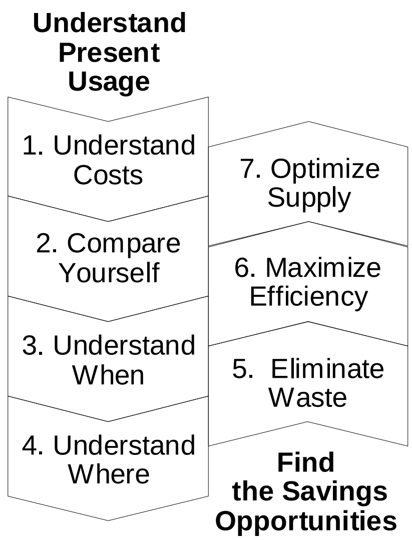
Energy Profile
&
Savings Opportunity Assessment

for

A Sample Hotel



March 2009

The Facility

The Hotel is an 86 room hotel serving the Some City area. This year round hotel is heated and cooled electrically primarily with through the wall heating and air conditioning units.

Domestic hot water for guest rooms and the laundry is heated by natural gas, which also provides heats for the dryers in the laundry.

Exterior lighting is provided by high pressure sodium wall packs and incandescent pot lamps in the lobby entry canopy.

Interior lighting is provided by a mix of incandescent lamps in ceiling pot fixtures and fluorescent wall sconces in hallways.

While the energy consumption of this hotel does not include that of the attached restaurant, there are ice, cold beverage and snack vending machines throughout the facility.

The walls and roof of this building are reasonably well insulated while windows are double glazed or double thermo-pane unit.

Each guest room features an array of incandescent ceiling and desk/table lighting, a small refrigerator, microwave oven, small coffee maker and an exhaust fan in the bathroom operated from the light switch.

Typical of this type of hotel, each of the lower floor guest rooms are served by large sliding glass doors.

A games room for guests contains various electronic arcade games.

Summary of Findings

The following table summarizes the current level of energy consumption costs, greenhouse gas emissions and the savings opportunities that have been identified in this facility:

Energy Analysis and Opportunity Summary for Sample Hotel

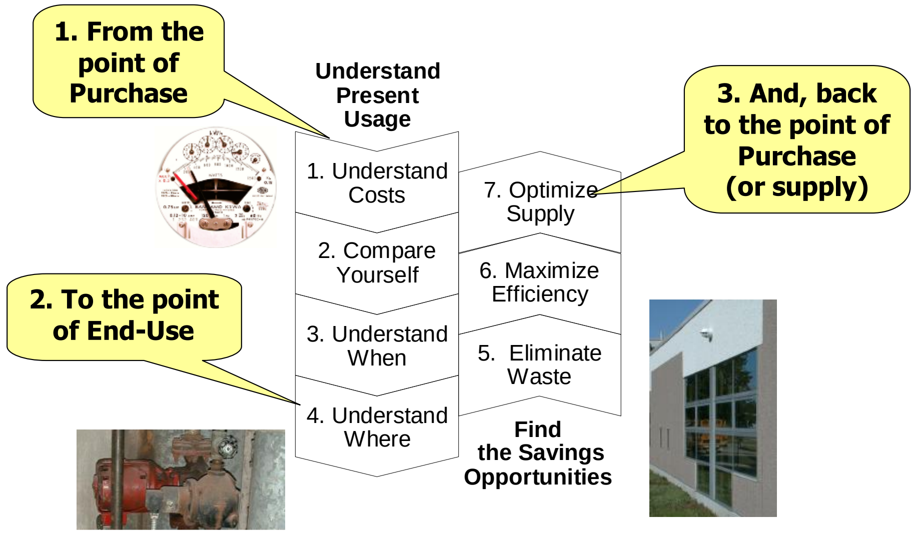
	Electricity Consumption		Natural Gas Consumption		Total Energy Use		Benchmark	CO2 Emissions	Esimated Cost	Simple Payback	IRR	Savings to Investment Ratio
	kWh	*$*	*m3*	*$*	*GJ*	*$*	*GJ/m2*	*kg*	*$*	*yrs*	*%*	
Current Situation	**351,169**	**$34,755**	**22,439**	**$10,334**	**2,093**	**$45,089**	**0.63**	**117,647**				
A Comparable Facility							0.70					
Energy Management Opportunties												
Building Envelope												
Reduce Air Leakage on Sliding Doors	33,000	$2,475			119	$2,475		7,260	$2,000	0.8	132.7%	11.7
Hot Water												
Utilize low-flow shower heads			3,060	$1,225	115	$1,225		5,508	$650	0.5	200.0%	17.9
Replace washing machine			1,500	$600	58	$600		2,700	$1,800	3.0	36.4%	3.2
Equipment												
Room refigerator temperature control	4,000	$300			14	$300		880	$100	0.3	316.0%	28.5
Occupancy control on vending machines	2,000	$150			7	$150		440	$300	2.0	55.0%	4.7
Lighting												
Room lamps from Incadescent to CFL	12,000	$1,300			43	$1,300		2,640	$3,250	2.5	44.0%	3.8
Hall pots from Inc. to induction	5,000	$425			18	$425		1,100	$650	1.5	71.5%	6.2
Canopy lamps from Inc. to Induction	3,000	$225			11	$225		660	$450	2.0	55.0%	4.7
Heat Recovery												
Install heat recovery on laundry dryers.			4,900	$1,960	183	$1,960		8,820	$8,000	4.1	25.6%	2.3
Savings for Selected Actions	59,000	$4,875	9,460	$3,785	568	$8,660	0.17	30,008	$17,200	**2.0**	**55.4%**	**4.8**
as a % of Current Situation	17%	14%	42%	37%	27%	19%	27%	26%				
Proposed Situation												
With All Oppoortunities Implemented	**292,169**	**29,880**	**12,979**	**6,549**	**1,525**	**36,429**	**0.46**	**87,639**				

Note 1: figures provided are annual totals

Note 2: IRR and SIR based upon 45 inlfation, 5% discount rate and 10 yr project life

The Energy Assessment Approach – The Seven Steps

Competing and succeeding in today's business environment requires clear strategies for managing a variety of expenses incurred daily. Improving the energy efficiency of your organization offers many cost-reduction opportunities. Energy management – the process of understanding and managing energy costs through energy efficiency and energy purchase strategies – is a management issue. As a management issue, achieving energy efficiency with the associated cost savings involves many aspects of your organization. There are technical issues because energy is consumed by technical systems. But people operate technical systems, and people can dramatically influence the level of energy consumption. As well, a strong organizational commitment is necessary to ensure the success of any business undertaking – energy efficiency included. A good starting point for energy management is an awareness of the possibilities from a technical perspective. The "seven steps" provides that awareness.



The "seven steps" methodology provides a methodical approach to developing an understanding of the following:

- **What is the facility's present energy use, and what influences it?**
- **What** opportunities exist to reduce your present use?

Accordingly, this assessment is presented with the context of the seven steps:

1. It begins with developing an **understanding** of the current consumption and **costs**
2. Next, the performance of this building will be examined in terms of how it **compares** to benchmark **performance** and in terms of the weather and occupancy that drives consumption.
3. As electricity is a significant component of cost and consumption the demand profile, a record **of when energy is used**, will be analyzed.
4. As a solid foundation for savings opportunities a comprehensive breakdown of **where energy, electricity and natural gas, is used** will be presented
5. The first priority of savings measures is to eliminate unnecessary usage – or **waste.**
6. Next savings opportunities that **improve the efficiency** of systems and equipment will be highlighted.
7. Finally actions that **optimize energy supply**, including such this as heat recovery are discussed.

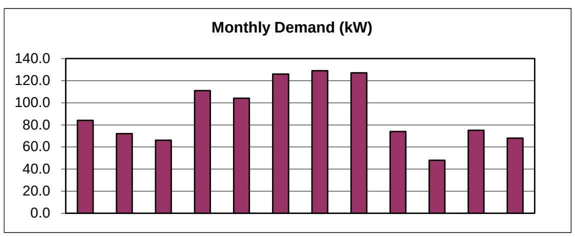
Step 1: Understand Cost

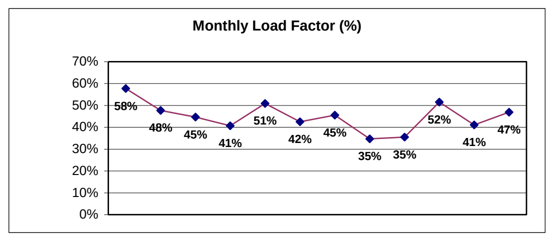
In this section an **understanding** of the current electricity and natural gas consumption, rates and **costs** will be developed.

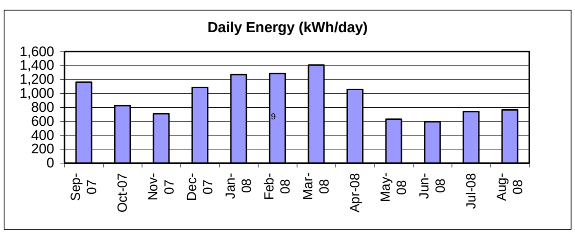
Electricity Consumption and Cost

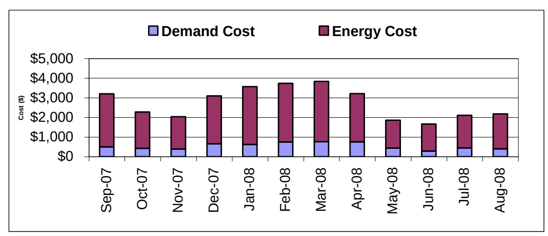
Electricity Consumption Data

Billing Date	Metered kVA	Metered kW	Power Factor	Billed kW	Energy kWh	Days	Daily kWh	Load Factor	Demand Cost	Energy Cost	Adjust (+/-)	Sub Total	Total Cost
1-Sep-07	0.0	84.0		84.0	36,053	31	1,163	58%	$500	$2,704	$0	$3,204	$3,396
1-Oct-07	0.0	72.0		72.0	24,707	30	824	48%	$428	$1,853	$0	$2,281	$2,418
1-Nov-07	0.0	66.0		66.0	21,934	31	708	45%	$393	$1,645	$0	$2,038	$2,160
1-Dec-07	0.0	111.0		111.0	32,523	30	1,084	41%	$660	$2,439	$0	$3,100	$3,286
1-Jan-08	0.0	104.0		104.0	39,330	31	1,269	51%	$619	$2,950	$0	$3,569	$3,783
1-Feb-08	0.0	126.0		126.0	39,835	31	1,285	42%	$750	$2,988	$0	$3,737	$3,962
1-Mar-08	0.0	129.0		129.0	40,843	29	1,408	45%	$768	$3,063	$0	$3,831	$4,061
1-Apr-08	0.0	127.0		127.0	32,775	31	1,057	35%	$756	$2,458	$0	$3,214	$3,407
1-May-08	0.0	74.0		74.0	18,909	30	630	35%	$440	$1,418	$0	$1,858	$1,970
1-Jun-08	0.0	48.0		48.0	18,404	31	594	52%	$286	$1,380	$0	$1,666	$1,766
1-Jul-08	0.0	75.0		75.0	22,157	30	739	41%	$446	$1,662	$0	$2,108	$2,235
1-Aug-08	0.0	68.0		68.0	23,699	31	764	47%	$405	$1,777	$0	$2,182	$2,313
Totals/Max	**0.0**	**129.0**		**129.0**	**351,169**	**366**			**$6,450**	**$26,338**	**$0**	**$32,787**	**$34,755**









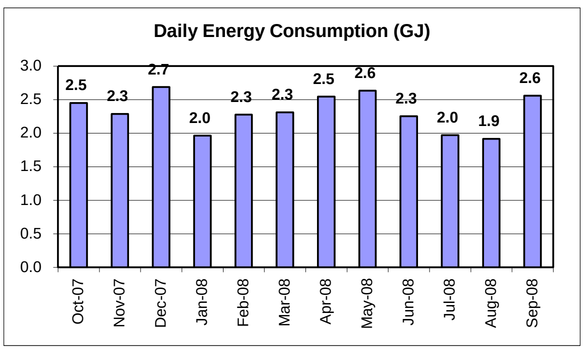
Discussion of Electricity Consumption and Costs

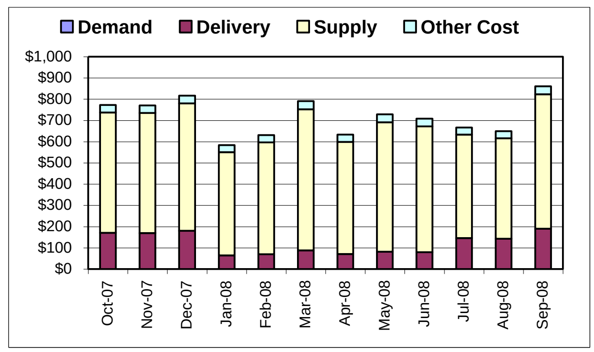
1. This site purchases electricity from ABC Hydro on a general service demand rate.
2. This site is not interval metered and as such is billed for electricity consumption (kWh) using a net system load shape and the prevailing Hourly Ontario Energy Price. (see www.ieso.ca)
3. The demand rate is $5.95 per kW while the weighted average energy price (including regulated charge for this site is estimated at $0.075/kWh.
4. The summer and winter seasonality of consumption and demand can be clearly seen from the month over month charts.
5. Demand is a modest 20% of total electricity cost.
6. The chart of load factor does not suggest any unusual consumption or demand patterns in this facility.

Natural Gas Consumption and Cost

Natural Gas Consumption Data

Billing Date	Season S/W	Consumption m3	Days	Energy GJ	GJ per Day	Demand Cost	Delivery Cost	Supply Cost	Other Cost	Adjust (+/-)	Total Cost
11-Oct-07	W	1,890	29	71	2.5		$170	$567	$36		$928
11-Nov-07	W	1,885	31	71	2.3		$170	$565	$36		$925
9-Dec-07	W	2,000	28	75	2.7		$180	$600	$37		$980
9-Jan-08	S	1,618	31	61	2.0		$65	$485	$33		$700
7-Feb-08	S	1,754	29	66	2.3		$70	$526	$35		$757
14-Mar-08	S	2,212	36	83	2.3		$88	$664	$39		$949
9-Apr-08	S	1,760	26	66	2.5		$70	$528	$35		$759
8-May-08	S	2,032	29	76	2.6		$81	$609	$37		$874
10-Jun-08	S	1,976	33	74	2.3		$79	$593	$37		$850
11-Jul-08	W	1,624	31	61	2.0		$146	$487	$33		$800
11-Aug-08	W	1,580	31	59	1.9		$142	$474	$33		$779
11-Sep-08	W	2,109	31	79	2.6		$190	$633	$38		$1,033
Totals/Max		**22,439**	**365**	**844**	**2.3**		**$1,452**	**$6,732**	**$428**		**10,334**

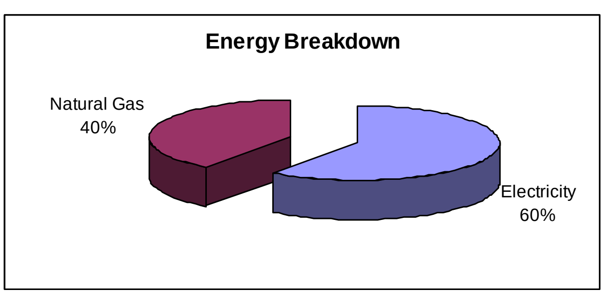


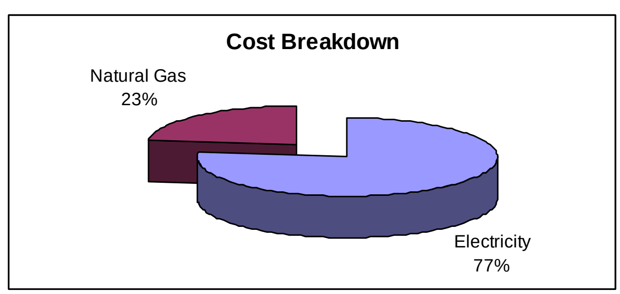


Discussion of Natural Gas Consumption and Cost

1. Natural gas consumption as expected is not heavily seasonal, in fact in the next section it will be shown that occupancy is a key driver.
2. The price of natrual gas has been assumed to be $0.40/m^3
3. Gas charges are primarily for supply or commodity.
4. Estimated reads are not apparent in the historical records.

Summary Breakdown of Cost and Consumption





Step 2: Compare Yourself

This step will provide comparisons of the facilities performance against published benchmarks and will quantify the drivers of consumption as a basis for future comparison of baseline to actual consumption. This can be the basis for measurement and verification following energy savings actions.

Benchmark Comparisons

The energy intensity of this facility is calculated as follows:

Total Energy	2,093 GJ
Total Area	3,300 m2
Total Rooms	85 Rooms
Energy Intensity by Area	0.63 GJ/m2
Energy Intensity by Room	24.6 GJ/Room

The Typical benchmarks for this type of facility are provided in the following table:

Hotels and Motels	Typical Annual Energy-Consumption Range*	Average Annual Energy Intensity*
Basic Accommodations (without restaurant or pool)	40 to 100 GJ per room 0.7 to 1.8 GJ/m^2	55 GJ per room 1 GJ/m^2
Full-Service Facilities (with restaurant and pool)	100 to 200 GJ per room 1.4 to 3.6 GJ/m^2	130 GJ per room 2 GJ/m^2

Reference

Energy Innovators Initiative Hospitality Sector Saving Energy Dollars in Hotels, Motels and Restaurants, Published in 2003
http://www.oee.nrcan.gc.ca/publications/infosource/pub/hospitality_sector/english/index.cfm

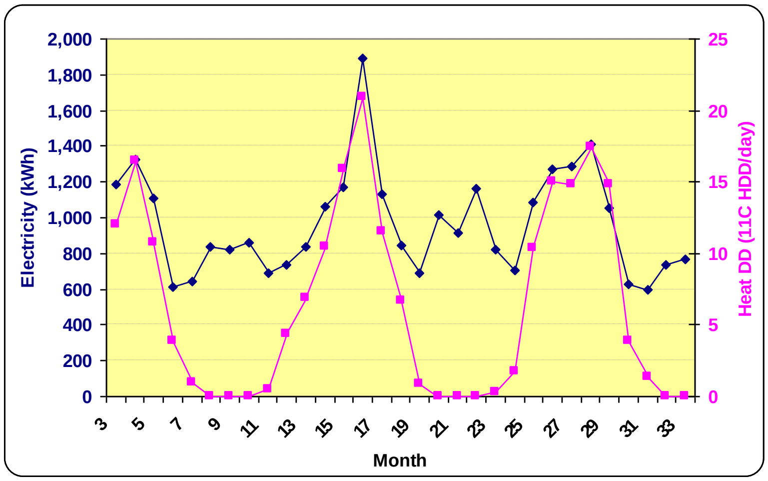
Discussion of Benchmark Comparisons

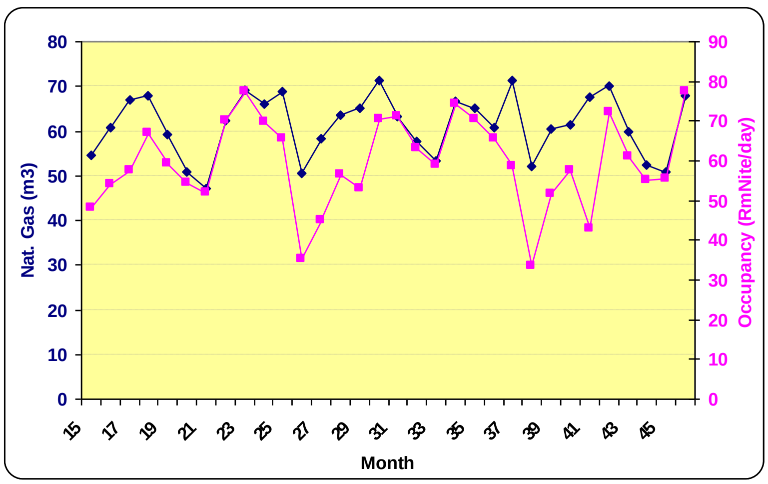
1. This hotel is performing well below the lower end of both the Area and Room intensity ranges suggesting an efficient operation.
2. It should be noted that the ranges where published in 2003, today the3 actual ranges maybe slightly lower given the current initiatives towards energy efficient design and operation.
3. That being said, the operational practices noted during the site visit to this facility are consistent with the level of performance noted.

Energy Performance Baseline

A visual and statistical analysis of the electricity and natural gas consumption data in conjunction with occupancy and weather data provides a reference baseline for future energy monitoring.

Visual Analysis





The charts to the right provide a visual representation of how weather and occupancy drive energy consumption in this hotel.

The upper graph shows that electricity is strongly influenced by weather represented by heating degree-days (HDD). Heating degree-days are a measure of how cold it is for how long.

The lower graph illustrates the impact that occupancy has upon natural gas consumption. This makes sense considering that natural gas is used to heat bother hot water and the dryers, the use of both is driven be occupancy.

While heating degree days and occupancy are the primary drivers of electricity and gas, as evidenced by the "scatter" on these graphs there are other drivers at work.

The equations presented below represent the full relationships for each of gas and electricity. These equations could be used to budget energy consumption on the basis of weather or occupancy and to monitor future consumption to detect future savings.

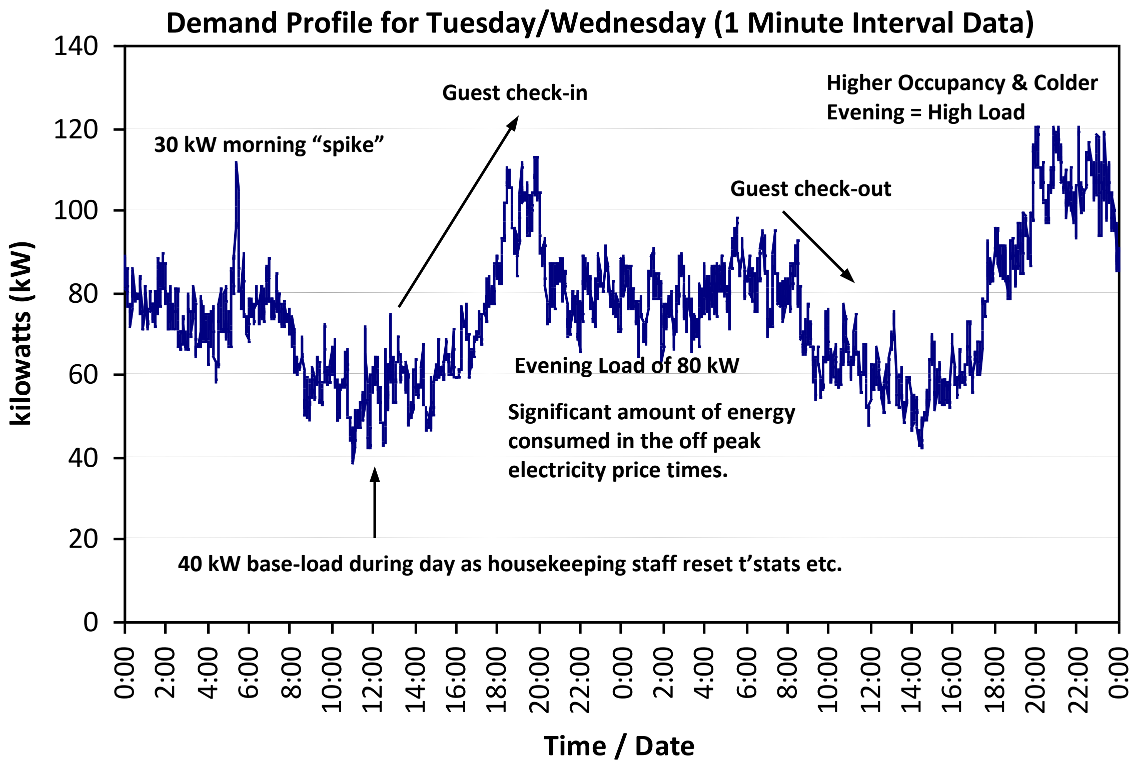
Monthly Natural Gas (m3) = 644.5 m3/month + 0.522 m3/Room Night + 0.406 m3/30CHDD

Monthly Electricity (kWh) = 889 kWh/month + 6.2 kWh/Room Night + 63.2 kWh/11CHDD + 58.22 kWh/11CCDD

Where: 11C CDD are cooling degree-days for a 11 deg c balance and 30C HDD are heating degree days per month for 30 deg C balance point. The R^2 for these equations was 0.76 and 0.86.

Step 3: Understand When Energy (Electricity) is Used

The cost of electricity is influenced by demand and time-of-use. The electrical demand profile shows the rate of use of electricity over time. This electrical fingerprint is a critical element in developing and understanding energy use patterns.

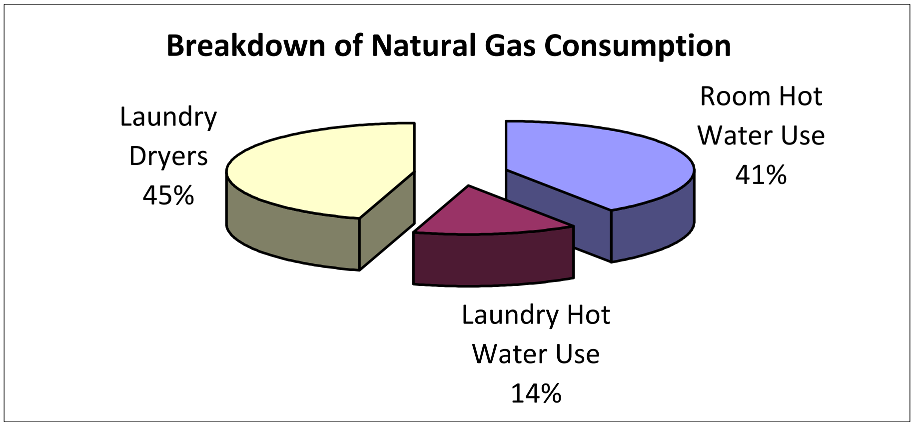


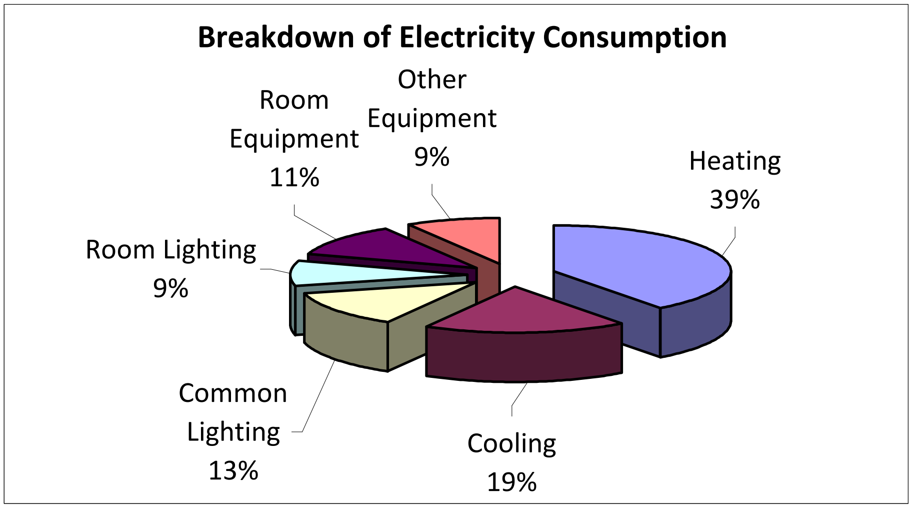
Discussion of Demand Profile

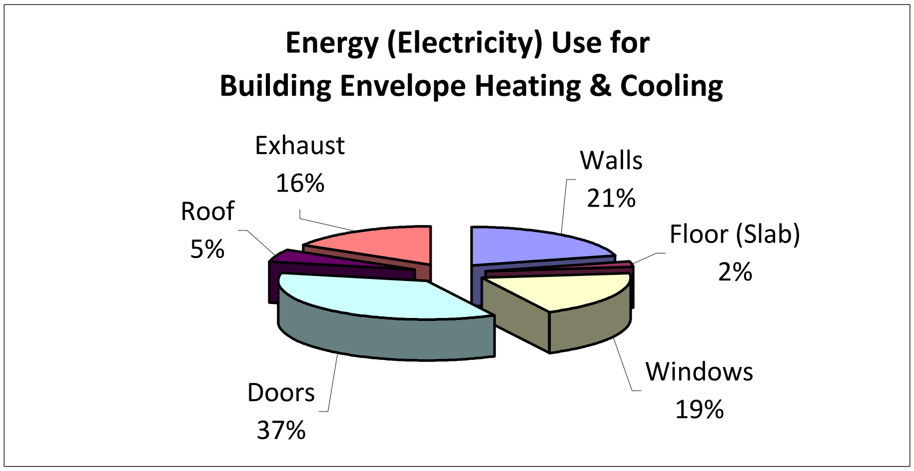
1. This profile reconciles well to the billed demand for this period or approximately 110 to 120 kW. Note that the billed demand would be measured on a 15 minute interval which would tend to be smoother and slight lower than this chart shows.
2. The lowest demand occurs during the day when this facility is less occupied. This demonstrate well the diligence of housekeeping staff in ensuring that room loads are turned off and thermostats are reset when rooms are not occupied.
3. As expected for this type of facility the evening represents the peak time as guest check in, turning on equipment and turning up temperatures. (this profile was measured in Jan '09)
4. While the load is steady overnight, it begins to grow at about 6:00 AM.
5. The load spiked abruptly on the 1st morning, with a magnitude of 30 kW. This cannot be explained in terms of normal operation such as electric heat as all rooms are autonomously controlled.
6. One will note that the load on the 2nd evening is considerably higher for two reasons - occupancy was higher and it was a colder night requiring more electrical heat.
7. The large amount of energy consumed in the "off peak" energy price times suggest an opportunity for the use of an interval meter to take advantage of off peak price.

Step 4: Understand Where Energy is Used

A key component of the energy assessment is a detailed inventory of electrical loads, and a heat loss and use analysis of the building envelope, hot water and laundry areas. The following charts provide insight into which are the key energy users in this facility.







Step 5: Eliminate Waste

The energy savings opportunities (ESO) with the highest priority are those that reduce unnecessary usage by various means. Usage of this type is sometimes called waste. Much is being done to avoid waste in this facility already evidenced by the low energy intensities. Staff is diligent in ensuring equipment does not operate when not needed. There are though a few more opportunities somewhat technological in nature:

ESO #1: *Reduce Air Leakage at Doors and Sliding Doors*

Outside air leakage in any building with increase both heating and cooling costs while detracting from occupant comfort. It is suggested that the weather stripping on all doors be checked and repaired as required. Savings estimates are based on modest reductions in air leakage, recognizing that it is not possible to seal such doors tightly.

Savings Summary	KWh	GJ	$ Saved
Direct Saving	29,000	0	
Indirect Cooling Savings	+4,000		
Indirect Heating Cost	0		
Net Savings	33,000		$2,475
Estimated Cost	$2,000		
Payback, IRR & SIR	0.8 yrs	132.7%	11.7

ESO #2: *Utilize Low Flow Shower Heads in Guest Rooms*

At the time of the site visit the showerheads in the guest where assessed to be of a type that will use upwards of 4-5 gallons per minute. There are presently showerheads available that will use under 2 gallons per minute. Union Gas will provide a limited quantity of showerheads free of charge to customers. Since the quality of a shower is important to good guest service it is suggested that any replacement showerhead be tested prior to widespread installation. Savings are based upon reducing show water consumption by 50%. In addition to energy saved there will also be water cost savings.

Savings Summary	KWh	Gas M^3	$ Saved
Direct Saving	0	3,060	
Indirect Cooling Savings	0		
Indirect Heating Cost	0		
Net Savings	0	3,060	$1,225
Estimated Cost	&650		
Payback, IRR & SIR	0.5 yrs	200.0%	17.9

ESO #3: Replace Washing Machine with New Low Water Model

At the time of the site assessment it was reported that the washer currently in use is aging and will leak a considerable amount of water per load - estimated to be 3-5 gallons. New washers today could reduce the routine consumption of water by as much as 50%, and would eliminate the leaking water. As in the previous measure, there will be additional water cost savings to the energy savings estimated below.

Savings Summary	KWh	Gas M^3	$ Saved
Direct Saving	0	1,500	
Indirect Cooling Savings	0		
Indirect Heating Cost	0		
Net Savings	0	1,500	$600
Estimated Cost	$1,800		
Payback, IRR & SIR	3.0 yrs	36.4%	3.2

ESO #4: *Adjust Upwards Guest Room Refrigerator Temperature Controls*

Many of the guest refrigerators in the 85 rooms are not utilized for a considerable length of time. Consider increasing the temperature in the fridges marginally to reduce compressor run time and hence energy consumption. Caution is suggested to avoid temperatures that are high enough to allow bacterial growth or cause guest food spoilage.

Savings Summary	KWh	Gas M^3	$ Saved
Direct Saving	6,000	0	
Indirect Cooling Savings	+1,000		
Indirect Heating Cost	-3,000		
Net Savings	4,000	0	$300
Estimated Cost	$100		
Payback, IRR & SIR	0.3 yrs	316.0%	28.5

ESO #5: *Utilize Motion Sensor / Time Control on Vending Machines*

There are devices available that will reduce the runtime of vending machines both cooled and un-cooled. These devices will detect occupancy and follow timer schedules to reduce the operating time of equipment when facility occupancy is low.

Savings Summary	KWh	Gas M^3	$ Saved
Direct Saving	3,000	0	
Indirect Cooling Savings	+1,000		
Indirect Heating Cost	-2,000		
Net Savings	2,000	0	$150
Estimated Cost	$300		
Payback, IRR & SIR	2.0 yrs	55.0%	4.7

Step 5: Increase Efficiency

Increasing efficiency can be done with the installation of new equipment with a higher rated efficiency. It can also result from improved operating conditions for equipment. It was reported that air conditioning and heating equipment is serviced and cleaned regularly – this contributes to operational efficiency. Still, a few technological opportunities exist to make improvements:

ESO #6: *Replace 100 W Incandescent Guest Lamps with 23 Watt Compact Fluorescent Lamps*

At the present time there are approximately 250-100 watt incandescent bulbs providing illumination in the guest rooms. Consider replacing these bulbs with 23 watt or possibly lower wattage, compact fluorescent lamps with a high colour rendering index and a suitable colour temperature. These bulbs will reduce energy consumption and typically have a 5,000 to 10,00 hour life.

Savings Summary	KWh	Gas M^3	$ Saved
Direct Saving	19,000	0	
Indirect Cooling Savings	3,000		
Indirect Heating Cost	-10,000		
Net Savings	12,000	0	$1,300 (1)
Estimated Cost	$3,250		
Payback, IRR & SIR	2.5 yrs	44.0%	3.8

(1) includes demand savings

ESO #7: *Replace Ceiling Pot Lamps in Hallways with Induction Lamps*

Consider replacing the incandescent pot lamps in the hallways with screw-in induction lamps (often referred to as electrode-less compact fluorescents). Induction lamps have extended lives and depending on design will tolerate the heat in a pot type of fixture.

Savings Summary	KWh	Gas M^3	$ Saved
Direct Saving	0	0	
Indirect Cooling Savings	0		
Indirect Heating Cost	0		
Net Savings	0	0	$425(1)
Estimated Cost	$650		
Payback, IRR & SIR	1.5 yrs	71.5%	6.2

(1) includes demand savings

ESO #8: ***Replace Canopy Pot Lamps with Induction Lamps***

Consider replacing the incandescent pot lamps in the hallways with screw-in induction lamps (often referred to as electrode-less compact fluorescents). Induction lamps have extended lives and depending on design will tolerate the heat in a pot type of fixture.

Savings Summary	KWh	Gas M^3	$ Saved
Direct Saving	3,000	0	
Indirect Cooling Savings	0		
Indirect Heating Cost	0		
Net Savings	3,000	0	225
Estimated Cost	$450		
Payback, IRR & SIR	2.0 yrs	55.0%	4.7

Step 7: Optimize Energy Supply

Supply options and opportunities include such things as renewable energy, onsite generation, heat recovery and electricity pricing options. While renewable energy may not be a 1st priority, it is worth consideration at some point as this facility looks for even greater savings. In the meantime there are two opportunities worth considering I this category:

ESO #9: ***Consider Installing of Heat Recovery on the Laundry Dryers***

The dryers in the laundry consume and subsequently exhaust a considerable amount of heat derived from natural gas. Consider the installation of a heat exchanger/heat recovery system to reclaim this heat to preheat the fresh air intake to the laundry that must be heated by the dryer or more expensively by the electric hallway heat. This requirement for heating of fresh make-up air is evident in the strong dependence of gas consumption on outside temperature .

Savings Summary	KWh	Gas M^3	$ Saved
Direct Saving	0	4,900	
Indirect Cooling Savings	0		
Indirect Heating Cost	0		
Net Savings	0	4,900	$1,960
Estimated Cost	$8,000		
Payback, IRR & SIR	4.1	25.6%	2.3