

ENERGY CONSERVATION MANUAL

for

GOVERNMENT OFFICE BUILDING TENANTS

PREPARED BY

**BUILT ENVIRONMENT RESEARCH UNIT
DEPARTMENT OF PUBLIC WORKS**

JUNE 1997

ENERGY CONSERVATION MANUAL
for
GOVERNMENT OFFICE BUILDING TENANTS

Table of Contents

SECTION I : INTRODUCTION	4
APPLICATION	4
ENERGY SAVINGS CONCEPT	4
MANUAL STRUCTURE	5
SECTION II : AWARENESS INFORMATION	7
ELECTRICITY TARIFFS	7
ENERGY MANAGEMENT	7
Starting Point	7
Implementing Measures	7
ENERGY OFFICER.....	7
ENERGY USAGE	8
Building Related Considerations	8
Building Services Related Considerations.....	8
Energy Conservation Related Considerations	9
Health and Safety	9
HIDDEN TRAPS.....	9
Inter Relationships	9
Conserve Water.....	10
HOUSE KEEPING	10
TERMINOLOGY DEFINITIONS.....	10
SECTION III : OPERATIONAL MANAGEMENT STRATEGIES	13
ACCOUNTABILITY	13
EMPLOYEE INVOLVEMENT	13
HOT LINE	13
STAFFING	13
SECTION IV : OPERATIONAL ACTIVITIES	15
AFTER HOURS OPERATION	15
House Keeping Measures	15
CATERING/COOKING ACTIVITIES.....	15
House Keeping Measures	15
Maintenance Measures.....	16
OFFICE EQUIPMENT USAGE/PURCHASES	16
House Keeping Measures	16
New Equipment Purchases	17

SECTION I

INTRODUCTION

SECTION I : INTRODUCTION

APPLICATION

- This manual has been produced for the use by core Departments required to achieve 5% energy savings over a two year period as an integral element of an enterprise bargaining agreement.
- Organisations at various stages of implementation of energy conservation programs can also use this document as a reference aid for energy auditing, installation modification, or staff education activities.

ENERGY SAVINGS CONCEPT

- The concept is to save 5% of the energy costs over the two year period of the enterprise bargaining agreement, compared to a "Business As Usual" approach as if no energy management measures had been adopted. See Fig I below.
- The aim of the concept is to modify employee behaviour to capture savings, and to identify other energy management activities which can achieve further energy savings but may require capital input from Departments.

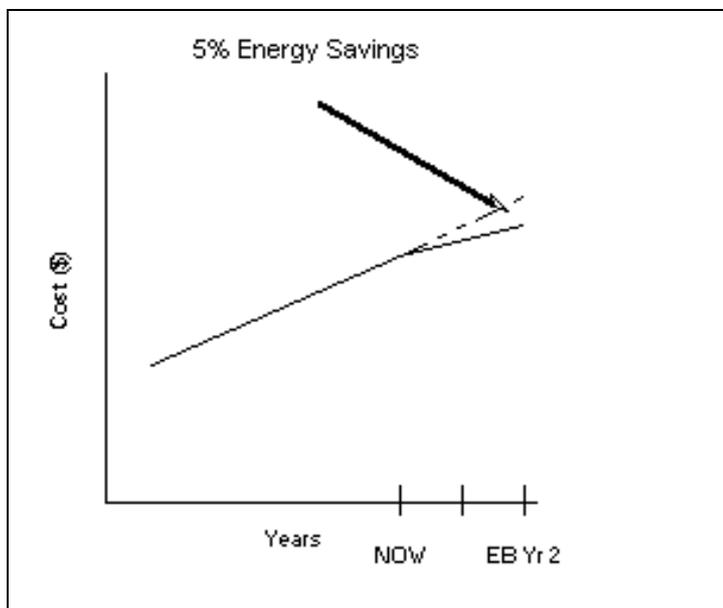


Figure 1

MANUAL STRUCTURE

- The philosophy behind this manual is one which will allow users to introduce energy conservation practices regardless of their position or role within their organisation.
- This manual is structured on a sectional basis to address the requirements with respect to Awareness Training (Section II), Operational Management (Section III), Operational Activities which impact Energy Usage (Section IV).
- This manual provides a "shopping list" of energy conservation related measures. It must be kept in mind that many measures will not apply to a particular building or situation. Manual users should disregard those sections which do not apply to their particular circumstances.

SECTION II

AWARENESS INFORMATION

SECTION II : AWARENESS INFORMATION

ELECTRICITY TARIFFS

- Electricity costs depend on when it is used, and on which tariff it is charged.
- Energy intensive functions such as heavy use of elevators, etc, have a major impact upon the buildings' peak demand profile.

ENERGY MANAGEMENT

Starting Point

- The identification and quantification of energy waste streams and their sources is Phase 1 of the total energy management program.

Implementing Measures

- Implement simple, low-cost measures first.
- Simple inexpensive measures that achieve modest energy cost savings will instil confidence by management and staff.

ENERGY OFFICER

- The job of energy officer is not necessarily a full-time assignment.
- This duty can normally be assumed by a member of the office staff.
- It is important that the responsibility be focused on one individual who is in a high enough organisational level to accomplish the program without delay.
- Duties for such a position are:
 1. Assume responsibility for co-ordinating all energy conservation functions.
 2. Regularly review the status of the energy conservation program and its effectiveness.
 3. Establish energy conservation procedures and regularly inspect the facility to insure that these procedures are being followed.
 4. Observe all phases of operations to determine the effects of energy consumption changes of one department on another department.

5. Investigate all ideas proposed for energy reduction, including estimation of capital and operating costs and environmental effects.
6. Notify general manager of changes or conditions which may affect energy availability or consumption.

ENERGY USAGE

Building Related Considerations

- Energy usage varies considerably from building to building.
- A buildings' energy requirements will vary seasonally, daily and even hourly, because of weather and occupancy influence, cooling, heating and lighting needs.
- For commercial office buildings the Energy Utilisation Indices is usually expressed in the form of an energy utilisation index in units of energy used per square meter of net rentable area per annum.
- In commercial buildings most of the energy consumed is for air conditioning, lighting, lifts and domestic hot water with little process energy being used except for office equipment, computers and some food preparation.
- Premises with multiple sub-tenancies have two areas of usage:
 - (a) Central Services: This area includes all air conditioning (chilling, heating and air movement), domestic hot water, core lighting and lifts.
 - (b) Tenancies: This load includes area lighting, power and special purpose ventilation or air conditioning, all of which is metered and switched separately.

Building Services Related Considerations

- Letting the air conditioning system operate on public holidays can increase your yearly energy costs by up to 4.5%.
- Hot water - The energy consumption for domestic hot water in an office building is close to 5% for a boiler system and 1% for local hot water units. many buildings have much higher consumption levels for this service due to inappropriate design.
- Lifts - Energy use by lift systems can be reduce by the use of stairs for travel between adjacent floors.
- In most plants, lighting accounts for about 25 percent of the total demand for electrical energy. If electrical consumption can be reduced, energy can also be saved through a lighting heat load reduction in air conditioned plants.

- Lighting constitutes 50% of energy consumption in typical office buildings.
- Lighting accounts for approximately 75% of the total electrical energy consumed by a school. The usage and cost for this energy may be reduced by as much as 30%.
- Dirty lamps reduce light output by 20%. Dirty interior room surfaces further reduce illumination by 15%. The additive effect of lamp life depreciation, lamp dirt depreciation and room surface dirt depreciation can reduce light output of the entire lighting system by as much as 50%.
- The wattage of a bulb does not measure the amount of light it gives, but rather the energy it needs. For example, a 100 watt bulb gives 50% more light than four 25 watt bulbs for the same amount of energy.
- Fluorescent lamps give 5 times the light and last up to 8 times longer than ordinary bulbs for the same energy input.

Energy Conservation Related Considerations

- Turning off unneeded equipment is perhaps the simplest and most obvious way to eliminate unnecessary energy use, but nevertheless, it is often overlooked.
- By reducing the energy consumption by 19 kWh/m²/annum will reduce your yearly energy costs by around \$25,000 for a 10,000 m² gross floor area building.

Health and Safety

- Do not compromise safety.
- Overzealous attempts to save energy costs by reducing standards of comfort and services below accepted levels can be counter-productive.
- Solicit co-operation of staff.
- People are likely to regard with suspicion any changes in their workplace which they feel are being imposed upon them without their knowledge.

HIDDEN TRAPS

Inter Relationships

- Study the system carefully before making changes - some changes may increase energy usage.
- Consider the impact that changes in one aspect may have on another ie. lighting changes may result in additional mechanical ventilation. etc.

- The various energy consumers within a plant must not be considered piecemeal - a total approach must be taken.
- Many energy-consuming units are interrelated. For instance, inefficiencies in electric motors and lighting systems convert electricity to heat. If this heat is used within the building for space heating, such inefficiencies do not necessarily constitute energy losses. This approach is real *energy management*.

Conserve Water

- Too often, water is taken for granted, and overlooked in energy conservation.

HOUSE KEEPING

- Continuously operating ventilation fans, and heating or cooling huge quantities of outdoor air are wasteful.
- Ensure that levels of services do not exceed that required.
 - Don't request the provision of services, plant, equipment etc over the minimum required to perform the task efficiently.

TERMINOLOGY DEFINITIONS

- Active Energy Conservation - this means incorporating mechanical devices such as solar hot water units, solar operated curtain and blinds, solar fans etc into a building.
- Data logging - this means collecting and displaying information such as energy usage, demand level, system status, system failures and program parameters.
- Duty cycling - this means turning loads off for selected periods of time regardless of demand level.
- Energy audit - this is an investigation of energy use in an organisation to identify major areas of energy use and opportunities for achieving energy savings.
- Energy Conservation - this is the employment of energy saving measures which involve reducing waste and improving the efficiency of energy use.
- Passive Energy Conservation - this refers to the materials, colours, orientation, eaves overhang, and insulation incorporated into the building ie. non mechanical inclusions.
- Peak demand - this is the highest kilowatt load obtained during any demand interval of 30 minutes within the billing period of one month.

- Time of day programming - this means turning loads on and off, based on a real time schedule.
- Demand limit control - the turning of selected loads off, at least for a short time, when total building demand approaches a target limit.

SECTION III

OPERATIONAL MANAGEMENT STRATEGIES

SECTION III : OPERATIONAL MANAGEMENT STRATEGIES

ACCOUNTABILITY

- Assign responsibility eg. to Heads of Departments/Regional Areas/Sections.
- "Charge" units, sections etc for their energy.

EMPLOYEE INVOLVEMENT

- Encourage employees to:
 - turn off lights when leaving work areas;
 - report leaking faucets, lavatory fixtures, piping,etc;
 - keep windows and outside doors closed;
 - leave thermostats at a constant setting to avoid forcing the system to cycle off and on;
 - turn off all tools and portable appliances when not in use.
- Assign the responsibility for tuning off designated items to specific employees.
- Instruct occupants and cleaners to close blinds at evening departure.

HOT LINE

- Establish a telephone number to report energy waste.

STAFFING

- Appoint an individual as the energy officer responsible for the implementation of the energy conservation program.
- Use Security Patrol Officers to advise on worst offenders (lights/doors etc left on).
- Use Energy Wardens on a Departmental or building basis.

SECTION IV

OPERATIONAL ACTIVITIES

SECTION IV : OPERATIONAL ACTIVITIES

AFTER HOURS OPERATION

House Keeping Measures

- Provide advance notice to the Building Services Co-ordinator to permit building management systems to be re-programmed.
- Where feasible open building windows to provide ventilation instead of operating mechanical ventilation or air conditioning systems.
- Where practical switch air conditioning system to ventilation operation.
- Report observances of lighting, equipment etc left on in adjacent un-occupied areas.
- Use stairs for inter-floor travel.
- Use a jug to boil hot water instead of switching on the hot water boiling unit or urn.
- Where practical provide portable infra-red heaters for space heating of private offices for after hours occupation instead of operating the air conditioning system.
- Where practical, use a stand alone personal computer instead of the local area network.
- Where practical provide desk lamps for task as well as private office lighting.

CATERING/COOKING ACTIVITIES

House Keeping Measures

- For that small cooking job, use the correct small appliance instead of your range, such as frypan, deep fry cooker or a pressure cooker.
- For your toast, use your electric toaster instead of the griller on your range.
- Clean and maintain cooking equipment to maintain peak efficiency.
- Eliminate unnecessary hot plates, coffee pots, etc, and limit use of remaining ones.
- Use volume cooling to reduce equipment heat losses, it is much easier to control one big pot than several small ones.
- Provide ovens, fryers and cooking tables with adequate cooking loads all the time the heat is on.

- Heat only to the temperature required by the task.
- Do not turn thermostats too high in an attempt to heat up or cook faster.
- Cover pots with lids to retain heated air in the pot to decrease the cooking time and the heat losses.
- While baking or roasting limit the number of other items of cooking equipment being used.

Maintenance Measures

- Clean burners and coils of encrusted matter and check them periodically for correct functioning.
- Clean refrigeration coils of frost and dust, dirty coils reduce efficiency and cause the compressor to use more energy.
- If the pots and pans are bent or worn out replace them with good solid-based pots and pans to ensure good heat transfer.

OFFICE EQUIPMENT USAGE/PURCHASES

House Keeping Measures

- Switch office equipment off after hours such as computers, printers, photocopiers, shredders, displays.
- Replace worn out equipment with modern efficient equipment.
- Use a stand alone PC rather than a network system for after hours operation where practical.
- Do not locate heat producing equipment below or within one to two metres of the air conditioning systems room temperature sensor/thermostat.
- Operations requiring the use of high energy consuming equipment for prolonged periods should be re-scheduled where possible so that the operational activity does not occur around the period of "peak demand" for building electricity usage.
- Undertake a periodic audit of equipment usage/units processed to identify abnormal usage or wastage.
- Equipment with air filtering devices should have the filter element replaced/cleaned on a regular basis.

- Install a notice adjacent to equipment to remind staff to switch off the item after use or end of day as appropriate.

New Equipment Purchases

- Purchase reverse cycle air conditioner units for cooling and heating applications.
- Select units with the highest co-efficient of performance or energy star rating.
- Select equipment with variable processing capacity capability rather than a single capacity unit.
- Select equipment which has on/off switches mounted in a readily accessible/visible position.
- Select equipment with lockable on/off switches or integral metering devices.
- Select equipment with a ducted ventilation exhaust air feature over one which exhausts hot air directly into the office space.
- Select equipment on the basis of that with the highest capability to operate under non-air conditioned/mechanically ventilated conditions.