

“Free Cooling” Installed at Technical Area IV Buildings



The cooling tower is the core of the system.

A newly installed free-cooling system at Sandia National Laboratories/New Mexico (SNL/NM) Technical Area IV (TA-IV) became fully operational on October 21, 2010. “Free cooling” describes a system that uses neither compressors nor refrigerant gases to produce cold water to cool interior spaces of buildings and processes. This type of system relies instead on dry, low-temperature ambient air to chill cooling water. Immediately, the system linking Buildings 962 and 963 reduced energy consumption and the SNL carbon footprint, cutting energy-related costs more than \$5,000 per month. Free-cooling systems are particularly effective in spaces with a constant heat load created by computers and other equipment.

A cooling tower (photo) comprises the core of the compressor-free system. The tower is essentially

a large evaporative cooler that rejects heat from buildings to the atmosphere. The two-stage free-cooling system installed at the TA-IV buildings also includes a variable-speed blower, water cascading through plastic fill material, and a heat exchanger. The air passes through the cooling tower, and through evaporative cooling the water is cooled. The cooled water then passes through a water-to-water heat exchanger.

Free-cooling systems integrate easily into the cooling loops of existing facilities, enhancing the synergy of current systems, and helping meet energy program objectives. Other technical innovations in the cooling loop at the TA-IV buildings include the Green Machine, used for water-system treatment, and magnetic bearings being tested for efficiency on the chillers.



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During the winter, when the outside temperature is low enough that the cooling tower can produce 45°F water, the chiller remains off. This reduces the electrical consumption for process and computer rooms by as much as 50%.

Free-cooling technology has been applied to six other facilities at SNL/NM. Energy, operational, and maintenance costs have been reduced because the chiller equipment does not require any preventive maintenance for approximately six months each year. By taking advantage of cool ambient temperatures and arid New Mexico air, SNL/NM can significantly reduce building energy consumption and its carbon footprint during the fall, winter, and spring. Energy-management data gathered between October 2010 and February 2011 show the energy demand from refrigerant compressors in Buildings 962 and 963 was zero.

During the same period in 2009–2010, the reported average energy use was 2,280 kWh (kilowatt-hours) per day. At an average utility rate of \$0.08 per kWh, approximately \$182 per day (or \$5,400 per month) has been saved. By operating the free-cooling system for at least six months each year, SNL/NM could save \$35,000 in energy



The cold plate heat exchanger uses the cold tower water that is produced in the winter to cool the chilled water in the building.

costs for Buildings 962 and 963. As new cooling towers are installed at other SNL/NM facilities, energy-related expenses will continue to decrease and, more importantly, SNL/NM will satisfy the Department of Energy's requirement to reduce energy consumption, greenhouse gases, and carbon footprint.

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