Rogers Centre
a project by Encelium Technologies

CASE STUDY OBJECTIVES

Given that commercial/institutional and industrial buildings account for about half of the total national energy consumption, energy price increases have significant effects on these sectors' operating costs.

In examining the implementation of Encelium's addressable lighting control system at the Rogers Centre, a world class sports and entertainment complex in Toronto, Canada, this case study will demonstrate how this technology supports the goal of developing an intelligent and green building. It will look at the performance criteria for the building including dollars per square foot of electricity, physical performance of the facility, and optimum lighting levels without wasted energy. According to United States Department of Energy (USDOE), lighting typically constitutes 30 to 35 percent of a buildings total energy load. Encelium's integrated lighting control and energy management system has demonstrated lighting energy costs reduction of 50 to 75 percent and average payback period from saved energy of three to five years. The case study will explore the integration of lighting systems with energy management systems and how this integration facilitates intelligent building capabilities, provides a substancial ROI, and green results.

The key aim of this retrofit project was to provide operational excellence using embedded personal control capabilities and enhanced flexibility to facilitate continuous monitoring, diagnosis, and preventive maintenance of the lighting system.

PROJECT OVERVIEW

The Rogers Centre facility management commissioned Encelium's engineering group with several priorities that included:

- Reduce overall lighting energy consumption by 50 percent and deliver a simple payback from energy savings in less than five years
- Provide computerized control of lighting from a central software application
- Providing office staff with personal control of lighting from their desktop PC
- Improve light levels and provide control in all stairways, luxury boxes, walkways, concourses and parking garage areas
- Provide global control of lighting loads in order to manage peak demand

The design approach comprised the following components of the facility:

- Parking garage
- Concourses and stairways
- Offices/media lounges
- Luxury boxes

The retrofit involved changes in these designated areas as shown in Figure1.

Figure 1 - Design Approach, Rogers Centre Project

Area	Design approach
Parking garage	Occupancy sensor based switching control on a zone basis. Additionally 8 ft T-12 96 watt lamps were replaced with 4 ft T-8 32 watt lamps and electronic ballasts
Concourses and stairways	Combination of occupancy sensing and time-scheduled switching (based on building events) was employed. The existing 175 watt metal halide fixtures were retrofitted with two 32 watt T-8 lamps and standard electronic ballasts
Offices	Personal lighting control, time scheduling, daylight harvesting and occupancy sensing technologies. All existing fluorescent fixtures were retrofitted with new dimming electronic ballasts
Luxury boxes	Involved control of lighting and television circuits by time schedule based on the scheduled events in the facility

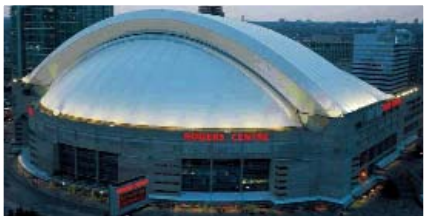
Source: Encelium Technologies

Prior to embarking on the energy retrofit with automated lighting controls, the Rogers Centre facility had an electricity bill exceeding $3 million annually. By the time the project is fully completed, when compared with baseline performance, the project is expected to generate a 76 percent savings in energy expenses from lighting.

The Energy Control System™ (ECS™) from Encelium represents an innovative solution in the area of lighting control and energy management technology. By combining addressable networking technology in conjunction with advanced control hardware and software, the ECS™ was designed to maximize energy savings and provide an ROI that exceeds customer expectations.

THE FACILITY

Rogers Centre, One Blue Jays Way, Toronto, is a world class sports and entertainment complex. Since its opening in June 1989 it has hosted more than 2,000 events with more than 50 million visitors. Formerly known as Skydome, the facility was renamed the Rogers Centre in February 2005.



The facility is capable of accommodating a variety of events such as sports events, concerts, trade shows and conventions, with capacities from 5,000 to 60,000 spectators. The complex contains approximately 7,000 light fixtures distributed over a total area of 1.4 million square feet.

RESULTS

Encelium considers the Rogers Centre project to be its biggest lighting retrofit to date, and the energy savings that are expected to be delivered at the end of the project are significantly large when compared to any other retrofit project. Based on interim assessment and the third party measurement & verification (M&V) process, cost savings reached $325,000 annually after phase 2. With energy reductions of 3,731,000 kWh annually, the project will have reduced its dependency on the energy grid equal to the energy required to power over 400 homes in Toronto.

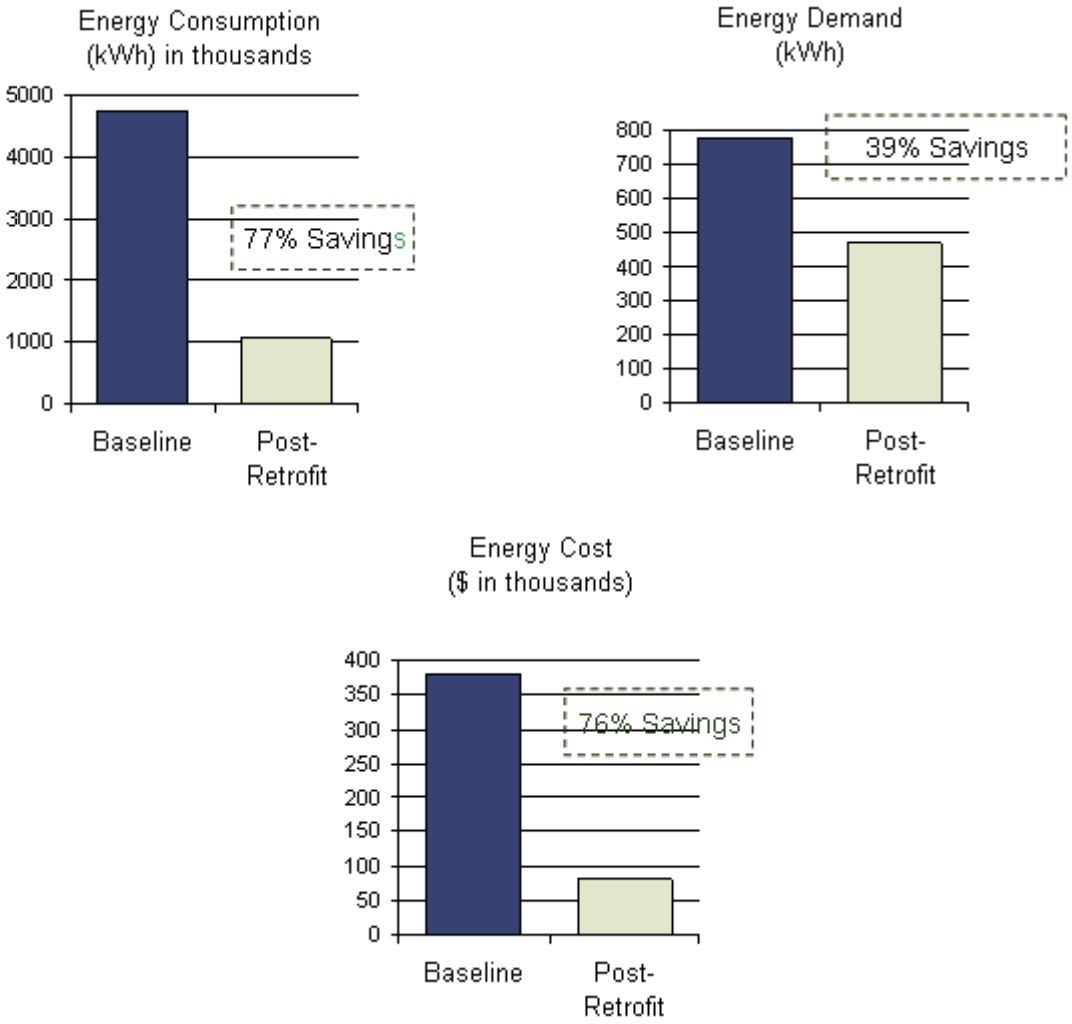
Figure 2 - Costs and savings associated with the Rogers Centre Project

Rogers Centre Project	Project Cost ($)	Annual Savings ($)	Average Payback
Phase 1	370,000	125,000	3 years
Phase 2	500,000	200,000	2.5 years

The project is eligible for rebates and subsidies administered by the Building Owners and Managers Association (BOMA) of Toronto and funded by the Ontario Power Authority, whereby companies can receive $400 for every kilowatt they can reduce during summer peak hours. Subsidies from Ontario Power Authority could offset the capital costs associated with this project by up to 40 percent. The project is expected to act as a signature case in conservation that will prompt other building owners to take on similar endeavors.

At the end of phase 3, when compared with baseline performance, the project is expected to generate a 77 percent savings in terms of energy consumption in kilo watt hours from lighting which translated to a 76 percent savings in terms of energy costs post retrofits, based on data validated by Toronto Hydro Energy Services. Chart 1 depicts the energy savings realized after phase 3 in the Rogers Centre Project.

Chart 1 - Energy Savings Post Retrofits at Phase 3



To document the project's outcome and actual savings and payback generated, a third party audit and verification process was initiated. Toronto Hydro Energy Services was contracted by Rogers Centre to undertake an M&V program to verify energy savings resulting from Encelium's lighting control retrofit program. Pre- and post-retrofit measurements of energy use and power demand were recorded and compared. Current data loggers were used to provide a means of verifying all lighting control strategies.

ENCELIUM ECS™

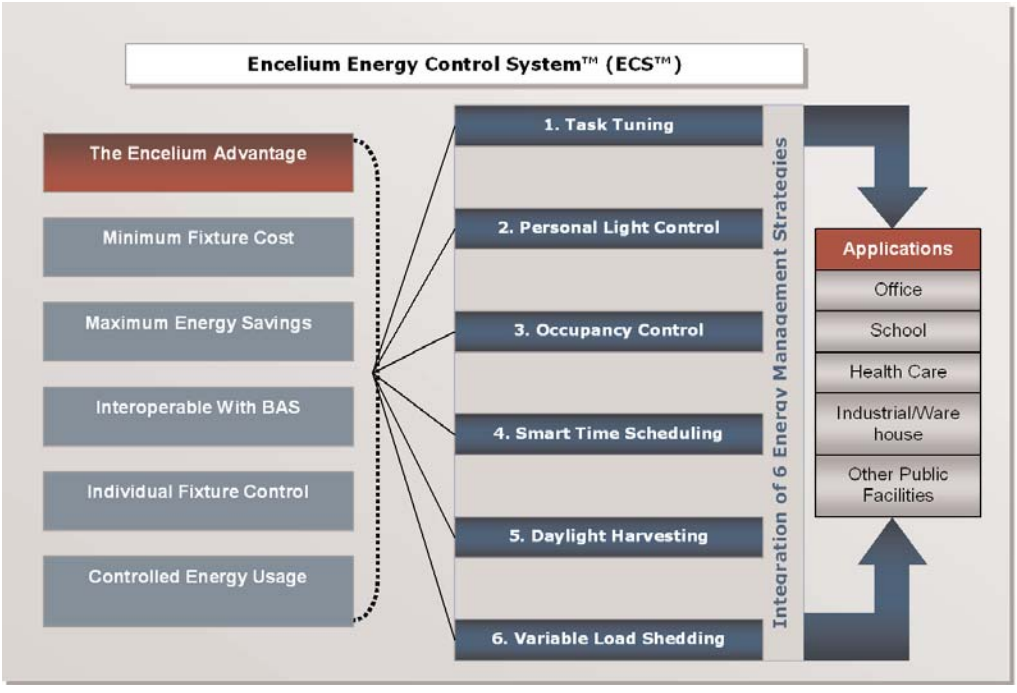
The Energy Control System™ (ECS™) represents an innovative solution in the area of lighting control and energy management technology, by:

- Maximizing Energy Savings
- Optimizing lighting quality and workplace ergonomics
- Providing ease of installation through a simplistic design
- Demonstrating ROI
- Centrally controlling each light fixture in the facility from one software interface

In light of the existing industry dynamics and legislative drivers, the Encelium ECS™ has a very time critical and responsive delivery platform that combines the niche requirements of the market, presents competitive cost advantage and, most importantly, documents the highest energy savings for both new and retrofit applications.

Personal lighting control capabilities, occupancy sensing and addressable dimming are key issues currently driving the interface market. Among system integrators, consulting engineers, and operations managers, there is a common understanding that lighting is one of the topmost areas for saving energy in buildings. Deployment of occupancy and photo sensors provides a cost-effective and simple route to achieving that savings. Going beyond the basic premise that a lighting control system switches light on and off as per a preset schedule, ECS™'s individually embedded software and hardware architecture enable it to control each fixture in a building and assign it with a unique IP address. By taking advantage of low-cost standard components such as analog dimming ballasts, as opposed to proprietary digital ballasts, and connecting an input/output device to make it digital and addressable, the ECS™ provides the same functionality and value to the end user at a reduced cost.

Chart 2 – ECS™ – Integration of 6 Energy Management Strategies



The Energy Control Unit (ECU), an embedded processor, automatically addresses each input/output module in the network of ballasts and sensors using proprietary communication technology called GreenBus™. The ECU collects and processes information received from the sensors and distributes commands to individual ballasts. The distinct advantage of the technology lies in its front-end software, the ability of the system to deploy the six energy management strategies across larger facilities, and unique occupant control capabilities at a comparably low cost, when compared to proprietary protocol-based digital dimming systems such as those using Digital Addressable Lighting Interface (DALI).

Encelium's GreenBus™ communication technology is a bus system designed specifically for controlling lighting to achieve maximum energy savings and optimum lighting comfort. GreenBus™ enables cost-effective, individual dimming control of thousands of fixtures in a building and integrates peripheral devices, such as occupancy sensors, photo sensors, relay-based controls, and low voltage wall controls into a complete, programmable lighting control system. GreenBus™ provides low voltage power to all devices on the network, eliminating the need for external power supplies and power packs for devices such as occupancy sensors. The need for associated installation labor for line voltage wiring and conduit is eliminated. GreenBus™ allows flexible daisy chain wiring topologies and the ability to add fixtures or control devices in-circuit at any time.

The system's functionalities are optimized by liberal deployment of occupancy sensors across the controlled footprint. If occupancy sensors do not detect any activity in a particular part of the building, the system can bring down illumination levels to minimum levels; rather than switching the lights off completely resulting in occupant discomfort.

ELIMINATING ERRATIC ENERGY CONSUMPTION PATTERNS

Lighting generally comprises the largest energy load in a commercial building and is historically the least controllable, with burning hours far exceeding inhabited hours in a building. Dimming the lights at times of peak energy demand works favorably towards flattening out the load profile of the building.

As the peak load requirement of utilities far exceeds the average load growth and the subsequent capital inefficiency of the transmission and distribution (T&D) infrastructure, utilities are adhering to the stipulations of the National Energy Policy that calls for resorting to a 'time of use' pricing schedule. Under such conditions, ECS™ is able to selectively shed as much as 50 percent of a building's lighting load (15 to 20 percent of total building load) over a 15 minute window in a manner that is generally transparent to building occupants. Load shedding can be initiated either in response to a demand response signal, a utility pricing signal, or to shave peak demand and flatten a building's load profile.

INTEGRATION WITH OTHER BUILDING SYSTEMS

A major feature of ECS™ is its ability to integrate with and share data with other building systems such as HVAC, fire, security and card access systems. Encelium's BACnet® IP interface enables the system to share lighting and control status with the building automation system (BAS) in a building. ECS™ not only operates autonomously to control lighting but also shares lighting status, lighting levels, and energy usage through BACnet® for use by other building systems. As part of its continued development and innovation, Encelium has recently launched a driver that is compatible with Tridium middleware, thus

providing interoperability in coherent distributed architectures within a Niagara AX framework. ECS™ can share data and be controlled through the Niagara AX platform or share data across other similar frameworks.

With virtually accurate information about occupancy status in a building, ECS™ can provide valuable information to easily integrate with BAS systems. In a traditional setup, BAS systems by themselves are programmed based on estimated occupancy time schedules, whereas with real time occupancy information, transmitted and shared by the ECS™ with BAS infrastructure, the functionality of the BAS systems is further enhanced. It may be noted here, the ECS™ software is currently being embedded on CISCO IP phones to enable them to control lighting through the CISCO phone interface.

LIGHTING THE WAY

The North American trend in new construction and the retrofitting of existing buildings is essentially combining enhanced efficiencies in energy and resource consumption with a sound asset and capital plan to achieve lower economic cost while, also mitigating environmental impact. It is estimated that optimizing energy use in a building could reduce incremental demand for electricity by 80 to 90 percent. An effective way of achieving this milestone is the integration of lighting controls into a building's operational framework. Lighting currently constitutes a substantial portion of total energy load in buildings, typically in the range of 30 to 35 percent according to the United States Department of Energy's (USDOE) estimates.

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By integrating and simultaneously employing six key energy management strategies in one seamless system, ECS™ has helped eliminate wasted energy from lighting in the facility. From being the least controllable load in a building, lighting can currently be transformed to a "controllable" energy load with ECS™, thereby enabling similar facilities to incorporate lighting as part of a portfolio wide energy management strategy to achieve results that are sustainable in the long term.

Lighting controls provide building owners and operators with the ability not only to save and manage their energy demand, but also reduce their environmental impact by reducing green house gas emissions. Electricity is identified as the single largest contributor to green house gas (GHG) emissions, with buildings accounting for the highest consumption, with future growth projections of nearly 37 percent by 2030.

While demand reduction and energy savings are being prioritized, cost of ownership associated with implementing such techniques can prove to be a deterrent. However, recent industry research indicate that the relatively low-cost abatement potential associated with incorporating advanced lighting controls and integrating lighting controls with the larger building automation network along with demonstrated financial payback can make it an acceptable norm in the building industry.