# A SUCCESS STORY FROM EMACX SYSTEMS, INC., AN ENERGY TECHNOLOGY COMPANY

# **CASE STUDY**





#### **CASE STUDY SUMMARY**

Through the use of a technologically advanced Automated Demand Control System (EMS) 11 Macy's Stores achieved significant KW savings and gained improved control of their HVAC equipment without jeopardizing shoppers comfort and operations.

- System Provider: Emacx Systems, Inc.
- Building Type: Retail Stores
- Building Size: 250,000 to 2.2 million ft<sup>2</sup>
- Overall Payback Time: 2.5 years
- Primary Benefit: Demand/Energy Cost Savings
- Equipment Installed: Automated Demand Control System ALC Expert-xp Load Controller, Visual-xp Software and VFDs

# Automated Demand Control helps Macy's save substantial costs

Macy's facility engineers PROBLEM have tried on occasion to "manually" optimize individual store energy consumption. However, with the onset of the New York, Metropolitan area's vast energy consumption and fear of an overloaded grid, Macy's wanted to be doing more to save energy and to help avert rolling blackouts in their community. Manually trying to control Demand of HVAC and other associated loads was labor and time intensive. involving the manual adjustment of several controls spread out over the many stores. Furthermore, participation in, "day ahead", demand response programs was near impossible for aforementioned reasons. Often the results of kW reductions and the associated savings were not satisfactory, if achieved at all. There was

simply no standardized system and procedure in place to address each store individually for automated demand control and maintain the flexibility to curtail load, as well as, maintain the shoppers' comfort, one of Macy's highest priorities.



▲ Demand controlled Chill Water Pumps via VFDs

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#### Project Site Locations:

Macy's Herald Square, New York City

Macy's Queens, New York City

Macy's Staten Island, New York City

Macy's Roosevelt Field, Long Island, New York

Macy's Manhasset, Long Island, New York

Macy's Valley Stream Long Island, *New York* 

Macy's Smith Haven, Long Island, New York

Macy's Huntington, Long Island, New York

Macy's White Plains, New York

Macy's Danbury, Connecticut

Macy's Stamford, Connecticut

## Summer Peak Demand: 730 kW to 6.9MW

kW-Shedding Level: 60 kW to 575 kW

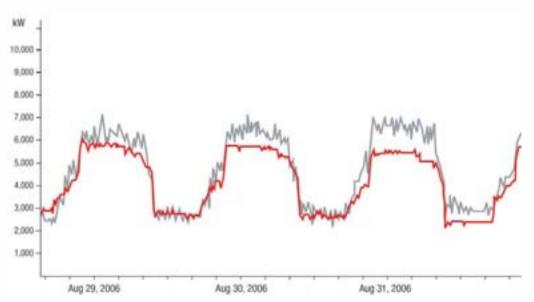
# SOLUTION

The availability of funding from Utilities

such as CL&P, LIPA and State Energy Authorities like NYSERDA for the installation of enhanced automated demand control technologies served as a catalyst for Macy's to move ahead with plans to implement demand control systems in several key stores. Macy's traditionally uses a Building Management System (BMS) for monitoring temperatures, humidity and for operating air-handlers and other mechanical HVAC equipment. However, automated demand control by trending the kW usage within the imposed utility interval to initiate intelligent curtailment was not possible.

Adding the desired level of automation involved linking the BMS to the automated demand control system (EMS) via Direct Digital Control (DDC). Additional control of HVAC equipment was achieved by installing 34 new VFDs throughout the different stores. Chillers are part of the demand reduction efforts as well and are controlled via the external current limiting set point function. Emacx Systems, Inc., the automated demand control system provider, secured and administered the NYSER-DA, LIPA and CL&P grant funds and played a key role in shaping and implementing the project together with HI Solutions, the BMS provider and key demand service providers.

The Automated Demand Control System allows Macy's to now program a not-toexceed set-point for electrical demand and instruct the EMS to initiate pre-programmed load shedding strategies when that set-point is approached. Dynamic calculations with specially developed algorithms allow for a non-jeopardizing operation at all times. The algorithm takes into consideration many different parameters and makes intelligent real time decisions determining whether the load needs to be curtailed or not. The electrical power used is transmitted synchronously to a utility measurement device (in most cases, the utility supplies measurements via power impulses). The transmitted actual power is monitored by a microprocessor, controlled and continuously compared with target values.



▲ The Graph shows a typical August demand curve at Macy's Herald Square, New York City, before and after (red line) demand control was implemented. The difference is 920 KW, where 575kW can be attributed to the demand control system and the balance to other measures such as lighting etc. One can also see that the load profile has become flat. There are no more peaks.

### **BENEFITS**

As a result Macy's is now able to shed

from 60kW to 575 kW depending on the peak load of the store, without disrupting shoppers' comfort or store productivity. Under their new load-shedding strategies, Macy's found that they could actually benefit from using the system on a day-to-day basis and not only for the mandatory load reduction under the enrolled program. Due to their conservation efforts over the past year, Macy's is currently saving substantial costs annually due to demand reduction and are curtailing a load of over 1.5 Mega Watt, a substantial contribution to unload the grid during critical energy shortages.

• Emacx Visual Software showing Trending, Alarms, Instantaneous Power Out-Put and Load Profile Direct control over their HVAC equipment with the Emacx Automated Demand Control system allows Macy's to maintain a successful demand reduction strategy throughout their stores. Even in cases where due to special circumstances, not all the connected loads can participate in curtailment efforts, the demand strategy is not jeopardized. Facility operators can easily monitor, visualize and control the set demand reduction efforts. They also have the capability of overriding the system in case of mechanical problems or malfunction. The system is centrally controlled by Macy's East Call Center. In case of an emergency or other avert situations they can access each Demand Controller over the LAN and make all necessary adjustments.









Trending is performed to evaluate power ratios in order to switch load / load groups connected to the ALC-expert xp on, or off, depending on pre-set parameters such as:

- Total real time kW consumption
- kW-slope
- Set priority of each load
- Target kW-value within utility period
- Maximum allowed curtailment time of each load
- Minimum curtailment time of each load
- Minimum run time after curtailment
- Maximum actual curtailments per day
- Wattage Integral of connected loads
- Imposed utility interval duration
- Power ratio

# TECHNICAL INFORMATION

Emacx's enhanced Energy Management System project for

demand control involved expanding the capabilities of an existing BMS systems. The modifications included software programming of the BMS, along with some new hardware and wiring. The result is a powerful combination of an automated demand control system and a building management system that can maintain demand set points without disrupting shoppers' comfort, nor jeopardizing operations.

To monitor the real-time effects of load-shedding strategies on overall demand, the Emacx System is linked directly to the electric utility meter. The system collects and archives 15-minute interval data. This linkage allows facility operators not only to see the immediate effects of load-shedding strategies, but also to program the EMS to reduce storewide demand to a specified kW amount. The EMS will now shed loads in a predetermined sequence until demand reaches the set point.

The main effort was to reduce the facility demand (kW) by maximizing control of the entire HVAC System. Equipment such as AHUs, Pumps and Chillers were integrated in the Emacx Load Controller and the BMS by using existing and new variable speed drives.

Supply and Return Fans are all programmed in a Master Slave mode to avoid in-balances. The combination of variable speed drives and the automated demand control system makes a substantial contribution towards energy savings. AHU-VFDs are reduced by maximum 15Hz increments, yielding over 30% in kWh and kW savings. An AHU will never be lowered beyond 20Hz minimum speed. Chilled water and condenser water pumps, as well as, cooling tower VFDs are reduced between 7Hz and 10 Hz maximum to ensure safe operations. Such a slight reduction will allow for enough cooling power, even on hot days in the nineties, without jeopardizing operations and comfort.

Electric chillers at Macy's can be outfitted by the manufacturer with a board allowing for external current limiting. That board accepts an analog signal (mA or Voltage) to control the current to the chiller. The Emacx Frequency Analog Module for chiller control (see diagram) accepts a frequency input and outputs an analog voltage or current in proportion to the input frequency with 0.1% accuracy. The full scale input frequency can be set to any value from 1 Hz to 25 KHz, with a frequency source provided by the ALC-expert xp. The maximum reduction is 10% of the chiller's output cooling capacity.

