



### Intern evaluates energy and water use at Tennant

Tennant Company of Golden Valley, Minnesota requested a MnTAP summer intern to tackle a waste and energy project.

Tennant Company of Golden Valley, Minnesota, manufactures floor maintenance and outdoor cleaning equipment.

#### Incentives for Change

Tennant’s vision is to create a cleaner, safer world; therefore, the company wanted to improve its process and reduce waste. Specifically, Tennant was interested in evaluating energy and water use to identify conservation opportunities. Tennant contacted MnTAP regarding the intern program and requested a MnTAP intern to tackle the waste and energy reduction project.

#### Water Reduction Project

Clean water is necessary to properly prepare parts for powder coating. Several of the stages in the coating pretreatment line use water purified by an on-site reverse osmosis (RO) system which includes sand filtration. In the sand filtration system, a sand filter removes small particulates from the incoming city water prior to the reverse osmosis system in order to protect the RO membranes, reduce the potential fouling of the membranes and thus extend the life of the membranes. At Tennant, the sand filtration process used 146,000 gallons of water per year prior to the intern project.

The MnTAP intern monitored the water use upstream and downstream of the sand filters and determined that the filters were regenerating based on a timed schedule rather than on their capacity to filter. The intern worked with facility maintenance staff and the equipment vendor to determine if the filter back-flushing cycle could be changed. The vendor was able to immediately change the cycle to capacity-based back-flushing.

The implementation cost was small, resulting in a payback of less than one month and savings of 100,000 gallons of water and \$850 annually.

#### Energy Conservation Projects

##### Unit Heater Controls

Tennant has 55 steam unit heaters located throughout the building, each of which runs on its own individual thermostat. Some of the thermostats were in need of repair or were ineffective due to bad sensors. Employees changed the temperature setting to their desired comfort levels and often neglected to reduce the setting when the area was unoccupied (nights and weekends). Tennant had previously purchased a building automation system, but unit heaters had not been included in the initial program.

The MnTAP intern researched the costs for installing a steam control valve on each unit heater and connecting the controls to the building’s automation system. A steam control valve on the condensate line can stop condensate from returning to the boiler, which allows the piping in the heater to cool and prevents the heater from using steam to generate heat. The intern worked with a heating contractor to determine that a control valve downstream of each steam trap would reduce the capital cost. The valve placed there would only need to be specified for water and the asbestos insulation on the steam lines would not need to be disturbed upstream of each trap. The intern based the savings estimates on employee interviews regarding operating status and historic natural gas and electricity prices as this project was evaluated during the summer when the heaters were not operating.

Tennant implemented this suggestion over the next 18 months and now has improved control over the facility steam unit heaters through the building’s automation system. The \$33,000 implementation cost will yield an annual cost savings of \$16,000 resulting in a payback in two years. The project has estimated savings of 22,000 therms annually.

#### Benefits Overview

Waste Reduction Option	Waste Reduced/ Materials Savings	Annual Cost Savings
Reset sand filter regeneration cycle	100,000 gal. water	\$850
Unit heater controllers	22,000 therms	\$16,000
Fix leaks in compressed air lines	33,000 kWh	\$2,300

After implementing the steam control valves, Tennant realized that if all the heaters are turned on at once after a weekend, a significant amount of condensate returns to the boilers. This can result in problems with boiler feed water volumes and temperatures. The company modified its procedures and now heaters are turned on sequentially eliminating the possibility that cold water would return to the boilers all at one time.

### Compressed Air Leaks

Tennant has two 100 hp and one 25 hp oil-injected rotary screw compressors. At Tennant, compressed air is used in the manufacturing, coating, and assembly departments. By simply walking through the facility, it became evident that the air compressor lines were leaking. Therefore, the intern listened for and identified leaks by walking through the factory during non-production hours. He marked twenty leaks, which the maintenance staff repaired. The intern used U.S. Department of Energy standards to estimate that the leaks were resulting in a loss of nearly 300,000 cubic feet per year. By eliminating the compressed air leaks, the company lessened the load on the compressor and reduced electricity use. The savings from these repairs saved Tennant an estimated \$2,300 and 33,000 KWh annually.

### Other Suggestions

Tennant uses steam to heat two of the four chemical stages of the eight-stage conversion coating system. The alkaline cleaner and the acid descale stages were maintained at 100°F by drawing heat from a 7 million Btu boiler. This boiler was required to run continuously, even during summer months. The inefficient use of the boiler was compounded by the large distance the steam must travel between the boiler room and the washer and resulted in significant energy loss.

The MnTAP intern investigated the heat loss from this system and evaluated two options for improvement. The first option would be to add an on-site water heater near the washer, reducing the heat lost through the steam pipes coming from the boiler room. The cost of this option was estimated to be \$20,000 and would result in savings of \$8,000 and 11,000 therms annually. The overall payback of the first option was 2.5 years.

The second option evaluated by the intern for heating the washer stages involved installing heat recovery coils on the curing oven exhaust. This project was deemed more risky as the heat recovery technology is not commonly in use by coating companies. Concerns about the selection of a compatible heat transfer fluid as well as potential condensate of exhaust contaminants which may foul the heat exchanger made this project less attractive. The system required for the second option would cost \$60,000 while saving Tennant \$46,000 and 64,000 therms annually for a payback of approximately 16 months.

Tennant did not move forward with either of the intern's options. However, the company did begin working with a chemical supplier to substitute the alkaline cleaner with a different cleaning chemical which does not require any heat. This chemical works at ambient temperature and therefore, does not require the tank to be heated. The company has found that the cleaning quality of the new chemicals meets its specifications. Should Tennant move forward now with one of the options suggested by the intern, the payback would be greater as the need for steam has been reduced through the use of the new chemical.

### Benefits

By implementing the changes recommended by the MnTAP intern, Tennant was able to reduce its annual water use by 100,000 gallons, its fuel energy use by 23,100 therms, and costs by nearly \$20,000.

### Additional Resources

Assistance in evaluating compressed air energy conservation opportunities is available at: <[www.mntap.umn.edu/energy/compair.htm](http://www.mntap.umn.edu/energy/compair.htm)>

*\*This project was conducted by MnTAP intern Matt Johnson, a chemical engineering student at the University of North Dakota.*



### For More Information

MnTAP has a variety of technical assistance services available to help Minnesota businesses implement industry-tailored solutions that maximize resource efficiency, prevent pollution, increase energy efficiency, and reduce costs. Our information resources are available online at <[mntap.umn.edu](http://mntap.umn.edu)>. Please call MnTAP at 612.624.1300 or 800.247.0015 for personal assistance or more information about MnTAP's Intern Program.