

## Case Study



# Stop & Shop Supermarkets –

*LESS is more...*

## Introduction

The average American family visits the grocery store 2.2 times a week, stopping on the way home to pick up a few items or making that regular pilgrimage to stock the pantry. Chances are, the last thing they think of at the store is how much it costs to keep that container of milk, butter or of ice cream at the ideal temperature.

But behind the aisles of fresh produce, chilled meat and refrigerated coolers, the electric bills represent one of the most significant costs for the industry, where the trend is to build ever-larger super stores. And because supermarkets, operate at miniscule profit margins, savings on those bills can translate into significant improvements to the bottom line. In a typical scenario, new energy- and money-saving equipment is introduced incrementally, and total gains grow over a period of years as individual systems such as lights, building controls and freezer cases are upgraded when stores are renovated.

Faced with a 17% jump in electric rates, highly volatile natural gas markets, and with a goal of being socially responsible, New England's largest grocery chain, Stop & Shop Supermarket, chose to take a different approach. The Quincy-based company set out several years ago to design and build a pilot superstore that would use significantly less energy and be more environmentally friendly than existing facilities. The company believed that reducing energy costs could significantly improve profit margins and increase the competitiveness of its stores.



## The Project

Stop & Shop designed the new prototype to use between 25 and 30 percent less electricity than comparable designs in the region, while also including a number of earth-friendly features. The store, dubbed Low Energy Superstore (LESS), was built in Foxboro, MA; it opened November 8, 2001. The company and its parent, Netherlands' based Ahold, consider this experiment a success: It matched the initial goal by achieving a 27 percent electricity savings while successfully demonstrating building techniques that could be adapted to Ahold supermarkets globally. The reduction of energy use at the LESS, translates to an annual savings of 8,000,000 kWh and has eliminated emissions of 987 tons of carbon dioxide annually, equivalent to leaving in the ground 374 tons of coal or 650 barrels of oil each year. What's more these savings are likely to extend over the full life of the new store.

The process leading to the Low Energy Superstore began back in 1998, when the company formed a special project team bringing together representatives of Stop & Shop, sister divisions (Giant Food-MD, Albert Heijn-Netherlands, Ahold USA, Royal Ahold Netherlands, Argentina's Disco and Bompreco of Brazil), joint-venture partners, and leading suppliers of the supermarkets heating, ventilation, and cooling equipment. In the eyes of vendors such as Carrier, Carlisle, Hill-Phoenix, Luftron, Holophane, and Seasons4, this represented a unique opportunity to forge a closer relationship with a key player and establish themselves as leaders in the design of cutting-edge retail equipment. In return for their participation in this experiment, the suppliers would have access to valuable real-world data from the operation of the new store.

In 1999 the team convened a two-day brainstorming session that helped develop an ambitious list of ideas and implementation techniques for more detailed consideration. The goal was to focus on three



criteria associated with green building: Indoor environment / air quality, energy conservation/efficiency, and the reduction of waste/damage to the natural environment. The renowned Rocky Mountain Institute facilitated this “Design Integration Workshop,” and encouraged architects, engineers and consultants experienced in green building practices from across the nation to generate a list of design options for consideration. Over the next 12 months those options, including light tubes, solar panels, fuel cells, and building materials featuring a high recycled content were evaluated and refined until a number were ultimately incorporated in the design for the new Foxboro facility.

According to Steve Krupski, senior vice president of Construction and Engineering at Stop and Shop, there was strong interest in pushing the envelope with this project, by considering state-of-the-art solutions. “We wanted to try something revolutionary, which would represent a great leap forward as far as energy efficiency, while maintaining the company’s standards for providing customers with a positive shopping experience,” he said, noting that a two-day charrette in Quincy helped launch the project, with participants tossing around ideas including light tubes, solar panels, fuel cells, and building materials featuring a high recycled content.

The Stop & Shop team labored over design decisions concerning the building envelope and materials, interior and exterior lighting, the general heating and cooling systems, product refrigeration, and water usage. At each step, the group compared the current practices employed by the chain with state-of-the-art alternatives, some of which were new and relatively unproven in a retail setting. This design process continued with monthly meetings for nearly three years, until an architectural/ engineering team and a potential building site were selected. Next, the designers took the most viable suggestions and integrated them into a complete blueprint for the building and site. The team’s computer simulations, mock-ups and scale models demonstrating the benefits of day lighting and other design features were instrumental in conveying the concept to key decision makers.

Once senior management at Stop & Shop approved the design concept, the project took an exciting turn. A full-scale mock-up was created in a vacant supermarket not far from corporate headquarters.

“Management wanted proof that these concepts would result in something that was pleasing to the eye, and help cut operating costs, while enhancing sales,” Krupski explained, adding that the full-scale mock-up provided a unique opportunity for stakeholders to fully experience the visual effect of the proposed skylights and high-tech fluorescent lighting designs, with actual store shelves and produce displays. Simultaneously the company was performance testing advanced refrigeration designs proposed for LESS at the manufacturer’s test facility and at the stores other divisions’ stores located in the mid-Atlantic region.

In addition to design features to enhance the performance and comfort levels within the store, the project team also explored a number of areas outside the store. Since the Main Street location previously housed a retailer, there were already well-established patterns of vehicles accessing the site. However, the team was sensitive to adjoining residential neighborhoods, taking into consideration noise both from delivery trucks and shoppers, the visual impacts of a supermarket, storm water runoff, the process of demolishing the old building, and the impact of a lengthy construction period.

### **The Results**

Due in part to the thorough design and review process, the Foxboro Stop & Shop successfully delivered an energy savings of 30 percent over similar sized stores in the chain. Experience to date seems to support national surveys, including one by the Herhong Mahone Group, which found that retail stores with significant levels of natural light register higher sales, as people linger longer, and return more frequently than customers in more traditional establishments.

In this store, light is task oriented, with the focus on the product rather than the ceilings and floors. In addition subtle design features enable customers to easily distinguish between departments, creating a less stressful environment, encouraging them to explore the store, a benefit not lost on the chain’s marketing department.

On entering the store, customers walk through a produce area bathed in the natural light from a 40-foot long skylight with crescent-shaped diffusers that help create a warm, inviting environment. Throughout the store, they are struck by the pleasing quality of light filtering down from 48 performance-glazed skylights and sophisticated lighting systems that can fill in with artificial light in the absence of sunshine. The 5’ x 5’ skylights provide natural lighting while maintaining a thermal barrier to heat loss and gain. In addition, a 10-foot flared light funnel lined with bright white acoustical tile enhances the daylighting effect of each skylight. While the sun provides a significant portion of the light during the day, shoppers in the evening experience an equally pleasant experience: state-of-the-art sensors and controls automatically fade-in interior fixtures featuring color-balanced T-8 fluorescent bulbs.



At the risk of over simplifying, grocery store customers have relatively simple needs. They want their beer cold, their ice cream frozen and they need to see the products clearly through the doors of refrigerated cases. In a typical Stop & Shop supermarket, this is accomplished through a conventional vapor compression condensing system that compensates for changes in ambient temperatures and humidity.

By working closely with vendors, the LESS development team settled on an advanced refrigeration system that more accurately matches the specific refrigeration needs of products in different display cases while, at the same time, minimizing energy consumption. This was accomplished through small electronic

sensors installed throughout the display cases that feed critical information to controllers that precisely manage variable frequency drives and remote air-cooled condenser fan motors.

This sophisticated system also allows more flexibility in managing capacity. In medium temperature displays, more efficient evaporator coils were specified that allow compressors and other equipment to run



less frequently without compromising product quality and shelf life. Thanks to energy-saving doors and anti-sweat heaters on glass cases that hold frozen food and ice cream, electric loads were reduced by one-third. Special consideration was also given to lighting the freezer cases, where efficient lamps were mounted behind a vertical diffuser to provide even light for all shelves.

The design of the LESS also treated shoppers to more comfortable conditions as they walk the aisles, while achieving those efficiency gains, a key factor in creating a more pleasurable experience. By specifying more efficient lighting and mechanical systems that produce less waste heat, it was possible to cut in half the number of HVAC

blowers normally operated by Stop & Shop to bring fresh air into the store while also handling necessary dehumidification during all seasons. The system was developed in a dual path format that allows the outside air to be handled separately from recirculated air. The system includes controls to match fresh air intake to the needs of shoppers and workers during low occupancy periods, thus keeping customers comfortable while reducing HVAC energy consumption. .

Similar savings were realized during the cold New England winter months, as the design required fewer space heaters. Where standard company specs call for two furnaces, the advanced system for LESS allowed the engineers to use a single unit. In addition, waste heat from refrigeration units is used to preheat domestic hot water and provide direct store heating. During the cold of winter these “free” sources of heat are supplemented by a high efficiency natural-gas fired burner. The design team specified rooftop HVAC equipment by Carrier that was upgraded to a higher efficiency, resulting in a 30 percent decrease in electricity consumption for this critical end use.

The savings are not limited to the store’s interior. In the parking, lot Stop & Shop installed 20-foot light poles with three 150-watt holophane fixtures to provide customers with a uniform light that limits spillage towards adjoining homes. Normally retail parking lots feature 400-watt fixtures on a 25-30 foot pole, and this one change alone should result in an energy reduction of approximately 58 percent, when compared to a typical Stop & Shop parking lot.

Through its collaboration with the Rocky Mountain Institute, and other national experts, the project team took a more holistic approach to the entire building process, considering materials use, waste disposal and water consumption, in addition to energy consumption. There is an environmental cost associated with every aspect of the structure, from cement, lumber and metal studs, plumbing and wiring, to insulation, flooring and paints. For example, in today’s global market these materials and products are often shipped long distances, generating more greenhouse gases. Stop & Shop decided to adopt a series of environmental procedures in the design specifications, integrating goals of the U.S. Green Building Council’s LEED rating system into the process. These goals included using local sources whenever possible, purchasing products that include recycled-content, and avoiding toxic chemicals.

The project team was also committed to providing extra protection to the area around the Main Street construction site, including preventing environmental pollution to the immediate site and adjoining areas

during construction as well as after the store was in operation. For instance, landscapers oversaw the movement and handling of topsoil, and carefully identified existing trees for protection and preservation during construction. This simple step eliminated the need to bring in non-native species that would require frequent watering. After the builders were done, the grounds crews worked to create a site that would frame the facility. This helped to reduce both noise and traffic to the adjoining residential neighborhood, while at the same time reducing future maintenance costs.

A sophisticated water management system was created to collect and filter runoff. Once processed it was allowed to help recharge the local water table, instead of being released into local storm drains. An on-site well serves the landscape irrigation system, reducing the demand that Stop & Shop places on Foxboro's water supply system, an important factor in helping to avoid municipal restrictions on water use during the warm, dry summers of Southeastern Massachusetts. Similar conservation measures were implemented indoors as well, where the men's restrooms include waterless urinals and non-toxic cleaners.

Although few people ever get to see the roof of their supermarket, the LESS team was sensitive to the heat island effect of a large expanse of dark surface<sup>1</sup>. The Foxboro store is sheathed in a white roofing membrane with an aged R-value of 19.6, resulting in less heat gain and reduced HVAC cooling load in the summer. This product has a secondary environmental benefit as well, since it is manufactured without the use of chlorine chemicals or plasticizers.

The designers kept an eye on the future as well. While renewables power failed to make the cut into this design, the building was hard wired so that, sometime in the future, photovoltaics, which convert sunlight into electricity, could be integrated into a pair of awnings near the front entrance.

Throughout the project, a team from Stop & Shop worked closely with the architects and engineers to assure that their goals were being met at every step. In some cases this meant providing training to contractors working the site, according to Steve Krupski, who said many of the carpenters, masons, and plumbers needed to understand why this project was so different from those they had worked on in the past.

“We needed to explain the need to reduce construction waste, for instance, and why we choose a wheat/strawboard substrate for casework and display signs, instead of particle board,” he explained. “It was important to talk about why low VOC-paints are beneficial on a site frequented by hundreds of tradesmen.”

The design team also had to convince workers accustomed to certain traditions to think outside the box in working with a cement-based siding product. It was chosen because it would “stand up to the extremes of New England's weather while eliminating the need to cut down cedar trees for the traditional look of our stores,” Krupski said, adding that “this project represented, for many of them, a completely different way of looking at building construction”.



<sup>1</sup> Dr. J. Marshall Shepard and colleagues at NASA's Goddard Space Flight Center, in 2002 found that urban areas with high concentrations of buildings, roads and other artificial surfaces retain heat, leading to warmer surrounding temperatures, and create urban-heat islands. This increased heat may actually promote rising air and alter the weather creating more summer rains in and around cities. (source - Goddard Space Flight Center , <http://www.gsfc.nasa.gov/topstory/20020613urbanrain.html>, June 18, 2002).

The project included building commissioning and monitoring and evaluation elements of the LEED program, to help to ensure that the energy performance by refrigeration, cooling, and lighting equipment lived up to their manufacturer's claims. The local utility, Massachusetts Electric, another stakeholder in the process, hired an independent commissioning agent to monitor the work and to verify performance of the building's various mechanical and electrical systems. An additional consultant was also retained to oversee the balance of systems not covered by the utility.

## **Lessons Learned**

Stop & Shop adopted a holistic approach to store planning for their new Foxboro location. By bringing together people involved in the design, construction, and operation early in the process, the company was able to choose from a much wider range of design options than was typical for its stores. This early design and evaluation process enabled the company to become comfortable with a number of innovations and to integrate the best of these into the building and site. As a result, the LESS incorporates:

- Natural lighting through banks of sky lights
- Low VOC paint on displays
- Anti-fogging glass in cooler cases,
- Water conservation indoors and rain water management and drought tolerant plantings outside super-efficient chiller systems

Together these innovations created a more pleasant shopping environment for consumers, saved money for the corporation, and made it easier for local officials to approve the project. To date, 15 Stop & Shop stores have benefited from the project, with more in the planning and construction stages.

### *Innovations Increased the Capital Cost but decreased Operating Costs*

Stop & Shop estimates that the process added \$500,000 to the cost of opening the Foxboro store, but they expect to make that up through energy savings within several years. The early projections were enough to convince management all the way up to the parent company in Europe that all the ingredients were present to achieve success.

### *Innovations Becoming Standard Procedure*

Many of the features debuted in the LESS, such as skylights, automatic dimmers that "read" natural light, chillers/compressors, energy efficient cooler doors, reduced reliance on fluorescents, and reflectors are becoming standard in both renovations and new construction within the company. As a result, the investment in time and money in LESS will not just payoff in the Foxboro store itself, but in other stores as they are renovated or constructed. The company also expects the new technologies adopted in LESS to become more and more cost effective as demand increases across the supermarket industry.



## Company Profile

Growing from a single corner grocer to a chain of more than 335 stores throughout New England, New York and New Jersey, Stop & Shop has offered its customers the best selection, quality and value for more than 85 years.

In 1914, the Rabinovitz family founded the Economy Grocery Stores Company in Somerville, MA. Four years later, family member Sidney Rabb introduced a idea new to retail – the self-service, modern supermarket. His novel idea caught on, allowing the company to rapidly expand the number of its stores. In 1946, the company officially became known as Stop & Shop, Inc. and sales climbed to \$42.5 million. Stop & Shop is currently a multibillion-dollar corporation and the largest food retailer in New England. A division of Ahold USA, the firm is owned by parent company Royal Ahold, which is based in Zaandam, The Netherlands. Stop & Shop employs more than 57,000 associates in its network of more than 335 stores, distribution centers, manufacturing plants and offices, which stretch across more than 180 communities in Connecticut, Massachusetts, New York, New Jersey and Rhode Island.

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### CLEAN AIR - COOL PLANET CASE STUDY RATING

This case study reduces CO2 emissions equivalent to the following:

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Avoiding the consumption of five (5) barrels of oil per day.



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Or taking 78.74 vehicles off the road for one year. (1 car = 10 cars)



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Assumptions: 1,093 lbs of CO2 per barrel of oil. Vehicles are average passenger cars (approximately 20 lbs CO2 per gallon of gasoline @ 22.5 miles per gallon, averaging 16,000 miles per year)