The University of New Mexico (UNM) in Albuquerque is investing in BACnet®, renewable energy technology, Enterprise Energy Management and Smart Grid practices to provide campus control and energy metering. It has a campus environment spanning more than 10 million ft2 (930 000m2). It is the largest public research university in New Mexico with more than 25,000 undergraduate and graduate students.

Energy Control Inc (ECI), through the use of Delta Controls Systems, has been the premier supplier of mechanical control systems at UNM over the last thirty years. ECI performs ongoing engineering analysis of mechanical systems and identifies opportunities for optimization, improvements in the learning environment, and energy cost savings. ECI assisted in acquiring a $600,000 grant from the U.S. Department of Energy for an Energy and Demand Response project at UNM's Albuquerque campus. This design/build DR demonstration project uses technology and energy storage from low demand/low cost hours to furnish power during high demand/high cost hours and helps to cut energy waste. The University played host to the GridWise Council to outline their new DR project. The GridWise Council is a committee formed through the Department of Energy utilizing experienced professionals to bring awareness to, and find solutions for, growing electric demand. This project won the Contracting Business Design/Build Award in 2009.

The first phase of the DOE sponsored Building Intelligence project consisted of analyzing energy usage of UNM's Main campus, and more specifically, the Mechanical Engineering facility which utilizes thermal storage and solar energy. Solar hot water is stored in super-insulated tanks which feed through a 20ton solar absorption chiller. The chiller takes 190°F water and converts it to 42°F chilled water which is used to cool the building.

The Enterprise Energy Management System captures real-time energy data from 80 buildings on campus. This Building Intelligence tool (*eBiz*) converts building information data into knowledge tools to assess carbon footprint and real-time building performance. UNM represents close to 2% of the local Grids total load. By altering consumption UNM is capable of responding to Grid status and to react and predict power consumption during high demand time periods to help meet sustainability needs. The increased level of grid-interoperability is substantial and the project will serve as a model to further technology for future smart-grid facilities.

The 70,280 square foot Mechanical Engineering Building along with 14 other buildings is designed to collect energy use detail down to the equipment level. 65 other campus facilities of approximately 4,929,720 square feet are metered to analyze electric, steam, and chilled water use for the building. Programmable Logic Controllers communicate with MODBUS protocol through converters in each building.

UNM's central campus can draw approximately 30 MW of electricity at peak. Part of which is generated locally using a 6 MW gas turbine installed during a 2001 renovation at the Ford Utilities Center. The campus energy system is capable of producing electricity and recovering waste heat by producing steam. This can be used for heating or chilled water (through absorption units) depending on the season. The co-generation plant currently meets approximately 40% of the campus electricity needs and 65% of heating needs.

UNM estimates 3 MW of possible load shedding with the approximate doubling if VFD motor control and lighting control were included in each building. System load shed is estimated by analyzing electrical consumption, the co-generation plant capability - heating and chilled water production, mechanical equipment systems and minimal acceptable occupant discomfort

levels. Complete assessment details are available for public viewing through the US Department of Commerce; National Technical Information Service at (800) 553-6847 orders@ntis.fedworld.gov Report: SAND2002-xxxx.

In 2004 the University embarked on an internally funded $60 million energy infrastructure integrated project that included chilled water system improvements, utility center renovation, and additional energy conservation measures. UNM received an Energy User News Project of the Year Award for this initiative. The phased projects primarily addressed campus heating and cooling equipment and the control of that equipment for comfort and efficiency. Of particular interest is the work done in the BSL3 labs, which require highly sophisticated control of airflows to protect against contamination. This is done through facility automation and allows for central and remote monitoring of systems that are also interfaced to the Ethernet Fiber Optic Campus Network and allow monitoring via Web Browser technology. Managing building systems is data-driven and requires access and the ability to manipulate extensive amounts of information.

The availability of a standard building automation protocol was needed to achieve enterprise-wide system functionality and benefits. Standardization offers the ability to integrate wide-ranging building systems from air handlers to chillers and other prime movers from different manufacturers. It becomes really interesting when these familiar systems are blended with information technology (IT), renewable energy resources and educational technology.

Since 80% of power plants built in the last 15 years are gas-fired, more electric utilities may adopt fuel-use charges that will drive electricity costs up. At UNM, a strategy to address this challenge is the implementation of a Solar Thermal Array with BTL-listed controllers for heating and cooling. The controller has an Ethernet port to allow UNM's local area network (LAN) to be used for interface anywhere, anytime, and also uses BACnet/IP for Internet access.

Energy Control Inc. worked with UNM's networking team to assign IP addresses to controllers and build in data security. The campus also has integrated energy generation with classroom comfort. This technology incorporates a BACnet® system for energy efficiency with solar as the source of renewable energy. With BACnet/IP-based enterprise energy management, the system monitors building conditions and solar generation.

UNM uses BACnet® technology from two manufacturers. Before the current project, it had legacy systems from seven manufacturers and a metering system. These systems are being integrated with BACnet® throughout the campus.

Of significant interest on the UNM campus is a program that the university has started to integrate energy metering and building management data to offer a campus-wide energy information system. This is done through facility automation and allows for central and remote monitoring of systems. These BACnet® systems are interfaced to the Ethernet fiber-optic campus network and allow monitoring via a Web browser. Through further initiatives it will remain the basis for next-generation systems.

Sequences such as the automated demand response routine at The University of New Mexico will be essential to maintaining electric grid reliability. These systems will also create tremendous energy and cost savings opportunities that do not detract from the working/learning environment.