Saving Energy by Saving Water

PNWS-AWWA Annual Conference
May 7, 2014

Layne McWilliams
Water/Wastewater Sector Specialist

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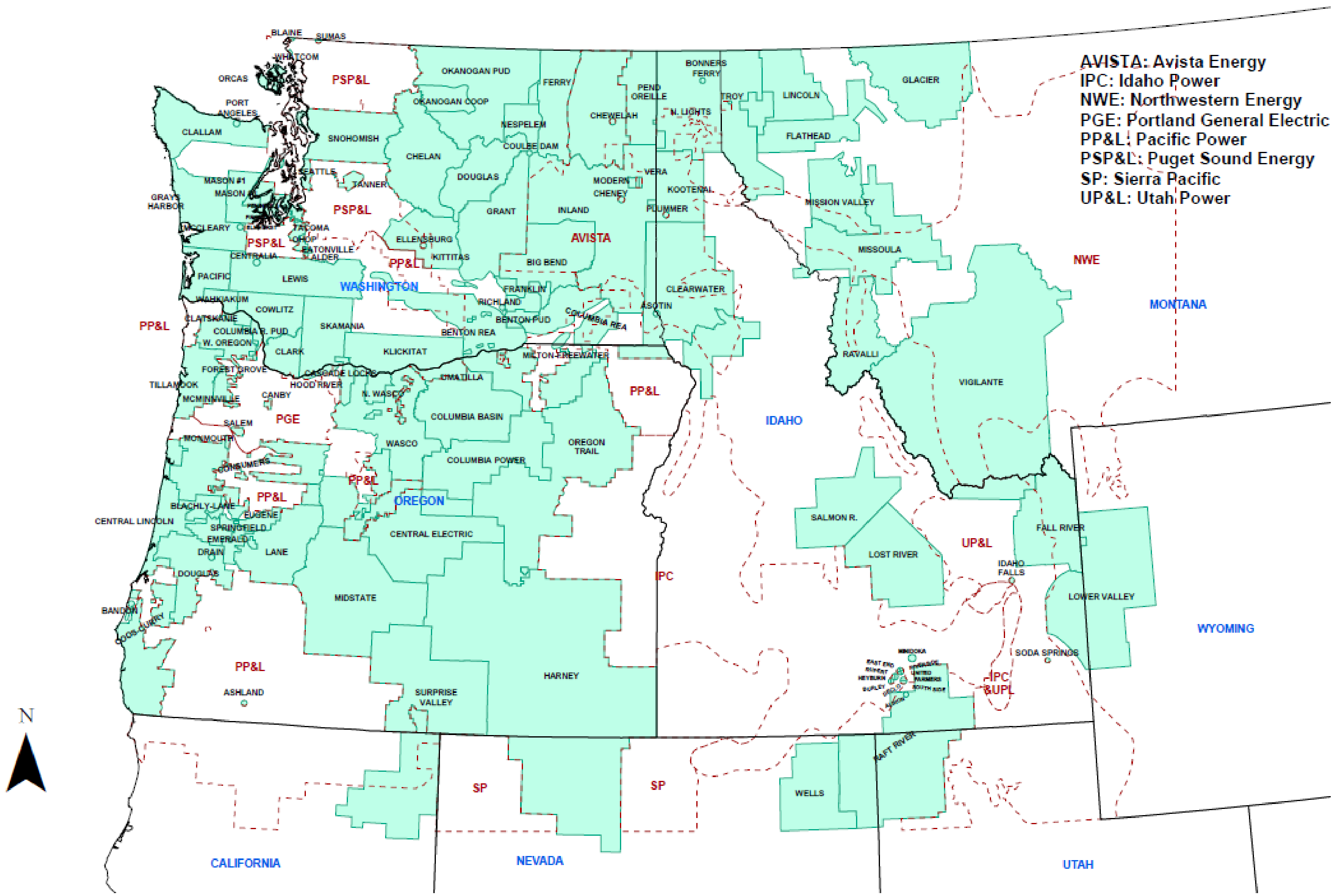
PNWS • AWWA
Eugene 2014
Tap the Wave of Change

Who do you pay for your water?



IOU

Public Utility

Utilities in the Bonneville Power Administration Service Territory

March 2005

ESI Utilities Within Washington

WASHINGTON (WEST)
Blaine, City of
Centralia City Light
City of McClearly Light & Power
Clallam County PUD
Clark Public Utilities
Cowlitz County PUD
Eatonville, Town of
Grays Harbor PUD
Jefferson County PUD #1
Klickitat Co. PUD #1
Lakeview Light & Power
Lewis County PUD
Mason PUD #1
Mason PUD #3
McCleary, City of
Milton, City of
Orcas Power & Light
Pacific Co. PUD #2
Peninsula Light
Port Angeles, City of
Seattle City Light
Skamania County PUD #1
Snohomish County PUD
Sumas, City of
Tacoma Power
US Navy Bremerton
Tanner Electric Coop
Wahkiakum PUD
Whatcom County PUD #1

WASHINGTON (EAST)
Asotin County PUD
Benton Co. PUD
Benton REA
Big Bend Electric Coop
City of Cheney Light & Public Works
City of Chewelah Electric Department
Columbia REA
Consolidated Irrigation District
Coulee Dam, Town of
Ellensburg, City of
Ferry County PUD #1
Franklin County PUD #1
Inland Power & Light
Kittitas County PUD
Modern Electric Water Company
Nespelem Valley Electric Cooperative
Okanogan PUD #1
Pend Oreille PUD
Richland, City of
Vera Water and Power

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ESI Utilities Within Oregon

Oregon
Ashland, City of
Bandon, City of
Blachly-Lane Co. Coop
Canby Utility Board
Central Electric Coop
Central Lincoln PUD
Clatskanie PUD
Columbia Basin Electric Coop
Columbia Power Coop Association
Columbia River PUD
Consumer Powers Inc
Coos-Curry Electric Coop
Douglas Electric Coop
Emerald PUD
Eugene Water & Electric Board
Forest Grove Light & Power
Hood River Electric Coop
Lane Electric Coop
McMinnville Water & Light
Midstate Electric Coop
Milton-Freewater Light & Power
Northern Wasco County PUD
Oregon Trail Electric
Salem Electric
Springfield Utility Board
Tillamook PUD
Umatilla Electric Coop
Umpqua Indian Utility Coop
Wasco Electric Coop
Western Oregon Electric Coop

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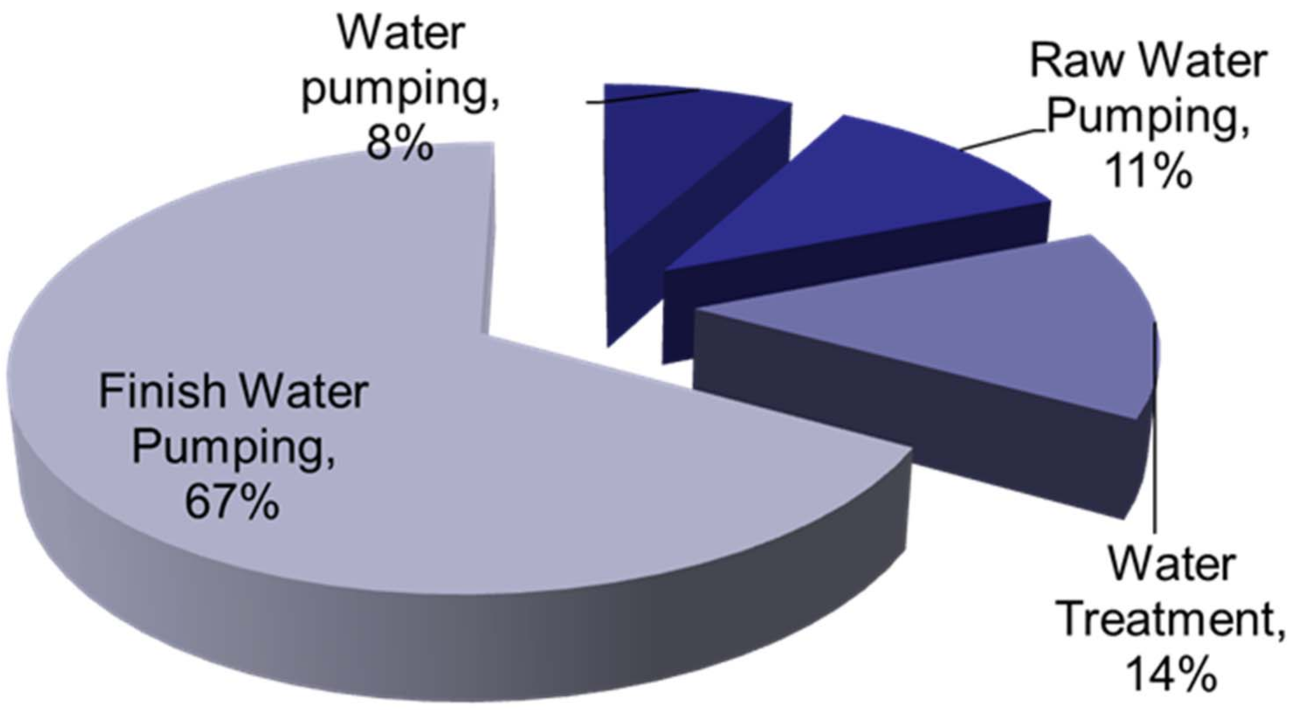
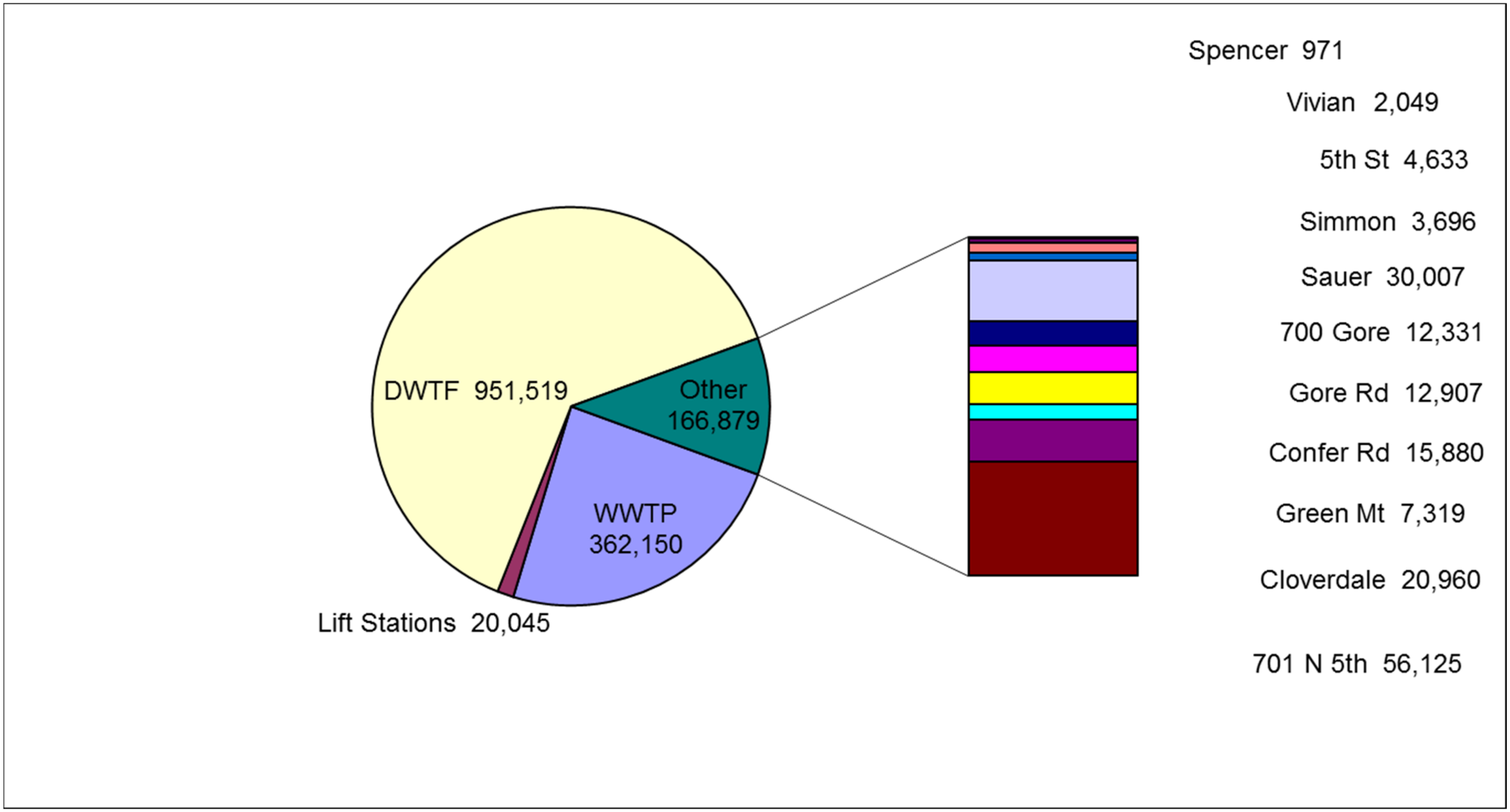
ESI Utilities Within Idaho

IDAHO
Albion, City of
Bonners Ferry, City of
Burley, City of
Clearwater Power Company
Declo, City of
East End Coop
Fall River Rural Electric Coop
Farmers Electric Coop
Heyburn, City of
Idaho County Light & Power
Idaho Falls, City of
Kootenai Electric Coop
Lower Valley Electric Coop
Northern Lights Inc.
Plummer, City of
Raft River Electric
Riverside Electric Coop
Rupert, City of
Salmon River Electric Cooperative
Soda Springs Municipal Light
United Electric Coop
Weiser, City of

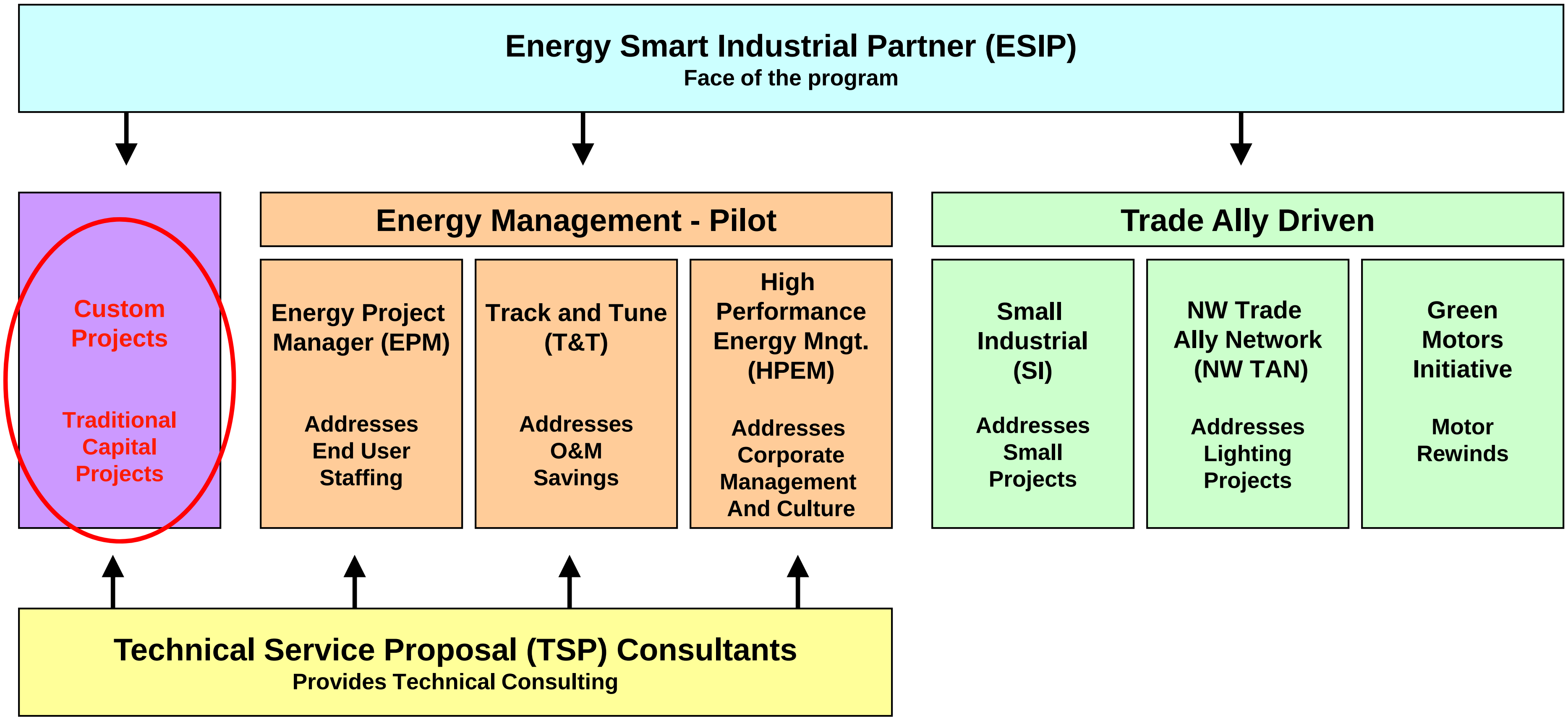
Typical Water Facility Energy Use

Thank you Steve James, J-U-B Engineers




Spencer 971
Vivian 2,049
5th St 4,633
Simmon 3,696
Sauer 30,007
700 Gore 12,331
Gore Rd 12,907
Confer Rd 15,880
Green Mt 7,319
Cloverdale 20,960
701 N 5th 56,125
DWTF 951,519
Other 166,879
WWTP 362,150
Lift Stations 20,045

Energy Smart Industrial Program Components



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Custom Projects

- Incentives for traditional capital projects.

- Pumps
- Fans
- Compressed Air
- Refrigeration
- Lighting
- Motors
- Variable Frequency Drives
- Control Upgrades
- Process Upgrades

-Depending upon utility, but up to $0.25 per kWh saved in first year.

-Capped at 50 to 70% of project cost (again, depending)

> -You get the lesser of 25 cents / kWh OR 70% of project cost.
>
> -Project cost can include design fees, and can be incremental cost between “baseline” and “efficient” equipment for new construction

-Paid based on Measured and Verified (M&V) savings.

> -The payment comes after the project is complete, so capital funds still needed upfront to cover the project.

Custom Projects

- And some not-so-traditional . . .

- Leak detection & repair
- Piping improvements
- Water network optimization
- Sourcing projects (surface water vs. wells)

Leak Detection & Repair

Yes, water projects are

ENERGY PROJECTS!

WATER TAP

WASHINGTON'S DRINKING WATER NEWSLETTER

- September 2012 Issue: Leak Detection Example

1	Energy Consumed 2011		400,000	kilowatt-hours (kWh)
2	Water Production 2011		200	Million Gallons (MG)
3	Your energy metric		2,000	kWh/MG Produced
4	Your energy rate	$	0.075	per kWh
5	Your water costs	$	150.00	per MG produced

WATER TAP
WASHINGTON'S DRINKING WATER NEWSLETTER

- September 2012 Issue: Leak Detection Example

	WUE Report:		
6	Customer Purchased	150	MG
7	Known non-revenue	10	MG
8	Unallocated (Leaks?)	40	MG
9	That costs you:	$ 6,000	annually

- 40 MG x $150/MG = $6,000

WATER TAP
WASHINGTON'S DRINKING WATER NEWSLETTER

- September 2012 Issue: Leak Detection Example

10	System Repairs Reduce Leaks by:		20	MG annually
11	Resultant energy savings		40,000	kWh
12	Resultant cost savings	$	3,000	annually

- 20 MG x 2000 kWh/MG = 40,000

- 20 MG x $150/MG = $3,000

WATER TAP
WASHINGTON'S DRINKING WATER NEWSLETTER

- September 2012 Issue: Leak Detection Example

13	Incentive Rate	$	0.180	per kWh
14	Incentive capped at ___ of project		50%	
15	Cost of detection & repair	$	10,000	your cost
16	Maximum incentive (no cap)	$	7,200	(40,000 x 0.18)
17	Incentive with cap	$	5,000	(50% of project cost)
18	Net project cost	$	5,000	

- 13 & 14 are power utility program specific

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WATER TAP
WASHINGTON'S DRINKING WATER NEWSLETTER

- September 2012 Issue: Leak Detection Example

Simple Economic Analysis				
19	Cost of Project After Incentive	$	5,000	net cost
20	Annual energy cost savings	$	3,000	
21	**Simple Payback**		**1.67**	**years**

- Incentive programs are intended to help you move forward with projects that lead to energy savings.

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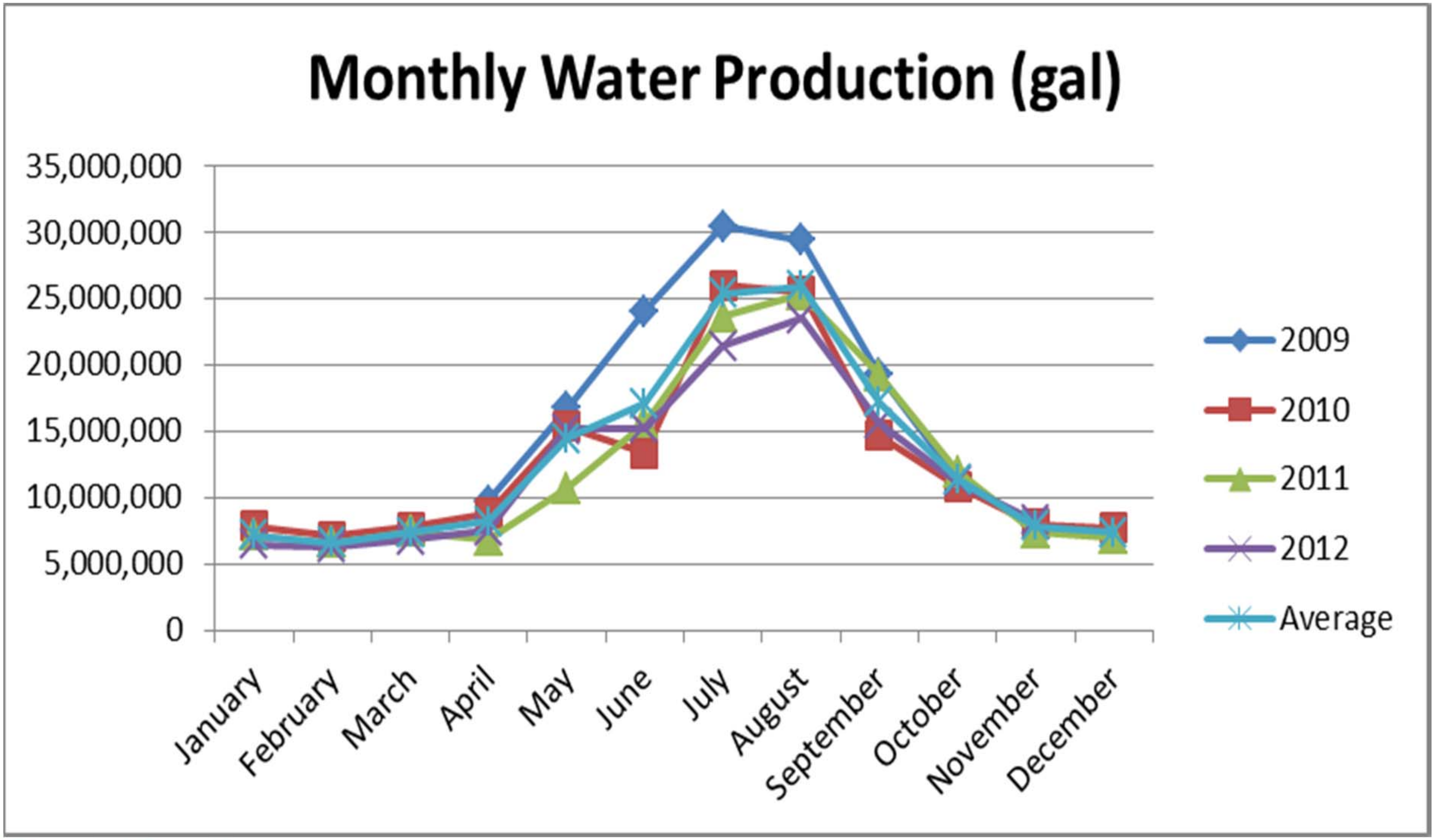
Recent Example of Analysis



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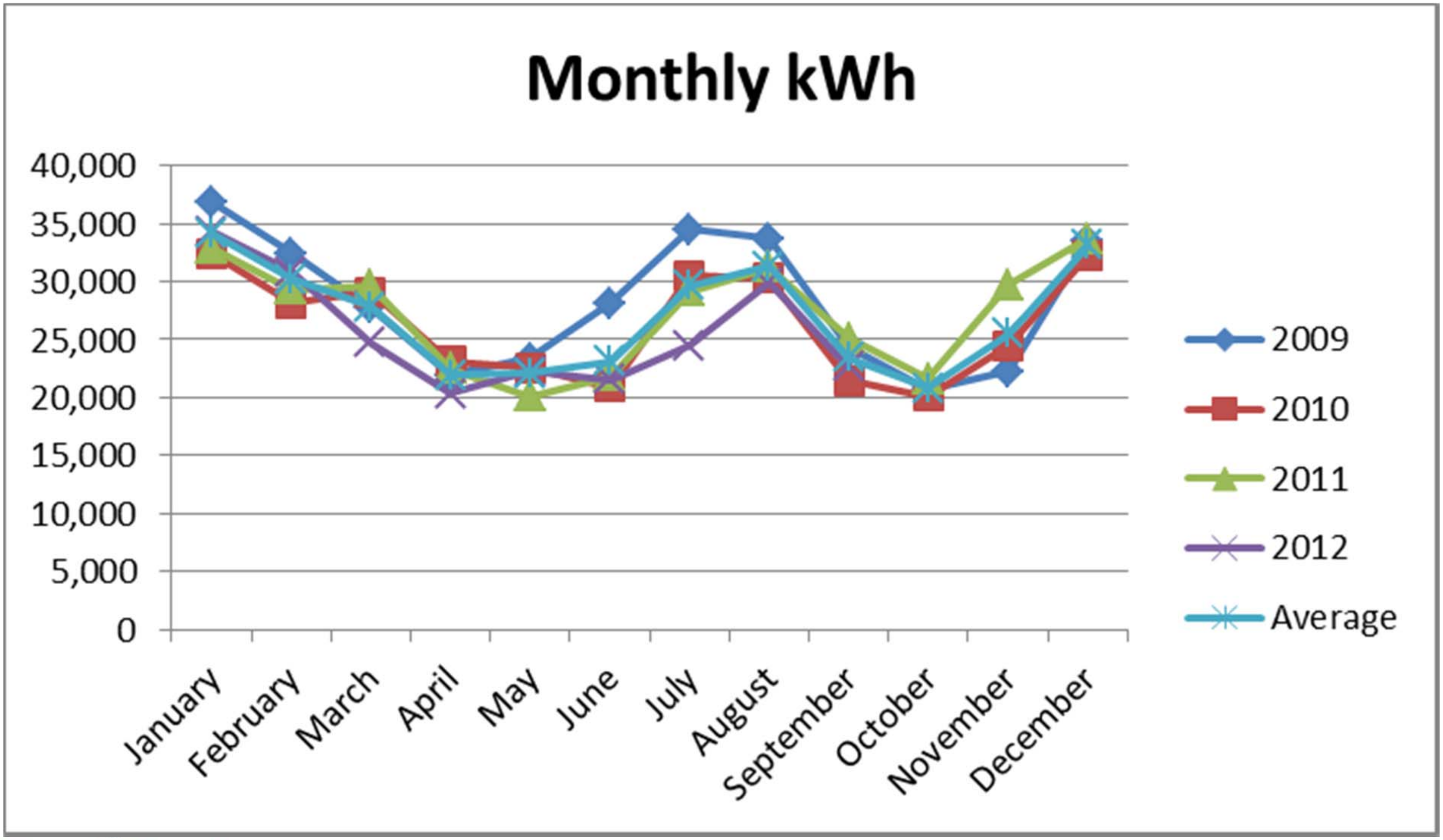
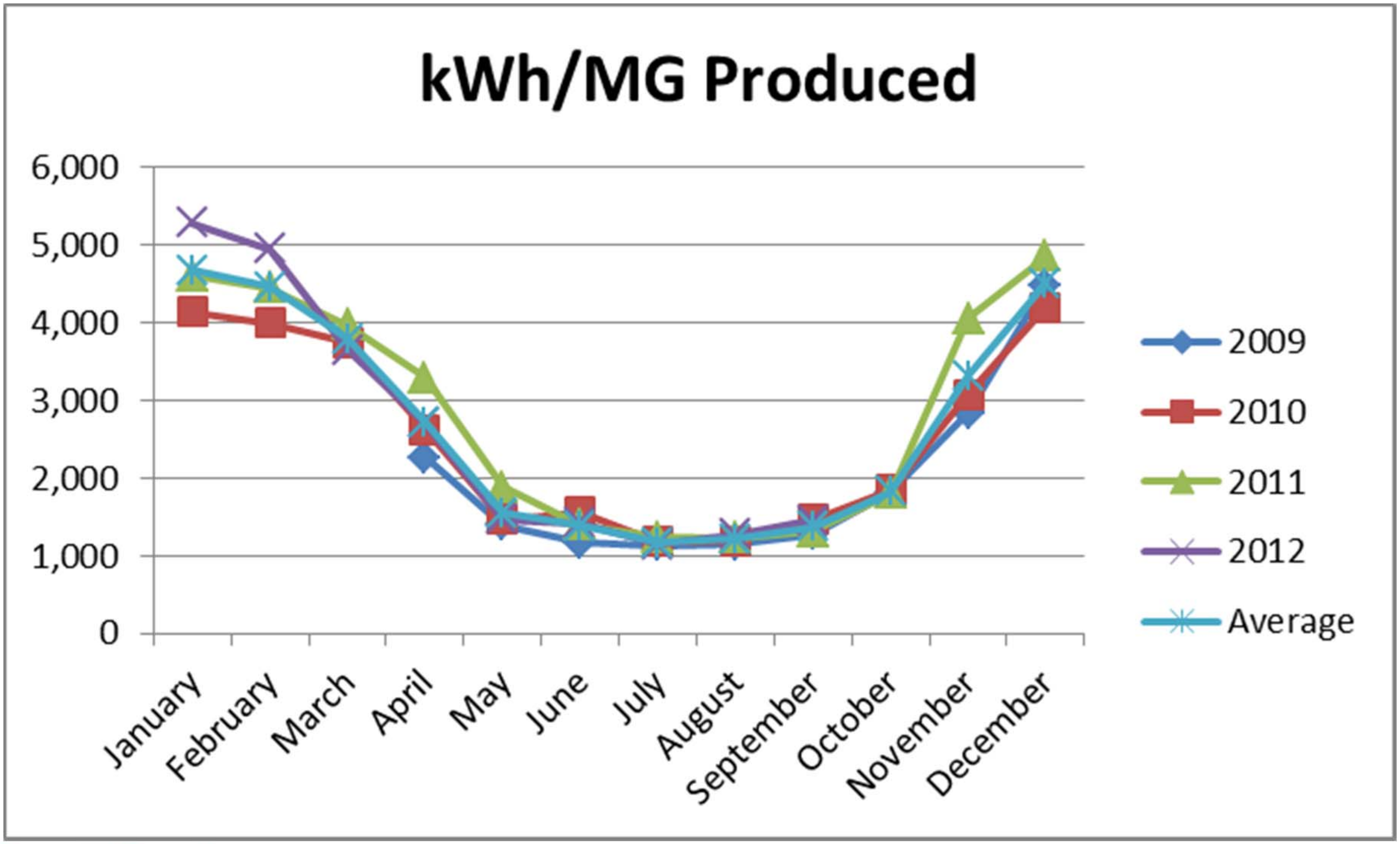
Recent Example of Analysis



Recent Example of Analysis



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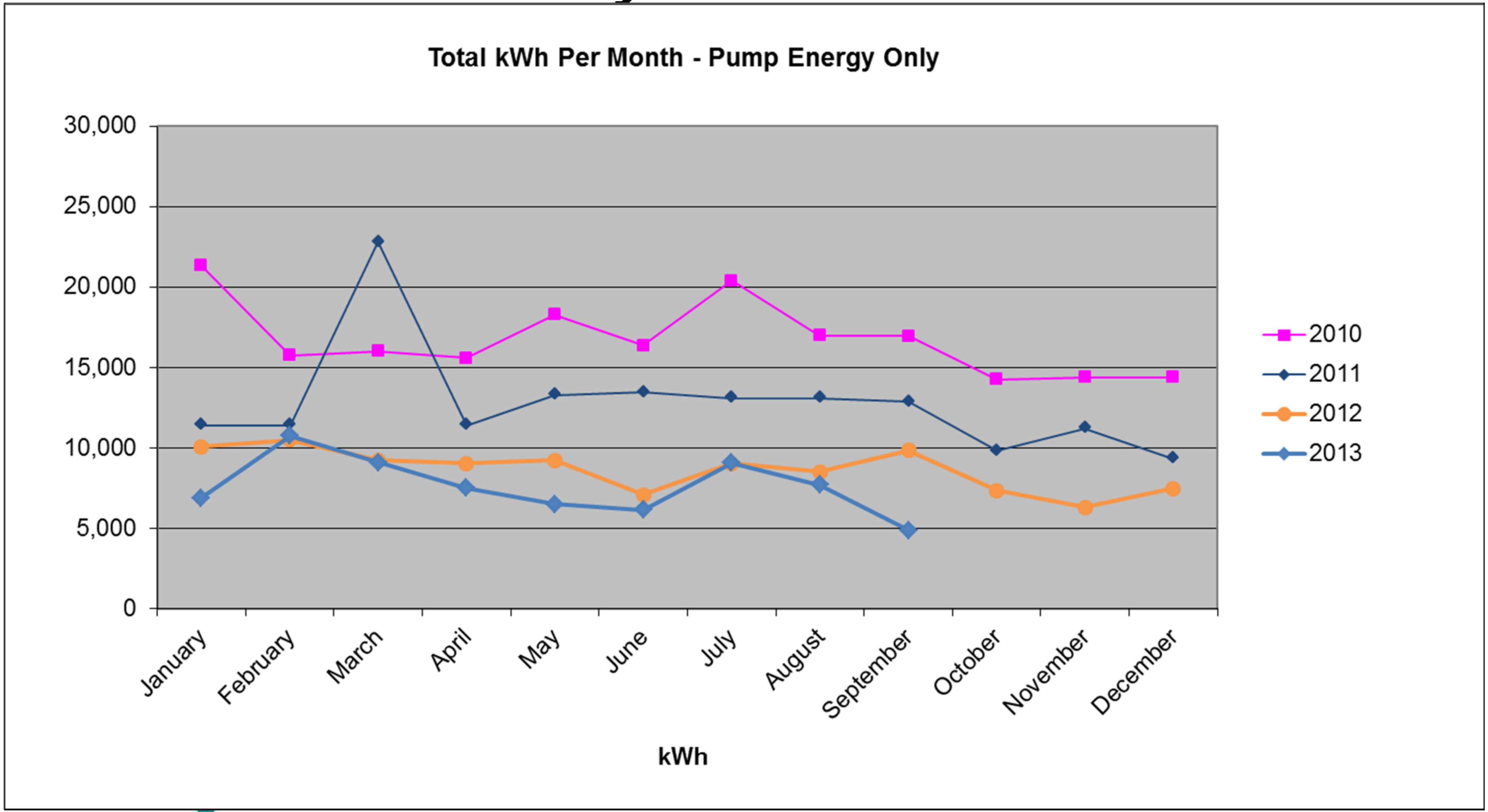
SUMMARY OF PROJECT ECONOMICS BASED ON 2009-2012 DATA			
ITEM	Amount	Unit	Description
a	156,005,667	gal	Annual Water Production (from report)
b	31,257,351	gal	Annual Unallocated Water (from report)
c	1,339	kWh/MG	Summertime Unit Pumping Energy (calculated)
d	323,127	kWh	Annual Overall Energy Consumption (from billing)
e	208,860	kWh	Annual Pumping Energy (= a x c)
f	114,267	kWh	Annual Heating Energy (= d - e)
g	41,847	kWh	Annual Energy Associated withUnallocated Water (= b x c)
h	$ 0.25		Incentive Rate per kWh
i	$ 10,462		Max Incentive (assumes 100% leak repair)
j	$ 0.045		Blended Energy Rate ($ / kWh)
k	$ 1,883		Annual Energy Cost Reduction from 100% Repairs

A Small System's Success



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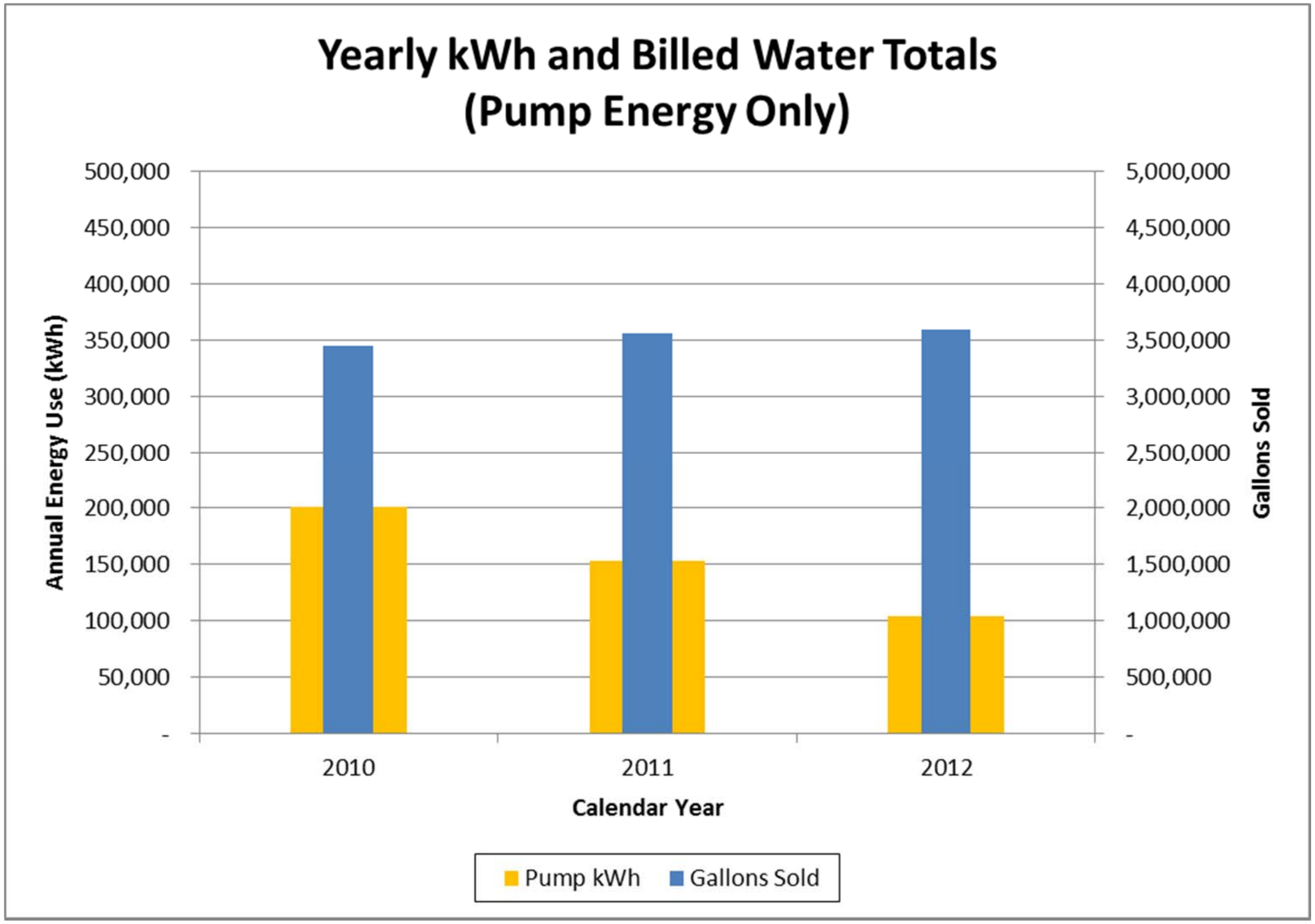
A Small System's Success



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A Small System's Success

	Winter Losses	Winter Leak Rate	Summer Leaks Repaired	Annual Water Saved	Cumulative Annual Savings	Annual Energy Saved**
Units-->	Gallons	GPM	GPM	Mill. Gal.	Mill. Gal.	kWh
2010	13,645,600	62.31	7.30	3.84	3.84	22,209
2011	12,047,380	55.01	19.90	10.46	14.29	60,549
2012	7,690,065	35.11	7.28	3.83	18.12	22,150
***2013	6,096,065	27.84	9.90	5.20	23.32	30,128

C A S	Cumulative Annual Avoided Cost
	$
21	$ 1,721
93	$ 6,414
17	$ 8,130
35	$ 10,465

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System Energy Optimization

- Mid-size city's hydraulic model relatively up to date.
  - Hydraulic modeling software was developed to help insure that every customer has sufficient volume and pressure.
  - Pump station modules included, but generally only concerned with flow and pressure capacity.
- ESI program provided funding for consultant to add energy modules to the model.
  - Includes pump curve information for each station, energy consumption and demand costs, motor information, etc.
  - City staff then calibrated the modeled characteristics with actual operations.

SCENARIO SUMMARY

SCENARIO	TOTAL PUMPED	DAILY TOTAL POWER USE - WINTER ADD	MONTHLY TOTAL POWER USE - WINTER ADD
# 1	19.35 MGD	$ 5,141.79	$ 154,253.76
# 2	18.55 MGD	$ 4,665.92	$ 139,977.59
# 3	18.54 MGD	$ 4,186.40	$ 125,591.87
# 4	18.47 MGD	$ 4,145.92	$ 124,377.50
# 5	18.51 MGD	$ 4,072.54	$ 122,176.29
# 6A	18.72 MGD	$ 4,163.24	$ 124,897.32
# 6B MINUS WS15	18.59 MGD	$ 4,208.11	$ 126,243.43
# 7	18.82 MGD	$ 4,145.69	$ 124,370.55
# 8	18.61 MGD	$ 4,282.75	$ 128,482.39
# 9 OLD BOOSTER	18.78 MGD	$ 4,739.17	$ 142,175.12
# 9 NEW BOOSTER	18.89 MGD	$ 4,300.81	$ 129,024.29
# 10	18.87 MGD	$ 3,970.44	$ 119,113.05
# 11	18.83 MGD	$ 3,828.59	$ 114,857.60
# 12	19.11 MGD	$ 4,589.41	$ 137,682.43

Close to Normal Ops

Best Case ~20% reduction in cost

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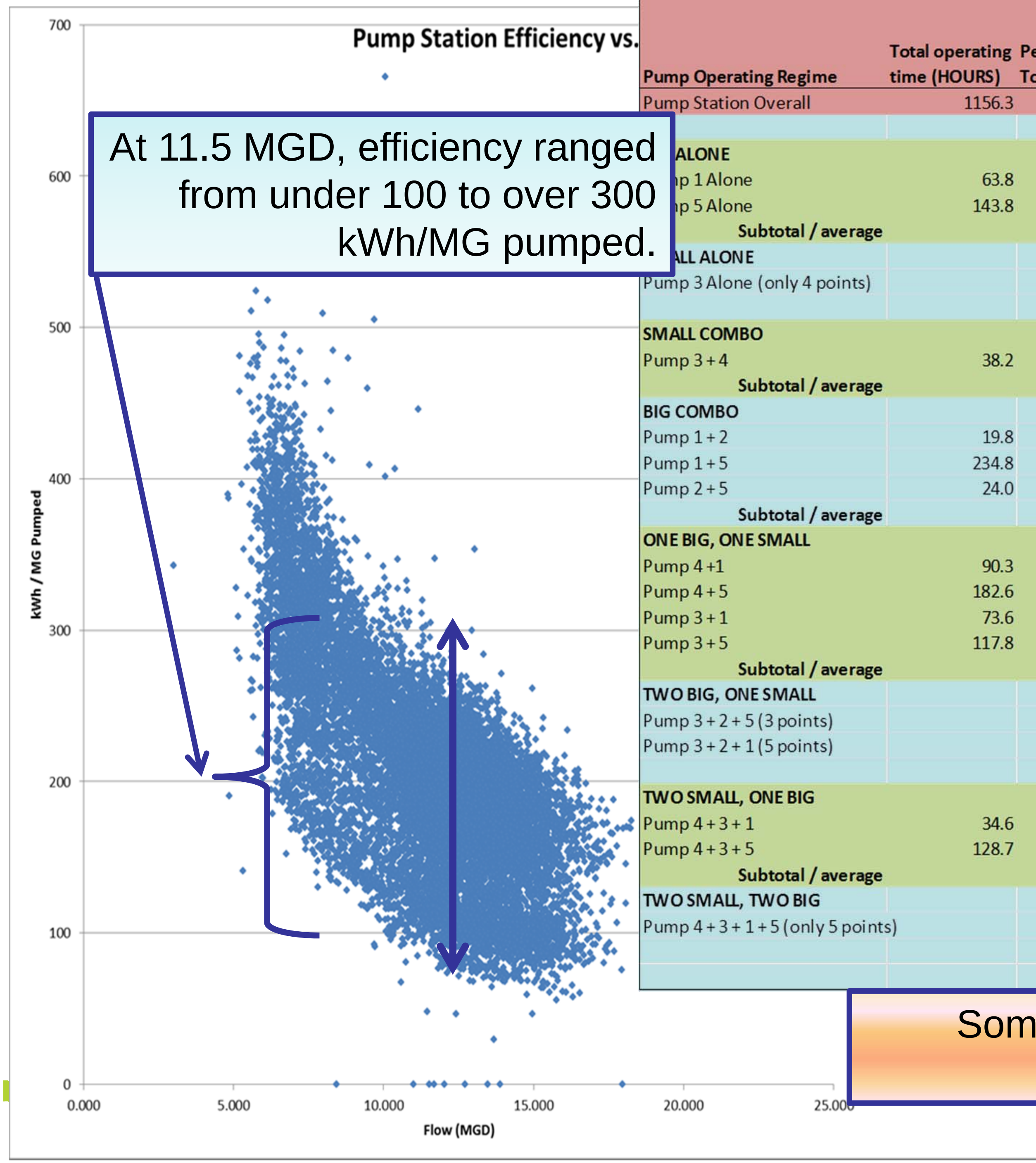
System Energy Optimization

- Influent pump lineup at a wastewater treatment plant.
- Three large and two small pumps to choose from
- Ragging was a maintenance nightmare
  - It was (and is) an energy nightmare as well
  - Using dataloggers and plant flowmeter, we were able to show the loss of performance due to ragging over time, as well as show how mis-matched pumps impact operating costs.

- The big message: "identical pumps" are not!



At 11.5 MGD, efficiency ranged from under 100 to over 300 kWh/MG pumped.

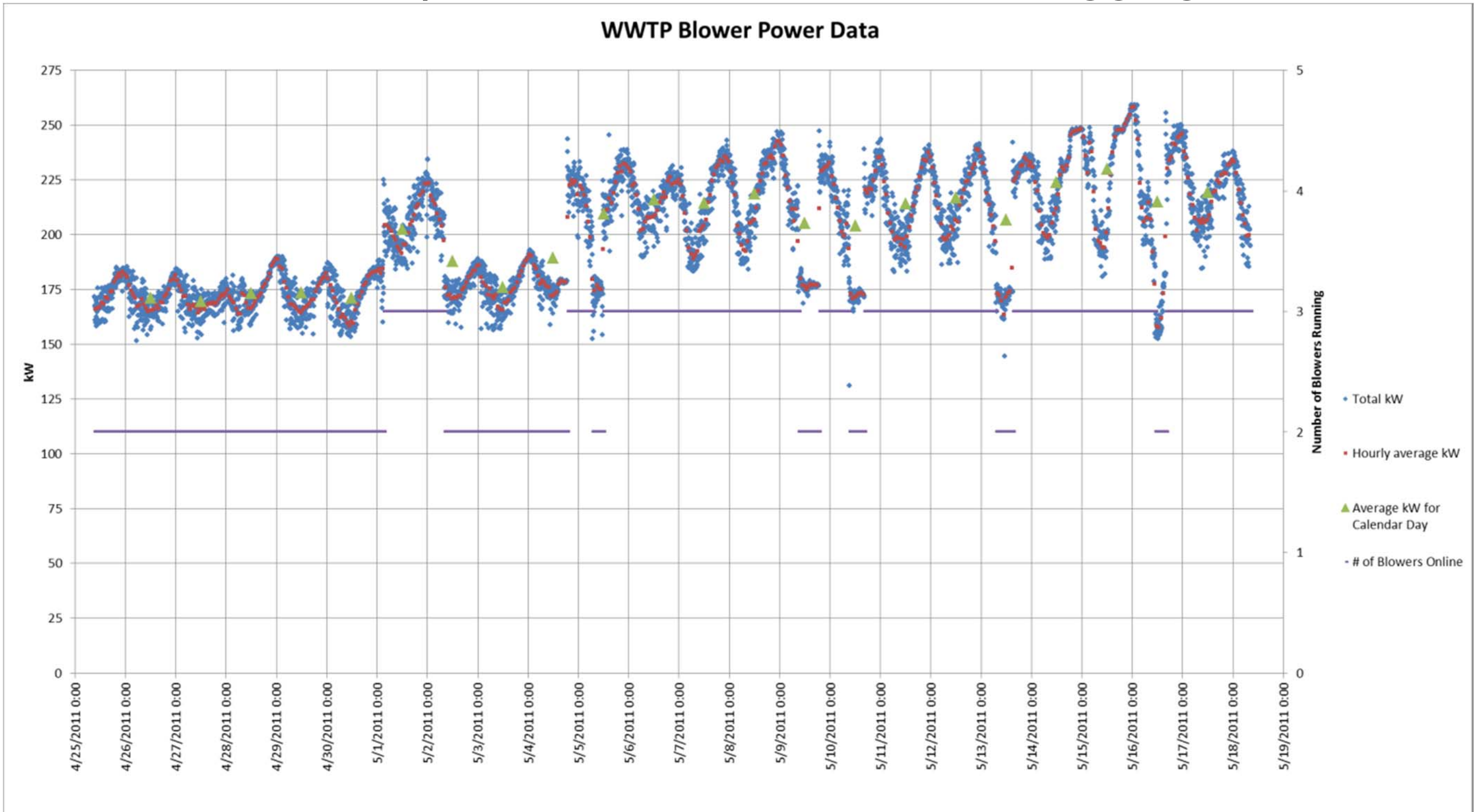
Pump Operating Regime	Total operating time (HOURS)	Percent of Total Runtime	Average flow (MGD)	Average kWh/MG Pumped	Flow % Offset from Ave	Eff % Offset from Ave
Pump Station Overall	1156.3		11.5	204.3	0.0%	0.0%
ALONE						
p 1 Alone	63.8	5.5%	10.9	140.2	-5.9%	31.4%
p 5 Alone	143.8	12.4%	12.2	126.8	6.0%	37.9%
Subtotal / average		**17.9%**	**11.5**	**133.5**	**0.1%**	**34.7%**
LL ALONE						
Pump 3 Alone (only 4 points)						
SMALL COMBO						
Pump 3 + 4	38.2	3.3%	12.9	100.3	12.2%	50.9%
Subtotal / average		**3.3%**	**12.9**	**100.3**	**12.2%**	**50.9%**
BIG COMBO						
Pump 1 + 2	19.8	1.7%	11.6	222.3	0.8%	-8.8%
Pump 1 + 5	234.8	20.3%	11.5	246.1	-0.7%	-20.4%
Pump 2 + 5	24.0	2.1%	11.4	243.3	-1.6%	-19.1%
Subtotal / average		**24.1%**	**11.5**	**237.2**	**-0.5%**	**-16.1%**
ONE BIG, ONE SMALL						
Pump 4 +1	90.3	7.8%	11.7	202.4	1.4%	0.9%
Pump 4 + 5	182.6	15.8%	11.3	209.3	-1.9%	-2.5%
Pump 3 + 1	73.6	6.4%	11.6	200.6	0.3%	1.8%
Pump 3 + 5	117.8	10.2%	11.1	208.7	-3.6%	-2.1%
Subtotal / average		**40.1%**	**11.4**	**205.3**	**-0.9%**	**-0.5%**
TWO BIG, ONE SMALL						
Pump 3 + 2 + 5 (3 points)						
Pump 3 + 2 + 1 (5 points)						
TWO SMALL, ONE BIG						
Pump 4 + 3 + 1	34.6	3.0%	13.3	206.1	15.3%	-0.9%
Pump 4 + 3 + 5	128.7	11.1%	10.9	260.0	-5.8%	-27.3%
Subtotal / average		**14.1%**	**12.1**	**233.1**	**4.7%**	**-14.1%**
TWO SMALL, TWO BIG						
Pump 4 + 3 + 1 + 5 (only 5 points)						

Some pump combinations should be avoided.

Project Documentation

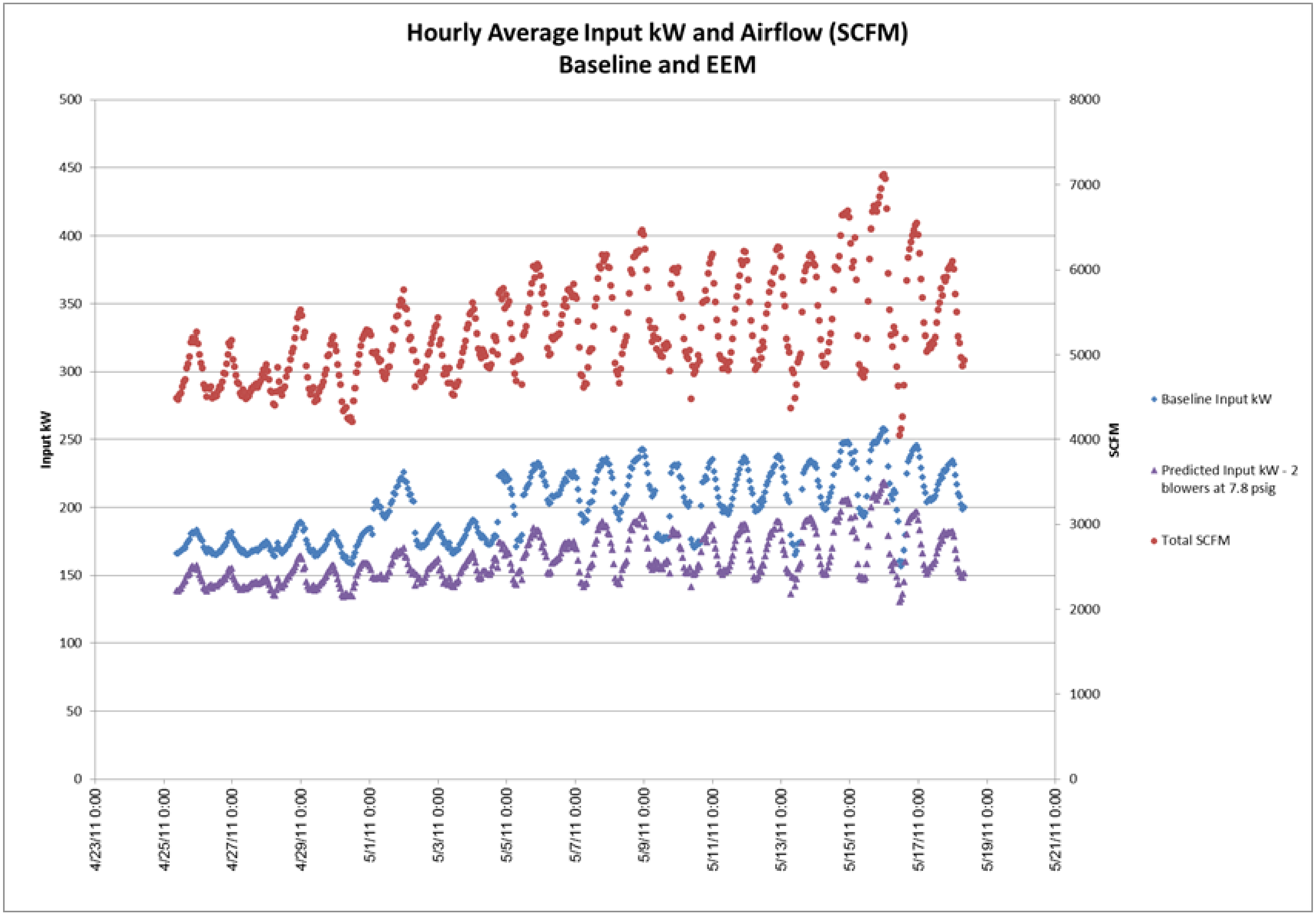
- ESI program will complete energy estimates and draft the Custom Project Proposal (CPP)
  - Engineer / Contractor help is welcome and usually required
- Once CPP is approved and project is complete, ESI program will complete the M&V
  - “M&V Light” = Spot checks + sound engineering
  - Full M&V can range from a couple weeks to several months of energy monitoring.
  - If monitoring equipment is part of plant, we can use that system in lieu of separate loggers.

Example of Robust, Short Term Logging



Resulting EEM Analysis

Figure 8: Model Results for Airflow, Baseline, and Predicted Blower kW



Things to Remember

- DON'T BUY EQUIPMENT UNTIL THE CPP IS APPROVED!

- We'll need to collect the project cost data, so if it can be gathered and organized during the project, it saves everyone time.

- We are here to help, so please just call or email.

The most common – and frustrating – tripping point is calling us too late to take advantage of the program.


Chad Reed →
thor
PARTS UNLIMITED
9
t: After grabbing the lead
to (2). Reed takes flight during

Don't be that guy…

You may be thinking . . .

This is hard! I need help! Is there someone around to help???

Layne McWilliams (east side)

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layne.mcwilliams@energysmartindustrial.com

Dawn Lesley (west side)

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