



Applied Materials Manufacturing & Clean Room



The Challenge

Applied Materials is a global leader in providing innovative equipment and services for manufacture of advanced semiconductor, flat panel display, and solar photovoltaic products. Located in Gloucester, MA it fabricates, tests, and ships ion-implanter tools for the semi-conductor and photovoltaic industries. Due to the sensitive nature of the tools and wafers, nearly all of the final tool assembly, testing, and research and development work is done in controlled clean room environments ranging in classification from Class 10,000 down to Class 10. All recirculation and make-up air units in the facility were pneumatically controlled at the time of the study.

The Opportunity

Applied Materials was eager to reduce their energy costs and improve control over their HVAC systems, while maintaining rigorous clean room standards. After requesting assistance from their utility, National Grid assigned B2Q Associates, Inc to identify energy efficiency and performance improvements, quantify project economics, and calculate utility incentives. Using design data, recent balancing reports, particle count data, occupancy level profiles, and gowning practices B2Q Associates identified a significant opportunity to reduce recirculation and make-up airflows in clean rooms and assembly areas, especially during 2nd shift, 3rd shift, and weekend nights. In office areas, B2Q Associates identified an opportunity to shut down and set-back air handlers which were unnecessarily running 24/7. B2Q Associates utilized power metering equipment, TMY3 weather data, and particulate and duct airflow measurements to establish baseline cooling and fan load energy profiles. The allowable airflow reductions for each space were determined using actual particle count data, shift-specific occupancy levels, and ISO/ASHRAE requirements for particle counts and ventilation air.

The Results

B2Q Associates recommended a DDC retrofit of the existing pneumatic control system for greater control and scheduling capabilities. Two custom clean room measures were identified to set recirculation and make-up unit drive speed by each shift in order to meet predetermined airflow rates and then actively reset within a defined bandwidth based on feedback from new return air particulate sensors. Four additional measures were identified for non-clean spaces including reduced airflows based on occupancy levels and shutting down air handlers serving office areas at night and on weekends. Total annual energy savings were calculated at 2,060,000 kWh and 57,000 therms, with a total cost savings of \$268,400 per year. The combined project had an estimated capital cost of \$1,079,000 and a combined utility incentive of \$538,000 for simple payback of 2 years. The keys to the success were the detailed measurements and balancing data to establish an accurate baseline model of HVAC energy use, as well as, the proposed addition of new particle count sensors to measure system performance and provide active feedback in order to maintain clean room standards.