CASE STUDY

Perishable food suppliers **cut energy use up to 40 percent**

Airixa is a refrigeration and energy management control system for today's food supply chain.
usa.siemens.com

As globalization continues to connect our world in new ways, food supply chains are being stressed as demand grows for perishable specialty produce needing long-distance shipping. The advanced Airixa refrigeration control system from Process Solutions delivers the integrated engineering, simplified operation, high availability, and energy-efficiency necessary to transport such goods at scale.

Ripe, ready-to-eat fruits and vegetables displayed for sale in a mid-winter supermarket in New York, Paris, or Tokyo don't just magically appear. They arrive courtesy of a carefully calibrated global refrigerated supply chain, which could be said to have a lot of engineering magic behind it. To ensure the freshness and quality of perishable foods, producers and distributors have turned to Process Solutions, Inc., a Seattle area-based Siemens Solution Partner.

"With the rise of globalization, our food-distribution clients have seen a steep increase in demand for exotic and specialty goods as consumers adopt more global, diverse diets," says Vaclav Mydlil, Senior Director of Energy Management and Refrigeration at Process Solutions. "Of course, consumers expect these foods to arrive fresh and delicious despite the far distances they've been transported."

Most farm-to-fork advocates would be shocked to know the average distance today's food travels to their dinner tables is 1,300 miles. But the world's increase in specialty produce demand pushes food distributors to find new ways to, quite literally, go the distance with minimal food waste and maximum profits. At the same time, they must contend with the steep energy costs and complex refrigeration required to keep perishables fresh.

"When we see such fundamental changes affect the core of our customers' business, we recognize this is a marathon, not a sprint," says Mydlil. "The solution must be built together in partnership with our customers. One-off projects just don't cut it."

Challenge: Create a state-of-the-art refrigeration control system with flexibility, visibility and efficiency at its core

Process Solutions partners with their produce-growing clients to develop advanced industrial refrigeration and energy management process control systems for post-harvest processing and distribution, including rapid pre-cooling, long-term storage cooling, and ripening rooms to extend produce life and combat food loss.

The initial challenges to the project were many, chief among them:

- As all facilities operated 24/7, the system needed high reliability and availability. In addition, it also had to provide central oversight, reporting and auditing capabilities for quality control. This would ensure, ultimately, the satisfaction of their supermarket customers and the consumers who shop there.

- Many fruits and vegetables require a cold chain to reduce food loss and deliver the fruit at the right ripeness level to be sold in grocery stores. Additional factors in the ripening process include: airflow; humidity and other psychrometric air properties; ethylene; an carbon dioxide. Each requires careful monitoring and tightly managed controls to minimize the risk of produce damage and must be adjusted depending on the season and degree of ripening desired.

Such a highly specialized cold chain requires significantly more energy than traditional supply chains—and can incur high power demand charges. Mydlil explains that while energy-efficiency measures can address high energy costs, demand-management capabilities are needed to contain power demand charges. As such, many produce facilities are susceptible to both issues, and

Process Solutions has designed Airixa to handle each one seamlessly. "Industrial scale refrigeration requires all sorts of motors, compressors, pumps, fans and other devices that consume a lot of energy," he adds. "But we also see each piece of equipment as an individual opportunity for energy savings."

Mydlil's engineering team, with support from Siemens, recognized the need for flexibility and scalability in the control system. "We knew we needed to design a system that could work with the facilities' current and future equipment," says Mydlil. "At the same time, we needed to design it so we could easily scale without losing visibility at the plant level."

Solution: Airixa, a technology platform for industrial refrigeration and energy management

To satisfy these multi-layered requirements, Process Solutions designed, engineered, and built the Airixa™ Energy Management and Refrigeration Control System. Airixa is an open-architecture technology platform to deliver integrated energy efficiency and utility demand management to industrial refrigeration facilities. Already installed in more than 20 locations across North and South America, Airixa now controls 2,000,000 square feet of production space. This includes 152 produce ripening rooms.

To provide full system analysis at both the plant and enterprise level, Airixa utilizes a highly flexible, interoperable control logic of a centralized supervisory control and data acquisition (SCADA) system, and the latest in smart programmable logic controllers from Siemens. Its object-oriented software design is capable of scaling to any facility size and flexible enough for new equipment to be added without major engineering effort. It can provide real-time data collection, visualization, alarming, and remote-control capabilities via web browser and native iOS and Android applications for greater user accessibility overall.

Airixa's SCADA system also enables plant operators to conduct full system audits in compliance with food safety requirements of the FDA CFR 21 part 11. The audits display changes to parameters, along with who made changes, from which location, and when, sending instant or text alerts for alarms and system health diagnostics. Historical data logging, trending, and secure, multi-user access ensures transparent and accurate reporting.

Airixa communicates and interoperates with other software systems too, such as existing facility controls, building management systems, or enterprise resource planning (ERP) systems. In communicating with those systems, Airixa uses advanced ripening process control features to ensure ripening process repeatability and standardization across all facilities, which prevents adding any complexity to a customer's overall facility operations.

Because Process Solutions programs and configures all Airixa's controls using the Siemens SIMATIC TIA Portal, a common software engineering framework, its engineers are able to perform unit testing and simulation of Airixa prior to onsite deployments. This simplifies and facilitates deployment at customer sites while minimizing any disruptions to existing operations

How Airixa can cut refrigeration utility bills and demand charges by 10-40%

Airixa provides energy demand control capabilities including intelligent peak load control, so users can avoid costly energy demand spikes. In addition, Demand Response features enable automated monitoring and control of energy loads to reduce or shift power usage during peak periods and generate direct revenue by partnering with a utility company or a demand response aggregator. Among Airixa's capabilities in this area are:

- Adaptive demand limits (setpoint learning)

- User-selected load reduction priorities

- Dynamic operation priorities based on production metrics and constraint

- Equipment system start-up sequencing

- Detailed energy, demand, and reduction monitoring of individual loads

- Available load sub-metering

- Support for multiple utility accounts within one facility

- Production reports

Continuous Improvement.
Process Solutions will continue to update Airixa over time, adding more functionality and value for its customers. To do that quickly and efficiently, the company's engineers use the Siemens SIMATIC TIA Portal with its global code libraries and code versioning to program new features and capabilities into the SIMATIC S7-1500 PLC and the WinCC OA SCADA software. By using the Siemens PLC platform, adding new features and capabilities to Airixa is quick and simple to accomplish," says Mydlil.

By standardizing on Siemens controls and components, Airixa's procurement, manufacturing, commissioning, service and support were all greatly simplified to enable greater scalability and localization capabilities for food suppliers expanding their reach geographically.

Onsite, Airixa's 22-inch HMI touchscreen displays are easy to read by operators and provide reports and diagnostics in both English and Spanish. Mydlil notes that the HMI's text can quickly be translated into nearly any other language a customer might need. "This greatly simplifies Airixa's localization for any customer's geographic requirements," he says.

For example, Process Solutions is currently working on releasing multi-lingual HMI support to make Airixa training and operating even easier, no matter where it is deployed. "Siemens is more global than any of our other strategic partners," says Mydlil. "So we can assure our customers that their Airixa systems have Siemens support and service behind them. That peace of mind is especially important for global and transnational producers and distributors of perishable foods."

Result: Improved operational efficiencies and significant energy savings

Airixa customers' utility bills are reduced by 10 to 40 percent – a big draw for companies wanting to significantly reduce their energy consumption and associated energy costs without compromising operational performance of their facilities or equipment.

Airixa delivers these savings by analyzing environmental conditions in real time and optimizing the following refrigeration controls:

- Evaporator VFD fan speed control

- Common defrost cycles (hot gas, air, electric)

- Condenser floating discharge pressure

- Compressor optimization with staging, sequencing, and floating suction pressure control

- Equipment start-up sequencing

- User-defined load reduction priorities

- Refrigerant vessel monitoring, modulated level control, and modulated recirculator pumps control

- Standard compressor interlock features

- Long distance wiring temperature sensors compensation (3- or 4-wire sensors)

- Application-based sensor types (relative humidity, absolute humidity, enthalpy, Superheat/Sub-cooling, Freon/Ammonia detection, CO2, etc.)

Optimized performance and sustainability

Airixa's fully integrated control system enables operators to reduce energy consumption without compromising operational performance. For facilities that already have implemented the most energy-efficiency measures available, savings can range up to 10 percent. For facilities without any or just a few energy-efficiencies implemented, the savings can conservatively be as much as 40 percent or more. This can provide a rapid return on investment that can quickly pay for the system, then provide years of reliable service and additional bottom-line returns.

Expanded Demand Management

Airixa not only enables a more resilient and efficient supply chain for food distributors but also delivers significant energy savings through its advanced demand management system. Reduced peak demand is a big draw for companies wanting to significantly cut their utility costs without compromising the operational performance of their facilities or equipment.

Airixa enables food distributors to more easily participate in utilities' demand response incentive programs and even generate revenue during incentive times by supporting multiple utility accounts, load-submetering, utility-grade power metering, and pulse interface (KYZ) integration.

Detailed reduction monitoring and sophisticated control and load shifting algorithms deliver intelligent control at the individual load level to help food distributors avoid costly energy demand spikes by reducing or shifting power usage during peak periods. To eliminate the risk of power overloads or failures, Airixa allows operators to use adaptive demand limits, select load reduction priorities, or even use dynamic operation priorities that are based on production metrics and constraints.

Visually, the Airixa HMI shows how much energy has been saved via its control system. Operators can see energy benefits as the control system optimizes use of time-of-day peak/off-peak rate charges in each compressor, pump, fan or other device. They can also see how much renewable energy was used; how much greenhouse gas emissions were saved.

In addition, Airixa enables customers to pursue other sustainability efforts such as solar or wind system integration and onsite energy storage. For example, Airixa measures the green energy savings through easy-to-read calculations, as seen in Figure 1.

Of course, by optimizing the ripening process along the entire supply chain and implementing high-end features for maintenance cooling such as product
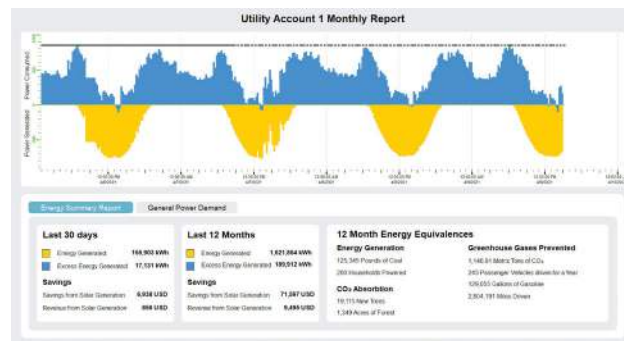

Figure 1. Airixa monthly utility report showing energy use, savings, and environmental conservation.

thermal shock mitigation, Airixa ensures customers' produce arrives at grocery stores fresh, intact, and ready-to-eat — just as consumers have come to expect. Incorporating Airixa into the supply chain also helps customers to minimize their food loss and, ultimately, the time, labor and resources required to grow their fruits or vegetables.

With interest in Process Solutions' Airixa refrigeration platform growing fast, Mydlil expects to expand its installed base rapidly in the coming years, especially beyond the Americas. "As we continue to stretch the limits of our food supply chains, technology will play a bigger, more critical role," says Mydlil.

We are excited to have built a technology platform that can sustainably scale to meet the challenges of the future."

Vaclav Mydlil,
Senior Director of Energy Management and Refrigeration at Process Solutions.

This document contains a general description of available technical options only, and its effectiveness will be subject to specific variables including field conditions and project parameters. Siemens does not make representations, warranties, or assurances as to the accuracy or completeness of the content contained herein. Siemens reserves the right to modify the technology and product specifications in its sole discretion without advance notice.