ELECTRICAL INSTALLATION ENGINEER

NEWS LETTER

TAMILNADU ELECTRICAL INSTALLATION ENGINEERS' ASSOCIATION 'A' GRADE (Regn. No. 211/1992)
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EDITORIAL

Dear Members, Fellow Professionals and Friends,

Seasons Greetings to all!

Prayers for 'Corona' free times soon!

Greetings for a Happy Ayudha Pooja Day!

October is the month to celebrate Mahatma Gandhi; we keep remembering him all the time. He could not only bring about a countrywide united fight for freedom of the country through his 'Satya' and 'Ahimsa', he also brought back the honour to our traditions and culture. He demonstrated his faith through his simplicity and established the ashrams in Sabarmati and Wardha in traditional lines to highlight to our own people our values and wisdom. He demonstrated to the World the values of Spiritualism and Nonviolence. As remarked by Einstein, the greatest of scientists, that it will be difficult for people of the future to believe that such a man like Gandhi lived. That is why he was aptly named the "Mahatma". Mahatma Gandhi believed in living in harmony with nature, which is considered of great importance today when the very safety of the world is being threatened due to abnormal rise of energy needs and unpardonable levels of use of FOSSILS to meet the energy needs. He firmly believed and advocated Ethics in Business and today in the world at large 'Ethics', apart from integrity and other values are considered important to build lasting Brands and Businesses.

We celebrate World Standards Day and World Habitat Day this month. IEC, ISO and ITU together celebrate World Standards Day, which is a means of paying tribute to the collaborative efforts of the thousands of experts worldwide who develop the voluntary technical agreements that are published as International Standards. We are all aware that Standards are the backbones of Safety and Reliability and they help ensure productivity. Advancements in computers and software and the likes of "Digital Twins, AI and IOT", are all aimed towards improving productivity. The economy improvements of Nations revolve around Productivity, Competitiveness, and the adherence to 'Standards' can help economy growth and can help the Urban Future and the Habitats too.

Navaratri and Ayudha Pooja are celebrated in different forms all over the country this month and in Tamilnadu, Ayudha Pooja represents our total faith and reverence to "Work is Worship". We can see elaborate worship of Tools and Machines and work place by everyone involved in any kind of work and in all kinds of work places. It will be interesting to know that Navaratri, indeed, is worship of Goddesses of Knowledge and Skill, Business and Wealth and Power and Valor, representing all activities of the society and the country at large.

We thank all those members who have helped us by participating in the advertisement appearing for the issue September 2020 – E Power, Mahindra & Mahindra, Mersen, Supreme Power Equipment Pvt. Ltd.

Editor

There's enough on this planet for everyone's needs
but nor for everyone's greed.

-Mahatma Gandhi

ELECTRICAL INSTALLATION ENGINEER

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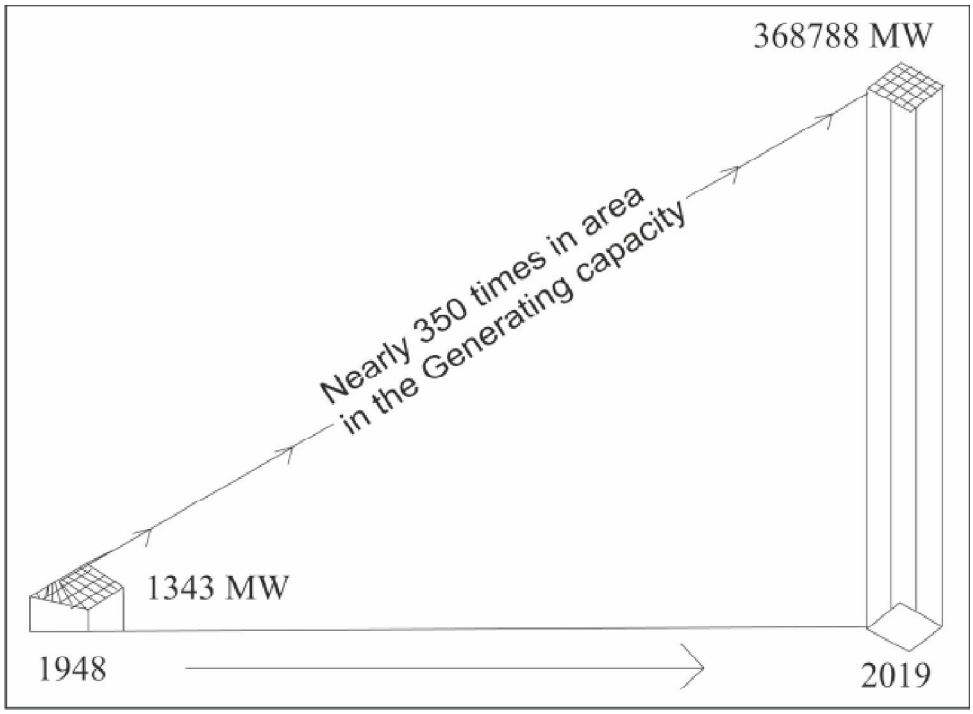

How the Growth of Power Sector Happens in the Last 7 years (7 above decades)

7. Important Terms Connected with Electricity Grid

S.No	Grid	
(i)	Super Grid	An inter connected (meshed) network of large electrical power stations and EHV Transmission networks. i.e. EHV Networks (400KV and above) constitute its transmission network. Due to this traditional 230KV and 110KV networks become sub transmission network.
(ii)	Traditional Grid	Present day power grids 400KV, 230KV and 110KV networks generally constitute the basic transmission network. 110KV and below network form its sub-transmission network.
(iii)	Smart Grid	It is nothing but the Traditional Grid enveloped by ICT networks. i.e. when a Super Grid / Traditional Grid utilizes computers and digital communications and control systems to monitor and control its power flows, it becomes a Smart Grid. Then it becomes more resilent, efficient and cost effective. Smart control of all its components is achieved. The presence of latest digital controls facilitates the use of Smart Meters, Net meters, introduction of many new products, services and markets, Informed participation of customers, Electrical Energy Storage options. Accommodation of all kinds of power generation sources like Solar Wind, Bio mass, Fossil fuels and Nuclear. Further it ensured the quality power supply and the introduction of 'e' vehicles. In short, it ensures the best use of electricity in all fields, optimization of power flow, minimizing transmission losses, better forecasting techniques for the right-mix of generating sources are the other benefits that will accure.

(iv)	Micro Grid (Nano Grid / Autonomous Grid)	It functions independently from the normal electricity grid. It is mainly constituted by Distributed Generation, Storage Devices and Controllable Loads. It is operated either in an islanding mode or in step with a nearby bulk power system (Electricity Grid)
(v)	Distributed Generation	It is nothing but a well co-ordinated generation grid which contains small Wind Electric Generators, Solar Photo Voltaic Cells and Diesel Generators.

8. A dashpot Summary

Table 1 depicts the changes observed during the movement of electric grid from its past to the present and then to the future.

Sl.No.	Description	Past (Earlier to 1991)	Present (1991 – 2020)	Future (After 2020)
I	II	III	IV	V
1.	Nature of Electricity Grid (structure)	Traditional	Smart Grid/Super Grid	Micro grids with back up of Smartly Controlled Super Grid
2.	Generating Sources	Fossil fuels like Coal, Diesel and Natural Gas, Nuclear, Hydel and Geothermal	Fossil fuel sources Nuclear and Hydel, Wind Mills, Photo Voltaic Cells and Biomass + Storage Systems	Same as in present (Column IV) and
3.	Transmission Links	Centralized around 230 KV and 110KV network	765KV, 400KV, 230KV and HVDC (500KV) networks	Same as in present (Column IV)
4.	Movement of Electric Power	Traditional through (Conventional) Grid	Smart and Super Grids	Micro and Super Grids

9. Inner View of the Power Grid – In Brief

An inner view of the grid mirrors how the transmission level voltages move common network from 765 to 1050 and 1200KV, how the generation sources also moved in steps from the conventional (Non Renewable) sources to the Renewable Energy Sources and also how the grid moved from its past status to the present one and also what happened during this 'Transition Period'. To keep in line with this, let us briefly look down from Tariff view point. Currently Thermal power is losing its "Sheen" and making a "losing / unfair fight" to the Renewable Energy Sources. Further it gets heavy blows from pollution control boards (both state and central boards). It suffers much from Environment Control Authority by way of stringent controls and regulations.

After the beginning of liberalization era in 1991, there was a massive build-up of Thermal, Gas Turbine and wind Electric Generating Stations both in private and government sectors. Coal fired power generation "Peaked" in the period between "2010 – 2016". Thereafter it slowed down to the present trickles. In this period, the contributions from the renewables had soared. The related figures are,

- 2010 – 2016 Addition of 106 GW of new coal fired generating capacity (7 year period – Average 15.2GW/Year)

- 2017 – 8.9 GW had been added
- 2018 – 8.4 GW had been added
- 2019 – 8.2 GW had been added

Presently 36GW of coal fired power stations are under construction and it is expected that they will come on line between 2020-30. The addition of TPS will be in the order of 5GW/year (mostly government owned NTPC only). It seems that the private sector has totally abandoned coal fired generation. In the meanwhile, the build-up of Renewables has soared; it is expected to be in the range of 20GW during 2020-21.

As regards Electricity Tariff, the present cost of generation from renewables works out to Rs 3/ unit whereas that from existing and newly built Thermal Power Stations are in the order of Rs 4/Kwh and Rs 5-6 / unit respectively. So there is no surprise that the power generation from fossil fuels like coal and gas finds it difficult to make both ends meet or to keep its head above the water level.

10. Grid Operation in the Past (Earlier years)

Now it is time to review our experiences during the "Past era" of the grid in Tamilnadu (i.e. between "1948-1991"). In this period, we had many opportunities to study the nature / behaviour of the grid during its,

- Over loading and under frequency operations and frequent load shedding conditions
- Inadequate VAR compensation (Voltage Instability) especially due to the presence of wind electric generators.
- Excess VAR compensation (Loss of Excitation faced by the generating units then in service)
- Islanding operation of Thermal power stations during under frequency condition
- Very severe faults on main Tie-lines
- Lack of adequate transmission links between the major generating centre. (Kundah Hydel area) and the main load centre (Chennai)
- Prevalence of over voltage conditions mainly caused by Dynamic over voltages (Idly charging of long EHV lines), Switching Surges and Severe lightnings
- Lack of high speed relay protection; inadequate surge protection (Removal of line entrance surge arresters in grid substations)
- Operating problems brought by Harmonics
- Lightly loaded operation of dedicated 22KV feeders which are conducive for the presence of Ferro- resonance.
- Added to this, certain problems are unexpectedly met with, while introducing certain measures, changes in the network. These brought unintended consequences of very severe in nature. Among them are,
- Creating **"Intentional Single Phasing"** in the 3 phase 4 wire LT distribution networks in rural areas. This results in higher losses, and also creates a fertile ground for Ferro resonance
- Introducing higher capacity fixed capacitors on the secondary side of Distribution transformers in rural networks, which creates a favourable atmosphere for over fluxing condition.
- Introduction of Shunt capacitors (VAR Compensation Devices) in 110KV networks nearer to generating stations
- Introduction of Static VAR compensators and Synchronous condensers in the EHV network.

- Removal of line entrance Surge arresters in EHV substations; Non-provision of Surge arresters in the GIS controlled Auto Transformers
- Floating tertiaries of Auto Transformers in EHV substations
- In-correct tap changing methods adopted on power transformers that led to "Overfluxing Conditions"
- Unmetered free power to agricultural pump sets, huts, weavers and similar categories of consumers that lead to no clear load data and line losses in the grid.

Among the dangerous end results experienced, as a consequence of these unintended measures are,

- Prevalence of very high voltage levels in the grid, especially in rural networks, during night hours with the consequential loss of equipment and devices both at the consumers and suppliers end.
- Frequent premature failures of Circuit Breakers, Distribution Transformers, Current Transformers, Surge Arresters and Line Insulators.
- Enhanced vulnerability of SS equipment like Transformers to the threats of over voltage surges due to the absence of Line Entrance Surge Arresters
- Unscheduled failure of costly grid-coupling transformers and current transformers with the consequential electrical fires. Certain correction measures adopted helped to limit / moderate all this adverse impacts faced in the grid; still they need a clear focus with these issues. We gradually moved along with the grid from its "Past to the Present" conditions. Yet certain issues have yet not been resolved; i.e. we are still unable to tide over / give up certain operating issues, as out lined above which haunt / "Tamilnadu Electricity Grid" like an albatross around its neck.

Added to this, the present "Generation Mix" issue also creates some additional problems. It is because, presently renewable energy sources which are "infirm" in nature, constitute a major portion of the generating capacity in the grid. In this connection, it is not out of context to cite that the Hydel generation which was predominant during the period from "1948-1970" gave way to Thermal Power Generation in Seventies; thereafter Thermal Power Generation attained the Prime position. Presently its dominance is challenged by renewable power sources like solar power and wind power. Within a short period from now on it is expected that the Thermal Power will be pulled down from its pedestal by renewable energy sources. It is mainly due to the fall in the cost/unit of electricity generated by *Renewable Energy Sources*. The available statistics also support this view. When the generation front faces such issues can Transmission section lag behind?

Such wide changes are also noticed in the Transmission sector also; the voltage level of transmission structure also markedly moved from the past "400KV-230KV level to the present 765KV-HVDC (500KV) – 400KV levels". Now the 230,110KV networks are down-graded to sub-transmission level. It is mainly because of the availability of very high generating capacity available in the grid.

In this context, one important point needs to be noted. Being a dynamic system, the electricity grid always spews / throws many critical situations; many of them are our own making or the results of our past actions / dealing with it.

11. Present Grid

Before moving from the past status of the electricity grid to the present condition, let us learn some more salient points. (i) If there is an effect, there must be a "Cause" but the cause does not depend on 'the effect' i.e. the cause never pervades the effect. (ii) When the network is permitted to operate with in its well defined set limits, its out-put will be on the expected lines i.e. it will take care of itself and the

quality power will out flow from it. It is just like the feeding correct data to get correct results in the case of computers. But due to a variety of reasons, we never permit our power network to function in its own natural way; either we thrust some man made issues or the nature / surrounding environment thrust some unexpected issues on it with the consequential erratic behaviours followed by undesirable impacts. Thus there is a need to look into the past events which pave the ways for its present and future. With this back drop, let us move from past to present status of the grid. When we enter the present environment of the grid, the first issue that comes into our view is the "Generation Mix and Tariff". Though coal fired thermal generation constitute the major portion of the generation in the grid, it slowly gives its place to the electric power from Renewable Energy Sources. But one point that needs attention in this context is the seasonal and infirmity of the power produced by the Resources. Solar power is available only during daytime with a clear sky (not available during cloudy and rainy days); in the case of wind power, it is predominant only during morning and evening hours. All these stress the necessity to have adequate "back-up power" in the grid. One noted aspect at this juncture is that the per unit cost of production of power from Renewable Energy Sources is around Rs 3/unit where as that of coal based thermal power is in the range of Rs 4-6. Thus the cost of generation plays a major role/deciding factor for the day-to-day functioning of the grids owned by the utilities like TANGEDCO. These utilities are chronic, already on the "red" and suffer from the paucity of funds. This poses a big question to them. Whether to go for coal based power or RE sources power.

The gradual introduction of Smart Grid in the present Super grid structure makes it easier for better load forecasting techniques selection of proper generation mix, loss reduction measures better stability and periodical shut down of generating units for maintenance. It is expected that it will facilitate modernize and optimize electrical grids. Further that this Smart, Super-Grid system will also facilitate a quality electric power supply and best use of the present hydel, thermal, nuclear and renewable sources of generation available in the Tamilnadu power grid.

12. Future

Our next site will be FUTURE Condition of Electric Power Grid in Tamilnadu, before stepping into this segment, many issues are required to be faced / solved. Among them are,

1. Are we ready or in a position to operate Micro-grids accompanied with smartly controlled super grid? Do we have we the where withal / facilities / resources for this arrangement? i.e. to redefine the grid with various innovative measures.
2. Do we have the resources / necessary supports to go for off-shore wind power generation? If we could say "Yes" for this, then we can get wind generated power round the clock. To put it simply, along with the present nuclear and Hydel Power Generation, our dependence on coal fired power generation will be less/limited.
3. Are we in a position to make intelligent designs and unique ability to operate the transmission circuits at higher temperatures and better margin (Dynamic Operation)?

Let us continue further the features of our future power grid in the coming issues.

Let us sign off now.

(To be continued)

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"One cannot manage change. One can only be ahead of it."
– PETER DRUCKER

ABSTRACT OF IS 1255 (INSTALLATION & MAINTENANCE OF CABLE) - 2

14) Railway Crossing

- When the cables are laid under railway tracks the cables should be laid in reinforced spun concrete or cast iron or steel pipes
- At such depths as may be specified by the railway authorities but not less than 1 m measured from the bottom of sleepers to the top of the pipe.
- On long run ducts, it is desirable to apply lubrication to the lead or serving/outer sheath as it enters the duct.
- Petroleum jelly or graphite powder or a combination of both is effective for this purpose and through lubrication will reduce the pulling tension by about 40 percent.

15) Laying on Racks in Air

- The vertical distance between the two racks should be minimum 0.3 m and the clearance between the first cable and the wall (if racks are mounted on wall) should be 25 mm.
- The width of the rack should not exceed 0.75 m in order to facilitate installation of cables.
- Ungalvanized steel work of cable racking/trays should be painted with a coat of primer and thereafter finished with suitable anti-corrosive paint.
- Only single-core cables laid on horizontal racks need be clamped at suitable intervals. Multi-core cables need not be clamped. The distance between the vertical clamps should not be more than 2 m.
- Laying Cables on Racks Inside a Tunnel: Horizontal distance between Two cable is min Diameter of Cable and vertical distance between two cable row is 30cm.In cable tunnel, the head room should not be less than 2 m and width sufficient to leave a free passage of at least 600 to 800 mm either from one side or in the middle.
- With temperatures below 3°C, the cables should be warmed before the laying out, since otherwise the bending would damage the insulation and protective coverings of cables. The cable laying must be carried out swiftly, so that the cable does not cool down too much
- Identification strips/tags of metal or plastics should be attached to the cables, particularly if several are laid in parallel, 8 to 10 m apart. Identification tags should also be attached at every entry point into the buildings and at the cable end termination
- The spacing between three cables laid in one plane should be not less than the cable diameter.
- When the cable run is several kilometers long, the cables should be transposed at one-third and at two-thirds of the total lengths.

16) Trefoil arrangement in ducts

- If several single-core cables are laid per phase, these should be arranged as follows to ensure balanced current distribution
- in Horizontal direction: R-Y-B-Distance-B-Y-R, (Distance=2 X Diameter of Cable) , vertical distance shall be 6 X Diameter of Cable

17) Insulation Colour

- For reduced neutral conductors, the insulation colour shall be black.
- For cables having more than 5 cores, the core identification may be done by numbers. In that case, the insulation of cores shall be of the same colour and numbered sequentially, starting with number 1 for the inner layer. The numbers shall be printed in Hindu-Arabic numerals on the outer surface of the cores.
- The numbers shall be of the same colour which shall contrast with the colour of the insulation. The numerals shall be legible."

- When the number is a single numeral, a dash shall be placed underneath it. If the number consists of two numerals, these shall be disposed one below the other and a dash placed below the lower numeral. The spacing between consecutive numbers shall not exceed 50 mm.

18) Type of Armoring:

- Where the calculated diameter below armoring does not exceed 13 mm, the armor shall consist of galvanized round steel wires.
- Where the calculated Diameter below armoring is greater than 13 mm, the armor shall consist of either galvanized round steel wires or galvanized steel strips.

19) Identification/Marking

- Type of Cable Legend:
- Improved fire performance or Category C1 FR
- Cables in constrained areas, Does not propagate fire even when installed in groups in vertical ducts),
- Improved fire performance for Category C2 FR—LSH (Cables in constrained areas with limited human activity and/or presence of sophisticated systems)
- Aluminum conductor = A,
- PVC insulation = Y, Steel round wire armor = W,
- Steel strip armor = F,
- Steel double round wire armor = WW,
- Steel double strip armor = FF,
- PVC outer sheath = Y

20) **Cable Route Indicator (Up to 33KV)**

- Route indicators — Power cable route indicators should be provided at an interval not exceeding 200 M and also at turning points of the power cable route wherever practicable.

21) **Cable Corrosion (Up to 33KV)**

- Electrolytic corrosion — Where the possibility of electrolytic corrosion exists, for example, adjacent to dc traction system, the potential gradient along the pipe-line and the cable sheath should be specified.

22) **Neutral (Up to 33KV)**

- The neutral point is earthed in such a manner that during a line-to-earth fault the highest rms voltage to earth of a sound phase(s) expressed as a percentage of the highest line-to-line voltage, does not exceed 80 percent, irrespective of the fault location,

23) **Earthing (Up to 33KV)**

- The neutral point is not earthed but a device is installed which automatically and instantly cuts out any part of the system which becomes accidentally earthed,
- In case of ac systems only, the neutral point is earthed through an arc suppression coil with arrangement for isolation within one hour for the non-radial field cables and within 8 hours for radial field cables, of occurrence of the fault provided that the total of such periods in a year does not exceed 125 hours.

24) **Cable Tensile Strength (Up to 33KV)**

- Maximum Permissible Tensile Strength for Cables: PVC and XLPE insulated armored power cables P = 9 D2 ,P = Pulling Strength(N), D = Outer Dia of Cable (mm)
- Maximum Permissible Tensile Strength for Cables: PVC and XLPE insulated unarmored power cables P = 5 D2
- Maximum Permissible Tensile Strength for Cables: Paper insulated armored power cables P = 5 D3

(To be continued)

Courtesy: ***Jignesh.Parmar***

ABSTRACT OF IS: 5613 (PART 1, 2, 3) - 3

26) Danger Plate (11KV To 220KV)

- Danger and number plates are located on Face (Feeding End (S/S)) of pole.

27) Anti Climbing Device (11KV To 220KV)

- Leg 1 (Right End Leg (Feeding End (S/S)) represents the leg with step bolts and anti-climb device gate if any. If two legs with step bolts are required, the next is No. 3 leg (Diagnostically opposite of Leg1)

28) Clearance (11KV to 220KV)

Voltage	Number Of Circuit	P-P Vertical Clearance	P-P Horizontal Clearance
	Single	1.5 Meter	1.5 Meter
33KV	Single/Double	1.5 Meter	1.5 Meter
66KV	Single/Double	2.0 Meter	3.5 Meter
110KV	Single/Double	3.2 Meter	5.5 Meter
220KV	Single/Double	4.9 Meter	8.4 Meter

- In case triangular formation has to be adopted, the conductor lying below an upper one shall be staggered out by a distance of X=V/150 Where V=System Voltage, X=staggered distance in meters.
- The earth wire sag shall be not more than 90 percent of the corresponding sag of power conductor under still air conditions for the entire specified temperature range

Line Voltage (KV)	Spacing between P-E
33 KV	1.5 Meter
66 KV	3.0 Meter
110 KV	4.5 Meter
132 KV	6.1 Meter
220 KV	8.5 Meter

29) Earthing (11KV To 220KV)

- All metal supports and all reinforced and pre stressed cement concrete supports of overhead lines and metallic fittings attached thereto, shall be permanently and efficiently earthed.
- For this purpose a continuous earth wire shall be provided and securely fastened to each pole and connected with earth ordinarily at 3 points in every kilometer, the spacing between the points being as nearly equidistant as possible. Alternatively, each support and metallic fittings attached thereto shall be efficiently earthed.
- Each stay-wire shall be similarly earthed unless an insulator has been placed in it at a height not less than 3.0 meters from the ground

30) Tower Height (up to 400KV)

- The transmission lines and transmission line structures of height 45 m and above shall be notified to the Directorate of Flight Safety (DFS), Air Headquarters (Air HQ), New Delhi.
- For construction of any transmission line/structure or a portion thereof, falling within a radius of 20 km around the Defense aerodromes and air to firing ranges provisions of the Aircraft Act 1934, Section 9A as amplified by the associated Gazette Notification SO 988 Part II, Section 3,

- Within a radius of 10 km around aerodromes and air to ground firing ranges, all transmission lines and structures of height 45 meters or more shall be provided with day and night visual aids.

31) Line Marker (up to 400KV)

- Line Markers: Coloured globules of 40-50cm diameter made of reinforced fiber glass or any other suitable material, weighing not more than 4.5kg each with suitable clamping arrangement and drainage holes shall be installed on the earth wire(s) in such a manner that the top of the marker is not below the level of the earth wire.
- Up to 400-metre span, one globule shall be provided in the middle of the span on the highest earth wire. In case of double earth wires, the globule may be provided on any one of them. For span greater than 400-metres, one additional globule may be provided for every additional 200-metre span or part thereof. Half orange and half white coloured globule should be used.

32) Structure Marking (up to 400KV)

- Structure Marking: The structure portion excluding cross-arms above 45m height shall be painted in alternate bands of international orange and white colours.
- The bands shall be perpendicular to the vertical axis and the top and bottom bands shall be orange. There shall be an odd number of bands. The maximum height of each band shall be 5m.

33) Span (up to 400KV)

- Minimum ground clearance from lowest point of power conductor shall be 8840 mm.
- Minimum mid-span vertical clearance between power conductor and ground wire in still air at normal design span shall be 9000 mm.

34) Clearance (up to 400KV)

- Vertical clearances above Railway Track : 220KV To 400KV =19.3 Meter

35) Shield Angle (400KV)

- For 440KV: Shielding Angle= 20"

36) Clearance (400KV)

- For 440KV: Maximum Length of Suspension Strings from Shackle Attachment at Hanger to Center Line of Conductor = 3850mm
- For 440KV: Maximum Length of Tension Strings from Tower Attachment to Compression Dead-End Attachment = 5600mm
- For 440KV: Minimum Mid-Span Vertical Clearance Between Power Conductor end Ground Wire in Stilt Air = 9000mm
- For 440KV: Right-of-way and transport requirements of maintenance, the following right-of-way width for 400 kV lines are recommended: Single/Double Circuit = 50meter
- For 400KV Road Crossing: At all important crossings, the towers shall be fitted with normal suspension or tension insulator strings depending on the type of towers but the ground clearance at the roads under maximum temperature and in still air shall be such that even with conductor bundle broken in adjacent span, the ground clearance of the conductor from the road surface shall not be less than 8’84 meters.
- At all national highways tension towers shall be used. The crossing span, however, shall not exceed 25 meters in any case

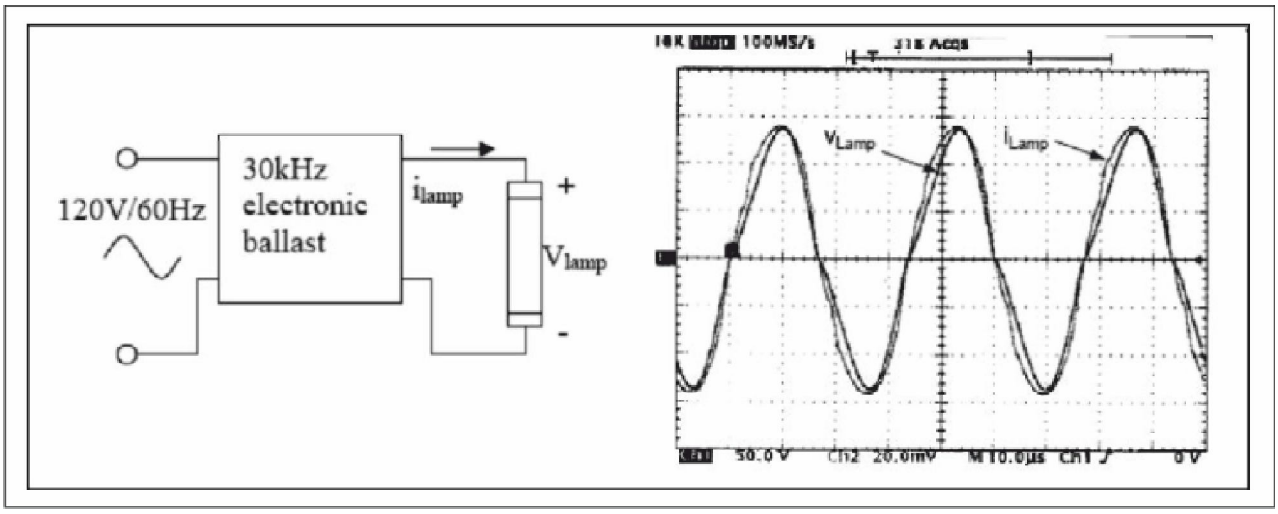
Courtesy: Jignesh Parmar

INSTALL LIGHTING SYSTEMS - 3

Electronic Ballast

A complex device that substitutes electronic components for the core and coil assemblies found in magnetic ballasts.

Electronic ballasts are significantly smaller, lighter and quieter than their magnetic counterparts. Also, it offers distinct advantages in energy efficiency and lamp operation.



Measured lamp voltage and current waveforms for an electronic ballast

The advantages of an electronic ballast as compared to a normal ballast are as follows :

1. It doesn't produce any noise and doesn't blink also.
2. It doesn't consume more electric power. It saves 33% of electric power.
3. It doesn't require a ballast and a capacitor.
4. It starts to emit light in less than 1 second.
5. Its weight is low.
6. It can work on voltage between 100 and 300 volts.
7. It doesn't get hot.
8. Its life is double.
9. It can work on either a.c. or d.c. source.
10. It gives more light (66 lux per watt) than tubes with normal magnetic ballast.

High pressure mercury-vapour discharge lamps

A mercury-vapour lamp is a gas discharge lamp which uses mercury in an excited state to produce light.

The arc discharge is generally confined to a small fused quartz arc tube mounted within a larger bulb which provides thermal insulation and protection from ultraviolet radiation.

Mercury-vapour discharge lamp

When a mercury vapour lamp is first turned on, it will produce a dark blue glow because only a small amount of the mercury is ionized and the gas pressure in the arc tube is very low.

As the main arc strikes and the gas heats up and increases in pressure, the light shifts into the visible range and the high gas pressure causes the mercury emission bands to broaden somewhat, producing a light that appears more-white to the human eye. Even at full intensity, the light from a mercury vapour lamp with no phosphors is distinctly bluish in colour.

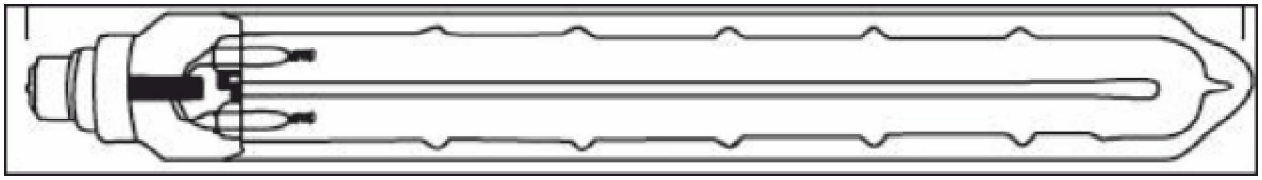
If the discharge should be interupted (e.g. by interuption of the electric supply), it is not possible for the lamp to restrike until the bulb cools enough for the pressure to fall considerably.

Mercury vapour lamps rarely burn out completely but suffer from lumen depreciation and the bulb produces 50% less light output every five years, to the point of becoming ineffective while still drawing the same amount of power they drew when they were new.

Low pressure sodium vapour discharge lamp

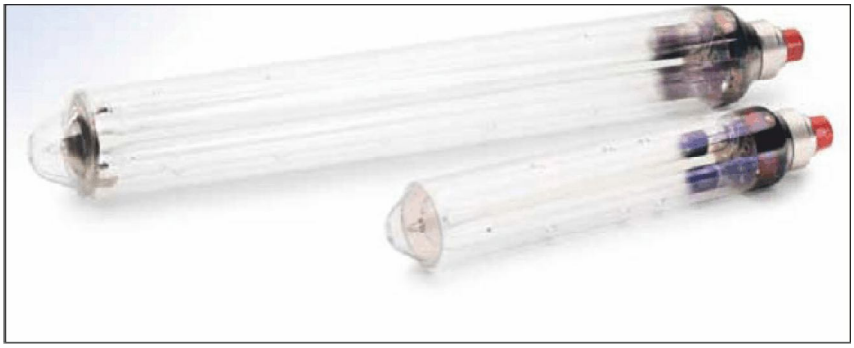
A low pressure sodium vapour lamp is a gas discharge lamp which uses sodium in an excited state to produce light.

Low pressure sodium (LPS) lamps, also known as sodium oxide (SOX) lamps, consist of an outer vacuum envelope of glass coated with an infrared reflecting layer of a semiconductor material that allows the visible light wavelengths out and keeps the infrared (heat) back.



It has two inner glass U-pipes that hold solid sodium and a small amount of neon and argon gas mixture to start the gas discharge, so when the lamp is turned on it emits a dim red/pink light to warm the sodium metal and within a few minutes it turns into the common bright orange colour as the sodium metal vaporizes.

LPS lamps are the most efficient electrically-powered light source. As a result they are widely used for outdoor lighting such as street lights and security lighting where colour rendition is viewed by many to be less important. LPS lamps are available with power ratings from 10 W up to 180 W.



Another unique property of LPS lamps is that, unlike other lamp types, they do not decline in lumen output with age. LPS lamps, however, do increase energy usage slightly (about 10%) towards their end of life, which is usually rated around 18,000 hours for modern lamps.

LPS lamp failure does not result in cycling; rather, the lamp will simply not strike, and will maintain its dull red glow exhibited during the start up phase.

High pressure sodium vapour discharge lamp

High pressure sodium (HPS) lamps are smaller than LPS and contain additional elements such as mercury, and produce a dark pink glow when first struck, and a pinkish orange light when warmed.

High pressure sodium lamps are quite efficient (100 lm/W). They are used for outdoor lighting such as streetlights and security lighting.

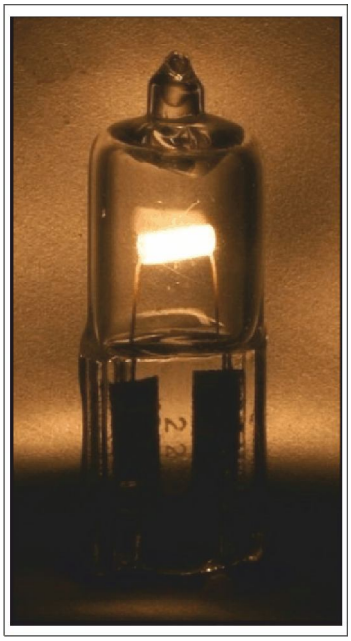
The lamp is powered by an AC voltage source in series with an inductive "ballast" in order to supply a nearly constant current to the lamp, rather than a constant voltage, thus assuring stable operation.

HPS lamps can be started at a relatively low voltage but as they heat up during operation, the internal gas pressure within the arc tube rises and more and more voltage is required to maintain the arc discharge.

At the end of life, high-pressure sodium lamps exhibit a phenomenon known as cycling, which is caused by a loss of sodium in the arc. When a lamp gets older, the maintaining voltage for the arc eventually rises to exceed the voltage provided by the electrical ballast.

As the lamp heats to this point, the arc fails and the lamp goes out. Eventually, with the arc extinguished, the lamp cools down again, the gas pressure in the arc tube is reduced, and the ballast can once again cause the arc to strike. The effect of this is that the lamp glows for a while and then goes out, repeatedly.

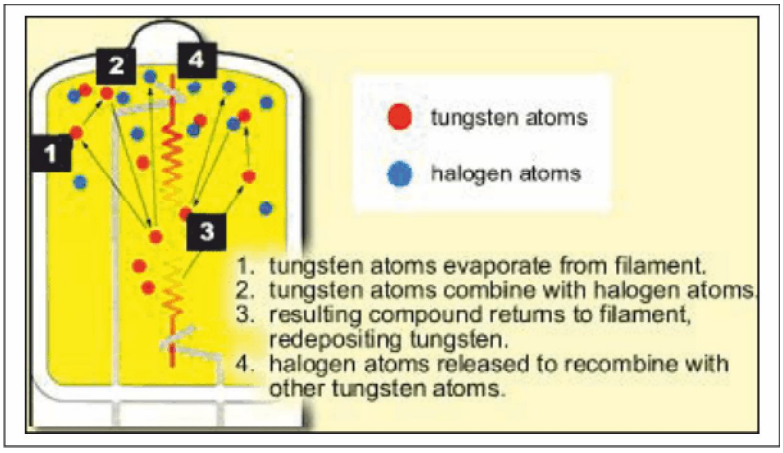
Halogen lamps



In ordinary incandescent lamps, the filament made of tungsten is mostly deposited on the bulb. A halogen lamp is an incandescent lamp in which a tungsten filament is sealed into a compact transparent envelope filled with an inert gas, plus a small amount of halogen such as iodine or bromine.

The halogen cycle increases the lifetime of the bulb and prevents its darkening by redepositing tungsten from the inside of the bulb back onto the filament.

The function of the halogen is to set up a reversible chemical reaction with the tungsten evaporating from the filament.



The regeneration cycle that occurs between the halogen and tungsten atoms is the key to the bulb's long life and its superior lumen maintenance.

Halogen lamps get hotter than regular incandescent lamps because the heat is concentrated on a smaller envelope surface, and because the surface is closer to the filament. This high temperature is essential to their operation. Because the halogen lamp operates at very high temperatures, it can pose fire and burn hazards.

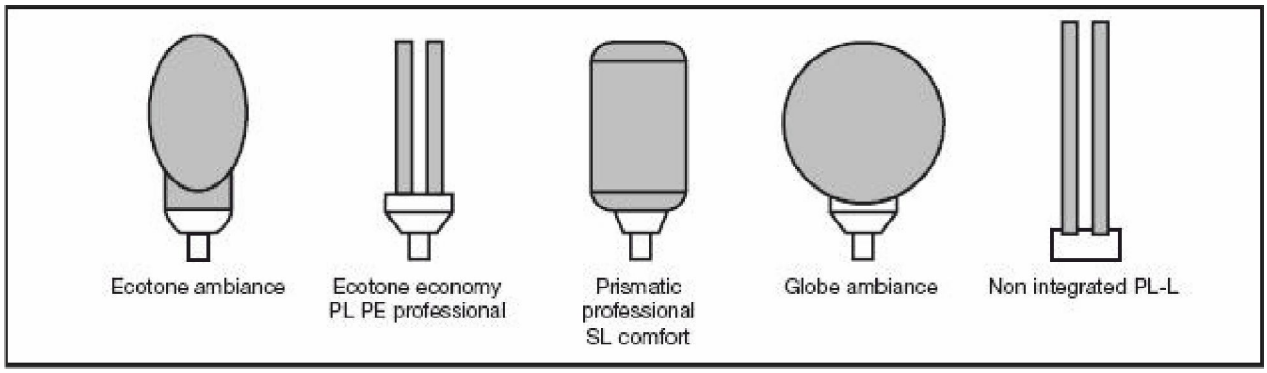
Energy savings lamps

Compact fluorescent (CF) lamps are commonly known as energy savings lamps.

Compact fluorescent lamps have some benefits in comparison with classic lamps. It consumes lower power (80%) and has a longer lifetime (5 to 15 times). The long life of CF lamps means that maintenance costs can be much lower than for incandescent lighting. A single CF lamp can save enough electricity (coal-fired) to keep a ton of carbon dioxide out of the atmosphere.

A compact fluorescent lamp consists of a gas-filled glass tube with two electrodes mounted in an end cap. It contains a low-pressure mix of argon gas, mercury vapour, and liquid mercury and is coated on the inside with phosphors.

Lamps can be of varying shapes, sizes, power output, lumen outputs, and colours.



Various compact fluorescent lamps

Compact fluorescent Lamps	Socket	Power W	Luminous flux lm	Luminous efficacy incl. Ballasts Lm/W	Colour and colour rendering	Average life h	Starting time Min.
With built-in ballast	E27	9…25	375…1200	41…48	ww/1	5000	2
	E27	7…32	400…2000	58…63	ww/1	8000	1
With external ballast	G23	5…11	250…900	28…60	ww/1	8000	1
	2 G 7	5…26	250…1800	42…50	ww/1	8000	1
	G R 10q	16…28	1050…2050	50…57	ww/1	8000	1
	2 G 11	18…55	1200…4800	40…79 EVG	ww/1 ww/1	8000 (10000 with EVG)	1

When the CF lamp is first turned on, the mains voltage across it is not sufficient to cause the initial ionization of the vapour. A starting element is thus needed to provide a high voltage pulse across the tube to start the process.

(To be continued)

Courtesy: Khemraz Ramduth

LABORATORIES FOR THE 21ST CENTURY: BEST PRACTICE GUIDE EFFICIENT ELECTRIC LIGHTING IN LABORATORIES - 2

Strategy #3: Consider alternative ambient lighting options for movable benches.

Movable lab benches are an approach to laboratory design that is gaining momentum. They give the researcher the flexibility to reconfigure an entire lab bay rather quickly using overhead service trunks as the pivoting points for new bench layouts. Several designers have addressed this issue by designing lighting systems that are mounted directly to the benches themselves, thereby taking the lighting along with the benches as they are relocated (see Figure 4). One drawback of bench-mounted lighting is that, if benches are moved often, the resulting vibrations may have a detrimental effect on expected lamp life. Also, there are often problems with uniformity if the bench configurations are very different from the original design. Another complexity to overcome is how to provide separately controlled electrical lighting circuits (often at 277 volts) to bench-mounted locations from raceways already carrying multiple circuits from several electrical sources. It is also likely that some degree of redundant ambient lighting is needed so that, if a bench is replaced with open floor space for equipment or movable tables, there will still be adequate illumination at that point.

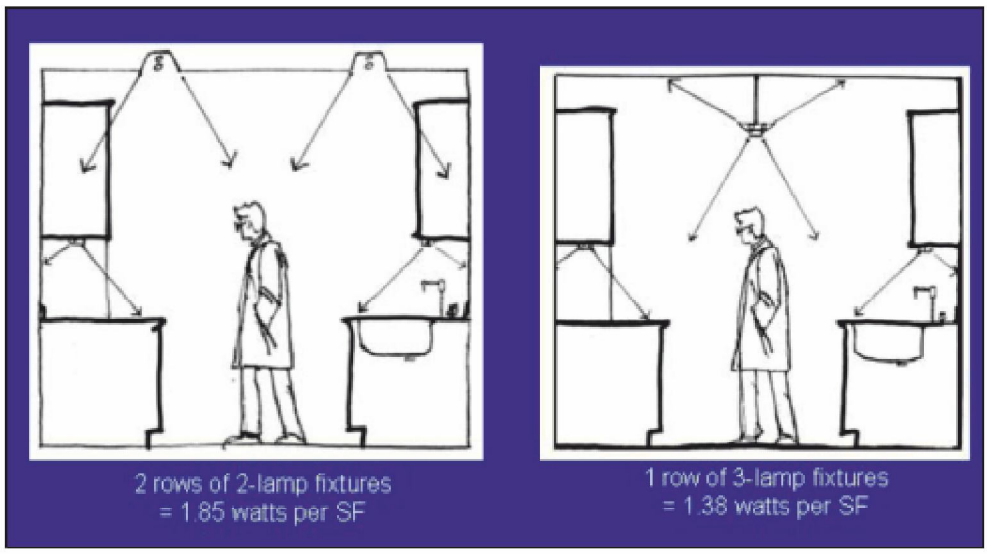


Figure 3: Lighting configuration options considered for the US EPA Research Triangle Park facility. *Source: HOK.*

A different approach to providing effective lighting for the movable bench lab plan is to place the 100% indirect lighting in direct relation to the possible bench configurations. Because electrical power, data and gases are usually fed from overhead service trunks located at modular intervals (typically between 10.5 ft and 11.0 ft in labs with movable benches) arranging area lighting on the same planning module assures that the lighting emphasis is above the benches, where it is desired (Figure 5). This approach eliminates the potential drawbacks of bench-mounted luminaires cited above, while still allowing for movable, bench-mounted task lighting wherever needed for supplementary illumination.

Economics that hurt the moral well-being of an individual or a nation are immoral and, therefore, sinful.

– MAHATMA GANDHI

Figure 4: Mock-up of a lab module for Memorial Sloan Kettering Cancer Center, showing bench-mounted ambient lighting with under-cabinet task lighting. Source: ZGF Architects.

Figure 5: Aisle-mounted indirect luminaires suspended in relation to the overhead service trunk can maintain good-quality lighting regardless of the position of the movable benches, as long as the ceiling remains somewhat consistent.

Figure 6 shows a fixture configured around vertical service trunks. This allows benches to be located along two perpendicular horizontal axes, thereby affording even more flexibility.

Physical mock-ups are an effective way to study different lighting configurations for a lab module. The mock- up should include, as a minimum, a sample installation of the proposed ceiling material as well as any mechanical diffusers or other ceiling elements that are likely to be within the beam spread of the indirect portion of the lighting system distribution pattern. An actual lab bench, fitted out with full-height shelving as specified, will provide very revealing clues about how the visual environment is shaped with these elements.

Figure 6: Conceptual study of a lighting array incorporated within the electrical, data, gases overhead service trunk. This scheme provides good lighting for benches located either parallel or perpendicular to the service trunks. Source: Flad Associates and Pivotal Lighting Design/ Affiliated Engineers.

Strategy #4: Use task lighting.

Figure 7: Under-cabinet task lighting in a USDA laboratory. Source: HOK.

Personally I like to believe that all become honest, the millennium is round the corner!

– MAHATMA GANDHI

The various types of tasks carried out in a laboratory often have different lighting requirements. Separating task and ambient lighting allows for greater user flexibility and energy efficiency. Consider using articulated-arm task lighting for maximum flexibility in meeting user needs. If this cannot be done, then consider under-cabinet task lighting (see Figure 7). However, the heat generated from under-cabinet task lighting may limit the types of chemicals stored on the shelf directly above the task light. Under-cabinet task lights also require that the space below the task light be free of clutter and storage that could potentially block the light. It is important to ensure that task lighting is explicitly integrated into the overall lighting design early in the design process. Energy efficiency is achieved by reducing ambient light levels (e.g., 30 fc) and ensuring that task lights are turned off when not needed. If task lighting is seen as an optional supplement to ambient lighting (e.g., as part of furniture and finishes), designers will likely configure ambient lighting to meet task requirements, negating the energy efficiency benefits of separating task and ambient lighting, and reducing its overall cost-effectiveness.

Lamps and Ballasts

Strategy #5: Use energy-efficient lamps and ballasts.

Over the past two decades, significant progress has been made in efficiency improvements to lamps and ballasts, and they are one of the most cost-effective measures for improving energy efficiency in buildings. Many publications, some of which are listed at the end of this guide, provide comparative analyses of lamps and ballasts. Figure 8 summarizes the range of efficiencies in terms of lumens per watt, which is the primary measure of lamp efficacy. It is interesting to note that daylight, in addition to all its other benefits, is also the most efficacious light source.

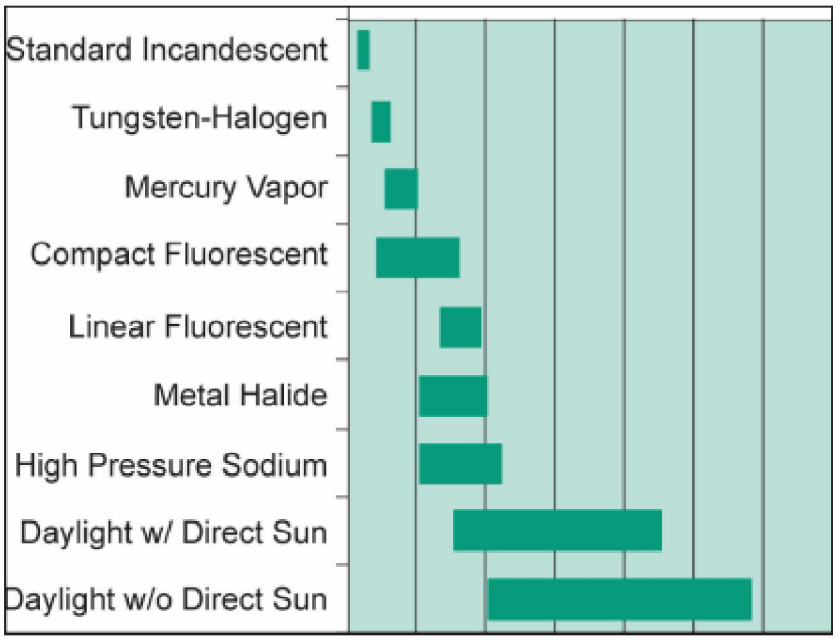


Figure 8 Luminous efficacy of various light sources. Daylight ranges calculated inside of single-pane clear and high-performance glass. Data source: Advanced Lighting Guidelines.

Efficacy can be evaluated on at least three levels:

- Lamp efficacy – which compares the efficacy of different lamps, without considering ballasts.
- Combined lamp and ballast efficacy – which includes ballast losses.

A nonviolent man cannot desire embarrassment.
– MAHATMA GANDHI

- Luminaire efficacy – which considers the efficacy of the luminaire system within the context of architectural space.

Efficacy metrics can be obtained from manufacturers and other resources. Some lamp and ballast considerations that apply specifically to laboratories include the following:

- Consider the use of T5 lamps in new construction. The smaller lamp size translates to smaller and sleeker luminaire designs and can yield far better optical control and greater luminaire efficiency, compared to T8s. T5s are also better in terms of reduced material use, consuming 60% less glass and phosphor material, and up to 50% less packaging when compared to T12 lamps (Yancey 1998).
- Always use electronic ballasts. In instrument labs where standard electronic ballasts and lamps may interfere with instrument operation, use radio-frequency-shielding luminaires. Alternatively, consider using light pipes or fiber-optic cables to provide lighting from a remote source.
- Always use compact fluorescent (CFL) or low wattage ceramic metal halide lamps instead of incandescent; the newer CFL and halide lamps have addressed color rendition issues.
- For fume hoods and bio-safety cabinets, which usually have their own lighting, coordinate the lamp colour and type with the manufacturer to ensure compatibility with the overall visual environment requirements.

(To be continued)

Courtesy: Lawrence Berkeley National Laboratory

INSPIRING STORY BEHIND THE NAMING OF TATA SUMO

Do you know why Tata Sumo is named so? It has nothing to do with the Japanese style of wrestling.

Every day top executives of Tata Motors used to take lunch together but they observed that Sumant Moolgaokar used to take his car and go out during lunch hour and come back as soon as the lunch break was over.

According to grapevine, it was said he was offered lunch at a 5-star hotel by some Dealers of Tata.

One day when some executives followed him during the lunch break, they were surprised to see that he stopped his car at one highway dhaba, ordered food and sat with the drivers of trucks who were eating food at that dhaba.

He discussed with them what was bad in a Tata Truck, jotted down and came back to his office. He used to improve upon the experiences of drivers.

Such was Sumant Moolgaokar's zeal for improving the Tata Vehicles.

Tata Sumo is the biggest corporate tribute paid by any company to its executive. Su stands for Sumant and Mo stands for Moolgaokar in this brand name.

Sumo is an immortal example of Work is worship, for all entrepreneurs.

You cannot cure a lesser evil by a greater evil.

– MAHATMA GANDHI

ELECTRICAL THUMB RULES-VENTILATION & CEILING FAN - 2

TYPE A CEILING FANS (IS-374)

FAN SIZE	AIR DELIVERY (m^3/min)	MAXIMUM INPUT
900	140	42
1050	165	48
1200	215	50
1400	270	60
1500	300	63

Size of Ceiling Fan

Area	Suggested Fan Size
Up to 9 Square Meters	900mm (36”)
Up to 12 Square Meters	1067mm (42”)
Up to 18 Square Meters	1200mm (48”)
Up to 30 Square Meters	1300mm (52”)
Up to 40 Square Meters	1400mm (56”)

Size and Number of Ceiling Fans for Rooms (As per NBC Table-10)

Room Width	Room Length										
	Fan Size (mm) /No of Fan										
	4 Meter	5 Meter	6 Meter	7 Meter	8 Meter	9 Meter	10 Meter	11 Meter	12 Meter	14 Meter	16 Meter
3 Meter	1200/1	1400/1	1500/1	1050/2	1200/2	1400/2	1400/2	1400/2	1200/3	1400/3	1400/3
4 Meter	1200/1	1400/1	1200/2	1200/2	1200/2	1400/2	1400/2	1500/2	1200/3	1400/3	1500/3
5 Meter	1400/1	1400/1	1400/2	1400/2	1400/2	1400/2	1400/2	1500/2	1400/3	1400/3	1500/3
6 Meter	1200/2	1400/2	900/4	1050/4	1200/4	1400/4	1400/4	1500/4	1200/6	1400/6	1500/6
7 Meter	1200/2	1400/2	1050/4	1050/4	1200/4	1400/4	1400/4	1500/4	1200/6	1400/6	1500/6
8 Meter	1200/2	1400/2	1200/4	1200/4	1200/4	1400/4	1400/4	1500/4	1200/6	1400/6	1500/6
9 Meter	1400/2	1400/2	1400/4	1400/4	1400/4	1400/4	1400/4	1500/4	1400/6	1400/6	1500/6
10 Meter	1400/2	1400/2	1400/4	1400/4	1400/4	1400/4	1400/4	1500/4	1400/6	1400/6	1500/6
11 Meter	1500/2	1500/2	1500/4	1500/4	1500/4	1500/4	1500/4	1500/4	1500/6	1500/6	1500/6
12 Meter	1200/3	1400/3	1200/6	1200/6	1200/6	1400/6	1400/6	1500/6	1200/7	1400/9	1400/9
13 Meter	1400/3	1400/3	1200/6	1200/6	1200/6	1400/6	1400/6	1500/6	1400/9	1400/9	1500/9
14 Meter	1400/3	1400/3	1400/6	1400/6	1400/6	1400/6	1400/6	1500/6	1400/9	1400/9	1500/9

Ceiling Fan Criteria (As per NBC)	
Capacity of a ceiling fan	=55D m3/min ,D= the longer dimension of a room
Height of fan blades above the floor	= (3H + W)/4, where H is the height of the room, W is the height of work plane.
Minimum distance between fan blades and the ceiling	= 0.3 m.

Size Your Fan for the Room (ENERGY STAR)

Room Size	Fan Size
Up to 75 sq. ft.	29 To 36 inches or smaller
75 to 144 sq. ft.	36 to 42 inches
144 to 225 sq. ft.	44 to 50 inches
225 to 400 sq. ft.	50 to 54 inches
Over 400 Sq. ft	54 To 72 inches multiple fans installed

Minimum Efficacy Levels of Ceiling Fans (ENERGY STAR)

Airflow (CFM)	Minimum Efficacy Level (CFM/W)
Low	At low speed, airflow of 1250 CFM and an efficiency of 155 cfm/W.
Medium	At medium speed, airflow of 3000 CFM and an efficiency of 100 cfm/W.
High	At high speed, airflow of 5000 CFM and an efficiency of 75 cfm/W.

Ceiling Fan Rod Extend Length

Ceiling Height	Pole Length
8 Feet	No Down rod
9 Feet	6 Inches
10 Feet	12 Inches
11 Feet	18 Inches
12 Feet	24 Inches
13 Feet	36 Inches
14 Feet	48 Inches
15 Feet	60 Inches
20 Feet or greater	72 Inches

Ceiling Fan Height Chart

Ceiling Height	Distance
< 8 Feet	Choose a low-profile ceiling fan. 18” Minimum distance blade to wall. 7’ minimum distance blade to floor.
> 9 Feet	Choose a ceiling fan down rod. 183 Minimum distance blade to wall.

Distance between Two Fans

Fan Size	Distance
363 (900mm)	1.8 Meter
423 (1000mm)	2 Meter
483 (1200mm)	2.5 Meter
563 (1400mm)	3 Meter

(To be continued)

Courtesy: ***Jignesh.Parmar***

LIGHTING GLOSSARY - 3

LUMEN: A unit of light flow, or luminous flux. The lumen rating of a lamp is a measure of the total light output of the lamp.

LUMINAIRE: A complete lighting unit consisting of a lamp or lamps, along with the parts designed to distribute the light, hold the lamps, and connect the lamps to a power source. Also called a fixture.

LUMINAIRE EFFICIENCY: The ratio of total lumen output of a luminaire and the lumen output of the lamps, expressed as a percentage. For example, if two luminaires use the same lamps, more light will be emitted from the fixture with the higher efficiency.

LUMINANCE: A photometric term that quantifies brightness of a light source or of an illuminated surface that reflects light. It is expressed as footlamberts (English units) or candelas per square meter (Metric units).

LUX (LX): The metric unit of measure for illuminance of a surface. One lux is equal to one lumen per square meter. One lux equals 0.093 footcandles.

MAINTAINED ILLUMINANCE: Refers to light levels of a space at other than initial or rated conditions. This terms considers light loss factors such as lamp lumen depreciation, luminaire dirt depreciation, and room surface dirt depreciation.

MERCURY VAPOUR LAMP: A type of high intensity discharge (HID) lamp in which most of the light is produced by radiation from mercury vapour. Emits a blue-green cast of light. Available in clear and phosphor-coated lamps.

METAL HALIDE: A type of high intensity discharge (HID) lamp in which most of the light is produced by radiation of metal halide and mercury vapours in the arc tube. Available in clear and phosphor-coated lamps.

MR-16: A low-voltage quartz reflector lamp, only 2" in diameter. Typically the lamp and reflector are one unit, which directs a sharp, precise beam of light.

NADIR: A reference direction directly below a luminaire, or “straight down” (0 degree angle).

NEMA: Abbreviation for National Electrical Manufacturers Association.

NIST: Abbreviation for National Institute of Standards and Technology.

NPF (NORMAL POWER FACTOR): A ballast/lamp combination in which no components (e.g., capacitors) have been added to correct the power factor, making it normal (essentially low, typically 0.5 or 50%).

OCCUPANCY SENSOR: Control device that turns lights off after the space becomes unoccupied. May be ultrasonic, infrared or other type.

OPTICS: A term referring to the components of a light fixture (such as reflectors, refractors, lenses, louvers) or to the light emitting or light-controlling performance of a fixture.

PAR LAMP: A parabolic aluminized reflector lamp. An incandescent, metal halide, or compact fluorescent lamp used to redirect light from the source using a parabolic reflector. Lamps are available with flood or spot distributions.

PAR 36: A PAR lamp that is 36 one-eighths of an inch in diameter with a parabolic shaped reflector (SEE PAR LAMP).

PARABOLIC LUMINAIRE: A popular type of fluorescent fixture that has a louver composed of aluminium baffles curved in a parabolic shape. The resultant light distribution produced by this shape provides reduced glare, better light control, and is considered to have greater aesthetic appeal.

PARACUBE: A metallic coated plastic louver made up of small squares. Often used to replace the lens in an installed troffer to enhance its appearance. The paracube is visually comfortable, but the luminaire efficiency is lowered. Also used in rooms with computer screens because of their glare-reducing qualities.

PHOTOCELL: A light sensing device used to control luminaires and dimmers in response to detected light levels.

PHOTOMETRIC REPORT: A photometric report is a set of printed data describing the light distribution, efficiency and zonal lumen output of a luminaire. This report is generated from laboratory testing.

POWER FACTOR: The ratio of AC volts x amps through a device to AC wattage of the device. A device such as a ballast that measures 120 volts, 1 amp, and 60 watts has a power factor of 50% (volts x amps = 120 VA, therefore 60 watts/120 VA = 0.5). Some utilities charge customers for low power factor systems.

PREHEAT: A type of ballast/lamp circuit that uses a separate starter to heat up a fluorescent lamp before high voltage is applied to start the lamp.

QUAD-TUBE LAMP: A compact fluorescent lamp with a double twin tube configuration.

RADIO FREQUENCY INTERFERENCE (RFI): Interference to the radio frequency band caused by other high frequency equipment or devices in the immediate area. Fluorescent lighting systems generate RFI.

RAPID START (RS): The most popular fluorescent lamp/ballast combination used today. This ballast quickly and efficiently preheats lamp cathodes to start the lamp. Uses a “bi-pin” base.

ROOM CAVITY RATIO (RCR): A ratio of room dimensions used to quantify how light will interact with room surfaces. A factor used in illuminance calculations.

REFLECTANCE: The ratio of light reflected from a surface to the light incident on the surface. Reflectances are often used for lighting calculations. The reflectance of a dark carpet is around 20%, and a clean white wall is roughly 50% to 60%.

REFLECTOR: The part of a light fixture that shrouds the lamps and redirects some light emitted from the lamp.

REFRACTOR: A device used to redirect the light output from a source, primarily by bending the waves of light.

RECESSED: The term used to describe the doorframe of a troffer where the lens or louver lies above the surface of the ceiling.

REGULATION: The ability of a ballast to hold constant (or nearly constant) the output watts (light output) during fluctuations in the voltage feeding of the ballast. Normally specified as +/- percent change in output compared to +/- percent change in input.

(To be continued)

Whatever I do is out of love.

– MAHATMA GANDHI

ELECTRICAL MAINTENANCE UNIT
(QUESTION & ANSWERS) - 2

21. What are the effects of temperature on resistance?

    The effects of temperature on resistance are

    a. In certain pure metals such as gold, copper, silver, aluminium etc. the resistance increases with increasing temperature at fairly regular manner. Such metals possess positive temperature co-efficient of resistance.

    b. In certain materials (alloys) such as eureka, nichrome etc. the change in resistance due to increasing temperature is irregular and negligible for a considerable range of temperature.

    c. In case of certain materials belongs to insulators, electrolytes such as paper, rubber, glass, mica, carbon, acids, alkalies etc. the resistance decreases with increasing temperature at fairly regular manner. Such materials posses negative co-efficient of resistance.

22. What are the classifications of voltages?

    a. Low voltage: Voltage not exceeding 250V. That is 0 – 250V.

    b. Medium voltage: Voltage above 250V upto 650V comes under medium voltage.

    c. High voltage: Voltage above 650V upto 33 kV comes under high voltage.

    d. Extra high voltage: Above 33 kV voltages are extra high voltages.

23. What is coulomb?

    It is the unit of charge. One (1) coulomb is the quantity of electricity, which is circulated by a current of one (1) ampere in one second. The letter Q denotes it. So that 1 coulomb = 1 amp * 1 second.

24. What is farad?

    Farad is the unit of capacitance and the letter F denotes it. A condenser has a capacitance of one (1) farad, if it is capable to maintain a charge of one coulomb under a potential difference of one volt between its plates.

    1 farad = 1 coulomb / 1 volt. = Q/V.

25. What is henry?

    It is the unit of inductance and the letter H denotes it. A circuit has inductance of one henry, if an electro-motive force of one volt if induced in that circuit, when the current in that circuit changes at the rate of one ampere per second.

    1 henry = 1 volt sec / ampere.

26. What is the least count of out-side micrometer?

    The least count of out-side micrometer is 0.01mm.

27. State symbols for quantities and units.

Sl.No	Name of the quantity	Symbol	Name of the unit	Symbol
1	Volume	V	Cubic meter	m^3
2	Time	T	Second	S
3	Frequency	F	Hertz	H_Z
4	Rotational frequency	N	Reciprocal second	S^{-1}
5	Slip	S		

6	Speed, Velocity	V	Meter per second	m/s
7	Mass	M	Kilogramme	Kg
8	Density	P	Kilogramme per cubic meter	Kg / m^3
9	Momentum	P	Kilogram meter per second	Kg m/S
10	Force	F	Newton	N
11	Weight	G	Newton	N
12	Torque	T	Newton meter	Nm
13	Pressure	P	Newton per square meter	N/m^2
14	Work	W	Joule	J
15	Energy	E, W	Joule	J
16	Power	P	Watt	W
17	Efficiency	η		
18	Electric charge	Q	Coulomb	C
19	Emf, Voltage, PD	E	Volt	V
20	Electric flux	ψ	Coulomb	C
21	Capacitance	C	Farad	F
22	Electric current	I	Ampere	A
23	Magneto motive force	Fm	Ampere turns	AT
24	Magnetic flux density	B	Telsa	T
25	Magnetic flux	φ	Weber	Wb
26	Self inductance	L	Henry	H
27	Mutual inductance	Lmm, m	Henry	H
28	Resistance	R	Ohm	Ω
29	Resistivity	ρ	Ohm meter	Ωm
30	Conductance	G	Mho	
31	Reluctance	S	Reciprocal henry	H^{-1}
32	Impedance	Z	Ohm	Ω
33	Reactance	X	Ohm	Ω
34	Admittance	Y	Mho	
35	Active power	P	Watt	W
36	Reactive power	Q	VAR	VAR
37	Apparent power	S	Volt-ampere	VA
38	Number of turns	N		
39	Speed	N	Rotation per minute	r.p.m

40	Number of phases	M		
41	Number of pair of poles	P		
42	Luminous intensity	L	Candela	Ca
43	Luminous flux	φ	Lumen	lm
44	Quantity of light	Q	Lumen second	lm S
45	Illumination	E	Lux	lx

28. State Greek alphabets and what for they are used?

Sl. No	Symbol	Name	Used for to indicate
1	α	Alpha	Angle, temperature co-efficient of resistance
2	β	Beta	Angle
3	γ	Gamma	Angle, conductivity
4	Δ	Delta	
5	η	eta	Efficiency
6	θ	Theta	Angle, temperature
7	λ	Lambada	Wave length
8	μ	Mu	Amplification factor
9	π	Pi	22/7
10	ρ	Rho	Specific resistance, resistivity
11	σ	Sigma	Charge density, fractional slip
12	ϕ	Phi	Phase angle
13	φ	Capital phi	Magnetic flux
14	Ψ	Psi	
15	ψ	Capital psi	Electric flux
16	ω	Omega	Angular velocity

29. What is conductance?

Conductance is the property of the conductor, which allows the flow of electric current through it. Conductance is denoted by the letter G and is reciprocal of resistance. The unit of conductance is mho. A substance, which posses conductance as its major property can be called as a good conductor.

30. What you mean by insulator? What are the qualities of good insulator?

A substance, which will not allow the flow of electric current to pass through it is called the insulator. The conductance and conductivity is zero in insulators. Insulators are used to isolate the electric current from neighbouring parts. Insulators will not allow the leakage of current, short-circuiting current, shock to the operator and isolates the electric current safely without any diversion to any other place.

Qualities of good insulator

a. It should be flexible
b. It should have good mechanical strength
c. It should easily moulded into any shape
d. It should not be effected by acid
e. It should be non-inflammable
f. It should have very high specific resistance to prevent leakage current
g. It should be withstand high temperature. Because insulators posses negative temperature coefficient of resistance. That is resistance decreases with increasing temperature
h. It should have high dielectric strength

(To be continued)

Courtesy: https://www.scribd.com/document/244623258/Question-and-Answers-Electrical-Maintenance-Unit

ELECTRICAL SAFETY RULES

- Do not renew a blown fuse until you are satisfied as to the cause and have rectified the irregularity.
- Do not close any switch unless you are familiar with the circuit which it controls and know the reason for its being open.
- Do not work on the live circuit without the express orders of the supervisor. Make certain that all safety precautions have been taken and you are accompanied by a second person competent to render First Aid and Artificial Respiration.
- Do not touch or tamper with any electrical gear or conductor unless you have made sure that it is DEAD AND EARTHED.
- Do not disconnect earthing connections or render ineffective the safety gadgets installed on mains and apparatus.
- Do not open or close switch or fuse slowly or hesitatingly. Do it quickly and positively.
- Don't use wires with poor insulation.
- Do not touch any electrical circuits when your hands are wet or bleeding from a cut or an abrasion.
- Do not work on energised circuit without taking extra precaution such as the use of rubber gloves.
- Don't use fire extinguisher on electrical equipment unless it is clearly marked for that purpose. Use sand and blanket instead.
- Do not throw water on live electrical equipment in cases of fire.
- Do not attempt to disengage a person in contact with a live apparatus which you cannot switch of immediately. Insulate yourself from earth by standing on rubber mat or dry board, before attempting to get him clear. Do not touch his body, push him clear with a peace of dry wood.
- Do continue artificial respiration until recovery or death is certified by doctor.
- Do not allow visitors and unauthorised person to touch or handle electrical apparatus or come within the danger Zone of HV apparatus.
- Do not test circuit with bare fingers.

ELECTRICAL Q & A PART - 3 (3)

21) Will a transformer change Three Phases to Single Phase?

- A transformer will not act as a phase changing device when attempting to change three phase to single phase.
- There is no way that a transformer will take three phase in and deliver single phase out while at the same time presenting a balanced load to the three phase supply system.
- There are, however, circuits available to change three phase to two phase or vice versa using standard dual wound transformers. Please contact the factory for two phase applications.

22) Can 60 Hz transformers be operated at 50 Hz?

- Transformers rated below 1 KVA can be used on 50 Hz service.
- Transformers 1 KVA and larger, rated at 60 Hz, should not be used on 50 Hz service, due to the higher losses and resultant heat rise. Special designs are required for this service. However, any 50 Hz transformer will operate on a 60 Hz service.

23) Can transformers be used in parallel?

- Single phase transformers can be used in parallel only when their impedances and voltages are equal. If unequal voltages are used, a circulating current exists in the closed network between the two transformers, which will cause excess heating and result in a shorter life of the transformer. In addition, impedance values of each transformer must be within 7.5% of each other.
- For example: Transformer A has an impedance of 4%, transformer B which is to be parallel to A must have impedance between the limits of 3.7% and 4.3%. When paralleling three phase transformers, the same precautions must be observed as listed above, plus the angular displacement and phasing between the two transformers must be identical.

24) What are causes of insulator failure?

- Electrical field intensity producing corona on contaminated areas, water droplets, icicles, corona rings, … This corona activity then contributes nitric acid to form a chemical soup to change the bonding cements and to create carbon tracks, along with ozone and ultraviolet light to change the properties of NCI insulator coverings. Other detrimental effects include water on the surface or sub-surface freezing and expanding when thawing, as a liquid penetrating into a material and then a sudden temperature change causes change of state to a gas and rapid expansion causing fracture or rupture of the material.

25) Causes of Corona

- Corona is causes by the following reasons:
- The natural electric field caused by the flow of electrons in the conductor. Interaction with surrounding air. Poor or no insulation is not a major cause but increases corona.
- The use of D.C (Direct Current) for transmission.(Reason why most transmission is done in form of AC)

26) Effects of Corona

1) Line Loss – Loss of energy because some energy is used up to cause vibration of the air particles.
2) Long term exposure to these radiations may not be good to health (yet to be proven).

You can only have lasting peace based on justice.
– MAHATMA GANDHI

3) Audible Noise

4) Electromagnetic Interference to telecommunication systems

5) Ozone Gas production

6) Damage to insulation of conductor.

27) What is polarity, when associated with a transformer?

- Polarity is the instantaneous voltage obtained from the primary winding in relation to the secondary winding.
- Transformers 600 volts and below are normally connected in additive polarity — that is, when tested the terminals of the high voltage and low voltage windings on the left hand side are connected together, refer to diagram below. This leaves one high voltage and one low voltage terminal unconnected.
- When the transformer is excited, the resultant voltage appearing across a voltmeter will be the sum of the high and low voltage windings.
- This is useful when connecting single phase transformers in parallel for three phase operations. Polarity is a term used only with single phase transformers.

28) What is exciting current?

- Exciting current, when used in connection with transformers, is the current or amperes required for excitation. The exciting current on most lighting and power transformers varies from approximately 10% on small sizes of about 1 KVA and smaller to approximately .5% to 4% on larger sizes of 750 KVA. The exciting current is made up of two components, one of which is a real component and is in the form of losses or referred to as no load watts; the other is in the form of reactive power and is referred to as KVAR.

29) What is Boucholz relay and the significance of it in to the transformer?

- Boucholz relay is a device which is used for the protection of transformer from its internal faults,
- It is a gas based relay, whenever any internal fault occurs in a transformer, the boucholz relay at once gives a horn for some time, if the transformer is isolated from the circuit then it stop its sound itself otherwise it trips the circuit by its own tripping mechanism.

30) Why we do two types of earthing on transformer (Body earthing & neutral earthing)

- The two types of earthing are Familiar as Equipment earthing and system earthing.
- In Equipment earthing: body (non-conducting part) of the equipment should be earthed to safeguard the human beings.
- The System Earthing: In this neutral of the supply source (Transformer or Generator) should be grounded. With this, in case of unbalanced loading neutral will not be shifted. So that unbalanced voltages will not arise. We can protect the equipment also. With size of the equipment (transformer or alternator) and selection of relying system earthing will be further classified into directly earthed, Impedance earthing, resistive (NGRs) earthing.

(To be continued)

Courtesy: Jignesh.Parmar

Religion to be true must satisfy what may be termed humanitarian economics, that is, where the income and the expenditure balance each other.

– MAHATMA GANDHI

2.4 Sample system design

The designing of a system can be better understood by the following example:

Step 1: Determine the DC load

DC load of a device 1 = No. of DC devices X Device Watts X Hours of daily use

= DC Watt Hours per Day (1)

Similarly calculate the DC load of other devices.

Suppose Total DC Watt Hours per Day of such devices = [A]

Step 2: Determine the AC load and convert to DC

AC load of a device 1 = No. of AC devices X Device Watts X Hours of daily use

= AC Watt Hours per Day (1)

Similarly calculate the AC load of other devices.

Suppose Total AC Watt Hours per Day of such devices = (B)

Divide by 0.9 (Inverter, losses) to convert into DC

Suppose Total DC Watt Hours per Day of such devices = [B]

Step 3: Determine the Total System load

Suppose total DC load [A] = 2000 Watt Hours per Day

& total DC load [B] = 1500 Watt Hours per Day

Total System Load [A+B] = 3500 Watt Hours per Day

Step 4: Determine Total DC Ampere Hours per Day

i.e. Total System Load/System Nominal Voltage

= 3500 Watt Hours per Day/48 Volts

= 73 Ampere Hours per Day

Step 5: Determine Total Ampere Hours per Day with Batteries

i.e. Total Ampere Hours per Day/(Battery efficiency X Module derating)

= 73/(0.9 X 0.9)

= 73/0.81

= 90.12

~ 100 Ampere Hours per Day

Step 6: Determine the Total PV Array Current

i.e. Total Daily Ampere Hour requirement / Design Insolation*

= 100 Amp-hrs / 5.0 peak solar hrs

= 20 Amps

* Insolation Based on Optimum Tilt for Season

Step 7: Select PV Module type

For example

Choose CEL PM 75 module:

Max Power = 75 W (@STC)

Max Current = 4.41 Amps

Max Voltage = 17 Volts

Step 8: Determine Number of Modules in Parallel

i.e. Total PV Array Current / (Module Operating Current)

= 20 Amps / (4.41 Amps/Module)

= 4.5

~ 5Nos.of modules

Step 9: Determine Number of Modules in Series

i.e. System Nominal Voltage / Module Nominal Voltage

= 48 Volts / (12 Volts/module)

= 4 Modules

Step 10:Determine Total Number of Modules

Number of modules in parallel X Number of modules in Series

= 5 x 4 = 20 modules of 75 Watt each i.e. 1500Wp

Step 11: Determine Minimum Battery Capacity

[Total Daily Amp-hr per Day with Batteries (Step 5) x Desired Reserve Time (Days)] / Percent of Usable Battery Capacity

= (73 Amp-hrs/Day x 3 Days) / 0.80

= 274

~ 300 Amp-hrs

Step 12: Choose a Battery

Use Flooded Lead Acid Battery Cells

Nominal Voltage = 2 Volts No. of cells =24

Rated Capacity = 100 Amp-hrs

(3 Strings in Parallel)

Or

Nominal Voltage 6Volts, No. of Batteries = 8 (series)

Rated Capacity 150 AH, 2 Strings in Parallel

Step 13: Choose Charge Controller

No. of Parallel Modules X Isc X 1.25 = Charge Controller Capacity

5 x 5x 1.25 = 31.25 Amps (Nearest higher available Value may be selected)

e.g. 48 Volts 40 Amps may be chosen.

Step 14: Choose Inverter

AC Watts on Inverter = Total AC Watts of AC devices X 25% extra.

Inverter of nearest higher rating may be chosen to cater for surge.

2.5 Solar Panel Requirement for IPS System at PI Station in Non-RE Area

RDSO has standardized the Solar Panel requirements for IPS System at Panel Interlocked Station in Non- RE area based on the assumption that all three sources of supply i.e. solar power, AC commercial supply and DG set supply will be utilized everyday for running signalling system at a station. Battery capacity has already been specified as 300 AH for IPS system in non-RE area. These requirements are separately worked out for up to 3 line station, 4 line station, 6 line station and 4 line station with DC LED Signals, and are tabulated in Table A below:

Sr. No.	Description	Upto 3 line station	Upto 4 line station	Upto 6 line station	Upto 4 line station with DC lit LED signal
1.	**Approximate Signalling Load (AC + DC) except track circuit at 110V**	13A	22A	28A	16A
2.	**Required from solar power (in AH)**				
(a)	For 12 hrs.load per day	12x13=156 AH	12x22 AH= 264	12x28= 336 AH	12x16= 192 AH
(b)	For 10 hrs. load per day	10x13= 130 AH	10x22= 220 AH	10x28= 280 AH	10x16= 160 AH
(c)	For 08 hrs. load per day	08x13= 104 AH	08x22= 176 AH	08x28= 224 AH	08x28= 224 AH
(d)	For 06 hrs. load per day	06x13= 78 AH	06x22= 132 AH	06x28= 168 AH	06x16= 96 AH
3.	**SPV requirement for 110 V system**				
(i)	Derating factor of Solar Panel	10% (0.9)	10% (0.9)	10% (0.9)	10% (0.9)
(ii)	Derating factor of Battery efficiency	10% (0.9)	10% (0.9)	10% (0.9)	10% (0.9)
(iii)	Sun availability assumed	5 Hrs.	5 Hrs.	5 Hrs.	5 Hrs.
(iv)	Charging current of Solar panel	4.2 A	4.2 A	4.2 A	4.2 A
(v)	No. of 12V, 70W Solar Panels required in parallel				
(a)	For 12 hrs. load per day	156/(0.9x0.9x5 x4.2) = 10 Nos	264/(0.9x0.9x5 x4.2) = 16 Nos	336/(0.9x0.9x5 x4.2) = 20 Nos	192/(0.9x0.9x5 x4.2) = 12 Nos
(b)	For 10 hrs. load per day	130/(0.9x0.9x5 x4.2) = 08 Nos	220/(0.9x0.9x5 x4.2) = 13Nos	280/(0.9x0.9x5 x4.2) = 17 Nos	160/(0.9x0.9x5x 4.2) = 10 Nos
(c)	For 08 hrs. load per day	104/(0.9x0.9x5 x4.2) = 07 Nos	176/(0.9x0.9x5 x4.2) = 11 Nos	224/(0.9x0.9x5 x4.2) = 14 Nos	128/(0.9x0.9x5 x4.2) = 08 Nos
(d)	For 06 hrs. load per day	78/(0.9x0.9x5 x4.2) = 05 Nos	132/(0.9x0.9x5 x4.2) = 08 Nos	168/(0.9x0.9x5 x4.2) = 10Nos	96/(0.9x0.9x5x 4.2) = 06 Nos
(vi)	No. of 12V, 70W Solar panel required	9	9	9	9
(vii)	Total solar panel required (nos.)				
(a)	For 12 hrs. load per day	90	144	180	108

(b)	For 10 hrs. load per day	72	117	153	90
(c)	For 08 hrs. load per day	63	99	126	72
(d)	For 06 hrs. load per day	45	72	90	54
4.	**Area requirement for fixing solar panels (size approx. 1.2 mx0.55m per panel) in square meter**				
(a)	For 12 hrs. load per day	60	95	119	72
(b)	For 10 hrs. load per day	48	78	101	60
(c)	For 08 hrs. load per day	42	66	84	48
(d)	For 06 hrs. load per day	30	48	60	36
5.	**Approximate cost of solar panels (@ Rs. 15400/-)**				
(a)	For 12 hrs. load per day	14 lakhs	23 lakhs	28 lakhs	17 lakhs
(b)	For 10 hrs. load per day	11 lakhs	18 lakhs	24 lakhs	14 lakhs
(c)	For 08 hrs. load per day	10 lakhs	16 lakhs	20 lakhs	11 lakhs
(d)	For 06 hrs. load per day	07 lakhs	11 lakhs	14 lakhs	9 lakhs

Note: Actual solar panel requirement shall be carried out by the Railway as per the guidelines given above in the table B based on actual signalling load at a station with IPS system.

(To be continued)

Courtesy: CAMTECH Gwalior

HUMOUR

Some Quotes that make you Laugh!

My luck is so bad that if I bought a cemetery, people would stop dying.

- Rodney Dangerfield

Money can't buy you happiness .... But it does bring you a more pleasant form of misery.

- Spike Milligan

Until I was thirteen, I thought my name was SHUT UP .

- Joe Namath

The secret of a good sermon is to have a good beginning and a good ending; and to have the two as close together as possible.

- George Burns

Santa Claus has the right idea. Visit people only once a year.

- Victor Borge

Be careful about reading health books. You may die of a misprint.

- Mark Twain

By all means, marry. If you get a good wife, you'll become happy; if you get a bad one, you'll become a philosopher.

- Socrates

I was married by a judge. I should have asked for a jury.

- Groucho Marx

My wife has a slight impediment in her speech. Every now and then she stops to breathe.

- Jimmy Durante

Don't worry about avoiding temptation. As you grow older, it will avoid you.

- Winston Churchill

Maybe it's true that life begins at fifty. But everything else starts to wear out, fall out, or spread out..

- Phyllis Diller

By the time a man is wise enough to watch his step, he's too old to go anywhere.

- Billy Crystal

ENERGY INDEPENDENCE AND ENERGY SELF RELIANCE - 2

Sustainable Growth, Sustainable Energy and Renewable Energy

In continuation of the various details and extracts of Indian Government's plans and actions for a **'Self Reliant India'** in the area of Energy, a summary is presented below about the Energy Projections as per some of the International experts:

SUMMARY:

- India's demand for energy is set to outpace domestic supply, providing the largest contribution (30 percent) to global energy demand growth to 2035.
- Energy is central to achieving India's development ambitions: bringing electricity to those who do not have it; and developing infrastructure.
- India will remain reliant on energy imports, particularly for fossil fuels. It will also provide a market for services and technologies that improve energy efficiency and the uptake of renewables.
- In terms of commodities, India will be heavily dependent on imports of oil and gas.
- India will be largely self-reliant in thermal coal in the longer term, but will need to import thermal coal well into the medium term.
- India will present a significant market for uranium out to 2035.
- There are emerging prospects in hydrogen.
- How all these opportunities play out will depend on India's reform path. India's aspirations to simultaneously and rapidly: change its energy mix; be energy self-sufficient; ensure energy security; and meet its climate change goals, will be difficult to achieve but show India's energy policy sentiment. The political compulsion to provide affordable 'power to all' will shape other reforms in this sector.
- India's energy sector is characterized by myriad, often highly inefficient policy interventions. Controls on supply and the lack of transparent price signals reduce incentives to invest. Distribution is a bottleneck and a bigger problem than capacity. While political constraints will make any change incremental rather than wholesale, India is seeking to tackle these challenges.
- India's integration into global energy markets will be a key shift in the global economy out to 2035, with India having a greater stake in their efficiency.
- Energy is one of India's most dynamic sectors and opportunities will evolve rapidly in renewables, energy technologies and power infrastructure. Political sensitivity around the provision of affordable electricity drives government intervention.

Analysis and understanding of the above points will show clearly the combinations of problems and challenges India has, which can be summed up as below:

a) How do we ensure Energy Security. There are constant efforts by the Government in this direction and with some mild hiccups periodically, this is largely achieved at present with sizable imports of Petroleum crude, CNG/LNG and Coal too. This is also achieved through stepping up local coal production and increasing exploration for oil and gas.

b) How to we start marching towards Energy Freedom with curtailment of export dependence. This is tough and almost impossible at present with increasing demands for oil and gas and coal.

c) How are we going to meet the international drive and our commitment for more and more and later becoming complete 'Green Energy'. In the past decade and more, there are large scale and visible projects of Wind and Solar energies which are commendable and some of the recent initiatives like EVs

and Bio CNG are impressive and they do contribute to greening of energy to some extent, but looking at the huge demand of oil for transportation and coal for the massive power plants and oil for standby power generation for all kinds of IT and other critical process plants, where uninterrupted power is a necessity, we have a long way to go to achieve sizable, if not 100%, greening of power.

We have been writing in these colomns regularly about the importance and vital role Bio Energy can play, particularly in the Indian context, in greening of our energy to a sizable extent and combined with other renewable energy sources like solar, wind and water, we can even plan for 100% green energy over one or two decades. We have been discussing in these colomns about the various technologies that are developed in various parts of the world, in the area of Bio Energy addressing the use of various kinds or even all kinds of biomass with varying degrees of calorific values and various degrees of moisture content to convert to various energy products like Bio Oil, Bio Coal or Bio Carbon, and Bio Gas and Biomass Power plants for power generation.

Before discussing briefly about the Bio Energy potentials in India and the present status of Bio Energy operations in India, we should be clear in our minds about a few basic tenets we will keep in mind.

a) "Waste to Energy" will be the basic philosophy we will keep in mind and we will talk about using only the biomass that are presently wasted or burnt away. The examples can be the 20 million tons per crop of straw and stubs that are burnt in Punjab every year and the sugar cane trashes and tops that are burnt away in the fields (about 50 million tons) every year.

b) Any Biomass, which is presently used directly as manure, if proposed for use for Bio Energy, we will make sure that the manure portion of the biomass is available even after extracting the energy. The example can be animal and poultry wastes, which, after subjecting to energy extraction either through digestion or through burning or gasification, the residues in the form of digested wastes or ash will have 100% manure value left in them for use as manure or fertilizer.

With this broad introduction, we will get on to discuss the merits of Bio Energy, India's special status and potentials with regard to biomass and bio energy, preset status of technologies and successes and failures in India, the various new technologies to be explored and so on.

A brief presentation about the problems and challenges of biomass sector by an expert in the field is presented below which brings out salient points in brief which will also be useful to take the subject forward.

Biomass Sector in India – Problems and Challenges Dt July 14, 2020

Biomass power plants in India are based mostly on agricultural wastes. Gasifier-based power plants are providing a great solution for off-grid decentralized power and are lighting homes in several Indian states. While for providing grid-based power 8-15 MW thermal biomass power plants are suitable for Indian conditions, they stand nowhere when compared to power plants being set up in Europe which are at least 20 times larger.

Energy from biomass is reliable as it is free of fluctuation unlike wind power and does not need storage to be used in times of non-availability as is the case with solar. Still it is not the preferred renewable energy source till now, the primary reason that may be cited is the biomass supply chain.

Biomass availability is not certain for whole year. Biomass from agriculture is available only after harvesting period which can stretch only for 2-3 months in a year. So there is a need to procure and then store required quantity of biomass within this stipulated time.

Some of the Indian states leading the pack in establishing biomass-based power projects are Karnataka, Andhra Pradesh, and Maharashtra. Ironically, states having agricultural-based economy have not properly been able to utilize the opportunity and figure low on biomass energy utilization. Only Uttar Pradesh has utilized large part of the biomass potential in north Indian States and that is mainly due to the sugarcane industry and the co-generation power plants.

Interestingly Punjab and Haryana don't have much installed capacity in comparison to potential even though tariff rates are more than Rs. 5 per unit, which are better than most of the states. This can be attributed to the fact that these tariffs were implemented very recently and it will take time to reflect the capacity utilization.

Table: Biomass Potential and Installed Capacity in Key Indian States

State	Power Potential (MWe)	Installed Capacity (by 2011)	Tariff
Punjab	2413.2	74.5	@ Rs 5.25 per unit, (2010-11)
Uttar Pradesh	1594.3	592.5	@ Rs 4.70
Haryana	1120.8	35.8	@ Rs 5.24 per unit
Rajasthan	1093.5	73.3	@ Rs 4.72/unit water cooled (2010-11)
Maharashtra	1014.2	403	@ Rs 4.98 (2010-11)
Madhya Pradesh	841.7	1.0	@ Rs 3.33 to 5.14/unit paise for 20 years with escalation of 3-8 paise
Karnataka	631.9	365.18	@ Rs 3.66 per unit (PPA signing date) Rs 4.13 (10th year)
Andhra Pradesh	625	363.25	@ Rs 4.28 per unit (2010-11)
Gujarat	457.7	0.5	@ Rs 4.40 per unit (with accelerated depreciation)
Chhattisgarh	248.5	231.9	@ Rs 3.93 per unit (2010-11)
Kerala	195.9	–	@ Rs 2.80 per unit escalated at 5% for five years (2000-01)

Source: Biomass Atlas by IISc, Bangalore and MNRE website

I may not unnerve myself while I can struggle against evil.
- MAHATMA GANDHI

The electricity generation could be cheaper than coal if biomass could be sourced economically but some established biomass power plants tend to misuse the limit of coal use provided to them (generally 10-15% of biomass use) to keep it operational in lean period of biomass supply. They are not able to run power plants solely on biomass economically which can be attributed to :

- Biomass price increases very fast after commissioning of power project and therefore government tariff policy needs an annual revision
- Lack of mechanization in Indian Agriculture Sector
- Defragmented land holdings
- Most of the farmers are small or marginal

Government policy is the biggest factor behind lack of investment in biopower sector in states with high biomass potential. Defragmented nature of agricultural lands do not allow high mechanization which results in reduction of efficiency and increase in procurement cost.

Transportation cost constitutes a significant portion of the costs associated with the establishment and running of biomass power plants. There is need of processing in form of shredding the biomass onsite before transportation to increase its density when procurement is done from more than a particular distance. While transportation in any kind or form from more than 50 Km becomes unviable for a power plant of size 10-15MW. European power plants are importing their biomass in form of pellets from other countries to meet the requirement of the huge biopower plants.

Not all the biomass which is regarded as agri-waste is usually a waste; part of it is used as fuel for cooking while some part is necessary to go back to soil to retain the soil nutrients. According to conservative estimates, only two-third of agricultural residues could be procured for power production.

As human mentality goes, waste is nothing but a heap of ash for the farmer till someone finds a way to make profit out of it, and from there on the demand of waste increases and so its price. Though there is nothing wrong in transferring benefits to the farmers and providing them a competitive cost of the agri-waste but operations becomes increasingly unviable with time.

A robust business model is necessary to motivate local entrepreneurs to take up the responsibility of supplying biomass to processing facilities. Collection centres covering 2-3 villages can be set up to facilitate decentralization of biomass supply mechanism. Biomass power plant operators may explore the possibility of using energy crops as a substitute for crop wastes, in case of crop failure. Bamboo and napier grass can be grown on marginal and degraded lands.

(To be continued)

S. Mahadevan, B.E., F.I.E., M.B.A.,
Consultant, Energy and Energy Efficiency,
Mobile: 98401 55209

There is no fundamental cleavage between Hindus and Mussalmans. We have lived in the same land as brothers for generations and what has been possible all these years will certainly be possible in the future.

- MAHATMA GANDHI

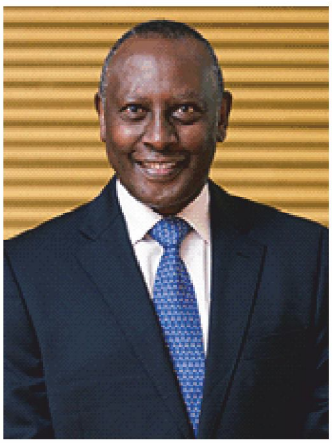
WORLD STANDARDS DAY

Each year on 14 October, the members of IEC, ISO and ITU celebrate World Standards Day, which is a means of paying tribute to the collaborative efforts of the thousands of experts worldwide who develop the voluntary technical agreements that are published as International Standards.

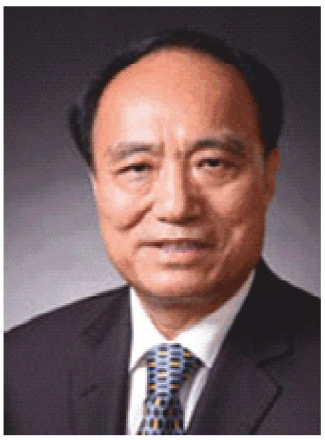
World Standards Day 2020

Protecting the planet with standards

Yinbiao Shu
IEC President



Eddy Njoroge
ISO President



Houlin Zhao
ITU Secretary-General

Earth, a finite vessel of life in the vastness of our solar system. Life on earth depends on energy coming from the sun. However, over the last century human and large-scale industrial activities of our modern civilization have added to earth's natural greenhouse gases. They negatively impact our climate and with it all forms of life. At the same time rapid population growth and broad urbanization call for the responsible use of limited resources.

To reduce human impact on our planet, we need the political will, concrete action and the right tools. International standards are one such tool. The international standards prepared by IEC, ISO and ITU take into account tried and true solutions to technical challenges. They help share expertise and expert know-how broadly within developed and developing countries alike. Standards cover all aspects of energy savings, water and air quality. They lay down standardized protocols and methods of measurement. Their broad use helps reduce the environmental impact of industrial production and processes, facilitates the reuse of limited resources and improves energy efficiency.

UN WORLD HABITAT DAY - 5th October

The United Nations designated the first Monday of October of every year as World Habitat Day to reflect on the state of our towns and cities, and on the basic right of all to adequate shelter. The Day is also intended to remind the world that we all have the power and the responsibility to shape the future of our cities and towns.

2020 Theme: Housing For All — A Better Urban Future

Having an adequate home is now, more than ever, a matter of life and death. As COVID-19 continues to spread, people have been told to stay at home, but this simple measure is impossible for people who do not have adequate housing.

At the same time, COVID-19 has reminded us that home is much more than just a roof. To make us feel safe and enable us to continue living, working and learning, a home needs to be secure, to allow us to access basic services and infrastructure for hygiene measures and to have enough room for physical distancing. It should also be located in a place that enables residents to access public green and open spaces, employment opportunities, health-care services, schools, childcare centres and other social facilities.

An estimated 1.8 billion people were already living in slums and informal settlements, inadequate housing or in homelessness in our cities worldwide before the pandemic began. Some 3 billion people lack basic hand-washing facilities. This means millions of people worldwide are more likely to experience poor health due to the absence of basic services and exposure to multiple socio-economic and environmental hazards.

Structural inequalities have been highlighted by the COVID-19 pandemic, showing how people from minorities, indigenous peoples and migrants are disproportionally affected by housing precarity, overcrowding and homelessness.

COVID-19 has spread in areas where people lack adequate housing, and are faced with inequalities and poverty. Residents in these areas are also often not recognized by the authorities or protected and face the risk of being evicted and relocated, particularly in times of crisis. According to ILO, 55 per cent of the world's population – about 4 billion people – do not benefit from any form of social protection.

Housing is a human right and a catalyst for all other fundamental rights. It is the only way to ensure the "Right to the City for All".

வாய் மற்றும் பற்களை ஈஸியா எப்படி சுத்தம் செய்யலாம்?

ஒருவரின் அழகை அதிகரித்துக் காட்டுவது சிரிப்பு தான். இப்படி சிரிக்கும் போது பற்கள் மஞ்சள் நிறமாக இருந்தால், நமது சுத்தம் கேள்விக் குறியாகி விடும். ஆரோக்கியமற்ற வாயையும், பற்களையும் வைத்துக் கொண்டு வெளியில் செல்லவோ, வெளிப்படையாக பேசவோ கூச்சப்படுபவர்கள் இருக்கின்றனர். முத்துப்போன்ற பற்கள் முகத்தை அழகாக்கும். பல் போனால் சொல் போச்சு என ஆதிகாலம் முதலே பேசி வருகிறார்கள். பற்கள் பாதிக்கப்பட்டால் பல்வேறு நோய்களும் நம்மை எட்டிப்பார்க்கும். வாய்துர்நாற்றம் வயிற்றில் உள்ள பிரச்சினைகள், உணவுக்குழாயில் உள்ள பிரச்சினைகளை காட்டிக்கொடுத்து விடும், அல்சர் இருந்தாலும் பற்களில் உணவுத் துணுக்குகள் சிக்கியிருந்தாலும் வாய் துர்நாற்றம் வீசும்.

முன்னோர்கள் பல் துலக்குவதற்கு சாம்பலையும் உப்பையும் பயன்படுத்தினார்கள். இதனால் வாய், பற்களின் ஆரோக்கியம் பாதுகாக்கபட்டது. இன்றைக்கு உங்க பேஸ்ட்ல உப்பு இருக்கா? கரி இருக்கா என்று கேட்டு நிமிடத்திற்கு ஒரு விளம்பரம் வெளியாகிறது. வாய் துர்நாற்றம், பற்களின் மீது படிந்துள்ள கறைகளை போக்க என்ன செய்வது, என்ன செய்யக்கூடாது என்று பல் மருத்துவர்கள் கூறியுள்ளனர்.

வாய் துர்நாற்றம்: வாய் துர்நாற்றம் ஏற்படுவதற்கு பல்வேறு காரணங்கள் உண்டு. உணவுத் துகள்கள் பல் இடுக்குகளில் மாட்டிக்கொண்டு வாய் கொப்பளிக்கும்போதோ அல்லது பல் துலக்கும்போதோ வெளியேறவில்லை என்றால் அழுகிப்போய் கெட்ட வாடை வீசலாம். தொண்டையில் நோய்த்தொற்று ஏற்பட்டு துர்நாற்றம் வீசலாம். ஈறு நோய், சொத்தைப் பல், வயிறு தொடர்பான பிரச்சினைகளால் துர்நாற்றம் அடிக்கலாம். இதுபோன்று இன்னும் வேறு பல காரணங்கள் உள்ளன. வாயில் துர்நாற்றம் எதனால் வீசுகிறது, என்பதைக் கண்டறிந்து அதற்கு சிகிச்சை எடுப்பது மட்டுமே இந்த பிரச்சனைக்குத் தீர்வு.

பற்கள் சுத்தத்தின் அவசியம்: ஒரு நாளைக்கு காலை மற்றும் இரவு என இருமுறை பல் துவக்குவது மிகவும் அவசியம். பற்கூச்சம் போன்ற பிரச்சினை உள்ளவர்கள் சா.்.ப்ட் வகை டூத் பிரஷ்களையும், மற்றவர்கள் மீடியம் வகை பிரஷ்களை மட்டுமே பயன்படுத்த வேண்டும். பல் வரிசையின் எல்லாப் பகுதிகளுக்கும் சென்று சுத்தம் செய்ய வசதியாக கைப்பிடி நன்றாக சௌகரியமாக இருக்க வேண்டும். அது மாதிரியான டூத் பிரஷ்களை மட்டுமே வாங்க வேண்டும். பல் துலக்கிய பிறகு ஈறுகளை மென்மையாக அழுத்தி மசாஜ் செய்ய வேண்டும். நாக்கில் உள்ள பசையை அகற்ற வேண்டும். 60 முதல் 90 நாட்களுக்கு ஒரு முறை பிரஷை மாற்றுவது நல்லது.

மஞ்சள் கறை: என்னதான் பல் தேய்த்தாலும் சிலருக்கு பற்களில் மஞ்சள் கறை படியும். பற்கள் மஞ்சளாக காணப்படுவதற்கு வயது, பாரம்பரிய காரணிகள், முறையற்ற பல் பராமரிப்பு, அதிக அளவு டீ மற்றும் காபி குடிப்பது, புகை பிடிப்பது ஆகியவற்றை காரணமாக கூறலாம். பற்களில் உள்ள மஞ்சள் கறையை நீக்க இயற்கையான வழிகள் உள்ளன. பற்களை எலுமிச்சை சாறுடன் உப்பு கலந்து தேய்த்து வந்தால், பற்களில் உள்ள மஞ்சள் கறை படிப்படியாக நீங்கும். எலுமிச்சை பழ தோலைக் கொண்டு பற்களை துலக்கி குளிர்ந்த நீரில் பற்களை கழுவினால் கறைகள் நீங்கி பிரகாசமாக தெரியும்.

I must dissent emphatically from any proposal to spend any money on preparing a statue of me, more especially at a time when people do not have enough food and clothing. – MAHATMA GANDHI

ஆரஞ்சு பழ தோல்: இரவு உறங்கும் முன் ஆரஞ்சு தோலில் பற்களை துலக்கி விட்டு வாயை கழுவாமல் படுத்துக் கொள்ள வேண்டும். ஆரஞ்சு தோலில் உள்ள வைட்டமின் "சி" சத்து பற்களில் உள்ள கறைகளை நீக்கிவிடும். இயற்கையான கரும்பு, அன்னாசிப்பழம் போன்ற சில உணவுப் பொருட்கள் நம்முடைய பற்களை சுத்தம் செய்யும் தன்மை கொண்டது. அதிக அளவில் நார்ச் சத்து உள்ள பச்சைக் காய்கறி போன்ற உணவுப் பொருட்களைச் சாப்பிடுவது உடலுக்கும், பற்களுக்கும் ஆரோக்கியமானது.

சாம்பல் பேஸ்ட்: சாதாரண சாம்பலை பேஸ்ட்டுடன் சேர்த்து காலை, மாலை பல் துலக்குவதால், பற்களில் உள்ள கறை நீங்கி, வெண்மையாக காட்சியளிக்கும். உங்கள் பல் மருத்துவரை வருடத்திற்கு குறைந்தபட்சம் இரண்டு முறை சந்தியுங்கள். இது உங்கள் பற்களை சிறந்த முறையில் பாதுகாக்க உதவும்.

பளிச் பற்கள்: சமையல் சோடா பற்களை வெண்மையாக்கும். பல் துலக்க மாதம் ஒரு முறையாவது சமையல் சோடாவை பயன்படுத்தலாம். ஆப்பிளை அதன் தோலுடன் சாப்பிடுவது ஆரோக்கியமானது. மேலும். இது உங்கள் பற்கள் இயற்கையாகவே சுத்தமாக உதவுகிறது. இந்த வழியில், உங்கள் பல்லிடிக்கில் துணுக்குகள் தங்காது. ஆரோக்கியமான ஈறுகள் மற்றும் இரத்தப்போக்கு தடுப்பு ஆகிய நன்மைகள் உண்டாகும்.

ஆயில் புல்லிங்: ஆயில் புல்லிங் செய்வதால் பல் வலி, பற்கள் விழுதல், வாயில் நோய்த் தொற்று, ஈறுகளில் ரத்தக் கசிவு போன்ற பிரச்சனைகள் நீங்குவதாகக் கூறப்படுகிறது. இயற்கையான நல்லெண்ணெயை வாயில் ஊற்றி 15 முதல் 20 நிமிடங்கள் கொப்பளித்த பிறகு அந்த எண்ணெயை வெளியே துப்பிவிட வேண்டும். பிறகு சுத்தமான நீரில் வாய் கொப்பளிக்க வேண்டும். ஆயில் புல்லிங் செய்து முடித்த பிறகு பிரஷ் செய்வதும், வாயை நன்றாக சுத்தம் செய்வதாலும் பற்களின் ஆரோக்கியம் பாதுகாக்கப்படும். உங்கள் பளிச் சிரிப்பை பார்த்து மயங்காதவர்களே இருக்க மாட்டார்கள்.

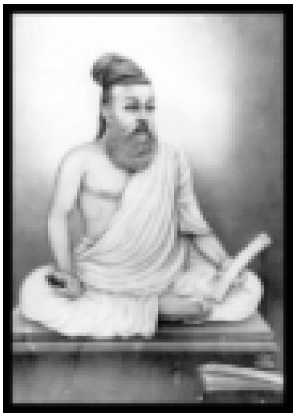
NICE LINE FROM RATAN TATA'S LECTURE IN LONDON

- Don't educate your children to be rich.
  Educate them to be Happy.
  So when they grow up they will know the value of things not the price.
- "Eat your food as your medicines.
  Otherwise you have to eat medicines as your food."
- The One who loves you will never leave you because even if there are 100 reasons to give up he/she will find one reason to hold on.
- There is a lot of difference between human being and being human. A Few understand it.
- You are loved when you are born.
  You will be loved when you die.
  In between You have to manage...!
- If u want to Walk Fast, Walk Alone..!
  But if u want to Walk Far, Walk Together..!!
- Six Best Doctors in the World-
  1. Sunlight
  2. Rest
  3. Exercise
  4. Diet
  5. Self Confidence &
  6. Friends

  Maintain them in all stages of Life and enjoy healthy life
- If you see the moon .....
  You see the beauty of God .....
  If you see the Sun .....
  You see the power of God .....
  And If you see
  the Mirror You see the best Creation of GOD.
  So Believe in YOURSELF.

That economics is untrue which ignores or disregards moral values.
– MAHATMA GANDHI

TENETS FROM TIRUKKURAL FOR THE DEFENSE AND THE ARMY



There was an apt quote from Tirukkural by the Prime Minister when he visited the army in the front, which is detailed below along with a few more that bring out need for valor as well the needs for best of armaments to fight with, to bring about victory. It is very satisfying that India is preparing itself in all the dimensions to confront the constant threats from our neighbors. India is equipping itself with missiles and fighters and trained army to ensure our defense.

Maramanam Manda Vazhichchelavu Thetram
Enanange Emam Padaikku Kural 766

மறமானம் மாண்ட வழிச்செலவு தேற்றம்
எனநான்கே ஏமம் படைக்கு. குறள் 766

"Valor, honour, decision in the midst of confusion, and devotion to the traditional principles of unblemished chivalry – these four are the armors of protection for an army,"

Kootrudandru Melvarinum Koodi Ethirnirkkum
Aatral Athuve Padai Kural 765

கூற்றுடன்று மேல்வரினும் கூடி எதிர்நிற்கும்
ஆற்ற லதுவே படை. குறள் 765

"That alone desrveth the name of army which can face valiantly even the God of death, if he should advance against it in all his fury."

Adalnagaiyum Aatralum Ilaneninum Thaneash
Padaiththagaiyal Padu Perum Kural 768

அடல்நகையும் ஆற்றலும் இல்லெனினும் தானை
படைத்தகையால் பாடு பெறும் குறள் 768

"Superiority of armaments may bring victory even though the army is lacking in dash or steadiness."

HOME FESTIVALS - 11

கார்த்திகை - Karttikai (November/December)

Krittika Dipa (right) is a joyous festival held on the Kritttika nakshatra (when the moon is in Pleiades constellation). Also called Sivalaya Dipa, it is celebrated most famously at Tiruvannamalai (upper left in the painting), on top of Arunachala Hill, home of saint Ramana Maharishi. A bonfire is lit on top that can be seen for miles around. Karthigai Purnima, the full- moon day, honours Lord Murugan. In one traditional story, six sparks from Siva's third eye became six babies (lower left), later gathered into one six-headed Arumugam (centre) by Parvati. Celebrations include lighting hundreds of oil lamps especially the standing lamp (right) of the home. On this day in Orissa, devotees make banana leaf boats and float them in the river with oil lamps, especially the standing lamp (right) of the home.

(To be continued)

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