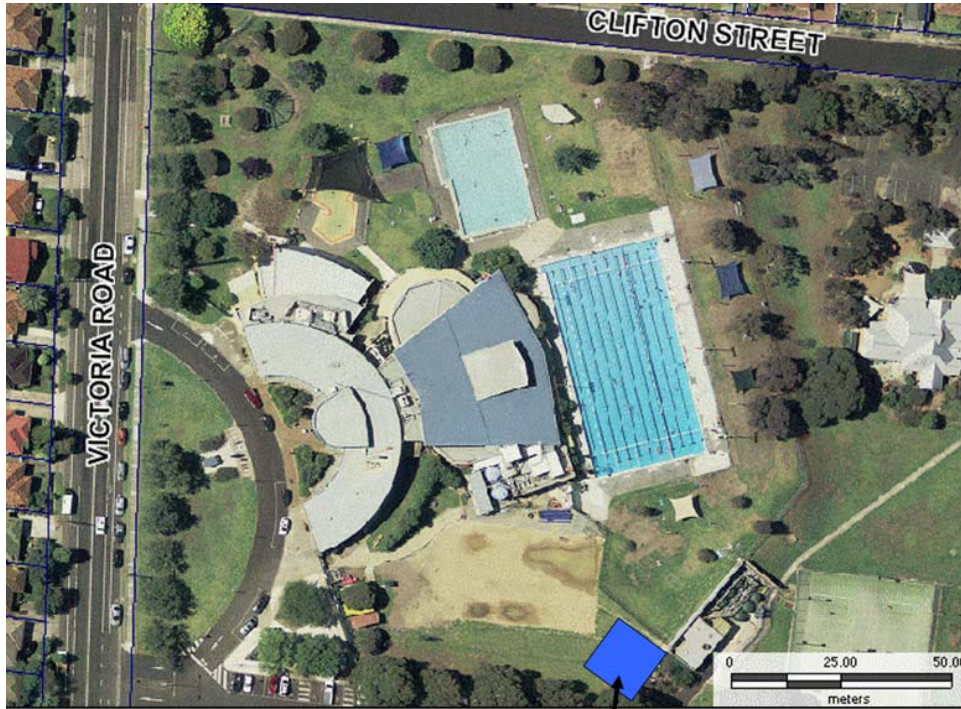


# APPENDIX A

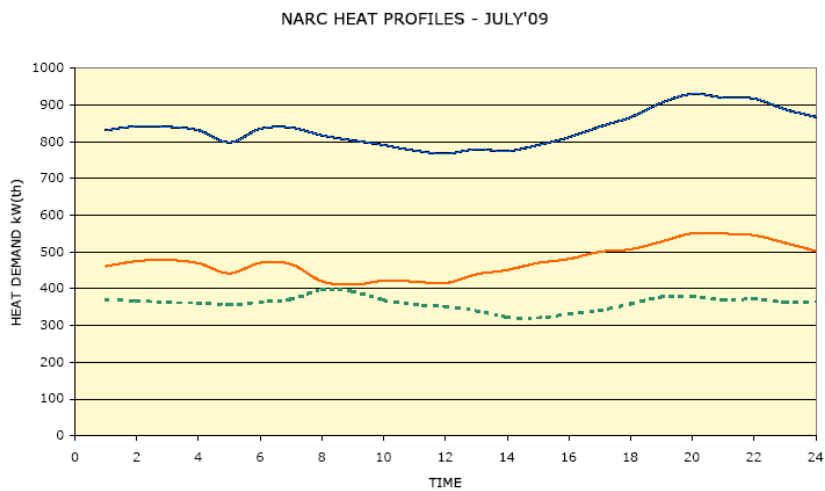
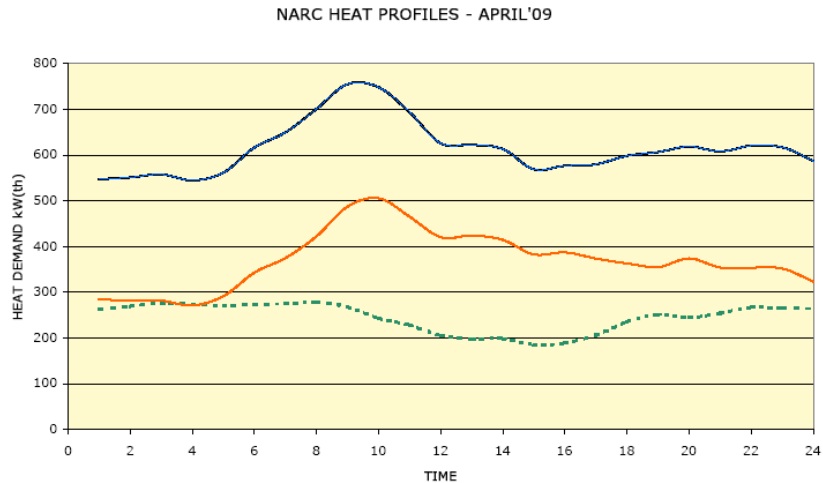
**Figure A – Aerial Photo of Northcote Aquatic and Recreation Centre**



Proposed  
Cogeneration Plant  
Room

## Figure B - Heat Profiles

The thermal energy demand for the outdoor pools is around 2,775,800 kWh(th), averaging over 315 kW(th)). It peaks at about 470 kW(th) in July and is much lower in summer (about 150 to 190 kW(th)). Note that the heat demand for the outdoor pools does not drop below 400 kW(th) in July and is typically over 300 kW(th) in April.



### Legend:

**TOP LINE ( blue ) = Total Site Heat Demand**

**CENTRE LINE ( red ) = Outdoor Pools Heating**

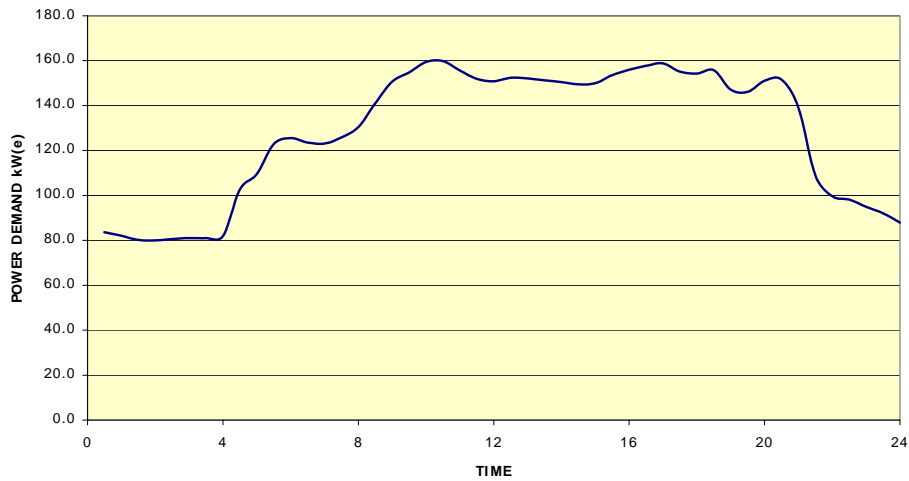
**BOTTOM LINE ( dotted ) = Indoor Air & Pools Heating**

### **Figure C – Power Demand**

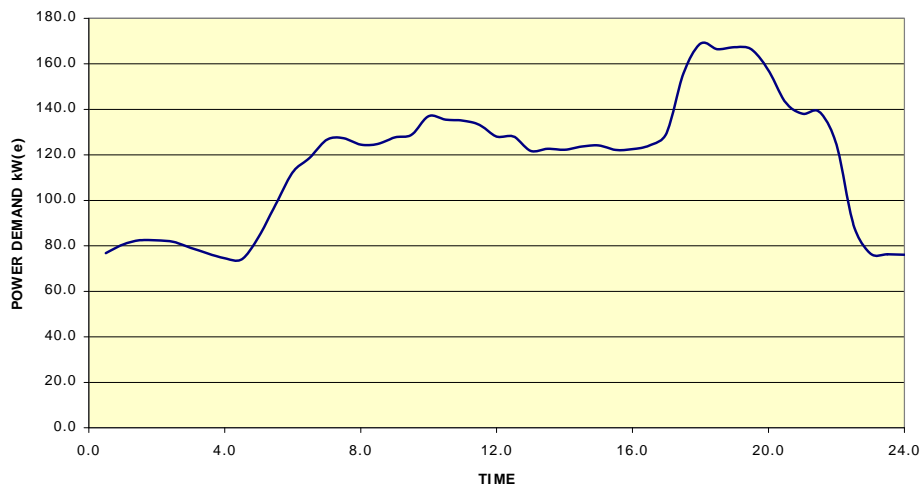
The daily power demand profile is top hat shaped, reflecting the incremental loads of gymnasium power consuming equipment, office use etc , starting from about 4.30 am and dropping to less than 100 kW(e) by 10 pm. See power profiles below.

Site electrical demands at NARC include general power, water filtration equipment, lighting, exercise equipment, some air conditioning, ventilation fans, pumps, and pool and DWH (Domestic Hot Water) heating equipment.

**NARC POWER PROFILE - JANUARY 2009**



**NARC POWER PROFILE - JULY 2009**



**Figure D – Summary of Engine’s Energy Demands and Payback**

**Cogen Engine Power and Fuel**

<b>Cogen Engine Option</b>	<b>Max Power Rating kW(e)</b>	<b>Power Generated kWh/year</b>	<b>Natural Gas Fuel, GJ/yr</b>	<b>% of site power Cogenerated</b>
FGLD 180-80	250	919,370	11,630	86.4%

*Without CO2 Credits*

<b>Cogen Engine Option</b>	<b>Cogen Engine Rating kW(e)</b>	<b>Capex Estimate w/o GST</b>	<b>Savings Expected Year 1</b>	<b>Simple ROI years</b>
FGLD 180-80	250	\$ 615,500	\$ 91,570	6.7

Photo of typical GASCO engine.



## **Figure E – Sensitivity Analysis**

In each case all other parameters are kept constant and equal to the respective base case Model. The cases illustrated include either a modelled “CO2 credit” @ \$ 20/tonne/year or the predicted energy price growth model as appropriate.

### 1) Effect of Discount Rate on Net Present Value (NPV)

<b>COGEN PLANT</b>	<b>NPV, 8%, 15 yrs</b>	<b>NPV, 7%, 15 yrs</b>	<b>NPV, 6%, 15 yrs</b>
GUASCOR FGLD 180-80	\$ 676,800	\$ 771,670	\$ 876,730

### 2) Effect of CAPEX on IRR & NPV

<b>COGEN PLANT</b>	<b>BASE CASE IRR</b>	<b>CAPEX + 10% IRR</b>	<b>CAPEX + 20% IRR</b>
GUASCOR FGLD 180-80	20.8 %	18.8 %	17.2 %

<b>COGEN PLANT</b>	<b>BASE CASE NPV, 8%, 15 yrs</b>	<b>CAPEX + 10% NPV, 7%, 15 yrs</b>	<b>CAPEX + 20% NPV, 6%, 15 yrs</b>
GUASCOR FGLD 180-80	\$ 676,800	\$ 615,246	\$ 553,696

### 3) Effect of Fuel Costs on Year 1 Savings

Gas Cost in models is the average cost at NARC - \$ 5.45 per GJ

<b>COGEN PLANT</b>	<b>Base Case Gas Yr 1 Savings</b>	<b>Gas Cost + 10% Yr 1 Savings</b>	<b>Gas Cost + 20% Yr 1 Savings</b>
GUASCOR FGLD 180-80	\$ 106,542	\$ 103,731	\$ 100,991

### 4) Effect of Maintenance Costs on Year 1 Savings

Maintenance Cost in models is 2.5 c/kWh for reciprocating engines.

<b>COGEN PLANT</b>	<b>Base Maint Cost Yr 1 Savings</b>	<b>Maint + 10% Yr 1 Savings</b>	<b>Maint + 20% Yr 1 Savings</b>
GUASCOR FGLD 180-80	\$ 106,542	\$ 104,243	\$ 101,945

The 250 kW(e) rated Guascor FGLD 180-80 cogeneration engine provides a net reduction in energy costs at NARC of about \$ 106,540 per year (a 37.6 % reduction), would reduced greenhouse gas (CO<sub>2</sub>) emissions by about 942 tonnes per year (a 35 % reduction) and would return its investment cost in 7 years.

A DCF (Discounted Cash Flow) analysis for the cogeneration project with the 250 kW cogeneration system shows an Internal Rate of Return (IRR) of 20.8 % and a NPV of \$676,800 over 15 years at a discount rate of 8%. This confirms the economic viability of the proposed initiative.