MOTOR MANAGEMENT SUCCESS:

Information, Cooperation and Teamwork Lead to Superior Decisions at Columbia Lighting

Results

Motor failures are inevitable in manufacturing, but who would think that a failed motor would eventually lead to a huge energy cost reduction? Columbia Lighting in Spokane, WA experienced this good fortune recently. Columbia had been using a 3-motor, 450-hp, compressed air system with electricity costs of $48,247 a year to support the operations at their Spokane, WA facility. Using system auditing services from Ingersoll-Rand, including leak detection, they determined that fixing air leaks and changing the control scheme on the compressors would allow all but one of the motors to be shut down. A 150-hp motor now accommodates the company's entire compressed air demand, for a cost saving of over $35,000 per year – over a 70% reduction. Even more exciting is that, with further modifications to the compressed air system, it may be possible to reduce this demand even more by using a 100-hp variable speed compressor in lieu of the fixed speed 150-hp.

"Scott Patterson and Dennis Short collect data from Columbia's 150-hp air compressor into a Palm Pilot for use with the EM2 motors software."

Columbia Lighting manufactures commercial and industrial fluorescent lighting products. With locations in Spokane, WA and Bristol, PA, the company employs over 1400 workers (600 in Spokane) and inhabits three-quarters of a million square feet of production floor between the two sites. The Spokane site operates 24/7 and has over 300 motors ranging in size from .5-hp to 200-hp.

Ingersoll-Rand is a global corporation with interests in infrastructure, industrial solutions, climate control, and security and safety. The company operates over 100 manufacturing facilities worldwide at which it employs approximately 45,000.

Project Overview

In spring of 2003, Dennis Short and Scott Patterson, Maintenance Manager and Electrician of Columbia Lighting respectively, attended an Electric Motor Management (EMM) seminar on the efficient management of electric motors systems sponsored by the Northwest Energy Efficiency Alliance. The seminar offered information on a variety of ways to improve plant operations and encouraged both Short and Patterson to reevaluate motor operations at Columbia Lighting. At the workshop, EMM field consultant Steve Dunnivant introduced them to the Electric Motor Manager (EM2), a motor data collection and efficiency analysis software used in the repair/replace decision-making process. The tool supports creation of a motor database and enables users to calculate motor operating costs.

After the seminar, Short and Patterson decided to use the EM2 software to inventory their plant's 300+ motors and to determine where they might be "overusing" motors. Columbia's personnel received on-site training from the EMM field consultant for entering nameplate information into the EM2 software using a Palm Pilot® and downloading the data to create the motors database for analysis. Then they went to work.

Shortly after the inventory process had begun, a motor failure occurred. While certainly not a desirable turn of events, at least the timing was fortuitous since the purpose of the inventory project was to aid in repair/replace decisions. Short and Patterson were particularly interested in the feasibility of replacing the failed motor with a new, energy-efficient one and contacted their vendor at Ingersoll-Rand, John Scofield. Running the numbers through the EM2 software allowed them to determine that, at twice the expense, the energy-efficient motor was not cost-effective for their purposes.

The failed motor was one of Columbia Lighting's larger units and, like the plant's other sizeable motors, primarily air compressor-related. Two of these were in the Main Plant – a 200-hp motor and a 150-hp – both of which ran during the first shift, with only the 150-hp used for swing and graveyard shifts. The Paint Plant area of the facility had the failed motor, one of two 100-hp motors, which operated alternately.

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Searching out other options, Scofield suggested that, since these main motors were largely air compressor systems, an air-loss survey of the plant using ultrasound might be useful to discover possible leaks. The compressed air process can be inherently inefficient, with a good deal of the power often squandered as waste heat. This is especially true if the system has developed air leaks, which will happen over time – especially in a plant that is a quarter-mile long!

Once leaks were identified and repaired, Scofield installed a device to monitor the compressed air system. Results of the weeklong survey were remarkable. By simply repairing leaks and changing the control scheme on the compressors in both the Main and Paint plants, power usage for the system decreased by 73%, about 47% due to fixing leaks and the balance (26%) the result of controls improvement. The more effective cycling of the system alleviated demand on the motors, which led Scofield to conclude that only one of the two Main plant motors was actually needed to satisfy plant demands. Scofield also suggested that, with modifications, the air from the one Main plant compressor would be sufficient to operate the Paint plant area as well. The plant air loop was adapted to accommodate this plan. When implemented, they determined that the smaller, 150-hp Main plant compressor was more than sufficient to supply the entire plant's requirements.

So what does this mean in terms of actual numbers and cost savings? Consider the table below with stats from Ingersoll-Rand's study:

	PRE REPAIR				POST REPAIR			
	Annual Hours	Hourly Estimated Demand	Yearly Electrical Consumption	Estimated Elec. Cost @ $.045/hr	Annual Hours	Hourly Estimated Demand	Yearly Electrical Consumption	Estimated Elec. Cost @ $.045/hr
Main: 200-hp	7,508	56.1 kW	420,448 kWh	$18,920	0	0	0	0
Main: 150-hp	7,508	37.5 kW	283,040 kWh	$12,737	7,508	37.5 kW	283,040 kWh	$12,737
Paint: 100-hp	6,257	58.9 kW	368,673 kWh	$16,590	0	0	0	0
TOTALS		152.5 kW	1,072,161 kWh	$48,247		37.5 kW	283,040 kWh	$12,737

As illustrated above, shutting down the 200-hp motor is estimated to reduce hourly demand by 56.1 kW, which translates to an annual electrical consumption savings of 420,448 kWh for an annual cost savings of $18,920. Shutting down the 100-hp air compressor in the Paint plant is estimated to reduce hourly demand by 59 kW, which translates to an annual electrical consumption savings of 368,673 kWh for an annual cost savings of $16,590. Bottom line? Overall cost savings to Columbia Lighting of $35,510 annually.

Electrical Demand Savings:	115 kW
Electrical Consumption Savings:	789,121 kWh
Annual Cost Savings:	$35,510
Percentage cost savings:	73%

*Note that Annual Cost Savings *do not* include demand cost savings.

What makes these statistics even more impressive is that further analysis work continues to increase their compressed air efficiency, with efforts pointing to the strong possibility that a 100-hp variable speed controlled motor could replace the fixed speed 150-hp – an enormous reduction from a system that had previously used four-and-a-half times that much.

Lessons Learned

A number of factors went into the successful restructuring of Columbia Lighting's Spokane compressed air motors system. Electricity costs are a major factor in manufacturing and conscientious maintenance engineers are constantly looking to improve their plant's efficiency. Disseminating practical information and tools by such means as the Northwest Energy Efficiency Alliance's Electric Motor Management workshops is a start and encourages people to seek out more knowledge. When Dennis Short and Scott Patterson first signed up for a motors management workshop, they were looking to inventory their system and replace a motor. What they learned led them to an examination of their motor and compressed air system as a whole. With valuable input from Ingersoll-Rand, their motors provider, they achieved dramatic improvements in efficiency while garnering significant energy and cost savings for the company's bottom line.

Columbia Lighting is committed to directing efforts towards the best system possible for their company. What's ahead? As Columbia's Scott Patterson puts it, "We want to stay the course of improvement we are on."

Project Partners

Columbia Lighting
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Motor Management Success Story, Sept 2004.

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