A $3 Billion Opportunity: Energy Management in Retail Operations

by Meriah Jamieson

Executive summary

Retail buildings consume $20 billion in energy each year. If retailers are able to harness the energy efficiencies available by leveraging existing technologies, this consumption could be reduced by $3 billion a year. This paper reviews retail building energy management opportunities, examines applicability of energy management best practices to multiple retail environments, and shares brief examples of retailers who achieved their energy management goals.

Acknowledgment:

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Schneider Electric

Introduction

Approximately 657,000 retail buildings (stand-alone facilities, strip malls, and enclosed malls) in the US consume more than $20 billion of energy each year[1]. A huge potential exists to reduce this energy consumption and save on operational costs. Energy savings from energy management initiatives can be as low as 1% for occupant sensors and as high as 30% or more for comprehensive lighting upgrades. Actual savings available vary by site and depend upon the initiatives already deployed, the characteristics of the building, and the retailer's level of buildings operational control.

This paper analyzes average energy load profiles of food and non-food retail environments and provides insight into which aspects of energy management are easiest to implement and which offer the greatest cost savings. Outside factors affecting energy prices are discussed to ensure risk mitigation is considered as a factor when developing an energy managment plan.

The energy opportunity

A study by the US Department of Energy's Pacific Northwest National Laboratory estimates that a reasonable range of energy savings potential in existing commercial buildings is between 10 and 20%.[2] The The Unitied States Environmental Protection Agency report "Sector Collaborative on Energy Efficiency Accomplishments and Next Steps" has identified energy savings potential up to 21% for supermarkets and up to 41% for retail stores[3] Based on the retail industry's $20 billion spend on energy a year, a 15% potential energy reduction represents a $3 billion dollar opportunity to reduce costs.

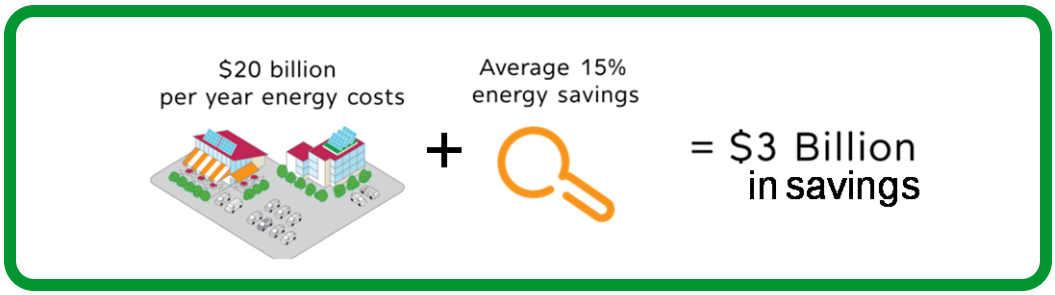

Figure 1
US Retail Industry savings opportunity

A lighting upgrade from T8s (fluorescent light bulbs) to light-emitting diode (LED) lights, for example can pay for itself in less than three years—and can result in a 30% reduction in energy consumption. The effect of this size of reduction in operating costs has a significant impact on retailer profits. A retailer's typical energy costs are 5.5% of operating costs. Most retailers operate at a 4% profit margin. A15% reduction in energy consumption will increase profit margin from 4 to 4.75%, which represents an 18.7% increase.

Factors impacting retail energy budgets

Energy is the second highest retailer operating expense[4]. Food and non-food retailers have different energy consumption profiles, mainly due to the use of refrigeration. Of their total energy consumption, **food retailers** consume 82% electricity and 18% natural gas/other fuels; their average consumption per square foot is 51.3 kWh ft².[5] Because of the refrigeration and HVAC needs, food retailers consume three times as much energy per square foot as non-food retailers. Therefore, those two systems should be the focus of energy efficiency initiatives.

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[1] Energy STAR Building Manual: Retail

[2] Energy Efficiency Potential in Existing Commercial Buildings: Review of Selected Recent Studies, PNNL

[3] EPA: Sector Collaborative on Energy Efficiency Accomplishments and Next Steps, B27

[4] Advanced Energy Design Guide for Medium to Big Box Retail Buildings, ASHRAE

[5] Sector Collaborative on Energy Efficiency Accomplishments and Next Steps, EPA

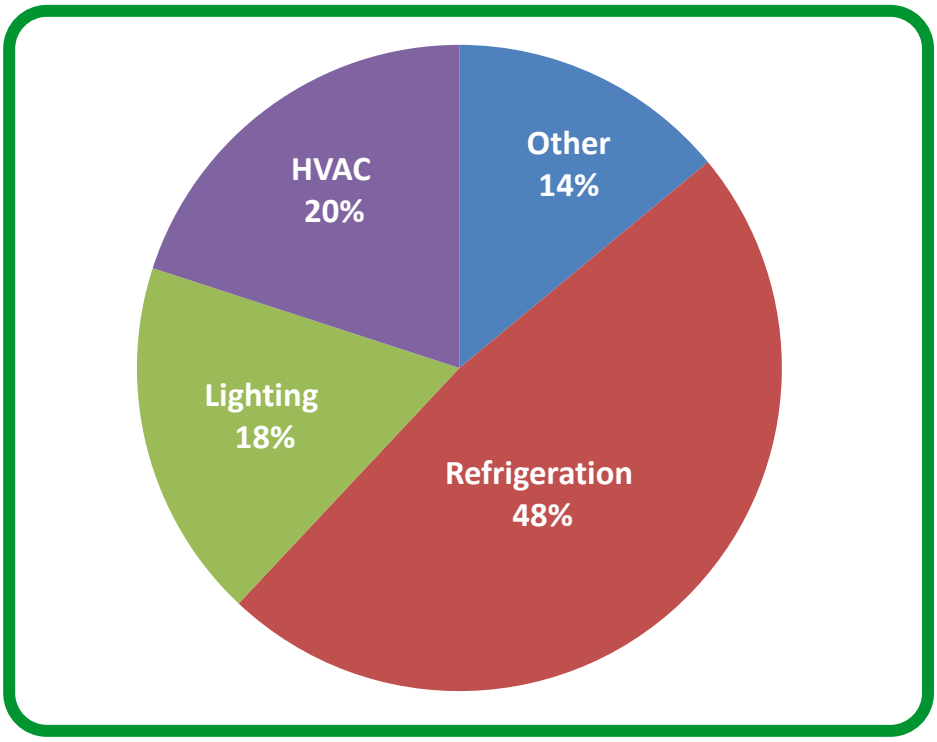

Figure 2
Average food retailer load profile based on Schneider Electric audits

Non-food retailers use 33% natural gas/other and 67% electricity, and their average consumption per square foot is 16.1 kWh ft².[6] Since lighting and then HVAC are the highest energy consuming systems in non-food retail, they should be the focus of energy programs.

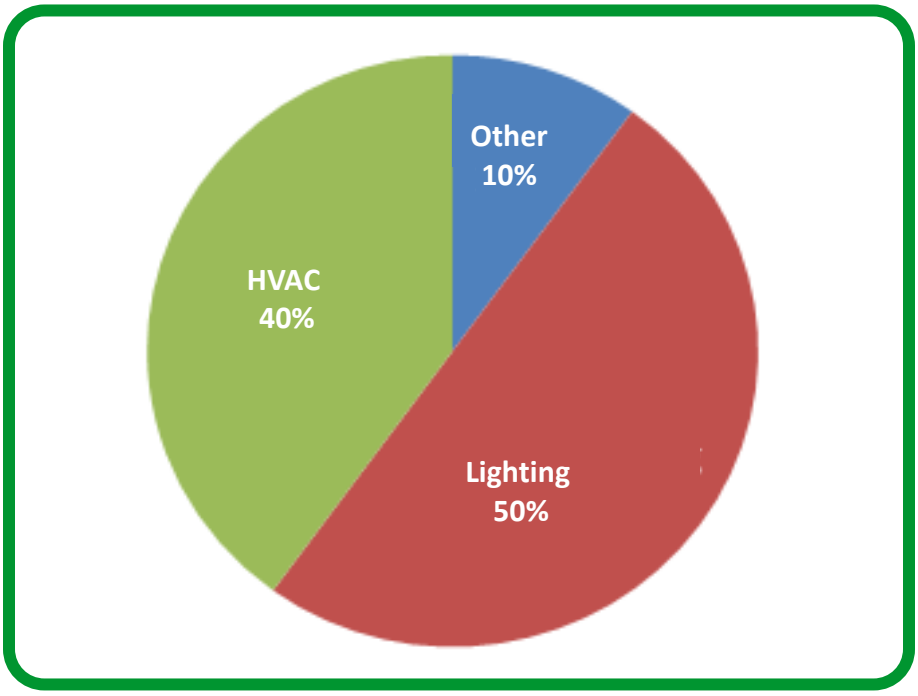

Figure 3
Average non-food retailer load profile based on Schneider Electric audits

[6] Sector Collaborative on Energy Efficiency Accomplishments and Next Steps, EPA

Global climate impact on energy cost

Climate change and extreme weather patterns impact energy usage trends, and therefore, energy budgets. As many regions across the world experience higher extremes in temperature, energy costs increase. For example, if a nation's climate warms by 1.8°F, the demand for energy used for cooling would increase by about 5-20%[7]. Increasing the energy efficiency of retail stores mitigates the risk of energy cost increases.

Since energy costs are increasing, energy efficiency projects that were evaluated in the past but put on hold due to a low return may present a more beneficial ROI in the near future. A re-evaluation should incorporate estimated energy cost increases.

Control of energy consumption reduction

"Large format stores have an energy consumption reduction potential of 20-30%."

Energy efficiency savings potential varies depending on the retailer's level of control over building infrastructure. Large format or big box stores and small format or mall stores have differing levels of control over their store's energy efficiency.

Small format stores - Of the 650,000 retail buildings in the U.S, approximately 110,000 are shopping malls or strip malls.[8] In these small format stores, control of energy consumption can be more challenging. These stores typically control the store's lighting and have some limited HVAC control, but the landlord often controls the main HVAC system. Due to limited control, the potential energy reduction of small format stores is **3-10%.**[9]

Large format stores – These sites are able to control most of their energy consumption (sometimes chillers and transformer rooms are excluded and controlled by a landlord). Because of this high level of control, the large format stores have an energy reduction potential of **20-30%,**[10] depending on what initiatives/equipment are already in place, and the age of the building.

While large format stores can apply more capital investment energy projects to reduce energy consumption, many low cost initiatives and behavioural changes that can be implemented in small format stores. Retailers operating both small and large format stores can cluster stores in order to develop a more comprehensive portfolio of energy reduction targets.

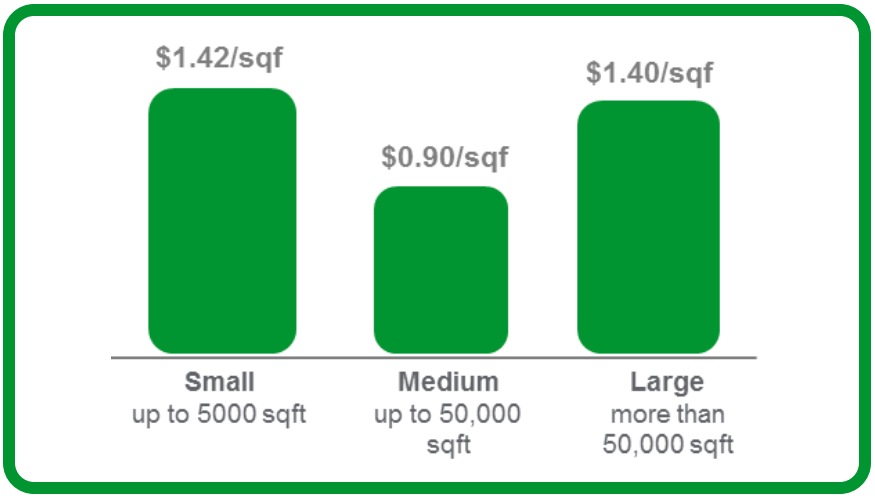

Figure 4
High energy consumption in small and big box retail facilities makes them attractive targets for energy cost reduction

[7] http://www.epa.gov/climatechange/impacts-adaptation/energy.html

[8] http://www.icsc.org/research/shopping-center-facts-and-stats

[9] Based on limited capita investment and behavior changes, Schneider Electric case studies

[10] Based on Schneider Electric case studies

Age, size, and location of buildings

Most retailers operate a diverse portfolio of buildings: warehouses, offices, small stores located in malls, larger leased stores in strip malls, heritage buildings and newly constructed buildings. Stakeholders who implement energy conservation programs often consider their entire portfolio and cluster buildings into groups by type, equipment housed, owned vs. leased space, size, or age of building.

Small buildings often have the highest per square foot energy costs.[11] The building's age is also a useful indication of energy costs, and surprisingly some of the most inefficient buildings are constructed after 1960.[12]

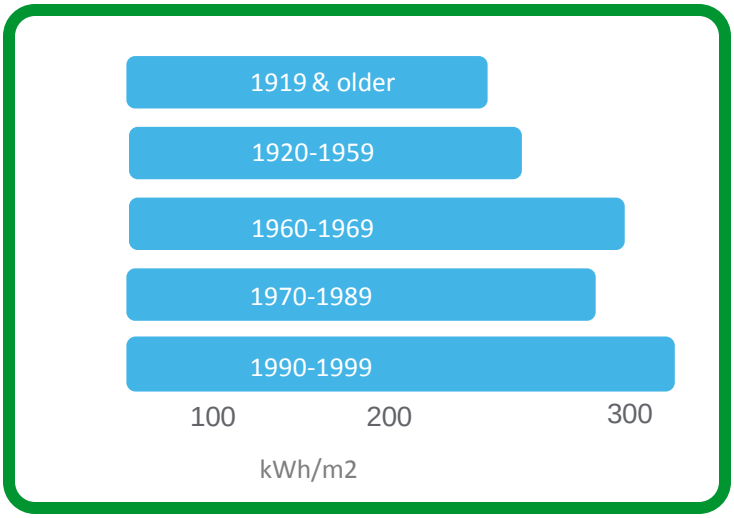

Figure 5
When consolidating a retail business building portfolio, age of the building will impact energy consumption rates

Energy consumption also varies depending geography. For example, stores in Miami consume far more electricity for cooling, but overall far less energy (including natural gas) than stores in Chicago which utilize much more gas for heating.[13]

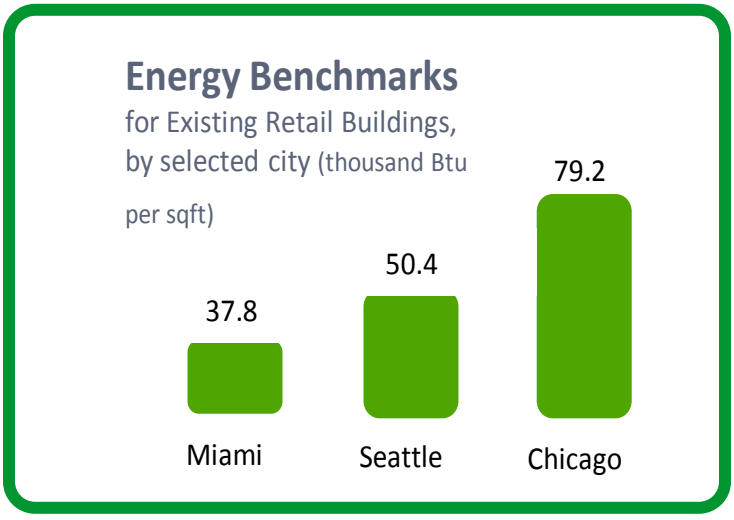

Figure 6
Location of buildings has an important impact on how much gas and electricity is consumed per site

[11] US Energy Information Administration (EIA)

[12] EIA 1999: Commercial Buildings Energy Consumption Survey (CBECS)

[13] Buildings Energy Data Book, US Department of Energy

Deployment examples

The following examples summarize some of the approaches retailers have taken in order to pursue energy cost reductions.

Retail logistics center

A retailer wanted to reduce the energy consumption of its logistics centers. The project analyzed energy usage over an area of 725,000 square feet (which included office space and 150,000 square feet of cold storage). The annual energy consumption for this space was 9 gigawatt hours (GWh), and a full 50% of this consumption was cooling for the cold storage areas. They were able to reduce their energy bill 18% by pursuing the following actions:

- Optimization of HVAC system controls
- Installation of variable speed drives
- Deployment of floating high pressure controls for refrigeration applications
- Measurement, monitoring, and benchmarking of site energy consumption

This particular energy management project resulted in a 36% decrease in energy use for cold storage without sacrificing any level of service and generated a payback within 2.1 years.

Non-food global retailer

A non-food global retailer wanted to reduce overall energy spend in one particular country with 178 stores. They drafted a strategic energy procurement plan with the goal of reducing the price they paid per kilowatt hour (kWh). After implementing their program, they were able to reduce energy costs by 15-25% per site. In order to conserve these initial savings they monitored store energy consumption using a remote energy monitoring platform. This allowed them to begin benchmarking their stores and to identify both poor performers and best practices so that gains could be replicated.

Food retailer

A large food retailer made a strategic decision to target refrigeration costs since this represented 42% of their total energy consumption. To increase efficiency they implemented a Floating Head and Low Pressure system. This system saves energy by reducing the average amperage draw and compressor run time and resulted in a savings of 14-16% on energy costs.

Conclusion

Energy management programs present a significant opportunity to reduce costs and improve the profitability of retail operations. Retail store energy consumption varies widely, and it is important to analyze the building portfolio and to account for both internal and external influences on energy prices and consumption. Statistics cited in the paper can help retailers to justify initiatives that will engage retail executive leadership and generate support for deploying enterprise-wide energy management programs.

About the author

Meriah Jamieson is a Marketing Strategy Manager at Schneider Electric, specializing in energy and sustainability management services. She graduated from British Columbia Institute of Technology and has spent 8 years working with energy management solutions. Meriah is also the author of a popular energy and sustainability blog: http://blog.schneider-electric.com/author/meriahjamieson/