

Shedding Light on Water

Reducing lighting and water costs at Highland Machine - a metal fabricator

The Challenge

A facility's lighting and water usage are often overlooked by plant managers and facility engineers. They search for more "obvious" conservation opportunities in heating, air conditioning, compressed air, boilers, etc. Lights are overhead and taken for granted. Water is usually hidden inside equipment, fixtures, plumbing and walls or floors. Both of these resources often go unnoticed. This case study tells how the University of Illinois Sustainable Technology Center (ISTC) worked with Highland Machine to assess potential savings in common commodities such as lights and water. Armed with this knowledge, perhaps other companies and the general public can spawn change in the way they operate.

About The Facility

Highland Machine is one the largest sheet metal fabricators and precision machinists serving the Midwest. Established in 1944 in rural Highland, Illinois just 40 miles east of St. Louis, this facility comprises three buildings, totaling approximately 140,000 square feet with a workforce of 130 employees. Manufacturing operations include: engineering, machining, assembly, finishing and packing. Highland Machine requested ISTC's assistance in reducing its consumption of water and electricity.

Water Usage - Before... "Let it flow"

The largest water consumer at Highland Machine is its first-shift powder coating operation. Here, all fabricated parts undergo pretreatment in a 5-stage aqueous spray washer in which they are degreased, rinsed, phosphated, rinsed and sealed. Then the parts proceed to dry-off, powder coating and curing. Historically, the two rinse tanks operated at a continuous flow rate between 5-10 gallons per minute (gpm) of city tap water each, resulting in approximately 1.6M gallons annually. Prior to ISTC's involvement, no meters or controls were utilized to measure usage, restrict consumption or cut costs. Operators manually turned the water on in the morning and then off at night.

The Pilot

ISTC's field engineers worked hand-in-hand with Highland personnel to install water meters to gather baseline usage data for each rinse tank. Meanwhile, efforts were initiated to determine product cleanliness and appearance standards for product leaving the rinse tanks. ISTC also consulted with the washer manufacturer and the chemical supplier to solicit input.

ISTC and Highland Machine opted to install and test a conductivity control system, which potentially offered maximum water savings, limited operator involvement and increased product quality. Conductivity control is a proven technology, utilized to varying degree within industry. Its premise is that water's conductivity is directly correlated to its contamination. In other words, as water becomes dirtier the conductivity increases. Highland's conductivity control system would consist of: 1) a sensor to detect conductivity, 2) an analyzer that monitors the conductivity level relative to a pre-set high and low limit, and 3) a solenoid valve on the water inlet which receives an electrical signal from the analyzer to open or close, allowing or restricting fresh water into the tank. (For more information on conductivity control system technology, see ISTC Fact Sheet TN00-72. It is available on-line at http://www.istc.illinois.edu/info/library_factsheets.cfm.)



Over the next four months, ISTC demonstrated its single-electrodeless pilot system on both rinse tanks, collected data, measured conductivity levels, and established operating controls. The pilot results indicated a reduction of 58-64% with a simple payback of 4.3 months. With this information in-hand, Highland staff easily solicited the owner's support in the purchase and installation of a conductivity control system.



Photo of Analyzer on left, electrical panel in middle and sensor on far right in tank 4, solenoid not shown.

Water Usage - After

A Hach SC-100 controller with two electrodeless sensors was installed. This dual-analyzer monitors and controls both rinse tanks (versus 2 independent analyzers) thereby reducing the initial equipment investment. ISTC assisted Highland's personnel with installation, setup and modification of the system. System performance data was collected four times per day by Highland's personnel and analyzed by ISTC process engineers to maximize system efficiency and savings potential. Tables 1 and 2 show the before/after results of each rinse tank.

Gallons Per Day Before Control	Gallons per Day After Control	% Reduction	Comments
3,109	903	71	Annual Projected Savings: \$4,720 Annual Water Reduction: 551,000 gallons

Table 1 Stage 2 Rinse Tank

Gallons Per Day Before Control	Gallons per Day After Control	% Reduction	Comments
3,652	545	85	Annual Projected Savings: \$6,649 Annual Water Reduction: 776,750 gallons

Table 2 Stage 4 Rinse Tank

Water...Savings To Whet Your Whistle

- Combined Annual Savings: \$11, 369
- Combined Water Reduction: 1,327,750 gallons (-78%)
- Simple Payback Period: 3.4 months

All of the project's goals were met or exceeded, while saving money. Water consumption was drastically lowered, the system was automated, and product quality improved.

Lighting - "It's all around, yet no one really sees it."



Most manufacturers don't know how much it costs to light their facilities. Lights either work or they don't. If a lamp burns out, it is replaced with a new lamp just like the old one without much thought to the efficiency of the lighting system.

The Assessment

At Highland's request, ISTC performed a lighting assessment with the goals of: 1) identifying current lighting expenditures, 2) identifying efficient upgrades, 3) educating management with available options, and 4) effecting change.

The assessment included: counting the types of lighting fixtures, the wattages of the fixtures and the height at which the fixtures were hung. The cost paid per kilowatt-hour (kWh) and demand rate charges were calculated from prior energy bills. Annual expenditures were calculated based on the hours of operation and the wattages drawn for each type of fixture. Recommended improvements, total wattages and annual operating costs were identified for each type of fixture. The difference between its current cost for lighting and the cost for lighting after improvements identified the potential savings.

Results - Quite Illuminating

The lighting assessment identified that Highland Machine currently spends \$38,072 annually for its lighting. Implementing the recommended improvements could reduce the direct costs of lighting its production processes by \$17,581 per year, plus an additional \$4,370 reduction in demand rate charges.

- Total annual savings: \$21,951 (-58%)



Photo of powder coating line with T8 fluorescent task lighting



Photo of machine shop with T8 fluorescent fixtures



Payback on Investment - A Bright Future

Because Highland Machine employs electricians who would perform the upgrade as production load permitted, ISTC recommended the following upgrade to Highland's lighting:

- Replace 141 metal halide HID fixtures with T8 fluorescent \$28,200
 - Convert 529 fluorescent T12 2-lamp fixtures to T8 \$13,225
 - Convert 63 fluorescent T12 4-lamp fixtures to T8 \$ 1,890
 - Convert 6 fluorescent T12 8' fixtures to 4' T8 \$ 270
 - Total Materials Cost \$43,585
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- Simple Payback Period (materials only): 1.99 years

The Final Word

As demonstrated at this facility, huge opportunities exist for conservation and cost savings. Overhead and beneath the floors lay opportunity. In the case of water, money is literally, "going down the drain." 90% of the challenge is first realizing that it's there...then doing something about it. Highland Machine saw the potential savings, seized it and is currently reaping the benefit of its labor.

For more information about water or energy conservation, consult additional ISTC Publications and Fact Sheets located at www.istc.illinois.edu. You may also contact:

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