Energy Management's Annual Report

Board of Regents Facilities Committee
February 7, 2013

Agenda:

What we plan to communicate today:

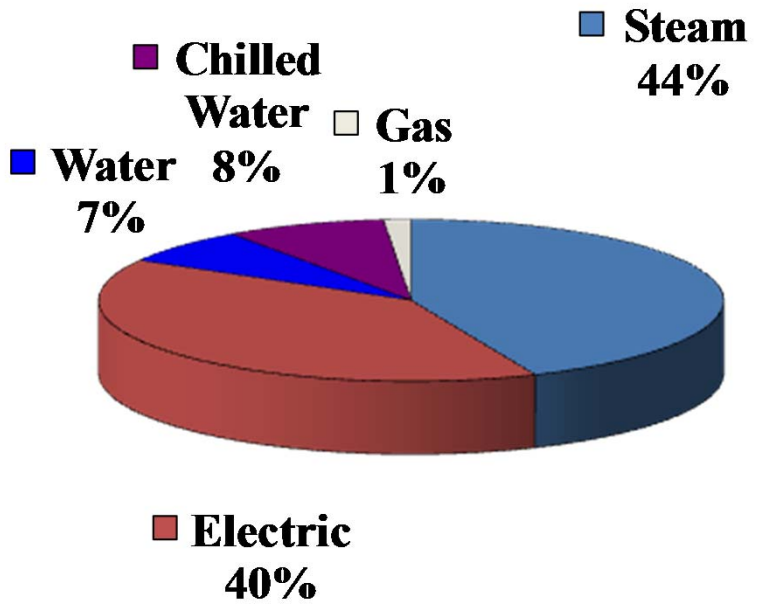
- TC Energy Management Principles:
  - Reliable
    - Steam
    - Electricity
    - Chilled Water
  - Sustainable
  - Cost Effective
- Coordinate Campus Updates
- Questions

Energy Management Principles

- Reliable
- Sustainable
- Cost-effective

Total Utility Cost Summary:

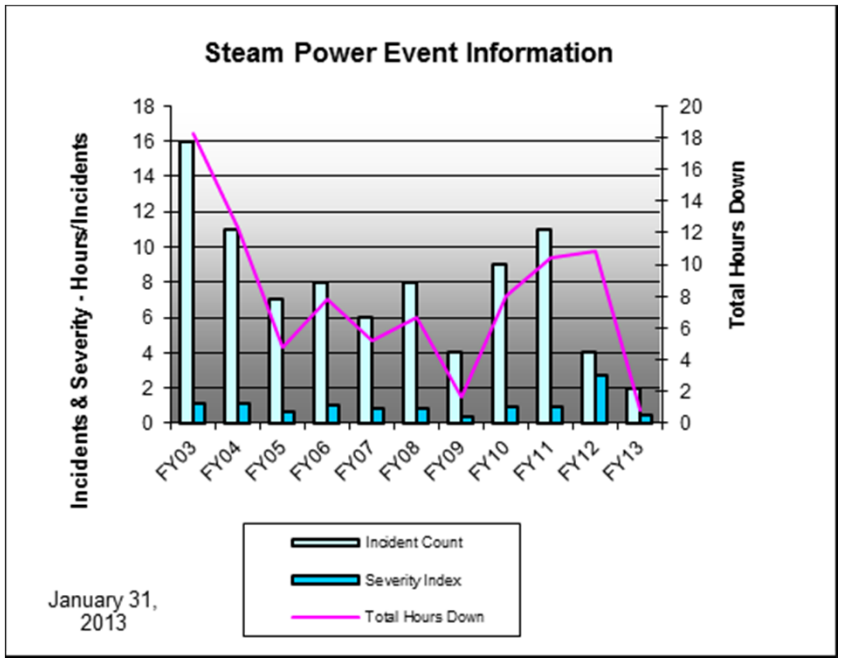
- FY 2014
  - Steam $43,141,000
  - Electric $39,338,000
  - Chilled Water $8,232,000
  - Water $6,987,000
  - Gas $1,411,000
  - Total $99,109,000



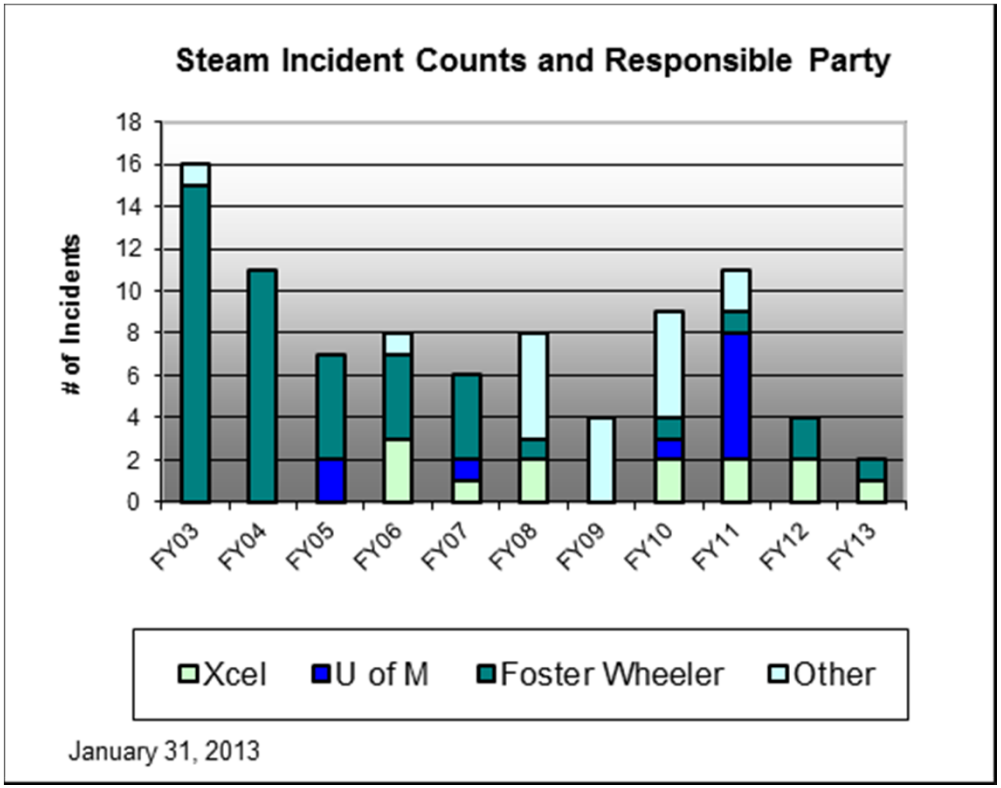
Rates include:

- **Purchased Fuel/Electricity**
- **Debt Service**
- **Capital Investment**
- **Operations/Repair**
- **Engineering & Tech Support**

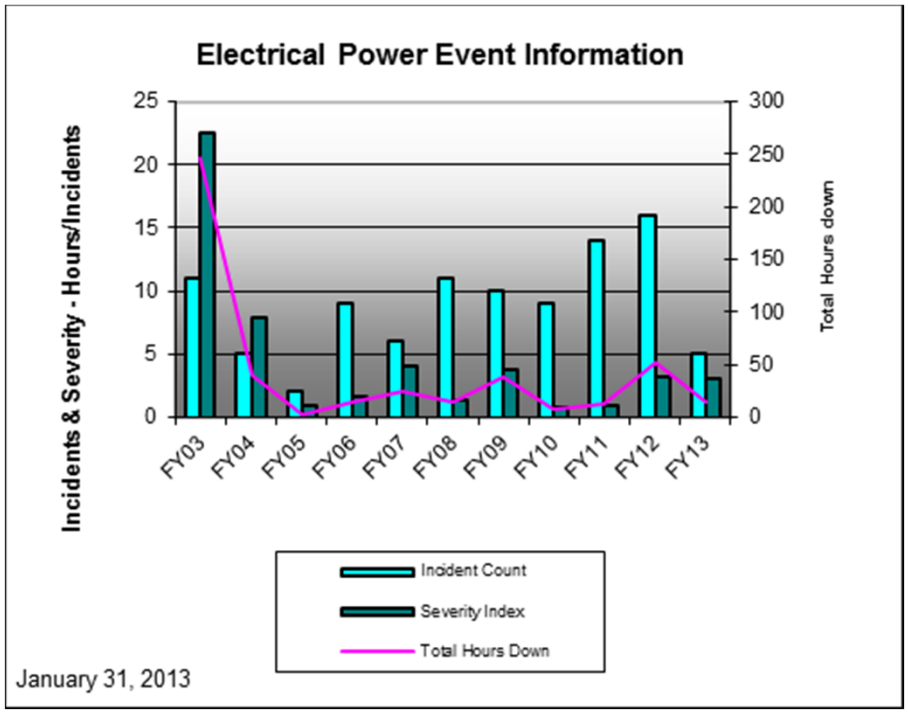
Reliable Utilities:



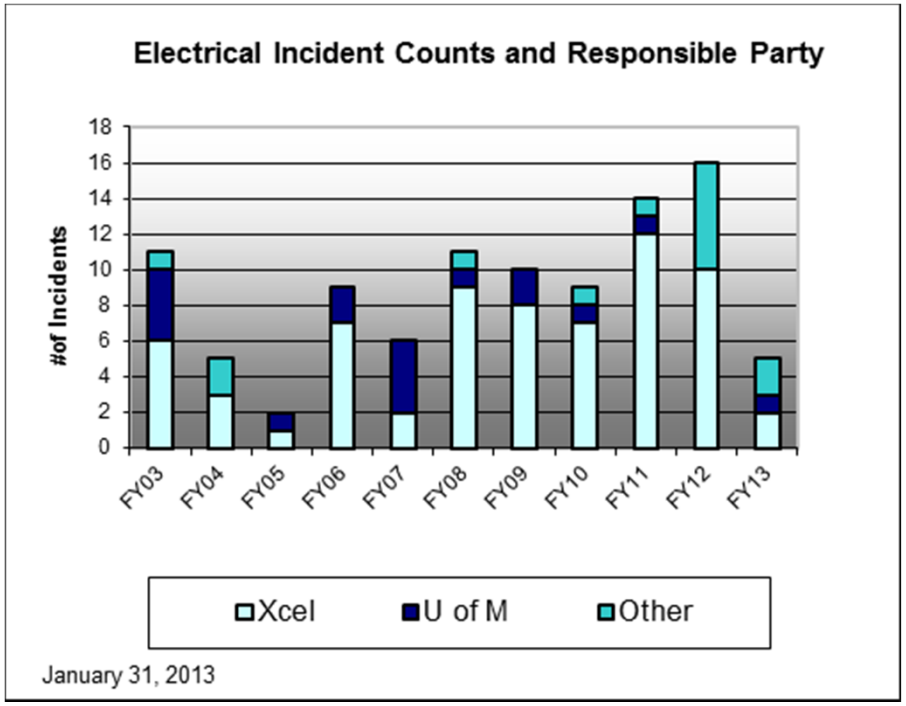
Steam Utility



Reliable Utilities:



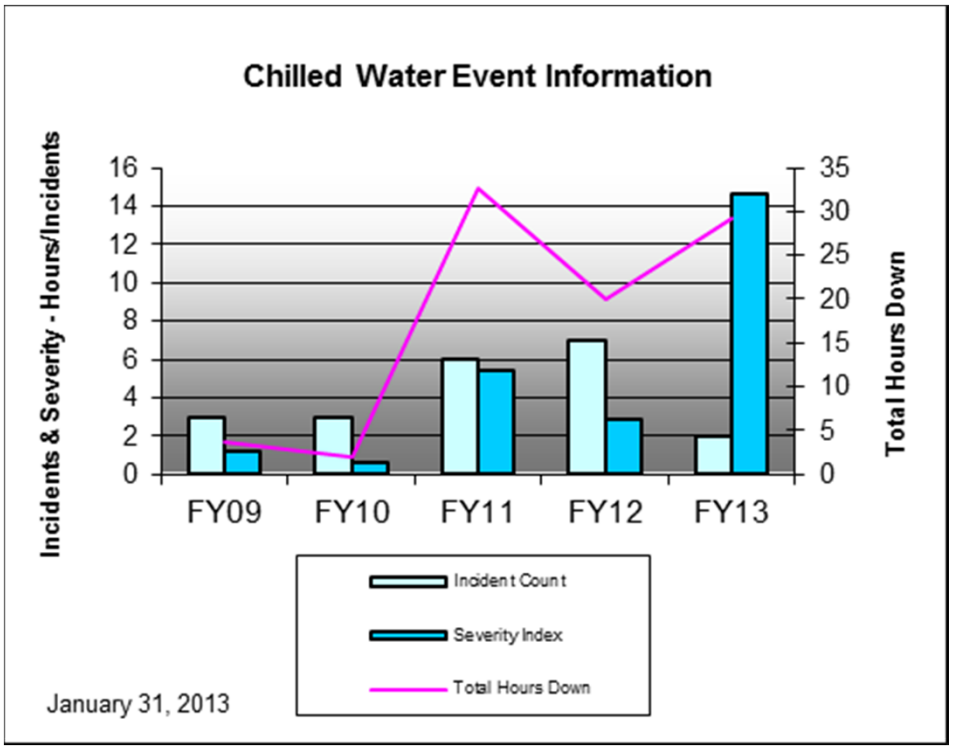
Electric Utility



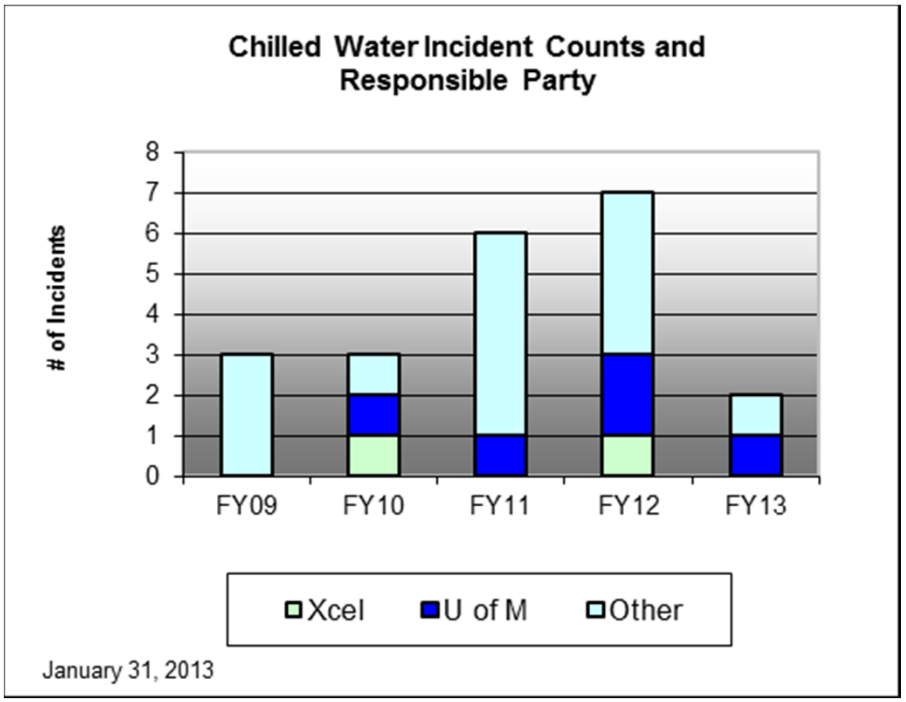
Reliable Utilities : Incident Tracking

Year	Date	Time	Who	Total Time	Feeders	Buildings	Cause
2013	09/08/12	8:50:00 AM	U of M	655	Como main 13.8kV feeder CO-2	Partial to all Como area buildings	At approximately 8:50 AM on Saturday, September 8, 2012, there was an unscheduled power outage in the Como area. There was a cable failure on the CO-2 circuit near Printing Services. We "single-phased" the main 13.8 kV feeder "CO-2," which means one of three fuses blew, thus leaving two legs of the circuit hot and one leg dead. This had the effect of leaving buildings with partial power, but not a complete loss of power. All Como area buildings were affected. At approximately 5:00 PM, Electric Utilities was notified of the problem. We were able to switch over to our backup feeder at approximately 7:45 PM to restore power.
2013	09/09/12	1:30:00 PM	Other	210	SAFL - overhead 13.8 kV feeder	Partial to SAFL	At approximately 1:30 PM on Sunday, September 9, 2012, there was a partial electrical outage at the St. Anthony Falls Lab. Based on the furry evidence at the crime scene, a squirrel managed to step in the wrong spot in the overhead 13.8 kV feeder and caused a flash. This blew some fuses in the overhead switches which directly feed the SAFL facility. Electric Utilities was called in to investigate the outage. Power was restored by approximately 5:00 PM.
2013	10/25/12	3:03:00 PM	Xcel	12	MST 78XY	SE Steam Plant	At approximately 3:03 PM on Thursday, October 25, 2012 there was an unplanned electrical outage at the SE Steam Plant. Power was lost on the Xcel feeder to the plant (MST 78XY) which caused the boilers to trip. The cause of the outage appeared to be within the Xcel substation and not on the MST 78XY feeder to the plant. Power was restored to the plant at approximately 3:15 PM by Xcel Energy. No other campus buildings were directly impacted by the electrical outage. Several buildings on the Minneapolis campus were impacted by the loss of steam pressure.

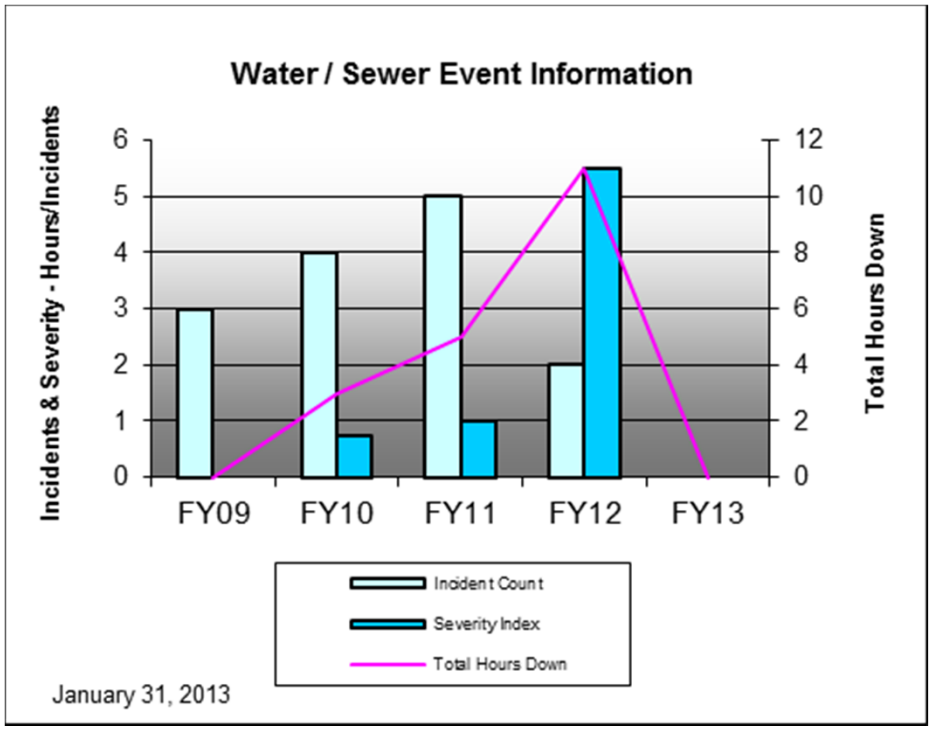
Reliable Utilities :



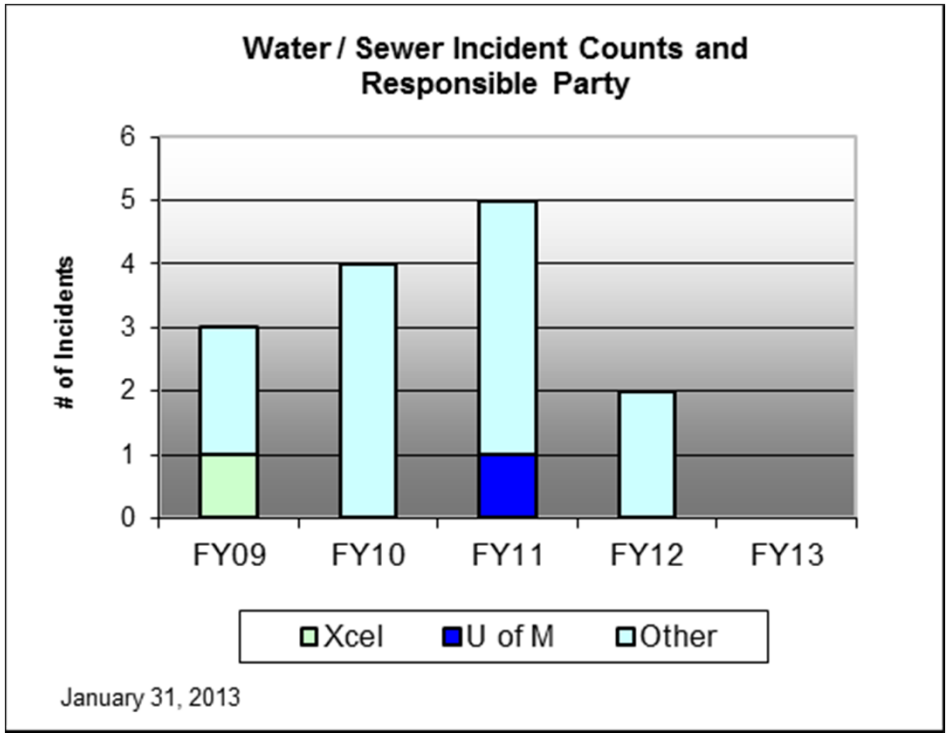
Chilled Water Utility



Reliable Utilities :



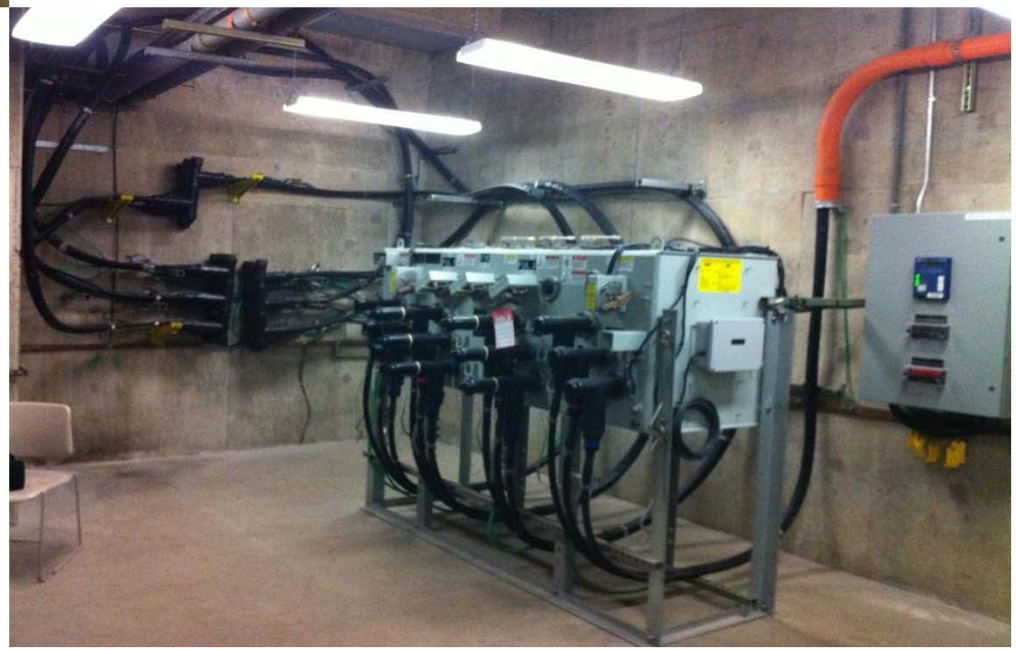
Water / Sewer Utility



Reliable: VFW Switch Gear Replacement

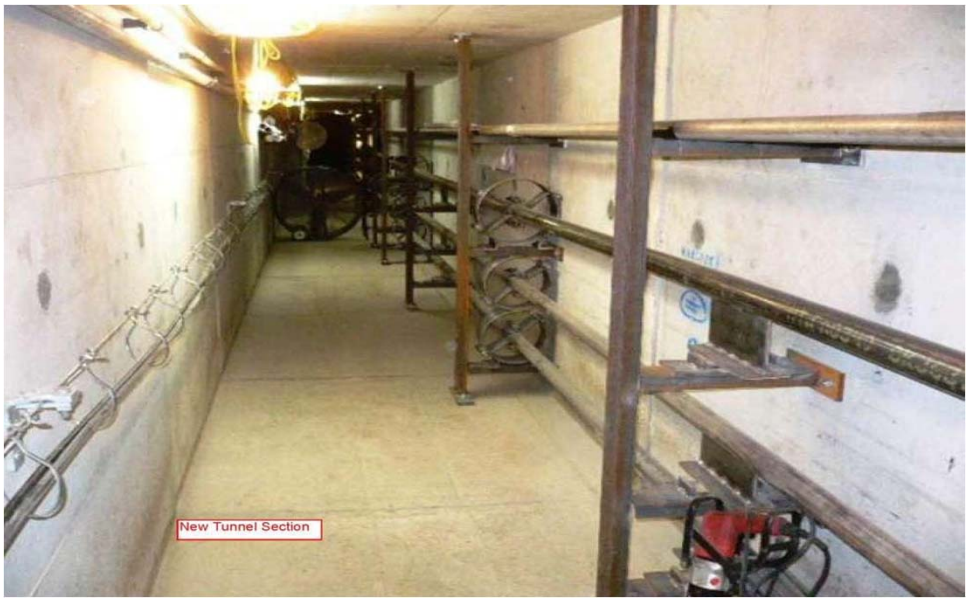
1960's Primary air-gap switch gear:
failed due to phase-phase flashover and age driven insulator breakdown
(example of many locations)

2012 Replacement switch gear
- compact gas switch gear



Reliable: St. Paul Tunnel Rebuild

1940 Construction Steam Tunnel:
Crumbling block walls under a
St. Paul roadway



2012 Complete tunnel and
piping system replacement

Reliable: Gortner Tunnel Rebuild

St. Paul Campus: Failing steam tunnel structure with planned replacement summer 2013

Sustainable: Storm Water Master Plan

Proposed Storm Water Features - Minneapolis West & East Bank

Data Sources: University of Minnesota Facilities Management, Enterprise GIS, Esri
Data Date: 06/14/2012

FIGURE 6a

Sustainable: Storm Water Management

17TH Ave Residence Hall: Rain water harvest underground storage vault, water reuse for facility
(a key storm water master plan strategy)

Rain Garden serving as part of BDD district storm water management system

Sustainable Solar Update:

Array on the Roof of University Plaza –

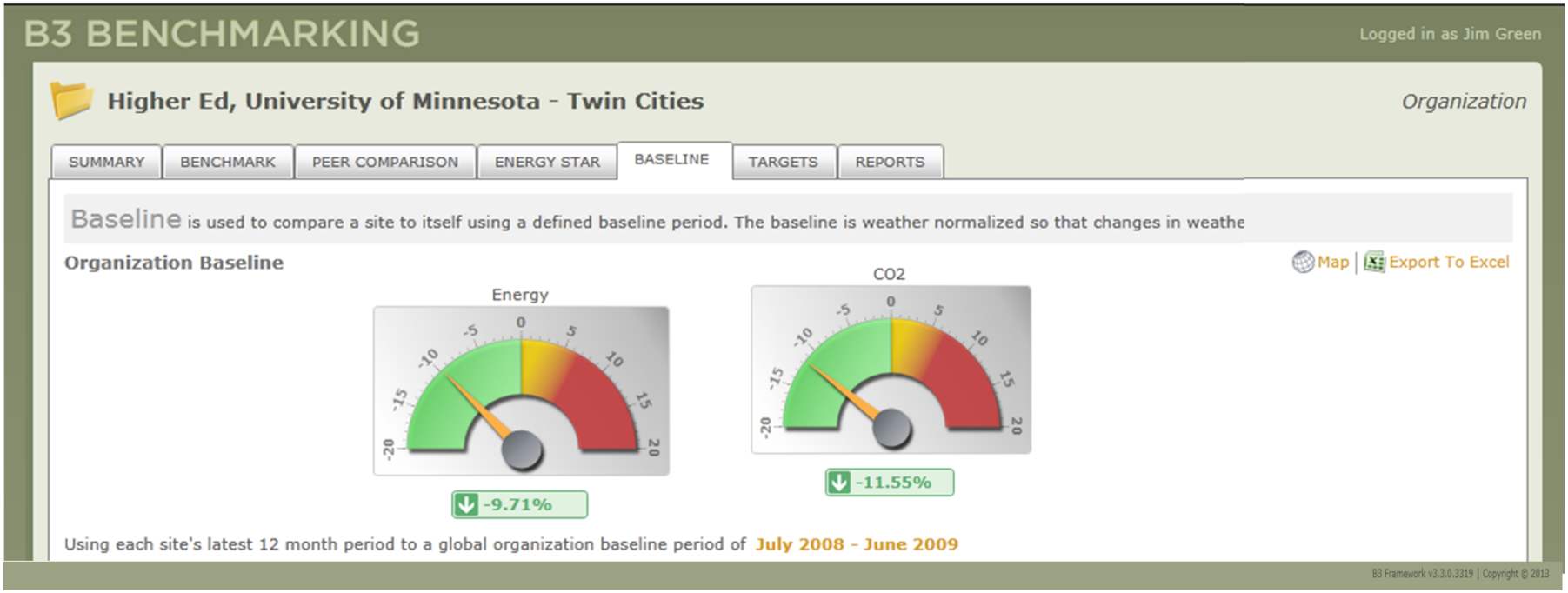
- CIP rebate = $86,400
- Solar energy grant = $216,100
- University cost = < $2,000

- First 8 months of real data:
  - 4.56% of total building energy provided.
  - Annualized voided cost = $3,647
  - Simple payback on total cost = 55.5 years
  - Payback after rebate = 39.7 years

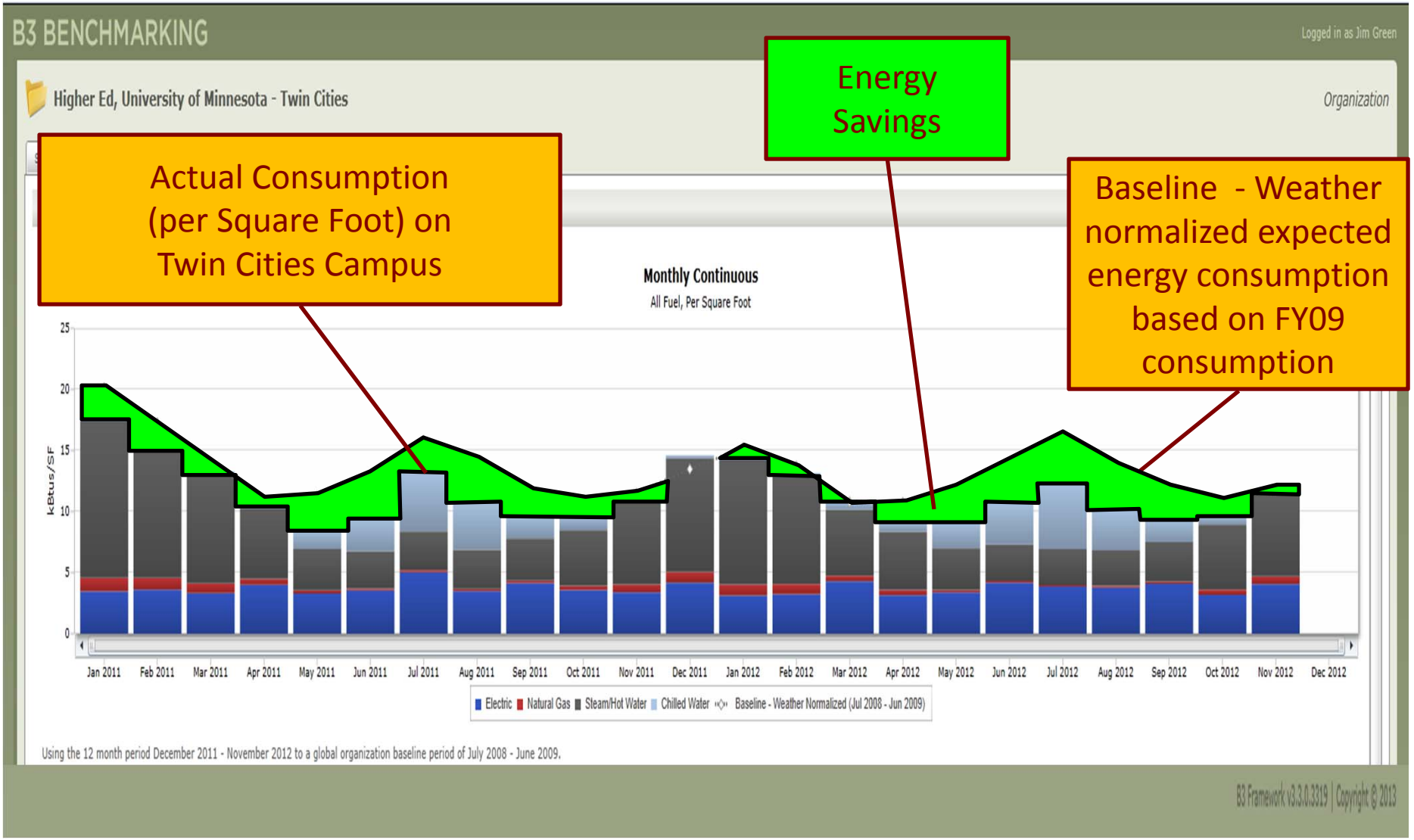
Support for education and research!

- On line link to near real time data: https://www.sunpowermonitor.com/partner/partner.aspx#

Sustainable: Leveraging State Tools

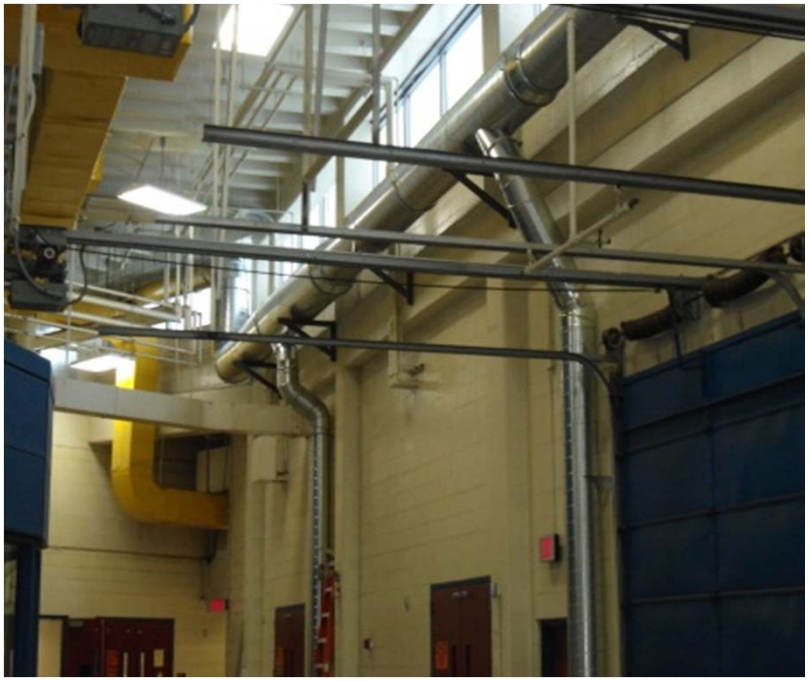


Sustainable: Actual vs. "Expected" Consumption



Sustainable: Example

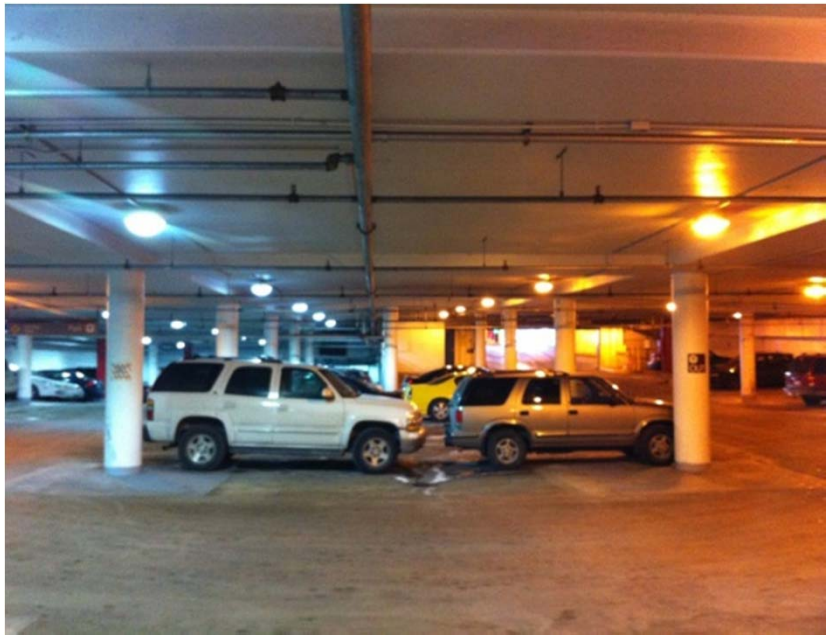
Faye Thompson Center Recommissioning



- Hazardous materials processed in building
- Moved air intakes closer to floor/hazardous material – improved comfort and ventilation
- HVAC modifications result in more than $**82K** in annual energy cost savings a ***45%*** *reduction*

Sustainable: Example

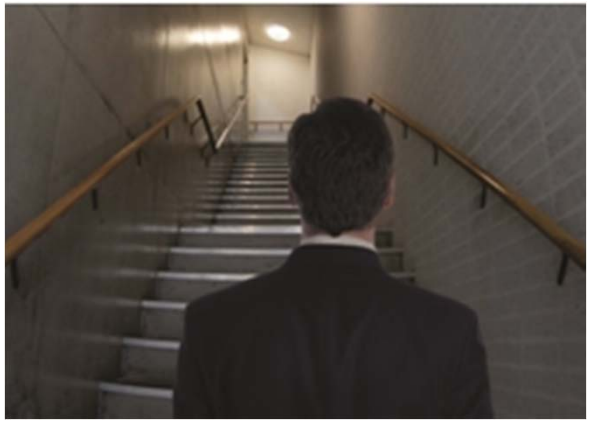
Parking Structure Lighting Retrofits

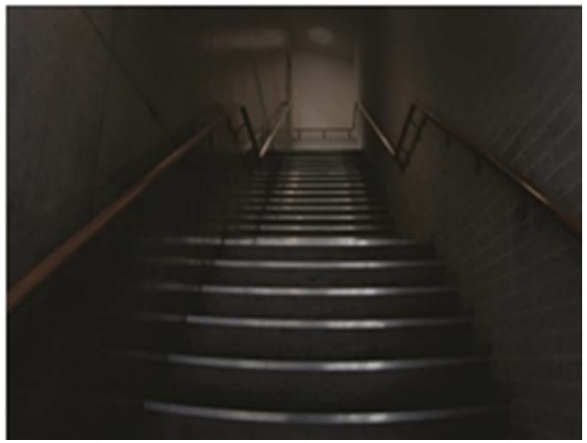


- Retrofit ramps with LED Fixtures
- Three ramps save more than $50k annually with a payback of less than 5 years
- PTS has programmed 3-4 parking structures retrofits each year until all 15 are complete

Sustainable: Example

Stairwell BI-Level Lighting Innovation





- Replaced inefficient stairwell lighting with energy efficient, low maintenance LED lighting.
- Lighting automatically turns down to lower, code-compliant levels when the no one is in the stairwell.
- West Bank buildings are complete and saving more than **$30K** in annual electricity costs.

Sustainable: Involving Campus Community

- The effort to eliminate incandescent and other inefficient lighting on campus has resulted in annual savings of over **$55K**.

- Over 50 old, inefficient refrigerators & freezers have been replaced with ENERGY STAR models through our “Cash for Clunkers” program.

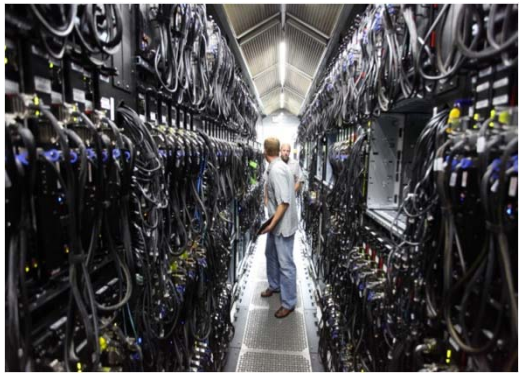
Sustainable: Future Opportunities

Exterior Lighting

Thousands of inefficient exterior light fixtures will be replaced with cost effective LED fixtures.

SMART Labs

Research laboratories make up 20% of the assignable space on campus but account for over 65% of the energy consumed.



Data Center Efficiency

Over $1M in annual energy efficiencies have been identified in a joint Energy Management - OIT study.

Sustainable: Climate Action Plan

Climate Action Plan Evaluation Criteria

- Annual reduction in greenhouse gas emissions
- Cost of implementation
- Operating cost or savings
- Net present value cost or savings
- Useful life
- Synergy with U mission and priorities
- Visibility
- Cost/Savings Per Unit of Emissions Reduced

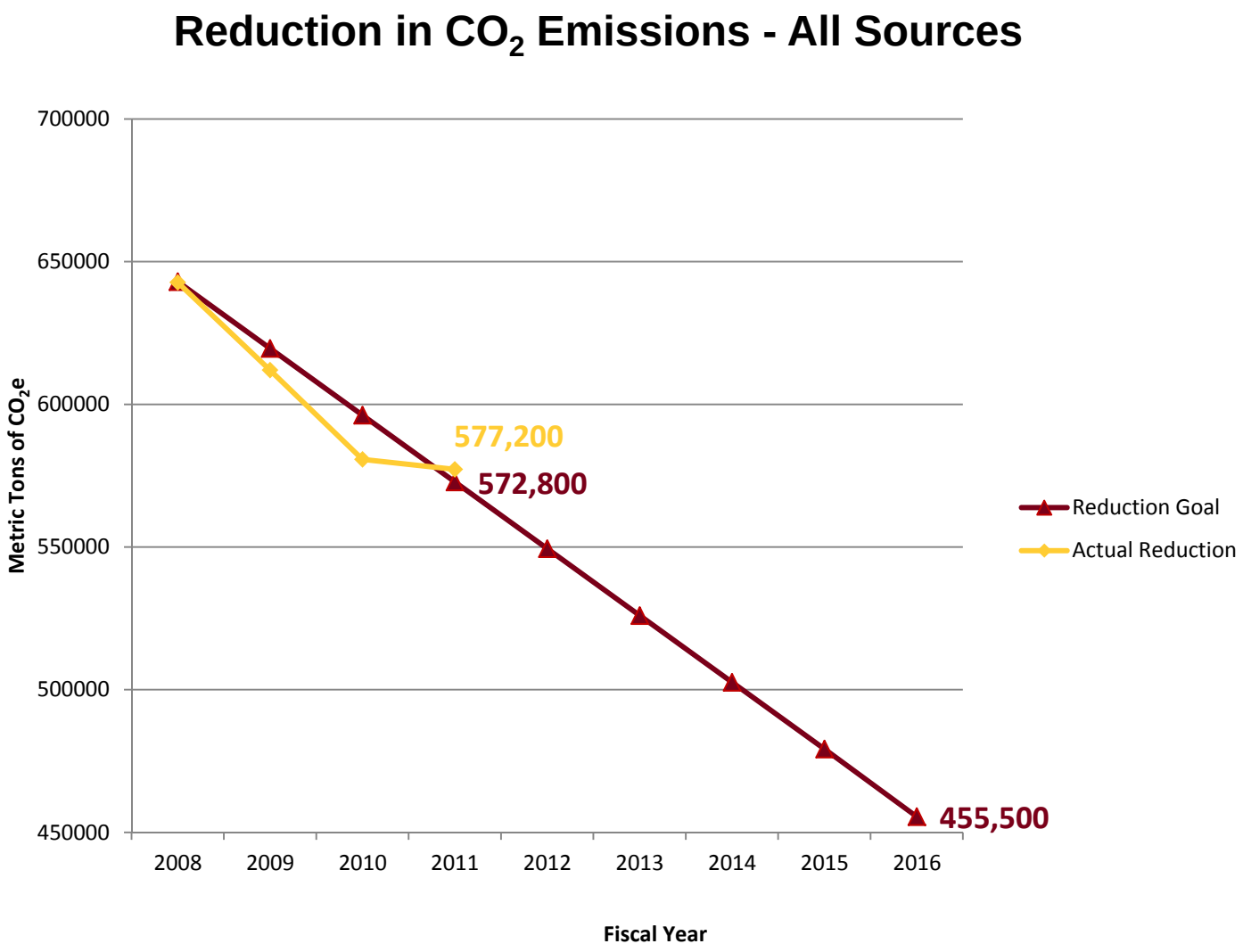
Sustainable: Climate Action Plan

Strategy Examples

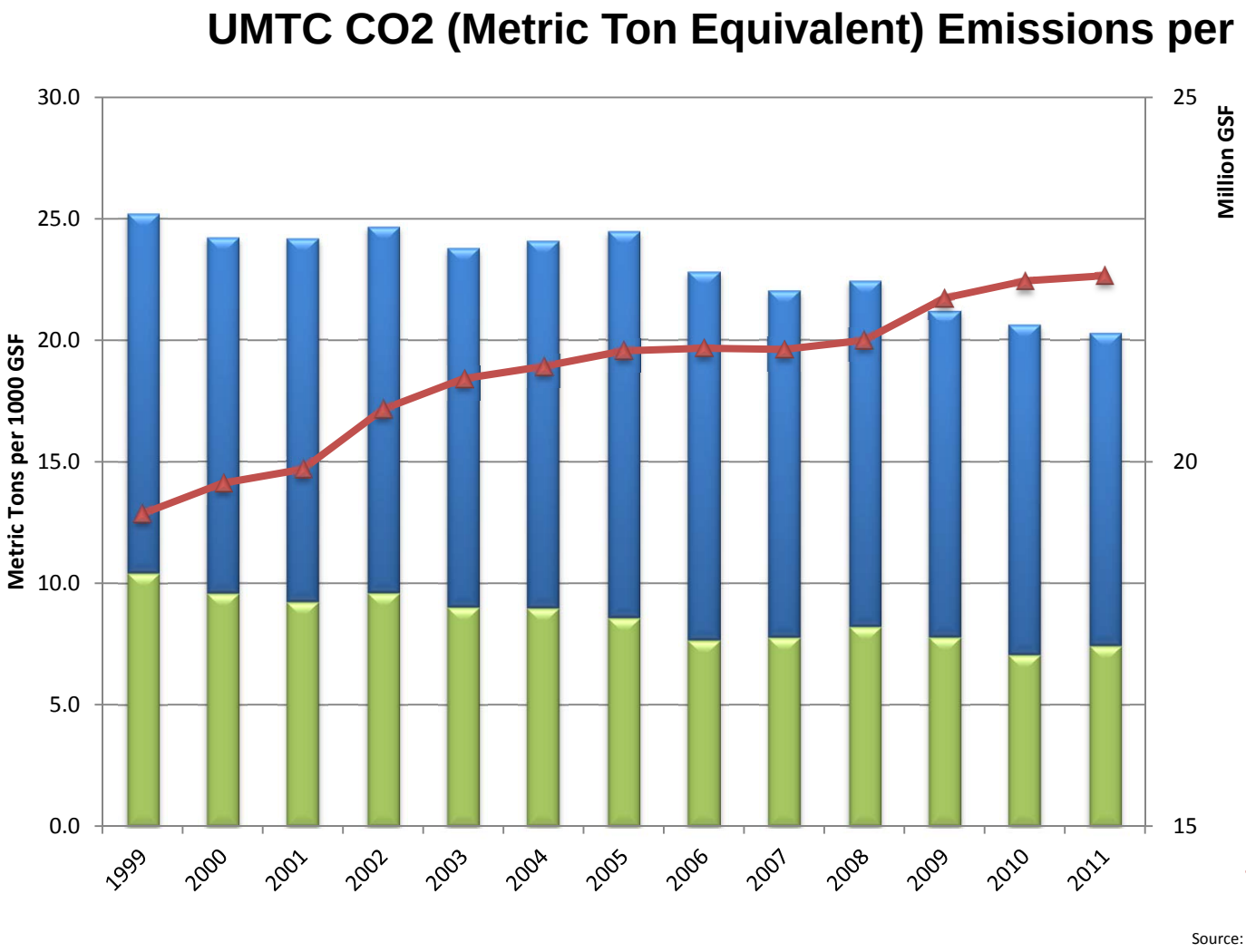
Strategy	Annual CO2 Reduction (metric tons)	Cost Per Metric Ton Reduced
Reduce campus 1 M GSF	22,000	($75.11)
Build CHP	68,300	($25.78) *
Reduce lab air exchanges	43,106	($21.28)
Recommission bldgs	59,001	($20.88)
Buy wind credits	2,988	$ 2.41

* Marginal cost over boiler

Sustainable: Climate Action Plan



Sustainable: Carbon Footprint

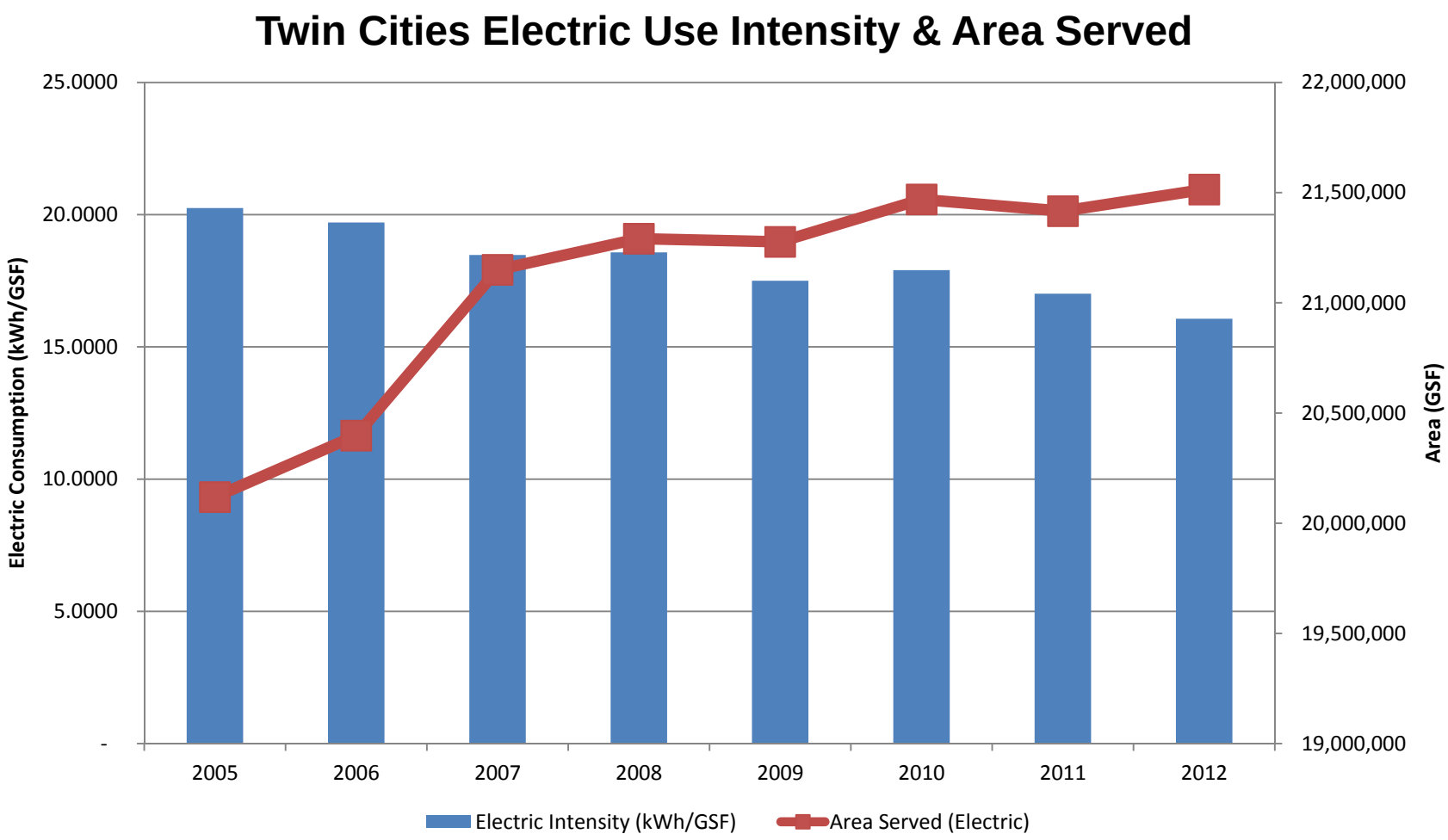


Since 1999:

- Campus increased by 2.5M SqFt
- CO2 emissions have been reduced by 5M metric tons
- 20% drop

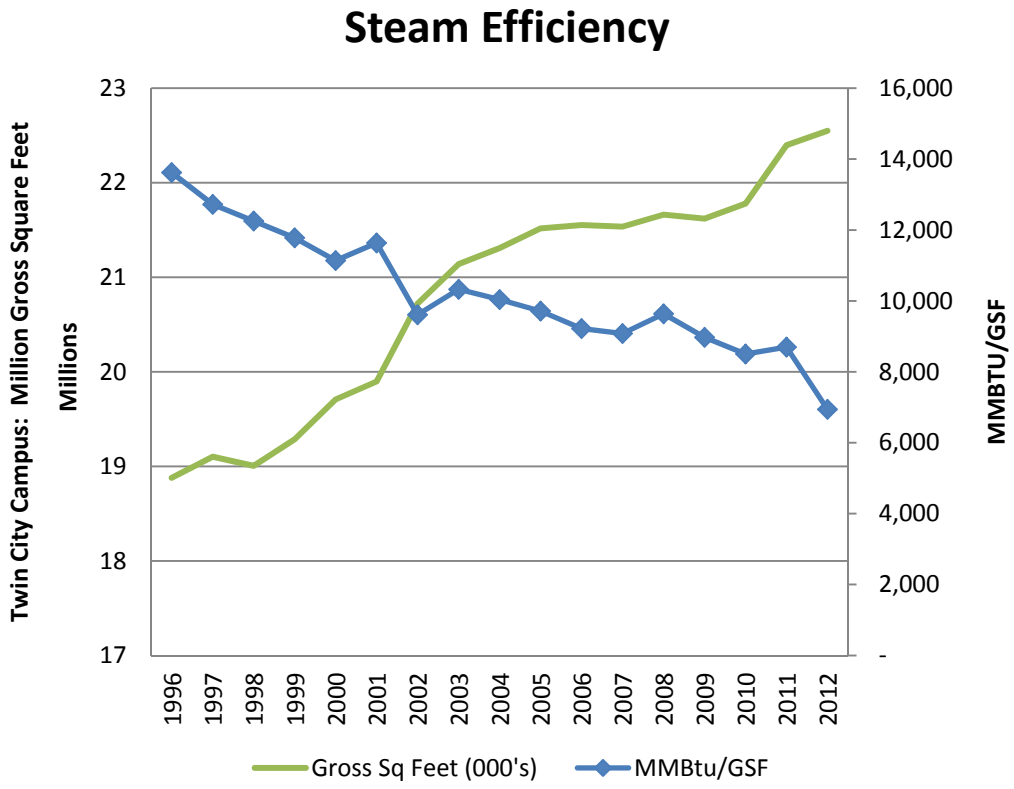
Source: Energy Management

Sustainable: Electric Energy Intensity

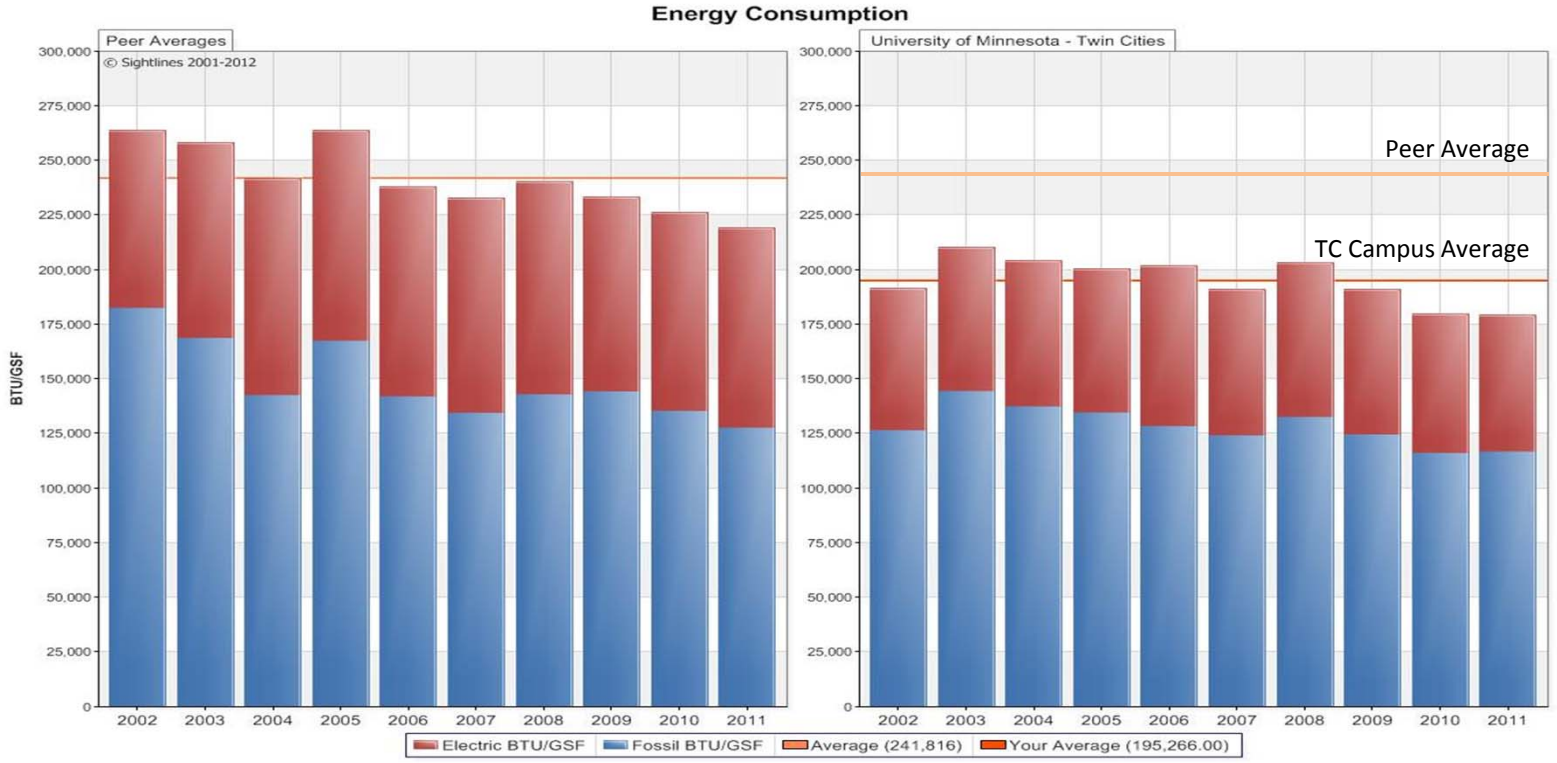


Steam Energy Intensity

- Since 1996:
  - Campus increased by 3.7M SqFt
  - Steam Efficiency increased by 49%
  - Cumulative savings due to efficiency gains = $167M (annualized for 2012 = $12.2M)



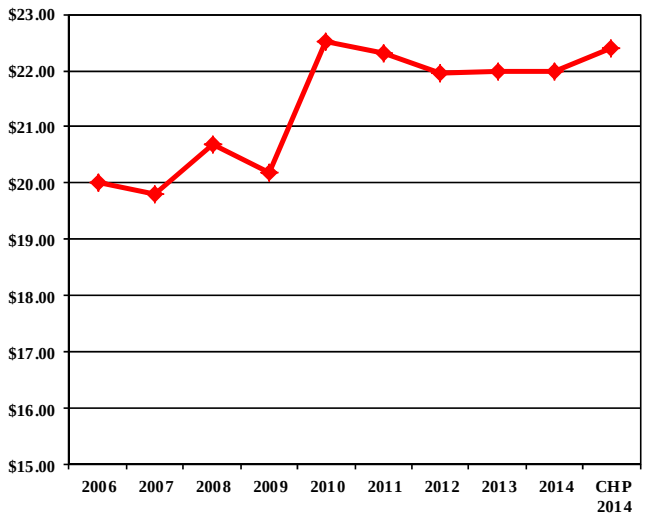
Cost Control: Energy Consumption vs. Peers



	FM	Peers (Sightlines)	Industry (IFMA)
Energy $/GSF	$2.31	$3.81	$2.38
Consumption BTU/GSF	179,000	217,000	94,000

Steam Rates

History of Rates: $/MMBTU



Components of $21.98/Mlb Rate

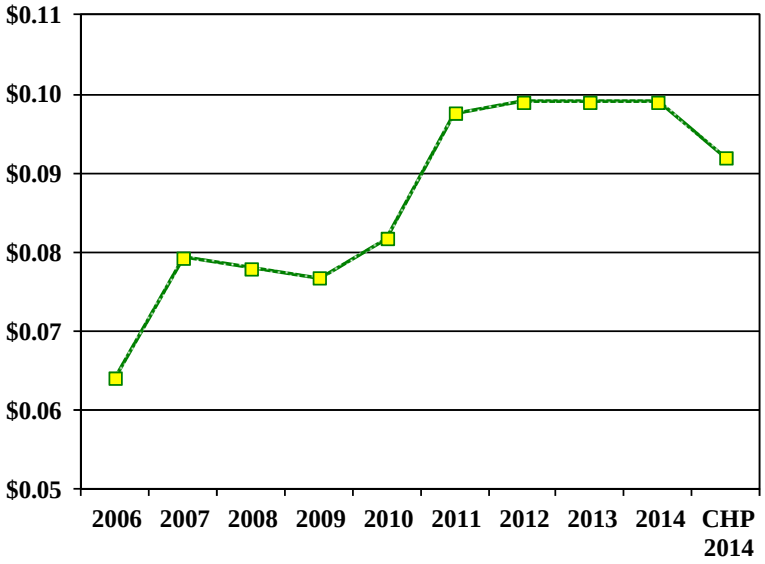
Component	$	%
Fuel Cost	$7.71	35%
Debt Service	$3.77	17%
Plant Ops	$5.46	25%
Other	$5.04	23%
Total	**$21.98**	**100%**

Other: renewal, debt, admin, conservation

FY	Rate	Consumption	Total $
12	$21.95	1,920	$42,138,000
13	$21.98	1,866	$41,004,000
14	$21.98	1,963	$43,141,000
Proforma Including CHP 14	$22.39	1,963	$43,947,726

Electricity Rates

History of Rates: $/Kwhr



Components of $0.0991/KWhr Rate

Component	$	%
Xcel Cost	$0.0827	83%
Less Refund	-$0.0033	-3%
Other	$0.0197	20%
Total	**$0.0991**	**100%**

Other: distribution, renewal, admin, debt,

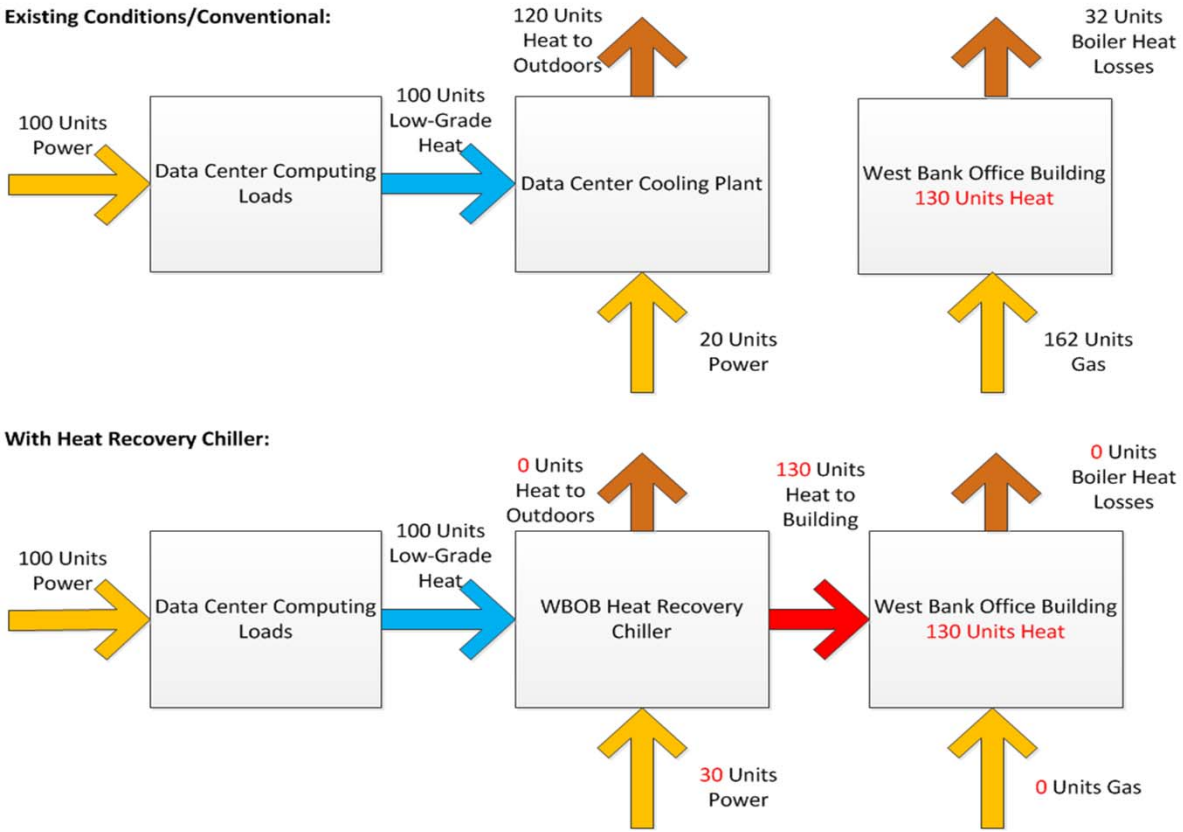
FY	Rate/KWhr	Consump./Mlb	Support $
12	**$0.0991**	**390,979**	**$38,743,000**
13	**$0.0991**	**375,806**	**$37,255,000**
14	**$0.0991**	**396,828**	**$39,338,000**
Proforma Including CHP14	**$0.0919**	**396,828**	**$36,481,017**

Cost-effective: EB Dist. Cooling Expansion

2012 System Expansion:
Supply both new and exiting buildings; Physics-Nano and 17th Ave Residence Hall, Shepard Labs, Civil Eng, Rec Center

District energy service provides greater energy efficiency, lower O&M expense and life cycle cost then standalone building heating & cooling equipment

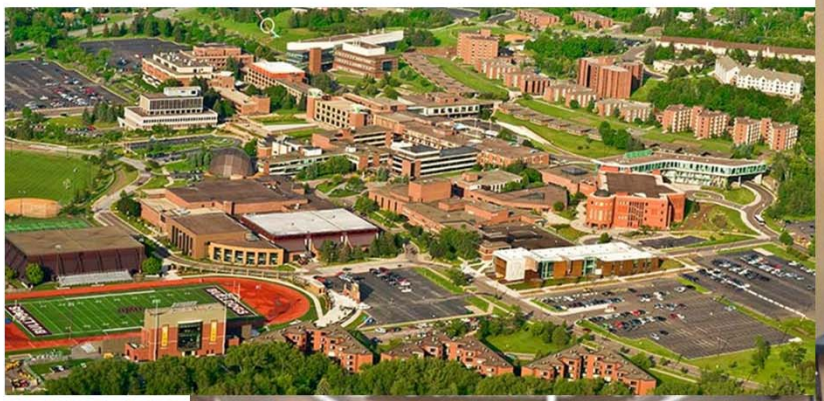
Cost-effective: WBOB Heat Recovery



Spring 2013 installation: 130 ton capacity screw heat recovery chiller & plant controls

Energy conservation - Capture waste heat, reducing winter heating energy demand (*5.5 year pay-back project)*

Working with Coordinate Campuses



Crookston, University of Minnesota

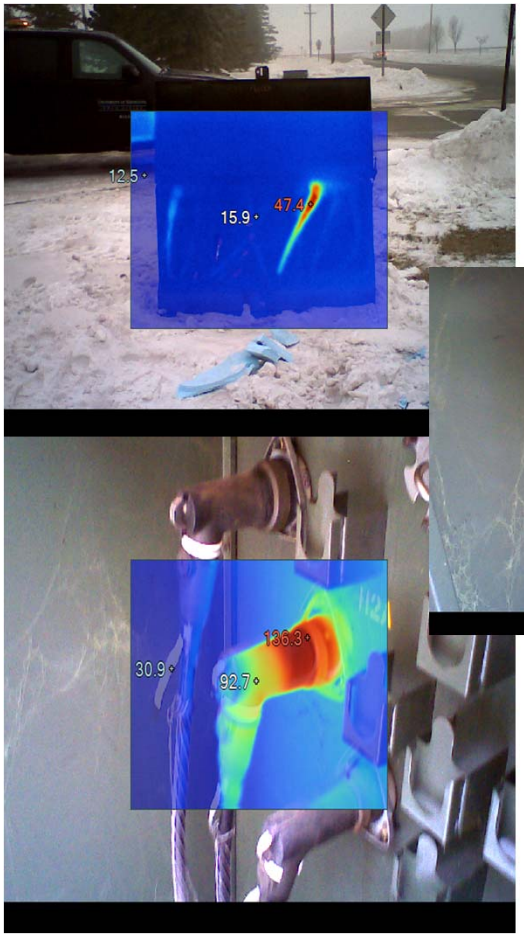
The Crookston Campus has worked collaboratively with Energy Management on several projects:

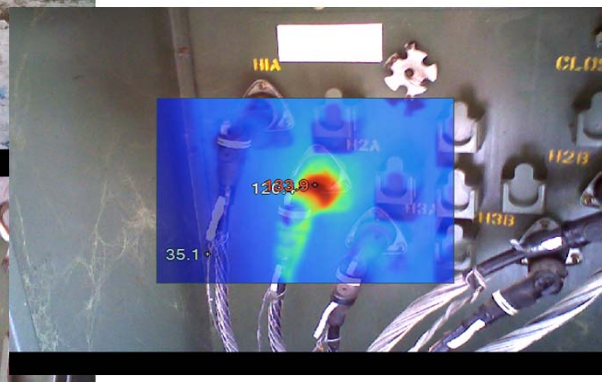
- Study of the central heating plant to prepare for the Area source boiler MACT 2014 compliance requirements.
- Commissioning and assessment of new buildings and energy efficiency projects.
- Study and assessment of the campus high voltage distribution network.

Crookston, University of Minnesota

Samples of High Voltage Distribution System Problems

- **Portions of 50+ yr old system shows signs of overload**
- **System reliability in decay significant PM investment needed**





HOT system components identified during IR scan inspection

Transformer connection cabinet, at risk for a phase-to-phase flash over

Duluth, University of Minnesota

Current Utility Upgrades:

- Replace Main Steam Header Piping to Increase Capacity – 2012
- Expand Chilled Water Piping Network – 2012
- Complete Chilled Water System Modeling Study – 2012
- Upgrade Metering and Control Systems – 2012/2013
- Replace Campus High Voltage Switches – Continuing
- OSHA Arc Flash Safety Analysis – Continuing
- Campus Fire Alarm Code Upgrades – Continuing

Duluth, University of Minnesota

Planned Utility Upgrades

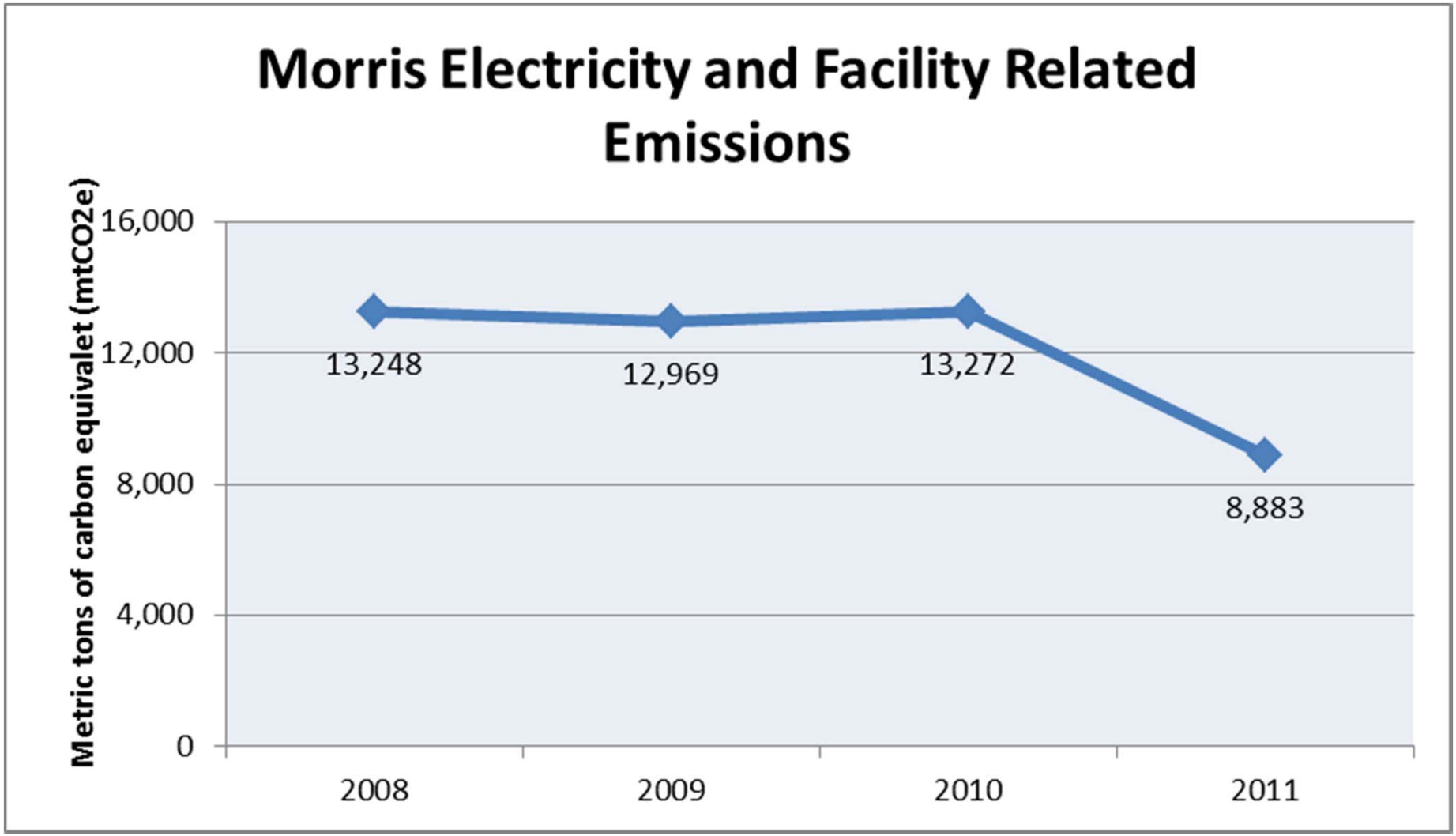
- New Campus Utility Building with Additional Chiller Plant – 2012/2013
- Upgrade Combustion Control Systems for all Boilers – 2012/2013
- Increase Heating Plant Capacity with Additional Boiler – 2015
- Replace Campus High Voltage Switches – Continuing
- OSHA Arc Flash Safety Analysis – Continuing
- Campus Fire Alarm Code Upgrades – Continuing

Duluth, University of Minnesota

Energy Efficiency Projects:

- Building Controls Upgrades – Continuing
- RhiZone Predictive Energy Modeling -2012/2013
- Field House Lighting Upgrade – 2012
- LED Lighting Upgrades – Continuing
- Lighting Control Systems – 2012
- Window Replacement Projects – Continuing
- Roof Replacement Projects – Continuing
- Sustainable Agriculture Project Wind Turbine – In planning

Morris, University of Minnesota



Energy Management - University of Minnesota