

SAVINGS IN AN AIRPORT HOTEL

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INTRODUCTION

Energy costs are one of the major operating costs of a business hotel. Improving energy efficiency can significantly improve the bottom line profit and environmental footprint of the hotel. The Holiday Inn is a 4 star hotel situated in the precinct of a busy airport in Mascot, Sydney.

The hotel is owned by the Schwartz Family Company who have a strong commitment and company philosophy in sustainable practices, conservation and reducing their carbon footprint through energy, waste and water reductions through the implementation of projects that fulfil these ideals.

The feasibility study of the hotel for an energy management control system was conducted by Enman Pty Ltd, an energy consulting company who specialises in energy savings through advanced and optimal control strategies. The reports and findings from this initial study highlighted the benefits that the Holiday Inn could obtain and the Schwartz Family Company at that time took the opportunity of

applying for the Ausindustry Green Building Fund (GBF). This program was introduced by the Commonwealth Government to commercial buildings in raising efficiencies, reducing energy and carbon emissions.

Due to the merit of the application and proposal the Government granted funds to implement the energy management control system (EMCS)

An energy management control system is a unique energy management and energy saving program which is required to improve the infrastructure of the hotel, including: Building management system (BMS), HVAC modification and variable speed drives. The system monitors energy usage and performance, controls the demand of electricity and provides advanced control optimising Chiller, cooling tower, pumps, fans and HVAC equipment. It also provides a strategy to reduce waste of energy such as not operating chillers and boilers when they are not necessary.

Such a system not only reduces energy costs but also assists in extending the service life cycle of equipment. Its energy and performance monitoring tools also provide the foundation for ongoing performance improvements of the hotel.

PROJECT

Enman was awarded to implement the entire energy management program.

This includes;

- Upgrading the HVAC system to introduce economy cycle

- Implementation of a building management system which used as a platform for the energy management control system
- Introducing variable speed drives for all major pumps and fans
- Upgrading the instrumentation system to monitor critical parameters for energy optimisation and performance monitoring
- An EMS works as a brain with higher level control for intelligent decisions, optimisation of equipment performance, energy and performance monitoring and reporting.

The hierarchy of this energy management system is shown in Fig 1.

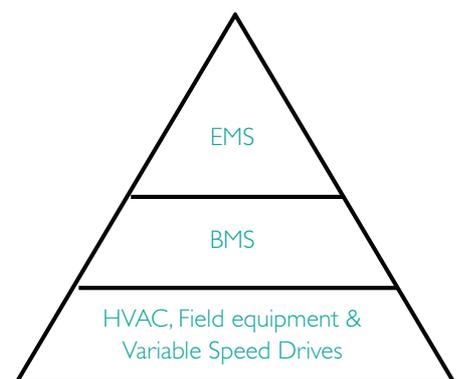


Figure 1: Hierarchy of the energy management control system

The schematic of the system architecture in fig 2 shows the functional inter relationship of different aspects of the EMS, BMS, VSD and field equipment.

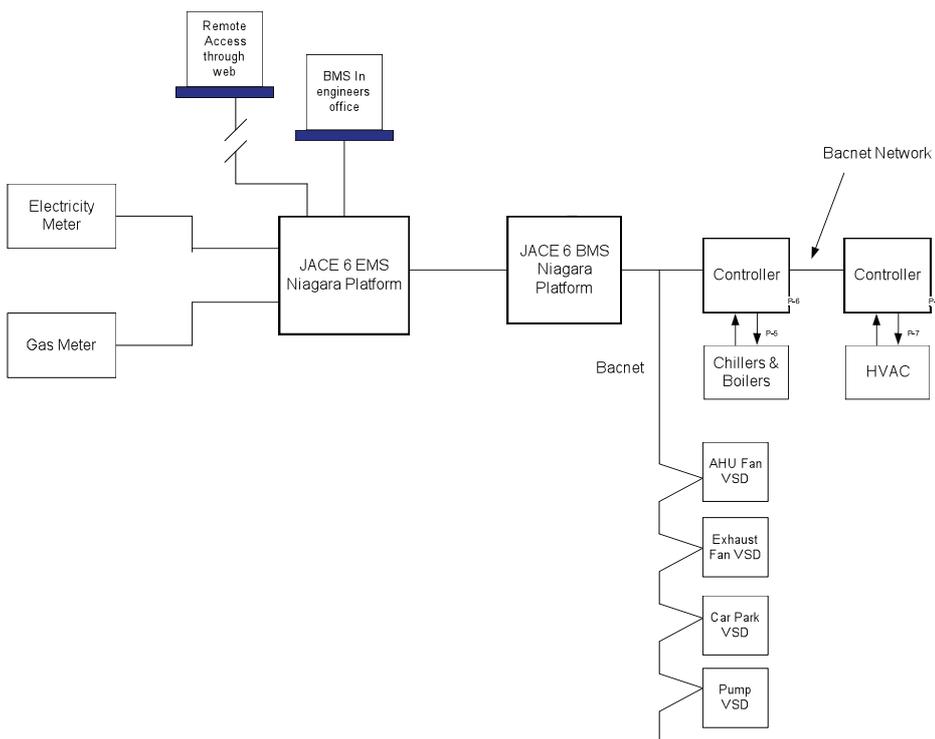


Figure 2: System architecture of the EMCS

ENERGY MANAGEMENT SYSTEM

This is a proprietary intellectual product of Enman called Enertrol. The EMS is based on JACE 6 which is a Tridium based controller utilising non-proprietary Niagara framework platform. This JACE 6 can communicate with all modern BMS systems available in the market.

The critical functionality of the EMS is;

- Chiller optimal control. This chiller optimal control provides
 - Chilled water temperature reset to produce required chilled water at minimum energy required by compressor
 - Condenser water temperature reset. The EMS calculates the condenser or cooling water temperature minimizing combined energy used by chiller compressor and cooling tower fan
 - Demand limiting of chiller. This is an important function to limit the electricity demand of a chiller especially during chiller start up.
 - Chiller selection and loading. This is to minimize or eliminate the need

for multiple chillers. When multiple chillers operate different efficiencies it allocates the load in order to minimize the combined energy required to meet the cooling demand of the hotel

- Chiller lockout. The chiller sometimes runs when there is no requirement of chilled water. This stops the running chiller when it is not required especially during cold weather conditions.
- Optimal speed control
VSD's are used for major supply/return air fans, kitchen exhaust, toilet exhaust, car park fans and cooling tower fans. Most of these are not conventional feedback controls and require a special model based control algorithm. VSD's have also been utilised in chilled water and condenser water pumps. This EMS provides a model based with feedback speed control.
- HVAC control. There are a number of energy saving functions implemented to improve energy efficiency which are;
 - Air handling units are modified to introduce economy cycle. Economy cycle is free air cooling instead of utilizing the chiller energy. It uses enthalpy based economy cycle

- Set space temperature as high as possible during summer and as low as possible during winter
- Use of VSD in supply and exhaust fans to match the heating and cooling load of the building.

MECHANICAL AND VSD INSTALLATION

All the mechanical modifications and installation of VSD's were carried out by Dalkia and designed by Enman Pty Ltd.

VARIABLE SPEED DRIVES

VSD's are used to conserve energy when full power is not required by the HVAC system. Today VSD's are used extensively for pumps, fans and chiller compressors to reduce energy waste when the equipment's operate at part load condition. All VSD's for pumps and fans were supplied by ABB.

Figure 3 shows how VSD's can reduce power consumption by changing the speed at a lesser load condition

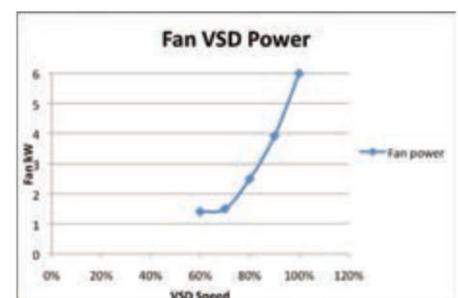


Figure 3: Power use for a supply air fan

BUILDING MANAGEMENT SYSTEM

A BMS is required which works as the backbone of the entire energy management control system. This monitors all field equipment and controls them to provide comfort level and reduce energy consumption. The energy management control system uses a non-proprietary Niagara framework based BMS which is supplied by I control Pty Ltd a Sydney based control system company.

ENERGY SAVINGS

This energy management program has already showed considerable energy savings. This saving can be further improved which

Table 1: Energy saving and correction analysis

Billing Period	kWh	kWh Previous Year	Saving Kwh	Chiller Saving Adjustment	Temperature Saving Adjustment	Total Savings	Percentage of Savings	Demand kVA	Demand kVa Previous Year
Jul 2012	182,734	189,251	6,517	12,750	-	19,267	10	540	-
Aug 2012	179,212	188,553	9,341	12,750	-	22,091	12	540	-
Sep 2012	176,255	183,062	6,807	12,750	-	19,557	11	540	-
Oct 2012	188,350	195,978	7,628	12,750	-	20,378	10	540	-
Nov 2012	194,152	213,375	19,223	12,750	-	31,973	15	540	-
Dec 2012	219,596	184,410	- 35,186	12,750	35,100	12,664	7	540	-
Jan 2013	245,213	205,631	- 39,582	12,750	39,200	12,368	6	540	673
Feb 2013	214,340	395,748	181,408	12,750	-	194,158	49	540	540
Mar 2013	226,558	403,843	177,285	12,750	-	190,035	47	463	540
Apr 2013	195,496	227,968	32,472	12,750	-	45,222	20	448	540
May 2013	194,432	207,535	13,103	12,750	-	25,853	13	448	540
Total	2,216,338	2,595,354	379,016			593,566	22.9		

are identified through this comprehensive energy monitoring system.

The achieved energy saving during the last 12 months have been analysed as follows with and without adjustment to weather condition, occupancy rate and equipment malfunctions as shown in table 1.

Figure 4 shows the electricity use month by month from the electricity bill.

The actual energy (ELECTRICITY) saving without any adjustment is 413,472kWh/year and the cost saving is \$55,322/year @ 13.38 Cents/kWh

The adjusted energy (ELECTRICITY) saving is 593566 kWh/year and the cost saving is \$79,419.00/year

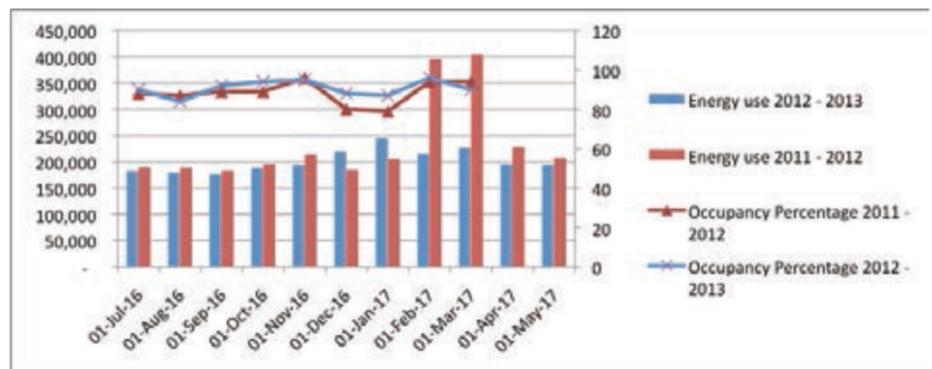


Figure 4: Electricity use

The demand has reduced from 673 kVa to 448 kVa providing a cost saving of \$26,730/year.

The adjusted energy saving is 23% of electricity consumption of the hotel. Also at the same time the electricity demand of the

site has decreased by 225 kVa providing a saving of \$26,730.00/year

This provides a total saving of

- Without adjustment : \$82,052.00/year

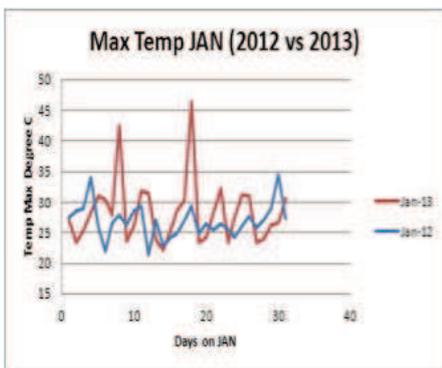


Figure 5: Ambient temperature

- With adjustment : \$106,149.00/year OR 23% OF Electricity consumption

ENVIRONMENTAL FOOTPRINT BEFORE AND AFTER

The total electricity consumed by the hotel before this project implementation was 2,831,295kWh/year with an annual carbon emission of 3,001,172 kg of CO₂-e.

Electricity used after the energy management program was implemented is

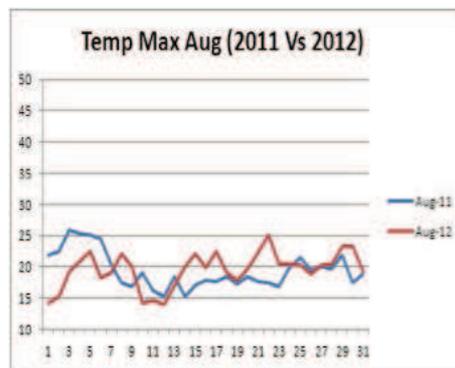


Figure 6: Ambient temperature

2,417,823 kWh/year with a carbon emission of 2,562,892 kg of CO₂-e/year

This is an emission reduction of 438,280kg of CO₂-e/year.

IMMEDIATE PLAN AND ONGOING OPPORTUNITIES

From the success of this project, the Schwartz Family Company has decided to replace the old multi stack chiller with two state of the art Powerpax chillers which are environmentally friendly. The powerpax

chillers with inverter technology will provide over 200% more energy efficiency than the current chiller. This will reduce energy consumption and carbon emission further.

The HVAC system has recently been tuned further to provide more energy savings, without compromising the comfort levels of hotel guests and patrons.

CONCLUSION

The energy management control system provided the infrastructure to provide and assist ongoing energy saving opportunities. It identified all the bottleneck of the HVAC system. The energy saving will grow further as the bottleneck of some inefficient HVAC operations are rectified. It is also possible to save additional energy by tuning the control system further which has to be compromised with the comfort level of the hotel. The Schwartz Family Company has an ongoing commitment in investigating and incorporating the very best in technologies and developments to reduce their carbon footprint.



Enman's promise:
Energy reduction up to 50% depending upon current energy efficiency

Benefit:

- Higher energy saving from conventional control reducing your carbon footprint further
- Demand reduction

Enman is a highly specialised energy management company dedicated in energy efficiency improvement, carbon reduction and performance contracts with a proven track record.

Enman's services

- Energy/water audit and NABERS rating
- Project engineering and management for major projects including turnkey supply for:
 - Chiller system upgrade
 - Boiler system upgrade
 - Control system upgrade BMS/HEMS
 - Variable speed drive, control and optimisation
 - HVAC Upgrade
 - LED lamps and lighting upgrade
 - Room management system
 - Co/Tri generation
- Assist in government subsidies and funding
- Assist in carbon trading

Enman's product

Hotel energy management system (HEMS) is the ultimate control, monitoring reporting and housekeeping to reduce energy consumption of your hotel incorporating Enman's cutting edge technology. **Saving:** Enman's HEMS can provide 15-30% energy & carbon reduction of the hotel

Features

- Chiller optimal control and performance monitoring
- Advanced optimal control of variable speed drives for all pumps, fans, plant and equipment
- Advanced HVAC Control
- Demand management and control
- Energy performance

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