



ANALYSIS OF ENERGY USE FOR ONTARIO LONG TERM CARE FACILITIES

PREPARED FOR
INDEPENDENT ELECTRICITY SYSTEM OPERATOR (IESO)

PREPARED BY: FINN PROJECTS (SYNCHRONICITY PROJECTS INC.)
737 MOUNT PLEASANT ROAD, SUITE 200
TORONTO, ON
PHONE: 416-921-0900
FAX: 416-921-0300
EMAIL: INFO@FINNPROJECTS.COM

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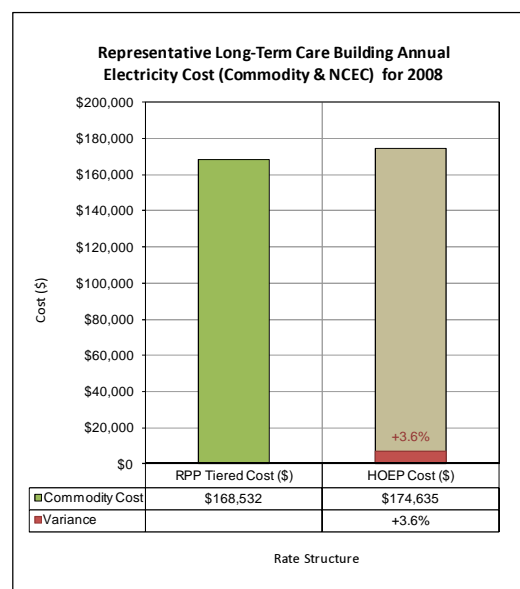
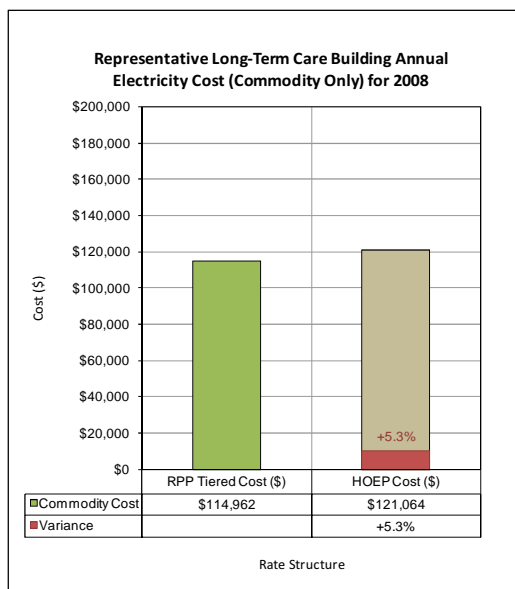
1 EXECUTIVE SUMMARY

The Public Sector in Ontario will move from paying the Regulated Price Plan (RPP) to hourly electricity pricing beginning November 1, 2009. To support understanding of the impacts of this price change within the hospitals and long term health facilities sectors, the Independent Electricity System Operator (IESO) contracted with Finn Projects to provide an analysis of the energy use and potential energy reduction strategies. This information will ultimately be used in the development of materials designed to support the IESO's Customer Education Program.

The sector analysis and investigations carried out by Finn Projects for the long term care facilities in Ontario identifies excellent opportunities for energy cost reductions in a number of areas, as described in this report, including energy auditing and retrofits of energy efficiency measures; HVAC; lighting; kitchens and laundries; plug load; retro-commissioning; energy awareness, including social marketing, employee engagement and energy training; and monitoring and targeting of energy consumption.

The long term care facilities from in Ontario's public sector move on November 1, 2009 from paying the Regulated Price Plan (RPP) to hourly electricity pricing (HOEP). The facilities analyzed showed electricity commodity cost increases varying between 5.3% and 7.6% in switching from RPP to HOEP rates, including OPG rebate and provincial benefits in 2008. When taking the NCEC into account as well, the analysis revealed an increase in the overall billed electricity costs of 3.6% to 4.6% in switching from RPP to the HOEP rate.

The following two graphs show a representative long term care facility's energy costs before and after the change from RPP to HOEP for 2008. The graph on the left shows the differences in the electricity commodity cost only, while the graph on the right shows the impact on the total bill, i.e. electricity commodity plus NCEC charges.



The rates for 2007 and 2009 were also examined and the annual commodity only cost was calculated for four long term care buildings using both the RPP and HOEP rate structures. The analysis of the electricity costs over these three years showed that the

HOEP costs for a long term care building can be higher (as found in 2008) or less (as found in 2007, shown in the figures below, and in 2009) than the RPP costs. Drawing conclusions based on only 2008 data may be misleading with regards to the impact of switching to HOEP pricing. The HOEP costs are highly dependent on market based price. In 2008, these appeared to be higher than 2007 or 2009.

The following two graphs show a representative long term care facility's energy costs before and after the change from RPP to HOEP for 2007.



Looking at the 29 months between January 2007 and June 2009, the overall net result on average for the long term care facilities show the HOEP costs are less than 2% higher than the estimated RPP costs for the same time period, excluding NCEC charges. With NCEC charges include, the overall average increase due to HOEP prices is only 1.2%.

Long term care facilities can achieve cost savings by implementing a comprehensive set of energy efficiency measures. The sector analysis and investigations carried out by Finn Projects for the facilities in Ontario identified excellent opportunities for energy cost reductions. Ontario's long term care facilities should embark on the following activities, as described in this report:

- Carry out energy audits and implement the resulting retrofit of energy efficiency measures.
- Undertake retro-commissioning of the building equipment and systems.
- Address energy and demand reduction strategies for HVAC, lighting, kitchens and laundries, and plug load.
- Enter into an energy awareness program that includes social marketing, employee engagement and energy training.
- Implement energy consumption monitoring and targeting systems.

The potential overall energy cost savings for the long term care facilities could be as high as 25% by carrying out the above recommendations and energy retrofits.

2 INTRODUCTION

The Public Sector in Ontario will move from paying the Regulated Price Plan (RPP) to paying the hourly electricity pricing, beginning November 1, 2009. To support understanding of the impacts of this price change within the sectors defined by hospitals and long term health facilities, the Independent Electricity System Operator (IESO) contracted with Finn Projects to develop materials designed to support the IESO's Customer Education Program.

The scope of the work for this project includes:

1. Conducting a series of interviews with hospital and long term facility staff responsible for energy management
2. Identifying risk management strategies in place or that under consideration by the facilities for coping with the change to the HOEP
3. Identifying the education needs of the facilities and how to address them regarding the switch to the HOEP and the management of electricity bills over the long term as a result of being in the wholesale market

3 OBJECTIVES OF ENERGY SECTOR PROFILE ANALYSIS

The objectives of the energy sector profile analysis are:

- To review information about how facilities in the long term care sector consume energy in order to develop case studies, fact sheets, information, workshops, educational brochures as Ontario's long term care facilities prepare for the move from paying the Regulated Price Plan (RPP) for electricity to market-based (or hourly) electricity pricing (HOEP) beginning November 1, 2009.
- Carry out energy audits in order to identify and quantify the opportunities for reducing electrical demand and energy consumption and to address specific opportunities for electrical demand reduction, load shifting, conservation and flexible load shape.

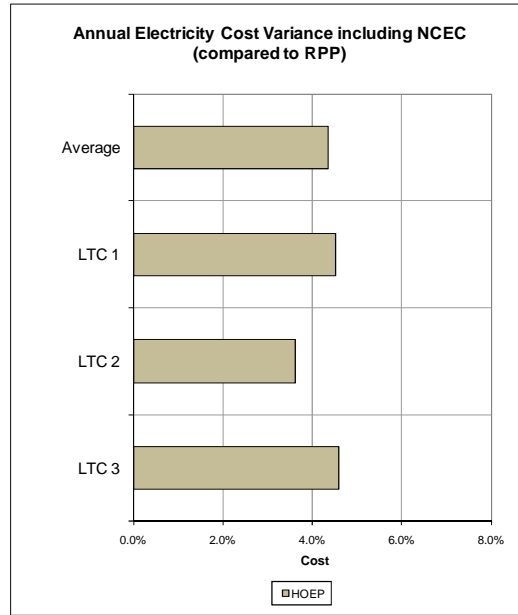
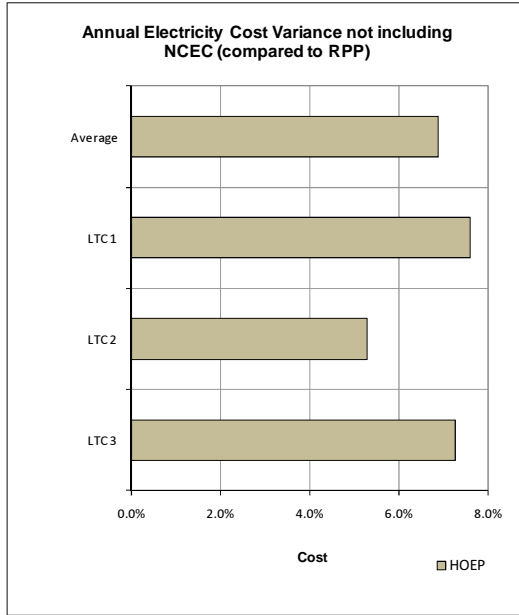
4 IMPACT OF THE ELECTRICITY RATE CHANGE BEGINNING NOV 1, 2009

Finn Projects reviewed the impact of the change in the rate structure for a number of long term care facilities as Ontario's public sector moves from paying the Regulated Price Plan (RPP) to hourly electricity pricing beginning November 1, 2009.

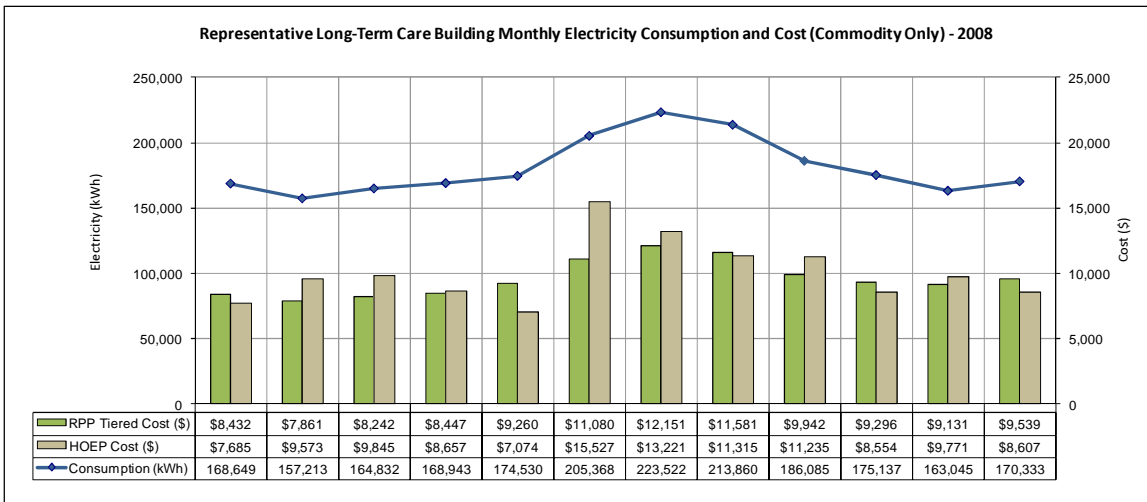
The hourly profiles for a number of long term care facilities were analyzed for electrical consumption for 2007, 2008 and 2009, and the RPP and HOEP rates were applied. The base year comparison used was 2008.

- The RPP rate from January to October 2008 was \$0.050 for the first 750 kWh and \$0.059 for the remainder; the RPP rate for November and December 2008 was \$0.056 for the first 750 kWh and \$0.065 for the remainder.
- For the comparison, the historical hourly electricity prices were applied against the long term care facilities' electricity consumption profiles. The OPG rebate and provincial benefits have been calculated and included these in the costs. The OPG rebate was discontinued at the end of March 2009.
- To assess the impact of the change on the total hydro bill, and not just the electricity commodity cost, the non-competitive energy costs (NCEC) were added. These costs include transmission charge, distribution charge, foregone revenue rate rider, deferral account rate rider, customer charge, transformer allowance, wholesale market operations, standard supply service, and debt retirement charge.

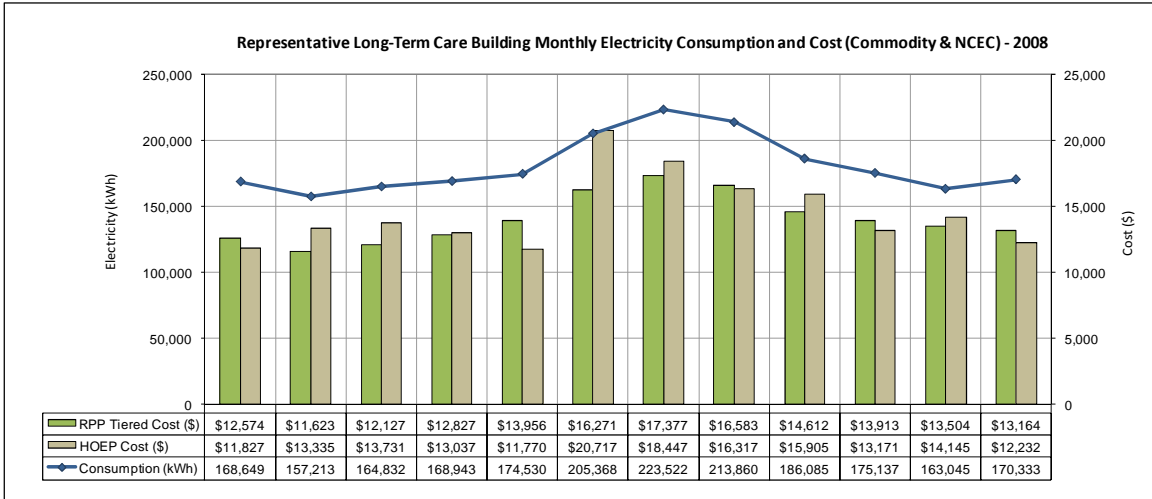
The long term care facilities from in Ontario's public sector will move on November 1, 2009 from paying the Regulated Price Plan (RPP) to paying hourly electricity pricing (HOEP). The analysis of the 2008 electrical consumptions of a number of long term care facilities showed that there would be electricity commodity cost increases varying between 5.3% and 7.6% in switching from RPP to HOEP rates, including OPG rebate and provincial benefits. When taking the NCEC into account as well, the analysis revealed an increase in the overall billed electricity costs of 3.6% to 4.6% in switching from RPP to the HOEP rate, as per the graphs below:



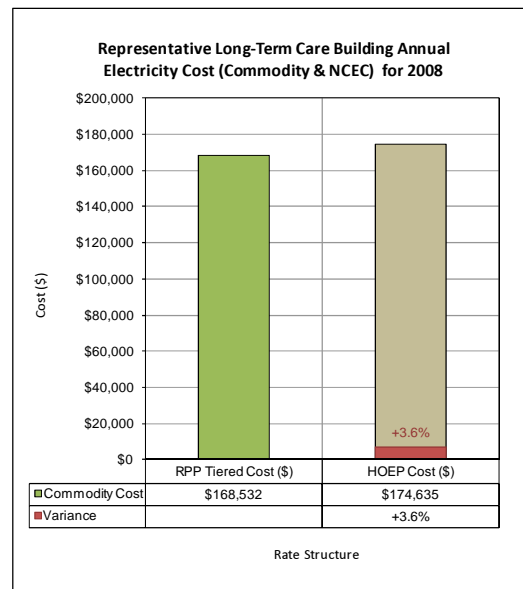
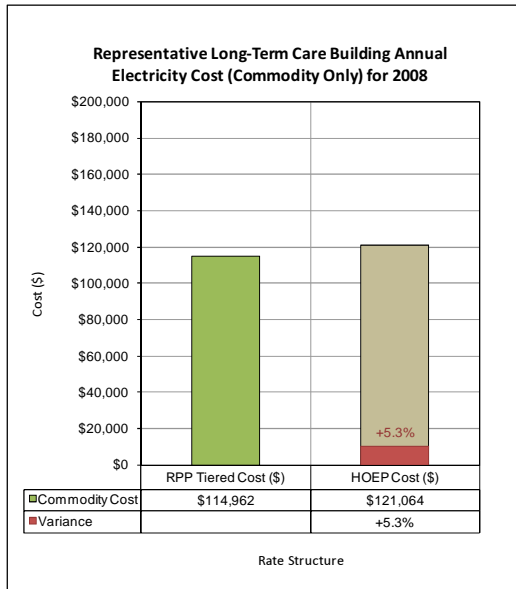
Considering the commodity costs only (no NCEC), the 2008 profile for a representative facility is given below. The figure shows the HOEP costs are higher than the RPP costs in six of the months, HOEP costs lower than the RPP costs in 4 of the months and there are marginal differences in April and August.



The graph below shows the commodity plus NCEC costs applied to the profile for the same long term care facility for 2008, showing associated monthly cost comparisons:



Using 2008 utility rates, the following two graphs show a representative long term care facility's annual energy costs before and after the change from RPP to HOEP. The graph on the left shows the differences in the electricity commodity cost only, while the graph on the right shows the impact on the total bill, i.e. electricity commodity plus NCEC charges.



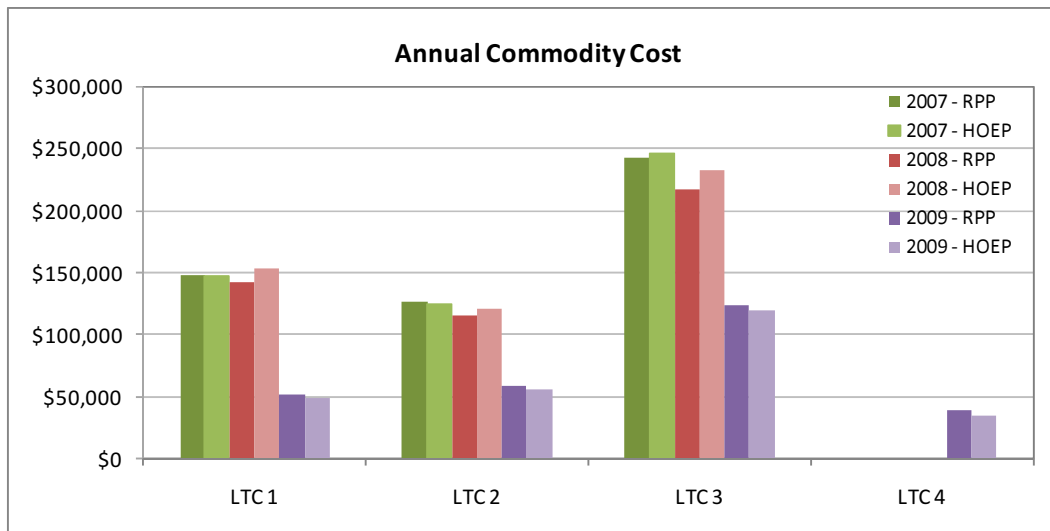
For 2007, the graphs are as follows:



This raises an issue:

- Basing the analysis of the HOEP cost structure on any particular year's rates provides no guarantee that the same level of savings will be achieved. The savings could be higher or lower, depending on how the electricity market reacts.

The rates for 2007 and 2009 were examined and the annual commodity only cost was calculated for four long term care buildings using both the RPP and HOEP rate structures:



*Note: LTC 4 had no interval data available until March 2009.
 LTC 1 only had 2009 interval data available from January to April.
 For LTC 2, 3 & 4 the 2009 interval data was available from January to June.

The figure above helps illustrate that the HOEP costs for a long term care building can be higher (as found in 2008) or less (as found in 2007 and 2009) than the RPP costs.

Drawings conclusions based on only 2008 data may draw incorrect conclusions about the impact of switching to HOEP pricing. The HOEP costs are highly dependent on market based prices, which were higher in 2008 than 2007 or 2009.

Looking at the 29 months between January 2007 and June 2009, the overall net result on average for the long term care facilities show the HOEP costs are approximately 2% higher than the estimated RPP costs for the same time period, excluding NCEC charges. With NCEC charges include, the overall average increase due to HOEP prices is only 1.2%.

5 POTENTIAL ENERGY CONSUMPTION SAVINGS AND DEMAND REDUCTION MEASURES FOR LONG TERM CARE FACILITIES

The following sections detail potential energy efficiency measures that long term care facilities could undertake to reduce their energy consumptions and reduce their electrical demand.

5.1 ENERGY AUDITS & RETROFITS OF ENERGY EFFICIENCY MEASURES

Energy audits of the long term care facilities should be carried out to assess the energy savings opportunities. The energy audit reports should include the estimated capital costs, energy savings, cost savings and paybacks for each energy efficiency measures, as well as the operational impacts. The goal, of course, is to lower the operating costs without sacrificing occupational comfort.

Finn Projects conducted energy audits of three long term care facilities and the analysis of the hourly energy profiles of four facilities for the IESO under this contract to identify energy saving opportunities, in particular with respect to electrical demand and energy consumption reducing. While the audits concentrated on electricity consumption and demand savings, natural gas use and potential savings were also assessed.

The first step in the process was to establish the weather-corrected energy consumption baselines and review the electricity load profiles. The energy baseline is the amount of energy that a facility will consume based on normal conditions. Specialized utility accounting programs allow for baseline adjustments due to the impacts of variables such as heating degree days (HDD), cooling degree days (CDD) and occupancy, using multi-linear regression analysis. The historical daily local weather data was entered into Metrix™ Utility Accounting System along with the historical energy billing data in order to develop the adjusted energy baselines.

The onsite energy audits of the facilities included an examination of all energy consuming equipment and building systems, including all public areas, offices, mechanical rooms, other back-of-house areas, as well as rooftop and parking areas. The audit captured the electrical and mechanical equipment condition and performance, including load inventory and review the controls systems with respect to type, condition, status and set-up. The operational and maintenance staff were interviewed to get an understanding of the building operation and control and to assess whether there were any problems that could be resolved or improved with the implementation of energy efficiency measures. The audits included mechanical and electrical systems; the building envelope and orientation; exterior energy and water usage; and it will incorporate a review of the present operating conditions and procedures, including the hours of operation.

The audits identified potential energy savings measures of over 25% with paybacks in the order of 7 to 9 years after incentives are taken into account. This is in addition to the cost savings that would be realized through the imminent rate change.

The measures identified in the energy audits of the three facilities include:

ENERGY EFFICIENCY MEASURES	
Controls	Expand the Existing Direct Digital Control System to Cover the Entire Building
	Install a New Building Automation System to Control the Major Mechanical Equipment
	Install Vending Machine Controls
Domestic Hot Water System	Replace the Existing Domestic Hot Water Boilers with Condensing Models
Heat Recovery	Recover the Heat Rejected by the Chiller & Use it to Preheat Domestic Hot Water
	Recover the Heat Rejected by the Refrigeration Equipment & Use it to Preheat the Kitchen Make-up Air
	Recover the Heat from the Sanitary Exhaust Air & Use it to Preheat the Corridor Make-up Air
	Recover the Heat from the Roof-Mounted Exhausts
	Recover the Heat Rejected by the Heat Pumps & Use it to Preheat Domestic Hot Water
Heating System	Replace the Existing Heating Boilers with High Efficiency Models
	Switch the Electric Heating Equipment to Hydronic, Using a New Boiler Plant
Lighting	Lighting Redesign
Motors & Variable Speed Drives	Install High Efficiency Motors on Existing Motors Larger than 1 HP
	Replace the Booster Pump with a Variable Speed Model
	Install a Variable Speed Drive on the Cooling Tower Fan

5.2 HEATING, VENTILATION AND AIR CONDITIONING (HVAC)

Heat recovery measures should be explored, including heat recovery from the exhaust air to transfer to the incoming fresh air stream.

Variable frequency drives (VFDs) should be considered for pumping systems and for the air handling units wherever possible. The VFD savings are very significant, for example running a fan at 80% of its speed would reduce the energy consumption by 50%.

The BAS should be used to optimize the chiller and chilled water system to provide very tight control of the chilled water production, distribution and usage in the facility.

The air-systems should be properly insulated and sealed and all hot water piping, where accessible, should be properly insulated.

Boiler combustion analyses should be carried out and the corrections that are identified should be implemented.

5.3 LIGHTING

While the majority of fluorescent lighting in most long term care facilities has been changed from T-12 to T-8 there are still some opportunities to upgrade the magnetic ballasts to electronic ballasts. Compact fluorescent lighting should replace all incandescent lights. Occupancy sensors should be installed in areas such as washrooms, storage rooms, mechanical and electrical rooms. LED exit lights should be installed.

Lighting levels throughout the building should be measured. Corridors and rooms are often over lit and there is an opportunity to reduce the number of lamps in the fixtures, which could significantly reduce electricity consumption.

5.4 KITCHENS AND LAUNDRIES

Demand ventilation systems with VFDs should be installed on all kitchen exhaust hoods to provide reduced exhaust volumes during periods when little cooking takes place below the hood. Turn fryers off, or cover and reduce them to idling temperatures during slow periods. During slow periods, turn off as many griddle burners as possible, and turn down other sections. Turn broiler flames to low between broiling operations and shut them off during slow periods.

Refrigeration coils should be cleaned at least once a quarter and strip curtains or plastic doors should be installed on the walk-in refrigerators and freezers as they can significantly reduce compressor runtime.

For maximum efficiency, ensure washers and dryers run only when fully and properly loaded. Consider using ozone laundry equipment for reduced energy use and reduced chemical use. Use the lowest water temperature at which proper cleaning and disinfecting can be achieved. The belts, pulleys, drain valves and balance of pressure for the equipment should be checked.

5.5 PLUG LOAD

Computers and monitors should be shut down when the staff leave for the evening or weekend; software updates could be carried out during regular business hours.

Printers and copy machines should be also switched off if possible.

VendingMisers monitor both occupancy levels in the area around the vending machine and ambient temperate changes, allowing only enough power to keep the cooled product inside at the right temperature and have it ready to dispense when someone is in the vicinity, powering down costly heat generating lighting and denying compressor cycles to run when they are not required.

5.6 RETRO-COMMISSIONING

Long term care facilities can achieve additional energy savings through a process called retro-commissioning. Retro-commissioning (RCx), or existing building commissioning, is a systematic process that identifies low-cost operational and maintenance improvements in existing buildings and brings the buildings up to the design intentions

of its current usage. RCx focuses on mechanical equipment, lighting and related controls. RCx optimizes existing system performance, rather than relying on major equipment replacement.

RCx would include the review of the facility's building automation systems (BAS), if applicable, to ensure that the proper ventilation levels are provided to each discrete area and that the programmed temperature settings are appropriate. Due to changes in function within the facilities there are many areas, for example, that are provided with 100% fresh air 24-hours per day, 7-days per week; whereas in reality they are unoccupied after 6:00 pm and on the weekends. The ventilation supplied to these areas could be switched off or cut back to 50% during unoccupied times.

The operation of the air handling units should also be reviewed to make sure all equipment is fully operational and is not causing additional energy usage. Examples would be valves passing steam or hot water, or dampers that are not operational allowing additional amounts of fresh air to flow to the facility, or variable frequency drives (VFDs) that are not operating properly.

5.7 ENERGY AWARENESS & TRAINING

There is an opportunity to adapt and implement the well established education and awareness programs currently being implemented in some hospitals and long-term care buildings into those facilities in the initial stages of design and those that have yet to consider education and awareness.

5.7.1 Social Marketing

Social marketing is the systematic application of marketing to achieve specific goals for a social good. Its main purpose is to influence social change. In the context of energy, social marketing is designed to reduce energy consumption in a facility using social marketing tools that encourage staff to make simple changes in their daily energy behaviours. The tools used in social marketing with regards to energy include detailed discussions of the environmental impact of specific behaviours, implementation strategies for changing that behaviour (energy conservation), and an assortment of 'action tools', such as e-mails, banners and posters etc. that are used to promote and prompt changed and sustained behaviour. The behaviours targeted by social marketing are simple yet have large collective impacts. These behaviours complement the potential energy saving opportunities identified above and may include: more efficient use of lighting, computers and monitors and personal appliances. For example posters, stickers and banners etc. can be produced to encourage staff to turn off lights, computers and other personal appliances.

Social marketing tools could be adapted from those already in use and rolled out in a formal fashion. The energy saving behaviours targeted should complement the other potential energy saving opportunities identified for the facilities.

5.7.2 Employee Engagement

Employee engagement is a marketing and communication tool or framework used to assist the long term care facility in identifying and implementing energy conservation actions. The difference between employee engagement and other types of communication tools such as social marketing is that employee engagement allows for

the two-way flow of information regarding energy and energy efficiency. In employee engagement not only do staff receive messaging on energy conservation, but they also have opportunities to provide their ideas for improvements in energy efficiency. Peers then evaluate these ideas and the most appropriate energy measures are implemented. The results of implementing the measures are then reported back to the employees in a timely fashion to motivate them. Employees are subsequently rewarded for their efforts. This process allows staff to become more aware of energy use and conservation and allows them to take ownership of the ideas and their implementation.

A formal employee engagement process should be developed for each long term care facility and expanded to include participation by other non-facilities staff within the building.

5.7.3 *Energy Training*

Training programs should be introduced to the long term care facilities for specialized staff to assist them in identifying process changes to ensure that equipment is utilized correctly and more efficiently. The training should address key equipment at the facilities including the building automations systems, HVAC and ancillary equipment.

Employee engagement, operator training and employee engagement are inextricably linked and integral to each other. Operator training provided facilities staff with training in identifying opportunities for energy savings and technical expertise on how to implement them; employee engagement provided the process for recommending and implementing energy saving ideas.

Through the implementation of an education, awareness and training program the potential energy savings for long term care are expected to be 5%+ for each facility.

5.8 **ENERGY MONITORING**

Monitoring of energy use should be integrated as part of the operation for the facilities. The daily hydro use profiles are available from the interval meters at each facility, either through the BAS or a web-based monitoring system. Reviewing and understanding the daily energy patterns and aberrations can lead to the identification of areas of waste. For example, high usage in the night and weekends can easily be identified for corrective action.

Monthly energy use for long term care facilities should be regularly compared the weather and occupancy corrected baselines to ensure that savings targets are met.

6 RECOMMENDATIONS

The analysis carried out on the energy profiles for a number of long term care facilities indicates that there will be a marginal increase of 1.2% in migrating from the current Regulated Price Plan (RPP) to hourly electricity pricing (HOEP). This, of course, is predicated on the assumption the HOEP will remain stable at historical levels. If the pricing levels from 2009 continue, which typically had lower costs with HOEP pricing, the small increase predicted may disappear or actually end up reducing the long term care building's electricity bill.

The sector analysis and investigations carried out by Finn Projects for long term care facilities in Ontario identifies excellent opportunities for energy cost reductions.

In conclusion, Ontario's long term care facilities should embark on the following activities, as described in this report:

- Carry out energy audits and implement the resulting retrofit of energy efficiency measures.
- Undertake retro-commissioning of the building automations systems.
- Address energy and demand reduction strategies for HVAC, fume hoods, lighting, kitchens and laundries, and plug load.
- Enter into an energy awareness program that includes social marketing, employee engagement and energy training.
- Implement energy consumption monitoring and targeting systems.

The potential overall energy cost savings for the long term care facilities could be as high as 25% in carrying out the above recommendations.