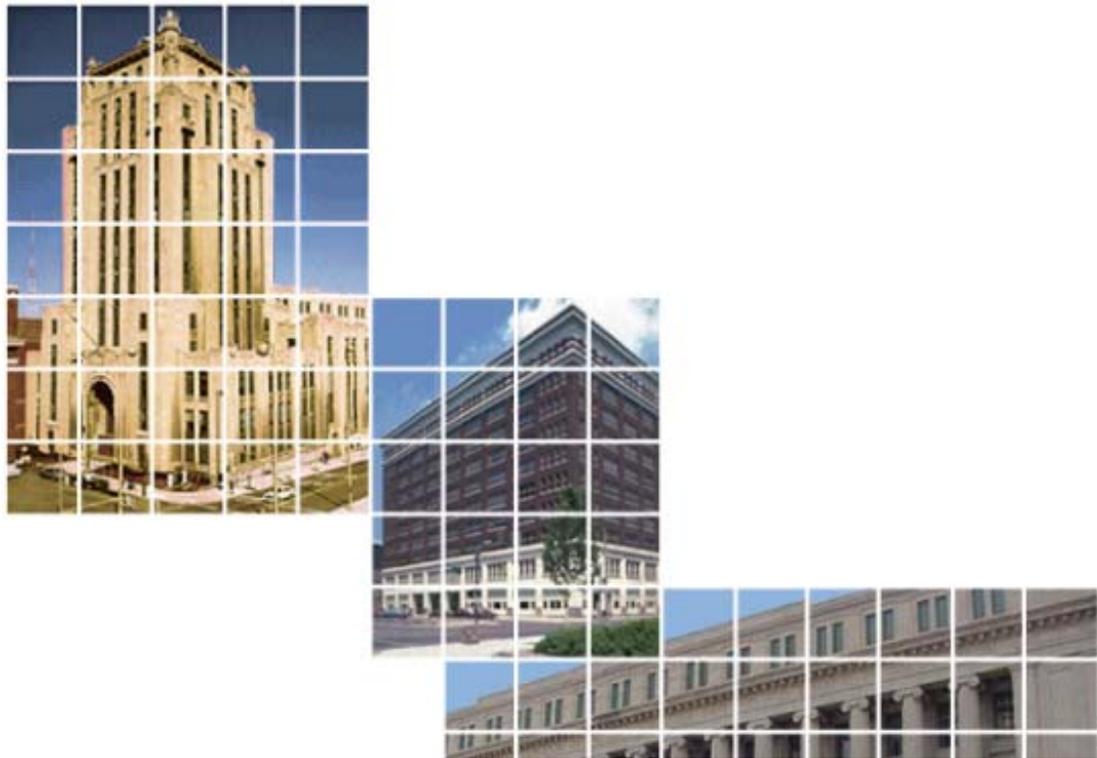


Hamilton County Energy Conservation Measures (ECM'S)

ANNUAL REPORT



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Overview

As in years past, the Hamilton County Department of Facilities has requested that ThermalTech Engineering, the Facilities Department current Engineering Partner, provide a report on the current state of the County's electric and natural gas usage for the past year. Due to numerous causes and changes in the past year this report will encompass the past two years as new information and the previous 3 years as reference for this report.

This years format has changed significantly from years past in the hope to provide a better "working" document that we can begin to use to track monthly and yearly usage in a much more effective and efficient manner for both ThermalTech and Facilities.

As you read through this report you will find a summary of all utility collected from each calendar year (Figure #1), a summary of what ThermalTech estimates would have been your savings if all degree days and utility cost remained constant (Figure #2), and six charts combined on one page showing annual electric and natural gas usage, degree days, cost per square foot, cost per square foot adjusted for degree days and average electrical and gas cost per year.

ThermalTech will use the charts to help reconcile, explain, and predict savings and losses as we explore each year's utility profile and compare it to the baseline year of 1997.

In 1998, ThermalTech collected the utility usage and cost for the six downtown buildings for calendar year 1997. We utilized Cinergy's electronic collection services as well as existing Cinergy bills provided by the County to track and reconcile the cost to the County. We have documented that original data and have labeled 1997 the "BASE YEAR" which was the last year before the County's Facility Department began actively implementing Energy Savings Measures (ECM's) within the six downtown buildings. We have continued to collect this information yearly and will present that information later in this report. It is important to note that initially the Alms & Doepke building was including as part of this report but has been replaced by the 237 William Howard Taft building in the calendar year 2000. Luckily, the usage is almost the same and doesn't adversely affect the County or its usage. ThermalTech will note significant changes as required.

The new report format will report on each year's progress and implemented ECM's chronologically from most recent to oldest work. ThermalTech will keep this information intact in this report and only add the most recent year's data as we expand on our reporting to the County. This will provide a history of what has been implemented in each of the buildings.

We will offer suggestions and recommendations at the end of each year's summary and then track the success and implementation of each of these suggestions in the following years report.

This should provide a very easy to read and use "working" document for the Hamilton County Facilities Department. With this information we should be able to set up goals, implement procedures, track progress and reporting on continued savings quickly and easily from year to year.

Reconciliation of Degree Days and Utility Cost

One of the most important factors in studying and tracking the County's yearly utility usage is the fact that each year has differing number of cooling and heating degree days (an HVAC

measure of hot how and cold a year was) and the ever changing utility cost the County is subject too. Figure #2 shows ThermalTech's best approximation at what the estimated savings would have been had these two factors remained constant from year to year. The County's current policy is to keep all office spaces at 72 degrees +/- 2 degrees F during occupied periods, so that is basically a constant from year to year.

In essence what must be reconciled on a yearly basis is that the electrical usage in a building is highly dependent on how many hours in a year require cooling to make the space comfortable and conversely the gas usage is highly dependent on how many hours in a year require heating to make the space comfortable. The degree day was created to assist in this analysis. For the Cincinnati area a cooling *degree day* is defined around the base of 65 degrees such that if the temperature were one degree above 65 for 24 hours that would be ONE *degree day* or if it were 24 degrees above 65 for one hour that would also be ONE *degree day*. It can be further applied to other ratios such as 12 degrees above 65 for 2 hours, etc. Regardless of what combination creates a *degree day* it is a measurement for how hot or cold a year was. Heating *degree day* are calculated in the same manner below 65 degrees F. ThermalTech collects this information from the National Weather Service and includes it in on Figure #2 in this report. We use this information to create a ratio of increasing/decreasing degree days to help explain higher/lower utility usage and cost. For example, it would be perfectly acceptable to have a building's KWH usage increase from one year to the next if the cooling degree days doubled for that same year. The chillers and all the other ancillary cooling equipment would have to run harder and longer to keep the building cool and meet the HamCo standard.

ThermalTech also takes into account that not all the electricity or gas usage is dependent on the weather. The interior lighting, computers and domestic water usage are prime examples of constant energy users that are not weather dependent. In Figure #2 you will notice a percentage shown in the upper right hand corner. This percentage is ThermalTech's "best guess" at what part of each building is not weather dependent. This "guesstimate" greatly affects your estimated savings for all reports.

The most obvious reason for additional cost is utility prices and with the onset of deregulation of electricity and natural gas the savings/losses must be incorporated and reconciled on a yearly basis as well. We have attempted to compensate for this on Figure #2 as well by applying the original base line cost to each years modified usage to produce a normalized usage and cost. We then compare that to the base year and produce an "all things being equal" estimated savings for each year. (See figure #2)

Utility Usage and Cost Synopsis

In 2001 the County suffered large increases in cost of natural gas even though they are contracted through a marketing pool with the County Commissioners Agency of Ohio (CCAO). The cost rose from \$5.23 in 1999 to \$6.33 in 2000 and to \$7.84 in 2001. Obviously this made a huge impact on the cost of utilities and help skyrocket the yearly utility cost from \$2.6 mil in the base year of 1997 to \$2.9 mil in 2001. The electric cost also increased in 2001 from \$.0551 per KWH to \$.0573 per KWH thus increases the utility cost to run each HamCo building. We must be diligent in looking for energy savings techniques during the next year and begin tracking usage and cost on a monthly basis. The normalized data estimates show that the buildings are still running more efficiently compared to the base year and that the building managers are doing a good job managing the buildings.

In 2000 the County experienced its first rise in utility bills since the ECM's inception as the total cost rose from \$2.58 mil to \$2.72 mil. Higher utility cost for natural gas and electric aided in the increased cost. We must begin to look for additional cost savings techniques in these buildings and ensure that we are diligent in using schedules for occupied and unoccupied periods. The normalized data estimates that the buildings are still running more efficiently compared to the base year and that building managers are doing a good job.

In 1999 the County's utility cost increased from 1998 but still remained well below the base year of 1997. A gradual increase is to be expected as utility prices continue to rise from year to year. The normalized data estimates show that the buildings are still running more efficiently compared to the base year and that the building managers are doing a good job managing the buildings.

In 1998 the ECM project proved extremely successful as the County's utility cost drop from \$2.6 mil to \$2.53 mil in one year even though cooling degree days increased. The normalized data estimates show that the buildings are still running more efficiently compared to the base year and that the building managers are doing a good job managing the buildings.

Detailed Information on ECM's, Installation, and Savings

2001 - In 2000, we attempted to put the Courthouse on IT rate gas but operation problems impeded our efforts as we have not been able to effectively run the Courthouse boilers with the Justice Center steam load connected without boiler shutdowns occurring. Automation and Mechanical was awarded the first phase of the IPAC Technology Grant and a Johnson Metasys system was installed in the 800 Broadway building and 8 additional air handling units were added to DDC control along with direct control over the chillers, boilers and cooling towers. The entire building is set for optimal start technology. ThermalTech created bid documents and bid out deregulated electricity for Hamilton County. Unfortunately, contract negotiations broke down and Hamilton County missed the limited Cinergy incentive for Government agencies to move to deregulated electricity and no further savings could be gained from that. The final decision was to continue receiving service from Cinergy and rebid the project when conditions were more favorable. Jack Middendorf retired as Facility Director and accepted a position of Energy Manager for Hamilton County. Ralph Linne took over as Facility Director.

Proposed ECM's

- Put the Courthouse on Interruptible Rate Gas Tariff (IT) rate gas through Cinergy and have the CCAO deliver gas into the Cinergy IT pool. Have the Courthouse start supplying all the steam required to the Justice Center all year to ensure the Cinergy minimum requirement of 1000 MCF in the summertime.
- Provide additional controls on 800 Broadway air handlers through County provided IPAC Grant Phase II.
- Study the possibility of using the Alms & Doepke parking garage "beer vault" space for a large ice storage facility and make ice during off peak Cinergy periods and cool the buildings from this alternative energy source.

Recommendations

- Implement the ECM's listed above and continue to watch the energy usage.
- Find Government Grant money for continuing the implementation of ECM projects.

- Replace the 237 WHT high temperature hot water boilers with standard flex tube hot water boilers.

2000 - All of the 1999 ECM's were incorporated during 2000. The County entered into a natural gas buying pool with other Counties in Ohio through the CCAO. The Courthouse began providing steam to the Justice Center year round but operational problems prevented the County from seeking the IT rate at this time plus new negotiations were underway with CCAO for new contract. The Hillcrest Training school installed 13 new electric heating air conditioners and Cinergy provided the EH rate for this school. Although not shown here the estimated cost for this scheme is \$60,000 per year. The County Commissioner's did pass a resolution stating that the County will buy equipment based on Life Cycle Cost analysis and not just first cost analysis. The final item from 1999 was seeing if it was economically feasible to have a peak shaving generator installed at Riverfront to lower the KW peak the stadium uses. The rental fees proved cost prohibitive for this ECM.

The actual cost of energy increased from \$2.53 mil in 1999 to \$2.57 mil in 1999 but so did the heating and cooling degree days. The cost of gas decreased in part to gas broker contracts while the cost of electricity slightly increased thus partially explaining the increased cost.

Proposed ECM's

- Put the Courthouse on Interruptible Rate Gas Tariff (IT) rate gas through Cinergy and have the CCAO deliver gas into the Cinergy IT pool. Have the Courthouse start supplying all the steam required to the Justice Center all year to ensure the Cinergy minimum requirement of 1000 MCF in the summertime.
- Provide additional controls on 800 Broadway air handlers through County provided IPAC Grant Phase I.
- Bid and Contract Deregulated Electricity from a marketer for the six major HamCo buildings.

Recommendations

- Implement the ECM's listed above and continue to watch the energy usage.
- Research the possibility of using district cooling for the new Cincinnati Reds Stadium

1999 - All of the aforementioned ECM's from 1998 were implemented except for the blowdown heat exchanger at the 800 Broadway building where it was determined that the actual savings cost turned out to be much lower than anticipated and this ECM's was not worth the investment. The final ECM report was given to Jack Middendorf in Microsoft PowerPoint format but in essence revealed that the project was extremely successful. The 800 Broadway building showed a decrease in utility usage of approximately 16 cents per square foot. The actual energy savings to the County this year was found to be \$68,972 (see Figure #1). Had the degree days and utility cost remained the same in 1998 the savings may have been as high as \$260,000 signifying an astounding return on investment (\$101,200 invested) by the County showing that the project has already paid for itself in less than one year. The County's investment for these projects was \$750 for 230 East Ninth building, \$88,750 for the 800 Broadway building, \$6,200 for the Administration building, \$2,000 for the Alms & Doepke building, \$0 for the Courthouse (since it is under construction) and \$3,500 for the Justice

Center. Cinergy was the winner gas bidder and the County entered into a gas broker agreement with CRI (Cinergy Resources Incorporated). Later CRI stopped providing deregulated gas and the County was forced to go back to Cinergy provided natural gas. The County began exploring options with buying deregulated natural gas through the CCAO.

Proposed ECM's

- Buy deregulated natural gas from another broker.
- Switch the Hillcrest Training School over to Electric Heating Rate electricity (not a downtown building but still has energy savings).
- Incorporate Life Cycle Cost buying plan for large equipment purchases.

Recommendations

- Implement the ECM's listed above and continue to watch the energy usage.
- Prepare for electric deregulation in the future.
- Research the possibility of using a generator to decrease Cincinnati Reds peak kW usage during Cinergy peak periods

1998 - Based on the previous years study, the County began an Energy Conservation plan by implementing Energy Conservation Measures (ECM's) prescribed by ThermalTech Engineering. The plan was to install the ECM's with the highest Return on Investment (ROI's) for the County. In general it was easy to see that the 800 Broadway building was the best candidate for the initial round of ECM's as it had the highest cost per square foot of all six downtown buildings at \$1.64 per square foot. The follow ECM's were undertaken in that building:

Proposed ECM's

- Provide a DDC system to monitor building and provide start/stop on HVAC units.
- Convert incandescent lighting to PL type fluorescent lighting.
- Shutdown aesthetic tower lighting after midnight every night.
- Provide direct vent domestic water heaters to allow boiler plant to be shutdown during the summer months and taken out of service.
- Provide DDC control on boilers to allow for control by OA temperature.
- Provide a heat recovery heat exchanger on boiler blowdown line to reheat boiler feedwater line.
- Provide tighter and better control over new steam valve in boiler room. Reset the steam pressure based on OA temperature and shut the valve completely when OA is above 55 degrees F and during unoccupied periods.
- Provide improved control of waiting room AHU's that run 24/7. Schedule off during unoccupied periods.
- Provide improved control of low rise AHU's that run 24/7. Schedule off during unoccupied periods.
- Limit use of free cooling loop to conditions that are favorable to the County.
- Provide improved control of steam convectors by limiting the amount of time the building has both heating and cooling plants on-line. Try to keep only one system on at a time.
- Calibrate the CHW pump VFD's such that they run in auto mode instead of fixed maximum speed.

- Eliminate operation of CHW pumps, chillers, free cooling system during unoccupied hours; allow the building temp to rise; provide optimal-start controls to automatically start the cooling system soon enough to precool the building before people arrive.
- Replace the 600-ton Trane chiller with a high-efficiency 350 ton unit similar to the existing York chiller (which can carry the entire building load on a peak day) if redundant cooling is desired; operate this chiller as the primary unit due to its higher efficiency
- Add insulation to all bare valve and fitting piping surfaces including boilers, condensate tank and steam piping.
- Utilize both cooling towers from one chiller. Allow the DDC system to have water run over the tower fill first, then one fan on low speed, the two fans on low speed and as a last resort run a fan on high speed if equipment has failed.
- Buy deregulated gas on the open market from a gas broker.

Recommendations

- Implement the ECM's listed above and continue to watch the energy usage.

1997

Jack Middendorf commissioned a "Utility Master Study" from ThermalTech Engineering. This was provided before ThermalTech became the County's Engineering Partner. ThermalTech prepared and delivered an equipment report that outlined existing equipment in place and probably life expectancies of this equipment.

ThermalTech presented a "Utility Master Savings Plan" that outlined helping the County track utility usage, create a baseline for each building, research alternative fuel sources, agree on construction standards, provide building energy audits, inspect operation and maintenance activities, provide cost reduction measures, troubleshoot existing problems and assist in management issues related to savings implementation.

Jack Middendorf created a Hamilton County Energy Committee to provide steering services for Hamilton County Facilities