

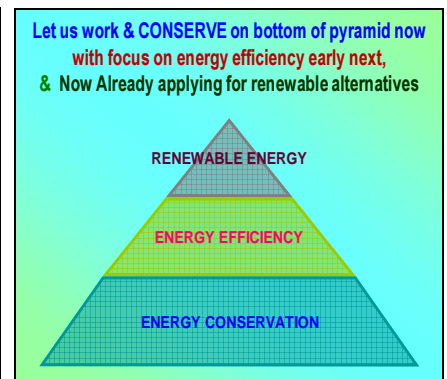
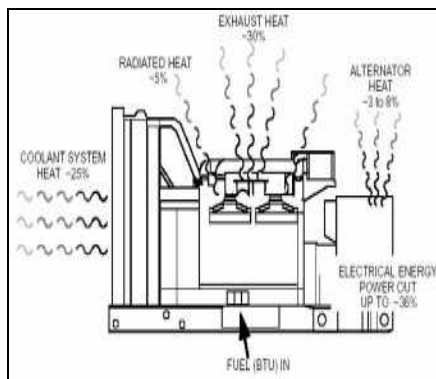
WHY CONSUME OUR DIESEL MORE, IN YOUR DG SET!

- We are used to low cost subsidized Electricity from the EB national & state grid till now. And today due to power cuts, we are forced to run our DG set to meet our production demands, but at high cost of electricity.
- Given below are the finer points of DG operation and maintenance to get the optimum units per liter at sustained DG set efficiency over years.
- **The whole world is thinking to switch over from Diesel & fossil fuel alternatives of power generation to Solar Renewable. Let us take a Small Step today to curb the diesel use in DG sets today and plunge for Giant Leap Tomorrow EARLY.**
- Till date, many industries were talking about the ampere output drawn from the genset as the basic criteria to load the same and are inefficiently loading the DG set. To run at the optimum Rated average KVA Loading is the priority now, to get the better UPL when other parameters of genset are healthy.
- In our DG set, only one third of the Diesel input as fuel in KCal (Kilo Calories) to the DG set is converted to Electrical output as KWH and so the efficiency of generation of DG set is around 35 % only. But it is very user friendly and instantly performs. That is why we pay Rs.7 to EB per unit where as the cost of 1 KWH unit thro our DG is nearing Rs.20/- now.

FINE TUNE THE DG SET INPUT & OUTPUT PARAMETERS TO GET BETTER UPL:

- The DG set is rated by KVA only and hence how much KVA we can take from the DG set is the focus point now. The power factor of the electrical system depends upon the nature of characteristics of the load. If the load ends are compensated so that an average of 0.9 at the load end, then we can efficiently make use of the DG set.
- We have to see to it that the PF is around 0.8. If the PF of load is less than 0.8 PF, alternator gets overloaded and the energy losses thro the alternator increases. If PF of load is more than 0.8 PF the engine gets overloaded. Hence operating the DG set at low PF increases the alternator losses.
- Whatever steps we take to increase the power output and decrease the waste outputs like damage control exercise and this will definitely improve the sustained UPL say up to 10 - 20 % to rated output of given size & condition by above.
- **We have to look in to the five systems in the dg set. The four inputs to function at their maximum efficiency are the air intake & ventilation, diesel, cooling circuit & lubrication function to get sustained & maximum units per liter over the years and the last but not the least is the nature of load & loading of the dg set.**

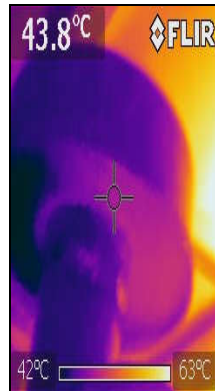
DG SET AIR INTAKE & HOUSE VENTILATION:



Expanded radiator duct - Waste heat from DG sub systems - Forced air intake - Bottom of Pyramid Priorities Now.

- 1. The radiator expanded radiator duct will maximize the heat transfer efficiency in the cooling water sub circuit**
- 2. The waste heat from DG sub systems, if not expelled out, they will interfere with DG inputs & reduce efficiency.**
- 3. Provide Fresh air fan at hood and extend DG air intake mouth beyond alternator and near to the above fan.**

- In the DG set the Higher back pressure at exhaust leads to Lower fuel economy, and so to keep the exhaust piping to be minimum and take short cut with minimum Long bends / no bends to out of the DG area in premises. Care is taken not to short circuit the exhaust gas back to the DG house to DG air intake.
- The engine room temp must be near to ambient & not rise more than 5°C above ambient temperature. Keep a temperature sensor (with the visual indicator + remote alarm) near air intake area of DG set. This is easy symptom of DG running health.
- Exhaust temperature limits the loading and KVA on DG Set. So monitoring exhaust temp is important to know about the possible running rating of engine & optimum loading. Over years we must know how much de-rating in KVA has happened? **We understand now, why DG OEM don't allow the consumer to ramp up to 100 % loading and limit to suit to above?**
- The exhaust piping and the silencers shall be insulated using 50mm thick mineral wool inside the container & up to the exhaust stack. The insulation shall be clad with 24G aluminium sheet. Exhaust pipe must not radiate to the skid area.
- All over, we find the DG set running with opened acoustic doors as the localized heating inside increases with closed doors. To provide louver type doors / doors with bottom air filters to meet the noise safety levels without starving the engine.
- But as a user we should give umbrella type sun shade protection with sufficient head room and all sides open area. This is followed by the Telecoms buildings in the open terrace machines, for all their HVAC condensers and other equipments.
- Now in any industry we see the trend, first they put the Ridge type for full length of shed or Power-less roof ventilators on their DG & Compressor house only. The roof vents do an excellent work to remove the hot radiating air from DG skid area.
- DG Set building should be Positive cross ventilated. Increase in air intake temperature from 25°C to 40°C, the air fuel ratio decreases by about 5%; that is diesel losses happen by 1 % for every 4 *C rise above the outside ambient temperature.



Energy conservation is to reduce the inputs to DG & losses within DG and fine tuning the output

- 1. INPUTS to the DG – Air, Diesel**
 - Ensure Cool dry air for the DG to suck & surround
 - Improve diesel quality – no water / no soluble etc
 - fuel injection to the engine to atomize more
- 2. Losses in DG – in water & Exhaust circuits,**
 - Condition monitoring of engine cylinder parameter
 - Efficiency of heat exchanger in water circuit
- 3. OUTPUT from DG – Refine the output**
Study KWH, KVAH, KVARH, average PF & improve

Hood V type air filter - Exhaust pipe choke - Air intake 10°C more – Conserve inputs, Reduce losses, Refine outputs

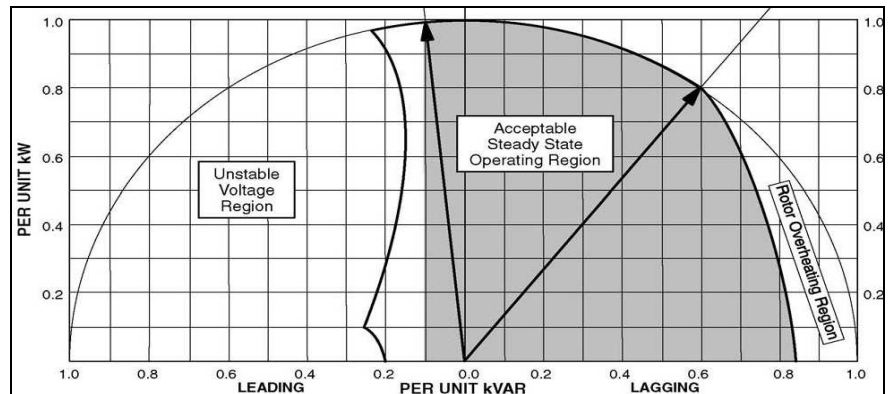
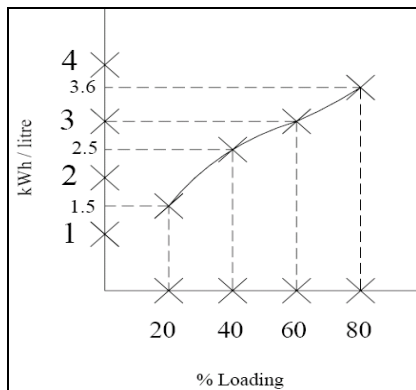
- 1. DG hood fitted with V type netlon mesh filter ensures positive cross ventilation inside the hood + forced air intake.**
- 2. The choked Exhaust pipe derates engine. So fit an Expanded Tee with inspection flange and rain cap on center pipe.**
- 3. When outside ambient is 34°C, air intake inside hood is 44 *C; instead of cool dry air, warm air heats up engine.**

- Please consult with your OEM whether your DG set room size, air requirements are met with the existing arrangements. Why so much emphasis is given because, many industries are using DG set room as unofficial store room stacking hesitant-to-throw materials and hazardous waste since the DG was used sparingly before and now the condition is frequent usage!
- Blue colour of the DG set exhaust smoke shows excess lubricating oil or worn out piston scraper rings. Light purple is OK. Grey smoke is the result of dirty fuel injector or the engine overloaded. To clean fuel injector and maintain proper loading. - Black smoke is due to incomplete combustion of fuel which is due to choked air filter or improper

compression. **Keep air filter clean, allow your DG set to breathe comfortably and please allow them to inhale and exhale smoothly.**

DG SET OPTIMUM KVA LOADING:-

- Till date, many industries were talking about the ampere output drawn from the DG set as the basic criteria to load the same and are loading up to 60 % only even in the new DG set due to lower PF and religiously following the safest loading as per the guidelines of their DG OEM. Optimum loading around 75 % subject to DG de-rating, will give 10 % more units per liter.
- The average EB frequency is at 49.5 Hz only now. Here it is wise to reduce the DG set (with electronic governor), frequency from 50 Plus Hz to 49 + Hz after studying the loading of all the loads and this gives instant savings.
- The average loading of motors in the industry indicates around 60 to 70 % it is wise to operate the DG set so as to get at 400 – 405 volts instead of 420-430 volts at heavy load end motor terminals at the plant. This gives instant savings in Diesel and the motor output does not reduce at its shaft. Make use of the Electronic Governor in your DG sets fully to conserve Diesel.
- Add power factor correction capacitors to all motors above 3 HP so as to give an average Power factor of 0.9 max at the load end, then we can try to load from 60 to 80 % load & more, the DG set to its optimum rated capacity and efficiency.
- The DG set is rated by KVA only and hence how much KVA we can take from the DG set is the focus point now. The power factor improvement capacitors on linear loads only not at the incoming of VFD loads etc. The symptom of a good VFD along with line reactor choke is that the VFD maintains PF 0.95 + at the input at the minimum & maximum level of motor loading.



DG load 40 – 80 % makes UPL 50 % UP Maintain Healthy steady P.F. from 0.80 to 0.95 for more Units / Liter.

When we operate our DG set, we can get 50 % more units for same liter of diesel when we load DG from 40 to 80 %

Or, We can reduce diesel consumption by One Third 33 %, provided we load at 80 % of rated KVA instead of 40 %

- Hence to have control over the DG output in terms of KVA, KW, and the PF, automation of DG set energy parameters is one of the ways to take the best out of DG set. So the Maximum Demand Controller MDC & APFC operating at PF 0.9 instead of 0.7 now. These are retrofitted to the existing DG set then, it will cap the max demand from the load to the DG set as well DG set is put to max optimum rating. Its audio visual alarm & multiple alarm settings can be used to pro-rate the production.
- The user can think of replacing ordinary KWH meter in his DG set with this MDC which gives per phase KVAH, KWH, and average PF and this not only acts to monitor but also control the max KVA demanded by the load automatically.
- It should be ensured the single phase loads are distributed evenly across the three phases so that the unbalance between 3 phases is not more than 10 % of the total DG set capacity. More the unbalance, this will lead to less UPL.

COOLING WATER & LUBRICATION CIRCUITS:-

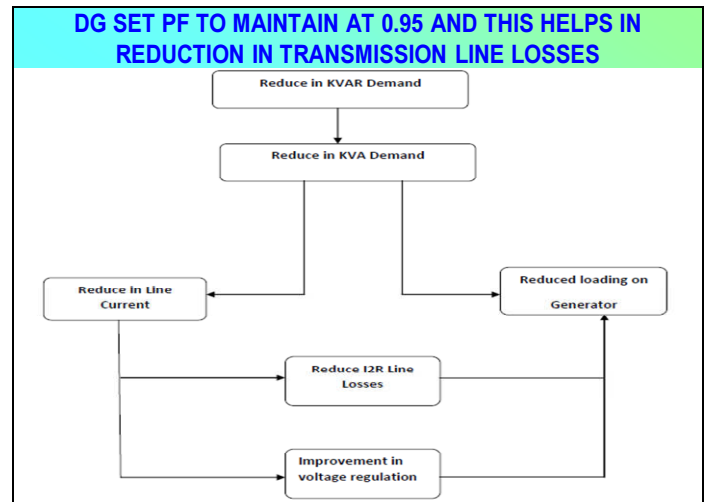
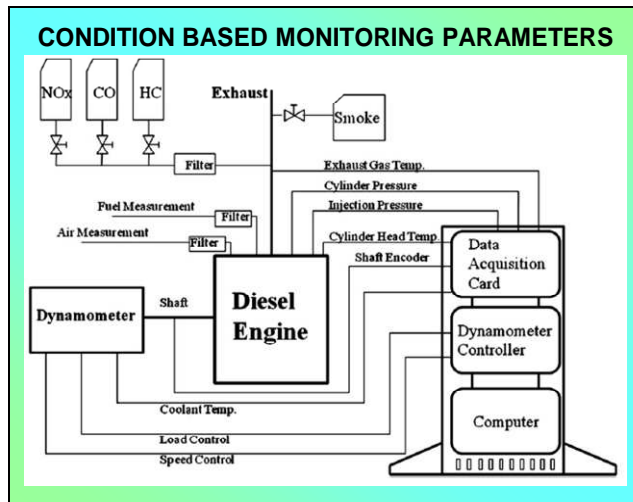
- Engine needs clean water. Never use hard water as it restricts the transfer of heat resulting in engine overheating. For proper heat dissipation and to avoid rusting/scaling, mix radiator coolant to water. If possible DM water may be used and 20 % coolant to be used along with the radiator water. This will ensure at least minimum saving of fuel in DG engine.
- The WATER TEMPERATURE will be 75°C to 93°C & the cooling system should be so designed that difference between inlet and outlet water temperature of the radiator to be 6 to 10°C. Measure with locally fixed temperature & pressure gauges.
- LUBE OIL - USE OF THE WRONG GRADE OF OIL COULD LEAD TO Overheating of the engine, Sluggish performance, Excessive fuel consumption, increased wear of bearings and other parts etc. Thicker oils cause 2 % excess fuel consumption.
- Monitor lubricant condition thro regular sampling and analysis of used oil. Please check your lube log and OEM manual for correct consumption. Higher lube consumption is indicated by chimney smoke, poor maintenance & less UPL.
- Use of multi-grade and high performance level oils with high detergency, alkalinity reserve, long drain type and anti-wear properties with improved air & oil filters help in lube & fuel conservation apart improving the engine mechanical efficiency.

DIESEL & QUALITY:-

FOR IGNITION, DG SET REQUIRES THE FOLLOWING: Requisite amount of clean air and proper temperature, Supply of clean fuel at proper viscosity, Injection and atomization of the injected fuel, Adequate compression temperature to promote ignition and proper combustion of oil.

Diesel viscosity is critical for atomization. When 30 % diesel returns from engine at 80°C, how many of us monitor & control diesel tank temperature for optimum viscosity to be maintained?

- A poorly maintained fuel injection pump increases fuel consumption by 4gm/kWh i.e. Correction gives 2 % savings. This is where the diesel is injected into the system and hence focus area is to condition monitor the fuel injection area, the pressures.
- Blocked fuel filters increase fuel consumption by 2gm/kWh i.e. Correction gives 1 % savings. The diesel has to reach the system clean and clear. Any partial blocks or pressure drops across the filter will increase the diesel consumption.
- Even the internal health of the DG electrical system is important. Even one bad cell in a battery will overwork the alternator and will consume more engines' power and fuel. That is why some users prefer to keep the battery outside DG set hood so that the battery is cool, accessible to the user and they can condition monitor the same easily.
- Diesel Additives can be used to counter injector nozzle choking in diesel engines. The claims with regard to additives that can improve the energy efficiency in an engine should be weighed carefully & after trial runs only to decide on the same. Recently the industry is using diesel additive and used and recommended by DG set OEM as well. Apart from Diesel savings around 5 %, what is more important to the user is that the additive cleans injectors, improves injection pressure, improves lubricity to the pump, which helps in complete combustion of diesel.
- Magnetic resonator retrofitted outside to the fuel injection line surrounding the line size near the DG set skid is tried many industries has improved the DG set performance. **Fuel injection is the focus area in the DG set to achieve regular diesel savings. The calibration of fuel injection pump frequently done will show scope for diesel savings.**
- When some industry needs only for lighting as an emergency measure instead of running the main utility DG set, it is better to go in for very small DG set operating LED lights or high PF (at 0.85) CFL etc instead of old CFL with 0.55 PF.
- The low efficiency of the DG set is due to Ageing, Inadequate maintenance, inadequate operation practices, Low capacity utilization, fluctuating load and de-ration effect due to higher flue gas temp & excess back pressure in the exhaust piping.



1. In-situ site gauge / remote indicator on DG sets to monitor many parameters automatically achieve Diesel savings.
2. DG output PF if maintained steady between 0.90 to 0.95PF using PLC controlled APFC for system efficiency.

- Apart from Site study, ECON Points compiled from:- Thanks to BEE, PCRA, CII bulletins & CUMMINS Manual.
- Please understand your engine. Adequately comfort & Feed the old cow now to same get sustained milk for years.
- Condition based monitoring of same by comforting thro above steps, definitely will achieve Diesel Saving in DG !

- Energy Conservation is a collective Responsibility for all of us from Today.

- Excess Energy consumption is a collective Liability for all of us since Yesterday.

- Energy Generation is a collective Proactivity to all of us from today onwards to Tomorrow.

- SHARING KNOWLEDGE TO SAVE OUR ENERGY •

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- For more details please visit:- www.energymeasuretosave.com / www.poweronprojects.in.