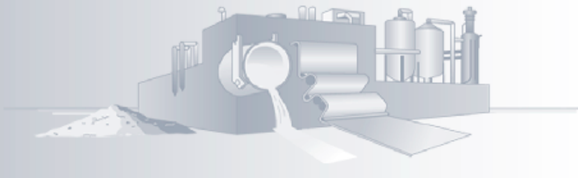
BestPractices Case Study



Industrial Technologies Program—Boosting the productivity and competitiveness of U.S. industry through improvements in energy and environmental performance

Weyerhaeuser: Compressed Air System Improvement Saves Energy and Improves Production at a Sawmill

Benefits

- Saves $55,000 in annual energy costs
- Saves 1.3 million kWh per year
- Increased throughput 1.5% and reduced downtime
- Achieved a 1-year simple payback

Application

Compressed air systems are found throughout industry and account for a significant amount of the electricity consumed by manufacturing plants. Applying a system-level strategy to optimize a compressed air system can improve system performance, save energy, and improve production.

Summary

In 2000, Weyerhaeuser Company, a U.S. Department of Energy Allied Partner, implemented a project that increased the efficiency of the compressed air system at its facility in Coburg, Oregon. The project was originally conceived by a Qualified AIRMaster+ Specialist. In addition to improving the system's performance, this project yielded important energy savings and enabled the mill to increase production without reconfiguring or adding production equipment. The project saved 1.3 million kWh. Total production costs, after capital funds were obtained outside Weyerhaeuser, were $55,000. Because the project yielded annual compressed air energy cost savings of $55,000, it had a simple payback of 1 year. Using the Coburg facility's project as a model, Weyerhaeuser commissioned evaluations and improvements of compressed air systems at six other company plants and mills. The aggregate energy savings and energy cost savings resulting from these six facilities' projects are 6.8 million kWh and $250,000.

Plant/System Overview

Founded in 1900, Weyerhaeuser has developed into one of the largest integrated forest products companies in the world, with annual sales of $18.5 billion. Weyerhaeuser is primarily engaged in the growth and harvesting of timber; production, distribution, and sale of wood and paper products; and real estate development. The company currently employs about 55,000 people in 18 countries. The company's products are sold primarily through its customer service centers or to wholesalers, home improvement centers, manufactured housing companies, industrial manufacturers, and users.

The Coburg facility, which opened in 1962, contains several independent operations, including log sorting, veneer drying, and a sawmill. The sawmill produces dimensional lumber for commercial sale — typically about 235 million feet of wood per year. Compressed air is important for air-operated cylinders and various pneumatic tools, and it is particularly critical for proper operation of the quad that saws the logs. The quad uses compressed air to precisely place the logs, and if a sawline is off by just one-tenth of an inch, 25% or more of a log's potential yield can be lost.

Originally, the sawmill and veneer plant were each served by separate compressed air systems. Later, the systems were connected with crossover piping to avoid purchasing more compressors. The facility's compressed air system is served by three rotary screw compressors with a total horsepower of 650 hp. A 300-hp unit resides in the sawmill, while 200-hp and 150-hp units are located in the veneer plant. Prior to the project, the system generated an average of 2,000 scfm for normal plant demand and slightly over 2,300 scfm for peak needs.

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To stabilize system pressure, compressed air is stored in containers such as this 800-gallon horizontal unit.

Project Overview

Weyerhaeuser personnel worked with a DOE/CAC Qualified AIRMaster+ Specialist from SAV-AIR, LLC. They formed a project team to evaluate the system for efficiency gains and possible energy savings. Part of the evaluation included preparing a block diagram to profile the system and performing baseline measurements of flow rate, power usage, and pressure levels to obtain an accurate picture of the system's performance. Then, the system's components were examined.

The team discovered several problems that were causing unstable pressure and excess compressed air generation. Although all three compressors were operated simultaneously, the system's pressure fluctuated by as much as 30 psi, from 65 to 95 psig.

One reason for the inconsistent pressure was the fact that the compressors were individually controlled, and no flow instrumentation was available to gauge the supply throughout the system. Another reason was that the compressors were located far apart from each other. This distance caused them to react to different control pressures, and consequently, they worked against each other. So, plant personnel operated all three compressors at full load to satisfy peak air demand. This arrangement generated more air than needed during off-peak air demand periods.

Next, the team found that a faulty timing board on the regenerative dryer caused both the inlet valves to close momentarily when the towers switched. This prevented airflow through the dryer and created a pressure spike at the compressor, causing it to operate erratically. Also, the inlet modulating valve on the 200-hp unit was not operating effectively, which caused the compressor to load up at a higher pressure. In addition, the oil cooler serving the 200-hp unit was smaller than the frame on which it was mounted. This problem allowed air to pass around the oil-cooler core and prevented it from cooling the oil sufficiently.

The review found that the condensate traps in the system were not operating well and allowed condensate to become entrained into the system. Also, the leak load was found to represent slightly more than 25% of the system's airflow.

Project Implementation

The Coburg facility's project was performed incrementally in two phases. Baseline measurements were taken after each phase to gauge its effectiveness. In the first phase, the mill installed a multiple compressor network control system to modulate the compressors more efficiently. The new controls package was linked to a remote-monitoring device that allowed the system's performance to be supervised by SAV-AIR. Several simulations were then performed to determine the most appropriate control strategies to maximize the system's efficiency.

The largest of three rotary screw compressors at the mill is this 300-hp unit.

To stabilize and lower the system pressure, the team installed a pressure/flow controller with 2,500 gallons of additional storage capacity. Once these devices were in place, the baseline measurements were retaken and the system pressure was lowered from 97 to 85 psig.

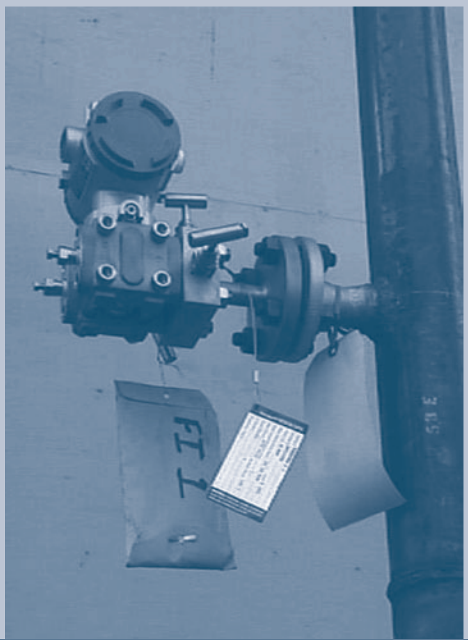
In the second phase, the mill's personnel addressed many of the other issues that were discovered in the evaluation. Of the mill's leak load, 25% was repaired. Several items were replaced, including the following:

- Ineffective condensate traps with electronic, no-loss models
- The defective timing board in the dryer
- The oil cooler serving the 200-hp compressor
- The inlet-modulating valve on the 200-hp unit.

When all of these measures were completed, the baseline measurements were retaken and the system pressure was further reduced to 76 psig.

Project Results

The Coburg mill's project greatly improved the performance of the compressed air system, resulting in energy savings and better productivity. With the new control system, the mill can more accurately match its air supply with its air demand. This saves energy because the system no longer generates excess compressed air. With the lower and more stable system pressure and a reduction of the flow rate from 2,000-2,300 scfm to 1,750 scfm, the mill can now satisfy its compressed air demand by just baseloading the 300-hp compressor and operating the 200-hp unit in load/unload mode. The 150-hp unit is now kept as a backup compressor. In addition, the repairs to the air treatment equipment have improved the mill's air quality and further reduced compressed air waste.



An air flow meter at the Coburg mill.

The annual energy savings for compressed air from the Coburg mill's project are $55,000 and 1.3 million kWh. The project's total costs were $110,000, but with an incentive payment of $30,000 from Emerald People's Utility District (EPUD) and a $25,000 cost-sharing contribution from the Northwest Energy Efficiency Alliance, the project costs were effectively $55,000. This yielded a 1-year simple payback. In addition, the mill's throughput increased by 1.5% because of the consistent air pressure. With the success of the Coburg mill's project, the compressed air systems at six other company wood mills were similarly optimized, yielding total annual energy savings of 6.8 million kWh and $250,000.

As a final addendum, the project results were validated using AIRMaster+. Although the project was implemented before AIRMaster+ was launched, the baseline measurements and project measures were entered in it later. The actual project results were just 3.5% under the predicted values generated by the program.

Lesson Learned

Optimizing a compressed air system's efficiency not only can yield important energy savings, it also can improve productivity. In the case of the Coburg mill, the location of the compressors coupled with the manual control scheme and convoluted piping led to severe pressure fluctuations that hindered production. The inconsistent pressure often caused logs to get stuck in the quad. To clear the jam, mill personnel had to shut off the quad and cut the logs with chainsaws to remove them. This resulted in production downtime and higher labor costs. It also caused product waste because the jammed logs were unusable.

To maintain the needed pressure, the mill had tried operating all compressors simultaneously, but that only generated excess air and wasted energy. The performance of the compressed air system improved substantially after the mill implemented a system-level project. The project upgraded the compressor controls, stabilized the pressure level, repaired leaks and fixed other problems with the air treatment equipment. In addition, the project served as a blueprint for successful projects at six other company facilities.

BestPractices is part of the Industrial Technologies Program, and it supports the Industries of the Future strategy. This strategy helps the country's most energy-intensive industries improve their competitiveness. BestPractices brings together emerging technologies and energy-management best practices to help companies begin improving energy efficiency, environmental performance, and productivity right now.

BestPractices emphasizes plant systems, where significant efficiency improvements and savings can be achieved. Industry gains easy access to near-term and long-term solutions for improving the performance of motor, steam, compressed air, and process heating systems. In addition, the Industrial Assessment Centers provide comprehensive industrial energy evaluations to small- and medium-size manufacturers.

Project Partners

Weyerhaeuser Company
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SAV-AIR, LLC
Portland, OR

Emerald Peoples' Utility District
Eugene, OR

Northwest Energy Efficiency Alliance
Seattle, WA

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