

## **Customer-Centered Utility Billing & Energy Information**

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## **Abstract**

For the past 13 years, I've been very fortunate to work as part of the Energy Management Department of Campus Facilities here at the University of Missouri. Once I started, I quickly realized that the enterprise or recharge concept worked very well for a utility service organization. As with most utility providers reliability was most important, but doing it efficiently was a philosophy I quickly embraced. At Energy Management, stewardship is one of our core values and it shows in all we do.

A key component to our success is our customer-centered utility billing and energy information system. From utility metering and data collection, to billing and energy conservation, data management and customer service are paramount. This comprehensive system has earned the confidence of the campus community and also helps our in-house staff to efficiently manage the utility supply to the Mizzou community.

In 2001, we finally became a fully metered utility. This was a significant accomplishment because we could now track, analyze, and manage all the energy use for Mizzou. However, it quickly became apparent that there was still a lot of work to be done. Billing adjustments, customer complaints driven by the lack of information, and inconsistent history were just some of the data management challenges we faced. We needed to develop a system that would meet the needs of our internal staff, as well as the needs of a very diverse customer base.

Our first task was to bring together internal stakeholders and our customers to listen and learn what tools were needed to effectively manage this energy data. Once we developed a plan, we utilized the talents of our existing staff to develop a data collection and software system enabling us to manage energy use for the entire campus. As you will see, this system goes beyond simple billing software. It is very customer-focused and has been very well received by the campus community.

The major components of this system are: utility meters, data collection systems, software, e-mail, web-based data distribution, and other communication tools, such as newsletters and periodic customer reports.

The benefits are numerous. Not only are we able to accurately report and track energy use, we can also identify energy waste and track the progress of our energy conservation efforts. Customers also enjoy being able to view their utility bills on-line and download historical energy data for their analysis.

Ongoing communication with the campus community and our customers was one of the last steps of this project. Distributing a monthly Energy Newsletter with the electronic utility bills is one of the ways we continually work to keep our customers informed regarding energy related issues. In summary, our customer-oriented utility billing system is just one way we can continue to help MU fulfill its mission of teaching and research.

I hope that the information in this paper can be used by other business officers as they, too, try to be the best stewards of their institution's very precious and limited energy resources.

## Introduction of the Organization

The University of Missouri-Columbia was founded in 1839 as the first public university west of the Mississippi River and the first state university in Thomas Jefferson's Louisiana Purchase territory.

MU provides all the benefits of two universities in one — it's a major land-



grant institution and the largest public research university in Missouri. Considered one of the nation's top-tier institutions, Mizzou has a reputation of excellence in teaching and research, and is the flagship campus of the four-campus system. Mizzou has a diverse enrollment with 28,000 students from every county in Missouri, every state in the nation and 100 countries.

Energy Management is a department within the division of Campus Facilities. Our mission is to “provide reliable and cost effective energy services to the University of Missouri”. We take seriously the value of being good stewards of the campus energy resources. In addition to **stewardship**, our core values include **efficiency, innovation, excellence, relationships, safety** and **integrity**. Energy Management provides utilities and related services needed by MU to fulfill its mission of teaching, research and service. We strive to provide these services at minimum cost to MU and have implemented many efficiency improvements and cost saving initiatives.

A key element to the efficient supply of energy to the campus is MU's



cogeneration power plant. MU has had a central power plant since 1892.

Energy Management is a recharge operation, fully funded by billing for metered utility use and by direct recovery for other energy services provided. Energy Management's utility rates are lower than outside utilities can offer, which was verified in the early 1990's by a thorough outsourcing analysis. Ongoing market comparisons demonstrate this is still true today.

Energy Management supplies electric, chilled water, steam, and potable water utility services to more than 13 million gross square feet in 235 buildings. The campus General Operating Fund pays for utilities used in 7.7 million gross square feet of Educational and General space, which accounts for 61 percent of total campus billing. Campus auxiliary operations and non-MU users (Veterans Administration Hospital, Mid-Missouri Mental Health, and U.S. Department of Agriculture) account for the other 39 percent.

## The Need for Customer-Centered Utility Billing & Energy Information

Metering utilities at the building level has been a priority since 1985 when Energy Management first became a recharge operation. With the completion of chilled water metering in 2001, we became a fully metered utility provider. Effectively utilizing all this data became a challenge both internally and for the campus community. Utility data had to be verified, tracked, accurately reported and effectively communicated to our customers. We identified several areas where improvement was needed:

- **Multiple Users in Facilities** – Utility billing in a university setting proved to be challenge. MU’s facilities are very complex and dynamic. Many buildings have multiple billing customers representing several colleges, divisions and/or departments, all of whom are responsible for their portion of the building’s energy bill. Off-the-shelf utility billing programs would require costly customization to handle the complexity of an institution like Mizzou.
- **Limited Customer Access to Utility Information** - We quickly learned that our customers had limited access to energy use and billing information. Numerous requests for utility information were difficult to manage and took significant staff time. All requests were handled on a first-come, first-served basis, with little consistency in format. More often than not, these inquiries resulted in time consuming discussions and meetings that required additional staff time.

- **Unfamiliarity with Utility Budget Preparation** – Individual departments and divisions were not familiar with preparing utility budgets and would make incorrect assumptions regarding utility use resulting in budgetary concerns during the fiscal year. Users also had little or no understanding of how weather and energy-market fluctuations affected utility use and, therefore, their bill.
- **Inability to Analyze Energy Use** - Comparing energy use for different buildings was difficult due to the complexity of the buildings, transient customers, and shared spaces.
- **Excessive Time for Billing** - Preparing monthly utility bills was very time consuming. Each month staff prepared, addressed and distributed over 300 paper bills through campus mail.
- **Limited Historical Data** - Records of past energy use was only kept on paper making it difficult to assist with audit requests for past fiscal years.
- **Inaccurate Energy Projections** - Forecasting the energy use of new buildings was difficult and not based on other buildings of similar style and functions. The only option was to rely on engineering estimates that were sometimes inaccurate. This also made it difficult to accurately budget fuel use.
- **Managing Energy Waste** - It was also difficult to identify energy waste and track the results of our energy conservation efforts.

## Design

The first step was to develop a list of requirements necessary to better manage utility and energy use data. This required input from both internal and external stakeholders.

Suggestions were solicited from engineering and accounting units within Energy Management regarding historical data requirements, desired format, and query and reporting functionality. Next, we requested input from several of our customers, including Campus Dining Services and Residential Life, regarding their need for utility and energy information.

The decision to dedicate in-house resources to this project, in lieu of purchasing and customizing a “canned” billing package, was relatively easy. Standard, off-the-shelf, software could not effectively handle the number of commodities we recharge (steam, chilled water, electric, potable water), nor could they easily handle shared space, internal chiller plants and interface with our existing software systems. In addition to in-house provided utilities the new system needed to record services provided to campus by outside utility companies. These functionality requirements and cost estimates, which exceeded \$400,000, led us to the decision to develop this system in house with our own staff.



## Implementation

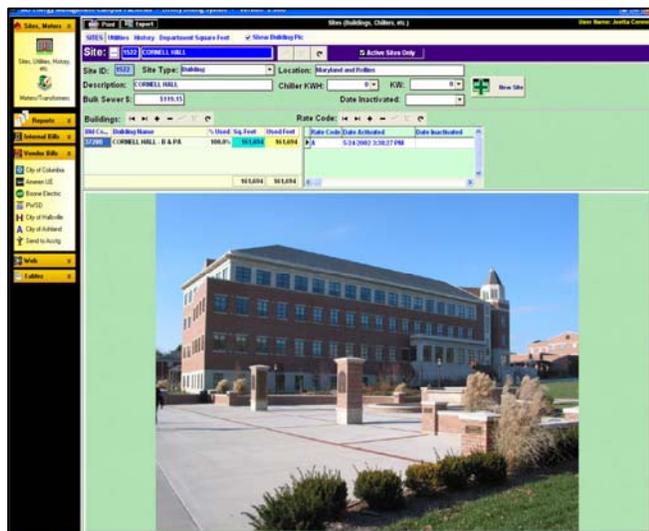
The new billing system was designed, developed and implemented without adding personnel. Due to the large number of duties assigned to our in-house computing staff, the development of the utility program took the better part of a year.



During the development process several prototypes were tested to make sure the system performed as needed. The utility billing system was also designed to integrate meter information into our preventative maintenance and asset management system. Concurrently, new administrative controls were needed to ensure the accuracy of the utility data. Monthly billing meetings are now a

routine occurrence. During these meetings representatives from each functional area - steam, water, electric and chilled water -- review the current month utility data and compare it to historical use. These meetings catch metering problems before bills are calculated and sent to the customer. As a result of these meetings, customers are also contacted regarding their energy use anomalies. These inquiries eliminate the element of surprise when they receive their utility bills.

After the billing software was complete and functional, the next step was to develop the web-based component of the system. In this



module, customers log on using their campus ID and are able to query the accounts, meters, and buildings for which they are responsible, as well as download past utility bills and historical data directly to an Excel spreadsheet.

The graphics below depict several of the on-line screens available to our customers:

The collage displays several key components of the Energy Management Utility Billing System interface:

- Main Menu:** Features a central logo and navigation buttons for 'EM Applications Menu', 'Info Help', 'Monthly Utility Bills', 'Accounting Info', 'Energy News', and 'Historical Usage'. It is branded as 'Campus Facilities' for the University of Missouri-Columbia.
- Historical Usage Table (Top Right):** A data table showing utility usage over time.
 

| Year | Month       | Total Amount | Electric Usage (kWh) | Electric Demand (kW) | Electric Amt. (kWh) | Electric Demand (kW) | Electric Amt. (kWh) | Electric Demand (kW) | Electric Amt. (kWh) | Electric Demand (kW) |
|------|-------------|--------------|----------------------|----------------------|---------------------|----------------------|---------------------|----------------------|---------------------|----------------------|
| 2007 | 2006-12-Dec | \$2,596.74   | 694000               |                      | \$3,600.43          | 1950                 | \$12,384.00         | 2744                 |                     |                      |
| 2007 | 2006-11-Nov | \$2,167.88   | 623000               |                      | \$7,249.62          | 1984                 | \$12,384.00         | 2743                 |                     |                      |
| 2007 | 2006-10-Oct | \$2,208.49   | 654000               |                      | \$25,492.72         | 1200                 | \$12,384.00         | 1664                 |                     |                      |
| 2007 | 2006-09-Sep | \$16,099.41  | 677000               |                      | \$25,154.36         | 1140                 | \$12,384.00         | 1238                 |                     |                      |
| 2007 | 2006-08-Aug | \$17,484.69  | 651200               |                      | \$31,482.18         | 1116                 | \$12,296.00         | 752                  |                     |                      |
| 2007 | 2006-07-Jul | \$26,889.82  | 823200               |                      | \$38,361.40         | 1900                 | \$12,255.00         | 571                  |                     |                      |
| 2006 | 2006-06-Jun | \$18,838.82  | 519000               |                      | \$76,798.77         | 1140                 | \$12,642.00         | 523                  |                     |                      |
| 2006 | 2006-05-May | \$19,943.86  | 594000               |                      | \$25,326.20         | 1140                 | \$11,825.00         | 1996                 |                     |                      |
| 2006 | 2006-04-Apr | \$9,787.83   | 681600               |                      | \$30,186.68         | 1984                 | \$11,825.00         | 878                  |                     |                      |
| 2006 | 2006-03-Mar | \$9,132.85   | 738000               |                      | \$38,044.13         | 1216                 | \$11,825.00         | 1611                 |                     |                      |
| 2006 | 2006-02-Feb | \$7,278.17   | 589400               |                      | \$36,057.26         | 1196                 | \$11,825.00         | 2148                 |                     |                      |
| 2006 | 2006-01-Jan | \$70,483.81  | 655200               |                      | \$32,192.22         | 1176                 | \$11,825.00         | 1879                 |                     |                      |
| 2006 | 2005-12-Dec | \$76,784.26  | 586000               |                      | \$29,911.63         | 1096                 | \$11,825.00         | 2737                 |                     |                      |
| 2006 | 2005-11-Nov | \$8,534.36   | 612000               |                      | \$38,191.44         | 1994                 | \$11,825.00         | 1662                 |                     |                      |
| 2006 | 2005-10-Oct | \$9,712.42   | 658000               |                      | \$43,666.00         | 1124                 | \$11,825.00         | 1209                 |                     |                      |
| 2006 | 2005-09-Sep | \$18,757.28  | 664000               |                      | \$38,366.13         | 1092                 | \$11,825.00         | 729                  |                     |                      |
| 2006 | 2005-08-Aug | \$18,710.97  | 662000               |                      | \$35,009.00         | 1000                 | \$11,739.00         | 709                  |                     |                      |
| 2006 | 2005-07-Jul | \$19,682.34  | 717600               |                      | \$35,434.32         | 1092                 | \$11,739.00         | 1290                 |                     |                      |
| 2005 | 2005-06-Jun | \$9,796.67   | 660000               |                      | \$26,203.13         | 1094                 | \$9,293.00          | 818                  |                     |                      |
| 2005 | 2005-05-May | \$19,168.36  | 672000               |                      | \$27,256.88         | 1020                 | \$9,933.00          | 1396                 |                     |                      |
| 2005 | 2005-04-Apr | \$8,585.18   | 617600               |                      | \$33,017.70         | 1100                 | \$9,933.00          | 1436                 |                     |                      |
| 2005 | 2005-03-Mar | \$7,180.08   | 571600               |                      | \$30,231.63         | 1096                 | \$9,933.00          | 2089                 |                     |                      |
| 2005 | 2005-02-Feb | \$6,479.75   | 550000               |                      | \$26,496.25         | 1068                 | \$9,933.00          | 2303                 |                     |                      |
- September 2006 - Utility Charges (Middle Left):** A summary page for 'ARTS AND SCIENCE' showing charges for Electric (\$4,184.65), Steam (\$0.00), Chilled Water (\$3,694.55), Water (\$278.25), and Sanitary Sewer (\$93.40). Total utility charges are \$8,250.85.
- Historical Usage (Middle Right):** A screen for 'ARTS AND SCIENCE' showing a table of monthly utility usage from January 2006 to November 2006.
 

| Month-Year | Electric (kWh) | Demand (kW) | Steam (kWh) | Chilled H2O (Ton-Hrs) | Water (kGals) | Nat. Gas (CCF) |
|------------|----------------|-------------|-------------|-----------------------|---------------|----------------|
| Jan-2006   | 86,000         | 122         | 0           | 0                     | 24            | 0              |
| Feb-2006   | 38,000         | 125         | 400         | 400                   | 73            | 0              |
| Mar-2006   | 60,760         | 152         | 252         | 252                   | 79            | 0              |
| Apr-2006   | 58,000         | 154         | 94          | 9,990                 | 79            | 0              |
| May-2006   | 40,900         | 174         | 8           | 10,100                | 132           | 0              |
| Jun-2006   | 50,000         | 102         | 0           | 3,476                 | 91            | 0              |
| Jul-2006   | 60,160         | 109         | 0           | 20,111                | 59            | 0              |
| Aug-2006   | 50,000         | 139         | 7           | 28,662                | 82            | 0              |
| Sep-2006   | 62,440         | 128         | 0           | 15,852                | 132           | 0              |
| Oct-2006   | 52,200         | 138         | 240         | 6,349                 | 116           | 0              |
| Nov-2006   | 60,000         | 138         | 276         | 2,908                 | 57            | 0              |
- Site Meter (Bottom Right):** A screen showing a table of meter details for various sites.
 

| Site   | Meter | Description | Unit  | Location     | Notes |
|--------|-------|-------------|-------|--------------|-------|
| Site 1 | M1    | Electric    | kWh   | Building 101 |       |
| Site 2 | M2    | Water       | kGals | Building 102 |       |
| Site 3 | M3    | Gas         | CCF   | Building 103 |       |

This component proved to be a very useful tool for the campus community, as the comments below attest.

*"Thanks so much Steve. I was able to log on and look at our bills. Also, as we discussed by telephone, you said a key word here that drew me back to your original e-mail and helped explain what I was confused about. The word was "Actual," I was comparing the wrong spreadsheet and now it all fits together much better! Further, thanks for the assistance in creating a pivot report. I really like how you can compare the months easier in that format. Finally, I appreciate your help in finding out who pays for the lights at the outdoor tennis courts by Green Tennis Center.*

*Please know that we are excited to have the new access and information your office has provided us with. I am very impressed with the customer service from your department and want to thank everyone again for your patience and information!"*

Mary Austin  
Associate Athletics Director-Compliance  
University of MO Department of Athletics

Steve,

*I recently received your letter in regard to EM's online utility billing. I was able to successfully logon and had no problems accessing all of the information. Your program is impressive and it's very user friendly.*

Thanks,  
Jeff

Jeff Atteberry  
Manager, Business & Fiscal Operations  
University of Missouri Research Reactor

*Steve, I just finished accessing the Online Utility Billing website. It works great. I had no problem viewing the different options available. I do have one request, will you please add Cyndie Parks, Director of Records Management, to the list so she can also access the Online Utility Billing.*

Thank you,  
Linda

Linda Moritz  
Records Management  
2910 LeMone Industrial Blvd.

The last step was to make sure our customers were aware of energy related issues and how they affect them. With their monthly utility bills, our customers now receive an Energy Newsletter electronically in which we inform them of pertinent energy topics.



**MU Energy News**  
**September 2006**



**Energy Management**  
Energizing Missouri!



**MU**

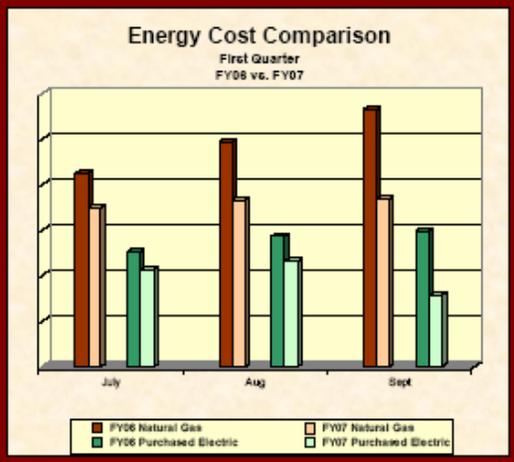
It's a pleasure to write about some positive trends regarding energy. Most of the energy news this past year has been discouraging to say the least. This fall, things are much better than we anticipated. Energy costs were considerably lower than a year ago when the nation was recovering from a very active hurricane season. Plus, even though we had some very hot days, overall this past summer was milder than normal! All of this is great news resulting in lower energy costs campus wide. Let's hope this trend continues as we move from fall into winter.

**Downturn in the Energy Market Yields Savings!**

The energy market this fall is totally different than the challenges we faced just a year ago. In September, 2005, we saw sharp increases in electric and natural gas prices due to hurricanes Katrina and Rita. With the absence of hurricanes and below average temperatures, current energy markets were much better. Thus, we are able to pass on a positive fuel cost adjustment for electricity.

Here is a comparison chart of the fuel costs between the 1st quarters of FY06 and FY07. As you can see, the average price of purchased wholesale electric in September was down almost 50% compared to last year.

Even though the wholesale energy market is favorable at times, achieving savings still requires our Operations Staff to make wise decisions when it comes to generation vs. purchase of electricity. Through their dedication, we can take advantage of our power production flexibility to generate electricity when the wholesale market is high and purchase wholesale electricity when the market is low. This means savings for you.



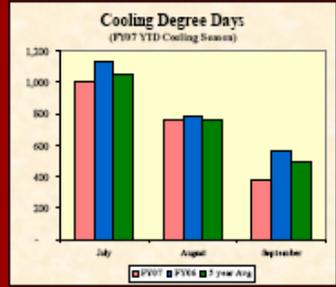
**Energy Cost Comparison**  
First Quarter  
FY06 vs. FY07

| Month | FY06 Natural Gas | FY07 Natural Gas | FY06 Purchased Electric | FY07 Purchased Electric |
|-------|------------------|------------------|-------------------------|-------------------------|
| July  | High             | Medium           | Medium                  | Low                     |
| Aug   | High             | Medium           | Medium                  | Low                     |
| Sept  | High             | Medium           | Medium                  | Low                     |

**Moderate September Results in Additional Savings!**

Not only did the milder September temperatures have a positive impact on fuel costs, it also had a positive impact on the Campus' energy use. Comparing FY06 and FY07, we see that September's chilled water use was **down 30%**! On the graph you will notice that September's cooling degree days were 24% lower than average and 33% lower than FY06. Also, when you look at the 1st quarter of FY07, you will see that the YTD Cooling Degree Days are 13% lower than FY06 and 7% lower than average.

The lower use equates to lower energy costs which should translate into more funds being available to fulfill your core mission. Remember, one month doesn't make a fiscal year. We'll keep you updated regarding temperature trends and campus energy use as we move into the winter heating season.



**Cooling Degree Days**  
(FY07 YTD Cooling Season)

| Month     | FY07  | FY06  | 7-year Avg |
|-----------|-------|-------|------------|
| July      | ~1000 | ~1100 | ~1050      |
| August    | ~750  | ~800  | ~780       |
| September | ~400  | ~550  | ~500       |

**ENERGY SAVINGS THROUGH RECYCLING:** Recycling a pound of steel saves enough energy to light a 60-watt light bulb for 26 hours. Recycling a ton of glass saves the equivalent of nine gallons of fuel oil. Recycling aluminum cans saves 95 percent of the energy required to produce aluminum from bauxite. Recycling paper cuts energy usage in half.

At Energy Management we continually strive to improve the information that we provide to you in order for you to make informed decisions. If you have ideas to improve this newsletter, please let us know.

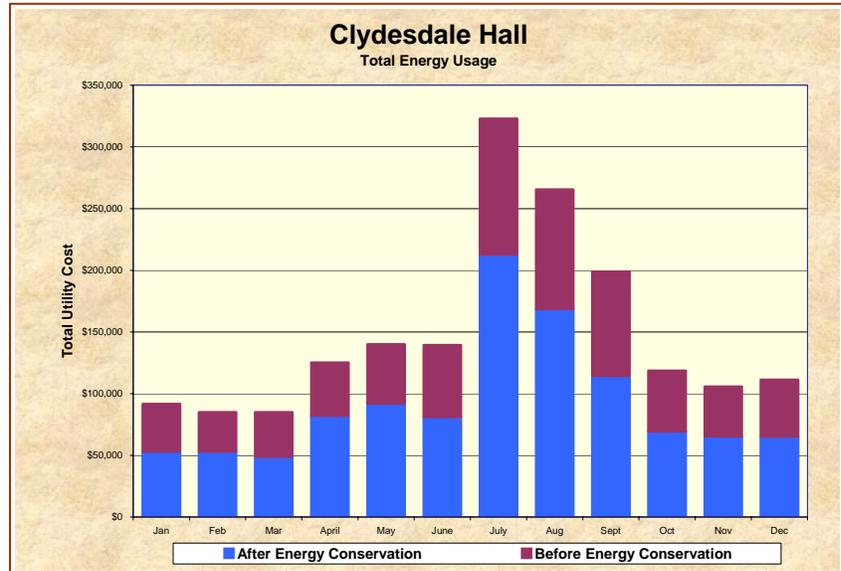
**“Reliable and cost effective energy services for the University of Missouri”**



## Benefits to the Campus Community

- **Energy conservation** – MU has actively pursued energy conservation since 1990. This program has proved to be very successful with cumulative savings of more than \$24 million. Currently, the annual savings are more than \$3.8 million and growing. Accurate energy data allows us to identify

buildings where the best rate of return on our energy conservation investments can be realized and the success of our



energy conservation project accurately measured. With access to their utility use, customers can also partner with Energy Management to identify and take corrective actions to eliminate energy waste.

- **Reduced staff time** – Once fully implemented, internal and external staff benefited by having readily accessible data. Customers can easily access and analyze their specific utility data on-line, virtually eliminating the need for Energy Management staff to develop customized reports. Customers also have on-line access to meter locations, funding codes and accounting percentages, further reducing the number of requests to Energy Management staff. In the past, some customers developed shadow systems requiring

manual data entry resulting in duplicated information. Now our customers can download their data directly to an Excel spreadsheet and manipulate it accurately and efficiently. This has helped our customers to reduce the time necessary to analyze utility data and prepare their annual budgets.

- **Increased accuracy** – Our utility customers very rarely question their utility bill because they have grown to trust our data. Through our ongoing communication efforts, customers also better understand how and why their utility bill changes.
- **Improved forecasting** - Energy Management also benefits by being able to accurately forecast campus energy use and the fuel necessary to meet these requirements.
- **Identifying and reducing system losses** - With the ability to accurately measure production versus building energy use, we can identify and correct distribution system losses, resulting in increased efficiency.
- **Helping the entire campus community** – We are stewards and builders of a priceless state resource. Our efforts must relate directly to MU's mission of teaching, research and service to the public. With the ability to track, analyze and report utility data we can translate simple energy data from engineering units such as Kilowatts and British Thermal Units to more meaningful values better understood by the campus community and citizens of Missouri.

Following is an example of how we report our energy conservation savings:



**Campus  
Facilities**

### **Campus Facilities - Energy Management**

University of Missouri - Columbia  
Energy Conservation Program  
2006 Annual Report



**Energy Management  
Campus Facilities**

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- New Savings (FY06) - \$463,856
- Annual Savings (FY06) - \$8,298,124
- Tons of CO2 Reduced - 198,000
- Equivalent Cars Removed from the Highways - 34,256
- Equivalent Acres of Trees - 54,002
- Equivalent Degree Programs - 6.57
- Equivalent FTE - 140
- Annual Tuition Savings per Student - \$338

In summary, effectively measuring and managing utility data translates into more funds being available for MU to continue fulfilling its core academic and research missions.

## **Retrospect**

After implementation of the utility enterprise model, we realized we had underestimated the need for a direct tie between operational, engineering, and fiscal staff. Initially, operational units were given the charge to install metering but didn't have the global understanding of how their efforts impacted others. Fiscal staff didn't understand some of the more complex concepts of metering, while the engineering staff didn't realize the magnitude of distribution losses and how they effected the department.

Effectively managing a utility enterprise model requires knowledgeable staff and teamwork. Our innovative customer-centered utility billing and energy information system is one way the Energy Management team has gained the trust of the campus community.

February 1, 2007