Case Study intelligent Demand Control and Demand Response Platform from Emacx Systems, Inc. for Memorial Sloan Kettering Cancer Center (MSKCC), NYC

Introduction

This paper describes how Memorial Sloan-Kettering Cancer Center (MSKCC) is using the Emacx intelligent Peak Load Control (iPLC) System to curtail the energy costs of their Manhattan facilities in a highly profitable manner. It will commence with a description of the Emacx iPLC system, followed by an overview of how it facilitates MSKCC's participation in Demand Response (DR) programs, including an analysis of the return on investment (ROI) it generates.

The Emacx intelligent Peak Load Control System (iPLC)

Emacx Systems, Inc. currently provides intelligent peak-load control (iPLC) systems to commercial facilities throughout the United States. This system is based on the highly efficient European approach to automatic energy curtailment, where the end-user rarely perceives that any curtailment is occurring. The Emacx iPLC system therefore helps facility managers minimize demand charges while maximizing revenues earned through demand-response programs. As a result, the Emacx iPLC system routinely delivers investment payback periods of less than two years.

The Emacx iPLC system curtails the peak power loads of a facility through a sophisticated feedback-control strategy that anticipates the demands of end-users and utilizes the building management system (BMS). Such popular American systems can be programmed to indirectly curtail power consumption by adjusting the environmental settings of a building, but that comes at the cost of end-user comfort. The Emacx iPLC system, when controlling the BMS system, directly controls the energy-consuming machinery to ensure that aggregate power demand remains below the desired threshold, based on live power input data, while constrained by end-users priorities. As a result, curtailment occurs without imposing new demands on the facility operators, discomfort to end-users, and degrading stress to machinery. By gradually changing the power flowing to individual components, such as air handlers, fans, motors, and pumps, the Emacx iPLC system also avoids the destructive mechanical stresses associated with on-off demand control that both manual operators and BMS systems can generate. The Emacx system thus appears to represent a paradox: it mitigates disproportionately expensive demand peaks, thus generating significant profit during DR events, while maintaining end-user operations and comfort.

Project Background

MSKCC facility engineers have tried on occasion to optimize individual building energy consumption through manual means. However, within the context of the New York City Metropolitan area's vast energy consumption and the threat of an overloaded grid, MSKCC sought 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 floors. 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 unsatisfactory, if achieved at all. There was simply no standardized system and procedure in place to address each Building; Rockefeller Research, Main Campus and the Zuckerman. As a result, MSKCC sought an Emacx iPLC system to facilitate on-going demand control and participate in demand response programs without compromising highly demanding end-user requirements.

Discussion of current operations: Main Campus

The Main Campus is a clinical care, research and education hospital operation comprising 21 floors, occupying 7 contiguous buildings, and containing a total area of 1.4 million square feet. The Main Campus has various functional spaces, in addition to general patient care, such as the reception area, intensive care units, surgical facilities, waiting rooms, food preparation kitchen, facility operation space and administrative offices. Currently Memorial Sloan Kettering spends more than $9,600,000 on electrical energy annually for the Main Campus. The Main Campus has a chilled water plant that contains two steam turbine chillers. On a hot and humid summer day, all chillers operate during the utility peak billing hours from 7 AM to 11 PM. The associated HVAC auxiliary equipment consists of redundant primary, secondary, and tertiary condenser water and chilled water pumps as well as cooling tower fans. The building is primarily conditioned using air-handling units (AHUs) that operate year round (24/7). As part of the project Emacx Systems, Inc. will be adding 20 VFDs to certain pumps and (AHUs) to achieve sufficient control. MSKCC will receive the additional day-to-day energy savings, and operational benefits created by the use of these VFDs.

Discussion of current operations: Rockefeller Research

The Rockefeller Research facility is a research and education hospital operation comprising 15 floors, occupying a total area of 355,000 square feet. The facility primarily houses research and development and administrative offices. Currently MSKCC spends more than $3.3 million dollars on electrical energy annually for Rockefeller Research.

The Rockefeller facility has a chilled water plant that contains two 1,000 ton centrifugal chillers. On a hot, humid summer day all chillers operate during the utility peak billing hours from 7 AM to 11 PM. The associated HVAC auxiliary equipment consists of redundant primary, secondary and tertiary condenser water and chilled water pumps as well as cooling tower fans. The building is primarily conditioned using air-handling units (AHUs) that operate year round (24/7). As part of the project we will be adding nine VFDs to certain pumps and AHUs to achieve sufficient control.

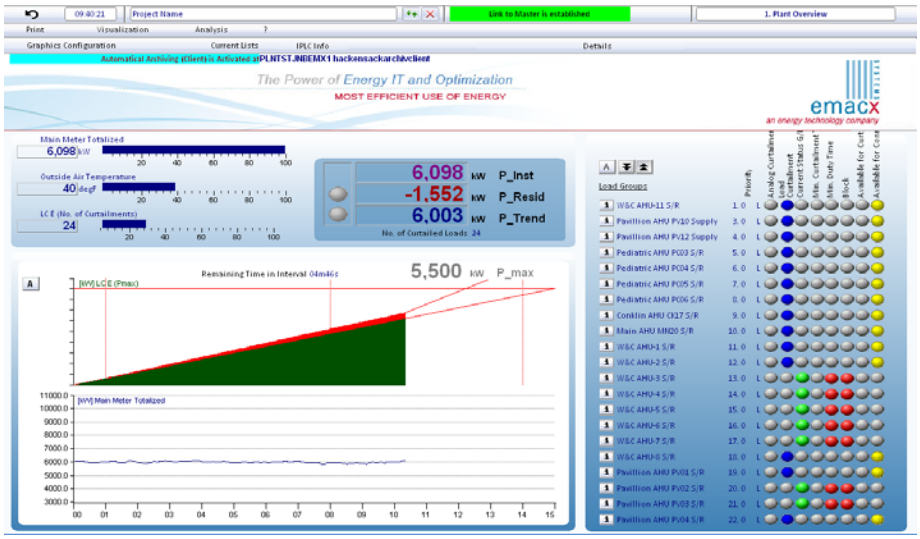
Discussion of current operations: Zuckerman Building

The Zuckerman Research Center is a research, development, education and office facility consisting of 22 floors, occupying a total area of 568,000 square feet. This newly constructed facility has various functional spaces, in addition to research and development such as the reception area, facility operation space and administrative offices. Currently the MSKCC is expected to spend more than $5,000,000 on electrical energy annually for the Zuckerman facility.

The Zuckerman facility has a chilled water plant containing four Carrier 1,500ton centrifugal chillers. On a typical summer day, a large percentage of chilled water capacity is utilized. As this building is new, there is limited historical data. Future plans include the sharing of chilled water capacity with the Main Campus. The chillers operate during the utility peak billing hours from 7 AM to 11 PM. The associated HVAC auxiliary equipment consists of redundant primary and secondary condenser water and chilled water pumps as well as cooling tower fans. The building is primarily conditioned using air-handling units (AHUs) that operate year round (24/7). All of the major pumps, AHUs, and cooling towers are outfitted with VFD's. A large number of fume hoods throughout the research areas utilize VFDs, as well. The engineering and design of this newly constructed facility makes it a prime candidate for automated demand control.

Project Description and Purpose

MSKCC 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 power usage within the imposed utility interval of 15 minutes to initiate intelligent curtailment is simply not possible with such a system. Such capability is provided by the Emacx iPLC system, however.



Additional levels of automation were necessary to link the different BMS' to the automated demand control system (EMS) via Direct Digital Control (DDC). Emacx Systems, Inc. achieved sufficient control of HVAC equipment by installing 29 new VFDs throughout the different buildings. Chillers are part of the demand reduction efforts and are controlled via the external current limiting set-point function.

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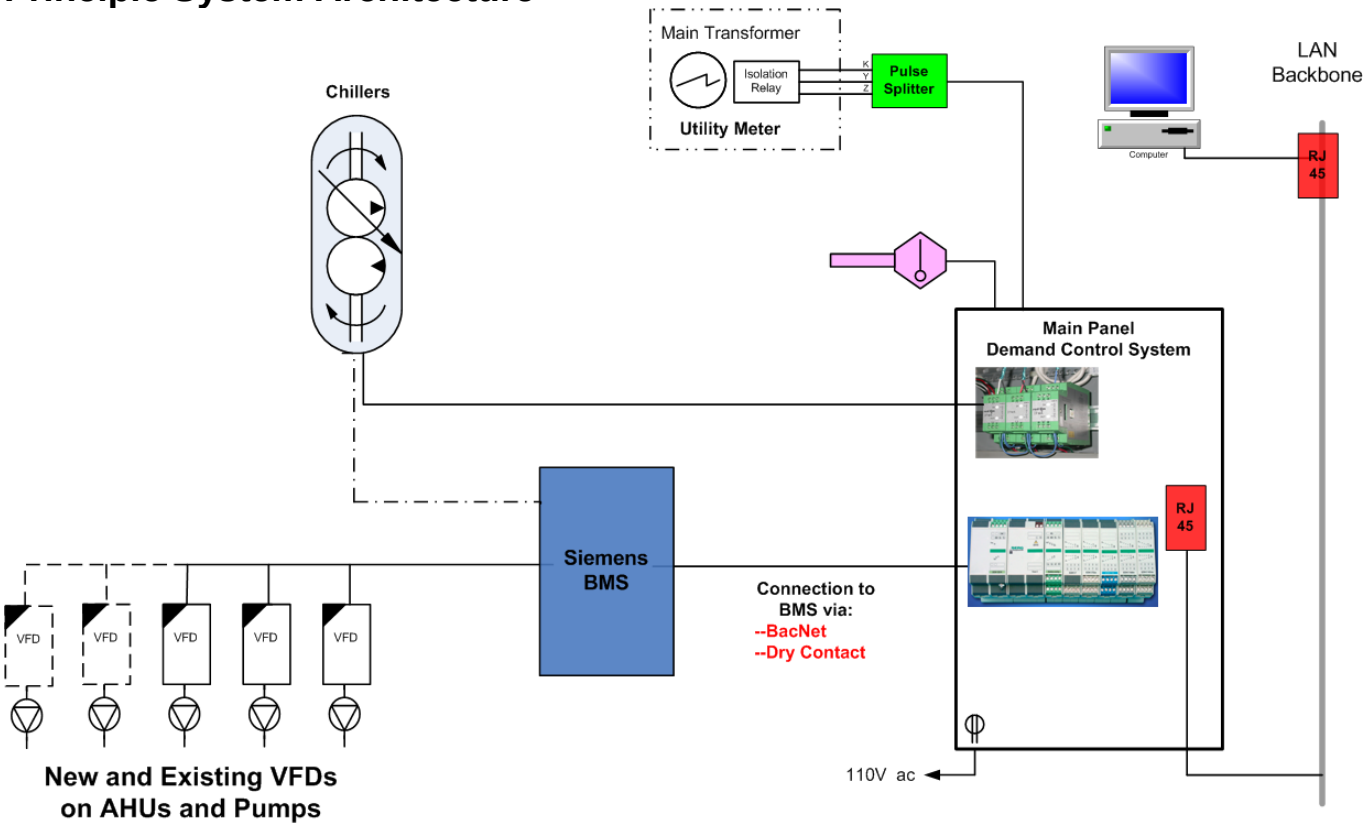
The Automated Demand Control System of Emacx Systems, Inc. allows MSKCC to program a not-to-exceed set-point for electrical demand and instruct the EMS to initiate pre-programmed load shedding strategies when that set-point is approached. Dynamic calculations with specially developed algorithms allow for a continuous non-compromising operation. The algorithm takes into consideration the demand for many different load parameters and makes intelligent real time decisions whether the load can be curtailed. The electrical power input 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

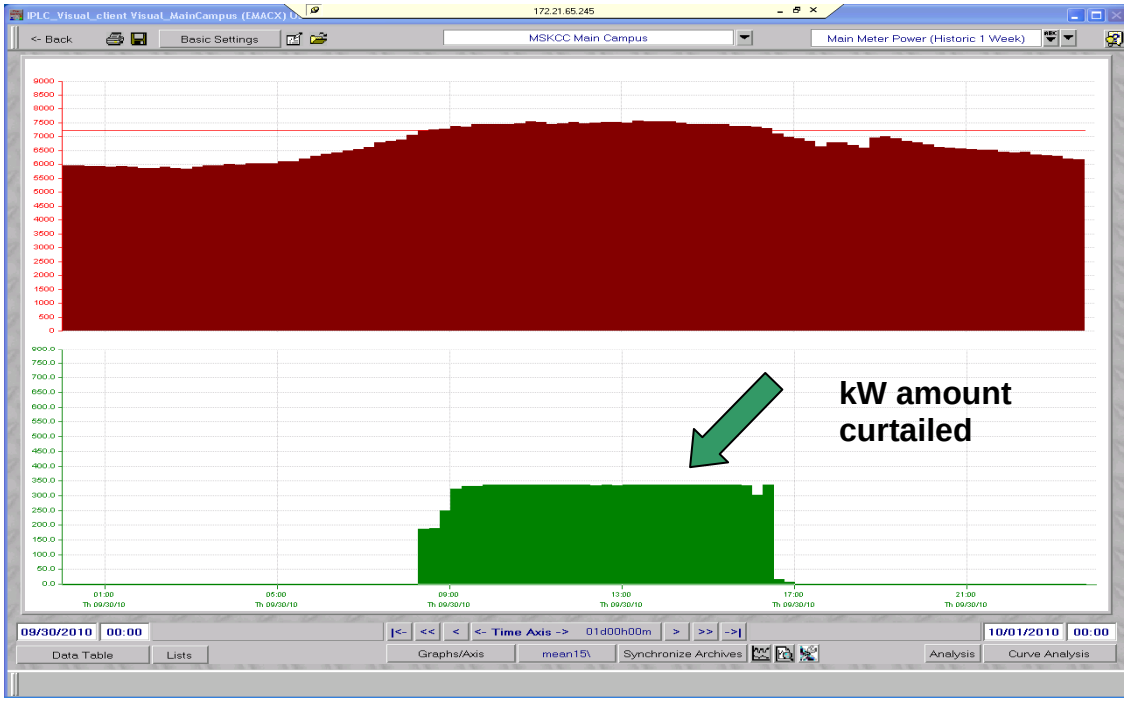
Principle System Architecture



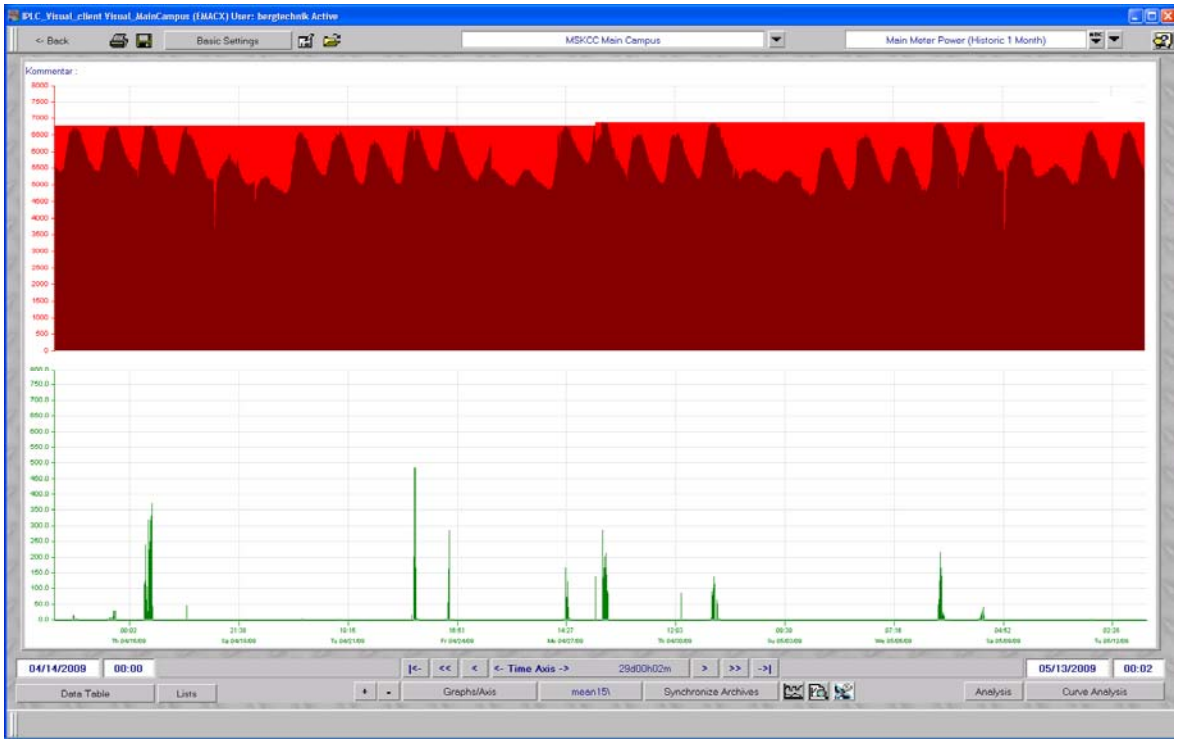
Benefits

The savings for all MSKCC facilities with an iPLC system from Emacx since commissioning are as follows:

	Up to 1/13/2011	Up-to-date kW-kWh-CO2 Savings since commissioning		
Store	**Savings**	**max. kW Reduction**	**Total kWh saved**	**CO2 Reduction**
MSKCC Zuckerman Bldg.	$ 276,425	753	568,152	515,314
MSKCC Main Campus	$ 170,300	450	477,187	432,809
MSKCC Rockefeller	$ 61,003	207	138,564	125,678
Total	**$ 507,728**	**1,410**	**1,183,903**	**1,073,800**



Daily Load Curtailment Graph MSKCC Main Campus Building - Curtailed Load kW 350kW



29 Day Load Curtailment MSKCC Main Campus Building

Pictures

Johnson Controls and Main Emacx Panel Zuckerman Building

Con Edison kWh Pulse Demarcation and Totalizer

Chiller Integration through Remote Chill Water Reset for DR

Installed 250Hp VFD for Air Handlers