

Electricity Benchmark Report, 2005-2013



Sustainability House
4 November 2013

Overview

This project aims to track and summarize the use of electricity on the University of Arkansas campus beginning with the year 2005 and continuing through 2013. An annual update of the project is key for tracking the most recent changes in use of electricity. The data are broken down into three main categories: Outdoor, Indoor, and Central Utilities. The data are then sorted into subcategories which will be further discussed below. The goal of this analysis is for the Office for Sustainability to benchmark electricity use by category, see where efforts for conserving electricity are most needed, and to track the progress of these conservation initiatives over time.

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Methods

The meter readings for electricity usage categories were defined as follows:

1. Outdoor
 - a. 1 - Parking Lots
 - b. 2 - Streets/Sidewalks
2. Indoor
 - a. 4 - Housing – Residence Halls/Greek
 - b. 5 - Dining Halls
 - c. 6 - Academic/Administration Buildings
 - d. 7 - Recreation/Athletics
 - e. 8 - Other (facilities, storage, warehouses, etc.)
3. Central Utilities
 - a. Central Chiller Plant – CCHP

- b. North Chiller Plant – NCHL
- c. South West Chiller Plant – SWCP
- d. Heating Plant – HEAT
- e. Bud Walton Chiller Plant - BWCP

To ensure consistency for each year, it was necessary to create a list of all buildings and electric meters that are used by the University of Arkansas and assign them a usage category. This list includes off-campus buildings such as research buildings and Uptown Campus buildings. The categories were assigned numbers 1-8 (from above) according to a list of buildings provided by Kevin E. Santos. Those that were not listed were categorized using Google Maps and the UA campus map. The final inventory with building number, address, building name or description, building code, and electricity usage category are archived on the University of Arkansas server, and summarized in Table 1.

Table1. An Example of Classification of University of Arkansas Electric Meters

| # | Address | Building | Code | Electric Classification |
|----|--|-------------------------|------|-------------------------|
| 1 | 859 S. California Blvd. Apt #1 | California House #1 | CAL1 | 8 |
| 2 | 859 S. California Blvd. Apt #2 | California House #2 | CAL2 | 8 |
| 3 | 491 N. Razorback Rd. | Alumni Center | ALUM | 8 |
| 4 | 155 N. Razorback Rd. | Administrative Services | ADSB | 6 |
| 5 | 722 W. Maple | Study Abroad Office | FIIR | 6 |
| 6 | 747 W. Dickson | Dickson Street Annex | DICX | 6 |
| 8 | 536 N. Leverett | Infant Development | INDC | 6 |
| 9 | S. Razorback Rd. - ODL Light, Lot #57A | parking | | 1 |
| 10 | 20 N. East Ave. | Campus on Square | CTED | 6 |
| 11 | Dickson & Duncan | Botany Greenhouse | BGHL | 6 |
| 12 | 410 N. Arkansas-A/C | unknown | SPCL | 8 |
| 13 | Douglas/Garland-Lot #75 | parking | | 1 |

This list was used as a reference to consistently categorize total use of electricity by meter type as listed in the annual electric bills for fiscal years 2005-2013, provided by Jeffrey E. Siebler. The values of annual use of electricity per meter were summed in each corresponding category to find total electricity usage per category per year. A portion (2012 and 2013 data) of the final summary is presented in Table 2.

Table2. Comparative University of Arkansas Electricity Use by Category, 2012 - 2013

| | 2012 | | | 2013 | | |
|---------------------|------------------|----------------------|-----------|------------------|----------------------|-----------|
| | Amount (kwh) | \$ | % | Amount (kwh) | \$ | % |
| Outdoor | | | | | | |
| 1 - Parking Lots | 1,900,074 | \$ 131,105.11 | 97% | 1,912,680 | \$ 131,974.92 | 98% |
| 2 - Roads/Sidewalks | 62,267 | \$ 4,296.42 | 3% | 47,761 | \$ 3,295.51 | 2% |
| TOTAL | 1,962,341 | \$ 135,401.53 | 2% | 1,960,441 | \$ 135,270.43 | 2% |

| | | | | | | |
|--------------------------------------|--------------------|------------------------|------------|--------------------|------------------------|------------|
| Indoor | | | | | | |
| 4 - Housing - Residence Halls/Greek | 11,930,895 | \$ 823,231.76 | 13% | 12,676,567 | \$ 874,683.12 | 14% |
| 5 - Dining Halls | 2,020,249 | \$ 139,397.18 | 2% | 2,313,337 | \$ 159,620.25 | 3% |
| 6 - Academic/Admin. Buildings | 46,890,197 | \$ 3,235,423.59 | 53% | 48,839,791 | \$ 3,369,945.58 | 55% |
| 7 - Recreation/Athletics | 17,356,739 | \$ 1,197,614.99 | 20% | 20,245,565 | \$ 1,396,943.99 | 23% |
| 8 -Other (facilities, etc.) | 10,296,094 | \$ 710,430.49 | 12% | 5,460,913 | \$ 376,803.00 | 6% |
| TOTAL | 88,494,174 | \$ 6,106,098.01 | 69% | 89,536,173 | \$ 6,177,995.94 | 77% |
| | | | | | | |
| Central Utilities | | | | | | |
| CCHP - Central Chiller Plant | 12,862,274 | \$ 887,496.91 | 34% | 14,586,938 | \$ 1,006,498.72 | 58% |
| NCHL - North Chiller Plant | 2,981,708 | \$ 205,737.85 | 8% | 1,169,404 | \$ 80,688.88 | 5% |
| SWCP - Southwest Chiller Plant | 6,202,306 | \$ 427,959.11 | 16% | 7,861,233 | \$ 542,425.08 | 31% |
| HEAT - Heating Plant | 13,860,225 | \$ 956,355.53 | 37% | 1,389,740 | \$ 95,892.06 | 6% |
| BWAR - Bud Walton Chiller Plant | 1,738,174 | \$ 119,934.01 | 5% | 48,067 | \$ 3,316.62 | 0% |
| TOTAL | 37,644,687 | \$ 2,477,549.40 | 29% | 25,055,382 | \$ 1,725,504.74 | 21% |
| | | | | | | |
| TOTAL ELECTRICITY USAGE (KWH) | 128,254,279 | \$ 7,621,418.09 | | 116,552,446 | \$ 7,505,391.82 | |
| | 128,101,202 | \$ 8,719,048.93 | | 116,551,996 | \$ 8,038,771.10 | |
| | | | | | | |
| Normalization Data | | | | | | |
| Total GSF in Footprint (GSF) | 7,731,036 | | | 7,807,144 | | |
| Total Enrollment (FTE) | 21,242 | | | 22,225 | | |
| Total Faculty (FTE) | 4,638 | | | 4,767 | | |
| TOTAL POPULATION | 25,880 | | | 26,992 | | |
| | | | | | | |
| Summary | | | | | | |
| Electricity Usage (KWH per Capita) | 4,956 | | | 4,318 | | |
| Electricity Usage (KWH per sq. ft.) | 17 | | | 15 | | |

The Total Electricity Usage (KWH) has two values listed to account for error. The top one is the true value calculated electronically within the electric bill spreadsheets themselves and the value below is the actual sum of the values listed above which were sorted and entered manually. The average error was .57 percent for years 2005-2013. Percentage based usage was calculated using the lower number. The spreadsheet, which includes years 2005-2013, is archived on the University of Arkansas Office for Sustainability server.

Using this system of assigning electricity usage category numbers to each electric meter ensured that each meter for every year was accounted for under the same category (housing, parking lot, etc.). Entering data manually was not only necessary in order to correctly categorize each meter listed on the electric bills, but also addressed translational challenges such as invalid reference cells in the spreadsheets.

Summary of Data

The amount and distribution of electricity usage on campus was fairly consistent over time. The majority of the electricity was being used indoors, slightly less in heating and cooling, while the least, almost none comparatively, was being used for outdoors (Figure 1). Variations in total usage can be attributed to years of construction periods, increase of student population, or even errors in record entry and changes in the metering system from earlier years. Taking a closer look at indoor patterns, one can see that the electricity being used peaked in 2009 and has been fairly stagnant since (Figure 2). This peak and subsequent drop is explained by the implementation of the Energy Savings Performance Contracts in 2009.

Figure 1. Electricity Usage over Time at the University of Arkansas

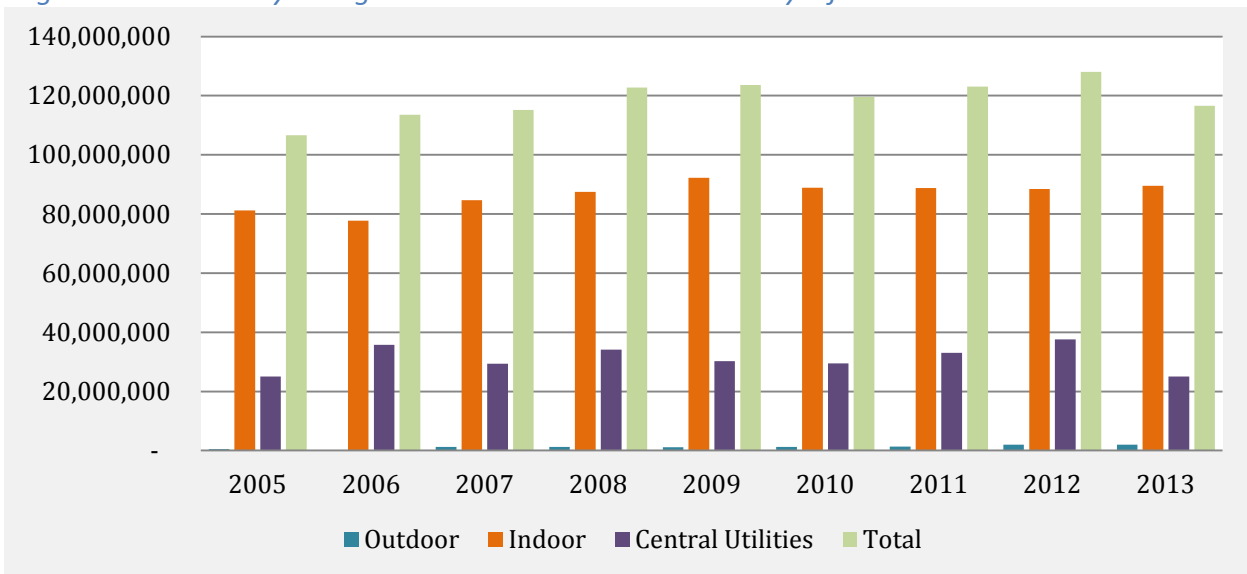


Figure 2. Electricity Used (in kWh) in Buildings over Time at the University of Arkansas, 2005 – 2013

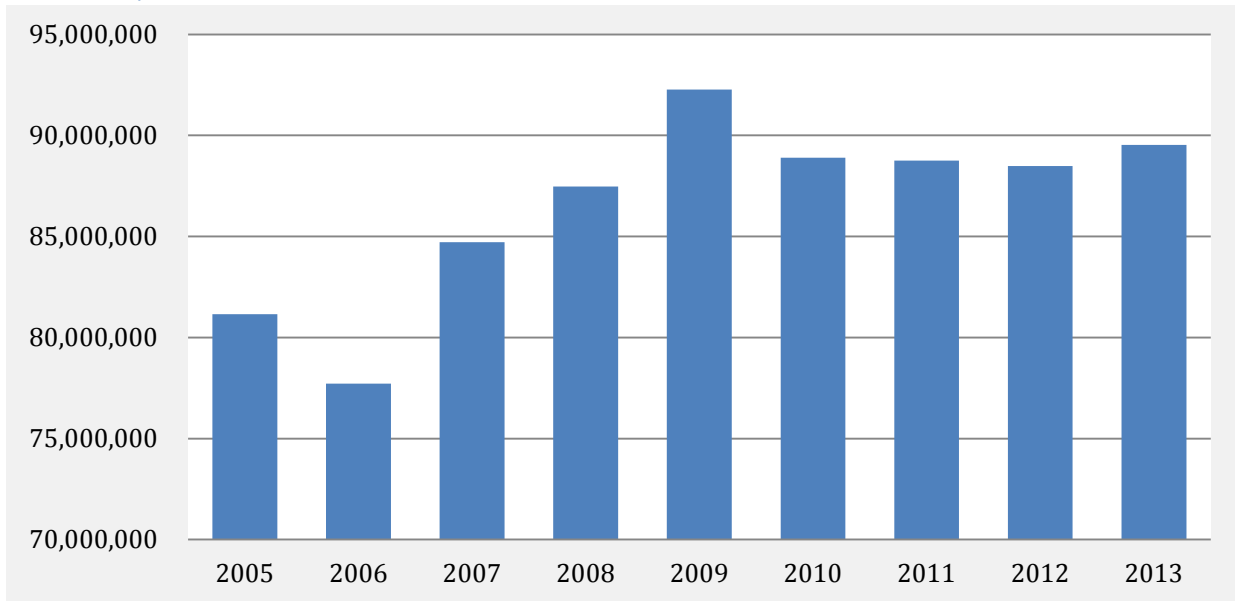
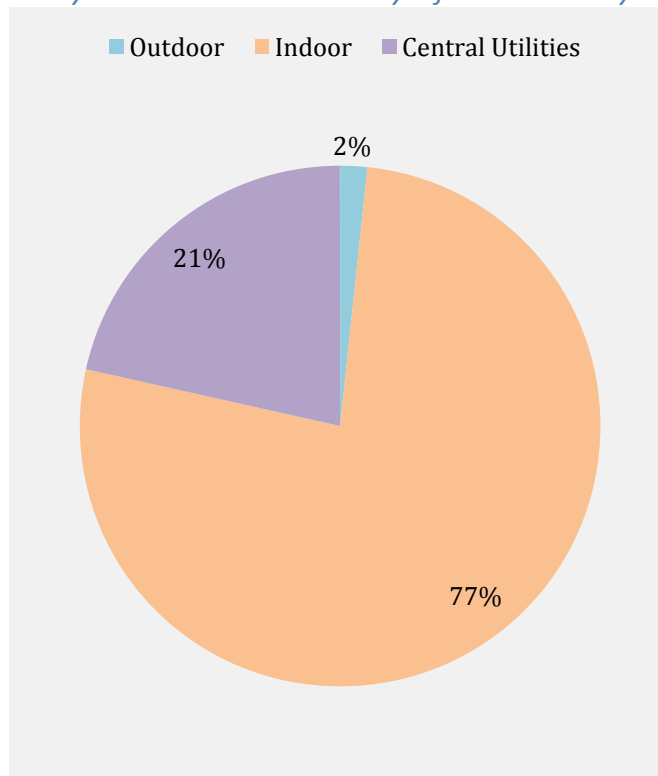


Figure 3. Electricity Use at the University of Arkansas by Category, 2013



Majority of the electricity used on campus, 77 percent, is indoors (Figure 3). Subcategory analysis suggests opportunities for electricity savings (Figures 4 and 5). The use of electricity in the academic buildings accounts for 54 percent of electricity used in all buildings and almost half, 42 percent, overall. Reducing this value by 1 percent saves

498,520 kWh of electricity, which equates to \$31,522. In regards to reducing electricity use on campus, efforts might best be focused on the athletic department, the second largest consumer of electricity on campus at 23 percent, and within the residence halls, the fourth largest consumer of electricity on campus at 14 percent (Figure 5).

Figure 4. Indoor Electricity Use at the University of Arkansas by Sub-Category, 2013

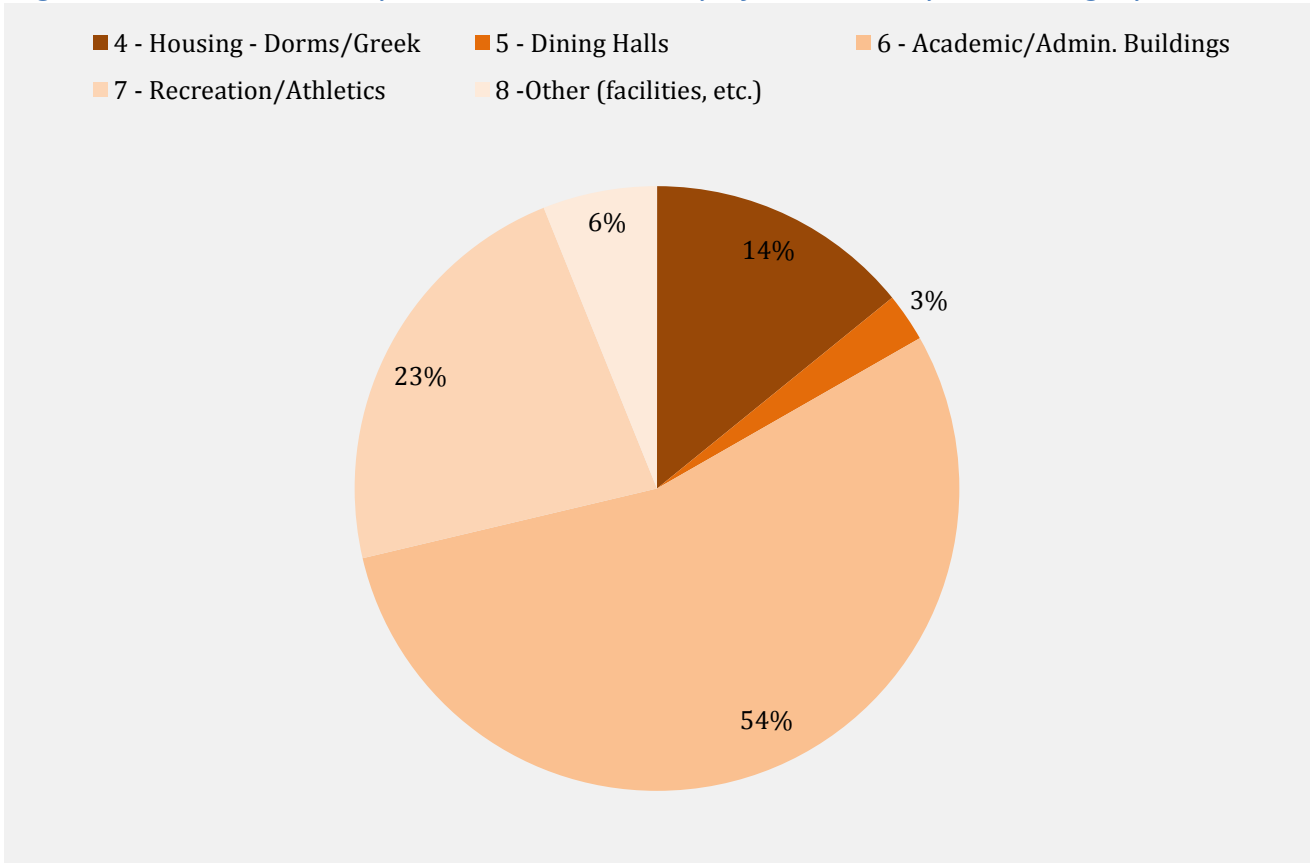
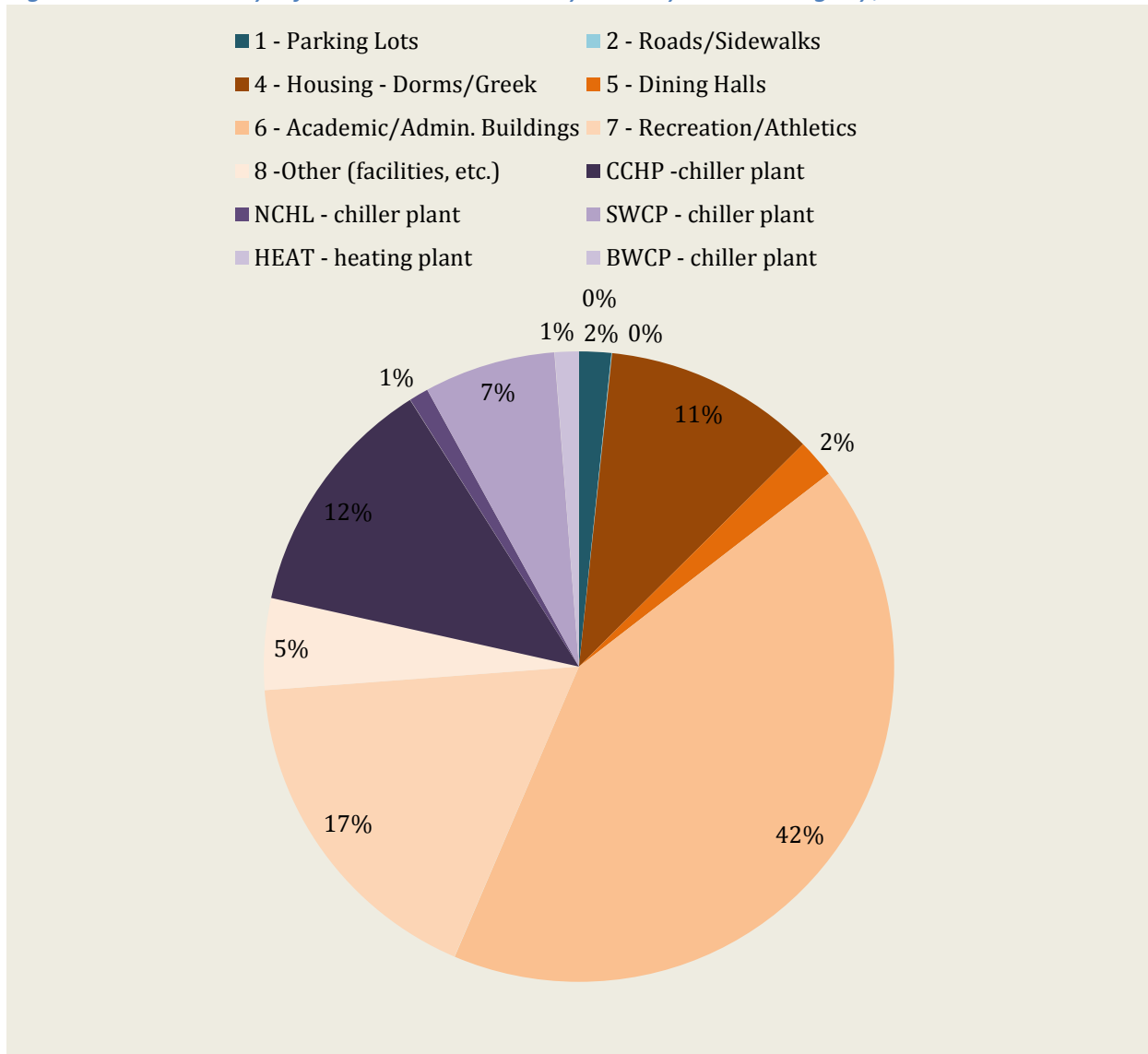


Figure 5. University of Arkansas Electricity Use by Sub-Category, 2013



Conclusion

Total annual electricity use at the University of Arkansas has been fairly consistent over the past 10 years, at approximately 120,000,000 kWh per year. In 2013, 77 percent of electricity was used indoors, of which 54 percent was used in the academic buildings (about 42 percent overall). There are many factors that may have contributed to the level of electricity use within all buildings in 2009, including various renovations throughout campus and implementation of the Energy Saving Performance Contract. The University of Arkansas currently pays \$0.069 per kilowatt hour; reducing electricity use by 10 percent could save \$750,539 annually.