



TEL FSI, Inc.



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Company Background

TEL FSI, Inc. manufactures semiconductor production equipment and specializes in wafer cleaning and surface preparation systems. Located in Chaska, TEL FSI produces machinery, such as the ORION, ANTARES, and ZETA that clean wafers by removing nanoscale particles and films. These tools use robotics to transfer wafers that will eventually be etched and go through photolithography to become microchips.



“The MnTAP intern program offered me a unique opportunity to lead and design a project that aligned with my environmental values. Being able to effect positive change was incredibly rewarding. The program also offers variety; one day I was meeting with a VP and the next I was sorting through trash. MnTAP gave me the confidence to approach engineering challenges using creative means.” ~AM

Project Background

TEL FSI has set reduction goals concerning water, liquid nitrogen, and waste with opportunities available in each area for reduction. TEL FSI's primary focus is to decrease their annual water usage, specifically to reduce deionized water usage in the process lab. The company identified that 75% of their deionized (DI) process lab water use is water that is sent to the drain instead of reclaimed through the bypass loop. Additionally, they would like to better understand which equipment and processes are responsible for the majority of their liquid nitrogen usage. Finally, TEL FSI has a 2015 recycling rate of 70.6% which leaves nearly 30% of their waste to be sent to the landfill. With those values in mind, there are three main focus areas for this project: reduce water usage, reduce liquid nitrogen and nitrogen gas consumption, and optimize recycling.

Incentives To Change

A major incentive for change comes from TEL FSI's corporate goals to reduce their environmental impact in water, energy, and waste. TEL FSI supports these corporate goals with site-wide initiatives to reduce water usage for 2016 to less than the 2015 level of 18.5 million gallons. Additionally, TEL FSI has a goal of recycling at least 72% of waste by 2017 and TEL has set a goal of recycling 97% of all waste for their subsidiaries. Cost is another motivator since liquid nitrogen, water usage, and associated costs are significant and continue to rise.

SOLUTIONS

WATER CONSERVATION

Decommission ORION 1

The ORION 1 is a Process Lab tool that utilizes both water and nitrogen gas in an idle state and during wafer cleaning. The ORION 1 is connected to the deionized (DI) water supply loop, bypass loop and several drains. Testing shows this unit is responsible for 55% of the process lab water sent to the drain. Since the tool has not been in high use this year, it was recommended to decommission this tool, saving an estimated 40% of total TEL FSI facility water. Decommissioning the ORION 1 would also save 2.4 million standard cubic feet of nitrogen annually.

Install Flow Meters in Process Lab

Currently, there are flow meters distributed throughout the facility. However, there are no flow meters that show individual water usage for each tool. Tests using bucket catches and tank level tests showed that 23% of facility water from the process lab cannot be tracked and therefore is likely not vital to the process. It is recommended that TEL FSI install fifteen meters on the supply loop and the reclaim loop before and after each tool. Flow meters can track water within the process lab and identify future reduction opportunities.

LIQUID NITROGEN REDUCTION

Fix Compressed Gas Leaks

TEL FSI uses compressed gases in their process including nitrogen, argon, and compressed dry air. In order to check for leaks, an ultrasonic leak detector was used in the water room, sub fab, production floor, and process lab. Leaks were identified, recorded, and most have been fixed. Though most leaks were small, significant cost savings are associated with fixing these leaks. Fixing just the nitrogen leaks will result in saving 1.3 million standard cubic feet of nitrogen and \$15,000 annually.

WASTE REDUCTION

A trash sort was conducted to analyze opportunities for waste reduction. Waste reduction recommendations were made from the sort which revealed that TEL FSI's trash is composed of 19% organic material, 12% clean room garb (hair bouffants, face masks, and boot covers), 13% plastic films, 10% single sort recycling, 2% miscellaneous recycling, and 44% true trash.

Add an Organics Recycling Stream

Many waste haulers offer organics recycling where organics are recycled into mulch. Adding an organics program would cost \$73/month, but would reduce waste sent to the trash and increase the recycling rate by 5%. In order to create a successful organics recycling program, trash bins would need to be reorganized, signs would need to be placed, and an employee education program implemented.

Recycle Clean Room Garb

Clean room garb is used in both the process lab and production clean rooms. Using the VWR clean room garment recycling program, TEL FSI would use twelve pre-marked cardboard boxes for garment collection. Full pallets would be shipped and the items converted into plastic resin for more permanent reuse like piping or floor decking. When implemented, the program would cost TEL FSI \$1,200 annually and increase the recycling percentage by 2%.

Expand Plastic Film Recycling

Currently there are plastic film recycling receptacles in the production floor for plastic bags, bubble wrap, and films. The bins are emptied and picked up by the Adult Training and Habilitation Center (ATHC) for recycling. The recommendation is to expand the program to the process lab and educate employees in affected areas to ensure that all plastic films are recycled. This recommendation has no cost and would increase the recycling rate by 3%.

Switch to Manual Shredding

TEL FSI shreds confidential documents through First Shred at a cost of \$98 every eight weeks; however, First Shred was recently purchased by Shred It and cost increases are expected. Since TEL FSI has manual shredding machines on-site, they decided to switch to manual shredding. The shredded paper can be recycled through ATHC and picked up in their bi-weekly pick-up at no additional cost. While this recommendation does not improve the recycling rate, it will save \$620 per year.

Discontinue Trash Compactor Lease

TEL FSI currently leases a trash compactor which is emptied about every six months and brought to the landfill. Ending the compactor lease and switching to a weekly trash pickup would save \$6,250 annually.



Recommendation	Annual Reduction	Annual Savings	Status
Water conservation	11,900,00 gallons	\$117,000	Implemented or in review
Nitrogen reduction	3,640,000 ft ³	\$21,600	Implemented or partially implemented
Waste Reduction	19.2 tons	\$4,800	Implemented or planned