



Energy conservation efforts at Dhirubhai Ambani Knowledge City Navi Mumbai

Location

Dhirubhai Ambani Knowledge City (DAKC) located in Navi Mumbai.



Houses the central offices of Reliance Infocomm, project implementation and Operational activities for Infocomm across the entire country as well as on the Interfaces with the Global communication partners

Built in year 2002 has over 2 Million sq ft of office and Operations space in multiplex of buildings.

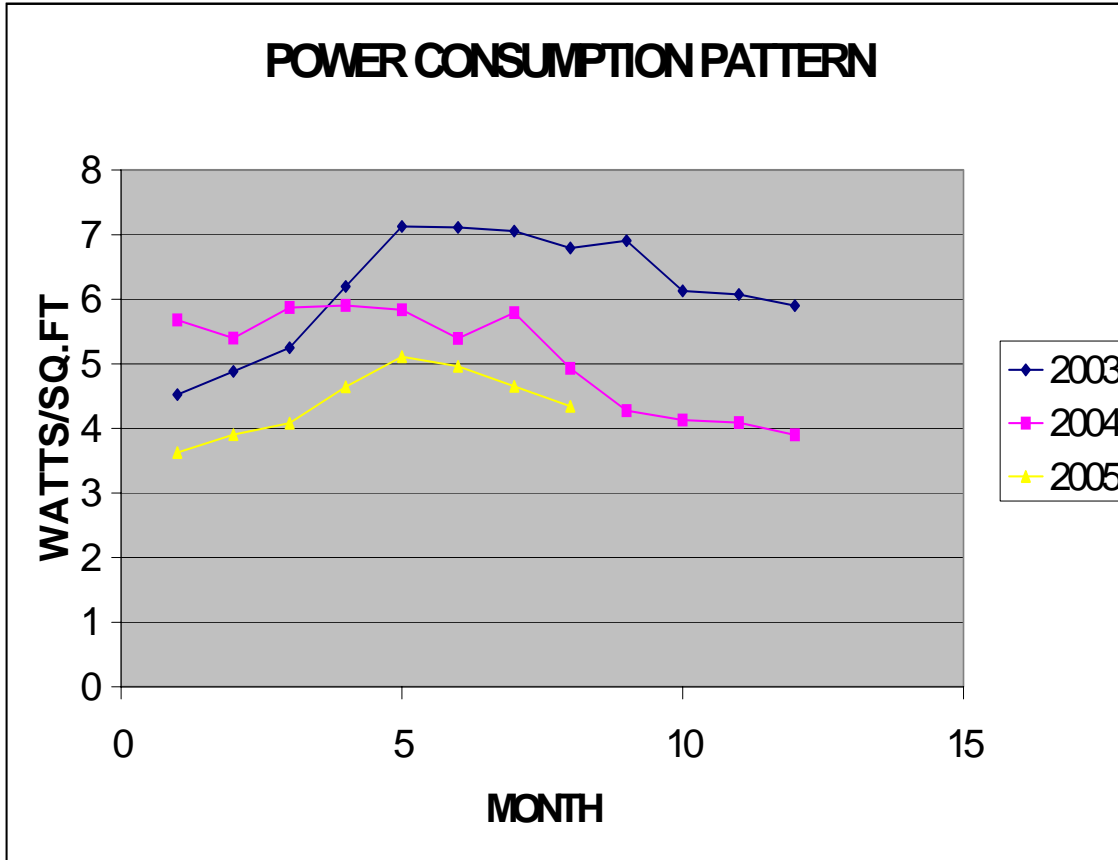


System

- Centralized utility block for Chillers with refrigeration capacity of 13,000 TR.
- Water cooled Air handling units (AHU) with variable frequency drives (VFDs).
- Control of the chilled water supply to each AHU through a motorized control valve.
- Diesel Generator with 100% power back up through 4 x 3.5 MW (total 14 MW) DGs.
- Start up and sequencing of the DG sets is automated using PLCs.
- Automatic start up of the DG sets ensures almost no power disruption during State grid failures.
- Distributed building management system (BMS) with centralized monitoring.
- The centralized BMS monitoring system provides on a desk top PC information related to the operations to the O&M staff and the energy conservation coordinating team.

POWER CONSUMPTION PATTERN (WATTS/SQ.FT)

YEAR	jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nov	dec	MAX	MIN	%REDUCTION
	1	2	3	4	5	6	7	8	9	10	11	12			
2003	4.524239	4.881166	5.248173	6.195762	7.128418	7.112548	7.05549	6.794173	6.905119	6.129179	6.071203	5.897412	7.128418407	4.524239406	
2004	5.67968	5.394577	5.869426	5.902277	5.834065	5.392861	5.789772	4.9282	4.271644	4.127107	4.08829	3.900903	5.902277213	3.900902728	17.2007467
2005	3.625563	3.906081	4.080704	4.642317	5.112605	4.960239	4.660989	4.342463					5.112604568	3.625563391	15.44560378



Energy conservation achievements

- Solar water heaters to generate 24000 liters of hot water to cater the hot water requirement of the Food courts which serve multi cuisine for 15000 people. It has saved the power to the tune of 697 KWH daily.No electricity is used for warm water supply for food courts.



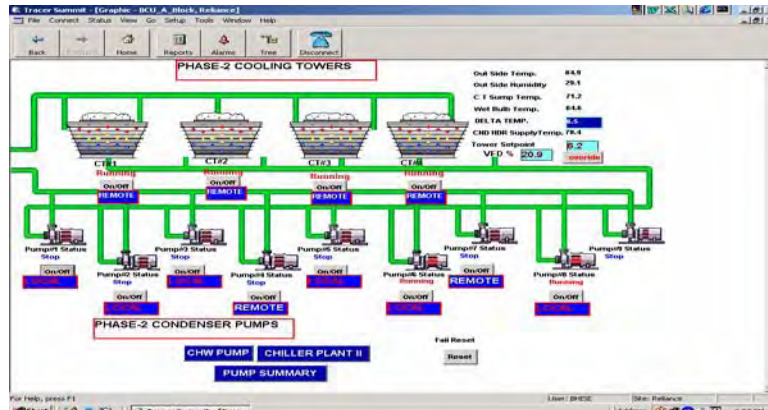
- Infra Red scanner installed for main street lighting on/off, which has reduced manual error of lighting stoppage.



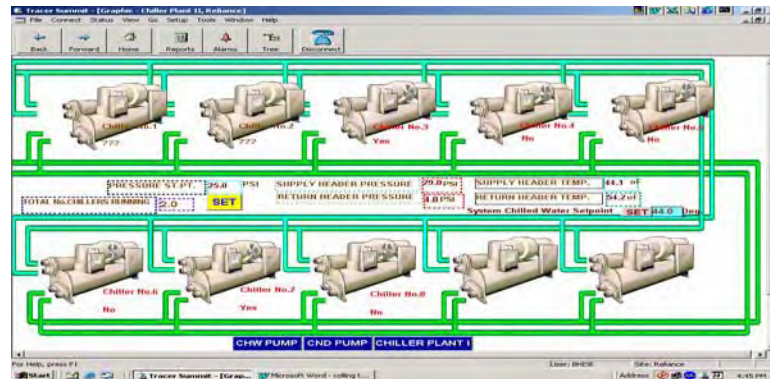
- Rainwater collected from the roof of the chiller house and main electric substation is diverted to the cooling tower basin. With this simple measure, the make up water needs of the Cooling tower are met and resulted in a saving of nearly 7200 M³ of water per year and associated pumping cost.



- Variable set point instead of fixed set point for supply air, set from a centrally located BMS work station. This has resulted in substantial saving of AHU fan power consumption and reduced the refrigeration load on chillers.
- VFDs installed for Cooling tower fan. Using the BMS control for decision on best possible approach. BMS checks the ambient WBT, cooling tower outlet temperature and load which controls the speed of CT fan. With this always best possible water temperature is achieved without wasting fan power.



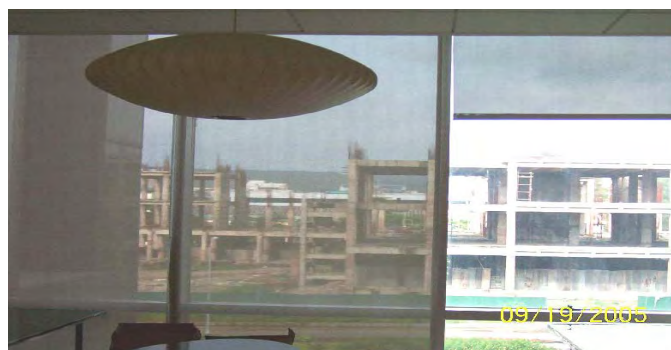
- Advance chiller operation based on chilled water return header and supply header temperature.



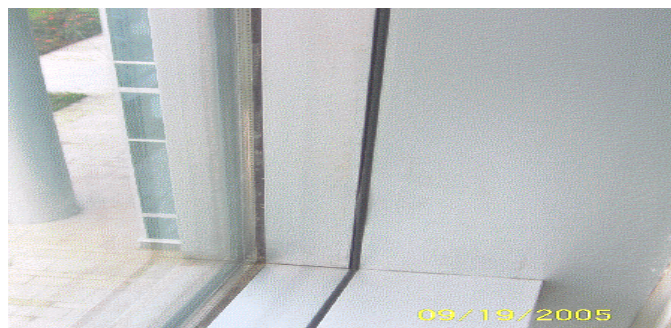
- Sun Visors provided on High Rise Buildings to avoid Radiation.



- Venetian translucent rolls provided on all windows. The photograph shows effect of one glass panel with fully closed roll & half open roll.



- Double glass Panels provided for NNOC, PHQ, NHQ, G, and H & I Blocks.



- Dry cladding is provided on concrete facing Sun.



- Sun film on single glass panel.



Energy conservation achievements

- Drip and irrigation pump spray head optimized and the old pump is replaced with new low head pump.
- Condenser pump and chilled water primary pump were operating with high head compared to head required at site and hence impellers were trimmed to save power.
- Ozone generator installed in AHU of the food courts to reduce the food smell, this has resulted in lesser fresh air intake.
- Change of VFD in AHU as per actual demand.
- Natural light utilized for food courts. No artificial illumination during day time.
- Maintaining unity power factor to reduce T&D losses.
- Automated lighting ON/OFF switches for offices.
- Replacement of 40 W tube lights by 36 W.
- Replacement of ferromagnetic ballast by electronic chokes

Energy conservation plan

- Introduction of differential winding on the parallel transformer to reduce harmonics due to electronic load.
- Switching of light automatically by BMS with time delay after switching of the AHU in office area.

Energy conservation commitment

Impact on environment

We are committed to reduce power and water consumption continually which shall reduce the impact on environment. The substantial reduction to the level of 40% from the starting consumption has dramatically reduced the CO₂ load of about 150 000 kg annually.



Energy Conservation in rain water harvesting

The rainwater collected from the roof of the chiller house and main electric substation are diverted to the cooling tower basin. With this simple measure with minimum investment, the make up water needs of the Cooling tower are met and resulted in a saving of nearly 7200 m³ of water per year and associated pumping cost. During Monsoon seasons the entire make water of the Cooling tower is met from this.

Area of Chiller House roof & Sub Station Roof

$$= (33 \times 35) + (57 \times 37) = 3264 \text{ M}^2$$

Considering 2.2 M rainfall every year, we get

$$= 3264 \times 2.2 \\ = 7180 \text{ M}^3$$

say 7200 M³ per Annum Approx.

Cost MIDC water saved

$$= 7200 \text{ M}^3 \times 20 \text{ Rs}$$

$$= \text{Rs. } 144000/- \text{ per Annum.}$$

Investment cost

$$= \text{Rs. } 125000/- \text{ Approx.}$$

Therefore pay back is of 11 months only

Replacement of gardening water pump

Installed Garden pumps were having capacity of 130 M³ / Hr at 60 M head. After assessing it was found that we are having requirement of 105 M³ / Hr at 45 M head. Present pumps were checked for trimming option from characteristic curve but even at minimum diameter required parameters were not getting. Therefore we decided to get new pump with energy efficient motor. This resulted in saving of 1.23 lacs per year & pay back was only 10 months.

Data for the current is given below.

Operating cost of Old Pump.

Current Drawn by Old Pump with Throttled valve

$$= 55 \text{ Amps}$$

$$= 31.6 \text{ Kw} \times 3.7 \text{ Rs} \times 12 \text{ Hrs} \times 300 \text{ days}$$

$$= \text{Rs } 420912/- \text{ Per Annum}$$

Current Drawn by New Pump with full valve open

$$= 34 \text{ Amps.}$$

$$= 22\text{Kw} \times 3.7 \text{ Rs} \times 12 \text{ Hrs} \times 300 \text{ Days}$$

$$= \text{Rs. } 293040/- \text{ Per Annum.}$$

Saving

$$= 420912 - 293040$$

$$= \text{Rs. } 127872/- \text{ Per Annum}$$

Say 1.25 Lacs per Annum

Investment cost

$$= \text{Rs. } 99500/-$$

Therefore payback period is 10 months only.

Impeller trimming for condenser and primary chilled water pump

The condenser pump and chilled water primary pump were operating with high head compared to head required at site. This was compared with characteristic curve and impellers were trimmed to get required parameters & save power.

a. Condenser pump.

Data from characteristic curve from Mather & Platt for Pump model 200/300 BST.

Original Dia of Impeller	= 335 mm
Trimmed Dia of impeller	= 315 mm
Saving per pump	= 12 Kw
No of pumps working	= 2.5 per day
Hence saving	= 12 x 2.5 x 3.7 Rs. x 24 Hrs x 365 days
	= Rs. 972360/-
Total investment cost	= Rs. 3000 x 4 pumps
	= Rs 12000/-

Pay back is less than one week.

b. Primary Chilled water Pump

Data from characteristic curve from Mather & Platt for Pump model 8/8 ALE.

Original Dia of Impeller	= 305 mm
Trimmed Dia of impeller	= 267 mm
Saving per pump	= 11 Kw
No of pumps working	= 2.5 per day
Hence saving	= 11 x 2.5 x 3.7 Rs. x 24 Hrs x 365 days
	= Rs. 891330/-
Total investment cost	= Rs. 3000 x 4 pumps
	= Rs 12000/-

Pay back is less than one week.

Unity Power factor maintenance

We were wheeling power from Patalganga plant till Oct 2004 as surplus self-generation capacity was available in the group. System power factor was around 0.91 at that time when we didn't operate capacitor banks. PF incentive was not available.

Due to Naptha price hike wheeling was stopped in Oct'2004. As the PF incentive is available, we switched on all capacitor banks and improved capacitors wherever needed. Unity PF is maintained at the site always. This gives us 7% discount on energy as per MSEB tariff.

We have approx 5% T & D losses in all over power/distribution, plus cabling & internal distribution. Our monthly consumption is 60 lacs units on an average.

So T & D losses = 5% of 60 lacs. = 300000 KWH/month.

I_1 = Current flow at 0.9 PF

I_2 = Current flow at 1.0 PF.

$$\sqrt{3} \cdot I_1 \cdot V \cdot \cos\phi = 60 \text{ lacs} = \sqrt{3} \cdot I_2 \cdot V \cdot \cos\phi$$

$$I_1 \times (0.9) = I_2 \times (1.0)$$

$$I_2/I_1 = 1/0.9 = 1.11$$

T & D losses are basically $I^2 R$ losses

$(1.11)^2 I^2 R = \text{losses at } 0.9 \text{ PF}$
 $\cong 1.23$ say 20 % higher losses.

Saving
Energy saved = 20% of 5% or 1% of total consumption
=60000 KWH /month
Yearly saving = 60000 x 12
= 7.2 lacs units per annum.
Saving around Rs.3.7 per KWH
= Rs. 26.64 lacs say Rs. 27 lacs.

Total investment = Rs. 6 lacs.

Pay back is less than one week.

Replacement of Tube lights Policy

Total 20000 tube lights have been used at the complex. We adopt a maintenance strategy of replacing these tube lights by 36 W. Originally filament was 40 W. No modification necessary. New tube light can be fixed in the same holder/fixture.

Lighting efficiency maintained.

Saving per tube light	= 4 W
We have replaced about 4500 Nos. in year 2004.	
Saving achieved	= 4500 x 4 =18000W = 18KW
Approximately burning hrs per day	= 15
KWH saved	=18 x 15= 270 Units
Units saved per year	= 270 x 365 = 98550 units say 1 lacs units.
So annual saving	= Rs. 3.7 lacs.

Summary: Since these tube lights are replaced at the end of existing lights, no extra cost is increased, hence payback is zero.

Replacement of Magnetic ballasts with Electronic ballast

For most of the tube lights, magnetic ballast were used as maintenance practice & energy conservation measures, these are getting replaced by electronic ballasts. As per energy saving of approx 8 Watts per ballast. In year 2004 we replaced 500 Nos. ballasts on these tube lights.

So total saving	= 500 Nos. x 8 W = 4000 Watts.
Approx operating hrs per day	= 15 hrs.
Daily saving	= 4500x 15 = 60000 WH = 60 KWH
Yearly saving	= 60 x 365 = 21900 KWH
Total saving	= 21900 x 3.7 = Rs. 81030 say Rs. 0.8 lacs.

Investment on these ballast is approx = 500x 800 (differential cost)= 4 lacs.

Pay back is 400000/80000 = 5 year approx.

Remark – This investment is notional as ballasts are due for replacement at the end of useful life.