Energy Conservation through Employee Suggestions

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ABSTRACT

Many large organizations have an employee suggestion program. Two of the reasons these programs may be underutilized in offering suggestions for reducing energy consumption are that employees struggle to understand the many ways energy is used at a facility and that they find it difficult to calculate the financial impact of conserving it. This article explains how one of Anheuser-Busch's breweries uses the company's employee suggestion program—Excellence Through Ideas—as a valuable tool to reduce energy consumption and therefore help the bottom line.

INTRODUCTION

Breweries and other food processing plants consume large quantities of utility commodities because they cook, clean, and refrigerate. All three of these processes are energy-intensive when conducted on a large-scale basis.

Cooking

At Anheuser-Busch, brews are produced in a batch process. Cooking 31,000 gallon brews requires a substantial amount of heat energy. The Baldwinsville brewery uses four, 100,000 pound-per-hour steam boilers to supply that energy.

The company's flagship brand, Budweiser, is produced through a seven-step process. First, a combination of two-row and six-row barley malt is milled to crush the husk and expose the proteins and starches contained in the kernels. Rice is also milled, mixed with some malt mash, and cooked to release the starches. The combination is then

heated in the mash cooker to naturally convert the starches to fermentable sugars. The liquid from this process is called wort. Wort is then strained by creating a filter media with the grain husks and transferred to the brewkettle, where hops are added and the mixture is boiled. After some settling time in a hot wort receiver, the wort is cooled and yeast is added in the primary fermenter. Following primary fermentation, the beer is transferred to secondary fermentation where the Beechwood aging takes place. Lastly, the beer is cooled and filtered for packaging.[1]

Cleaning

After the cooking is complete, the vessels and piping must be cleaned. A modern, automated brewery utilizes cleaning in place (CIP) to clean the equipment and piping. There are several advantages to our automated CIPs. First, the temperature, flow, and time are all carefully controlled. The metering and controls associated with this automation provide valuable tools to measure and control energy consumption. A typical CIP cycle consists of a pre-rinse, a circulating cleaning solution, a post rinse, and a final testing for residual cleaning solution.

Cooling

The large quantities of beer that must be cooled after boiling produce a significant refrigeration load. The Baldwinsville brewery has 8,000 tons of refrigeration capacity.

Main Body

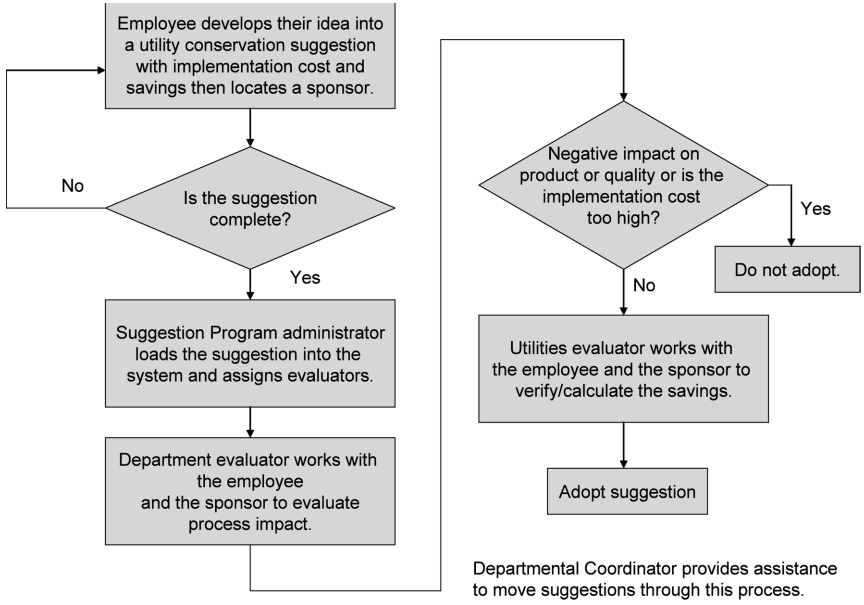
Energy costs are one of the largest components of locally managed cost at a brewery, second only to labor. These costs are difficult to track, because we simultaneously see changes in expenditures when volume, ambient conditions, and prices change. Both our production volume and operating conditions change seasonally. As we produce more beer, we also consume more energy. The incoming water at the Baldwinsville brewery varies seasonally, from 34°F to 72°F. And lastly, the prices of commodities are volatile and can not be used to track consumption.

We utilize our employee suggestion program to engage our staff in the effort to reduce our energy cost. The key elements for success include:

- Securing support of the program from top management
- Prioritizing suggestions based on their potential to reduce bottom

line cost
- Ensuring mid-level managers and employee involvement in program implementation
- Hosting public recognition for adopted ideas and employee awards
- Adopting timely review processes to keep employees motivated
- Maintaining ongoing employee communication about the program
  - — Publishing information in employee newsletters
  - — Introducing the program during new employee orientation
  - — Scheduling special promotions to maintain employee interest, such as an energy fair during Green Week
- Viewing the program as a valuable source of cost reductions and considering all ideas as potential "winners"
- Ensuring that the program is inclusive and open to all employees
- Avoiding making it personal—evaluating the idea, not the submitting employee.

We combat the "it's their job" challenge by employing the performance review test, asking, "Would it reflect poorly on the employee's performance review if they had not implemented the suggestion?" If



Employee Suggestion Flowchart

the answer to that question is no, then the bottom line is enhanced by the employee's suggestion.

Employee involvement is an essential element of the program. In our system, the employees are responsible for tracking the progress of their suggestions. By maintaining employee involvement in measuring the impact of a suggestion, i.e. by getting quotes for any work to be performed by contractors, the employee moves the suggestion forward. Therefore, we try to avoid problems that can stem from the time lag between submission, implementation of the suggestion, and receipt of the award. We also remind employees that receiving the award depends on their continued involvement and successful measurement of their idea's impact on the company's bottom line.

CASE STUDY—CIP OPTIMIZATION

Our focus on the employee suggestion program as a driver of utility conservation began in the summer of 2003. One of our first steps was an article published in our employee newsletter and mailed to everyone's home. The first article explained how expensive it is to heat water to 180°F. The article proved to be very beneficial. After reading the newsletter, a brewer's wife telephoned him to tell him to enter suggestions to reduce hot water use. The brewer, Bob, had been actively involved in the employee suggestion program for some time. Bob started looking for savings opportunities.

At first, we focused on the cleaning-in-place (CIP) systems, because we knew they consumed significant quantities of hot water. We developed a spreadsheet that was tailored to calculating the expense associated with heating water for use in the CIPs. Bob began observing the CIPs as they ran. He would simply observe the pre-rinse as the water went to the drain and measure the amount of time the water ran after it was clear. Then, he entered a suggestion to reduce the pre-rinse time by that amount. Very soon afterward, he started evaluating post-rinses for residual cleaning solution in a similar fashion. Over the next two years, Bob earned more than $30,000 in addition to his salary. Among his peers, he promoted the suggestion program and the savings calculation tool we developed. We began to see suggestions from other brewers as well.

Another brewer, Tony, noted that the last step in some of the brew-

ing transfer processes was a rinse of the piping. He also realized that the first step in the CIP process was a pre-rinse. He entered a suggestion to eliminate one of the rinses and avoid rinsing a pipe twice in succession.

As word of the potential to earn extra income via the suggestion program spread, one of the utility operators noticed that we had some uninsulated steam piping running overhead through a refrigerated space. He entered a suggestion to insulate the piping, but he was unable to calculate the potential savings associated with the heat loss. We had an engineer develop a spreadsheet to calculate the value of the heat loss for both uninsulated steam and hot water piping. The development of the spreadsheet took some time and made the first suggestion take longer than we would have liked, but we eventually worked through it. In the meanwhile, the operator got a quote from a contractor to insulate the pipe. He also began to look for other areas where a similar situation might exist. As the number of sections of pipe that could be insulated grew, the operator asked the insulation contractor for a price per foot to insulate pipes of various diameters. The insulation cost estimator worked well, but it obviously was not universally applicable since access to some of the piping was more difficult than usual and therefore more expensive.

During the two-year period between the summers of 2003 and 2005, we generated nearly $1 million in savings. Most of the ideas involved reduction of heat consumed throughout our process. See Table 1.

Table 1. Savings Data 2001 to 2007

Year	*Savings*	*Awards*	*Utilities Savings*	*Percent of Total*
2001	$150,950	$15,150		
2002	$257,575	$26,125		
2003	$977,962	$42,475		
2004	$1,092,738	$87,825	$244,203	22.3%
2005	$871,722	$95,575	$631,837	72.5%
2006	$1,682,643	$151,372	$814,580	48.4%
2007	$2,002,656	$156,900	$840,564	42.0%
2008				
Oct YTD			$858,000	

*Utility savings were not tracked separately until 2004.

One of the key elements of the long-term success of any program that has the potential to provide supplemental income to employees and reduce expense budgets is an audit trail. We documented the changes we made to our controls and the methods we used to calculate the savings, and we tracked the changes to our budgets to prepare for any future audits. Anheuser-Busch tracks all programmable logic controller (PLC) program changes via a system we call change management reporting (CMR). As we made program changes (based on the suggestions that we entered) to reduce our utility commodity consumption, we also created an audit trail that can be used to validate our results if they are ever challenged. The CMR numbers for the changes associated with the suggestions were recorded with the suggestions.

Another essential element is an easy-to-use screening tool for suggestions. As other suggestions were entered, we developed tools to calculate their potential savings. In addition to the hot water expense calculator, we ultimately developed spreadsheets to calculate the expense associated with:

- Three-phase electric motor operation
- Uninsulated steam and water piping in a refrigerated space
- Compressed air flowing through a nozzle

These tools allowed employees to easily screen their ideas without needing to get an engineer involved. (See Figures 1 through 4.) All of these calculation tools are available via the plant intranet website.

CONCLUSIONS

The energy conservation savings from Anheuser-Busch's employee suggestion program have been substantial over the past few years. By promoting and supporting our suggestion program, we have energized employees to help make our brewery more competitive. By involving and empowering employees to evaluate and optimize our energy-consuming systems, we have fostered the culture and created the right tools that continue to drive reductions. We could have hired an engineer to evaluate all our CIPs and optimize their flow to achieve the same reductions, but we would not have created the tools or the culture that continues to drive our reductions. The use of the employee suggestion

Three Phase Electric Power Consumption							
Suggestion #							
Suggestion Title							
Description	*Amperage*	*Voltage*	*Annual Hours of Operation*	Efficiency	$ per KWh	Cost per Hour	**Annual Savings**
Motor #1	*10*	*480*	*8760*	$0.850	$0.093	$0.82	**$7,204.56**
Motor #2	*10*	*480*	*500*	$0.850	$0.093	$0.82	**$411.22**
Motor #3	*5.5*	*480*	*8760*	$0.850	$0.093	$0.45	**$3,962.51**
Note - Use this spreadsheet when the calculation is based on amperage readings.							
This is the more accurate and preferred method.							
There are 8,760 hours in a standard year.							
Enter values into the blue italic cells to get the annual savings for each application.							

Figure 1. Amperage Based Motor Savings Calculator

2008 Hot Water Savings Calculator		
ETI Suggestion #		*< ==Enter Suggestion Number*
ETI Title :		
Description	**Value**	**Notes**
Water Temperature (°F)	*100*	*<==Enter Temperature of Water Here*
Hot Water Cost per 1000 Gallons	**$5.49**	
Minutes Saved per Cycle (min)	*5*	*<==Minutes Saved per Cycle Here*
Flowrate (gpm)	*420*	*<==Enter Flowrate Here*
Tanks per Month	*75*	*<==Enter Number of Cycles per Month Here*
Annual Water Savings (gal)	**1,890,000**	
Annual Cost Savings	**$10,373**	

Figure 2. 2008 Hot Water Savings Calculator

Heat Loss through Uninsulated Pipes (WATER)					
	Pipe #1	**Pipe #2**	**Pipe #3**	**Pipe #4**	
Nominal Pipe Size (in)	***2***	***6***	***8***	***12***	***<=== Enter Nominal Pipe Size Here***
Exposed Length of Pipe (ft)	***50***	***100***	***100***	***100***	***<=== Enter Length of Pipe Here***
Fluid Temp Inside Pipe (°F)	***150***	***150***	***150***	***150***	***<=== Enter Fluid Temp Inside the Pipe Here***
Space Temp Outside Pipe (°F)	***70***	***45***	***45***	***45***	***<=== Enter Temp Outside the Pipe Here***
Cost Savings per Year*	**$ -**	**$ 3,227**	**$ 4,216**	**$ 6,229**	
* If hot water has to be reheated at its final destination because of the losses, the savings can be doubled.					
* If space temperature is greater than ***56 deg F*** there are no refrigeration savings to be realized					

Figure 3. Uninsulated Pipe Savings Calculator

Electric Power Savings for Compressed Air Suggestions								
Description	Gage Pressure before Orifice psig	Orifice Size (inches in decimals)	Estimated Air Flow (cfm)	Estimated Air Flow (cfh)	Estimated Hours w/Savings	Annual Air Saved	Annual Air Savings ($)	Annual KWh Savings
Sample	60	0.125	16.9	1014	6729	6,823,206	$1,935	24,632
			#N/A	#N/A	6729	#N/A	$0	0
			#N/A	#N/A	6729	#N/A	$0	0
			#N/A	#N/A	6729	#N/A	$0	0
			#N/A	#N/A	6729	#N/A	$0	0
			#N/A	#N/A	6729	#N/A	$0	0
						Total	**$1,935**	**24,632**

Figure 4. Compressed Air Savings Calculator

program is helping to create a culture within the plant that not only reduces our consumption but is also willing to tolerate change as we apply new technologies to further enhance our operations. The involvement of employees in the program is growing, but it is a long-term process. Employee participation has grown from 17.5 to 24.9 percent.

In conclusion, this program is driving significant improvement in the operation of the brewery. For example, as of March 2008, through a combination of capital improvements and energy conservation driven by the employee suggestion program, 100 percent of process hot water consumed in the brewery is either heated or preheated with reclaim heat. (See the flowchart.)

References

1. http://www.budweiser.com/index.aspx

ABOUT THE AUTHOR

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