

INFOSHEET 9

Conducting a school energy audit

This InfoSheet describes how to conduct a site survey of your school's energy use. Alternatively you may prefer to contract a specialist energy consultant to conduct an on-site assessment of your school's energy use.

The billing data used in the save energy@school spreadsheet provides a good picture of how much total energy is used and how consumption varies throughout the year. However billing information does not provide any information about the end use of the energy. This is best done in a 'walk through' audit or site survey.

THE SITE SURVEY

The purpose of an energy audit is to account for consumption and recommend where savings are possible. A 'walk through audit' or 'site survey' involves sighting every light and piece of equipment that consumes energy, recording power ratings and estimating hours of operation. Obvious energy waste and inefficiencies are noted, as are items in need of maintenance or replacement. An action plan for your energy management strategy can be formulated as a result of the audit.

For planning of new and refurbished buildings, an audit can comprise an assessment of all proposed energy consuming equipment, which in turn enables the preparation of an energy budget.

Note: The Department of Education and Training expects these 'Energy Cost Worksheets' to be completed for all new buildings. (See the Building Quality Standards Handbook. February 2000 DET.)

To audit your school you will need:

- a site plan or map of the school showing every classroom, office, storeroom etc. Each room should be clearly numbered (or named). If the plan shows floor area this will provide valuable information and save taking measurements. External lighting should also be marked on the plan;
- a key to the plan detailing names and number of rooms in each wing or building, construction type of each building as well as the location of any known hot water services, boiler rooms and fan rooms;
- audit record sheets provide a format for recording this information and can form the basis for calculating energy consumption and operating costs. The ws-audit.xls file on this CD contains these worksheets.
- thermometer and lux meter for taking measurements of temperature and light levels.

INVESTIGATION AND ANALYSIS

Lighting (sheet 1)

Analysis of your lighting use can be divided into:

- classrooms;
- corridors and passages;
- special purpose areas such as libraries, workshops, gymnasias, canteens and administration;
- toilets and changing rooms;
- indoor and outdoor security lighting.

For each location, record the number of lamps (some fittings will contain more than one globe or tube), the types of lamps (incandescent or fluorescent), and the power rating of lamps (number of Watts). For each fluorescent tube add about 9 W for the magnetic ballast or 4 W if a low loss ballast is installed.

Estimate the daily hours of usage by visiting rooms throughout a typical day or asking class teachers. Don't forget to check if lights are on during lunchtimes, after school and at night. Ask the cleaner how long lights are on during cleaning or check yourself. Try to take into account weather conditions on the day of the survey; on a dull day, lighting use may be above average, and on bright day, below average.

Electrical equipment (sheet 2)

Repeat the above approach for electrical equipment. Use this information to calculate the running costs for your school's computers, office and canteen equipment. The power rating for equipment will be on the case or name plate of each appliance. It will also be stated in the printed specifications.

Hot water (sheet 3a, 3b and 3c)

The key items to note for electric hot water units are the types and size of hot water units, daily hot water consumption and the hot water temperature. For gas hot water services the burner rating (MJ/h) and the energy star rating are required for the electronic spreadsheet to calculate energy consumption. For all hot water heaters check for any obvious maintenance required. If a large centralised boiler is used as a hot water system, measure the temperature of the hot water in each room. Significant variations in hot water temperature between rooms near the boiler and rooms at the other end of the school, indicate that there are large energy losses in the pipes distributing the hot water around the school. Assessing the condition and efficiency of boiler systems may require the opinion of a specialist contractor.

Space heating (sheets 4a, 4b and 4c)

Room heaters are usually gas fired in schools while portable heaters are often electric. Estimate the number of days heating is used throughout the year. For electric heaters, (4a) note the power rating and estimated hours use per day. For gas heaters, (4b and 4c) find out the energy star rating and the gas burner rate in MJ/h. The manufacturer or the Sustainable Energy Authority can assist with this information if it is not listed in *Infosheet 1*. Typical heaters in schools are:

- Rinnai 1001—37 MJ per hour, 4 Stars;
- Wall furnaces—22 or 40 MJ per hour with 3–4 stars.

When surveying the school:

- Estimate the hours of use per day.
- Check for heaters left on with windows open.
- Check at lunchtime and after school for heaters left on in unoccupied rooms.

Central Heating Systems (sheet 4d)

Large centralised heating systems usually use a gas-fired boiler to heat water, which is circulated to electric fan coil units or hydronic panels. Some smaller units use a furnace that directly heats air which is blown by a fan into nearby rooms. These systems use both gas and electricity, so if efficiency measures reduce the operating time of the system, both types of energy are saved.

Estimate the number of days and hours per day the heating system is in operation.

Establish the energy rating of the boiler or furnace and the power rating of electric motors driving pumps and fans.

If you have specific concerns about central heating systems obtain the opinion of qualified service contractors or contact the Sustainable Energy Authority.

Cooling (sheet 5)

Estimate the number of days on which cooling is used in the school.

Electricity is primarily used for cooling in schools. In Victoria ceiling fans are common in classrooms and air conditioners are used in some critical areas. Schools may use evaporative coolers, room air conditioners (RACs) or split systems.

Again, note power ratings and/or average energy use of equipment installed, and hours of operation per cooling day.

The electrical power required by refrigerative air conditioners is calculated by dividing the cooling output (kW) by the Coefficient of Performance (COP) for the air conditioner. The COP can be found in the specifications of the air conditioner and is usually a number between 2.0 and 3.0.

Example:

An air conditioner with a cooling rating of 7.2 kW has a COP of 2.5.

It will have an electrical power demand of $7.2/2.5 = 2.88$ kW.

If the air conditioner runs for 5 hours per day then the energy use = 2.88×5 hours = 14.4 kWhs per day.

At a peak electricity price of 16 cents/kWh the air conditioner will cost \$2.30/day to operate.

ANALYSIS

Total your estimates of daily energy use from each sheet. These are then collated on the Energy worksheet summary, where annual estimates and costs are calculated. The costs will need to be estimated from the tariffs that apply to your school.

Convert all energy figures to MJ by multiplying kWh x 3.6.

Tabulate and graph the energy used by each major area:

- lighting;
- hot water;
- space heating;
- cooling;
- equipment.

Note: The electronic audit spreadsheet collates the summary table automatically and produces a pie chart

Look for a reasonable match between the results of your survey and the actual energy consumption figures recorded from accounts. If there are large differences review your estimates or check you did not miss out on major areas or pieces of equipment.

Write a summary of any maintenance items required and include it in a report summarising the findings of your survey.

Report your findings to the school community and set priorities for energy saving actions. If time allows, carry out more detailed assessments of energy consumption using meter reading techniques.

The survey may indicate the need to contract an energy specialist or someone who can sub-meter areas of your school or log energy use electronically from existing meters. Your decision in this matter depends on whether the savings will justify the costs involved.

CONTRACTING AN ENERGY SPECIALIST

You can have the total energy audit completed by a contractor by obtaining the services of a professional energy auditor or engineer. Alternatively, if you have completed some of the tasks yourself an energy specialist can more fully investigate and assess the potential energy efficiency options raised in your own site survey. Energy auditors vary in their area of expertise so it is important to develop a brief or specification detailing what work you wish performed, and the outcomes you desire. Include the scope of the work, specific areas of concern, relevant maintenance issues and a timeframe for the delivery of a report.

Check whether the contractor can guarantee the costs quoted for any recommended works, and ask for references or examples of similar work performed in other schools.