZ now **DPLER**)
 - Generation Charge – approx 55%
 - Capacity Charge – approx 13%
 - Ancillary Services Charge – approx 1%
- Distribution and Transmission Charges (**DP&L**)
 - Customer Charge – approx 0.25%
 - Distribution Charge – approx 17.5%
 - Non-bypassable (Gen Rider + Network) – approx 13%

How do we control these?



Electric Bill Components

- Generation Charge (GDF SUEZ now DPLER)
 - **Generation Charge – approx 55% - PROCUREMENT**
 - Capacity Charge – approx 13%
 - Ancillary Services Charge – approx 1%
- Distribution and Transmission Charges (DP&L)
 - Customer Charge – approx 0.25%
 - Distribution Charge – approx 17.5%
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PROCUREMENT Control



Electric Bill Components

- Generation Charge (GDF SUEZ now DPLER)
 - **Generation Charge – approx 55% - PROCUREMENT**
 - **Capacity Charge – approx 13%**
 - **Ancillary Services Charge – approx 1%**
- Distribution and Transmission Charges (DP&L)
 - Customer Charge – approx 0.25%
 - **Distribution Charge – approx 17.5%**
 - **Non-bypassable (Gen Rider + Network) – approx 13%**

USAGE Control



Block and Index pricing

BLOCK (similar to fixed)

- Set price per kWh used
- Blocks sold in 0.1 MW increments
- Price set on historical usage patterns (load profile)
- FLAT profile = better pricing
- Better rate than fixed price - less risk to supplier because of historical usage patterns

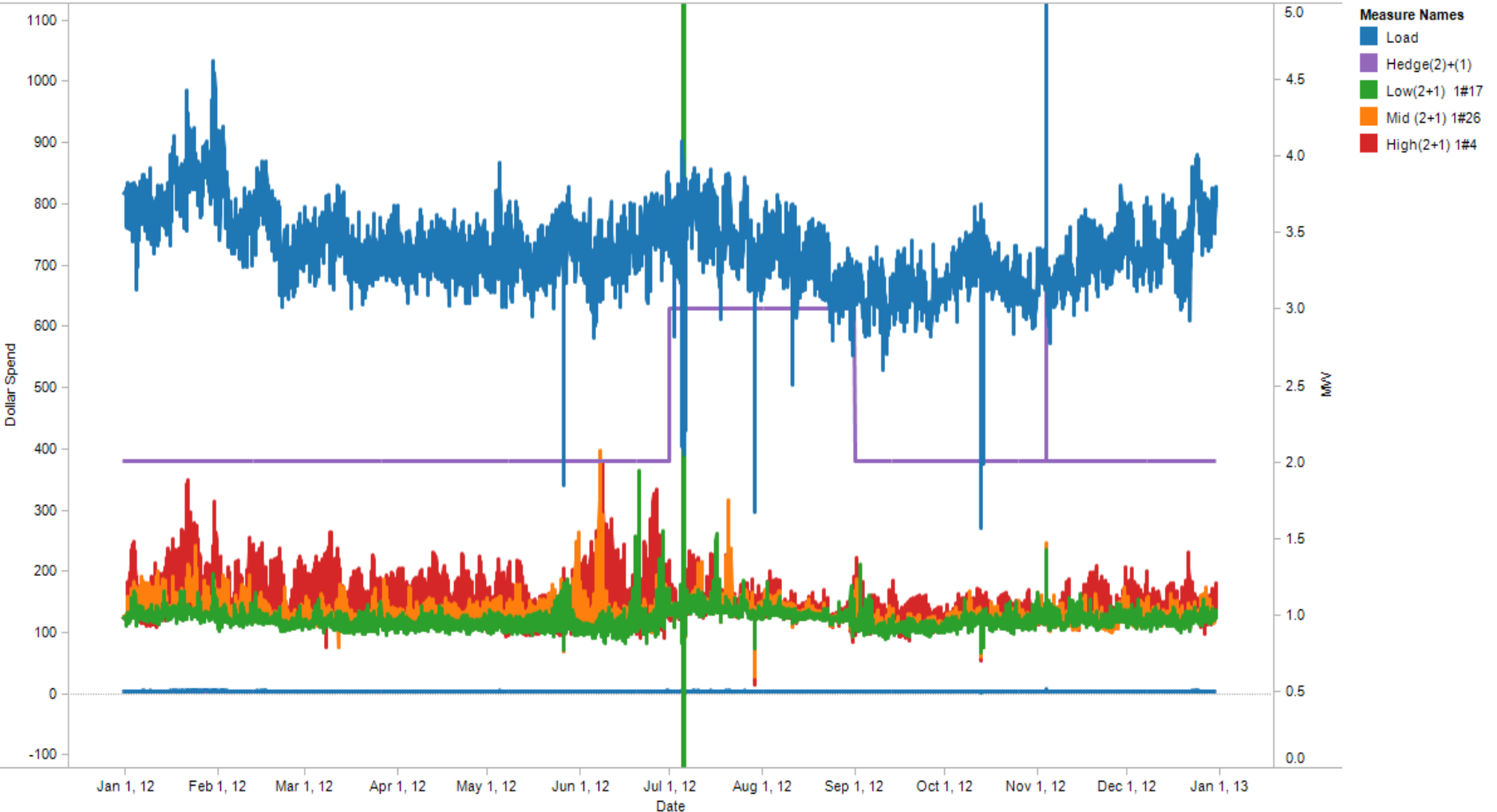
INDEX

- Pricing set hourly by projected demand in PJM RTO (Day ahead)
- Index price used to settle pricing that is over the amount of MW Block purchase
- Peak pricing occurs when <20 degrees or >80 degrees
- Meeting HVAC needs of RTO

Best of both worlds



2012 Load Run On Low, Medium, and High Price years
 2+1 MW Hedge
 \$1.17 Low, \$1.26 Med, \$1.4 High

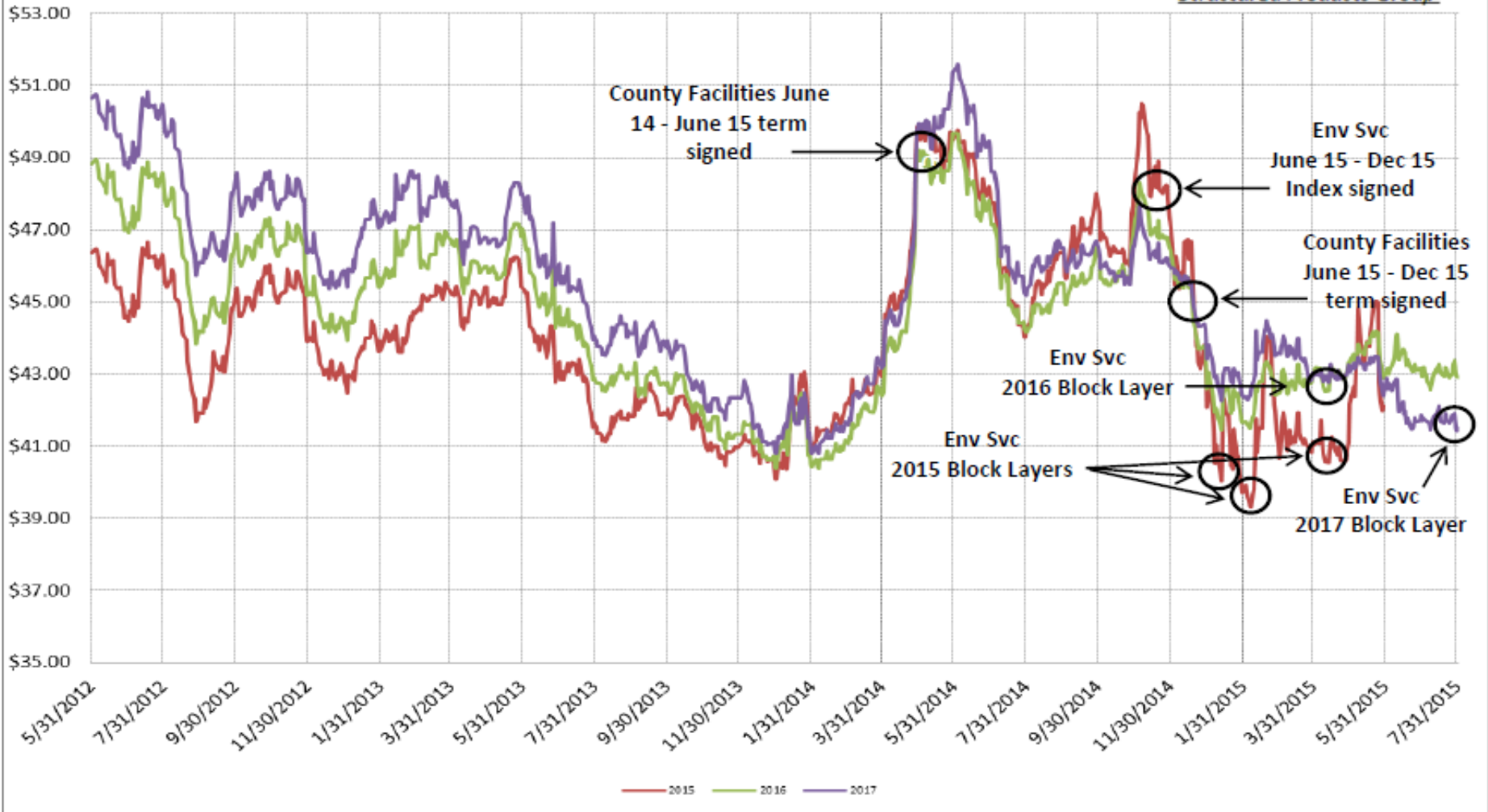


The trends of Hedge(2)+(1), High(2+1) 1#4, Load, Low(2+1) 1#17, Mid (2+1) 1#26, Hedge(2)+(1), High(2+1) 1#4, Load, Low(2+1) 1#17 and Mid (2+1) 1#26 for Date. Color shows details about Hedge(2)+(1), High(2+1) 1#4, Load, Low(2+1) 1#17 and Mid (2+1) 1#26. The view is filtered on Date, which keeps all values.

Load Profile of “six” major facilities



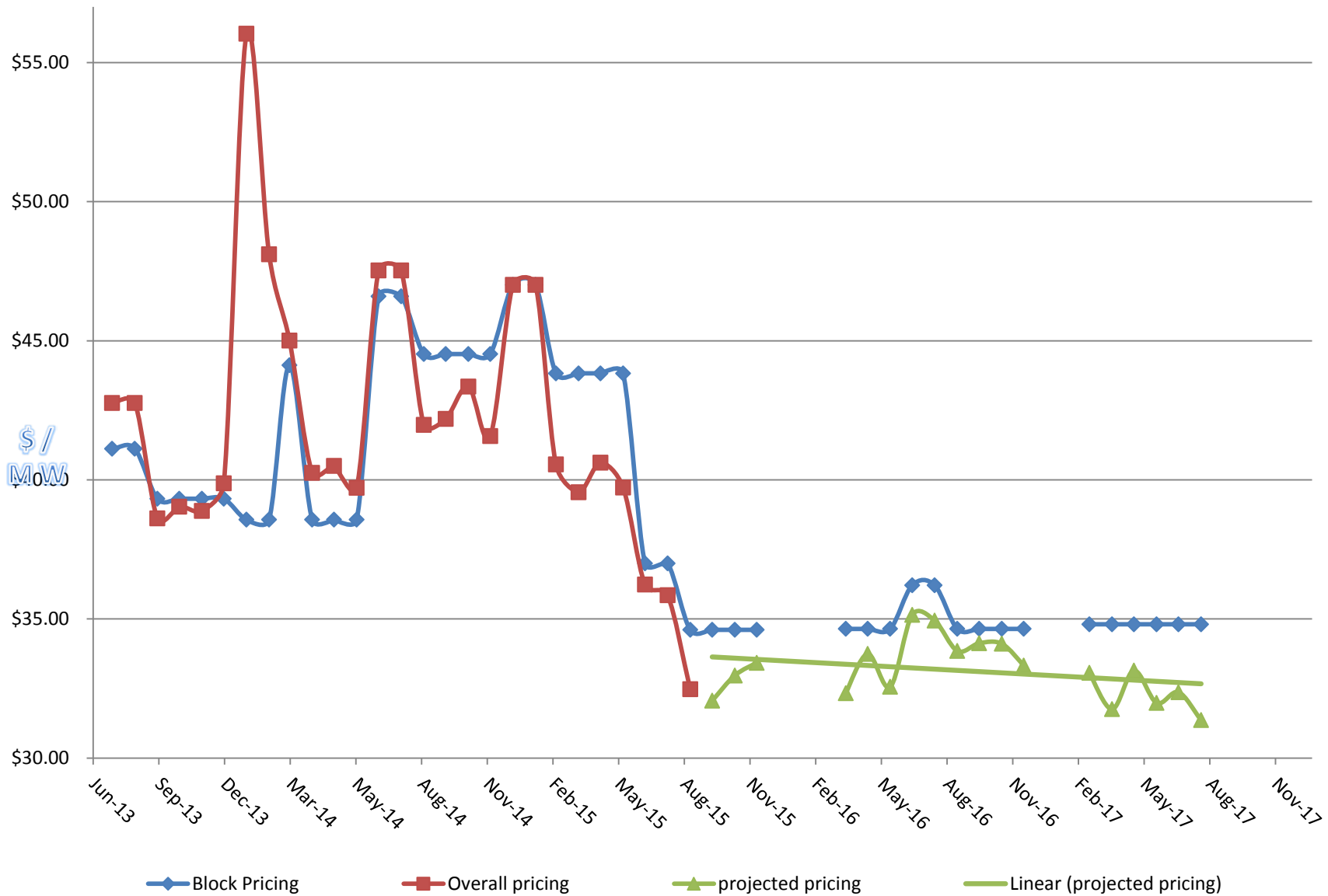
AEP Dayton Hub Peak Forwards



Successful in purchasing Blocks

Same day transactions





CPI Adjusted \$/MW "Block Price" and Overall Price

In 2015 dollars



For power outages and other electrical emergencies, call your electric distribution company:

Dayton Power & Light

1-800-433-8500

Utility Account Number:

0000609000

ACCOUNT BALANCE AS OF DEC 5, 2014

Previous Balance	\$39,977.56
Payment Received Dec 01 - THANK YOU	\$39,977.56
Balance Remaining	\$0.00
Current Charges	\$34,276.56
Total Amount Due	\$34,276.56

Charges for Billing Period for Nov 4, 2014 - Dec 3, 2014

Energy Charges	
Energy 708107 kWh at \$0.039971 per kWh	28,303.49
Network Integration Transmission Charge	
34.84 kW @ \$0.0 /kW for 29 days	0.00
Unforced Capacity Charge	
11/04-12/02 250.85 kW at \$0.1284/kW for 29 days	934.07
BLOCK ENERGY	
1-3XL9NR_1-4KRALU 11/04 - 11/30 On PK 2 @ \$43.65	-268.67
1-3XL9NR_1-4KRALU 11/04 - 11/30 Off PK 2 @ \$43.65	3,442.49
1-3XL9NR_1-4KRALU 12/01 - 12/02 On PK 2 @ \$43.65	17.26
1-3XL9NR_1-4KRALU 12/01 - 12/02 Off PK 2 @ \$43.65	210.63
Ancillary Services Charge	
11/04-12/03 714536.01 kWh @ \$0.00229/kWh	1,637.29
Subtotal Energy Charges	34,276.56
Taxes	
Sales Tax	0.00
Subtotal Taxes	
Total Energy Charges	\$34,276.56
Total Charges for this Billing Period	\$34,276.56

4.84 cents per kWh

GENERAL INFORMATION

Thank you for being a GDF SUEZ Energy Resources customer, we value your business.

Your monthly charges from GDF SUEZ Energy Resources average 4.84¢ per kWh (Price to Compare).



Service Address:
 MONTGOMERY COUNTY
 4111 HYDRAULIC RD
 DAYTON OH 45449

Billing Period:
 Jun 3, 2015 to Jul 07, 2015

DPL Energy Resources Account Number:
 81881-08007

Pay This Amount

AMOUNT DUE:
\$27,747.17
DUE DATE:
September 8, 2015

Questions about Your Bill?	Phone	Online	Email
	1-888-674-3753	www.dplenergy.com	dpl.energy@dplinc.com

For power outages and other electrical emergencies, call your electric distribution company:

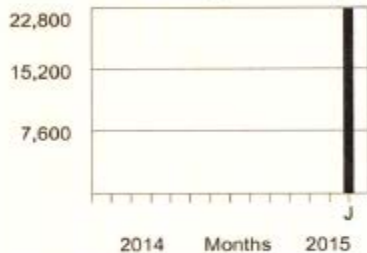
Dayton Power & Light
 1-800-433-8500

Dayton Power & Light Account Number:
 0000609000

Account Balance as of Aug 11, 2015

Previous Balance	\$0.00
Charges for Billing Period - Jun 3, 2015 to Jul 7, 2015	
Day Ahead Index Charges	26,379.27
TRUE UP AMOUNT	1,528.12
Capacity Charges	442.30
Energy based Ancillary Charges	474.97
TLC Credit	-266.21
Renewable Energy Charges	108.15
ARR Credit	-192.57
De-ration Adjustment	-726.86
Sales Tax	0.00
Total Charges for this Billing Period	\$27,747.17
Total Amount Due	\$27,747.17

kWh - Average Per Day



Types of Meter Readings:

Actual Estimated

You used 772,474 kWh in 34 days, or an average of 22,720 kWh a day.

3.59 cents per kWh

25.86 % Less

Not fun to figure out what is what.



Capacity Charges

Western Regional WRF

Shift of operations and generator usage

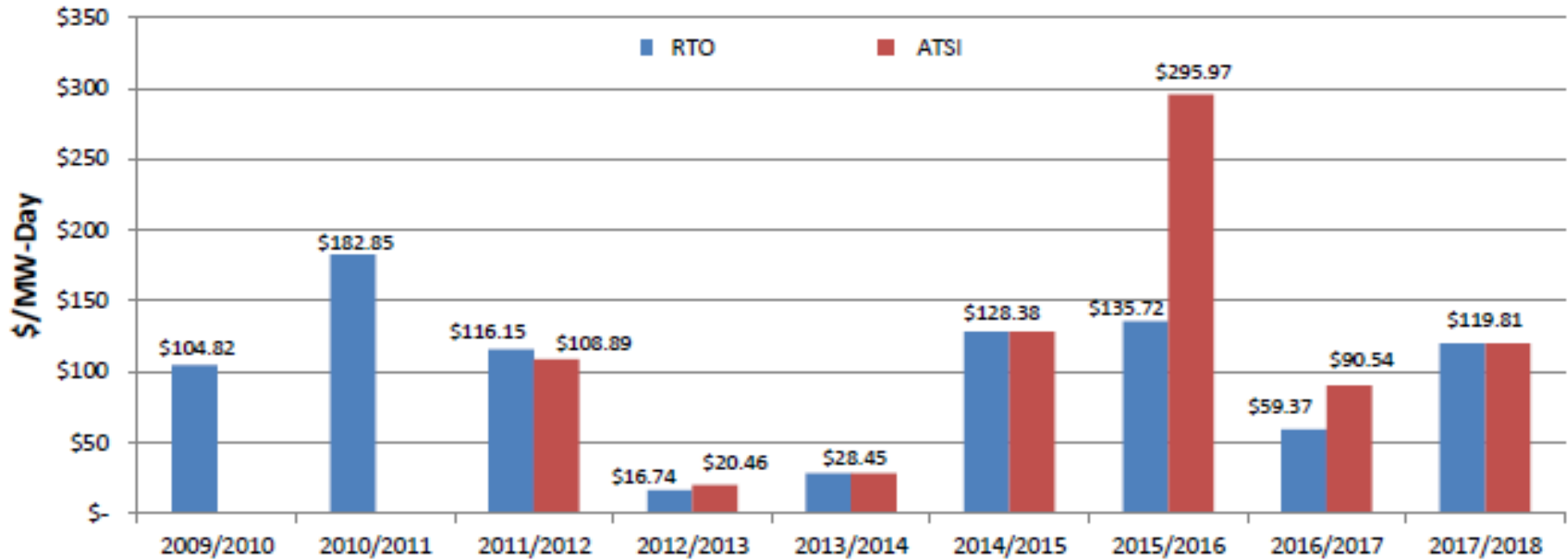


Capacity Charge

- 8-10% of total energy bill
- Changes YTY in June
- Projected 3-4 years out
- Set by 5 highest hour peaks in PJM Region in previous 6/1 → 9/30
- = (Avg MW online during 5 peak)*(Clearing costs)*(365 days)
- So, June 1, 2015 → May 31, 2016 was set by 2014 peaks



Ohio Capacity Clearing Prices Jun 2009- May 2018



Zone	2009/2010	2010/2011	2011/2012	2012/2013	2013/2014	2014/2015	2015/2016	2016/2017	2017/2018
DPL	\$ 102.04	\$ 182.85	\$ 116.15	\$ 16.74	\$ 28.45	\$ 128.38	\$ 135.72	\$ 59.37	\$119.81
Duke	\$ 102.00	\$ 182.85	\$ 116.15	\$ 16.74	\$ 28.45	\$ 128.38	\$ 135.72	\$ 59.37	\$119.81
AEP	\$ 104.82	\$ 182.85	\$ 116.15	\$ 16.74	\$ 28.45	\$ 128.38	\$ 135.72	\$ 59.37	\$119.81
FE/ATSI			\$ 108.89	\$ 20.46	\$ 28.45	\$ 128.38	\$ 295.97	\$ 90.54	\$119.81

Notes:

- PJM's Planning Year runs June 1 - May 31
- Values are adjusted for the Zonal Capacity Transfer Rights Credits

**Capacity Charges 8-10% of Bill
\$164.77 in 2018/2019**





PJM Regional RTO



Capacity charge savings

Peaks	Paid	MW	Clearing	\$ Capacity/year	If did nothing	\$ Saved
2012	2013	3.888	28.45	\$ 40,373.96		
2013	2014	2.106	128.38	\$ 98,684.42	\$ 182,186.63	\$ 83,502.20
2014	2015	1.691	135.72	\$ 83,768.42	\$ 192,602.97	\$ 108,834.55
2015	2016	1.456	59.37	\$ 31,551.59	\$ 84,253.15	\$ 52,701.56
					3 year total	\$ 245,038.31

Doing nothing costs money



How do we do this?

- Watch weather
- Watch PJM usage
- Use available tools
- Run Generators 10-12 times a year
- Watching trends

Go off the grid with Generators



Telemetry time: 08/11/15 13:10 EDT

Load	MW
PJM RTO Total	117,860
Mid-Atlantic Region	40,788
Southern Region	15,138
Western Region	61,933
AE Zone	1,524
AEP Zone	18,308
APS Zone	6,867
ATSI Zone	9,836
BC Zone	4,935
COMED Zone	15,377
DAYTON Zone	2,559
DEOK Zone	3,838
DOM Zone	15,158
DPL Zone	2,648
DUQ Zone	2,237
EKPC Zone	1,944
JC Zone	3,392
ME Zone	2,233
PE Zone	5,671
PEP Zone	4,883
PL Zone	5,683
PN Zone	2,500
PS Zone	6,451
RECO Zone	255

Instantaneous Load History

Load: **PJM RTO Total**

Telemetry time: 08/11/15 13:10 EDT

Timestamp	MW
08/11/15 13:10 EDT	117,860
08/11/15 13:05 EDT	117,393
08/11/15 13:00 EDT	117,023
08/11/15 12:55 EDT	116,756
08/11/15 12:50 EDT	116,276
08/11/15 12:45 EDT	116,304
08/11/15 12:40 EDT	115,916
08/11/15 12:35 EDT	115,311
08/11/15 12:30 EDT	115,032
08/11/15 12:25 EDT	114,782
08/11/15 12:20 EDT	114,492

More Tools





RTO COMBINED HOUR ENDING INTEGRATED FORECAST LOAD MW

DATE: 8/24/2014

Date	Hour	1	2	3	4	5	6	7	8	9	10	11	12
8/24/2014	am	78880	74930	71608	69916	69009	68817	69606	71200	76953	82960	88581	93773
	pm	98075	101472	104266	106539	108725	109837	108927	106421	105768	103410	97096	89795
8/25/2014	am	82702	78081	75242	73756	74142	77590	83749	89149	94744	100441	106383	111829
	pm	116621	120988	124066	126181	127506	127328	124436	120291	118242	114391	105770	96378
8/26/2014	am	86725	81444	77911	75883	75821	79022	85197	90576	95896	101533	107384	112776
	pm	117586	122019	125330	127737	129239	128828	125590	120935	118688	114526	105633	95953
8/27/2014	am	87030	81511	77846	75719	75642	78837	84974	90336	95790	101441	107404	112916
	pm	117842	122478	126069	128596	130194	129764	126353	121734	119283	114955	106115	96479
8/28/2014	am	87952	82408	78787	76700	76651	79854	85948	91359	96853	102345	107902	112992
	pm	117293	121287	124077	125859	126804	126086	122592	118012	115702	111868	103510	94442
8/29/2014	am	86667	81318	77797	75796	75716	78757	84471	89595	94938	100307	105582	110141
	pm	113960	117372	119669	120881	121350	120034	116298	111536	109165	105885	99134	91134
8/30/2014	am	84076	78868	75404	73095	71999	72401	73475	76139	82099	88382	94025	98441
	pm	101825	104321	106064	107330	108137	107926	105827	102445	100987	98870	93320	86512

*Source: PJM

2013 PJM 5 Coincident Peaks (5CPs)

Date:	Peak (MW)	Hour Ending:
Thursday, July 18, 2013	158,953	5:00 PM
Friday, July 19, 2013	156,085	3:00 PM
Wednesday, July 17, 2013	154,070	5:00 PM
Tuesday, July 16, 2013	151,439	5:00 PM
Monday, July 15, 2013	150,726	6:00 PM

2014 PJM YTD Peak Days

Date:	Peak (MW)	Hour Ending:
Tuesday, 6/17/2014	141,674	6:00 PM
Tuesday, 1/7/2014	140,510	7:00 PM
Wednesday, 6/18/2014	139,497	5:00 PM
Tuesday, 7/1/2014	139,386	6:00 PM
Tuesday, 7/22/2014	138,196	6:00 PM

Tools to predict peaks



Energy Usage Reductions

Western Regional WRF

Technology Improvements & Operational Changes



Aeration Upgrades Project

2013-2015

\$3,600,000

- Replace Original Infrastructure (1978)
- Replaced all aeration piping
- Upgrade aeration technology (14 Tanks)
- Replace controls and monitoring of system
 - Shut off valves
 - 14 new actuators
- Increase operations options
 - Computer controls
- Increase Western WRF Capacity
 - Handle wet weather events better

All lead to reduced energy usage



Why needed?



Original Aeration Piping





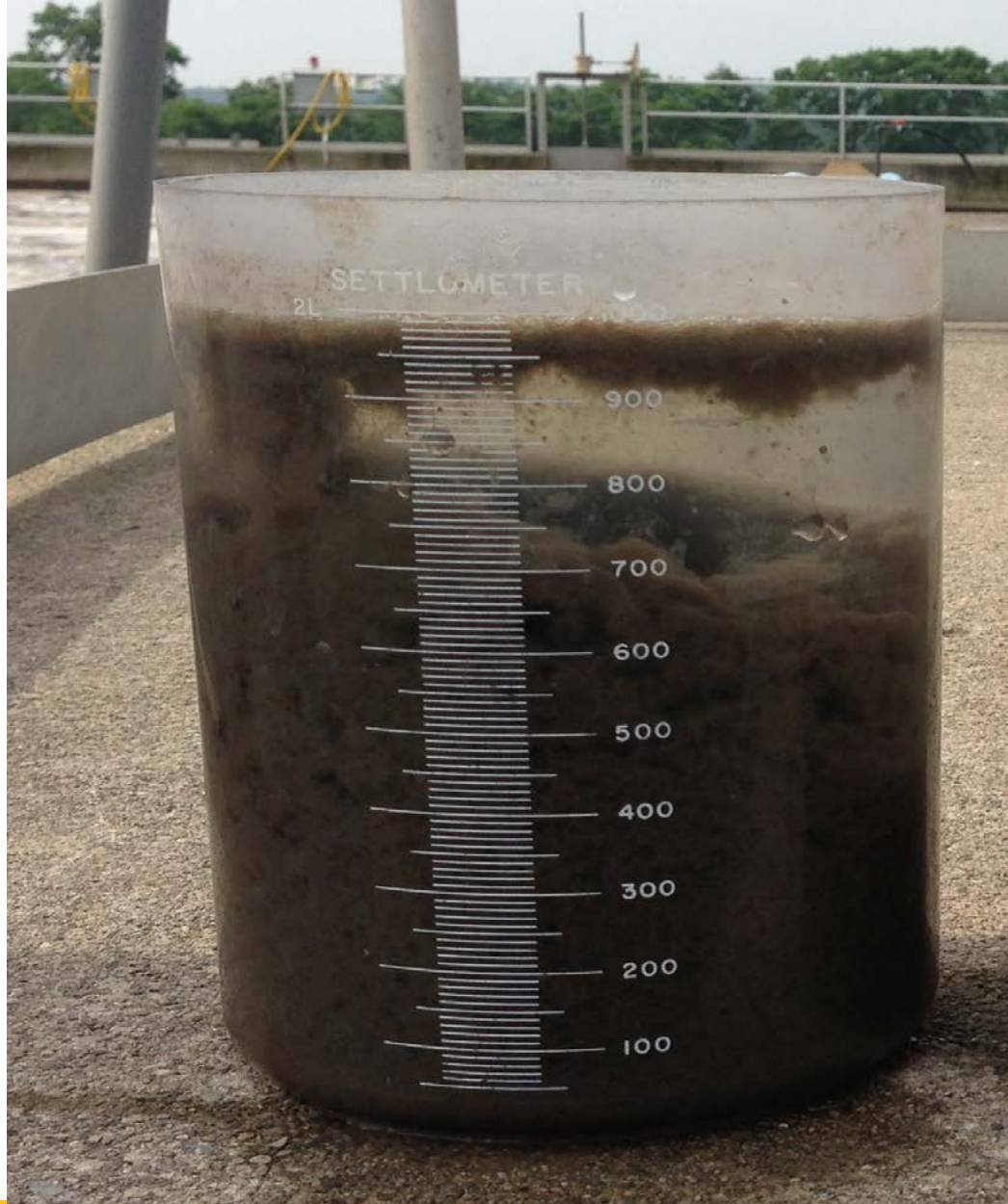
Air leaking through pavement





Inefficient Oxygen Transfer Rate





Terrible clarifier settling



Project Improvements



New Fine Bubble Diffusers





Testing new fine bubble diffusers





30 minute settling before and after



Aeration Basin Upgrade Proof

10 month side-by-side comparison

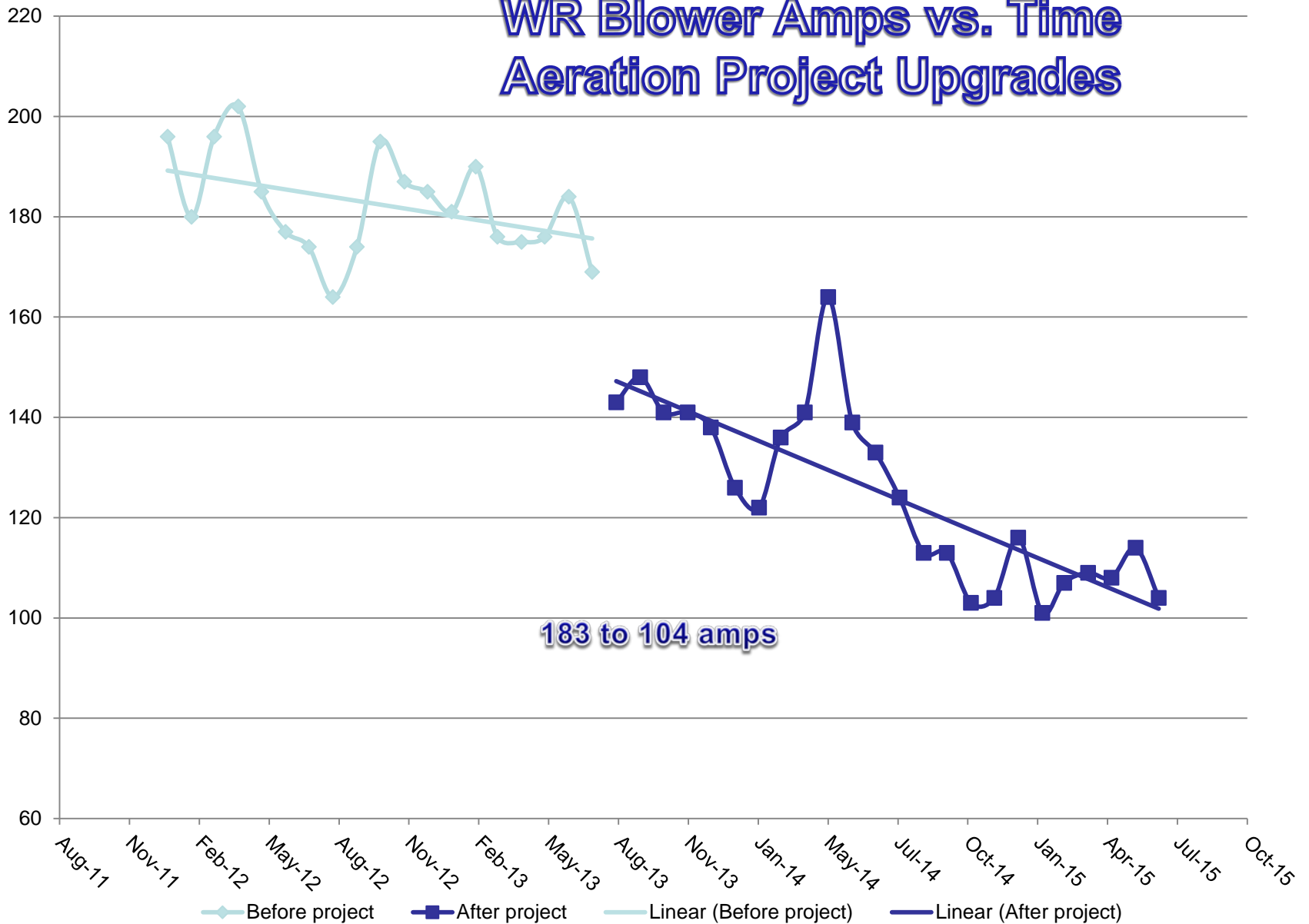
MLSS	lbs solids in aeration	Aeration Flow MGD	Jet Aeration Tanks				Fine Bubble Tanks		
			average cfm	30 min Settle	ammonia (mg/l)	SVI	Average cfm	30 min Settle	ammonia (mg/l)
3206	89127	16.2	3048	281	2.65	88	2026	270	1.70

% less	33.5%	3.9%	36.0%
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33% less air with 36% better treatment



WR Blower Amps vs. Time Aeration Project Upgrades



Aeration Upgrades



Aeration Project Upgrade

Electrical Savings

Aeration Needs	
Before amps	183
After	104
Amps	79
Volts	4160
watts	328640
kW	328.64
kWh/day	7887
kWh/year	2,878,886
per year @\$0.07/kWh	\$ 201,522

Mixing Pumps	
Online	18
Amps	14
watts	120960
kW	121
kWh/day	2,903
kWh/year	1,059,610
\$ per year	\$ 74,173

$$\text{\$201,522} + \text{\$74,173} = \text{\$275,695/year}$$

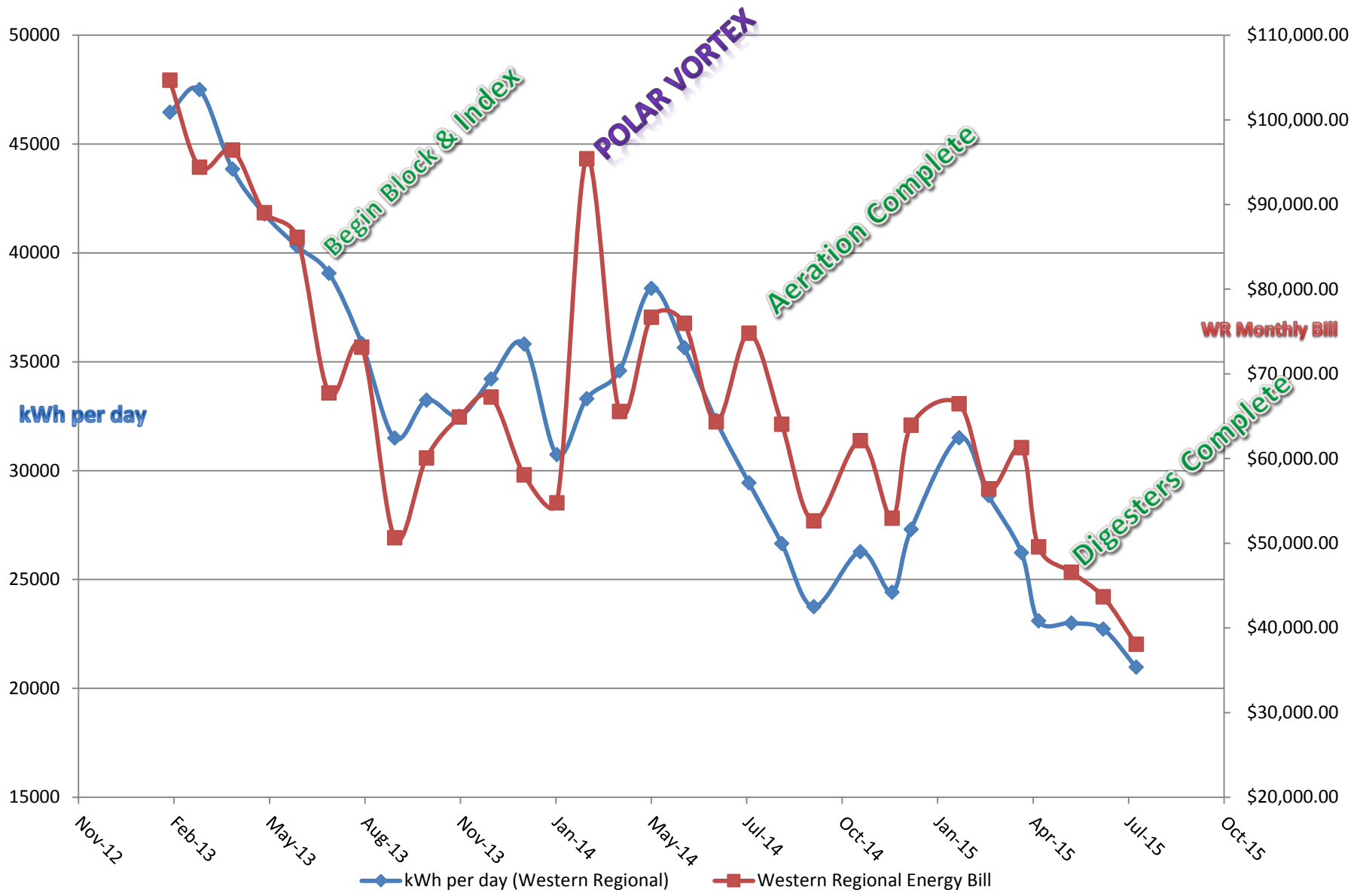


Additional Benefits

- Better treatment of wastewaters
 - (Increased Capacity)
- Better settling sludge
 - Potentially extend life of clarifiers equipment
- Passing digesters faster
 - Lower Biosolids costs and flexibility
- Potential DPLER energy rebates
 - Rebate evaluation and processing in the works
- Decreased foaming of basins and digesters
- Increased operations/maintenance moral
- Potential for phosphorus reduction
 - New controls will help WRF meet potential future phosphorus limits

Many hidden long term benefits





Western Regional Usage & Bills



Key Performance Indicators

WHY DO YOU NEED THEM?

Book Answer

Once an organization has analyzed its mission, identified all its stakeholders, and defined its goals, it needs a way to measure progress toward those goals. Key Performance Indicators are those measurements.

My Answer

Streamline operations and document using rate payers money in a responsible manner



Targeting Zero

- If you are targeting zero violations, and this is your main KPI, you will never try to run your plant more efficient- Hence no need for KPIs
- Zero Target will promote robot operators and over treatment in operations that will cost \$\$\$
- Wasting electricity and chemicals is guaranteed



Problems with External Benchmarking

There are lots of factors that make your utility unique. **Do not** waste your time comparing yourself to others that might be similar. They are not.

Here are a few of the many reasons why?



Regional Weather

- Many different climates in the US
- Wet areas, dry areas, harsh winters, mountains, depth to water, storm events (inflow and infiltration),
Combined sewer systems



Population Density

- Various population settings
- Urban, suburban, rural, size of watershed, growing cities, dying cities, manufacturing bases



Socioeconomically

- This is a financial based comparison
- Cost of living
- Price of energy, chemicals, labor
- Union vs. non-union labor
- Employee retirement systems
- Age of the workforce
- New infrastructure vs. old infrastructure



Permit Limits

- Nitrogen limits
- Phosphorus limits
- Seasonal Limits
- Discharge locations and discharge bodies of water

Benchmarking

- Compare yourself to your **old** self, your **current** self and your **future** self!!!
- Find historical trends of operations, set yearly goals, and keep improving each year until your trend lines plateau
- Trend before and after known changes to verify changes are for the better

Excel and charting are how you show trends



What do Good KPIs need?

- Need to be **quantifiable** - numbers
- Need to be in units that **do not change**
- If using dollar amounts need to be **consistent over time** (commodity swings not representative)
- Need to use Consumer Price Index (CPI) to **standardize dollar amounts** over time
- Need to be in units that are easy and consistent to measure over time
- Hopefully data you have **historically**



Time Period

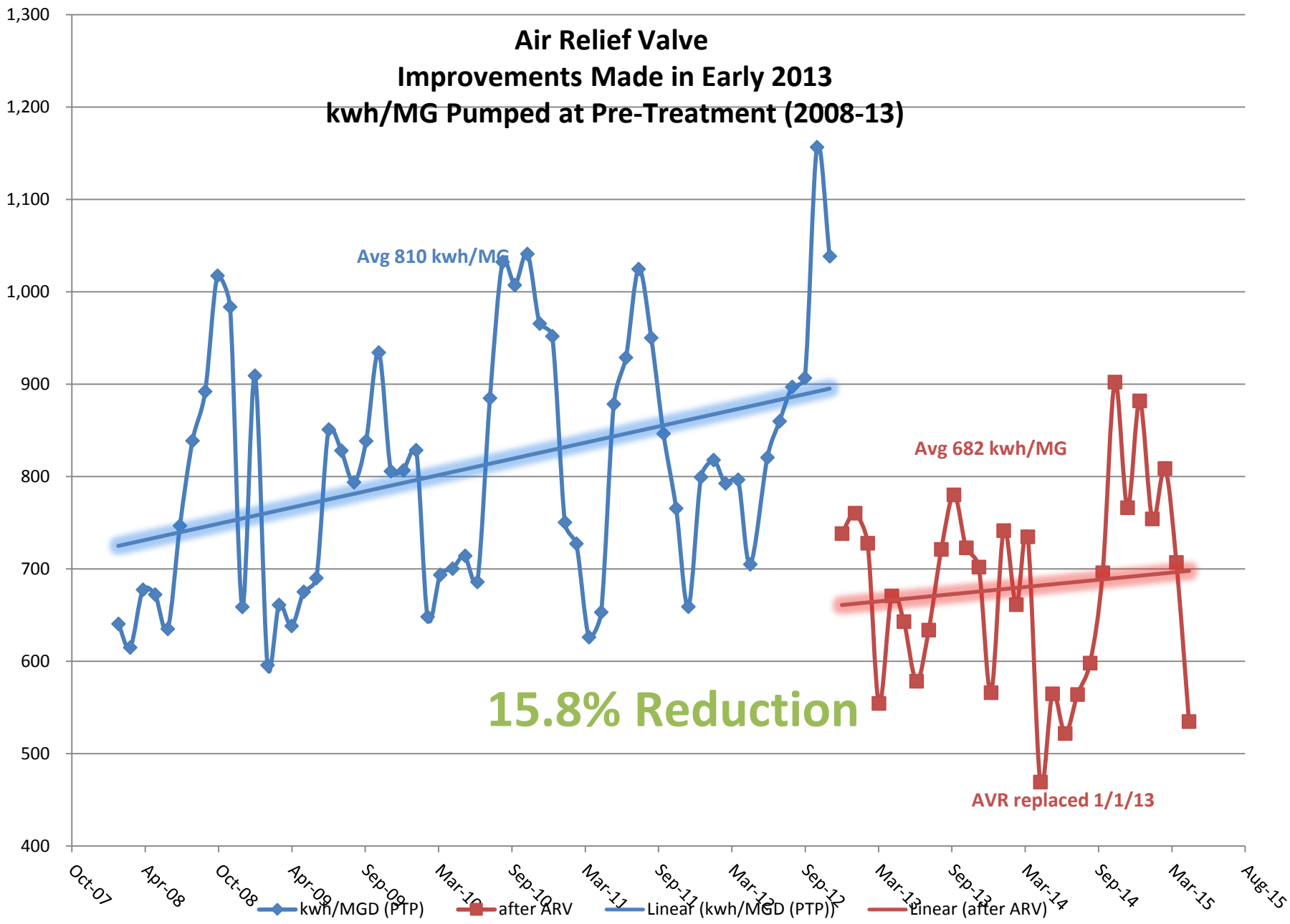
- At least a month (average daily results) to show noticeable trends
 - Electric bills monthly
 - eDMR monthly (permit)
 - Bacteria take 2-3 weeks to grow (see changes)
 - Financial reports monthly
- Quarter or yearly too long to wait to see changes or comparisons

So I recommend monthly KPIs

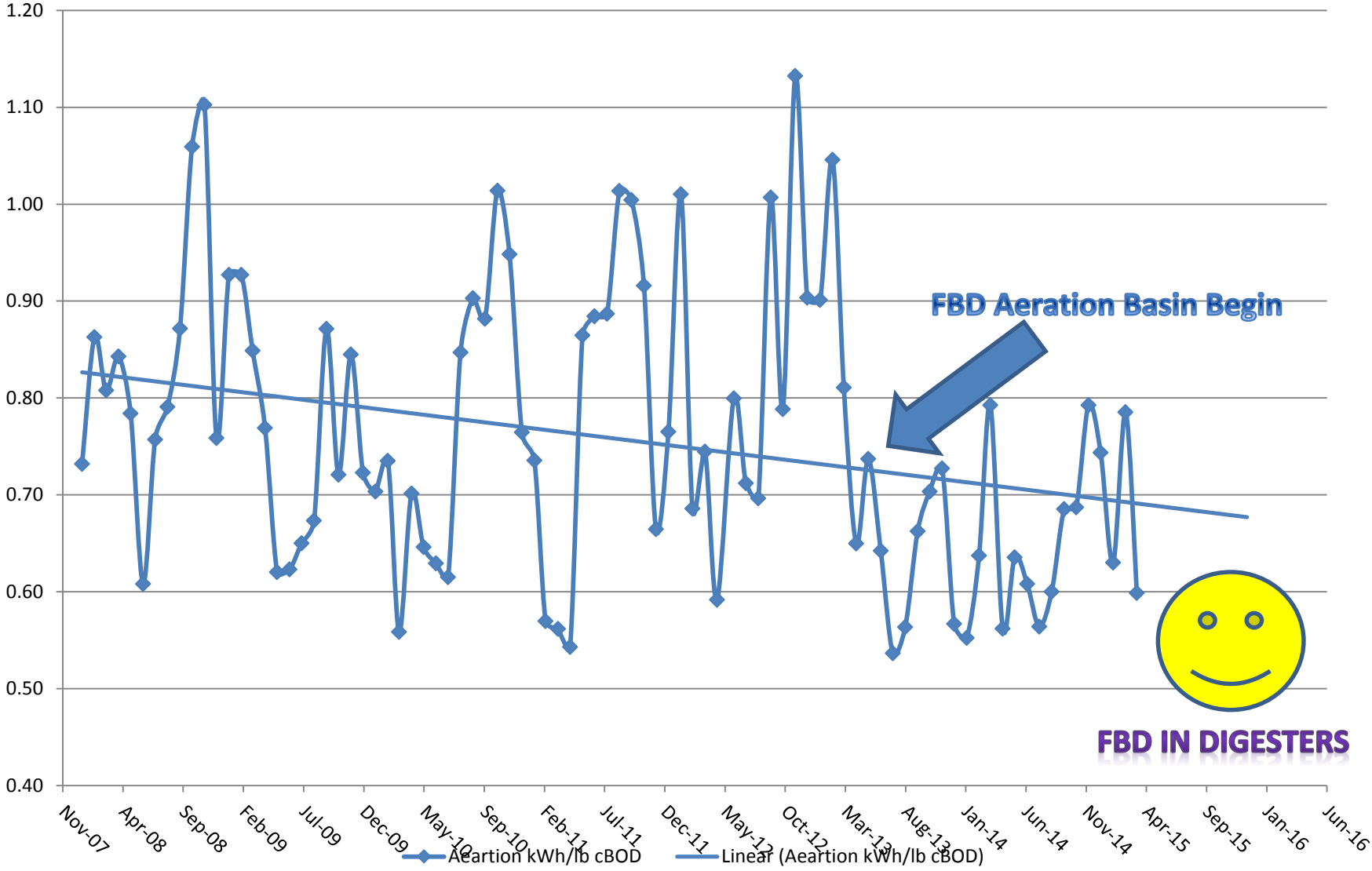


Air Relief Valve Improvements Made in Early 2013

kwh/MG Pumped at Pre-Treatment (2008-13)



Aeration kWh/lb cBOD



FBD IN DIGESTERS



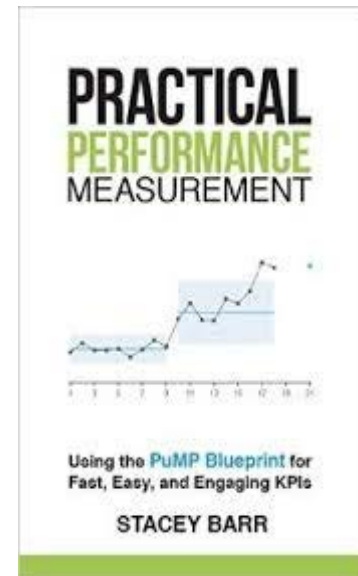
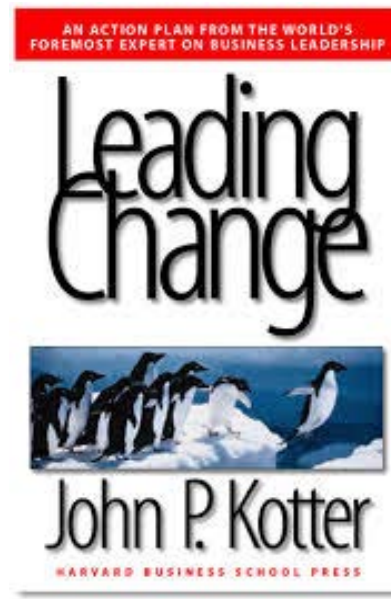
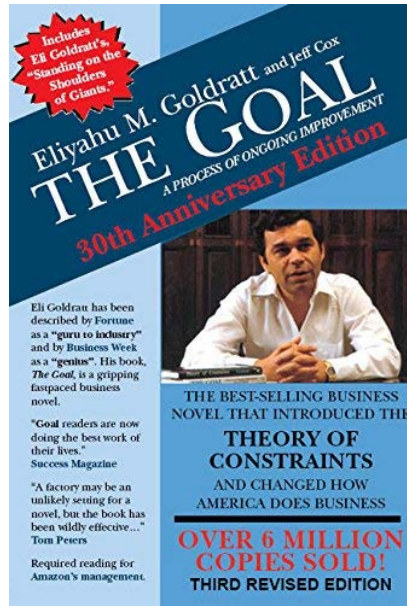
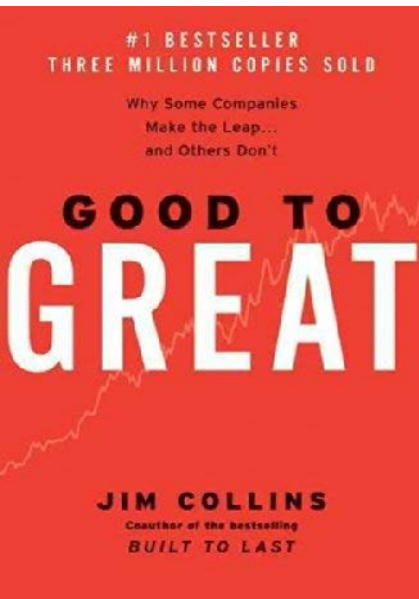
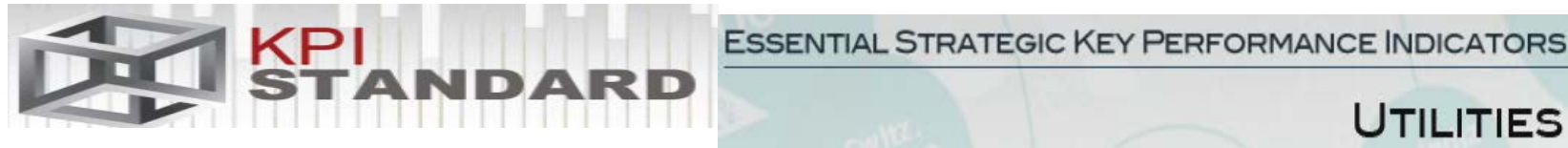
Wastewater KPIs

- *O & M Expense per month*
- *Aeration kWh per pound of cBOD treated per month (WR)*
- *kWh per pound of cBOD treated per month*
- *% Emergency Maintenance work per month*
- *Pounds of disinfection chemicals per MG per month*
- *kWh per MG pumped at Pre-Treatment (PTP)*
- *pounds of ferric chloride per pounds of Total Phosphorus removed per month*
- *Biosolids costs per month (pressing +disposal)*
- *kWh per pound of ammonia treated per month*
- *kWh per pound of TSS treated per month*



Sources of Information and Ideas

- http://en.wikipedia.org/wiki/Performance_indicator
- http://www.pwc.com/gx/en/audit-services/corporate-reporting/assets/pdfs/UK_KPI_guide.pdf



Questions Now

Or Later

Kevin Krejny

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