

Hamilton County 2014 Energy Management and Utility Usage Report



DEPARTMENT OF COUNTY FACILITIES

Director County Facilities: Ralph W. Linne, MBA, CPM, BOC

Assistant Director – Facilities Management: Anthony K. Matre

Energy Consultant: Terry Cannon, P.E., CEM - ThermalTech Engineering

Mission Statement

The Hamilton County Facility Department is committed to providing strategies, equipment, guidelines and methodologies to achieve tenant comfort in all buildings managed by the Facility Department while aggressively minimizing taxpayer costs and benchmarking the energy efficiency of the facilities managed in the process.

Commissioned by:
Hamilton County Department of Facilities
Issued April 2015
in conjunction with
ThermalTech Engineering, Cincinnati, OH

Table of Contents

Executive Summary	3
2015 Energy Outlook	4
2015 Energy Challenges	6
Vision Statement And Objectives	7
Benchmarking & Program Results	9
Energy Star Certifications	9
USGBC LEED Certifications	9
Energy Conservation Results	10
Greenhouse Gas Emissions and Energy Use Index Results.....	10
Implementation	11
Aggregate and Annual Usage Summary	13
Annual Energy Usage.....	13
Use Per Square Foot Methodology.....	13
Total Utility Expenditures	17
5 Year Utility Comparisons Charts (electric, gas and water)	18
Performance Contracting Baseline Review	19
Building Utility Tracking Graphics	20
222 Central Parkway	22
230 East 9th (William Howard Taft Law Center)	28
800 Broadway.....	34
2020 Auburn.....	40
County Administration Building	46
Hamilton County Courthouse.....	52
Justice Center.....	58
Coroner's Office.....	64
Courthouse IT (Interruptible Tariff) Savings	65
Hamilton County Natural Gas Broker Agreement	66
Deregulated Electricity Commodity Purchasing	67
Appendix A - Glossary of Terms	68
Appendix B - Accomplishments	71
Appendix C - History	76
Energy Conservation Master Plan (ECM)	76
Performance Contract.....	76
Cinergy Resources	76
CCAOSC Service Corporation Natural Gas Programs.....	77
Procurement of Electricity from the Deregulated Market	77
Energy Manager	77
List Energy Related Awards.....	77
Appendix D - Conversions & Methodologies	79
Appendix E - Duke Energy Electric Rate Schedule	86

Executive Summary

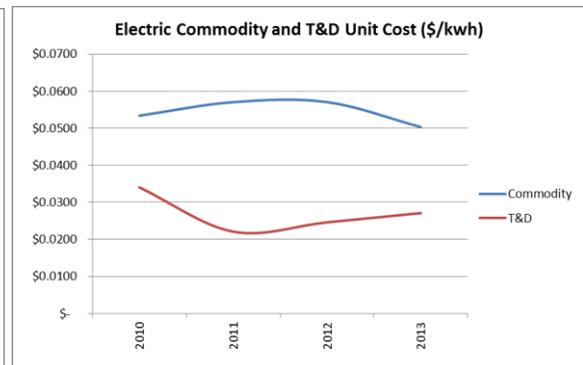
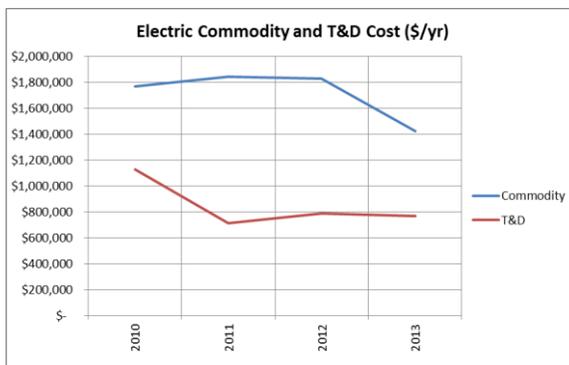
Calendar Year 2014 was another successful year for the Hamilton County Facility Department in regards to electrical, natural gas and water/sewer cost and usage. The 2.75 million square feet of managed space yielded some of the most efficient energy usage since 1998 when the Energy Conservation Efforts began.

- In the last ten years the Energy Conservation Program has yielded a total savings (including avoided cost and grant participation) to the amount of \$12,286,000 dollars.
- Electric usage decreased 3,178 megawatt-hours (MWH) in 2014 compared to 2013. This is a new 10 year low for the facilities under the management of the Facilities Department.
- Natural Gas usage increased 3 million cubic feet (MCF) in 2014 compared to 2013 but still remained the third lowest usage since we began tracking in 2006.
- Water usage was down 1,589 kilogallons (kgal) in 2014 posting a new six year low.
- Performance Contracting was completed in third quarter of 2014 for the Phase 1 buildings (230 East Ninth, 222 East Central Parkway and the County Administration Building). We are beginning to see the impact of these upgrades in our usage declining but the full impact of this project will be seen in 2015 and the future years.
- Performance Contracting for the Phase 1A (800 Broadway, Courthouse and Justice Center) and Phase 2 (Sheriff Patrol, Records Center and Comm Center) buildings is scheduled to be completed in late 2015 with the full impact of these energy efficiency projects being realized in 2016.
- Four buildings received the Energy Star Award in 2014 as a result of the Performance Contracting Work, changes in building operations, and energy efficiency training for building managers and maintenance staff. This was our best year since we started benchmarking to this standard. Also we have been informed that the A&D building will qualify for the Energy Star award in 2015.
- This year the Building Managers along with key staff have completed Certification Level 1 from the Midwest Energy Efficiency Alliance (MEEA) which included a total of 56 hours of training in the field of energy efficient programs, products and practices.
- 800 Broadway was the first County level government building to be LEED-EB:O&M certified.
- In 2015 the following is occurring:
 - Facilities will be issuing an ITB for the provision of electric power for the calendar years 2016-2018 for all county owned facilities.
 - Ralph Linne, Facilities Director, will continue in 2015 to represent Hamilton County as a member of the CCAOSC Energy Executive Committee.
 - Facilities will finalize implementation of the energy module within Archibus which will allow for detailed tracking of energy usage on a monthly basis. This upgraded tracking allows the Facility Department to
 - Ensure targeted reductions are being met per agreement with Ameresco.
 - Find and rectify billing errors within the fiscal year.
 - Eliminate or greatly reduce estimated bills from Duke Energy and brokers.
 - Pinpoint meter and meter reading errors within 30 days of occurrence.

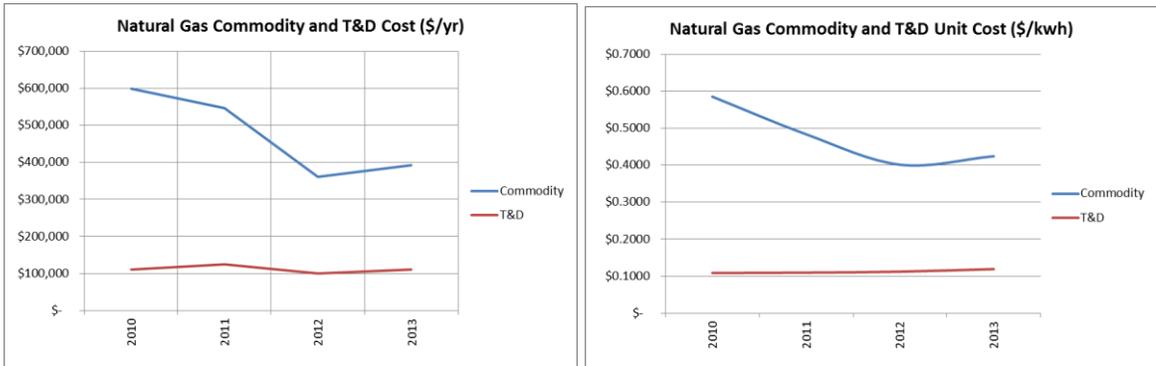
2015 Energy Outlook

There are several main factors currently shaping Ohio's Energy Outlook at this time. Based on research, seminars and learnings from the 2015 Ohio Energy Conference the following key market influences should be watched:

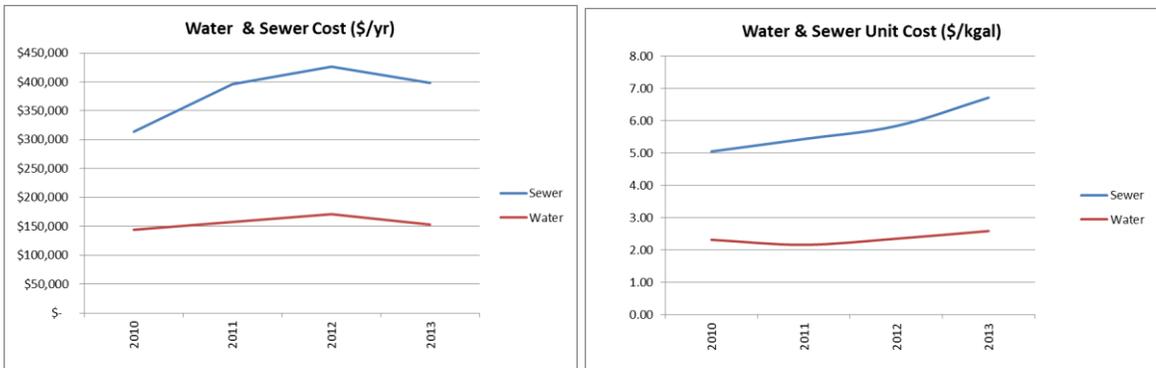
- The current Electricity Deregulation contracts expire December 31, 2015. The Facility Department is currently assembling the ITB to solicit prices for calendar years 2016-2018. Based on historical data, the goal is to open the bids July 2015 taking service Jan 1, 2016 for all accounts. This service was extended to other County departments as well and the Stadia and Parking, Engineer's, DDS and Communication Center have joined the bid.
- New EPA regulations are set to "retire" up to 30% of Ohio's coal burning electricity plants in the next 5 to 10 years. The consensus from the Ohio Energy Conference is that this will drive up electrical generation prices and decrease reliability in the Midwest region.
- Natural gas "fracking" in the Utica and Marcellus deposits are delivery higher than expected natural gas and oil reserves. This may prompt Investor Owner Utilities to build natural gas generating plants to produce electricity in the future. The thinking is that natural gas may very well be a bridge fuel between coal and renewable energy futures. Even with the cold winter the Midwest just experience, the natural gas reserves are expected to be very high heading into spring.
- Duke Energy Ohio is currently negotiating a new Electric Securities Plan (ESP) with PUCO. On June 1, 2015 the new plan is supposed to take effect. Several tariffs are changing again and this could cost the County over \$100,000 annually as they did 3 years ago.
- Commodity and Transportation & Delivery Cost are certainly going to rise.
 - Electrical Deregulation has decoupled electric bills into two main components. Commodity (the actual energy) and Transportation & Deliver (the cost to transport the energy). See Appendix "D" for a complete Rate Tariff Worksheet of a Duke bill. The Commodity is currently being publicly bid out through an ITB process to reduce cost. However the T&D portion is regulated and cannot be bid out - this is a cost paid to the local utility and the rate payer has little control over this portion.



- Natural Gas is also a deregulated market similar to electric. The natural gas costs had been on the decrease since the beginning of the fracking boom but for the last two years these cost has been on a slight increase even with higher than expected production. It may be the pressure from lower oil prices across the globe or market pressure to recover lost earnings but the commodity and total cost are both higher in 2013 and 2014 as evidenced below.

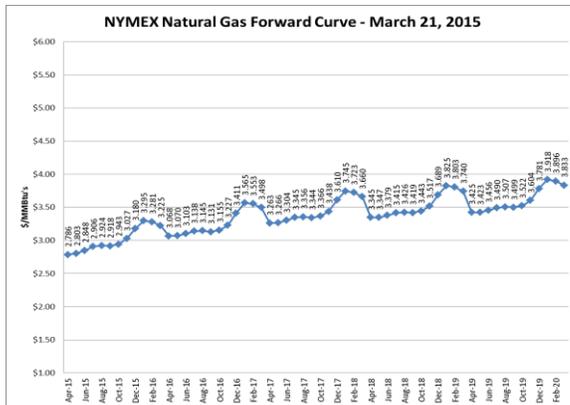


- Water and Sewer costs declined in 2014 due to water efficiency projects implemented in 2013 and 2014 at all buildings. However the associated base cost of these utilities is on the rise and eventually the usage savings will be outpaced by unit cost escalations. The total cost of water and sewer will require additional funds in the near future even at the reduced usages.



2015 Energy Challenges

- The County faces many energy challenges at the present time even with the Facilities Department proactively pursuing deregulation, lower utility tariffs, enhanced building schedules, night setback, equipment replacements, low flush water fixtures, and low wattage lighting replacements. However, more work remains;
 - Electric Power - The next time to bid out deregulated electricity is mid-2015. Electric prices have been on the rise annually since the last contract "locked in" a three year fixed price. Given the projected retirement of coal fired base load electric generation plants, the commodity for electricity is expected to be higher than 2010.
 - Electric T&D - The cost for electric transportation and distribution is expected to continue to increase, but is not known until their rate plans are submitted and approved by the PUCO. This appears to be happening on annual basis. The rider LFA in the current Duke Rate Tariff has cost the County over \$100,000 annually.
 - Water/Sewer Usage - Water/Sewer Usage - The County continues to be challenged to reduce water usage to offset the increase in both water and sewer rates per from the Consent Decree agreement. Sewer cost continues to increase at a rate of 8% annually. The CWW 2015 budget includes a recommendation for a water rate increase of 7.5%.
 - Adverse Weather - The Public Utilities Commission of Ohio (PUCO) filed comments and recommendations with the Federal Energy Regulatory Commission (FERC) addressing the impacts of the recent winter weather events on grid reliability and electricity market prices. The PUCO recommends the establishment of a generation auditing process and a further review of capacity price suppression, including the role demand response resources. The PUCO also requested the FERC examine the causes and actual costs of "uplift" charges, and seeks further exploration on the impact that firm transmission and on-site fuel storage could have in responding to winter weather conditions.
 - Nature Gas Procurement - Natural gas prices continue to increase even though they remain historically much lower than 2005-2007. Retirement of coal powered electric generation plants will continue to put more demand on natural gas generating plants and this will mostly likely drive the cost up of natural gas going forward.



Vision Statement And Objectives

The Hamilton County Facility Department envisions a continued aggressive energy savings plan by utilizing the following strategies:

- Continue the energy management consulting services which consists of the following:
 - Monthly review of electric, gas and water usage
 - Conducting an annual review of electrical pulse meter data for large accounts
 - Entering and monitoring each building's energy usage and cost through energy usage tracking software and Energy Star Portfolio
 - Document and submit data to US EPA to receive Energy Star Awards.
 - All major buildings under Facility control will continue to be entered into the EPA Energy Star program. As buildings reach the 75% passing criteria they will be submitted for the award.
 - For the buildings that do not qualify in this calendar year, the cost and advantages of ECM projects for these buildings to meet the EPA Energy Star minimum guideline will be evaluated.
- Pursue shared services in the area of procurement of energy
 - Purchase deregulated natural gas and deregulated electricity through a block managed by an outside firm through the County Commissioner's Association of Ohio Service Corp. (CCAOSC)
 - The County has renewed its commitment to the CCAOSC Natural Gas Program with extending the agreement thru 2019.
 - The County is committed to First Energy Resources Services for its deregulated electricity commodity through 12/31/2015. This contract will be rebid in 2015.
 - Director of County Facilities will continue to be a member of the CCAOSC Executive Committee and will be directly involved in approval of the purchase of natural gas.
- Performance Contracting with Ameresco, Inc will be completed in 2015 and M&V verification shall begin and continue for at least the next ten years;
 - Phase 1 projects shall begin their Measurement and Verification (M&V) phase.
 - Phase 1A shall have construction completed and start the M&V process mid to late 2015.
 - Phase 2 projects shall be completed and start the M&V process late 2015.
 - Quarterly M&V reports shall begin from which management can be provided performance of the HVAC and Building Systems.
 - Completion of these projects in 2015 should further reduce the total County expenditures in electric, water and natural gas costs with the annual savings set aside to pay for the bonds financing the projects.
- Update the Energy Conservation Master Plan (ECM) in 2015 as a result of the IGA Projects approved and implemented.
- Eliminate inefficient use of energy systems wherever possible by:
 - Purchasing efficient major mechanical equipment (boilers, chillers, cooling towers) per County Life Cycle Cost Analysis Resolution

- Use the Duke Energy Smart \$aver energy efficiency program wherever possible to enjoy Duke rebates energy efficient equipment and light fixtures.
- Fully integrate and finalize the Energy Management Module inside the Archibus framework. This scope shall include;
 - Providing County Administration and Budget Departments with data showing the results of the Performance Contracting Initiative.
 - Monthly reports on targets, goals and usage once the final targets and baselines are established.
 - Projecting increases in cost and usage due to rate changes in the commodity and transportation and delivery cost as rate structures change.
 - Begin weekly monitoring of electric, water and natural gas bills via the online bill entry module inside Archibus. Find and correct improper billing immediately (estimated bills, incorrect bills, missing bills).
- Involve building managers in tracking and saving energy use and cost in County owned buildings to ensure that the required reduction in usage per the agreement with Ameresco occurs over the next 12 years.
 - Continuous monitoring of electric, gas and water usages on major equipment to ensure systems are running efficiently and as designed.
 - Pursing energy efficient building operation, including scheduling night and weekend setback in all buildings where tenants are not using the spaces, practicing demand curtailing, turning off non-essential equipment when not in use, setting outdoor air dampers to minimum positions, and reducing lighting and other electrical loads as agreed in the IGA with Ameresco.
- Secure a full-time Energy Manager position to manage energy usage/contracts.
- Stay on the leading edge of energy saving techniques and implementable solutions for public governments
 - Director continues to maintain his Building Operations Certification (BOC)
 - Attending annual energy conferences and energy saving workshops. Including attendance at the Annual Ohio Energy Conference in Columbus, OH as a means of improving our energy savings strategies, understandings and techniques are in effect.
 - Look into the certification of additional County buildings to the USGBC LEED-EB:O&M Silver Level standard where applicable per County Policy Directive.
 - Train and certify new building mangers through the Midwest Energy Efficiency Alliance Building Operator Certification program.

Benchmarking & Program Results

Energy Star Certifications

Four buildings received the US EPA Energy Star Awards in 2014 which is the highest single year accomplishment to date.

- All major buildings were updated in the Energy Star portfolio last year which includes the updating of all electric, natural gas and water bills, verifying square footage use, people counts and computer counts in the EPA Energy Star Portfolio.
- The County Administration Building, 230 East Ninth, 250 William Howard Taft and 800 Broadway all reached the minimum score of 75 or better to qualify.
- Alms & Doepke Building reached qualification level in late December 2014 after the submission deadline but is currently beginning its validation process for 2015.
- The Alms & Doepke Building and the 250 William Howard Taft Building will be submitted for Energy Star Recognition awards given their vast improvement in Energy Star scores from their baseline scored.
- 800 Broadway continues to show strong Energy Star scores with a County leading 87 posted in 2014. 800 Broadway was also a finalist in the USGBC and Business Courier Green Building Awards held March 5, 2015 at the Sharonville Convention Center.

Energy Star Ratings for Major County Buildings for Last 5 Years

<i>Buildings</i>	<i>2010</i>	<i>2011</i>	<i>2012</i>	<i>2013</i>	<i>2014</i>	<i>Notes</i>
222 (A & D)	48	44	57	67	80	Qualified January 2015
230 East Ninth	74	75	71	87	84	Energy Star Award 2013, 2014 (1)
800 Broadway	88	86	88	86	87	Energy Star Awards 2009 thru 2014
2020 Auburn (Jail)	78	81	79	74	76	Jails do not qualify for award.
Administration	90	93	97	74	79	Energy Star Award 2011, 2012, 2014
Courthouse	46	41	48	46	50	Working with EPA on approval (2)
Justice Center	86	85	85	90	94	Jails do not qualify for award.

(1) All ratings in **BOLD** are above the 75 rating required to certify for the Energy Star Award.

(2) The Courthouse currently provides all the steam for the Justice thus giving the Justice Center an artificially high score and the Courthouse an artificially low score. Negotiations are currently underway with the EPA to build a district steam plant to better represent the operations of these two buildings.

USGBC LEED Certifications

LEED, or Leadership in Energy & Environmental Design, is a green building certification program that recognizes best-in-class building strategies and practices. To receive LEED certification, building projects satisfy prerequisites and earn points to achieve different levels of certification.

- In 2014 the 800 Broadway qualified as first County Level Government Building LEED Certified for Existing Buildings: Operations and Maintenance (LEED-EB:O+M) in Ohio. The 800 Broadway qualified at the LEED Certified Level of 42 points.
- 800 Broadway has shown a 28.1% reduction in potable water usage. This reduction has resulted from reducing the buildings water usage to a level 21.16% below the LEED-EB:O&M baseline. The Energy Use Index (EUI) for this building has decreased from 149.6 kBtu/sf to 141.7 kBtu/sf (201-2014). The Green House Gas (GHG) Emissions have reduced from 3445.6 Metric Tons of CO₂e to 3051.2 CO₂e.
- A major ASHRAE Level II Energy Audit was performed, during the latest round of Energy Conservation measures, for the baseline energy use for the natural gas, electrical and water systems. This audit resulted in implementations of low, or no cost, energy efficiency measures including consolidation of server rooms, replacement of old HVAC equipment, lighting retrofits,

new variable frequency drives, air balance retro-commissioning and a direct digital controls retro-commissioning.

- This Hamilton County building has also been awarded three exemplary credits while demonstrating Innovations in their Building Operations. Sustainable purchasing forms show that 96.15% of the ongoing consumables purchased during the performance period were Sustainable. 100% of the cleaning products and 100% of the cleaning equipment used in this building have successfully qualified under the required sustainable criteria.
- As part of the standard LEED-EBOM required practice an "Enhanced Refrigerant Management and Emissions" procedure has been implemented and all Chlorofluorocarbons (CFC) are planned to be phased out of this building within 5 years.

Energy Conservation Results

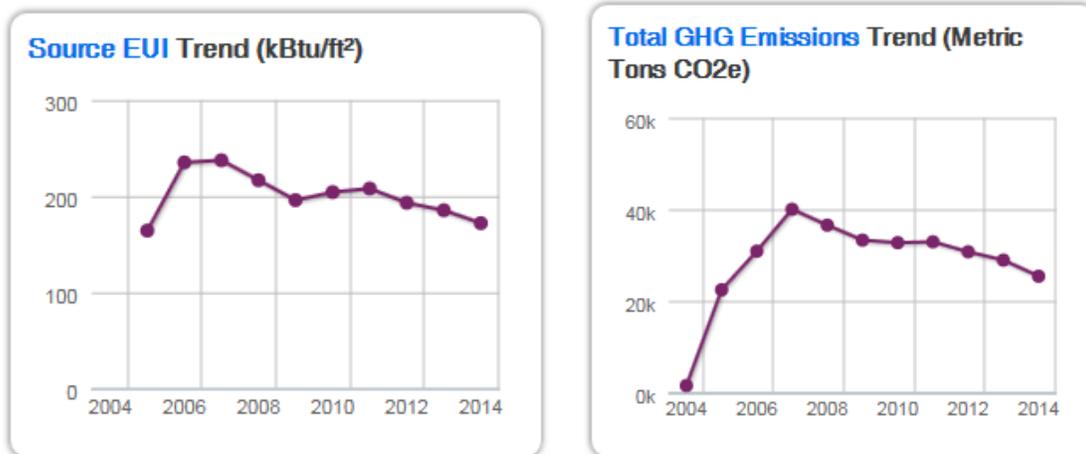
Since the beginning of the Energy Conservation Master Plan in 1997 the County has saved or avoided cost in the following amounts;

- Direct Expenditure Savings - \$4,192,000. These savings include energy efficiency equipment replacements, schedule modifications, interruptible gas tariff savings, deregulated gas and electric savings, and usage reductions throughout this time period for electricity, natural gas and most recently water and sewer.
- Avoided Cost - \$9,072,000. These monies also include the savings accumulated from the deregulated electricity and gas compared to the standard service offer from Duke Energy Ohio (the local utility). These are cost savings had the County not participated in any competitive bidding markets for utilities.
- To date the avoided electric savings are \$3.26 million, the avoided gas savings are \$1.61 million, the interruptible gas savings are \$676,000, direct deregulated electricity savings are \$2.37 million, direct deregulated natural gas savings are \$846,000, and water/sewer savings are \$297,792.

Since implementation in 1998 this program has been one of the cornerstones of the department's ability to reduced its budget and still achieve an acceptable service levels.

Greenhouse Gas Emissions and Energy Use Index Results

Energy Star tracks the Greenhouse Gas Emissions and Energy Use index charts automatically. The following charts indicate decreasing trends in both charts as is desired by the County.



Implementation

- The Energy Conservation Master Plan (ECM) was implemented in conjunction with ThermalTech Engineering in 1998, updated in 2002 through the Rebuild America Grant, and continued with Ameresco Performance Contracting with Ameresco in 2012. The total worth of this program to date is over \$12.2 million dollars in savings. These savings are a compilation of utility savings, avoided cost, rebates, refunds, grants and bill reconciliations. The average annual savings to the taxpayer has been approximately \$394,000.
- In 2010 the process of selecting a qualified Energy Services Company was undertaken to provide Performance Contracting for County Facilities with the County successfully contracting with Ameresco, Inc to perform these duties. These savings are being used to pay directly for the bonds used to finance the following projects.
- Phase 1 - in September 2011, Ameresco delivered an Investment Grade Audit (IGA) which included ECM's for the County Administration Building, 230 East 9th Street, and Alms & Doepke. Projects were implemented in 2012-2014 with the projected annual dollar savings of \$402,807 based on the utility rates in 2010-2011.

County Administration Building

Lighting Retrofit	Boiler and Water Heater Upgrades
Direct Digital Controls Upgrade	Computer Room A/C Heat Recovery
VFD Installation & Motor Replacements	Water Conservation Measures

222 East Central Parkway (Alms & Doepke)

Lighting Retrofit	Domestic Hot Water Heat Pumps
Direct Digital Controls Replacement	Water Conservation Measures
VFD Installation & Motor Replacements	

230 East Ninth Building

Lighting Retrofit	Boiler/Flue Economizer Upgrades
Direct Digital Controls Replacement	Cooling Tower Replacement
VFD Installation & Motor Replacements	Water Conservation Measures
High Efficiency Boiler and Domestic Water Heater Upgrades	VAV (Variable Air Volume) Retrocommissioning

- Phase 1A - in April 2012 Ameresco delivered an Investment Grade Audit (IGA) which included Energy Conservation Measures for the County Courthouse, Justice Center and 800 Broadway buildings. Projects were implemented in 2013 with the projected annual dollar savings of \$574,875 based on the utility rates in 2011.

Courthouse

Lighting Retrofit	High Efficiency Water Heater Upgrade
Direct Digital Controls Upgrade	Boiler Efficiency Improvements
VFD Installation & Motor Replacements	Computer Room A/C Upgrades
Free Cooling Heat Exchanger	Solar Panel Hot Water Storage System
Water Conservation Measures.	

Justice Center

Lighting Retrofit	Heat Pump Water Heaters
Direct Digital Controls Upgrade	LCC Variable Refrigerant Flow System
VFD Installation & Motor Replacements	High Efficiency VFD Chiller Upgrades
Water Conservation Measures	Solar Panel Hot Water Storage System

800 Broadway

Lighting Retrofit	Data Center Consolidation
Direct Digital Controls Upgrade	Phone Room A/C Modifications
VFD Installation & Motor Replacements	Heat Exchanger Replacements
Water Conservation Measures	High Efficiency Domestic Water Booster Pump Replacements

- Phase 2 - in March 2013 Ameresco delivered an Investment Grade Audit (IGA) which included Energy Conservation Measures for 2020 Auburn, 250 William Howard Taft, Communications Center, Sheriff Patrol Headquarters, Clerk of Courts Records Center, and Public Works Garage. Projects were implemented in 2014 with the projected annual dollar savings of \$150,570 to start in 2015.

2020 Auburn

Lighting Retrofit	Water Conservation Measures
Direct Digital Controls Upgrade	High Efficiency Water Heater Upgrade
VFD Installation & Motor Replacements	

250 William Howard Taft

Lighting Retrofit	Water Conservation Measures
Direct Digital Controls Upgrade	VFD Installation & Motor Replacements

Communications Center

Lighting Retrofit	Water Conservation Measures
Direct Digital Controls Upgrade	Computer Room Heat Recovery Unit

Sheriff Patrol Headquarters

Lighting Retrofit	Water Conservation Measures
Direct Digital Controls Upgrade	HVAC Equipment Upgrades

Clerk of Courts Records Center and Public Works Garage

Lighting Retrofit	Water Conservation Measures
Direct Digital Controls Upgrade	HVAC Equipment Upgrades

Aggregate and Annual Usage Summary

Annual Energy Usage -The chart below represents actual data collected over the last three years for the major buildings under Facility Department management. This non-normalized data provides a general overview on energy use, square foot use and square foot cost independent of all variables inside the buildings which include vacancy, schedules and weather conditions.

Table 1: Annual Energy Usage

	2012												Avg Elec Cost/KWH
	Electric		Gas		Water & Sewer		Building	Electric	Gas	Water	All	All	
	KWH	Cost	MCF	Cost	CCF	Cost	Area (SF)	KWH/SF	MCF/SF	CCF/SF	Usage/SF	Cost/SF	
230 E9th	2,954,080	\$ 283,236	8,146	\$ 46,892	7,306	\$ 44,550	196,000	15	0.0416	0.0373	7.56	1.91	
800 Broadway	4,211,074	\$ 349,305	5,988	\$ 39,057	6,922	\$ 65,194	250,000	17	0.0240	0.0277	8.43	1.81	\$ 0.0814
Administration	3,771,632	\$ 331,213	3,040	\$ 22,460	9,613	\$ 64,491	186,000	20	0.0163	0.0517	10.15	2.25	Avg Gas Cost/MCF
222 East Central	4,911,254	\$ 407,759	5,535	\$ 36,453	3,743	\$ 31,116	275,000	18	0.0201	0.0136	8.94	1.73	\$ 5.34
2020 Auburn	2,363,537	\$ 183,240	4,550	\$ 27,164	5,804	\$ 45,050	170,000	14	0.0268	0.0341	6.96	1.50	Avg Water Cost/CCF
Courthouse	5,028,498	\$ 447,941	73,589	\$ 363,676	22,051	\$ 132,158	440,000	11	0.1672	0.0501	5.80	2.14	\$ 6.32
Justice Center	11,154,453	\$ 796,241	1,739	\$ 11,947	48,095	\$ 271,444	525,000	21	0.0033	0.0916	10.62	2.06	Total Utility Cost
	34,394,528	\$ 2,798,934	102,587	\$ 547,649	103,534	\$ 654,002		17	0.0428	0.0437	8.35	\$ 1.92	\$ 4,000,585
	2013												Avg Elec Cost/KWH
	Electric		Gas		Water & Sewer		Building	Electric	Gas	Water	All	All	
	KWH	Cost	MCF	Cost	CCF	Cost	Area (SF)	KWH/SF	MCF/SF	CCF/SF	Usage/SF	Cost/SF	
230 E9th	2,173,974	\$ 227,651	6,142	\$ 39,203	4,592	\$ 33,124	196,000	11	0.0313	0.0234	5.56	1.53	
800 Broadway	3,632,177	\$ 280,967	10,503	\$ 62,551	5,498	\$ 59,182	250,000	15	0.0420	0.0220	7.29	1.61	\$ 0.0771
Administration	3,521,518	\$ 290,316	4,841	\$ 31,831	5,706	\$ 45,700	186,000	19	0.0260	0.0307	9.48	1.98	Avg Gas Cost/MCF
222 East Central	4,125,047	\$ 311,940	5,815	\$ 36,149	2,846	\$ 27,989	275,000	15	0.0211	0.0103	7.51	1.37	\$ 5.43
2020 Auburn	2,391,082	\$ 167,496	5,824	\$ 37,396	5,240	\$ 48,488	170,000	14	0.0343	0.0308	7.05	1.49	Avg Water Cost/CCF
Courthouse	4,826,947	\$ 403,085	77,999	\$ 393,135	21,644	\$ 143,628	440,000	11	0.1773	0.0492	5.57	2.14	\$ 7.27
Justice Center	9,967,990	\$ 681,245	1,315	\$ 10,408	39,071	\$ 256,664	525,000	19	0.0025	0.0744	9.49	1.81	Total Utility Cost
	30,638,735	\$ 2,362,699	112,438	\$ 610,674	84,597	\$ 614,776		15	0.0478	0.0344	7.42	\$ 1.70	\$ 3,588,149
	2014												Avg Elec Cost/KWH
	Electric		Gas		Water & Sewer		Building	Electric	Gas	Water	All	All	
	KWH	Cost	MCF	Cost	CCF	Cost	Area (SF)	KWH/SF	MCF/SF	CCF/SF	Usage/SF	Cost/SF	
230 E9th	2,240,772	\$ 237,628	7,315	\$ 51,086	3,843	\$ 32,031	196,000	11	0.0373	0.0196	5.73	1.64	
800 Broadway	3,546,447	\$ 282,436	11,052	\$ 74,037	6,281	\$ 68,287	250,000	14	0.0442	0.0251	7.11	1.70	\$ 0.0817
Administration	3,423,074	\$ 303,400	4,932	\$ 36,320	5,149	\$ 45,212	186,000	18	0.0265	0.0277	9.22	2.07	Avg Gas Cost/MCF
222 East Central	3,660,955	\$ 309,862	8,828	\$ 61,058	3,059	\$ 31,176	275,000	13	0.0321	0.0111	6.67	1.46	\$ 6.28
2020 Auburn	2,123,033	\$ 161,466	6,821	\$ 47,661	5,118	\$ 46,588	170,000	12	0.0401	0.0301	6.26	1.50	Avg Water Cost/CCF
Courthouse	4,456,770	\$ 389,046	73,241	\$ 427,866	19,793	\$ 143,996	440,000	10	0.1665	0.0450	5.15	2.18	\$ 7.78
Justice Center	8,770,517	\$ 621,991	1,128	\$ 13,639	38,959	\$ 272,414	525,000	17	0.0021	0.0742	8.35	1.73	Total Utility Cost
	28,221,568	\$ 2,305,829	113,316	\$ 711,667	82,202	\$ 639,705		14	0.0498	0.0333	6.93	\$ 1.75	\$ 3,657,201

A review of this data above can be summarized as follows;

- Electric consumption decreased by 8% (2,417,000 less kwh) in 2014 but the total cost of electricity only decreased 2% (\$56,870).
- Natural gas consumption increased slightly by 1% (888 MCF) for an increased cost of 17% (\$96,809) compared to 2013. This was mostly attributable to construction projects on boiler plants and a very cold winter (highest heating degree required since ECM projects began in 1998).
- Water consumption decreased by 3% (20,000 less gallons) showing a second straight year in decreased consumption but the cost increased 4% (\$25,000) illustrating the fact the even with declining usage, it is not outpacing rate increases by CWW and MSD.
- When weather is taken into account ("normalizing" the data) the electric usage decreases by 13,430,000 KWH, natural gas decreases by 130,047 CCF and the water usage remains unaffected. This demonstrates that weather played a significant role in natural gas usage in 2014.

Use Per Square Foot Methodology - another metric used to review building efficiency is the usage per square foot charts shown below. These are tabulated for major facilities to ensure that the ECM's being implemented are working and the general use/sf trend is downward for the portfolio. The usage per square foot graphs included in this year's report show a very consistent downward trend in the last several years for each of the buildings. The average electric, natural gas, and water consumption for all of the buildings has shown improvement in the last several years. The ultimate goal is to try to offset any forthcoming rate increases with lower usage whenever that is possible.

Electric – These two charts demonstrate that usage per square foot is decreasing while the cost per kWh continues to increase as a general rule. The outlook is that electricity will cost more in the next three year strip even with decreased usage. The forthcoming prices from the electric bid will mostly likely be higher than the 2010 prices.

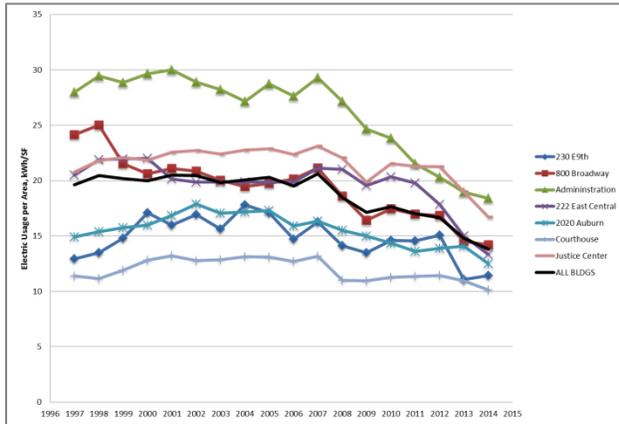


Figure 1 - Electric Usage per Square Foot

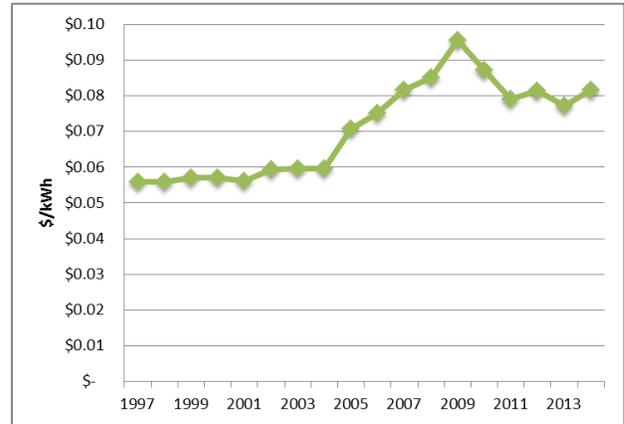
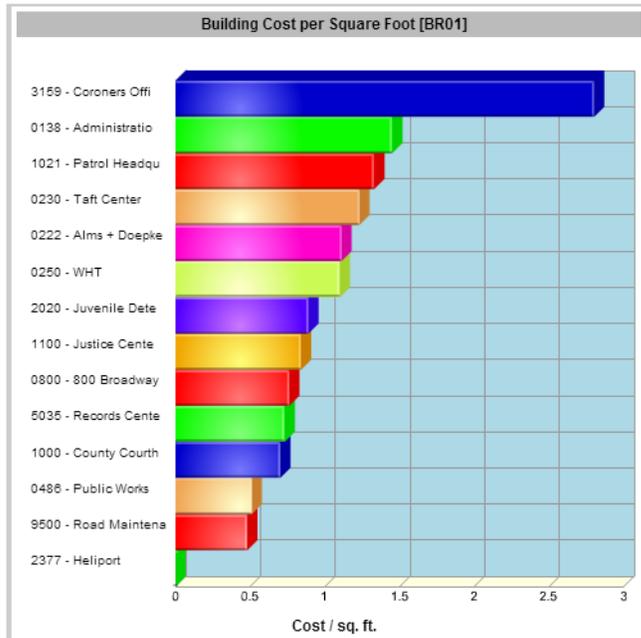


Figure 2 - Electric Cost per kilowatt hour



This bar chart to the left indicates that some of the smaller buildings are the largest users of electricity per square foot. But this can be explained due to the uses of these particular buildings. For instance,

- The Coroner's Office is a laboratory space with 24/7 use in some areas.
- The Administration building hosts a Data Center which are high electrical load usages.
- The Patrol Headquarters is also a 24/7 operated building.

Natural Gas – As demonstrated below the gas usage per square foot is on an overall downward slope although several buildings showed a slight increase in gas usage in 2014. Facilities is addressing those increased usages and monitoring gas bills monthly to bring these accounts back down to previous year's usages. This is part of the Ameresco M&V services as well. Natural gas cost is up after seeing extremely low prices back to 2000. It can be expected that overall gas budgets will increase in the next three years (see next page).

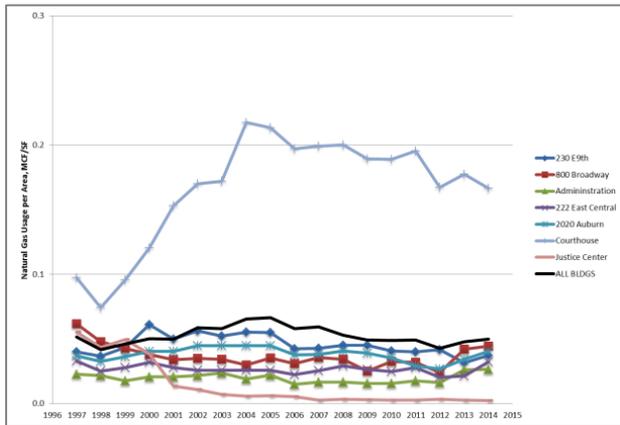


Figure 3 - Natural Gas Usage per Square Foot

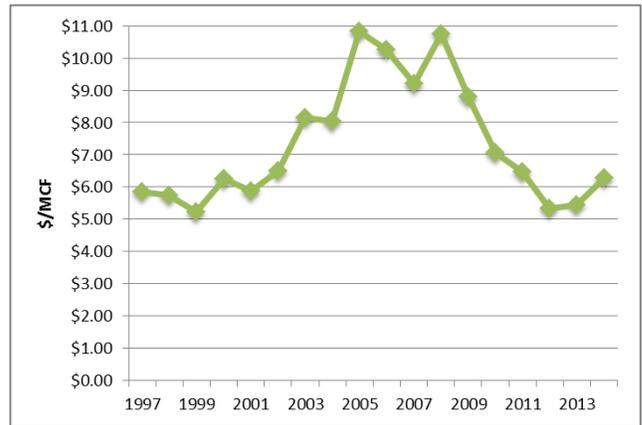
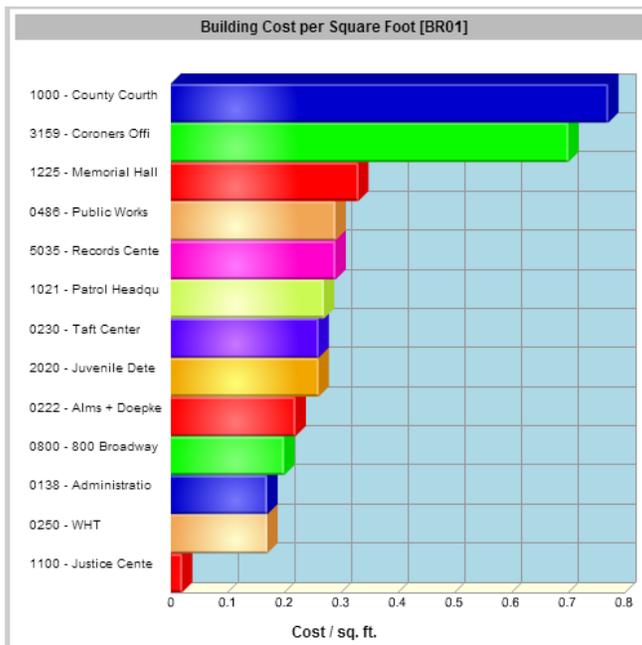


Figure 4 - Natural Gas Cost per 1000 cubic feet



This bar chart to the left indicates that the Courthouse clearly is the largest user of natural gas per square foot. These usages can be explain as follows;

- The Courthouse provides all heat for the Justice Center in order to qualify for the IT rate savings.
- The Coroner's Office is a laboratory space with 24/7 use in some areas.
- Memorial Hall is an older building with older boilers that has not been upgraded to new heating technologies yet
- Public Works and Records center are warehouse and garage type space requiring a lot of heating.

Water and Sewer – The usage per square foot is generally on a downward with a slight leveling in 2014 evidence by the solid black line. The cost of water/sewer is on the rise most likely due to increased sewer rates after coming off a four year drop in unit cost. It is expected that water and sewer rates will continue to required increased budgets until the Consent Decree work is complete and sewer rates level off.

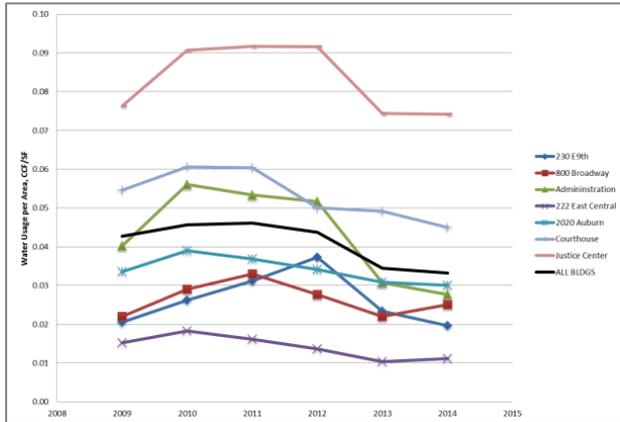


Figure 5 - Water Usage per Square Foot

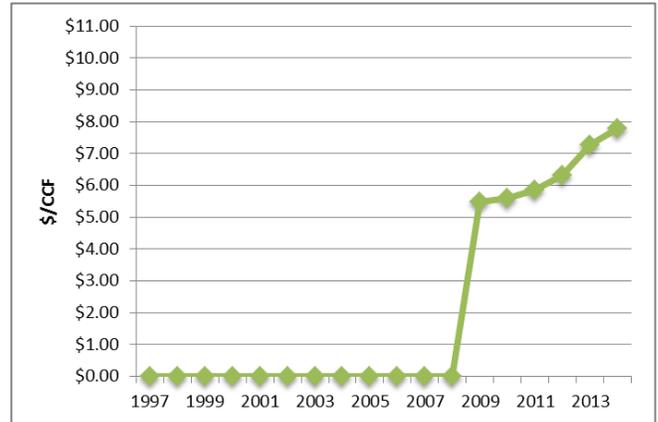
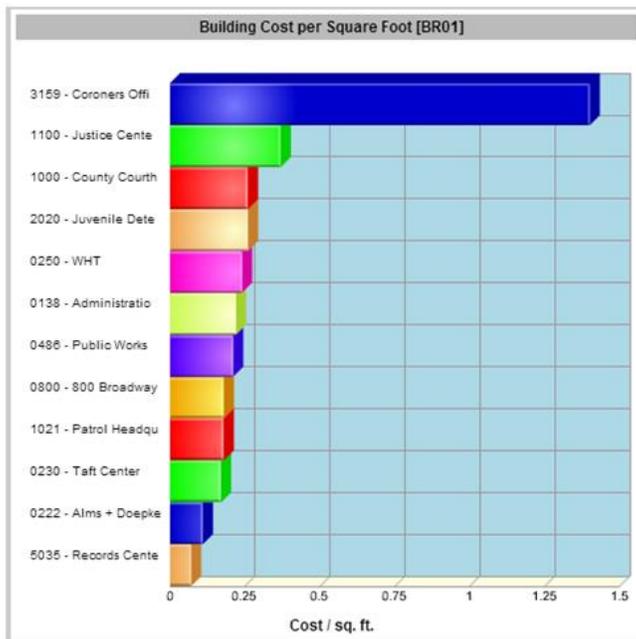


Figure 6 - Water Cost per 1000 cubic feet



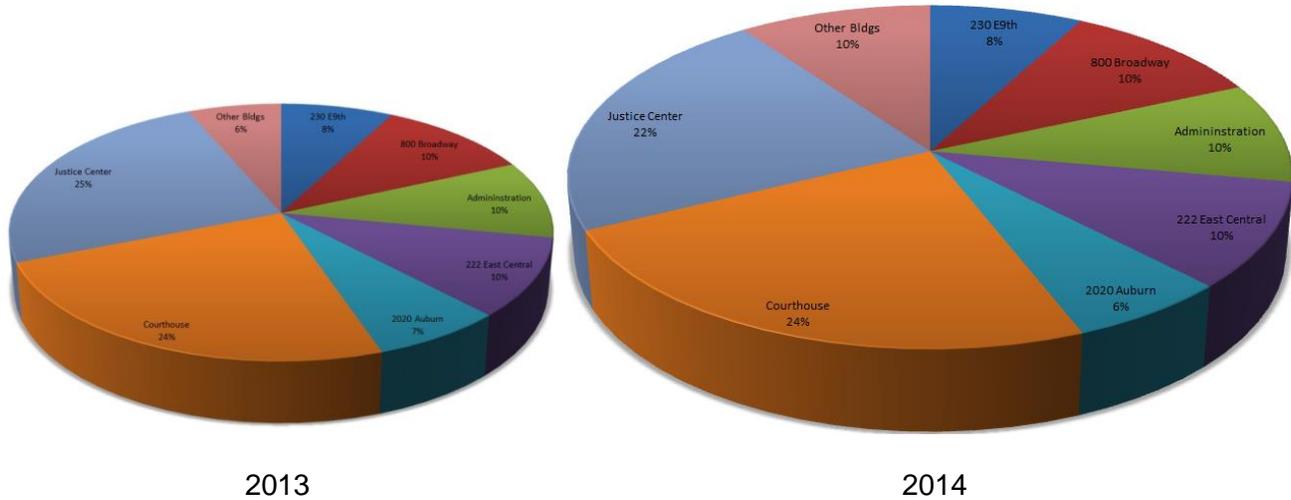
This bar chart above indicates that the Coroner's Office is clearly the largest user of water per square foot. These usages can be explained as follows;

- At the Coroner's Office the morgue coolers are water cooled equipment thus they use a tremendous amount of water to provide the cooling required for a morgue facility.
- The showers and kitchen at the Justice Center required a lot of water to provide required sanitation and food.
- The Courthouse hosts the Sheriff's garage where Sheriff's cars are washed and serviced.

Total Utility Expenditures

The following charts present an overall view of the total utility expenditures for 2014 in several variations; Total Utility Cost for 2013 vs 2014 in the pie charts and historical usages by month. Without actively participating in the Deregulated Electricity and Natural Gas markets that these cost would be significantly higher.

Figure 7: Utility Cost Contribution to Global Cost (Elec, NG & Water)

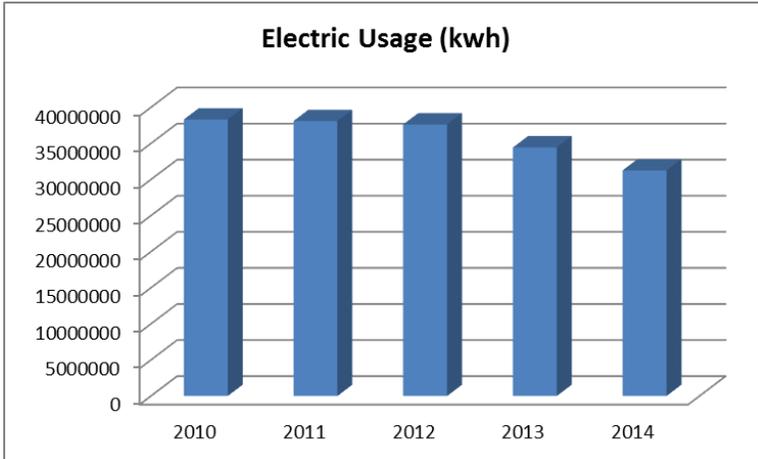


After a 16% decrease in "Large Building" vs "Other Bldg" usage in 2012-2013 (Performance Contract ECM projects Phase 1 and Phase 1A), it can be seen that in 2014 these trends leveled off. Now the "Other Buildings" have decreased their utility cost by 4% compared to the portfolio. This makes sense because the Performance Contract work has begun in the smaller buildings while the same work is mostly complete in the larger buildings. This phase of the Master Energy Conservation Plan continues to provide valuable benefit.

Other Buildings include: 250 William Howard Taft, Public Works Garages, Sheriff Parking Lot, Patrol Headquarters, Memorial Hall, Communication Center, Coroner's Office, Records Center, Target Range, and Road Maintenance.

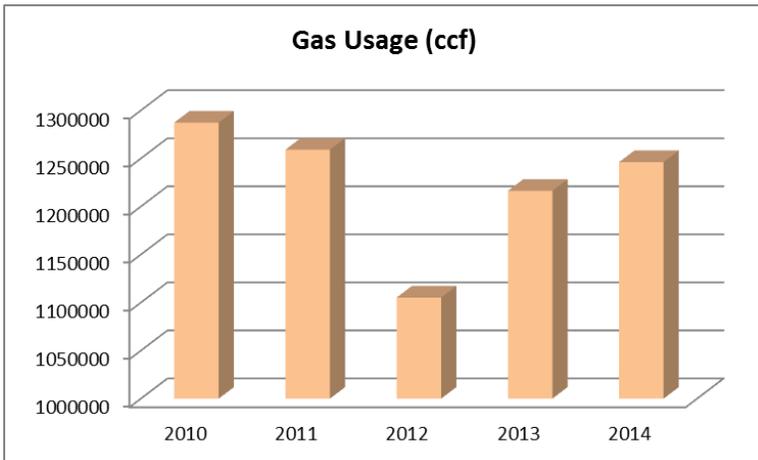
5 Year Utility Comparisons Charts (electric, gas and water)

Electric Usage



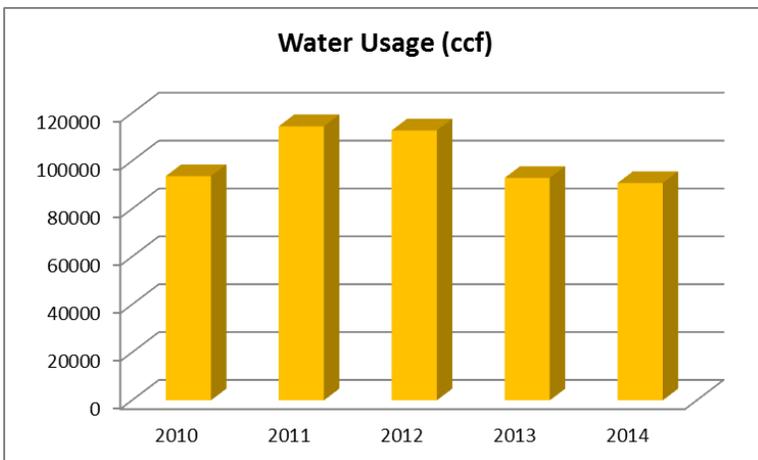
The 5-year electric usage analysis shows a steady decline in electric usage resulting in an overall decrease of 7,055,175 kwh since 2010 which is a 19% drop in usage in the last 5 years. Includes All Buildings independent of weather conditions.

Natural Gas Usage



The 5-year natural gas usage shows a drop and rise in natural gas usage mostly attributed to very cold winters in 2013 and 2014. Irrespective of the winter cold the natural gas usage has dropped 41,091 ccf or 4% since 2010. Includes All Buildings independent of weather conditions.

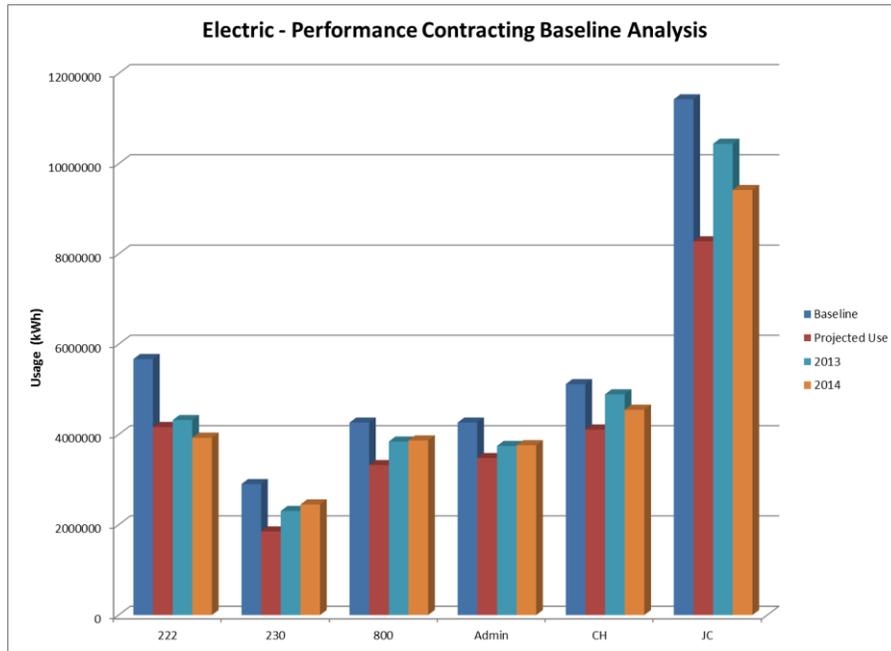
Water Usage



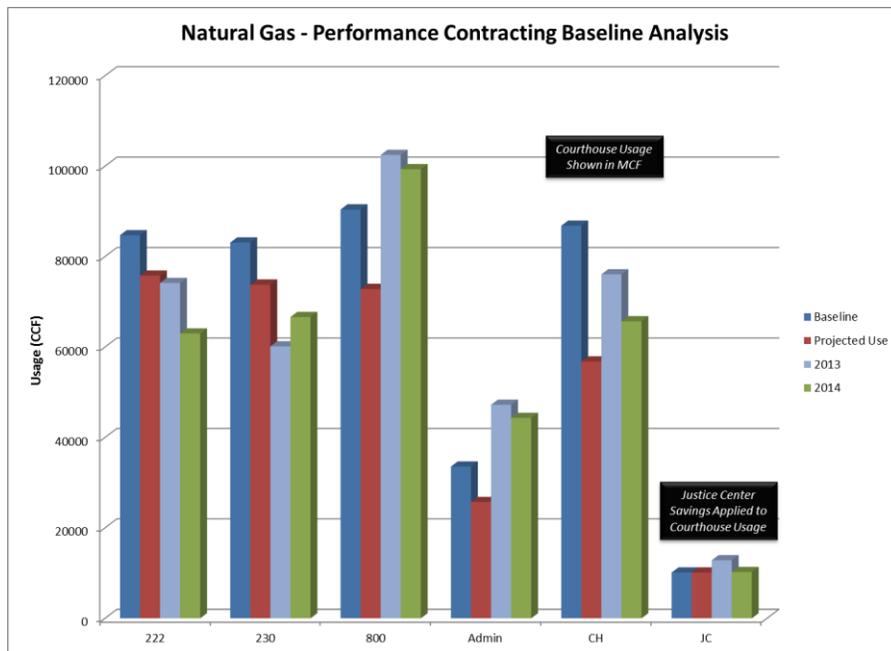
The 5-year water usage shows an increase initially but has been on a steady decrease since 2011. In 2014 the water usage dropped 2154 kgals or 4% compared to 2010 readings. Includes All Buildings independent of weather conditions.

Performance Contracting Baseline Review

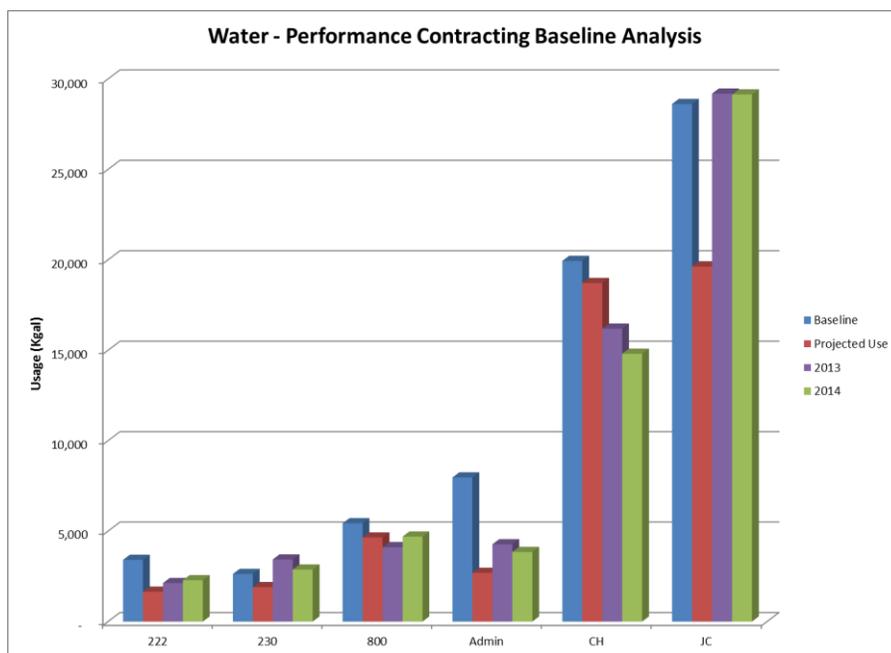
The following charts are a summary review of the in the Performance Contracting projects. Baselines were set in 2010-2012. Performance Targets are shown in Red. Phase 1 buildings M&V performance starts in 2015. Phase 1A and 2 are scheduled to be online in late 2015/early 2016.



All buildings are showing vast improvements compared to the baseline year with 222 East Central Parkway already meeting target goals in 2014. Justice Center is still over predicted savings target.



Most buildings show a sharp decrease in natural gas usage except for 800 Broadway and the County Administration Building. Changes in schedule and use are currently underway to bring these buildings back in line with their project savings goals.



Most buildings are down compared to the baseline year with the Courthouse doing a particular nice job in saving water usage. The 230 Building and Justice Center are both using more water which will require attention in 2015 to rectify these issues.

Building Utility Tracking Graphics

The following tables and figures are visualization and tracking tools used to study, verify and predict usage in the County Facilities Portfolio of buildings.

These section provide a more detailed review of the findings earlier in this report.

Each building section is comprised of the following data:

- Building Profile from Archibus showing the building footprint, square footage, construction and year built.
- Annual Electric Usage with corresponding Cooling Degree Days chart.
- Annual Natural Gas Usage with corresponding Heating Degree Days chart.
- Annual Water Usage Summary.
- General Summary for the utility usage for all three utilities.
- Historical Monthly Electric and Natural Gas Usage Spreadsheet.
- Three-year review of Hourly Electric Usage with comments.
- Electrical profile review for demand curve, load duration and daily trends.
- Current Energy Star score and review and metrics.
- Summary of Energy Savings Projects (ECM's).

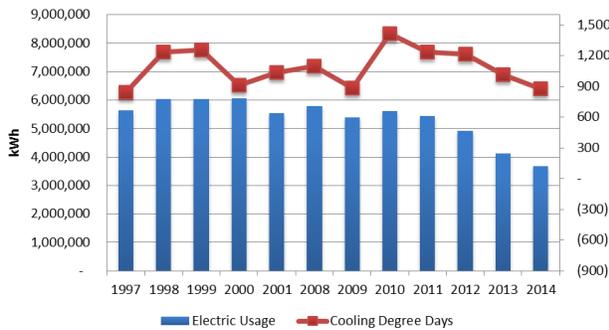
(individual building data begins on next page)

222 Central Parkway

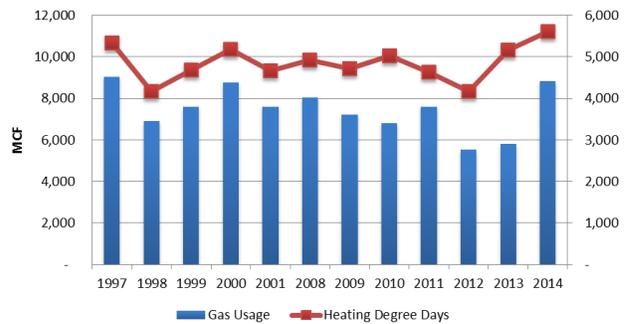
0222 - Alms & Doepke Building				ARCHIBUS/FM Bldg Data			
				Bldg Code:	0222		
				Bldg Name:	Alms & Doepke Building		
				Address:	222 East Central Parkway		
				City:	CINCINNATI		
				State:	OH		
				Postal Code:	45202		
				Site Code:	COUNTYCAMPUS		
				Agency:	Job/Family Services		
				Use:	Office		
				Const Type:	Brick		
Date Built:	1878						
Ext Gross Area:	278,611.88 sf						
Int Gross Area:	260,361.49 sf						
Rentable Area:	249,800.68 sf						
Estimated Area:	0.00 sf						
Total Roof Area:	0.00 sf						
Leased/Owned:	Owned						
Floor Count:	8						
Sprinklered? :	Yes						
Property:	075-0004-0240-00						

Fl Code	Int Gross	Ext Gross	Vert Pen	Service	Rentable	Usable	Room Area
01	37,349 sf	39,398 sf	1,432 sf	5,301 sf	35,917 sf	30,616 sf	24,610 sf
02	37,707 sf	40,218 sf	1,467 sf	3,183 sf	36,240 sf	33,056 sf	24,001 sf
03	37,766 sf	40,236 sf	1,406 sf	3,502 sf	36,360 sf	32,857 sf	27,015 sf
04	37,835 sf	40,218 sf	1,457 sf	3,158 sf	36,378 sf	33,220 sf	24,916 sf
05	37,981 sf	40,932 sf	1,355 sf	3,412 sf	36,626 sf	33,214 sf	24,096 sf
06	29,458 sf	31,598 sf	1,694 sf	3,118 sf	27,764 sf	24,646 sf	22,437 sf
07	4,950 sf	5,460 sf	376 sf	475 sf	4,574 sf	4,098 sf	3,704 sf
0B	37,315 sf	40,552 sf	1,372 sf	6,602 sf	35,943 sf	29,341 sf	31,443 sf
OUT	0 sf	0 sf	0 sf	0 sf	0 sf	0 sf	0 sf
SB	0 sf	0 sf	0 sf	0 sf	0 sf	0 sf	0 sf

222 East Central Annual Electric Usage

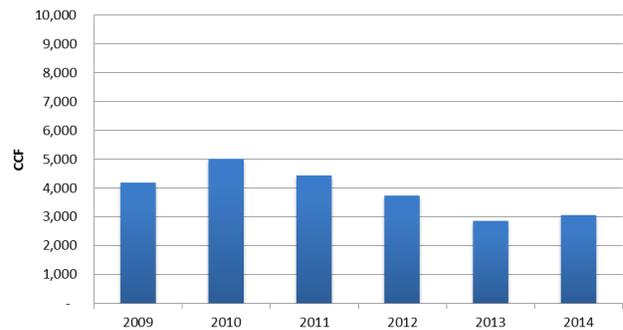


222 East Central Annual Gas Usage



The 222 East Central Parkway has been trended over the last several years, with historical data collected for comparison. The Facilities Department took over building operation at this facility in 2008. The building continues to become more energy efficient in electric utilities but has seen it's water and natural gas usage go up mostly due to the harsh weather Cincinnati had in 2014. Water consumption is lower and in 2015 this building will qualify for the Energy Star rating.

222 East Central Annual Water Usage



222-Historical Monthly Electric and Gas Data

The following data is a representation of electrical, water and gas usage by month. The green cells show the minimum usage for the month.

- Electric consumption (KWH) decreased 3% compared to a 14% reduction in degree days.
- Electric demand (KW) remained approximately the same.
- Natural gas consumption decreased 8% compared to a 9% increase in heating degree days.
- Water consumption increased 7% compared to the previous year. Overall however the water usage is down 28% compared to 2010.

222 East Central Electric Data

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL	
2012	kWh	417,048	370,011	404,928	468,938	450,211	450,648	486,679	445,487	445,068	332,628	323,287	316,321	4,911,254
	kWa	885	884	1,175	1,109	1,128	1,071	1,115	1,040	1,023	947	874	737	1,175
	kWb	1,115	1,115	1,175	1,115	1,128	1,115	1,115	1,040	1,023	947	874	737	1,175
	Cost	\$ 34,367	\$ 33,071	\$ 35,475	\$ 37,331	\$ 36,707	\$ 36,543	\$ 38,214	\$ 35,184	\$ 34,906	\$ 33,710	\$ 27,327	\$ 24,924	\$ 407,759
2013	kWh	337,496	354,816	313,070	356,482	400,208	406,048	394,272	348,445	362,249	322,602	264,616	264,743	4,125,047
	kWa	749	754	742	986	979	881	1,008	854	873	900	972	619	1,008
	kWb	749	754	742	986	979	881	1,008	845	873	900	972	856	1,008
	Cost	\$ 25,545	\$ 23,603	\$ 22,012	\$ 27,473	\$ 29,296	\$ 28,143	\$ 29,799	\$ 25,796	\$ 26,537	\$ 25,743	\$ 24,914	\$ 23,078	\$ 311,940
2014	kWh	306,097	306,530	312,321	299,077	308,426	374,809	363,170	330,622	352,800	256,782	218,512	231,809	3,660,955
	kWa	634	650	650	931	862	938	941	1,027	898	763	811	540	1,027
	kWb	857	857	857	931	862	938	941	1,027	898	873	873	873	1,027
	Cost	\$ 24,857	\$ 24,872	\$ 25,075	\$ 25,860	\$ 25,143	\$ 30,718	\$ 28,429	\$ 28,666	\$ 27,354	\$ 23,772	\$ 22,302	\$ 22,813	\$ 309,862

222 East Central Taft Gas Data

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
2012	CCF	13,689	11,375	5,297	4,209	1,248	130	102	100	1,005	7,983	10,109	55,349
	Cost	\$ 9,363	\$ 6,934	\$ 3,425	\$ 2,088	\$ 815	\$ 391	\$ 381	\$ 381	\$ 379	\$ 866	\$ 4,804	\$ 6,626
2013	CCF	15,975	18,223	13,664	7,975	1,688	329	38	35	17	40	64	101
	Cost	\$ 9,269	\$ 10,237	\$ 7,934	\$ 5,278	\$ 1,440	\$ 571	\$ 375	\$ 377	\$ 252	\$ 124	\$ 137	\$ 155
2014	CCF	33,553	16,668	12,052	8,340	3,119	532	35	36	35	571	3,968	9,370
	Cost	\$ 21,635	\$ 11,422	\$ 8,237	\$ 6,038	\$ 2,604	\$ 758	\$ 405	\$ 408	\$ 262	\$ 659	\$ 2,647	\$ 5,982

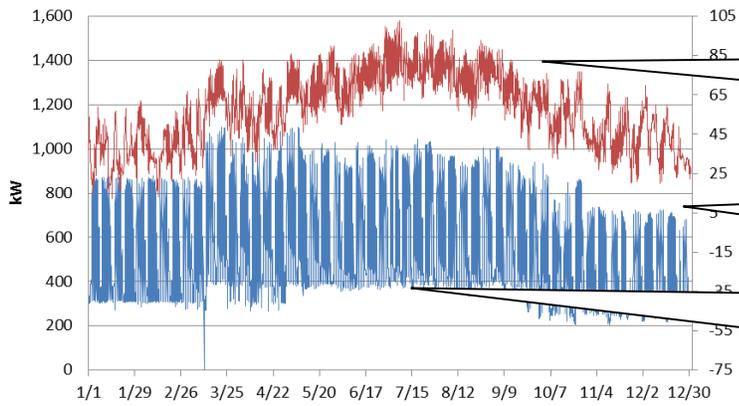
222 East Central Taft Water Data

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
2012	CCF	184	220	203	318	308	420	474	513	501	290	180	132
	Cost	\$ 1,794	\$ 2,232	\$ 2,039	\$ 2,542	\$ 2,558	\$ 3,279	\$ 3,364	\$ 3,593	\$ 3,694	\$ 2,396	\$ 1,869	\$ 1,757
2013	CCF	110	152	126	147	222	360	391	339	412	246	195	146
	Cost	\$ 1,504	\$ 1,979	\$ 1,778	\$ 1,744	\$ 2,292	\$ 3,006	\$ 3,121	\$ 2,830	\$ 3,419	\$ 2,269	\$ 2,064	\$ 1,983
2014	CCF	109	155	162	203	212	271	389	342	425	224	280	286
	Cost	\$ 1,594	\$ 2,104	\$ 2,216	\$ 2,273	\$ 2,197	\$ 2,631	\$ 3,383	\$ 2,985	\$ 3,597	\$ 2,327	\$ 2,751	\$ 3,118

Green cells = minimum of month for past 3 years

222-Three Year Electrical Review

222 E Central Annual Electric Profile (2012)

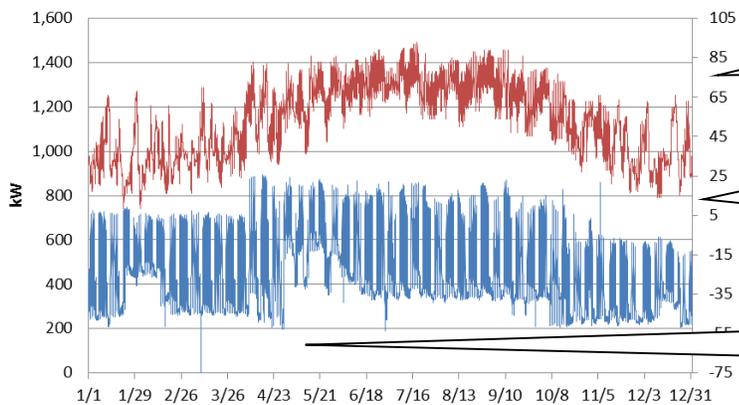


Not only has consumption decreased by 10%, but the summertime peak demand decreased by 10% as well.

The recorded winter peak demand is significantly lower after a lighting retrofit.

The significant decrease in electricity consumption (10%) is partly contributable to a lower summer base demand. Less cooling equipment is running constantly during the season.

222 E Central Annual Electric Profile (2013)

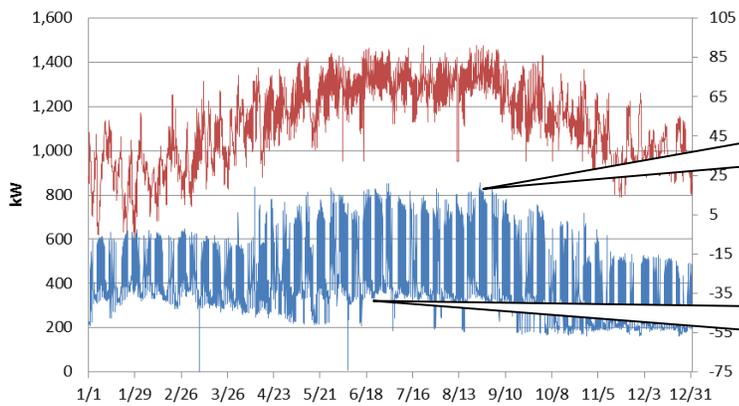


The peak demand has reduced by 170 kW.

Demand has reduced throughout the year. The peak is lower but the base demand is also lower than previous years.

In Jan/Feb and May, the base demand was disrupted, indicating equipment operating at night atypically.

222 E Central Annual Electric Profile (2014)



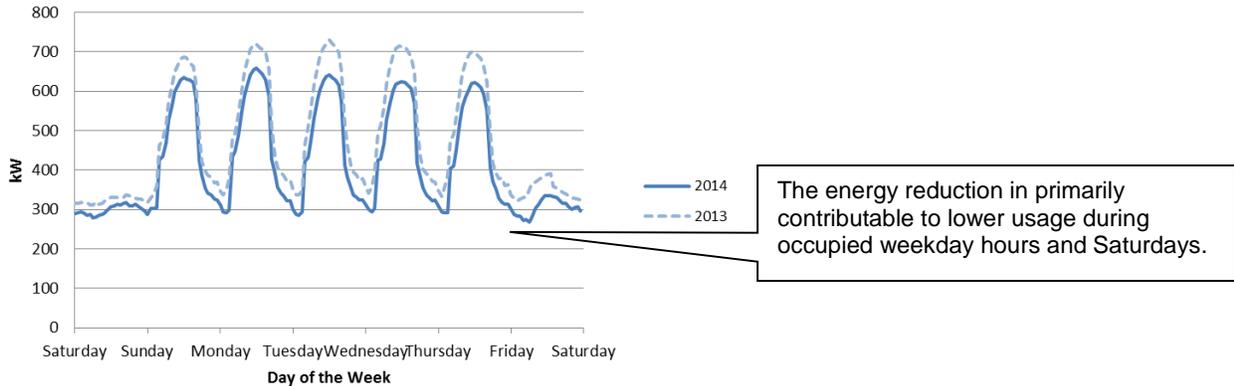
The peak demand has reduced in frequency with fewer spikes over 800 KW

Overnight setback is working perfectly. A&D has decrease amount of electric being used overnight consistently.

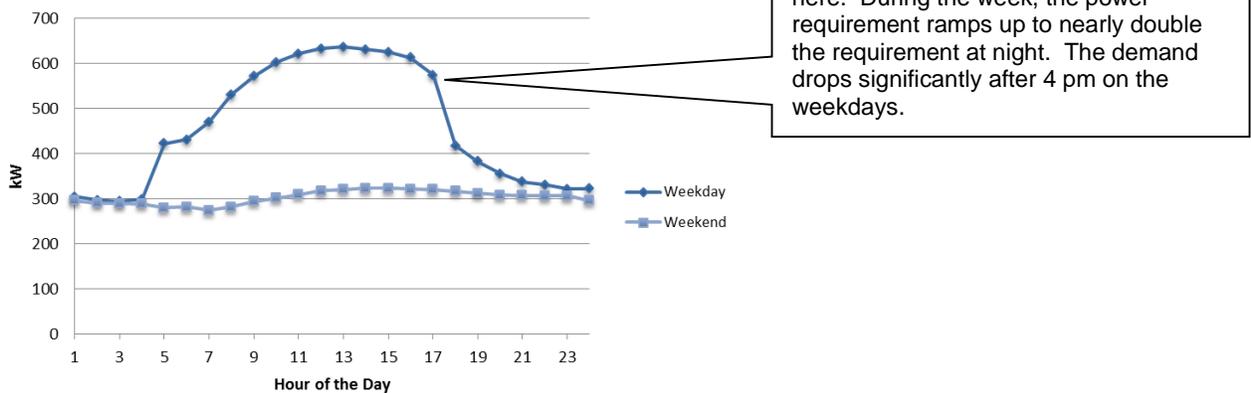
222-Electric Profile Review

The graphs below illustrate the power requirements of the facility throughout a typical week, typical day and the year. The typical week and typical day profiles are averaged throughout the year in order to view how the electric demand varies during the day and across the week. The load duration curve represents the demand as a function of cumulative time for the year.

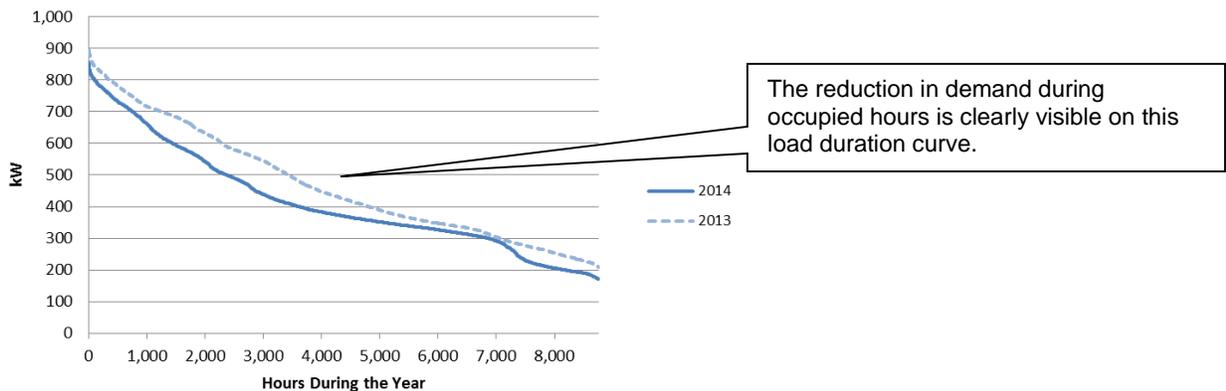
222 E Central Typical Week Profile



222 E Central Typical Day Profile (2014)



222 E Central Load Duration Curve



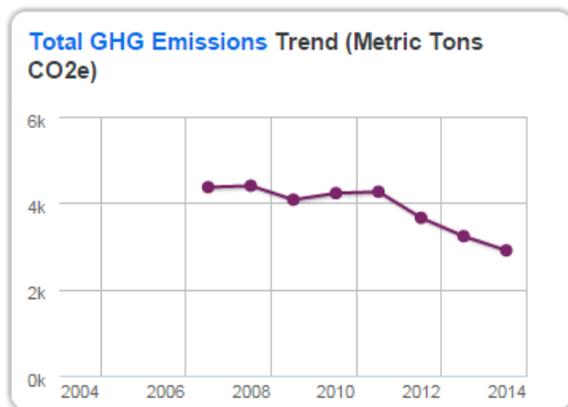
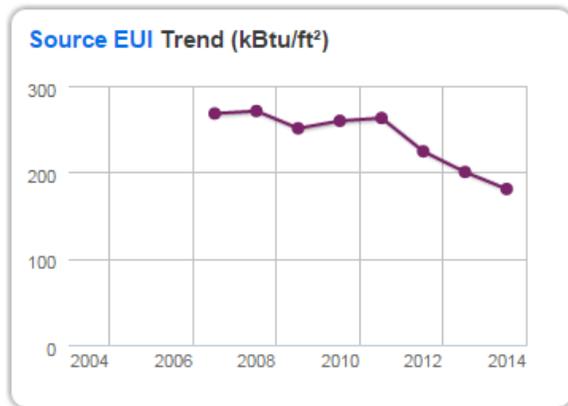
222 East Central Parkway - Alms & Doepke -Energy Star Review

Alms & Doepke Building

222 East Central Parkway, Cincinnati, OH 45202 | [Map It](#)
 Portfolio Manager Property ID: 1647872 | Primarily: Office
 Year Built: 1878



ENERGY STAR Score (1-100)	
Current Score:	80
Baseline Score:	53



Energy Star Charts:

The EPA's Energy Star website tracks the Energy Use Index EUI and the Green House Gas GHG emissions annually for a building based on the electricity, natural gas and water usage. These charts demonstrate the history of this building based on that data.

Energy Star Score:

The Alms & Doepke building has a current Energy Star score is 80 which is an all-time high from its baseline score of 53 when Facilities took over the building. This building qualified for Energy Star Certification in January 2015.

EUI Trend:

The downward trend for 2014 shows that the energy conservation projects are working. The EUI dropped from 271 in 2008 to 180 in 2014 in kBtu/sf.

GHG Trend:

The downward trend for 2014 shows the current energy conservation projects are working. GHG emissions dropped from 4399 in 2008 to 2899 in 2014 in MtCO2e.

Energy Star Metrics Using the latest metrics it can be seen that the ECM's in this building has pushed the building to a qualifying level for Energy Star.

Metric	Baseline (Dec 2008)	Current (Dec 2014)	Target*	Median Property*
ENERGY STAR score (1-100)	40	75	75	50
Source EUI (kBtu/ft²)	271.0	180.6	183.0	247.5
Site EUI (kBtu/ft²)	107.4	77.3	78.4	106.0
Source Energy Use (kBtu)	70,563,831.1	47,013,450.3	47,658,924.6	64,436,326.9
Site Energy Use (kBtu)	27,961,111.8	20,134,436.6	20,410,873.3	27,596,126.4
Energy Cost (\$)	497,220.12	356,177.22	361,245.63	488,174.01
Total GHG Emissions (Metric Tons CO2e)	4,399.0	2,899.0	2,940.3	3,973.4

222 East Central Parkway - Energy Conservation Measures and Recommendations

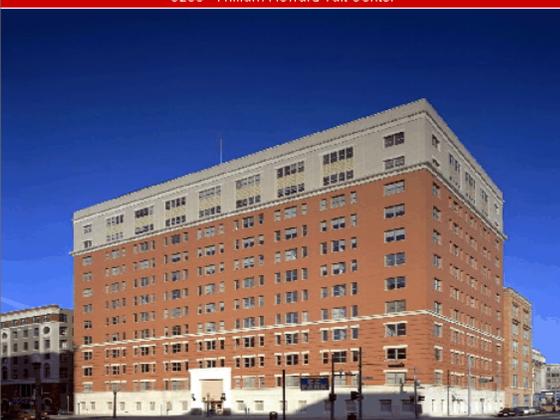
Previous ECM's

- Continue to use night setback on chillers as much as possible. There are numerous times throughout the summer where the chillers run 24/7 in this building. Use night setback on chiller plant even during summer months.
- Energy conservation measures from completed Ameresco ECM audit.
 - Retrofit lighting and add occupancy sensors.
 - Replace domestic water heaters.
 - Install domestic hot water heat pump.
 - Perform water conservation survey and associated work.
 - Upgrade and retro-commission controls.
 - Variable frequency drives and motor replacements.
 - Participate in full Ameresco M&V process.

Proposed ECM's

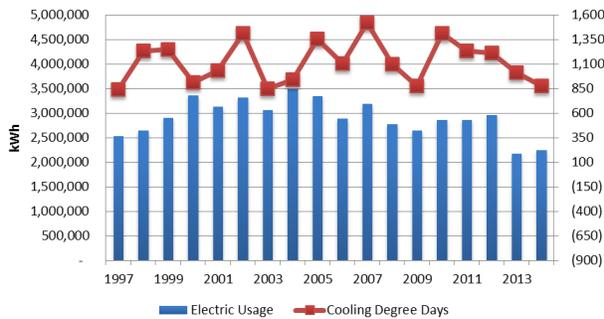
- Replace existing secondary chilled water pump package with upgraded VFD's.
- Upgrade controls on Chilled Water System including adding differential pressure sensors and monitoring of both chilled water pumps.
- Modify heating on first floor to eliminate cold spots.
- Add heater to employee vestibule to provide air curtain to prevent cold air from entering the building.

230 East 9th (William Howard Taft Law Center)

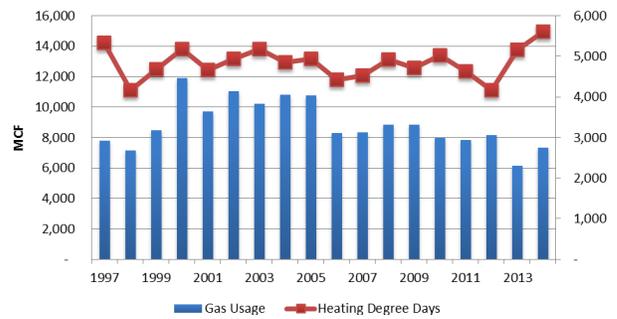
0230 - William Howard Taft Center	ARCHIBUS/IFM Bldg Data
	Bldg Code: 0230 Bldg Name: William Howard Taft Center Address: 230 East Ninth Street City: CINCINNATI State: OH Postal Code: 45202 Site Code: COUNTYCAMPUS Agency: BOCC Use: Office Const Type: BrickStone Date Built: 1925 Ext Gross Area: 193,524.83 sf Int Gross Area: 184,574.10 sf Rentable Area: 172,180.32 sf Estimated Area: 0.00 sf Total Roof Area: 15,111.27 sf Leased/Owned: Owned Floor Count: 16 Sprinklered?: Yes Property:

Fl Code	Int Gross	Ext Gross	Vert Pen	Service	Rentable	Usable	Room Area
D1	13,655 sf	14,439 sf	1,395 sf	3,001 sf	12,260 sf	9,259 sf	13,655 sf
D2	13,838 sf	14,482 sf	946 sf	2,164 sf	12,892 sf	10,728 sf	13,781 sf
D3	13,778 sf	14,503 sf	886 sf	2,182 sf	12,892 sf	10,710 sf	13,770 sf
D4	13,737 sf	14,502 sf	842 sf	2,092 sf	12,895 sf	10,804 sf	13,703 sf
D5	13,848 sf	14,503 sf	880 sf	1,843 sf	12,967 sf	11,124 sf	13,848 sf
D6	13,895 sf	14,503 sf	903 sf	1,612 sf	12,992 sf	11,380 sf	13,885 sf
D7	13,775 sf	14,498 sf	897 sf	1,530 sf	12,878 sf	11,348 sf	13,775 sf
D8	13,895 sf	14,503 sf	850 sf	1,654 sf	13,045 sf	11,392 sf	13,895 sf
D9	13,890 sf	14,503 sf	883 sf	2,262 sf	13,007 sf	10,745 sf	13,888 sf
D0	14,480 sf	15,049 sf	785 sf	7,484 sf	13,696 sf	6,211 sf	14,480 sf
DP	2,488 sf	2,647 sf	242 sf	2,246 sf	2,246 sf	-0 sf	2,488 sf
DR	0 sf	0 sf	0 sf	0 sf	0 sf	0 sf	0 sf
D10	13,880 sf	14,503 sf	915 sf	2,070 sf	12,965 sf	10,895 sf	13,878 sf
D11	13,883 sf	14,503 sf	914 sf	1,492 sf	12,969 sf	11,477 sf	13,269 sf
D12	13,825 sf	14,503 sf	912 sf	2,220 sf	12,913 sf	10,694 sf	13,825 sf
OUT	0 sf	0 sf	0 sf	0 sf	0 sf	0 sf	0 sf
SB	1,706 sf	1,886 sf	144 sf	1,562 sf	1,562 sf	0 sf	1,706 sf

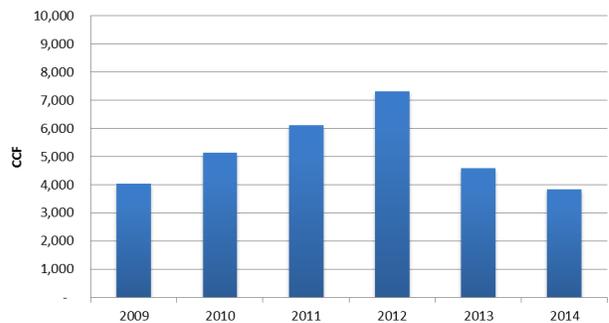
230 East Ninth Annual Electric Usage



230 East Ninth Annual Gas Usage



230 East Ninth Annual Water Usage



The 230 East 9th Building is one of the newer buildings on the County Campus having full DDC control and VAV boxes. It was renovated in the 1990's and includes "Varicone" VAV Air Central Station Air-Handlers, a full DDC building control system and intelligent lighting panels.

The electricity consumption has been steadily decreasing, natural gas usage has been steadily decreasing and water usage is on the decline. This building has recently added vfd's, economizers, new cooling towers and a summer condensing boiler to its equipment stock.

230-Historical Monthly Electric and Gas Data

The following data is a representation of electrical, water and gas usage by month. The green cells show the minimum usage for the month.

- Electric consumption (KWH) increased 3% compared to a 14% reduction in degree days.
- Electric demand (KW) increased over the previous year.
- Natural gas consumption increased 19% compared to a 9% increase in heating degree days.
- Water consumption decreased 20% compared to the previous year.

230 East Ninth Electric Data

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL	
2012	kWh	222,473	195,727	220,515	228,397	242,858	281,691	342,018	310,690	351,499	268,162	165,315	124,735	2,954,080
	kWa	652	664	814	793	850	826	954	970	870	659	691	384	970
	kWb	825	826	826	826	850	826	954	970	870	824	824	824	970
	Cost	\$ 21,021	\$ 21,073	\$ 22,182	\$ 22,535	\$ 23,528	\$ 24,853	\$ 29,413	\$ 28,310	\$ 28,547	\$ 24,211	\$ 19,682	\$ 17,881	\$ 283,236
2013	kWh	123,526	131,835	161,447	182,375	177,455	200,151	241,594	216,196	236,702	194,663	155,321	152,709	2,173,974
	kWa	397	435	381	656	682	752	812	732	860	784	713	505	860
	kWb	824	824	824	824	824	824	824	739	860	784	731	731	860
	Cost	\$ 17,656	\$ 16,998	\$ 18,043	\$ 18,925	\$ 19,069	\$ 20,141	\$ 21,624	\$ 19,396	\$ 22,023	\$ 19,443	\$ 17,213	\$ 17,120	\$ 227,651
2014	kWh	172,490	154,431	165,235	188,346	185,408	240,434	237,014	207,353	228,834	169,706	140,490	151,031	2,240,772
	kWa	461	518	496	618	813	810	931	838	867	678	675	438	931
	kWb	732	732	732	732	813	810	931	838	867	792	792	792	931
	Cost	\$ 18,038	\$ 17,373	\$ 17,771	\$ 18,644	\$ 19,882	\$ 23,213	\$ 23,679	\$ 21,100	\$ 22,362	\$ 19,135	\$ 18,013	\$ 18,418	\$ 237,628

230 East Ninth Gas Data

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL	
2012	CCF	14,166	11,578	8,270	7,113	5,309	4,475	4,232	4,169	4,270	6,226	4,878	6,775	81,461
	Cost	\$ 9,596	\$ 6,965	\$ 5,079	\$ 3,221	\$ 2,266	\$ 2,268	\$ 2,209	\$ 2,196	\$ 2,169	\$ 3,498	\$ 2,971	\$ 4,454	\$ 46,892
2013	CCF	10,477	8,459	11,080	7,335	3,334	1,136	834	1,767	1,579	2,414	3,941	9,066	61,422
	Cost	\$ 6,099	\$ 4,835	\$ 6,401	\$ 4,783	\$ 2,383	\$ 981	\$ 670	\$ 1,187	\$ 1,147	\$ 1,593	\$ 2,440	\$ 6,685	\$ 39,203
2014	CCF	10,377	13,783	9,893	7,733	4,710	2,112	1,851	2,138	2,420	2,964	5,076	10,092	73,149
	Cost	\$ 6,857	\$ 9,400	\$ 6,719	\$ 5,515	\$ 3,596	\$ 1,748	\$ 1,525	\$ 1,582	\$ 1,835	\$ 2,440	\$ 3,367	\$ 6,503	\$ 51,086

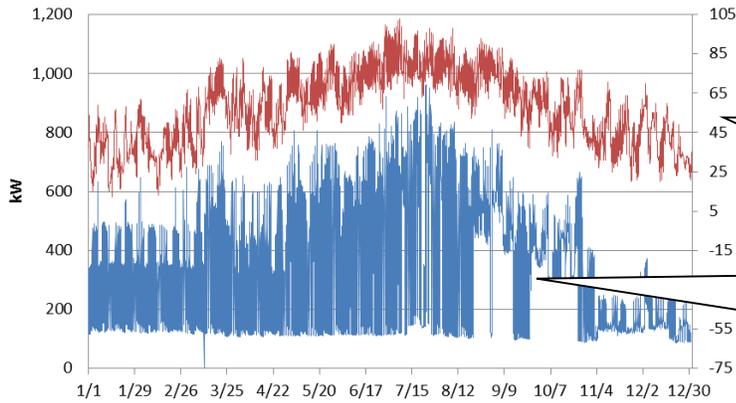
230 East Ninth Water Data

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL	
2012	CCF	450	546	519	590	646	770	774	867	957	649	300	240	7,306
	Cost	\$ 3,056	\$ 3,875	\$ 3,572	\$ 3,513	\$ 3,745	\$ 4,394	\$ 3,942	\$ 4,329	\$ 5,100	\$ 4,147	\$ 2,427	\$ 2,451	\$ 44,550
2013	CCF	289	282	264	373	504	453	418	409	517	341	422	320	4,592
	Cost	\$ 2,468	\$ 2,717	\$ 2,504	\$ 2,814	\$ 3,388	\$ 2,736	\$ 2,539	\$ 2,538	\$ 3,076	\$ 2,266	\$ 3,153	\$ 2,926	\$ 33,124
2014	CCF	220	256	219	241	279	378	509	393	486	330	237	295	3,843
	Cost	\$ 2,159	\$ 2,619	\$ 2,443	\$ 2,584	\$ 2,238	\$ 2,696	\$ 3,181	\$ 2,749	\$ 3,313	\$ 2,604	\$ 2,369	\$ 3,075	\$ 32,031

Green cells = minimum of month for past 3 years

230-Three Year Electrical Review

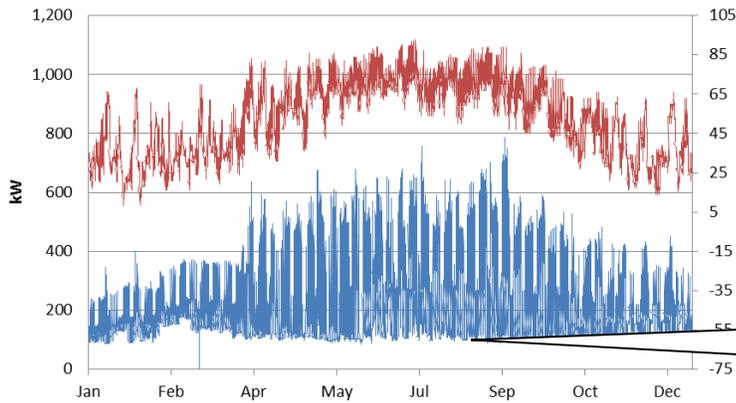
230 E 9th Annual Electric Profile (2012)



Continuing from the previous year, the weekend daytime loads were much higher than they have been in the past.

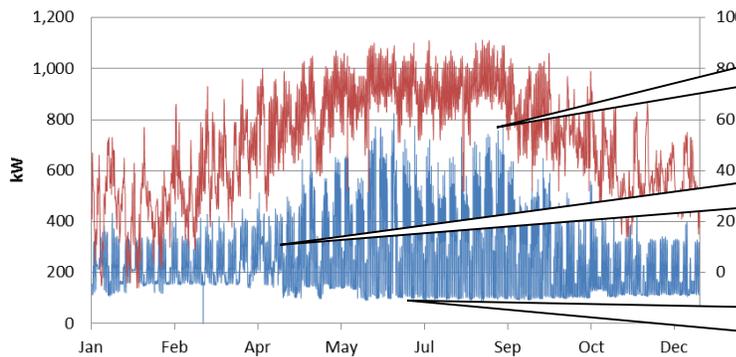
The construction period for the energy conservation measures, as well as the resultant change in load profile, are clearly visible in the second half of the year.

230 E 9th Annual Electric Profile (2013)



The demand has decreased in both the winter and the summer, with a 110 kW reduction in peak demand.

230 E 9th Annual Electric Profile (2014)



Peak demand remains at acceptable levels from previous ECM projects.

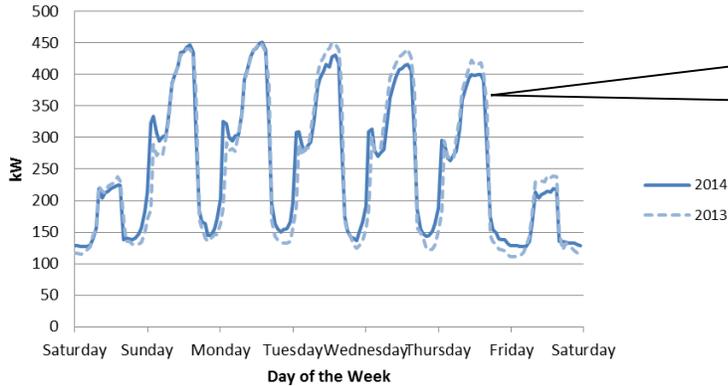
Overall usage appears to be down from a decreasing area of the curve being present in this graph

Overnight setback continues to get better. No 24/7 usages of chilled water plant indicated on this data.

230-Electric Profile Review

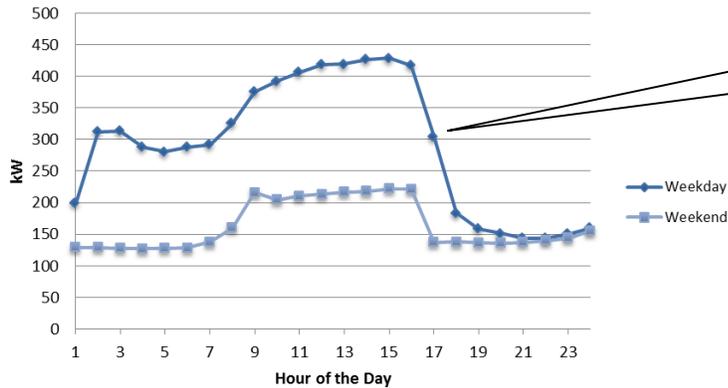
The graphs below illustrate the power requirements of the facility throughout a typical week, typical day and the year. The typical week and typical day profiles are averaged throughout the year in order to view how the electric demand varies during the day and across the week. The load duration curve represents the demand as a function of cumulative time for the year.

230 E 9th Typical Week Profile



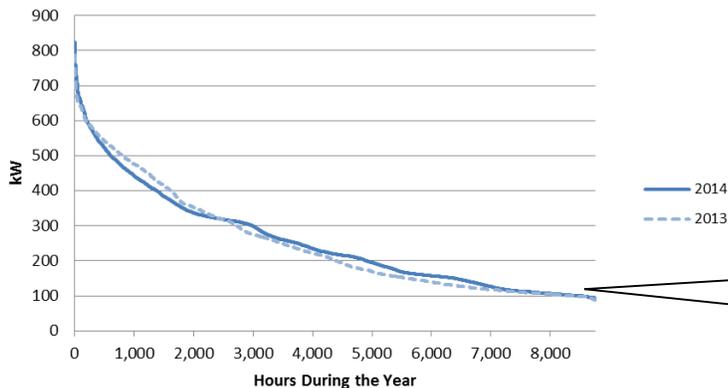
The solid electric demand lines show a decrease in usage compared to the previous dashed year. The setback on the nights and weekend can also be seen.

230 E 9th Typical Day Profile (2014)



The setback of lights and HVAC in this building is clearly visible, where the load drops by 2/3 after 5 pm.

230 E 9th Load Duration Curve



The base load of the facility remained the same as the previous year, while the higher loads decreased by a consistent amount.

230-Energy Star Review

230 East 9th Street

230 East 9th Street, Cincinnati, OH 45202 | [Map It](#)

Portfolio Manager Property ID: 1075175 | Primarily: Office

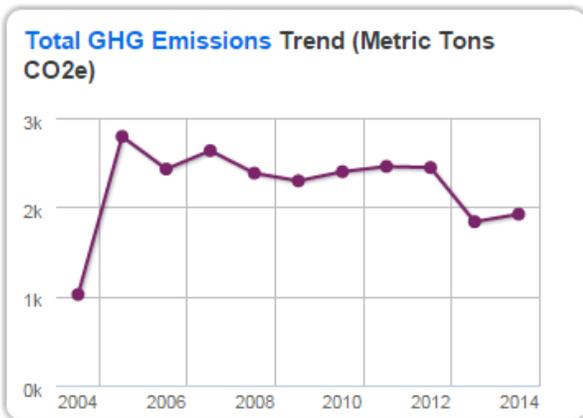
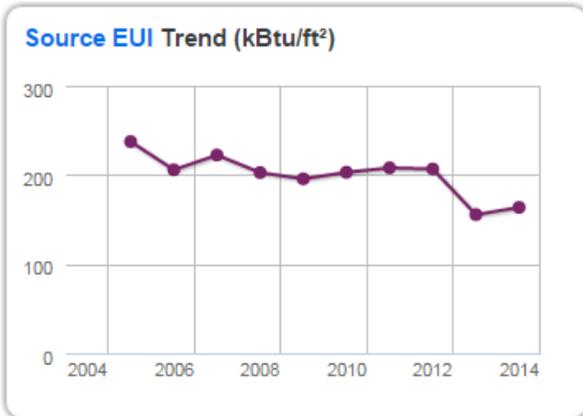
Year Built: 1925



ENERGY STAR Score (1-100)

Current Score: 84

Baseline Score: 71



Energy Star Charts:

The EPA's Energy Star website tracks the Energy Use Index EUI and the Green House Gas GHG emissions annually for a building based on the electricity, natural gas and water usage. These charts demonstrate the history of this building based on that data.

Energy Star Score:

The 230 East Ninth Street building has a current Energy Star score is 84. This building qualified in 2013, 2014 and appears to be on its way to qualifying in 2015.

EUI Trend:

The downward trend for 2014 shows that the energy conservation projects are working. The current EUI is now at 77.8 kBtu/sf.

GHG Trend:

The downward trend for 2014 shows the current energy conservation projects are working. GHG emissions dropped from 2,421 in 2007 to 1,922 in 2014 in MtCO2e.

Energy Star Metrics

Using the latest metrics available from the Energy Star website it can be seen that the 230 East Ninth Street building has improved significantly over the baseline and median targets.

Metric	Baseline (Jan 2007)	Current (Dec 2014)	Target*	Median Property*
ENERGY STAR score (1-100)	71	84	75	50
Source EUI (kBtu/ft²)	205.1	163.7	191.6	259.0
Site EUI (kBtu/ft²)	94.4	77.8	91.1	123.1
Source Energy Use (kBtu)	39,701,098.1	31,682,890.5	37,077,071.1	50,129,336.6
Site Energy Use (kBtu)	18,269,617.6	15,062,428.2	17,626,888.2	23,832,093.2
Energy Cost (\$)	358,859.70	285,311.65	334,085.97	451,426.09
Total GHG Emissions (Metric Tons CO2e)	2,421.4	1,922.1	2,250.7	3,041.2

230 East 9th Energy Conservation Measures and Recommendations

Previous ECM's

- Night setback for equipment.
- Increase boiler efficiency.
- Programmed lighting schedule for unoccupied periods.
- Energy conservation measures from Ameresco ECM audit.
 - Retrofit lighting and add occupancy sensors
 - Replace summer boiler with condensing hot water boiler
 - Reline boiler flue and repair boiler economizers
 - Perform water conservation survey and associated work
 - Upgrade and retrocommission controls
 - Variable frequency drives and motor replacements
 - Replace cooling towers
 - Reclaim AHU condensate for make-up water (bldg staff ECM)

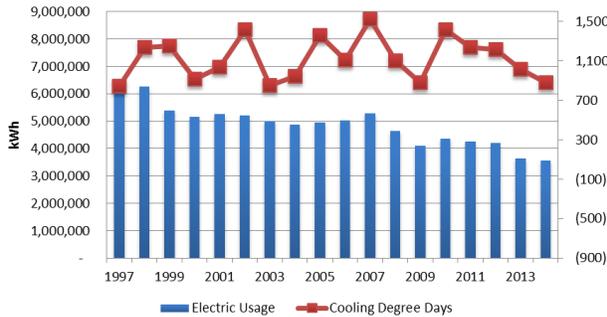
Proposed ECM's

- This building has always had hot water recirculation shortfalls. Investigate a method of providing faster hot water and use less energy to keep it hot.

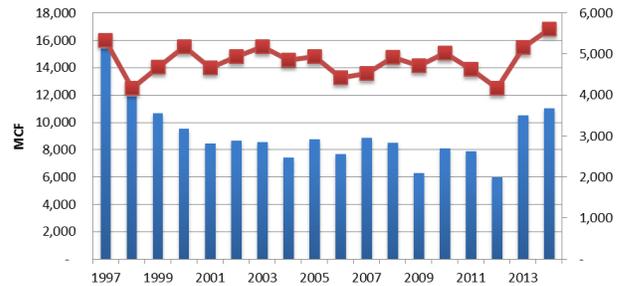
800 Broadway

0800 - 800 Broadway Building				ARCHIBUS/FM Bldg Data			
				Bldg Code:	0800		
				Bldg Name:	800 Broadway Building		
				Address:	800 Broadway Street		
				City:	CINCINNATI		
				State:	OH		
				Postal Code:	45202		
				Site Code:	COUNTYCAMPUS		
				Agency:	BOCC		
				Use:	Office		
				Const Type:	Stone		
Date Built:	1931						
Ext Gross Area:	372,420.59 sf						
Int Gross Area:	349,318.78 sf						
Rentable Area:	295,239.16 sf						
Estimated Area:	0.00 sf						
Total Roof Area:	41,856.63 sf						
Leased/Owned:	Owned						
Floor Count:	19						
Sprinklered? :	Yes						
Property:	079-0003-0146-00						
Fl Code	Int Gross	Ext Gross	Vert Pen	Service	Rentable	Usable	Room Area
D1	35,947 sf	38,116 sf	2,107 sf	6,402 sf	33,839 sf	27,438 sf	35,937 sf
D2	35,943 sf	38,208 sf	2,794 sf	4,193 sf	33,148 sf	28,956 sf	35,981 sf
D3	36,159 sf	38,196 sf	6,056 sf	5,417 sf	30,103 sf	24,686 sf	36,159 sf
D3M	35,962 sf	38,076 sf	19,499 sf	6,494 sf	16,463 sf	9,970 sf	35,962 sf
D4	31,920 sf	33,764 sf	1,386 sf	3,068 sf	30,534 sf	27,466 sf	31,920 sf
D5	21,001 sf	22,426 sf	4,848 sf	1,667 sf	16,153 sf	14,487 sf	20,988 sf
D6	20,426 sf	21,652 sf	1,248 sf	4,474 sf	19,178 sf	14,705 sf	20,241 sf
D7	5,609 sf	6,191 sf	758 sf	1,226 sf	4,851 sf	3,628 sf	5,609 sf
D8	5,682 sf	6,191 sf	754 sf	1,220 sf	4,928 sf	3,707 sf	6,169 sf
D9	5,749 sf	6,190 sf	750 sf	1,247 sf	4,999 sf	3,752 sf	5,749 sf
D9B	39,778 sf	41,884 sf	7,997 sf	10,776 sf	31,781 sf	21,004 sf	40,126 sf
DR	0 sf	0 sf	0 sf	0 sf	0 sf	0 sf	0 sf
D10	5,683 sf	6,191 sf	730 sf	1,275 sf	4,954 sf	3,678 sf	5,682 sf
D11	5,703 sf	6,191 sf	771 sf	1,307 sf	4,933 sf	3,625 sf	5,704 sf
D12	5,040 sf	5,541 sf	766 sf	1,146 sf	4,274 sf	3,128 sf	5,040 sf
D14	5,133 sf	5,541 sf	764 sf	1,117 sf	4,369 sf	3,252 sf	5,133 sf
D15	4,397 sf	4,851 sf	761 sf	856 sf	3,636 sf	2,780 sf	4,397 sf
D16	3,751 sf	4,151 sf	748 sf	1,278 sf	3,003 sf	1,725 sf	3,753 sf
D17	3,655 sf	4,193 sf	473 sf	3,182 sf	3,182 sf	0 sf	3,655 sf
D18	2,980 sf	3,294 sf	91 sf	2,889 sf	2,889 sf	-0 sf	2,980 sf
OUT	0 sf	0 sf	0 sf	0 sf	0 sf	0 sf	0 sf
SB	38,800 sf	41,573 sf	779 sf	11,072 sf	38,022 sf	26,950 sf	38,803 sf

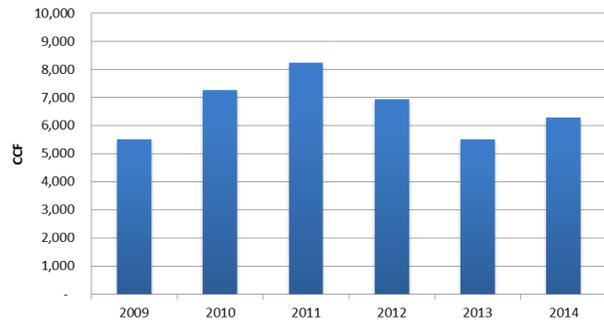
800 Broadway Annual Electric Usage



800 Broadway Annual Gas Usage



800 Broadway Annual Water Usage



The 800 Broadway Building was one of the least efficient buildings in 1997 when the ECM program started. Most of the original ECM projects were concentrated on this building. The building was the first to qualify for an Energy Star Award and now the LEED-EB+OM award. Electrical usage continues to decrease but natural gas and water usages took an unexpected hike in 2014. We will seek to explain and rectify these issues in 2015.

800-Historical Monthly Electric and Gas Data

The following data is a representation of electrical, water and gas usage by month. The green cells show the minimum usage for the month.

- Electric consumption (KWH) decreased 2% compared to a 14% reduction in degree days.
- Electric demand (KW) decreased in each of the last three years.
- Natural gas consumption increased 5% compared to a 9% increase in heating degree days.
- Water consumption increased 12% compared to the previous year but is down 8% compared to the base year.

800 Broadway Electric Data

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL	
2012	kWh	322,109	283,751	308,426	352,530	354,468	429,690	456,096	391,284	382,396	310,010	309,320	310,994	4,211,074
	kWa	768	941	922	922	998	960	941	922	864	883	845	845	998
	kWb	881	941	922	922	998	960	951	935	881	883	845	845	998
	Cost	\$ 26,483	\$ 26,659	\$ 27,447	\$ 29,369	\$ 30,601	\$ 33,305	\$ 34,316	\$ 31,262	\$ 30,069	\$ 26,980	\$ 26,370	\$ 26,443	\$ 349,305
2013	kWh	334,577	290,801	299,235	285,703	279,262	305,187	341,210	318,107	340,305	286,493	261,915	289,382	3,632,177
	kWa	691	691	672	727	794	828	845	806	864	827	692	691	864
	kWb	816	816	816	816	816	828	845	811	865	827	735	735	865
	Cost	\$ 26,563	\$ 22,492	\$ 22,780	\$ 22,370	\$ 22,419	\$ 23,717	\$ 25,222	\$ 23,904	\$ 25,515	\$ 23,218	\$ 20,912	\$ 21,853	\$ 280,967
2014	kWh	295,679	255,657	256,712	271,713	266,905	317,921	342,203	327,191	357,134	286,143	269,330	299,859	3,546,447
	kWa	672	653	614	806	826	768	768	768	788	845	826	653	845
	kWb	736	736	736	811	827	781	781	781	796	845	827	653	845
	Cost	\$ 22,436	\$ 21,016	\$ 21,053	\$ 22,906	\$ 23,088	\$ 26,349	\$ 25,109	\$ 24,564	\$ 25,897	\$ 24,505	\$ 23,593	\$ 21,920	\$ 282,436

800 Broadway Gas Data

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL	
2012	CCF	19,505	14,758	5,456	1,484	463	268	204	170	169	207	6,937	10,261	59,882
	Cost	\$ 13,123	\$ 8,813	\$ 3,431	\$ 857	\$ 416	\$ 359	\$ 335	\$ 318	\$ 314	\$ 347	\$ 4,122	\$ 6,622	\$ 39,057
2013	CCF	24,840	20,182	20,563	9,834	764	211	199	187	190	361	7,865	19,830	105,026
	Cost	\$ 14,102	\$ 11,200	\$ 11,665	\$ 6,329	\$ 740	\$ 388	\$ 349	\$ 349	\$ 275	\$ 451	\$ 4,620	\$ 12,083	\$ 62,551
2014	CCF	24,008	24,852	17,277	7,032	301	323	297	298	336	490	11,198	24,103	110,515
	Cost	\$ 15,500	\$ 16,719	\$ 11,520	\$ 5,041	\$ 504	\$ 490	\$ 465	\$ 450	\$ 482	\$ 624	\$ 7,105	\$ 15,137	\$ 74,037

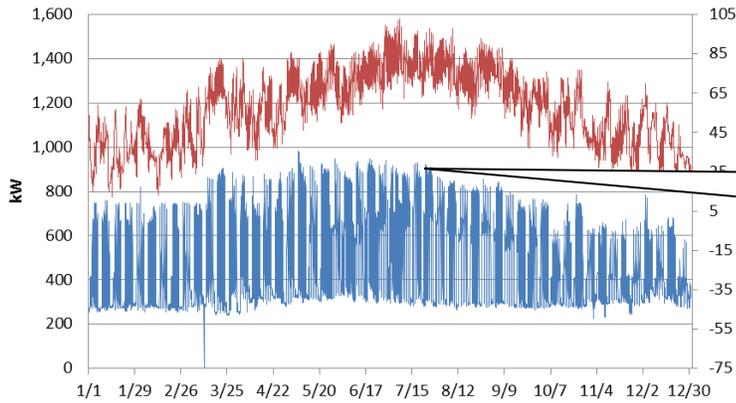
800 Broadway Water Data

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL	
2012	CCF	322	506	425	451	500	796	842	874	932	564	369	341	6,922
	Cost	\$ 4,234	\$ 5,596	\$ 5,139	\$ 4,734	\$ 5,080	\$ 6,468	\$ 5,852	\$ 6,238	\$ 6,893	\$ 5,132	\$ 4,672	\$ 5,156	\$ 65,194
2013	CCF	296	660	319	339	636	442	481	502	635	417	369	402	5,498
	Cost	\$ 4,386	\$ 6,036	\$ 4,519	\$ 4,347	\$ 5,304	\$ 4,707	\$ 4,735	\$ 4,721	\$ 5,814	\$ 4,429	\$ 4,642	\$ 5,542	\$ 59,182
2014	CCF	294	741	428	374	392	517	701	590	819	508	411	507	6,281
	Cost	\$ 4,306	\$ 6,463	\$ 6,017	\$ 5,147	\$ 5,039	\$ 5,731	\$ 6,243	\$ 5,438	\$ 6,927	\$ 5,345	\$ 5,020	\$ 6,612	\$ 68,287

= minimum of month for past 3 years

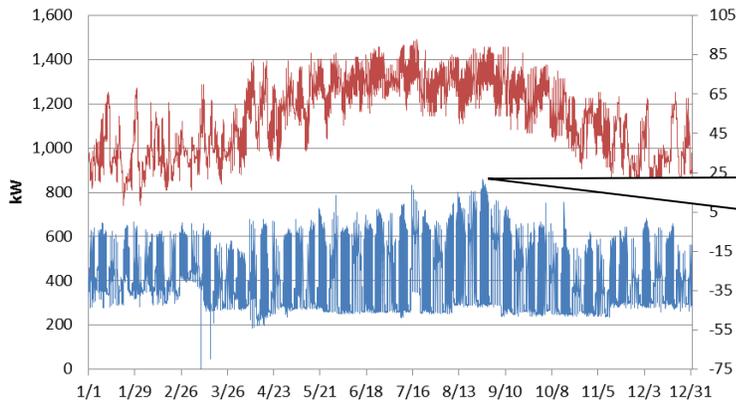
800-Three Year Electrical Review

800 Broadway Annual Electric Profile (2012)



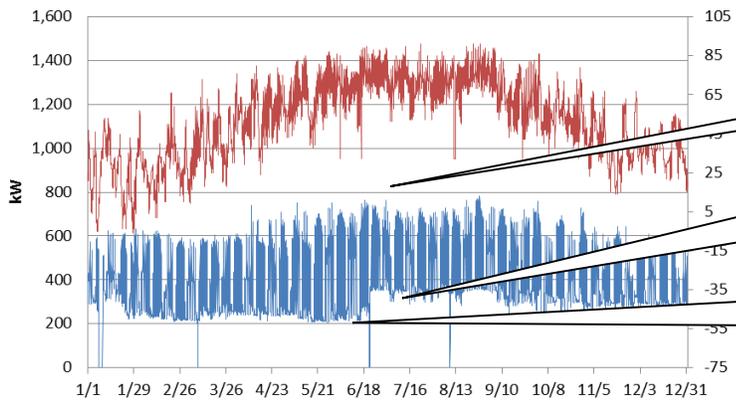
The demand during the day in the winter has decreased about 100 kW.

800 Broadway Annual Electric Profile (2013)



The peak demand has decreased by 130 kW. The wintertime peak has decreased as well.

800 Broadway Annual Electric Profile (2014)



The 800 peak continues to remain consistent in 2014

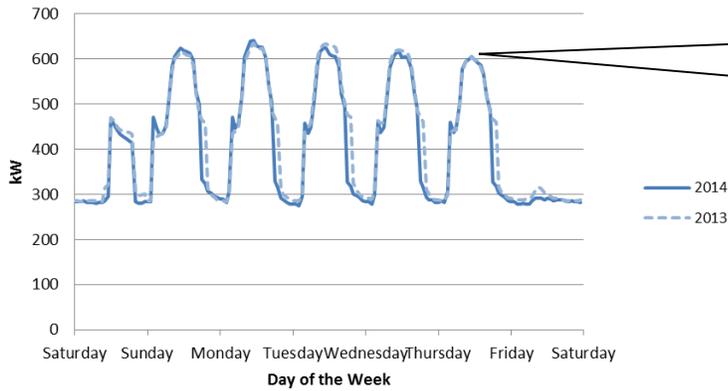
This jump shows more electric being used overnight compared to 2013.

Night setback seems to be working really well.

800-Electric Profile Review

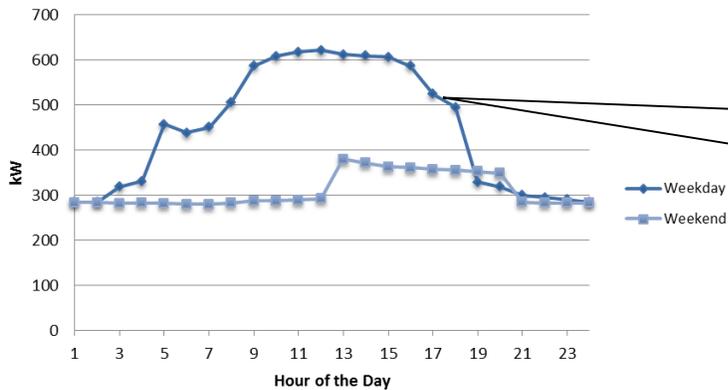
The graphs below illustrate the power requirements of the facility throughout a typical week, typical day and the year. The typical week and typical day profiles are averaged throughout the year in order to view how the electric demand varies during the day and across the week. The load duration curve represents the demand as a function of cumulative time for the year.

800 Broadway Typical Week Profile



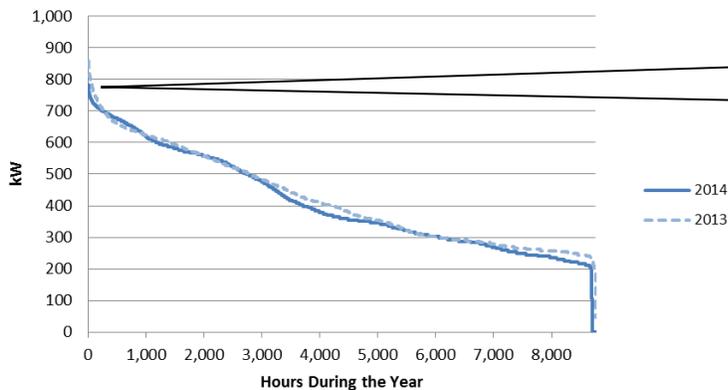
The daytime demand has decreased evenly throughout the week, likely due to the peak demand reduction seen in the second half of the year.

800 Broadway Typical Day Profile (2014)



The weekend load has increased compared to the previous year, which appears to be occurring mostly in the summer.

800 Broadway Load Duration Curve



The peak demand has decreased in the building, while the higher weekend load has increased the number of operating hours around 350-400 kW.

800-Energy Star Review

800 Broadway

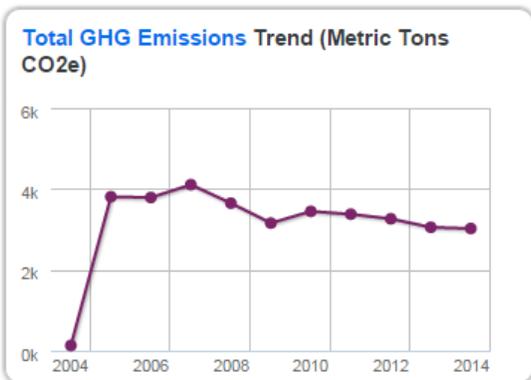
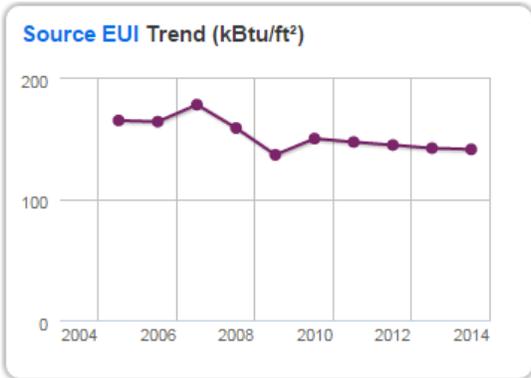
800 Broadway Street, Cincinnati, OH 45202 | [Map It](#)
 Portfolio Manager Property ID: 1161591 | Primarily: Office
 Year Built: 1931



ENERGY STAR Score (1-100)

Current Score: 87

Baseline Score: 88



Energy Star Charts:

The EPA's Energy Star website tracks the Energy Use Index EUI and the Green House Gas GHG emissions annually for a building based on the electricity, natural gas and water usage. These charts demonstrate the history of this building based on that data.

Energy Star Score:

This building received the Energy Star award in 2014 for the seventh straight year. This building also received the LEED EB+OM certification in 2014.

EUI Trend:

The Energy Use Index EUI is leveling off in 2014 but still continues a slight downward trend. The EUI has decreased from since from 72.8 (2007) to 66.1 kBtu/ft² (2014).

GHG Trend:

The GHG trend has also leveled off but is still down from the initial years. GHG emissions dropped from 3156 (2009) to 3014 (2014) in MtCO2e.

Energy Star Metrics

Using the latest metrics available from the Energy Star website the 800 Broadway building continues to receive good marks in the Energy Star score.

Metrics Comparison for Your Property & Your Target

Metric	Baseline (Dec 2007)	Current (Dec 2014)	Target*	Median Property*
ENERGY STAR score (1-100)	75	87	87	50
Source EUI (kBtu/ft²)	177.6	140.7	143.0	239.5
Site EUI (kBtu/ft²)	72.8	66.1	67.2	112.5
Source Energy Use (kBtu)	66,127,776.5	49,705,391.9	50,511,142.1	84,587,945.3
Site Energy Use (kBtu)	27,117,903.4	23,345,455.4	23,723,896.4	39,728,970.1
Energy Cost (\$)	537,120.66	349,595.31	355,412.93	594,936.41
Total GHG Emissions (Metric Tons CO2e)	4,103.1	3,021.5	3,071.8	5,142.0

* To compute the metrics at the target and median levels of performance, we will use the fuel mix associated with your property's current energy use.

800 Broadway Energy Conservation Measures and Recommendations

Previous ECM's

- Night setback for equipment.
- Time clocks and schedules for all lighting and equipment.
- New more efficient chiller.
- New more efficient boilers.
- New high efficiency domestic water boilers.
- VFD's on pumps and air handlers.
- New high efficiency cooling towers with VFD's.
- Selective lighting replacements.
- Additional lighting retrofits with Duke Energy incentives or ESCO.
- Replacement of large low rise air handlers with more efficient equipment.
- Perform water conservation survey and associated work.
- Upgrade control system and retro-commission equipment and controls for schedules.
- Computer room consolidation with new A/C units.

Proposed ECM's

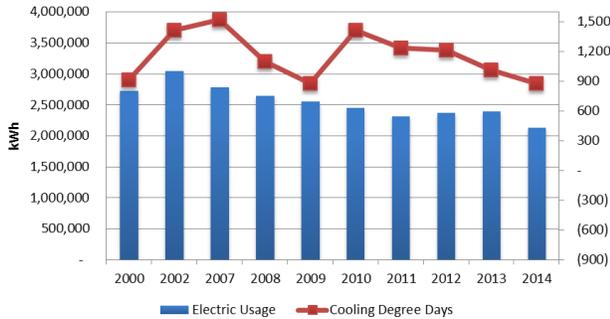
- Monitor the spring, summer and fall usage of natural gas and try to curb the recent uptick in natural gas usage.
- Limit the use of reheat in the summer time and use control system to tweak temperatures.
- Monitor water usage and try to reduce overall use.
- Investigate ways to run CWP-3 more efficiently and install automatic changeover on CWP-3 power feeders to save unnecessary trips to the building on power outages.

2020 Auburn

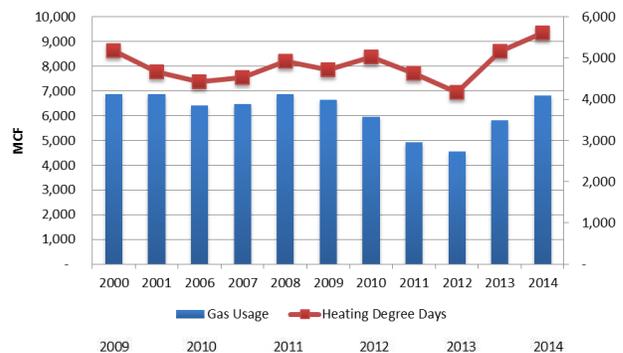
2020 - Juvenile Youth Center				ARCHIBUS/FM Bldg Data				
				Bldg Code:				2020
				Bldg Name :	Juvenile Youth Center			
				Address :	2020 Auburn Ave			
				City :	CINCINNATI			
				State :	OH			
				Postal Code:	45219			
				Site Code :	OTHER LOCATIONS			
				Agency :	Juvenile Court			
				Use :	Jail			
				Const Type:	ConcreteBrick			
Date Built :	1995							
Ext Gross Area:	171,449.94 sf							
Int Gross Area:	164,410.41 sf							
Rentable Area:	158,431.96 sf							
Estimated Area:	0.00 sf							
Total Roof Area:	40,319.30 sf							
Leased/Owned :	Owned							
Floor Count :	6							
Sprinklered? :	Yes							
Property :	088-0007-0020-90							

Fl Code	Int Gross	Ext Gross	Vert Pen	Service	Rentable	Usable	Room Area
01	41,361 sf	42,828 sf	1,201 sf	12,926 sf	40,160 sf	27,234 sf	41,360 sf
02	29,514 sf	30,891 sf	1,323 sf	4,940 sf	28,191 sf	23,250 sf	29,514 sf
03	29,611 sf	30,891 sf	1,132 sf	4,678 sf	28,480 sf	23,802 sf	29,611 sf
04	19,237 sf	20,422 sf	1,132 sf	3,615 sf	18,105 sf	14,489 sf	19,237 sf
0B	3,179 sf	3,535 sf	0 sf	3,179 sf	3,179 sf	0 sf	3,179 sf
0R	0 sf	0 sf	0 sf	0 sf	0 sf	0 sf	0 sf
LL	41,508 sf	42,884 sf	1,190 sf	19,207 sf	40,318 sf	21,111 sf	41,508 sf

2020 Auburn Annual Electric Usage



2020 Auburn Annual Gas Usage



The energy use 2020 Auburn Building has improved steadily overall in the last several years. The electric usage continues to decrease. The natural gas usage rose in 2013 and 2014 from cold winter temps most likely. The water usage has decrease steadily from 2010. The increase in the natural gas directly corresponds to the increase in degree days.

Note: this facility is not currently fully utilized. When the juvenile population increases in the future it can be expected that all three utility usages will increase a commensurate amount.

2020-Historical Monthly Electric and Gas Data

The following data is a representation of electrical, water and gas usage by month. The green cells show the minimum usage for the month.

- Electric consumption (KWH) decreased by 11% compared to a 14% reduction in degree days.
- Electric demand (KW) decreased by 30 KW or 7%.
- Natural gas consumption increased by 17% compared to a 9% increase in heating degree days.
- Water consumption decreased 2% compared to the previous year.

2020 Auburn Electric Data

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL	
2012	kWh	154,815	154,523	175,524	183,143	225,790	230,482	266,283	224,642	215,052	184,335	164,666	184,282	2,363,537
	kWa	306	298	485	403	466	466	490	434	447	418	370	326	490
	kWb	415	415	488	415	466	466	490	434	447	419	416	416	490
	Cost	\$ 13,093	\$ 13,077	\$ 15,107	\$ 14,313	\$ 16,931	\$ 17,133	\$ 19,044	\$ 16,403	\$ 16,130	\$ 14,400	\$ 13,513	\$ 14,095	\$ 183,240
2013	kWh	157,023	157,144	169,621	174,445	213,721	244,386	251,452	235,781	245,182	183,881	185,886	172,560	2,391,082
	kWa	302	324	317	418	442	480	492	480	480	432	422	374	492
	kWb	416	416	416	418	442	480	492	480	480	432	427	418	492
	Cost	\$ 11,760	\$ 11,764	\$ 12,289	\$ 12,476	\$ 14,444	\$ 16,329	\$ 16,594	\$ 15,866	\$ 16,240	\$ 13,380	\$ 13,368	\$ 12,986	\$ 167,496
2014	kWh	165,045	175,027	153,474	153,444	196,545	213,274	219,428	209,558	210,128	146,056	144,331	136,723	2,123,033
	kWa	322	341	319	391	394	461	454	406	413	396	382	254	461
	kWb	418	418	418	418	418	471	461	420	423	404	400	400	471
	Cost	\$ 12,722	\$ 13,072	\$ 12,329	\$ 12,379	\$ 15,102	\$ 15,396	\$ 15,458	\$ 14,434	\$ 14,709	\$ 12,044	\$ 11,920	\$ 11,903	\$ 161,466

2020 Auburn Gas Data

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL	
2012	CCF	7,121	6,443	3,353	3,508	2,198	1,787	1,547	1,665	2,175	3,256	5,623	6,826	45,502
	Cost	\$ 4,374	\$ 4,009	\$ 1,823	\$ 1,716	\$ 1,084	\$ 1,053	\$ 965	\$ 1,027	\$ 1,280	\$ 1,950	\$ 3,394	\$ 4,490	\$ 27,164
2013	CCF	6,909	6,656	8,518	3,610	3,030	2,765	2,600	2,550	2,755	3,330	7,190	8,325	58,238
	Cost	\$ 2,531	\$ 1,207	\$ 4,980	\$ 7,450	\$ 2,190	\$ 2,027	\$ 1,505	\$ 1,604	\$ 1,986	\$ 2,099	\$ 4,247	\$ 5,569	\$ 37,396
2014	CCF	11,715	10,710	6,890	4,115	3,825	3,035	2,900	2,760	3,110	3,755	7,585	7,805	68,205
	Cost	\$ 7,708	\$ 7,383	\$ 4,768	\$ 3,081	\$ 2,997	\$ 2,394	\$ 2,283	\$ 1,898	\$ 2,547	\$ 2,561	\$ 4,954	\$ 5,087	\$ 47,661

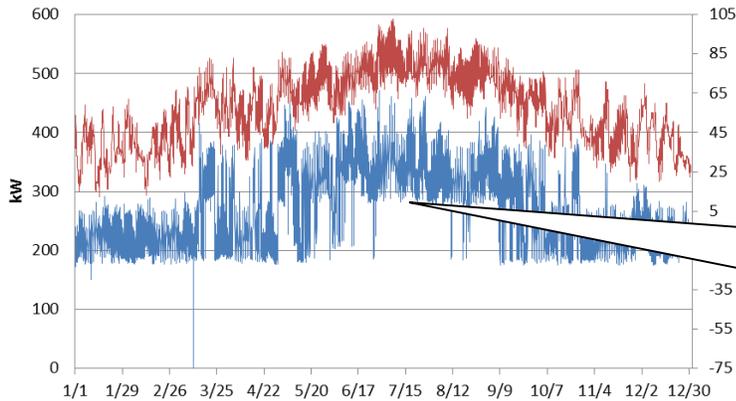
2020 Auburn Water Data

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL	
2012	CCF	272	333	295	317	360	508	880	723	887	475	392	365	5,804
	Cost	\$ 2,378	\$ 2,978	\$ 2,664	\$ 2,723	\$ 3,013	\$ 4,026	\$ 5,942	\$ 5,075	\$ 6,166	\$ 3,670	\$ 3,187	\$ 3,228	\$ 45,050
2013	CCF	273	326	317	348	457	516	695	351	976	246	320	415	5,240
	Cost	\$ 2,559	\$ 3,111	\$ 3,161	\$ 3,093	\$ 3,900	\$ 4,174	\$ 5,282	\$ 5,226	\$ 7,113	\$ 4,043	\$ 2,971	\$ 3,854	\$ 48,488
2014	CCF	306	352	373	280	438	473	571	708	654	326	322	316	5,118
	Cost	\$ 2,904	\$ 3,441	\$ 3,786	\$ 2,845	\$ 3,885	\$ 4,248	\$ 4,619	\$ 5,770	\$ 5,352	\$ 3,129	\$ 3,292	\$ 3,320	\$ 46,588

= minimum of month for past 3 years

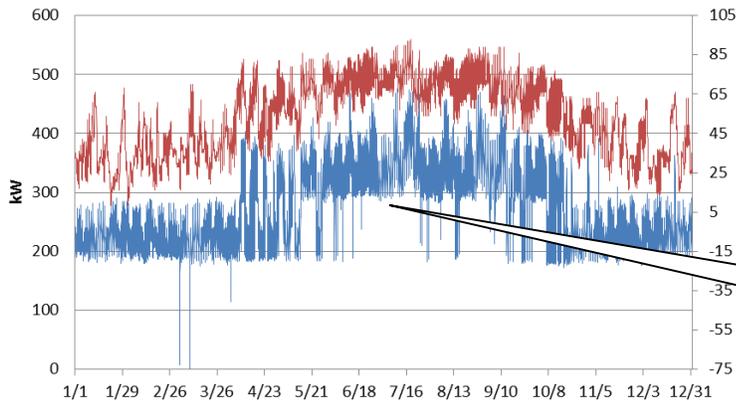
2020-Three Year Electrical Review

2020 Auburn Annual Electric Profile (2012)



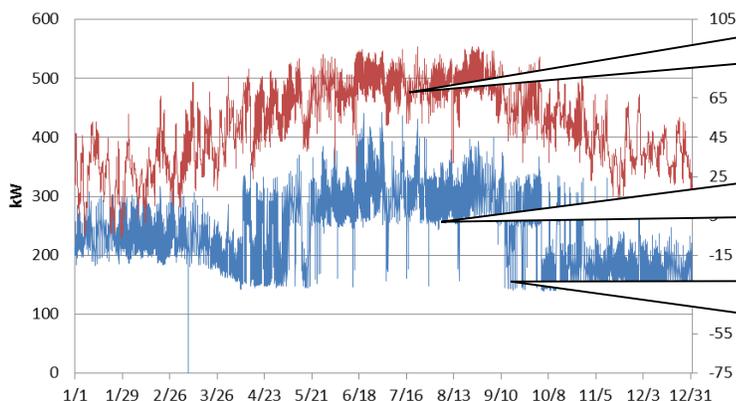
This step up in kwh usage indicates the chilled water plants runs all night to keep the building cool. This is typical of spaces that operate 24/7 and have large populations.

2020 Auburn Annual Electric Profile (2013)



The electric profile has remained very similar to 2012.

2020 Auburn Annual Electric Profile (2014)



In 2014 during the ECM projects the frequency of the peak KW load has decreased.

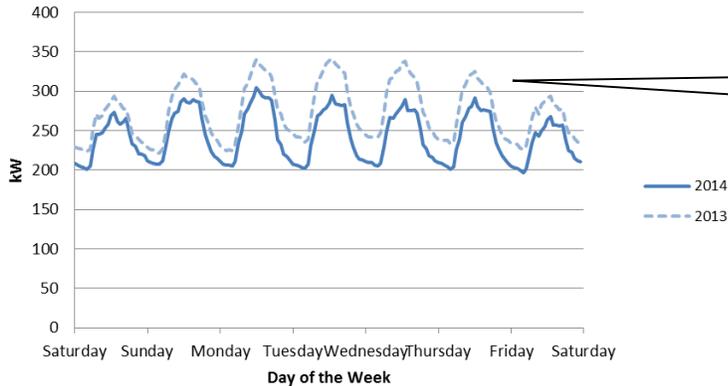
The overnight peak has decreased 50 KW indicated even though the building still has equipment running its more efficient

The overnight setback has decreased approximately 50 KW. This is a very good trend and indicates better efficiency

2020-Electric Profile Review

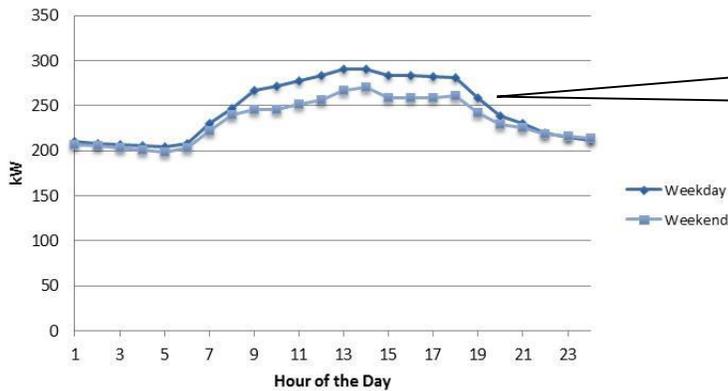
The graphs below illustrate the power requirements of the facility throughout a typical week, typical day and the year. The typical week and typical day profiles are averaged throughout the year in order to view how the electric demand varies during the day and across the week. The load duration curve represents the demand as a function of cumulative time for the year.

2020 Auburn Typical Week Profile



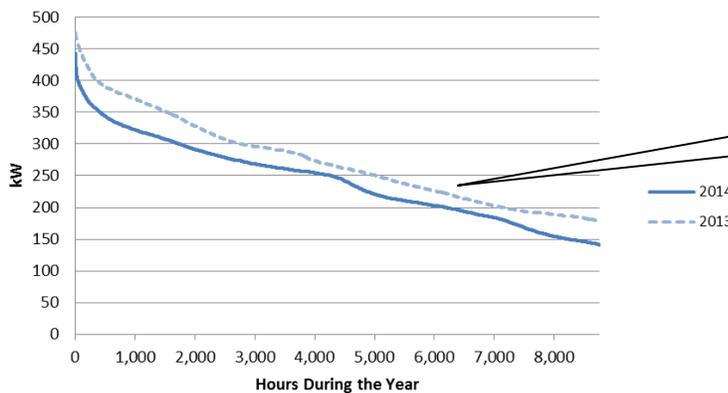
The weekend loads are slightly lower than the weekday loads during the day.

2020 Auburn Typical Day Profile (2014)



The power requirement for weekdays and weekends is very similar, because this facility is used 24/7.

2020 Auburn Load Duration Curve



The profile shows a nice decrease in 2014 compared to the 2013 data.

2020-Energy Star Review

Juvenile Youth Center (2020)

2020 Auburn Avenue, Cincinnati, OH 45219 | [Map It](#)

Portfolio Manager Property ID: 1255920 | Primarily: Office

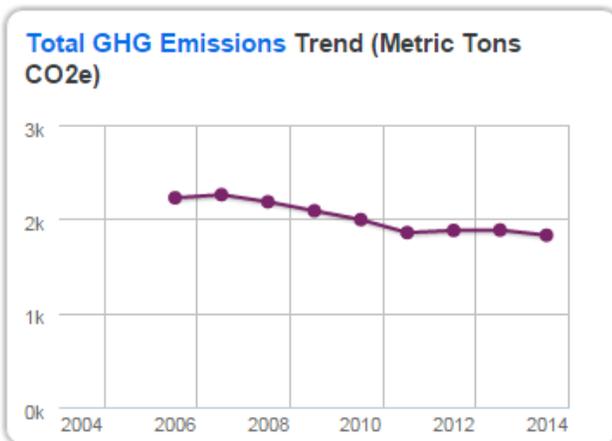
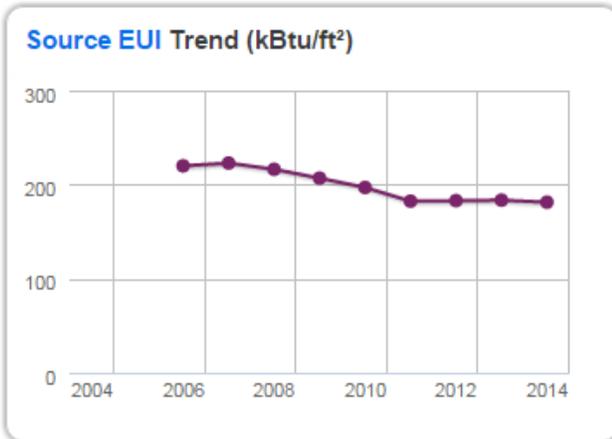
Year Built: 1995



ENERGY STAR Score (1-100)

Current Score: 76

Baseline Score: 58



Energy Star Charts:

The EPA's Energy Star website tracks the Energy Use Index EUI and the Green House Gas GHG emissions annually for a building based on the electricity, natural gas and water usage. These charts demonstrate the history of this building based on that data.

Energy Star Score:

This building has been gradually improving and has a score high enough to qualify. However Detention Facilities cannot receive the award under the current EPA guidelines.

EUI Trend:

The downward trend is leveling off in 2014. The EUI of 85.7 (2014) continues to be lower than the base year of 97.5 (2006).

GHG Trend:

The downward trend is leveling off in 2014. The GHG emissions of 1828.1 (2014) continues to be lower than the base year of 2225.9 (2006).

Energy Star Metrics

Using the latest metrics available from the Energy Star website it can be seen that 2020 Auburn is performing very well given its full time occupancy of tenants. The fact that it almost qualifies vs other similarly sized "office buildings" is a very good achievement.

Metric	Baseline (Dec 2006)	Current (Dec 2014)	Target*	Median Property*
ENERGY STAR score (1-100)	58	76	75	50
Source EUI (kBtu/ft²)	219.9	181.2	185.8	251.9
Site EUI (kBtu/ft²)	97.5	85.7	87.9	119.2
Source Energy Use (kBtu)	36,286,951.6	30,109,737.3	30,880,216.5	41,858,186.5
Site Energy Use (kBtu)	16,094,706.1	14,248,564.4	14,613,170.0	19,808,177.0
Energy Cost (\$)	214,505.84	200,537.41	205,685.41	278,784.71
Total GHG Emissions (Metric Tons CO2e)	2,225.9	1,828.1	1,875.0	2,541.4

2020 Auburn Energy Conservation Measures and Recommendations

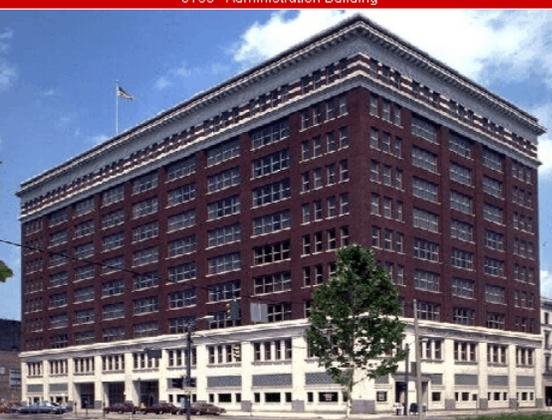
Previous ECM's

- Boiler replacement with high-efficiency condensing boilers.
- Control Upgrades and programming changes (by Owner).
- Heat recovery from garage spaces via controls changes (by Owner).

Proposed ECM's

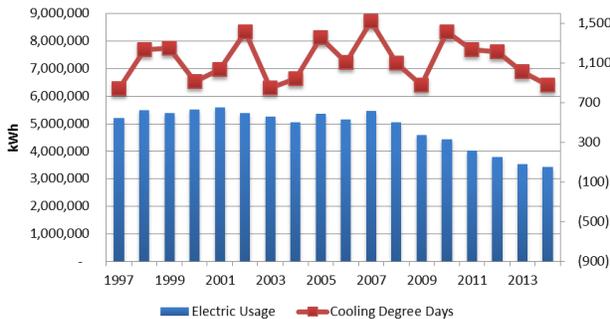
- Implement energy conservation measures from completed Ameresco ECM audit.
 - Retrofit lighting and add occupancy sensors
 - Replace domestic water heaters
 - Replace city water booster pumps
 - Perform water conservation survey and associated work
 - Upgrade and retrocommission controls
 - Variable frequency drives and motor replacements

County Administration Building

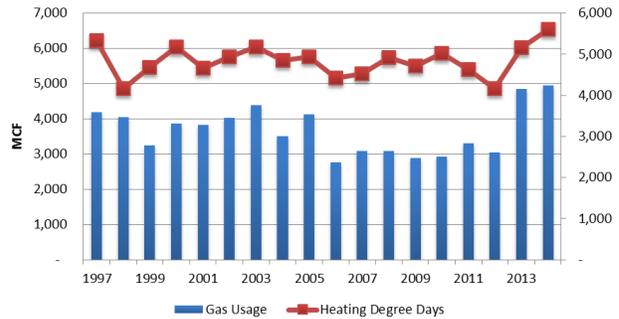
0138 - Administration Building		ARCHIBUS/FM Bldg Data	
	Bldg Code:		0138
	Bldg Name :		Administration Building
	Address :		138 East Court Street
	City :		CINCINNATI
	State :		OH
	Postal Code:		45202
	Site Code :		COUNTYCAMPUS
	Agency :		BOCC
	Use :		Office
	Const Type:		BrickStone
	Date Built :		1987
	Ext Gross Area:		209,063.30 sf
	Int Gross Area:		196,735.49 sf
	Rentable Area:		182,724.33 sf
	Estimated Area:		0.00 sf
Total Roof Area:		20,488.00 sf	
Leased/Owned :		Owned	
Floor Count :		11	
Sprinklered? :		Yes	
Property :		079-0001-0128-90	

Fl Code	Int Gross	Ext Gross	Vert Pen	Service	Rentable	Usable	Room Area
01	16,844 sf	17,852 sf	2,008 sf	4,981 sf	14,838 sf	9,854 sf	16,844 sf
02	18,027 sf	19,162 sf	2,071 sf	2,679 sf	15,956 sf	13,277 sf	18,027 sf
03	17,934 sf	19,039 sf	1,564 sf	2,980 sf	16,369 sf	13,389 sf	17,934 sf
04	17,929 sf	19,030 sf	1,559 sf	2,972 sf	16,371 sf	13,398 sf	17,929 sf
05	17,419 sf	18,552 sf	893 sf	2,709 sf	16,526 sf	13,817 sf	17,419 sf
06	17,414 sf	18,553 sf	925 sf	3,174 sf	16,490 sf	13,315 sf	17,414 sf
07	17,407 sf	18,549 sf	902 sf	2,680 sf	16,505 sf	13,825 sf	17,407 sf
08	17,400 sf	18,553 sf	893 sf	3,102 sf	16,507 sf	13,405 sf	17,400 sf
09	17,400 sf	18,553 sf	862 sf	2,136 sf	16,538 sf	14,403 sf	17,400 sf
0B	21,521 sf	22,816 sf	1,432 sf	10,231 sf	20,089 sf	9,858 sf	21,521 sf
0R	0 sf	0 sf	0 sf	0 sf	0 sf	0 sf	0 sf
10	17,440 sf	18,606 sf	902 sf	3,615 sf	16,538 sf	12,923 sf	17,440 sf
OUT	0 sf	0 sf	0 sf	0 sf	0 sf	0 sf	0 sf

Administration Annual Electric Usage



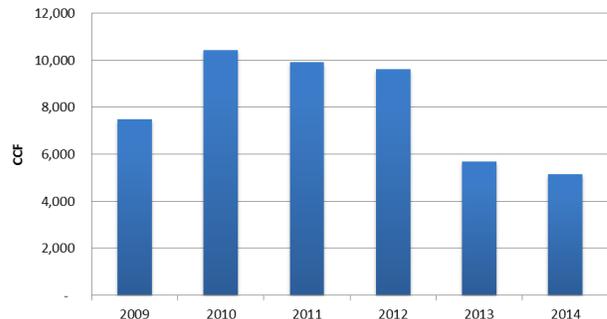
Administration Annual Gas Usage



The County Administration Building was renovated in the 1980's and prior to the performance contract work received two new rooftop units, a new rooftop "swing" chiller and upgraded DDC controls. The Phase 1 work included steam boiler replacements with a new hot water heating plant, VFD pumps and, low flush water fixtures, cooling water reclaim loop and retrocommisioining on the DDC system

The electrical graph shows relatively steady consumption pattern up until 2007, where it has continued to decrease each year. The consumption decreased by 7%, totaling a 21% reduction relative to 2010. The gas history chart demonstrates a increase in natural gas usage in 2013 & 2014. We are seeking to explain and rectify.

Administration Annual Water Usage



ADMIN-Historical Monthly Electric and Gas Data

The following data is a representation of electrical, water and gas usage by month. The green cells show the minimum usage for the month.

- Electric consumption (KWH) decreased 3% compared to a 10% reduction in degree days.
- Electric demand (KW) remained approximately the same.
- Natural gas consumption decreased 8% compared to a 9% increase in heating degree days.
- Water consumption increased 7% compared to the previous year. Overall however the water usage is down 28% compared to 2010.

Administration Building Electric Data

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL	
2012	kWh	299,296	263,992	285,864	316,316	303,592	359,529	408,847	371,314	354,123	267,465	266,000	275,294	3,771,632
	kWa	719	728	986	917	984	948	1,074	1,025	895	888	830	739	1,074
	kWb	780	769	846	968	986	975	1,079	1,025	983	952	763	755	1,079
	Cost	\$ 24,653	\$ 23,370	\$ 25,503	\$ 28,629	\$ 28,334	\$ 30,634	\$ 34,397	\$ 31,948	\$ 30,553	\$ 26,244	\$ 23,340	\$ 23,609	\$ 331,213
2013	kWh	276,366	249,758	240,037	290,638	294,009	343,187	374,799	325,471	338,102	278,865	234,992	275,294	3,521,518
	kWa	641	679	590	739	863	1,003	1,038	933	1,037	875	787	738	1,038
	kWb	730	760	728	747	935	1,003	1,038	933	1,037	915	858	1,151	1,151
	Cost	\$ 22,883	\$ 20,229	\$ 19,406	\$ 21,619	\$ 24,962	\$ 28,054	\$ 29,741	\$ 26,353	\$ 28,430	\$ 24,573	\$ 20,460	\$ 23,605	\$ 290,316
2014	kWh	245,235	220,822	235,328	252,974	271,503	354,996	359,140	316,211	373,195	296,074	253,682	243,914	3,423,074
	kWa	518	706	704	874	900	1,026	1,019	1,044	1,037	922	857	646	1,044
	kWb	733	771	760	833	940	1,026	1,060	1,044	1,058	979	886	773	1,060
	Cost	\$ 20,775	\$ 20,522	\$ 20,875	\$ 22,702	\$ 25,171	\$ 31,066	\$ 30,293	\$ 28,491	\$ 30,781	\$ 27,001	\$ 23,944	\$ 21,779	\$ 303,400

Administration Building Gas Data

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL	
2012	CCF	9,062	3,568	2,426	1,487	494	158	150	140	78	101	179	12,558	30,401
	Cost	\$ 6,328	\$ 2,415	\$ 1,746	\$ 964	\$ 381	\$ 417	\$ 417	\$ 418	\$ 380	\$ 398	\$ 454	\$ 8,142	\$ 22,460
2013	CCF	8,465	9,968	5,664	3,687	2,103	1,826	1,752	1,604	1,708	731	4,210	6,590	48,308
	Cost	\$ 5,089	\$ 5,931	\$ 4,940	\$ 3,508	\$ 2,228	\$ 1,990	\$ 1,550	\$ 1,540	\$ 1,329	\$ 757	\$ 2,700	\$ 4,298	\$ 35,860
2014	CCF	7,527	10,815	4,399	2,539	1,573	1,128	996	7,274	891	909	5,590	5,679	49,320
	Cost	\$ 5,155	\$ 7,554	\$ 3,111	\$ 2,147	\$ 1,536	\$ 1,182	\$ 1,067	\$ 4,850	\$ 967	\$ 1,048	\$ 3,801	\$ 3,903	\$ 36,320
		9062	3568	2426	1487	494	158	150	140	78	101	179	12558	

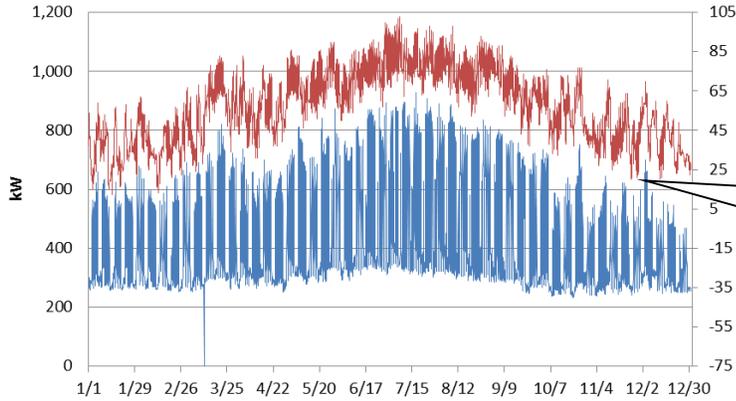
Administration Building Water Data

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL	
2012	CCF	344	369	362	485	571	1,097	1,458	1,730	1,353	765	574	505	9,613
	Cost	\$ 2,636	\$ 3,069	\$ 2,943	\$ 3,584	\$ 4,098	\$ 7,130	\$ 8,939	\$ 10,463	\$ 8,532	\$ 5,115	\$ 4,116	\$ 3,866	\$ 64,491
2013	CCF	253	266	200	185	288	425	534	732	1,076	822	726	199	5,706
	Cost	\$ 2,310	\$ 2,651	\$ 2,137	\$ 2,188	\$ 2,727	\$ 3,511	\$ 4,142	\$ 5,274	\$ 7,458	\$ 5,738	\$ 5,240	\$ 2,322	\$ 45,700
2014	CCF	140	209	221	220	494	892	1,002	811	569	266	189	136	5,149
	Cost	\$ 1,774	\$ 2,434	\$ 2,508	\$ 2,615	\$ 4,060	\$ 6,626	\$ 7,350	\$ 6,084	\$ 4,708	\$ 2,681	\$ 2,223	\$ 2,149	\$ 45,212

= minimum of month for past 3 years

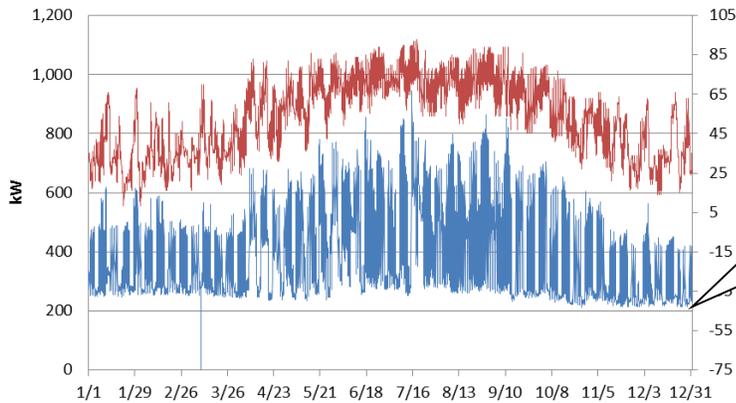
ADMIN-Three Year Electrical Review

Administration Annual Electric Profile (2012)



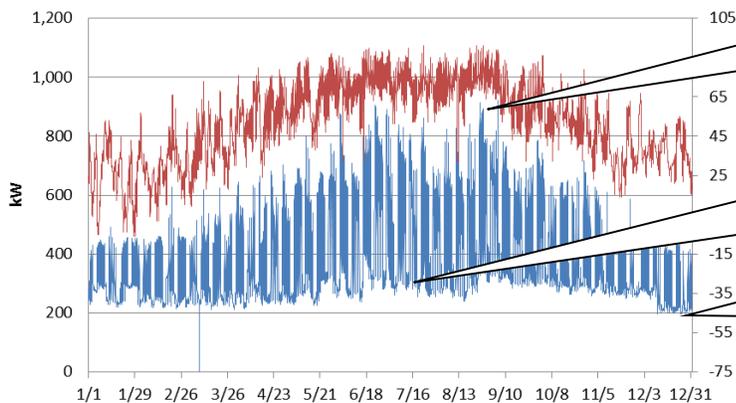
Similar to other buildings, the peak load decreased during the last few months of the year.

Administration Annual Electric Profile (2013)



While the peak demand was 40 kW lower than 2012, the occupied demand is consistently much lower than 2012 throughout the year.

Administration Annual Electric Profile (2014)



Peak demand shows an increase of only 6 kw which happened in August of 2014 vs July of 2013.

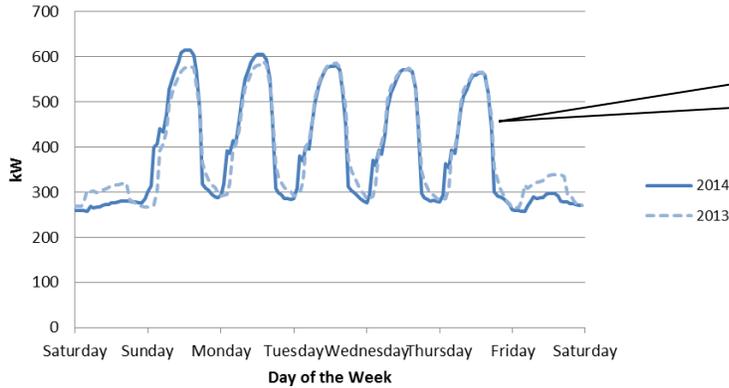
This gentle rise in the summer indicates summer time cooling is on but in this building it can be the Liebert Units for the data center

Overnight usage all the way down to 200kW, this is a very good trend.

ADMIN-Electric Profile Review

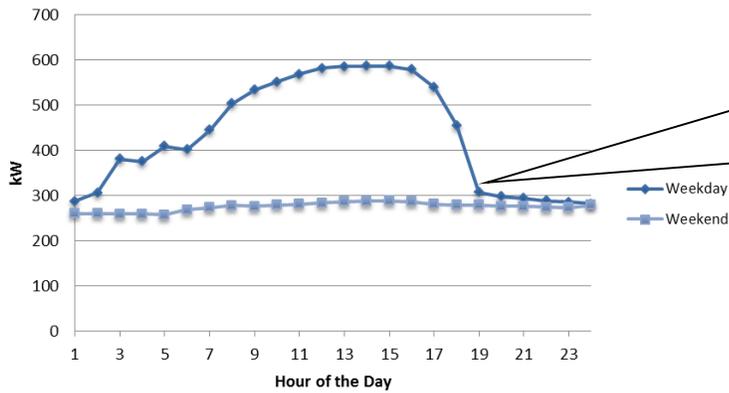
The graphs below illustrate the power requirements of the facility throughout a typical week, typical day and the year. The typical week and typical day profiles are averaged throughout the year in order to view how the electric demand varies during the day and across the week. The load duration curve represents the demand as a function of cumulative time for the year.

Administration Typical Week Profile



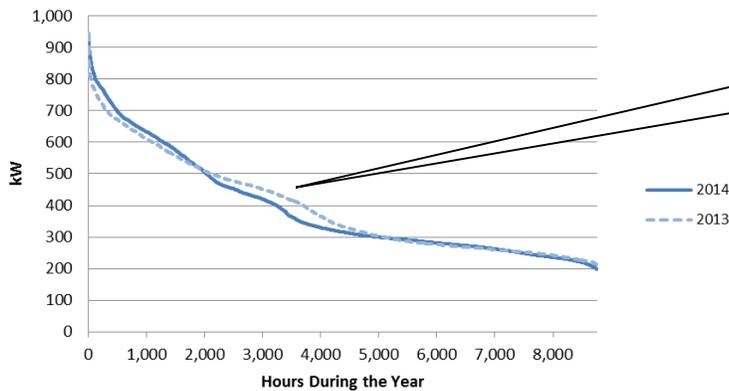
Electric demand profile virtually the same as previous years.

Administration Typical Day Profile (2014)



The facility has a weekday curve typical of facilities with space conditioning. The weekend load remains somewhat constant throughout the day. The weekday loads have decreased slightly throughout the day.

Administration Load Duration Curve



The reduction in load is most significant during the higher demands, despite a similar peak demand.

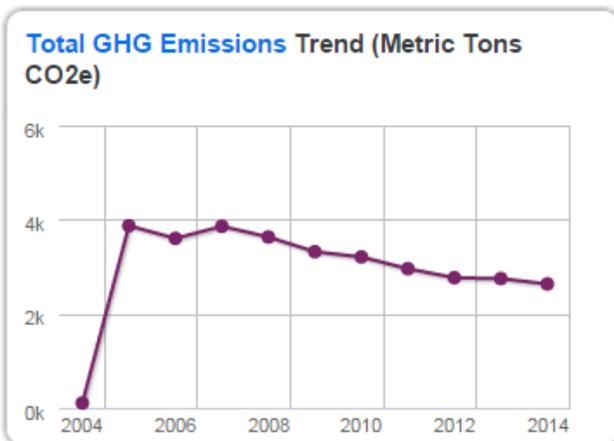
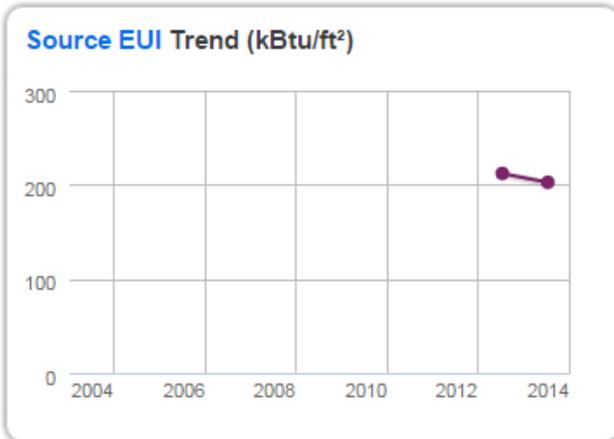
ADMIN-Energy Star Review

County Administration Building

138 East Court Street, Cincinnati, OH 45202 | [Map It](#)
 Portfolio Manager Property ID: 1161598 | Primarily: Office
 Year Built: 1987



ENERGY STAR Score (1-100)
Current Score: 79
Baseline Score: N/A



Energy Star Charts:

The EPA's Energy Star website tracks the Energy Use Index EUI and the Green House Gas GHG emissions annually for a building based on the electricity, natural gas and water usage. These charts demonstrate the history of this building based on that data.

Energy Star Score:

This building qualified for Energy Star in 2014 after missing the minimum grade in 2013 due to a new Data Center rule at the EPA. We made the necessary changes and got this building back to certification this year so this building has qualified 3 of the last 4 years.

EUI Trend:

The downward trend of the EUI shows an overall savings in electric and gas usage to about 200kBtu/sf. This is a very respectable number for a building that hosts a 24/7 Data Center with HVAC cooling. The data does not go back beyond 2012 because of the aforementioned Data Center changes.

GHG Trend:

The general downward and continued trend of the GHG at this building is a model for all buildings.

Energy Star Metrics

Using the latest metrics available from the Energy Star website it can be seen that the County Administration Building is performing very well compared to its 2006 baseline of 58 (no longer shown) and median property of 50.

Metric	Baseline (Jan 2014)	Current (Dec 2014)	Target*	Median Property*
ENERGY STAR score (1-100)	<u>Not Available</u>	79	75	50
Source EUI (kBtu/ft²)	206.1	202.6	216.8	286.7
Site EUI (kBtu/ft²)	83.2	82.4	88.2	116.6
Source Energy Use (kBtu)	43,084,042.9	42,355,777.4	45,324,220.0	59,939,423.3
Site Energy Use (kBtu)	17,388,430.0	17,230,285.6	18,437,842.8	24,383,291.5
Energy Cost (\$)	323,027.76	339,306.96	363,190.10	480,167.20
Total GHG Emissions (Metric Tons CO2e)	2,679.2	2,631.1	2,816.2	3,723.3

County Administration Building Energy Conservation Measures and Recommendations

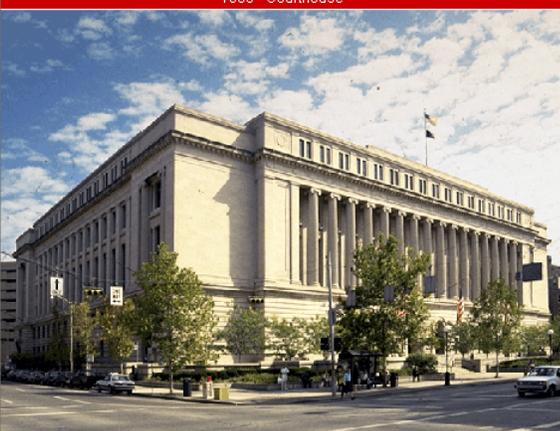
Previous ECM's

- Night setback for equipment.
- New rooftop chiller for "swing" seasons.
- New high efficient rooftop air handling units bought on Life Cycle Cost Methodology.
- Selective lighting replacements.
- Energy conservation measures from Ameresco ECM audit.
 - Lighting retrofits using Duke Incentive program with occupancy sensors
 - Replace inefficient steam boilers and domestic water heaters
 - Convert steam plant to heating hot water plant
 - Recover heat rejection from computer room A/C units
 - Perform water conservation survey and associated work
 - Upgrade and recommission controls
 - Variable frequency drives and motor replacements

Proposed ECM's

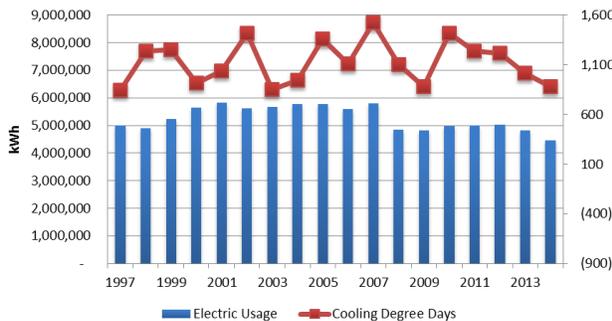
- Examine the hot water reclaim unit and utilize this heat in another area of the building, possibly hot water reheat in the summer time.
- Eliminate summertime reheat schedule on new condensing boilers. Past data shows no gas usage on steam boiler plant in the summer; coordinate this schedule change with Ameresco as they have submitted a summertime use plan to provide reheat.

Hamilton County Courthouse

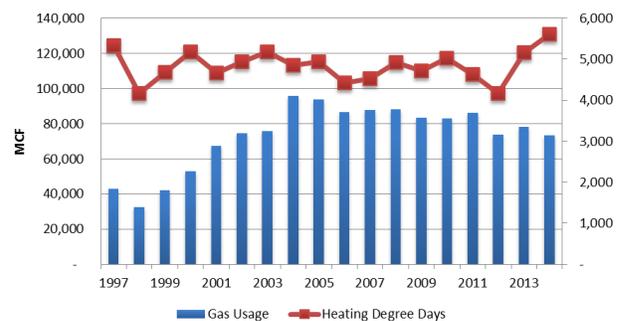
1000 - Courthouse				ARCHIBUS/FM Bldg Data						
				Bldg Code:						1000
				Bldg Name:						Courthouse
				Address:						1000 Main Street
				City:						CINCINNATI
				State:						OH
				Postal Code:						45202
				Site Code:						COUNTYCAMPUS
				Agency:						BOCC
				Use:						Office
				Const Type:						Stone
				Date Built:						1915
				Ext Gross Area:						553,685.24 sf
				Int Gross Area:						516,480.17 sf
				Rentable Area:						400,528.35 sf
Estimated Area:						0.00 sf				
Total Roof Area:						77,077.67 sf				
Leased/Owned:						Owned				
Floor Count:						9				
Sprinklered? :						Yes				
Property:						079-0002-0017-90				

Fl Code	Int Gross	Ext Gross	Vert Pen	Service	Rentable	Usable	Room Area
01	69,885 sf	73,992 sf	12,388 sf	21,457 sf	57,497 sf	36,040 sf	69,937 sf
02	69,717 sf	74,373 sf	19,912 sf	18,337 sf	49,805 sf	31,468 sf	69,711 sf
03	68,305 sf	75,498 sf	12,721 sf	16,207 sf	55,583 sf	39,377 sf	68,303 sf
04	68,301 sf	73,426 sf	24,512 sf	18,556 sf	43,789 sf	25,232 sf	68,306 sf
05	68,236 sf	73,420 sf	13,199 sf	19,435 sf	55,036 sf	35,601 sf	68,300 sf
06	70,734 sf	73,464 sf	23,067 sf	12,595 sf	47,667 sf	35,072 sf	70,734 sf
07	24,384 sf	26,699 sf	7,335 sf	2,988 sf	17,049 sf	14,061 sf	24,384 sf
0B	70,255 sf	75,493 sf	2,817 sf	27,221 sf	67,438 sf	40,217 sf	70,553 sf
0R	0 sf						
0UT	0 sf						
SB	6,665 sf	7,319 sf	0 sf	6,395 sf	6,665 sf	270 sf	6,665 sf

Courthouse Annual Electric Usage

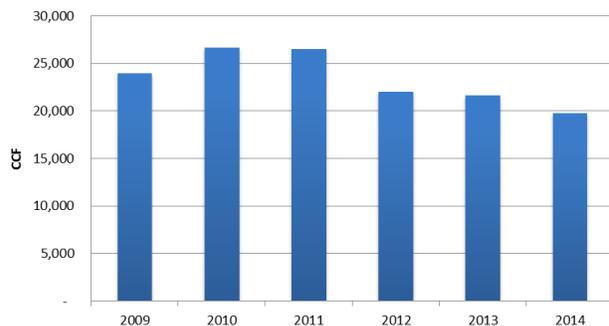


Courthouse Annual Gas Usage



The County Courthouse has had many renovations in the 1990's as part of a large scale Public Works upgrade project. Future projects were never started due to lack of funding. Those original projects provided five new boilers and several large VAV air handlers. The building has modern electronic DDC controls and two new VFD driven cooling towers. The new free cooling heat exchanger will hopefully decrease kWh usage in future years.

Courthouse Annual Water Usage



The electric usage at this site has been on a decline and is slowly continuing that trend. The natural gas did not rise as fast as the degree days did in 2014 indicating this building is not hugely weather dependent. The water usage has also decrease over the last few years which given the cost of water and sewer is a very good trend.

CH-Historical Monthly Electric and Gas Data

The following data is a representation of electrical, water and gas usage by month. The green cells show the minimum usage for the month.

- Electric consumption (KWH) decreased 8% compared to a 14% reduction in degree days.
- Electric demand (KW) decreased approximately 100 kw on average this year.
- Natural gas consumption decreased 6% compared to a 9% increase in heating degree days.
- Water consumption decreased 9% compared to the previous year. Overall the water consumption is down 28% compared to 2010.

Courthouse Electric Data

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL	
2012	kWh	420,650	375,940	384,386	382,867	373,711	425,163	540,784	493,647	453,535	363,974	401,700	412,141	5,028,498
	kWa	1,089	1,187	1,204	1,200	1,235	1,374	1,435	1,441	1,300	1,028	1,142	1,042	1,441
	kWb	1,089	1,187	1,204	1,200	1,235	1,374	1,435	1,441	1,300	1,225	1,225	1,225	1,441
	Cost	\$ 34,265	\$ 34,405	\$ 35,022	\$ 34,903	\$ 35,034	\$ 39,352	\$ 45,257	\$ 43,317	\$ 39,452	\$ 34,418	\$ 36,035	\$ 36,481	\$ 447,941
2013	kWh	408,473	369,084	378,190	410,065	366,776	404,561	469,938	402,168	447,548	416,066	375,949	378,129	4,826,947
	kWa	1,020	1,144	1,079	1,195	1,184	1,183	1,356	1,176	1,318	1,250	1,198	1,060	1,356
	kWb	1,225	1,225	1,225	1,225	1,225	1,225	1,356	1,176	1,318	1,250	1,198	1,152	1,356
	Cost	\$ 35,758	\$ 31,289	\$ 31,595	\$ 32,939	\$ 31,940	\$ 33,611	\$ 37,922	\$ 32,748	\$ 36,568	\$ 34,589	\$ 32,399	\$ 31,726	\$ 403,085
2014	kWh	416,152	320,210	337,637	351,524	401,885	416,192	393,687	389,121	434,982	330,499	315,857	349,024	4,456,770
	kWa	986	964	978	1,099	1,201	1,252	1,264	1,178	1,105	1,082	1,063	883	1,264
	kWb	1,153	1,153	1,153	1,153	1,201	1,252	1,264	1,178	1,105	1,082	1,074	1,074	1,264
	Cost	\$ 33,529	\$ 30,120	\$ 30,752	\$ 31,298	\$ 33,978	\$ 38,272	\$ 34,724	\$ 33,191	\$ 33,657	\$ 29,888	\$ 29,206	\$ 30,432	\$ 389,046

Courthouse Gas Data

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL	
2012	CCF	119,374	99,495	63,084	49,987	33,808	30,820	30,226	32,763	31,688	55,782	92,008	96,854	735,889
	Cost	\$ 66,711	\$ 55,722	\$ 37,902	\$ 17,450	\$ 11,830	\$ 12,257	\$ 13,091	\$ 14,952	\$ 13,048	\$ 24,811	\$ 44,264	\$ 51,639	\$ 363,676
2013	CCF	112,101	102,500	105,219	59,801	36,757	32,217	31,860	30,840	28,489	43,351	89,543	107,316	779,994
	Cost	\$ 53,047	\$ 46,512	\$ 50,463	\$ 32,675	\$ 21,127	\$ 18,703	\$ 17,134	\$ 15,891	\$ 14,779	\$ 21,764	\$ 44,339	\$ 56,703	\$ 393,135
2014	CCF	110,127	103,355	92,497	47,924	38,165	25,578	28,007	25,868	28,013	47,037	88,686	97,153	732,410
	Cost	\$ 63,397	\$ 64,642	\$ 54,279	\$ 32,088	\$ 17,957	\$ 7,482	\$ 18,219	\$ 16,057	\$ 17,315	\$ 28,530	\$ 49,104	\$ 58,640	\$ 427,711

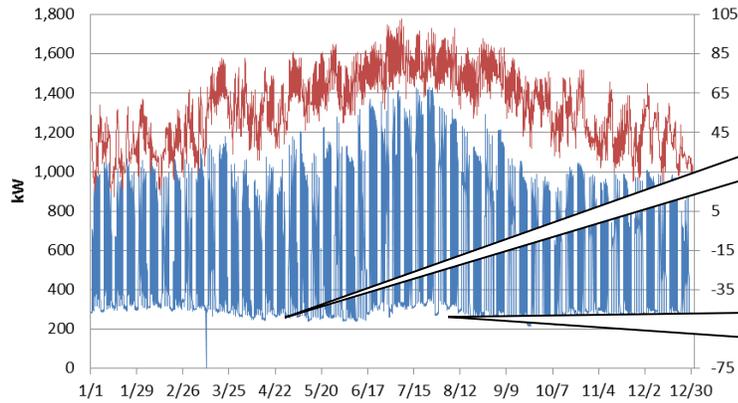
Courthouse Water Data

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL	
2012	CCF	1,563	1,890	1,450	2,010	1,911	2,360	2,268	2,632	1,664	872	987	2,444	22,051
	Cost	\$ 10,023	\$ 12,565	\$ 9,964	\$ 12,274	\$ 12,119	\$ 14,412	\$ 12,906	\$ 11,859	\$ 9,029	\$ 6,305	\$ 6,858	\$ 13,841	\$ 132,158
2013	CCF	1,667	1,919	1,577	1,482	1,688	1,698	1,864	1,911	2,417	1,823	1,751	1,847	21,644
	Cost	\$ 10,370	\$ 12,904	\$ 11,041	\$ 10,305	\$ 11,788	\$ 11,555	\$ 11,937	\$ 11,964	\$ 15,152	\$ 12,095	\$ 11,813	\$ 12,706	\$ 143,628
2014	CCF	1,533	1,711	1,639	1,458	1,492	1,637	1,790	1,626	2,027	1,571	1,374	1,936	19,793
	Cost	\$ 10,654	\$ 13,108	\$ 12,531	\$ 11,416	\$ 10,547	\$ 11,514	\$ 12,399	\$ 11,443	\$ 13,396	\$ 11,648	\$ 10,784	\$ 14,556	\$ 143,996

█ = minimum of month for past 3 years

CH-Three Year Electrical Review

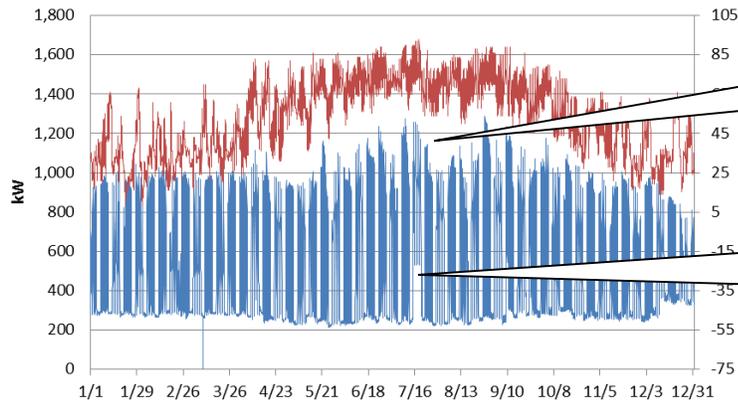
Courthouse Annual Electric Profile (2012)



Night setback is working and this building does a great job of shedding its load at night.

This bump indicates the chillers are running overnight in this building.

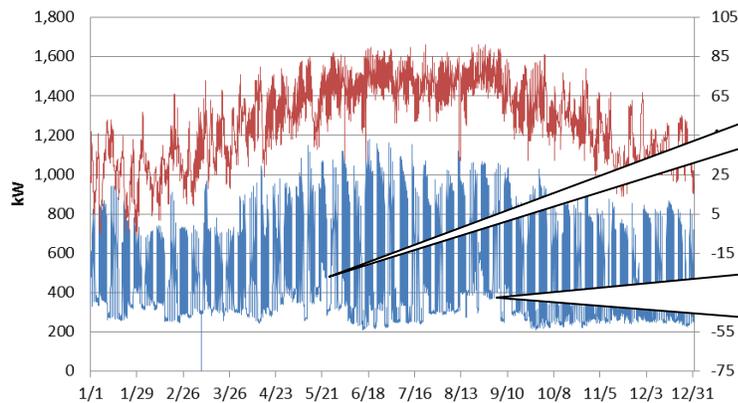
Courthouse Annual Electric Profile (2013)



The summertime demand has decreased from 2012 about 200 KW and that is very good.

The building operators have minimized the bump so very few times were the chillers on all night

Courthouse Annual Electric Profile (2014)



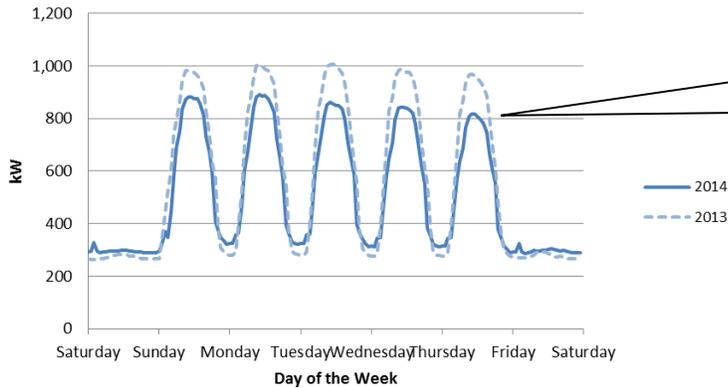
Overnight usage is up.

Night Setback does not appear to shutting the chiller plant down at night. This bump can be seen multiple times throughout the year. Free cooling should help minimize this.

CH-Electric Profile Review

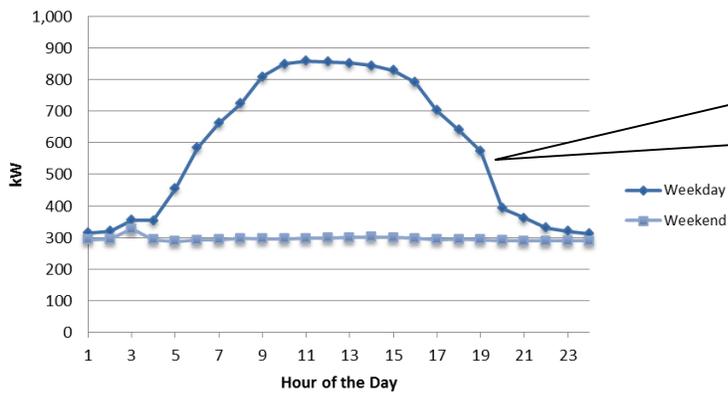
The graphs below illustrate the power requirements of the facility throughout a typical week, typical day and the year. The typical week and typical day profiles are averaged throughout the year in order to view how the electric demand varies during the day and across the week. The load duration curve represents the demand as a function of cumulative time for the year.

Courthouse Typical Week Profile



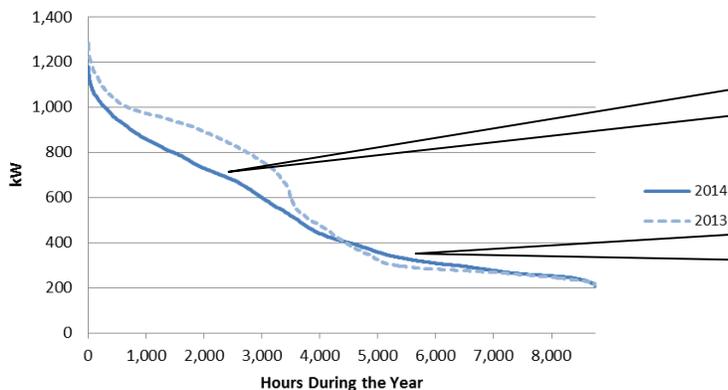
The occupied demand has slightly decreased during the weekdays, likely due to the summertime improvement.

Courthouse Typical Day Profile (2014)



Equipment ramps up early in the morning during the weekdays and remains off through the weekend. The setback scheduling appears to be slightly more aggressive than in 2011.

Courthouse Load Duration Curve



The electric demand improved during higher demand periods which is very good.

The electric demand increased during lower demand periods which should be investigated.

CH-Energy Star Review

Courthouse

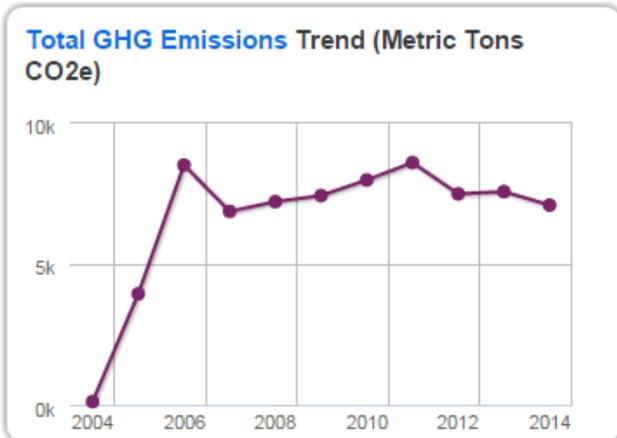
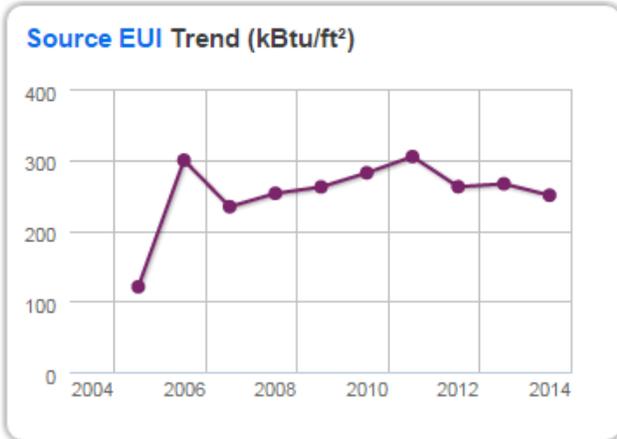
1000 Main Street, Cincinnati, OH 45202 | [Map It](#)
 Portfolio Manager Property ID: 1161608 | Primarily: Office
 Year Built: 1915



ENERGY STAR Score (1-100)

Current Score: 50

Baseline Score: 31



Energy Star Charts:

The EPA's Energy Star website tracks the Energy Use Index EUI and the Green House Gas GHG emissions annually for a building based on the electricity, natural gas and water usage. These charts demonstrate the history of this building based on that data.

Energy Star Score:

Because the Courthouse provides hot water, steam and heating for the Justice Center, it has never qualified for energy star given the EPA rules for "campus buildings" However the EPA has agreed to let us model this building as a district steam plant.

EUI Trend:

The jump in 2005 is when the Courthouse took over heating the JC. However since 2011 the EUI has continued to drop to 178.9 this year.

GHG Trend:

The general downward and continued trend of the GHG at this building is a model for all buildings. The GHG is down to 7053 in 2014.

Energy Star Metrics

Using the latest metrics available from the Energy Star website, the Courthouse is performing right at median level even with its forced additional heating of the Justice Center

Metric	Baseline (Dec 2006)	Current (Dec 2014)	Target*	Median Property*
ENERGY STAR score (1-100)	31	50	75	50
Source EUI (kBtu/ft²)	299.3	249.7	185.6	250.9
Site EUI (kBtu/ft²)	211.9	178.9	133.0	179.8
Source Energy Use (kBtu)	151,934,115.4	126,915,698.8	94,329,004.0	127,535,704.8
Site Energy Use (kBtu)	107,565,665.2	90,924,664.7	67,578,977.6	91,368,849.0
Energy Cost (\$)	1,159,597.41	761,253.85	565,940.55	764,972.57
Total GHG Emissions (Metric Tons CO2e)	8,470.6	7,053.1	5,243.5	7,087.6

Hamilton County Courthouse Building Energy Conservation Measures and Recommendations

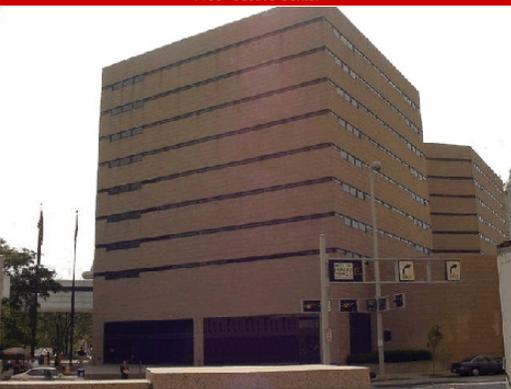
Previous ECM's

- Night Setback for equipment.
- VAV air handlers.
- Selective lighting replacements.
- Implement energy conservation measures from Ameresco ECM audit.
 - Lighting retrofits using Duke Incentive programs with occupancy sensors
 - Steam plant efficiency improvements
 - Free-cooling heat exchanger
 - Perform water conservation survey and associated work
 - Computer room A/C modifications
 - Upgrade and retro-commission controls

Proposed ECM's

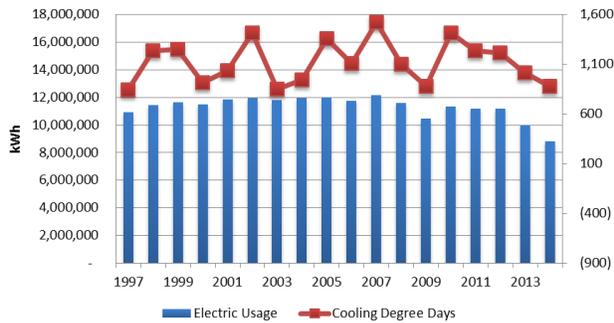
- Complete original construction plans and upgrade all air handlers to newer standards.
- Optimize the DDC control systems associated with the boiler and chiller plants.

Justice Center

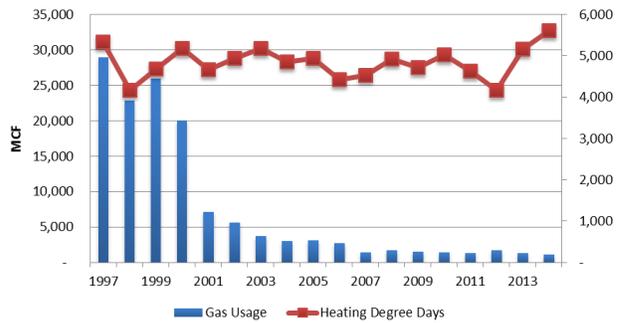
1100 - Justice Center		ARCHIBUS/FM Bldg Data	
	Bldg Code:	1100	
	Bldg Name:	Justice Center	
	Address:	1000 Sycamore Street	
	City:	CINCINNATI	
	State:	OH	
	Postal Code:	45202	
	Site Code:	COUNTYCAMPUS	
	Agency:	Sheriff	
	Use:	Jail	
	Const Type:	Masonry	
	Date Built:	1995	
	Ext Gross Area:	736,871.36 sf	
	Int Gross Area:	721,566.85 sf	
	Rentable Area:	489,538.49 sf	
	Estimated Area:	0.00 sf	
	Total Roof Area:	95,778.18 sf	
Leased/Owned:	Owned		
Floor Count:	26		
Sprinklered? :	Yes		
Property:	075-0001-0147-90		

FI Code	Int Gross	Ext Gross	Vert Pen	Service	Rentable	Usable	Room Area
N01	33,634 sf	34,489 sf	1,916 sf	8,055 sf	31,719 sf	23,664 sf	33,614 sf
N01M	32,814 sf	35,007 sf	14,246 sf	7,811 sf	18,588 sf	10,757 sf	32,990 sf
N02	31,926 sf	32,831 sf	2,347 sf	3,887 sf	29,579 sf	25,692 sf	31,351 sf
N02M	31,901 sf	32,810 sf	25,698 sf	46 sf	6,202 sf	6,157 sf	31,890 sf
N03	32,256 sf	32,676 sf	2,678 sf	378 sf	29,578 sf	29,199 sf	31,841 sf
N03M	32,365 sf	32,673 sf	20,333 sf	43 sf	12,032 sf	11,989 sf	31,993 sf
N04	32,166 sf	32,606 sf	2,680 sf	367 sf	29,486 sf	29,119 sf	32,311 sf
N04M	32,302 sf	32,606 sf	14,472 sf	43 sf	17,829 sf	17,787 sf	32,376 sf
N05	32,070 sf	32,673 sf	2,317 sf	351 sf	29,752 sf	29,401 sf	32,071 sf
N05M	32,072 sf	32,673 sf	20,479 sf	43 sf	11,593 sf	11,550 sf	31,952 sf
N0B	21,707 sf	22,489 sf	994 sf	14,568 sf	20,713 sf	6,145 sf	21,707 sf
N0P	1,851 sf	2,112 sf	351 sf	1,354 sf	1,500 sf	146 sf	1,851 sf
N0R	0 sf						
NSB	0 sf						
OUT	0 sf						
S01	55,187 sf	56,216 sf	2,334 sf	12,264 sf	52,853 sf	40,589 sf	55,122 sf
S01M	53,671 sf	55,123 sf	26,257 sf	13,465 sf	27,414 sf	13,949 sf	53,642 sf
S02	33,024 sf	33,320 sf	2,809 sf	338 sf	30,215 sf	29,877 sf	33,047 sf
S02M	32,385 sf	32,794 sf	21,586 sf	42 sf	10,799 sf	10,757 sf	32,385 sf
S03	32,376 sf	32,676 sf	2,651 sf	410 sf	29,724 sf	29,315 sf	32,290 sf
S03M	32,243 sf	32,675 sf	20,626 sf	44 sf	11,617 sf	11,572 sf	32,243 sf
S04	32,167 sf	32,606 sf	2,543 sf	352 sf	29,624 sf	29,272 sf	32,172 sf
S04M	32,249 sf	32,673 sf	20,633 sf	44 sf	11,617 sf	11,572 sf	32,162 sf
S05	32,133 sf	32,673 sf	2,195 sf	351 sf	29,937 sf	29,586 sf	32,134 sf
S05M	32,072 sf	32,673 sf	20,395 sf	44 sf	11,677 sf	11,633 sf	31,204 sf
S0B	5,168 sf	5,684 sf	1,158 sf	1,564 sf	4,010 sf	2,447 sf	5,168 sf
S0P	1,851 sf	2,112 sf	351 sf	1,354 sf	1,500 sf	146 sf	1,851 sf
S0R	0 sf						

Justice Center Annual Electric Usage

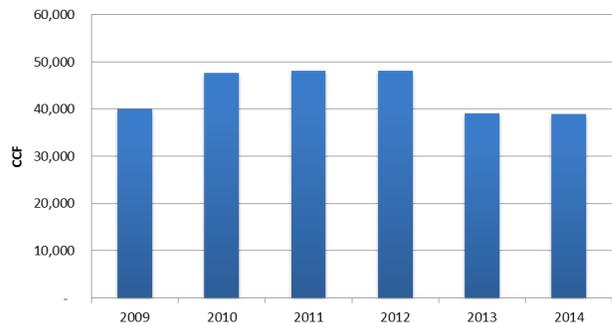


Justice Center Annual Gas Usage



The Justice Center is the full time penal institution that houses inmates 24/7. The building is air-conditioned via (2) new Trane Earthwise 475-ton chillers, cooling towers and large air handlers on the mezzanine levels. A recent retrocommissioning project upgraded the DDC system, added VFD's on major motors, and optimized controls. The electrical usage in this building has shown a steady decline and that continued in 2014. The natural dropped significantly in 2001 when the Courthouse took over heating duties for the JC. The water load has also dropped since 2012.

Justice Center Annual Water Usage



JC-Historical Monthly Electric and Gas Data

The following data is a representation of electrical, water and gas usage by month. The green cells show the minimum usage for the month.

- Electric consumption (KWH) decreased 12% compared to a 14% reduction in degree days.
- Electric demand (KW) remained approximately the same.
- Natural gas consumption decreased 14% compared to a 9% increase in heating degree days.
- Water consumption remained the same in 2014 but is down 19% compared to 2012.

Justice Center Electric Data

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL	
2012	kWh	911,399	776,521	831,217	900,164	890,455	1,012,535	1,205,084	1,073,998	1,053,538	828,287	850,955	820,300	11,154,453
	kWa	1,336	1,342	1,620	1,598	1,843	1,766	1,848	1,860	1,853	1,584	1,553	1,301	1,860
	kWb	1,692	1,693	1,693	1,693	1,843	1,766	1,848	1,860	1,853	1,584	1,581	1,581	1,860
	Cost	\$ 66,340	\$ 59,309	\$ 61,665	\$ 64,583	\$ 66,444	\$ 70,449	\$ 79,829	\$ 74,465	\$ 73,490	\$ 59,715	\$ 60,624	\$ 59,328	\$ 796,241
2013	kWh	903,234	763,267	753,368	845,582	365,039	929,214	1,121,389	937,744	993,653	871,897	742,635	740,968	9,967,990
	kWa	1,296	1,514	1,481	1,407	1,682	1,800	1,857	1,797	1,872	1,677	1,413	1,224	1,872
	kWb	1,581	1,581	1,581	1,581	754	1,800	1,857	1,797	1,872	1,677	1,591	1,591	1,872
	Cost	\$ 61,596	\$ 49,957	\$ 49,624	\$ 53,187	\$ 54,342	\$ 60,605	\$ 67,997	\$ 60,854	\$ 63,924	\$ 56,910	\$ 51,154	\$ 51,098	\$ 681,245
2014	kWh	756,159	606,638	595,996	581,033	654,601	887,648	905,692	840,142	932,713	695,256	630,050	684,589	8,770,517
	kWa	1,147	1,075	996	1,147	1,346	1,598	1,630	1,565	1,622	1,409	1,358	1,078	1,630
	kWb	1,591	1,591	1,591	1,591	1,591	1,598	1,630	1,591	1,622	1,409	1,385	1,385	1,630
	Cost	\$ 52,551	\$ 47,308	\$ 46,935	\$ 46,458	\$ 49,245	\$ 62,906	\$ 58,897	\$ 55,972	\$ 59,732	\$ 48,510	\$ 45,741	\$ 47,738	\$ 621,991

Justice Center Gas Data

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL	
2012	CCF	875	717	416	2,503	819	212	109	190	608	6,960	2,327	1,654	17,390
	Cost	\$ 812	\$ 651	\$ 475	\$ 1,287	\$ 554	\$ 335	\$ 289	\$ 327	\$ 516	\$ 3,883	\$ 1,545	\$ 1,272	\$ 11,947
2013	CCF	1,772	607	618	633	592	1,089	442	439	518	716	1,337	4,384	13,147
	Cost	\$ 1,234	\$ 571	\$ 584	\$ 635	\$ 633	\$ 954	\$ 471	\$ 487	\$ 319	\$ 653	\$ 995	\$ 2,872	\$ 10,408
2014	CCF	1,573	456	1,113	528	604	1,296	417	700	544	1,601	1,198	1,252	11,282
	Cost	\$ 1,257	\$ 555	\$ 1,011	\$ 640	\$ 719	\$ 1,177	\$ 548	\$ 699	\$ 803	\$ 1,866	\$ 1,781	\$ 2,583	\$ 13,639

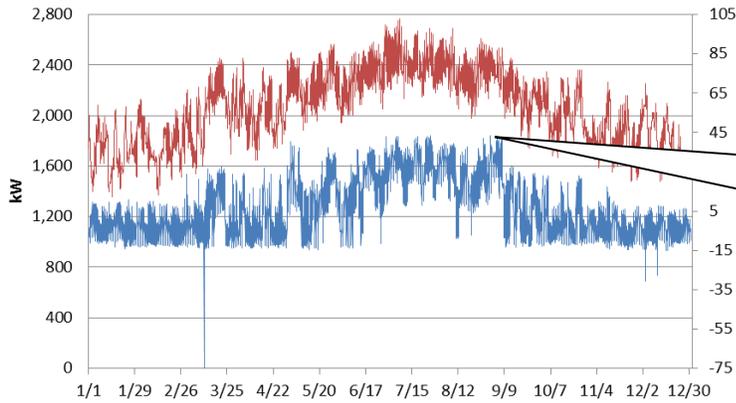
Justice Center Water Data

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL	
2012	CCF	3,763	4,340	4,100	3,673	3,843	4,193	3,653	4,329	5,160	3,625	3,404	4,014	48,095
	Cost	\$ 21,509	\$ 26,394	\$ 24,672	\$ 21,258	\$ 21,751	\$ 22,984	\$ 18,158	\$ 21,623	\$ 27,254	\$ 20,810	\$ 20,413	\$ 24,616	\$ 271,444
2013	CCF	3,316	3,862	2,952	2,441	2,883	3,438	3,680	3,514	4,335	2,945	2,678	3,027	39,071
	Cost	\$ 20,611	\$ 25,186	\$ 19,612	\$ 16,697	\$ 19,089	\$ 22,581	\$ 23,952	\$ 22,921	\$ 28,128	\$ 19,355	\$ 17,937	\$ 20,594	\$ 256,664
2014	CCF	2,447	2,772	3,149	2,591	2,529	3,392	4,151	3,321	4,110	3,227	3,572	3,698	38,959
	Cost	\$ 16,886	\$ 19,960	\$ 22,365	\$ 18,905	\$ 17,920	\$ 23,480	\$ 28,272	\$ 23,030	\$ 28,189	\$ 22,474	\$ 24,668	\$ 26,266	\$ 272,414

█ = minimum of month for past 3 years

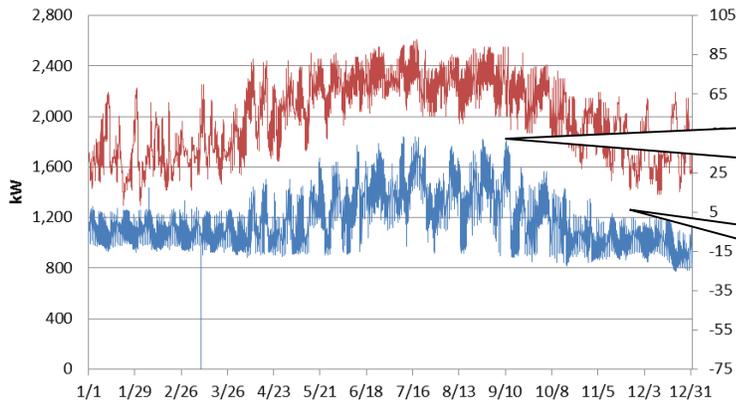
JC-Three Year Electrical Review

Justice Center Annual Electric Profile (2012)



The peak demand of the facility has decreased 130-150 kW compared to 2011 and 2012. This will result in savings in the bill for the winter months as well.

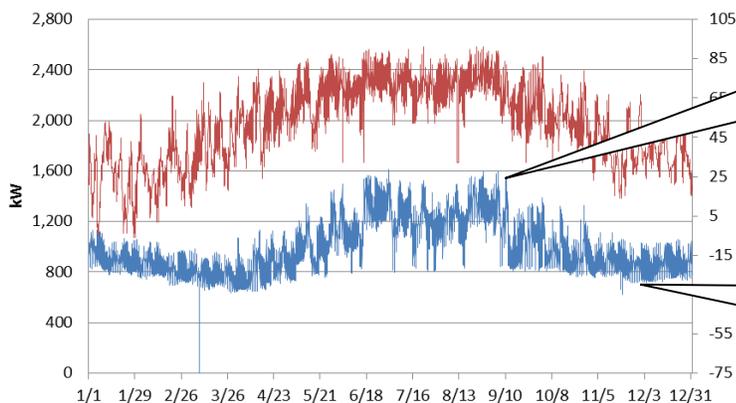
Justice Center Annual Electric Profile (2013)



The peak demand remained about the same, but the summertime base demand improved.

The demand decreased later in the year.

Justice Center Annual Electric Profile (2014)



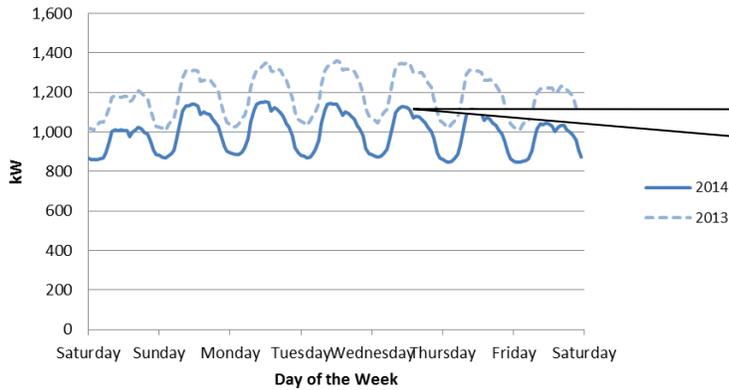
The new maximum peak is 1600 kwh indicating the new chillers and lighting are making a big difference in this building.

The overnight setback is lower than 2013 and 2012 - another great achievement.

JC-Electric Profile Review

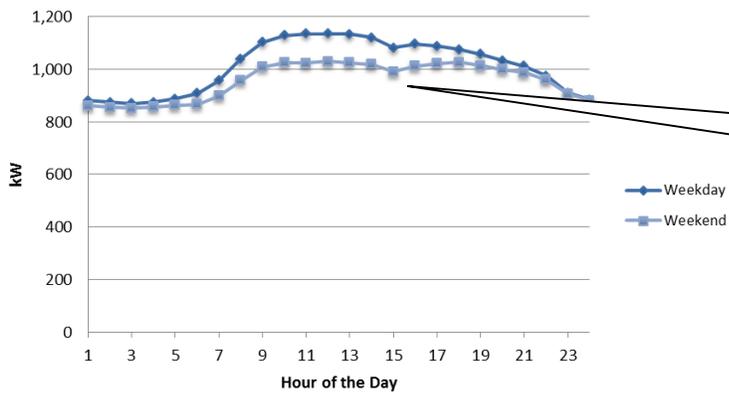
The graphs below illustrate the power requirements of the facility throughout a typical week, typical day and the year. The typical week and typical day profiles are averaged throughout the year in order to view how the electric demand varies during the day and across the week. The load duration curve represents the demand as a function of cumulative time for the year.

Justice Center Typical Week Profile



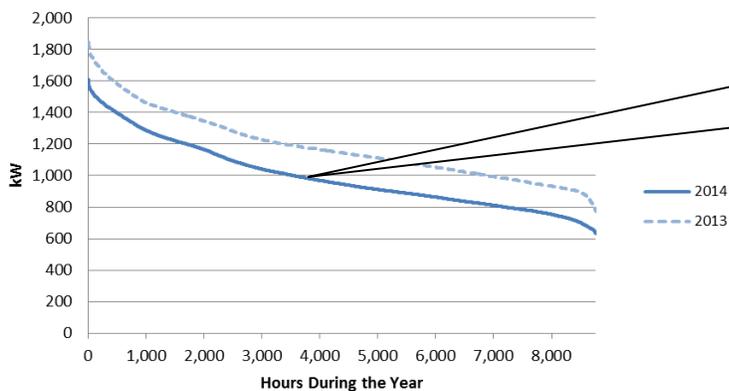
The daily demand has decreased significantly throughout the week during both occupied and unoccupied hours.

Justice Center Typical Day Profile (2014)



The weekend load in the middle of the day is slightly lower than the weekday.

Justice Center Load Duration Curve



All aspects of the peak demand dropped significantly for all load duration hours. This is a fantastic visual that the ECM projects are working pre.

JC-Energy Star Review

Justice Center

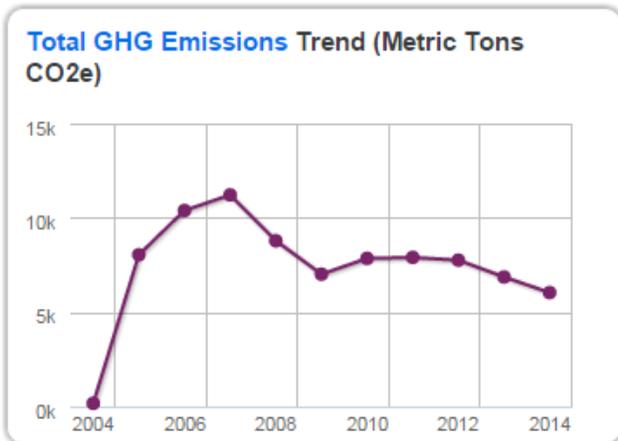
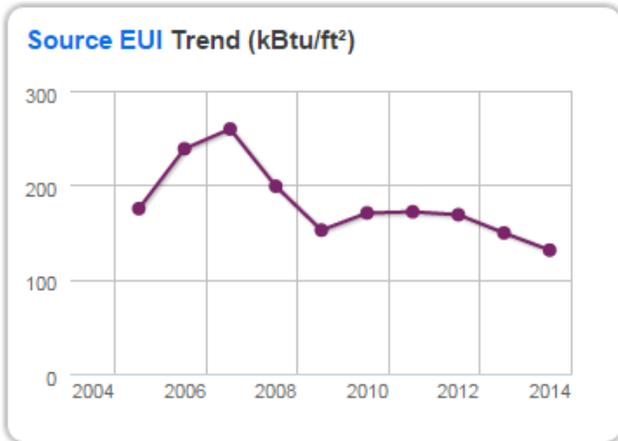
100 Sycamore Street, Cincinnati, OH 45202 | [Map It](#)
 Portfolio Manager Property ID: 1161610 | Primarily: [Courthouse](#)
 Year Built: 1985



ENERGY STAR Score (1-100)

Current Score: 94

Baseline Score: 61



Energy Star Charts:

The EPA's Energy Star website tracks the Energy Use Index EUI and the Green House Gas GHG emissions annually for a building based on the electricity, natural gas and water usage. These charts demonstrate the history of this building based on that data.

Energy Star Score:

The unusually high score for the Justice Center is partially due to the combined heating plant from the Courthouse whereas all the steam, heating, hot water are provided from the boilers in the CH.

EUI Trend:

The jump in the EUI trend is contrary to what should be seen in these years as the Courthouse provides heating for this building but after that settles out the results are downward and acceptable.

GHG Trend:

The jump in the GHG emissions trend is contrary to what should be seen in these years as the Courthouse provides all heating for this building but after that settles out the results are downward and acceptable.

Energy Star Metrics

Using the latest metrics available from the Energy Star website, the Justice center is performing at a high level but these results are not viable given the relationship with the CH boiler plant.

Metric	Baseline (Dec 2006)	Current (Dec 2014)	Target*	Median Property*
ENERGY STAR score (1-100)	61	94	75	50
Source EUI (kBtu/ft²)	238.5	131.1	205.8	278.3
Site EUI (kBtu/ft²)	116.8	42.8	67.2	90.8
Source Energy Use (kBtu)	172,103,478.7	94,572,541.7	148,509,414.8	200,789,280.8
Site Energy Use (kBtu)	84,245,677.7	30,867,324.0	48,471,661.2	65,535,171.6
Energy Cost (\$)	785,095.80	630,934.99	990,626.61	1,339,553.21
Total GHG Emissions (Metric Tons CO2e)	10,389.8	6,035.4	9,476.1	12,813.9

Justice Center Energy Conservation Measures and Recommendations

Previous ECM's

- New cooling towers with VFD's.
- DDC control system upgrade.
- Upgraded Domestic Water pumping system to new Grundfos with VFD control.
- Energy conservation measures from Ameresco ECM audit.
 - Lighting retrofits using Duke Incentive programs with occupancy sensors
 - Perform water conservation survey and associated work
 - Upgrade and retrocommission controls, demand controlled ventilation.
 - Install single zone cooling in local control rooms to allow for system-wide setback on supply air temperatures.
 - Solar panels and heat pump water heaters for domestic water
 - Variable frequency drives and motor replacements.
 - Chiller Replacement with Green Chiller options based on LCC selections.
 - Ozone laundry cleaning.

Proposed ECM's

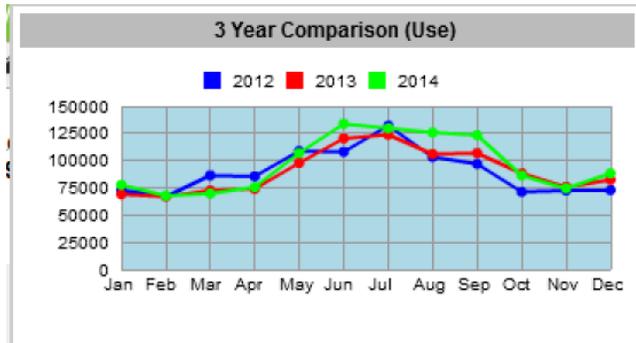
- Investigate water usage increased compared to the projected baseline savings goals.
- Assist with Kitchen water heater control.. Possibly modify solenoid control.
- Study UPS battery space conditions.
- Study Elevator room space conditions.

Coroner's Office

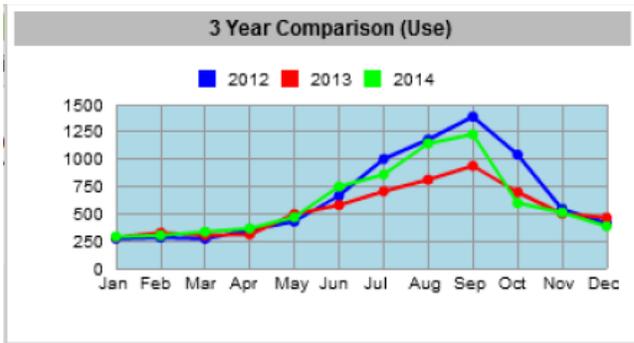
3159 - Coroner's Office	ARCHIBUS/FM Bldg Data
	Bldg Code: 3159
	Bldg Name: Coroner's Office
	Address: 3159 Eden Avenue
	City: CINCINNATI
	State: OH
	Postal Code: 45219
	Site Code: OTHER LOCATIONS
	Agency: HC CORONER
	Use: Medical
	Const Type: Brick
	Date Built: 1971
	Ext Gross Area: 34,863.21 sf
	Int Gross Area: 32,922.79 sf
	Rentable Area: 30,847.59 sf
	Estimated Area: 0.00 sf
	Total Roof Area: 11,146.05 sf
Leased/Owned: Owned	
Floor Count: 5	
Sprinklered?: No	
Property: 104-0005-0174-00	

FI Code	Int Gross	Ext Gross	Vert Pen	Service	Rentable	Usable	Room Area
01	10,180 sf	10,929 sf	583 sf	2,353 sf	9,598 sf	7,245 sf	10,180 sf
02	10,574 sf	11,084 sf	609 sf	2,775 sf	9,965 sf	7,190 sf	10,574 sf
03	10,575 sf	11,084 sf	573 sf	2,808 sf	10,002 sf	7,194 sf	10,575 sf
0P	1,593 sf	1,766 sf	311 sf	1,283 sf	1,283 sf	-0 sf	1,593 sf
0R	0 sf	0 sf	0 sf	0 sf	0 sf	0 sf	0 sf

Electric Use



Natural Gas Use



Water Use



The Coroner's Office is one of the larger energy users on a "per square foot" basis in the managed portfolio. These charts show that Facilities has managed to decrease usage from 2012 and the trend is to save energy and cost. The building is served by 3 large air handlers, one per floor, two hot water boilers and two air cooled chillers on the roof of the building. The morgue coolers have a hybrid cooling system utilizing city water and chilled water for cooling when it's available. One proposed ECM would be to investigate the use of DX cooling in place of the water cooled equipment now that water and sewer cost have risen.

Courthouse IT (Interruptible Tariff) Savings

This program was put in place in 2003 and was ready for 2004 usage. An agreement exists between the end user and the local utility (Duke Energy Ohio) that stipulates that natural gas service can be curtailed at the local utility request during high demand times. The end user must also use at least 1,000 MCF during the summer months which the Courthouse because it provides steam to the Justice Center. Table 3 shows the accumulated savings of this plan.

Year	Gas Usage CCF	Firm Cost	Interruptible Cost	Curtailement Cost	Annual Savings	Accumulated Savings
2004	957,232	\$147,918	\$54,208	\$0	\$93,710	\$93,710
2005	938,086	\$144,969	\$58,271	\$0	\$86,698	\$180,408
2006	866,570	\$133,956	\$49,751	\$0	\$84,205	\$264,613
2007	876,079	\$135,420	\$50,218	\$0	\$85,202	\$349,815
2008	880,728	\$157,511	\$62,663	\$0	\$94,847	\$444,662
2009	832,908	\$144,772	\$59,864	\$0	\$84,908	\$529,570
2010	831,541	\$118,086	\$68,508	\$0	\$49,578	\$579,148
2011	859,877	\$119,445	\$69,020	\$0	\$50,425	\$629,573
2012	735,889	\$106,063	\$67,682	\$0	\$38,381	\$667,954
2013	779,994	\$108,849	\$69,691	\$26,642	\$12,516	\$680,470
2014	732,410	\$109,200	\$75,457	\$38,116	-\$4,373	\$676,097
Total	9,291,314	\$1,426,188	\$10,717,502	\$64,758	\$676,097	\$680,470

Table 2: Courthouse FT / IT Natural Gas Rate Comparison

Starting in 2013 a column was added for curtailment cost. The Courthouse was curtailed by Duke Energy three times in 2013 and 2014 and it is believed given the current status of PJM and EPA regulations that County will see additional curtailments in the future.

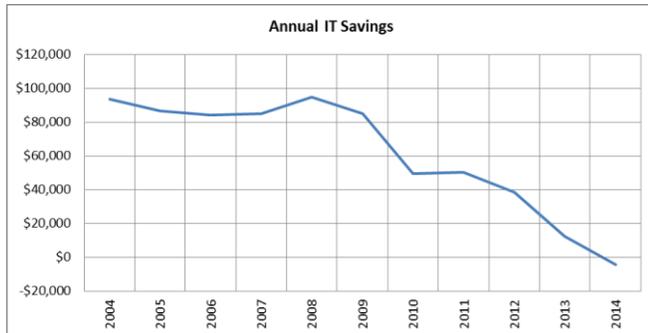


Figure 8: Courthouse Annual IT Savings

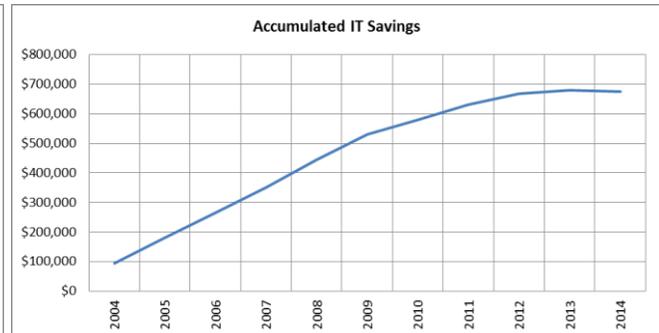


Figure 9: Courthouse Accumulated IT Savings

Although this program has saved over a half million dollars historically the latest is showing a reduced annual savings. Facilities will periodically review the necessity of this program and search for alternatives that may save more money. This program currently cost nothing to maintain so all savings beneficial. Some of the reduction in savings in recent years is due to improved natural gas consumption - a lower consumption results in lower overall costs. Curtailment in 2014 reduced savings by 11% putting the program in negative savings for the first time ever. The County has never had this many curtailments in one year while on this program previously and Duke Energy stated that they do not anticipate this many curtailments next heating season. Given the recent performance over the last two years, leaving the program and going back to Firm Transport gas may provide little to no additional cost for the lower risk rate tariff.

Hamilton County Natural Gas Broker Agreement

This program was put in place in 2000, with an agreement between the County and County Commissioners' Association of Ohio (CCAOSC). The CCAOSC manages a third party gas marketer who aggressively buys natural gas on the open market with strategies that are intended to provide the best gas prices possible to the group with a manageable risk. Monthly totals vary between savings and expenditures but overall the plan is saving money.

Table 3: Natural Gas Comparison, Commodity versus Duke Energy

Year	Gas Usage (mcf)	Commodity Cost	Duke Cost	Savings (Annual)	Accumulated Savings
2001	103,533	\$ 629,185	\$ 724,333	\$ 95,148	\$ 95,148
2002	111,710	\$ 491,285	\$ 456,254	\$ (35,031)	\$ 60,116
2003	109,540	\$ 679,907	\$ 684,903	\$ 4,996	\$ 65,112
2004	109,540	\$ 746,382	\$ 870,079	\$ 123,697	\$ 188,809
2005	123,376	\$ 1,204,177	\$1,174,869	\$ (29,309)	\$ 159,501
2006	114,970	\$ 1,173,280	\$1,104,029	\$ (69,252)	\$ 90,249
2007	117,147	\$ 958,818	\$1,116,246	\$ 157,428	\$ 247,677
2008	116,377	\$ 1,120,661	\$1,233,389	\$ 112,728	\$ 360,405
2009	108,652	\$ 845,947	\$ 849,018	\$ 3,072	\$ 363,477
2010	107,817	\$ 594,920	\$ 701,462	\$ 106,541	\$ 470,018
2011	106,140	\$ 538,309	\$ 608,793	\$ 70,483	\$ 540,502
2012	92,502	\$ 365,166	\$ 454,702	\$ 89,537	\$ 630,038
2013	94,656	\$ 369,114	\$ 492,974	\$ 123,861	\$ 753,899
2014	113,316	\$ 562,463	\$ 654,743	\$ 92,280	\$ 846,179

Accumulated Savings Total: \$ 846,179

As can be seen above in the spreadsheet the County has saved approximately \$846,179 in the last fourteen years by participating in deregulated natural gas commodity purchasing.

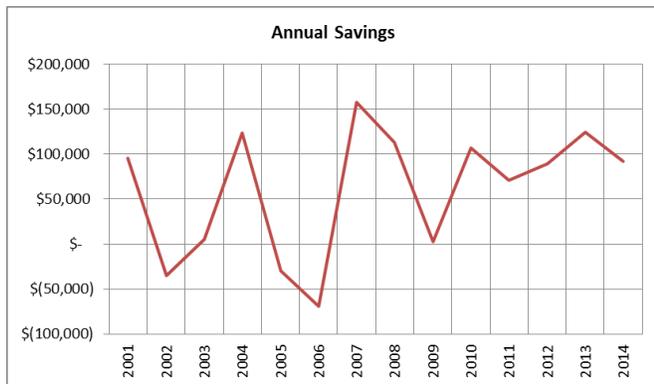


Figure 10: Annual NG Commodity Savings

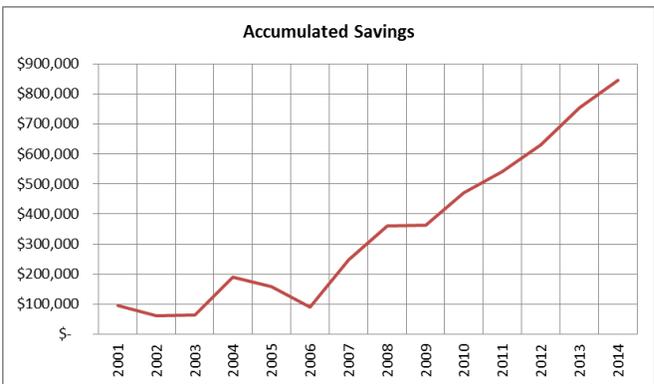


Figure 11: Accumulated NG Commodity Savings

As with any open market commodity purchase plan there is always risk on a year to year basis - some years are better than others but the accumulated savings has shown a steady incline indicating this program has performed very well and should be continued.

Deregulated Electricity Commodity Purchasing

In 2012 County Facilities bid out the Provision of Electric Power through a public bid process (ITB) for a second three year period. This bid was open to all Certified Electric Suppliers approved in the Duke Energy Territory. First Energy Services was the lowest and best bidder for the fixed rate offers for the Facilities Department but many other county agencies who piggybacked on this ITB also signed up with First Energy Solutions. Service began for all sites on the first billing cycle in 2012.

- From January 1, 2010 - December 31, 2012 the first "Deregulated Commodity Contract" was awarded to Duke Energy Retail Service (DERS) with an electric rate of \$0.0570 per kWh at a three year fixed price contract avoiding a cost of \$1,750,695 in its three year period.
- From January 1, 2013 through December 31, 2015 the First Energy price has been locked in at \$.0493 cents per kWh yielding a two year total of \$621,246.

Table 4: Electric Comparison, Electric Broker vs. Local Utility Company (Duke)

Year	Usage (kwh)	Non-Shopper Cost (\$)	Shopper Cost (\$)	Savings (Annual)	Accumulated Savings
2010	38,283,754	\$3,970,566	\$ 3,195,133	\$ 775,433	\$ 775,433
2011	35,831,797	\$3,739,180	\$ 2,798,953	\$ 940,227	\$ 1,715,660
2012	34,568,328	\$2,845,793	\$ 2,810,759	\$ 35,035	\$ 1,750,695
2013	32,584,898	\$2,778,860	\$ 2,459,886	\$ 318,974	\$ 2,069,669
2014	29,874,979	\$2,685,077	\$ 2,382,805	\$ 302,272	\$ 2,371,941
2015				\$ -	\$ 2,371,941
2016				\$ -	\$ 2,371,941
2017				\$ -	\$ 2,371,941
2018				\$ -	\$ 2,371,941
2019				\$ -	\$ 2,371,941
2020				\$ -	\$ 2,371,941
Accumulated Savings Total:					\$ 2,371,941

To date this program has saved over \$2.3 million with 2014 showing significant savings compared to 2012. Although electric futures markets are always risky, the County has always done well with electric purchasing contracts to date. In 2015 County Facilities Department will publicly bid this contract again through the ITB process. It is believed however that the unit cost will be higher than the previous two bids and therefore the associated savings will likely decrease. The ITB will once again be open to other county agencies.

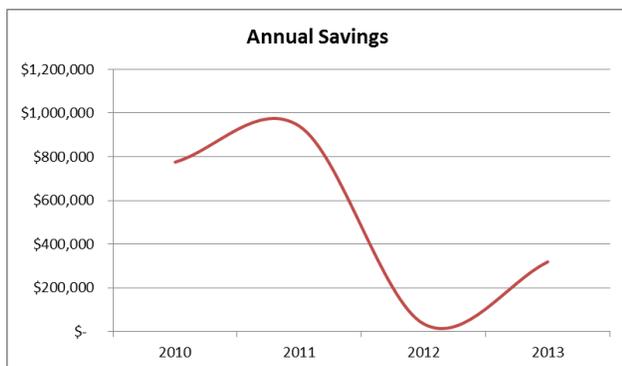


Figure 12: Yearly Savings Total

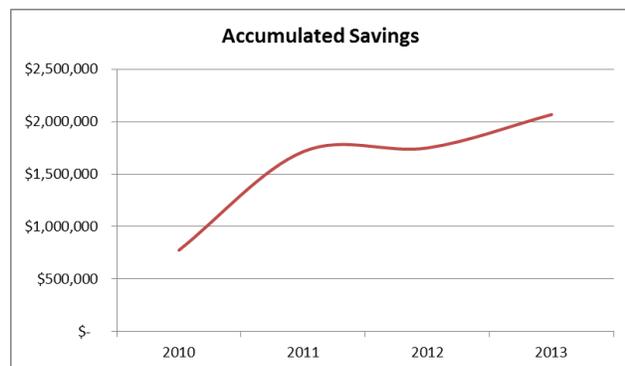


Figure 13: Accumulated Savings

Appendix A - Glossary of Terms

BASELINE OR BASEYEAR - The reference to the year in which the County began its Energy Conservation Project, the calendar year 1997.

BROKER OR MARKETER - Natural gas marketers, or brokers, are independent companies that arrange alternate rates and terms of service for Primary Gas or Electric supply. Marketers offer the option of different terms of pricing than that offered by Duke Energy, such as a fixed rate for a fixed period of time. Marketers only arrange a customer's gas or electric supply—they do not deliver the natural gas or provide utility services.

BTU - A British thermal unit (BTU) is a standard unit of energy that is used in the United States. A 5-ton air conditioner that conditions a typical home is equivalent to 60,000 BTU/hour. A 100 watt light bulb dissipates 341 BTU/hour. The BTU is often used as a quantitative specification for the energy-producing or energy-transferring capability of heating and cooling systems such as furnaces, ovens, refrigerators, and air conditioners.

CCAOSC - County Commissioners' Association of Ohio. For the purposes of this report this refers to the organization in which Hamilton County Facilities is partnered with to provide all natural gas commodities for Hamilton County owned buildings. The CCAOSC manages the contract through Exelon Energy for all the Counties in the current buying block.

DDC - Direct Digital Control is a name given to computer systems used to monitor, trend, adjust and control building HVAC (Heating, Ventilating and Air Conditioning) Systems.

DEGREE-DAY - A rough measure used to estimate the amount of heating or cooling required in a given area, defined as the difference between the mean daily temperature and 65 degrees Fahrenheit. Cincinnati typically experiences about 4,500 heating degree-days per year.

DEO - Duke Energy Ohio is the regulated utility provider in Hamilton County.

DERS - Duke Energy Retail Service is the deregulated branch of Duke Energy in the Hamilton County area.

ECM - Energy Conservation Measure. Reference to any activity (project, scheduling, replacement, task) that is taken to save or use energy more wisely.

ESCO - Energy Service Company.

FT RATE - See IT Rate.

ENGINEERING ENERGY PARTNER - An energy service company or registered professionals, such as architectural and engineering firms, that provide the expertise, services, equipment, and financing without performance contracting guarantees (e.g. ThermalTech Engineering in this report).

GS RATE - See IT Rate

HVAC - Heating, Ventilating and Air Conditioning.

IGA - Investment Grade Audit.

IT RATE - Interruptible Rate Tariff. An optional rate schedule offered by Duke Energy that charges the customer lower transportation prices on natural gas in exchange for Duke Energy's ability to curtail the gas supply to building during high demand periods. The gas can be purchased on the open market from companies other than Duke Energy. GS stands for General Service (the default residential and commercial rate schedule) and FT stands for Firm Transportation (similar to IT but it cannot be curtailed).

KW - The kilowatt (symbolized kW) is a unit of power measurement. Used by the utility industry to measure the peak power consumption of buildings. A peak kW of usage costs about \$10-15/month.

KWH - The kilowatt-hour (symbolized kWh) is a unit of energy equivalent to one kilowatt (1 kW) of power expended for one hour (1 h) of time. It is commonly used in electrical measurement applications. A 100 watt light bulb operated for 10 hours consumes 1,000 watt-hours or 1 kWh. A kWh costs about \$0.03-0.05.

LEED® - Leadership in Energy and Environmental Design. A rating system created by the U.S. Green Building Council to allow the sustainability and energy efficiency of buildings to be compared. Points can be earned for energy and water savings strategies, indoor environmental quality, materials recycling. The rating system has reward levels of certified, bronze, silver and gold.

LIFE CYCLE COST (LCC) - A financial decision-making calculation for building owners and designers. It provides a means of comparing the net present value or rate-of-return of two or more design alternatives. For each alternative, first costs and annual maintenance and energy costs are combined with financial factors input to a LCC spreadsheet. The final result is a number that shows the total cost of ownership over an economic period (20 years typically for mechanical equipment) and allows the owner to select the piece of equipment that provides the best financial return.

MCF – A unit of measurement used for natural gas equal to 1,000 cubic feet of gas or about 1 mmBTU. An MCF costs about \$5-10.

NIGHT SETBACK -A terminology used when HVAC control systems are schedule off when the building is unoccupied. Normally these setbacks will allow the building to rise to 80 degrees in the summertime and drop to 65 degrees in the wintertime before bringing the building system back on to maintain the building temperature.

NORMALIZED - For the purposes of this report there are two cases of normalization. The first is the way in which Duke Energy bills it customers. Since meter read dates often occur in the middle of the month the bills often range from dates (i.e. the 21st of one month to the 21st the next month). When this happens the usage and cost is put in the month with the most days represented (i.e. if a bill arrives on March 1st for the dates of Jan 21 through Feb 21 that is considered the February bill). The second occurrence of normalization occurs in comparing successive calendar years to the baseline year of this report. To accurately decide if energy usage and cost have increased or decrease the rising or falling cost of gas and electric is factored out in addition to the effect of hotter summers and colder winters. This is accomplished by acquiring the degree-days for each year and building a ratio from each year to the base year. Lastly, the minimum utility usage of a building that is independent of external stimuli (e.g. computers, lights, elevators, etc) is determined. The "Normalized" Master Spreadsheet is then created.

PAYBACK PERIOD - The amount of time required for an asset to generate enough savings to offset the initial outlay for the asset.

PC - Performance Contractor or ESCO as in Energy Service Company.

PROJECTED SAVINGS (In a savings-based financing agreement) - Refers to the expected annual dollar value of the reduced energy consumption due to implementing conservation measures.

SAVINGS-BASED FORMULA - The formula (calculation of savings procedure) specified in the contract, which is used to determine savings. Usually involves four steps:

1. Determine actual historical usage and contributing operating conditions to form a base year
2. Adjust base year actual usage for variations (temperature, occupancy, etc.) to form a baseline
3. Subtract actual usage from adjusted baseline consumption and
4. Calculate savings by multiplying the units of energy saved by the current cost per unit.
5. Note: Calculations for electrical demand savings are considered part of the formula but are computed separately.

Appendix B - Accomplishments

Since the implementation of the Energy Conservation Master Plan in 1998, County Facilities has implemented the following ECM's and continues to look for similar improvements in the buildings:

➤ **All Buildings**

1998 Hamilton County Facilities uses an outside firm, ThermalTech Engineering, to assist in monitoring energy usage monthly. To date this alliance has discovered a \$50,000 billing error at the 800 Broadway building and a \$16,000 electric tariff billing error at an MRDD facility.

2000 Life Cycle Cost and Total Cost of Ownership to purchase large mechanical equipment (boilers, chillers, air handlers and cooling towers).Facilities began purchasing deregulated natural gas with the CCAOSC in October 2000.

Implement FT gas rate for all buildings (Duke Energy Resources won bid and later went defunct).

2009 County Facilities has accepted deregulated electricity bids twice to try to beat Duke Energy prices (currently no bidders have ever been able to meet County bid requirements and Duke Energy prices). In 2010 the County entered into a contract with Duke Energy Retail Services for commodity electricity for three years.

A three year contract with Duke Energy Retail purchasing deregulated electric power reduced the cost of electric power by 20%.

2012 The deregulated purchase of electric power was continued with the award of a three year contract with First Energy.

➤ **230 East 9th**

1994 Completed building upgrade of all HVAC and electrical systems. Upgrade included new DDC building automation system complete with night setback and two hour overrides that turn off unscheduled starts of the heating and cooling system automatically after two hours of unoccupied use. Power Logic electrical panels also allow for two hour unscheduled use of lighting system before it automatically places the lights back into unoccupied mode. A complete variable-flow air handling system with similar zones for better space control and varicone air handlers on roof to handle part load conditions within the building utilizing these new VFD's.

2012 Implementation of energy conservation measures from Ameresco Investment Grade Audit Phase 1 including high-efficiency condensing boiler and domestic water heater upgrade, boiler flue relining and boiler economizer repair, cooling tower replacement and condensate reclaim from rooftop units (RTU).

➤ **237 William Howard Taft (building was sold in December 2011)**

2001 Purchased and installed two new higher efficiency boilers using the Life Cycle Cost procedure and modern control strategies.

2006 Purchased and installed a new 400-ton Chiller using the Life Cycle Cost resolution interlocked with DDC system to provide optimal start/stop and night setback. Added VFD to primary chilled water pump for better flow control through chiller. Controls contractor added additional programming for better backup control of building while in setback over weekends.

2007 Upgraded DDC system with night setback programming.

2009 Public Works replaced HVAC system with new equipment, DDC controls upgrade, chilled water and heating hot water upgrades.

➤ **250 William Howard Taft**

2014 Implementation of energy conservation measures from Ameresco Investment Grade Audit Phase 2 including lighting upgrades, water conservation, HVAC and controls upgrades.

➤ **800 Broadway**

1999 Eliminated unnecessary space cooling during unoccupied periods in the cooling season. Turned off Waiting Room AHU fans with timeclocks during unoccupied periods.

Used night setback to eliminate unnecessary space heating and cooling during unoccupied periods.

Used small compressors in the computer room cooling units in lieu of the large building chiller during the heating season.

Added sewer deduction water meter for cooling tower and boiler make-up water.

Insulated bare steam and condensate piping and related equipment in various parts of the building.

Installed fluorescent lighting fixtures in place of incandescent units.

Upgraded secondary CHW pump VFD controls to allow variable speed operation of pump; block all bypass ports of 3-way valves to promote variable flow.

Installed two high-efficiency power burner gas water heaters and shutdown large steam boilers all summer long.

Combined cooling tower operation to take advantage of low speed fan operation.

Replaced the 600-ton Trane chiller with a high efficiency chiller. Modified the cooling tower piping and fan controls to allow both towers to serve one chiller at lower fan speed.

Upgraded the building automation to full DDC system. Utilize scheduling and setbacks. IPAC Phase I. 2000.

Programmed "Near optimized control of Chiller Plants" into DDC system.

2001 Upgraded the building automation to full DDC system. Utilize scheduling and setbacks. IPAC Phase II. 2001.

2002 Upgraded the building automation to Full DDC system. Utilize scheduling and setbacks. IPAC Phase III. 2002.

2003 Replaced outdated cooling towers utilized two speed motors with new counterflow cooling towers equipped with VFD's.

2003 Discovered \$50,000 billing error from Duke. Recovered cost as a credit for local utility for this building.

2004 Replaced old boilers with new higher efficiency boilers.

2013 Implementation of energy conservation measures from Ameresco Investment Grade Audit Phase 1A including lighting upgrades, controls/recommissioning, VFDs on pumps or fan motors, water conservation measures, heat exchanger package, domestic water booster pump package, phone room A/C, computer room consolidation, OPFMA training, and energy behavior modification training.

➤ **2020 Auburn (the Juvenile Jail)**

- 2010** Installed new high-efficiency condensing boilers.
- 2014** Implementation of energy conservation measures from Ameresco Investment Grade Audit Phase 2 including lighting upgrades, water conservation, VFD and mechanical upgrades.

➤ **Alms & Doepke Building**

- 1994** Low VOC materials - paint, furniture, carpet.
Met LEED criteria for daylighting/view access to staff.
Installed a high efficiency charcoal filtration system with 100% OA.
Mechanical system flushout ran one week at high temperatures to encourage early off-gassing.
Mechanical system monitored offsite to see that the building systems continue to operate at best levels.
Mechanical system computer controls defaults to appropriate setting when changed manually to inappropriate settings.
High efficiency lighting - among the best available at the time.
Reused/recycled content materials - flooring (primarily carpeting), systems furniture, ceiling tile.
- 1999** Insulated domestic hot water storage tank in penthouse.
Insulated bare steam and condensate piping and related equipment in various parts of the building.
Upgraded insulation values in building.
Insulated bare steam and condensate piping and related equipment in various parts of the building.
Insulated bare steam and condensate piping and related equipment in various parts of the building.
- 2012** Implementation of energy conservation measures from Ameresco Investment Grade Audit Phase 1 including replacement of domestic water heaters with the addition of a heat pump water heater.

➤ **Communications Center**

- 2014** Implementation of energy conservation measures from Ameresco Investment Grade Audit Phase 2 including lighting upgrades, water conservation, heat recovery, HVAC and controls upgrades.

➤ **County Administration Building**

- 1999** Insulated bare steam and condensate piping and related equipment in various parts of the building.
- 2005** Replaced old evaporative tenth floor chiller with a high efficiency air cooled chiller purchased through life cycle cost analysis.
Replaced Rooftop Units 1 & 2 with new Trane Intellipak systems.
- 2012** Implementation of energy conservation measures from Ameresco Investment Grade Audit Phase 1 including replacement of existing steam boilers with high-efficiency condensing boilers, domestic water heater replacement and recovery of heat rejection from computer room A/C units.

➤ **County Courthouse**

- 1999** Replaced constant volume air handlers with energy efficient VAV units under DDC control.
- 2003** Upgraded boiler plant to utilize separate condensate receiver and deaerator so that boiler stack economizers can be utilized to preheat feedwater for better efficiency at steam production.
- 2004** Converted to IT Rate transport gas supply from Duke Energy (Commodity purchased through CCAOSC).
- 2006** Modified Boiler DDC system to fire boilers more efficiency and prevent moisture carryover during steam production.
- 2013** Implementation of energy conservation measures from Ameresco Investment Grade Audit Phase 1A including lighting upgrades, controls/recommissioning, VFD's on pumps or fan motors, water conservation measures, domestic water heater, blowdown heat recovery, computer room A/C modifications, well water makeup, OPFMA training, and energy behavior modification training.

State Term Contracting was used to upgrade inefficient DX equipment that provides cooling to several sections of the Courthouse requiring after hour space conditioning.

➤ **Justice Center**

- 2001** Replaced cooling towers with new cooling towers equipped with VFD's.
- 2006** Recommissioned the DDC system to eliminate many obsolete and broken control components. Take better control of schedules and outdoor air control. Repaired system back to original specifications.
- 2006** Replaced dual duct boxes in Sheriff's Offices to improve comfort and energy usages.
- 2007** Installed VFD drives on stairwell pressurization fans to reduce amount of conditioned air being exhausted from building.
- 2010** Replaced Domestic Water Booster pumping system with higher efficiency Grundfos VFD domestic water pumps.
- 2013** Implementation of energy conservation measures from Ameresco Investment Grade Audit Phase 1A including lighting upgrades, controls/recommissioning, VFDs on pumps or fan motors, water conservation measures, chiller replacement, heat pump water heaters, solar water heaters, control area HVAC, OPFMA training, and energy behavior modification training.

➤ **Public Works Garage**

- 2014** Implementation of energy conservation measures from Ameresco Investment Grade Audit Phase 2 including lighting upgrades, water conservation, HVAC and controls upgrades.

➤ **Sheriff Patrol Headquarters**

- 2014** Implementation of energy conservation measures from Ameresco Investment Grade Audit Phase 2 including lighting upgrades, water conservation, HVAC and controls upgrades.

➤ **Winton Road Records Center**

- 2001** Installed Air Handling Unit with no economizers to reduce the humidification costs for archive storage facilities. HVAC load calculations indicated that use of free cooling outdoor air would actually use more energy than recirculation. The County acquired a variance from Building Department for this installation.
- 2014** Implementation of energy conservation measures from Ameresco Investment Grade Audit Phase 2 including lighting upgrades, water conservation, HVAC and controls upgrades.

Appendix C - History

Since the large portion of utility usage is directly attributable to seven major downtown buildings (222, 230, 800, 2020, Admin, CH and JC) the charts in this report primarily reflect their usage and cost. However the Facility Department manages or co-manages over 2.5 million square feet which includes these six buildings and the following facilities: 250 & 264 William Howard Taft, 911 Communication Center, 9500 Target Range, Coroner's Office, Heliport, Public Works Garage, Memorial Hall, Sheriff Patrol Headquarters and Winton Road Records Center. County Facilities does not provide all services in all of these buildings as some of them have their own management, pay their own utility bills, or perform their own maintenance but for the most part County Facilities has something invested in each of these facilities.

Energy Conservation Master Plan (ECM)

In 1998 County Facilities began an Energy Conservation Master Plan (ECM) study with a local engineering firm called ThermalTech Engineering. The County selected ThermalTech Engineering because of their long-standing tradition of engineering energy management (they have performed over 100 Federal Title III energy audits, have a full understanding of Duke Energy's rate tariffs and engineering design experience to assist with installations).

In 2003 the ECM was updated with a grant from Rebuild America and again in 2011 the ECM was update thru Energy Audits performed by Ameresco.

Performance Contract

Ameresco performed several phases of Investment Grade Audits through a performance contract per House Bill 295/300. Phase 1 included Alms & Doepke, A&D Parkhaus Garage, County Administration and 230 East 9th. Annual project savings in the report dated 9/9/11 is \$403,000. \$1,450,000 of federal grants (EEGBC funds) was used to co-fund this project. \$284,500 of incentives through the Duke Energy Smart Saver program were awarded to fund implementation of the energy and water conservation measures identified. These projects were implemented in 2012.

Phase 1A

The following phase of audits included the Courthouse, Justice Center and 800 Broadway. Annual project savings in the report dated 4/19/12 is \$767,000. \$1,352,901 of federal grants (EEGBC funds) were used to co-fund this project. \$72,250 of incentives through the Duke Energy Smart Saver program were awarded to fund implementation of the energy and water conservation measures identified. The recommended energy and water conservation projects were implemented in 2013.

Phase 2

The next phase of audits included 2020 Auburn, 911 Communications Center, Sheriff Patrol HQ, 250 William Howard Taft, Coroner's Facility, Clerk of Courts Records, 264 William Howard Taft, Public Works Garage, and 2611 Highland. Annual project savings in the report dated 3/28/13 is \$151,000. The recommended energy and water conservation projects were implemented in 2014.

Cinergy Resources

As the project continued, opportunities to acquire natural gas supplies through deregulation were identified. Facilities and ThermalTech prepared bid documents and secured a brokered supplied natural gas commodity from Duke Energy Resources in 1999 but shortly after the program started, Cinergy Resources went defunct and the County was forced back onto CG&E natural gas.

CCAOSC Service Corporation Natural Gas Programs

In 1999 the CCAOSC Service Corporation (CCAOSC) Board of Trustees authorized the establishment of a Natural Gas Program for CCAOSC members. The 30 counties that signed up for the program saved money in two ways: Pre-payment and Aggregation (buying as a group). Taxable bonds which totaled \$29,890,000 were issued by Hamilton County on October 31, 2000 to assist the CCAOSC Service Corporation and 30 CCAOSC Natural Gas Program member counties. The program began November 1, 2000 with Exelon Energy managing the gas portion of the program and ended in May 2009.

The County signed on to a new program with the CCAOSC in May 2009 with Palmer Energy acting as the Energy Broker for the CCAOSC Natural Gas Program member counties of which in 2010 there were over 50. Presently the Facilities Director, Ralph Linne, serves on the Natural Gas Executive Committee and is the representative for Hamilton County.

Procurement of Electricity from the Deregulated Market

County Facilities has also attempted to buy electricity on the deregulated market and has produced bid packages for this purpose. Jim Clarkson of Resource Management, Inc along with ThermalTech Engineering prepared the bid packets. Bids were opened on two occasions but in one case the prices were not low enough to project any savings to the County and ThermalTech recommended not accepting any bid.

The second bid was not executable due to contract and pricing restrictions by the marketers - basically a contract could not be agreed upon fast enough to keep the bid prices on bid day intact (the market is very volatile).

The third try in 2010 was successful with a three year contract with Duke Energy Retail lowering the cost of electric power by 20%.

In 2013 the fourth bid was again successful with First Energy Solutions being awarded a three (3) year contract for calendar years 2013 thru 2015.

Energy Manager

County Facilities has had two full time energy managers since 2001, but has not had this position filled for several years. In lieu of a having a full time employee, ThermalTech Engineering has provided monthly review and reconciliation of utility bills, prepared the RFPs for electric power, updated the ECM, and assisted in preparing the data presented in this report. Presently they analyze trends and reports monthly on County utility usage and prepare this annual Energy Report.

List Energy Related Awards

Over the years in this program, County Facilities has applied for numerous awards and have won many significant awards that honor the efforts. Here is a list of accomplishments to date:

2014

- Energy Star Award for the 800 Broadway, 230 East 9th and County Administration Building
- LEED-EB:O&M Certification - 800 Broadway Building (5-Year Certification)
- Business Courier Green Building Awards - Finalist

2013

- EPA Energy Star Award for the 800 Broadway and 230 East 9th Street buildings.
- Business Courier Green Awards - Participant

- Building Owners and Managers Association (BOMA) of Cincinnati Highest Performing Building 2nd Place for County Administration Building
- BOMA of Cincinnati Most Improved Performance 2nd Place for County Courthouse
- BOMA of Cincinnati Most Improved Performance 3rd Place for Alms & Doepke

2012

- EPA Energy Star Award for the 800 Broadway and County Administration Building
- Business Courier Green Awards - Finalist

2011

- EPA Energy Star Award for the 800 Broadway, County Administration Building and 230 East Ninth Street buildings

2010

- EPA Energy Star Award for the 800 Broadway Building
- Who's Who 2009: Leaders in Energy Management and Sustainability

2009

- EPA Energy Star Award for the 800 Broadway Building

2008

- EPA Energy Star Award for the 800 Broadway Building

2006

- Governor's Award for Energy Excellence - Honorable Mention

2005

- Governor's Award for Energy Excellence - Second Place Finisher
- Local and Regional TOBY (The Office Building of the Year) for 800 Broadway

2004

- Governor's Award of Energy Excellence - First Place Finisher
- Alliance to Save Energy - Participant

2002

- Rebuild America Energy Grant Recipient - Winner

2001

- NACO Award for Life Cycle Cost Purchasing - Winner
- Regional TOBY (The Office Building of the Year) for the County Courthouse

2000

- Local TOBY (The Office Building of the Year) for the County Courthouse
- Regional TOBY (The Office Building of the Year) for the 230 East Ninth Building

1999

- Local TOBY (The Office Building of the Year) for the 230 East Ninth Street Building

Appendix D - Conversions & Methodologies

The following equations, references, unit conversions and methodologies were used in the creation of this report and with the Energy Conservation Project from 1998- present;

References

- Archibus - <http://hamiltoncounty.asset-fm.com/archibus/login.axvw>
- Energy Watchdog - www.pro.energywatchdog.com
- EPA Energy Star - <https://portfoliomanager.energystar.gov/pm/login.html>
- ASHRAE - <https://www.ashrae.org/>
- AEE Handbook
- HVAC Equations, Data and Rules of Thumb, Second Edition
- Guide to Energy Management, Fourth Edition
- Trane Trace
- DOE eQuest
- www.degreday.net
- www.duke-energy.com
- Engineering Spreadsheets created by ThermalTech Engineering for the express purpose of tracking and reporting data for this report.

Methodologies

- Linear Regression Modeling for Weather Normalization
- Excel Spreadsheet for Duke Tariff reconciliation for electric and natural gas.
- Excel Spreadsheet Demand Curve Analysis for load profiles.
- Life Cycle Cost Analysis for equipment purchases during Energy Conservation Projects.

Popular Conversions

Unit	Name	Definition/Notes
BTU	British Thermal Unit	Heat required to raise 1 lb water 1 degree F
C	100	equals one hundred (100).
CCF	100 cubic feet	100 cubic feet (cf) of natural gas.
MCF	1000	1000 cubic feet (cf) of natural gas
M	1000	equals one thousand for HVAC (not Mega)
MM	1,000,000	One Million for HVAC Applications.
MMBtu	1,000,000	One Million BTU's
Therm	= 100,000 BTU	Btu/CF cf; one Ccf = 102,300 Btu or 1.023 therms
CF ng	= 1023 btuh	Cubic Feet of Natural Gas
CCF ng	= 102,300 btu's	or 1.023 therms
MCF ng	= 1.023 MMbtu	or 10.23 therms
W	Watts	Watts
K	1000	Kilo
KW	= 1000W	1000 Watts
KWH	Kilowatt-hours	Kilowatt-Hours
1 W	= 3.413 btuh	normally the hours is added to BTU
1 KW	= 3413 btuh	1000 times the amount of a Watt
1 KW motor	to Horsepower	x 1.34 HP
1 HP motor	to KW	x 0.745 KW
PPH	Steam	Pounds Per Hour of Steam
1 PPH	x 970	= btuh (BTU per hour)

Kgal	Kilocal	1000 Gallons of Water
\$/Kgal	\$/CCF	= 748/100 (multiply \$/kgal by 0.748 to get \$/CCF)
1 CF water	= 7.48 gallons	1 CCF = .748 kgal
1 HP	1 Horsepower (boiler)	= 33479 btuh
1 HP	1 Horsepower (boiler)	= 12 SF of heating surface
1 HP	1 Horsepower (boiler)	= 34.5 PPH steam
Ohio Special	Boiler Rating	> 360 SF of Heating Surface or
1 Ton AC	1 ton of cooling	12,000 btuh

Equations

Airside System

$$H_S = 1.08 \times CFM \times \Delta T$$

$$H_S = 1.1 \times CFM \times \Delta T$$

$$H_L = 0.68 \times CFM \times \Delta W_{GR.}$$

$$H_L = 4840 \times CFM \times \Delta W_{LB.}$$

$$H_T = 4.5 \times CFM \times \Delta h$$

$$H_T = H_S + H_L$$

$$SHR = \frac{H_S}{H_T} = \frac{H_S}{H_S + H_L}$$

$$H_S = 1.08 \frac{BTU \text{ min.}}{hr \text{ ft}^3 \text{ } ^\circ F} \times CFM \times \Delta T$$

$$H_L = 0.68 \frac{BTU \text{ min. Lb DA}}{hr \text{ ft}^3 \text{ Gr H}_2\text{O}} \times CFM \times \Delta W$$

$$H_T = 4.5 \frac{Lb \text{ min.}}{hr \text{ ft}^3} \times CFM \times \Delta h$$

$$H_T = H_S + H_L$$

$$H_S = \text{Sensible Heat} \left(\frac{BTU}{hr} \right)$$

$$H_L = \text{Latent Heat} \left(\frac{BTU}{hr} \right)$$

$$H_T = \text{Total Heat} \left(\frac{BTU}{hr} \right)$$

$$\Delta T = \text{Temperature Difference (} ^\circ F \text{)}$$

$$\Delta W_{GR.} = \text{Humidity Ratio Difference} \left(\frac{GR. H_2O}{Lbs. DA} \right)$$

$$\Delta W_{LB.} = \text{Humidity Ratio Difference} \left(\frac{Lbs. H_2O}{Lbs. DA} \right)$$

$$\Delta h = \text{Enthalpy Difference} \left(\frac{BTU}{Lbs. DA} \right)$$

$$CFM = \text{Air Flow Rate (Cubic Feet per Minute)}$$

$$SHR = \text{Sensible Heat Ratio}$$

$$m = \text{Mass flow} \left(\frac{Lbs. DA}{hr} \right)$$

$$c_a = \text{Specific Heat of Air} \left(0.24 \frac{BTU}{Lbs. DA \text{ } ^\circ F} \right)$$

$$DA = \text{Dry Air}$$

Waterside System

$$H = 500 \times GPM \times \Delta T$$

$$GPM_{EVAP} = \frac{TONS \times 24}{\Delta T}$$

$$GPM_{COND} = \frac{TONS \times 30}{\Delta T}$$

$$H = \text{Total Heat} \left(\frac{BTU}{hr} \right)$$

$$H = 500 \frac{BTU \text{ min.}}{hr \text{ gal } ^\circ F} \times GPM \times \Delta T$$

$$H = \text{Total Heat} \left(\frac{BTU}{hr} \right)$$

ΔT = Temperature Difference ($^\circ F$)
 GPM = Water Flow Rate (Gallons per Minute)
 GPM = Water Flow Rate (Gallons per Minute)
 ΔT = Temperature Difference ($^\circ F$)
 $TONS$ = Air Conditioning Load (Tons)
 GPM_{EVAP} = Evaporator Water Flow Rate (Gallons per Minute)
 GPM_{COND} = Condenser Water Flow Rate (Gallons per Minute)
 c_w = Specific heat of Water $\left(1.0 \frac{BTU}{Lbs \cdot H_2O} \right)$

Air Change Rate

$$\frac{AC}{HR} = \frac{CFM \times 60}{VOLUME}$$

$$CFM = \frac{\frac{AC}{HR} \times VOLUME}{60}$$

$$\frac{AC}{HR} = \text{Air Change Rate per Hour}$$

CFM = Air Flow Rate (Cubic Feet per Minute)
 $VOLUME$ = Space Volume (Cubic Feet)

Fan Laws

$$\frac{CFM_2}{CFM_1} = \frac{RPM_2}{RPM_1}$$

$$\frac{SP_2}{SP_1} = \left[\frac{CFM_2}{CFM_1} \right]^2 = \left[\frac{RPM_2}{RPM_1} \right]^2$$

$$\frac{BHP_2}{BHP_1} = \left[\frac{CFM_2}{CFM_1} \right]^3 = \left[\frac{RPM_2}{RPM_1} \right]^3 = \left[\frac{SP_2}{SP_1} \right]^{1.5}$$

$$BHP = \frac{CFM \times SP \times SP.GR.}{6356 \times FAN_{EFF}}$$

$$MHP = \frac{BHP}{M/D_{EFF}}$$

CFM = Cubic Feet/Minute
 RPM = Revolutions/Minute
 SP = in.W.G.

BHP = Break Horsepower
Fan Size = Constant
Air Density = Constant
SP. GR. (Air) = 1.0
FAN_{EFF} = 65 – 85%
M/D_{EFF} = 80 – 95%
M/D = Motor/Drive

Pump Laws

$$\frac{GPM_2}{GPM_1} = \frac{RPM_2}{RPM_1}$$

$$\frac{HD_2}{HD_1} = \left[\frac{GPM_2}{GPM_1} \right]^2 = \left[\frac{RPM_2}{RPM_1} \right]^2$$

$$\frac{BHP_2}{BHP_1} = \left[\frac{GPM_2}{GPM_1} \right]^3 = \left[\frac{RPM_2}{RPM_1} \right]^3 = \left[\frac{HD_2}{HD_1} \right]^{1.5}$$

$$BHP = \frac{GPM \times HD \times SP. GR.}{3960 \times PUMP_{EFF}}$$

$$MHP = \frac{BHP}{M/D_{EFF}}$$

$$VH = \frac{V^2}{2g}$$

$$HD = \frac{P \times 2.31}{SP. GR.}$$

GPM = Gallons/Minute
RPM = Revolutions/Minute
HD = ft. H₂O
BHP = Break Horsepower
Pump Size = Constant
Water Density = Constant
SP. GR. = Specific Gravity of Liquid with respect to Water
SP. GR. (Water) = 1.0
PUMP_{EFF} = 60 – 80%
M/D_{EFF} = 85 – 95%
M/D = Motor/Drive
P = Pressure in psi
VH = Velocity Head in ft.
V = Velocity in ft./sec
g = Acceleration due to Gravity (32.16 ft./sec²)

Steam and Condensate

$$\frac{LBS. STM.}{hr} = \frac{BTU/hr}{H_{FG}} = \frac{BTU/hr}{960}$$

$$\frac{LBS. STM. COND.}{hr} = \frac{EDR}{4}$$

$$EDR = \frac{BTU/hr}{240}$$

$$\frac{LBS. STM. COND.}{hr} = \frac{GPM \times 500 \times SP. GR. \times C_w \times \Delta T}{H_{FG}}$$

$$\frac{LBS. STM. COND.}{hr} = \frac{CFM \times 60 \times D \times C_q \times \Delta T}{H_{FG}}$$

$$\frac{LBS. STM. COND.}{hr} = \frac{GPM(WATER) \times \Delta T}{2}$$

$$\frac{LBS. STM. COND.}{hr} = \frac{GPM(FUEL OIL) \times \Delta T}{4}$$

$$\frac{LBS. STM. COND.}{hr} = \frac{CFM(AIR) \times \Delta T}{900}$$

STM. = Steam
GPM = Quantity of Liquid in Gallons per Minute
CFM = Quantity of Gas or Air in Cubic Feet per Minute
SP. GR. = Specific Gravity
D = Density in Lbs./cubic feet
C_a = Specific Heat of Air (0.24 BTU/Lb)
C_w = Specific Heat of Water (1.00 BTU/Lb)
H_{FG} = Latent Heat of Steam in BTU/Lbs. at Steam Design Pressure (ASHRAE Fundamentals)
ΔT = Final Temperature minus Initial Temperature
EDR = Equivalent Direct Radiation

Mixed Air Temperature

$$T_{MA} = \left(T_{ROOM} \times \frac{CFM_{RA}}{CFM_{SA}} \right) + \left(T_{OA} \times \frac{CFM_{OA}}{CFM_{SA}} \right)$$

$$T_{MA} = \left(T_{RA} \times \frac{CFM_{RA}}{CFM_{SA}} \right) + \left(T_{OA} \times \frac{CFM_{OA}}{CFM_{SA}} \right)$$

CFM_{SA} = Supply Air CFM
CFM_{RA} = Return Air CFM
CFM_{OA} = Outside Air CFM
T_{MA} = Mixed Air Temperature (°F)
T_{ROOM} = Room Design Temperature (°F)
T_{RA} = Return Air Temperature (°F)
T_{OA} = Outside Air Temperature (°F)

Psychrometrics

$$W = 0.622 \times \frac{P_W}{P - P_W}$$

$$RH \cong \frac{W_{ACTUAL}}{W_{SAT}} \times 100\%$$

$$RH = \frac{P_W}{P_{SAT}} \times 100\%$$

$$H_S = m \times C_p \times \Delta T$$

$$H_L = L_v \times m \times \Delta W$$

$$H_T = m \times \Delta h$$

$$W = \frac{(2501 - 2.381T_{WB})(W_{SAT WB}) - (T_{DB} - T_{WB})}{2501 + 1.805T_{DB} - 4.186T_{WB}}$$

$$W = \frac{(1093 - 0.556T_{WB})(W_{SAT WB}) - (0.240)(T_{DB} - T_{WB})}{1093 + 0.444T_{DB} - T_{WB}}$$

W = Specific Humidity, Lbs. H₂O/Lbs. DA or GR. H₂O/Lbs. DA
W_{ACTUAL} = Actual Specific Humidity, Lbs. H₂O/Lbs. DA or GR. H₂O/Lbs. DA
W_{SAT} = Saturation Specific Humidity at the Dry Bulb Temperature
W_{SAT WB} = Saturation Specific Humidity at the Web Bulb Temperature
P_W = Partial Pressure of Water Vapor, Lb./sq. ft.
P = Total Absolute Pressure of Air/Water Vapor Mixture, Lb./sq. ft.
P_{SAT} = Saturation Partial Pressure of Water Vapor at the Dry Bulb Temperature, Lb./sq. ft.
RH = Relative Humidity, %
H_S = Sensible Heat, BTU/hr

H_L = Latent Heat, BTU/hr
 H_T = Total Heat, BTU/hr
 m = Mass Flow Rate, Lbs. DA/hr or Lbs. H₂O/hr
 c_p = Specific Heat, Air – 0.24 BTU/Lbs. DA, Water – 1.0 BTU/Lbs. H₂O
 T_{DB} = Dry Bulb Temperature, °F
 T_{WB} = Wet Bulb Temperature, °F
 ΔT = Temperature Difference, °F
 ΔW = Specific Humidity Difference, Lbs. H₂O/Lbs. DA or GR. H₂O/Lbs. DA
 Δh = Enthalpy Difference, BTU/Lbs. DA
 L_v = Latent Heat of Vaporization, BTU/Lbs. H₂O

Ductwork

$$TP = SP + VP$$

$$VP = \left[\frac{V}{4005} \right]^2 = \frac{(V)^2}{(4005)^2}$$

$$V = \frac{Q}{A} = \frac{Q \times 144}{W \times H}$$

$$D_{EQ} = \frac{1.3 \times (A \times B)^{.625}}{(A + B)^{.25}}$$

TP = Total Pressure
 SP = Static Pressure, Friction Losses
 VP = Velocity Pressure, Dynamic Losses
 V = Velocity, ft./min
 Q = Flow through Duct, CFM
 A = Area of Duct, sq. ft.
 W = Width of Duct, in.
 H = Height of Duct, in.
 D_{EQ} = Equivalent Round Duct Size for Rectangular Duct, in.
 A = One Dimension of Rectangular Duct, in.
 B = Adjacent Side of Rectangular Duct, in.

Air Conditioning Condensate

$$GPM_{AC\ COND} = \frac{CFM \times \Delta W_{LB}}{SpV \times 8.33}$$

$$GPM_{AC\ COND} = \frac{CFM \times \Delta W_{GR}}{SpV \times 8.33 \times 7000}$$

$GPM_{AC\ COND}$ = Air Conditioning Condensate Flow (gal./min)
 CFM = Air Flow Rate (cu. ft./min)
 SpV = Specific Volume of Air (cu. ft./Lbs. DA)
 ΔW_{LB} = Specific Humidity (Lbs. H₂O/Lbs. DA)
 ΔW_{GR} = Specific Humidity (GR. H₂O/Lbs. DA)

Efficiencies

$$COP = \frac{BTU\ OUTPUT}{BTU\ INPUT} = \frac{EER}{3.413}$$

$$EER = \frac{BTU\ OUTPUT}{WATTS\ INPUT}$$

$$\frac{KW}{TON} = \frac{12,000\ BTU/hr\ TON}{COP \times 3,517\ BTU/hr\ KW}$$

Turndown Ratio = Maximum Firing Rate: Minimum Firing Rate (e. g., 5: 1, 10: 1, 25: 1)

$$OVERALL\ THERMAL\ EFF. = \frac{GROSS\ BTU\ OUTPUT}{GROSS\ BTU\ INPUT} \times 100\%$$

$$COMBUSTION\ EFF. = \frac{BTU\ INPUT - BTU\ STACK\ LOSS}{BTU\ INPUT} \times 100\%$$

Overall Thermal Efficiency Range 75 – 90%
 Combustion Efficiency Range 85 – 95%

Electricity

$$KVA = KW + KVAR$$

$$KW_{1\phi} = \frac{V \times A \times PF}{1000}$$

$$KVA_{1\phi} = \frac{V \times A}{1000}$$

$$BHP_{1\phi} = \frac{V \times A \times PF \times DEVICE_{EFF}}{746}$$

$$MHP_{1\phi} = \frac{BHP_{1\phi}}{M/D_{EFF}}$$

$$KW_{3\phi} = \frac{\sqrt{3} \times V \times A \times PF}{1000}$$

$$KVA_{3\phi} = \frac{\sqrt{3} \times V \times A}{1000}$$

$$BHP_{3\phi} = \frac{\sqrt{3} \times V \times A \times PF \times DEVICE_{EFF}}{746}$$

$$MHP_{3\phi} = \frac{BHP_{3\phi}}{M/D_{EFF}}$$

KVA = Total Power (Kilovolt Amps)
KW = Real Power, Electrical Energy (Kilowatts)
KVAR = Reactive Power or "Imaginary" Power (Kilovolt Amps Reactive)
V = Voltage (Volts)
A = Current (Amps)
PF = Power Factor (0.75 – 0.95)
BHP = Break Horsepower
MHP = Motor Horsepower
EFF = Efficiency
M/D = Motor Drive

Solar Radiation

$$q = \sum (A \times SC \times MSHG \times CLF)$$

$$q = \text{Cooling Load} \left(\frac{BTU}{hr} \right)$$

A = Window Area (Square feet)
SC = Shading Coefficient
MSHG = Maximum Solar Heat Gain (Btu/hr/ft²)
CLF = Cooling Load Factor

Motor Load Factor

$$KW = \frac{HP(0.746KW)(LF)}{\text{Efficiency HP}}$$

LF = Load Factor

Simple Payback Period

$$SPP = \frac{\text{implementation cost}}{\text{annual savings}}$$

Greenhouse Gas Emissions

$$GHG_E = EF_E \times \frac{1 \text{ KWhr usage}}{\text{year}} \times \frac{1 \text{ metric ton}}{2205 \text{ Lb}}$$

$$GHG_{NG} = EF_{NG} \times \frac{1.03 \text{ MMBTU}}{1 \text{ MCF}} \times \frac{1 \text{ MCF usage}}{\text{year}} \times \frac{1 \text{ metric ton}}{2205 \text{ Lb}}$$

GHG_E = Greenhouse gas emissions due to electric

GHG_{NG} = Greenhouse gas emissions due to natural gas

$EF_E = 1.51152 \frac{\text{Lb.CO}_2\text{e}}{\text{KWhr}}$ = Emission factor for electric, per EPA eGRID 9th edition, 2010, for subregionRFCW

$EF_{NG} = 116.98 \frac{\text{Lb.CO}_2\text{e}}{\text{MMBTU}}$ = Emission factor for natural gas, per EPA Climate Leaders GHG Inventory protocol

Life Cycle Cost for Equipment

$$LCC = \text{Equipment Cost} + \text{Installation} + \text{Other Costs} + NPV_E \times \text{Energy} + NPV_S \times \text{Service} + NPV_W \times \text{Warranty}$$

<i>Equipment Cost</i>	<i>Fist Cost of equipment through Bid or State Term or</i>
<i>Other Costs</i>	<i>Additional construction costs incurred due to the selected unit such as ventilation or exhaust requirements, noise abatement, floor space required, piping and wiring costs, control interface costs, foundation costs, etc.</i>
<i>Energy</i>	<i>Annual cost of energy usage</i>
<i>Service</i>	<i>Annual cost of service/maintenance agreement</i>
<i>Warranty</i>	<i>Annual cost of extended warranty</i>
NPV_E	<i>Net Present Value factor to bring future energy costs for the economic life of the equipment back to the present using the agreed-upon discount rate, escalation rates</i>
NPV_S	<i>Net Present Value factor to bring future service costs for the economic life of the equipment back to the present using the agreed-upon discount rate, escalation rates</i>
NPV_W	<i>Net Present Value factor to bring future extended warranty costs for the length of the warranty back to the present using the agreed-upon discount rate</i>

Standard Rates of Heat Gain from People

Seated at rest	400 btuh
Seated, writing	480 btuh
Seated, typing	640 btuh
Standing, light work	800 btuh
Light bench work	880 btuh
Normal walking	1040 btuh
Heavy work, lifting	1600 btuh

Appendix E - Duke Energy Electric Rate Schedule

(continued on next pages)