

Retro-Commissioning Dressing for Success



Jake Yanulavich

**Energy Services Engineer
Burlington Electric Dept.**



Eveline Killian

**Senior Engineer
Cx Associates, LCC**

Presentation Objectives

Retro-commissioning

- **Why** – The problem it solves and value it brings
- **What** is it?
- **Examples** of real projects and savings
- **How** do I get me some of that?
- **Value** of a trusted team

Retro-commissioning Defined:

Making the Building Work

Smoothly

Efficiently

Effectively

Buildings – Susceptible to Demons





Typical Findings



Leaky valves

Improper system setpoints

Simultaneous heating and cooling

Inoperative economizers

Unnecessary equipment runtime

Improper settings of VFDs

Why It's Worth Doing

- Commercial Buildings consume nearly 20% of all energy used in the United States.
- We spend more than \$200 billion each year to power our country's commercial buildings.
- “A typical commercial building could save 20% on its energy bills simply by commissioning existing systems so they operate as intended.”

USA Energy Efficiency Performance

As Reported by the ACEEE in 2012

- 1 – United Kingdom
- 2 – Germany
- 3 - Japan
- 4 - Italy
- 5 - France
- 6 - European Union
- Australia
- China
- **9 - USA**
- 10 – Brazil
- 11 - Canada
- 12 - Russia

As Reported by the ACEEE in 2014

- 1 – Germany
- 2 - Italy
- 3 - European Union
- 4 - China
- 5 - France
- 6 - Japan
- 7 - United Kingdom
- 8 - Spain
- 9 - Canada
- 10 - Australia
- 11 - India
- 12 – South Korea
- 13 – USA**
- 14 - Russia
- 15 – Brazil
- 16 - Mexico



A Trusted Team Working Together



Local Commercial Examples

- Building #1 –60,000sf, 4-story, 100 years old
- Building #2 – Fletcher Free Library
- Building #3 – Multi-story Park Garage

Example #1 – Typical Burlington Building

60,000 sf

100 years old

4 story brick construction





Commercial building

**Tenant heat pumps and central chilled/hot
water plant**



Problem Statement



-  **Constant speed pumps**
-  **Manual diverter valve**
-  **Failing controls**
-  **Open ductwork to MEP**



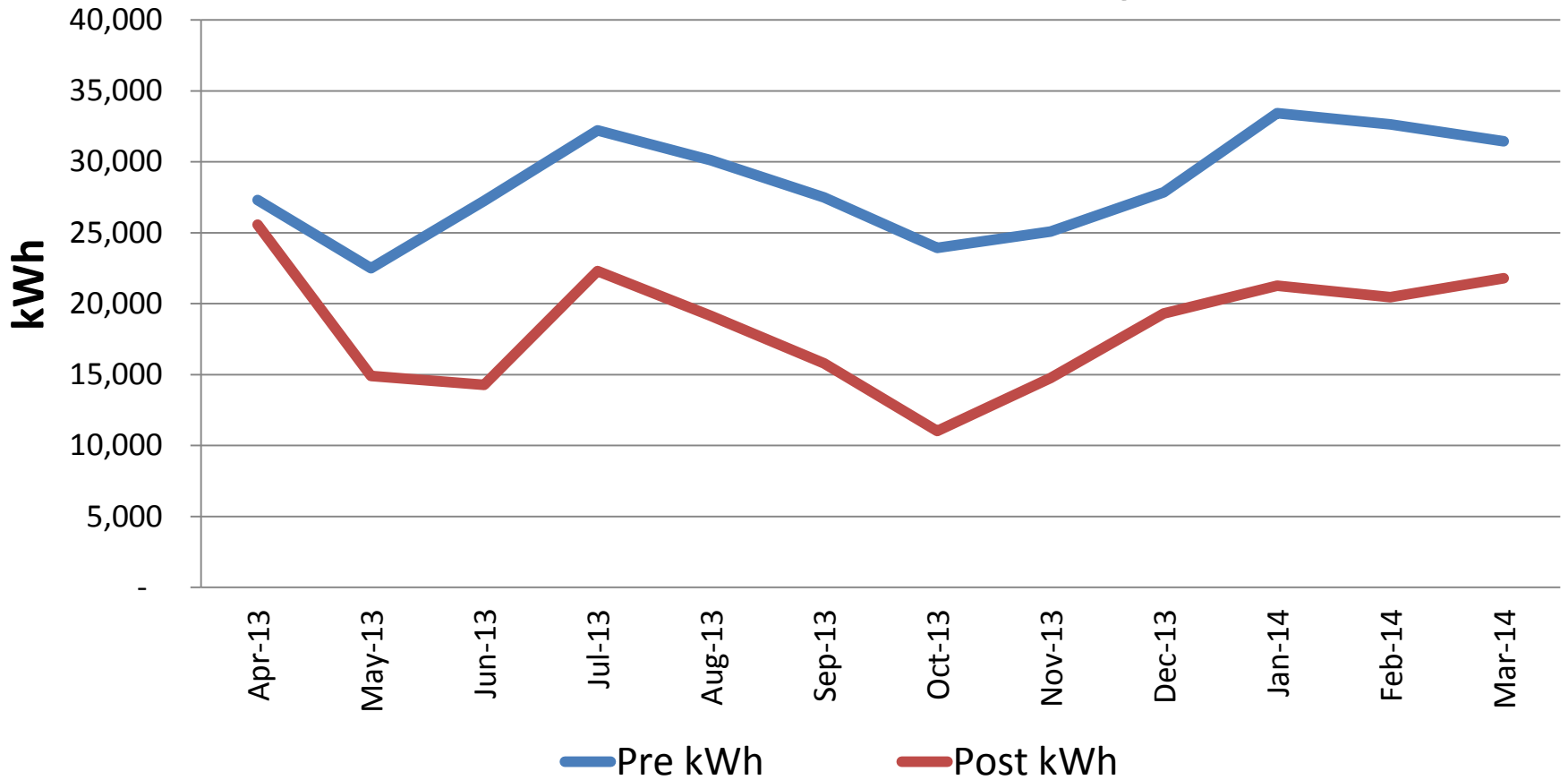
RCx Solutions

- VSDs on cooling tower and main pumps
- Removal of diverter valve
- Boiler circulating pump
- Central Plant controls
- Controlled OA dampers



Realized Savings

Pre- and Post-Installation Monthly kWh

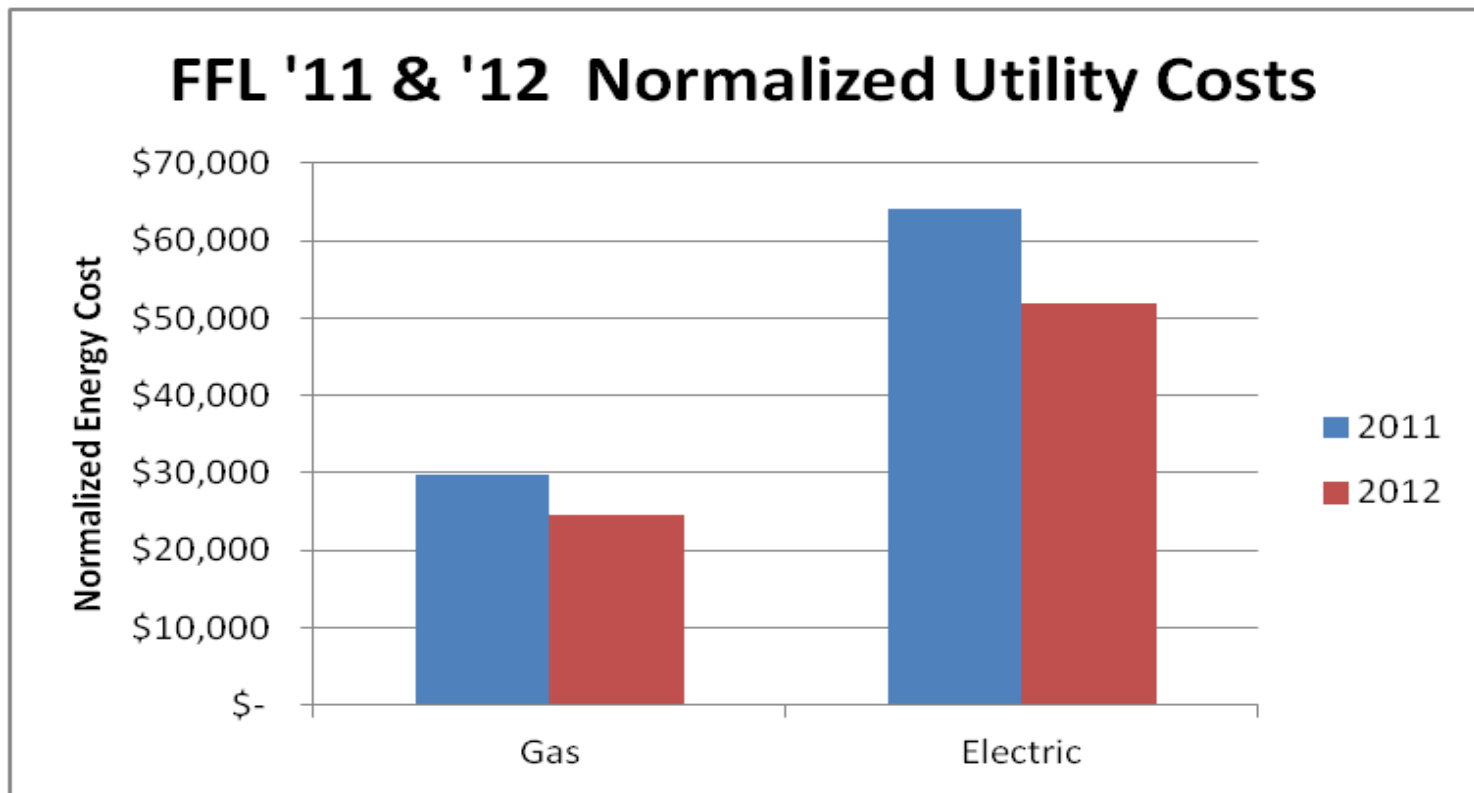


Example #2: Fletcher Free Library



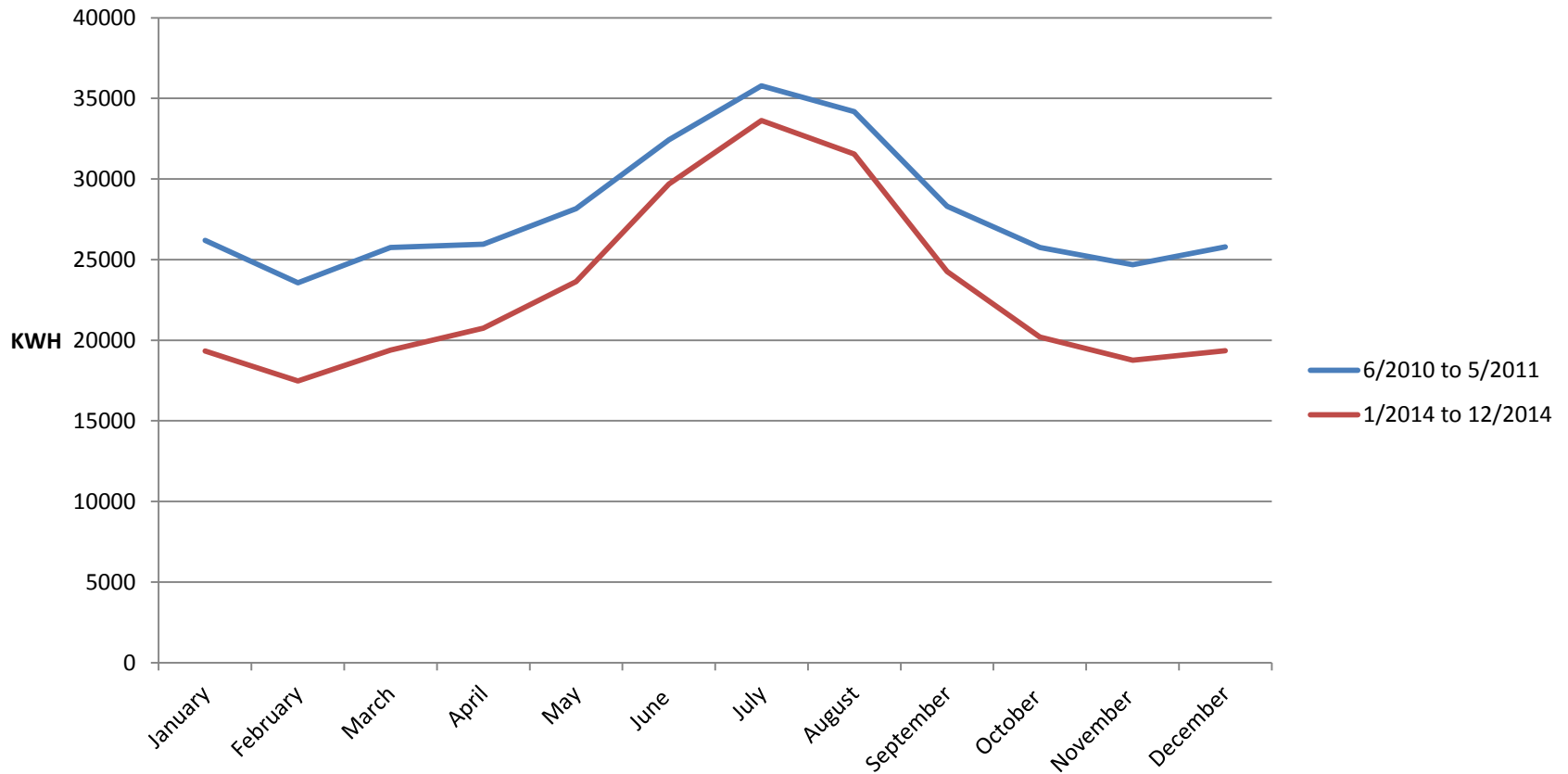
Controls Upgrade Savings

Average annual utility bill savings of 18%.



Avg. Electric Bill Savings 17.4 %

FF Library Pre / Post Project



Operational Performance Support Services Contract

- Monitor HVAC system operation & utility bills
- Maintenance program definition & oversight
- Assessment of unplanned maintenance items
- Further energy savings identification
- Long-term capital planning for HVAC system costs

Performance Monitoring Successes

- Chiller compressor failure → Early cooling tower failure warning.
- HVAC-1 economizer/fan speed control.
- Exhaust fan failure discoveries.
- Resolution of draft issues at circulation desk.
- Freezestat failure discoveries.

Example #3: Parking Garage Ventilation

- Located in the City of Burlington
- Three Floors, partially enclosed underground parking
- QTY=2 3 HP Fans per Floor
- Scheduled on 100% from 6AM to 8PM



Parking Garage Ventilation – A Solution

- Add Variable Speed Fan Control
- QTY=6 CO Sensors Installed per Floor
- Maintain a minimum daytime speed – 20 Hz unless CO level on floor exceeds 25 PPM
- Ramp up to 100% over a 5 minute period until CO drops to below 22 PPM



Parking Garage – What was Found

 Old Equipment



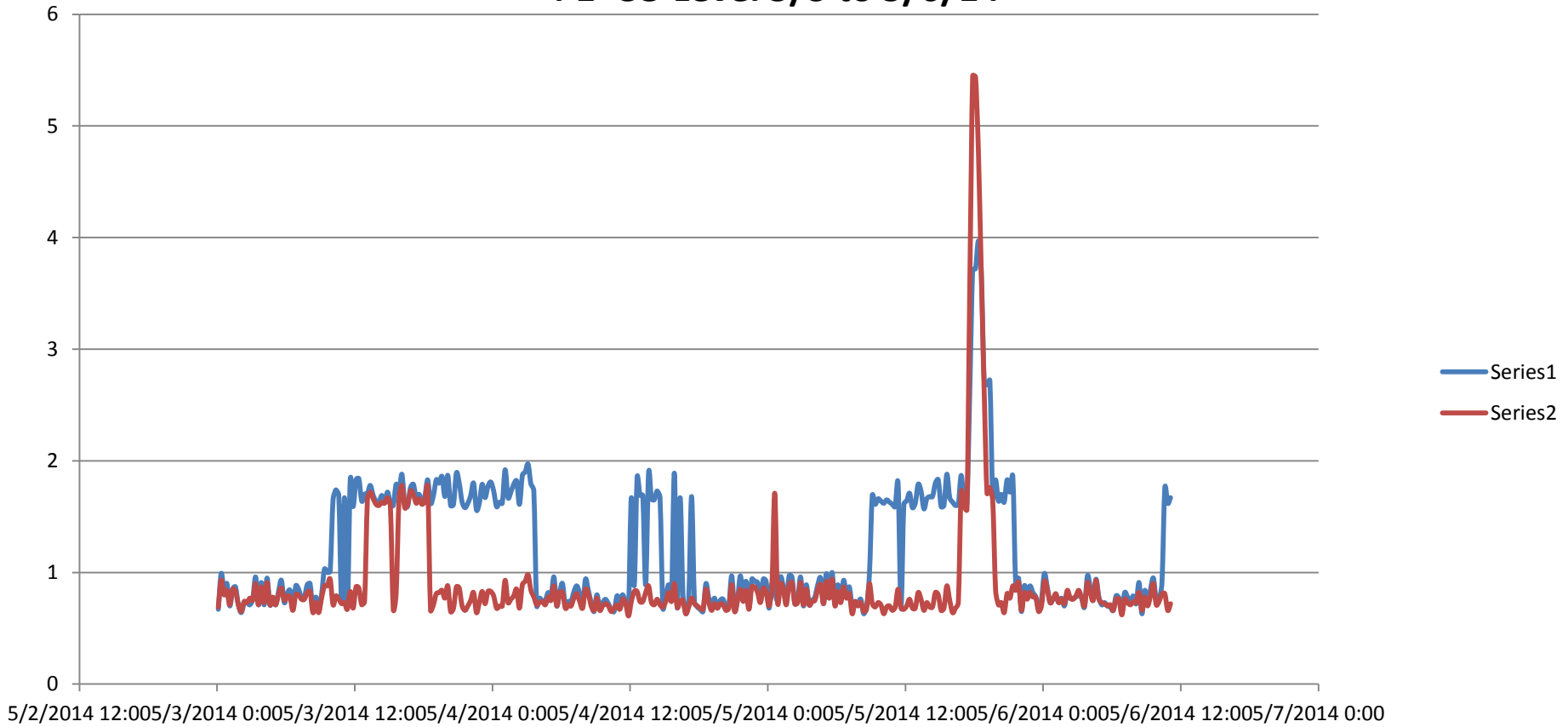
Parking Garage – What Was Found

 Missing Equipment

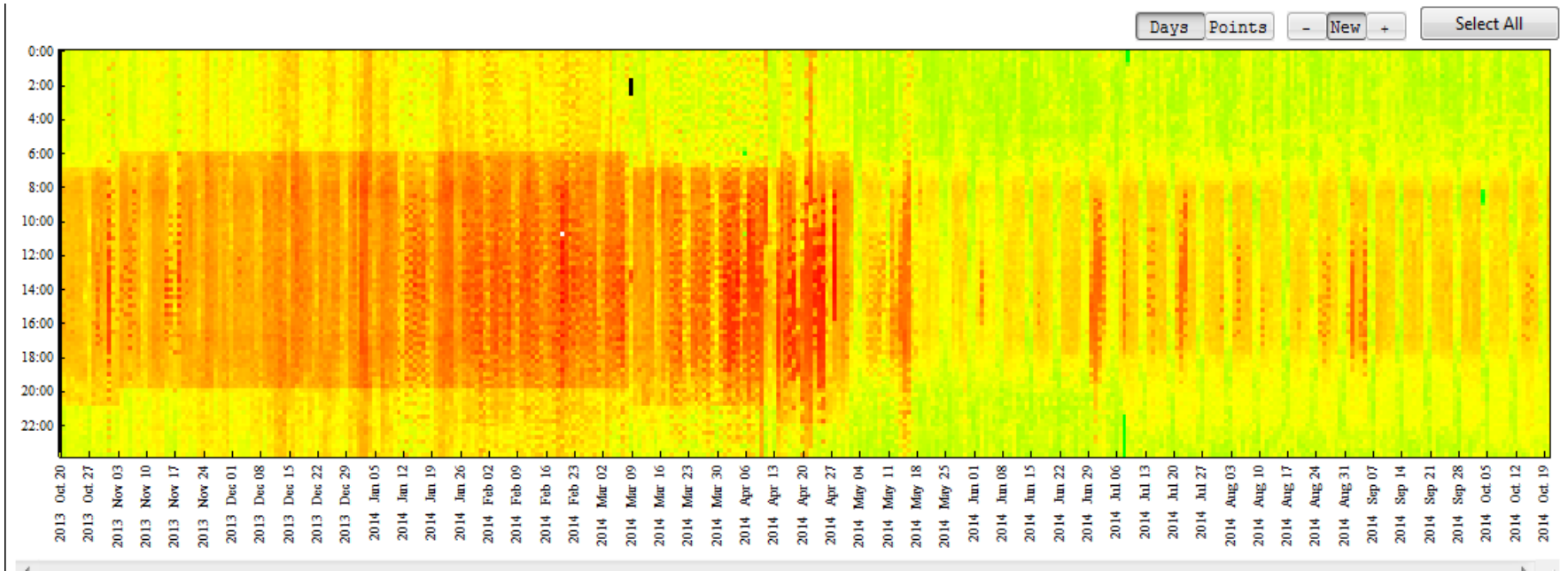


Analyzing the Results

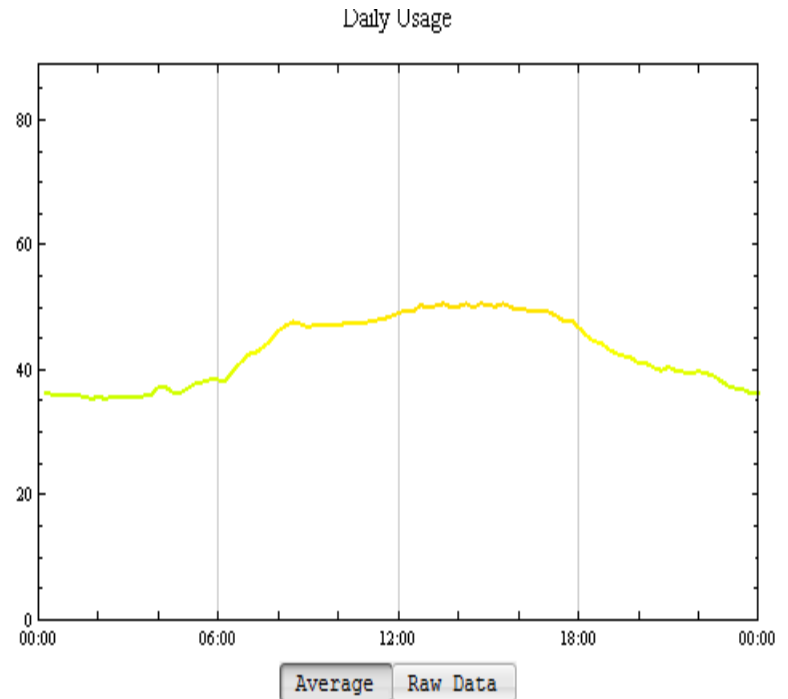
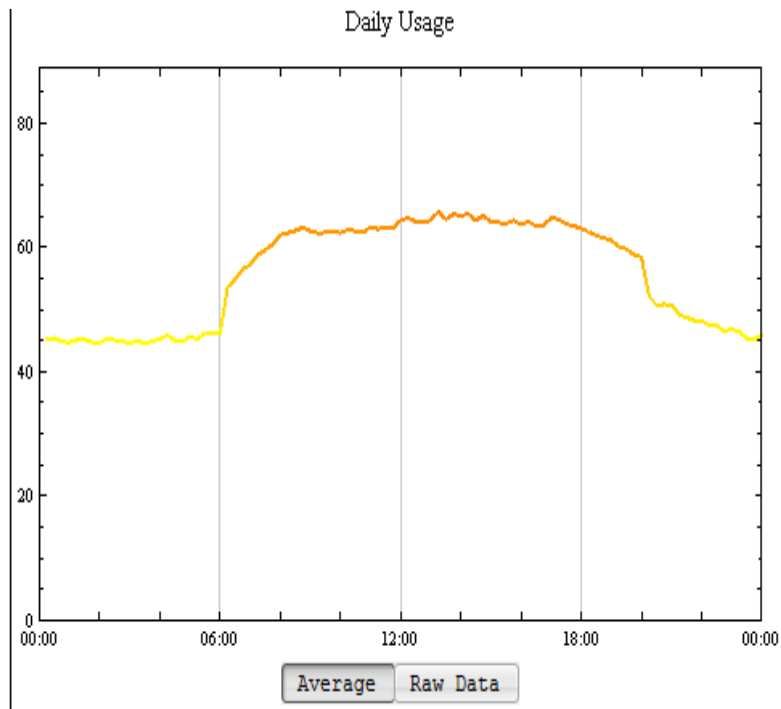
P1 CO Level 5/3 to 5/6/14



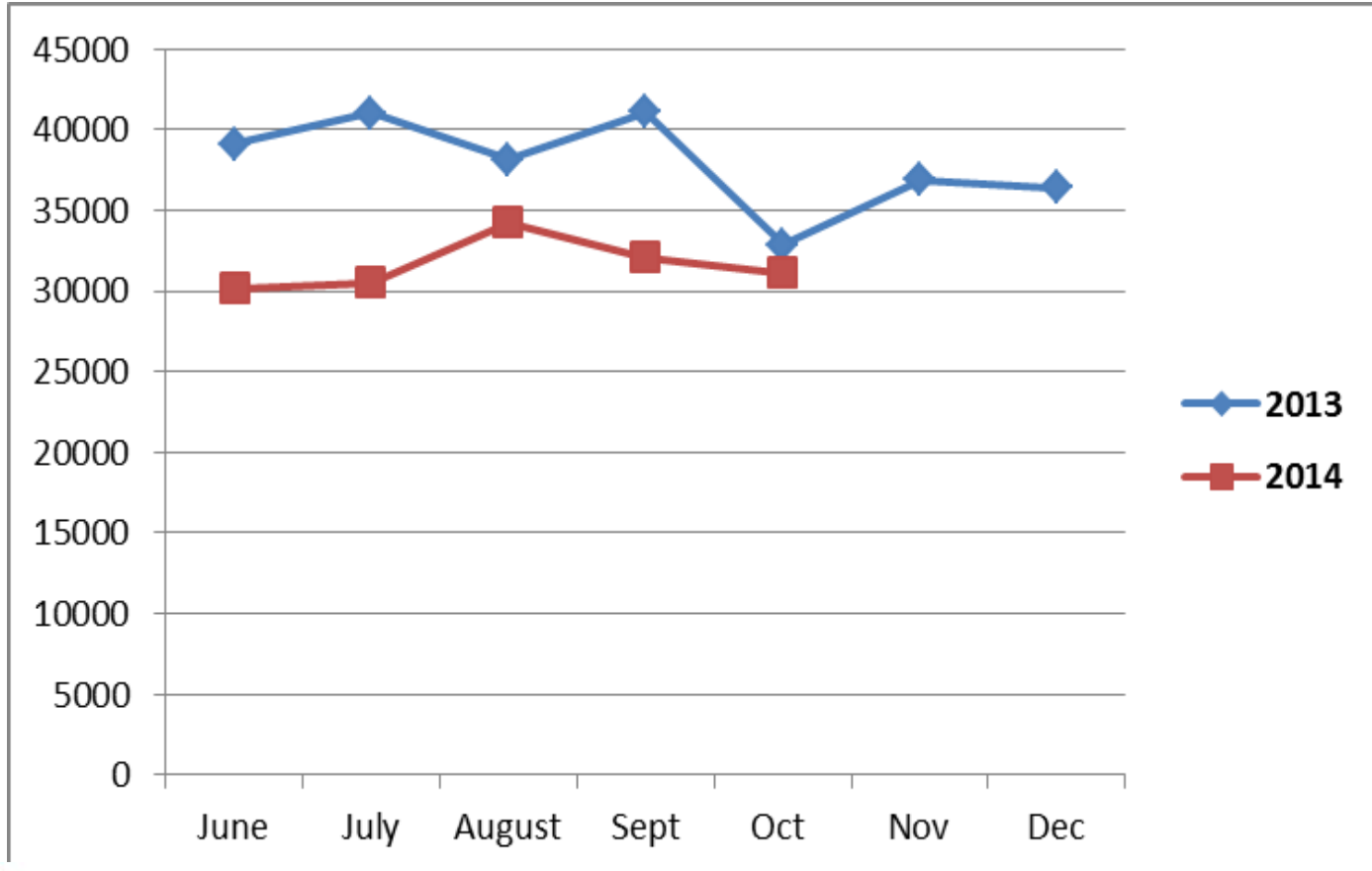
Heat Map



Pre vs. Post Project



15% Realized Savings



Retrocommissioning - How?

That's not so simple....

- Does the Owner know what Re-Cx is ... or care?
- Do they have any money to spend?
- Does the building have any savings to offer, anyway?



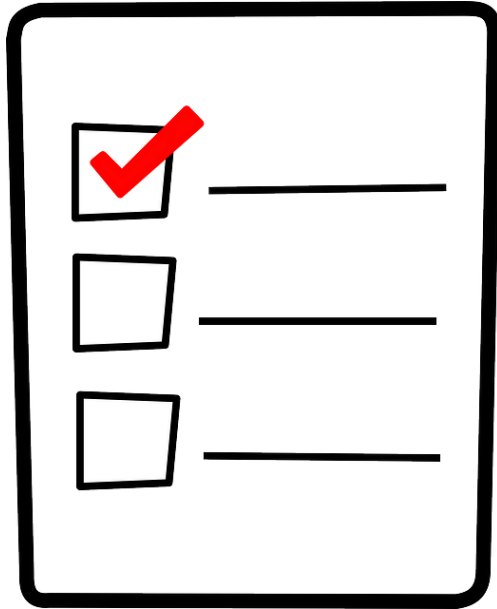
Choose Wisely

If you can, pick owners that:

- **Care about their building**, not just their bottom line
- Have the **internal support** to make a project happen
- Are in the building for the **long term**
- Have a **trigger project**



Tread Lightly



- Provide options:
 - *Tier 1*: Conservative approach that addresses owner's concerns
 - *Tier 2*: Deeper cost-effective opportunities
 - *Tier 3*: Long-term opportunities
- Don't push – they'll balk
- Don't try to do it all – they'll balk

What Doesn't Matter Much



Age of
building
(over 1 year)

Type of HVAC
system

There are ALWAYS savings opportunities!

Simple Rules of Thumb

- Disassemble the Project into Phases
- Go Further than just Low-Cost / No-Cost Measures
- Develop the Owner's Trust
- Minimize the first-cost barrier



Re-Cx Simple Rules of Thumb

Only work with commissioning agents of the
highest caliber.



Creative Capital

On-Bill-Financing

- ✓ **No money down**
- ✓ **Loan paid off on the electric bill**
- ✓ **Positive cash flow from day 1**



Capital Project – No Money Down On-bill Financing Example

Estimated Project Cost	\$62,500
BED Incentive	\$30,900
Customer Loan Principal	\$31,600
Interest Rate	4.00%
Loan Terms	42 months
Interest Amount	\$2,316
Total Loan Amount	\$33,916
Payment/Month	\$806.53
Estimated Annual Energy Savings	\$10,629
Project Savings/Month	\$885.75
Monthly Net Savings (during loan period)	\$78
Estimated Return on Investment	31.34%

How to Move the Project Ahead

- Project Champion (internal and external)
- Long-term Vision of Owner
- Confidence in Delivering Savings
- Creative Financing
- Timing the Opportunity



Conclusion

Facilities Manager Comment:

After retrocommissioning, we are saving 32% in annual energy costs and the pumps don't shake the building anymore when they turn on.

Owner Comment:

I was delighted to see the overall reduction in electricity usage on our last electric bill. I am very thankful that you prompted us to get started on this project.



All Pulling in the Same Direction

“Coming together is a beginning.

Keeping together is progress.

Working together is success.”

-Henry Ford

