

CRI Australia for Cochlear



Cochlear Global Headquarters, Macquarie University ESD Report

Issue C

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Contents

1	Executive Summary	1
2	Building Description	2
3	ESD Statement	3
4	Green Star	4
5	Green Star Rating	5
6	ABGR.....	6
7	Passive Energy Efficient Design.....	7
	7.1 Building Form	7
	7.2 Glazing	7
	7.3 Sun shading	8
8	Other ESD Measures.....	9
	8.1 Building Users Guide.....	9
	8.2 Commissioning	9
	8.3 Construction Waste Management	9
	8.4 Recycling Waste Storage	9
	8.5 Cyclist Facilities	10
9	Building Services	11
	9.1 Mechanical Services	11
	9.2 Electrical Services	13
	9.3 Hydraulic Services.....	15
	9.4 Fire Protection Services	17
10	Appendix A	18
11	Appendix B	19

1 Executive Summary

This report highlights Ecologically Sustainable Design principles applied to the development of Cochlear Global Headquarters, Macquarie University. The report gives descriptive consideration to the ESD principles including efficient usage of energy, indoor environment quality.

The building will achieve a Green Star rating of 4 star, which represents best practice and an ABGR (Australian Building Greenhouse Rating) of 4.5 star.

To achieve a 4 star rating a minimum score of 45 is required. For Cochlear Global Headquarters 49 points have been claimed with another 21 potential points to be confirmed. We recommend a buffer of 7 points giving a weighted score of 52. The need for a buffer is due to the assessment process being highly thorough and it is likely some points will be lost during evaluation by GBCA.

The building has been designed with water conservation in mind. 85% of all points associated with water conservation have been achieved. A rainwater tank that collects the water run off will be installed. When the tank is full it will be capable of supplying the toilets and urinals for 20 days.

Adequate cyclist facilities for 10% of the building staff will be supplied with visitor bicycle storage outside the main entrance.

The thermal performance of the building has been assessed using an approved 3D thermal modelling program called IES Virtual Environment. The model parameters are based on ABGR's Validation Protocol for computer simulation. Below is a summary of the energy figures calculated.

Annual energy consumption to be estimated per square metre of total FSA and per major function.	Function		Totals kWh/yr/m ² FSA
	Area		22,536
	Heating		0.97
	Cooling		17.95
	Ventilation		32.41
	AC Auxiliaries		2.79
	Hot/Cold water pumps		1.29
	Base Building		15.17
	Lighting (inc external)		7.29
	Tenant Plant		15.38
Total		93.25	
Tabulation of the estimated base building annual fuel and energy supplied to the site to satisfy development needs.	Total electricity	kWh/yr	2,273,279
	Total gas	MJ/yr	190,458
	Total energy	kWh/yr	2,326,184

2 Building Description

The project involves the construction of a new 6 story building (inc. ground floor) to be used as the new Cochlear Global Headquarters.

The building will comprise two levels of basement car park with essential plant and equipment located in a three plant rooms on the roof.

The building is predominantly made up of precast panelling and double glazed curtain walls for the north and south facades. “Book Ends” with double glazing are used on the East and West Façade. Internal partitioning walls are plasterboard and the floors are concrete. Refer to Architectural plans for specific details.

For details of all windows and balcony doors throughout the project refer to architectural plans prepared by Toland Williams.

This report should be read in conjunction with the architectural plans and details as prepared by Toland Williams, which are not attached to this report.

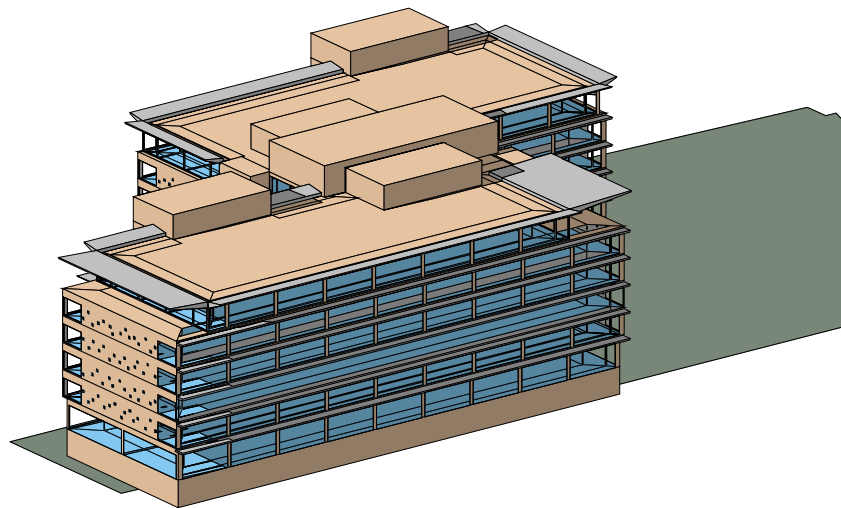


Fig 2.1: 3D Model of Cochlear Global Headquarters

3 ESD Statement

This report highlights the ecologically sustainable design principles in the development of Cochlear Global Headquarters, Macquarie University. The appropriate design principles and guidelines for energy conservation and ESD measures shall be applied to the whole building to generate an ecologically friendly building, ensuring at the same time, a high quality of comfort for the occupants. The design shall address the issues of management, indoor environment quality, energy consumption, transport, water consumption, land use and ecology, and emissions.

The building will achieve a Green Star rating of 4 star which represents best practice and an ABGR (Australian Building Greenhouse Rating) of 4.5 star.

The building shall be suitably designed and selected considering present worth analysis of the investment options, energy efficiency, indoor environment quality, ecologically sustainable design principles, and good engineering practice. The project shall be designed to the level of a Grade A building.

To produce a 4 star Green Star and a 4.5 star ABGR building, the awareness of ESD principles must not be restricted to the design phase, but must be carried over into the construction, commissioning, operating and maintenance phases. It is also important that a similar attitude be adopted by the management infrastructure and tenants.

4 Green Star

The Green Star design tool is an Environmental Rating System for buildings to introduce the elements Environmentally Sustainable Design for a Green Building.

The project was evaluated against eight environmental impact categories, plus innovation. Within each category, points are awarded for initiatives that demonstrate that a project has met the overall objectives of Green Star and the specific criteria of the relevant rating tool credits. Points are then weighted and an overall score is calculated, determining the project's Green Star rating. The environmental categories are;

- Management
- Indoor Environment Quality
- Energy
- Transport
- Water
- Materials
- Land Use and Ecology
- Emissions

The assessment adhered strictly to the requirements prescribed in Green Star Technical Manual - Office Design V2. Technical Manual is a key element of the Green Star rating system. It provides detailed descriptions of each credit and is essential for projects seeking certification. Technical manual provides the following supporting Information for each credit:

- Aim of Credit,
- Number of Credits Available,
- Credit Criteria,
- Compliance Requirements,
- Additional Guidance,
- Background Information, and
- References & Further Information Sources.

5 Green Star Rating

The current predicted rating using Green Star Office Design V2 is a 4 star rating, which signifies best practice.

To achieve a 4 star rating a minimum score of 45 is required. For Cochlear Global Headquarters 49 points have been claimed with another 21 potential points to be confirmed. These additional points to be confirmed cannot be determined at this stage of the process but with further investigation it will be possible to achieve some of these points to bring the project up to a comfortable safety margin.

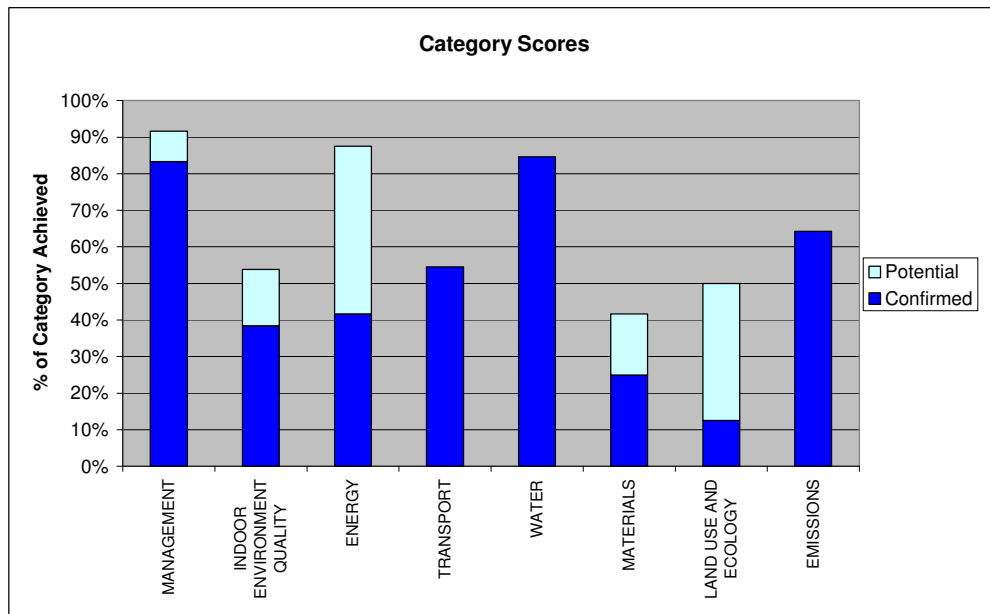


Fig 5.1 Graph of Achieved Score for each Category

6 ABGR

The current predicted rating for ABGR is 4.5 star. The building was modelled using the computer software IES Virtual Environment. The computer model was created using the ABGR Validation Protocol for computer simulations.

The building has been modelled using the latest Architectural drawings and uses values based on the current services design. A safety factor of 10% has been applied to the energy calculations.

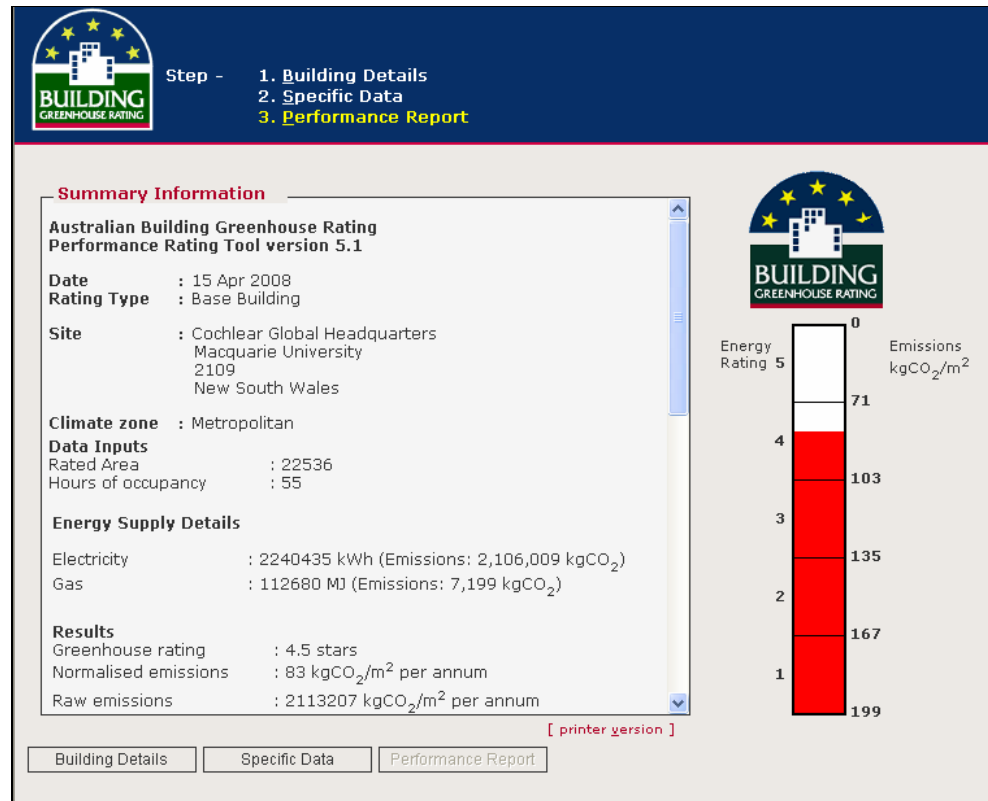


Fig 6.1: ABGR Rating

7 Passive Energy Efficient Design

Passive systems are those in which internal conditions are modified as a result of the behaviour of the building form and fabric. There are appropriate passive strategies for lighting, heating and cooling. The degree of emphasis placed on each in the design of a building depends on the orientation and climate in which the building is to be located. Such aspects of this building shall become the responsibility of the architect and other like designers.

The objective of the passive design section is to assess the strategies developed to improve the performance of the passive elements. Addressed within the passive design are the following systems:

7.1 Building Form

The building will be located at Macquarie University. All commercial office suites will be susceptible to the solar environment during certain times of the day. The building has been designed to minimise the east and west peak loads by reducing the east and west façade.

Incorporation of appropriate amounts of thermal mass, use of insulation and provision for ventilation are important design features in passive heating and cooling strategies and will continue to be developed for the new building. The insulation will meet the Section J requirements and will be low ODP.

7.2 Glazing

The glazing openings will provide good natural light within the commercial office suites.

Appropriate treatment of the glazing will ensure reduced levels of solar penetration as well as maintaining high levels of transmissivity. The Glazing scheme involves a ratio of glazing to northern façade to improve the indoor environment quality. The east and west facades have a lower ratio to reduce the peak energy demand. Occupant controlled internal blinds will be used to reduce glare throughout the day.

7.3 Sun shading

The building has sun shading schemes on the northern façade from Ground level to level 4. On level 5 there is a shading scheme on all facades. This controls the level of solar radiation penetrating the glass and reduces the direct light penetration throughout the peak times of the year.

The northern shading scheme from ground level to level 4 consists of a 1.2m overhang with 600mm, 30° horizontal louvres. Ground level and level 1 have a 3 louvre scheme and levels 2 to 4 have a 2 louvre scheme. The overhangs on the north façade are to decrease the load on the thermal mass in the building, particularly in the mid summer afternoons. The louvres are to decrease winter load and to reduce the glare in the winter due to the low lying sun.

8 Other ESD Measures

8.1 Building Users Guide

A Building User's Guide which includes information on Energy and Environmental Strategy, Monitoring and Targeting, Building Services, Transport Facilities, Materials and Waste Policy, and Expansion/Re-fit Considerations will be supplied.

8.2 Commissioning

There will a contractual requirement with the contractor to have an Environmental Management Plan (EMP) and have an ISO 14001 Environmental Management System Accreditation applicable to the building.

The client will be committed to a firm 12 month commissioning building tuning period after handover with minimum of quarterly reviews.

8.3 Construction Waste Management

A comprehensive waste management plan will be implemented with 60% of all waste by weight being recycled or reused. A dedicated on-site waste management area will be established to sort and segregate the waste. Waste skips or bins will be provided for the following materials;

- Cardboard
- Timber
- Metal
- Soft Plastic
- Polystyrene
- Insulation
- Concrete
- Glass
- Bricks

Records will be kept by the contractor to demonstrate the actual percentage of waste recycled.

8.4 Recycling Waste Storage

A dedicated storage area will be provided for the separation, collection and recycling of office consumables. The storage area will be located in the basement next to the lift shaft to provide easy access for all building occupants and recycling companies.

The storage area will provide recycling bins for the following waste streams, paper, glass, plastics, metals and organic (compost) materials.

8.5 Cyclist Facilities

Secure cyclist facilities will be provided to accommodate 10% of the building staff. The facilities will include secure bicycle storage and lockers, accessible showers with changing facilities.

Visitor bicycle storage will be provided in an assessable location, signposted near the main public entrance.

- System components are not undersized – correctly sized pipes and valves reduce pressure drop thereby reducing energy consumption of the associated plant equipment;
- Economy cycle operation of all air handling plants.
- The noise levels of the building services will meet the recommended design sound levels provided in Table 1 of AS/NZS 2107:2000.
- Cooling towers will be selected with water treatment that achieves six cycles of concentration or better.

9.1.3 Ventilation

Mechanical ventilation systems are provided as required by AS 1668.1 & 2 and the BCA. Fan systems will minimise environmental impact and increase indoor environment quality by ensuring;

- High efficiency motors are considered where fans are constantly running.
- Fans are correctly sizes to suite the needs.
- Variable speed drives are proposed where fans do not require full loaded all the time.
- CO monitoring for carpark ventilation systems.
- Ductwork systems and components are not undersized – appropriately sized ductwork and balancing dampers reduce pressure drop thereby reducing energy consumption of the fan motor;
- Smart diffuser layout to achieve an air change effectiveness greater than 0.95.
- The tenant exhaust riser will allow for noxious fumes from print rooms to be exhausted.
- 50% improvement on AS 1668.2 for fresh air supply.

9.1.4 Controls

The mechanical services system includes a DDC base BMS for all the mechanical systems control. The BMS is to incorporate features that can substantially reduce energy consumption. The features include:

- Variable chilled water, condenser water and hot water flow systems.
- Variable flow for cooling tower system.
- Variable Air Volume (VAV) air handling systems.
- Variable carpark ventilation systems.
- Twelve months advance programming with quarterly reviews during the first year of operation.
- Automatic adjustment of times at the start and finish of daylight saving.

9.2 Electrical Services

The electrical services have been designed to achieve a Green Star rating of 4 and an ABGR rating of 4.5 stars, the following includes design parameters and information on the aspects of the mechanical systems that help to minimise environmental impact and increase indoor environment quality.

9.2.1 Lighting

All lighting is to be designed and selected on the basis of maximising lamp life, minimising energy consumption and improving indoor environment quality. The lighting mixture of metal halide, LED, linear fluorescent and compact fluorescent luminaires is to be designed to suit the functional requirements of the space and not be excessive. Switching arrangements for lighting will be such as to permit illumination in an efficient manner with zonal switching. Design features include:

- Lighting performance and loss factors are in accordance with AS 1680.1 Section 12. The provision of illuminance and loss factors in excess of these recommendations are wasteful of energy: additional cooling capacity (with consequent additional energy use) would be required to remove the heat generated by luminaires in air conditioned spaces;
- Integration of artificial lighting with daylight. Where appropriate controls are to take into account where the option to reduce or turn off entire areas upon adequate daylight.
- High Frequency Ballasts for fluorescent luminaires will be used.
- Lighting levels will comply with the requirement of AS1680. 320 Lux will be achieved within open plan office areas.
- Lighting power densities will not exceed 8W/m² for 95% of the NLA
- All individual or enclosed spaces will have individual switches.

9.2.2 Controls

The electrical services system includes programmable controls and local switches. These programmable controls and switches incorporate features that can substantially reduce energy consumption. Design features include:

- Control devices such as local switches, time switches, light sensing devices or movement sensing devices, where appropriate, are to be utilised, thereby restricting the unnecessary use of lighting;
- Electrical sub-meters will be used on all substantive energy uses (greater than 100kVa) and tenancy sub-meters will be provided for all floors and tenancies.
- Twelve months advance programming with quarterly reviews during the first year of operation; enabling automatic adjustment of times at

the start and finish of daylight saving, shutdown of the lighting on public holidays.

9.3 Hydraulic Services

The hydraulic services have been designed to achieve a Green Star rating of 4 and an ABGR rating of 4.5 stars, the following includes design parameters and information on the aspects of the hydraulic systems that help to minimise environmental impact.

9.3.1 Cold Water

- Water efficient taps and faucets to be considered throughout the development to restrict flow to the outlets and therefore conserve water consumption.
- The maximum working water pressures will be controlled via adjustable pressure reduction valves.

9.3.2 Hot Water

- Hot water generation for commercial office suites will consist of a centralised gas fired hot water storage systems
- Hot water generation for commercial office suites will consist of a gas boosted central hot water plant will be located in the roof top plant room, will heat the domestic hot water to 65 °C and reticulate via a balanced flow and return pipe system to all hot water consuming fixtures within the building core and Change rooms amenities in the basement. Secondary Circulators will ensure hot water temperature in the system is maintained at min.60 °C. The hot water plant will have adequate capacity to meet the highest demand spread over a 60 minute peak period.
- Temperature control of hot water to personal hygiene fixtures (basin, bath & shower) shall be in accordance with the intent of AS 3500.4
- Accessible toilets will be provided with thermostatic mixing valve to control hot water temperature to all personal hygiene fixtures at 42 deg C.
- Male and female toilets change rooms amenities will be provided with thermostatic mixing valves to control hot water temperature to all personal hygiene fixtures at 50 deg C
- Water efficient taps and faucets to be considered throughout the development to restrict flow to the outlets and therefore conserve water consumption;
- Hot water pipework to be lagged throughout the development to conserve energy (heat) losses via pipework.

9.3.3 Sanitary Fixtures and Tapware

- All tapware and/or outlets to incorporate flow restriction. All spouts to terminate with aerators.
- All shower and basin tapware to be “AAA” water consumption rating.
- All WC cisterns to incorporate dual flush.
- All Urinal cisterns to be operated via proximity activation sensors.
- All tapware for basins, sinks and showers to incorporate ceramic disc valves, either “single lever mixers” or “half turn”, with adjustable or fixed flow settings.

9.3.4 Internal Stormwater Plumbing & Drainage

- All roof water run-off will be collected via a rainwater collection tank this water will then be distributed to the toilets, urinals and irrigation. When the tank is full it will be capable of supplying the toilets and urinals for 20 days.
- Tank overflow will discharge into the surface stormwater collecting system prior discharging to the OSD tank and GPT
- All basement areas to be collected and discharged via an gravity oil separator before discharging into the external gravity stormwater system

9.3.5 External Stormwater Plumbing & Drainage

- For external stormwater run-off details refer to Costin Roe Consulting stormwater report

9.3.6 Irrigation System

- A water efficient irrigation system comprising of subsoil drip systems and automatic timers with rainwater or soil moisture sensor control override will be installed. It is possible that a certain amount of stored rainwater will be supplied to the irrigation system.

9.4 Fire Protection Services

The building will be fully sprinklered and will be equipped with hydrants, hose reels, stair pressurisation systems, smoke detection systems, smoke relief system, EWIS systems and other essential services systems as required by the BCA and other relevant standards.

The test water and maintenance drain-downs will be transferred into the rainwater tank.

Annual Fuel and Energy Requirements.

4010 - Cochlear Global HQ
Proposed Equipment Performance Review
Energy Consumption Summary

Assumptions - Building Load		Summary - Building Load	
Area Schedule (17/10/08); NLA = 22,536		Floor Area	22,200 Sq.m
		Calculated Energy Consumption (elec)	2,273,279 kWhr pa
		Calculated Energy Consumption (gas)	190,458 MJ pa
Assumptions - Hours of Operation			
Plant Hours		Occupancy	55 hours/week
Hours per day	11	Star Rating	4.5
Days per week	5	Max. Allow. Energy Consumption (elec)	2,300 MWhr pa
Weeks per year	52	Max.Allow Normalised Emissions	87 kg CO2/m2 pa
Total	2860		

Air Cond Equipment	Power (MJ/yr)	Power (kWhrs/yr)	Safety Factor	Power (kWhrs/yr)
VE-Apsim (dynamic model)				
kW Consumption				
Cooling Load		406,449	15%	467,416
Auxillary Load		730,732	15%	840,342
Lighting Load			15%	-
Heating Load		18,787	15%	21,605
Total AC Equipment Electrical Consumption				77778.2
Total AC Equipment Electrical Consumption				1,307,758

Misc. Fan Operation	No. Off	Electrical Loading (kW)	Equipment (%)	Running Hours per (hrs)	Power (kWhrs/yr)
Miscellaneous Fans					
Toilet Exh.	1	10.0	100%	2860	28,600
Carpark Exhaust					
Car Park Exhaust Fan No.2	1	50.0	30.0%	2080	31,200
Total Fans Electrical Consumption					59,800

Tenant Central Plant	No. Off	Electrical Loading (kW)	Equipment (%)	Running Hours per (hrs)	Power (kWhrs/yr)
Cooling Towers	1	25.0	70%	8760	153,300
Loading Dock	1	15.0	10%	2080	3,120
Total Fans Electrical Consumption					156,420

Hydraulic Services Equip	No. Off	Electrical Loading (kWhr)	Equipment Loading (%)	Running Hours per year (hrs)	Power Consumption (kWhrs/yr)
Hydraulics Cold Water Pumps Hot Water Pumps	2	7.5	50%	2860	21,450
	2	2.2	50%	2860	6,292
Total Hydraulic Electrical Consumption					27,742
Gas Hot Water System	1	MJ/yr 5.0	100%	Area 22,536	(MJ/yr) 112,680
Total Hydraulic Gas Consumption					112,680

Lift Services Equip	No. Off	Electrical Loading (kW)	Equipment Loading (%)	Running Hours per year (hrs)	Power Consumption (kWhrs/yr)
Lifts Nth Building - High Rise Lifts	3	kWhr/sqm/yr 5.00	100%	Area 22000	330,000
Total Lift Electrical Consumption					330,000

Electrical Services Equip.	Percentage Area (%)	Area (NLA/FSA)	Electrical Loading	Running Hours per year (hrs)	Power Consumption (kWhrs/yr)
Lighting Common Area Lighting	4%	22,000	(W/sqm) 8.32	2860	20,940
External Lighting	100%	-	(kW/hr) 30.0	2184	65,520
Car Park - Full	60%	12,300	5.2	4368	167,626
Car Park - 24hour Sec.	60%	12,300	1.1	8736	70,919
Total Misc. Power Consumption					325,005

<i>(Excluding VE Apache Energy Consumption Figure.)</i>	5%	Safety Factor	44,948
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Total Electrical Consumption	2,273,279
Total Gas Energy Consumption	112,680

Green Star Graphs

Green Star - Office Design v2

Summary for: Cochlear

