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

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EDITORIAL

Dear Members, Fellow Professionals and Friends,

Greetings To One And All!

Best Wishes For Better Business, Growth And Prosperity!!

Economic slowdown is seen quite widespread all over the country and is reflected in all activities, be it luxury or essentials purchases or festivities. There were reports from various parts that Deepavali purchases were at much lower key this year. But the big relief is that normal life is going on, by and large, peacefully all over the country and many elections including 2 state elections were gone through quite peacefully. The 2 bi elections in Tamilnadu made it look like a state wide elections with lot of activities, noise and expectations and the ruling party has pulled it through. The most satisfying aspect is that the monsoon, both south west and north east have been more than normal to aggressive in many parts of the country and as experience and the history suggest, our economy will boom back in due course. We have just celebrated Deepavali the festival of lights and prayers for prosperity which should also help. We are also seeing lot of measures by the Government to increase lending by all financial institutions and increased flow of money in circulation to activate the markets. We all know the nature of the Indian public that when things go down a little, they take it too much below and when the things look up, they take it up much higher. Therefore with much better harvests ahead we can look for economy to improve by leaps and bounds. With our international presence and improvements in all fronts, we can certainly look forward to a much better times ahead.

Mahatma Gandhi trained and gave 2 important persons to the country, to run the country after him in his lines and one was Sardar Patel, whom we remembered last month whose greatest contribution is uniting the country. We are going to remember the second, Pandit Jawaharlal Nehru this month, who really laid the foundation for our large scale growth, be it steel or power or fertilizer or irrigation dams and many such that we have shaped to be one of the powers in the area of manufacturing, in the world. Nehru's Birth Day is celebrated all over the country as children's day due to his great love for children and he must have viewed them as the future of this great country. Many of our readers must be having children as their immediate next generation or a generation next to that. It is relevant to recall at this stage the 'Technological Environment' in which they are and will be growing which pose lot of challenges as well as opportunities. As we are all fully aware, the Technologies particularly with regard to Communication and IT are galloping at such great speed that they throw open both 'Dangers' and opportunities for the children and youth of coming years. As it is popularly analyzed by one and all, the 'Screen Time' is going totally out of control for everyone, particularly for the children and the youth leading to the level of addiction. The great opportunity thrown open is learning everything through net and 'Skype'. Use of modern technologies more by choice and not by compulsiveness can lead to lot of good.

We thank all those members who have helped us by participating in the advertisement appearing for the issue Oct 2019 – Galaxy Earthing Electrodes Pvt. Ltd., Om Saravana Electricals, Power Square Engineers (Indotech Transformers Ltd.), Ringlet, Supreme Power Equipment Pvt. Ltd., Visewham Electricals.

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CONTENTS

KNOW THY POWER NETWORK - 146

7. Reusable Bags-which should be preferred-Plastic Bag or Cotton Bag?

On taking all factors like water needed to produce, carbon-di-oxide released per bag and climate changing causes like Ozone depletion into account; you may find that the number of times that these bags are needed to be reused to produce **equal environment impact** are,

– Plastic	**1**
– Polyester	**35**
– Paper	**43**
– Recycled Pet	**84**
– Conventional Cotton	**7100**
– Organic Cotton	**20000**
	Reference: Sunday Times of India, Chennai, April 21, 2019

This information suggests that the plastic bags are the best from the above said environmental factors, while cotton bags are the worst.

On considering other concerned factors also in depth, it is found that,

Plastic Bag	Cloth Bag
– Non-bio de-gradeable – It takes a very long time for their final de-gradation. Before this, happened they impact the surrounding environment and the lives of many birds and animals on land and marine species like whales in oceans, sharks and fishes as well. i.e. it takes more energy and time to decompose them. Besides this there is the release of its toxicity.	– Bio-degradeable. – It decomposition easily carried out by micro organisms.

Final View

So on viewing the entire issue in its totality, not in isolation, we can find that the plastic bags is a silent scourage choking the earth and it has to be discarded at any cost and in its place, cloth bags may be substituted. This should be carried out with one condition. The cloth bags are to be reused as many times as possible before they are finally despatched to "garbage bins". Thus we can totally ward off the use of poisonous and carcinogenic plastic bags from our lives

8. Decision Taken on Political Measures vs Economic Basis

Political Decision	Economic Measures
– It is purely based on political ground; mainly concerned about vote bank politics. – Most of the time it cannot withstand the reforms of "Economic Tests". – It always be a burden on the fiscal/monitory system of the country and impacts the stability of its economic structure. – Not preferred by economists and also those who work for the welfare of a nation.	– Mainly based on the economic condition of any country. – It simply passes the "Touch Stone" test of economics. Most of the time it fails to fetch political advantage; actually it brings the reverse. – Generally preferred for the wellness of a Nation.

Final View

This issue demands a real balance act-to strike a right balance between two face, off issues. When the Finance Minister of a Country takes decision on political basis he/she invites troubles. Keeping the progress, stability and wellness of the Country in mind, he/she should take decision on any matter on the basis of "Economics" Only and not on Political Basis.

Recent examples in this regard are

- Drinking water project vs Deforestation
- Construction of six way/eight way express roads vs Deforestation and other environmental issues.
- Continuity with old experienced people vs disruption with new inexperienced but smart people in any system.

9. If Higher Population is desirable for a Nation?

Some of the basic factors that are responsible for higher population in any country are,

- Poor economic condition which leads to unemployment.
- Dependency on monsoon rains for its agriculture production.
- Emission of comparatively higher quantum of green house gases. Everyone knows that uncontrolled population growth always spell undesirable consequences; yet there are some positive aspects of higher population. Lets us view its positives and negatives here in.

Positive Effect	Negative Effect
– Higher population may create higher demographic quotient. It leads to higher population density. It need not de adverse; at times it may bring increased productivity and prosperity. e.g. Baharin and Moraco where it is not a problem but becomes a strength. – Though natural resources are limited, the creativity and productivity of human beings are unlimited. – Higher population leads to higher economic activity and networks, (i.e.) growth is embedded in higher demographic quotient. – Human resources are Renewable and in exhaustible and highly rewarding. It is the main advantage of higher population or higher demographic. – At times of war, it gives a big advantage.	– Too many hands aspire for limited resources. This results in under/unemployment. – Too much pressure on the existing scarce resources leads to poverty. – Too many workers for the same job; so their bargaining power is reduced. Hence wages will fall. – Occurrence of natural disasters may lead to heavy human losses. – Restricted population generally brings better economy, higher productivity and stability.

"Do not make recession your obsession,
just remember to forget it and you'll be ok."

– MINA TADROS

As it is difficult to pronounce any considered opinion on this topic, final verdict is left to the readers themselves.

10 Cricket-when should Pace/Spin be adopted?

Normally the option is left to be captain of the teams concerned. Being spectators, we can debate this issue and express our opinions. Prior to this, let us have common view of this contemporary games.

In the game the pitch conditions always assume the prime importance. In any match the release, pace, line and length of the balls are important. The batsman in consideration of all these, finally decide what shot is he has to play. Before going for pace/spin mode of bowling, the captain access the pitch conditions, match structure and in what way the batsman is thinking and going to play. Please remember in this context that the bowlers are always proactive and the batsman are reactive. When good balls are continuously bowled, good results can be expected. When a match is going on, you can express your opinions based on the factors outlined above. Each match is a separate game. We cannot express our views on a common template.

Before concluding this article, I would like to add one more item to the list of Technical Issues. The issue is why should Auto Transformers are selected for step down purpose in Transmission Substations?

11 What are its main advantages? Is there any downside in this selection?

Advantages: Single winding transformer

i) Occupies less space. Land is a big problem while going for EHV substations when the space requirement is high. Because of its very high installation cost, gas insulated sub-station cannot be a cost effective alternative.

ii) Investment and operation cost are less in the case of Auto Transformers when a comparison is made with Power Transformers.

iii) Step down voltage level can be in the order of 1:3 : maintenance is DC.

iv) Losses are comparatively less.

Disadvantages

i) Short circuit level or fault level on the transformer terminals is very high i.e. any fault occurs nearest to the transformer or its terminals, the damages will be very severe.

This aspect is its main demerit.

The cost factor over rites this demerit; hence Auto Transformers are chosen for EHV Transmission Substations.

Let me sign off here. Till then, please stay tuned.

(To be continued…)

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

"The recession won't be over till we raise a generation that knows how to live on what they've got." – Unknown

GUIDELINE – ENERGY EFFICIENT STREET LIGHTING-1

Background

Providing street lighting is one the most important – and expensive – responsibilities of a city: Lighting can account for 10–38% of the total energy bill in typical cities worldwide (NYCGP 2009). Street lighting is a particularly critical concern for public authorities in developing countries because of its strategic importance for economic and social stability. Inefficient lighting wastes significant financial resources each year, and poor lighting creates unsafe conditions. Energy efficient technologies and design can cut street lighting costs dramatically (often by 25-60%); these savings can eliminate or reduce the need for new generating plants and provide the capital for alternative energy solutions for populations in remote areas. These cost savings can also enable municipalities to expand street lighting to additional areas, increasing access to lighting in low-income and other underserved areas. In addition, improvements in lighting quality and expansion in services can improve safety conditions for both vehicle traffic and pedestrians.

A well-designed, energy-efficient street lighting system should permit users to travel at night with good visibility, in safety and comfort, while reducing energy use and costs and enhancing the appearance of the neighborhood. Conversely, poorly designed lighting systems can lead to poor visibility or light pollution, or both. Quite often, street lighting is poorly designed and inadequately maintained (e.g., there are large numbers of burned-out lamps), and uses obsolete lighting technology—thus consuming large amounts of energy and financial resources, while often failing to provide high-quality lighting. The Bureau of Energy Efficiency, based on Central Electricity Authority statistics, has estimated gross energy consumption for public lighting to be 6,131 million kWh in India for the years 2007-2008.

Energy-efficient Street Lighting

Energy-efficient street lighting projects have several stages, as illustrated in Figure 1.

In the last few years, technological advancements in lighting have led to the development of energy-efficient lighting systems that consist of one or more components listed below:

- Low loss ballasts
- Constant wattage high intensity electronic ballasts
- Energy-efficient luminaires
- Better monitoring and control mechanisms

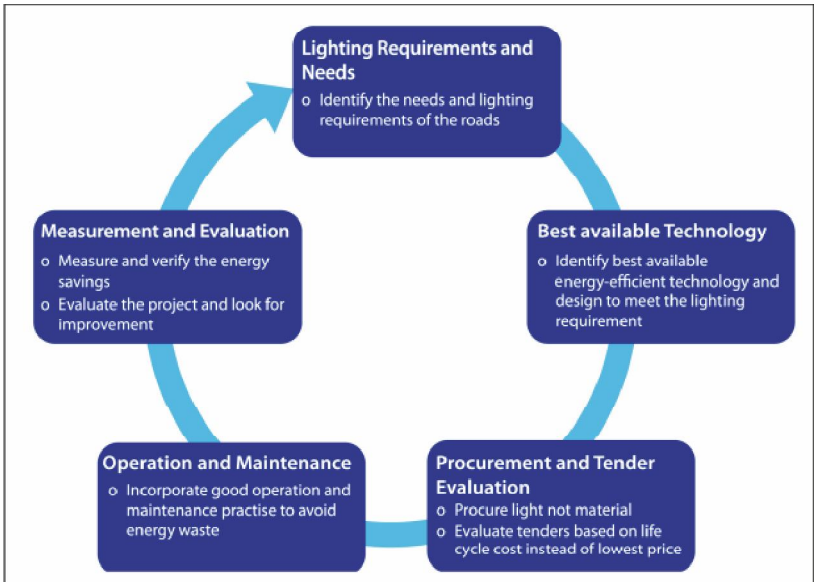


Figure1: Energy – efficient Street Lighting Project Cycle

Guidance for lighting of public streets, roads, and highways is provided in the Indian Standard (BIS, 1981). Since these guidelines are not enforced by any regulatory authority, it is common for municipalities to be unaware of the standards, and many fail to comply.

The most common reasons for inefficient street lighting systems in municipalities are:

- Selection of inefficient luminaires
- Poor design and installation
- Poor power quality
- Poor operation and maintenance practices

There is tremendous potential to improve lighting quality while reducing energy use, costs, and greenhouse gas emissions—through energy-efficient retrofits for street lighting and improved operation and maintenance (O&M) practices.

The purpose of these guidelines is to increase the awareness about the Bureau of Indian Standards (BIS) Code of Practice for lighting of public thoroughfares and to provide practical guidance on energy-efficient street lighting best practices. Since the Code has not been updated since 1981, these guidelines can also contribute to the development of future standards. Although the main target audience is municipalities, all stakeholders interested in street lighting projects—such as regulatory bodies, technology suppliers, donor agencies, corporations, and universities with campuses—can benefit from these guidelines.

Effective energy-efficient street lighting design integrates efficient lamp technologies, optimum pole height and placement, efficient light distribution, and aesthetics while using the least energy and meeting requirements for visibility and appropriate light levels (NYSERDA, 2002)

Guidelines for Decision Making in Street Lighting Projects

Lighting Requirements in Streets

When designing or making changes in street lighting, it is important to first understand the light requirements of the road. Street lighting in India is classified in the Indian Standard (BIS, 1981), based on the traffic density of the road (see Table 1). Based on the classification in the code, the local engineer matches the category of road, and designs and provides installation specifications for the street lighting system.

Retrofit or New Installation

Based on the purpose and lighting requirements of the roadway as well as the age of the existing lighting infrastructure, decisions have to be taken whether new design and installation of street lighting is required, or whether project goals can be accomplished by retrofitting the existing lighting system. To retrofit existing street lighting, it must be determined whether existing poles can be used with replacement of only the luminaires, or if the ground needs to be dug up to construct new bases and trenches for laying cables (NYSERDA, 2002).

Table 1: Classification of Roads (BIS, 1981)

Group	Description
A1	For very important routes with rapid and dense traffic where the only considerations are the safety and speed of the traffic and the comfort of drivers
A2	For main roads with considerable mixed traffic like main city streets, arterial roads, and thoroughfares
B1	For secondary roads with considerable traffic such as local traffic routes, and shopping streets
B2	For secondary roads with light traffic
C	For residential and unclassified roads not included in the previous groups
D	For bridges and flyovers
E	For towns and city centers
F	For roads with special requirements such as roads near airports, and railways

Retrofitting

Retrofitting is generally considered for energy and maintenance savings. Sometimes it is necessary to retrofit or replace luminaires or a pole – e.g., in cases where light is not distributed correctly, or where a pole has been damaged. Opportunities for significant efficiency improvements are limited in these cases, since the pole location does not change (NYSERDA, 2002).

New Installation or Replacement

This option involves removing existing street lighting and installing new equipment, or designing and installing a completely new system where street lighting did not previously exist. This option provides greater flexibility in the design with regard to location and number of poles. If a main street improvement project is planned, new poles and lighting fixtures may be the best option for the most effective energy-efficient design of the street lighting system.

Technical Assessment of Street Lighting Technologies for Energy Efficiency

Lighting components can be grouped based on their functions. They are generally described as the structural systems, electrical systems, and optical systems. The items covered include:

Structural

- Poles
- Pole Bases (foundations)

Optical

- Luminaires

Electrical

- Lamps
- Ballasts
- Service Cabinets (fuse box)

All systems should be designed to minimize life-cycle cost, while meeting lighting requirements (e.g., minimum illuminance requirements to ensure proper functioning and safety of users). To achieve an effective energy-efficient design, it is essential to select the proper lamp/ballast combination that produces high lumens per watt together with fixtures that meet design requirements and minimize glare, light trespass, and light pollution.

Lamp Technology

The most important element of the illumination system is the light source. It is the principal determinant of the visual quality, cost, and energy efficiency aspects of the illumination system. An electric light source is a device, which transforms electrical energy, or power (in watts), into visible electromagnetic radiation, or light (lumens). The rate of converting electrical energy into visible light is called "luminous efficacy" and is measured in lumens per watt.

Table 2: Lamp Technology

Type of Lamp	Luminous Efficacy (lm/W)	Colour Rendering Properties	Lamp life in hrs	Remarks
High Pressure Mercury Vapour (MV)	35-65 lm/W	Fair	10,000-15,000	High energy use, poor lamp life
Metal Halide (MH)	70-130 lm/W	Excellent	8,000-12,000	High luminous efficacy, poor lamp life
High Pressure Sodium Vapour (HPSV)	50-150 lm/W	Fair	15,000- 24,000	Energy-efficient, poor colour rendering
Low Pressure Sodium Vapour	100-190 lm/W	Very Poor	18,000-24,000	Energy-efficient, very poor colour rendering
Low Pressure Mercury Fluorescent Tubular Lamp (T12 &T8)	30-90 lm/W	Good	5,000-10,000	Poor lamp life, medium energy use, only available in low wattages
Energy-efficient Fluorescent Tubular Lamp (T5)	100-120 lm/W	Very Good	15,000-20,000	Energy-efficient, long lamp life, only available in low wattages
Light Emitting Diode (LED)	70-160 lm/W	Good	40,000- 90,000	High energy savings, low maintenance, long life, no mercury. High investment cost, nascent technology

The types of lamps commonly used for street lighting are listed in Table 2 with brief descriptions. While the luminance on the road surface (the intensity of light, or the amount of light per unit area of its source traveling in a particular direction) can vary widely and still provide the required performance, the measurement of illuminance (amount of light or total luminous flux incident on a surface, per unit area – it is easier to measure illuminance than luminance) can still be used as a benchmark indicator to signal required lamp replacement or cleaning.

Energy Saving Tip

By replacing all high pressure mercury vapour lamp fittings in street lighting with high pressure sodium vapor lamps with slightly lower wattage, savings of 20-25% can be achieved.

Selection of Lamps

Street lighting installations normally use one of three types of high intensity discharge (HID) lamps: high pressure sodium vapor (HPSV), metal halide (MH), or mercury vapor (MV). HSPVs produce a yellowish light, have a long life, are very energy-efficient, and have good lumen maintenance (maintain light output for a long period of time), but have poor colour rendering properties. MH lamps are the most frequently used alternative to HPSV

in new installations. They are also quite efficient and provide much better color rende+ring. However, these lamps tend to have a shorter lamp life (some models below 10,000 hours) and poor lumen maintenance over the life of the lamp. Recent developments have shown improvements in these areas, but the improved lamps are presently limited in supply and higher in cost. MV lamps are the least efficient of the HID types and have poor lumen maintenance.

Light-emitting diode (LED) technology is a fast-evolving technology with significant energy-saving potential. Operating for an average of 10 hours per day, LEDs have a life span of up to 13 years, and provide a pleasant spectrum of light (Masthead LED Lighting, 2009). The lifetime and performance depends on quality of the LED, system design, operating environment, and other factors such as the lumen depreciation factor over a period of time.

Although the upfront cost of the LED is more than the cost of most HID lamps, the energy consumed by the LED is half of the lamp's energy (or less) and LEDs last longer than conventional lamps, resulting in significant savings. The LED fixture does not require a ballast or a capacitor; instead it converts the supply voltage to low voltage direct current, using a small electronic power supply.

Ballasts

Ballasts are required for all HID and fluorescent lamps. The ballast generally serves three functions. First, it provides the proper open circuit voltage to start the lamp. Second, it keeps the lamp operating within its design parameters. Third, it adapts the lamp to any one of the line voltages commonly available.

Sodium vapour and metal halide lamps require an igniter to initiate the arc in the lamps. High frequency electronic ballasts are recommended for tubular fluorescent lamps in street lighting in order to optimize energy use and to avoid flickering during low voltage conditions at peak traffic hours. Another useful technology to save energy in HPSV and MH lamps is the new dimmable electronic ballast that enables both constant wattage and variable illumination. The advantage of this ballast is the maintenance of desired lux level (illumination level) during low and high voltage periods at night, which helps ensure good visibility for road users during peak traffic hours. In addition, capacitors and igniters are not required when using this technology, which brings down the maintenance costs.

Luminaires

Lighting energy efficiency is a function of both the light source (the light "bulb" or lamp) and the fixture, including necessary controls, power supplies, other electronics, and optical elements. A luminaire is defined as a complete unit consisting of a lamp, together with the parts designed to distribute the light, to position and protect the lamp, and to connect the lamp to the power supply. Components that make up a luminaire include the reflector, the refractor, and the housing. These are important to ensure luminaire efficiency and cutoff and glare control, to guarantee the right level of lighting while avoiding light pollution. The specification for selection of street lighting luminaires has been provided in IS 10322 Part I to Part V.

Luminaires are classified into three categories according to the degree of glare (BIS, 1981) (their application is indicated in Table 6):

A. **Cutoff luminaire:** A luminaire whose light distribution is characterized by rapid reduction of luminous intensity in the region between about 80º and the horizontal. The direction of maximum intensity may vary but should be below 65º. The principal advantage of the cutoff system is the reduction of glare.

B. **Semi-cutoff luminaire:** A luminaire whose light distribution is characterized by a less severe reduction in the intensity in the region of 80º to 90º. The direction of maximum intensity may vary but should be below 75º. The principal advantage of the semi-cutoff system is a greater flexibility in siting.

C. **Non-cutoff luminaire:** A luminaire where there is no limitation on light distribution at any angle. This luminaire is permissible when a certain amount of glare may be accepted (when daytime appearance of the street is important) and when the luminaires are large and have reduced brightness.

Design and Procurement of Energy-efficient Street Lighting Systems:

In order to properly design new lighting schemes, it is important to consider the appropriateness and effectiveness of the various energy efficient street lighting technologies and systems for different situations. Street lighting technology and design decisions should be based on meeting local lighting requirements while achieving maximum energy efficiency. Most importantly, the design of a street lighting system must be appropriate for the site and should provide the level of illumination (lux) and uniformity of light specified in the Indian Standard (BIS, 1981). Decisions about lighting systems also should take into account the relative importance in each situation of such characteristics as lamp efficacy, good colour rendering, and light distribution of different types of lamps.

In addition to these criteria, other considerations may affect street lighting system design decisions. For example:

- Lighting controls such as dimming systems can result • in significant energy savings, but are not appropriate for every application (see Dimming Systems section for details).
- Operations, maintenance and replacement costs and ease of use for each technology option need to be considered carefully.

Light-Emitting Diode (LED) Street Lights

Advantages:

- *Very long life*
- *Reduced maintenance costs due to long lifetimes*
- *Do not contain toxic chemicals (e.g., mercury)*
- *No warm up needed (no time delay to reach • optimum brightness levels)*
- *No production of ultraviolet light (which is • what attracts insects)*
- *Useful for directing light on specific areas, since • they produce "directional" light — light emitted in one direction, rather than a diffused glow*
- *Can be dimmed (unlike CFLs), allowing for • flexibility in controlling light levels*
- *High colour index, providing bright, true colours • during nighttime hours*
- *No glare effect, reducing visual fatigue for • both drivers and pedestrians*

Disadvantages:

- *High initial costs can lead to long (several- year) paybacks*
- *Provision of only directional light (inability to produce a "glow" emanating in all directions) limits usefulness to only streetlights that are hanging or facing downward*
- *Adequate heat-sinking is required to ensure long life with high-powered LEDs*

Spotlight: *In Solar LED Lighting, solar energy is used to charge a self-contained battery during daylight; at night, the battery powers the street lights. Solar LED street lighting is an especially cost-effective solution for parking lots, parks, residential streets, airports, and other applications where providing electricity is expensive or problematic. Two additional benefits of these types of LEDs is ease of installation - since the lamps rely on solar power, there is no need to dig trenches to lay underground cables - and immunity to power outages. (Silverman, Jacob 2009; Armand Hadife n.d.)*

This section describes typical design-based street lighting systems. The design must be appropriate for the site and should provide the level and uniformity of light suggested in the Indian Standard (BIS, 1981).

Table 3 shows important features to consider when designing and procuring an energy-efficient street lighting system (NYSERDA, 2002).

Street Light Poles

Swage (insertion) type steel tubular poles are used for street lighting and the specification for street lighting poles is explained in Indian Standard (BIS, 1980). The specifications are listed in Table 4.

Mounting Height of Luminaires

One of the important aspects of designing new street lighting systems is to determine the optimum position of the luminaires and the capacity of the light sources.

Table 3: Effective Energy-efficient Street Lighting Systems (NYSERDA, 2002)

Features	Benefits
Proper pole height and spacing	Provides uniform light distribution, which improves appearance for safety and security Meets recommended light levels Minimizes the number of poles, reducing energy and maintenance costs

Features	Benefits
Proper luminaire aesthetics	Blends in with the surroundings
High lamp efficacy and luminaire efficiency	Minimizes energy cost
Life of the luminaire and other components	Reduces lamp replacement costs
Cost effectiveness	Lowers operating cost
High lumen maintenance	Reduces lamp replacement costs
Good color rendering	Helps object appear more natural and pleasing to the public Allows better recognition of the environment, improves security
Short lamp restrike	Allows the lamp to quickly come back after a power interruption
Proper light distribution	Provides required light on the roads and walkways
Proper cutoff	Provides adequate optical control to minimize light pollution
Minimizing light pollution and glare	Reduces energy use
Automatic shutoff	Saves energy and maintenance costs by turning lamps off when not needed

Table 4: Specification for Street Lighting Poles (BIS, 1981)

Section	Overall length 11 m + 25 mm (base plate)			Overall length 9.5 m +25 mm (base plate)		
	Outside Dia (mm)	Thickness (mm)	Length (mm)	Outside Dia (mm)	Thickness (mm)	Length (mm)
Bottom section	139.7	4.85	5600	165.1	4.85	5000
Middle section	114.3	4.5	2700	139.7	4.5	2250
Top section	88.9	3.25	2700	114.3	3.65	2250
Planting depth		1800 mm			1800 mm	
Nominal weight of the pole		160 kg			147 kg	

Tolerance on mean weight for bulk supply is 7.5 %

Tolerance for single pole weight is 10%

This can only be done after comparing various options. The optimum mounting height should be chosen by taking into account the light output of the sources, the light distribution of the luminaires, and the geometry of installation. The mounting height should be greater for more powerful lamps, to avoid excessive glare (BIS, 1981). Table 5 shows the mounting heights recommended by the Indian Standard.

Table 5: Mounting Height of Luminaries (BIS, 1981)

Group	Recommended Mounting Height
A	9 to 10 meters
B	7.5 to 9 meters
Others (roads bordered by trees)	Less than 7.5 meters

Spacing

Spacing is the distance, measured along the center line of the road, between successive luminaires in an installation. To preserve longitudinal uniformity, the space-height ratio should generally be greater than 3.

Outreach

Outreach is the horizontal distance between the centre of the column and the centre of the luminaire and is usually determined for architectural aesthetic considerations (Corporation of Chennai, 2003).

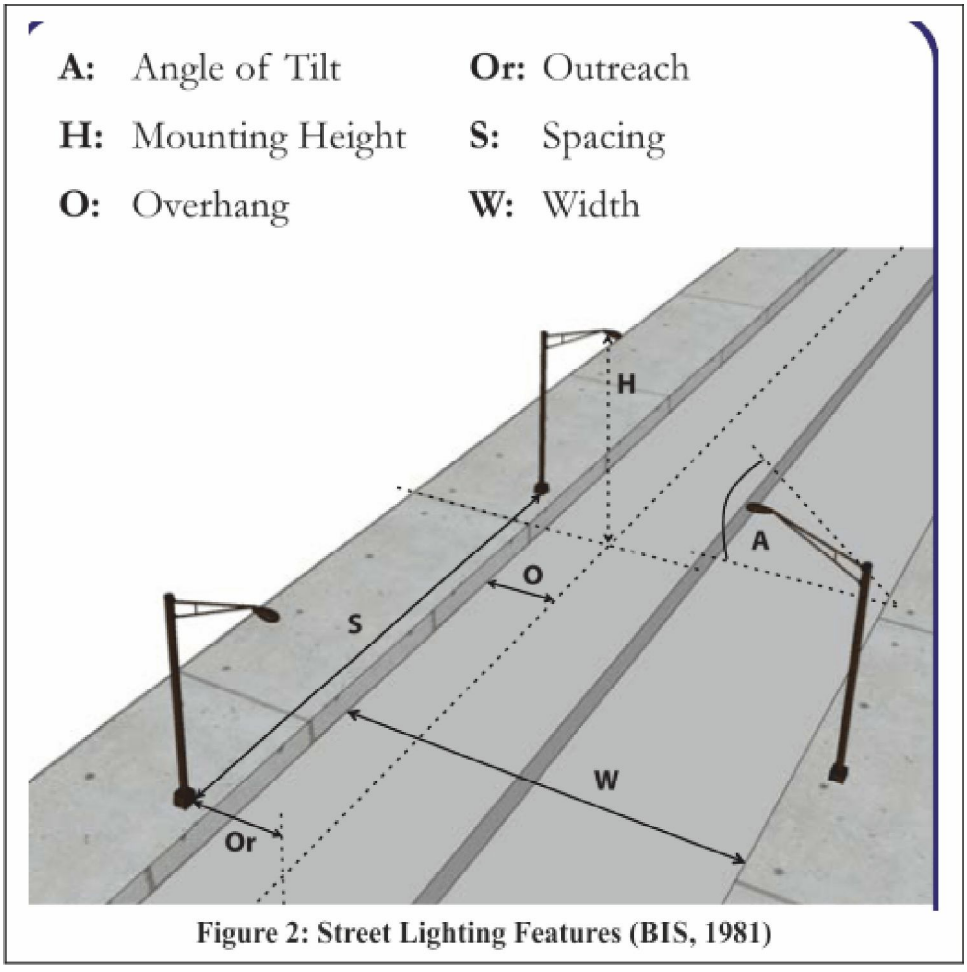


Figure 2: Street Lighting Features (BIS, 1981)

Overhang

Overhang (see Figure 2) is the horizontal distance between the centre of a luminaire mounted on a bracket and the adjacent edge of a carriage way. In general, overhang should not exceed one-fourth of the mounting height to avoid reduced visibility of curbs, obstacles, and footpaths (Corporation of Chennai, 2003).

Siting of Luminaires

Four fundamental types of siting arrangements are recognized in street lighting (BIS, 1981). They are:

1. **Single side arrangement,** where all the luminaires are on one side of the road. This is recommended only when the width of the road is equal to or less than the mounting height.
2. **Staggered arrangement,** where the luminaires are placed on either side of the road in a zigzag formation. This is recommended when the road width is 1 to 1.5 times that of the mounting height.
3. **Opposite mounting,** where the luminaires are situated on either side of the road opposite to one another. This is advisable for road widths more than 1.5 times that of the mounting height.
4. **Axial mounting,** where the luminaires are placed along the axis of the road. This is recommended for narrow roads the width of which does not exceed the mounting height.

Recommended Level of Illumination

Recommended levels of illumination for street lighting related to groups A1, A2, B1, and B2 are shown in Table 6 below.

Procurement

It is suggested that municipalities stipulate energy efficiency as a requirement in procurement of street lighting equipment. Municipalities also should incorporate energy efficiency specifications in the procurement tender or bid document/contract, and specify minimum technical specifications such as lumen output, lumen maintenance, and life of lamp, for the lamp as mentioned below (Subodh, 2002).

Lamp

- Wattage
- Luminous flux
- Lumen/Watt
- Average burning life

Luminaires

- Symmetrical light distribution
- Cutoff angle
- Quality of reflector
- Ingress protection

It is also important that the tender give a thorough description of what functional demands should be addressed in a lighting installation to enable selection of the best total solution, in terms of both investment and O&M costs. The life-cycle cost of the products and alternatives must be calculated and presented to provide a holistic view of the project and its future cost.

Lamp and Luminaire Depreciation Factors

In determining the light output for a luminaire, the lighting system designer must consider the luminaire light loss factor. The luminaire light loss factor is a combination of several factors including the Lamp Lumen Depreciation factor and the Lamp Dirt Depreciation factor. The loss factor is applied to the light output of a new luminaire (initial light output) to determine the light output of the luminaire after a fixed period of time. This should be considered during procurement to reduce maintenance cost.

Best Practice in Street Lighting for HPSV

The best practices for HPSV, listed below in Table 7, are based on field measurements for HPSV lamps and can be used as a reference for energy-efficient street lighting (Corporation of Chennai, 2003). However, it is important to identify the needs and lighting requirements for the particular road since it may have different features.

Table 6: Recommended Levels of Illumination (BIS, 1981)

Type of Road	Road Characteristics	Average Level of Illumination on Road Surface in Lux	Ratio of Minimum/Average Illumination	Type of Luminaire Preferred
A-1	Important traffic routes carrying fast traffic	30	0.4	Cutoff
A-2	Main roads carrying mixed traffic like city main roads/streets, arterial roads, throughways	15	0.4	Cutoff
B-1	Secondary roads with considerable traffic like local traffic routes, shopping streets	8	0.3	Cutoff or semi-cutoff
B-2	Secondary roads with light traffic	4	0.3	Cutoff or semi-cutoff

Table 7: Best Practices for HPSV

Lamp		Application	Desired Illumination (Lux)	Mounting height (m)	Width of road (m)	Spacing between poles (m)	Uniformity ratio	Angle of tilt (degree)	Over hang (m)
Watt	Lamp output	Residential	6	6	8	30	0.24	5	0.8
70 w	5800 lumens	Shopping street/road	10	6	6	25	0.38	5	0.8
		Factory road	15	6	6	17	0.53	5	0.8
150 w	14000 lumens	Factory road							
250 w	27000 lumens		30	10	15	30	0.42	15	2.0

Dimming Systems

Although the use of dimming systems yields considerable energy savings and represents a financially justified investment, it should be used with caution. The use of dimming systems for street lighting is recommended when the supply voltage exceeds 220 V. This typically occurs between late night and early morning hours when traffic density is significantly reduced.

Common Types of Lamp Dimming Systems

There are presently three types of lamp dimming systems in line voltage: step-level, bi-level, and continuous dimming.

Step-level line voltage dimming circuits work by changing the applied voltage in the street lighting system. A variable voltage low loss transformer is installed at switching points and has timer control and a power factor correcting mechanism.

Bi-level dimming electronically modifies the input voltage into low or high near the lamp by employing electronic low or high frequency switching circuits.

Continuous dimming systems reduce the line voltage continuously through variable step transformers/ variable reactors/wave choppers using electronic circuits.

Case Studies

Akola Municipal Corporation, India: T5 Lamps Yield Payback of Less than One Year

In Akola Municipal Corporation (AMC), an Urban Local Body in the state of Maharashtra, more than 11,500 conventional street lights (standard fluorescent, mercury vapor, and sodium vapor) were replaced with efficient, T5 fluorescent tube lamps. The project, which was implemented using an energy savings performance contracting approach, has resulted in energy savings of 2.1 million kWh per year – a 56% reduction in the ULB's energy use for street lighting. These energy savings have resulted in cost savings of about INR 6.4 million per year, and the project paid for itself in only 11 months. The project's success has already led to the implementation of similar projects in Maharashtra and Madhya Pradesh. (ESMAP 2009)

Planned LED Retrofits and Remote Monitoring System Installations in the City of Los Angeles, USA

The City of Los Angeles, California has approved a $57 million retrofit project, involving the replacement of 140,000 city street light fixtures with LED fixtures and the installation of a remote monitoring system to collect and centrally report real-time performance data (including equipment failures) for each fixture outfitted with the technology. The project will be carried out from 2009 to 2013 in five year-long phases:

Year 1 began in July 2009 and encompasses 20,000 fixtures.

Years 2 thru 5 will each encompass 30,000 fixtures.

To take into account the rapid evolution of LED fixtures, for each yearlong project phase the City will reevaluate LED products on the market to determine which products it should install.

Annual maintenance savings (resulting from the long life of LED fixtures)
and energy savings are projected to total $10 million, and the corresponding energy savings are project to be 68,640,000 kWh/year. The expected projected payback period is 7 years. (Clinton Climate Initiative 2009)

(To be continued....)

"As sure as the spring will follow the winter, prosperity and economic growth will follow recession." – BO BENNETT

ELECTRICAL SAFETY - BASIC INFORMATION

Why is it so important to work safely with or near electricity?

The voltage of the electricity and the available electrical current in regular businesses and homes has enough power to cause death by electrocution. Even changing a light bulb without unplugging the lamp can be hazardous because coming in contact with the "hot", "energized" or "live" part of the socket could kill a person.

What do I need to know about electricity?

All electrical systems have the potential to cause harm. Electricity can be either "static" or "dynamic." Dynamic electricity is the uniform motion of electrons through a conductor (this is known as electric current). Conductors are materials that allow the movement of electricity through it. Most metals are conductors. The human body is also a conductor. This document is about dynamic electricity.

Note: Static electricity is accumulation of charge on surfaces as a result of contact and friction with another surface. This contact/friction causes an accumulation of electrons on one surface, and a deficiency of electrons on the other surface. The OSH Answers document on How Do I Work Safely - Static Electricity has more information.

Electric current cannot exist without an unbroken path to and from the conductor. Electricity will form a "path" or "loop". When you plug in a device (e.g., a power tool), the electricity takes the easiest path from the plug-in, to the tool, and back to the power source. This is action is also known as creating or completing an electrical circuit.

What kinds of injuries result from electrical currents?

People are injured when they become part of the electrical circuit. Humans are more conductive than the earth (the ground we stand on) which means if there is no other easy path, electricity will try to flow through our bodies.

There are four main types of injuries: electrocution (fatal), electric shock, burns, and falls. These injuries can happen in various ways:

- Direct contact with exposed energized conductors or circuit parts. When electrical current travels through our bodies, it can interfere with the normal electrical signals between the brain and our muscles (e.g., heart may stop beating properly, breathing may stop, or muscles may spasm).
- When the electricity arcs (jumps, or "arcs") from an exposed energized conductor or circuit part (e.g., overhead power lines) through a gas (such as air) to a person who is grounded (that would provide an alternative route to the ground for the electrical current).
- Thermal burns including burns from heat generated by an electric arc, and flame burns from materials that catch on fire from heating or ignition by electrical currents or an electric arc flash. Contact burns from being shocked can burn internal tissues while leaving only very small injuries on the outside of the skin.
- Thermal burns from the heat radiated from an electric arc flash. Ultraviolet (UV) and infrared (IR) light emitted from the arc flash can also cause damage to the eyes.
- An arc blast can include a potential pressure wave released from an arc flash. This wave can cause physical injuries, collapse your lungs, or create noise that can damage hearing.
- Muscle contractions, or a startle reaction, can cause a person to fall from a ladder, scaffold or aerial bucket. The fall can cause serious injuries.

What should I do if I think I am too close to overhead power lines?

Do not work close to power lines. Recommended distances vary by jurisdiction and/or utility companies. Check with both your jurisdiction and electrical utility company when working, driving, parking, or storing materials closer than 15 m (49 feet) to overhead power lines.

- If you must be close to power lines, you must first call your electrical utility company and they will assist you.
- If your vehicle comes into contact with a power line:
  - **DO NOT** get out of your vehicle.
  - Call 911 **and** your local utility service for help.
  - **Wait** for the electrical utility to come and they will tell you when it is safe to get out of your vehicle.
  - Never try to rescue another person if you are not trained to do so.
  - If you must leave the vehicle (e.g., your vehicle catches on fire), exit by jumping as far as possible – at least 45 to 60 cm (1.5 to 2 feet). Never touch the vehicle or equipment and the ground at the same time. Keep your feet, legs, and arms close to your body.
  - Keep your feet together (touching), and move away by shuffling your feet. Never let your feet separate or you may be shocked or electrocuted.
  - Shuffle at least 10 metres away from your vehicle before you take a normal step.
- Do not enter an electrical power substation, or other marked areas.

What are some general safety tips for working with or near electricity?

- Inspect portable cord-and-plug connected equipment, extension cords, power bars, and electrical fittings for damage or wear before each use. Repair or replace damaged equipment immediately.
- Always tape extension cords to walls or floors when necessary. Do not use nails and staples because they can damage extension cords and cause fire and shocks.
- Use extension cords or equipment that is rated for the level of amperage or wattage that you are using.
- Always use the correct size fuse. Replacing a fuse with one of a larger size can cause excessive currents in the wiring and possibly start a fire.
- Be aware that unusually warm or hot outlets or cords may be a sign that unsafe wiring conditions exists. Unplug any cords or extension cords from these outlets and do not use until a qualified electrician has checked the wiring.
- Always use ladders made with non-conductive side rails (e.g., fibreglass) when working with or near electricity or power lines.
- Place halogen lights away from combustible materials such as cloths or curtains. Halogen lamps can become very hot and may be a fire hazard.
- Risk of electric shock is greater in areas that are wet or damp. **Install Ground Fault Circuit Interrupters** (GFCIs) as they will interrupt the electrical circuit before a current sufficient to cause death or serious injury occurs.
- Use a portable in-line Ground Fault Circuit Interrupter (GFCI) if you are not certain that the receptacle you are plugging your extension cord into is GFCI protected.
- Make sure that exposed receptacle boxes are made of non-conductive materials.
- Know where the panel and circuit breakers are located in case of an emergency.

- Label all circuit breakers and fuse boxes clearly. Each switch should be positively identified as to which outlet or appliance it is for.
- Do not use outlets or cords that have exposed wiring.
- Do not use portable cord-and-plug connected power tools if the guards are removed.
- Do not block access to panels and circuit breakers or fuse boxes.
- Do not touch a person or electrical apparatus in the event of an electrical incident. Always disconnect the power source first.

What are some tips for working with power tools?

- Switch all tools OFF before connecting them to a power supply.
- Disconnect and lockout the power supply before completing any maintenance work tasks or making adjustments.
- Ensure tools are properly grounded or double-insulated. The grounded equipment must have an approved 3-wire cord with a 3-prong plug. This plug should be plugged in a properly grounded 3-pole outlet.
- Test all tools for effective grounding with a continuity tester or a Ground Fault Circuit Interrupter (GFCI) before use.
- Do not bypass the on/off switch and operate the tools by connecting and disconnecting the power cord.
- Do not use electrical equipment in wet conditions or damp locations unless the equipment is connected to a GFCI.
- Do not clean tools with flammable or toxic solvents.
- Do not operate tools in an area containing explosive vapours or gases, unless they are intrinsically safe and only if you follow the manufacturer's guidelines.

What are some tips for working with power cords?

- Keep power cords clear of tools during use.
- Suspend extension cords temporarily during use over aisles or work areas to eliminate stumbling or tripping hazards.
- Replace open front plugs with dead front plugs. Dead front plugs are sealed and present less danger of shock or short circuit.
- Do not use light duty extension cords in a non-residential situation.
- Do not carry or lift up electrical equipment by the power cord.
- Do not tie cords in tight knots. Knots can cause short circuits and shocks. Loop the cords or use a twist lock plug.

What is a Ground Fault Circuit Interrupter (GFCI)?

A Class A Ground Fault Circuit Interrupter (GFCI) works by detecting any loss of electrical current in a circuit (e.g., it will trip at a maximum of 6mA). When a loss is detected, the GFCI turns the electricity off before severe injuries or electrocution can occur. A painful non-fatal shock may occur during the time that it takes for the GFCI to cut off the electricity so it is important to use the GFCI as an extra protective measure rather than a replacement for safe work practices.

GFCI wall outlets can be installed in place of standard outlets to protect against electrocution for just that outlet, or a series of outlets in the same branch circuit. A GFCI Circuit Breaker can be installed on some circuit breaker electrical panels to protect an entire branch circuit. Portable in-line plug-in GFCIs can be plugged into wall outlets where appliances will be used.

When and how do I test the Ground Fault Circuit Interrupter (GFCI)?

It is important that you follow the manufacturer's instructions with respect to the use of a GFCI. Test permanently wired GFCIs monthly, and portable devices before each use. Use a GFCI tester. You may also test by pressing the "test" and "reset" buttons. Plug a "night light" or lamp into the GFCI-protected wall outlet (the light should turn on), then press the "TEST" button on the GFCI. If the GFCI is working properly, the light should go out. If not, have the GFCI repaired or replaced. Press the "RESET" button on the GFCI to restore power.

Contact a qualified electrician if you are unsure or to correct any wiring errors.

What is a sample checklist for basic electrical safety?

Inspect Cords and Plugs

- Check extension cords and plugs daily. Do not use, and discard corns and plugs if they are worn or damaged.
- Have any extension cord that feels more than comfortably warm checked by an electrician.

Eliminate Octopus Connections

- Do not plug several items into one outlet.
- Pull the plug, not the cord.
- Do not disconnect power supply by pulling or jerking the cord from the outlet. Pulling the cord causes wear and may cause a shock.

Never Break OFF the Third Prong on a Plug

- Replace broken 3-prong plugs and make sure the third prong is properly grounded.

Never Use Extension Cords as Permanent Wiring

- Use extension cords only to temporarily supply power to an area that does not have a power outlet.
- Keep extension cords away from heat, water and oil. They can damage the insulation and cause a shock.
- Do not allow vehicles to pass over unprotected extension cords. Extension cords should be put in protective wireway, conduit, pipe or protected by placing planks alongside them.

Document last updated on September 20, 2019

HUMOUR

Economics – A light (Joke) view

What happens when you put 10 economists in a room? You'll get 11 opinions.

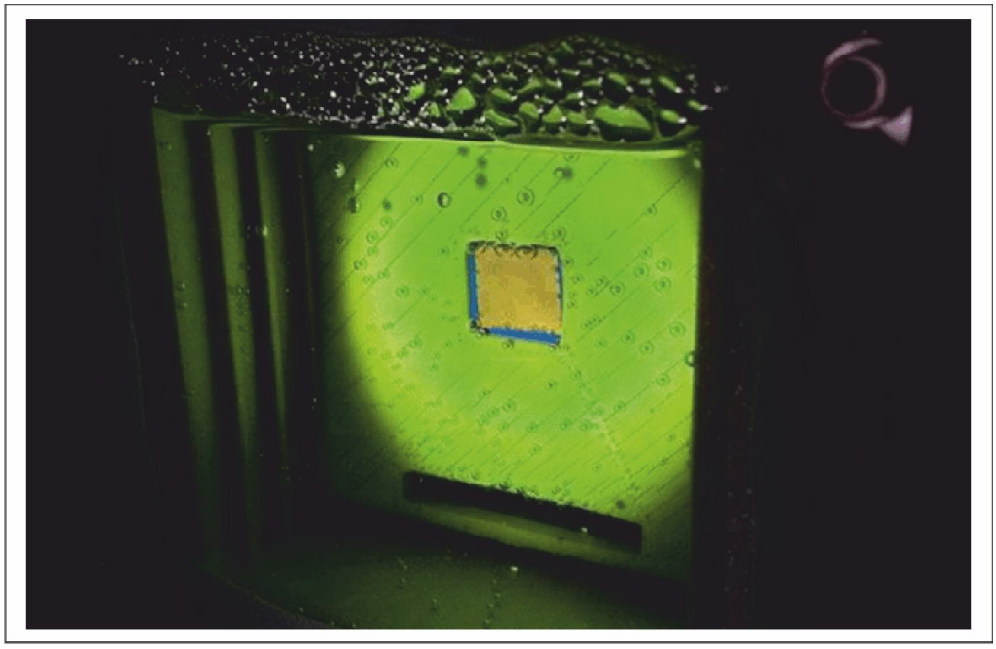
That old joke is arguably more popular to the general masses than most actual economic theories. It's no wonder that economists tend to get such a bad rap. Nobody truly understands what they do and how they do it. Quite frankly, nobody wants to.

When you think about it, it can't be fun being an economist. Your job involves examining a system of billions of different moving parts and trying to make sense of it all. The fact that the closest you'll ever get to an answer is essentially an educated guess should be a sign that macroeconomics is too complex a discipline to be completely understood.

And yet, the same people who have even less idea what makes the world economy tick than you do spend most of their time mocking your theories. That said, economist jokes are funny. And reveling in that may be the only way we can come to grips knowing that even the world's most educated people on the subject still can't tell you exactly why gas or milk costs what it costs.

ARTIFICIAL LEAF DEVICE THAT CONVERTS SUNLIGHT TO CLEAN GAS

Scientists at the University of Cambridge have developed an 'artificial leaf' device that uses sunlight to produce a widely-used clean gas currently made from fossil fuels.



Scientists have developed an 'artificial leaf' device that uses sunlight to produce a widely-used clean gas currently made from fossil fuels and could be used to create a sustainable liquid fuel alternative to petrol. The carbon-neutral device can directly produce the gas called 'syngas', in a sustainable and simple way from carbon dioxide and water, setting a new benchmark in the field of solar fuels.

Rather than running on fossil fuels, the artificial leaf developed by researchers at the University of Cambridge is powered by sunlight, although it still works efficiently on cloudy and overcast days.

Unlike the current industrial processes for producing syngas, the leaf does not release any additional carbon dioxide into the atmosphere, according to the research published in the journal Nature Materials.

Syngas is currently made from a mixture of hydrogen and carbon monoxide and is used to produce a range of commodities, such as fuels, pharmaceuticals, plastics and fertilizers.

"You may not have heard of syngas itself but every day, you consume products that were created using it. Being able to produce it sustainably would be a critical step in closing the global carbon cycle and establishing a sustainable chemical and fuel industry," said Professor Erwin Reisner from Cambridge.

The device is inspired by photosynthesis — the natural process by which plants use the energy from sunlight to turn carbon dioxide into food.

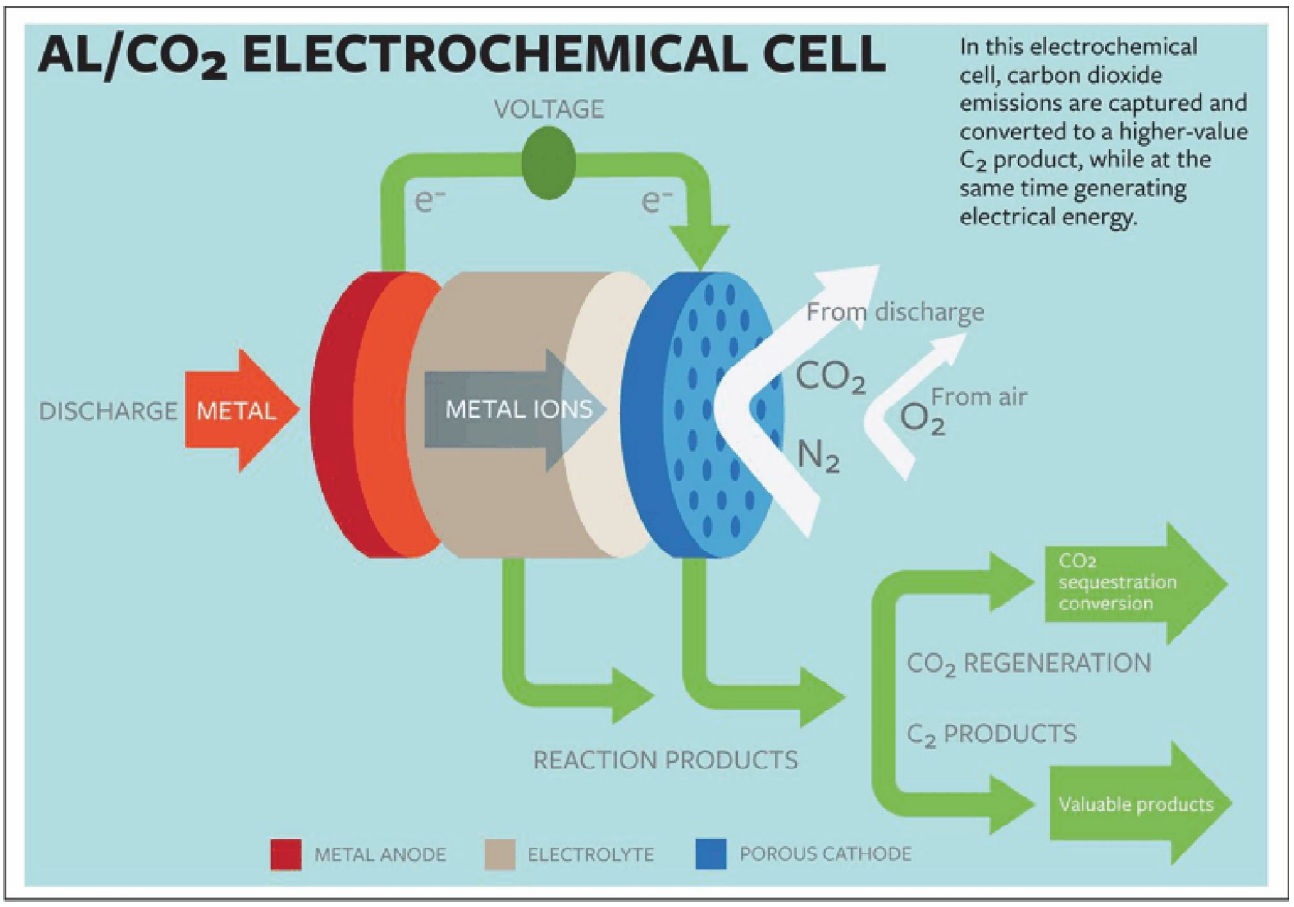
On the artificial leaf, two light absorbers, similar to the molecules in plants that harvest sunlight, are combined with a catalyst made from the naturally abundant element cobalt. When the device is immersed in water, one light absorber uses the catalyst to produce oxygen. The other carries out the chemical reaction that reduces carbon dioxide and water into carbon monoxide and hydrogen, forming the syngas mixture.

The researchers discovered that their light absorbers work even under the low levels of sunlight on a rainy or overcast day.

"This means you are not limited to using this technology just in warm countries, or only operating the process during the summer months," said Ph.D. student Virgil Andrei, first author of the research. "You could use it from dawn until dusk, anywhere in the world," Andrei said.

ENGINEERS DEVELOP A NEW WAY TO REMOVE CARBONDIOXIDE FROM AIR

Most methods of removing carbon dioxide from a stream of gas require higher concentrations, such as those found in the flue emissions from fossil fuel-based power plants. A few variations have been developed that can work with the low concentrations found in air, but the new method is significantly less energy-intensive and expensive, the researchers say. The technique, based on passing air through a stack of charged electrochemical plates, is described in a new paper in the journal Energy and Environmental Science, by MIT postdoc Sahag Voskian, who developed the work during his PhD, and T. Alan Hatton, the Ralph Landau Professor of Chemical Engineering.



The device is essentially a large, specialized battery that absorbs carbon dioxide from the air (or other gas stream) passing over its electrodes as it is being charged up, and then releases the gas as it is being discharged. In operation, the device would simply alternate between charging and discharging, with fresh air or feed gas being blown through the system during the charging cycle, and then the pure, concentrated carbon dioxide being blown out during the discharging.

As the battery charges, an electrochemical reaction takes place at the surface of each of a stack of electrodes. These are coated with a compound called polyanthraquinone, which is composited with carbon nanotubes. The electrodes have a natural affinity for carbon dioxide and readily react with its molecules in the airstream or feed gas, even when it is present at very low concentrations. The reverse reaction takes place when the battery is discharged — during which the device can provide part of the power needed for the whole system — and in the process ejects a stream of pure carbon dioxide. The whole system operates at room temperature and normal air pressure.

"The greatest advantage of this technology over most other carbon capture or carbon absorbing technologies is the binary nature of the adsorbent's affinity to carbon dioxide," explains Voskian. In other words, the electrode material, by its nature, "has either a high affinity or no affinity whatsoever," depending on the battery's state of charging or discharging. Other reactions used for carbon capture require intermediate chemical processing steps or the input of significant energy such as heat, or pressure differences.

"This binary affinity allows capture of carbon dioxide from any concentration, including 400 parts per million, and allows its release into any carrier stream, including 100 percent CO_2," Voskian says. That is, as any gas flows through the stack of these flat electrochemical cells, during the release step the captured carbon dioxide will be carried along with it. For example, if the desired end-product is pure carbon dioxide to be used in the carbonation of beverages, then a stream of the pure gas can be blown through the plates. The captured gas is then released from the plates and joins the stream.

In some soft-drink bottling plants, fossil fuel is burned to generate the carbon dioxide needed to give the drinks their fizz. Similarly, some farmers burn natural gas to produce carbon dioxide to feed their plants in greenhouses. The new system could eliminate that need for fossil fuels in these applications, and in the process actually be taking the greenhouse gas right out of the air, Voskian says. Alternatively, the pure carbon dioxide stream could be compressed and injected underground for long-term disposal, or even made into fuel through a series of chemical and electrochemical processes.

In a working plant — for example, in a power plant where exhaust gas is being produced continuously — two sets of such stacks of the electrochemical cells could be set up side by side to operate in parallel, with flue gas being directed first at one set for carbon capture, then diverted to the second set while the first set goes into its discharge cycle. By alternating back and forth, the system could always be both capturing and discharging the gas. In the lab, the team has proven the system can withstand at least 7,000 charging-discharging cycles, with a 30 percent loss in efficiency over that time. The researchers estimate that they can readily improve that to 20,000 to 50,000 cycles.

The electrodes themselves can be manufactured by standard chemical processing methods. While today this is done in a laboratory setting, it can be adapted so that ultimately they could be made in large quantities through a roll-to-roll manufacturing process similar to a newspaper printing press, Voskian says. "We have developed very cost-effective techniques," he says, estimating that it could be produced for something like tens of dollars per square meter of electrode.

Compared to other existing carbon capture technologies, this system is quite energy efficient, using about one gigajoule of energy per ton of carbon dioxide captured, consistently. Other existing methods have energy consumption which vary between 1 to 10 gigajoules per ton, depending on the inlet carbon dioxide concentration, Voskian says.

The researchers have set up a company called Verdox to commercialize the process, and hope to develop a pilot-scale plant within the next few years, he says. And the system is very easy to scale up, he says: "If you want more capacity, you just need to make more electrodes."

"Some people believe recession is a bad thing, but it is actually a healthy economy cycle. When we experience a pain somewhere, it is a sign of something is not right thus we must quickly remedy the problem. As for the economy, when there is a recession, the best method is always the most bitter method, just like medicine."

HINDUSTAN AERONAUTICS SEEKING PARTNERS FOR EV CHARGING BUSINESS

Hindustan Aeronautics Limited (HAL) has issued a Request for Information (RFI), seeking interest from eligible Indian firms for partnering with in the electric vehicle (EV) charging business.

As per the RFI document, the applicant should have the technical know-how and should be in the business of EV charging. The successful business entity should also be willing to transfer the intellectual property rights of the developed product to HAL. The ulterior motive of the RFI is to seek out the right partner to explore the emerging EV charging business area in the upcoming EV market.

The scope of work for the selected entity will include (but not be limited to) providing the EV charging hardware and software development, communication protocols, cloud support, power handling, installation and certifications, and approvals from the Automotive Research Association of India (ARAI). As per the RFI, the project is expected to be completed within three to four months from the date of signing the transfer of manufacturing technology (ToT) contract. The prototype development will take place within three to four months of the signing of the development contract.

The last date for submission of proposals in response to the RFI is November 22, 2019.

The selected Indian entity would need to share the technology of EV charging if already developed or else provide technical expertise and know-how for the joint development of EV charging infrastructure. Additionally, the EV chargers that are developed should also be compatible with CHAdeMO connector, CCS Connector, Type 2 AC, Bharat DC-001, and Bharat AC-001 standards.

In July 2019, the government reduced the applicable rate of Goods and Services Tax (GST) on electric vehicles (EVs) and corresponding charging infrastructure. The GST council meeting, chaired by Finance Minister Nirmala Sitharaman, had announced that the GST rate on all the electric vehicles will be reduced from 12 percent to 5 percent. Moreover, the GST rates on chargers or charging stations for EVs have been reduced from 18 percent to 5 percent.

RENEWABLES EXCEED 20.1% OF U.S. ELECTRICITY

Renewable energy sources (i.e., biomass, geothermal, hydropower, solar, wind) accounted for more than a fifth (20.1%) of net domestic electrical generation during the first six months of 2019, according to a SUN DAY Campaign analysis of just-released data from the U.S. Energy Information Administration (EIA). A year earlier, renewables' share was 19.9%

The latest issue of EIA's "Electric Power Monthly" (with data through June 30, 2019) reveals that solar and wind both showed continued growth. Solar, including small-scale solar photovoltaic (PV) systems, increased by 10.5% compared to the first half of 2018 and accounted for 2.7% of the nation's total net generation. Small-scale solar (e.g., distributed rooftop systems) – which increased by 19.9% – provided nearly a third (32.7%) of total solar electrical generation. U.S. wind-generated electricity increased by 0.9% and topped that provided by hydropower by 0.4%. Wind's share was 7.8% of total electrical output vs. 7.7% from hydropower.

Combined, wind and solar accounted for 10.5% of U.S. electrical generation through the end of June. In addition, biomass provided 1.5% and geothermal contributed a bit more than 0.4% (reflecting 2.2% growth). Moreover, during the six-month period, electricity from renewable energy sources ran neck-and-neck with that from nuclear power — 399,585 vs. 400,005 thousand megawatt-hours or 20.11% vs. 20.14% of total domestic electrical output.

In addition, during the first half of 2019, renewables further closed the gap with coal. A year ago, renewables provided 74.6% as much electricity as coal. However, growth in renewable electrical output coupled with a 13.2% drop in that of coal has resulted in renewables generating 85.0% as much electricity as coal during the first six months of 2019.

LIGHT TOUCH: PREDICTIVE MAINTENANCE FOR ELECTRICAL SYSTEMS

The potentially catastrophic consequences of electrical system failures and hazards must be avoided at all costs. Regular predictive maintenance (PdM) on electrical systems lets maintenance teams detect and correct problems before they can shut down equipment or production lines or cause a safety incident.

Whether conducted in-house or outsourced to reliability specialists, PdM inspections – followed up with timely, precise repairs – can protect against electrical accidents and save companies millions of dollars by reducing unscheduled downtime, lowering equipment maintenance costs, and extending the useful life of machinery.

Effective tools and technologies

Wide-ranging options exist for online/energized and offline testing of electrical systems. Tom Bishop, senior technical support specialist at the Electrical Apparatus Service Association (EASA), notes that there's a wide scope of available inspection types with these common motor tests:

Offline tests for motors

Insulation resistance tests

Polarization index tests

Motor electrical circuit parameters evaluation (resistance, inductance and capacitance)

Rotor influence tests to check for open rotor bars

Online tests for motors

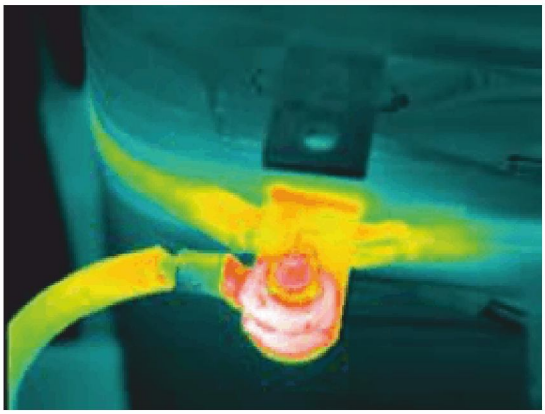
Measuring line voltages and currents

Motor current signature analysis

Vibration analysis for electrically induced frequencies

Thermography

Ultrasonic inspection



Technology has come a long way in the past 30 years, remarks John Bernet, mechanical application and product specialist at Fluke Industrial Group. "There are now easy-to-use tools available for operators to screen components of electrical systems for potential problems," Bernet says. "Technicians can then troubleshoot

the problem to find the specific fault and recommend a correction and then use the same screening tools to verify that the fault has been corrected and quickly get the machine back into service."

The emergence of the internet of things (IoT) is extending the value of PdM. "By collecting data through connected maintenance technologies, personnel can better evaluate the asset's utilization, environment, lifecycle and performance," says Emanuel Kourounis, services business development manager at Schneider Electric. "This data also enables a more condition-based maintenance approach to help companies allocate limited resources in managing their op-ex and cap-ex budgets along with maximizing their general maintenance activities."

Thermal imaging

One of the most effective PdM technologies for operating electrical systems is infrared (IR) thermography, says R. James Seffrin, director of the Infraspection Institute. "A thermal imager converts the normally invisible infrared radiation emitted by an object into a monochrome or multicolor image that is representative of the thermal patterns across the surface of the imaged object." Many thermal imagers also can provide temperatures of imaged objects, he notes.

Infrared inspections are conducted while the electrical system is energized and under load. Typical defects that may be found include loose/deteriorated connections, overloaded circuits, unbalanced loads, and defective equipment, Seffrin says.

Predictive IR technologies can be employed to mitigate the potential for human error in monitoring and maintaining assets, notes Schneider Electric's Kourounis. "Asset-specific algorithms, thresholds, and rules can be used to detect thermal abnormalities in the performance of the monitored assets, which can then be further analyzed by industry experts to validate the findings and develop a list of recommended next steps," he says.

Ultrasonic inspection

Ultrasonic inspection, another nondestructive test (NDT) technique, detects and isolates high-frequency sounds that are otherwise inaudible to the human ear. It is used to differentiate electrical discharge noises from normal sound patterns.

Electrical inspection with ultrasound is being driven by three main factors: safety, electrical maintenance standards, and insurance company interest, says Adrian Messer, manager of U.S. operations at UE Systems.

How Ultrasonic Electrical Detection Works

Arcing, tracking and corona all produce ionization which disturbs the surrounding air molecules. An Ultraprobe detects high frequency sounds produced by these emissions and translates them (via heterodyning) down into the audible ranges. The specific sound quality of each type of emission is heard in headphones while the intensity of the signal is observed on a display panel. These sounds may be recorded and analyzed through ultrasound spectral analysis software for a more accurate diagnosis. Normally, electrical equipment should be silent, although some equipment such as transformers may produce a constant hum, or some steady mechanical noises. These should not be confused with the erratic, sizzling frying, uneven and popping sound of an electrical discharge.

Detection Method

Before beginning any inspection of electric equipment, be sure to review your plant or company's safety procedures. Be familiar with NFPA 70E (in Canada, CSA Z462) Essentially, as in generic leak detection, the area of inspection is scanned starting at a high sensitivity level. To determine the location of the emission, reduce the sensitivity and follow the sound to the loudest point. If it is not possible to remove covers, or plates or doors, scan around the seams and vent slots. Any potentially damaging discharges should be detected.

When it is not possible to get close to the test equipment, such as for safety reasons or while inspecting over-head power lines, use a parabolic microphone. UE Systems has two models, a parabolic dish – the Ultrasonic Waveform Concentrator (UWC) and the Long Range Module (LRM). These highly sensitive, directional sensors double the detection distance of a standard scanning module and provide pinpoint accuracy.

For more accurate diagnosis, ultrasound spectral analysis software helps identify sound patterns related to electrical emissions through spectral (FFT) and Time Series screens. Some of the more advanced instruments have on-board sound recording while others have on-board spectral analysis screens to help provide a diagnosis on the spot.

"Safety is improved because we are able to inspect the energized electrical equipment without having to open it up," Messer says. "Electrical standards, such as NFPA 70B and CSA Z463, specifically mention the use of ultrasound to detect corona, tracking, and arcing from energized electrical equipment." He adds: "And, insurance companies are writing into procedures that before opening anything up to do visual and infrared inspections, ultrasound should first be used to detect any fault that may be producing high-frequency sound."

It's best practice to use both infrared and ultrasound technologies together, as they detect different failure modes and together provide significant safety benefits, suggests Doug Waetjen, vice president of global operations at UE Systems. "Infrared detects resistance-based problems, like overheating fuses and insulation breakdown, while ultrasound detects ionization-based problems like tracking on loose and faulty connections in switchgear, tracking on transformer windings as well as cracked insulators, and destructive corona in substations," he notes.

Another effective combination is ultrasonic inspection and vibration monitoring. EASA's Bishop said he has seen these methods used together to detect failing bearings – a situation that could have escalated into a rubbing fault between stator and rotor that would have damaged the stator windings.

Infrared and ultrasound windows

Infrared and ultrasound windows from companies like Exiscan let inspectors look at and listen to energized switchgear without being forced to open enclosed cabinets, says UE Systems' Waetjen. "By listening to what's going on internally and only opening the door when no evidence of tracking or arcing sounds are present, the chances of an arc flash incident are greatly reduced."

Motor current signature analysis

Motor current signature analysis records and analyzes motor current readings to diagnose faults. This test is able to identify rotor cage failures that result in reduced output torque, increased stator current, and increased motor temperature, says EASA's Bishop.

Insulation resistance testing

Insulation degradation can be detected with insulation resistance testing. This test is temperature-sensitive, and the readings must be corrected to a common base temperature. Bishop has seen insulation resistance tests identify motors with ground insulation weakness caused by moisture contamination that could have resulted in winding failure to ground if the motor had been started.

Partial discharge testing

Partial discharge (PD) monitoring looks for pockets of electrical breakdown within the insulation of electrical equipment. "In the past, PD monitoring was primarily used on higher-voltage machines rated over five kilovolts, but with the prevalence of low-voltage motors powered by variable frequency drives (VFDs), the use of PD monitoring is increasing," remarks Bishop.

PD technology is applicable to voltages higher than 2400 volts AC and can be applied to a wide variety of assets within an electrical distribution system, such as switchgear, some cable types, some bus duct applications, large rotating equipment, and power transformers, says Schneider Electric's Kourounis. "Continuous online monitoring is the ideal methodology for capturing activity and facilitating trending based upon available data," he says.

Wireless temperature monitoring

Wireless temperature monitoring can be applied to everything from dry-type transformers to cable connections. Thermal monitoring combined with load profiling has proved to be a reliable means of monitoring equipment performance, says Kourounis.

Oil analysis

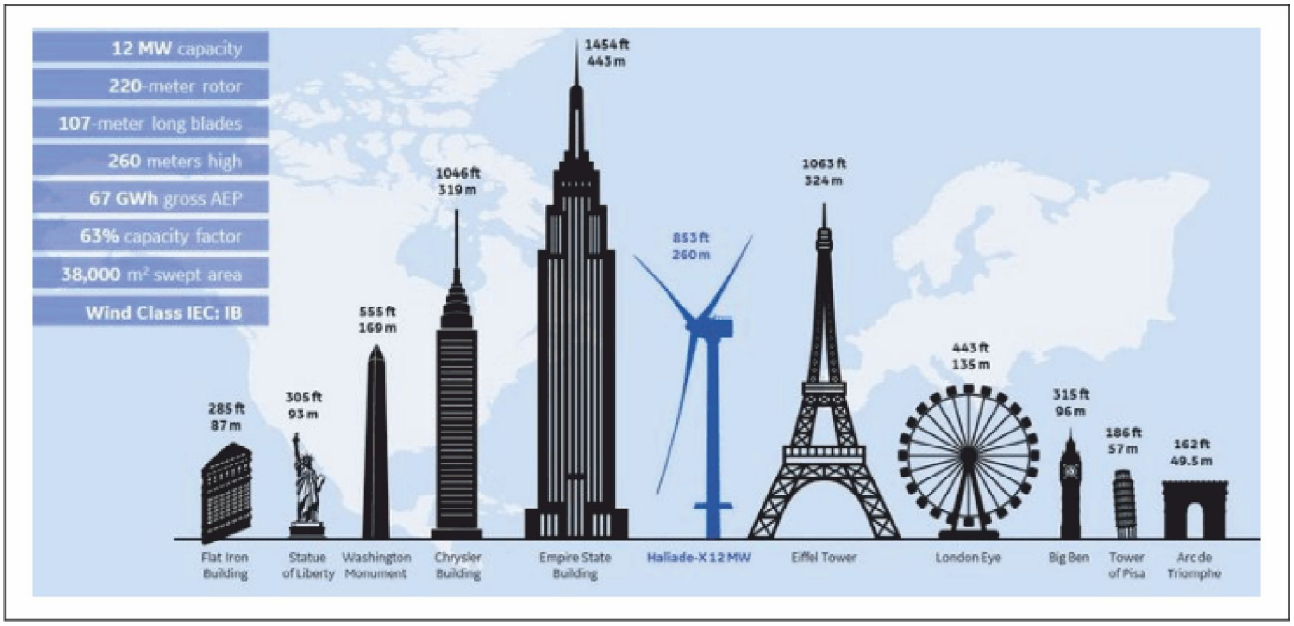
Oil quality and gases-in-oil analyses are additional PdM testing options. "Transformer oil should be monitored for its physical characteristics compared to the ASTM standards, which might include color, specific gravity, dielectric strength, moisture content, surface tension, contents of acids, carbon or furans," says Kourounis. Gases-in-oil analysis, as Kourounis explains it, measures the existing percentages of specific combustible gases, such as hydrogen, oxygen, methane, ethane, ethylene and acetylene, and indicates combinations and ratios that indicate potential problems.

WIND TURBINES JUST KEEP GETTING BIGGER, BUT THERE'S A LIMIT

Wind turbines have certainly grown up. When the Danish firm Vestas began the trend toward gigantism, in 1981, its three-blade machines were capable of a mere 55 kilowatts. That figure rose to 500 kW in 1995, reached 2 MW in 1999, and today stands at 5.6 MW. In 2021, MHI Vestas Offshore Wind's V164 will rise 105 meters high at the hub, swing 80-meter blades, and generate up to 10 MW, making it the first commercially available double-digit turbine ever. Not to be left behind, General Electric's Renewable Energy is developing a 12-MW machine with a 260-meter tower and 107-meter blades, also rolling out by 2021.

That is clearly pushing the envelope, although it must be noted that still larger designs have been considered. In 2011, the UpWind project released what it called a predesign of a 20-MW offshore machine with a rotor diameter of 252 meters (three times the wingspan of an Airbus A380) and a hub diameter of 6 meters. So far, the limit of the largest conceptual designs stands at 50 MW, with height exceeding 300 meters and with 200-meter blades that could flex (much like palm fronds) in furious winds.

To imply, as an enthusiastic promoter did, that building such a structure would pose no fundamental technical problems because it stands no higher than the Eiffel tower, constructed 130 years ago, is to choose an inappropriate comparison. If the constructible height of an artifact were the determinant of wind-turbine design then we might as well refer to the Burj Khalifa in Dubai, a skyscraper that topped 800 meters in 2010, or to the Jeddah Tower, which will reach 1,000 meters in 2021. Erecting a tall tower is no great problem; it's quite another proposition, however, to engineer a tall tower that can support a massive nacelle and rotating blades for many years of safe operation.



Larger turbines must face the inescapable effects of scaling. Turbine power increases with the square of the radius swept by its blades: A turbine with blades twice as long would, theoretically, be four times as powerful. But the expansion of the surface swept by the rotor puts a greater strain on the entire assembly, and because blade mass should (at first glance) increase as a cube of blade length, larger designs should be extraordinarily heavy. In reality, designs using lightweight synthetic materials and balsa can keep the actual exponent to as little as 2.3.

Even so, the mass (and hence the cost) adds up. Each of the three blades of Vestas's 10-MW machine will weigh 35 metric tons, and the nacelle will come to nearly 400 tons. GE's record-breaking design will have blades of 55 tons, a nacelle of 600 tons, and a tower of 2,550 tons. Merely transporting such long and massive blades is an unusual challenge, although it could be made easier by using a segmented design.

Exploring likely limits of commercial capacity is more useful than forecasting specific maxima for given dates. Available wind turbine power [PDF] is equal to half the density of the air (which is 1.23 kilograms per cubic meter) times the area swept by the blades (pi times the radius squared) times the cube of wind velocity. Assuming a wind velocity of 12 meters per second and an energy-conversion coefficient of 0.4, then a 100-MW turbine would require rotors nearly 550 meters in diameter.

To predict when we'll get such a machine, just answer this question: When will we be able to produce 275-meter blades of plastic composites and balsa, figure out their transport and their coupling to nacelles hanging 300 meters above the ground, ensure their survival in cyclonic winds, and guarantee their reliable operation for at least 15 or 20 years? Not soon.

"You cannot spend your way out of recession or borrow your way out of debt." – DANIEL HANNAN

RENEWABLES TO GROW BY NEARLY 1200 GW IN NEXT 5-YEARS: IEA

A new report has forecasted that the world's total renewables-based power capacity will grow by 50 percent between 2019 and 2024, and this increase of 1200 gigawatts (GW), which is equivalent to the current total power capacity of the United States, will be driven by cost reductions and concerted government policy efforts.

The report, "Renewables 2019" by the International Energy Agency (IEA), further adds that solar PV will account for 60 percent of the rise. The share of renewables in global power generation is set to rise from 26 percent at present to 30 percent in 2024. The installation of solar PV systems on homes, commercial buildings and industrial facilities are set to take off over the next five years, transforming the way electricity is generated and consumed, according to the latest renewable energy market forecast.

Distributed PV accounts for almost half of the growth in the overall solar PV market through 2024. Contrary to conventional wisdom, commercial and industrial applications rather than residential uses dominate distributed PV growth, accounting for three-quarters of new installations over the next five years. This is because economies of scale combined with better alignment of PV supply and electricity demand enable more self-consumption and bigger savings on electricity bills in the commercial and industrial sectors.

Still, the number of solar rooftop systems on homes is set to more than double to some 100 million by 2024, with the top markets on a per capita basis that year forecast to be Australia, Belgium, California, the Netherlands and Austria.

"As costs continue to fall, we have a growing incentive to ramp up the deployment of solar PV," said Dr. Fatih Birol, the IEA's Executive Director. The cost of generating electricity from distributed solar PV systems is already below retail electricity prices in most countries. The IEA forecasts that these costs will decline by a further 15 percent to 35 percent by 2024, making the technology more attractive and spurring adoption worldwide.

The expected growth predicted by the report will come after renewable capacity additions stalled last year for the first time in almost two decades. The renewed expansion, however, remains well below what is needed to meet global sustainable energy targets.

"Renewables are already the world's second-largest source of electricity, but their deployment still needs to accelerate if we are to achieve long-term climate, air quality, and energy access goals," said Dr. Birol.

Additionally, according to the report's Accelerated Case, improving economics, policy support and more effective regulation could push distributed PV's global installed capacity above 600 GW by 2024, almost double Japan's total power capacity today. Yet this accelerated growth is still only 6 percent of distributed PV's technical potential based on total available rooftop area.

Despite the rapid expansion of electric vehicles, renewable electricity only accounts for one-tenth of renewable energy consumption in transport in 2024. And the share of renewables in total transport fuel demand still remains below 5 percent. The Accelerated Case sees renewables in transport growing by an additional 20 percent through 2024 on the assumption of higher quota levels and enhanced policy support that opens new markets in aviation and marine transport.

MATERIALS THAT CAN REVOLUTIONIZE HOW LIGHT IS HARNESSED FOR SOLAR ENERGY

Researchers at Columbia University have developed a way to harness more power from singlet fission to increase the efficiency of solar cells, providing a tool to help push forward the development of next-generation devices.

In a study published this month in Nature Chemistry, the team details the design of organic molecules that are capable of generating two excitons per photon of light, a process called singlet fission. The excitons are produced rapidly and can live for much longer than those generated from their inorganic counterparts, which leads to an amplification of electricity generated per photon that is absorbed by a solar cell.

"We have developed a new design rule for singlet fission materials," said Luis Campos, an associate professor of chemistry and one of three principal investigators on the study. "This has led us to develop the most efficient and technologically useful intramolecular singlet fission materials to date. These improvements will open the door for more efficient solar cells."

All modern solar panels operate by the same process — one photon of light generates one exciton, Campos explained. The exciton can then be converted into electric current. However, there are some molecules that can be implemented in solar cells that have the ability to generate two excitons from a single photon — a process called singlet fission. These solar cells form the basis for next-generation devices, which are still at infancy. One of the biggest challenges of working with such molecules, though, is that the two excitons "live" for very short periods of time (tens of nanoseconds), making it difficult to harvest them as a form of electricity.

In the current study, funded in part by the Office of Naval Research, Campos and colleagues designed organic molecules that can quickly generate two excitons that live much longer than the state-of-the-art systems. It is an advancement that can not only be used in next-generation solar energy production, but also in photocatalytic processes in chemistry, sensors, and imaging, Campos explained, as these excitons can be used to initiate chemical reactions, which can then be used by industry to make drugs, plastics, and many other types of consumer chemicals.

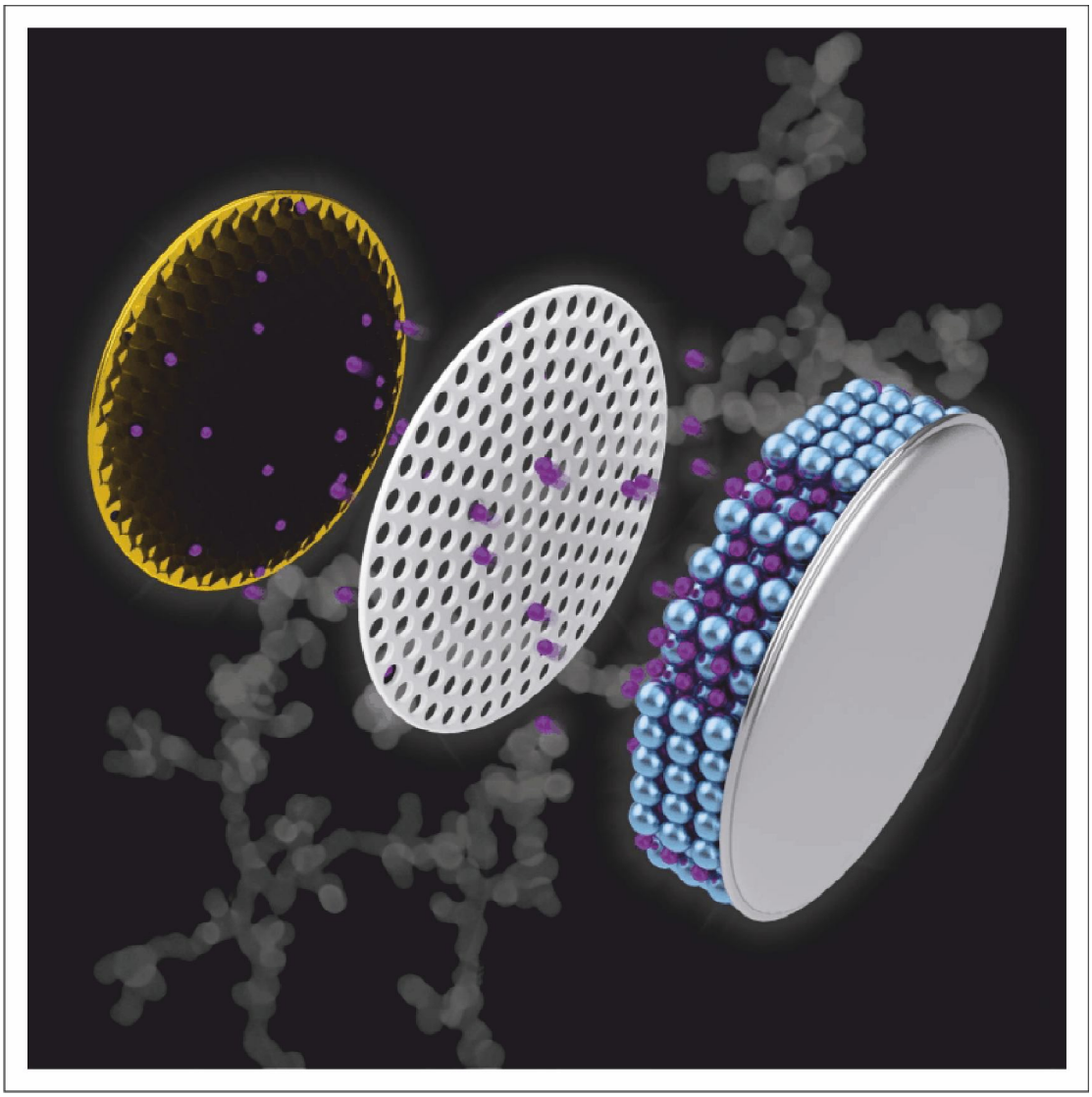
"Intramolecular singlet fission has been demonstrated by our group and others, but the resulting excitons were either generated very slowly, or they wouldn't last very long," Campos said. "This work is the first to show that singlet fission can rapidly generate two excitons that can live for a very long time. This opens the door to fundamentally study how these excitons behave as they sit on individual molecules, and also to understand how they can be efficiently put to work in devices that benefit from light-amplified signals."

The team's design strategy should also prove useful in separate areas of scientific study and have many other yet-unimaginable applications, he added.

Campos' study co-authors are: Samuel Sanders and Andrew Pun, of Columbia University; Matthew Y. Sfeir, of City University of New York; and Amir Asadpoordarvish, of the University of New South Wales.

NANOCHAINS' COULD INCREASE BATTERY CAPACITY, CUT CHARGING TIME

How long the battery of your phone or computer lasts depends on how many lithium ions can be stored in the battery's negative electrode material. If the battery runs out of these ions, it can't generate an electrical current to run a device and ultimately fails.



Materials with a higher lithium ion storage capacity are either too heavy or the wrong shape to replace graphite, the electrode material currently used in today's batteries.

Purdue University scientists and engineers have introduced a potential way that these materials could be restructured into a new electrode design that would allow them to increase a battery's lifespan, make it more stable and shorten its charging time.

The study, appearing as the cover of the September issue of Applied Nano Materials, created a net-like structure, called a "nanochain," of antimony, a metalloid known to enhance lithium ion charge capacity in batteries.

The researchers compared the nanochain electrodes to graphite electrodes, finding that when coin cell batteries with the nanochain electrode were only charged for 30 minutes, they achieved double the lithium-ion capacity for 100 charge-discharge cycles.

Some types of commercial batteries already use carbon-metal composites similar to antimony metal negative electrodes, but the material tends to expand up to three times as it takes in lithium ions, causing it to become a safety hazard as the battery charges.

"You want to accommodate that type of expansion in your smartphone batteries. That way you're not carrying around something unsafe," said Vilas Pol, a Purdue associate professor of chemical engineering.

Through applying chemical compounds - a reducing agent and a nucleating agent - Purdue scientists connected the tiny antimony particles into a nanochain shape that would accommodate the required expansion. The particular reducing agent the team used, ammonia-borane, is responsible for creating the empty spaces - the pores inside the nanochain - that accommodate expansion and suppress electrode failure.

The team applied ammonia-borane to several different compounds of antimony, finding that only antimony-chloride produced the nanochain structure.

"Our procedure to make the nanoparticles consistently provides the chain structures," said P. V. Ramachandran, a professor of organic chemistry at Purdue.

The nanochain also keeps lithium ion capacity stable for at least 100 charging-discharging cycles. "There's essentially no change from cycle 1 to cycle 100, so we have no reason to think that cycle 102 won't be the same," Pol said.

Henry Hamann, a chemistry graduate student at Purdue, synthesized the antimony nanochain structure and Jassiel Rodriguez, a Purdue chemical engineering postdoctoral candidate, tested the electrochemical battery performance.

The electrode design has the potential to be scalable for larger batteries, the researchers say. The team plans to test the design in pouch cell batteries next.

RENEWABLES PREDICTED TO GROW BY OVER 50% IN NEXT 5-YEARS

A new report has forecasted that the world's total renewables-based power capacity will grow by 50 percent between 2019 and 2024. A new report has forecasted that the world's total renewables-based power capacity will grow by 50 percent between 2019 and 2024. This increase of 1,200 gigawatts (GW), which is equivalent to the current total power capacity of the United States, will be driven by cost reductions and concerted government policy efforts.

The report, "Renewables 2019" by the International Energy Agency (IEA), further adds that solar PV will account for 60 percent of the rise. The share of renewables in global power generation is set to rise from 26 percent at present to 30 percent in 2024. The installation of solar PV systems on homes, commercial buildings and industrial facilities are set to take off over the next five years, transforming the way electricity is generated and consumed, according to the latest renewable energy market forecast.

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already below retail electricity prices in most countries. The IEA forecasts that these costs will decline by a further 15 percent to 35 percent by 2024, making the technology more attractive and spurring adoption worldwide.

The expected growth predicted by the report will come after renewable capacity additions stalled last year for the first time in almost two decades. The renewed expansion, however, remains well below what is needed to meet global sustainable energy targets.

"Renewables are already the world's second-largest source of electricity, but their deployment still needs to accelerate if we are to achieve long-term climate, air quality, and energy access goals," said Dr. Birol.

Additionally, according to the report's Accelerated Case, improving economics, policy support and more effective regulation could push distributed PV's global installed capacity above 600 GW by 2024, almost double Japan's total power capacity today. Yet this accelerated growth is still only 6 percent of distributed PV's technical potential based on the total available rooftop area.

The report also offers forecasts for all sources of renewable energy. Renewable heat is set to expand by one-fifth between 2019 and 2024, driven by China, the European Union, India and the United States. The heat and power sectors become increasingly interconnected as renewable electricity used for heat rises by more than 40 percent. But overall, renewable heat potential remains vastly underexploited. The share of renewables in total heat demand is forecast to remain below 12 percent in 2024, calling for more ambitious targets and stronger policy support.

Biofuels currently represent some 90 percent of renewable energy in transport and their use is set to increase by 25 percent over the next five years. Growth is dominated by Asia, particularly China, and is driven by energy security and air pollution concerns. Despite the rapid expansion of electric vehicles, renewable electricity only accounts for one-tenth of renewable energy consumption in transport in 2024. And the share of renewables in total transport fuel demand still remains below 5 percent. The Accelerated Case sees renewables in transport growing by an additional 20 percent through 2024 on the assumption of higher quota levels and enhanced policy support that opens new markets in aviation and marine transport.

RINGLET

~ DIRECT CHANNEL PARTNER of :hager

Distribution boards

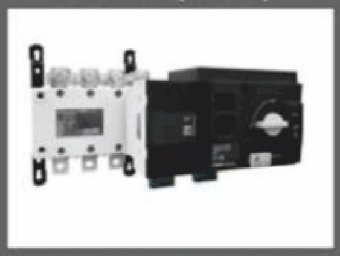
Miniature Circuit Breakers (MCB)

Moulded Case Circuit Breakers (MCCB)

Residual Current Circuit Breakers (RCCB)

RCBO ,RCD+MCB modules

Manual Changeover Switches



Automatic Transfer Switches

Time Switches

Digital Energy Meters

Contactors

Isolating Switches

Surge Protection Devices

LED Indicators

Plug & Socket Outlets

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Email : epowerengineering @ gmail.com / epowerengg2013 @ gmail.com
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ENERGY, ELECTRICAL ENERGY AND RENEWABLE ENERGY – 26

Sustainable Growth, Sustainable Electrical Energy and Renewable Energy

Problem of Plastics and solution

Problems of Plastics are discussed in all forums in India and all over the world and the Government was actually planning complete ban of all one time use plastics from this year October 2nd, but this has been postponed to the year 2022.

The problems are detailed from some of the figures available and a probable safe and reliable solution is also detailed. The solution is to convert all plastic wastes into Electricity for which safe and reliable technologies are developed both in India and abroad, which are also summed up in this article.

The problem is really huge and some of the details below disturb very much and even make us wonder whether the problem can ever be solved.

Indian production of plastics per annum is expected to be 22 million tons in the year 2020. Per capita consumption of plastics stands at about 11 kg per head per annum. Global production is about 150 Million tons per annum. Only about 9% goes for recycling, about 10% is burnt which is dangerous emitting toxic gases etc., and balance goes as waste accumulation, part of it going to the sea as well. Every second about 20,000 plastic bottles

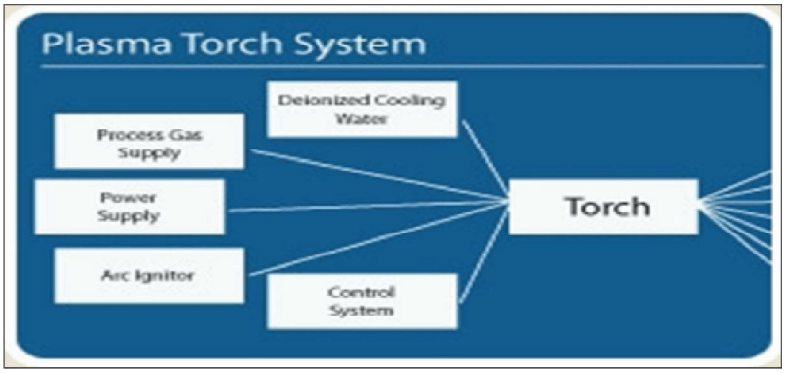
are purchased. There are estimates that the sea has accumulated about 150 million tons of plastics with addition of about 8 million tons per annum and at this rate, by 2050 there will be more plastics in the sea than fishes. The total plastics produced in the world till now is around 83,000 Million Tons out of which about 12,000 Million Tons are accumulated as wastes all over the world.

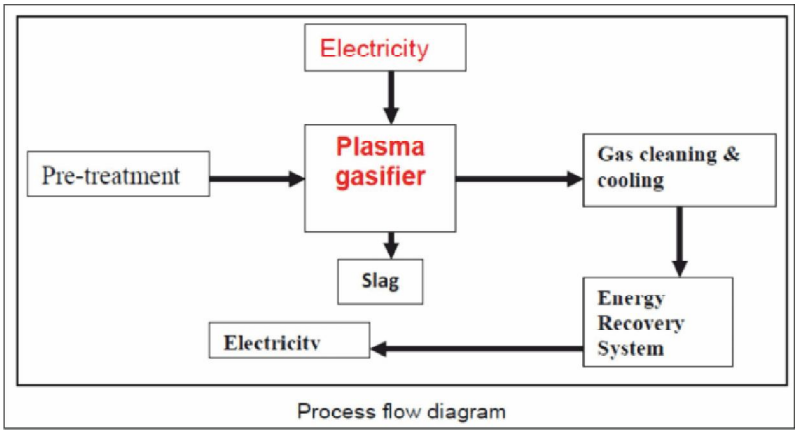
The problem creation is mainly on account of irresponsible behavior of all human being world over by littering of waste plastics anywhere and everywhere. First of all there must be a strict discipline in place, even by force and punishment, to accumulate all plastic wastes in specified places so that the disposal and elimination can be planned. Plastic wastes are highly potential feed materials for Electricity Generation as each Kg can yield up to 3 Units of Electricity and after adjusting for captive consumption of Power for the process, the net yield can easily be 2 Units or more depending on the efficiency of the process.

Combustion and Electricity generation is also feasible and is employed successfully in many places, but the challenges to neutralize the toxic gases and make the flue gas free of them, are quite serious and there must be continuous checks in place.

Plasma Gasification (which has been dealt in some details in one of the earlier articles) is an important solution, particularly for plastic wastes, as the emission of toxic gases are completely eliminated.

CSIR (Council of Scientific and Industrial Research) has developed a simple Plasma Gasification process for generating electricity from plastics. The principle, the process details and a photograph of the set up for the process are given below





Process flow diagram

Plasticwaste Plasma Gasifier (20 kg/hr.)

Specification of 20 kg/hr. Plastic waste plasma gasifier:

Input

Raw materials:	Plastic waste
Feed rate:	20 Kg/hr.
Feed size:	6-8 mm
Power requirements:	20 kW
At voltage:	70V
Current:	130 Amp

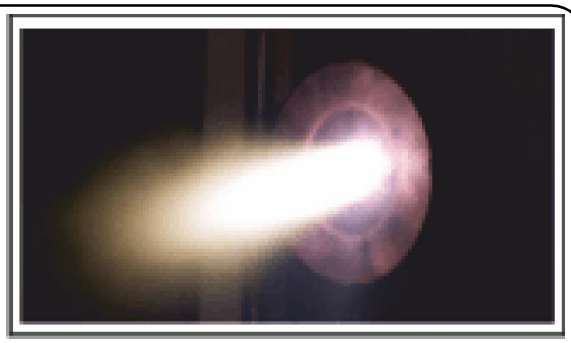
Output

Reactor temp.:	1600°C at wall
Gas composition (%):	
H2:	13-17%
CxHy:	26-51%
CO:	4-6%
Net power generation:	40 kW (Gross 60KW – Torch Consumption of 20Kw

Processes for feeding 100 Kgs per hour generating a net output of 200 KW per hour have been developed and tested.

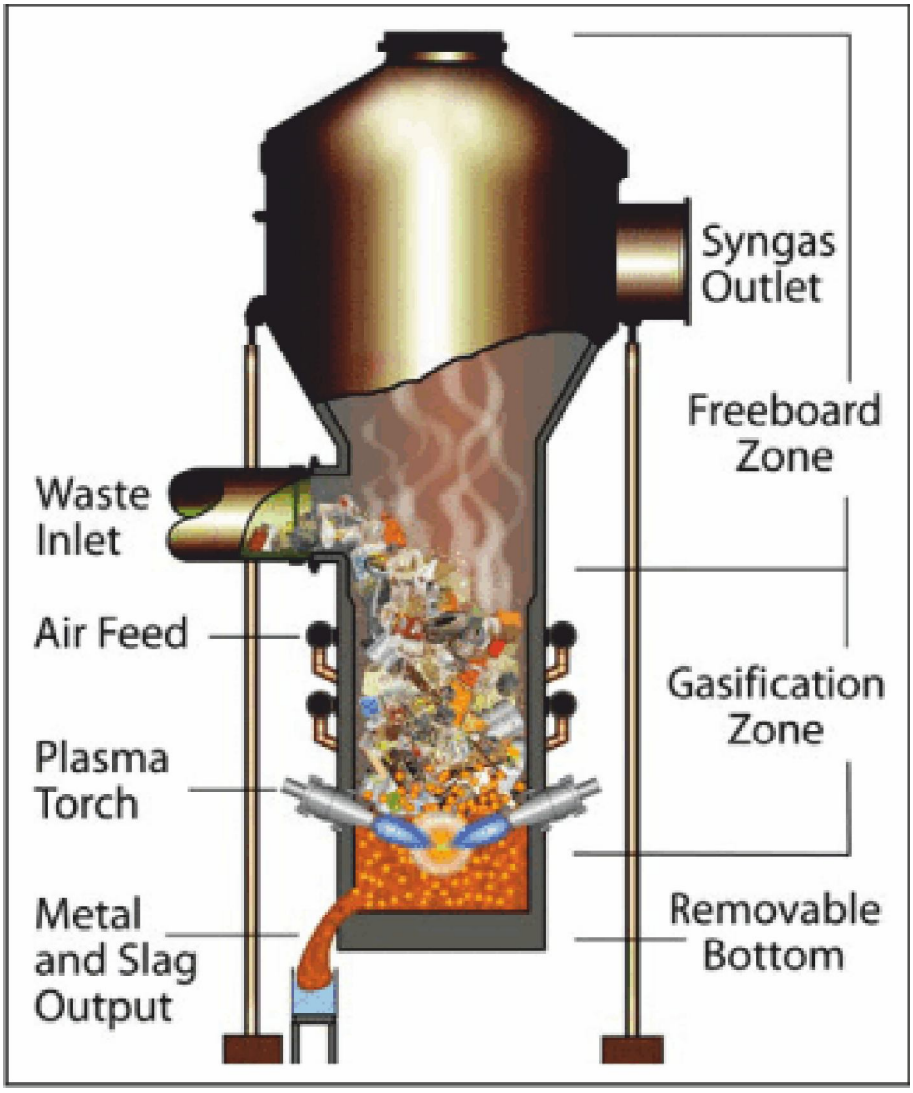
Analyzing the overall efficiency of the system, it is seen that in the CSIR developed system, the captive consumption of power is almost 33%. At International level, Plasma Gasification Torches are developed with captive power consumption of as little as 5% and standardized ratings of Torches from 30KW onwards of available and Plasma Gasification systems are developed using these.

More Details on the Plasma Gasification Process



The main aspect of gasification, whether it is plasma-arc plasma gasification or "traditional" gasification is to raise carbon–rich materials or waste to a high temperature in an oxygen–deficient reactor, where the materials break down thermo chemically versus combustion.

This process is more efficient than incineration, has a significantly lower environmental footprint, while the syngas can be transformed into a number of end products (liquid fuels, power, chemicals, etc.).



The feed stocks for traditional gasification processes range from coal, the organic components of municipal waste and biomass while the range is even greater for plasma-arc plasma gasification processes, which can handle just about any waste stream with the exception of radioactive materials.

Due to the fact that gasification occurs pre-combustion (assuming the syngas would be burned to generate electricity), it supports easier carbon capture than incineration where the chemistry can be more complex.

Plasma-arc plasma gasification is just one type of gasification. Other common forms include (1) updraft, (2) downdraft, (3) fixed bed and (4) fluidized bed. The first two are quick similar with exception of the gas flow.

To address plastic wastes in particular, immediate plans can be put in place by the concerned parties to set up adequate numbers of different capacities (matching with the rate of waste collection) of Plasma Gasifiers to arrange for conversion to electricity and disposal of plastic wastes in a decentralized manner as and when they are collected. This will also form a part of solution of 'De centralized Generation' of Electricity.

(To be continued)

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

I've heard there's going to be a recession.
I've decided not to participate."
– WALT DISNEY

தமிழ்நாடு அரசு

மக்கள் நல்வாழ்வு மற்றும் குடும்பநலத்துறை

இந்திய மருத்துவம் மற்றும் ஹோமியோபதி ஆணையரகம்

நிலவேம்பு குடிநீர்

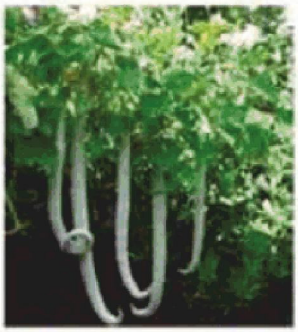
இவற்றில் சேரும் மருந்துகள்

நிலவேம்பு

வெட்டிவேர்

விலாமிச்சம்வேர்

சந்தனம்



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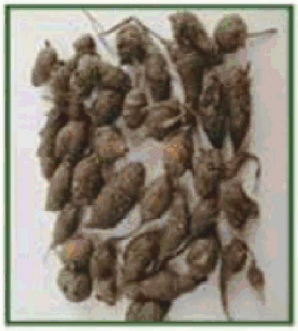

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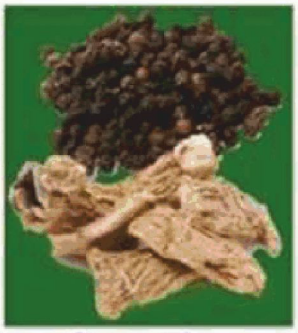
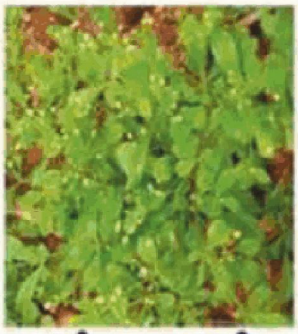


சுக்கு,மிளகு



பற்பாடகம்

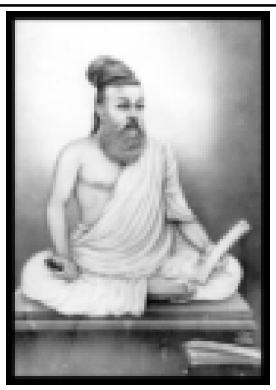
குடிநீர் அளவு

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 - 10



There are some basic characteristics for men in Management to aim and practice Ethical Management and Tiruvalluvar has lots and lots to convey in this regard. Let us see some samples in the area of being fair and courteous.

Apart from being men of knowledge, wisdom and training, they should possess love for justice and righteousness and ensure smooth functioning and harmony all around.

Nayanodu Nandripurintha Payanudaiyar
Nandri Paarattum Ulagu ***Kural 994***

நயனொடு நன்றி புரிந்த பயனுடையார்
பண்புபா ராட்டும் உலகு. *குறள் 994*

"Behold the men who love justice and righteousness and who are of a helpful disposition; the world setteth a high value on their manners"

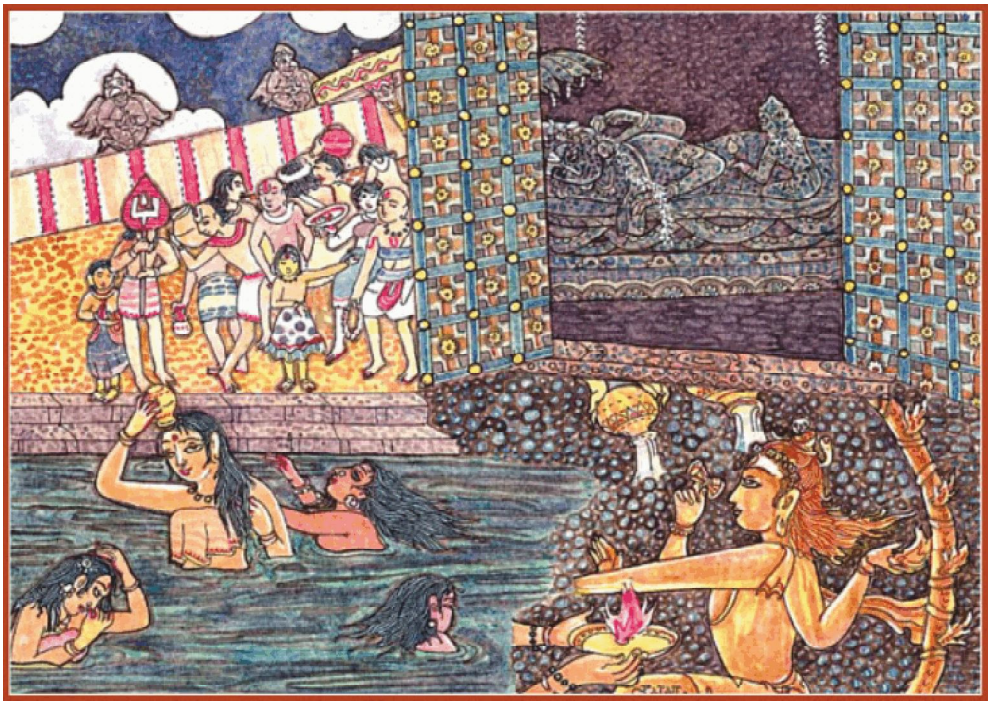
Panbudaiyar Pattundu Ulagam; Athuvindrel
Panbukku Maayvathu Man ***Kural 996***

பண்புடையார்ப் பட்டுண்டு உலகம் அதுஇன்றேல்
மண்புக்கு மாய்வது மன். *குறள் 996*

"The world goeth on smoothly because of the men of good breeding; verily, but for them, all this harmony would be dead and buried in the dust"

HOME FESTIVALS - 12

மார்கழி - Markali (December/January)



During Tirupuval (below, in upper left of painting), people bathe (lower left) and gather in the early morning to go on procession singing devotional Vaishnava songs (upper left). Especially popular are those of the 9th century lady saint Andal, venerated as one of South India's greatest devotional poets. On **Vaikunth Ekadasi**, the 11th day of the lunar month, the doors of the huge temple of Srirangam are opened to devotees from morning to night for darshan of Rangam, an aspect of Lord Vishnu, sleeping on Adishani, the serpent king (upper right). Another famed festival is **Ardra Darshana**, when Siva Nataraja is decorated and taken from the temple in procession throughout the community (lower right). Especially the ill and those of old age seek to have a glimpse of Nataraj. A renowned sweet, **aurudra kalli**, is made with vegetables on this day.

"All of these festivals are earnestly conducted. People wait for the day with their mind on God. The purpose is to gather in the home and worship for the prosperity of the family and of all mankind."

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