



# SkyWater Technology Foundry



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## Project Background

SkyWater Technology Foundry is a designer and manufacturer of semiconductor products for many industries, including a special accreditation for manufacturing US government microelectronics. They have 80,000 square feet of cleanrooms that are in use 24 hours a day, seven days a week, 365 days a year. Some common products include automotive chips and touchscreen controllers. They also produce products for niche applications such as quantum computing and DNA sequencers. SkyWater was previously owned and operated by Cypress Semiconductor from 1991 to 2017. In March of 2017, Cypress sold this facility to the newly incorporated company: SkyWater Technology Foundry.



*“My experiences at SkyWater have made me feel much more confident in learning new sides of engineering and ultimately becoming a more well-rounded engineer. A big lesson I learned was that even small gestures of good faith can go a long way towards gaining the respect of technicians, whose buy-in is critical.” ~ BN*

## Project Background

The energy usage at SkyWater is concentrated into two main areas: process equipment and ancillary equipment. The process equipment is effectively a constant load throughout the entire year and consists of the equipment to turn the raw silicon wafers into integrated circuits. The ancillary equipment load fluctuates based on the weather and includes systems such as de-ionized water, compressed dry air (CDA), liquid nitrogen, heating, ventilation, and air conditioning (HVAC), electrical, and life safety. The HVAC load fluctuates seasonally based on the outdoor ambient weather conditions since the cleanrooms have strict set points for temperature and relative humidity. The 80,000 square feet of cleanrooms require five air changes per minute, resulting in significant HVAC energy costs. SkyWater wants to reduce their HVAC energy costs.

## Incentives to Change

SkyWater Technology Foundry uses a great deal of energy because of the energy-intensive manufacturing processes operating around the clock, 365 days a year. In 2016, SkyWater used 83.3 gigawatt hours (83.3M kWh) of electricity. 83.3 gigawatt hours of electricity is slightly more electricity than the amount that would be generated by the world’s largest wind turbine, which is 722 feet tall and 538 feet in diameter, operating at constant maximum capacity for a year. Following the cost of labor, electricity is their largest cost. Operating more efficiently and reliably is therefore a high priority to keep SkyWater competitive with the rest of the semiconductor manufacturing industry.

*“Having the MnTAP intern working at SkyWater has allowed us to understand and reduce our energy use while maintaining the air quality in a class 10 cleanroom. The new understanding and maintenance plan implementation will be remembered for years.”*

*~ Bill Groboski, Staff Equipment Engineer,  
SkyWater Technology Foundry*

# Solutions

## Clean Make-up Air Coils

The coils in the make-up air units transfer heat to and from the make-up air. At the start of the project, the coils were coated in dirt and debris. Dirty coils caused the make-up air units to work harder to condition the same amount of air at the required temperature and humidity. By cleaning the coils with pressure washers and hot water, the fans and the heat transfer fluid pumps can slow to their nominal values.



## Reduce Condenser Water Pump Speed

The condenser water pumps are the part of the chiller system that cycles the condenser water through the condensers, cooling towers, and sumps. The current American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) guidelines suggest that a flow rate of two gallons per minute (GPM) per ton of refrigeration is the most efficient operating point. Currently, the pump speed isn't controlled to GPM per ton. This means the GPM per ton fluctuates based on the load, and does not consistently operate close to the efficient two GPM per ton recommended value. Installing flow meters to each chiller allows the pump speed to be controlled to the two GPM per ton operating point.

Recommendation	Annual Reduction	Annual Savings	Status
Clean fab A/B & C makeup air unit (MAU) heat transfer coils	71,000 kWh	\$4,800	Implemented
Remove charcoal filters MAU A/B	13,000 kWh	\$900	Implemented
Reduce fab C condenser water pump speed	480,000 kWh	\$32,600	Recommended
Reduce fab A/B condenser water pump speed	540,000 kWh	\$36,700	Recommended

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