

# Report

## Example Level 1 Energy Review - Typical Nursing Home

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### Prepared For

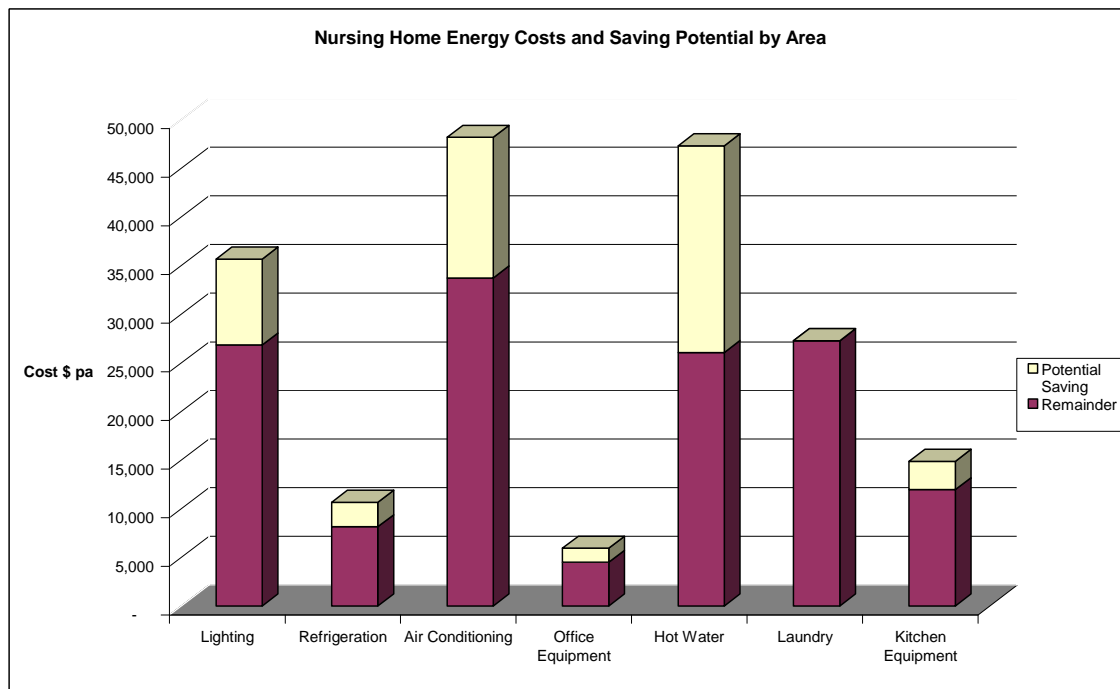
Typical Nursing Home  
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## 1. EXECUTIVE SUMMARY

The following report is a hypothetical example of energy savings typical of many nursing homes. The results of the assessment can be summarised in **Figure 1**:



**Figure 1: Energy Saving Opportunities by Area**

**Total Potential Savings \$58,000 pa**

The current energy consumption for the Example Organisation is 1,280,000 kWh or \$192,000 pa. so the \$58,000 in identified opportunities represent a substantial 30% of current consumption. This also represents a potential reduction of 357 tonnes of CO<sub>2</sub>.

### 1.1 Step 1 - Low Cost Measures

Measure	Resource Type	Saving kWh pa	Saving \$ pa.	Capital	Payback (years)	CO2 (tonnes pa.)
Fit timers to hot water systems	Hot Water	0	\$2,523	\$200	0.1	0
Sleep mode for chilled/boiling water	Hot Water	2778	\$440	\$200	0.5	2
Replace 50W with 35W IRC Halogen down lights	Lighting	3247	\$514	\$700	1.4	3
Motion sensors to meeting/server/vacant rooms	Lighting	2778	\$440	\$900	2.0	2
Turn off all office equipment when not in use	Office	4113	\$651	\$500	0.8	4
<b>Subtotal</b>		<b>12,915</b>	<b>\$4,569</b>	<b>\$2,500</b>	<b>0.5</b>	<b>11</b>

### 1.2 Step 2 - Medium Cost Measures

Measure	Resource Type	Saving kWh pa	Saving \$ pa.	Capital	Payback	CO2 (tonnes pa.)
Upgrade Power Factor	Power	0	\$800	\$1,500	1.9	0
Fit VSD to kitchen exhaust fan	Kitchen	8333	\$1,320	\$3,000	2.3	7
Virtual servers - 40% reduction	Office	5556	\$880	\$3,000	3.4	5
A/C timers and economy cycle	Air conditioning	96360	\$15,263	\$4,000	0.3	86
<b>Subtotal</b>		<b>110,249</b>	<b>\$18,263</b>	<b>\$11,500</b>	<b>0.6</b>	<b>98</b>

### 1.3 Step 3 - Higher Cost Measures

Measure	Resource Type	Saving kWh pa	Saving \$ pa.	Capital	Payback	CO2 (tonnes pa.)
Refrigeration system upgrade	Refrigeration	16667	\$2,640	\$10,000	3.8	15
Replace electric fryers with gas	Kitchen	11111	\$1,760	\$10,000	5.7	10
Lighting voltage reduction	Lighting	55757	\$8,832	\$21,600	2.4	50
T5 to T8 Fluoro replacement	Lighting	55757	\$8,832	\$39,600	4.5	50
Install heat pump hot water systems	Hot Water	138889	\$22,000	\$40,000	1.8	124
<b>Subtotal</b>		<b>222,423</b>	<b>\$35,232</b>	<b>\$81,600</b>	<b>2.3</b>	<b>198</b>

Note that some items listed above are alternatives or implementation of one measure may reduce the effectiveness of other measures e.g. voltage reduction is an alternative to T8 to T5 fluorescent light upgrade. Costs and savings are generally accurate to +/- 40%.

## 2. RESULTS

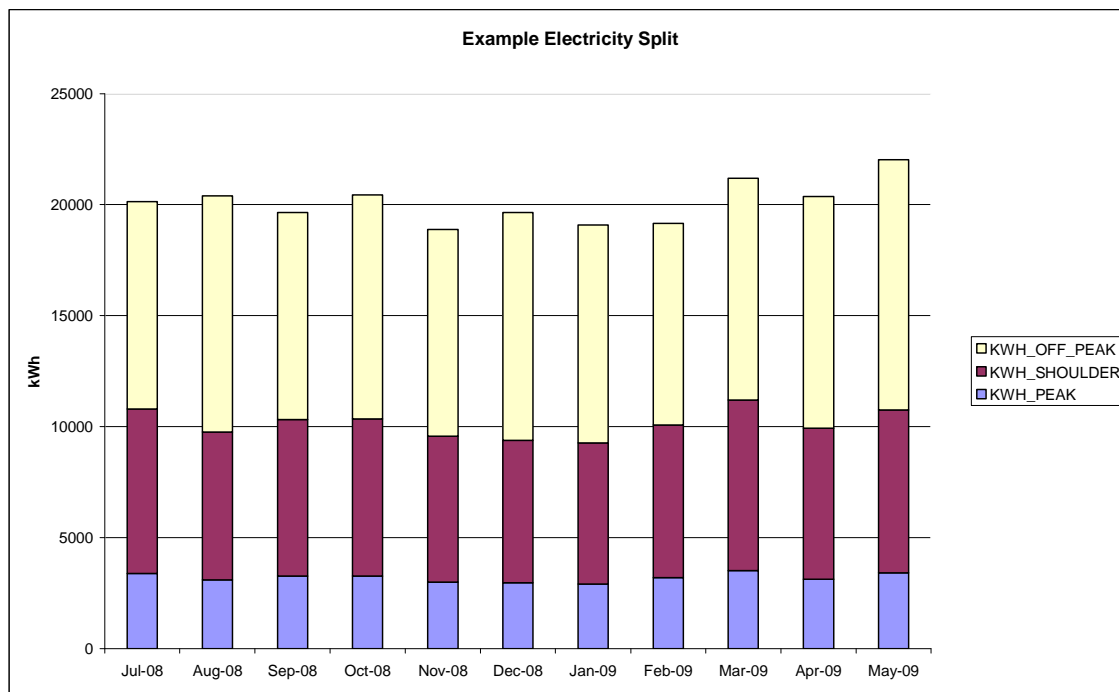
### 2.1 Baseline Energy Use

Table 1 shows the annual electricity consumption for the site occupied by Example Organisation.

**Table 1: Baseline Energy Use - 2008**

Energy Type	kWh pa.	GJ pa.	% of Energy Use	Annual Energy Cost	GHG tCO <sub>2</sub> pa.	Cost \$
Electricity	1,280,000	4,608	79	\$185,300	1,360	0.1449 / kWh
Gas		1,200	21	\$43,300	80	36.1 / GJ

Figure 2 shows the electricity consumption for the site for the period from 1 June 2008 to 1 June 2009. Consumption appears to be relatively stable and does not vary with the seasons.



**Figure 2: Electricity Consumption for 2008/2009**

### 2.2 Building Management System

Example Organisation does not have a building management system (BMS) and due to the relatively small energy cost it is not considered economically feasible to install such a system.

## 2.3 Key Aspects of Building Fabric

All buildings have small glass windows facing East, North and West; however due to shading and tinting these windows provide little natural illumination. Ceiling insulation is installed but there is no wall or floor insulation. Floor and wall insulation is not considered economically feasible.

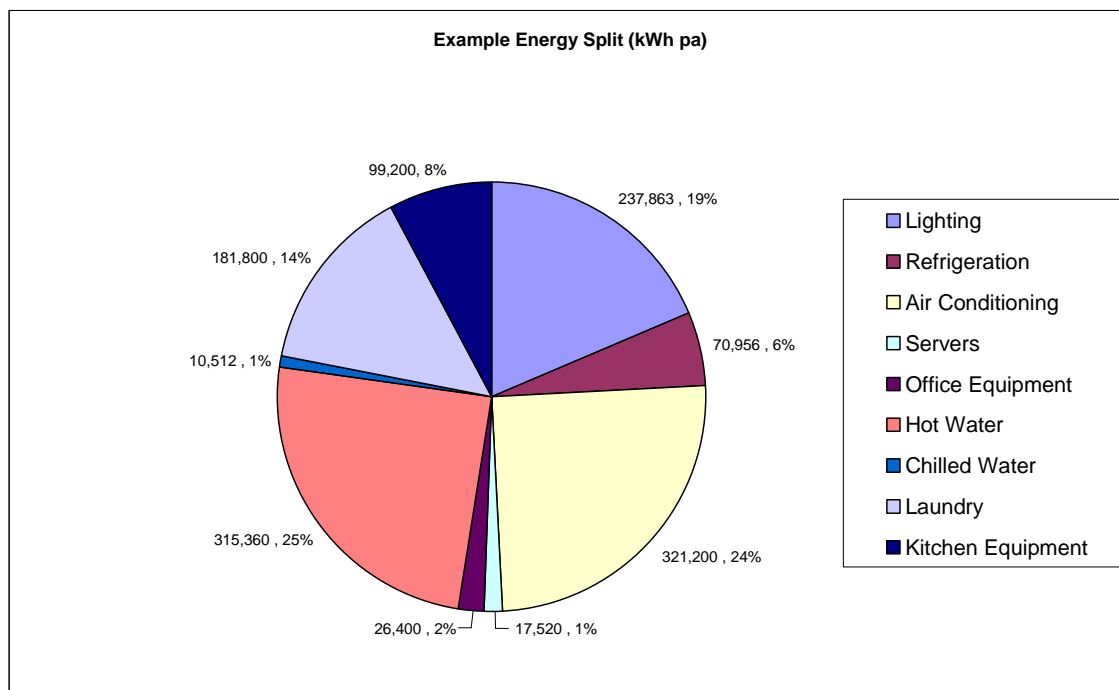
## 2.4 Illuminance

On the day of the audit the weather was cool but clear and sunny. Measured Lux levels averaged 300 for most areas which is considered satisfactory according to AS1680.

## 2.5 Energy balance

Name plate appliance data and appliance numbers were multiplied by estimated daily operating hours. The calculated overall hourly, daily and annual consumptions were then adjusted to match the known hourly, daily and annual electricity consumption.

The results are shown graphically in **Figure 3**.



**Figure 3: Example Organisation Electricity Consumption by End Use**

## 2.6 Identified Energy Efficiency Opportunities

### 2.6.1 Power Factor

Power Factor is a measure of the efficiency of the electricity demand. A power factor of 1 is ideal and indicates that 1 kVA of energy delivered to the site is equivalent to 1 kW of energy consumed. A low power factor indicates that equipment is drawing relatively more current than required.

The site currently has power factor correction equipment fitted but, based on the reported values for power factor, it appears to be ineffective. The Energy Australia data shows the average power factor (PF) at maximum demand is only 0.80.

Savings can be achieved by correcting the Power Factor (PF). Power Factor is the ratio of true power (kW) to peak demand (kVA), and is calculated using the following formula:

$$\text{Power Factor (PF)} = \text{Actual Power (kW)} / \text{Peak Demand (kVA)}$$

The highest maximum demand in the 2007 - 2008 period, as measured by Energy Australia, was 157 kVA with a power factor = 0.80. To achieve a more desirable Power Factor of 0.95, the peak demand would need to be reduced to 132 kVA. By improving power factor, the demand costs could be decreased by \$800 per year.

These calculations are summarised in **Table 2**.

**Table 2: Expected Savings Related to Power Factor Correction**

Highest Max. Demand kVA	157
Actual PF	0.80
Target PF	0.95
Calculated Max. Demand (kVA)	132.2
Demand reduction (kVA/month)	24.8
Demand cost (\$/kVA)	\$ 2.70
Saving (\$/annum)	\$ 800

Note: A power factor of 0.95 has been chosen as this value is associated with the optimum value for return on investment when purchasing power factor correction equipment

To achieve the potential cost savings, power factor correction equipment is required. The typical cost of this equipment is \$1,500, plus electrical installation costs.

## 2.6.2 Lighting

The cost of providing lighting to floor areas is approximately 19% of the total site electricity use. Although Example Organisation staff are encouraged to turn lights off when they leave or when not required, a tour of the site by day showed some areas where lighting was being left on when not required in vacant offices and meeting rooms. Motion sensors are recommended for these areas. Additional lighting switches would also allow staff to turn off lights in unoccupied areas.

The measured Lux levels for the majority of the building were above the minimum levels specified by *AS 1680.1:2006 Interior and workplace lighting - General principles and recommendations*.

Due to the variances in the hours that lights are left on (ranging from 9 h to 17 h), an average base of 16 h/day and 300 days per annum was used for the following tables.

Budget estimates and energy savings for lighting upgrades are based on the following costs (capital and labour):

- Electronic ballast T5 Fluorescent - \$45 each
- 35 W IRC halogen lamp - \$17 each
- Electricity cost of 16 c/kWh or \$44/GJ

In order to maximise return on investment it is recommended that the lights left on most frequently are changed over first. For example if rooms are fitted with motion sensors which are expected to turn lights off for 50% of the time, the payback period for upgrades will be doubled.

**Table 3** shows an option for replacing 50 W halogen down lights with 35 W IRC halogen lamps. These lamps are a simple replacement and have the same light intensity as the 50 W lamps. The current 36W T8 fluorescent tubes can also be easily upgraded to the 28 W T5 tubes using a Save-It-Easy retrofit pack resulting in a similar 30% energy saving.

Another lighting option that could be investigated further includes fitting Powersave voltage reduction units to the lighting circuits. These can save 25% of total lighting energy but require that the office has circuits primarily dedicated to lighting and the current voltages are in excess of 230 V. The cost effectiveness will decrease if these assumptions are not correct. This option could be undertaken in conjunction with previous technologies or as a standalone project.

LED lights generally offer substantial advantages over conventional lights with respect to much longer life (up to 100,000 hours compared to 15,000 hours) and as much as 80% savings of the energy consumption. However, the payback periods are much longer if energy is the only consideration. Factoring in reductions in labour costs for bulb replacement could reduce these payback periods to less than two years in areas where lights are left on for long periods. Emergency exit lights could be retrofitted with LED lighting as they are left on continuously; however the estimated savings are only \$350 pa and the payback would exceed ten years.

**Table 3: Lighting Upgrade**

Light Type	No. of Lights	kW per Lamp	Energy (kWh pa)	Energy Reduction (%)	Energy Saved (kWh pa)	Energy Saved (GJ pa)	Cost Saving (\$ pa)	Capital Cost	Payback (years)
Fluoros - 44W	880	0.044	185,856	30	55,757	201	\$ 8,364	\$39,600	4.7
Halogen D/L 50W	41	0.055	10,824	30	3,247	12	\$ 487	\$ 697	1.4
Voltage reduction	880		185,856	30	55,757	201	\$ 8,364	\$21,600	2.6
Total	222				14,670	53	\$2,200	\$15,456	7

Other simple low cost actions to reduce lighting levels are:

- Reduce unnecessary use of lighting, install time switches. These can be push buttons or time delay switches. Note: time switches are relatively cheap and simple to install. Install sensor devices to automatically turn lighting on and off (e.g. when a room is not in use) and to control dimming, ensure external lighting is not in use during the day.
- Help staff/personnel to use lights only when needed: locate switches throughout each area of a building to take into account the usage patterns of work areas, avoid having one or only a few switches controlling lights in large areas.

- Educate all staff/personnel in the best practice use of lighting: remind staff to switch off lights when not needed (e.g. turning off lights in storerooms, toilets, meeting rooms etc. when not in use), provide easy to read signage near all lights that remind staff/personnel to turn off lights when not in use. Note: All personnel including cleaners, security guards and other contractors should be aware of best practice use of lighting.
- Ensure your lighting is operating at its optimum level: keep lights and light coverings clean. Dirt and dust reduces light output and the life expectancy of lighting.

### 2.6.3 Office Equipment

The office equipment consumes approximately 2% of total tenant electricity consumption. The following actions are recommended to reduce energy consumption in office equipment:

- Changing all monitors from CRT to LCD;
- Purchase of more efficient small form factor desktops computing;
- Implementing efficient power schemes across all desktop, automatically turn off monitor and hard disk after idle period (Savings of up to 40% can be made);
- Computer placement policy to enhance air flow;
- Regular cleaning of computer vents same as above;
- Thin client computing by moving processing to a consolidated data-centre;
- Virtualisation of under utilised services;
- Move to modular or 'blade' infrastructure resulting in consolidated processing;
- Data centre redesign to promote airflow;
- Aggressive sleep mode settings for all printing and copying devices; and
- Implementation of video conferencing throughout the offices, substantially reducing travel between the sites.

The apparently high server number and power use appear to indicate potential for further virtualisation of servers.

### 2.6.4 Hot and Cold Water

Hot water usage represents 25% of energy use and several simple steps could minimise this level:

- Converting electric hot water systems to heat pump systems;
- Fitting timers to hot water systems to prevent operation in the expensive electricity period from 2 pm to 8 pm;
- Use dishwashers only when full to conserve energy and water;
- Ensuring dishwashers are connected to hot water not cold water supplies; and
- Activating the sleep mode on the Zip chilled and boiling water units.

## 2.7 Kitchen Equipment

The operation of kitchen equipment during the expensive peak periods from 2 pm to 8 pm should also be minimised if possible. Potential actions include:

- Soft drink dispensing machines could be turned off from say 5 pm to 10 pm;
- Turn off equipment that is on standby power and save up to 10% energy use. A simple action of turning off devices such as computers overnight or when not in use for extended periods is a zero cost opportunity for energy savings;
- Check refrigeration seals regularly. Seals in poor condition allow cool air to escape, resulting in higher energy consumption and costs. Refrigeration Seal Test: Close the door on a \$5 note. If you can easily pull the note out then you need to replace the seals. Visually inspect the seals for cracks and signs of wear, particularly at the bottom of the door;
- Electric fryers should be converted to gas fryers; and
- Espresso machines should be switched off at night (perhaps a timer could ensure this occurs).

## 2.8 Air Conditioning

The three water cooled server room air conditioners are operating continuously to maintain a constant 20 degree temperature inside the server rooms. Example Organisation IT staff have expressed some concerns about changing this system however significant energy savings could be obtained by experimenting with alternative systems such as:

- Increasing set points to say 24 degrees (the recommended summer temperature for offices);
- Utilising the free outside air supply (when ambient conditions are suitable);
- Decreasing set points to say 20 degrees during off peak times then allowing set points to rise to say 24 degrees during peak electricity periods;
- For general building use set your thermostat to between 24°C and 27°C in summer and to between 18°C and 20°C in winter. For every degree you raise your air conditioning set point in summer or lower your set point in winter, you will save up to 10% in energy use; and
- Maintain air conditioning systems according to the manufacturer's instructions. This includes ensuring that the system is free of dust; burners, coils and filters are clean, pipes are insulated; and there are no leaks. This ensures equipment is operating efficiently, saving energy and costs.

The efficiency or Co-efficient of Performance (COP) of the larger Mitsubishi units was determined as 2.86 for cooling. This is equivalent to a current Energy Star rating of 3.5. A new 6 Star air conditioner could be expected to improve the COP to 3.5 or 22%. The COP of the smaller Mitsubishi and Panasonic units was determined as 2.5 for cooling. This is equivalent to a current Energy Star rating of 2.5. A new 6 Star air conditioner could be expected to improve the COP to 3.5 or 40%.

Assuming an average improvement of 30% replacing all eight air conditioners could be expected to save approximately 96,000 kWh or \$15,000 pa.


## 3. RECOMMENDATIONS AND CONCLUSIONS

The actions identified in this report can save the Example Organisation up to \$66,000 pa or 30% of the current energy bill. Energy prices are expected to increase by 20 to 40% in the next few years as a result of increases in base fuel costs and the governments move to increase renewable energy use and the Carbon Pollution Reduction Scheme. These increases will reduce the payback period for energy saving investments.

Both state and federal governments are offering a number of incentives for organisations and individuals to reduce energy consumption. To progress this energy audit report the recommended next steps for Example Organisation are:

- Engage staff participation as previously explained by The Issue Communications Company e.g. encourage them to undertake the free home energy assessment;
- Request written quotations from suppliers for energy system upgrades (The Issue Communications Company can assist with this if required); and
- Explore possible government subsidies and incentives. (The Issue Communications Company can assist with this if required).

## Endorsements

Function	Signature	Name and Title	Date
Written By		Advitech Senior Consultant	8 October 2009
Checked By			8 October 2009
Authorised for Release By			8 October 2009

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