Performance Track Leading Practices

DENSO Manufacturing's Michigan Facility Reduces its Carbon Footprint through Heat Reclamation and Energy Efficiency Improvements

Costs and Benefits of Heat Reclamation

Costs	Savings and Other Benefits
Wide range of installation costs depending on size and scale of a facility's energy profile.	Reduced operating cost as demand for fuel and electricity drops. Uses a freely available waste product that would otherwise end up contributing to climate change. Prepares facilities for a carbon-regulated economy. Creates new capabilities in energy management and opportunities for product innovation. Provides marketable improvements in corporate environmental performance.

National Environmental PerformanceTrack
U.S. Environmental Protection Agency

EPA United States Environmental Protection Agency

PERFORMANCE TRACK FACILITY

DENSO Manufacturing Michigan Inc.,
Battle Creek, Michigan

GOAL CATEGORY

Air Emissions

RELATED INDICATORS

Emissions of Greenhouse Gases and
Associated Improvements in Total Energy Use

OVERVIEW

DENSO Manufacturing Michigan (DMMI) designs and produces automotive heating and cooling components and systems. Located on a 100-acre site in Battle Creek, Michigan, the facility houses more than 1 million square feet of manufacturing and administrative floor space. As a Charter Performance Track member since 2001, DMMI has taken advantage of the program to pursue new and creative ways to align its operations with DENSO Group's global environmental initiative, EcoVision 2015.

One of EcoVision 2015's goals is to reduce normalized carbon dioxide (CO_2) emissions by 18 percent in manufacturing facilities during a six-year period between 2004 and 2010. DENSO's approach to maintaining global production increases and reducing greenhouse gas emissions involves a new operational paradigm called the "perfect energy factory." In implementing this approach, DMMI's most significant energy savings have come from recovering waste heat and putting it to use.

HOW THE DMMI'S HEAT RECLAMATION SYSTEM WORKS

Beginning in 2004, DMMI began rolling out the heat reclamation system as part of its Performance Track goal to reduce CO_2 emissions from direct and indirect sources through efficiency improvements in electrical and natural gas use. These activities focused primarily on process improvements and plant heating and cooling: facility engineers developed a process that supplements plant heating with waste process heat, effectively recovering thermal energy from process exhaust and reusing it to both heat and cool the facility.

DMMI's production process depends on enormous energy inputs to power 15 brazing furnaces that are heated to 1,100°F. Capturing heat from the exhaust—in conjunction with a high level of furnace insulation—has succeeded in significantly cutting the facility's utility bills and CO_2 emissions. As a result, DMMI's 2006 Performance Track report showed a reduction of approximately 15,000 metric tons of carbon dioxide equivalent ($MTCO_2E$), normalized to account for increased production. The original heating system used 13 burners on standby to heat the facility; now, on average only two or three burners were needed even on the coldest winter days. As a result, energy efficiency at the facility improved by more than 30 percent.

Ceiling ducts draw wasted heat from the furnaces, transporting it to cooler areas of the DMMI facility

Other energy management initiatives complement DMMI's heat reclamation as part of its "perfect energy factory" efforts, contributing to the overall reduction in the facility's total non-transportation energy use. Key process improvements undertaken at DMMI include:

- ★ Adjust set points for heating and cooling of the entire facility.
- ★ Systematically identify and fix air leaks in every area of the facility.
- ★ Hold "no energy days" where the majority of the equipment in the facility is turned off during long holiday weekends—a practice that helps to identify "energy vampires" (equipment that uses electricity even when turned off).
- ★ Install a sleep mode on furnaces, which turns off the burners for non-production times and returns them to set-points before production resumes; this is being considered for plant-wide implementation.
- ★ Implement a new system to track and fix compressed air leaks in the heater area of the facility, with plans for plant-wide implementation.
- ★ Remove fluorescent bulbs throughout the facility, including high population areas.
- ★ Install new technologies that reduce CO_2 emissions while raising water usage; one example is a scrubber that was installed instead of an incinerator at the end of 2007.

IMPLEMENTATION

The first step in evaluating the potential for waste heat recovery is to determine the costs and operational benefits. Questions to consider include: How does the supply of waste heat compare with current or expected demand? How easily can the waste heat source be accessed? How far is the source from where it is needed? Is the waste heat source of good quality and in good condition? Are there any implications affecting product quality in using waste heat? How much will the waste heat have to be upgraded or raised in temperature before it can be used? And finally, a facility should consider any regulatory restrictions, in terms of product contamination or health and safety, associated with using waste heat.

Facility managers should begin by instituting regular inspections and maintenance of all heat-intensive equipment. In some cases managing waste heat can involve simply eliminating sources, and at a minimum it should be possible to reduce the temperature of the waste heat. Simple housekeeping can also reveal big energy management opportunities. One of the most straightforward ways to recover waste heat is to capture and pipe it to where it can be used. For example, a facility could use warm exhaust air from a mechanical room to heat an adjacent room. In the case of DMMI, a more advanced system was designed to move large quantities of hot air from the brazing furnaces into the HVAC system, and controls were installed to maintain environmental health and safety requirements.

Data for heat reclamation improvements and overall energy use can be collected from utility bills and meters, entered into a spreadsheet, and aggregated for the whole facility. In addition, individual machines can have meters installed to track the effects of changes made at the machine level. This data can then be integrated into a facility EMS and tracked in a spreadsheet for further analysis.

BENEFITS OF HEAT RECLAMATION

At DMMI, the "perfect energy factory" is a process of continual improvement designed to empower facility managers to reduce facility and corporate energy use. Reusing hot exhaust air presents an easy opportunity for energy savings by capturing free and available energy. The more heat recovered, the less electricity needed and the less fuel burned, thereby reducing greenhouse gas emissions both on-site and from electricity production by utilities. According to DMMI, its heat reclamation system reduced CO_2 emissions by 6 percent between 2003 and 2006, a total reduction of 3.9 million pounds—exceeding even DENSO's ambitious global goals for greenhouse gas reduction. The energy management system pushes these improvements further, with enormous cost-saving opportunities as well.

RESOURCES FOR MORE INFORMATION

- ★ EPA's and the U.S. Department of Energy's (DOE) ENERGY STAR program [http://www.energystar.gov/index.cfm?c=business.bus_index]
- ★ DOE's Industrial Technologies Program within the Energy Efficiency and Renewable Energy Division [http://www1.eere.energy.gov/industry/] works with industry to improve industrial energy efficiency and environmental performance.
- ★ EPA's Climate Leaders program [http://www.epa.gov/climateleaders/] works with companies to develop comprehensive climate change strategies.