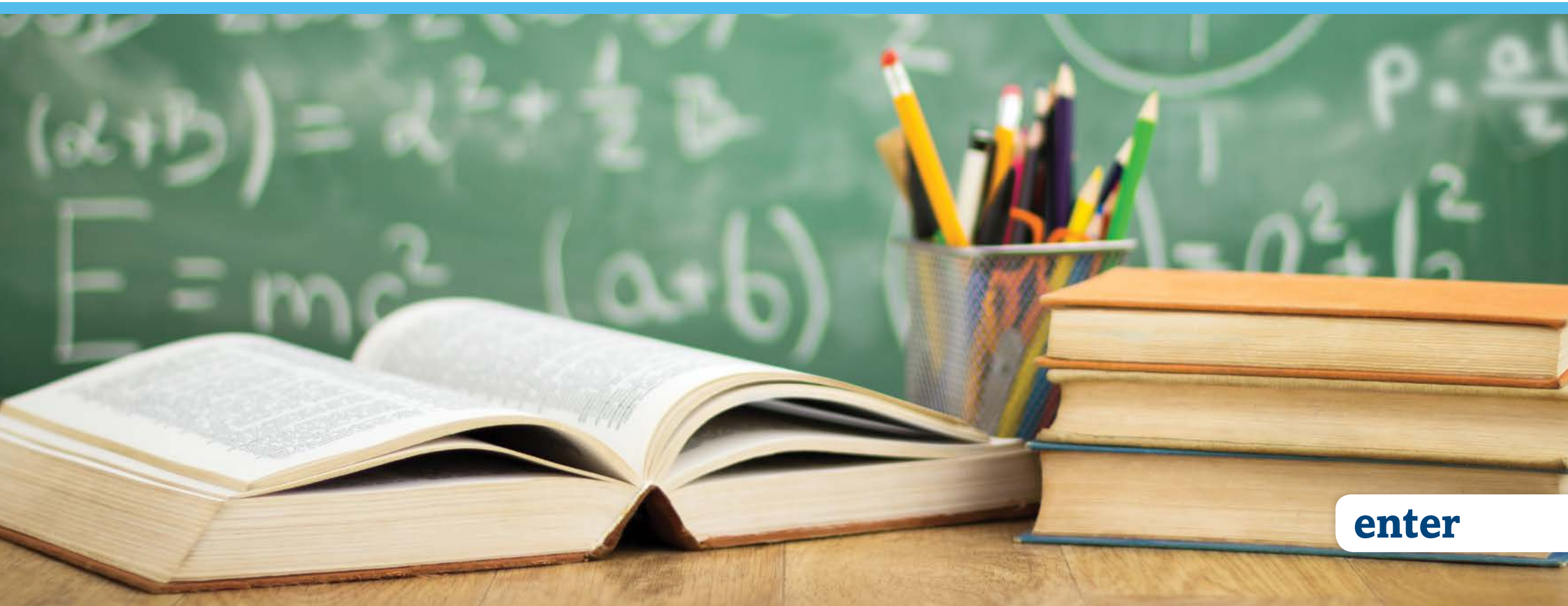
NATIONAL BUSINESS INITIATIVE

PSEE
PRIVATE SECTOR ENERGY EFFICIENCY

SCHOOLS

Learning to improve energy efficiency



Preface

Reducing energy should be a priority for all organisations; it saves money, is socially responsible and helps everyone in the fight against climate change.

The Private Sector Energy Efficiency (PSEE) programme provides simple, effective advice to help businesses and the public sector take action to cut emissions. One of the simplest ways to do this is to use energy more efficiently.

This overview for the schools sector introduces the main energy saving opportunities that can be found in the majority of schools and demonstrates how simple actions save energy, cut costs and enhance the learning environment.

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Introduction

Improving energy efficiency in schools does not mean compromising the comfort of staff and students. In many cases, implementing some simple energy saving measures actually improves conditions, as well as saving money.

Both primary and secondary schools are pushed to make the most of their resources, while providing a solid education for students. Being energy efficient saves money, so is an excellent way to release funds for curricular resources or facilities.

In addition to economic benefits, there are social and environmental advantages to reducing energy consumption, such as preserving fossil fuels and minimising impact on the environment. This is increasingly important to the reputation of schools, as students, teachers and parents become increasingly aware of climate change.

Moreover, actions taken to become energy efficient provide an excellent opportunity for practical learning and real-life application for students. Many of the actions in this overview could be undertaken or monitored by students, while the science behind them might be a great opportunity for targeted classes. Although this publication is not an educational resource, ideas are given throughout this overview, and many more can be generated by teachers and students themselves.

Who is this publication for?

Primarily, this overview is aimed at those who are responsible for the 'business' of the school, such as school managers, maintenance staff, governors, administrators and teachers.

Focusing on low and no-cost measures with quick paybacks, this overview will help to:

- Assess the potential for energy savings and indicate key areas for improvement
- Raise awareness and motivate action amongst the whole school community
- Prioritise activities to maximise savings.

How can you benefit from energy efficiency?

- The school manager will benefit from reduced costs and enhanced learning environments
- Staff and students will have improved comfort conditions which can boost productivity and morale
- Students can learn about and experience 'real world' activities when exploring energy efficiency in maths, English and science classes
- Parents and the wider community could reduce their own energy use as a result of pupil action and awareness
- The environment will benefit from reductions in energy use and carbon emissions which will enhance school image.

Energy consumption in schools

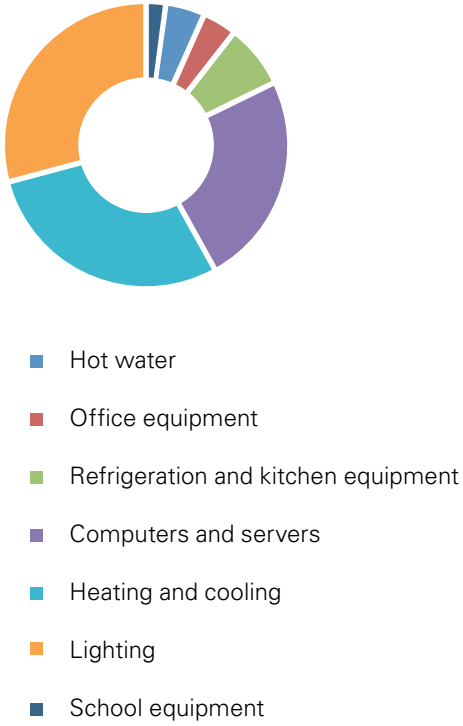
Breakdown of energy costs in a typical school

Energy consumption in schools can vary depending on the age of the buildings, their state of repair, occupancy hours and the amount and type of electrical equipment installed.

Generally, secondary schools will have higher energy costs than primary schools. This can be explained by secondary schools' longer hours and larger number of students, as well as more widespread use of electrical equipment in ICT, science, sports and crafts lessons.

However, areas of energy waste are often the same regardless of school size or level. The chart (right) details where the biggest savings can be made.

Figure 1 ***Schools – percentage of energy use***



Making savings

In each of the key consumption areas identified in the chart (previous page) there are three main opportunities to save energy:

Switching off – all energy consuming equipment should be switched off when not required. This can be done by staff and students, by timer switches or by adjusting building control systems – and need not cost any money.

Maintenance – a number of energy efficiency measures can be carried out as part of routine maintenance procedures at no extra cost.

Refurbishment – energy saving measures taken when planning major refurbishment can be extremely cost effective.

Energy use in schools is escalating due to the use of ICT equipment which, in turn, increases electricity demand. Moreover, school buildings are now being used for community purposes, increasing occupancy hours and the use of facilities.

Did you know?

Controlling energy usage can improve comfort for staff and students – and comfortable students will be more attentive, making learning more enjoyable for everyone.

Get students involved

Getting students involved in energy efficiency can be fun and enrich their studies. It can also raise awareness and give them lifelong skills.

Opportunities for energy saving

There are many low and no-cost solutions you can use to reduce consumption in the main areas of energy use, without adversely affecting the comfort of students or staff.

Heating and cooling

Heating and cooling are usually the largest and most expensive energy users in a school.

Savings made in heating and cooling can have a positive impact on energy bills, with even simple, low-cost measures making a difference.

Temperature setting

Children have higher metabolic rates than adults and so are comfortable at lower temperatures. Recommended temperatures are outlined in Table 1.

Maintaining optimum internal temperatures for staff and students will improve comfort conditions which can help boost attentiveness and morale. Happier students can be easier to communicate with and contribute to a more productive learning environment.

Heat and cool only when needed

Heating and cooling needs vary throughout the day so check that the system operating hours match the times when heating and ventilation are required. Review time settings every month or so to check that they are correct. Many systems function inefficiently because someone made a short-term adjustment and then forgot about it. Fitting tamper-proof thermostatic radiator valves can prevent this from happening.

Check thermostats regularly

Discourage staff from using them as on/off switches – turning to maximum does not speed up the heating or cooling process, it usually just results in an overheated or cold space. It is important to ensure thermostats are not influenced by draughts, sunlight or internal heat sources like radiators or ICT equipment. Settings should reflect the activity taking place in the space.

Keep systems clear and unobstructed

Schools always have lots of activities going on and furniture is constantly being rearranged to accommodate students' needs. Make sure radiators and vents are not obstructed by any equipment and that filters are kept clean and free of dust. This ensures better circulation of air into the space and reduces the energy required to meet the heating and cooling demand.

Table 1 ***Recommended temperatures for schools, by activity***

18-24°C	Normal teaching: Heat up to 18 degrees. Cool down to 24 degrees.
15°C	Circulation spaces Heat: up to 15 degrees. Cool down to 24-26 degrees.
21°C	For very young children: Heat up to 21 degrees. Cool down to 24 degrees.

Did you know?

Effective temperature management requires good maintenance of walls, floors, windows and roofs, so think about these when making improvements to heating systems. See the section on building fabric for more information.

Maintain system components to ensure efficiency

Energy consumption can increase by up to 60% if regular maintenance is not undertaken. Dirty or faulty fans, air ducts and components directly affect system efficiency and will increase running costs and risk of breakdown. The performance of the whole system should be reviewed annually and replacement parts ordered as necessary. Always consult a maintenance technician.

The need for mechanical cooling will reduce if you control your heat gains – which can come from the sun or from lighting and equipment.

Consider fitting variable speed drives (VSDs)

In a school ventilation system, fans often do not need to operate at full speed all of the time and VSDs can help to reduce costs by enabling the output speed of the fans to match requirements at different times of the day. This reduction in speed saves energy and there are corresponding heating and cooling cost savings too.

Recover heat from exhaust air

It costs money to heat the air in a building – so why not recover some of that energy? The simplest way to recover the heat from exhaust air is to simply recirculate a proportion of the exhaust air along with fresh air. More advanced solutions are available which allow the heat from the exhaust air to be used to pre-treat fresh incoming air. This is a worthwhile technology, but expert advice should be sought.

Stay cool at night

Use the lower external temperatures at night to cool the building ready for the following day, thus delaying the switching on of air conditioning. This is known as 'night cooling'. Information on this topic can be found in the PSEE's publication, Heating ventilation and air conditioning.

Take advantage of natural ventilation and free cooling to halve energy costs

As simple as it sounds, natural ventilation and cooling relies on natural air flow between openings on opposite sides of a room or building – or rising warm air being replaced with cooler air sucked in through windows or vents. It may be possible to use windows and doors to provide good levels of natural ventilation, allowing mechanical ventilation to be switched off or turned down to save money. When opening vents, doors and windows, always consider security implications.

Myth

Leaving air conditioning on overnight reduces energy costs as the system stays at the required temperature.

False
The result is a much higher energy consumption than necessary.

Remedy
An office only needs a fraction of overnight energy to reach adequate temperatures for the start of the day. Air conditioning may not be needed at all at this time if 'night cooling' is used (see left).

Maintain boilers and pipework

Have boilers serviced regularly by a reputable firm. Gas-fired boilers should be serviced once a year; oil/coal boilers twice a year. A regularly serviced boiler can save as much as 10% on annual heating costs.

Boilers, hot water tanks, pipes and valves should be insulated to prevent heat escaping. Payback can usually be expected within a few months of installation, with additional savings in subsequent years.

These actions are explored in more depth in Heating ventilation and air conditioning, available from the PSEE.

Upgrade controls

System control can be problematic with old, inefficient time controls. Upgrades are well worthwhile implementing as they can pay for themselves very quickly through energy and cost savings.

New types of heating and cooling systems can adjust themselves in line with the climate. A compensator is a form of control for heating systems that automatically regulates the temperature based on the weather. An optimum start controller learns how quickly the building reaches the desired temperature and turns the heating or cooling on at the optimum time prior to building occupancy, again depending on the weather.

These types of controls can save tens of thousands of rand and can pay back their investment in just a few years.

Top tip

Perfect timing

Adjust timers so that the building reaches optimum temperature just as people arrive and begins to cool down as people leave. This is best done by gradually altering settings over a number of days and checking the response of the building and its occupants. If the school is occupied for different periods over the week, install seven-day timers to allow the systems to operate only when the building is likely to be occupied. See also the section on Upgrading controls (left), particularly optimum start controls, for ideas on how to automate this process.

Consult a qualified heating technician to discuss the range of options available. For further information contact the PSEE on 0801 113 943.

Obtain feedback

Encourage staff to report any areas that are too hot, cold or draughty. Ensure any problems are investigated promptly as these will help identify any maintenance issues. If these are addressed, staff and students are less likely to open windows whilst heating or cooling is on or request portable electric heaters or fans – all major causes of excessive energy consumption.

Case study

What are other schools doing?

A school had not updated its heating system since its installation in 1977. Controls were old and inappropriately set, and broken or faulty thermostats and timers meant the system was very inefficient. With a R100,000 investment in boiler controls, the school's heating costs were reduced by 21%, providing year-on-year operational savings. The initial cost outlay was paid back in four years.

A primary school had a preschool building added to the main schoolhouse which required different heating times and temperatures. To accommodate these needs, each building was given separate heating circuits providing better time and temperature control. Draught stripping and timers on ventilation fans were also installed to save the school over R10,000 a year in heating costs.

Get students involved

Ask students to draw the layout of their classroom or building. Ask them to make suggestions about how the furniture could be better placed so that vents are not obstructed and so that the warmth of equipment does not affect students, teachers or thermostats. The best group could present their findings to the class.

Hot water

Wasting hot water penalises a school twice: once for the energy used to heat the water and again for the actual water used.

Costs can be reduced without compromising hygiene by:

- Fitting percussion taps, which turn off automatically
- Dealing with dripping taps and leaks promptly
- Insulating hot water storage tanks and their distribution pipework
- Making sure hot water is generated using the most effective heat source
- Fitting and checking time switches to ensure that water is heated only where and when it is needed
- Rationalising the system to reduce long distribution pipe runs
- Providing cleaning staff with point-of-use water heaters for use during holidays.

Did you know?

Getting drinkable tap water is not free — it requires energy in treatment and pumping. Water treatment consumes 0.2 KWh per cubic metre for freshwater and 3 KWh per cubic metre for saltwater.

Building fabric

Improving building fabric makes sense for many reasons – it saves energy, makes the learning environment more comfortable and can improve the appearance of the school.

Around two-thirds of heated or cooled air from a typical school building is lost through the building fabric (walls, floors and ceilings) so it makes good sense to make improvements in this area, particularly if the school is considering replacing its heating or cooling system.

Establish a housekeeping schedule

Compile a checklist to address areas where energy is lost via the building structure. It is a good idea to appoint a specific staff member to conduct regular walk rounds using the checklist – a comprehensive schedule should include checking window panes and frames, skylights, roofs, skirting and eaves. Involve students too, so they can obtain firsthand experience of the benefits of saving energy.

Undertake regular maintenance

Good building maintenance requires potential problems to be identified and dealt with promptly. In particular, gaps in the building fabric should be repaired immediately. Install draught stripping to windows and doors, check for signs of damage or damp and replace when required. Keep windows and external doors closed as much as possible when heating is on and consider sealing unused doors or windows to further reduce draughts. Make sure that automatic door-closers operate.

Regularly check buildings for damp

Damp causes significant damage to the building structure and reduces its insulating properties. Repair split down-pipes, faulty gutters and leaky roof tiles. Check for signs of damp and condensation at least once a year, preferably prior to winter months.

Check and maintain insulation

Hot water and heating pipes should be insulated, as should any accessible loft spaces. Check insulation is in good condition and replace if required. Insulating pipes can also improve internal comfort by reducing the risk of overheating.

Shade for comfort

Curtains and blinds can be used to keep classrooms comfortable. Closing them at the end of the day during winter months will reduce draughts and help the room retain more of its residual heat overnight. This same process can help in summer to reduce heat in rooms that receive early evening direct sunlight. Blinds can also be an effective way of controlling daylight and glare problems; see page 15 for more information.

Maintenance matters: Take action early and avoid problems later on

Improved glazing

Different types of glass and coating will have an impact on the light of the room and its insulation.

Specify double glazing for new windows – it is the minimum recommendation for all new windows and offers good comfort and energy saving. Reflective and low emissivity coatings can reduce overheating and glare.

Some schools were built to maximise the light and so have highly glazed areas; however, the heat gained through these can make staff and students uncomfortable. Consider replacing some of the panes with blank panels. Although it will reduce the light, the improved temperature and minimal glare will be appreciated.

Install more insulation during refurbishment

25% of a building's heated air will escape via an uninsulated roof, which adds thousands of rand per year to energy bills. Insulating any roof spaces and external walls is an effective and inexpensive way of reducing heating losses.

Unfortunately many school buildings have flat roofs and single external walls making insulation measures more difficult, disruptive and costly. Improvements to these are most cost effective during refurbishment projects and should always be considered when the opportunity arises.

Draught lobbies

Installing a draught lobby at frequently used entrances can reduce heating costs and draughts. Lobbies should be large enough to provide unrestricted access and enable one set of doors to be closed before the other is opened. Where possible, the two sets of doors should have automatic control.

Case study

What are other schools doing?

A primary school suffered from draughts through external doors at each end of the main corridor. Access to toilets and classrooms was constantly required which meant the external doors were opened frequently during break periods. External draught lobbies were installed at both ends of the corridor and direct access to the toilets from outside was provided. Estimated cost savings are expected to pay back the initial cost of investment within four years. Furthermore, the school has benefited from additional display areas within each lobby and the corridor is now used as additional working space with a play shop and craft area.

A primary school built in the 1950s occupies two separate school buildings with large windows and flat roofs. One of the school's three halls had a high-pitched roof which made the space very difficult to heat. This caused condensation problems and pupils to complain of the cold. Of the various solutions considered, the most practical was to fit a suspended ceiling, thereby reducing the volume of space to be heated and improving the insulation properties of the roof. Cavity wall insulation was also installed to further reduce heat loss. These new measures combined cost R180,000 to implement. They solved the problem and reduced energy consumption by R10,000 p.a, whilst providing a more usable school hall.

Lighting

Well-lit spaces are essential for an effective teaching and learning environment. As a result, lighting accounts for approximately 30% of the total energy used in schools. However, there is considerable scope for making savings by implementing some simple good housekeeping measures.

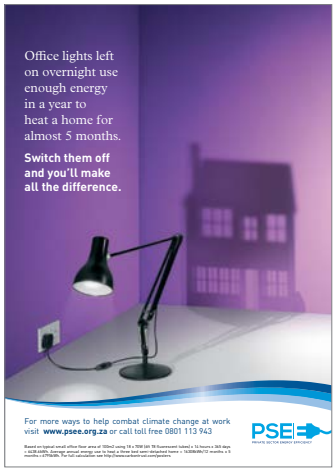
Switch off

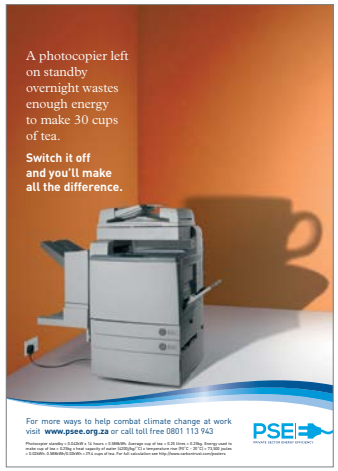
Staff and students should be involved in making savings – this can be achieved through raising awareness during assembly and non-teaching class time, placing stickers above light switches and posters around the building.

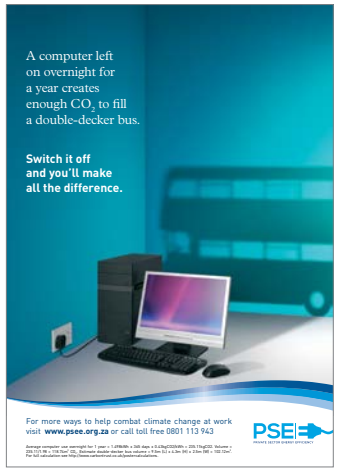
Did you know?

Making good use of daylight in a classroom can reduce lighting costs by 19%.

Examples of posters available from the PSEE







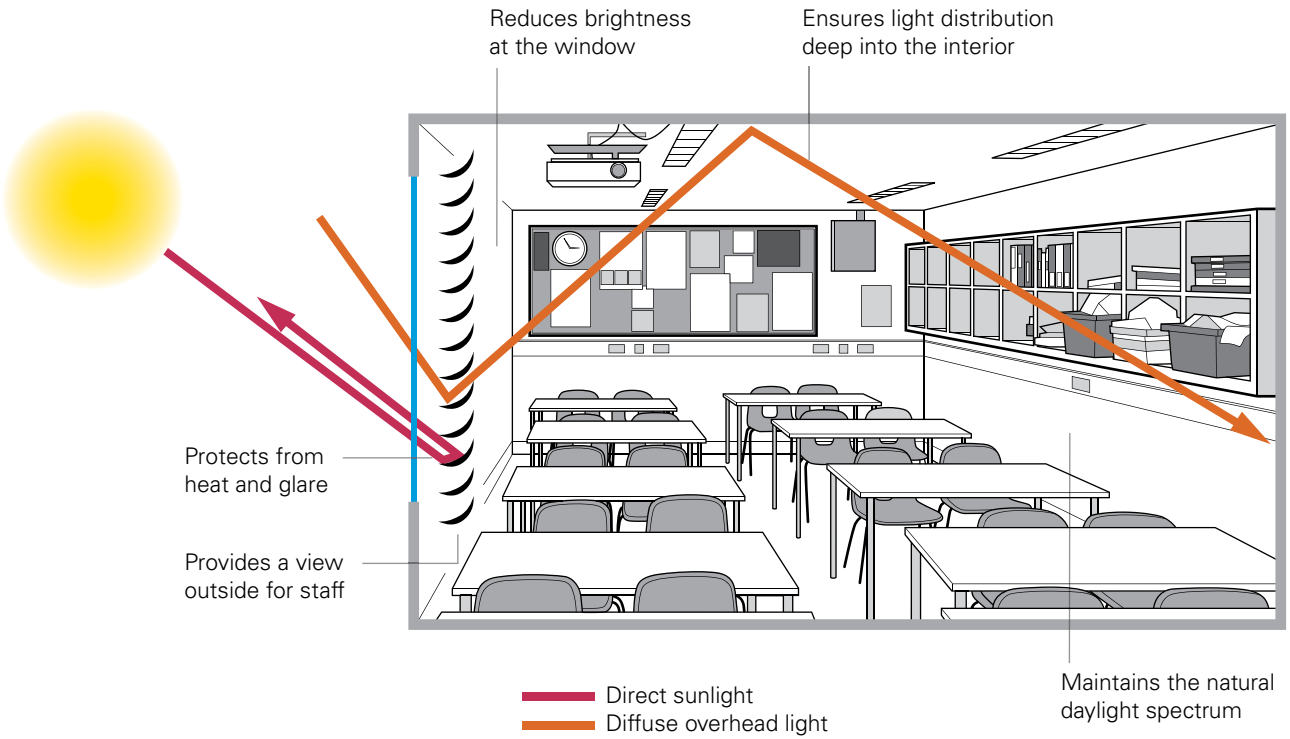
Download

Avoid blinds down and lights on

A familiar scene in classrooms and offices is the use of blinds to control glare when it is bright outside. Where possible, encourage staff to use blinds to direct daylight onto the ceiling and walls instead. This should reduce the need for electric lighting in the classroom whilst reducing glare.

Daylight blinds are particularly effective. They enable the natural light to enter the space by re-directing the light onto the ceiling, thereby allowing the 'free' daylight to enter the space, alleviating discomfort felt by the occupants from glare. Many daylight blinds also have perforated blades to enable a view outside, which can create a positive atmosphere. *Figure 2* (below) shows how this works.

Figure 2 ***The benefits of daylight blinds***



Get students involved

- Appoint 'light monitors' from each year group to ensure that lights are not left on at break times or at the end of the day. Classes could even compete with each other to see who is the most energy efficient
- Run an awareness campaign on switching off lighting and equipment. Students can design their own stickers and posters in art classes. Create a display and award prizes for the best submissions.

Did you know?

Actions taken as a result of good energy metering and monitoring can save 5–10% of a site's energy use.

Replace failing lamps

All teaching and activity areas should be well lit in order to create an environment conducive to learning. Encourage staff and students to report any failing lamps and replace them immediately to help maintain the desired light output and optimum comfort levels.

Safety first!

Take care when replacing standard light bulbs where they are used as task lighting for machinery in, for example, woodwork or metalwork workshops. Some energy saving bulbs can cause a stroboscopic effect, so standard lighting can sometimes be the safest option. An alternative is to use LED luminaires or a fluorescent fitting with high frequency electronic control gear which eliminates the stroboscopic effect.

Label light switches

Help staff and students to select only those lights they need by attaching labels to every bank of light switches. Turn off lights that are not needed but remember to consider health and safety implications, particularly in corridors and stairwells.

Maintenance

Design and follow a maintenance schedule which includes:

- Cleaning windows, skylights and fittings
- Checking and replacing old and dim lamps
- Ensuring controls are in good order and set properly
- Cleaning occupancy sensors.

Without regular maintenance, light levels can fall by 30% in 2–3 years.

Myth

It is better to leave fluorescent lights permanently switched on as starting them up each time wastes more energy.

Reality
Fluorescent tubes use only a few seconds worth of power in start up.

Remedy
Switching them off when leaving a room always saves energy.

Install low-energy lighting

Choose the most efficient lighting possible. For example, upgrade standard tungsten light bulbs to energy saving LED lamps or compact fluorescent lamps (CFLs) which use over 75% less energy, produce less unwanted heat and last 8 to 10 times longer. Be careful, however, as some areas are not suitable for certain types of energy saving bulbs (see *Table 2* on page 18).

Replace blackened, flickering, dim or failed fluorescent tubes with T8, or preferably T5, triphosphor coated ones (this is stated on the packaging). Triphosphor coating provides a more natural, brighter light for the whole life of the tube. If the tubes are 38mm (1.5 inch), replace them with slimmer 26mm (1 inch) tubes. Alternatively, choose purpose designed LED luminaires.

Specify high frequency fluorescent lighting systems and mirror reflectors whenever fluorescent lighting is to be replaced. High frequency tubes reduce energy use and heat output, eliminate flicker and hum, extend lamp life (by up to 50%) and can allow dimming – all of which can make a classroom more comfortable. Make sure this happens by including it in the school's purchasing policy.

The chart overleaf outlines the various energy efficient lighting options. Always consult a qualified lighting technician before upgrading lighting systems.

Controls and sensing technology

Consider suitable lighting controls such as time switches with a manual override for teaching areas and occupancy sensors in intermittently occupied spaces. If these are used in sports halls, an override must be provided for when the area is used for quiet, still activities such as examinations. Also make sure that lighting controls take into account the requirements of cleaners and security staff as well as any community usage of the school facilities.

Energy Efficiency Financing

Investing in energy efficient equipment makes sound business and environmental sense. The guide to Energy Efficiency Finance by the PSEE provides information about financial support available from the government, the private sector, energy services companies and other partnerships, as well as foreign agencies present in South Africa. This includes tax incentives loans, cash incentives, R&D incentives and funding in the form of carbon credits or offsets.

Case study

What are other schools doing?

A primary school was suffering from under-lit classrooms as a result of older recessed light fittings. With help from their Local Authority, the school invested in more efficient ceiling-mounted lighting and new occupancy and daylight controls. This reduced lighting costs by 30% whilst increasing light levels.

Table 2 ***Energy efficient lighting options***

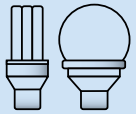
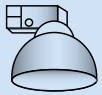
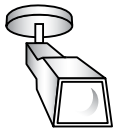
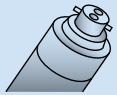
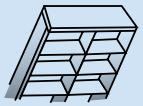
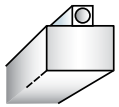
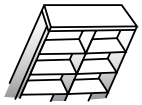
	Existing lamp type	Uses		Energy efficient option	Energy saving/benefits	Application notes
	Tungsten light bulbs	General lighting, a common bulb for domestic applications		Replace with LED lamps or compact fluorescent lamps (CFLs) in the same fitting	75-80% saving plus longer lamp life	General lighting – attractive modern LED and CFL replacements may also be acceptable for display and feature lighting
	38mm (T12) fluorescent tubes in switch-start fittings	General lighting, commonly used in classrooms, corridors and office spaces		Replace with equivalent 26mm (T8) triphosphor fluorescent tubes of lower wattage, or preferably with new, high frequency T5 fluorescent tubes or LED luminaires	10-40% saving plus longer lamp life withT8. Even greater savings with T5 or LED tubes	General lighting, but even better when used with modern fittings
	High-wattage filament lamps or tungsten halogen lamps as used in floodlights	For lighting large spaces, such as gymnasia, tennis courts, assembly halls, sportsfields, playgrounds		Replace with metal halide, LED or high wattage compact fluorescent lighting	65-75% saving for equivalent lighting performance plus longer lamp life	Floodlighting, external lighting and some general lighting situations
	Mains voltage reflector lamps, filament spot and flood types	General lighting, often applicable to areas that need bright light and good colour rendering, such as workshops/ art studios		Replace with low-voltage tungsten halogen lighting or metal halide discharge lighting	30-45% saving with much improved lighting quality. The use of high frequency electronic control gear eliminates flicker, hum and stroboscopic effect	Where compact metal halide or LEDs are not appropriate, then low-voltage tungsten halogen spotlights can reduce lighting energy use by 30%, with further savings available by using 35W infrared (IRC) bulbs instead of standard 50W bulbs

Table 2 ***Energy efficient lighting options***

	Existing lamp type	Uses		Energy efficient option	Energy saving/benefits	Application notes
	Fluorescent fittings with the old 2ft 40W, and 8ft 125W fluorescent lamps	General lighting, commonly used in classrooms, corridors, and office spaces		Replace with efficient fittings using reflectors/ louvres or efficient prismatic diffusers with high-frequency electronic or low loss control gear and triphosphur lamps or choose purpose designed LED luminaires	30-45% saving with much improved lighting quality. The use of high frequency electronic control gear eliminates flicker, hum and stroboscopic effect	General lighting
	Fluorescent fittings with opal or prismatic diffusers which are permanently discoloured	General lighting, commonly used in classrooms, corridors, and office spaces		Replace with new prismatic diffusers or replace complete fittings as above	No reduction in energy consumption but increases the amount of light by 30-60%	General lighting

Catering and food technology equipment

School kitchens are a major energy consumption area. Saving money in this area does not have to compromise working conditions or the service offered – it can even improve both.

Energy is primarily used to power catering equipment and heat hot water; however, these are areas that can offer significant cost savings without compromising hygiene or resources. Managing energy use can also have additional benefits of improving the quality of food produced as well as the working environment for kitchen staff. The following actions can help save money and energy:

- Do not switch on too soon – most modern catering equipment reaches optimum temperature quickly. Label equipment with its preheat time and educate staff to switch on only when required
- Avoid using kitchen equipment to warm the space on staff arrival – the school's heating system should do this effectively. If it does not, find out why
- Switch off ovens, grills, fryers and hobs immediately after use
- Avoid overfilling saucepans and kettles and use lids where possible; select the right size of saucepan to avoid underfilling
- Keep fridge and freezer doors closed and defrost regularly to save energy and prolong equipment lifetime
- Switch off equipment, lights and extraction fans when they are not being used
- Reduce drying times on dishwashers and allow residual heat to finish the drying process
- Move storage fridges and freezers out of kitchen areas into well ventilated, uncooled spaces
- Avoid using open boiling water steriliser systems as these are dangerous and wasteful.

Purchase equipment with running costs in mind

Although gas-fired equipment can be more expensive to buy than electrical or steam equivalents, savings made on running costs can make it a more efficient option.

Equipment that automatically switches off (such as pan sensors on hobs) can save 25% on energy costs. Select ovens with large double glazed viewing windows to reduce the need to open doors to inspect contents.

Raise awareness amongst kitchen staff and reduce energy use by 25%

Get students involved

The information in this section is also useful for students who are studying food and nutrition – and for the teachers who are taking the classes.

Submetering

Submeters can help identify cost savings and justify any investment required in order to lower running costs. This is particularly useful if catering is provided by a separate company, as they may not have been made aware of the importance of energy efficiency and how this fits into the school's activities. Submeters also allow for budget allocation and charging to take place. This can act as an incentive for kitchen managers to reduce energy costs by providing some financial reward for doing so.

Consider heat recovery

School kitchens expel large volumes of warm air. Many kitchen managers do not realise that over 50% of this heat can be recovered using heat recovery devices which can significantly reduce energy costs. An air-to-water recovery device is often the most effective method of recovering heat because it can then preheat hot water, providing a year-round use for the recovered heat.

Case study

What are other schools doing?

A primary school has implemented several simple measures to reduce costs:

- Energy and water consumption are regularly monitored to allow comparisons to be made
- A dishwasher has replaced a hot water steriliser to reduce consumption
- Equipment warm-up times have been established, preventing everything being automatically switched on at the start of the day
- Hot cupboards are switched on only as required, reducing food holding times and increasing meal quality
- Windows are fitted with insect mesh to allow them to be used instead of extractor fans for some of the time
- Equipment and lighting is kept clean and regularly maintained to keep it operating as efficiently as possible.

These actions have resulted in kitchen electricity savings of 30%. Moreover, water consumption has dropped by 25% despite a 33% increase in meals produced.

Catering equipment hints

Cookers

Ovens and hobs use relatively large amounts of power in a school kitchen. A large secondary school typically uses cookers for more than 10 hours a week. Minimise the energy consumption of cookers and hobs by observing the tips on the previous page. In addition, make it policy to use microwave ovens where possible as these are quicker and use less energy.

It is common in catering facilities to turn oven equipment on early to ensure adequate preheating. But getting the oven to the right temperature does not usually take longer than 10 minutes so savings can be made by turning them on for preheat as late as possible.

Consider investing in cookers with either induction or gas hobs – these heat up and cool down faster than conventional hobs.

Refrigerators

Refrigerators and freezers consume significant amounts of energy as they are on 24 hours a day, seven days a week. Regular maintenance checks are important as is careful monitoring of consumption. Take the following actions to make sure refrigerators are as efficient as possible:

- Position fridges/freezers away from heat sources (such as cookers)
- Set the thermostat at the right level for the fridge's contents. Settings may need adjustment when the fridge is empty. Note that freezers operate more efficiently when full
- Check the seals are intact so cold air is not escaping
- Encourage students and staff not to open doors unnecessarily
- Defrost regularly
- Turn off fridges during holiday periods, where appropriate. If it is not possible to switch off all fridges, consolidate the contents of fridges so that some can be turned off.

When purchasing, remember:

All domestic sized cookers, fridges and freezers have an energy rating which indicates their efficiency; an A rating is the best and a G rating is the worst. Some appliances may also have a separate Energy Star label – this is found on products that have been carefully selected for their energy efficiency. Always choose the most energy efficient model within your price range.

Further information

For more information, order Food preparation and catering sector guide from the PSEE.

Electrical equipment

The use of electrical equipment in schools is rising, and the growth of computer suites, science labs and art studios is having an effect on electricity bills.

ICT and audio-visual equipment are the major energy users; however, the consumption of smaller apparatus such as vending machines and water coolers also has an impact. This means that there are good opportunities for cutting costs and making energy savings across the board.

Office and ICT equipment

ICT equipment is one of the largest single users of electricity in many schools. A table of the energy consumption figures for key items of equipment is shown opposite.

Turn off and power down

Switch off all equipment when not in use and enable power down modes to reduce energy consumption and heat production. This will also reduce the risk of overheating in a space, therefore improving occupant comfort. Equipment should last longer which could mean lower maintenance costs and fewer breakdowns.

Table 4 Typical energy consumption figures for types of ICT equipment

Equipment type	Average power consumption while in use (watts)	Standby energy consumption (watts)
PC (processor only)	74	6/36*
PC monitor	100	4/7*
Inkjet printer	17	9
Laser printer	280	18
Fax machine	82	7
Photocopier	400	103
Interactive whiteboards	120	10

*Two sets of data correspond to 'deep sleep' and 'sleep' mode respectively

Install plug-in seven-day timers

These only cost a few rand from most DIY stores and reduce the likelihood of machines being left on out of hours. They are best fitted to communal equipment such as photocopiers, printers, vending machines and fume cupboards that can be switched off when not in use. Check with your equipment supplier first about any service agreements that might be affected.

Match the equipment to the task

Set default printing to double-sided (duplex) where possible and try to print in batches to allow the machine to spend more time on standby or off, than in idling mode. Take care though; machines with a very deep sleep mode can take longer to reach the right temperature, frustrating users and increasing the risk of the feature being disabled.

Myth

When equipment is on standby, it's off.

Reality

Many people assume electrical products are off when they are on standby, yet in this mode they continue to consume power. Be especially wary of equipment that has a remote control – this is a telltale sign that the equipment is likely to be left on standby while waiting for the 'on' signal from the remote. A red or green LED light is another sign.

Top tip

One of the key actions for all school equipment is to undertake regular maintenance. Check ICT equipment, copiers, kilns and fume cupboards and clean them regularly. Keep parts and filters free of dust. Follow the manufacturer's advice on servicing schedules in order to maintain optimum efficiency.

Did you know?

A single computer and monitor left on 24 hours a day can cost around R400 a year. Switching them off out of hours and enabling standby features could reduce this to less than R90 a year each and prolong the lifespan of equipment.

You could save enough energy to make 30 teachers 6 cups of coffee every day.

Relocate heat-emitting equipment

Place heat-emitting equipment such as printers and photocopiers in a separate, naturally-ventilated area with good airflow. This helps prevent overheating, removes potential emissions from the equipment and reduces the effect of noise. Cooler areas on the south side of buildings are ideal.

Purchase for your requirements

Choose equipment that meets current and predicted requirements. Do not over-specify, for example: high specification PCs with large screens and fast processors use more energy. Always take running costs into account.

Ensure all new equipment has energy saving features meeting at least 'ENERGY STAR' performance specifications. See the PSEE's Office equipment technology overview for further information or visit www.energystar.gov to find out more.

Consider upgrading existing PCs

Some computers can simply be upgraded with newer, more energy efficient components. Look into this option before purchasing new machines. Flat screen (LCD) monitors reduce monitor energy use by over 65% compared with old CRT monitors. There are also obvious space advantages and they are more attractive to use.

ICT equipment hints – be PC wise

Activate the standby mode: Most PCs have an in-built standby mode. When the PC is not in use but left on, the PC can power down to a low energy mode. Time to power down can be preset, and usually 15 minutes is appropriate. On average nine out of ten PCs do not have the standby mode enabled so it may be worth doing a full audit on your ICT suite. Demonstrate setting this function in class, and ask the students to do it then and there, thus ensuring the PCs are set up properly. Standby should only be used during lessons and when equipment is being used intermittently. After lessons, equipment should be completely switched off (see the Myth box on the previous page).

Switch off monitors: This will save over 60% of the energy used by a PC during break times and when it is not required for a particular lesson.

Screen savers don't save: Screen savers are designed to increase the operating life of the screen – NOT to save energy. If a screen saver is complex and colourful it may actually use more energy than operating in normal working conditions, while inhibiting the power-saving features of the computer.

Top tip

Give careful thought to running costs and anticipated use when purchasing new or replacement kit.

Science, technology and craft

Most schools use electrical equipment in science laboratories, arts and crafts studios and for audio-visual and food technologies. The energy used by these small items of apparatus can be significant when added together.

What equipment do you have?

To manage energy use, a practical first step is to make an inventory of the curriculum-based equipment that the school has. The inventory should include the numbers of each item and their location. Assign responsibility for the maintenance of the equipment to an appropriate person.

The easiest way to conserve energy is to use equipment in a way that minimises energy consumption. Staff and pupils may be uncertain as to how to do this. Add instructions to the existing documents which outline how equipment should be used efficiently.

Usually, equipment is prepared by a technician at the start of the lesson and left on until the session ends. In busy science labs and studios, there is a danger that equipment will be left on all day – and maybe even overnight.

It is good practice to assign clear responsibility for switching off equipment after the lesson and encourage staff and students to minimise energy use during lessons. It may be impractical to turn off some measurement equipment for which the accuracy is affected by insufficient 'warm-up' time.

Fume cupboards

Not only do fume cupboards use electrical energy to drive the fan, they also remove warm and cooled air from the lab, increasing the need for space heating and cooling. Fume cupboards are obviously essential to avoid hazard, but a few simple procedures can avoid excessive energy use:

- Use the right sash height – an inappropriate sash height can increase energy use as well as putting users at risk from the ineffective extraction of fumes
- Do not use the fume cupboard as bench space – use the cupboard for stages of the experiment that present a hazard rather than the entire experiment
- Switch cupboards off when they are empty or not in use and avoid using them to store chemicals. Instead, store chemicals in a dedicated storage cupboard.

Energy use associated with fume cupboards can be significantly reduced by careful consideration of incoming and extract air systems and by selecting equipment with the ability to vary the extract air rate to meet requirements.

Did you know?

During normal operation, a single 1,500mm wide fume cupboard will extract around 1,200m^3 of air an hour, or 30 air changes an hour for a 4m^2 science lab.

Kilns and small power equipment

Make sure that kilns are fully loaded before firing and are cleaned as set out in the manufacturer's instructions or they will fail to perform efficiently. Kilns are heavy electrical users. Consider whether they can be fired overnight or at weekends to reduce the school's maximum electrical demand. Other equipment used in art and craft studios will have very small power loads but can have a number of students using it. Soldering irons heat up fairly quickly, so turn them off when not needed.

Audio-visual (AV) and music equipment

Schools use a range of AV equipment to deliver education across most curriculum areas and TV/video sets are responsible for significant energy consumption. Some equipment, such as musical keyboards, consume energy when switched on even if not being operated. Separate mains transformers continue to consume energy even if the equipment they are supplying is not switched on. Similarly, separate power supply units should be switched off at the mains when the equipment is not in use.

To effectively manage AV equipment energy use, consider implementing the following simple suggestions:

Switch off

Remember that equipment in standby mode uses energy. Regularly leaving AV equipment in standby mode wastes significant amounts of energy and school funds.

- If equipment is used for part of the lesson, switch it on only when needed rather than at the start of the class
- Switch AV equipment off between lessons if it is not going to be used in consecutive classes
- AV equipment is most likely to be left on when it is not moved around. Implement a switching-off regime in dedicated TV rooms and music studios.

Use the right settings

Programmable equipment, such as a DVD player, may lose its settings when switched off. In this instance, the standby mode will still save more energy than if the equipment is left in operating mode.

OHPs often have a switch for reducing the lamp brightness; this should be used where appropriate.

Vending machines and water coolers

Your school might also make vending machines and water coolers available to staff and students. These tend to be left on out of school hours and energy can be saved by:

- Speaking to your supplier about turning water coolers and vending machines off at night and weekends. A simple seven-day timer can be fitted to automate switching off. Note that timers should not be fitted to refrigerated food vending machines
- Remembering that in some cases, the energy used to run these items continuously is more than the revenue the school may be getting from the supplier
- Buying or renting more efficient hot drink vending machines. These hold water at 70°C and only raise it to boiling point on demand. They also have smaller hot water storage tanks and lower lighting levels.

Did you know?

Switching the school's vending machine off at night and at the weekends reduces energy costs by more than 70% and saves enough energy to print seven million A4 pages.

Swimming pools

Schools with a swimming pool will find it to be one of their highest energy users. Costs are significantly increased if the pool is used as a community resource.

Use a pool cover

Swimming pools in schools may only be used for a few hours a day yet maintain 24-hour heating and ventilation regimes that are only required when the pool is occupied. Using a pool cover when the pool is not being used can produce savings of tens of thousands of rand through reducing the need for heating (water and pool hall air), pool hall ventilation and make-up water. Even those which are open to the public and are, therefore, in use more often, can benefit from a pool cover.

Case studies have shown that where a full cover is fitted, ventilation in indoor pool halls has been switched off at night without any condensation problems occurring. It also allows for the temperature of the pool hall to be decreased overnight without adversely affecting the water temperature. Initial installation costs are offset with a payback period of period of 2-4 years.

Schedule backwashes

Backwashing pool filters is very costly in terms of both water and energy so any reductions in this area can lead to significant savings. The interval between backwashes will depend on the type of pool and the degree of usage. Cyclic (for example, weekly) backwashes are often recommended but some manufacturers advise that the pressure drop across a filter should be used as an indicator of when a backwash is required. Always consult the manufacturer of the pool equipment if you are considering changing the maintenance regime.

Maintain comfortable pool temperatures

Swimming pool water is usually heated to 28-30°C. To reduce condensation in indoor pool halls, air temperature should be 1°C above the water temperature. These relatively high temperatures will result in high heat losses from the pool hall which must be replaced. In addition, high ventilation rates are necessary to protect the pool hall structure from condensation, further increasing the amount of heat lost.

Closely regulate water and air temperatures and control ventilation using variable speed fans. A special type of control called a 'humidistat' can be fitted within the pool hall to ensure that ventilation is switched on only if relative humidity within the hall rises above 65-70%.

Knowing how much a swimming pool is costing can also help make the case for any investment required to reduce these costs

Explore solar water heating potential

Solar water heating can be very effective for swimming pools and is relatively easy to connect to a conventional heating system. Unglazed solar collectors perform well in summer and are generally the cheapest to buy and install. Glazed collectors provide more energy in spring and autumn and can give a substantial contribution to pool heating throughout the year, with the remainder provided by a conventional heating system.

Use heat recovery of ventilation air

It is possible to recover heat from the pool hall that would normally be lost, by means of heat recovery. This heat can then be used to preheat incoming fresh air. If you have a pool and are not recovering heat from the ventilation system, this could be a very cost-effective measure. There are many technologies available but getting it wrong could have health and safety implications so always seek professional help.

Consider submetering if not already in place

By installing submeters to pool heating and to the pool hall electricity supply, it is possible to obtain exact information on how much the facility is costing. Take meter readings at regular hourly intervals when the pool is occupied and at the beginning and end of the day to identify how energy is used.

Did you know?

A typical 600 pupil school with a heated pool may have an energy bill of around R300,000 a year. A quarter of this could be a result of heating the pool.

Case study

What are other schools doing?

A secondary school was excessively ventilating its pool hall. Temperature and humidity sensors were installed in the exhaust air vents. The humidity sensor controlled the speed of the extract fan, varying ventilation to keep humidity levels stable at around 65%. Temperature sensors adjusted the heating controls to ensure that just enough heating was provided to replace the lost heat. Together, these actions saved nearly R75,000 a year, paying back the investment in less than two years.

Installing heat recovery to the ventilation system would have provided even more opportunities for savings.

Renewable energy

Renewable energy technologies utilise natural and recurring energy sources to generate power (electricity) or heat.

The best time to consider renewables is during the design and construction of new buildings; however, opportunities can be considered at any time. Correctly designed, installed and maintained systems, can save energy whilst demonstrating the school's commitment to the environment and providing practical teaching opportunities.

Generating green energy at the school

Renewables projects are restricted by costs and the practicality of the site.

The energy sources most likely to be suitable for schools are:

- Solar energy (to generate heat mainly or hot water and electricity)
- Wind energy (to generate electricity to use on-site or export to the electricity grid)
- Biomass (sometimes called organic energy or biofuels, and mostly used to generate heat).

Solar thermal technologies

These use dark surfaces to absorb heat from sunlight and daylight. Glazing is employed to help keep this heat in. Direct sunlight can produce reasonably high temperatures and even dull or overcast conditions can generate some level of warmth.

Fluid in the solar panels absorbs the heat and transfers it to a 'heat exchanger' which passes the heat, but not the fluid, into a building's hot water or heating system. This heat is best utilised to heat (or preheat) hot water and systems are usually sized to meet hot water requirements in summer. Supplementary heating from conventional boiler plant can be used during the rest of the year or in peak times.

Solar thermal technologies can be quite cheap to buy and install. Moreover, they are silent and nearly invisible from the ground.

Photovoltaic (PV) technology

Photovoltaics use a semi-conducting material to convert sunlight into electricity. The process generates a lot of heat and panels can get very hot during operation. They should be mounted facing a northerly direction in a safe and secure location. Avoid installation in areas where part of the panel may be shaded during the day.

Photovoltaic panels are expensive to buy, install and connect to the main electricity supply. However, once they are fitted, they have no moving parts, produce no noise, are nearly invisible from the ground and are pollution free.

Make sure that the school is as efficient as possible before considering installing new energy systems

Wind turbines

Wind energy can also be a cost-effective option for generating electricity in a school. Schools would require adequate grounds to be able to site the turbine at a safe distance from the main buildings and have adequate wind speeds coming from one prevailing direction.

Turbines can cause some noise and are mounted high up on a mast which makes them highly visible. It is therefore important to have open discussions with occupants of neighbouring buildings so they are fully aware of, and are in agreement with, any installation plans. Getting local support early on in the project is essential for its success.

Wind turbines offer good educational opportunities, not just for students but for local communities. To find out more, visit the South African Wind Energy Association website at www.sawea.org.za.

Biomass

Biomass can be stored in pellet, liquid or gas form. The main benefit is constant availability regardless of weather conditions. Using bioenergy is generally a good option if there is a local supply. Sites require a safe storage location for the biofuel and easy access to it for delivery vehicles.

Biomass has a lower calorific value (less energy) than fossil fuel equivalents (gas, oil or coal), so more frequent deliveries may be required to meet school demand. This will mean more heavy vehicles using local roads and moving around on-site.

It is possible for old coal or oil boilers to be adapted at reasonable cost to run on biomass equivalents, otherwise this option is only really viable during heating system replacement.

Case study

What are other schools doing?

A school converted an existing coal-fired boiler to run on wood pellets. The overall investment was less than R18,000 and although there is no immediate cost advantage in changing fuel, it takes less wood than coal to maintain a fire overnight, at weekends and during the holidays. There are lower carbon emissions and maintenance costs, as wood is less abrasive and cleaner than the coal it replaced. This also has the additional benefit of freeing up the caretaker's time, allowing more to be spent on other jobs around the school.

Heat pumps

Heat pumps simply move heat from one area to another, not unlike a refrigerator, but often do this using less electricity than the heat they provide. They are not strictly classed as a renewable technology unless the electricity required for them to operate comes from a renewable source.

Heat pumps can either extract heat from an external source (the air, water or ground) and provide it to a building or they can operate in reverse by extracting heat from a building and dumping it to an external source. This reversibility allows them to provide heating in winter and cooling in summer.

Energy management

Involving staff and students is an ideal way to make sure that energy saving opportunities are implemented at every level. It is also a great way to equip them with practical skills and knowledge that they can use on a daily basis, both in and out of school.

Many good housekeeping measures are simple to carry out and need not require any initial outlay. Everyone plays a part in becoming energy efficient, so remind the whole school community that good energy management achieves:

- Environmental benefits
- Healthier and more productive teaching/learning conditions
- Cost savings
- Better communication across the school
- Improved social and environmental credentials with parents, governors and community groups.

Whether starting an energy conservation programme from scratch or simply checking the effectiveness of an existing management system, there are a number of basics to consider.

Responsibility and commitment

As everyone in a school has an impact on energy use, it should be everyone's responsibility to use energy wisely. Appoint an energy team comprising management, teachers, maintenance staff, cleaners and students to help identify opportunities for savings.

- Ask cleaning staff to report any faulty lamps and to only use lighting where it is required
- Ask students to report areas that are overheated, where doors and windows are not closing properly, or where lighting or equipment is being left on unnecessarily
- Ask maintenance staff to monitor and adjust control settings to meet but not exceed internal requirements for heating and ensure all non-essential equipment is switched off at the end of the day
- Ask managers or administrators to investigate current and past energy use and to continue to monitor energy consumption.

Develop a policy

Commitment to energy efficiency has to come from the top and should be backed up by a mission statement and energy policy. Develop a policy which:

- Makes a clear statement of commitment
- Specifies clear objectives and targets for energy consumption
- Identifies responsibilities and resources
- Provides an action plan and states how it will be achieved
- Sets out the review timeframe.

The energy team should review the policy periodically and report savings and areas for improvement.

Undertake regular housekeeping walk rounds

It is a good idea to walk round the school and identify where energy might be wasted. Start by checking equipment, lights, heating and building fabric. Walk around at different times of the day, for example during lessons, at break times and after school. Note usage patterns, poor habits and maintenance issues as these can show up obvious savings as well as investment opportunities.

A walk round helps to:

- Establish current operating practices
- Eliminate wasteful practices and ensure they do not recur
- Demonstrate commitment to improving energy performance
- Identify opportunities for savings
- Involve staff and students.

For more hints on walk rounds, see the box opposite.

Record and understand energy consumption

Understand energy consumption by reviewing energy invoices and meter readings. Create meter reading sheets and plot energy use over time. Take meter readings last thing at night and first thing in the morning to find out how much energy is used when no-one is there. It is likely that this can be reduced.

Energy benchmarks are also a good way to monitor the school's performance. To get the figures, divide your annual energy use (in kWh) by the floor area of the school (in m^2) to get a benchmark figure. This can be used to monitor improvements year on year. It can also be used to measure performance against other schools if they carry out monitoring in a similar way.

Get students involved

A walk round can provide an opportunity for students to explore their own environment and learn about energy efficiency.

Students may assist the energy manager in conducting a walk round of their building. Split the class into teams to look at different aspects such as lighting, building fabric, heating etc. Each group could devise its own checklist, based on material from this overview. Further tips are available from Assessing the energy use in your building fact sheet, available from the PSEE.

After the walk round, results can be fed back to school managers and used to create an overall picture of the school's energy use, and to identify wastage.

Students can also monitor progress and contribute to the success of energy saving initiatives.

Teaching opportunities

There are many ways to involve students in energy management and all levels of school can participate. Students and teachers will find learning about energy efficiency both practical and creative, and it will raise awareness. Tailored classes could culminate in an energy week where students could participate in the following ways:

- Involve students in carrying out energy walk rounds, analysing and interpreting consumption data and calculating the results of energy saving measures
- Include them in the development and running of ongoing awareness campaigns
- Create an energy notice board or make use of an existing one to help keep everyone informed of energy related activities in school
- Ask students to calculate energy usage and graphs in maths sessions
- Teach them about energy sources and climate change in science and geography
- Communicate key messages in English lessons and ask them to design energy saving posters in art classes.

Linking energy awareness to existing curricular activity and project work will add value to students' education and to the school's energy saving activities.

Raise awareness

Everyone in a school can contribute to energy saving, so it is very important to raise awareness throughout the whole school and train everyone in what they can do.

Running a campaign for students, teachers, other staff and parents can help by convincing everyone to play their part in the drive to save.

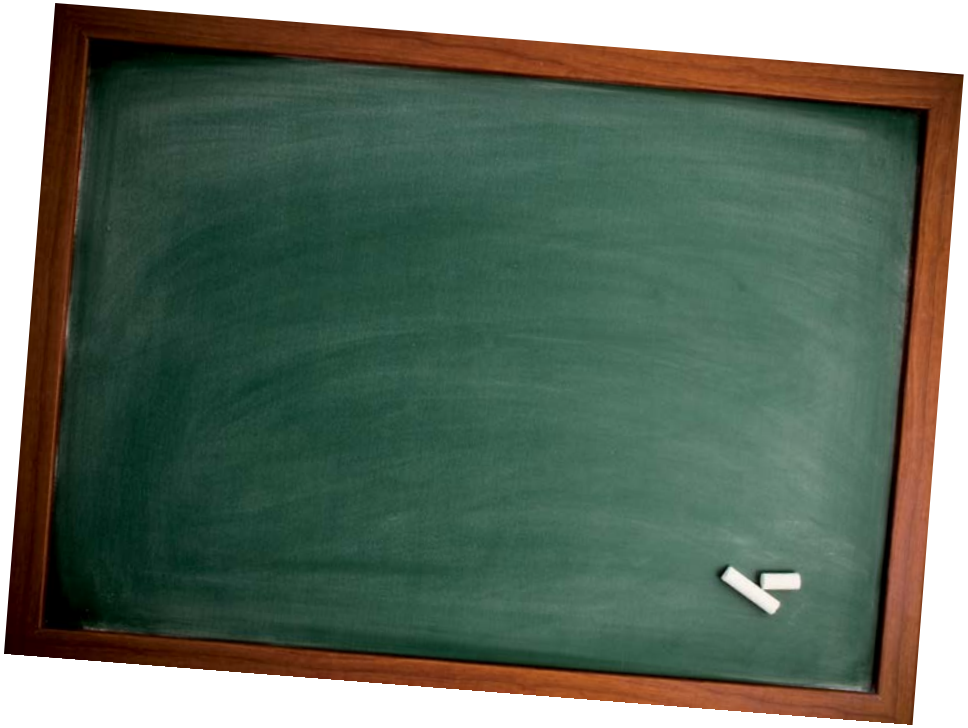
Further information

For further information download:

Introduction to energy management

Energy management guide

Energy surveys



Next steps

There are many easy low and no-cost options to help save money and improve the operation of your school.

Step 1. Understand your energy use

Look around the school and identify the major areas of energy consumption. Check the condition and operation of equipment and monitor the power consumption over, say, one week to obtain a base figure against which energy efficiency improvements can be measured.

Step 2. Identify your opportunities

Compile an energy checklist. Walk round the school and complete the checklist at different times of day (including after hours) to identify where energy savings can be made. An example checklist is available on the previous page, and helpful tips can be found in Conducting a walk around energy survey from the PSEE.

Step 3. Prioritise your actions

Draw up an action plan detailing a schedule of improvements that need to be made and when, along with who will be responsible for them. Where funding is limited, focus on energy intensive areas or those that are performing badly first.

Step 4. Seek specialist help

It may be possible to implement some energy saving measures in-house but others may require specialist assistance. Discuss the more complex or expensive options with a qualified technician or your local government property department.

Step 5. Make the changes and measure the savings

Implement your energy saving actions and measure against original consumption figures. This will assist future management decisions regarding your energy priorities. Setting up a ring-fenced energy management budget for efficiency investments could ensure limited funding is available for specific projects. Savings from investments could be fed back into the budget to provide a revolving fund.

Step 6. Continue to manage the school's energy use

Enforce energy policies, systems and procedures to ensure that the school operates efficiently and that savings are maintained in the future.

Related publications

Fact Sheets

Assessing the energy use in your building

Technology overviews

Heating, ventilation and air conditioning

Lighting

Office equipment

Plug into energy efficiency with PSEE

The Private Sector Energy Efficiency (PSEE) programme aims to improve energy efficiency in industrial and commercial sectors across South Africa. PSEE offers a variety of services to help companies plug in to energy efficiency:

Website – Visit us at www.psee.org.za for our full range of advice and services.
➘ **www.psee.org.za**

Publications – We have a library of publications detailing energy saving techniques for a range of sectors and technologies.
➘ **www.psee.org.za/Resouces**

Case Studies – Our case studies show that it's often easier and less expensive than you might think to bring about real change.
➘ **www.psee.org.za/Resouces**

Remote advice – Call us on 0801 113 943 or visit **www.psee.org.za** to access independent, authoritative advice and our publications and tools.

Survey-based support – Review of energy use for medium-sized companies to identify energy savings opportunities and develop a suggested implementation plan.
➘ **www.psee.org.za/Services/Medium-Companies**

Strategic energy management – Holistic engagements for large companies to help improve operational energy efficiency and support the development of a comprehensive energy and carbon strategy.
➘ **www.psee.org.za/Services/Large-Companies**

The Private Sector Energy Efficiency (PSEE) programme aims to improve energy efficiency in commercial and industrial companies in South Africa through the provision of various services to assist companies in identifying and implementing energy saving measures. The PSEE programme is implemented by the National Business Initiative (NBI), supported by the Department of Energy, and funded by the UK Department for International Development (DFID).

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