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Consulting Electrical Engineers Association of Maharashtra

CEEAMA E-NEWS

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From the President's Desk

Dear All,

Greetings from CEEAMA Governing Council (GC).

We are pleased to receive good response from members in the form of comments on the draft of the letter, to be issued to power ministry of Maharashtra Government; in connection with accreditation of CEEAMA members as Safety engineers. However, we have received very few suggestions on structure of CEEAMA-E-News.

I am sure that all of us have become member of CEEAMA to share our experiences with each other and get mutually benefited. Keeping this in mind, I once again Request you all to increase the involvement for betterment of CEEAMA. It may be by way of writing articles or case studies, giving constructive feedbacks, etc. As informed earlier, in case you are having the contents and not sure about the language to be used, you may write in your style and we will provide editorial help to make it printable. Suggest taking first very simple step by dropping in your suggestions and /or review of CEEAMA-E-NEWS at admin@ceeama.org.

Hope all of you have marked your diary for CEEAMATECH-2018. We are now engaged in planning the activities for CEEAMTECH-2018 - one day conference cum exhibition at NSE-Goregaon, Mumbai.

We are on the verge of end of the year and we all shall be taking a look back to see about our accomplishments on our new year resolutions- at the beginning of 2017. Wish that most of you have achieved your goals. Also we shall start thinking on new goals to be set.

Thanks & Regards,

Anil Bhandari

Hon. President

In This Issue...

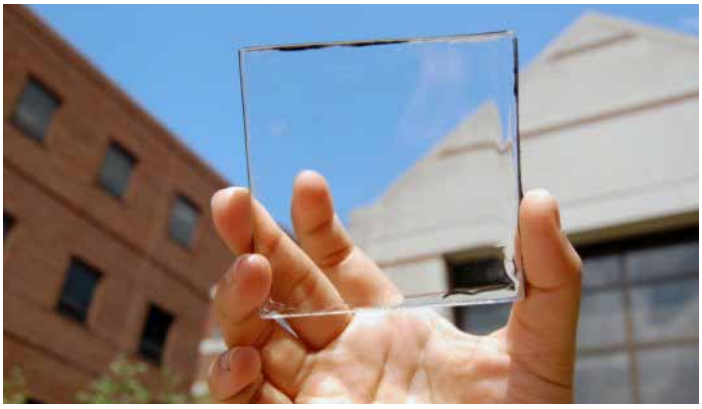
What is New?

"Transparent solar technology represents 'wave of the future'."

Michigan State University. ScienceDaily, 23 October 2017

See-through solar materials that can be applied to windows represent a massive source of untapped energy and could harvest as much power as bigger, bulkier rooftop solar units, scientists report in Nature Energy.

"Highly transparent solar cells represent the wave of the future for



See-through solar-harvesting applications, such as this module pioneered at Michigan State University, could potentially produce 40 percent of U.S. electricity demand.

Credit: Michigan State University

new solar applications," said Richard Lunt, the Johansen Crosby Endowed Associate Professor of Chemical Engineering and Materials Science at MSU. "We analyzed their potential and show that by harvesting only invisible light, these devices can provide a similar electricity-generation potential as rooftop solar while providing additional functionality to enhance the efficiency of buildings, automobiles and mobile electronics."

Lunt and colleagues at MSU pioneered the development of a transparent luminescent solar concentrator that when placed on a window creates solar energy without disrupting the view. The thin, plastic-like material can be used on buildings, car windows, cell phones or other devices with a clear surface.

The solar-harvesting system uses organic molecules developed by Lunt and his team to absorb invisible wavelengths of sunlight. The researchers can "tune" these materials to pick up just the ultraviolet and the near-infrared wavelengths that then convert this energy into electricity

But in terms of overall electricity potential, the authors of this paper note that there is an estimated 5 billion to 7 billion square meters of glass surface in the United States. And with that much glass to cover; transparent solar technologies have the potential of supplying some 40 percent of energy demand in the U.S. -- about the same potential as rooftop solar units.

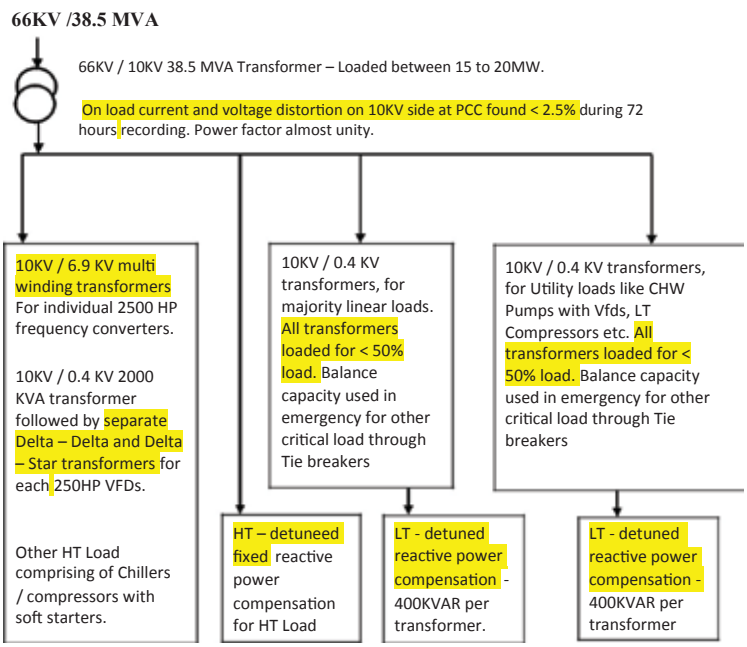
"Story Source:

Michigan State University Source Https://Www.Sciencedaily.Com/Releases/2017/10/171023123526.Html

Technical Notes

Subject: Traditional ways of Current Harmonic Mitigation: During Oct 15, we conducted power quality audit of a large engineering company in China with a running load of 18MW. About 10MW load was non linear involving AC / DC drives and frequency converters of ratings ranging from 80HP to 2500HP. The client is of American origin and the plant is hardly 5 years OLD. Entire electrical system is designed by American consultants and executed by Siemens, employing state of the art automation. This puts stringent demands on power quality. I found all conventional methods used in this plant to mitigate harmonics at load end and power quality maintained within required limits. Initial investment was obviously more but the solution is long lasting and almost maintenance free. In today's crowd of Active Harmonic filters, RTPFC, tuned filters, detuned filters, capacitors etc suggested by equipment manufacturers mostly for wrong reasons and with wrong intentions, I thought of sharing this experience with CEEAMA members.

Block diagram of electrical system.



LT side power factor is almost unity at secondary side of all the transformers – minimizing cable and transformer losses. Voltage distortion < 1.5%, current distortion < 10%

I had referred Dr. Prof. Rammoorthy's book (who was professor in IIT Kanpur at that time) on power – electronics during my graduation days in early 80's. The book had advised to use multi - winding transformers, line and load reactors, using natural phase shift due to delta – star arrangements between non linear loads running simultaneously to restrict harmonics at next upstream level.

Highlights of above arrangement:

1) Every large non linear load has a multi winding or delta – star transformer at the input. This results into multi pulse rectification and reduced upstream harmonics.
2) All step down transformers are loaded up to 50% only. Results into keeping voltage harmonic distortion under control while handling non linear current.
3) Power factor correction at all levels is done using detuned filters, avoiding resonance.
4) Balance capacity of transformers is used as standby capacity for critical feeders.
5) Plant has experienced less than 10 electrical and electronic failures in more than 35000 continuous working hours.
6) Plant meets all statutory requirements regarding harmonic control and power factor.
7) Plant invested about 30% extra in electrical systems while purchasing extra capacity transformers, while the project cost increased marginally due to this. This was recovered by avoiding breakdowns and associated production loss in very little time.
8) Most of the electrical distribution handles very less harmonic currents thereby increasing life of electrical system.

As against this in most of the plants we do not see recommendation of such systems to reduce initial investment. Latter on whenever the harmonics prevailing in the system start troubling the system, half hearted efforts are made without considering the theoretical requirements. The vendors suggest unnecessary equipment as a part of their business and the results are either complicating the system or partial compliance.

With increasing percentage of non linear loads, the issue of harmonics needs to be considered at design stage and solutions should be implemented in a planned way. The importance of restricting and / or limiting the harmonics at their source – which is nonlinear load should be understood and practiced to help maintaining required level of power quality.

Prepared by

Narendra Duvedi

Article

STATUS AND TECHNICAL ASPECTS OF SOLAR SYSTEM

INTRODUCTION

India is a power deficit state. As of 2013, we have a peak deficit of 12.9% and energy deficit of 10.3%. There are coal and gas shortages. As an example in Maharashtra Mahagenco was able to generate only 37% of its capability in thermal generation due to lack of coal. RGPPL is closed due to shortage of gas. Nuclear generation is moving at a snail's pace since so many years. On this background, the cost of solar generation has considerably reduced over the years. The most important aspect of solar is it can provide the electrical energy to our isolated rural areas where grid has not reached so far. The installation can be done in a short time compared to thermal besides being pollution free.

Jawaharlal Nehru National Solar Mission (JNNSM)

This scheme has been able to put India on the global solar Map. It has two objectives:

1. To promote solar power generation:

This objective has higher priority and the central government has set a target of 20,000 MW by 2022. Out of this 2,000 MW is expected to be contributed by small installations ranging from 0 to 1000 kwP. Solar lighting schemes for villages, roof top installations, etc. are examples of such installations. Remaining 18,000 MW are expected to come from utility scale installations with capacities of 1 MW and above.

In Phase I of JNNSM, Gujarat took a lead to fulfil this policy to a large extent and had nearly 850 MW out of the total around 1880 MW capacity installed all over India. Rajasthan comes next with a total installed capacity of around 200 MW. Recently they have announced a mega project with 1000 MW expected in 2016. Other states like Tamil Nadu, Karnataka, Andhra Pradesh, Madhya Pradesh, and Orissa have contributed up to 25 MW. Maharashtra had abysmal performance till recently, but Mahagenco's 125 MW solar plant in Sakri – the largest solar PV plant at a single location in India till date – and Tata Power Solar's 25 MW plant near Satara have helped improve its numbers. 10,000 MW of solar capacity is expected to be installed in phase 2 in the next five years. Tamil Nadu and Andhra Pradesh have announced a target of 3,000MW by 2015.

2. To promote domestic manufacturing of solar equipment:

By imposing the condition that capital subsidy will be available only on Indian manufactured PVpanels, the Indian government tried to encourage manufacturing of PV panels in India. While many Indian companies have got into the fray and manufacture PV panels as of today with a decent chunk of it meant for exporting. These companies haven't been able to make much of an impact in the global market where Chinese manufacturers rule the most. The largest Indian manufacturer has an annual manufacturing capacity of 200 MW; the largest Chinese company manufactures PV panels in the GW range. With introduction of "net metering", roof top solar market is also expected to grow at an accelerated pace.

Technical Aspects of Solar

i. Solar Power system Components

A typical solar system consist of solar PV panels (built up from solar cells), power control unit (PCU), batteries, mounting structures for the PV panels, and the cables. PV cells are made

Residential Solar Sun power – 5

Typical Solar PV Panel Installation

of crystalline silicon or thin film. The former have higher conversion efficiencies ranging from 13% to 16%, whereas the latter have lower efficiencies ranging from 8% to 11% but are much lower in cost though. The task before cell manufacturers is to increase the efficiency to higher values around 25%.

ii. Amount of electricity generated

The amount of solar energy generated by the PV panels depend on amount of insolation they receive. In India, the daily solar radiation varies greatly from one place to another and varies 4 to 7 kWh/m2/day. Needless to say, the solar radiation levels go down when there is a cloud cover. The solar radiation levels also change with the angle at which they are incident on the PV panels.

The number of units generated by PV panel varies from 3 to 5 units/kw per day. Most places get 300 clear sunny days in a year; some places may get more and some may get less. The number of units generated reduces due to high ambient temperature (for every degree that the temperature is higher than 25 degrees, the number of units generated decreases by 0.3% to 0.5%). Module mismatch loss, DC and AC cable loss, and inverter loss are the other types of losses. Needless to say, PV panels will generate lesser number of units if they are not cleaned regularly and if you let dust or other stuff collect on it.

iii. Modes of operation.

a) Grid connected solar system: These are usually utility scale solar power plants which feed electricity into the grid. Power plants with capacities ranging from 1 MW to 10 MW can be connected to 11 KV, 22 KV, or 33 KV sub stations; larger power plants have to be connected to 66 KV or 132 KV sub stations.

b) Grid supportive or grid paralleled solar system without batteries: These are smaller capacity power plants ranging from 0 to 500 kwP which feed electricity to the loads after the metering point and takes care of day time energy needs. The connection with the grid is maintained. So, if the solar system is not generating any electricity or isn't generating enough, electricity is drawn from the grid. The solar system always gets higher priority but is not allowed to feed to the grid as per the current rules in Maharashtra and many other states. 0 to 100 kwP systems are installed on roof tops of small to large houses or buildings, while the large systems ranging from 100 kwP to 500 kwP are installed for commercial and industrial consumers.

These systems do not work when the grid fails since they have to be synchronized with the grid; it is counter-intuitive, but it is true. For solar systems to work when the grid fails, they have to have a backup either from the batteries or from a DG set.

c) Grid supportive or grid paralleled solar system with batteries: These types of systems are similar to the system (2) except that they work even when the grid fails. The batteries get charged when the load is less than the maximum electricity that the solar system is capable of generating. The batteries can also be charged from the grid. The batteries provide the power during non-sunshine hours. However, they have to be sized properly to ensure that they provide as much energy as is required. These systems are perfectly suited for energy supply during non sunshine hours.

d) Grid supportive or grid paralleled solar system with DG set: These types of systems are typically used for industries where the grid interruptions are frequent but power failure cannot be tolerated. The DG set can come online automatically or may have to be switched on manually. Either way, when it does come online, the solar system starts feeding the loads again and reduces the diesel consumed by the DG sets. In such cases, solar systems are very attractive because they will result in savings of fuel cost. DG set's running cost is in excess of Rs.15 per unit at today's rates of diesel.

e) Off grid solar system with batteries: These systems are typically small capacity systems where the grid is not there. Although we take electricity for granted in urban areas, there are approximately 300 million people in India without access to electricity, believe it or not. The population of such people is the highest in the states of Bihar and Uttar Pradesh. Jharkhand Madhya Pradesh, Chhattisgarh, West Bengal, and Orissa. Off grid systems are also very popular for telecom towers in remote places.

iv. Cost aspects

The cost of solar systems as on today is considerably reduced. The cost without batteries varies from Rs.100 to Rs.125 per watt, whereas the cost of systems with batteries varies from Rs.180 to Rs.250 per watt. There is no doubt that solar generation cost will soon reach grid parity.

v. Space Required. The space required is a challenge and roughly 5 acres of land required per MW of project size. It is for the state governments to locate the unused waste land and make it available for solar projects. State like Rajasthan has recently declared mega project of 4000 MW size. On a smaller scale around 10 sq m of area is required on Roof top per KW for PV Panels. The space for other components is negligible.

vi. Companies in solar Business

Visa Power, Sterling Wilson, Sun Edison, Waaree, Premier Solar Systems, Welspun Energy, Mahindra EPC and Oerlikon Solar and many others are into solar Photovoltaic and Clique Solar in Solar Thermal technology applications.

Thrust Required from Govt.

The Indian govt need to think about revising its strategy. There is a need to offer cheaper loans i.e. with reduced interest rates and to provide incentives to international module manufacturers to invest in

India. Govt should offer income tax benefits on the EMI (Equated Monthly Instalments) to be paid to lending banks. Banks should offer lower interests loans for solar growth. Govt should remove VAT on manufacturing of solar modules and encourage attractive Feed in Tariff for growth of solar generation and to achieve completion of Phase ii and phase iii of JNNSM before 2022.

In Maharashtra we do not have so far clear policy document on this subject even though some other few states like Gujarat, Uttarakhand, Andhrapradesh etc have taken lead in this matter . This needs to be issued by Maharashtra govt on priority in order to encourage the growth of solar energy in the state.

Mr. P P Karhade
Certified Energy Manager by BEE. CEEAMA LFM, Indian Inst. of Engrs. Fellow MSEB - 9 years, Tata Consulting Engineers - 25 years and retired as chief engineer

Mark your Diary

17th Nov 2017 : Visit to Siemens factory, Kalwa.

Proposed Agenda shall be :

Introduction and briefing on Standards applicable to LV Switchgear, Network planning and Innovative products, Introduction to Medium Voltage product portfolio AIS, GIS, Compact Substation.

24 Nov 2017: Technical Seminar by Essener Transformer, Tarwade Clark's Inn, Pune

Seminar Topics:

- Welcome to new Indian standards IS 1180
- Solar Inverter Duty Transformers
- Cast Resin Dry Type Transformers