POTENTIAL COST SAVINGS WITH ULTRASONIC TECHNOLOGY

STEAM SURVEY RESULTS

"Over 45% of all the fuel burned by U.S. manufacturers is consumed to raise steam. Steam is used to heat raw materials and treat semi-finished products. It is also a power source for equipment, as well as for building heat and electricity generation. But steam is not free. It costs approximately $18 billion (1997 dollars) annually to feed the boilers generating the steam.

Many manufacturing facilities can recapture energy through the installation of more efficient steam equipment and processes. ***A typical industrial facility can realize steam savings of 20%*** *by improving their steam system. If steam system improvements were adopted industry-wide, the* ***benefits*** *would be* ***$4.0 billion in fuel cost reductions*** *and* ***32 million metric tons of emission reductions****."*[1]

An overview of 41 audits for a variety of boiler plants is available from the Office of Industrial Technology website at www.oit.doe.gov. In summary, the potential savings for the plants was 13.7% savings in natural gas consumption. Payback for all of the identified savings opportunities was just over 1 year. One of the programs implemented was a steam trap survey program. Thirty-eight plants implemented the program and were able to save more than 4 million cubic meters/year of gas, an estimated $1.2 million. The cost of implementation was less than $550,000. The payback of the steam trap survey program in each of the plants was 0.5 years or less.

AIR/GAS SURVEY RESULTS

(As conducted by CTRL Systems, Inc.)

Corrugated Plant

A 200 hp compressor is used to supply air pressure to lines throughout a packaging plant including to the corrugator, the finishing equipment, and the conveyor system. About six months ago, an informal air survey was performed in order to find and fix leaks. Recently, another informal air survey was performed to make sure the air compressor was continuing to operate as efficiently as it did after the last survey.

The air compressor is constantly on and is operated in start/stop mode. This means that the pump will throttle up to provide air to sustain a certain pressure and throttle down once the pressure has been reached. The more leaks there are, the more the pump has to operate at full throttle.

It was estimated that this compressor's pump was working at full throttle for 70% of the time. Furthermore, a quick survey of the plant with the CTRL UL101 ultrasonic sensor revealed more than 40 leaks. The following equations were used to estimate the cost of running the compressor and the cost savings by fixing the leaks:

$$Cost(\$) = \frac{(bhp)\times(0.746)\times(\#\,of\ operating\ hours)\times(\$/kWh)\times(\%\,time)\times(\%\ full\ load\ bhp)}{Motor\ Efficiency}$$

$$Cost\ Savings = \#\ of\ \ leaks \times leakage\ rate(cfm)\times kW/cfm\times \#\ of\ \ hours\times \$/kWh$$

Using a rate of $0.05/kWh, the cost to run the compressor at full throttle for 70% of the time was calculated to be $57,618.00/year. The estimated cost savings from fixing the 40 leaks ranged between $6,000 and $10,000 in decreased compressor usage (exact savings depending upon the size and shape of each leak).

Payback: 5-8 months.

Furthermore, if 40 leaks developed over a 6-months period, it is possible that 40 more leaks will develop in 12 to 18 months and that the current leaks will also worsen. Therefore, if leaks are left unfixed, the cost of operating a 200 hp compressor would rise from approximately $50,000/year to over $70,000/year.

[1] Office of Industrial Technologies. http://www.oit.doe.gov/bestpractices/steam/

Book Distribution Center

Four separate events occurred over the period of two months at a distribution center, which uses a 20-horse power compressor to operate a 20,000-foot conveyor system for the packaging and distribution of books to warehouses and retailers along the east coast.

1. An initial reading was taken using a meter to measure the amount of energy used by a single 20-horse power compressor as it supplied air to the distribution center. The initial test was performed for a period of 3.15 days. The compressor was running at 60% capacity during the initial test.
2. Following the initial test, a crew of 5 CTRL employees spent 4 hours locating air leaks in the air system with the CTRL UL101 and PowerBeam 300. A total of 134 leaks were located and tagged for repair.
3. A maintenance crew was organized to repair all of the leaks. The CTRL UL101 was used to confirm that repairs were made. 124 leaks were repaired. The remaining 10 were not repaired due to the size of the leak and/or the difficulty to repair the leak. A total of 75 hours was spent repairing the leaks with a cost estimate of about $25.00 per hour.
4. A final reading was taken to measure the amount of energy used by a single 20-horse power compressor as it supplied air to the distribution center. The final test was performed for a period of 3.15 days. The compressor was running at 40% capacity after repair of the leaks.

The number of materials distributed during both periods of testing was approximately equal. The CTRL UL101 and PowerBeam 300 were used to pinpoint leaks in the air system and confirm the repairs of the leaks. The result was a 4.3% decrease in total energy usage for a 20-horse power compressor, operating 20,000 feet of conveyors. The reason for the relatively small decrease in energy consumption in this case is due to the fact that the compressor was running in managed control.

The potential energy savings would lie in resetting the compressor out of managed control, rather than continuous operation. This would enable a 33% decrease in capacity (60% to 40%) under which the compressor was operating to be realized as energy savings. It is estimated that this would translate into, at minimum, a 20% reduction in energy usage.

Payback: Not calculated. Limited test to support feasibility of technology and savings.

Packaging Distribution Center

Air surveys were performed at two distribution centers, which reroute parcel packages. The first location has an air system that operates at 100 psi 16 hours/day, 6 days/week, and 52 weeks/year. A total of 13 leaks were found using the UL101 ultrasound sensor, ranging in size from small (1/64 inch) to large (greater than 1/4 inch). An estimated 98 cfm's were being lost. The second location operates under the same conditions. However, using the UL101 ultrasound sensor, a total of 25 air leaks were found ranging in size from small to large. An estimated 782 cfm's were being lost. The following equation was used to estimate the cost of the air leaks:

$$Cost\ of\ \ Air\ \ Leaks = total\ cfm\ loss \div hp\ rate \times 0.746 \times hours/day \times days/year \times \$/kWh$$

The distribution centers are charged $0.04 / kWh. Therefore, the estimated cost of the air leaks is $3,600 and $29,000 respectively.

Payback: 1.6-13 months

For more information about this technology, contact CTRL Systems, Inc.

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