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**DESIGN DEVELOPMENT REPORT**

**ON**

**BUILDING SERVICES DESIGN**

**AND**

**ADOPTED ESD INITIATIVES**

**FOR THE REFURBISHMENT OF**

**CASTLEMAINE SCHOOL OF MINES BUILDING,**

**27 LYTTLETON STREET,**

**CASTLEMAINE**

Prepared for:

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## TABLE OF CONTENTS

<b>1.</b>	<b>INTRODUCTION .....</b>	<b>1</b>
<b>2.</b>	<b>ECOLOGICALLY SUSTAINABLE DESIGN .....</b>	<b>2</b>
2.1	EXTERNAL SHADING TO EAST, NORTH AND WEST ELEVATIONS.....	2
2.2	PAINTING EAST, NORTH AND WEST EXTERNAL BRICKWORK .....	2
2.3	BUILDING SEALING .....	2
2.4	INTERNAL BLINDS FOR GLARE REDUCTION.....	3
2.5	BUILDING ENVELOPE INSULATION.....	3
2.6	NATURAL OR MIXED MODE VENTILATION OF ROOMS .....	3
2.7	GLAZING.....	8
2.8	DOMESTIC HOT WATER HEATING .....	8
2.9	DESIGNING FOR POTABLE WATER EFFICIENCY.....	9
2.10	COOLING/HVAC .....	9
2.11	RADIANT HEATING SYSTEM.....	10
2.12	LIGHTING EFFICIENCY AND CONTROLS.....	10
2.13	CYCLIST OR JOGGER FACILITIES.....	10
<b>3.</b>	<b>MECHANICAL SERVICES.....</b>	<b>11</b>
3.1	HYDRONIC RADIANT HEATING SYSTEM.....	11
3.2	AIR CONDITIONING .....	11
3.3	NATURAL VENTILATION SYSTEMS .....	12
3.4	MECHANICAL VENTILATION SYSTEMS .....	12
3.5	SMOKE MANAGEMENT SYSTEMS.....	12
3.6	INDICATIVE SCOPE OF WORKS .....	13
3.7	PRELIMINARY COST ESTIMATES .....	13
<b>4.</b>	<b>ELECTRICAL SERVICES .....</b>	<b>14</b>
4.1	POWER SUPPLY .....	14
4.2	RETAIL AUTHORITY METERS. ....	14
4.3	EXISTING MAIN SWITCHBOARD .....	14
4.4	GENERAL LIGHTING.....	14
4.5	LIGHTING CONTROL SYSTEM .....	15
4.6	EMERGENCY & EXIT LIGHTING .....	15
4.7	GENERAL PURPOSE POWER .....	15
4.8	METAL CABLE DUCTING.....	16
4.9	STRUCTURED COMMUNICATIONS SYSTEM.....	16
4.10	TELECOMMUNICATIONS RACK .....	16
4.11	TELECOMMUNICATIONS OUTLETS.....	17

4.12	SECURITY SYSTEMS .....	17
4.13	MATV AND AV SERVICES .....	17
4.14	INDICATIVE SCOPE OF WORKS .....	17
4.15	PRELIMINARY COST ESTIMATE .....	17
<b>5.</b>	<b>HYDRAULIC AND FIRE PROTECTION SERVICES .....</b>	<b>19</b>
5.1	SANITARY DRAINAGE .....	19
5.2	GREASY DRAINAGE AND TRADE WASTE APPARATUS.....	19
5.3	POTABLE WATER RETICULATION.....	19
5.4	RAINWATER HARVESTING AND RETICULATION OF RECYCLE WATER.....	19
5.5	FIRE HYDRANTS AND HOSEREELS .....	19
5.6	FIRE DETECTION AND OCCUPANT WARNING SYSTEMS .....	20
5.7	FIRE SPRINKLERS.....	20
5.8	NATURAL GAS RETICULATION .....	20
5.9	INDICATIVE SCOPE OF WORKS .....	20
5.10	PRELIMINARY COST ESTIMATE .....	20
<b>6.</b>	<b>APPENDICES .....</b>	<b>22</b>
6.1	APPENDIX 1: 9AM AND 3PM WIND ROSES FOR WARMER MONTHS .....	
6.2	APPENDIX 2: CENTRIFUGAL HYBRID ROTARY VENTILATOR.....	
6.3	APPENDIX 3: LANTERN/DRAFT SHAFT DESIGN .....	
6.4	APPENDIX 4: DESIGN DEVELOPMENT SERVICES DRAWINGS.....	

## 1. INTRODUCTION

The following report is based on our project Concept Design report issued in November 2011. However it has been revised and extended to include the current services design strategies, cost estimates and ESD initiatives proposed to be adopted at this Design Development stage of the School Of Mines building refurbishment project.

The report is based on our walk-through inspections of the site, examination of available existing conditions information and the development of the design response in conjunction with the architectural details provided by the project architects Gregory Burgess Pty Ltd.

Appropriate ESD measures have been summarized in a separate section of the report including details of the initiatives proposed at this stage and how these measures are to be applied in respect to both the services and the building fabric.

In general most of the building services are to be replaced. Only some elements of the hydronic heating system, the electrical services switchboard and some hydraulic pipework are suitable for retention in the refurbished building to suit office occupancy. The proposed new and modified building services concepts are examined in greater detail in the sections that follow.

With regard to certain other aspects (in particular hydrant coverage aspects and any requirement for sprinkler or fire detection systems), advice may still be needed from third parties (eg. CFA, Fire Engineering Consultant or Building Surveyor) to confirm the final scope of the refurbishment.

Preliminary cost estimates have been included under each of the building services sections based on the design concept outlined, the current services design development drawings and the indicative scopes described for air conditioning, electrical light and power and the like.

The scope of our report does not extend to the proposed new passenger/utility lift, audio-visual services or acoustic considerations.

## 2. ECOLOGICALLY SUSTAINABLE DESIGN

The following section incorporates ESD measures considered at the Concept Design stage of the project and extends that discussion to summarise the specific initiatives that have been adopted for inclusion in the continuing Design Development process.

The general assumption remains that all spaces are to function as administrative offices and associated meeting rooms.

### 2.1 External Shading to East, North and West Elevations

To promote passive building envelope cooling it is recommended that the east, north and west-facing windows are externally shaded. Most of the glazed area faces east and west.

Effective external shading strategies for the east and west facing glazing include adjustable vertical blinds, adjustable angled horizontal louvres, fixed vertical perforated sheet metal or fixed mesh screens. These should ideally be mounted in a plane away from the external wall plane to allow airflow into and around the shading, and clearance for any opening high level window panes.

Shade screen external face can be a light colour (to minimise screen heat gain and re-radiation) with their internal face dark coloured (to minimise glare discomfort). The lower edge of the screen can be above the lower opening window pane (to maximise natural ventilation potential). Consideration could be given to graded perforations with the smallest perforation ratio at the top of the screen and the highest perforation ratio at the bottom of the screen.



**Figure 2.1** Shading location for west façade brickwork and glazing (image courtesy of Gregory Burgess Architects).

The architectural Design Development drawings indicate how effective window shading devices are to be incorporated in keeping with these principles.

### 2.2 Painting East, North and West External Brickwork

Dark brickwork can be painted white or similar light colour to reduce heat storage and re-radiation to internal spaces in the east, north and west facing brickwork, which make the spaces uncomfortable for occupants in warmer months. Due to aesthetic and heritage considerations, this strategy will only be implemented in the southeast external courtyard.

### 2.3 Building Sealing

It is necessary that façade openings such as the trickle ventilators are blocked or at least controlled so that they will be shut whenever appropriate. Repair of openable windows, particularly those with gaps around opening panes, is also to form part of the building works. All opening panes are to be

refurbished to seal tightly with sealing strips and unnecessarily openable panes will be fixed shut and well sealed. All remaining fireplace chimneys are also to be sealed shut.

## 2.4 Internal Blinds For Glare Reduction

With the orientation of most of the external glazing (east and west), glare control will only be achieved by the introduction of internal blinds. Where open weave blinds are proposed, it is recommended that the openness factor is no greater than 10% in line with Greenstar glare control credit requirements.

## 2.5 Building Envelope Insulation

Provision of effective insulation into ceiling/roof cavity immediately above the conditioned spaces of the First Floor is strongly recommended. Wherever external walls are able to be internally lined, it is highly recommended that such walls include wall insulation in the cavity. This eliminates occupant discomfort resulting from cold internal surfaces on external walls in winter and from hot internal surfaces on external walls in summer.

Current building regulations require R3.7 roof insulation (heat flow upwards) and R2.8 in the walls for new buildings in Castlemaine (Climate zone 7). If the roof is to be replaced in any areas, insulation incorporating a reflective foil barrier should be placed below the roof sheeting. Alternatively, bulk insulation can be placed above the ceiling.

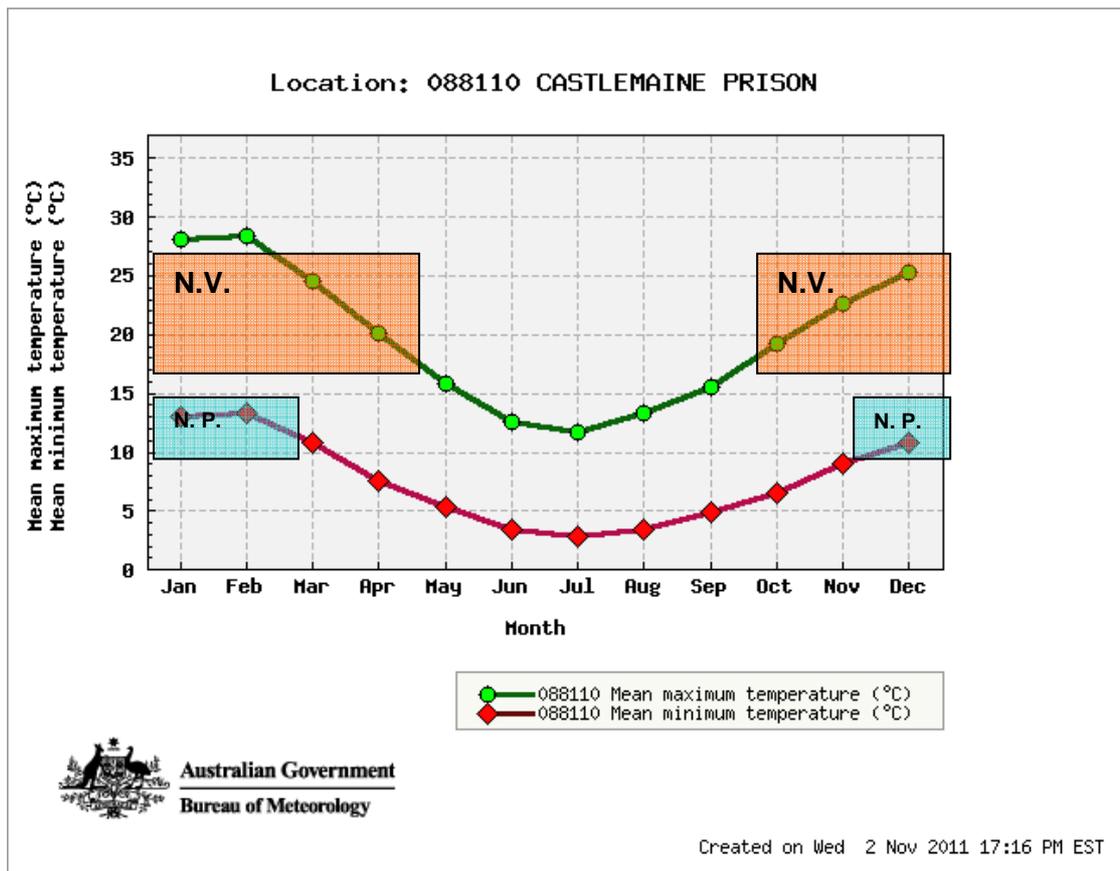
## 2.6 Natural or Mixed Mode Ventilation of Rooms

Mixed mode or hybrid ventilation is a strategy that allows natural ventilation during periods of favourable external weather conditions and mechanical ventilation during unfavourable weather. The addition of high level ventilation openings in the corridor particularly at First Floor level will help to draw air through the spaces using the negative pressure generated by winds passing over the roof and with some assistance from thermal stack effect and a small electric motor during still conditions.

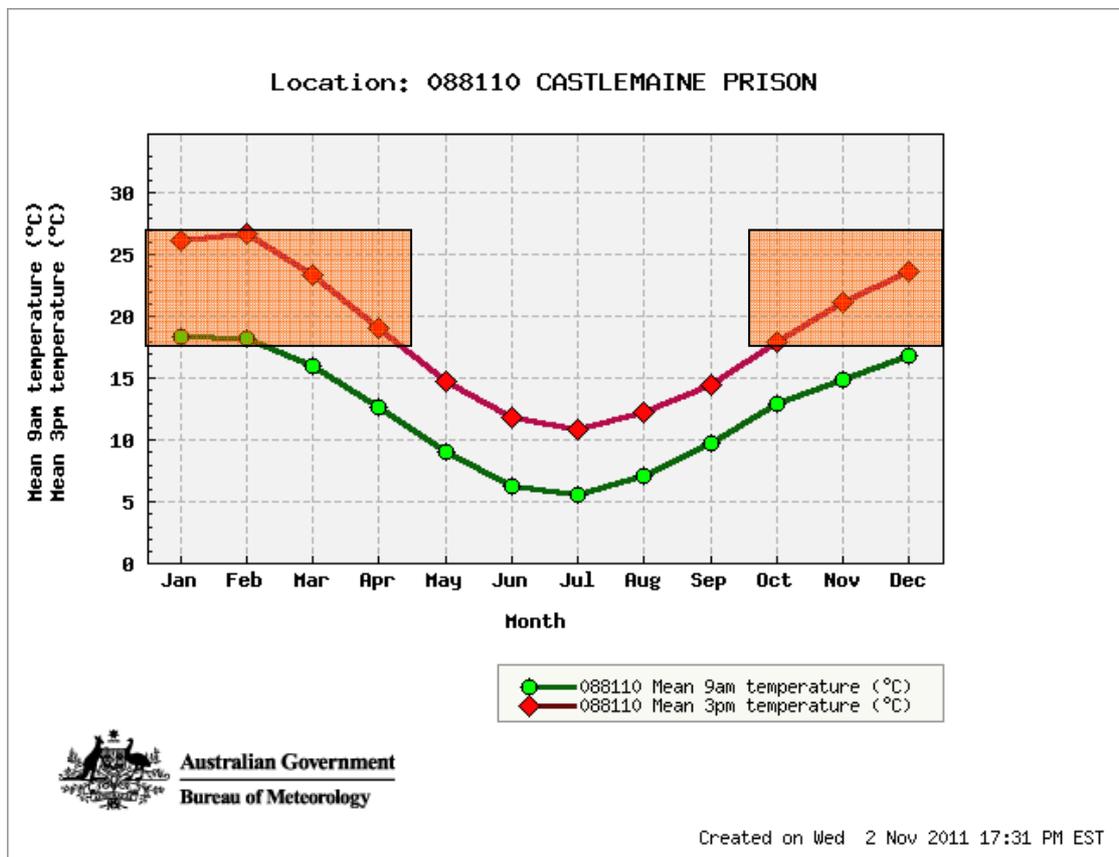
Natural ventilation is suitable for office buildings in a wide range of temperatures when ceiling fans are provided in spaces with high ceilings. During occupancy hours, ventilation openings can be opened when outdoor temperatures are as low as 18°C, and as high as 26°C with the use of ceiling fans to promote low speed air movement. Figure 2.2a (monthly minimum and maximum average temperatures) and Figure 2.2b (monthly 9am and 3pm average temperatures) demonstrate that windows could be opened for around half of the occupancy hours in a year (orange rectangles on the monthly temperature average graphs). The blue rectangles highlights the months in a year when nightpurge operation may be beneficial.

Overnight automated night purges in the early hours of the morning can also assist in cooling the uninsulated internal thermal mass of the building ready for occupation at the start of workdays immediately after or prior to a hot summer day (blue rectangles on figure 2.2a). To night purge the building passively, opening areas equivalent to 2% of floor area are required to be automated. Approximately 1.3% (0.9m<sup>2</sup> opening area in a 70m<sup>2</sup> room) would need to be at low level inlets in the space and 0.7% at high level at the top of the ventilation stacks or the suggested lantern located over the central corridor. Where HVAC of suitably large capacity is provided, economy cycle dampers and controls can be incorporated and used to night purge with a small energy penalty for the associated fan power. However the air conditioning unit capacities required for this project are unsuited to the provision of this facility.

Windroses during the warmest months of the year (November to April) for 9am and 3am are included in Appendix 1. At 9am, much of the wind is from the easterly direction (south east, east and north east) so will flow over the high level vents, helping to induce air through the upper floor rooms. Morning windspeeds are generally low, mostly up to a maximum of 10km/h. At 3pm the wind direction has changed to coming from all directions with more winds from westerly directions (particularly south west and west). In the hottest months the windspeeds are higher in the afternoon, often in the 10-20km/h range. Some wind comes from the north but these winds are likely to coincide with hot ambient conditions so natural ventilation mode would be likely to be programmed to not operate under these conditions.



**Figure 2.2a** Monthly average maximum and minimum daily temperatures for Castlemaine



**Figure 2.2b** Monthly average 9am and 3pm temperatures for Castlemaine

Three diagrams 2.3, 2.4 and 2.5 follow showing an indicative cross-section of the proposed design and the proposed Ground Floor and First Floor layouts. The diagrams divide the spaces into three ventilation strategies for habitable spaces:

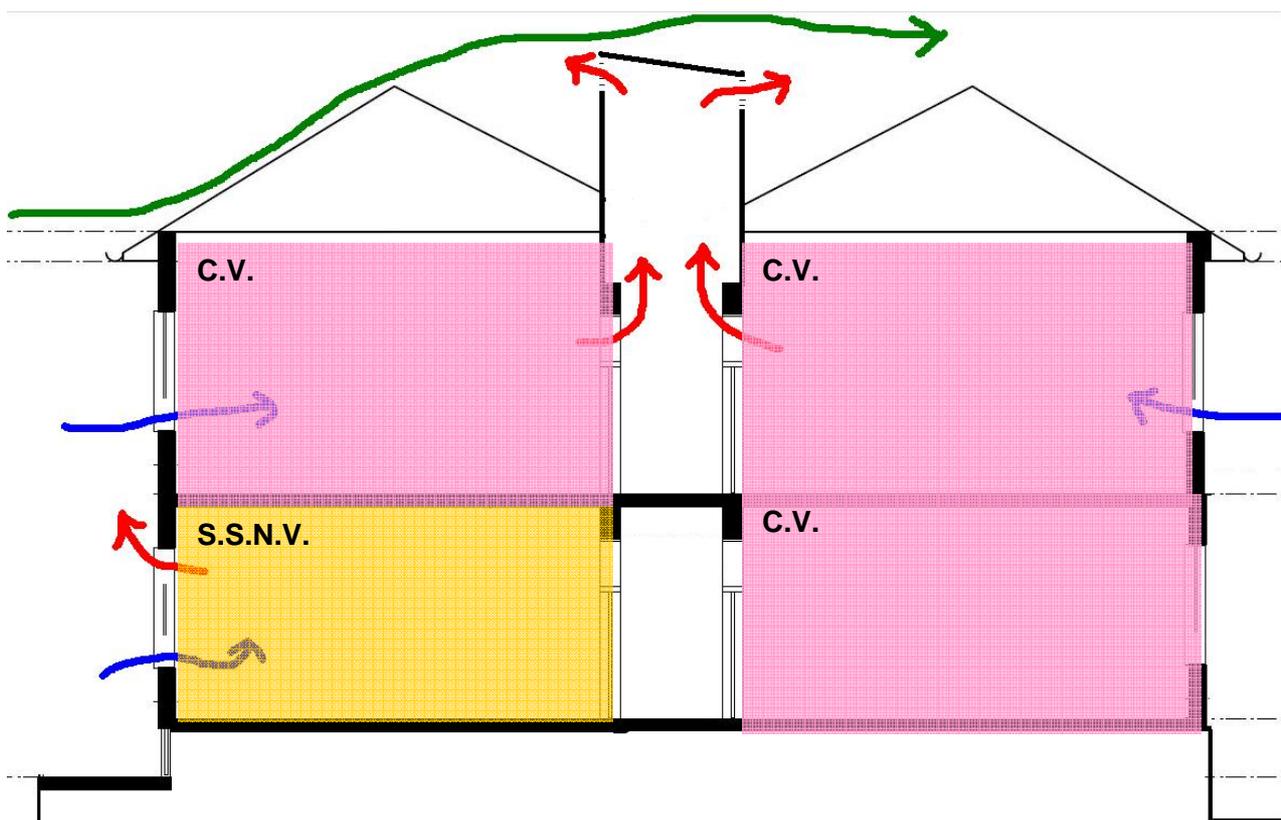
- **S.S.N.V.** Single sided natural ventilation is proposed for rooms where the room width is no more than 6 metres.

*The ventilation effect will be enhanced by including high and low level window openings in the external wall.*

- **C.V.** Double sided or cross-flow natural ventilation is proposed for spaces where the air path distance from the air inlet to the air outlet is no more than 5 times the ceiling height (19m for this building). This strategy relies on the introduction of controllable high level vents for some spaces. Other spaces already have historical vents ending in flues protruding above the roof level which would require new controllable dampers to be installed.

*Because the forces driving crossflow ventilation are very small, the airflow path must be relatively unobstructed and where possible avoid right angle bends between inlet and outlet. Where opening window panes are nominated for the natural ventilation mode, care should be taken in the design of external shading devices to keep these potential restrictions to air movement well away from these opening panes.*

More information on effective natural ventilation strategies can be found at [http://www.resourcesmart.vic.gov.au/documents/Natural\\_Ventilation\\_Systems.pdf](http://www.resourcesmart.vic.gov.au/documents/Natural_Ventilation_Systems.pdf)



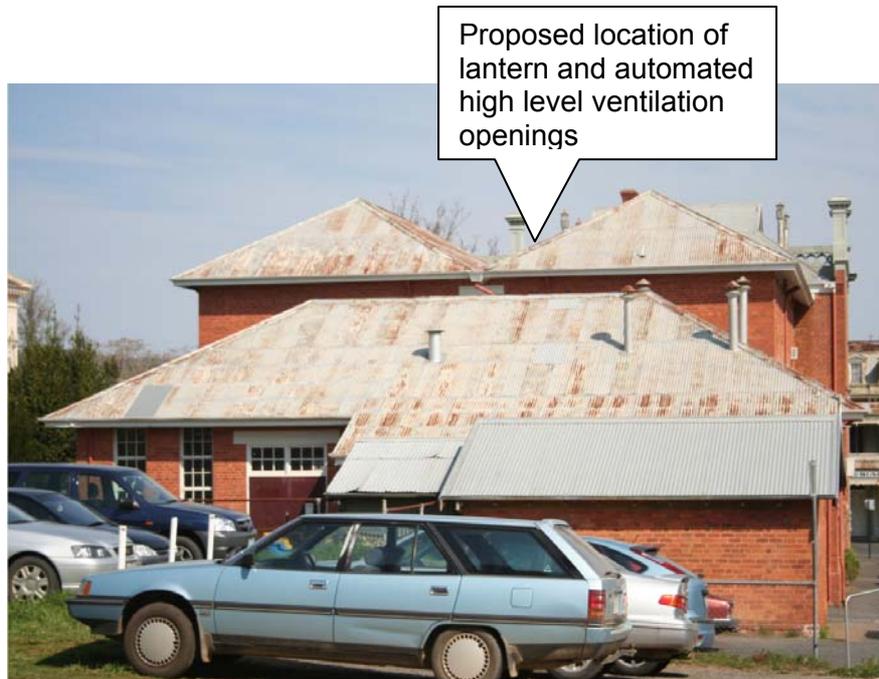
**Figure 2.3** Cross section showing concept of high level air outlet which can also double as a lantern to bring daylight into the central first floor corridor.

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**Figure 2.6** New draft vents for cross ventilation will be visible mainly from rear of the building.

## 2.7 Glazing

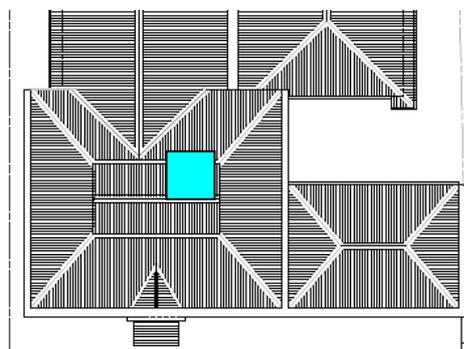
Wherever significant refurbishment or replacement of windows is to occur, it is recommended that poorly attached shading film is removed (external shading will eliminate the need), and existing clear glazing is replaced by higher performance low-E single pane glass.

## 2.8 Domestic Hot Water Heating

There are three major hot water demands in the buildings, namely for staff kitchen areas, hand washing, and showering. These demands will be present year-round on weekdays.

Solar hot water pre-heating collectors are to be provided to take advantage of available solar heat for hot water heating. Natural gas boosting will be used as the primary heat source. The hot water recirculation system will be installed with timeclock control to avoid energy wastage.

The solar collector panels are to be located on the unshaded section of roof that slopes down to the north above the proposed first floor amenities as depicted in Figure 2.7.



**Figure 2.7** Part plan of north-facing roof (southern end) with the blue square showing proposed location for locating solar thermal collectors for domestic hot water preheat.

## 2.9 Designing for Potable Water Efficiency

To conserve potable water, the provision of WELS star rating taps, showerheads and toilets in wet areas will form part of the project.

Space for a rainwater tank exists at the rear (northern end) of the building. Rainwater collection from the majority of the existing roof area (670m<sup>2</sup> catchment area) has been calculated to approximately match the expected demand for toilet flushing. A large (15,000 litre) above ground tank is proposed which would allow for most of the rainwater collected to be utilised. Such a system would cost in the order of \$20,000 including the necessary filtration and reticulation. This cost is dependent on the ease with which roof runoff can be intercepted in the current downpipe configuration.

Should budget limitations preclude a tank of this size, a reduced scope of rainwater collection could collect from the roof over Ground Floor Rooms 8/9/10 and 11/12 only and feed into a much smaller tank of the order of 3,000 litres.

## 2.10 Cooling/HVAC

Staff may be willing to accept widened comfort bands particularly where the windows are operable and ceiling fans are installed to create cooling air movement in warmer weather. These strategies are particularly suited to this particular building due to the high ceilings and high levels of thermal mass and contribute to a more greenhouse-efficient cooling strategy than merely controlling air temperature by refrigerated air conditioning.

However above external temperatures of around 26°C, air conditioning would generally become necessary to maintain acceptable inside conditions for the carrying out of normal office functions. Ducted air conditioning will therefore be placed into the roof spaces to service First Floor rooms. Air conditioning for Ground Floor spaces is also proposed using a variety of configurations to suit the individual rooms and their heritage constraints. This is discussed further in Section 3 of this report.

Due to potential high occupant density, the Council/Seminar Meeting Room at Ground Floor level will require high rates of mechanically forced fresh air supply. Distribution of conditioned air could be provided either through ventilation diffusers at low level supplied via underfloor ductwork or through exposed sheet metal or fabric ductwork suspended from the ceiling. Figure 2.8 shows an example of suspended fabric ductwork at nearby Coles Gisborne.



**Figure 2.8** Suspended fabric air distribution ductwork for displacement ventilation (Coles Gisborne).

Alternatively floor mounted console air conditioning units connecting to sub-floor refrigeration pipework could be provided to give the required room cooling in conjunction with a separate ducted fresh air supply to the room. This however, has the disadvantage of introducing mechanical noise sources and maintenance requirements into the room itself. The console units also reduce available floor space and need to be coordinated with furniture.

As a result, a ducted air conditioning system using wall-mounted diffusers with supply air ducted from a fan coil unit located in the First Floor roof void has been adopted as the preferred solution for the Council Room.

## 2.11 Radiant Heating System

Radiant heating is an efficient technology for rooms with high ceilings and lots of uninsulated internal thermal mass, such as the spaces in this facility.

It is proposed to reuse the existing cast iron radiator panels and retain the present heating water boiler plant and pump. New insulated two pipe reticulation will be provided. The locations of the radiators need to be carefully coordinated with the intended office furniture layout.

## 2.12 Lighting Efficiency and Controls

Efficient light fitting choices for the building are as follows:

- T5 fluorescent tubes, low glare specular reflectors and electronic dimmable ballasts
- Suspended light fittings are proposed possibly with an up-light component to better distribute light around the spaces with tall ceilings.

Separate daylight dimming control is recommended for perimeter lighting circuits adjacent to external windows. Users of rooms with windows facing east and west should be encouraged to manually open internal blinds during times of the day that the direct sun is not entering the building. This will allow lighting energy savings to be realised and the benefits of regular exposure to natural daylight to be experienced by occupants.

Occupancy sensor control and time switches are recommended for the majority of new areas. These sensors can also be used to control air-conditioning for further energy savings.

## 2.13 Cyclist or Jogger Facilities

In line with the Greenstar office rating tool, it is proposed that cyclist facilities (that can also serve joggers) are included in the project. These facilities reduce the greenhouse gas emissions associated with staff commuting and encourage a healthy lifestyle for staff. A shower is proposed for the Ground Floor and the brick shed to the north of the building is earmarked for secure bike storage. The Greenstar recommended numbers of cyclist facilities for 80 staff or an NLA of 1,200m<sup>2</sup> are provided in the table below:

	<u>For 1 credit</u>	<u>For 2 credits</u>
Assumed cycling population	4 (5% of staff)	8 (10% of staff)
Number of secure bike spaces	4	8
Number of lockers in changing rooms	4	8
Number of showers	1	1

The project currently contains secure bicycle racks, one shower and ten lockers.

## 3. MECHANICAL SERVICES

### 3.1 Hydronic Radiant Heating System

The existing cast iron radiator panels are in keeping with the heritage aspects of the School of Mines and are to be retained and relocated where necessary to coordinate with the new furniture layouts. Radiant heating is an efficient means of heating such buildings with high ceilings and significant thermal mass. The associated gas fired boiler plant and pump in the First Floor roof void are relatively new (approx. ten years old) and are to be retained and recommissioned.

The existing single pipe heating water reticulation system is, however, not preferred as this arrangement does not ensure that a uniform heating water temperature is supplied to each radiator panel. We have also observed that the existing pipework is uninsulated in many sections. It has therefore been proposed to generally provide a new insulated two pipe reticulation system, at least for the man risers and trunk pipework. Short sections of single pipe reticulation could be retained subject to examination of its condition in order to help reduce costs. Exposed heating water pipework at high level in the Ground Floor (serving First Floor radiators above) would be finished with continuous smooth UPVC shielding suitable for painting. Pipework serving the Ground Floor radiators would be generally concealed beneath the suspended floor and again retained wherever possible to reduce cost.

The system will be fully recommissioned and the controls modified to integrate with the proposed new natural ventilation and air conditioning strategies discussed below.

### 3.2 Air Conditioning

Air conditioning systems will be provided to maintain comfort conditions within the office spaces at times when heating and natural ventilation measures are inadequate.

Separate variable refrigerant flow (VRF) air conditioning systems are proposed to serve the Ground Floor and the First Floor occupied areas. The associated condensing units will be located on the east side of the property in a ventilated enclosure with suitable maintenance access as per the drawings.

Twin insulated refrigeration pipework would be reticulated to provide heat recovery operation of all connected indoor sections. This arrangement allows for simultaneous operation of different fan coil units in either heating or cooling mode if necessary and improved energy efficiency.

On the Ground Floor, a combination of ducted fan coil units located above false ceilings and floor mounted console units is proposed so that all equipment is readily accessible for maintenance. On the First Floor, ducted fan coil units should generally be able to be mounted above the ceilings within the roof cavity. It appears that practical maintenance access to each of these areas should be able to be achieved.

The use of VRF systems enables the consolidation of outdoor air-cooled equipment into one location. It also enables the connection of multiple indoor sections to give separate thermal zoning of areas with dissimilar heat loads to maintain comfortable internal conditions and in addition permits the future provision of extra units by connection to the same pipework system.

Air distribution to the main Council/Seminar Meeting Room at Ground Floor level poses some specific challenges. Two primary alternatives were considered, the first being underfloor ducting of supply air grilles incorporated into joinery or false wall cavities and the second being console units arranged round the perimeter of the room. The ducted option has now been adopted with supply grilles to be located in the east and west walls, nominally 3m above floor level. The design requires supply and return air risers to pass via the adjacent kitchenette on Ground Floor and the First Floor above to plant within the roof space and assumes adequate space and access being provided for the necessary sub-floor ducting.

An automatic control system will be provided to ensure that the operation of each of the heating, cooling and ventilation systems is straightforward and reliable and avoids the possibility of one system opposing another to maximise operating efficiency.

### **3.3 Natural Ventilation Systems**

The principle of using natural ventilation to provide an acceptable indoor environment during suitable ambient conditions has been discussed in Section 2 under ESD measures.

Low level manually operated openable windows in each classroom will be used as the source of cross flow ventilation in the office areas with air drawn out of these spaces via the corridors and shafts by new roof mounted centrifugal ventilators. The windows are to be refurbished and retrofitted with stays and levers that will enable them to be manually opened and closed by the occupants. This will also limit the extent of window opening for security purposes and ensure that the windows seal effectively when they are closed.

Air will be able to pass to the common corridors via either the classroom entry door openings or the existing highlight windows immediately above these doors. The corridors will in turn be vented by the centrifugal ventilators located at roof level. Some concept designs for suitable venting controlled devices were previously examined in THE Concept Design Report. In simplest terms, negative pressure generated by wind flowing over or around a louvred upstand above roof level will draw air out of the building with make-up air drawn in through the open windows. However it has been decided that for this project, rotating centrifugal ventilators complete with back-up electric motor drive will be used ensuring that ventilation flow is able to be maintained even under still conditions outside. Glazing is also to be integrated into the upstand venting device (lantern) to provide daylighting as previously described and indicated in Appendix 3.

Concepts have also been indicated for separately venting the Ground Floor. The project Building Surveyor has confirmed that there is no requirement for maintaining fire separation of the Ground and First Floors. A single venting device could therefore be used to serve both levels or alternatively, a separate shaft fitted with a hybrid centrifugal ventilator (as described below) could be provided to assist with cross ventilation of the Ground Floor areas. The latter strategy has been adopted with a dedicated shaft to be constructed immediately north of the new lift shaft.

It is very important, however, that under winter heating conditions warm air is prevented from rising thorough the building and escaping via these venting paths as it would then be made-up by colder air entering through any low level openings thereby increasing heating energy consumption and occupant discomfort. To prevent this, fully sealing motorised dampers must be incorporated into all venting devices such as the proposed lantern/draft vent. All existing local air vents considered for reuse must similarly be fitted with dampers to seal these openings airtight when necessary.

### **3.4 Mechanical Ventilation Systems**

New toilets and amenities are to be provided with ducted mechanical exhaust systems to AS 1668. No kitchen exhaust systems are provided as reheating of food only in the kitchenettes is intended. However, tea room exhaust systems have been provided to serve the kitchenettes and the staff lounge kitchen.

As noted above, hybrid centrifugal ventilators of the type included in Appendix 2 have also been included to assist venting from the Ground and First Floor office areas under cross ventilation mode. These ventilators can operate either in unpowered mode during suitable wind conditions or driven by an inbuilt low power electric motor if required to maintain a minimum exhaust airflow during relatively still conditions.

### **3.5 Smoke Management Systems**

There are no existing smoke management systems in the building and subject to confirmation by the project Building Surveyor, it is not anticipated that any new systems will be required.

### 3.6 Indicative Scope Of Works

The Scope of Works for the Mechanical Services is as follows:

- Modifications to the existing hydronic heating system including new insulated pipework
- Provision of separate variable refrigerant flow (VRF) air conditioning systems to serve the Ground and First Floors using both ducted and console type indoor sections and condensing units located in an enclosure on the east side of the premises.
- Provision of new or modified mechanical ventilation systems to AS 1668 to serve toilets, kitchenettes and amenities.
- Provision of controlled natural ventilation vent dampers and centrifugal ventilators with associated automatic controls to enable cross ventilation of offices and night purging.
- Provision of associated mechanical electrical and controls work.

### 3.7 Preliminary Cost Estimates

Based on the above scope, our preliminary estimate for the Mechanical Services is **\$370,000** excluding GST.

This estimate allows for:

- Separate variable refrigerant flow (VRF) air conditioning systems to serve the Ground Floor and the First Floor (Mechanical drawings show proposed unit locations and configurations). In general these would be ducted units to be concealed within ceiling spaces and roof voids as well as several floor mounted console units to serve the specifically nominated meeting rooms.
- Ducted air conditioning systems to serve most office areas as indicated on the drawings.
- Console air conditioning systems to serve meeting rooms and Mayor's office.
- New insulated pipework and recommissioning of the hydronic heating system.
- Motorised vent dampers and centrifugal ventilators to control natural ventilation modes.
- Mechanical ventilation systems to serve toilets, kitchenettes and amenities.
- Modifications to the existing hydronic heating system including new insulated pipework.

The estimates excludes:

- Natural gas pipework modifications (under Hydraulic Services).
- Replacement or repair of existing central hydronic heating plant.
- Large scale relocation of radiators (limited alterations accommodated).
- Maintenance access walkways, hatches, ladders, etc. (indicated on drawings).
- Louvred enclosure around VRF condensing units on east side of site at Ground Level.
- False ceilings and bulkheads (eg. over the Ground Floor Reception area).
- Internal plant decks (eg. over the First Floor Kitchen/Amenities).
- Repairs to windows to eliminate air leakage when closed.
- Sealing closed of chimneys and all trickle ventilators in building envelope.
- Natural ventilation draft shafts through roof including centrifugal ventilators (refer sketches).
- Insulation of all ceilings with roof voids over.
- Builder's margins and builder's works in association.
- Penetrations in building structure, walls floors and roofs for passage of ducts or pipes.
- Automatic control of make-up air entry openings or openable windows.
- Provision of electronic indication and control system to aid occupants in the operation of the natural ventilation system including Ground and First Floor LED display screens and lights, external temperature and wind speed measurement devices and associated digital controller and cabling.

## **4. ELECTRICAL SERVICES**

### **4.1 Power Supply**

The Electrical power supply serving the Castlemaine School of Mines appears to originate from a below ground street supply in Lyttleton Street.

The preliminary estimated maximum electrical demand for the refurbished building is in the order of 100kVA (140Amps per phase). It is yet to be confirmed that the existing supply has adequate current carrying capacity to serve the proposed refurbished building. An on-site investigation in conjunction with the Council's electrical maintenance contractor has been arranged. Subject to what is found it is possible that the existing underground supply may need to be upgraded by the the supply authority.

The existing incoming supply does not have a Capacity Control Device installed and the Supply Authority may require one to be installed to comply with the Electrical Service Installation Rules. This device allows the Authority to isolate power to the site if necessary and usually is required to be installed at the property boundary.

In some cases the Supply Authority may agree to install the Capacity Control Device adjacent to the existing Main Switchboard and thus negate a Control Device external to the site.

### **4.2 Retail Authority Meters.**

There are two direct wired electrical retail meters serving the existing building.

With the introduction of new smart metering technologies, the existing direct metering arrangement will need to be replaced with a CT metering arrangement. It is proposed to install one electricity retail meter to serve the whole Castlemaine School of Mines building.

### **4.3 Existing Main Switchboard**

The existing main switchboard appears to be in good working order and therefore it is proposed to retain it and provide new earth leakage circuit protective devices to serve all general light and power sub circuits.

### **4.4 General Lighting**

The existing luminaires throughout the building are inefficient, more than likely would not be able to comply with the lighting power density requirements set out in the BCA and are not of a standard to suit the new occupancies.

It is therefore intended to replace the luminaires which complement the architectural features of the building and provide illumination levels that comply with the requirements of AS1680 and Section J of BCA.

In general, continuous suspended extruded natural anodised aluminium luminaires with prismatic Y5 diffusers will be provided throughout. The luminaires have been specified with both downward and upward lighting components to provided some illumination of the ceilings. Currently these lights are shown to be suspended at a height of 3.6m above floor level. Some reduction to this height may be necessary to avoid generating localised bright spots on ceilings directly above luminaires.

The lamps in the luminaires will be high efficiency T5 lamps with addressable electronic control gear. In specific areas such as counters and the like, the general lighting will be supplemented with recessed low wattage LED downlights.

New ceiling sweep fans have been integrated with the lighting layout and will be manually controlled by the occupants.



**Figure 4.1** Suggested typical main building luminaire

#### **4.5 Lighting Control System**

All luminaires are proposed to be controlled by an automatic lighting control system with occupancy and daylight sensors to ensure the luminaires are automatically switched off if the surrounding space is unoccupied or dimmed where there is sufficient daylight. Where appropriate, the luminaires adjacent to windows and skylights will be dimmable to maximise the available daylight harvesting.

The luminaires in the main Council/Seminar Room will be manually dimmable to enable video screening, projection of presentation materials and the like.

#### **4.6 Emergency & Exit Lighting**

Emergency and exit lights will be installed in accordance with the BCA. The condition of the power supply serving the local lighting sub circuits will be monitored so that in the event that the lighting sub-circuit power supply is interrupted, the emergency lights will operate.

#### **4.7 General Purpose Power**

It is proposed to replace all the existing power outlets throughout the building as it is unlikely that any of the outlets are installed in locations that suite the new layouts.

New general power outlets (GPO's) will be provided to suit the equipment and occupants needs. Generally these will be wall or duct mounted outlets but in some specific instances (such as the Council/Seminar Room), floor boxes will be provided.

All power outlets would be labelled to enable circuit identification should the circuit need to be isolated.



**Figure 4.2** Suggested typical C2000 Series DGPO

## 4.8 Metal Cable Ducting

New metal wiring duct is to be installed on perimeter and internal walls where shown on the drawings to enable future flexibility with power and telecommunications outlet (TO) locations. The wiring duct is proposed to be 3 compartment thin profile type and mounted as requested by the Council at bench level. This ducting height will coincide with the integral wiring ducting provided in all workstation screens, enabling power and communications cabling to be run to each workstation position.

At this stage and subject to review of final workstation layouts in consultation with the architect, a soft wired power and data cabling solution is not anticipated to be appropriate.

GPO's & TO's will be mounted on wiring duct with 3.0 metres excess cables so that outlets can be relocated to suit equipment rearrangement. The duct lid shall be clipped into position and able to be removed to enable repositioning of outlets

The power outlets are to be mounted on a mounting block to provide segregation between power and data outlets.

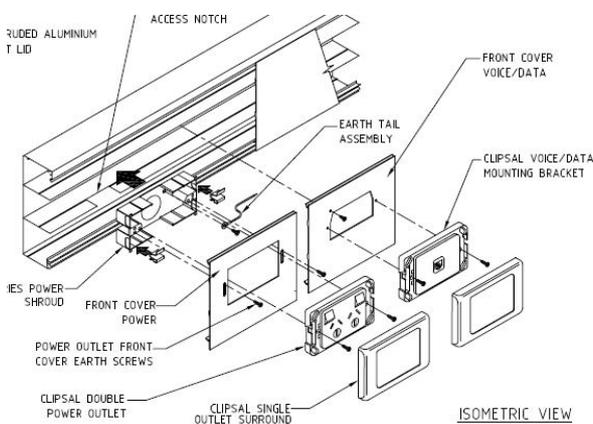


Figure 4.3 Diagram of a typical TAL 50150 Wiring Duct

## 4.9 Structured Communications System

The existing communications cabling system is not able to be reused due to uncertainty of the integrity of the existing system and the existing outlets being located in positions to not suited to the new furniture layouts. The existing telecommunications system is therefore to be replaced as described below.

## 4.10 Telecommunications Rack

A new full height 45RU Telecommunication equipment rack will be installed on the Ground Floor in the nominated Communication Room to serve the School of Mines building. The communication rack will be connected to the existing Main Campus distributor in the existing Town Hall building via an 8 core single mode fibre optic cable and 6 off Cat 6 4UTP gel filled below ground cables for voice services.

The Telecommunication rack will incorporate the following major features:

- Free standing
- 800mm wide x 800mm deep x 45RU high.
- Lockable front and rear door
- Roof mounted exhaust fans
- Cat 6A patch panels
- Cable management rings
- Rear power rail with 10 power outlets

#### 4.11 Telecommunications Outlets

A new structured integrated Voice and Data communication system will be provided throughout the building. The telecommunications outlets (TO's) will be CAT 6A 4 UTP and located to suit the new occupancy. It is intended to provide 3 TO's per workstation as shown on the drawings.

#### 4.12 Security Systems

Passive infrared motion detectors will be documented throughout the building to provide for intruder alarm. We anticipate that this service would be connected back to an existing Town Hall security system and remote monitored.

In the Cost Plan B budget costings, electronic access control of specific nominated doors has been allowed. Provision of a duress alarm has also been allowed.

#### 4.13 MATV and AV Services

We anticipate that MATV outlets will be required by the Council in selected locations and therefore an MATV system with 10 points has been allowed in the budget estimate at this stage.

We also anticipate that in some meeting rooms and in the main Council Meeting/Seminar Room AV facilities will be provided to Council by specialist contractors. Appropriate power and data points to facilitate these services only is to be documented under the Electrical Services.

#### 4.14 Indicative Scope Of Works

The Scope of Works for the Electrical Services is as follows:

- Provision of new metering and upgrade of existing main switchboard to incorporate earth leakage protection.
- Provision of new lighting to serve all areas including corridors, office areas, meeting rooms and amenities including automatic lighting control with dimming and motion detection.
- Provision of new general power reticulation to all areas and to supply new Mechanical Services switchboards and equipment.
- Provision of emergency and exit lighting to the requirements of the BCA.
- Extension of the voice and data communications cabling from the existing Town Hall server to a new rack in the School of Mines building and new structured cabling to communications outlets throughout to suit the new layouts.
- Provision of new MATV services to a total of 10 points.
- Extension of existing Town Hall motion detection security system.
- Extension of existing Town Hall electronic access control system to serve nominated doors.
- Provision of duress alarm t a single location.

#### 4.15 Preliminary Cost Estimate

Based on the above scope, our preliminary estimate for the Electrical Services is **\$400,000** excluding GST.

This estimate allows for:

- Suspended luminaires with electronic ballast.
- Occupancy sensors to control lighting.
- New retail metering arrangement.
- General purpose power outlets to suit the occupancy layout.
- Power supplies for new A/C's.
- Total of 4 off floor boxes.
- New communications equipment rack.
- New fibre link to existing server in Town Hall.
- New Cat 6 4UTP structured cable system (TO's).

- Replacement of existing CB's with RCD breakers.
- Access control for nominated doors.
- Passive motion detection systems.
- Duress alarm.

The estimates excludes:

- Supply Authority charges (existing incoming power supply currently assumed adequate).
- Fire detection systems (Building Surveyor to confirm if required).
- Builder's margins and builder's works in association.
- AV cabling and equipment.
- PABX systems.
- Standby generator equipment.

We suggest that these estimates and notes be read in conjunction with the current CPG and GBA Design Development drawings issued, particularly to ascertain the extent of the associated building works items.

## **5. HYDRAULIC AND FIRE PROTECTION SERVICES**

### **5.1 Sanitary Drainage**

Little of the existing sanitary pipework will remain other than possibly some vents and stacks as it is intended to demolish the majority of the current toilet facilities and replace these with new amenities, in some cases in new locations.

The existing Ground Floor sewer drainage systems will be reconstructed to suit the proposed lowered slab of the Foyer and Reception area and extended to pick up the Staff Amenities to be constructed north of Reception.

### **5.2 Greasy Drainage and Trade Waste Apparatus**

No provision of trade waste apparatus or greasy waste drainage has been made to the premises. We understand that the kitchenette facilities indicated on both the Ground and First Floors will be primarily for the preparation of hot drinks and snacks with possibly some reheating of pre-prepared food but no actual cooking activities.

### **5.3 Potable Water Reticulation**

The existing cold water reticulation would be modified and extended to supply the new amenities and sink locations.

Domestic hot water is currently provided from a gas fired system located on the plant deck in the roof space above the First Floor kitchen and an electric storage unit serving the toilets and amenities on the Ground Floor.

The existing gas system will be upgraded to serve the entire building. This system will be extended and an insulated pumped circulation loop and solar boosting added. Temperature control of hot water to AS3500 will be provided for all outlets.

### **5.4 Rainwater Harvesting and Reticulation of Recycle Water**

Currently there is no rainwater harvesting facilities installed on site. It is proposed that 15,000 litres of above ground storage capacity be provided for use as recycle water primarily for toilet flushing purposes. The preferred tank location adjacent to the NE corner of the building. New stormwater pipework and pumping will be necessary to enable connection to the existing downpipes and capture of rainwater drainage from the roof.

Recycle water will be reticulated to supply all toilet cisterns. Particulate and UV filtration is to be provided to render the recycle water safe for toilet flushing.

Some alteration of roof drainage including gutters and overflows is necessary to accommodate the lantern/draft vents required for the natural ventilation of both floors.

### **5.5 Fire Hydrants and Hosereels**

There are no fire hydrants presently installed in the building. It is proposed to have a new street hydrant provided immediately adjacent to the Town Hall building in Lyttleton Street. This will then provide adequate coverage of the School of Mines building. The available pressures and flows have been assessed and application made to the CFA for this external hydrant to provide an engineered alternative solution to that deemed-to-satisfy under AS2419.

Currently there are fire hosereels and fire extinguishers installed on both levels of the building. These will be retained and modified or supplemented as necessary to meet the requirements of the Building Surveyor.

## 5.6 Fire Detection and Occupant Warning Systems

We have been advised that provision of both these systems is required (subject to confirmation by the Building Surveyor) despite this not being mandated by the applicable standards. As a result these services are currently documented on our Electrical Services lighting layouts.

## 5.7 Fire Sprinklers

Fire sprinkler systems are not installed at present and are not anticipated to be required.

Confirmation is needed from the project Building Surveyor that for the new usage, occupancies, escape distances and building construction (timber floors, etc.), provision of sprinklers is not required. A fire engineering analysis and report may be necessary in order to make this assessment.

## 5.8 Natural Gas Reticulation

Currently there is a small gas meter located external to the building at the north western corner and another larger meter is located at the north western corner of the rear car parking lot. Natural gas is reticulated to the gas-fired hydronic heating system boiler plant and DHW system which are located on a deck in the roof void above the existing First Floor kitchen.

The Mechanical Services refurbishment strategies proposed are not expected to result in any additional demand for gas. The hydronic heating system is to be retained and used in conjunction with natural ventilation and heat recovery reverse cycle air conditioning systems. It is also not intended to supply gas to the kitchenette facilities on both levels.

Additional gas demand may arise from the proposed central solar boosted gas fired DHW system. The total gas demand will be assessed to verify that the existing supply and metering are adequate.

## 5.9 Indicative Scope Of Works

An indicative Scope of Works for the Hydraulic & Fire Protection Services would be as follows:

- Modification and extension of the existing sewer and vent pipework and stacks to suit the new amenities to be constructed and the new floor level of the Ground Floor reception area.
- Upgrade of existing or provision of new stacks and vents as required.
- Demolition of redundant services.
- Modification and extension of cold water reticulation to the new fixtures.
- Provision of new fire detection and alarm system to the requirements of the Building Surveyor.
- Provision of gas-boosted central solar domestic hot water system with reticulated ring main.
- Revisions to fire hoses to authority requirements.
- Modification and extension of existing natural gas reticulation to new DHW plant.
- Provision of rainwater harvesting storage tanks and filtration systems.
- Provision of recycle water reticulation to all toilet cisterns.
- Provision of new fire hydrant adjacent to the Town Hall.

## 5.10 Preliminary Cost Estimate

Based on the above scope, our preliminary estimate for the Hydraulic/Fire Services is **\$140,000** excluding GST.

This estimate allows for:

- Demolition of redundant fixtures and pipework.
- New sanitary fittings and fixtures including new kitchenette sinks.
- Combined under-bench chilled/boiling/ambient water units at sinks.
- Provision of fire extinguishers and fire blankets.
- Gas-boosted central solar domestic hot water system and ring main.

- 15kl total capacity rain water tank and recycle water reticulation to cisterns complete with cartridge and UV filtration.
- Alterations to existing fire hose reel provisions to the satisfaction of the building surveyor.
- Provision of new street hydrant located adjacent to the Town Hall to provide adequate coverage of the School of Mines building (subject to CFA confirmation).

The estimates excludes:

- Supply Authority charges other than noted above.
- Builder's margins and builder's works in association.
- Greasy drainage and trade waste apparatus.
- Fire sprinkler systems.
- Provision of new internal fire hydrants or booster pumps (subject to CFA confirmation).
- Upgrading of any external Authority mains or services to suit.

We suggest that these estimates and notes be read in conjunction with the current CPG and GBA Design Development drawings issued, particularly to ascertain the extent of the associated building works items.

## **6. APPENDICES**

The following information is appended for reference and information purposes:

**6.1 Appendix 1: 9AM AND 3PM WIND ROSES FOR WARMER MONTHS**

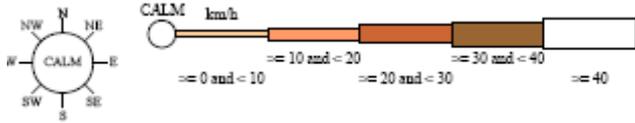
**6.2 Appendix 2: CENTRIFUGAL HYBRID ROTARY VENTILATOR**

**6.3 Appendix 3: LANTERN/DRAFT SHAFT DESIGN**

**6.4 Appendix 4: DESIGN DEVELOPMENT SERVICES DRAWINGS**

## **APPENDIX 1**

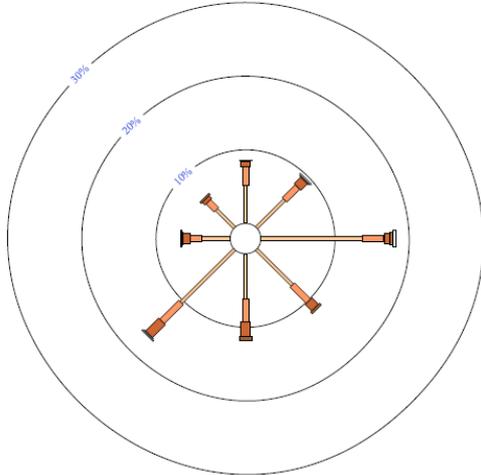
### **9AM AND 3PM WIND ROSES FOR WARMER MONTHS**



### 9am Windroses for warmer months

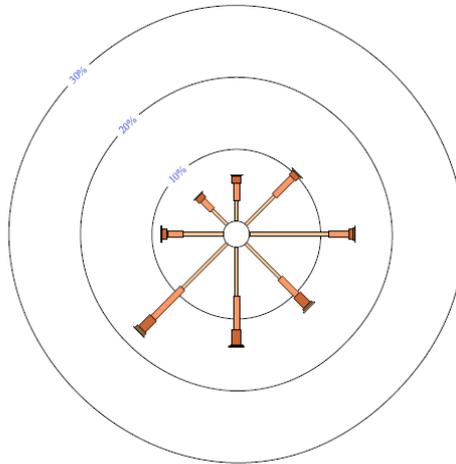
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 1196 Total Observations

Calm 10%



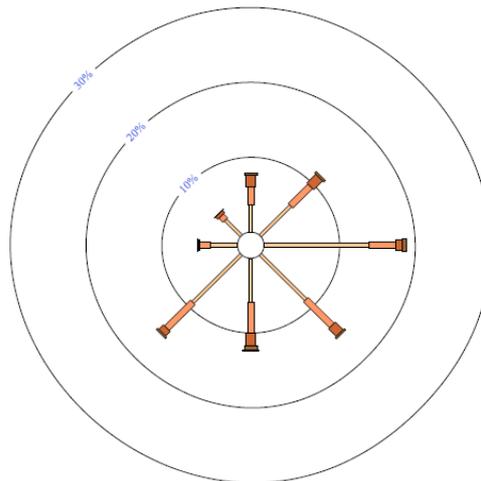
9 am Dec  
 1263 Total Observations

Calm 9%



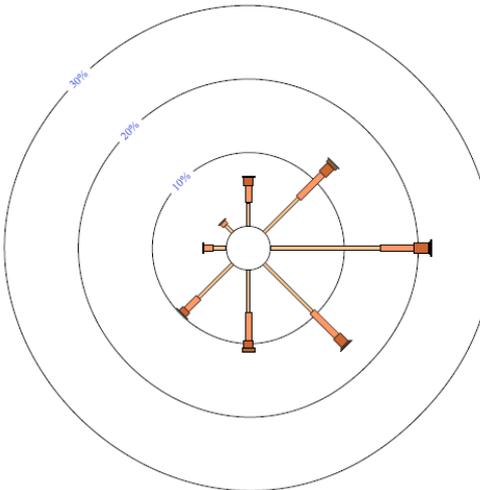
9 am Jan  
 1165 Total Observations

Calm 9%



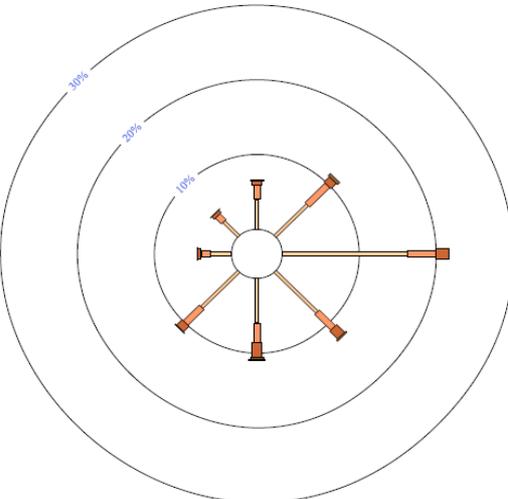
9 am Feb  
 1064 Total Observations

Calm 15%



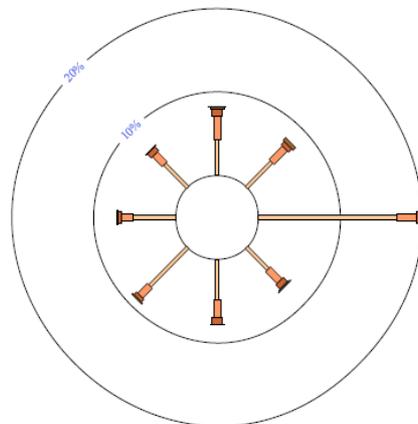
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 1214 Total Observations

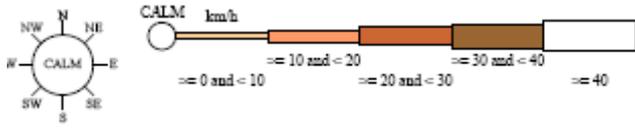
Calm 17%



9 am Apr  
 1186 Total Observations

Calm 26%

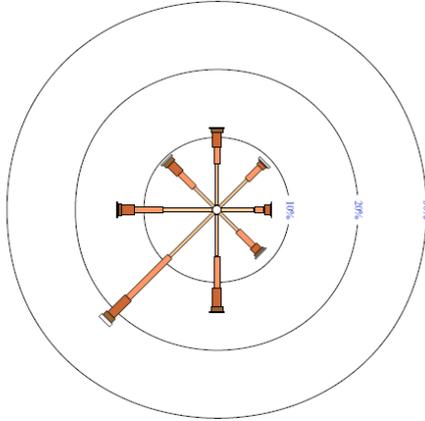




### 3pm Windroses for warmer months

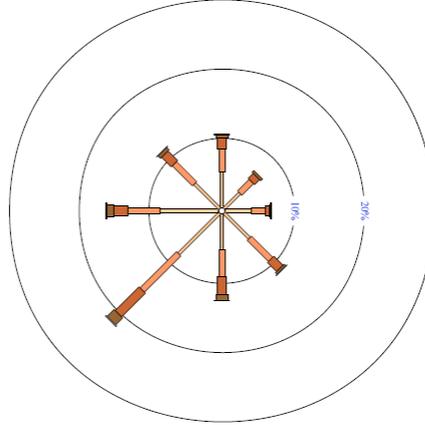
3 pm Nov  
 1189 Total Observations

Calm 3%



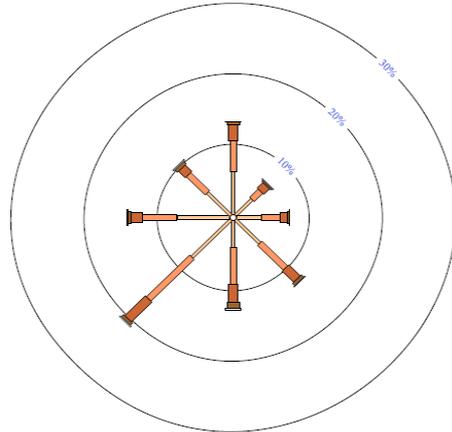
3 pm Dec  
 1254 Total Observations

Calm 2%



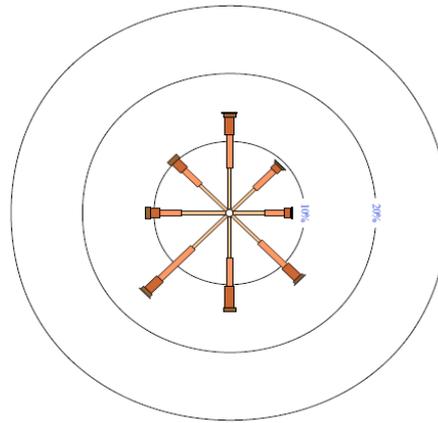
3 pm Jan  
 1140 Total Observations

Calm 2%



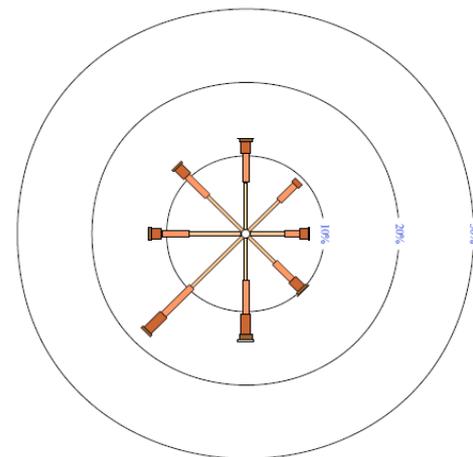
3 pm Feb  
 1046 Total Observations

Calm 3%



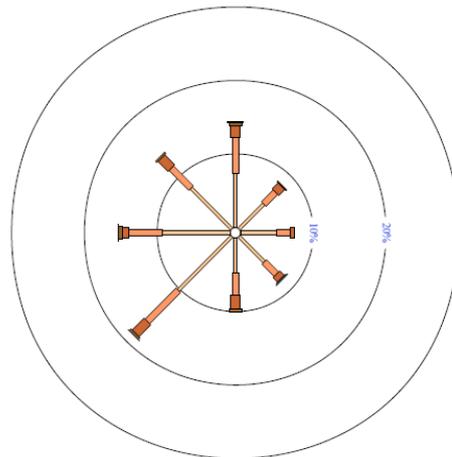
3 pm Mar  
 1175 Total Observations

Calm 3%



3 pm Apr  
 1139 Total Observations

Calm 3%

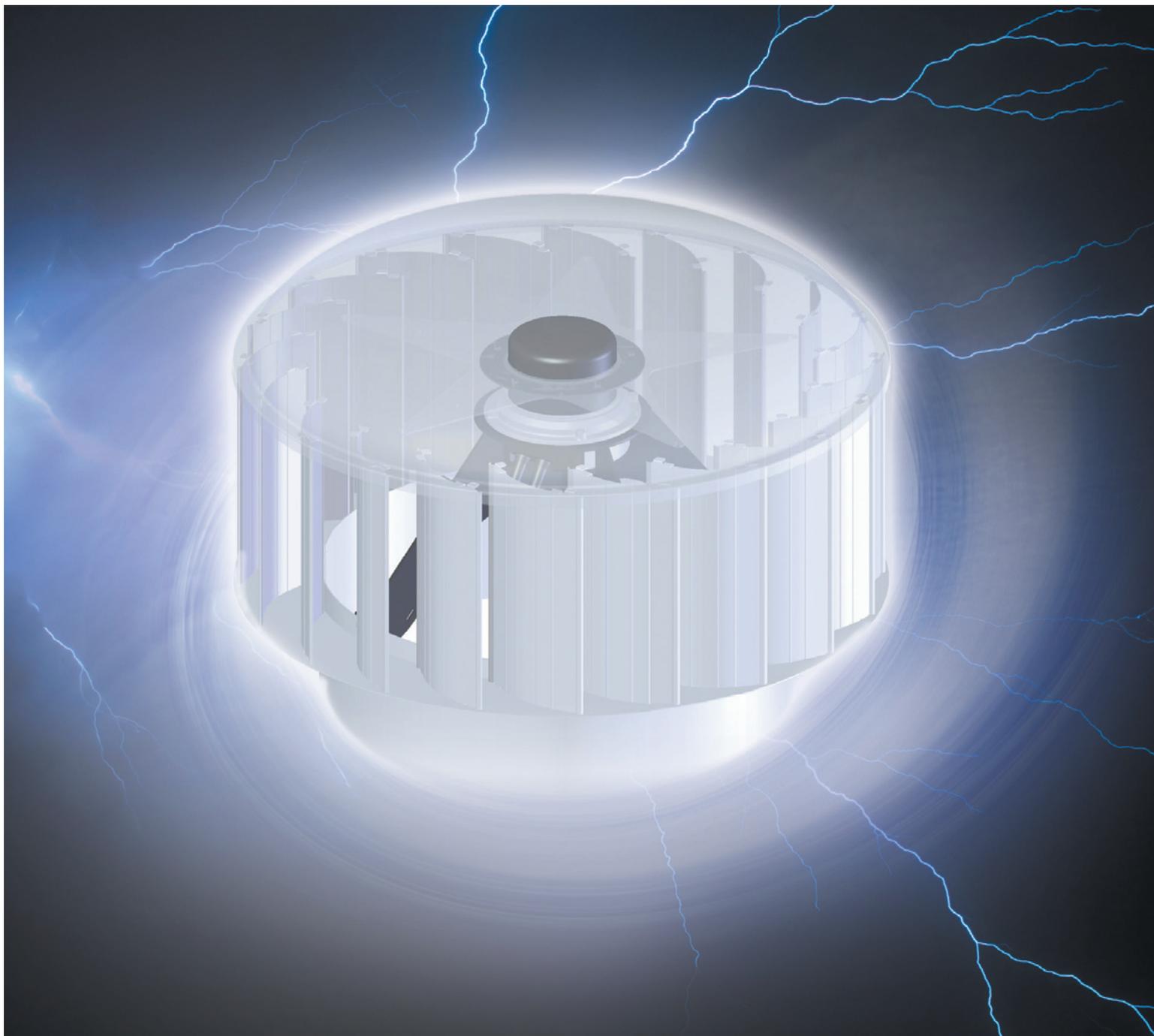


## **APPENDIX 2**

### **CENTRIFUGAL HYBRID ROTARY VENTILATOR**

**ecopower**<sup>®</sup>

# A REVOLUTION IN VENTILATION



Clean, fresh air. You'd think it would be something we all have the right to expect in our homes and work places and yet so often this isn't the case. Inadequate ventilation can lead to the build up of heat, moisture and even potentially harmful chemicals in the air that we breathe inside our buildings every day.

The revolutionary **ecopower**<sup>®</sup> from Edmonds is a hybrid roof vent developed to ensure a constant supply of fresh air with minimum energy use. It combines natural ventilation with a computer controlled, high efficiency electric motor in a single unit to ensure consistent air quality and guaranteed performance when you need it.



## ecopower<sup>®</sup> – TRUE HYBRID VENTILATION

The **ecopower**<sup>®</sup> can operate in either natural or power mode alone or in both simultaneously.

The natural ventilation mode functions through two processes. The first allows hot air to escape as a result of 'stack effect' buoyancy pressure. Hot air in the building rises and is released through the vent to be replaced by cooler ambient air.

The second process results from the wind driving the impeller unit, thereby creating flow through centrifugal suction.

The efficient power mode allows natural flow rates to be boosted by powering the Electronic Commutating (EC) motor to drive the impeller.

This provides on demand response to boost flow rates during periods of low wind speed or special ventilation needs.

In power mode, **ecopower**<sup>®</sup> has a flow rate 3-5 times greater

than the equivalent size natural ventilator operating at average Australian capital city wind speeds.

What makes the **ecopower**<sup>®</sup> revolutionary is its patented design. The **ecopower**<sup>®</sup> design allows the wind turbine itself to be used as a centrifugal impeller, no separate fan is required when running in powered mode. The motor is installed in a direct drive configuration to the impeller, ensuring minimum flow obstruction for maximum air movement. It also results in lower maintenance costs.

The bearing system of the motor functions as the bearing system of the ventilator. This means that the vent can be free spinning under wind load or power activated as conditions require.

The motor can be activated by a simple manual switch or operation can be controlled by any digital measure, such as temperature, humidity, gas concentration level etc.

### Benefits of ecopower<sup>®</sup>

**ecopower**<sup>®</sup> offers customers the following unique benefits:

- **High efficiency ventilation at all times**
- **Low energy costs**
- **Significantly lower noise levels than axial fan vents**
- **Advanced German EC motor technology**
- **Edmonds vertical vane vent technology for higher performance\***
- **Light weight**
- **Single-phase power and low voltage (selected models) for easy electrical installation**

\* Flow coefficient tests performed under AS4740:2000 by Edmonds.



# AWARD WINNING DESIGN

The unique design of the **ecopower**<sup>®</sup> combines a number of innovative features to ensure its incredible efficiency.

## Open throat

Unique among hybrid vents, **ecopower**<sup>®</sup> has **no separate axial fan in the throat** allowing unparalleled airflow. Research using AS4740:2000 (Performance of Natural Ventilators) has shown clearly that any obstruction in the throat of a natural ventilator will greatly decrease vent performance. The level of flow reduction can be 40% or greater. Also, axial fans located in the throat of wind vents can produce significant noise levels.

## Dual bearing function

The direct drive centrifugal design means the bearing system of the motor functions as the bearing system of the ventilator. This means that the vent can be free spinning

under wind load or power activated as conditions require.

## Electronic Commutation motor

The use of an innovative Electronic Commutation (EC) motor ensures that the best energy efficiency features available are factored into the product design and also results in low maintenance.

## Intelligent speed control

The **EP900** model incorporates intelligent speed control. This allows a simple sensor to be connected for full feedback control of the motor. This can in turn be connected to a computer for ease of programming.

# PERFORMANCE

The **ecopower**<sup>®</sup> has been developed to provide the highest levels of performance. When compared with similar sized axial roof fans, **ecopower**<sup>®</sup> has demonstrated extraordinary energy efficiency under power load, requiring up to 76%

less power to maintain the same extraction rate.

The **ecopower**<sup>®</sup> also operates at a new level of quietness running at levels up to 14.5dB(A) lower than traditional mechanical axial fans.

Product	Exhaust Rate [m <sup>3</sup> /hr]	Power [W]	Noise @ 3m [dB(A)]
300mm, 2p, 1Φ - Axial fan	2160	160	55
EP400	2400	68*	46
<b>Improvement</b>		<b>63% lower</b>	<b>9 dB(A) lower</b>
450mm, 4p, 1Φ - Axial fan	4280	480	60
EP600	4280	116*	49
<b>Improvement</b>		<b>76% lower</b>	<b>11dB(A) lower</b>
630mm, 6p, 3Φ - Axial fan	9000	1000	60
EP900	10000	260*	45.5
<b>Improvement</b>		<b>76% lower</b>	<b>14.5dB(A) lower</b>

\*Power consumption can be reduced by up to 20% by prevailing winds of 30km/hr when in powered mode.

# ENERGY SAVINGS

The example below demonstrates the running cost savings and CO<sub>2</sub> emission reductions available in a typical 10 unit installation compared to mechanical axial vents. In this example energy and greenhouse gas reductions of 75% are achieved, this equates to a \$1,763 annual energy saving and an annual greenhouse gas emissions reduction of 12.3

tonnes based on the use of coal fired electricity.

The **ecopower**<sup>®</sup> not only uses less power in powered mode, but can also run for a shorter period due to the availability of continuous ventilation in natural mode. This allows for similar air change rates over a 24 hour period compared to the mechanical unit, which must run for a longer period.

Product	Number of Units	Exhaust Rate	Run Time	Annual Energy Consumption [kWh]	Annual Energy Cost @ 10c/kWh	CO <sub>2</sub> emissions @ 700g/kWh [tonnes]
EP600	10	Same	8hrs power 16hrs natural	3387	\$338.70	2.4
Standard Mechanical Axial Roof Fan Unit	10	Same	12hrs on 12hrs off (no ventilation)	21024	\$2102.40	14.7

# APPLICATIONS

The economy of natural ventilation combined with the reliable high extraction rates of a highly efficient powered ventilator make **ecopower**<sup>®</sup> ideal in a wide range of applications including:

## School classrooms

The **ecopower**<sup>®</sup> energy efficient hybrid ventilator was originally designed for classroom applications. When ducted to the ceiling it allows natural ventilation of a classroom during the day to meet air quality standards (AS1668.2). The powered mode can then be activated by a timer later in the day to purge the room of heat build up and allow replacement by cooler night air. The cooler air settles into structures, providing thermal storage and helping to neutralise heat build up the following day. This results in more comfortable classrooms, reduced air-conditioning load and lower energy costs.

The low operating noise of **ecopower**<sup>®</sup> ensures it will not impact residents living close to schools, even during late evening.

## Factories and storage facilities

**ecopower**<sup>®</sup> provides reliable ventilation that can be controlled by a range of inputs to ensure the comfort and safety of personnel within these facilities. The sensor control feature allows the **ecopower**<sup>®</sup> to provide high performance

natural ventilation which is power-boosted when certain conditions exist, such as higher temperatures or gas concentration levels.

## Ventilation shafts on multistorey buildings

Noisy and relatively inefficient 3 phase powered ventilators have traditionally been used in these applications.

**ecopower**<sup>®</sup> offers a high efficiency option with lower running costs and reduced environmental impact, along with lower operating noise levels.

## Auditoriums and indoor sports facilities

**ecopower**<sup>®</sup> allows energy free wind driven operation during periods of lower ventilation demand with the option to switch to power mode and significantly increase the rate of extraction during high usage periods.



To find out more, call your local Edmonds Ventilation Specialist on **1300 858 674**  
or visit **[www.edmonds.com.au](http://www.edmonds.com.au)**

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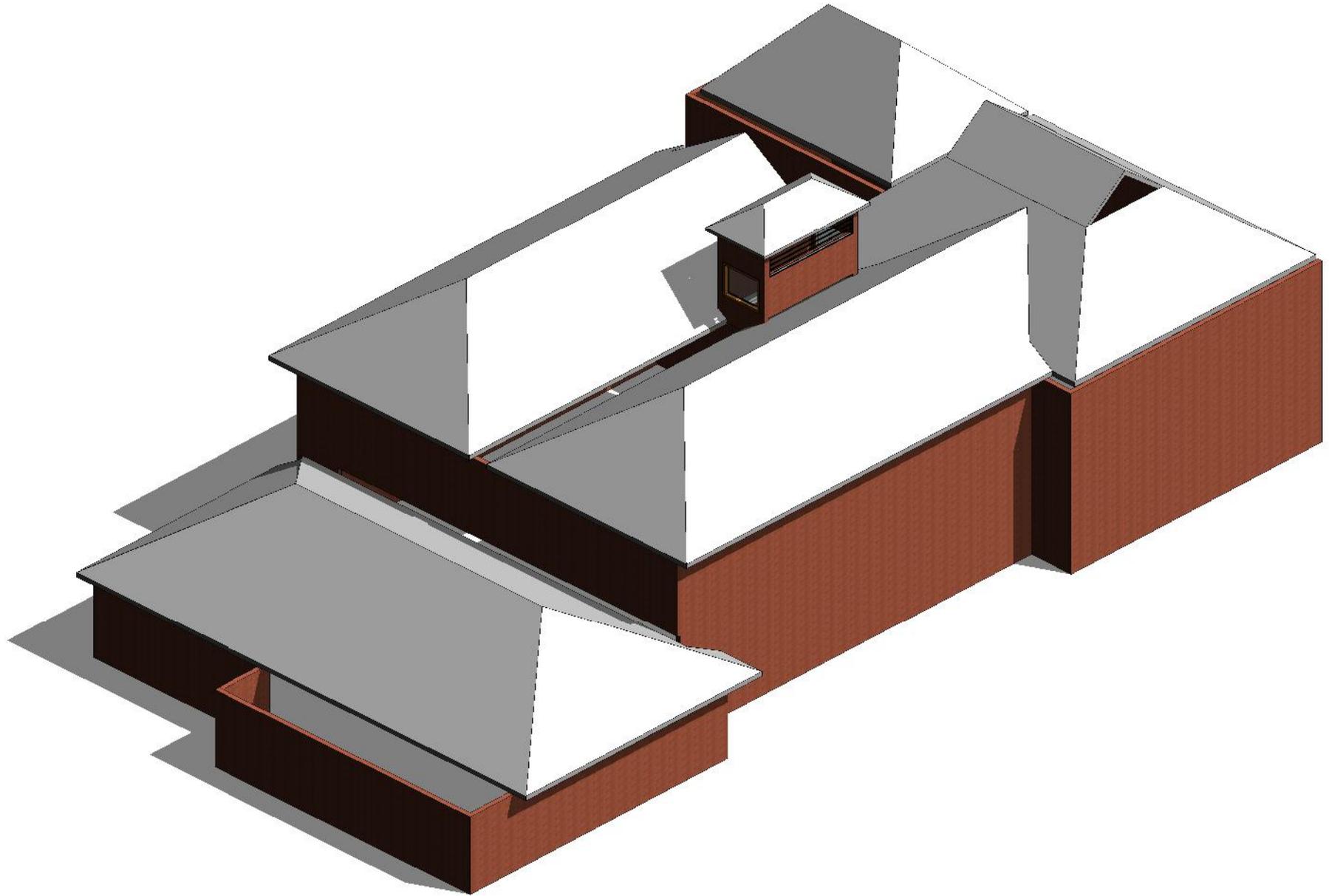
## **APPENDIX 3**

### **CONCEPTUAL VIEWS OF LANTERN/DRAFT SHAFT**



1

North East Isometric View



1

North West Isometric View

## **APPENDIX 4**

### **DESIGN DEVELOPMENT SERVICES DRAWINGS:**