hub automation

ENERGY SAVINGS TOOLKIT

REGISTERED CLUBS

1,000SQM~20,000SQM

hub energy

INTRODUCTION TO ENERGY AUDITING

Energy costs represent a significant proportion of the overall operating costs of registered clubs. This toolkit provides information to club members, club executive office holders, club managers, building management system contractors, electrical contractors and HVAC contractors to assist with the process of:

- auditing a club's energy performance
- calculating the return on investment associated with energy efficiency upgrades
- management techniques for driving incremental cultural change toward a lower energy cost future.

WHAT IS AN ENERGY AUDIT

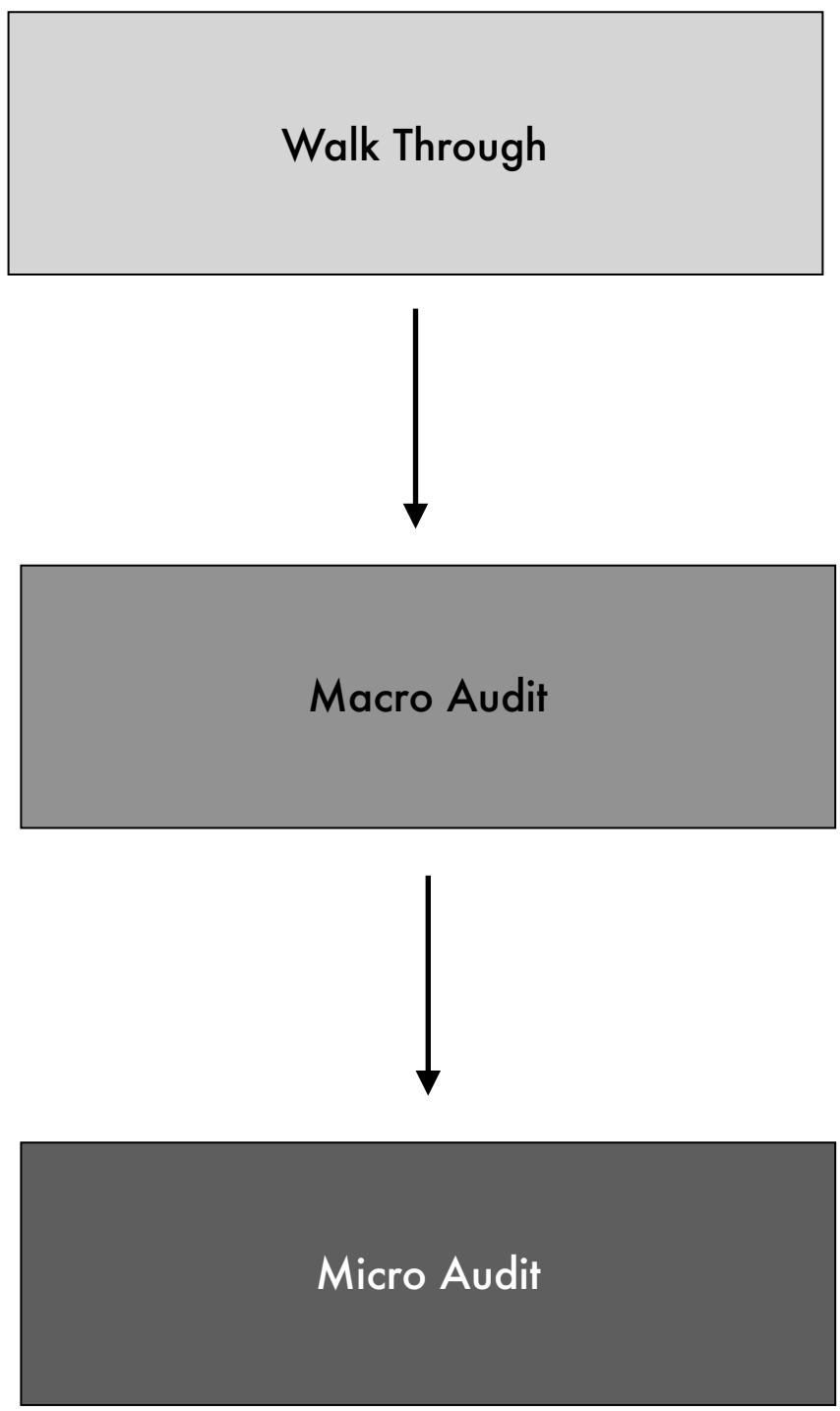
An energy audit is a process through which key stakeholders can understand the benefits associated with the implementation of an energy management program (EMP). There are differences in approach to energy auditing in terms of scope, methodology and objective between energy auditors, this document recognises these differences and seeks to provide a pathway for selecting an audit's scope, process and deliverables.

In short an energy audit is completed to determine where, when, why and how energy is being used. At the completion of the audit energy saving opportunities (ESO) will be identified and if commercially viable a return on investment (ROI) will be calculated to guide investment in an energy management system (EMS). Occasionally clubs will defer investment in an EMS due to capital restriction, in this case the component of the audit that guides cultural change shifts to a first step rather than post EMS implementation.

This toolkit provides toolkit for a systematic, documented verification process of objectively obtaining and evaluating audit evidence, in conformance with energy audit criteria and followed by communication of results to the client.

STAGES OF AN ENERGY AUDIT

There are three stages to an energy audit. The modular approach detailed in this guidebook is designed to allow key stakeholders an opportunity to exclude components of, or the entirety of remaining stages so that only activities that decrease overall energy costs are selected. This toolkit does not seek to identify emissions reduction and a primary goal however it is important to note that an automatic consequence of reduced consumption there is a proportional decrease in emissions. If the primary goal of an audit is emission reduction a wider scope is required to identify the most appropriate energy source in both quantity and dispatch-ability.



WALK THROUGH ENERGY AUDIT

The walk through audit is the first component of the process that incurs cost. The walk through audit can only be completed after the energy savings toolkit has been discussed and selected as the pathway to identifying ESO's by key stakeholders. An audit action group (AAG) should be in place prior to the walk through energy audit. The AAG should organise access to plant and additional information requested by the audit team including but not limited to energy bills / invoices for the previous three years, architectural and engineering plans, equipment list including model and year of installation. The audit team will research climate conditions for the previous three years and may need verification of estimated occupancy during spike periods of consumption.

The AAG should include but not be limited to a representative of the executive management team, a duty manager, a training officer, the onsite maintenance officer and two representatives of the contractor providing the audit service (the contractor providing the audit service should include an expert on HVAC and an expert on building management systems - BMS).

This type of audit does not require a lot of measurement and data collection. The walk through audit takes a relatively short time and the results are more general, providing common opportunities for energy saving opportunities. The ROI analysis is limited to a payback period on capital investment through realised energy savings based on benchmarking information included in this guidebook.

At the completion of the walk through audit key stakeholders will be presented with a report that provides the following information:

- Energy Asset Register
- Identified ESO's that can be actioned without further auditing
- ROI based on identified ESO's with an accuracy of +/-50% over the target reduction period
- A recommendation on the appropriateness of an EMS for the audited site
- A Macro Audit Plan including scope, duration/timeline, element with high priority, responsibilities for each AAG member
- A completed Walk Through Audit Checklist

MACRO ENERGY AUDIT

The macro energy audit is tailored to a specific site. It is a response to the identified ESO's in the walk through audit report. Typically a macro audit will include verification of the published performance data of energy assets (basic instrumentation), graphical analysis of historical energy use, graphical analysis of projected energy use without implementation of the macro audits recommendations, graphical analysis of projected energy use with implementation of the macro audit recommendations.

At the completion of the macro energy audit all stakeholders will understand where, when, why and how energy is being used. The AAG will have a high level understanding of all opportunities for reduced consumption and the financial and cultural impact of change.

The energy saving opportunities are different for each site and the macro energy audit is completed in response to the opportunities identified in the walk through energy audit. Typically at the completion of the macro energy audit key stakeholders will be presented with a report including:

- Tabulated actual vs published performance data for each energy asset
- HVAC asset analysis (see typical HVAC checklist for details)
- Refrigeration asset analysis (see typical Refrigeration checklist for details)
- Lighting asset analysis (see typical Lighting checklist for details)
- BMS asset analysis (see typical BMS checklist for detail)
- Gaming asset analysis
- Graphical representation of where energy is being used
- Graphical representation of when energy is being used
- Graphical representation of how energy is being used
- Graphical representations of energy saving opportunities
- Recommendations for action including ROI
- A completed Macro audit checklist inline with the audit plan

MICRO ENERGY AUDIT

In short the macro energy audit identifies the low hanging fruit of energy saving opportunities. Typically the macro energy audit identifies and recommends changes that can be made with a return on investment ranging from two to five years, measurements are completed using basic instrumentation and the ongoing incremental change to energy culture are achieved through management engaging with their team. The micro energy audit utilises laboratory level verification of energy asset performance and often results in recommendations for change with an ROI ranging from five years to the life of the plant or structure, incremental change to energy culture is driven through set targets being compared on a monthly basis to actual use verified through a high level monitoring system . The majority of clubs do not proceed to level of audit as part of the initial process but may return to it after the implementation of macro audit recommendations.

Typically at the completion of the micro energy audit key stakeholders will be printed with a report including:

- Recommended process for monitoring, reporting and acting on energy culture moving forward
- A replacement program for energy assets that are not performing at appropriate coefficient of performance ratio (COP)
- COP & EER analysis of all HVAC equipment using enthalpy tunnels method
- A sensible and latent breakdown of all ventilation and extraction equipment
- Graphical representation of plant energy intensity
- Luminance Map
- Thermal energy use inventory
- Graphical representation of energy inflows and outflows
- Load demand profile per energy asset
- Heatload demand profile of structure

BENCHMARKING AND COMPARATIVE ANALYSIS

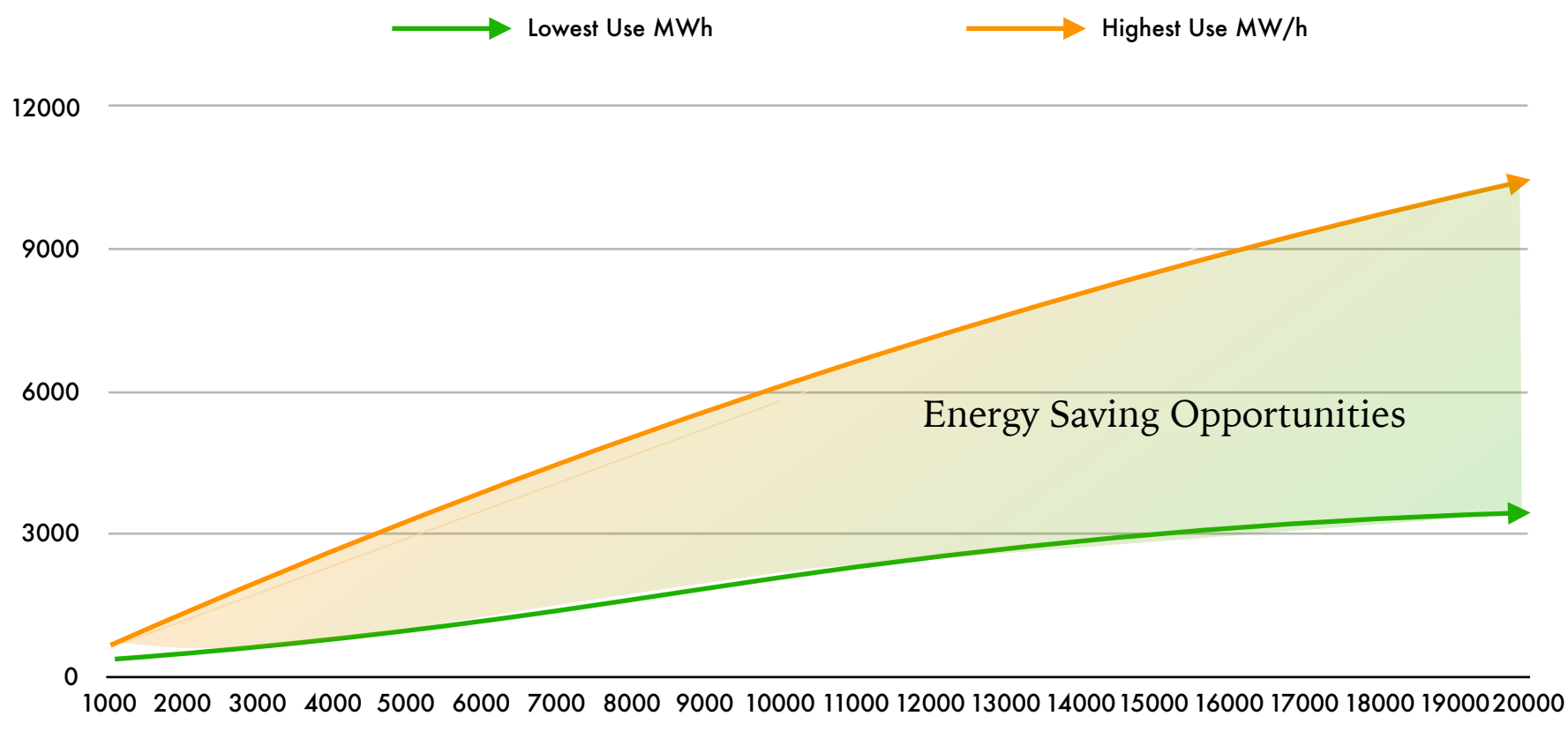
METHODOLOGY

The cost of energy has been increasing at greater than historical trend and varies significantly across clubs. As a result it is not practical to include the price of energy in this guidebook. This guidebook focuses on units of consumption rather than cost as a benchmark.

Benchmarks are important when entering into an audit process to gain an understanding of how each site is positioned relative to other clubs, as the audit process progresses a comparative analysis detailing the shifts in consumption within the club is a more appropriate measure.

This section of the guidebook provides an understanding of the quantity of energy used and the proportion consumed in each category. It is important to be mindful that each site is different and the benchmarks are design to provide key stakeholders with an understanding of a sites position relative to other sites. In many cases the benchmark values represent the mean value with the removal of outliers. There are many sites that sit outside the benchmarks shown.

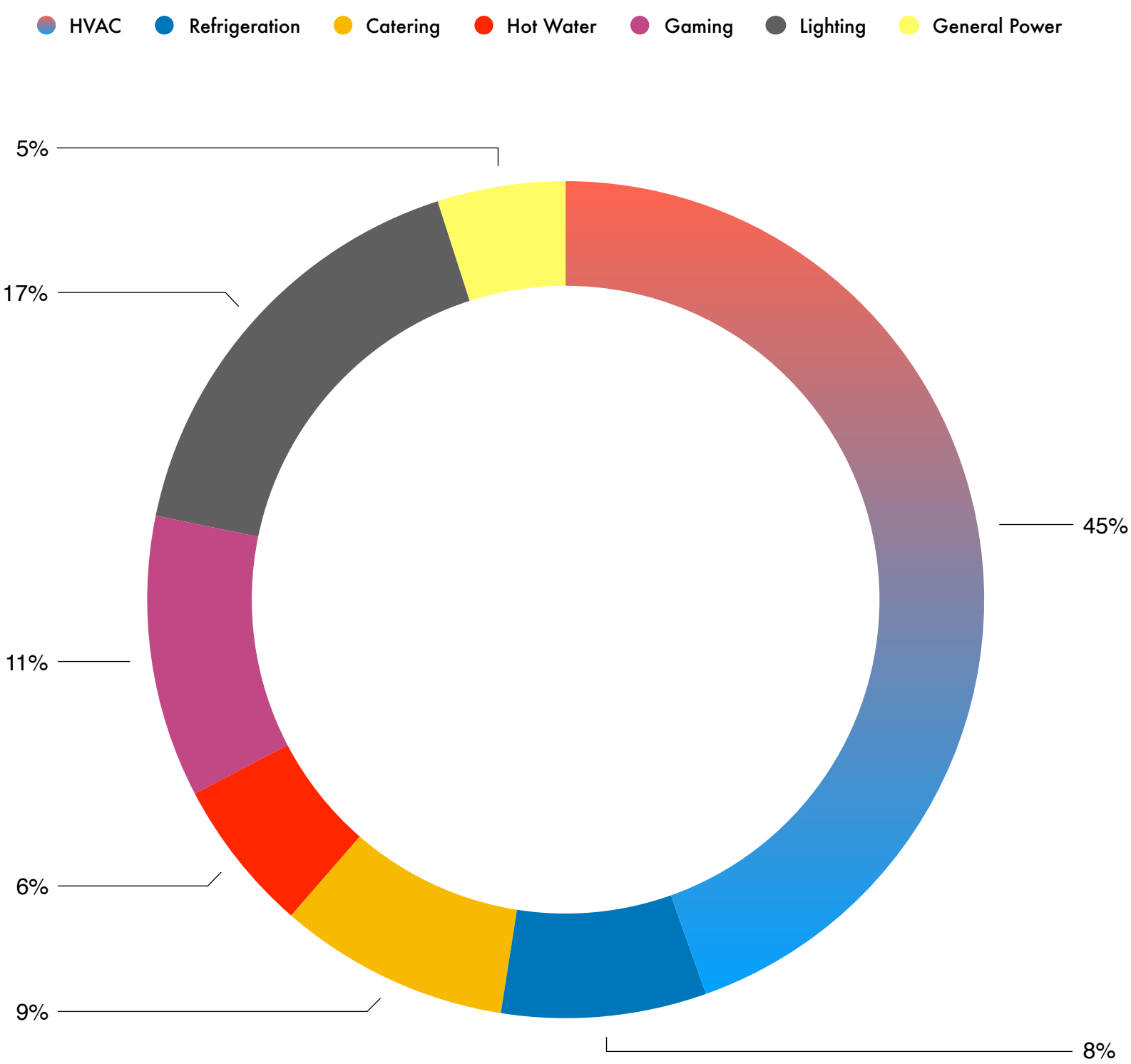
ELECTRICITY USAGE PER SQUARE METRE



GAS USAGE PER SQUARE METRE

Energy saving opportunities are limited with gas usage. This guidebook excludes savings in this area from the toolkit provided. Please check with your audit professional to better understand potential savings in this usage segment.

ENERGY USE BY LOAD SEGMENT



PROBABLE OPPORTUNITY FOR SAVINGS

HVAC

Providing a comfortable environment within the gaming and function areas of a club are essential to maximising the return to the local community. On entry it needs to be apparent that a transitioned has occurred between an outdoor ambient environment and a comfort controlled environment. It is also necessary to provide a climate where it is possible to spend long periods of time and remain thermally comfortable. Heating and cooling a club is the main consumption area and the comfort of patrons can impact considerably on earnings, for this reason this guidebook has a proportional focus on heating and cooling.

In most instances the heating and cooling system is not only the largest consumer of energy but also represents the greatest possibilities for savings. There are many areas where savings can occur including:

- Add all heating and cooling equipment to the BMS for temperature targeting and scheduling purposes (expanding the BMS to include all system types/brands)
- Improving the BMS interface so that team members can actively pursue energy savings (an intuitive graphical user interface will engage team members to pursue savings by shutting down unused assets)
- Altering the fresh air strategy to occupancy based modulation rather than peak period flow (CO2 triggered modulation)
- Economy cycle in targeted areas (Utilising outside air as the first stage of heating or cooling when the temperature or enthalpy of the outside environment will benefit)
- Monitoring filter pressure drop to make sure the system does not operate for long periods with reduced airflow (automated filter clean or change flag through the BMS)
- Altering the filtration rating to fit the purpose (changing filter type)
- Maintaining a clean coil to reduce pressure drop (UV system or improved maintenance)
- Altering the diffusion pattern to target heat at ingress (relocating or adding diffusers)
- Occupancy sensors to limit system capacity when unoccupied outside of scheduled off periods. (PIR sensors used to shift the temperature target or shed system capacity)

- Adjust of refrigerant levels to a precise match to the installation (set suction line superheat for key performance period)
- Adjusting the sensible heat ratio of a system to fit the purpose (manipulate system components to shift the sensible and latent capacities to match the actual demand)
- Cap peak usage with a computerised load management system (integrate the ability defer corrective action so that the panned peak is not exceeded)
- Adjust ventilation and make-up air volumes to match use profile (kitchen canopies, toilet exhaust, miscellaneous exhaust and infiltration)
- Add variable speed drives to ventilation motors and pump motors to interact with the computerised load management system.

LIGHTING

The bulk of savings in the lighting segment is achieved through three methods:

- Replacing existing lighting with energy efficient lighting
- Utilising scheduling and/or occupancy sensors to reduce the run time in unoccupied areas
- Dimming lights to a target lumens so that natural light can support a component of the lighting requirement during daylight hours

When considering these options it is important to understand the maintenance and/or replacement schedule of existing lighting. Often lighting upgrades make sense outside of energy saving opportunities.

GAMING

Gaming machines should be switched off or placed in a low power mode when not in use. Even is the non-use period is three hours the energy savings associated with off or low pawer mode are significant.

CATERING

This guidebook focusses on fans, filters and pumps in the catering component of use. Energy saving opportunities outside of fans, filters and pumps are achieved through providing the catering team with information on when, where and why energy is being used within the catering space so that they can make decisions on the most appropriate way to achieve reductions. In many cases the majority of energy saving opportunities relate to upgrading appliances to more energy efficient models. Where possible gas appliances should be chosen over electric and heat recover features for commercial dishwashers can also provide significant savings.

REFRIGERATION

Appropriate maintenance of refrigeration equipment is essential for achieving energy savings. Sensor calibration, defrost cycle calibration, refrigerant level calibration and the cleanliness of heat exchangers are all high impact items on energy consumption and plant longevity. Door seals and occupancy sensors for lighting is also an area your audit team will check for energy saving opportunities. Where possible as parts fail AC motors should be replaced with electronically commutated motors (EC or brushless DC), when an EC replacement is not available variable speed drives can provide an alternative. Refrigeration systems should be included in a computerised load management system and the BMS should have an alarm feature to protect produce.

HOT WATER

Improving the insulation of pipes and tanks is the first stop in reducing energy consumption of the hot water system. In a limited number of cases the asset may be close to end of life or energy inefficient to the extent that a replacement system fits within the nominated ROI period. Hot water systems should be included on the computerised load management system as the how water tank is already a thermal battery that can extend the off period when usage is approaching the planned peak.

GENERAL POWER

Energy saving opportunities in this consumption segment are easily identified during the walk through audit. Often significant reactions are achievable in this segment without significant cost.

CHANGES TO THE BUILDING STRUCTURE

Limiting infiltration, shading and additional insulation are all probable recommendations. The walk through audit will identify possible reductions and if included in the macro audit plan the audit team will utilise solar azimuth angles at different times of the day to calculate irradiation levels.

The addition of photovoltaic arrays (PV) to harvest energy have been excluded from this toolkit as this guidebook is focussed on reducing consumption. It is important to note that often the harvest of energy from PV is at the time the cooling load is at its maximum. For many clubs PV is a sensible inclusion in the overall approach to reducing energy cost.

VOLTAGE REGULATION

Voltage regulation or optimisation units have been fitted to many clubs. This guidebook does not recommend the use of these units as it has insufficient data to comment on any energy saving associated with their use. Anecdotal evidence suggests that savings are limited and there may be some improvement in the life of some equipment.

GLOSSARY