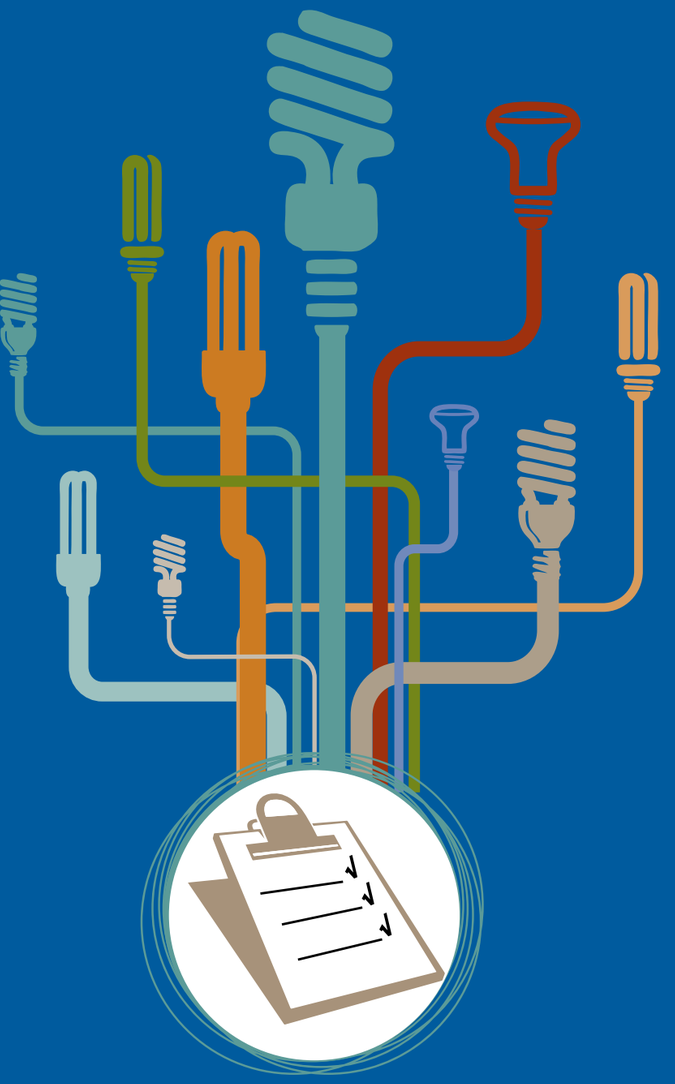
Guideline for schools to do self energy audits



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Introduction

With an annual increase in electricity tariffs, it is critical to reduce electricity usage in all sectors of the economy, including at schools. A reduction in energy usage contributes to lower electricity bills, a reduction in green house gas and less coal and water being used to generate electricity.

Energy savings can be achieved in two ways: Changing human behaviour or replacing electrical equipment.

Electrical equipment has improved tremendously in terms of energy efficiency. The aim, therefore, is to conduct energy use assessments to identify poor performing, energy intensive technologies and replace them with energy efficient equipment. Energy use assessments are the first step in improving the energy efficiency of buildings and commercial facilities.

What is energy efficiency?

Efficient energy use, sometimes simply called energy efficiency, aims to reduce the amount of energy required to drive the same amount of products and services.

What is an energy use assessment

An energy use assessment identifies where and how much energy is consumed in an existing facility, building or structure.

> “A walk-through energy use assessment involves an examination of a school building, including a visual inspection of each of its associated systems.”

Who is an energy use assessment team?

A team, inclusive of a responsible team leader (who could be a teacher), facilities and maintenance staff and pupils, should be established to organise and manage the process.

What are the steps in an energy use assessment?

Step **one**

• Preliminary Consultation

The initial step is to consult with knowledgeable parties to determine the most suitable type of audit.
(Energy audit team and Eskom Energy advisor)

Step **two**

• Initial Data Gathering and Assessment

At least two years' worth of Electrical Energy Bills should be compiled and reviewed.
(Energy audit team to gather data and Eskom energy advisor to review)

Step **three**

• On-site Inspection

This step involves detailed inspection of building components and systems and responding to issues/ questions raised in the initial audit.
(Energy audit team)

Step **four**

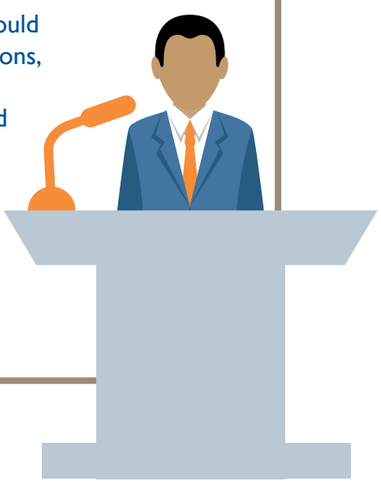
• Data Analysis and Evaluation

Information obtained during the inspection has to be evaluated. The analysis of audit data involves calculating energy efficiencies.
(Eskom energy advisor)

Step **five**

• Reporting

The final written report should include data, recommendations, savings estimates, and cost estimates for recommended conservation measures and systems improvements.
(Energy energy advisor)



Your school

Checklist

Step **1** ☐

Step **2** ☐

Step **3** ☐

Step **4** ☐

Step **5** ☐

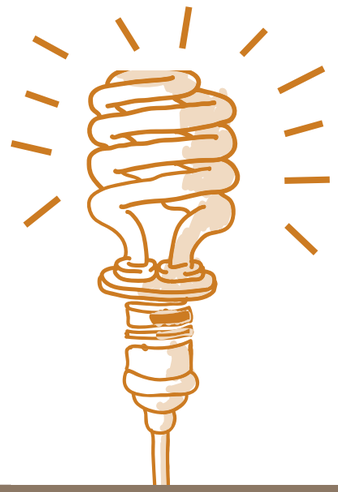
What are the types of electrical equipment relevant to a school?

The aim of this guide is not to go into technology design and detail but to touch on the type and use of the technology.

- Lighting
- Hot-water systems
- Geysers
- Central hot-water heating units
- Water heaters for kitchen use
- Air-conditioning systems
- Portable space heating units such as bar heaters
- Electronic equipment such as personal computers and servers, printers and photo copiers
- Smaller electrical equipment

Table 1 Typical exisitng technologies

Lighting	Light type	
Fluorescent lamp	A fluorescent lamp is a low-pressure mercury-vapour gas-discharge lamp that uses fluorescence to produce light. The most common tube is a T8 - 26mm diameter. Standard T8 sizes are 18w - 2ft / 600mm; 30w - 3ft/ 900mm; 36w - 4ft / 1200mm; 58w - 5ft / 1500mm; 70w - 6ft / 1800mm.	
Incandescent bulb	An incandescent light bulb, produces light with a wire filament, heated to a high temperature by an electric current passing through it until it glows.	
Water heating system.		
Geyser	Appliances that provide a continual supply of hot water are called geysers, or calorifiers.	



Water heating systems *continued*		
Central water heating systems	These water heaters, have been designed to supply large quantities of hot water for use in hotels, ablution blocks and large domestic applications.	
Hot-water system for kitchen use	Commercial kitchens make use of small storage water heating vessels to boil water for hot drinks.	
Air-conditioning system		
HVAC	Air conditioning changes temperature and humidity to more comfortable conditions, typically in buildings, to improve thermal comfort and indoor air quality	
Heating units		
Space heater	A space heater heats small enclosed spaces as opposed to central heating that heats many connected spaces.	

How do I identify the electrical specifications of equipment?

All electrical equipment has a data plate or indication of the rated power of the equipment. This data is crucial in the calculation of energy use; accuracy is, therefore, very important.

Fluorescent Lamp

Figure 1 Fluorescent Lamp – F for Fluorescent, 28 for colour code, T5 for diameter, 28 Watt

Electrical motor

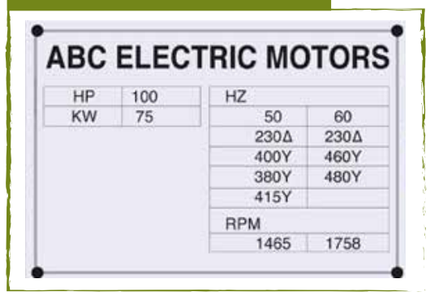


Figure 2 This electrical motor is rated at 75kW

Air-conditioner

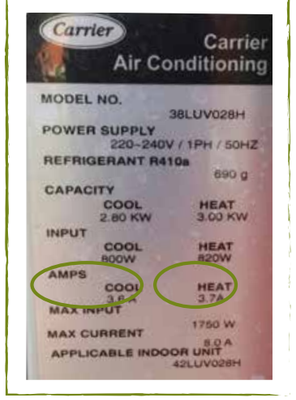


Figure 3 This Air-conditioner is rated 800Watts when cooling and 820Watts when heating

What is a watt (W)?

A watt (W) is a unit of power used to measure the rate at which energy is produced or consumed at a specific moment in time.

What is a watt-hour Wh?

A watt-hour (Wh) is a standard unit of energy and a way to measure the amount of work performed or generated.

What is the difference between watts and watt-hours?

Watt-hours (Wh) measure amounts of energy used for a specific period of time while watts (W) measure rates of power at a specific moment in time.

How do I calculate watt-hours?

The formula:

The **wattage** of the appliance x **hours** of use per month = the **amount of electricity** the appliance uses per month (Wh).

Example:

10 x 100Watt lamp X 1 hour = 1 000 watt/hr divided by 1000 = 1 kWh or a unit

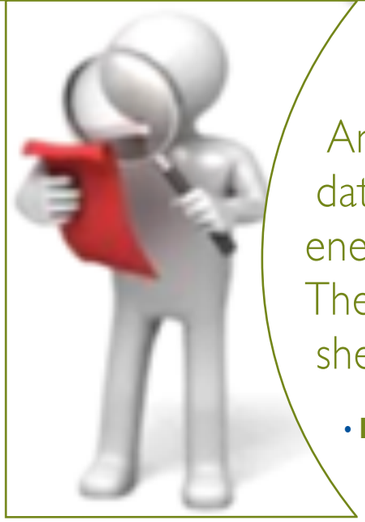
How do I calculate cost of energy?

The formula:

Monthly electricity cost = the **number of units** of electricity in **kWh** x the **cost** of electricity.
1 000 Watt = 1 kiloWatt = 1 unit

Example:
10 x 100 Watt lamp/1000 x 1 hour x R1.40/kWh=R1.40

How do I capture existing data?



An assessment sheet is used to capture audit data. This data will assist to calculate existing energy usage versus proposed energy usage. The following items form part of the assessment sheet:

- **Location** – a description of the location is very important, especially when it comes to installation; data is captured per location.

- **Technology type** – technology type is needed, such as 'lighting', 'geyser' or 'air conditioner'.

- **Technology description** – a description of the technology is crucial to identify the type within the technology range - there are, for instance, hundreds of types of light fittings and the description will typically indicate the amount of tubes per fitting, length of the tubes and power rating in Watts.

- **Rated watts** – the watt rating as per the data plate on the device.

- **Quantity** – the quantity of technology of that specific type in that specific location.

- **Time** – the time period is critical in the calculation; how long an appliance is in use; Gather data as accurately as possible - time is divided into hours per day, days per week and weeks per year.

Energy usage per annum -

- ***Before:***
  36Watts/1000 x 2 lamps x 30 light fittings
  x 8 hours/day x 5 days/week x 42 weeks/year =
  3 628kWh -

- ***After:***
  The proposed energy efficient technology solution is needed to calculate the saving. Since all new technologies are supported by specialists in the market, it is wise to make use of such a person to assure the success of your project - a proposed light replacement is given for this exercise.

  28 Watts/1000 x 2 lamps x 30 light fittings
  x 8 hours/day x 5 days/week x 42 weeks/ year =
  2 822kWh

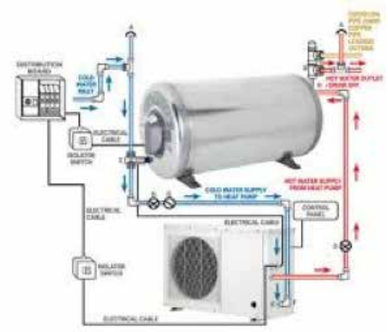
- ***Energy saved per annum:***
  Energy usage before – Energy usage after
  = Energy saved
  3 628kWh -2 822kWh = **806kWh**

- ***Energy cost saved per annum @ R1.40/kWh***
  Energy cost before – Energy cost after
  = Energy cost saved
  3 638kWh x R1.40/kWh – 2 822kWh x
  R1.40/kWh = **R1 142.40**

What is typically proposed energy efficient technologies?

Lighting		
Fluorescent lamps	The T5 (16mm diameter) fluorescent tube is designed to replace the older T12 and T8 fluorescent tubes. It is smaller in diameter and rated at a lesser wattage but with the same lighting output.	
Compact Fluorescent Lamp (CFL)	The CFL is designed to replace an incandescent lamp. The lamps use a tube, which is curved or folded to fit into the space of an incandescent bulb, and a compact electronic ballast in their base.	
Light Emitting Diode (LED)	An LED is a light-emitting diode assembled into a lamp (or light bulb) for use in lighting fixtures. LEDs have a lifespan and efficiency that are several times better than incandescent lamps and significantly better than most fluorescent lamps - some chips are able to emit more than 100 lumens per watt.	 
Water heating systems		
Hot water systems for precise temperature control in the kitchen	Washing dishes requires water that's up to 15 degrees hotter than the ideal shower. Having advanced control over the temperature of the hot water in your kitchen, which is separate from your bathroom, makes perfect sense.	

What is typically proposed energy efficient technologies? cont....

Lighting		
Electronic timers	An electronic timer is a simple but effective method of saving energy by preventing a system from running when it's not needed.	
Heat pumps	A heat pump works like an air conditioner but in reverse. It uses a relatively small amount of electricity to extract heat from the surrounding air and then heats water with this energy. Heat pumps are up to three times more energy efficient than electric element geysers.	
Air conditioning		
Air conditioners	An inverter in an air conditioner is used to control the speed of the compressor motor that drives the variable refrigerant flow. By contrast, traditional air conditioners regulate temperature by using a compressor that is periodically either working at maximum capacity or switched off completely.	
Heating		
Space heaters	The heating cycle of an inverter air conditioner is much more energy efficient than any other space heater.	

Safety precautions when doing an energy use assessment:

Safety should always be a top priority. Although the purpose of this assessment is to gather high-level data by reading from data plates, more comprehensive assessments require a person to open cover plates or distribution boards where electrical connections are exposed.

- Please note that only an authorised person has the permission to open an electrical distribution board, work on electrical installations and do energy recordings - an authorised person is someone who is declared competent as an electrical technician under the Occupational Health and Safety Act.

Consider the following safety measures during your energy use assessment:

- Treat all equipment as live (energized).
- Do not touch hot objects such as light bulbs when reading the data - switch off lights and give them time to cool down.
- Use safety glasses and gloves for protection when taking out a light bulb or tube.
- Use a steady ladder and, as an additional measure, have a partner keeping it stable.
- Do not climb to dangerous heights. Exceeding 2 meters is considered dangerous and safety equipment as a prevention against falling is needed. It is not advisable to climb that high for the energy use assessment.

Remember:

- Switching off when not in use is the most effective way to save electricity.
- Sustained energy savings as a result of human behaviour can only be achieved by continuous reminding.

Assessment sheet

Location	Technology type	Existing technology description	Age of equip	Qty.	kW	Replacement technology	Qty.	kW	Time period			Energy usage before (kWh)	Energy usage after (kWh)	Proposed saving (kWh)
									Hours	Days	Weeks			
Class room 204	Lighting	2-lamp, 4Ft, T8 fixture, 36W each		30	2.16	2-lamp, 4Ft, T5 fixture, 28W each	30	1.68	8	5	42	3628	2822	806

Schools name:	
Contact person:	
Contact details:	
GPS co-ordinates:	

Principal name:		**Principal signature:**
Principal contact details:		

School Stamp:

* *Please affix photos of old technologies for visual reference if desired*