

Greening ACEEE: Extending Energy Savings and Sustainability in an Office Setting

*Julia A. Edwards, Garrett Herndon, Virginia Hewitt and Sameer Kwatra,
American Council for an Energy-Efficient Economy*

ABSTRACT

This report examines the potential for energy-saving retrofits and practices that can be adopted by tenant organizations of leased commercial spaces within existing large, multitenant office buildings. The experiences of an energy efficiency organization are documented as it investigated means to increase energy savings in a space it has leased for several years. This report is written for the purpose of examining the experience of an individual organization in order to inform the actions of other tenant organizations who are looking to improve the energy efficiency of their leased office spaces. Special emphasis is placed on the tenant–building owner relationship and the prospect of improving office energy efficiency through coordination and interaction.

This report is centered on a unique case study of an organization with an already energy-savvy and efficiency focused office culture as it implemented minor energy-saving practices and behavioral programs that inform best practices and help shape behavior. The organization’s interactions and relationships related to energy efficiency improvements (both current and historic) with building owners, utilities, and building administrative staff are detailed, as well as the opportunities available for tenant organizations to influence whole-building efficiency improvements and building operations.

Introduction

The 800,000 office buildings in the United States occupy the most floor space of any commercial building type and consume 17% of the total energy of the commercial buildings sector (EIA 2003). While the potential to save energy from office buildings is enormous, there are also significant barriers. Almost 50% of all non–government-owned buildings are not owner occupied. This creates the problem of split incentives (EIA 2003). About 90% of the office buildings have fewer than 50 workers (EIA 2003). Small organizations and small offices in general have limited capital to invest in efficiency improvements. In this paper, we explore the journey of a very typical small organization on a quest to make its offices more efficient and environment friendly in the face of these challenges. We hope that, however modest, the successes from this case study will encourage other organizations to seriously consider similar efforts and collectively make an impact on reducing our environmental footprint.

The American Council for an Energy-Efficient Economy (ACEEE) is a small, nonprofit organization based in Washington, D.C., consisting of less than 50 staff. The core mission of the organization is to advance energy efficiency policies, programs, technologies, investments, and behaviors through research and engagement with policymakers, private businesses, and the public. Since 1980, ACEEE has actively promoted the adoption of energy-efficient measures on a broad scale and typically held itself, as an organization, to the same, or higher, standards. However, members of the organization have consistently envisioned ways in which ACEEE could go the extra mile in terms of increasing the efficiency and sustainability of its organizational practices to add weight to the core tenets of the organization, as well as to serve as

a model for other similarly situated and sized organizations. It is the process of acting on this vision that the paper relates, with a focus on accomplishing the following three tasks:

1. ACEEE will "walk the walk as well as talk the talk." We have written about offices with "green teams" trying to reduce their carbon footprint. Now, we will join them and gain firsthand experience. ACEEE staff will be asked to engage in actions themselves and be given opportunities to reflect on what it means to implement energy efficiency.
2. It will prove to be a valuable learning experience for ACEEE employees to engage in the same activities and changes that they are proposing in their research and outreach.
3. It will provide a thoughtful experiment in workplace engagement, a research area of interest to ACEEE.

This is an outreach and action project that will engage ACEEE employees in energy-efficient and sustainable actions in the ACEEE workplace. It seeks to apply research, leadership, and organizational skills to reduce energy use and waste in our office. Our action plan uses a green-team model to lead the research and outreach efforts in the office, and includes initiatives under three categories: energy conservation, waste reduction, and sustainable procurement.

In each of these areas, the green team will target defined actions and apply research, education, recognition, and (where appropriate) internal policy advocacy. Work at each step will be documented and outcomes will be estimated and measured for effectiveness. While ACEEE staff are more likely to be "above average" in terms of completing energy-conserving and waste-reducing actions, this paper seeks to raise the bar and recognition, encourage new actions, and challenge staff to reflect on what this type of change entails.

Background

ACEEE's Office Locations

1001 Connecticut Avenue, N.W., Washington, D.C. By way of some history, for over 20 years, ACEEE's offices were located in this 12-story, 155,214-square-foot office and retail building at the corner of 17th and K Streets in the heart of Washington, D.C.'s central business district. The building sits directly above the Farragut North Metro rail station, D.C.'s Metro red line, providing direct access to over 25,000 riders per day, or over 500,000 riders monthly.

The building, erected in 1953, has windows made of single-glazed, clear glass with aluminum frames. Most exterior office windows operate with a horizontal hinged pane per window set. The heating, ventilating, and air-conditioning (HVAC) system at this location is a two-pipe boiler/chiller system with unit ventilators beneath each set of windows, meaning that the entire building (all orientations, all floors) had to be either in cooling mode and therefore served by the chiller(s) or in heating mode and served by an oil-fired boiler. Oftentimes, there was inadequate air-conditioning (AC) for interior zones. ACEEE tried at least twice to compensate with a small split system unit to serve a conference room and IT area. Installers were unable to make these systems work; the vertical distance from our offices to the roof-mounted condenser made cold operation and refrigerant management beyond their capabilities.

In 2001, this location completed common-area renovations that included:

- A new entrance and lobby

- New retail signage to enhance the presence of the building
- New common areas
- Renovations to the elevator cabs. Prior to these elevator renovations, the building was using obsolete technology: electromechanical relays controlling the AC motor, a DC generator, and a DC geared traction motor. The motor-generators were replaced when the building cut over to microprocessor controls.

Over the course of time, ACEEE’s staff size grew from a 1-man office to a staff of 37, all working in an area of just over 5,184 rentable square feet (RSF). Even with the acquisition of additional office space, accommodating a staff of this size was becoming untenable at this location. Renovations were needed in our existing space, but in-place renovations would have proven difficult.

529 14th Street, N.W., Washington, D.C. In 2008, ACEEE found itself “walking the walk as well as talking the talk” when it relocated its burgeoning staff and offices to the National Press Building (NPB) a 14-story, 494,196-square-foot office and retail building located at 529 14th Street, N.W., within two blocks to the Metro Center metro station, which sees nearly 30,000 riders per day.¹

In addition to simply needing more space, several considerations went into choosing ACEEE’s new location, the primary one being its proximity and access to Metro’s rail system. Additionally, in selecting office space at the NPB, ACEEE benefited from renovations that incorporated triple-glazed windows, a new four-pipe heating and cooling system with a non-chlorofluorocarbon chiller, and a modern electrical and plumbing system, including compliance with American Society of Heating, Refrigerating, and Air-Conditioning Engineers Standard 62 (indoor air quality) through a) the installation and balance of new outside-air rooftop units above each mechanical riser to condition and increase outside-air quantities throughout the building, and b) the installation and balance of new return-air ductwork on all floors to improve airflow and quantity throughout tenant space.

Further, moving into a new location provided ACEEE with an opportunity to build out its offices with energy efficiency–minded considerations. The actual build-out of the 10,536 RSF that was to become ACEEE’s new space was led by a team of individuals who had ACEEE’s mission at heart and incorporated many energy-efficient components into the design. These included:

- Energy-efficient lighting and occupancy sensors with about 30% energy savings relative to prevailing building codes (we’re at about 0.65 connected watts [W] per square foot)
- Use of sidelights and clerestory windows on the perimeter offices to optimize daylight penetration throughout the suite
- ENERGY STAR[®] appliances in the kitchen
- Carpeting that contains recycled content and is recyclable at the end of its life, with other floor areas utilizing linoleum, not vinyl-based products.
- Zero VOC (volatile organic compounds) paint
- Acoustic ceiling tiles with a minimum 40% recycled content

¹ http://www.wmata.com/pdfs/planning/FY12_Historical_Ridership_By_Station.pdf

The lighting system includes suspended lighting fixtures using “super T8” lamps and ballasts, with ballasts tuned to each room’s lighting needs, T5 recessed indirect lighting fixtures, and LED desk lamps (using 3 or 6 W).

The architects designed ACEEE’s new space to create strong impressions through form, light, and color. The primary architect was Leadership in Energy and Environmental Design (LEED)–certified and the construction firm had issued a challenge to all of its project managers to be LEED certified by year-end. Our commercial real estate firm provided the means to navigate the entire process of this build-out and ensure that all decisions were environmentally sound and energy efficient. ACEEE’s staff provided many design suggestions and used this project as an opportunity to pass on energy efficiency knowledge to the design team.

The National Press Building

The National Press Building was built in 1928 and underwent major renovations in 1985 and 2007. In speaking with the building’s engineers, we learned that some of its challenges regarding energy savings are related to the building’s need to run continuously—it does not shut down. As a result of this, the NPB is not LEED certified; a majority of the tenants are news organizations requiring 24-7/365 operations. Managing energy consumption under such circumstances is a tricky task. However, the NPB has reduced energy consumption throughout the building through the following measures:

1. Reducing the amount of fuel oil used for heating of the closed-loop hot-water system, which in turn reduces the carbon footprint of the property (cleaner-burning natural gas is used)
2. Installing frequency drive booster pumps on the domestic water system to reduce electrical consumption during low-occupancy times at the property (i.e., evenings, weekends, and holidays)
3. Replacing all T12 fluorescent lighting with more-efficient T8 fluorescent lighting to reduce electrical consumption throughout the property
4. Replacing incandescent lights with compact fluorescent lights to reduce electrical consumption throughout the property
5. Installing motion sensor lighting on all new space build-outs to reduce electrical consumption when not occupied
6. Installing motion-sensing stairwell lighting to reduce electrical consumption when stairwells are not occupied
7. Monitoring energy usage to create a profile and adjust where needed to achieve energy savings
8. Installing frequency drive cooling tower fans, reducing the amount of electrical consumption needed for cooling

The NPB has earned the U.S. Environmental Protection Agency ENERGY STAR rating, the national symbol for superior energy efficiency and environmental protection, in recognition of the building management’s energy efficiency efforts. In general, commercial buildings that earn the ENERGY STAR rating use an average of 35% less energy than typical buildings and also release less carbon dioxide into the atmosphere. QDC Property Management, Inc., improved the energy performance at the NPB by managing energy strategically throughout the property.

The tying in of rooftop units to the energy management system and the replacement of a majority of incandescent lighting with energy-efficient florescent fixtures in public areas were key components in achieving this designation.

QDC Property Management, Inc., recognizes that achieving the ENERGY STAR rating is only possible by partnering with their tenants, vendors, and contractors in order to ensure continued implementation of energy efficiency operating policies and practices.

ACEEE's Lease

ACEEE is in a gross commercial lease arrangement with the owners of the NPB, meaning the landlord pays for the building's property taxes, insurance, and maintenance. In this type of relationship, because building owners pay energy expenses, tenants have little incentive to save energy in their leased spaces. ACEEE's challenge is looking for ways to reduce energy consumption throughout the office while recognizing that there is little funding available for capital improvement.

Methodology

Several steps were taken in the implementation of these measures. In recent months, ACEEE management had started to send the message that ACEEE should do what it could to be more energy efficient within its own office space. At a recent all-staff strategic planning meeting, one of the strategies identified was the greening of ACEEE's office. Having this included in the organization's strategic implementation plan was a major achievement.

ACEEE created a green team whose members represented a cross-section of ACEEE's organization. Members' interests and expertise include buildings, policy, and operational knowledge.

In addition to a strategic alignment and the formation of a green team, this team conducted two baseline measurements that focused on "green" practices and attitudes among ACEEE staff.

1. Sustainability survey
2. An office walk-through with power meters to determine power load

Findings

Survey results. The survey, consisting of 14 questions, focused on three key energy-efficient and sustainable activities in the workplace, including (1) power management (Figure 1), (2) commuter choices (Figure 2), and (3) waste reduction (Figure 3). A sample of those results is included here and represents the low-hanging fruit that can be easily addressed.

In Figure 1, the numbers reflect a potential for energy savings through power management. Currently, when staff leave the office during the day for a meeting, approximately 70% leave their computers "as is" or have power settings defaulted to "sleep" mode. In comparison, when staff leave for the day, almost 70% shut down their computers, while over 30% simply leave their computers to the default power management settings in the control panel. Through messaging and power management, these 30% could easily be encouraged to shut down at night. Making a recommendation for a power management setting throughout the organization will have a significant impact on energy savings.

Q1 In what state do you leave your computer when heading:

Answered: 43 Skipped: 1

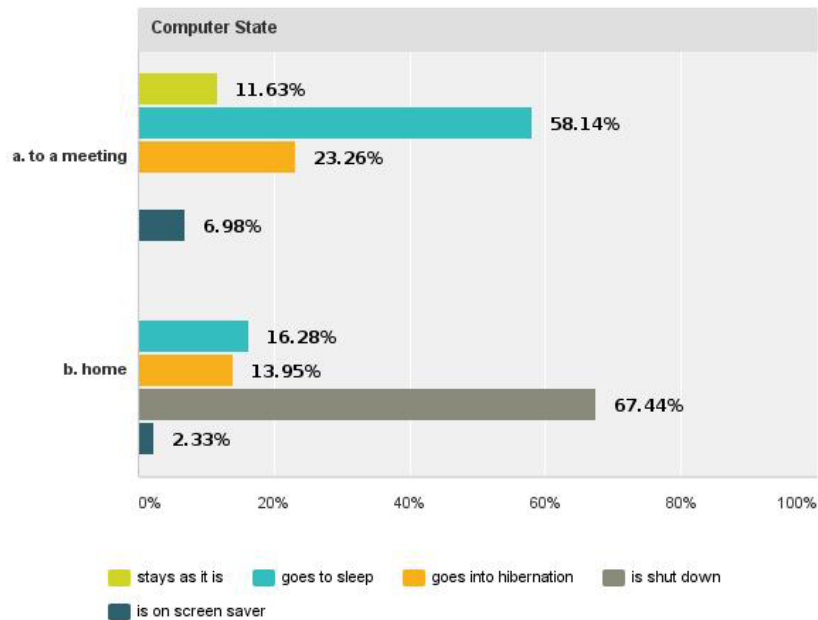


Figure 1. Power management.

The commuting trends of ACEEE staff, reflected in Figure 2, far exceed the trend in the Washington, D.C., area. According to a recently released U.S. Census Bureau report,² among the 306,336 workers in Washington, D.C., 12.1% walked, 3.1% biked, 37.8% took public transportation, and 4.9% worked at home. Compare this to the over 75% of ACEEE staff that take advantage of Washington’s Metrorail system alone! Several factors lend themselves to the high percentage of ACEEE’s commuter preferences, including several transit-related benefits ACEEE offers to D.C. staff (WMATA SmartBenefits,³ Capital Bikeshare,⁴ and Commuter Check Vouchers⁵ for bicyclists), the ease of accessibility of these myriad transportation options, and an eco-minded organization.

² <http://www.prnewswire.com/news-releases/census-bureau-reports-31-percent-of-workers-commute-by-bike-in-washington-dc-258929841.html>

³ http://www.wmata.com/business/employer_fare_program/

⁴ <http://www.capitalbikeshare.com/partners>

⁵ <http://commuterbenefits.com/employers/products/>

Q8 Please choose the two most frequently employed methods of transportation for your home-work-home commute.

Answered: 41 Skipped: 3

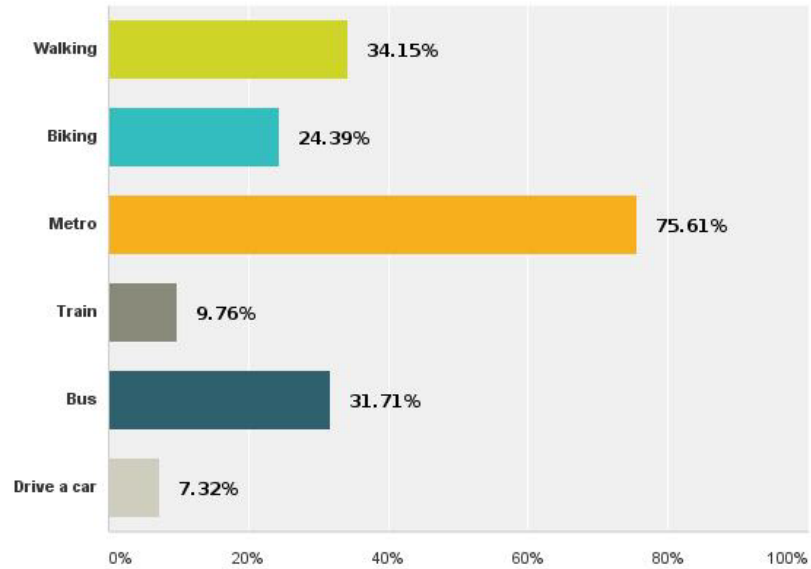


Figure 2. Commuter choices.

In Figure 3, the question of recycling, one aspect of waste reduction, is considered. In order to ensure compliance with commercial recycling regulations (DC § Code 8-1001⁶) within Washington, D.C., the NPB requires its tenants to recycle.

Q13 What do you see as the biggest barrier to your recycling habits?

Answered: 17 Skipped: 27

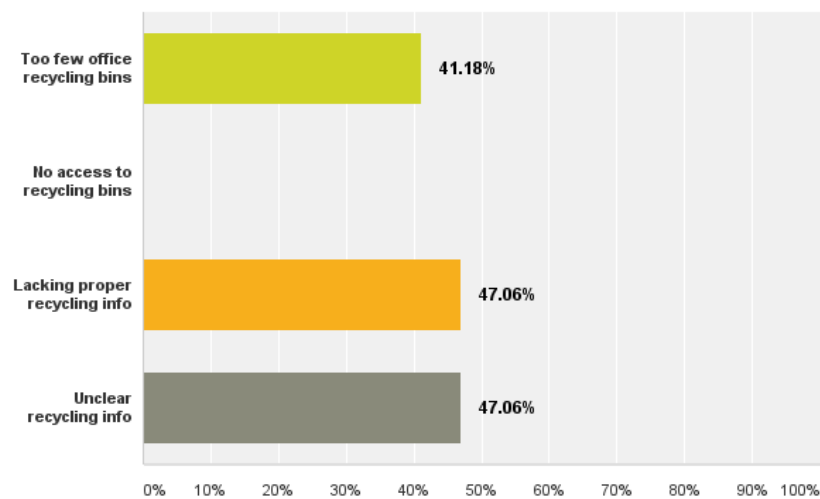


Figure 3. Waste reduction.

⁶ <http://dcode.org/simple/sections/8-1001.html>

The NPB deploys source separation using a bin system, in which recyclable materials are separated from solid waste and placed in separate, labeled containers. Mandatory recyclable materials are defined as paper products; aluminum, steel, and tin cans; brown, green, and clear glass bottles and jars; corrugated cardboard; and narrow-necked plastic bottles. These items must be separated and containerized independently of other solid waste. ACEEE participates in this recycling program by placing personal recycling boxes at each desk, which are then emptied into a larger, centrally located collection container. Additionally, glass jars, plastic bottles, and metal and tin cans are placed in their own comingled collection containers. This is an effort that will benefit from staff education and better messaging.

Power load measurements. To date, we have been able to measure the power load on five devices and have extrapolated from these baseline load measurements as shown in Figure 4.

Type of device	# installed	Baseline		New	
		Power settings	Average power consumption (kWh/year)	Power settings	Average power consumption (kWh/year)
Printer	9	PowerSave time 30 minutes	1605.4	PowerSave time 1 minute	
MFD	1	Low power mode 15 minutes, sleep mode setting 20 minute, power save setting low power	693.9	Low power mode 2 minutes, sleep mode setting 2 minutes, power save setting sleep	
All-in-one computers	11	Balanced or equivalent	833.4	Low power mode 2 minutes, sleep mode setting 15 minutes, power save setting sleep	
Computer	37	Balanced or equivalent	2475.3	Power saver or equivalent	
Total	58.0		5608.0		0
				Energy Savings (kWh/year)	5608.0

Figure 4. Power load analysis.

We will comment on the data at a later date, once post-baseline data can be gathered. However, the multifunction device (MFD), a Konica Minolta copier, consumes more power than any of the other printers. And while the all-in-one computers draw more energy than the standalone computers, their energy draw includes the monitors' power.

Greening measures. Through the implementation of best practices, ACEEE hopes to improve the workplace behaviors and attitudes of the staff with regard to all aspects of sustainability, including energy efficiency, transportation, waste reduction, and sustainable procurement. The following table describes measures in each of these categories as well as actions that have either been taken by ACEEE or can be taken and are easily modified through messaging and education.

Table 1. Greening measures

Energy Efficiency	
	Measures
	Occupancy sensors —While efforts were made to set the timers to a lower setting, staff did not respond well to lights turning off more frequently. Note: Some staff have opted to turn lights off altogether during the day, using instead ambient lighting.
	Turning off common-area lights —Through messaging; staff will turn off common-area lights. In reference to custodial staff, it is important to communicate with building management to

Energy Efficiency	
	Measures
	express the organization’s desire that all lights (except emergency lighting) be turned off when the cleaning crew leaves the suite.
	Turning off office lights at night —Through messaging; staff will turn off any lighting as they leave the office.
	Computer power management —See analysis above.
	Power strips —Either timer equipped or current sensing
	Other plug loads —Reduce; use power strips.
	Copier —Establish power management settings; turn off at night.
Server room —Establish acceptable temperature settings.	
Transportation	
	Measure
	Commuting —Analyze commuting habits of local staff and suggest options.
Waste Reduction	
	Measures
	Recycling, including batteries —Through messaging and education
	Paper —Make duplex printing the default; identify sources of “orphan print jobs.”
	Plastic bags —Create a common stock; deploy a “bag dispenser” for easy access and organization.
	Lunch containers —Carry personal containers to coffee shops or take-out establishments.
Sustainable Procurement	
	Measures
	Kitchen cleaning supplies (hand soap, dish soap, dishwasher detergent, sponges)—Switch to eco-friendly/biodegradable.
	Kitchen paper supplies (paper towels, napkins)—Switch to rags (recycled/recyclable).
	Office furniture —Encourage Forest Stewardship Council certification or equivalent.
	Catered meals —Minimize waste (e.g., request no need for utensils, napkins, etc.).

Recommendations

A major take-away of this paper is that even small organizations can make a difference. Have management begin by articulating the strategic importance of energy efficiency within the office and by establishing a green team. The green team can then identify no-cost/low-cost

measures that look at green practices and staff behavior. Through messaging and education, tenants in a tenant–landlord relationship can improve energy efficiency in their leased office spaces.

Another important role for the green team is to open a channel of communication with the building management. Ask building management what energy efficiency measures are in place or are anticipated in the near future. What is being done to reduce energy consumption in the building? What challenges does the building face in terms of energy savings? Using your energy efficiency knowledge, work with the management of the building to implement energy efficiency operating policies and best practices.

Be sure to engage the administrative side of the organization. Check with the individual who orders your supplies. Consider all consumable items: Are they eco-friendly? Sources for eco-friendly products are bountiful. Changing vendors does not mean forfeiting quality or increased prices. And last but not least, have the human resources department include the sustainability best practices of the organization in the new-hire orientation session.

Conclusion

To date, ACEEE has identified several greening measures that will continue to be modified and monitored to look for energy savings as well as opportunities to change staff behavior and attitudes. While ACEEE is already engaging in many of the greening measures identified (purchasing eco-friendly consumables, commuting to and from work, monitoring power loads), work needs to continue on educating staff on the importance of being good stewards of energy use and products in our office. Through messaging and education, it is expected that this will become second nature to all individuals.

References

EIA (Energy Information Administration). 2003. U.S. Energy Information Administration Commercial Building Energy Consumption Survey 2003. EIA. Washington, DC.