The focus on cost reduction has continued, leading the company to research and implement a variety of energy-saving strategies. The company has emerged as an example in reducing energy use in cold storage facilities.

Four Seasons moved into a 25,000 ft² warehouse in 1986 and moved into its current distribution center in 2004, which includes nearly 200,000 ft² of cold storage space. It started new initiatives to improve energy efficiency and sustainability in 2006, and realized significant savings:

• 1.4 million in annual kWh savings from 2006 to 2009;
• Annual energy cost savings of more than $150,000, a 22% reduction, from 2005 to 2009;
• Avoidance of 2,400 tons of CO₂ emissions annually;
• 1.4 million gallons in annual water use savings, a 21% reduction;
• 20% waste diversion rate through recycling (as of 2009); and
• Elimination of more than 740,000 truck fleet miles in 2008 through routing and delivery improvements, a 13% reduction.

Energy-Saving Strategies
Commercial buildings that earn the ENERGY STAR label, such as the Four Seasons distribution center, use an average of 35% less energy than typical buildings and also release 35% less carbon dioxide into the atmosphere, according to ENERGY STAR. Four Seasons Produce was the first warehouse to earn the ENERGY STAR label when it received a rating of 82 in 2008.

An energy management project started in 2006 has reduced electricity use through the implementation of integrated refrigeration software. It monitors and controls power use, limiting peak demand.

Four Seasons partnered with energy management firm EnerNOC to develop a demand response program. Four Seasons began participating in PJM Interconnection’s Synchronized Reserves Market and Emergency Load Response programs. PJM Interconnection is an electric grid operator for a region including 13 states and the District of Columbia. Other utilities across the country also offer demand response programs.

Demand response programs pay organizations to voluntarily reduce
energy use during times of peak demand. Four Seasons receives about $25,000 a year for its participation.

During a short-term synchronized reserves event, the Four Seasons facilities staff receives phone calls and e-mails two minutes before the company’s refrigeration systems are shut down remotely. Events last approximately 10 minutes, and when they are over, the refrigeration systems go back online automatically. Evaporators and fans are briefly cycled off and back on during short-term events. The temperature remains within the normal 1°F to 2°F thermostatic cycle around the setpoint, so the produce is not affected. During the first six months of its participation in the program, Four Seasons experienced approximately 25 short-term events.

During an emergency load response event, which occurs primarily during the high-demand summer months, Four Seasons might be called upon to reduce its energy use for longer periods to avoid a brown-out or shortage from its energy provider. These

Above, left: To maximize the accuracy and timeliness of pallet building and shipments, the company uses a warehouse management system (WMS) integrated with voice recognition. With their hands free, order selectors can do their work more accurately and efficiently.

Above, right: The company’s fleet delivers produce from Massachusetts to North Carolina to Ohio. Routing and delivery improvements in 2008 eliminated more than 740,000 truck fleet miles.

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<td>Waste cost</td>
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| Diversion Rate                        | 81% | 82% | 85% | 86% | 88%

*thousand cubic ft

Trucks are loaded through the warehouse’s 35 dock doors. Recent retrofits to the dock shelters and dock levelers have produced energy savings and improved the cold chain and food safety in the facility.

During an emergency load response event, which occurs primarily during the high-demand summer months, Four Seasons might be called upon to reduce its energy use for longer periods to avoid a brown-out or shortage from its energy provider. These
Four Seasons uses a back-up generator to power lights and computers to reduce energy use during an emergency load response event. Refrigeration is not turned off during the longer response events. Four Seasons retains full control and can choose to override any shutdown without penalty.

**ENERGY AT A GLANCE**

- Energy Use Intensity (Site): 113.8 kBtu/ft²
  - Natural Gas: 5.7 kBtu/ft²
  - Electricity: 108.1 kBtu/ft²
- Annual Energy Cost Index (ECI): $2.27/ft²·yr

**KEY SUSTAINABLE FEATURES**

- Water Conservation: Rainwater used for landscape irrigation, truck washing
- Recycling: 88% of waste recycled in 2009
- Daylighting: Portion of office area
- Lighting: T8 fluorescent lamps

**BUILDING ENVELOPE**

- Roof Type: Black EPDM (ethylene propylene diene monomer)
- Latitude: 40.203983°

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THE BEST WAY IS
The power quality system was installed in 2008 to improve quality and lower energy costs. The curtailment service provider installed a metering system at Four Seasons’ warehouse and worked with the company to identify energy curtailment strategies.

During a demand response event, Four Seasons’ energy curtailment ranges from 400 kW per event during the winter to 1,000 kW during the summer.

The power quality system was installed in 2000 to improve quality and lower energy costs. The system
reduces electrical equipment maintenance and eliminates voltage surges. It also provides voltage stability, current balancing, power factor correction and increased kVA capacity.

The lighting retrofit project involved replacing metal halide lamps with T8 fluorescent lamps, which have increased lighting levels by 40%. The new lights decrease the cooling load for the refrigeration. It has reduced annual electricity use by more than 900,000 kWh. Energy savings paid for the project in two years.

Four Seasons’ office was retrofitted with HVAC controls in 2009, reducing electrical equipment maintenance and eliminating voltage surges. The lighting retrofit project involved replacing metal halide lamps with T8 fluorescent lamps, which have increased lighting levels by 40%. The new lights decrease the cooling load for the refrigeration.

**KEEPING PRODUCE FRESH**

Four Seasons handles almost one million cases each month, or 12 million cases a year. Each case weighs between 25 and 40 lb, so a 30 lb average equates to 30 million lb a month.

Most of the perishable produce is in the distribution center for less than a week, while some highly perishable produce is shipped out within a day or two. The distribution center holds 7,000 pallets across 22 aisles. Since different types of produce require varying storage requirements, produce is separated into seven different room conditions based on temperature, humidity, and ethylene sensitivity. Temperatures range from 33°F to 55°F.

Ripening rooms for bananas, tomatoes, and some tropical items are typically 58°F. Prefabricated insulated panels separate rooms, and evaporators in each room are set to maintain storage conditions. The facility maintains the cold chain by receiving and shipping on a 40°F dock. Recent retrofits to the dock shelters and dock levelers have sealed gaps, generating energy savings and improving the cold chain and food safety in the facility.

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- Small Footprint
- Low Maintenance
- Easy Future Expansion
- Redundancy
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was inadequate to handle the local water, which is extremely hard. Now a contractor treats the cooling tower water with limited use of chemicals. Treating the water concentrates the water (via evaporation) to less

Sustainability
To conserve water, the produce company has tried several methods of treating the cooling tower water. The company initially tried a non-chemical approach, but this method

Refrigeration
Refrigeration is provided by an ammonia/glycol split system with 1,030 tons of cooling capacity. The zero-emission system used by Four Seasons cools and refrigerates the building through a closed glycol loop that is chilled by a central ammonia plant with three centrifugal chillers. This system improves safety for staff and products by limiting the total amount of ammonia used and keeping it contained within the central plant. An energy management system that manages refrigeration peak demand has contributed to energy savings. A water treatment program maintains optimal efficiency.

Four Seasons Produce built its distribution center in 2004. It started new energy-efficiency and sustainability measures in 2006, which have reduced energy consumption, water use and waste and helped the facility qualify to receive the first ENERGY STAR label for a warehouse.

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The changes have reduced annual water use by 1.4 million gallons. The company started a waste diversion program in 2000, which recycles or composts materials ranging from rubber tires to produce waste, and has diverted more than 21,000 tons of waste from landfills as of 2009. Composting (a nonsorting recycling system) simplifies recycling and increases employee productivity. This system has reduced waste and led to a recent milestone of not having to remove a single trash container from the 262,000 ft² facility for a month. The company found a way to recycle leftover wax cardboard in 2002. Wax cardboard is used for shipping moist products as well as produce on ice.cardboard is used for shipping moist products as well as produce on ice.

Look for the ROI in unexpected places. Initial analysis of the lighting retrofit focused on the reduction in wattage and possible improvement in productivity. Through better illumination of the warehouse, this alone would have led to a healthy payback. But as more was understood about the heat impact of the existing metal halide fixtures in a refrigerated space, it became clear that the reduction in cooling load from a retrofit to T8 lighting was significant. Through additional analysis before and after the changeover, the company concluded that the removal of a heat source contributed 25% or more of the payback for the project. The recent office HVAC upgrade, which adjusts the fresh air intake based on occupancy, is beginning to show evidence of reduced cooling demand during the warmer months. This side benefit was not included in the original payback calculations for the project.

Work with suppliers to test solutions (if possible) before investing. The lighting retrofit was launched after installing a sample array of T5 and T8 lights provided by a supplier. This live comparison of the lighting effectiveness of the two options helped management make a good decision. Although engineering data indicated the T5s perform better under refrigerated conditions, the T8 lights turned out to be the better choice for this particular application. Four Seasons is evaluating an option for parking lot lights with a sample future from a supplier. In some cases, proposals include a guaranteepted result, but that assumes the result can be clearly proven. The company is considering a project that requires verification during the first several months of implementation to ensure the guarantee offered by the supplier is fulfilled.

A culture of continuous improvement sustains high performance results. Four Seasons has tried many strategies to improve efficiency and sustainability, but sometimes the strategies required revision. Office occupancy sensors are one example. The units installed in private office areas in 2004 were not effective because they frequently turned lights off while associates were working at their desks. Some staff chose to have the units removed rather than periodically wave their arms to keep the lights on. More recently, sensors in the right price range have improved sensitivity and effectiveness, and the company is researching using occupancy sensors again. This time, in addition to the change in technology, the payback will be enhanced by utility rebates that are now available.

About the Author

Nelson Langenacker is vice president of Business Innovation for Four Seasons Produce.