Cost Analysis [Singapore Site] :

GPAC 500 used to reduce O/A cooling operational cost

- Calculations for Australian sites use detailed climate frequency data and this is necessary as the weather pattern there is variable.
- Singapore has a remarkably constant day-to-day weather pattern and no heating season; so an accurate analysis can be made using averages.
- Singapore weather averages are:
    - 31.0C av. High (29.9C in Dec to 31.7C in Apr.)
    - 24.1C av. Low (23.3C in Jan to 24.8 in May)
    - 84.2% Relativity Humidity (86.9% in Dec; 82.9% in Feb.)
- Calculate 24 hr./day *sensible cooling* load as follows:
    - Airflow = 500 l/s (GPAC 500 capacity); Indoor condition is 23C/60% RH.
    - Average outdoor temp = (31+24.1) /2 = 27.55C
    - Average air cooling required is 500 l/s *(27.55-23)* 1.2 (i.e. specific heat air) = 2730 watts.
- Calculate 24 hr./day *latent cooling* load as follows:
    - Airflow= 500 l/s;
    - Indoor condition is 23C/60% RH i.e. 10.5g moisture/kG air absolute humidity.
    - Outdoor condition is 84.2% humidity @average 27.55C i.e. 19.7 g moisture/kG air (from sea level psychometric chart).
    - Average cooling required for this dehumidification is 500 l/s * (19.7-10.5) g/kG * 3.0 (i.e. latent specific heat) = 13,800 watts.
- Total cooling requirement is 2730 +13,800 = 16,230w i.e. 16.23kW refrigeration – note dehumidification is clear majority of load.
- Allowing that the refrigeration system will have an average COP of 3.0 then the average electrical power use will be 16.23/3.0 = 5.41kW electrical.
- For 24 hour/day operation and S$0.28/kW tariff, **annual power cost saving by use of GPAC 500 will be:**
- 24 * 365 * 5.41 * 0.28 = **SGD$13,270**
- As the latent load dominates and the outdoor g/kG absolute humidity will be fairly constant (though the %RH varies a bit) the day and night power uses will not be greatly different: say about **SGD$8,000/annum (day) and SGD$5270/annum (night).**