

## Energy Intake- Industry is Gulping or Munching?

- The Industry consumes Energy by Munching and not by Gulping, when its Energy Intake is Regulated, Balanced, Filtered, slightly Lagging, Metered and Sustained-released in stages to the loads. Similarly, the Indian irrigation understands now that Diffuser Irrigation means less watering & more crops output compared to Drip & Sprinkler irrigation or even the conventional watering. Hence the Indian industry too must wake up to the call of Sustained Release of Regulated & Metered Energy intake at the point of Final Energy Consumption ie at the load ends of the plant.
- The difference between the primary and final energy consumption lies in the Transport, Transmission & Distribution, and the Refinement. Within the industry, the transmission losses are less and constant over short periods but the distribution losses is more and this varies frequently. Hence if the industry views with lens, the Distribution losses frequently, then they can constantly maintain and update, crosscheck the Energy intake of machines and improve upon further.
- This is similar to the capacitor relocation to load ends improves the motor efficiency indirectly as the voltage drop comes down. But now the industry must concentrate on the Refinement areas of Energy Intake, not only to improve dramatically, the Input part Efficiency of the process but also to improve the machines' health and durability.

### Energy Between the Cup & the Lip losses in industry:

Electricity input:

- Regulation of Voltage at the Transformer level makes the industry comfortable. The industry now rethinks that the OLTC or the Stabiliser on the Transformer is a must compared to Off-load tap changeover above 500 KVA. The industry not only saves energy by regulation but defines the voltage to the equipments as stipulated by manufacturer, thereby avoiding problems to equipment due to high / low voltages etc. Apart from voltage regulation, the industry sees to it now, the % unbalance input voltage at the motor terminals doesn't exceed 1 % phase-to-phase volts.

### Power Factor Input:

- For the given industry, the total quantity of capacitor in KVARs with respect to the actual running load; decides the loading of machines, Efficiency of motors and the network losses. Power factor is a practical tool to assess the electrical network health of the industry. Motor is the pf puller in the plant and pf corrected at & from the motor end, the capacitor addition is less. Mind you, now that like the harmonics creeping in the electrical network and similar is pf, the correction at source than at sink, is better for the network in the aspect of losses, safety and hazards.
- Now the high load factor industry segment like the textile mill etc. has to adopt stage wise PF correction and not to restrict them on fixed banks only. The existing industry sometimes due to over enthusiasm to achieve unity power factor, add more fixed banks which leads to leading situations and the industry burns its fingers due to over voltage hazards. The stage wise regulation of pf is very much ideal and practical & economical to the industry in the long run.

### Stage wise PF correction:

- I stage PF correction by way of shunting fixed capacitor 10 % less than the no load KVAR of the motor. II stage pf correction by way of Automatic Power Factor Control APFC is done at the SSB ie local distribution boards for group of motors. III stage is done at the MCC room at the Transformer secondary by way of APFC panel. The industry must not aim for PF incentive from the EB authority for unity power factor at the MCC end when the load end suffers due to poor pf. Where as, if the industry aims for a better pf of more than 0.95 at load end, this will give immediate profits in days to the industry.
- Of the two alternatives of total APFC at MCC end and other above mentioned stage wise Fixed & APFC combination, the stage wise pf correction will definitely help the industry in first cost, running cost and indirectly improves the motor efficiency by reducing volt drop at motor end.
- Similar is the Energy intake by modern Indian, which is not in stages now. The elders followed the age-old practice in food intake, ie I stage is primary grinding of food by the teeth and II stage is the churning by the stomach and they lived longer healthily. Now the typical modern Indian gulps food fastly, giving less work to teeth but more work to the stomach. Hence is the higher incidence of Diabetes now spreading more in India?

### Lighting Input:

- The industry has taken care of heavy loads like motors etc. using Coarse regulated supply at the Transformer like OLTC etc., the industry is actually losing heavily on the soft loads like Lighting due to absence of Fine Regulation of voltage. That is why, they switched over to finer control ie clamped the voltage at 200 volts at servostabiliser and tube light replacement has come down drastically. Apart from fixed voltage to lighting load, the actual loss can be classified as distribution losses of lighting; ie the lighting did not reach the user or machine. Hence especially for visual tasking applications, the industry brought down the luminaries to safe height of 8 feet instead of 14 feet aesthetic lighting concept.

### Energy Inputs to the process:

- Industry Process comes with a large design safety factor, which has to be optimized after process stabilization for optimum power consumption. So the Quality and Quantity of energy inputs at the load end is the focus area now. Ensure best quality input like dry saturated steam, pure dry air without moisture, fuel with additives, softened water to wet process, and then quantify, ie meter the refined inputs to the equipment & process. This automatically eliminates the errors due to fluctuating & deviating energy inputs and stabilizes the process instantaneously.
- Of the two types of energy, High grade energy is Electricity and rational thinking in industry is that high grade energy must be used for high grade application like melting of metal etc and not for low grade application like heating of water, slow process etc.
- Of many energy forms available to process, we pinpoint the only energy as Electricity which is the Energy used and talked with respect to Time factor. This is obvious from energy units that of all the energy units, only the Electricity is quantified as KWH. The industry has to make use of this feature of Electricity by suppressing its 30-minute instantaneous energy demand and spread the daily load curve in the utilities and process. Example is the use of ice banks in HVAC area and use of Load-end air receivers in the CA system.

### Boiler water Input:

- Quality input to the boiler is softened water at the Makeup stage itself. This is the cost effective solution and as well serves as short cut to avoid boiler-associated problems in steam. When big boiler user has taken the adequate precautions, The small boiler users, say in the Textile Processing industry segment etc. are satisfied with the feed water temperature savings by measuring the feed water tank temperature. Practically they have to measure the feed water temperature at the point of entry to the boiler after feed water pump discharge. The boiler user is satisfied to bring the condensate return back to feed water tank.
- But retrieving the hot condensate water temperature and realizing the same in feed water inlet to boiler is more cost effective. This helps the boiler operator to match to load demands. When the process load demands more steam, the hot condensate return via feed water circuit practically helps to achieve the right quantity of steam in shorter time. This avoids frequent cycling of boiler operations apart from fuel savings.

### Furnace Fuel Input:

- One of reasons of poor efficiency of furnace, the distribution loss is taken care if the following steps are followed. Ultimately the real loss starts only at the distribution level at the furnace. In the energy balance, more than double the heat energy is given from fuel to furnace compared to the heat absorbed by the stock. That is why now; furnace users opt to distribute fuel with more burners relocated in the furnace wall to cover more, the projectile area of the stock. This reduces the distribution losses; heat to stock is transferred in shorter time, and enhancing furnace productivity.
- The fuel oil / gas lines in the heat treatment furnaces are to be provided with pressure, temperature and flow meters near the vicinity of the burner. The flow / pressure metering of fuel line as well the airline at the inlet of burner definitely helps the user to quantify the transport and transmission losses in fuel; the air-fuel ratio is taken care at the feed-forward control itself.
- Now many industries in the fuel refinement area apart from fuel additives have started trying the Magnetic Resonator on the fuel injection line, which relieves the fuel from the surface adhesion in line and helps smooth transfer of fuel molecules to combustion thus enhancing its efficiency.

### Compressed Air input: -

- The industry is aware now that in the T & D losses in CA system, the transmission loss is one means distribution loss is more than twice. Hence the CA user does reverse house keeping at the load end ie corrects the leakage from usage point to the distribution sub header to the equipment. More than that, the refinement of CA is more important to machine health and cut down breakdown costs.
- Stage wise Refinement of CA is ideal for any process air health. I stage in CA house is that Intercooler and after cooler remove major moisture say in CA discharge. II stage is either desiccant or refrigeration drying of air. Here care is taken that coolers are well maintained to take maximum water away from air and reduce the load on power driven drying systems in drying the air. III stage is Automatic Level control Drain valves at the CA house receiver, main header ends. IV stage is the Filter Regulator / Filter -Lubricator - Regulator at the intake of pneumatic cylinder / actuator. This apart a mini air bottle or receiver at load entry points is fixed to give steady non-pulsating pressure during air-in-demand condition of equipment.
- The Indian irrigation has switched over from GI to rigid PVC pipes and now the industry has started trying Raised Temperature aluminum inner-lined polyethylene hoses to Aluminum pipes (where the friction head is drastically reduced) in the CA system. Air header distribution suffers due to narrow pipeline sizes and the lines get further narrowed due to GI material of pipe where in corrosion inside the pipe reduces the cross section of the pipe over years.
- The suction air to CA system is kept cool, clean and correct volume and sufficient (no blockage, no hot air, no clean air etc) always and this action nips in the bud many impending breakdowns in the CA system. So the input primary secondary filters in the compressed air system where in primary air filter is on line cleanable and frequently done to reduce the load on the secondary filter and subsequently the system gets cleaned and correct volume of air in the case of DG set, CA systems etc.

### Humidification Input:

- The Humidification utility user industry understands now by logical running the plant and actually feeling the effect in conditioned premises using Sensors, they can comfort process parameters to achieve say around 10 % more productivity. The industry has practically understood that the distribution losses start from & at the poor functioning of small nozzles and have reduced the pumping losses by half and simultaneously have improved humidification effect immensely.
- The industries have circumvented this problem now to adopt less number of Bulk nozzles instead of hundreds of small nozzles. Also they optimized the pump delivery to match the nozzle rated pressure. This critical change ensures uniform & constant distribution of whirl- water. This resulted in air-water mist spray to dwell longer in the air throw area in the chamber. Finally the conditioned area gets quickly the RH & temperature.

### Solar, rain inputs:

- Now many industries have started to accept the Solar Lighting and heating inputs to the industry is the free and clean source of input. But only after measuring them they are happy to find they could harness such a potential thrust by the nature on the industry. Similarly like in domestic buildings, the industry now, has made full use of the Rainwater Harvesting not only from the roof but also from throughout the industry premises. Now they find the water available to them from ground after RWH is more in quality & quantity.

### End to end Energy level Drop < 10 %: -

- Practically speaking, the industry Electrical system needs to maintain between end to end say from MCC to remote heavy load end, voltage drop very much less than 10 %, but now, more stringently around 1 % drop in 415 volts especially in the high load factor industry like the textile industry etc.
- Similarly the air pressure drop is kept < 10 % from CA house to final load end. Now the designers concentrate on the pumping head losses and find 10 % excess head to be maintained at the pump delivery to withstand the total head.

### Energy Measure & control:

- The major initiative towards ECON in the industry, what we are concentrating now is that we need to measure the Energy inputs (Electricity, fuel oil, water and Air inputs) fed to the industry. We have to make sure; the above inputs are consumed as per industry standards. Here we find that many a parameters are not monitored. Even if they are monitored, they are not measured accurately.
- Energy Auditing leads to Creative House Keeping and this craving habit of energy recovery from all possible angles in the plant will lead us to pollution-less environment apart from cost effective production. The non-contact infrared pyrometer costing around Rs.4000/- helps the user to generate records of many thermal parameters like uneven temperature, temperature gradient, etc. in short interval of time. This speedy assessment is a quick tool to diagnose all abnormal heat outputs of the plant.
- When the roadside petrol bunk is equipped with Digital Air facility for inflating tyre, why not the industry Digitize the energy inputs at the entrance, and at the load end? This will help in the long run in accurate data reading of what energy is used & what is wasted.
- In the industry what we see is that the inputs available at the entrance do not reach fully at the load end. This is in the case of water, air, electricity, and fuel. Though received well in the supply or generation end, any restriction at single location in the transmission line to the user area or at the distribution lines can give lot of fluctuation as well drops of values in the end usage locations.
- Rupee-wise & paisa-unwise industry Manager has telescopic vision to anticipate the energy savings in the future years whereas Paisa-wise & Rupee -unwise Industry manager has only lens view of magnifying today's' expense as first cost now to look into the reduced running costs coming later. The industry manager is interested to know the simple payback period for any energy efficient retrofit, but he must know that the Energy Measurement is the simple tool to assess the payback period and provide the same on first priority.

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