Leaving the Meter Running: A Survey of Furman University's Energy Consumption

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I. Abstract

Amongst rising concerns about escalating energy costs and the deleterious effects of global climate change, approaches to improve energy efficiency have become more prominent throughout the world, including at Furman University. Our results from investigating recent energy use for 32 Furman campus buildings display that the campus has become gradually more energy efficient in recent years, likely due to Furman's sustainability initiatives. However, particular buildings, such as the chapel, dining hall, music building, Chiles and Gambrell halls, and the Physical Activities Center, remain highly inefficient and need energy conservation measures. Future research would be valuable to analyze of energy use change over time.

II. Background

As an advocate for sustainability, Furman University has recently enacted many measures to use less energy and reduce the school's 'carbon footprint.' Many initiatives, such as the installation of motion sensor lighting, have resulted in LEED certification for multiple campus buildings, a paramount achievement toward Furman's sustainability efforts. Coupled with the university's "Year of the Environment" in 2007, energy efficiency is a overarching priority for Furman University. Since Furman University's steps to improve sustainability regarding energy consumption became intensified during the 2006-2007 academic year, and have continued to the present, this analysis represents consumption statistics (kilowatt hour used per heated square foot) for each building from August 2006 to September 2009.

III. Objectives

Our main goals are twofold. First, to determine if Furman's application and installation of energy saving initiatives in recent years has actually resulted in a reduction of consumption. Second, to analyze consumption statistics to uncover which, if any, buildings on campus are most in need of energy-saving measures. Although certain buildings certainly demand more energy than others due to high daily occupancy and differing building uses, any reduction in energy usage is a positive step for environmental and economic sustainability.

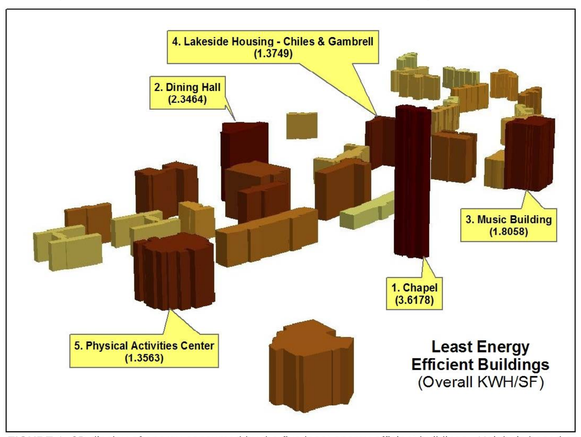


FIGURE 1: 3D display of energy consumed by the five least energy efficient buildings. Height is based on actual average KWH/SF.

Building	Average Monthly Energy Cost
1. Chapel	(63772kwh x $0.053) = **$3380**
2. Dining Hall	(110005kwh x $0.053) = **$5830**
3. Music Building	(82495kwh x $0.053) = **$4372**
4. Lakeside – Chiles & Gambrell	(60449kwh x $0.053) = **$3204**
5. Physical Activities Center	(93108kwh x $0.053) = **$4935**

Source: Furman University Facilities Services

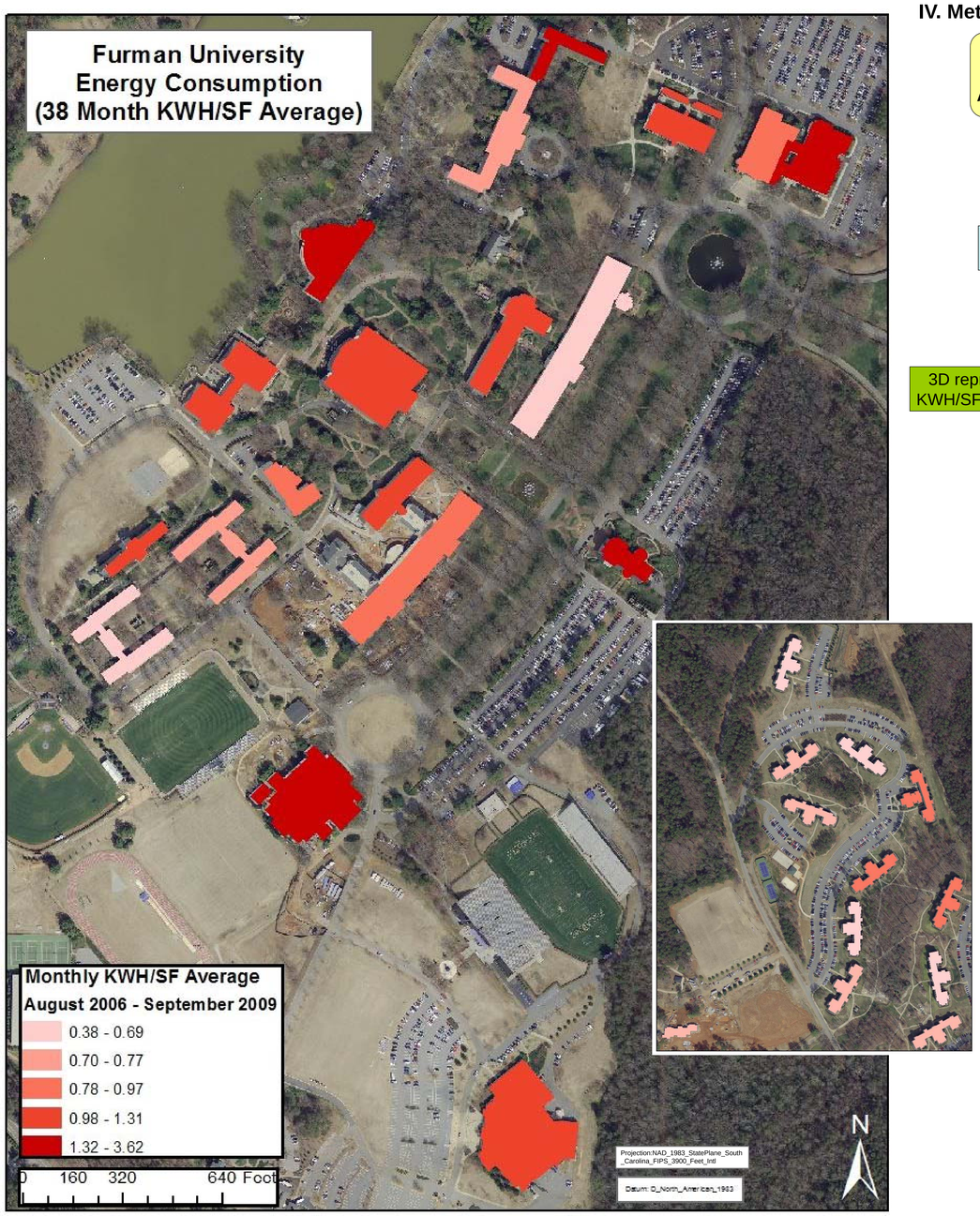
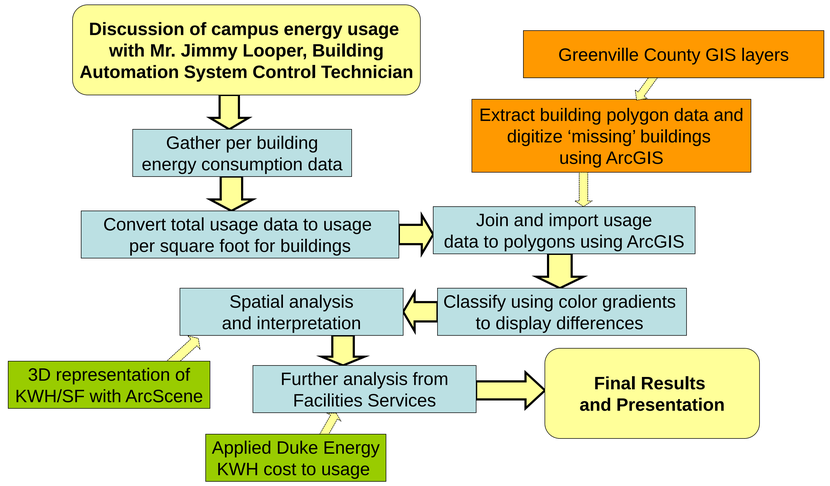


FIGURE 2: Monthly average KWH/SF usage per building over recent 38 month period (8/2006 to 9/2009). Darker reds represent higher consumption, while pink colors signify lower consumption and better efficiency. The inset represents North Village apartments.

IV. Methods



V. Discussion

After analyzing the data, attention should be directed at high energy consumption in particular Furman University campus buildings. **Surprisingly, amongst all campus buildings, the Daniel Memorial Chapel consumes the most average monthly energy per square foot** (fig. 1,2,7). After further research, Facilities Services notes that high usage is largely due to two factors:

1) The building's lighting is costly with 250 dimmable outdoor lights to illuminate the exterior. Unfortunately, more energy efficient light bulbs (CFL bulbs) are not yet reliable enough to last multiple years outdoors, and LED light bulbs are not bright enough.

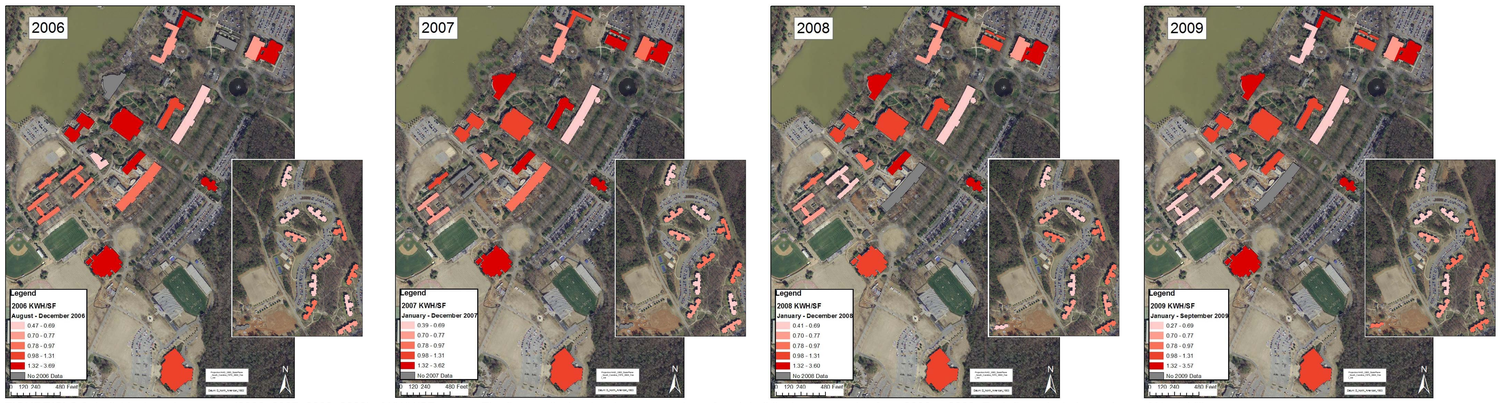
2) The chapel's pipe organ demands precise climate control to remain tuned. The sanctuary's HVAC operates 24 hours a day to maintain a constant temperature and humidity level.

Hartness Organ in Charles E. Daniel Memorial Chapel[1]

The Daniel Dining Hall has high consumption, largely due to high daily occupancy and dozens of cooking appliances. As for the Daniel Music Building, Facilities Services explains that high consumption is due the building's outdated and inefficient HVAC system and needs replacement. High usage in Chiles and Gambrell Halls is mainly because the units maintain their own A/C system, whereas most other campus buildings are supported by the Central Plant. The Lay Physical Activities Center formerly had very poor insulation; however, such issues have been remedied by recent construction renovations that have improved efficiency[2].

However, the data also details that energy saving initiatives enacted at Furman University since the 2006-2007 school year have indeed reduced consumption in many campus buildings. **Implementation of motion sensor lighting and remote lighting systems in buildings such as Furman Hall, along with LEED-certified Hipp Hall and the Duke Library, has evidently cut usage over time** (fig. 3-7). Also, various initiatives such as the "Kill-o-watt Challenge" have notably either reduced consumption or maintained already low levels of energy use in the North Village apartments. Furthermore, the conversion to use of the "Central Plant" for HVAC replaced old, outdated HVAC systems in many campus buildings, resulting in more efficient energy use in recent years.

Overall, as the change-over-time model suggests, Furman University's campus has gradually become more energy conscious (fig. 3-6). The model displays a trend toward more efficient energy usage throughout campus. However, Furman administration should direct additional energy saving tools to the inefficient buildings listed above to not only reduce Furman's 'carbon footprint,' but also to save money on energy expenses (fig. 2).



FIGURE(S) 3-6: Individual yearly average (2006, 2007, 2008, 2009) of KWH/SF usage. The figures display the change-over-time of each building's consumption from 2006 to 2009. Each figure includes an inset of North Village apartments.

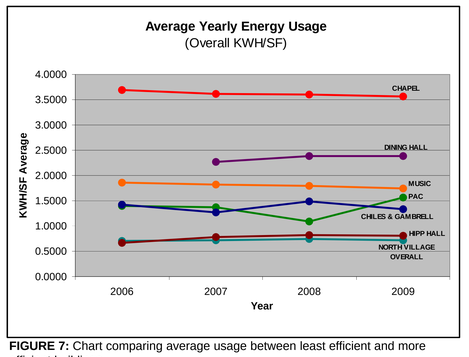


FIGURE 7: Chart comparing average usage between least efficient and more efficient buildings.

VI. References

[1] - Hartness Organ in Daniel Chapel Image: http://www.furman.edu/press/PressImages/organ.jpg

[2] - 12/01/2009 email from Jimmy Looper, "Re: Some Wrapup Questions"

VII. Acknowledgments

We would like to extend an enormous "thank you" to Mr. Jimmy Looper and Facilities Services for their constant help with data collection and information. This project would not have been possible without Mr. Looper's assistance. Much appreciation, as well, to Dr. Suresh Muthukrishnan, Mr. Mike Winiski, Ms. Amelie Davis, and Mr. Rick Schosky for their help.

VII. Data Sources

Furman University footprint data and Greenville County aerial image - N:\Data\Greenville2008\Aerial\2008COLOR_7.sid

Facilities Services Energy Statistics Microsoft Excel Spreadsheet - N:\users\jones\Term Project\USEcampusenergyuse-averages.xls

Facilities Services Square Footage Microsoft Excel Spreadsheet - N:\users\jones\Term Project\USEcampusenergyuse-averages.xls

Duke Energy KWH cost and general analysis of GIS results -

"Re: Some Wrapup Questions" – Jimmy Looper 12/01/2009 email

IX. Projection and Datum

Projection: NAD_1983_StatePlane_South_Carolina_FIPS_3900_Feet_Intl

Datum: D_North_American_1983