

AIR- CONDITIONING UTILITY ASSESSMENT IN PLATINUM RATED GREEN FACTORY

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The industry and the utility vendor do work together as a team in selecting the energy efficient equipments. Also, the industry sees now, the practical running cost of equipments, and practically works towards zero breakdowns during the sustained running of utility with the timely preventive and predictive maintenance schedules.

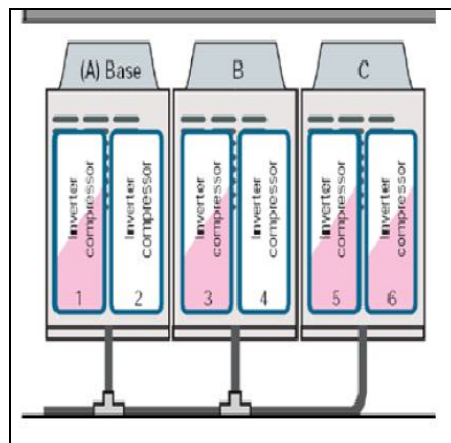
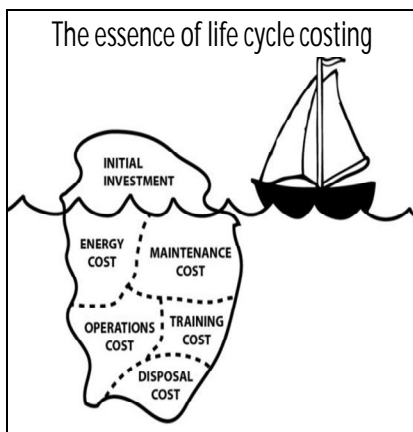
Energy saving in any process or here in the Air-conditioning utility can be first achieved by COARSE step control of AC compressors switching ON & OFF automatically suiting to process / utility load demands. And then, the FINE control of each AC compressor operation is done thro VFD throttling to achieve pin-point regulation of the SET indoor temperature.

The first step towards energy efficiency air conditioning is that when the TR head load is demanding only, the AC needs to come on line. Otherwise, it can be shut off automatically and the AC need not be idling thro inverter all the time waiting for the load demand. The load also does not call for stringent availability and a lapse of few minutes in between during switching ON delay is OK here. The AC Inverter working is efficient but more efficient is to switch OFF that part of the AC system when not required.

Recently, we conducted energy audit in a Platinum rated IGBC green factory. We are sharing with you, a part of energy study related air-conditioning utility of the industry during the energy audit and the steps taken by the industry immediately after the audit to monitor and target the air conditioning consumption and conservation related condition monitoring procedures.

INDUSTRY LOAD DETAILS:-

1. The industry is a HT consumer with a 500 KVA transformer. The Air conditioning utility rating is 30 TR AC package feeding to the CNC machine area of the factory. The 30 TR AC package system of 3 OD packs of VRF systems each with 2 AC compressors of 5 TR in the pack (2 x 5 TR per pack x 3 no = 30 TR) and the same located in the open terrace area of the factory.
2. The Air conditioning system given by the vendor is a comprehensive intelligent system. Being 100% inverter compressors, at part load condition, the system intelligence decides the speed of each compressors and number of compressors it should operate to have minimum power consumption to achieve required capacity. All the compressors try to operate 30% to 80% as much as possible to optimize the efficiency.



- Initial Investment cost towards energy is only visible to the Industry now. But it has to visualize the life cycle costing considering the energy cost, wear & tear cost due to 24 x 7 mode run hours of the AC utility.

ENERGY AUDIT SITE OBSERVATIONS:-

3. When the energy audit was conducted, it was a lean period of production and hence not many machines were ON and working. But we found that the 30 TR AC package system was fully LIVE and ON throughout the day.
4. The plants' heat load requirements for the AC was only 15 TR but actually 30 TR was fully ON to maintain the 15 TR load. For this load requirement, 2 packages of total 20 TR will be adequate and sufficient to cater to the 15 TR load. These were observed for three hours in the morning and during the starting of the shift time and only few machines were only ON.
5. Here we measured the KW to find all the 3 packages; with each package running with only compressor out of 2 compressors per block totaling 15 TR. We could vary the load conditions since it was start of the morning shift and found for 8 TR requirements, this 30 TR AC package system, runs on minimum loading thro VFD to meet the lean heat load demand.
6. Why should we run 3 OD packs of 30 TR when the AC demand can be met by only one OD Pack of 10 TR? So to provide automatic ON /OFF switching to each pack with suitable time delay taking care to avoid frequent switching. The EPROM controller in the vendor console to have few more steps like 1. Automatic switching off individual packs in case of under loading with due time delay between switching on & off states. 2. The three OD can be rotated to run in turns automatically, so as to achieve equal run hours of all the compressors.

ENERGY AUDIT OBSERVATIONS AND RECOMMENDATIONS:-

7. We observed the factory had done networking of energy parameters of all the equipments and hooked them to the computers. We suggested them to buy Hour meter Rs.400/- to fit in each of the AC compressor to know how much each 5 TR AC compressor worked per day in all the 6 AC compressors to know the run hours of the AC compressors along with kwh meter costing Rs.3000/- to each AC compressor of each package. Or if the same input is available from the vendor console, that needs to be hooked to the plant computers.
8. We have clarified to the user; say for 50 % load is there now, say 15 TR out of 30 TR why should we run all the three packages of 10 TR totaling 30 TR at 50 % loading each say 5 TR on each package now? Instead we suggested running only 2 packages of 10 TR at 75 % loading; hence equal to 15TR say at 7.5 TR per each package and automatically shutting off the third package.
9. The sole reason is ONLY for the sake of power saving in not running idling third pack in loop here. Now we are running unnecessarily 3 AC compressor packages of higher KW even for part loading of 30 %. We understand that the AC compressor efficiency for sustained IPLE is better at 50 to 70 % load band & over a broader band of 30 to 80 % loading.
10. Precisely to say here, the functioning of 30 TR to be like this, that during rise and fall in demand as :-
 - one package only (10 TR) to be ON automatically up to 8 TR max demand,
 - and 2 packages to be ON in Auto for (20 TR = 2 x 2 x 5 TR) from 8 to 16 TR demand
 - and 3 packages 30 TR to run in Auto from 16 to 30 TR demand.



1 & 2 images – Umbrella shade on top needed for protection against direct Sun and heat and against hot spot failures.

11. To provide umbrella type shade like in the Telecoms buildings, wherein the outdoor of AC package Air cooled condensers located under umbrella shed on the open terrace. If the space is not constraint, then spread the outdoors with sufficient spacing in between. Also provide V type pre filter to each of the condenser fins for daily cleanability on line.



- The industry utilities say like DG sets, Air compressors, coil cooler etc are having Daily cleanable Vee type Pre – filter now. We can also provide to each of AC block and clean the same daily in the morning to avoid dust particles.
12. To put slide in slide out window AC air filter in the entire fresh air duct opening to avoid outside dust entering inside. To daily clean the same first thing in the morning before starting the AC utility.
 13. Why the AC package installation crew don't provide suction and discharge pressure gages as in-situ type inside the hood and viewable from outside? This gages will help us to know that the Refrigerant gas is optimally pressurized midway between the high and low limits and not leaked out during routine monthly checks.
 14. This brings down the AC run hours as shown by the AC hour meter running **up to 10 % less hours per day** when not under the Sun. To provide shade on top of the entire outdoors to comfort the heat transfer and this will not directly heat up all the inverter PCB inside the machine panel but under the direct Sun heat ingress. The micro processors are in the panel kept directly under the Sun. To plan for sustainable long working, to provide weather proof sunshade on top of the systems.
 15. To provide Velocity Recovery Ring for all the above open-to-top exhaust fans for better air efficiency exchange. Shade can be provided with more head room to accommodate the throw distance of condenser exhaust fans.
 16. To increase the temperature settings to 25 * C inside premises especially and this yields 5 % savings and fit in BLDC type SUPER fans inside premises for positive cross ventilation with no hot pockets inside. This fan consumes only 11 watts at the mid speed position knob and gives mild breeze.
 17. The harmonics generated from the AC packages is more & around 30 % THD and H 5 Amps predominant. The vendor OEM to insert Line Reactor Choke or Harmonic Reduction LC filter to reduce harmonics distortion towards the EB incoming grid. Because of the utility VFDs working, this industry was forced to go in Active Harmonic Filter at the transformer secondary. Let us collectively try to arrest the harmonics at source within the respective utility and production machine panels.

POINTERS TO THE INDUSTRY SEGMENT:-

18. . The industry needs to work towards sustained energy savings in the utility by lean running of minimum utility during the lean running of their production equipments. The vendor also becomes a part of industry energy management in educating & supporting the industry generically, that the utility equipment needs comfort for its running first now and prolong the MTBF so as to allow the industry to efficiently utilize the same for decades.
19. The factory has gone for an efficient & intelligent system of operating the HVAC facility and we have suggested to fine tune the same further to reduce & sustain the AC running cost further.
20. "A green building is one which uses less water, optimizes energy efficiency, conserves natural resources, generates less waste and provides healthier spaces for occupants, as compared to a conventional building." This industry decided to monitor and target the Air conditioning utility consumption immediately after the audit.

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