ELECTRICAL INSTALLATION ENGINEER NEWS LETTER

TAMILNADU ELECTRICAL INSTALLATION ENGINEERS' ASSOCIATION 'A' GRADE (Regn. No. 211/1992)
No.1/61-10, Plot no. 48, Ground Floor, 3rd Street, Ravi Colony, Near Kathipara, St. Thomas Mount, Chennai – 600 016.
Phone: 044-22330601, 9710204300 Email : tnagrade@gmail.com Website : www.teiea.com

ISSUE NO. 168 | VOL : No. 15/2020 | MONTHLY ISSUE NO. 2 | PRIVATE CIRCULATION ONLY | FEBRUARY 2020

EDITORIAL

Dear Members, Fellow Professionals and Friends

Seasons Greetings to One and All!

February is the month of the Budget Presentation by the Government which was presented on the 1st of February. General Economic slowdown globally and in our country are a reality and allied problems of industrial slow down and lack of employment opportunities and so on are all seen. We are a large country and Democracy with huge potentials of all kinds, be it natural resources or Sunlight through the year or Agriculture or Horticulture or Plantations or Human resources with large youth population and in many other dimensions and what is needed is right kind of a push and support which seems to have been attempted in this year's Budget. They have addressed all areas of the economy including Agriculture, Rural Development, Industries, Infrastructure, MSMEs, Startups, Health and all other services and various other areas with lot of proposals and allocation of funds. Equitable distribution of water can help agricultural production to double and triple and investments in rural infrastructure can help storage and proper distribution and realization of appropriate prices. Encouraging and helping entrepreneurship is very apt for our country as it is naturally in the genes of all Indians. It is interesting to recall a historical event that when Vascodagama was finding sea route to India way back in the 15th century, his ship was guided to reach Indian shores by large Indian ships with cargo, who were on their way for trading with different countries of the world. Our knowledge, skills and excellence in services can be seen by one example that almost 80% of the diamonds sold across the world are cut and polished in India. Our potential in tourism is extraordinary and the thrust can help increase employments and revenues in a big way.

Investments in Infrastructure and Energy and the measures directed to Agriculture and Development and Industries and MSMEs and Startups can all help Electrical business and services to grow faster.

National Science Day is celebrated on the 28th of this month and we are all aware that the contribution of science and technology in all the activities and growth are paramount. Our knowledge and expertise and skills in all areas like Engineering, Production, Space, Nuclear, Communication and IT related activities are well known and application and excellence in technology in all areas of Products, offerings, production and distribution can certainly help growth of our trade, commerce and exports. Though there are apprehensions and criticism, our growth seems steady which is reflected in the growth of direct and indirect tax collections, which are received after all kinds of avoidances and evasions and activities of the parallel economy, which are unfortunate realities in our country. It continues to be a challenge for the Government to minimize and totally eradicate the evasions and the black money.

Let us all resolve to contribute our might in strengthening the economy and establishing excellence in all our activities.

We thank all those members who have helped us by participating in the advertisement appearing for the issue January 2020 – Galaxy Earthing Electrodes Pvt. Ltd., Power Square Engineers (Indotech Transformers Ltd.), Ringlet, Sakthi Transformer, Supreme Power Equipment Pvt. Ltd., Value Engineers.

Editor

ELECTRICAL INSTALLATION ENGINEER

President : S.D. POONGUNDRAN
Secretary : P. SUYAMBU
Treasurer : M. BALAMURUGAN

Editor : S.K. PANDIAN
Advisor: S. MAHADEVAN
Printer : M. VENKATARAMAN

CONTENTS

KNOW THY POWER NETWORK - 149

"ELECTRICAL POWER GRID – LOOKING BACK AND MOVING FORWARD"

You may wonder why this title has been chosen? It is because the Electrical Power constitutes one of our basic necessities and all that connected with it are sacrosanct for us. By looking back is, its history of development and advancement, we can move on forward easier. The behavioural patterns of the electricity grid as experienced by us, facilitates to plan or approach its growth in the present as well as in the future. We are always advised/guided to look forward but we can do it efficiently only when we look backwards also. i.e. the power of the lessons we learnt earlier always carry forward our efforts and further it has a tendency either to make or break our advancement in the present and in future as well. The past experiences that include failures also invariably move with the development of the electricity grid and impacts it present and future. In other words, we can use the past events more beneficially to get better productivity/results in the present and the future as well. OK. Let us move further to get answer for the question here under. What is Electricity Grid or Electrical Power Grid? How it looked in the earlier years and now appear at present and will look in the coming years?

ELECTRICITY GRID

It is an invisible, vertically integrated and rigidly coupled platform or network where all electrical generators pool/pump their energies (their outputs) for onward transmission, distribution to the premises of the consumers for their effective utilization. It is a kin to the damed water supply which feeds commercial, domestic, industrial, agriculture sectors by collecting water from various sources (Rains, Rivers, Streams), store it and transmit it through various canals, channels and pipes. The main difference in this analogy is that water can be stored in a dam where as electricity can never be stored in the grid; **it has to be used instantly**. Another example is present internet-network. It is analogues to electricity grid.

Before delving deep into subject on hand, let us make our journey to three sites viz.

i.) Electricity Grid from the year 1948 to 1991.

ii.) Electrical Power Grid from the year 1991 (year of liberalization) to till date 2020. This includes the events witnessed after the enactment of electricity act of 2003.

iii.) Future that starts the decade from 2020 onwards.

These three sites/stages are labelled as "past, present and future". Though the site titled "Past covers the developments prior to 1948 (prior to our independence), this is not given much importance. It is mainly because upto 1947 electricity grid was not extended wide spread in our Country. It was mainly produced for the use of our erstwhile rulers (British People). The Electricity Grid had grown at a faster pace only after the enactment of electricity supply act in the year 1948. i.e. after our independence. Then the State and Central Government started to build the Electricity Grid on a larger and wider scales.

"The oppressed are allowed once every few years to decide which particular representatives of the oppressing class are to represent and repress them in parliament."

The milestones crossed in this regard are shown as follows:-

Growth of Power Industry in India – Key Milestones

1899	Calcutta Electricity supply company provided electric power to the residences of Calcutta city through in its generating station at Emumburg lane, Calcutta
1900	Total generating capacity in the country reached “1.1 MW” (Thermal-1 MW; Hydel-0.1 MW)
1910	Indian Electricity Act was enacted
1947	Installed capacity-”1363" MW. (During the period 1900-1947, the generation and distribution of Electric power were mainly in the hands of private sector. Hydel stations and Coal Based Thermal Power Stations formed the main constituents).
1948	Electricity Supply Act was enacted. State Electricity Boards were formed to speed up the development of Power sector. The grid formed as a consequence of this act was a vertically integrated unit with rigid coupling. Its control was with the States.
1956	Indian Electricity Rules were framed: Central Electricity Authority (CEA) was created to oversee the integrated development of the Power Sector in the Country. SEBs were empowered to set up all types of Power Generating stations except Nuclear Power Plants. (This had remained with the Central Government).
1970-1990	Rapid development of Power Sector. This had prompted the formation of Central Sector Organisations like NTPC, BHEL, NHPC, Power Grid, REC and PFC. Five Regional Electricity Boards were also formed to coordinate and regulate the Power Generation and Transmission in the Country.
1991	Liberalisation started
2001	Generating capacity of the Country touched – 100000 MW. From 1991 onwards, Private sector played a great role in Electric Generation-Wind Mills, Solar Panels, Diesel Generating Stations and Gas Turbine Stations enter into the Electricity Grid.
2003	Indian Electricity Act was enacted; it replaced Indian Electricity Act 1910 and Electricity Supply Act 1948. CEB was removed; the role of CEA was limited; Central and State Regulatory Commissions were planned to regulate the flow of Electric Power in Inter State and Inter State Grids. Trading of Electricity and Electricity Tariffs by SEBs. Un bundling of State EBs also happened. Generation and distribution segments were open to Private Sector. Open access in the Transmission Sector had also been provided to this sector. Only the Transmission sector was in the control of State and Central Government. All this effectively reduced to role of SEBs and made them simply utilities like other Private Sector Electrical utilities. (e.g. BEST in Mumbai; Calcutta Electricity Supply Company in Calcutta).

With this, I would like to conclude my article here.

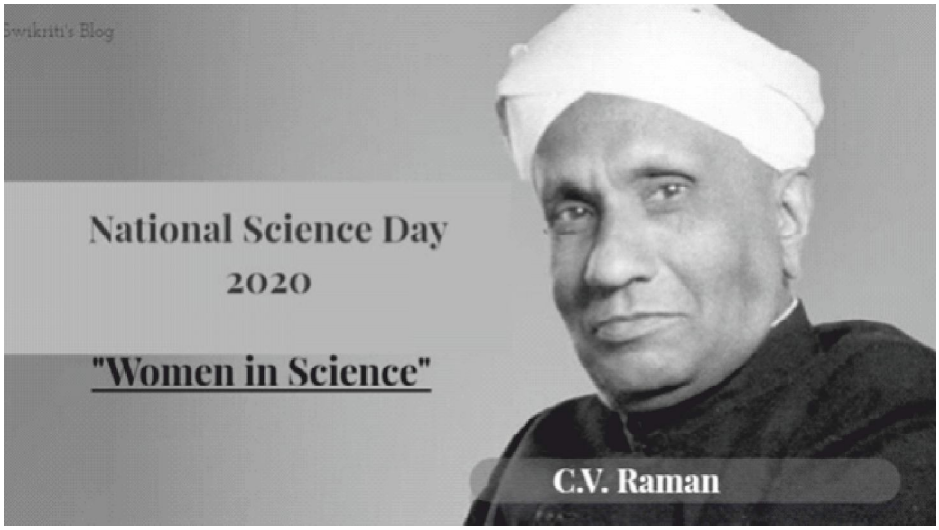
Please stay tuned till we meet again next month.

(To be continued…)

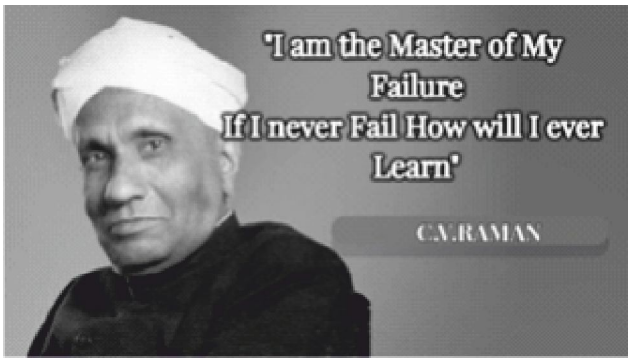
V. Sankaranarayanan, B.E., FIE,
Former Addl. Chief Engineer/TNEB
E-mail: vsn_4617@rediffmail.com
Mobile: 98402 07703

NATIONAL SCIENCE DAY 2020 THEME

In India every year February 28 is celebrated as National Science Day. This day marks the discovery of the Raman effect phenomenon of the Scattering of light by the Indian physicist Sir C.V Raman on 28 February 1928. For the discovery of the Raman effect, he was awarded the noble prize in 1928.



Due to the contribution of C.V Raman in the field of Physics and in discovery, the Nation Council for Science and Technology Communication (NCSTC) has proposed that every 28 February will be celebrated as National Science Day. The request was approved by the Government of India and from 1936, this is celebrated by the whole country.



Why should we care about Science?

Science is not just about innovation and new technologies, it is Curiosity based. Science occurred in the age of stone, when the cavemen learned what would happen when two stones were rubbed against one another. There was no internet that time but the curiosity helped their brain grow in finding new knowledge.

Theme of National Science Day 2020

Every year National Science Day is celebrated with a theme that spreads the message about the importance of science. This year Department of Science and Technology has the theme of National Science Day 2020 is "Women in Science". Last year the theme of National Science Day 2019 is "Science for the People, and the People for Science".

This year's theme is dedicated to women involved in science and also to motivate them to participate more in a science activity. From past year women are now taking active participation in the space program like we can take the example from mission mars (mangalyan) and Chandrayan 2.

What is the Raman effect?

It is an inelastic scrambling of a photon by molecules, which means that there is an exchange of energy and a change in light direction this effect is named by Raman Scattering. This phenomenon is also knowns as Raman Spectroscopy which now utilizes the chemist and physicists to know about materials.

What is the purpose of celebrating National Science Day?

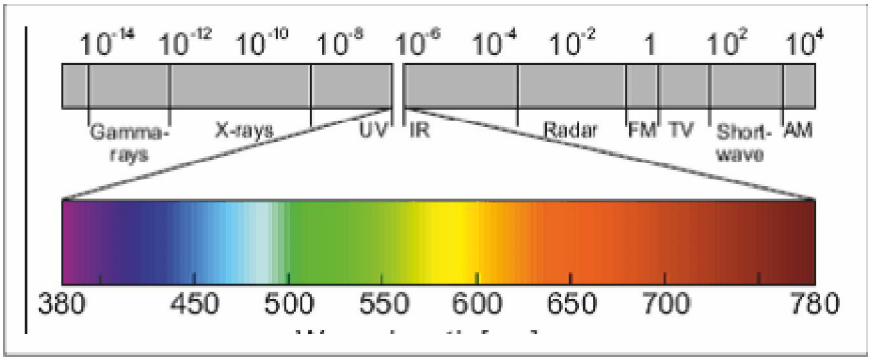
This day is celebrated to show light on the importance of science in our daily life also to show the achievements and the efforts made in the field of science for human welfare. National Science day is celebrated to discuss the important issues facing the field of science.

INSTALL LIGHTING SYSTEMS - 1

Light

Light is defined as electromagnetic radiation or energy transmitted through space or a material medium in the form of electromagnetic waves.

The electromagnetic spectrum covers an extremely broad range of radiation, ranging from radio waves with wavelengths of many metres, spanning several orders of magnitude, down to X-rays with wavelengths of less than a billionth of a metre.



The electromagnetic spectrum

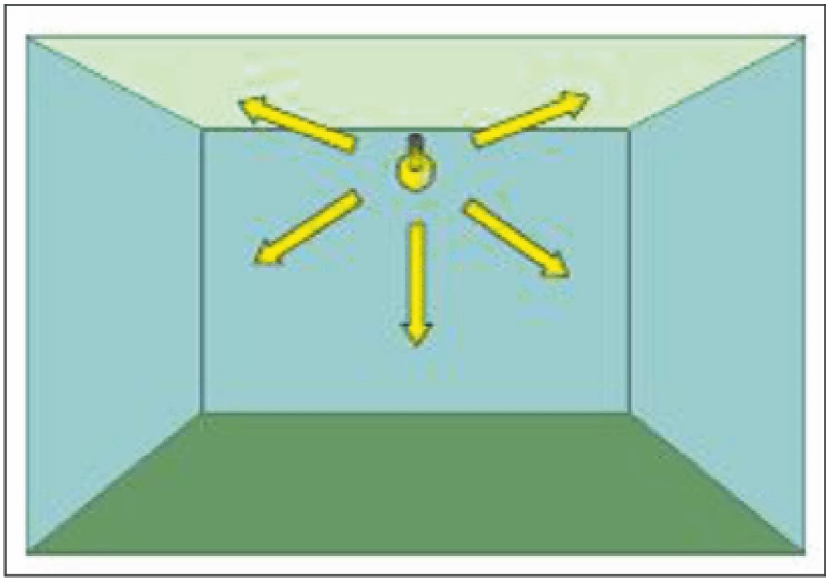
The range of the electromagnetic spectrum from 380 to 780 nm is called light.

The main units used to describe light and its effects are:

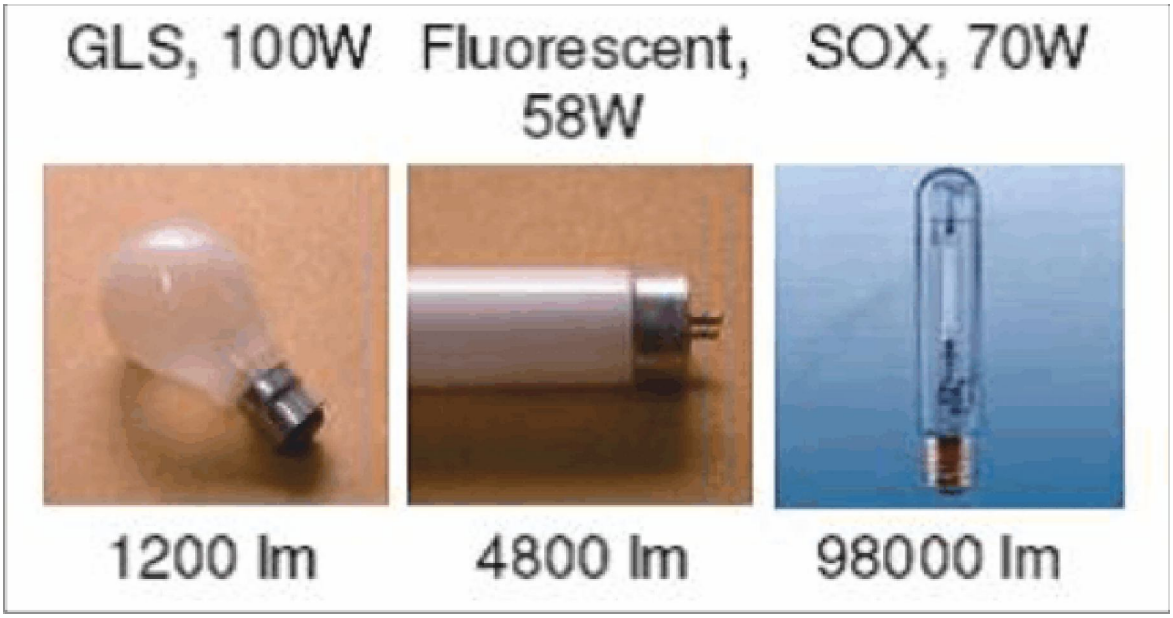
1. Luminous flux
2. Luminous intensity
3. Luminance
4. Illuminance

The flow of light or **luminous flux (ϕ)** is the light energy radiated out per second from a body in the form of luminous light waves. Its unit is the **lumen (lm)**

symbol	F	unit	lumen



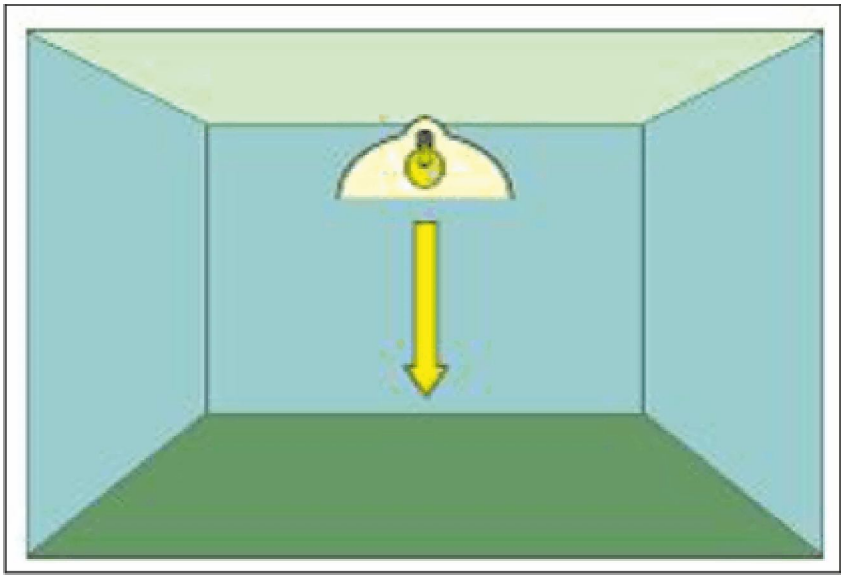
Luminous flux from a lamp



Luminous flux of some typical light sources

The power of a source of light is known as its luminous intensity.

Luminous intensity measures flux in a given direction.



Luminous intensity

- It is abbreviated as *I*.
- Its unit of measurement is the candela (cd)

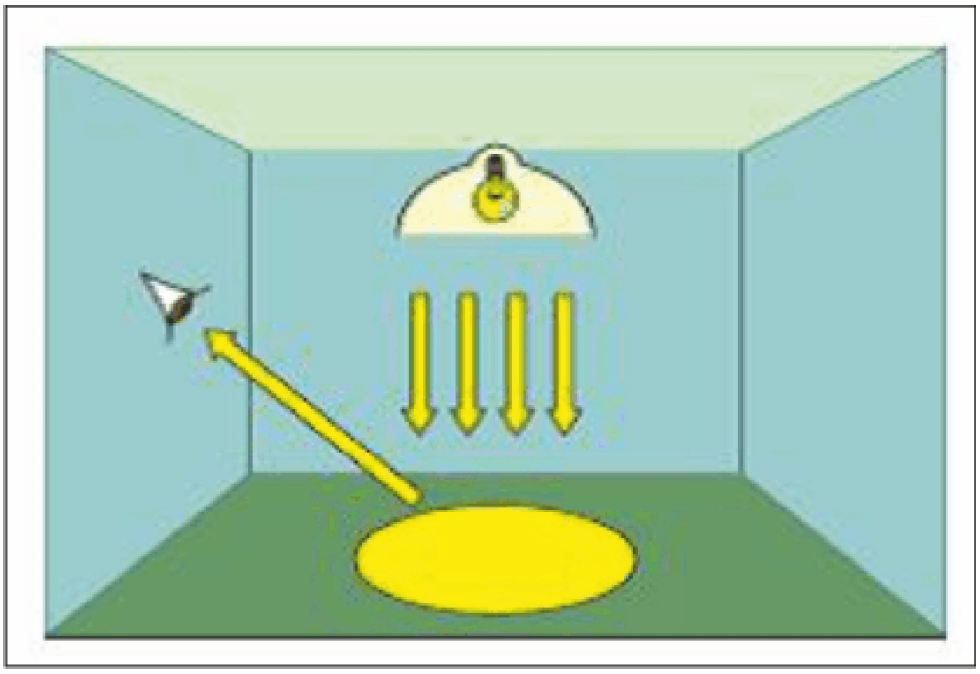
symbol	I	unit	candela

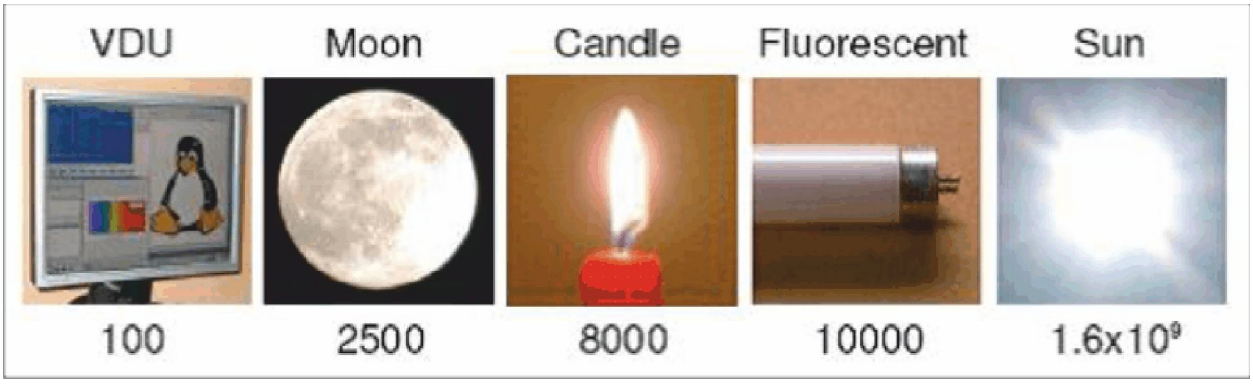
Some typical luminous intensities

Luminance indicates the lightness of an emitting surface (e.g Sun, moon, candle) for an observer.

- It is abbreviated as L .
- Its unit is the candela per square metre (cd m^{-2}).

symbol	L	unit	candela/m²



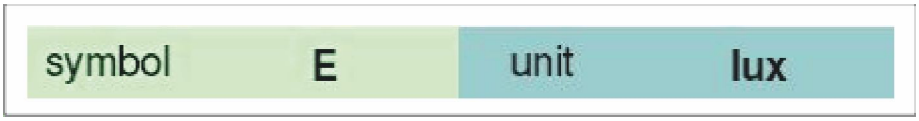


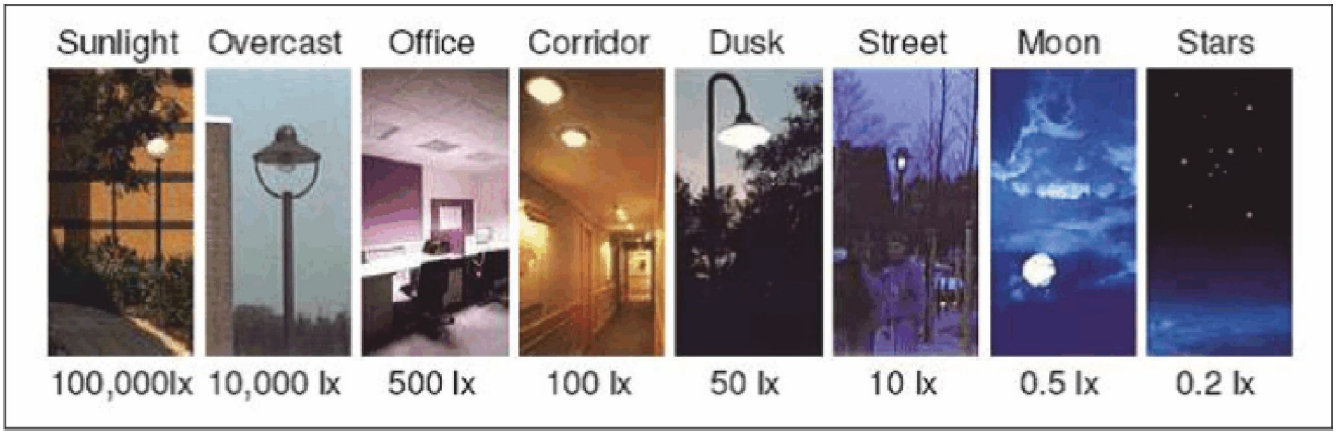
Luminance of some light sources (in cd/m²)

Illuminance (E) is the light falling on a surface.

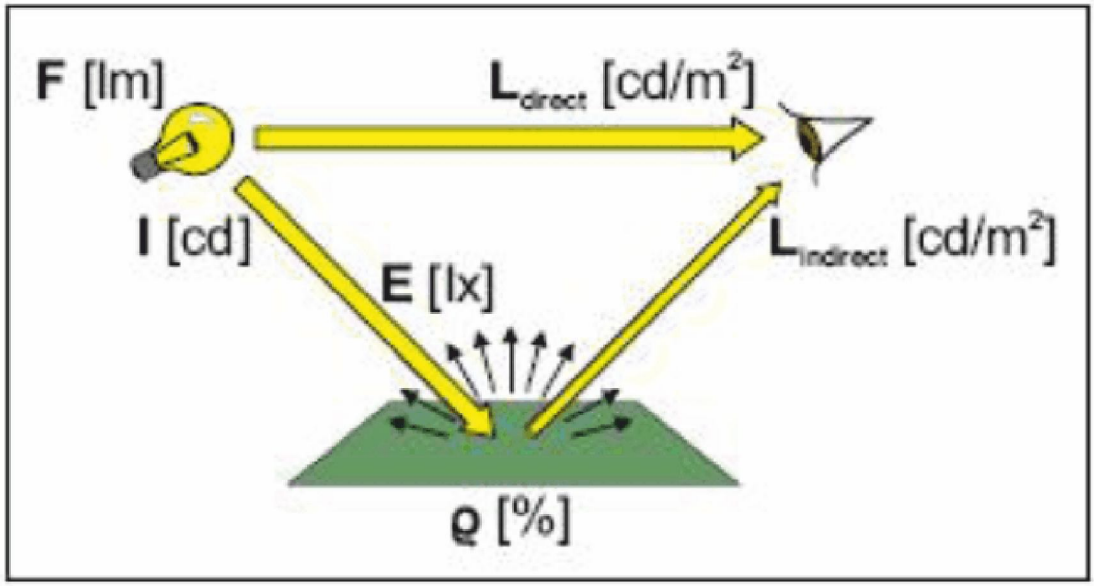
It is measured in terms of luminuous flux received on unit area, *i.e lumens per square metre (lm/m ²)* .

Its unit is the **Lux**



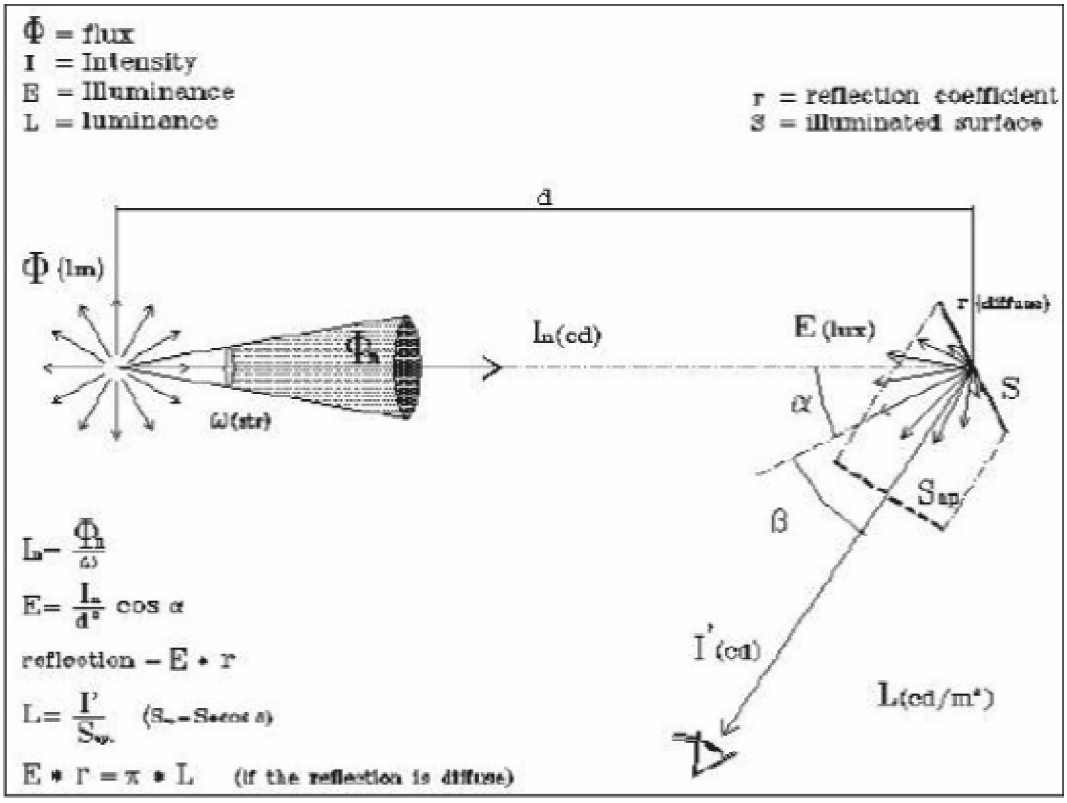


Some typical illuminances



Schematic of the most important lighting terms

Illustration of the Four main units



In any light phenomenon, it can be observed that the light originating from an emitting source expands through space. As it moves away from its source, the illuminance that it produces on a surface decreases by the square of the distance.

Equally, if the surface is not orthogonal to the incident beam, the illuminance decreases by the cosine of the angle of deviation, resulting in the following:

$$E = (I/d^2) \cos(\alpha)$$

4.1 State the following factors relating to illuminance :-

(i) Illumination law.

(ii) Inverse square law

(iii) Cosine law

(i) **Illumination law.**

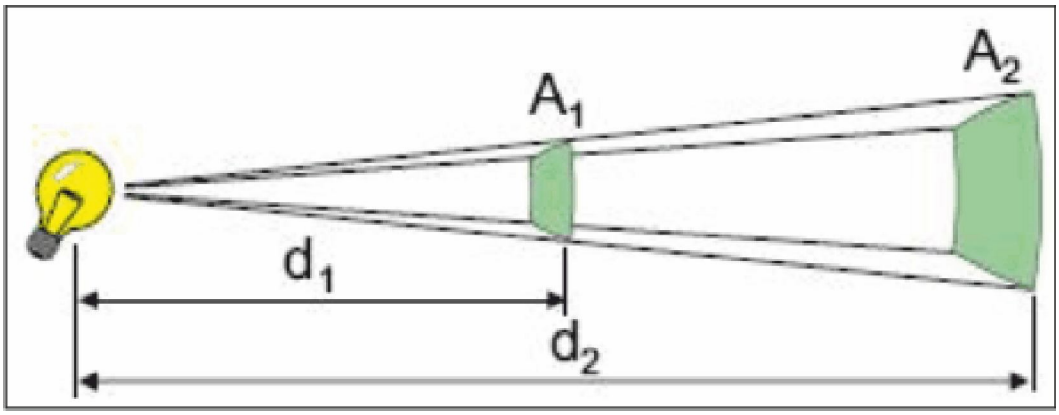
Illumination (E) is directly proportional to the luminous intensity (I) of the source of light.

$$\mathbf{E \propto I}$$

(ii) **Inverse square law**

The illumination of a surface is inversely proportional to the square of the distance (d) of the surface from the source.

$$\mathbf{E \propto I / d^2}$$



The surfaces A1 and A2 both cover the same solid angle from the light source. Because light travels in straight lines, they both intercept the same luminous flux.

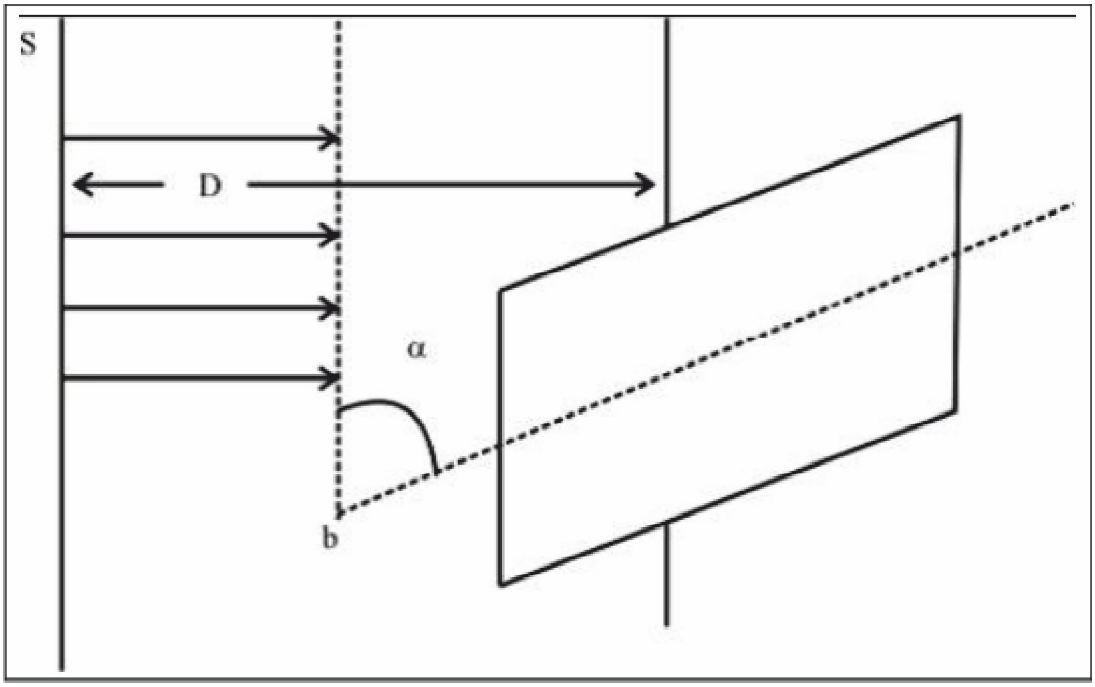
However, since their areas are different, the illuminance that this flux produces on the surfaces is not the same. The illuminance depends on the area on to which the light is falling; it is proportional to the inverse of the distance to the source squared.

$$I = d_1^2 E_1 = d_2^2 E_2$$

(iii) **Cosine law**

Illumination (E) is directly proportional to the cosine of the angle made by the normal to the illuminated surface with the direction of the incident flux.

$$E \propto I \cos^{\alpha} / D^2$$



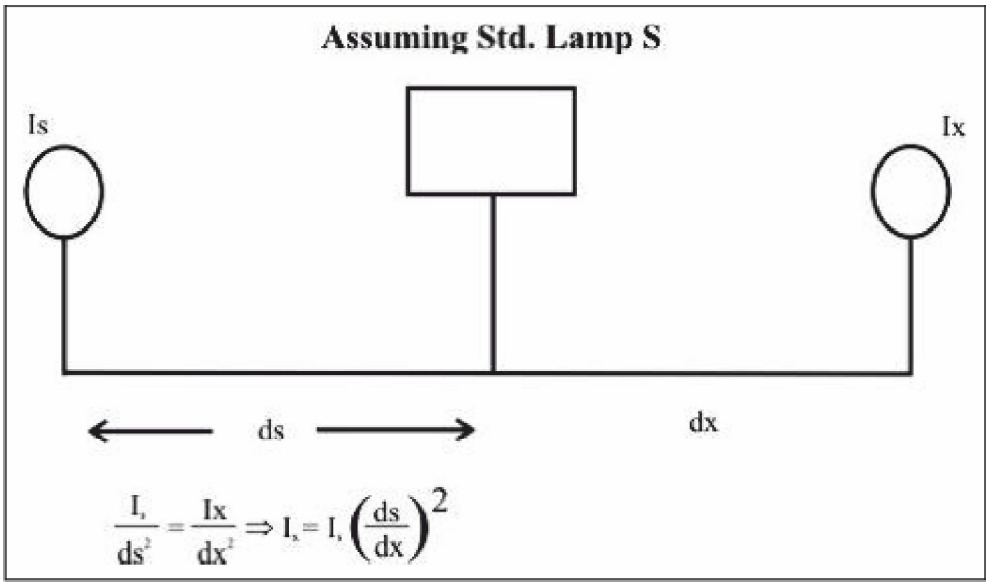
4.2 Explain the meaning of the term photo bench.

A photo bench is an instrument used to compare the light intensities of two lamps.

The lamps are supported on an optical bench fitted with a ruler. A photometer head is mounted between the lamps (**Is** & **Ix**) so that its position can be varied until its two sides are equally bright. The distances (**ds** & **dx**) of the lamps from the photometer are noted. The location of the photometer is adjusted until the illumination on its two faces is judged to be equal.

Then,

$$\frac{\text{Intensity of standard lamp} - \text{Is (cd)}}{ds^2} = \frac{\text{Intensity of test lamp} - \text{Ix(cd)}}{dx^2}$$



4.3 State the use of illumination meter / luxmeter

An illumination meter is used to measure the amount of light (lux) falling on an object.

A simple way of measuring the luminance is to use a photocell with a special shading rod.

(To be continued)

Courtesy: Khemraz Ramduth

ELECTRICAL THUMB RULES-LIGHT SOURCES

Watts & Light Brightness			
Incandescent Watts	**CFL Watts**	**LED Watts**	**Lumens (Brightness)**
40	8 to 12	6 to 9	400 to 500
60	13 to 18	8 to 12.5	650 to 900
75 to 100	18 to 22	13 to 15	1100 to 1750
100	23 to 30	16 to 20	1800 to 2779
150	30 to 55	25 to 28	2780

Minimum Lumens	
Incandescent (Watt)	**CFL , Halozan , LED (Minimum Lumen)**
25 Watt	200
40 Watt	450
60 Watt	800
75 Watt	1100
100 Watt	1600
150 Watt	2700

Wattage Comparison chart					
Incandescent/ Halogens	**Mercury Vapour**	**Metal Halide**	**High Pressure Sodium**	**Compact Fluorescent (CFLs)**	**Light Emitting Diodes (LEDs)**
40 to 60	15 to 25	5 to 15	5 to 15	12 to 15	5 to 8
60 to 75	25 to 35	15 to 25	15 to 25	15 to 18	7 to 10
75 to 100	35 to 45	20 to 35	20 to 35	18 to 23	10 to 15
100 to 150	50 to 60	25 to 40	25 to 40	23 to 35	15 to 20
150 to 200	70 to 85	35 to 45	35 to 45	30 to 45	20 to 25
200 to 250	90 to 110	40 to 55	40 to 55	45 to 60	25 to 30

Luminous efficacy	
Light type	**Typical luminous efficacy (lumens/watt)**
Tungsten incandescent light bulb	12.5 to17.5 lm/W
Halogen lamp	16 to 24 lm/W
Fluorescent lamp	45 to 75 lm/W
LED lamp	30 to 90 lm/W
Metal halide lamp	75 to 100 lm/W
High pressure sodium vapor lamp	85 to 150 lm/W
Low pressure sodium vapor lamp	100 to 200 lm/W
Mercury vapor lamp	35 to 65 lm/W

Selection parameter of LED Bulbs			
Parameter	**Average**	**Good**	**Best**
Lumens/Watt	75	90	100
Power Factor	0.7	0.8	0.9
CRI	60	70	80
LED Life in Hours	15000	25000	50000

Available CRI of Various Lighting Sources	
Source	**CRI**
Incandescent / Halogens	>95
T8 Linear Fluorescent	75 to 85
Cool White Linear Fluorescent	62
Compact Fluorescent	82
Metal Halide	65
High Pressure Sodium (HPS)	22
LED	80 to 98

Color Accuracy – CRI Chart	
CRI	**Rating**
>90	Great
80 to 90	Very Good
70 to 80	Good
60 to 70	Good
40 to 60	Poor

Color Temperature & CRI Chart			
Kelvin	**Light Effect**	**CCT**	**CRI**
< 3600K	Incandescent Fluorescent (IF)	2750	89
< 3600K	Deluxe warm white (WWX)	2900	82
< 3600K	Warm white (WW)	3000	52
3200K to 4000K	White	3450	57
3200K to 4000K	Natural white (N)	3600	86
Above 4000 K	Light white (LW)	4150	48
Above 4000 K	Cool white (CW)	4200	62
Above 4000 K	Daylight (D)	6300	76
Above 4000 K	Deluxe Daylight (DX)	6500	88
Above 4000 K	Sky white	8000	88

Color Temperature & CRI		
Lighting source	**Color Temperature**	**Color Rendering Index**
High Pressure Sodium Lamp	2100K	25
Incandescent Lamp	2700K	100
Tungsten Halogen Lamp	3200K	95
Tungsten Halogen Lamp	3200K	62
Clear Metal Halide Lamp	5500K	60
Natural Sun Light	5000K to 6000K	100
Day Light Bulb	6400K	80

Lighting Source CCT	
Source	**Color temperature in Kelvin**
Skylight (blue sky)	12,000 – 20,000
Average summer shade	8000
Light summer shade	7100
Typical summer light (sun + sky)	6500
Daylight fluorescent	6300
Xenon short-arc	6400
Overcast sky	6000
Clear mercury lamp	5900
Sunlight (noon, summer, mid-latitudes)	5400
Design white fluorescent	5200
Special fluorescents used for color evaluation	5000
Daylight photoflood	4800 – 5000
Sunlight (early morning and late afternoon)	4300
Bright White Deluxe Mercury lamp	4000
Sunlight (1 hour after dawn)	3500
Cool white fluorescent	3400
Photoflood	3400
Professional tungsten photographic lights	3200
100-watt tungsten halogen	3000
Deluxe Warm White fluorescent	2950
100-watt incandescent	2870
40-watt incandescent	2500
High-pressure sodium light	2100
Sunlight (sunrise or sunset)	2000
Candle flame	1850 – 1900
Match flame	1700
Skylight (blue sky)	12,000 – 20,000

Average summer shade	8000
Light summer shade	7100
Typical summer light (sun + sky)	6500
Daylight fluorescent	6300
Xenon short-arc	6400
Overcast sky	6000
Clear mercury lamp	5900
Sunlight (noon, summer, mid-latitudes)	5400
Design white fluorescent	5200
Special fluorescents used for color evaluation	5000
Daylight photoflood	4800 – 5000
Sunlight (early morning and late afternoon)	4300
Bright White Deluxe Mercury lamp	4000
Sunlight (1 hour after dawn)	3500
Cool white fluorescent	3400
Photoflood	3400
Professional tungsten photographic lights	3200
100-watt tungsten halogen	3000
Deluxe Warm White fluorescent	2950
100-watt incandescent	2870
40-watt incandescent	2500
High-pressure sodium light	2100
Sunlight (sunrise or sunset)	2000
Candle flame	1850 – 1900
Match flame	1700

CCT – Correlated Color Temperature

Kelvin	Associated Effects	Type of Bulbs	Appropriate Applications
2700°	Warm White, Very Warm White	Incandescent bulbs	Homes, Libraries, Restaurants
3000°	Warm White	mostly halogen lamps, Slightly whiter than ordinary incandescent lamps	Homes, Hotel rooms and Lobbies, Restaurants, retail Stores
3500°	White	Fluorescent or CFL	Executive offices, public reception areas, supermarkets
4100°	Cool White		Office, classrooms, mass merchandisers, showrooms
5000°	Daylight	Fluorescent or CFL	Graphic industry, hospitals
6500°	Cool Daylight	Extremely white‘	Jewellery stores, beauty salons, galleries, museums, printing

Courtesy: Jignesh.parmar

ELECTRICAL QUESTION & ANSWER PART-3

1) Why We use of Stones/Gravel in electrical Switch Yard

- Reducing Step and Touch potentials during Short Circuit Faults
- Eliminates the growth of weeds and small plants in the yard
- Improves yard working condition
- Protects from fire which cause due to oil spillage from transformer and also protects from wild habitat.

2) What is service factor?

- Service factor is the load that may be applied to a motor without exceeding allowed ratings.
- For example, if a 10-hp motor has a 1.25 service factor, it will successfully deliver 12.5 hp (10 x 1.25) without exceeding specified temperature rise. Note that when being driven above its rated load in this manner, the motor must be supplied with rated voltage and frequency.
- However a 10-hp motor with a 1.25 service factor is not a 12.5-hp motor. If the 10-hp motor is operated continuously at 12.5 hp, its insulation life could be decreased by as much as two-thirds of normal. If you need a 12.5-hp motor, buy one; service factor should only be used for short-term overload conditions

3) Why transmission line 11KV OR 33KV, 66KV not in 10KV 20KV?

- The miss concept is Line voltage is in multiple of 11 due to Form Factor. The form factor of an alternating current waveform (signal) is the ratio of the RMS (Root Mean Square) value to the average value (mathematical mean of absolute values of all points on the waveform). In case of a sinusoidal wave, the form factor is 1.11.
- The Main reason is something historical. In olden days when the electricity becomes popular, the people had a misconception that in the transmission line there would be a voltage loss of around 10%. So in order to get 100 at the load point they started sending 110 from supply side. This is the reason. It has nothing to do with form factor (1.11).
- Nowadays that thought has changed and we are using 400 V instead of 440 V, or 230 V instead of 220 V.
- Also alternators are now available with terminal voltages from 10.5 kV to 15.5 kV so generation in multiples of 11 does not arise. Now a days when, we have voltage correction systems, power factor improving capacitors, which can boost/correct voltage to desired level, we are using the exact voltages like 400KV in spite of 444KV

4) What is electrical corona?

- Corona is the ionization of the nitrogen in the air, caused by an intense electrical field.
- Electrical corona can be distinguished from arcing in that corona starts and stops at essentially the same voltage and is invisible during the day and requires darkness to see at night.
- Arcing starts at a voltage and stops at a voltage about 50% lower and is visible to the naked eye day or night if the gap is large enough (about 5/83 at 3500 volts).

5) What are the indications of electrical corona?

- A sizzling audible sound, ozone, nitric acid (in the presence of moisture in the air) that accumulates as a white or dirty powder, light (strongest emission in ultraviolet and weaker into visible and near infrared)

that can be seen with the naked eye in darkness, ultraviolet cameras, and daylight corona cameras using the solar-blind wavelengths on earth created by the shielding ozone layer surrounding the earth.

6) What damage does corona do?

- The accumulation of the nitric acid and micro-arcing within it create carbon tracks across insulating materials. Corona can also contribute to the chemical soup destruction of insulating cements on insulators resulting in internal flash-over.
- The corona is the only indication. Defects in insulating materials that create an intense electrical field can over time result in corona that creates punctures, carbon tracks and obvious discoloration of NCI insulators.

7) How long does corona require creating visible damage?

- In a specific substation the corona ring was mistakenly installed backwards on a temporary 500kV NCI insulator, at the end of two years the NCI insulator was replaced because 1/3 of the insulator was white and the remaining 2/3 was grey.

8) What voltage are corona rings typically installed at?

- It varies depending upon the configuration of the insulators and the type of insulator, NCI normally start at 160kV, pin and cap can vary starting at 220kV or 345kV depending upon your engineering tolerances and insulators in the strings.

9) How do we select transformers?

- Determine primary voltage and frequency.
- Determine secondary voltage required.
- Determine the capacity required in volt-amperes. This is done by multiplying the load current (amperes) by the load voltage (volts) for single phase.
- For example: if the load is 40 amperes, such as a motor, and the secondary voltage is 240 volts, then 240 x 40 equals 9600 VA. A 10 KVA (10,000 volt-amperes) transformer is required.
- Always select Transformer Larger than Actual Load. This is done for safety purposes and allows for expansion, in case more loads is added at a later date. For 3 phase KVA, multiply rated volts x load amps x 1.73 (square root of 3) then divide by 1000.
- Determine whether taps are required. Taps are usually specified on larger transformers.

10) Why Small Distribution Transformers are not used for Industrial Applications?

- Industrial control equipment demands a momentary overload capacity of three to eight times' normal capacity. This is most prevalent in solenoid or magnetic contactor applications where inrush currents can be three to eight times as high as normal sealed or holding currents but still maintain normal voltage at this momentary overloaded condition.
- Distribution transformers are designed for good regulation up to 100 percent loading, but their output voltage will drop rapidly on momentary overloads of this type making them unsuitable for high inrush applications.
- Industrial control transformers are designed especially for maintaining a high degree of regulation even at eight time's normal load. This results in a larger and generally more expensive transformer.

(To be continued)

Courtesy: ***Jignesh.Parmar***

INDIAN RAILWAYS TO SOURCE ABOUT 1000 MW SOLAR POWER BY 2021-22; NANDYAL – YERRAGUNTLA SECTION IN GUNTAKAL DIVISION HAS BEEN DECLARED AS THE FIRST SOLAR SECTION IN SOUTH CENTRAL RAILWAY

All 08 stations in the section provided with solar panels at one stretch; capable of meeting all the power needs of these railway stations

Indian Railways has planned to source about 1000 Mega Watt (MW) Solar Power and about 200 MW of wind power progressively by 2021-22 across Zonal Railways & Production Units. Of this, 500 Mega Watt (MW) solar plants are to be installed on the roof top of Railway buildings which will be used to meet non-traction loads at Railway Stations, etc. About 500 MW land based solar plants will be used to meet both traction & non-traction requirements.

South Central Railway is one of the zones actively implementing several measures aimed at energy conservation by harnessing renewable energy. One of the significant actions taken in this direction has been the installation of solar panels at stations, service buildings, LC gates etc across the zone. Taking this step to the next level, for the first time all the stations in a particular section of the South Central Railway have been provided with solar panels at one stretch to tap the natural energy. This will not only help in meeting power needs of all the stations in the section but also save expenditure for the Railways.

The Nandyal – Yerraguntla section in Guntakal Division has been declared as the first solar section in South Central Railway. Nandyal – Yerraguntla section is a new railway line laid by Railways and opened for passenger traffic in the year 2016 to bring the hinterland areas into rail map by providing rail connectivity. All the 08 stations in the section – Madduru, Banaganapalle, Koilakuntla, Sanjamala, Nossam, S.Uppalapadu, Jammalamadugu and Proddutur – have been provided with solar panels capable of meeting all the power needs at these railway stations.

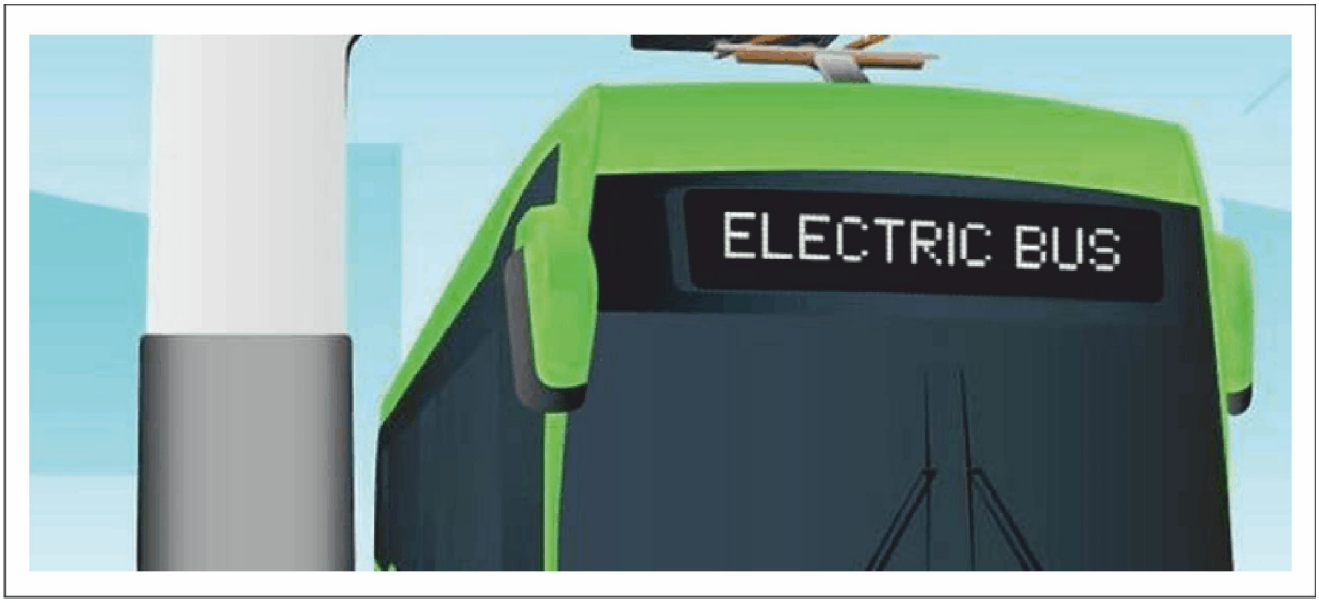
In order to make use of solar power, 37 kWp off Grid Roof Top Solar plants along with 250/125 Wp solar panels have been installed in each station. In addition, Inverters and 12V 150 AH Battery banks are also installed at all these stations. The total connected load on solar plants is on an average 30 kWp. In total, 152 solar panels have been installed at these stations. With an average exposure of 8 sunny hours per day, 148 KWh energy units can be generated throughout the year resulting in energy generation of 54,020 units. Anticipated savings in terms of revenue is around Rs 5 lakh per annum. Significantly, it also helps in reducing carbon footprint to the tune of 49 metric tonnes per annum thus contributing towards greener environs.

16 stations have already been declared Green Railway stations across Indian Railways, which are meeting energy needs completely either through solar or wind power. These stations are Roha, Pen, Apta in Central Railway, Niamatpur halt, Kanhaipur halt, Teka Bigha halt, Mai halt, Garsanda halt, Niyazipur halt, Dhamaraghat in East Central Railway, Shri Mata Vaisno Devi, Shimla in Northern Railway, Unhel, Khanderi, Bajud, Ambli Road, Sadanapura & Sachin in Western Railway – are 100% Green Powered stations.

Ashok Leyland, ABB arm ink pact to develop electric buses with flash- charging tech

ABB's flash-charge technology, Tosa, can top up the battery in just seconds

Truck and bus maker Ashok Leyland and ABB Power Products and Systems India Ltd have signed an agreement for development former's new electric buses using latter's fastest flash-charging technology to advance urban mobility while cutting down carbon emissions.



The pact is to develop a pilot electric bus based on ABB's flash-charge technology, Tosa, which tops up the battery in just seconds while passengers get on and off the bus. This avoids the need to take the vehicle out of service for recharging every few hours or having a replacement bus ready, thus minimising the size of the fleet while increasing passenger carrying capacity, according to a statement.

"The aim is to provide a zero local emission mass public transportation bus system with high passenger capacity. We are pleased to be working with Ashok Leyland in advancing responsible urban mobility," said N Venu, Managing Director, ABB Power Products and Systems India, which represents ABB Power Grids' business in India.

Tosa is claimed to be the fastest flash-charging connection technology that lets cities reduce the environmental pollution of their transit systems without affecting passenger capacity or journey times. At selected passenger stops, its system connects the bus to the charging infrastructure, and in a mere 15 seconds the batteries are charged with a 600-kilowatt power boost. An additional few minutes charge at the final terminal enables a full recharge without interrupting the bus schedule.

"To stay competitive in our domestic and global markets, we are joining hands with ABB to use their world-renowned Tosa technology on our e-buses to take forward our vision of expanding in the EV space," N Saravanan, Chief Technology Officer, Ashok Leyland.

TOSA fast-charging can save as much as 1,000 tonnes of carbon dioxide on a line covering 600,000 km per year. It also offers operating cost savings of 30 per cent compared to an equivalent diesel-transit system, the statement added.

ABB is also providing its software solution for asset optimisation, as well as its other system to monitor and control the power network for charging stations and e-buses.

On its part, Ashok Leyland will be providing vehicle, energy and EV-related technical information using its iAlert Platform. This will further optimise maintenance processes, enable a fast response to fault incidents and better predict maintenance and performance needs. The overall solutions are equipped with remote access and 'cloud' capabilities and is scalable to meet future needs.

Source: thehindubusinessline

"Everybody is a political person, whether you say something or you are silent.
A political attitude is not whether you go to parliament;
it's how you deal with your life, with your surroundings."

HANDBOOK ON INSTALLATION & MAINTENANCE OF SOLAR PANEL - 1

Designing a Solar Photovoltaic System

1.1 Definitions

The following definitions are very important in designing a solar photo voltaic system.

Solar Cell

The basic photovoltaic device, which generates electricity when exposed to sunlight, shall be called a "Solar Cell".

Solar Module

The smallest complete environmentally protected assembly of interconnected solar cells shall be called "Module".

Solar Panel

A group of modules fastened together, pre-assembled and interconnected, designed to serve as an installable unit in an Array shall be called "Panel".

Solar Array

A mechanically integrated assembly of modules or panels together with support structure, but exclusive of foundation, tracking, thermal control and other components, as required to form a dc power producing unit shall be called an "Array".

Solar irradiation

On any given day the solar radiation varies continuously from sunrise to sunset and depends on cloud cover, sun position and content and turbidity of the atmosphere. The maximum irradiance is available at **solar noon** which is defined as the midpoint, in time, between sunrise and sunset. The total solar radiant power incident upon unit area of an inclined surface (Watt/m^2) is called total solar irradiance.

Insolation

Insolation differs from irradiance because of the inclusion of time. Insolation is the amount of solar energy received on a given area over time measured in kilowatt-hours per square meter squared (kW-hrs/m^2) - this value is equivalent to "**peak sun hours**".

Peak Sun Hours

Peak sun hours is defined as the equivalent number of hours per day, with solar irradiance equaling 1,000 W/m^2, that gives the same energy received from sunrise to sunset.

Peak sun hours is of significance because PV panel power output is rated with a radiation level of 1,000W/m^2.

Many tables of solar data are often presented as an average daily value of peak sun hours (kW-hrs/m^2) for each month.

Conversion Efficiency

The ratio of the maximum power to the product of area and irradiance expressed as a percentage.

$$n = \frac{\text{Maximum power x 100\%}}{\text{Area x irradiance}}$$

1.2 General & Technical requirements for Solar Photo Voltaic Module

Following are the general and technical requirements of solar photovoltaic module for use in Railway S&T installation for the correctness of its material, design and electrical characteristics as per IRS specification IRS:S 84-92

1.2.1 General Requirements

The solar module for the purpose of this specification shall consist of the following three main components:

i. Toughened front glass.

ii. A suitable mounting frame.

iii. An assembly of suitably interconnected, silicon solar cells working on the principle of photovoltaic conversion of sunlight into electricity.

The silicon wafers cut from the large crystal shall be polished and necessary chemical treatment shall be given to achieve requisite surface characteristics for optimum efficiency of individual cells.

P-N junction on individual wafer shall be made by injecting impurity (phosphorous or any other suitable material) by diffusion process.

The solar cells required to form a module shall be connected in series/ parallel through tinned copper foils. These shall be mounted behind a high transparency, toughened glass front surface. Two thin transparent films of suitable plastic material, preferably (Ethylene Vinyl Acetate) shall be interposed between the solar cell layer and the front glass and the solar cell layer and the back plastic laminate. This assembly shall then be kept in a temperature controlled oven at a suitable temperature, so that the above assembly becomes a solid mass with the cells protected against corrosion, moisture, pollution and weathering.

The transparency of toughened glass used shall not be less than 91%. A certificate to this effect shall be submitted by the supplier. A copy of test results from a recognized test house or their own laboratory shall be submitted at the time of type approval.

The complete solar module shall be sealed in an Anodized Aluminium Frame with RTV silicon rubber compound filling around the edges to give further moisture barrier and shock resistance.

The output terminals of the module shall be provided on the back of the solar PV-module. Terminal block shall be made of Nylon-6. It shall be housed in a HDPE-UV stable junction box secured physically uniformly to the frame of the PV module. The junction box should have a hinged lid with self-holding fasteners enabling easy handling. The box lid should be secured with a gasket for greater protection against ingress of moisture (conforming to IP-55) of IS: 2147-62). Cable outlets from solar PV module terminal shall be through cable glands to be provided in the junction box (with addl. knockouts provided) to help in series /parallel connection of solar PV modules. The junction box should have common terminals with suitable by pass diodes for prevention of hot spot problem.

If required by the purchaser the module shall be fixed on a mounting bracket, which shall be suitably designed to withstand the weight of the panel. The mounting arrangement shall be suitable for pole mounting, column mounting or flat surface, as desired by the purchaser.

Provision for directional and angular adjustment shall be provided to get maximum utilization of incident sunlight.

The design/drawings of the mounting bracket shall be supplied along with the module to the purchaser.

The supplier shall give information regarding the weight and dimensions of the module, to the purchaser.

The solar photovoltaic module shall be highly reliable, light-weight and shall have a long operational life.

The recommended values of output power from each module are 4, 6, 9, 12, 30, 32, 35, 40, 50, 70, 80 & 100 watts. The purchaser shall, however, specify the output wattage of the module required by him.

The recommended nominal voltages of each module are 4, 6, 9, 12 & 24Volts. The purchaser shall, however, specify the voltage of the module required by him.

2.2.2 Technical requirements

Some of the important technical requirements as per IRS:S 84-92 are as given below:

The following parameters shall be clearly specified by the manufacturer for different type of solar modules manufactured by him:

a) Peak power output (Pm)
b) Current at peak power output (Im)
c) Voltage at peak power output (Vm)
d) Short circuit current (Isc)
e) Open circuit voltage (Voc)
f) Conversion efficiency of the module (n)

The values of parameters from (a) to (f) above shall be specified under standard test conditions of

a) Cell junction temperature of 25 ± 2ºC
b) Irradiance of 1000 Watt/M.Sq. as measured with a reference solar cell (duly certified by a recognized national/international test house/lab. nominated for this purpose).
c) Standard Solar spectral energy distribution.
d) Air Mass of 1.5.

The frame of the mounting fixture shall be made of anodized aluminium, conforming to specification/IS: 7088-1973 with 20 micron anodization thickness. All other parts such as fasteners etc. shall be made of galvanized or stainless steel to make them weather-proof. In addition to holes provided for fixing on to mounting structure, extra holes are to be provided suitably in the frame for cable routing.

The solar module shall be able to withstand a maximum mean hourly rainfall of 40 mm.

The solar module shall be able to withstand humidity level of upto 95%.

The conversion efficiency of the modules upto 35W shall not be less than 8% and for modules greater than 35W shall not be less than 12%.

The cell efficiency of the solar cells shall be greater than 12%.

If required by the purchaser, the back plastic laminate shall be replaced by a toughened glass sheet to make the module suitable for use in coastal areas/industrially polluted areas/places where the plastic laminate is likely to get corroded.

If required by the purchaser, an aluminum backing plate to protect the module from miscreants shall be provided.

(To be continued)

Courtesy: CAMTECH Gwalior

IS 15652/11171/1445/1678

ABSTRACT OF IS: 15652 - INSULATING RUBBER MAT

- Four classes of mats, covered under this standard and differing in electrical characteristics for different use voltages are designated

Class A	AC (Rms)KV=3.3	DC(V) =240	Thickness =2.0mm
Class B	AC (Rms)KV=11	DC(V) =240	Thickness =2.5mm
Class C	AC (Rms)KV=33	DC(V) =240	Thickness =3.0mm
Class D	AC (Rms)KV=66	DC(V) =240	Thickness =3.5mm

- Most of all classes hall be resistant to acid and oil and low temperature and shall be identified by the respective class symbol. However a category with special property of resistance to extreme 'low' temperature will be identified by a subscript's 'to, the 'respective "c" Class symbol.
- Roll of Mat shall be in multiple Length of of 5000mm and ion width of 1000mm.Standard Shape in length of 1000, 2000, 3000mm.
- Leakage current for all Class of Mat shall not be more than 10 Micro Amp.
- In Case of Mat in Roll It shall be min 1m X 1m.

Abstract of IS: 11171

Transformer Cooling Method indication

- Type of cooling Medium: A=Air, G=Gas. Type of Circulation: N=Natural, F=Forced
- First Letter = Type of Cooling Medium (Contact with Winding),
- Second Letter = Kind of Circulation(Contact with Winding),
- Third Letter = Type of Cooling Medium (Contact with external cooling System),
- Forth Letter = Kind of Circulation (Contact with external cooling System),

Transformer Temperature Rise Limit

Part	Type of Insulation	Degree (Centigrade)
Part = Winding	Type of Insulation = A	50 Centigrade
Part = Winding	Type of Insulation = E	65 Centigrade
Part = Winding	Type of Insulation = B	70 Centigrade
Part = Winding	Type of Insulation = F	90 Centigrade
Part = Winding	Type of Insulation = H	115 Centigrade
Part = Winding	Type of Insulation = G	140 Centigrade
Part = Core, Metallic Part	Type of Insulation = -	Not rise to damage core or metallic part

Transformer Reduce Temperature Rise Limit

- TRANSFORMER designed for operation at an altitude greater than 1 000 m but tested at normal altitudes the limits of temperature rise are reduced by the following amounts for each 500 m by which the intended working altitude exceeds 1000Meter
- Natural-air-cooled Transformers 2.5 % (b) Forced-air-cooled Transformers %

Transformer Parallel operation Condition

1) Rated power (kVA);
2) Rated voltage ratio;
3) Voltage ratios corresponding to tappings other than the principal tapping.

4) Rated power (kVA); Rated voltage ratio; Voltage ratios corresponding to tappings other than the principal tapping.
5) Load loss at rated current on the principal tapping, corrected to the appropriate reference temperature.
6) Impedance voltage at rated current (on the principal tapping).
7) Short-circuit impedances, at least on the extreme tappings, if the tapping. Range of the tapped winding exceeds + or – 5 %.

Abstract of IS: 1678

PCC Pole:

Class of Pole	Length of Pole	Min Ultimate Transverse Load
Class 1	17 Meter	3000 Kg
Class 2	17 Meter	2300 Kg
Class 3	17 Meter	1800 Kg
Class 4	17 Meter	1400 Kg
Class 5	16 Meter	1100 Kg
Class 6	12.5 Meter	1000 Kg
Class 7	12 Meter	800 Kg
Class 8	12 Meter	700 Kg
Class 9	11Meter	450 Kg
Class 10	9 Meter	300 Kg
Class 11	7.5Meter	200 Kg

PCC Pole Tolerance

- Tolerance: The tolerance of overall length of the poles shall be + 15 mm.
- The tolerance on cross-sectional dimensions shall be + 3 mm.
- The tolerance on cross-sectional dimensions shall be + 3 mm.
- The tolerance on uprightness of the pole shall be 0.5 per cent.

PCC Pole depth in Ground:

Length of Pole	Min depth in ground
6 Meter To 7.5 Meter	1.2 Meter
8 Meter To 9 Meter	1.5 Meter
9.5 Meter To 11 Meter	1.8 Meter
11.5 Meter To 13 Meter	2.0 Meter
13.5 Meter To 14.5 Meter	2.2 Meter
15 Meter To 16.5 Meter	2.3 Meter
17 Meter	2.4 Meter

Abstract of IS: 1445

Porcelain Insulator

- Overhead line insulators are divided into two types according to their construction.
- Type A- An insulator unit in which the lengths of the shortest puncture patch through solid insulating material is at least equal to half the length of the shortest flash over path through air outside the insulator.
- Type B- An insulator or an insulator unit in which the length of the shortest puncture patch through solid insulating material is less than half the length of the shortest flash over path through air outside the insulator

Courtesy: ***Jignesh.Parmar***

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

1) Overhead Line

- Pole Foundation hole should be drilled in the ground with the use of earth-augers. However, if earth-augers are not available a dog pit of the size I.2 x O.6 m should be made in the direction of the line.
- The depth of the pit shall be in accordance-with the length of the pole to be planted in the ground as given in respective Indian Standards.

2) Tubular Pole

- Steel Tubular Poles, Rolled Steel Joists and Rails – A suitable pad of cement concrete, stone or steel shall be provided at the bottom of the pit, before the metallic pole is erected.
- Where metal works are likely to get corroded (points where the pole emerges out of the ground), a cement concrete muff, 20 cm above and 20 cm below the ground with sloping top shall be provided.

3) RCC Pole

- RCC poles generally have larger cross-section than the PCC poles and, therefore, the base plates or muffing are usually not provided for these types of poles.
- However, for PCC poles, a base plate (40 x 40 x 7 cm concrete block) shall be provided. Cement concrete muff with sloping top may also be provided, 20 cm above and 20 cm below-the ground level, when the ground or local conditions call for the same.

4) H.V Line (120m to 160m Span)

- The insulators should be attached to the poles directly with the help of 'D' type or other suitable clamps in case of vertical configuration of conductors or be attached to the cross arms with the help of pins in case of horizontal configuration
- Pin insulator: and recommended for use on straight runs and up to maximum of 10' deviation.
- The disc insulators are intended for use a pole positions having more than 30' angle or for dead ending of I1 kV lines.
- For lines having=, a bend of 10" to 30', either double cross arms or disc insulators should be used for HT lines up to 11 kV. For low and medium voltage line, shackle insulators should be used
- For Vertical configuration for Conductor erection:
- Distance between Pole's Top to Disc insulation=200mm.
- Between Disc insulator to Disc Insulator=1000mm.
- Between Disc insulator to Guy Wire=500mm.

5) Stay Wire Angle with Pole

- Overhead lines supports at angles and terminal positions should be well stayed with stay wire, rod, etc. The angle between the pole and the wire should be about 45" and in no case should be less than 30". If the site conditions are such that an angle or more than 30"

between the pole and the stay wire cannot be obtained, special stays such as, foot stay, flying stay or struts may be used

- Hard drawn galvanized steel wires should be used as stay wires. The tensile strength of these wires shall not be less than 70 kgf/mm^2. Only standard wires should be used for staying purpose.

6) Stay Rod

- Mild steel rods should be used for stay rods. The tensile strength of these rods shall not be less than 42 kgf/mm^2

7) Stay Anchor

- Stays should be anchored either by providing base plates of suitable dimensions or by providing angle iron or rail anchors of suitable dimensions and lengths.

8) Guy Insulator

- Stay wires and rods should be connected to the pole with a porcelain guy insulator. Wooden insulators should not be used. Suitable clamps should be used to coMeCt stay wires and rods to its anchor.
- For low and medium voltage lines a porcelain guy insulator should be inserted in the stay wire at a height of 3 m vertically above the ground level. For high voltage lines, however, the stays may be directly anchored.

9) Stay Setting

- The inclination of stay relative to the ground is roughly determined before making the hole for excavation. This enables the position of the stay hole to be fixed so -that when the stay is set, the stay rod will have the correct inclination and will come out of the ground at the correct distance from the pole. The stay rods should be securely fixed to the ground by means of a suitable anchor

10) O/H Conductor Drum

- In loading, transportation and unloading conductor drums should be protected against injury. The conductor drums should never be dropped and may be Tolled only as indicated by the arrow on the drum side. The drums should be distributed along the route at distance approximately equal to the length of the conductor wound on the drum.

11) Binding of O/H Conductor

- The insulators should be bound with the line conductors with the help of copper binding wire in case of copper conductors, galvanized iron binding wire for galvanized iron conductors and aluminum binding wire or tape for aluminum and steel reinforced aluminum conductors (ACSR). The size of the binding wire shall not be ‘less than 2 mm”

12) Different Voltage on Same Support

- Where conductors forming parts of systems at different voltages are erected on the same supports.

“If you take 10,000 chimpanzees and cram them together into Wembley Stadium or the Houses of Parliament, you will get chaos. But if you take 10,000 people who have never met before, they can co-operate and create amazing things.”

- Adequate clearance and guarding shall be provided to guard against the danger to lineman and others from the lower voltage system being charged above its normal working voltage by leakage from or contact with the higher voltage system.
- The clearance between the bottom most conductor of the system placed at the top and the top most conductor of the other system should not be less than 1.2m.

13) Jumper

- Jumpers from dead end points on one side of the pole to the dead end side on the other wide of the pole should be made with conductor of same material and current carrying capacity as that of the line conductor.
- The jumpers should be tied with the line conductor with a suitable clamp. If the material of the jumper wire is different from that of the line conductor, suitable bimetallic clamps should be used. If copper and aluminum bimetallic clamps are to be used, it should be ensured that the aluminum conductor is situated above the copper conductor so that no copper contaminated water comes in contact with aluminum.

14) Jumper Clearance

- For high voltage lines the jumpers should be so arranged that there is minimum clearance of 0.3 m under maximum deflection condition due to wind between the live jumpers and other metallic parts. This may involve erection of insulators and dead weights specially for fixing the jumpers.

15) Binding of O/H Line

- Length of Binding wire on Insulator (From outer surface if Insulator to end of binding wire) should be **6D** (Where D=Diameter of O/H Conductor)

16) O/H Patrolling

- All overhead lines should be patrolled periodically at intervals not exceeding 3 months from the ground when the line is live.

17) Pole Earthing

- All metal poles including reinforced cement concrete and pre-stressed cement concrete poles 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 pole, and metallic fitting attached thereto shall be efficiently earthed.

18) Stay wire Earthing

- All stay wires of low and medium voltage lines other than those which are connected with earth by means of a continuous earth wire shall have an insulator inserted at a height of not less than 3 m from the ground.

(To be continued)

Courtesy: Jignesh Parmar

"When I took over as president, I studied the Constitution, and the more I studied it, the more I realised that it does not prevent the president of India from giving the nation a vision. So when I went and presented this vision in Parliament and in legislative assemblies; everyone welcomed it, irrespective of party affiliations."

– A. P. J. Abdul Kalam

ENERGY, ELECTRICAL ENERGY AND RENEWABLE ENERGY – 29

Sustainable Growth, Sustainable Electrical Energy and Renewable Energy

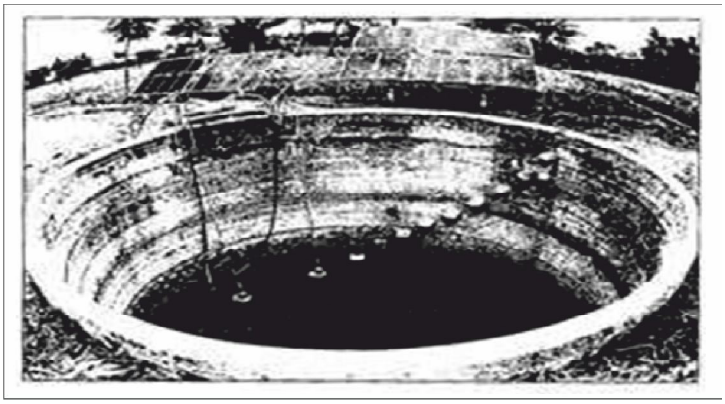
Solar Energy – Focus on Solar PV & Solar Thermal and Electricity.

Solar Agricultural Pumping Sets:

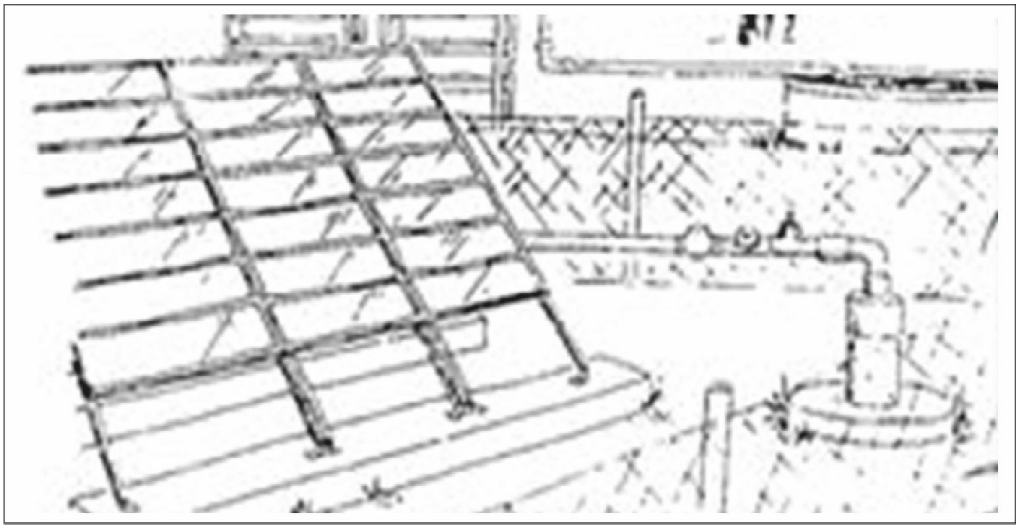
We will deal with Solar Pumping Solutions with focus on Agriculture in this part in view of the announcement in the 2020 – 2021 Budget that the Government will promote installation of over 20 Lakh Solar Agricultural pumping sets to help farmers which will serve a dual purpose of promotion of Renewable Energy in a big way and help farmers with reliable lift irrigation through the day. The interesting feature is that these stand alone systems will work only on sunny days when water will be needed as on cloudy or rainy days the water requirements will be minimum or nil. These can also help release the connected loads on the grid which can be used to give to industrial and commercial users with better revenue realization.

These kinds of Solar Pumps were successfully installed in many parts and in Tamilnadu too, a few decades ago but it could not take off in a big way because of high costs of solar panels and inadequate funding. With changed situation with regard to Solar Panel prices and Government push, these can really a boon to the farmers. These solutions can be for both open wells and borewells and in open wells it can be both 'Floating Type' or surface mounted type. Generally the efficiencies of such solar pumps are better in floating type for open wells and submersible type for bore wells. As the pumping is going to be through the sunny day of say 9-00am to 4-00pm, the capacities can be decided to suit the water requirements.

Some photographs of Solar pumps with 'Floating type' pumps in open wells are given below for information, where the discharges to the extent of 1 lakh litres per sunny day with 1000W panel and floating DC Pumps are obtained. The floats were made of PVC materials with tyre like construction with mounting platform on top of it.



In case of Solar Submersible Pumps and solutions, the discharges per watt of installation will reduce depending on the depth in which water is available. In a 1000W installation it could be around 25000 litres per sunny day from about 45 meters head. Some Submersible pumps and installations are shown for information.



In order to understand the specifications and requirements, some details extracted from the Government Documents are provided for information.

Types of Solar Pumping Systems and Applications:

A solar pumping system consists of an array of Photovoltaic (PV) panels mounted on a fixed or tracking mounting structure, connected to an Alternating Current (AC) or a Direct Current (DC) motor, suction and delivery pipes and electrical switchgears. A DC pump could be driven by a brushed or brushless permanent magnet DC motor. In case of an AC motor, an inverter or a Variable Frequency Drive (VFD) is used to convert DC power from the solar array to AC power required by the pump.

The versatility and robustness of solar pumps make them suitable for practically all types of conventional pumping applications. Thus besides irrigation solar pumping systems can be used in a urban and rural municipal Services, residential applications amongst various other applications.

Standards/Quality:

A. PV ARRAY

The SPV water pumping system for irrigation and domestic drinking water should be operated with a PV array capacity in the range of 75 Watts peak to 5000 Watts peak, measured under Standard Test Conditions (STC). In case of municipalities and rural drinking water installations than 5 KWp of array size would be considered. Sufficient number of modules in series and parallel could be used to obtain the required PV array power output. The power output of individual PV modules used in the PV array, under STC, should be a minimum of 74 Watts peak, with adequate provision for measurement tolerances. Use of PV modules with higher power output is preferred.

Indigenously produced PV module (s) containing mono/multi crystalline silicon solar cells should be used in the PV array for the SPV Water Pumping systems. Modules supplied with the SPV water pumping systems should have certificate as per IEC 61215 specifications or equivalent National or International/ Standards. Modules must qualify to IEC 61730 Part I and II for safety qualification testing. The efficiency of the PV modules should be minimum 14% and fill factor should be more than 70%. The terminal box on the module should have a provision for "Opening" for replacing the cable, if required.

B. MOTOR PUMP-SET

The SPV water pumping systems may use any of the following types of motor pump sets: 1. Surface mounted motor pump-set 2. Submersible motor pump set 3. Floating motor pump set 4. Any other type of motor pump set after approval from Test Centres of the Ministry.

The "Motor Pump Set" for irrigation and domestic drinking water should have a capacity in the range of 0.1 HP to 5 HP. Municipal and rural community applications could choose a higher capacity solar pump. In case of clustering of pumps in a solar pump micro grid each pump load should not exceed 5 HP. Solar Pumps should have the following features: The mono block DC/ AC centrifugal

motor pump set has its driving unit and impeller mounted on a common shaft, thereby giving it a perfect alignment. The pump should be provided with specially developed mechanical seals which ensure zero leakage. The motor is of 0.1-5 HP having spring loaded carbon brushes in case of D.C. Motor Pump Sets. The suction and delivery head will depend on the site specific condition of the field.

Submersible pumps could also be used according to the technical need of the particular case. The suction/ delivery pipe (GI/HDPE), electric cables, floating assembly, civil work and other fittings required to install the system. The following details should be marked indelibly on the motor pump set a) Name of the Manufacturer or Distinctive Logo, model Number and serial Number.

C. MOUNTING STRUCTURES AND TRACKING SYSTEM.

The PV modules should be mounted on metallic structures of adequate strength and appropriate design, which can withstand load of modules and high wind velocities up to 150 km per hour. The support structure used in the pumping system should be hot dip galvanized iron with minimum 80 micron thickness.

To enhance the performance of SPV water pumping systems above 0.5 HP, manual or passive or auto tracking system must be used. For manual tracking, arrangement for seasonal tilt angle adjustment and three times manual tracking in a day should be provided. For smaller pumping system, less than 0.5 HP a fixed mounting structure would be permitted. In areas where security of solar panels is a concern it would encouraged to mount solar pumps on movable trolley. A portable solar pumping system with mounting of solar panels on a movable trolley, with tracking for above 0.5 HP pump and without tracking for less than 0.5 HP pumps, would be allowed.

D. ELECTRONICS AND PROTECTIONS - Maximum Power Point Tracker (MPPT) should be included to optimally use the Solar panel and maximize the water discharge. Inverter could be used, if required, to operate an A.C. Pump. Adequate protections should be incorporated against dry operation of motor pump set, lightning, hails and storms. Full protection against open circuit, accidental short circuit and reverse polarity should be provided.

E. ON/OFF SWITCH

A good reliable switch suitable for DC / AC use is to be provided with the motor pump set. Sufficient length of cable should be provided for inter-connection between the PV array and the motor pump set.

Testing: Following organisations will provide technical help and testing facilities. They will be strengthened with support from MNRE a. National Institute of Solar Energy (NISE) Gurgaon b. EQDC, Ahmadabad c. CPRI, Bangalore d. International Horticulture Innovation & Training Centre, Jaipur

2. Technical Specifications:

For D.C. Motor Pump Set with Brushes or Brushless D.C. (B.L.D.C.): (i) 100 litres of water per watt peak of PV array, from a Total Dynamic Head of 10 meters (Suction head, if applicable, minimum of 7 meters) and with the shut off head being at least 12 meters. (ii) 55 litres of water per watt peak of PV array, from a Total Dynamic Head of 20 meters (Suction head, if applicable, up to a maximum of 7 meters) and with the shut off head being at least 25 meters. (iii) 35 litres of water per watt peak of PV array, from a Total Dynamic Head of 30 meters and the shut off head being at least 45 meters. (iv) 21 litres of water per watt peak of PV array, from a Total Dynamic Head of 50 meters and the shut off head being at least 70 meters. (v) 14 litres of water per watt peak of PV array, from a Total Dynamic Head of 70 meters and the shut off head being at least 100 meters.

The actual duration of pumping of water on a particular day and the quantity of water pumped could vary depending on the solar intensity, location, season, etc.

Indicative performance specifications for the Shallow and Deep well SPV Water Pumping Systems are given below.

For A.C. Induction Motor Pump set with a suitable Inverter: (i) 90 litres of water per watt peak of PV array, from a Total Dynamic Head of 10 meters (Suction head, if applicable, minimum of 7 meters) and with the shut off head being at least 12 meters. (ii) 50 litres of water per watt peak of PV array, from a Total Dynamic Head of 20 meters (Suction head, if applicable, up to a maximum of 7 meters) and with the shut off head being at least 25 meters. (iii) 35 litres of water per watt peak of PV array, from a Total Dynamic Head of 30 meters and the shut off head being at least 45 meters. (iv) 21 litres of water per watt peak of PV array, from a Total Dynamic Head of 50 meters and the shut off head being at least 70 meters. (v) 13 litres of water per watt peak of PV array, from a Total Dynamic Head of 70 meters and the shut off head being at least 100 meters.

Observations:

Lift irrigation is playing a major role at present in many parts of India to ensure adequate food production. Approximately 22 million pumping sets are working all over the country and the number in Tamilnadi is about 3 Million. There are plans for ensuring equitable distribution of waters available in various rivers of the country through interlinking of rivers etc which can drastically reduce the number of lift irrigation pumps required. The introduction of solar pumps for all the lift irrigation needs can further help relieve massive connected loads in the grid easing the power situation in the country as well as help reduce Green House Gas reduction substantially.

(To be continued)

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

HUMOUR

Indians (Let us not feel hurt, this is our nature)

Four old retired guys are walking down a street in London . They turn a corner and see a sign that says, “Old Timers Bar - ALL drinks at 10p.”

They look at each other and then go in, thinking, this is too good to be true. Each of the men orders a martini. In no time the bartender serves up four iced martinis and says, “That will be 10p each, please.”

They can’t believe their good luck. They pay the 40p, finish their martinis, and order another round. Again, four excellent martinis are produced, with the bartender again saying, “That is 40p, please.” They pay the 40p, but their curiosity gets the better of them.

Finally, one of them says, “How can you afford to serve martinis as good as these for a 10p a piece?”

“I am a retired tailor,” the bartender says, “and I always wanted to own a bar. Last year I hit the Lottery Jackpot worth £25 million and decided to open this place. Every drink costs 10p. – wine, liquor, beer – it‘s all the same.”

“Wow! That’s some great story!”

As the four of them sip at their martinis, they can’t help noticing seven other people at the end of the bar who don’t have any drinks in front of them and have not ordered anything the whole time they have been there.

Nodding at the seven at the end of the bar, one of the men asks the bartender, “What is with them?”

The bartender says, “Oh! They are retired “Indians” and they are waiting for Happy Hour!” when it is one free for one.

என்றும் இளமையோடு வாழ திருமூலர் கூறும் வழி!

நமது உடலில் நோய் தோன்றக் காரணம் என்னவெனில், உஷ்ணம், காற்று, நீர் ஆகியவை தன் னளவில் இருந்த மிகுதல் அல்லது குறைவதால்தான். இதனாலேயே நோய் தோன்றுகிறது.

உஷ்ணத்தால் பித்த நோய்களும், காற்றினால் வாத நோய்களும், நீரால் கப நோய்களும் உண்டாகின்றன.

நமது தேகத்தை நீட்டித்து. ஆயுளை விருத்தி செய்ய திருமூலர் சித்தர் எளிய வழியை கூறுகிறார்.

ஒருவனுடைய உடல், மனம், ஆன்மா ஆகிய மூன்றையும் தூய்மை செய்யும் வல்லமை கடுக்காய்க்கு உண்டு என்று குறிப்பிடுகிறார் திருமூலர்.

கடுக்காய்க்கு **அமுதம்** என்றொரு பெயரும் உண்டு.

தேவர்கள் பாற்கடலைக் கடைந்த போது தோன்றிய அமிர்தத்திற்கு ஒப்பானது கடுக்காயாகும்.

"பெற்ற தாயைவிட கடுக்காயை ஒருபடி மேலானது" என்று கருதுகின்றனர் சித்தர்கள்.

கடுக்காய் வயிற்றில் உள்ள கழிவுகளையெல்லாம் வெளித்தள்ளி. அவனுடைய பிறவிப் பயனை நீட்டித்து வருகிறது.

கடுக்காயின் சுவை துவர்ப்பாகும்.

நமது உடம்புக்கு அறுசுவைகளும் சரிவரத் தரப்பட வேண்டும்.

எச்சுவை குறைந்தாலும் கூடினாலும் நோய் வரும்.

நமது அன்றாட உணவில் துவர்ப்பின் ஆதிக்கம் மிகவும் குறைவு.

துவர்ப்பு சுவையே ரத்தத்தை விருத்தி செய்வதாகும்.

ஆனால் உணவில் வாழைப்பூவைத் தவிர்த்து பிற உணவுப் பொருட்கள் துவர்ப்புச் சுவையற்றதாகும்.

பின் எப்படி ரத்த விருத்தியைப் பெறுவது?

அன்றாடம் நமது உணவில் கடுக்காயைச் சேர்த்து வந்தால், நமது உடம்புக்கு தேவையான துவர்ப்பைத் தேவையான அளவில் பெற்று வரலாம்.

கடுக்காய் அனைத்து நாட்டு மருந்துக் கடைகளிலும் கிடைக்கும்.

இதில் தினசரி ஒரு ஸ்பூன் அளவு இரவு உணவுக்குப்பின் சாப்பிட்டு வர, நோயில்லா நீடித்த வாழ்க்கையைப் பெறலாம்.

கடுக்காய் குணப்படுத்தும் நோய்கள்:

கண் பார்வைக் கோளாறுகள், காது கேளாமை, சுவையின்மை, பித்த நோய்கள், வாய்ப்புண், நாக்குப்புண், மூக்குப்புண், தொண்டைப்புண். இரைப்பைப்புண். குடற்புண், ஆசனப்புண், அக்கி, தேமல், படை, தோல் நோய்கள், உடல் உஷ்ணம், வெள்ளைப்படுதல், மூத்திரக் குழாய்களில் உண்டாகும் புண், மூத்திர எரிச்சல், கல்லடைப்பு, சதையடைப்பு, நீரடைப்பு, பாத எரிச்சல, மூல எரிச்சல், உள்மூலம், சீழ்மூலம், ரத்த மூலம், ரத்தபேதி, பௌத்திரக் கட்டி, சர்க்கரை நோய், இதய நோய், மூட்டு வலி, உடல் பலவீனம், உடல் பருமன், ரத்தக் கோளாறுகள், ஆண்களின் உயிரணுக் குறைபாடுகள் போன்ற அனைத்துக்கும் இறைவன் அருளிய அருமருந்தே கடுக்காய்.

இதை பற்றி சித்தர் கூறும் பாடல்...

"காலை இஞ்சி
கடும்பகல் சுக்கு
மாலை கடுக்காய்
மண்டலம் உண்டால்
விருத்தனும் பாலனாமே".

காலை வெறும் வயிற்றில் இஞ்சி-

நண்பகலில் சுக்கு-

இரவில் கடுக்காய் என தொடர்ந்து ஒரு மண்டலம் (48 நாட்கள்) சாப்பிட்டுவர, கிழவனும் குமரனாகலாம் என்பதே இந்தப் பாடலின் கருத்தாம்.

எனவே தொடர்ந்து கடுக்காயை இரவில் சாப்பிட்டு வர நோய்கள் நீங்கி இளமையோடு வாழவாம்.

கடுக்காய் வீடுகளில் கண்டிப்பாய் இருக்க வேண்டிய பொக்கிஷமாகும்.

"ஆரோக்ய வாழ்வுக்கு நாட்டு வைத்தியம் அவசியம்".

"இதை அனவைருக்கும் பகிர்வோம்".

"ஆரோக்ய பாரதத்தை உருவாக்குவோம்"

தகவல் சித்த மருத்துவம்

(நண்பர்களே இப்பதிவை சாதாரண பதிவாக எண்ணிவிடாமல் அனைவரும் முக்கியத்துவத்துடன் பகிருமாறும் நம் குழந்தைகளையும் தீர கவனிக்குமாறும் பணிவன்புடன் கேட்டுக்கொள்கிறேன்).

TANJORE TEMPLE – PRIDE OF INDIA AND THE WORLD – UNESCO WORLD HERITAGE!

Interesting Things about the Brihadeeswara Temple of Tanjore!!

The Mahakumbhabishekam of the Tanjore Temple was performed on the 5th of February, 2020, with great reverence, fanfare and very large scale attendance of devotees and tourists from all over the World. Some interesting details are presented in brief, highlighting the level of mature Art and Architecture that existed in this part of India more than 1000 years back.

Architectural history is incomplete without the study of the very famous and the very big Tanjore Brihadeeswara Temple. Here are some interesting facts about this temple.

1. This imposing structure was built by Raja Raja Cholan and his sister Kundavai, both ardent devotees of Lord Shiva. It was constructed by the King at the height of the Chola reign to signify his power and strength.

2. The original name of the deity was Rajarajeshwar. It was the Marathas who gave it the name Brihadeeswara or the Great Ishwara.

3. The main temple is entirely built of granite. More than 130,000 tons of granite is said to have been used to build it. The cutting and carving of the granite stone is not an easy task even today. We can't even imagine how this would have made possible in those days without any special equipment.

4. The statue of Nandi at the entrance of the temple is carved out of a single stone.

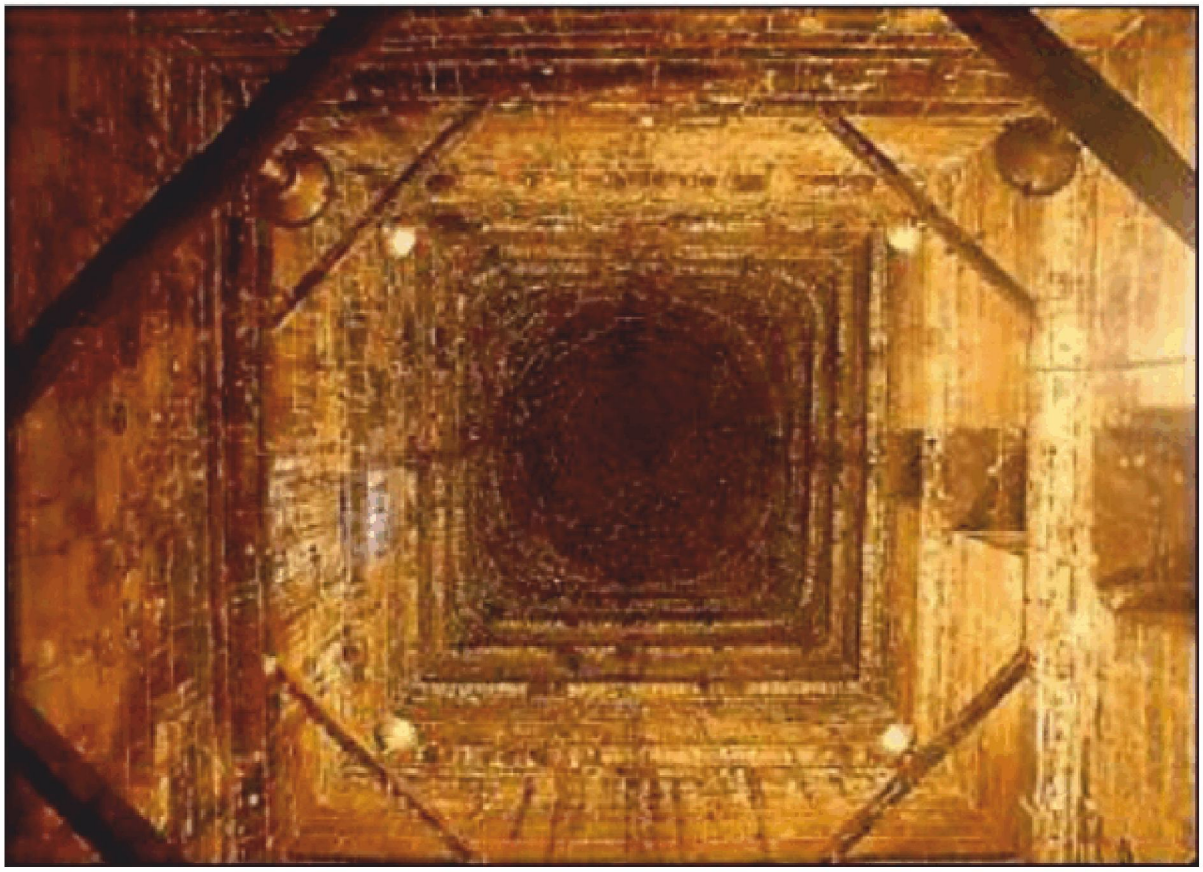
5. The main Vimanam, which is at about 200 feet is often called Dakshina Meru or Southern Meru.

6. The temple has a portrait of Raja Raja Cholan paying obeisance to Lord Natarajar. This is undoubtedly, the first ever instance of a royal portrait.

7. Inscriptions in the temple point towards Kunjara Mallan Raja Raja Perunthachan as the chief architect of the temple. His successors survive to this day and practice the art of Vastu or Vastu Shastra.

8. Depictions of nartakis or dancers showing eighty one of hundred and eight karanas (synchronised movements of hands and feet) in Bharata Natyam are carved here. These karanas are a part of karanas mentioned in the Natya Shastra of Bharata Muni or Sage Bharata. There is also evidence that the temple was a platform for talented dancers to showcase their talent. These depictions are first of their kind.

9. The big Tanjore temple is said to have more than hundred underground passages that connects to various other places. Nowadays, most of the passages are sealed. In the earlier days, the passages were used by sages, Kings and Queens to roam about different temples and places, especially during auspicious festivals like Deepavali, Maha Shivarathri and Makar Sankranti.



10. The temple is said to have a huge cap stone on top of it, and the weight of the stone is said to be 80 tonnes. The Garbhagriha where the Shiva lingam is located is said to generate large amount of electromagnetic energy. The 80 tons stone acts a repulsive force and channels the energy to the inner areas of the temple to sustain its piousness and divinity. The positive energy radiant within in the temple structure is said to have a calming, soothing effect both mentally and physically on the devotees.

HUMOUR

Battery Charged...

Police arrested two kids yesterday, one was drinking battery acid, the other was eating fireworks.

They charged one - and let the other one off.

Life is Like That

What is...?

Q. What is a snake's favorite subject?

A. Hissssssssstory

Most of us are worried about their writing skills or even for the matter their language proficiency. Such is our complex, we prefer the company of those who we are extremely comfortable, rather mingling with everyone that we know. We become kind of introvert and avoid speaking in gatherings.

It is important to use appropriate language, but not always necessary to be precise. . . . no one is perfect in the world. Go ahead express yourself and enjoy!

தமிழ்நாடு அரசு

மக்கள் நல்வாழ்வு மற்றும் குடும்பநலத்துறை

இந்திய மருத்துவம் மற்றும் ஹோமியோபதி ஆணையரகம்

நிலவேம்பு குடிநீர்

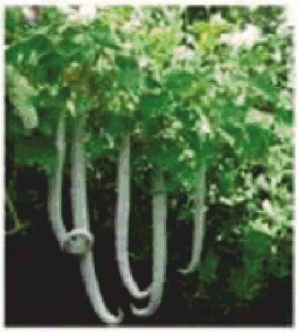
இவற்றில் சேரும் மருந்துகள்

நிலவேம்பு

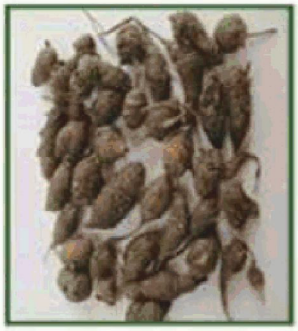
வெட்டிவேர்

விலாமிச்சம்வேர்

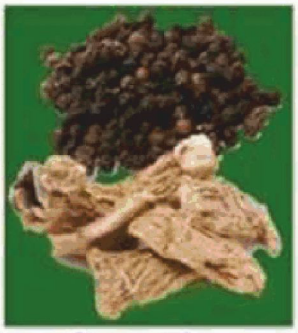
சந்தனம்



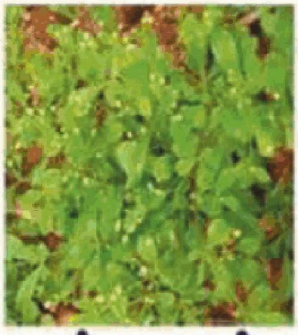
பேய்ப்புடல்



கோரைக்கிழங்கு



சுக்கு,மிளகு



பற்பாடகம்

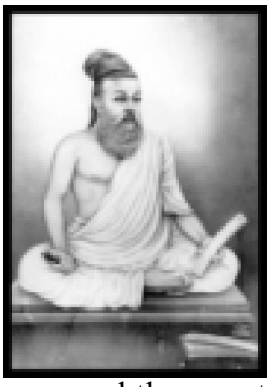
குடிநீர் அளவு

5 வயது முதல் 12 வயது வரை உள்ள குழந்தைகளுக்கு 10 மி.லி. தினமும் 2 வேளை அருந்தவும்.

பெரியவர்களுக்கு 50மி.லி. தினமும் 2 வேளை அருந்தவும்.

எல்லா வகை காய்ச்சலும் குணமாகும்

TIRUKKURAL AND FAIR AND ETHICAL MANAGEMENT - 13



Wealth generation is very important economic activity for the country to ensure prosperity, safety and growth. Be it Agriculture or Industries or Services activities, wealth generation is ensured by proper and efficient Management. This aspect was addressed both during this year Republic Day addresses and the recent budget presentation with quotes of some Kurals too. Tiruvalluvar has stressed on the need for wealth generation as well as the need for ethical practices which can only ensure long lasting happiness. He has also detailed the steps in wealth generation activities as the duty of head of an enterprise or nation.

In the 1st Kural dealt below, the steps are given for wealth generation as the basic capability of the head of an enterprise or nation. In the 2nd, the power of wealth as the power to deal with any situation is illustrated and in the 3rd the necessity of ethical practices in wealth generation is stressed.

Iyatralum Eettalum Kaaththalum Kaaththa Vaguththalum Valla Tharasu ***Kural 385***

இயற்றலும் ஈட்டலுங் காத்தலும் காத்த வகுத்தலும் வல்ல தரசு. குறள் **385**

"Devising the ways, wealth generation, ensuring safety of the wealth generated and proper use and distribution of wealth are the fundamentals for the head (of kingdom or enterprise)"

Seyga Porulai Serunar Serukkarukkum Ekkathanir Kooriya thil ***Kural 759***

செய்க பொருளைச் செறுநர் செருக்கறுக்கும் எக்கதனிற் கூரிய தில். குறள் **759**

"Amass wealth: for there is no sharper steel to cleave thy foeman's pride"

Aran Eenum Inbamum Eenum Thiran Arinthu Theethindri Vantha Porul ***Kural 754***

அறன்ஈனும் இன்பமும் ஈனும் திறனறிந்து தீதின்றி வந்த பொருள். குறள் **754**

"Behold the wealth that is acquired by means that are not evil: righteousness floweth there from and happiness too".

(To be continued)

HOME FESTIVALS - 3

பங்குனி - Panguni (March/April)

This month brings the popular nine-day festival of Ram Navami, celebrating the birthday of Lord Rama, an incarnation of Lord Vishnu. When the full moon rises, Vishnu in the form of Satyanarayana is worshiped before a decorated kumbha pot with a branch of mango leaves placed in its mouth and a coconut on top. Rice is spread on banana leaves and the sacred vessel is completed with a tray of fruits, flowers an betel leaves and nuts. This month is also known for Sita's marriage to Rama. King Janaka, Dasaratha and priests surround the sacred fire, as Sita garlands Rama in Janaka's royal palace.

(To be continued)

EXECUTIVE MEETING ON 25.01.2020 HELD AT CHENNAI

Printed and Published by 'Tamilnadu Electrical Installation Engineers' Association
"A" Grade, Chennai -16. Editor : S.K. Pandian Advisor : S. Mahadevan