Kellogg's Eggo Decreases Energy Consumption by over 675,000 kWh

By Patricia Boyd, Ecos Air

Where: San Jose, CA

Industry: Food Processing

Issues: Lack of storage, multiple compressors controlled by local pressure switches and modulation control.

Audit Type: Supply Side

Reduction in Energy Use: 685,000 kWh

Approximate Annual Savings @ $0.09/kWh: $62,000

Utility Incentive: $71,072

Simple ROI: 1.41 years

Ecos Air worked with subcontractor Capitol Air Systems Senior Auditor Mike Mendoza who is a Department of Energy "Compressed Air System Energy Expert," to perform the assessment of the existing compressed air system. Michael Ludwick who is the Senior Field Service Engineer of Capitol Air Systems performed the subsequent ultrasonic leak detection survey.

Introduction

This article describes a compressed air retrofit project implemented at Kellogg's Eggo (Figure 1) factory located in San Jose, California. Kellogg's continues to realize both annual energy savings and quality improvements because of the upgrade. In addition, Kellogg's received a substantial utility incentive from Pacific Gas and Electric Company, which was based on the achieved energy savings.

This program is funded by California utility customers and administered by PG&E under the auspices of the California Public Utilities Commission.*Pacific Gas and Electric (PG&E) funds the Ecos Air program to identify and implement compressed air projects that result in verified energy savings.

Baseline System

The Eggo factory uses compressed air for production, packaging, cooling, and clean-up processes. When approached by Ecos Air (see sidebar), Kellogg's realized that in addition to decreasing the continued energy use of their compressed air system while simultaneously improving overall performance, there may also be an opportunity to receive a considerable monetary incentive from their utility, Pacific Gas and Electric (PG&E). The monetary incentive could offset the cost of the suggested energy reduction improvements.

Baseline Determination

As a requirement of the utility incentive program, the auditor performed an analysis to determine the baseline energy usage of the system. This included collecting compressor power and system pressure data via data loggers and storage equipment. Afterward, the Ecos Air audit team used calculated flow and measured power to determine system overall efficiency by calculating CFM/kW. They extrapolated estimated/expected savings based on this demand profile for a full year. The collected data were tallied for the year (Table 1).

BASELINE ENERGY ESTIMATE			
COMPRESSOR HP	MONITORED KW	HOURS	KWH
300	204	8,760	1,787,000
75	60		526,000
50	35		307,000
Total	**299**		**2,620,000**

Table 1

Incentive Details

Kellogg's Eggo received a substantial rebate of $71,072 (approximately 45% of the total project cost) from PG&E's Ecos Air Program.

This innovative incentive program works with industrial facilities on behalf of a utility to search for users of compressed air, coordinate walkthroughs and site audits, manage all applications and forms, establish flow and kW baseline parameters, and develop a financial summary with payback. Once the customer implements the project, the Ecos Air team returns to verify final operating conditions to ensure that the savings claimed by the customer are genuine and verifiable when reported to their utility commission.

While there are many utilities that provide kWh reduction incentives for customers that implement efficiency measures, the process is normally administered either by the customers themselves or by the equipment vendor. Alternatively, the Ecos Air Program was developed for utilities willing to fund a vendor-neutral third-party contractor to implement an efficiency program for industrial system compressed air users. In this case, the utility simply establishes a financial budget and leaves program execution to the Ecos Air team.

Issues with the Existing System

The current compressed air system consists of two (2) 300 hp rotary screw air compressors, one (1) 75 hp rotary screw air compressor, one (1) 50 hp rotary screw air compressor, two (2) refrigerated air dryers, and two (2) line filter systems, two (2) small receivers, and several timer condensate drains.

- Local pressure switches and modulation regulators, typically the most common and inefficient control method, controlled each of the compressors.
- Minimal storage was available with approximately one (1) gallon per CFM.
- Existing piping was mostly galvanized which is dirty and had corroded over time.
- The system lacked pressure/flow control.
- Timed condensate drains were used.
- After implementing the project, and receiving the incentive, customer received the incentive, the Ecos Air audit team analyzed the system via ultrasonic leak detection to find and repair numerous leaks throughout the system.

The New System

After the upgrade, they set one of the 300 hp compressors on the front pad for load/unload control to provide the base load and they set the other 300 hp compressor to emergency standby. A single 75 hp Sullivan-Palatek variable frequency drive compressor replaced both the 75 hp and 50 hp modulation controlled rotary screw compressors on the rear pad (Figure 1).

In order to improve the storage capability of the system, an one (1) spooled 5,000-gallon offline dry air receiver, while they added one (1) spooled 1,550-gallon offline dry air receiver to the rear pad. This brought the system storage capacity from approximately one (1) gallon per CFM to more than five (5) gallons per CFM.

Next, and keeping in mind that the pressure drop of the filtration system is a large contributing factor to overall system efficiency, they upgraded the line filters to be oversized and include 3,000 SCFM of food grade filtration on the front pad and 600 SCFM food grade filtration on the rear pad.

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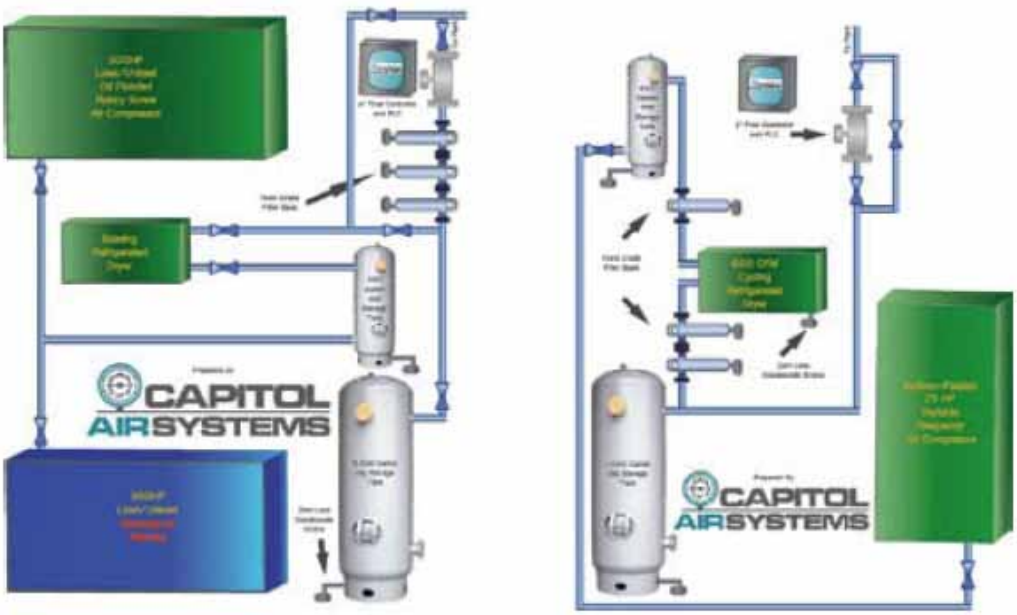

Front New *Back New*

Figure 1

New Accumulation Tank on Main Compressors

Conclusion

The average air demands of the system were reduced from 1,347 SCFM to 1,296 SCFM due to the added receiver volume and a pressure/flow controller set point of 93psig. Another contributing factor to the reduced air demand was the replacement of 11 timer condensate drains with new zero air loss auto drains. In addition, part-load efficiency of the system was greatly enhanced due to a lower compressor pressure set point and the VFD control on the rear pad in lieu of modulating trim compressors that operated constantly. Now, the peak demand is met in the most efficient manner possible by the VFD trim compressor on the rear pad responding to the factory's periodic peak demand needs

As a result of the above changes to Kellogg's compressed air system, compressor output more closely matches system demand and continued energy costs have been reduced by approximately $62,000 annually. In addition, Kellogg received a rebate of over $71,000, which lowered the project cost by approximately 45%. Both the process and the project made Kellogg's as a company much more aware of the importance of the compressed air system and its impact on their processes. The company is now more educated on the significance of inefficiencies and waste that can occur in compressed air systems.

As previously mentioned, the Ecos Air audit team performed an ultrasonic leak detection audit after the incentivized upgrade was complete. Through this process, they identified and remediated approximately 324 SCFM of compressed air leakage through various fittings and machinery. In addition, the facility opted to install CDI flow meters downstream of each of the flow controllers in order to monitor their real compressed air usage in SCFM daily and weekly, allowing them to understand and control their current, variable, and future compressed air needs.

Leaks Identified & Repaired

	EXISTING SYSTEM		NEW SYSTEM	
	FRONT	REAR	FRONT	REAR
Compressors	1 x 300 hp Modulating 1 x 300 hp Modulating	75 hp Modulating 50 hp Modulating	1 x 300 hp Load/Unload 1 x 300 hp Emergency Standby	75 hp Variable Frequency Drive
Storage	1,060 gallon Wet	660 gallon Wet	1,060 gallon Wet 5,000 gallon Spooled Dry	660 gallon Wet 1,050 gallon Spooled Dry
Dryer	1,800 cfm Refrigerated	400 cfm Refrigerated	unchanged	600 cfm Refrigerated
Flow Control	N/A		4" Flow Controller and PLC	2" Flow Controller and PLC
Average Pressure	95–109 psig supply 95–107 psig downstream	97–115 psig supply 97–114 psig downstream	103–112 psig supply 93 psig downstream	108–122 psig supply 93 psig downstream
Estimated Annual Energy	2,620,000 kWh ($236,000)		1,935,000 ($174,000)	

ESTIMATED ENERGY SAVINGS	KWH
Existing System	2,620,000
New System	1,935,000
Savings	**685,000**

This project was created and managed by Myles McCarron of Millennium Mechanical.

For more information on how to design, procure and construct a Compressed Air Energy Controls System visit mil2k.com. See airbestpractices.com for the original article.