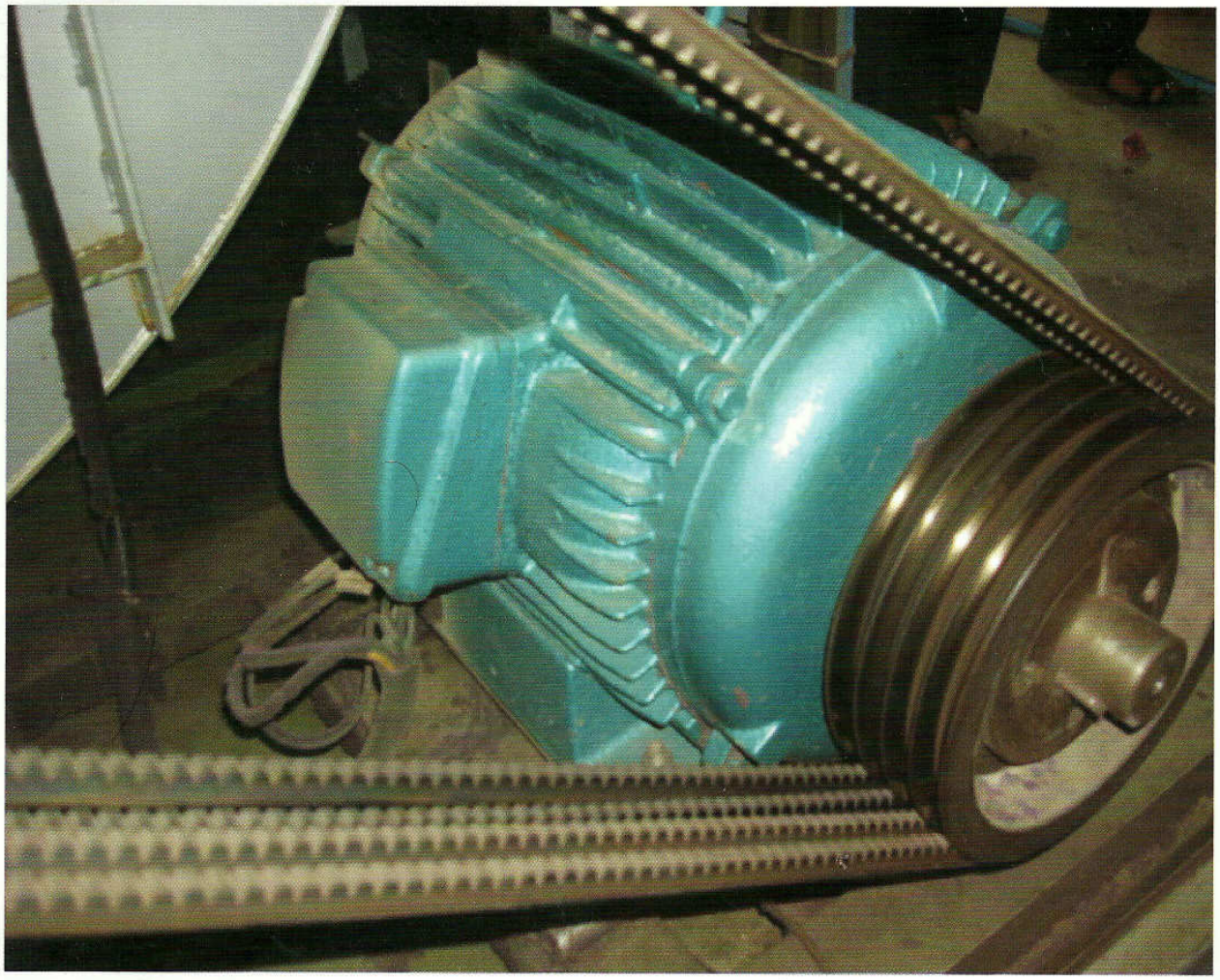


Brim your Utility to Trim Energy Losses

The existing utility in the industry works like a Brim-less Energy Tumbler when feeding the energy to production. When we drink water from a brim-less tumbler, there is always a slip between the cup and the lip. This is due to full level of water in the tumbler and it is without brim. Hence, the loading of utility and here, its brim is focused to trim the energy losses that happen in between the production & utility.

- S Ashok

The industry now, is thinking ways and means to reduce the input energy to the utility so as to achieve better specific power consumption in the utility; so as to match its running cost of utility to production. On the contrary, if the industry concentrates on reducing the output losses in the respective utility like lighting, motor, pump, fan, compressor & DG set etc then we can achieve higher optimum production for the given utility running costs.

As an analogy, for any form of energy; the transmission loss is less and distribution loss is always more. Taking Electrical utility for instance, the transmission loss is just less than quarter of the distribution loss in the national T&D survey. So focusing and targeting the utility end generation, distribution, consumption & reduction subsequently yields instant results. That is an easily achievable option, practically now.

Lighting Losses

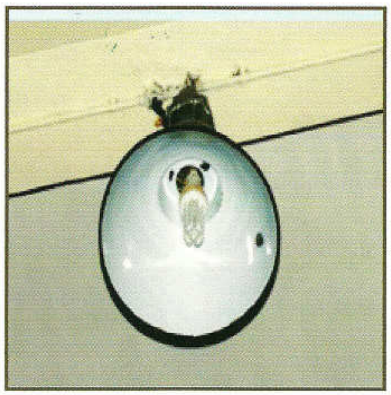
I image – the height of the light can be optimally reduced to increase luminance at the shop floor & in offices.

The Inverse Square Law

- The inverse square law defines the relationship between luminance from a point source and distance.
- It states that the intensity of light per unit area is inversely proportional to the square of the distance from the source (essentially the radius).
- E = Luminance, I = Luminous intensity d = distance
- An alternate form, taken conveniently : $E1\ d1^2 = E2\ d2^2$
- You measure 10.0 lm/m² from a light bulb at 1.0 meter. What will the flux density be at half the **distance?**
- **Soln.** $E1m = (d2 / d1)^2 * E2 = (1.0 / 0.5)^2 * 10.0 = 40\ lm/m^2$

II image – The back ground reflector to match light source and regular routine maintenance/ swapping improves.

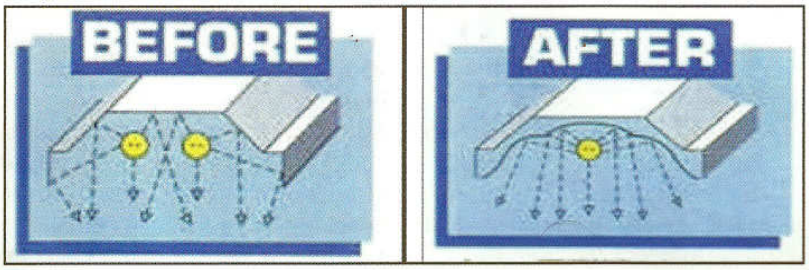
III image – The 4 inch CFL can be expanded to 1 sq ft CFL with dome reflector so as to improve visual comforts.



BRIM - Lighting reflector, optimum height & distance to visual task trim the lighting losses.

Having measured the watts in the lighting system, we can apply the inverse square law in the lighting too and illuminate the visual tasking area to match to the user's requirements. Not only in industries but in the office area, the lights are fixed on & above the 10 ft high ceiling for aesthetic sense, the same on descending gives 50 % lighting more. The office area needs comfortable lighting. More lighting pollutes and less lighting strain the eyes.

The reflector plays a vital role to increase the lighting area and this is not only for the florescent tube lamp but more for the compact florescent lamp (since this lamp is compacted from tube lamp only). The dome type reflector is a must for CFL because we have a tendency to fix near our eye's height and this is harmful in the long run. So the reflector for CFL diffuses the light well inside the dome and arrests the lighting outside the dome.



Motor Losses

EE motor OEMs have given more fins now compared to old motors as this is the easy way to dissipate the heat & improve its working. The symptom of loss comes out as heat and is fanned out of the fins by throwing away the heat all round the motor to outside. The motor efficiency improves by better ventilation by the cooling fan material & sizing and by the choke-proof cowl design at the fan inlet. The low cost infra red gun points out the difference in skin temperature from drive end to non drive end of motor and this may be due to poor cooling by motor fan too.

The conventional grease in a 24 x 7 hour run motor bearings is a misfit now and we have to go in for specialized grease with poly-urea thickener as additive. The base oil and additives also play a major role in deciding re greasing interval. Doubling the re-greasing interval as compared to lithium based general purpose greases is seen now.

I image – Std motor fan cowl design to be replaced to suit to process & ambient surroundings (in textile mills)

II image – Motor bearing needs specialty greasing to dissipate heat, as bearing constitutes 70% failure in motor.

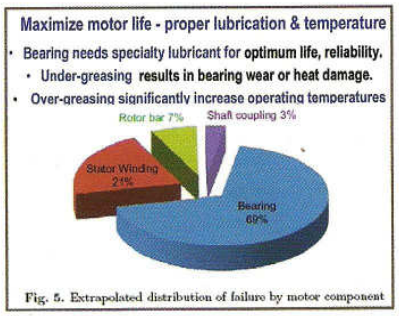


Fig. 5. Extrapolated distribution of failure by motor component

III image – BEE Guidelines on the Motor belt transmission losses due to V belts & reduction by cogged belts.

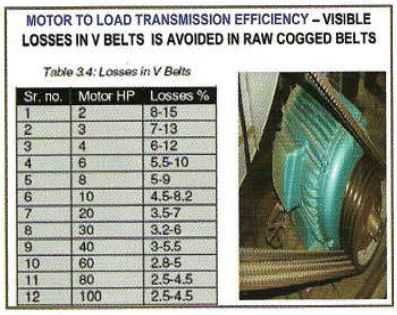


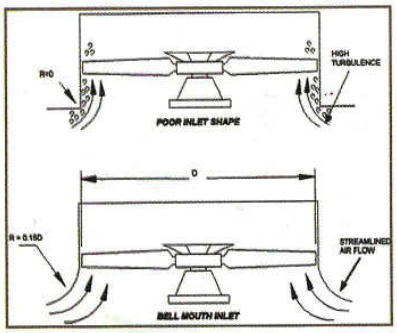
Table 3.4: Losses in V Belts

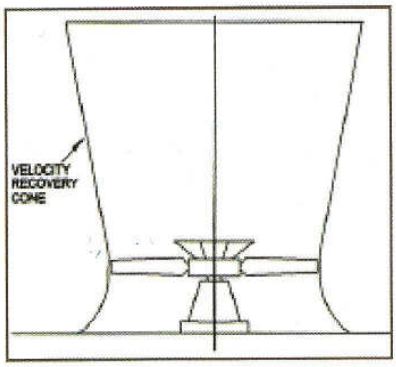
Sr. no.	Motor HP	Losses %
1	2	8-15
2	3	7-13
3	4	6-12
4	6	5.5-10
5	8	5-9
6	10	4.5-8.2
7	20	3.5-7
8	30	3.2-6
9	40	3-5.5
10	60	2.8-5
11	80	2.5-4.5
12	100	2.5-4.5

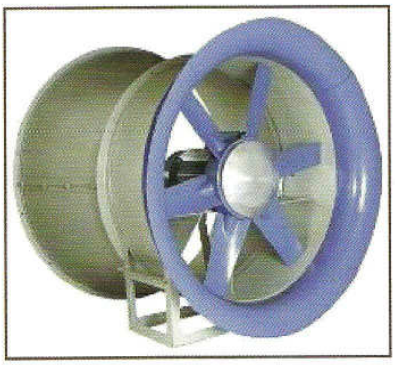
BRIM: Better fan, cowl, cleaner fins, specialty greasing, warm-not-hot motor skin temperature to trim losses.

Fan Losses

For the given KW input to the fan, the air output can be enhanced at the suction bell mouth and at the discharge, using the velocity recovery ring / cone. Though it improves the fan performance, we have to consult with the fan vendor regarding the sizing,







orientation and the 5 to 10% or more increase in output in CFM by the retrofit. Apart from this, many industries / telecom buildings have installed taller roof sheds above the open terrace AC units, condenser fans, DG hoods now to avoid solar heat ingress to machines. Can we also follow their comforting route?

I & II image - Courtesy PARAG fans / Inlet Bell mouth streamlines & at discharge as Velocity Recovery Cone.

III image - Axial flow fan with FRP bell mouth and discharge cone, thus increasing air output efficiency in CFM.

IV image - panel exhaust fan retrofitted with discharge duct. Have we fixed the bell mouth & velocity recovery ring to our utility in HVAC condenser fans, cooling tower, DG set heat exchanger, other fans?

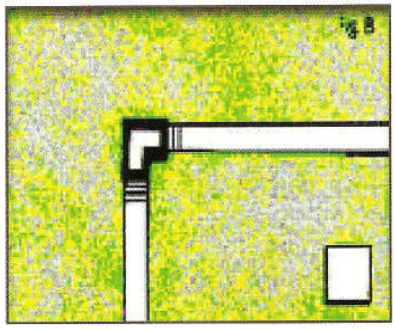
BRIM - The suction Bell mouth, discharge cone enhance the fanning efficiency of the heat transfer process.

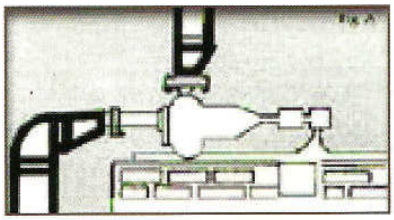
Pump Losses

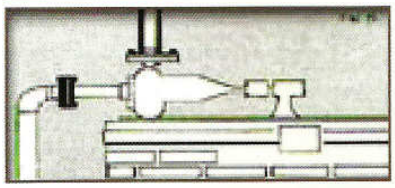
Taking the clue from PCRA's tips on diesel saving in the agriculture pump and we can use the finer points of pipe jointing practices in our industry process and utility especially at the pump suction and discharge. These trivial points are ignored by the piping erectors for the sake of their convenience and for the aesthetic looks of their piping jobs and silently accepted by the industry.

Sharp bends and L-joints in the pipe can lead up to 70% more frictional loss than standard bends. Please go inside your plant or utility and you will be surprised to find many sharp L joints instead of standard long bends. Where as, the equipment vendor in his skid internal piping, you will find only the long bends and sometimes hydraulically bended piping with no pipe fittings so as to avoid pressure drops in skid piping.

Visualize a long stretch of road; 40 feet wide x 1000 meter long having a culvert in between at 500 meters. The culvert is 100 meter long and 20 feet wide. Invariably during busy traffic on this road, an aerial view of the road will show us the traffic jam at both ends of culvert with vehicles queuing longer. This is the case with wetted parts of process & utility like compressor, water piping and this is clearly seen now by the Thermal Imaging tool easily. So stream lining the process flow in pipe fittings at







the middle & ends reduces dynamic pressure drop while running.

I & II images - shows 70 % more frictional losses in sharp L bends than standard long bends.

III & IV image - shows the pump existing suction & delivery fitting restrictions is the focus area first.

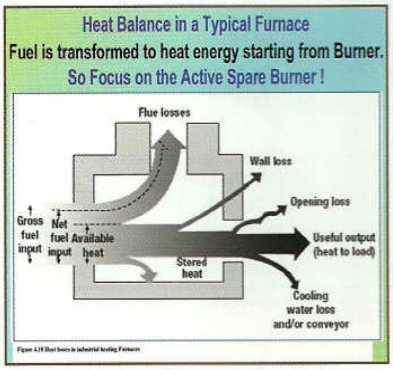
Courtesy: PCRA, Integrated Energy solution provider, Ministry of Oil & Gas, GOI. www.pcra.org.

BRIM:. Pump suction, discharge fittings; Elbow line fittings improve the flow rate of pumping system.

Similarly, the mismatched suction piping flanges and the pump is seen in many industries now. If we just replace the suction & delivery fittings at the pump end with a bigger size reducer etc, we can assure that the pump is not starved at its suction end and its discharge end is not choking the pumping inside. Some times this option can solve major pump internal problems. Again, this is visible in the thermal imaging when checked minutely in certain cases.

Active Spare Burner Reduces Losses

The Active spare burner concept can be tried in the domestic, commercial gas stoves and in the industry furnaces using the LPG, Diesel burners. In the furnaces, the cleaning schedule to be made more frequent now and with the active spare burner being swapped during the daily / weekly / monthly maintenance gives instant fuel savings.



I,II,III images - LPG burners at commercial (& domestic), in gas torches of foundry, in Textile Singeing machines.

IV image - Furnace burner tip & fuel passage thro burner first is the starting point for better combustion in furnace.

BRIM: Active spare Burner in stove, furnace and the frequent swapping routines trims fuel losses.

In our few-year-old domestic LPG stove, the gas burner head to be treated as a consumable if the color of flame is blue with orange / yellow tinge and not uniform, then by replacing the burner, the potential for LPG saving by the household is 5 to 10 % depending on the condition of worn

out existing burner. This condition based swapping maintains optimum air to LPG ratio in the long run, improves combustion efficiency.

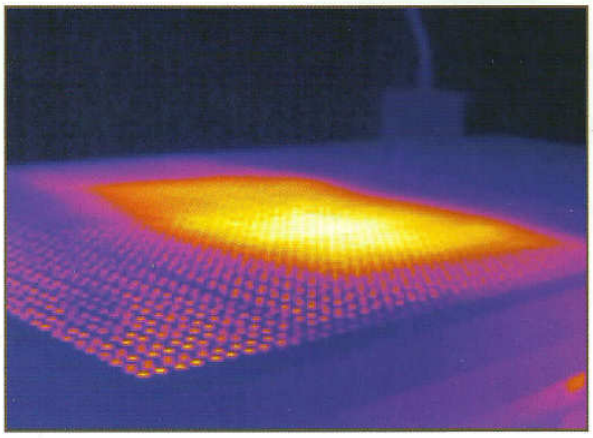
This is applicable to open-to-air burners and to LPG or Diesel /FO operated furnace burners. The savings depends on the existing burner condition compared to the new burner and matched to size and quality. This Active Spare Wetted part concept can be tried on existing corroded or scaled pump impellers too to improve the pump flow rate.

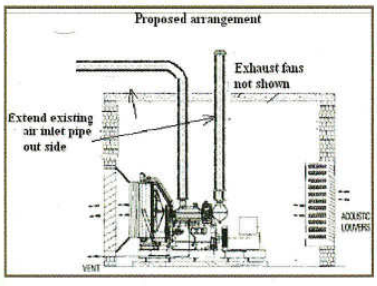
Compressor/DG House-Warming Losses

The compressor house can be fitted with the high volume low static temperature sensing roof vents to function on the compressor / DG house roof to equal the compressor house temperature to that of ambient temperature outside.

I image - Thermal imaging of oil heat exchanger top view of screw compressor hood, taken in the field.

II image – Top extended air intake on DG / compressor skid and the same ducted out to the cool ambient.





III image – V type suction air pre filters on side / this fabricated pre-filter box can be put on skid top / side.

IV image - The compressor exhaust duct double sized to top skid mouth to dissipate heat of compression.

BRIM: Ducting in, the cool dry air to suction, expanded exhaust ducting out heat of compression from oil HX.

Look for the Hidden Losses Inside, Today

The efficiency of the utility can be enhanced by the above said thought process by retrofitting at the suction / discharge end of the utility equipment. This is an easy to achieve, quick to install, low in cost, and practically possible option. The benefit of this retrofit may not look tangible on the same day of retrofitting. But in short period; this will show the reduction in run hours of utility or will be reflected in the production improvements. As an industry consumer, you can even do this retrofit on your few-year-old equipment in consultation with your OEM vendors. Kindly look into these aspects today, by way of condition monitoring to assess & then trim the energy losses in your utility, effortlessly. ■

S Ashok

S Ashok is a BEE certified Energy Auditor, Coimbatore. He has done BSc BTech (M.I.T.) in Instrument Technology. He has vast field experience & Professional Training in India & Abroad. He conducts Energy Audits under POWERON Projects, and also delivers Energy Conservation Training programs thro PCRA to many Industries & Associations. He promoted a website www.energymeasuretosave.com to serve the Society through Energy Education to the Industry & Domestic segments.