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1200 BUILDINGS PROJECT ADVICE SHEET

Considering the building technologies

Perhaps the most difficult decision to make when contemplating a retrofit is the choice of technologies given the number of options now available.

Technologies will play a critical role in reducing your energy /water consumption.

Please see the 1200 Buildings webpages for more information on retrofit technologies: www.melbourne.vic.gov.au/1200buildings.

1200 BUILDINGS

Prepare. Plan.

When making technology decisions, it is advisable to adopt three principles

1 Optimise the building first

In successful cases of building refurbishments that have achieved excellent energy efficiency results, the building has been optimised first.

This means: sealing the building; insulating the building roof, walls, ceiling and floors; insulating windows by double / triple glazing and tinting; shading windows and roofs externally and internally where possible; reducing heat load from lights, computers, equipment, etc. Undertaking these measures will mean that any high energy consuming heating, ventillation and air conditioning (HVAC) system that will be installed will be smaller and more energy efficient.

2 Match the technology to the building

Every building is unique, and every retrofit is likewise.

Technology choices may be based on legacy systems, such as existing air conditioning ductwork, water towers that are still functional, etc. In older buildings, most HVAC systems have reached the end of their life cycle and need to be completely replaced. If the building needs to be fully occupied whilst the retrofit is happening, the technology choice may depend on what is the least disruptive.

The essential factor is the balance and integration of technologies with natural or passive systems. Seek expert advice.

3 Keep it simple

Some new technologies entail complex systems to manage them. This is not always a good idea. Simple but effective technologies are easier to manage, balance and maintain. Automated systems are effective so long as they are easy to over-ride manually.

Read more

See City of Melbourne case studies - 636 Bourke Street, 490 Spencer Street, 406 Collins Street, 131 Queen Street

Design. Implement.

Technology options: There are many technology options, and we have listed the most important for each category below.

Heating, ventillation and air conditioning (HVAC)

The heating and air conditioning system in a building consumes the most energy. Therefore it needs the most attention when reducing the building's energy consumption.

- **New generation air conditioning** components such as chillers, water towers, variable speed fans and pumps are now highly energy efficient. Variable speed drives match the load that is put on them, which generally fluctuates across the day or across seasons.
- **Variable Air Volume (VAV)** is highly efficient because the volume of air pumped into a space is related to the temperature of the room, and fan speeds run accordingly. (Fans are one of the highest energy consumption components of HVAC).
- **Chilled beams** are located on the ceilings of a room, and chilled water is passed through them providing the air conditioning. Passive chilled beams provide the conditioning separate to the ventilation, whereas with active chilled beams, the air flows over them. Chilled beams are highly energy efficient, but are not so effective in high heat load and/or leaky spaces.
- **Economy air cycles** are efficient because they utilise outside air to heat or cool a space when appropriate to do so.
- **Night-flushing** purges the building of heat from the previous day using natural ventilation rather than an air-conditioning system. Depending on the building, this can be achieved by simply opening windows to enable air cross-flow, or using mechanical systems to ventilate the space.
- **Zoning** is efficient because perimeters of buildings where load is highest can be air conditioned or heated independently of other spaces.
- **Gas-fired boilers** for heating produce relatively low CO2 emissions.

How can I make sure the system is the correct choice?

Seek expert opinion. A reputable engineering consultant will advise on the best solutions for the building. They will draw up their solution in a Basis of Design (BOD) document.

A Basis of Design (BOD) and Technical specification will ensure that the HVAC is modelled and installed to perform as designed.

See Advice Sheet #7

Building management control systems (BMCS)

The building management control system (BMCS) is digitally connected to all mechanical components and plant – fans, pumps, chillers, lights, etc. The more effective the control, the better the building will perform and the more efficient it will be.

- BMCS both control the HVAC and collect data that can be analysed to diagnose and remedy problems.
- BMCS send alarms when components of HVAC fail or are not operating at correct levels.
- Building controls ensure the HVAC Is operating only at the levels necessary and at the times when it is needed, thus maximising efficiency.

How can I ensure that the BMCS meets the building requirements?

BMCS should be selected, installed and commissioned by reputable contractors.

A formal handover of the system (including training) to the building management team is essential so that they can control and monitor the system in the future.

The complexity of the BMCS will depend on the size of the building.

For more information, see *AIRAH Application Manual DA27 – Building Commissioning* www.airah.org.au/Content/NavigationMenu/Publications/TechnicalPublications2/default.htm

Onsite Energy

Electricity produced on site provides an energy efficient option to coal-fired power. Three technologies include:

- **Solar photovoltaic (PV or solar cells):** Electricity is generated directly from the sun. The installation of solar panels will depend on roof space availability. Solar panels are still expensive, so conduct a cost benefit analysis to determine viability.
- **Co-generation:** This means using an on-site gas-fired generator to simultaneously produce electricity and heat. The heat generated by the plant is captured and used as another energy source for internal heating or hot water. This is only cost effective when used in very large buildings.
- **Wind turbines:** Installed on the roof of a building, wind turbines can generate electricity but need to be carefully positioned to take advantage of the wind.

Lighting

The most energy efficient lighting is natural light. Daylighting reduces the need for artificial lights. Its use, however, has to be balanced against glare to building occupants and radiant heat, which places load on the air conditioning system.

Reducing energy use and heat load can be achieved by installing:

- **Energy efficient luminaries** – using T5 or T8 fluoro tubes, LCD and incandescent globes.
- **Mirrorlux reflectors** – reduces the number of fluoro lamps required by introducing a reflecting surface behind one tube.
- **Motion sensors** – detects when space is in use. Lights are off when space is not in use.

Sub-meters

Electricity or gas meters, installed by the service providers, give an indication of overall building energy consumption.

Sub-meters can be installed at relevant locations to provide useful consumption data – for each floor or tenancy, on sets of equipment such as HVAC fans, pumps and chillers, base building lighting, lifts, etc. The data can be used to analyse and manage performance. Consideration must be given to the additional space required and costs of installation.

More information available in: *AIRAH Applications Manual DA 28 Building Management and Control Systems*
www.airah.org.au/Content/NavigationMenu/Publications/TechnicalPublications2/default.htm

Water

Technology options are available for reducing the consumption of water. These include:

- **Controlling water flows** – water efficient fittings can be used for toilets, showers, urinals, sinks, etc.
- **Collecting stormwater** – roofs are plumbed so that stormwater is collected by tanks (generally located in building basements).
- **Recycling grey water** – water from sinks, showers, bathtubs, etc. can be collected and recycled, though never used for drinking water.
- **Treating black water** – sewerage can be treated on site and the water reused. However, the energy used in the process can outweigh its contribution to water efficiency.