VOLTAFFAIR 2016

Departmental Journal of Electrical Engineering

Technique Polytechnic Institute

Panchrokhi, Sugandhya, Hooghly

West Bengal-712102

EDITORIAL

It is great privilege to bring before you the technical magazine of the department of Electrical Engineering. Students are gradually getting interested in self-study and study beyond syllabus. They come up with interesting ideas and technologies. This year students have also participated in the publication of the technical magazine. The faculty members have thrown light on some interesting topics. As management is a very important aspect of engineering, project management has also been discussed. Hope it will intrigue in the readers and urge to read the articles.

INTRODUCTION

Busy with the framed schedule and academic calendar, we often miss out some interesting technologies of the ever-growing world of innovations. Whether it is energy, power, storage, measurement, instrumentation or management, technologies are ever widening. It is a responsibility of the engineers to keep track of the new technologies as well as research on further possibilities. This technical magazine contains some interesting aspects of engineering and management.

Editor	Mr. Avijit Karmakar, Lecturer, In – Charge
Faculty Members	Miss. Anjana Sengupta, Lecturer
	Mr. Rajeev Kumar, Lecturer
	Mr. Ayan Ghosh, Lecturer
	Mr. Snehashis Das, Lecturer
	Mr. Shamik Chattaraj, Lecturer
	Mr. Kaustav Mallick, Lecturer
	Mr. Pintu Das, Technical Assistant
	Mr. Sk. Ansar, Support Staff
Our Sincere Thanks to	Mr. Tapas Kumar Saha, Chairman, Governing Body, Technique Polytechnic Institute
	Mr. Soumendra Nath Basu, Executive Director, Technique Polytechnic Institute
	Mr. Abhijit Chakroborty, Principal, Technique Polytechnic Institute
	Mr. Partha Sarathi Bhattacharya, Co-ordinator, Technique Polytechnic Institute
Publisher	Department of Electrical Engineering
	Technique Polytechnic Institute
	Panchrokhi, Sugandhya, Hooghly
	West Bengal – 712102
	©Voltaffair – 2015, Department of Electrical Engineering

CONTENTS

Project- Planning, Supervision and Evaluation

ANJANA SENGUPTA

Lecturer of Electrical Engineering Department

Technique Polytechnic Institute, Hooghly, West Bengal, India

Email id: anju.aeccrj@gmail.com

ABSTRACT

A Very important programme outcome expected from the diploma or B.Tech engineering students is that they should be able to plan, supervise and analyze a project. All these qualities contribute in an engineer developing his entrepreneurial skills. The wave of MAKE IN INDIA will need contribution from the fresh graduates who should have in them the qualities of an entrepreneur embedded. In the process decision taking forms an important part. This paper covers some aspects an engineer should be aware of while participating in a project which may be departmental or multidisciplinary and participation may be as a group member or as a leader.

A. INTRODUCTION

Over the past decade the use of projects at the undergraduate level in the University curricula has been seen as increasingly important for a number of reasons. The project works have always been viewed as an effective means of research training and of encouraging discovery approach to learning through the generation and analysis of primary data. This type of approach is aimed at the development of higher level of cognitive skills such as analysis, synthesis and evaluation. Apart from this a project is considered as an effective means of-

- Diversifying assessment;
- Promoting transferable skills and skills of employability;
- Empowering the learner;
- Motivating students into self-learning;
- Development of multidisciplinary studies.

B. WHAT IS PROJECT?

Before going into details we should know what actually a project is. A project is a long term programme which has a particular starting time and ending time. It involves planning for the basic course of action and allocation of resources. The resources may be human resources, material resources or the required knowledge or technology. The course of action can be divided into four distinct parts- ideation, planning, execution, evaluation and analysis. The various steps of project work as should be followed by a student are as follows:

- The student selects the project topic;
- Locates own resource material;
- Presents an end product;
- Conducts and independent piece of work;

The project lasts for a period of time under the guidance of teacher.

As a matter of fact the project work is intended to integrate the attitude, skill and knowledge (famously known as ASK) which the student should have acquired over the entire period of courses of study. It should have a measurable and achievable outcome, a realistic time frame \; an action plan and persons identified for each activity. The project work consists of various merit components relating students. They are:

- Develops decision making skills;
- Develops idea of designing and presenting;
- Enhances innovation skills;
- Encourages interest in taking initiatives;
- Enhances confidence and skills to solve problems.

C. OBJECTIVES OF THE LEARNING STRATEGY

The objective of choosing a project should be clear to the students and the supervisor. A teaching learning process may precede the project so that the objectives are clear. The project should encourage student centered learning and not only be traditional. The project work also should invoke research techniques and methods among students. The unique feature of project signifies the shift of control from supervisor to supervise which imposes the greatest challenge to both students and supervisor.

D. SUPERVISOR OF PROJECT WORK

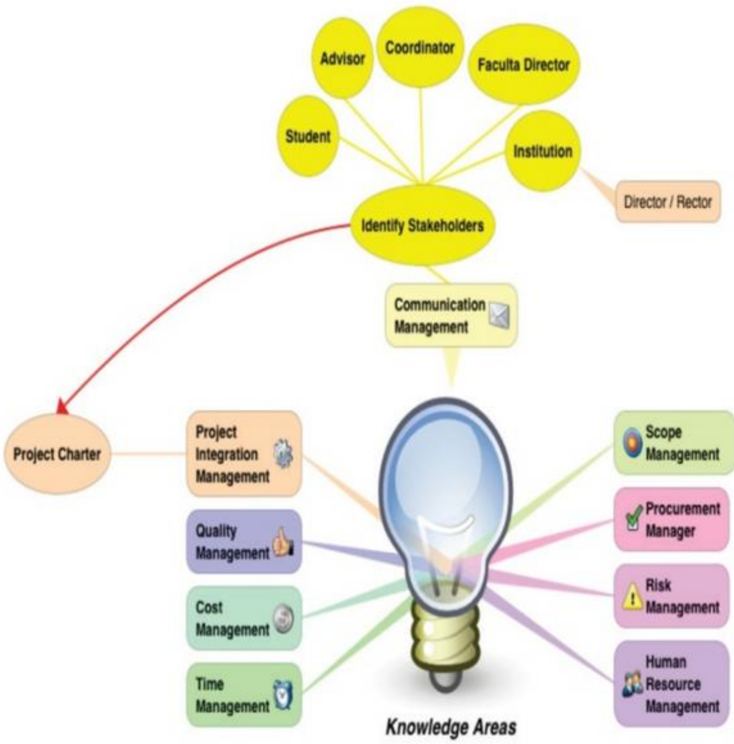
The supervisor has a very important role to play in the project work. The supervision requires a time bound managed activity that requires management skills on the part of both supervisor and supervisee. In the process the teacher should take up the role of a facilitator who can easily transfer the control to the students. Before taking up the role of a supervisor the teacher should evaluate whether they themselves are suitable for the role. The key points to be checked are:

- Their own motivation in choosing a project as a learning strategy;
- Whether to opt for structured or unstructured projects;
- Ways of broadening the prospects of supporting the team members.

The following pictorial representation provides an insight into the various aspects a supervisor should take care of during the various stages of the project work. And the various stratas of an institution involved in the process.

The four major features of the supervisory frame work requiring planning and sharing are:

- Determination and reaching of agreement regarding educational objectives;
- Determination and reaching of agreement on specific objectives to include formative deadlines;
- Reaching agreement on set targets;
- Review and ensure understanding of the assessment criteria.



E. STUCTURED AND UNSTRUCTURED PROJECTS

The required framework is planned before starting to decide whether the project is Structured or unstructured. Though generating a framework of the project helps in the time, cost and quality management structured projects also have some disadvantages. They are:

- Insufficiently open ended;
- Too prescriptive;
- Offering rationalist approach;
- Lacking constructive approach;
- Absence of real challenges.

And though the unstructured or semi-structured projects don't provide a preview, the positive aspects are:

- Promotes a deep approach in learning;
- Allows potential for students to progress along a hierarchy of understanding;
- Encourages awareness among students.

In short the management of work schedule of a supervisor can be divided into the following:

- Planning for the supervision;
- Agenda preparation;
- Collecting Information needed to be referred.
- Arrangement for the supervision meeting;
- Well-structured meeting.

F. EVALUATION OF PROJECT WORK

The evaluation of performance of a student after completion of the project according to objectives shall be performed to verify:

- Awareness of basic factors involved in successful completion of the project;
- Skill in utilizing standard codes of practice;
- Skill in fabrication and in utilizing the machines and tools;
- Resourcefulness and initiative in collecting information and making use of available resources;
- Ability to analyze and solve problems independently;
- Quality of work regarding its utility;
- Confidence on his/her ability to arrive at the goal;
- Preparedness to try other alternative in case of failure at any stage.

Proper evaluation pattern would always provide justice to the worth of project work. In technical institutions generally two types of project works are followed-

- Design and implementation based projects
- Design based projects.

Thus the evaluation process also varies. The evaluation process may be in tabulated form.

The following may be considered a generalized pattern of evaluation.

G. PROJECT TYPE: DESIGN BASED

STUDENT'S NAME:
ROLL NO:
TITLE:

Mark the suitable block for each criterion.

Criteria	Excellent	Satisfactory	Unsatisfactory
Background-general understanding of the subject			
Report organization and structure			
Justified conclusions and critical appraisal			
Key problems identified and solved			
Documentation			
Whether objectives were achieved fully			
Requirements and objectives well understood and presented			
Appropriate use of design methodology			
Overall quality of the final design			
Verification of the design (prototyping)			
Practicality of the design			
Count the ticks in each column			

H. PROJECT TYPE: DESIGN AND IMPLEMENTATION BASED

STUDENT'S NAME:
ROLL NO:
TITLE:

Mark the suitable block for each criterion.

Criteria	Excellent	Satisfactory	Unsatisfactory
Background-general understanding of the subject			
Report organization and structure			
Justified conclusions and critical appraisal			
Key problems identified and solved			
Documentation			
Whether objectives were achieved fully			
Requirements and objectives well understood and presented			
Appropriate use of design methodology			
Overall quality of the final design			
Verification of the design (prototyping)			
Practicality of the design			
Count the ticks in each column			

I. CONCLUSION

A project can be described as a unique learning opportunity where students can demonstrate project management skills and a time bound domain. The project work is clearly a student centered learning experience where a teacher takes up the role of supervisor. Further supervisor's management and interpersonal skills can also be tested through the process. But before starting a project analysis of the strengths, weaknesses, opportunities and threats (commonly known as SWOT ANALYSIS) should be done to measure the practicality of a project.

J. REFERENCE

1. A handbook for teaching and learning in higher education- Heather fry, Steve Ketteridge, Stephanie Marshall.
2. Project Management Principles Applied in Academic Research Projects
   Pollyana Notargiacomo Mustaro & Rogério Rossi Mackenzie Presbyterian University, São Paulo, SP, Brazil.

Energy-Efficient Motors

AYAN GHOSH

Lecturer of Electrical Engineering Department

Technique Polytechnic Institute, Hooghly, West Bengal, India

Email id: ayan0589@gmail.com

ABSTRACT

Electric motor systems account for about 60 percent of industrial electricity consumption and about 15 percent of final energy use in industry worldwide. It is estimated that a full implementation of efficiency improvement options could reduce worldwide electricity demand by about 7 percent. Electric motors drive both core industrial processes, like presses or rolls, and auxiliary systems, like compressed air generation, ventilation or water pumping. They are utilized throughout all industrial branches, though the main applications vary. With only some exceptions, electric motors are the main source for the provision of mechanical energy in industry. Size classes vary between motors with less than one kW and large industrial motors with several MW rated power. In recent years, many studies identified large energy efficiency potentials in electric motors and motor systems with many saving options showing very short payback times and high cost-effectiveness.

Still, investments in improving the energy efficiency of electric motor systems are often delayed or rejected in favor of alternative investments. Different barriers and market failures were found to be responsible for that. Among them are a lack of attention of the plant manager, principal agent dilemmas, higher initial cost for efficient motors and many more. Particularly in developing countries, access to capital and initial higher costs of energy efficient motors are a very relevant barrier. In many cases, broken motors are rewound and reused even though motor rewinding often reduces its efficiency.

Keywords: Efficiency, Electric motor drive, Payback time, cost-effectiveness etc.

A. INTRODUCTION

The electric motor has a long history of development since its invention in 1887, with most early effort aimed at improving power and torque and reducing cost. The need for higher efficiency became apparent during the late 1970s and by the early 1980s. Energy-efficient motors (EEM) are the ones in which, design improvements are incorporated**.** Specifically to increase operating efficiency over motors of standard design (as shown in Figure 1).Design improvements focus on reducing intrinsic motor losses. Improvements include the use of lower-loss silicon steel, a longer core (to increase active material), and thicker wires (to reduce resistance),

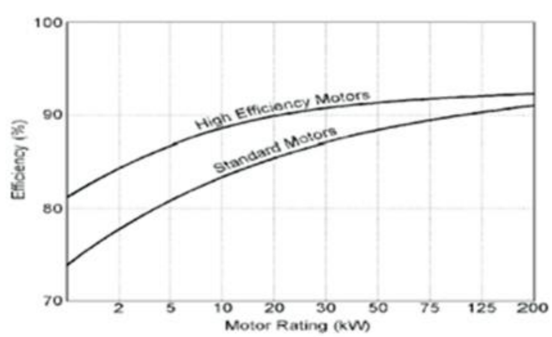


Figure 1: Standard Vs. High Efficiency Motors Efficiency according to Motor Rating (kW)

thinner laminations, smaller air gap between stator and rotor, copper instead of aluminum bars in the rotor, superior bearings and a smaller fan, etc.

Energy-efficient motors now available in India operate with efficiencies that are typically 3 to 4 percentage points higher than standard motors. These motors are designed to operate without loss in efficiency at loads between 75 % and 100 % of rated capacity. This may result in major benefits in varying load applications. The power factor is about the same or may be higher than for standard motors. Furthermore, energy- efficient motors have lower operating temperatures and noise levels, greater ability to accelerate higher-inertia loads, and are less affected by supply voltage fluctuations.

Energy-efficient motors offer other benefits. Because they are constructed with improved manufacturing techniques and superior materials, energy-efficient motors usually have higher service factors, longer insulation and bearing lives, lower waste heat output, and less vibration, all of which increase reliability. Most motor manufacturers offer longer warranties for their most efficient models.

An electric motor can consume electricity to the equivalent of its capital cost within the first 500 hours of operation - a mere three weeks of continuous use, or three months of single shift working. Every year, the running cost of the motor will be from four to sixteen times its capital cost. Over its working life, an average of thirteen years, it may consume over 200 times its capital cost in energy. Clearly, the lowest overall cost will not be achieved unless both capital and running costs are considered together.

B. ENERGY LOSSES

It must be emphasized that the standard electric motor is already a very efficient device with efficiencies above 80% over most of the working range, rising to over 90% at full load. However, because of the high energy consumption, and the very large number of installed units, even a small increase in efficiency can have a major impact on costs. The efficiency of an electric motor depends on the choice of materials used for the core and windings, their physical arrangement and the care and precision with which they are handled and assembled. Losses can be categorized into two groups; those that are relatively independent of load (constant losses), and those that increase with load (load dependent losses). The factors that affect efficiency are:

Conductor content	(Load dependent)
Magnetic steel	(Mainly constant)
Thermal design	(Mainly load dependent)
Aerodynamic design	(Constant)
Manufacture and quality control	(Constant)

C. CONDUCTOR CONTENT

Resistive losses in the windings increase with the square of the current (which increases with the load) and normally account for around 35% of the total losses. These resistive losses can be reduced by putting more copper into the windings - using a thicker gauge wire - and improving manufacturing techniques to shorten the end windings (which do not contribute to output power but do contribute to loss). Since more copper requires more space, both for the end windings and in the stator slots, the volume of material in the magnetic circuit would be reduced, leading to earlier saturation and increased iron losses. Consequently, it is necessary to increase the length of the magnetic core, and sometimes the diameter as well. Normally, the increased length is accommodated by increasing the overhang at the non-drive end of the unit. Because copper losses are load-dependent, the benefit of increasing the copper content is most apparent at high loading. Since the coefficient of resistance of copper is positive, the losses increase as temperature rises.

D. MAGNETIC STEEL

Magnetic steel is the most expensive component of the motor, so any increase in the total amount used is undesirable on cost grounds. Core losses are those found in the stator-rotor magnetic steel and are due to hysteresis effect and eddy current effect during 50 Hz magnetization of the core material. These losses are independent of load and account for 20 – 25 % of the total losses. Hysteresis loss is due to the non-linearity of the flux density/magnetizing force curve and is a property of the steel itself and to minimize it two properties are required - a low energy loss grade of silicon steel laminations and good high field permeability, i.e. the steel must be easy to magnetize and must not saturate at high flux densities of up to 1.8 Tesla. This is the subject of on-going research that is making promising progress. Eddy-current losses are due to induced current in the stator laminations and are reduced by reducing the thickness of the laminations and by ensuring good insulation between adjacent laminations. Thinner laminations are, naturally much more expensive to produce and more difficult to handle, so the chosen thickness is always a compromise. Magnetic losses are particularly important when the supply is distorted by harmonics because eddy current losses increase with the square of the frequency while hysteresis losses are proportional to frequency. The benefit of using improved magnetic steel is a reduction in loss across the whole of the working range, but, because it is not load dependent, it is particularly apparent at low loadings.

E. THERMAL DESIGN

New modeling techniques have allowed the production of motors with optimized cooling flow, reduced clearances (increasing the efficiency of the magnetic circuit) and lower copper losses. Lower losses and good thermal design result in lower operating temperatures and hence a longer service life.

F. AERODYNAMICS

Most electric motors are cooled by drawing air through the windings by an integral fan and exhausting it over the externally ribbed casing. The airflow is complex and computer modeling has been used to optimize the design of the fan and cowling to produce more efficient cooling with a lower noise level. Windage losses can be reduced by careful design of the rotor.

G. MANUFACTURE & QUALITY CONTROL

The introduction of stresses in the magnetic steel during motor assembly can increase iron loss by up to 50%. By considering assembly techniques at the design stage and by paying attention to handling techniques, this increase in iron loss during manufacture has been reduced to negligible proportions. Eccentricity between the stator and rotor generates harmonic fluxes with consequently higher losses. The overall result of these improvements is an increase in efficiency of 3% (corresponding to a reduction in loss of about 30%) at full load and a halving of losses at low loads. Figure 2 shows the comparison between the efficiency of 75 kW standard and high-efficiency motors against actual load.

Because many motors spend considerable time running at low loading or idling, designers of high- efficiency units have paid great attention to reduction of the constant losses. The result is a halving of losses at loadings less than 25% load and an efficiency improvement of 3 to 5% at full load, a reduction in losses of about 28%. This represents an impressive achievement.

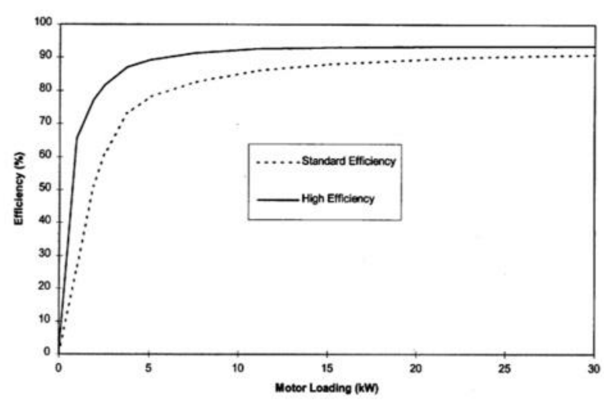


Figure 2: Standard Vs. High Efficiency Motors Efficiency according to Motor Loading (kW)

H. APPLICATION of HIGH EFFICIENCY MOTORS

The benefits of HE motors will only be realized if good installation techniques are used. Energy is lost in cabling. Voltage balance in three phase machines causes unbalanced currents in the stator winding. The effect is super-proportional i.e. the percentage unbalanced current is much higher than the percentage unbalanced voltage, causing significantly increased temperatures. The effect is equivalent to the introduction of a negative sequence voltage, i.e. one that has a rotation opposite to that of the fundamental, leading to higher current, reduced torque and reduced full-load speed. Preferably, the voltages should be balanced as closely as can be read on a voltmeter, and where this is not possible, the motor should be de-rated according to Figure 3. Operation above 5% unbalance is not recommended.

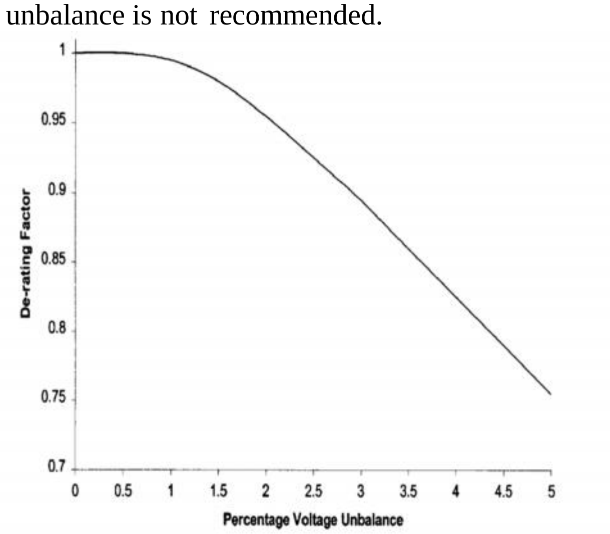


Figure 3: De-rating factor Vs. Percentage Voltage Unbalance

Voltage balance can be improved by segregating motor supply circuits, using oversized conductors to reduce voltage drop and ensuring that single-phase loads are not fed from a three phase motor circuit.

I. ECONOMIC JUSTIFICATION FOR SELECTING HIGH-EFFICIENCY MOTORS

Justifying a capital purchase is probably one the most difficult tasks. This is because there are so many methods of calculation, and even more opinions about which is right! There is enormous pressure to minimize the cost of projects, and this means that decision makers tend to be looking for lowest first cost. However, this initial cost is only part of the story - as mentioned above, a motor may consume up to 200 times its capital cost in electricity, so a proper examination must include running costs.

Starting from the premise that the need for, and cost justification of, the purchase of a new motor has been made, how can the selection of a premium quality motor be justified? As with any project, the capital outlay required, in this case the difference in cost between the high-efficiency motor and a standard unit, must be judged against the future cash, in this case the savings due to reduced energy consumption, generated in future years. The criteria by which the results are assessed will depend on the culture of the organization, and may often involve comparison with other potential uses for the capital available. Electrical Energy Efficiency defines some of the popular methods of calculation, together with several case histories, which demonstrate that, under a wide range of circumstances, the payback periods are typically around two years. This payback period is short enough to be considered a good investment by most organizations.

The economics of the installation of high-efficiency motors are best when new plant is being built. However, in certain circumstances, the cost of replacing an existing motor before the end of its serviceable life can be justified, but the economic considerations are more complex. It may be justified by comparing the additional cost of early replacement (the lost value of the residual life of the existing unit, the higher cost of immediate, rather than future, capital) with the future savings, or by taking account of future energy savings to avoid or delay the expense of increasing the capacity of

local supply transformers and circuits.
Another good time to consider the selection of high-efficiency motors is when an existing unit is being considered for rewinding. The efficiency of rewound motors is extremely important. The loss in efficiency on rewinding depends on the techniques; processes and skill used to perform the rewind, and is usually between 1 and 2%. If the choice is between rewinding a standard efficiency motor and purchasing a new HE motor, the difference in efficiency will be 4 to 5% at full load in favor of the HE motor, which will also have a much longer service life. It will be found more cost effective in most cases to prefer the new high-efficiency unit. The rewinding of HE motors has been studied with the objective of defining rewinding techniques which will limit the reduction in efficiency to 0.5%, so that the advantage of the HE motor can be preserved after rewinding.
Whenever a motor is to be newly installed or replaced, it should be standard practice to examine the cost benefits of selecting a high-efficiency type. The cost of running the plant can be estimated for both types of motors. If the 'equipment is going to be running for a significant proportion of each day, then it is very likely that it is worth selecting a high quality high-efficiency design. There is a need for a management policy commitment towards potential cost savings at the design and specification stages.

J. CONCLUSION

Over half of all electrical energy consumed in a country is used by electric motors. Improving the efficiency of electric motors and the equipment they drive can save energy, reduce operating costs, and improve the nation's productivity.
Energy efficiency should be a major consideration when we purchase or rewind a motor. The annual energy cost of running a motor is usually many times greater than its initial purchase price. For example, even at the relatively low energy rate of $0.04/kWh, a typical 20-horsepower (hp) continuously running motor uses almost $6,000 worth of electricity annually, about six times its initial purchase price.

K. REFERENCES

[1] Energy efficiency in electric motor systems: Technical potentials and policy approaches for developing countries (2011) - Tobias Fleiter, Fraunhofer Institute for Systems and Innovation Research Karlsruhe. Wolfgang Eichhammer, Fraunhofer Institute for Systems and Innovation Research Karlsruhe. Joachim Schleich Fraunhofer Institute for Systems and Innovation Research Karlsruhe.

[2] Energy-Efficient Electric Motor Selection Handbook (1993) - Gilbert A. McCoy, Todd Litman, John G. Douglass, Washington State Energy Office, Olympia, Washington

[3] BUYING AN ENERGY-EFFICIENT ELECTRIC MOTOR- a Program of the U.S. Department of Energy.

[4] ELECTRICAL DESIGN – A GOOD PRACTICE GUIDE (1997) - David Chapman, AMIEE

ROGOWOSKY COIL & Its APPLICATIONS

KAUSTAV MALLICK

Lecturer of Electrical Engineering Department

Technique Polytechnic Institute, Hooghly, West Bengal, India

Email id: kaustavmallick91@gmail.com

ABSTRACT:

This writing presents a brief idea about Rogowsky coil-it's working principle, its advantage design as well as its area of application. Going through this writing basic over view about Rogowsky sensing technology can be obtained.

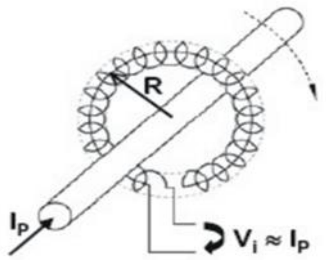
Key words: Rogowsky coil principle, benefits, Power and Power Quality Monitoring, Rectifier Monitoring, Relay Protection, switchgear etc.

A. INTRODUCTION

Modern days Rogowsky coil is providing most promising technology to be used in varieties of ac current monitoring application. Rogowski coils have been in use since 1912. Early applications of the technology were limited because the low output voltage was inadequate to drive the measuring equipment of the day. As the sensitivity of measurement equipment improved, Rogowski coils began to be used in a variety of specialized ac current monitoring applications. Solid state electronics and increased use of microprocessor technology provides opportunities to apply Rogowski coil technology in an ever widening range of Applications More recently Rogowski technology has been incorporated into commercially available sensor products in a variety of configurations, including the popular flexible type. These products offer several distinct advantages over other forms of ac current measurement, in some cases at lower cost.

B. WHAT IS ROGOWSKY COIL PRINCIPLE?

Rogowsky coil is basically named after the scientist Walter Rogowsky. It is being used for last few decades for measuring alternating current as well as transient current. It is toroidal coil without any iron core. Now this coil is placed around the conductor whose current is to be measured. Thus the magnetic field produced by the current carrying conductor induces voltage in the coil. Now this output voltage is proportional to the rate of change of current in the conductor. The output voltage is now fed TO AN INTEGRATOR CIRCUIT WHICH PRODUCES an output signal maintaining proportionality with the current.



Basic Rogowsky coil diagram

C. DESIGN

The wire loop may be configured as single turn simple helix or any other configuration used to form a sensor. Rogowsky coil sensor may be formed by making a flexible coil wound upon a nonferrous core or air core. One characteristic of this configuration is the coaxial routing of the coil end back to the beginning. This allows the coil end to be separated temporarily to allow installation around the primary conductor. If this co-axial return was not incorporated, the sensor would essentially become one turn loop around the conductor and the Rogowsky coil would be sensitive to any magnetic field which was perpendicular to the plane of coil.

D. MATHATHEMATICAL EXPRESSION

In this configuration the sensor provides a voltage output is proportional to the rate of change of magnetic field expressed as follows:

V = -K N A df/dt

Where:
K = Constant
N = Turns per length
A = Average area of a turn
df/dt = Time rate of change of magnetic flux
‘

The rate of change of the magnetic field is directly proportional to the rate of change of the primary current and the voltage output of a Rogowski coil can be defined by the following simplified equation.

V = -K N A dI/dt
Where,

dI/dt= rate of change of current.

E. MAIN FEATURES OF ROGOWOSKY COIL

1. Suitable to measure currents from mA to hundreds of kA.
2. High linearity
3. Wide dynamic range
4. Very useful with large size or awkward shaped conductors or in places
5. with limited access
6. No danger from open-circuited secondary
7. Not damaged by large overloads
8. Non-intrusive, no power drawn from the main

F. BENEFITS OF ROGOWOSKY COIL

- Low Cost
- Not influenced by external magnetic fields
- Are non-intrusive – draws no power from the main circuit
- Have a very wide Sensing bandwidth extending from 0.1 Hz up to 17 MHz
- Measures AC signals superimposed on a large DC Current
- No danger from open-circuited secondary

G. APPLICATION

The advantages offered by Rogowski technology are accuracy, measurement range, bandwidth, unlimited short circuit current tolerance and design flexibility are rapidly generating interest in a number of application. Some main applications are

- *Power and Power Quality Monitoring:*

Flexible Rogowski based current probes have gained rapid acceptance in the power monitoring and power quality industry. The advantages of a flexible measurement head and light weight are important factors to those involved in field studies of power and power quality. The advantages of bandwidth and measurement range provide the user with confident measurement of transients and harmonics when used with a range of power quality analyzers power recorders and data loggers. The applications for power quality measurements range from monitoring office equipment to utility distribution equipment.

- *Rectifier Monitoring :*

Although Rogowski coils are insensitive to dc they can be used to measure pulsed dc current.

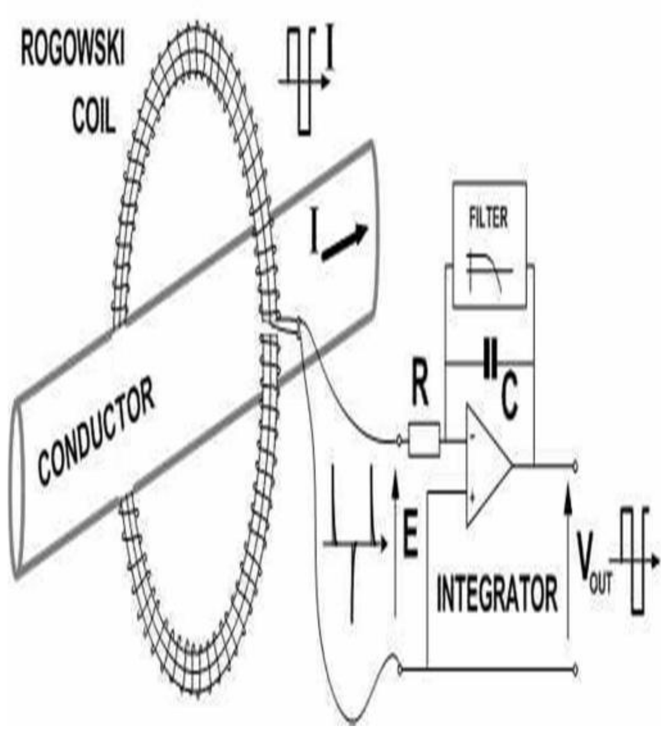
- *Relay Protection :*

Microprocessor-based relays do not accept the 1A or 5A signal directly from a CT secondary but require low voltage inputs in the range of 5V. In a typical application the signal from the CT secondary is transformed to the low voltage level by the insertion of scaling transformers. The low voltage output of a Rogowski coil can be connected directly to the relay voltage input eliminating the need for scaling transformers.

- *Switchgear :*

Rogowski coils could be used for relay protection in medium voltage switchgear. Recently, some switchgear manufacturers have begun to use Rogowski coils as an alternative to traditional CT.s in medium voltage switchgear.

H. CONNECTION OF ROGOWOSKY COIL ALONG WITH AN INTEGRATOR CIRCUIT



I. SPECIFICATION OF A ROGOWSKY COIL SAMPLE:

Some required values which are needed to specify a Rogowsky coil are

- Coil length
- Coil diameter
- Fastening
- Weight
- Material
- Protection degree
- Operating temperature
- Output level (RMS)
- Coil resistance
- Accuracy
- Frequency range
- Working voltage
- Test voltage

J. CONCLUSION

Rogowsky coil can provide a very useful contribution to the art of measuring electric current in very difficult situations. A wider understanding of what they are and what they can do is obviously essential if their full potential is to be exploited and hopefully this article has made a contribution in that direction.

K. REFERENCES

1. Using Rogowski coils for transient current measurements by D. A. Ward and J. La T. Exon , engineering science and education journal june 1993
2. Using Rogowski Coils Inside Protective Relays by Veselin Skendzic and Bob Hughes Schweitzer Engineering Laboratories, Inc. 39th Annual Western Protective Relay Conference, October 2012
3. Practical Aspects of Rogowski Coil Applications to Relaying. Sponsored by Power System Relaying Committee of the IEEE Power Engineering Society, September 2010.

New Technologies in Space craft

Priyanka Roy[1] Sounak Ghosh[2] Arnab Banerjee[3]

Student of Electrical Engineering Department

Technique Polytechnic Institute, Hooghly, West Bengal, India

Email id: [1]roy.priyanka96.pr@gmail.com [2]sounaktittughosh@gmail.com [3]arribc@gmail.com

ABSTRACT

In early 2011, NASA's office of the Chief Technologist released a set of technology roadmaps with the aim of fostering the development of concepts and cross-cutting technologies addressing NASA's needs for the 2011-2021 decade and beyond. NASA reached out to the National Research Council (NRC) to review the program objectives and prioritized technologies. Specifically this chapter focuses on technology area TA04 "Robotics, Tele-Robotics and autonomous Systems" and discusses in some detail the technical aspects and challenges associated with three high priority TA04 technologies; "Relative Guidance Algorithms", "Extreme Terrain Mobility" and "small body/microgravity mobility. Each of these technologies is discussed along g four main dimensions, scope, need, state of the art and challenges and future direction. The result is a unified explanation of key autonomy challenges for next generation space missions.

Keywords: NASA, Chief Technologist, National Research Council, Tele-Robotics, Relative Guidance Algorithms

A. INTRODUCTION

In early 2011, in an effort to streamline future resource allocation and refine its plans, NASA's Office of the Chief Technologist (OCT) released a set of technology roadmaps with the aim of fostering the development of concepts and cross-cutting technologies addressing NASA's needs for the 2011-2021 decade and beyond (NRC, 2011; NASA2011). This set was organized into 14 technology areas (TA01 through TA14), divided into a total of 64 technology subareas. NASA reached out to the National Research Council (NRC) to review the program objectives and prioritize their list of technologies. In January 2012, the NRC released its report entitled "Restoring NASA's Technological Edge and Paving the Way for a New Era in Space," which reviewed an initial 320 technologies. The NRC report revolved around three technology objectives:

I. TECHNOLOGY OBJECTIVE A: Extend and sustain human activities beyond low Earth orbit. Invest in technologies to enable humans to survive long voyages throughout the solar system, get to their chosen destination, work and return safely.

II. TECHNOLOGY OBJECTIVE B: Explore the evolution of the solar system and the potential for life elsewhere (in situ measurements). Investigate technologies that enable humans and robots to perform in situ measurements on bodies effectively.

III. TECHNOLOGY OBJECTIVE C: Expand understanding of Earth and the universe (remote measurements). Develop technologies for capturing remote measurements from platforms that orbit or fly-by Earth and other planetary bodies, and from other in-space and ground-based observatories Earth (astrobiology) and on other planets.

B. SPACECRAFT

In recent years, increasing attention has been paid to smaller spacecraft enabling low-cost missions through then utilization of COTS technology, consumer technology and ride shares. In order to drastically reduce mission costs, the objective is to have one or more small spacecraft complete the same task as their compartments.

- A SYSTEM VIEW OF SPACECRAFT:-

The journal is concerned with spacecraft system. The variety of types and shapes of these systems is extremely wide. But it is also important to recognize that the satellite itself is only an element within a larger system. There must be a supporting ground control system that enables commands to be sent up to the vehicle and status and payload information to be returned to the ground. There must also be launcher system that sets the vehicle on its way to its final orbit. Each of the elements of the overall system must interact with the other elements, and it is the job of the system designer achieve an overall optimum in which the mission objectives and realized efficiently. Chambers science and Technology Dictionary provides the following very apt definition of the term 'System engineering' as used in the space field:

"A logical process of activities that transforms a set of requirements arising from a specific mission objective into a full description of a system which fulfills the objective in an optimum way. It ensures that all aspects of a project have been considered and integrated into a consistent whole."

- DYNAMIC OF SPACECRAFT:-
  - This chapter serves as a general introduction to the subject of the dynamics of bodies and sets a framework for the subjects of celestial mechanics and attitude control (Chapters 4 and 9). For both of these, Newtonian dynamics will provide a sufficient means of forecasting and of understanding a spacecraft's behavior. The summary presented here is chosen with a view to its relevance to spacecraft. The approach adopted is to develop an understanding of dynamics in two stages. The first is to express dynamics of both translation and rotation in terms of the appropriate form of momentum-linear or angular. Momentum becomes an important concept. In terms of which it is relatively easy to determine the consequences of forces or moments. The second stage is to interpret the momenta in terms of the physical movement-the velocities, linear and angular. This is straightforward for linear momentum since momentum and velocity are in the same direction. More difficult is the relationship between rotational movement and angular momentum.

- **State-of-the-art:-**

Small spacecraft missions are made possible through miniaturization technologies. Miniaturization is the act of creating systems of ever-smaller scales and thereby increasing the functional density of the product. Devices have a comparable capability, but are of smaller size than their predecessors. Perhaps the Most of which roughly states that the number of transistors on integrated circuits doubles every two years (Moore, 1998): this trend has remained valid since the invention of the integrated circuit in the late 1950's. Although Moore's two-year law cannot be applied directly to small spacecraft, a significant amount of miniaturization has been achieved for spacecraft subsystems and components.

- RELATIVE GUIDANCE ALGORITHMIC CHALLENGES FOR AUTONOMOUS SPACECRAFT:-

Relative guidance algorithms were categorized by the NRC as the top-ranked technology for robotics, Tele-robotics, and autonomous systems; their improvement would mark a tremendous milestone for robustifying and augmenting current capabilities in autonomous guidance and control. This section addresses the technical details and challenges for relative guidance of autonomous spacecraft in four space-based application areas:

a. Planetary Entry, Descent, and Landing (EDL)

b. Proximity Operations for primitive bodies

c. Autonomous Rendezvous and Docking (AR&D)

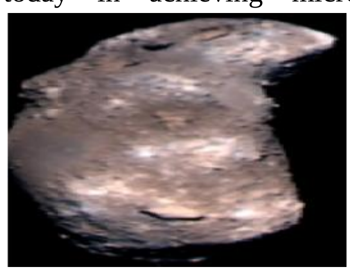
d. Autonomous Inspection and Servicing (AIS)

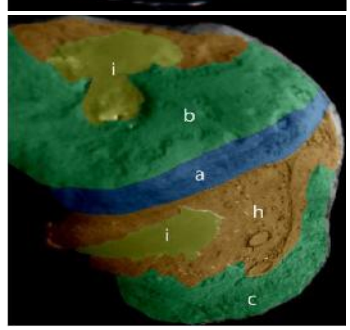
- EXTREME MOBILITY:-

Among the top technical challenges of technology area TA-04 is maneuvering in a wide range of NASA relevant environmental, gravitational, and surface and subsurface conditions. Two different review boards in the NRC process ranked extreme terrain mobility a high-priority technology for the next five years to address part of this maneuvering challenge: the study panel ranked it 6th and the steering committee ranked it 8th (National Research Council, 2012). This section discusses the technical aspects and challenges associated with extreme terrain mobility.

- MICROGRAVITY MOBILITY:-

The National Research Council recommended small body/microgravity mobility as a high priority technology for NASA for the next five years. Initially, microgravity mobility was assigned a low score due to the expensive nature of development and testing of microgravity systems and its limited applicability outside the aerospace community. The panel later elevated the priority of this technology from medium to high because the NASA 2010 Authorization Act indicated that small body missions should be an objective for NASA human spaceflight beyond Earth orbit. If this goal is pursued as a high NASA priority, it would also likely require precursor robotic missions to small body. This section describes the benefit, technical aspects, and challenges facing the robotics community today in achieving microgravity mobility.





C. CHALLENGES & FUTURE DIRECTIONS:-

To date, planetary rovers have been designed to explore rocky but relatively flat regions and were not intended for terrains such as deep craters, canyons, fissures, gullies and cry volcanoes. Such extreme terrains pose a unique set of challenges and requirements for a robotic explorer. Conventional, flat topography rover designs must be re-evaluated in the context of high-risk terrain missions. Typical of Martian craters, Victoria consists of steep slopes, scattered rocks, exposed bedrock, and tall cliffs. A rocker-bogie class rover such as MER or MSL is not designed for such terrain and would not likely be well-suited to navigate it. Such terrains would be very difficult to traverse, as platforms would face reduced mobility on such steep slopes due to loose soil that can severely diminish traction forces, interplanetary spacecraft, must operate over distances of many millions of kilometers from Earth.

D. CONCLUSION

This chapter has addressed the engineering aspects and challenges of technology area TA04 “Robotics, Tele-Robotics, and Autonomous Systems,” extending the discussion of the 2011 NRC Report on top technology priorities for NASA’s Office of the Chief Technologist to a more detailed &technical scope. Specifically, this chapter has discussed “Relative Guidance Algorithms”, “Extreme Terrain Mobility”, and “Microgravity Mobility” in the autonomous systems area, motivating the importance of each technology, highlighting current state-of-the-art methods, and outlining major technical hurdles facing the aerospace engineering and robotics communities.

E. REFERENCES

1)http://www.nasa.gov/directorates/spacetech/small_spacecraft
2)https://www.google.co.in/Pavone.ea.Springer.2013

The Prospect of Nuclear Energy

Ankita Paul[1] Krishna Gopal Mondal[2] Kaustav Das[3]

Student of Electrical Engineering Department

Technique Polytechnic Institute, Hooghly, West Bengal, India

Email Id: [1]*anki.paul007@gmail.com* [2]*krish6834@gmail.com* [3]*kaustav1994@gmail.com*

ABSTRACT

For many years the idea of the nuclear energy was unknown to the human race. But with the ushering light of discovery of these minute atomic particles, there was a rapid reformation in the human way of thinking. Presently as there a great shortage of the natural resources in the world an immediate need of tremendous supply of energy is needed to fulfill the need of the human race. So humans have shifted their focus over the renewable sources of energy. Coming to the nuclear energy it has been seen that the output is expectedly much higher than any other sources. The energy produced per unit weight of the isotopes is much higher than that produced by the coal or any other energy sources. People are also thinking of expanding this source of energy over a wide area and not just keeping it confined within a small space. Thus a report over the prospects of the nuclear energy can be of help in better understanding of its advantages and also the disadvantages too.

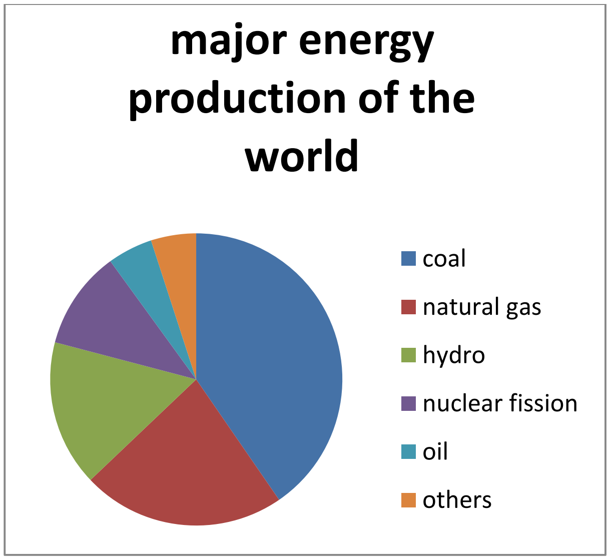
Keywords: nuclear energy, atomic particles, renewable sources of energy

A. INTRODUCTION

Nuclear power is the use of nuclear reactions that release nuclear energy to generate heat, which most frequently is then used in steam turbines to produce electricity in a nuclear power station. The term includes nuclear fission, nuclear decay and nuclear fusion. Presently, the nuclear fission of elements in the actinide series of the periodic table produce the vast majority of nuclear energy in the direct service of humankind, with nuclear decay processes, primarily in the form of geothermal energy, and radioisotope thermoelectric generators, in niche uses making up the rest.

Along with other sustainable energy sources, nuclear fission power is a low carbon power generation method of producing electricity, meaning that it is in the renewable energy family of low associated greenhouse gas emissions per unit of energy generated. As all electricity supplying technologies use cement etc., during construction, emissions are yet to be brought to zero. A 2014 analysis of the carbon footprint literature by the Intergovernmental Panel on Climate Change (IPCC) reported that fission electricity embodied total life-cycle emission intensity value of 12 g CO_2 eq/kWh is the lowest out of all commercial Base-load energy sources, and second lowest out of all commercial electricity technologies known, after wind power which is an Intermittent energy source with embodied greenhouse gas emissions, per unit of energy generated of 11 g CO_2eq/kWh. Each result is contrasted with coal & fossil gas at 820 and 490 g CO_2 eq/kWh. With this translating into, from the beginning of

Fission-electric power station commercialization in the 1970s, having prevented the emission of about 64 billion tone of carbon dioxide equivalent, greenhouse gases that would have otherwise resulted from the burning of fossil fuels in thermal power stations.

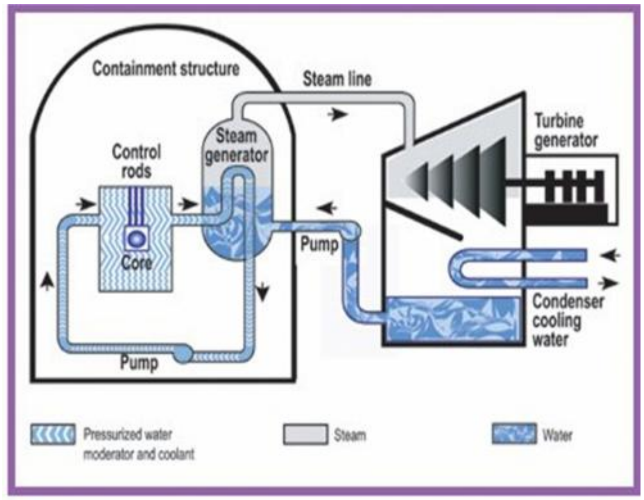


B. DISCOVERY of the PARTICLES

Many attempts had been made to know as to what is the ultimate particle of matter. The idea of the smallest unit of matter was first given by MAHARSHI KANADA in 16th century BC India. According to him, matter consisted of indestructible particles called 'paramanus' (param means ultimate and anu means particle), which is now generally called atoms.

The Greek philosopher Democritus called the 'paramanu' an atom, which comes from the Greek word meaning indivisible. But the scientific theory about the structure of matter was given by John Dalton in 1808 which considered atoms as indivisible particles that are the fundamental building blocks of matter.

Rutherford's experiment led to the discovery of atom. Following him several scientists discovered protons, neutrons and electrons. While Professor J.J. Thomson discovered electrons, Goldstein explained the positively charged particles protons, neutrons were known from the Rutherford's Atomic models itself.



With the discovery of these fundamental particles many initiatives were being implemented for studying their properties. These properties of the atomic particles were later utilized in different fields.

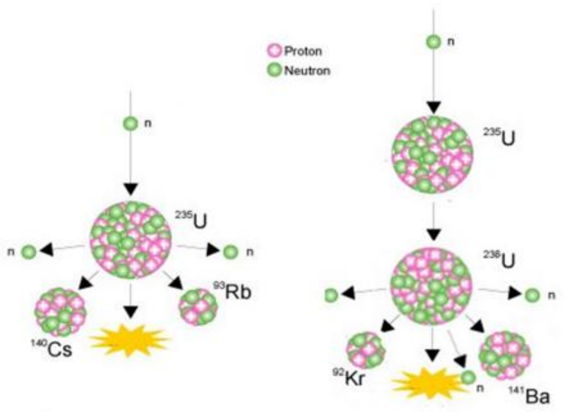
C. WORKING of A NUCLEAR REACTOR

A nuclear reactor produces and controls the release of energy from splitting the atoms of uranium. Uranium-fuelled nuclear power is a clean and efficient way of boiling water to make steam which drives turbine generators. Except for the reactor itself, a nuclear power station works like most coal or gas fired fire station.

D. THE REACTOR CORE

Several hundred fuel assemblies containing thousands of small pellets of ceramic uranium oxide fuel make up the core of a reactor. For a reactor with an output of 1000 megawatts (MWe), the core would contain about 75 tons of enriched uranium.

In the reactor core the U-235 isotope fissions or splits, producing a lot of heat in a continuous process called a chain reaction. The process depends on the presence of a moderator such as water or graphite, control rods, shielding material &is fully controllable.



The moderator slows down the neutrons produced by fission of the uranium nuclei so that they go on to produce more fission.

Some of the U-238 in the reactor core is turned into plutonium and about half of this is also fissioned similarly, providing about one third of the reactor's energy output.

The fission products remain in the ceramic fuel and undergo radioactive decay, releasing a bit more heat. They are the main wastes from the process.

The reactor core sits inside a steel pressure vessel, so that water around it remains liquid even at the operating temperature of over 320°C. Steam is formed either above the reactor core or in separate pressure vessels, and this drives the turbine to produce electricity. The steam is then condensed and the water recycled.

E. NUCLEAR POWER IN JAPAN

The people of Japan have extensively improvised the nuclear power, because it is major source of electricity in their country. When India is putting a lot of efforts in building up greater number of thermal and hydroelectric plants, Japan has always topped the list for nuclear plants. Nuclear power has been expected to play an even bigger role in Japan's future. In the context of the Ministry of Economy, Trade and Industry Cool Earth 50 energy innovative technology plan in 2008, the Japan Atomic Energy Agency modeled 54% reduction in carbon dioxide emission by 2050.

F. NUCLEAR WEAPONS

As discussed earlier nuclear energy is a tremendous source of energy which can be both useful and destructive, if not handled properly. A major application of this is in the production of nuclear weapons.

Atom bombs and the hydrogen bombs are mainly based on the principle of the nuclear fission and fusion respectively. The bombing of the Hiroshima and Nagasaki are the living examples for it.

G. CONCLUSION

The prospect of nuclear energy has a large area where it can be implemented. It is also expected in the coming years the great need of energy could only be supplied by the nuclear sources. Thus its curve will always have a rising nature. Irrespective of the immense advantages of the nuclear power, care should also be taken about its harmful effect for the human race. Nuclear sources are the major store house of the harmful radiations causing fatal diseases to the living organism. Thus with its increase in the positive aspect there must also be development for its safety and protection.

Prospect of Solar Power in India

MANIK SAHA[1] ANUSHREE BASAK[2] SOUMYA MUKHERJEE[3]

Students of Electrical Engineering Department

Technique Polytechnic Institute, Hooghly, West Bengal, India

Email Id: [1]maniksaha1707@gmail.com [2]sree202122.a@gmail.com [3]soumyam081@gmail.com

ABSTRACT

With the ever growing increase in population, demand of energy is also increasing every day. As we know the non-renewable sources are limited and not environment friendly. The increase or decrease in production of these sources can have direct result on the inflation. Since day by day we are facing serious energy crisis, as the oil production is peaking worldwide which means no more cheap oil. In this situation, we need an alternative source of energy that universally available, abundant, renewable and efficient. Solar energy fits all these criteria and so we have to deal with this alternative source of energy. Solar energy is not only sustainable, it is renewable and this means that will never be run out of it. It is a natural source of power implemented as to generate electricity. The creation of solar energy requires a little maintenance. Once the solar panels have been installed and are working at maximum efficiency. The paper is discussing on the basis of the following topic.

Keywords: Demand of energy, Non-renewable, Solar energy, Sustainable

A. INTRODUCTION

Mass uproar against global warming increasing greenhouse gas has become headache to the mankind. Light and lightening to ignite man uses different chemical combination that gives off more poisonous gases than the use of usual fuel resources in nature like coal, petrol, bog wood etc. Realizing the impact of dreadful environmental stand man has been in quest of source of such an energy that may cause less harm for pollution. Now he is bent on following up the use of solar energy but he is dreading the cost of initial state that lies on technological expanses. If it is worth of echo friendly, man will be relieved from the unwanted danger. To keep up the traditional civilization man must have to be up and going in invention of alternative fuel system thinking all-around of its effect.

B. WAYS TO HARNESS SOLAR ENERGY

- **Photovoltaic Cells**

A photovoltaic cell is a specialized semiconductor diode that converts visible light into direct current. Some of the photovoltaic cells can also convert the infrared or ultraviolet radiation in DC electricity. These cells made of thin wafers of two slightly different types of silicon. One, the P-type, which is doped with tiny quantities of Boron and contains positively charged "holes," that are missing electrons. The other type of silicon, called N-type, which is doped with small amounts of Phosphorus and contains extra electrons. When these two thin P and N materials are put together, it produces a junction that, when it is comes in contact to light, it produces a movement of electrons, thus producing an electric current. The panels of these types of cells are widely used to convert solar energy to electricity. The industrial average for the efficiency of solar energy conversion into electricity using solar panel is about 15-20%. However, researchers are developing thin film solar panel systems which can deliver same efficiency but at about 20% of the cost. These are based on nanotechnologies and use extremely thin layers of solar conversion material which significantly lowered the production costs.

- **Solar thermal collector**

A solar thermal collector collects heat by absorbing sunlight. It is a collector device which captures solar radiation. Solar radiation is energy in the form of electromagnetic radiation from the infrared to the ultraviolet wavelengths. The quantity of solar energy striking the Earth's surface averages about 1,000 watts per square meter under clear skies, depending upon weather conditions, location and orientation. It is basically used in the sunnier regions of our country; it can still be used in regions where it snows. By using solar thermal system one can save around 70-80% on annual water heating costs. These kinds of systems have been accepted by many countries for many years. These have been widely used in countries like Greece, Turkey, Israel, Australia, Japan, Austria and China.

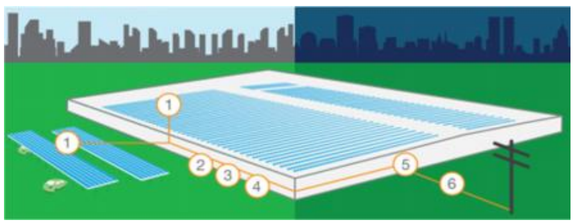
- **Concentrated Solar Power**

It is a process in which solar energy is concentrated at a single place which is like a big tower. There are many water pipes in the tower. Water is circulated in these pipes. When concentrated solar energy falls on these pipes, the water in them gets heated. Heated water forms steam and the kinetic energy in this steam can then be used to run turbines that produce electricity. The process is very similar to conventional energy generation where coal is used to heat water to form steam. Burning of coal releases some harmful gasses like carbon-monoxide and other greenhouse gasses, that may affect our environment adversely. If solar energy is used for the same process, then no such gasses are released into the atmosphere.

- **A Dynamic Duo**

There have been many significant developments in the field of solar energy but the most significant one was from the scientists of Massachusetts Institute of Technology (MIT). They developed a process for storing solar cell generated electricity in a fuel cell for later use, when the sun is not shining. Users could use their solar panels during the day to power their homes, while also using energy to split water into hydrogen and oxygen for storage. At night, when sunlight is not available, hydrogen can be combined with oxygen to generate energy using a fuel cell. The energy generated during this process can be used to generate power when the solar panels are not active.

C. HOW DOES SOLAR ENERGY WORKS?



Solar Panel— solar panel is designed to absorb the sun's ray as a source of energy for getting electricity. The solar panels are made up of photovoltaic (PV) cells, which convert sunlight into direct current (DC) electricity throughout the day.

Inverter—this device converts the DC electricity generated by the solar panels into the alternating current (AC) electricity.

Electrical Panel—the AC electricity is sent from the inverter to your electrical panel to power your lights and appliances with solar energy. The electrical panel is often called a "breaker box."

Utility Meter—the utility meter measures your energy use. It actually goes backward when your system generates more power than you immediately need. This excess solar energy offsets the energy you use at night.

Utility Grid—your business is still connected to the grid. You'll need that power from the utility company at night, but don't worry. The cost is offset by any excess solar energy you put into the grid during the day.

Power Guide Monitoring System—our exclusive Power Guide monitoring system continuously tracks your energy production and ensures that your solar power system is running smoothly. It will even alert our repair crews in the rare event that problems arise.

Significant steps are being undertaken in India to establish a solid foundation for solar power, including re-vamping policies and infrastructure in the country.

With a population of more than 1.2 billion people, a widening supply and demand gap in the energy sector has led to widespread power outages, leaving as many as 75 million households, especially in rural areas, without power.

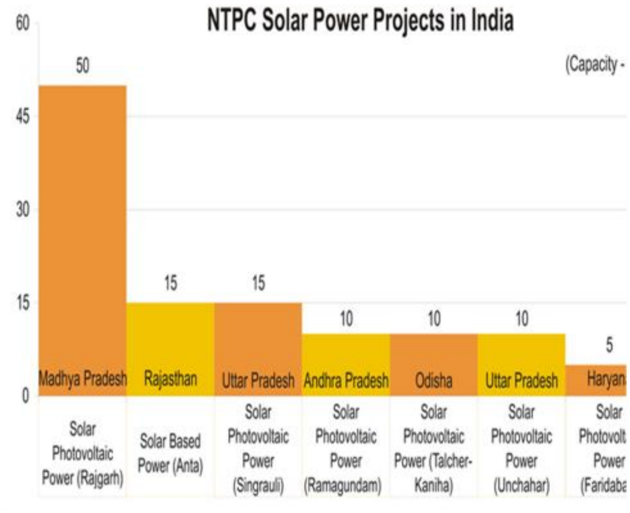
In response to issues caused by the overburdened grid network, officials are increasingly looking to alternative energy sources like solar power to solve the power shortage.

A recent article in the Economic Times accounted plans to establish the country's largest ultra-mega solar power plant in Madhya Pradesh's Rewa district, and similar initiatives are being undertaken across the country.

D. LONG TERM PLANS TO INCREASE SOLAR POWER GENERATION

In a country that receives almost 3,000 hours of sunshine each year; solar power does seem to be the answer to India's energy woes. Those 3,000 hours translate into 5,000 trillion kWh of energy, and have huge potential to bridge the energy supply and demand gap.

Ambitious plans have been undertaken across the country and the Indian Government has outlined long-term plans to attain an installed solar power generation capacity of 20,000 MW by 2020, which would increase to 100,000 MW by 2030 and to 200,000 MW by 2050.



Regional Segmentation of Solar Power Market in India by State

E. HUGE POTENTIAL IN THE INDIAN SOLAR POWER INDUSTRY

Surprisingly, given the average of 300 sunny days that the country experiences, solar power production facilities are not nearly as well established in India compared with other alternative energies like wind power. This is partly due to the high capital investment involved in the installation of PV cells or CSP systems. Recently though, several private and corporate firms have started showing interest in solar power generation and are adopting green and emission-free technologies.

- **General Solar Energy Facts**

- Solar Energy is healthier for the environment than traditional fossil related forms of energy.
- Solar energy has many positive uses, such as the production of electricity through photovoltaic cells, and the direct heating of water for a variety of other applications.
- Solar energy can also be used to heat swimming pools, power cars, for attic fans, calculators and other small appliances. It produces lighting for indoors and outdoors. You can even cook food with solar energy.
- Solar Energy is becoming more and more popular. The worldwide demand for Solar Energy is currently much greater than the amount we have been able to supply.

- **Photovoltaic Energy and Its Development**

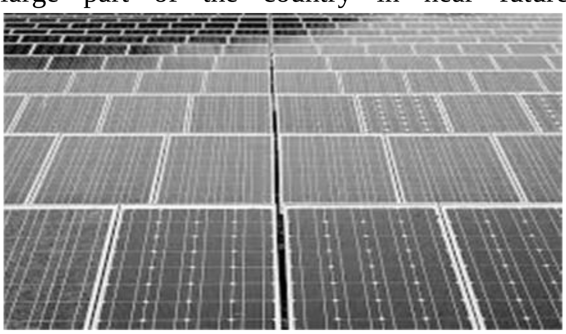
The two primary technologies used today to capture solar energy are photovoltaic and thermal. Photovoltaic (PV) cells convert light energy into electricity at the atomic level. There are some materials that exhibit a property known as the photoelectric effect. This causes them to absorb photons of light, and in turn, release electrons. When these free electrons that are released are captured, it results in an electric current, or electricity. When these solar cells are used in conjunction with each other, they form solar panel. A solar panel, otherwise known as a photovoltaic module or photovoltaic panel, is a packaged assembly of many solar or photovoltaic cells. The solar panel can then be used as a component of a larger photovoltaic system, or solar array. This is then used to generate and supply electricity for residential solar power or for commercial solar panels.

F. SOLAR IS THE FUTURE OF RENEWABLE ENERGY IN INDIA

Energy prices in India are climbing, and supply, while growing, is not keeping pace with steep demand. Solar power, despite initial challenges, is becoming a multibillion-dollar opportunity.

Coal is becoming more difficult to obtain, sources of domestic gas are shrinking, and there is more focus than ever on sustainability. The result: Stakeholders are scaling back expectations that conventional energy sources can fulfill India's power needs. Solar energy will become a crucial component of India's energy portfolio in the next decade perhaps more so than it is in most other countries. We believe a solar market can develop fairly quickly going from nothing to several billion-dollar solar-centric firms within a decade.

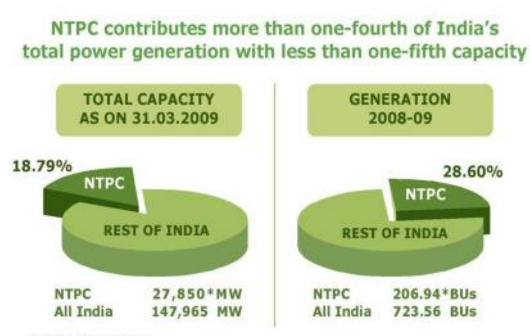
Clean and green energy is a basic theory of modern life although the governmental focus is more on grid power, which is a polluting, inefficient and unreliable source of power. AT&C losses account for close to 40% of the total power generation, amounting to a total of Rs 75 thousand crores and more every year that could wipe out energy poverty across the country. Smart grids and infrastructure updates are the need of the hour. But the government is still focused on spending Rs 2 lakh crores to bail out bankrupt companies whereas that amount could have been used to deliver distributed energy and reduce dependence on companies for large part of the country in near future.



The Indian government recognized this potential and the MNRE (Ministry of New and Renewable Energy) launched an ambitious programme in 2010 called JNNSM (Jawaharlal Nehru National Solar Mission) to deploy 22,000 MW of grid-connected solar power by 2020. The programme has seen limited success with phase I meeting its PV targets and phase 2 on the way in the form of 750 MW via the Viability Gap Funding (VGF) programme. Thermal-concentrated sources of energy are optimal for urban and semi-urban areas. However, towns need to reduce dependence on the grid and adopt the German model, which enables local, as well as distributed power, using net-metering.

The MNRE programmes have barely managed to dent the potential of distributed RE, requiring focused attention and financial muscle to enable the nation on its path towards renewable energy. But MNRE has not paid out a large part of the residential subsidies of 30% of capital costs over the past year due to lack of funds, a serious damper, especially for solar on rooftops. The current VGF programme is scheduled to cost the MNRE Rs 2,500 crores and push solar procurement costs down to below Rs 5.5 per KWh, enabling it to compete with conventional energy.

The essence of solar success lies in empowering the distributed 400 million poor who are currently consuming fossil fuel not touched by the power grid and thus reduce India's CAD (current account deficit), environmental pollution and health concerns. But there lies the irony. The rural/tribal populace pays nearly twice or thrice the rate of power than those living in cities, but has received minimal attention although the impact is the highest to those using fossil fuel and government subsidies in daily life.



Every unit of power generated has the ability to multiply economic growth, especially in rural areas that suffer from energy paucity due to unreliable connections or load shedding. State governments of Tamil Nadu, Kerala and a few other states have already initiated proactive steps by increasing the state subsidies, in addition to subsidies from the central government, and are also looking at replacing grid-connected agricultural equipment with solar-enabled ones.

Solar has the potential to reduce the current energy peak deficit significantly and improve delivery due to its distributed nature, provided it can get the appropriate financial support from the Centre, as well as all the states. The central government continues to think that grid power, with its huge losses, is the solution. But in reality, distributed energy, delivered to every home and the excess pumped into the grid, would result into least amount of losses while reducing energy generation needs.

Over the next few years, solar power will come into its own, both from financial viability and availability perspectives, with exponential growth in distributed solar, coupled with storage, transforming the entire energy spectrum in India. The future of Indian energy segment is here and it is the Sun that will continue to power our economic and energy growth into the next millennium. Rate of power than those living in cities, but has received minimal attention although the impact is the highest to those using fossil fuel and government subsidies in daily life.

G. DISCUSSION

It is a well-known fact that the rapidly growing businesses and population are putting a lot of pressure on India's power resources. Unfortunately, India is woefully lacking in all types of power resources, except one – solar power. We take a look at what solar power generation entails for India and how it will change the energy scenario in India.

Solar power entails producing energy from the sun instead of oil and electricity. The sun's energy is available abundantly and freely and can be used in two ways:

- Solar thermal energy: Here the solar energy is converted into solar power through equipment. Example, solar hot water heating system, solar drying system, solar cooking system, etc.

- Solar photovoltaic energy: In this method, the solar energy is converted into electrical energy through equipment using solar photovoltaic technology. It can be used to power anything from a single bulb to all the street lights in the city.

Solar power can be an important source of power for India. These are the reasons why India should focus more on solar power:

- India gets plenty of sunlight due to its proximity to the equator. It receives an annual average of 4-7KWh per day for every square meter, meaning the country receives a lot more sunlight than what it can use in a year, making it an abundant source of power.

- India is a poor source for conventional fuel sources. It is dependent on the Gulf countries for its oil supplies. With the oil prices skyrocketing and the reluctance of the Indian government to hike the prices of LPG and kerosene, Indian oil companies are suffering major losses. Even electric supply in the country is unable to meet the burgeoning demands of the growing population and businesses.

- India does not have resources to pay the huge bills of the oil producers.

Keeping in mind the growing potential of solar power generation, several large players have entered into this business. Solar Power India, Tata and Reliance Industries are some of the biggies that have major plans for this industry. This will give a big boost to this field as these companies can invest a lot of money in research to make the technology cheaper. This, in turn, will make solar energy accessible to the common man. As more and more people take to solar power, the costs are expected to reduce.

What are the steps you think the Government of India should take to encourage companies to set up solar power plants in India? What do you think is the future of this source of energy in India?

H. REFERENCES

http://www.eai.in/ref/ae/sol/policies.html

http://www.indiafilings.com/learn/2015-solar-subsidy-in-india/

https://en.wikipedia.org/wiki/Solar_power_in_India

http://www.seci.gov.in/content/govt_initiatives.php

Smart Grid Technology

ARIJIT MONDAL[1] ADITI MANNA[2]

Students of Electrical Engineering Department

Technique Polytechnic Institute, Hooghly, West Bengal, India

Email Id: [1]dmondal.95@gmail.com [2]aditimanna95@gmail.com

ABSTRACT

Smart Grids components include scalable metering, energy prediction (both production and consumption) and pricing. Their primary objective is to attract consumers for using green energy, to promote periods of low consumption and introducing a solution to the customers to get rid of the use of their greedy devices during peak periods. The main aim is to determine the optimal suggested prices by the energy operator and the optimal demands of consumers. Micro grid development is primarily the implementation of micro grid was to satisfy the energy demands of remote areas due to inaccessibility of utility power. But with the gradual merging of the rural and remote areas of the world into urban communities the burden on utility grid is increasing at an alarming rate. Hence, Hybrid Power Systems (HPS) are nowadays playing an active in designing micro grid by using locally available renewable energy sources (RES).Smart Grid facilitates efficient and reliable end-to-end intelligent two-way delivery system from source to sink through integration of renewable energy sources, smart transmission and distribution. This paper is based on the active role of the smart grid technology in the development of mankind.

Keywords: Green energy, Hybrid Power Systems (HPS), renewable energy sources (RES), smart grids, active grid, micro grid, distributed generation.

A. INTRODUCTION

"SMART GRID" generally refers to a class of technologies that people are using to bring utility electricity delivery systems into the 21st century, using computer-based remote control and automation. The central nervous system of this technology lies in a two way digital communications technology and computer processing that has been used in other industries over decades. Nowadays they are being used in a large scale on electricity networks, from the power plants and wind farms all the way to the consumers of electricity in homes and businesses. They are very much beneficial to us – mainly high energy efficiency and reliability. Smart Grid facilitates efficient and reliable end-to-end intelligent two-way delivery system from source to sink through integration of renewable energy sources, smart transmission and distribution. In this way Smart Grid technology shall efficiently bring sustainability in meeting the growing demand for electricity with reliability and best of the quality.

Smart Grid also enables real time monitoring and controlling of power system as well as helps in reducing AT&C losses, demand response and demand side management, power quality management, outage management, smart home energy system etc. Smart Grid as a backbone infrastructure will pave the path for new business models like smart city, electric vehicles, smart communities apart from more resilient and efficient energy system and tariff structures. With the aim of satisfying the future power demand and to reduce $CO2$ emissions designers of the next generation of electric power, distribution grid initiate a large research and technological action under the "Smart Grid" banner that starts to tackle some of the issues as follows:

- Indicative reductions in residential peak demand energy consumption achieved by providing real-time price and environmental signals in alliance with advanced endogenous technologies.
- Amalgamation of the green energy production from both second tier operators and private clients to reduce carbon impressions. Hence this energy source is going to play a major role in the future Smart Grid. Nowadays electric vehicles are also being considered as very important future elements as they can affect the consumption peaks but they could also act as energy buffers to provide missing energy during these peaks.
- Provision of open infrastructure for newcomers to be easily mingled, in the same way as mobile telecom market has been deregulated.
- Provide a real time measurement and control tools that administer scalable and amelioration actions on the energy grid.

The resulting architecture of a Smart Grid is defined as a standard power grid that is coupled with both a telecommunication network and a distributed information management system, and associated with services (handled within an energy-dedicated service architecture) to allow the following:

- Administering better energy consumption.
- Better management of energy production and its delivery.
- Mixing of heterogeneous energy sources both renewable and non-renewable in an efficient and dynamic way.
- Reduction of the impacts of power blackouts.
- Dynamic evaluation of cost.
- Increment in efficiency of global energy.

B. SCOPE OF A SMART GRID

A smart grid uses digital technology to improve reliability, security, and efficiency of the electric system from large generation, through the delivery systems to electricity consumers and a growing number of distributed-generation and storage resources. The information networks transforming our economy in other areas are also being applied to applications for dynamic upgrade of electric system operations, maintenance, and planning. Separately managed resources and services are now being integrated and rejuvenated as we address traditional problems in new ways, harmonize the system tackling new challenges, and innovating new benefits that have transformational potential.

The various fields of electric system that cover the scope of a smart grid enclose the following:

- The delivery infrastructure (e.g., transmission and distribution lines).
- The end-user based systems and related distributed-energy resources (e.g., building and factory loads, electric vehicles, distributed generation).
- Administration of the generation and delivery infrastructure at the various stages of system coordination (e.g., transmission and distribution control centers, regional reliability coordination centers and national emergency response centers).
- The information forms a network among them (e.g., public Internet, inter- and intra-enterprise communications).

- ❖ Investments and motivation of the decision makers to promote, practice, and maintain all aspects of the system(e.g., stock and bond markets, government incentives, regulated or non-regulated rate-of-return on investment) is controlled by the financial and regulatory environment.

C. OVERVIEW OF SMART GRID

In terms of overall vision, the smart grid shows the following characteristics:

- **Intelligent** – It has capability to sense system overloads and preventing or minimizing a potential blackout by rerouting the power. Moreover it's also capable of working autonomously when conditions require resolution faster than humans can respond and cooperatively in aligning the goals of utilities, consumers and regulators.
- **Efficient** – Without addition of infrastructure it can conveniently meet the increased consumer demands.
- **Accommodating** – It has capability to integrate any and all better ideas and technologies like energy storage technologies. Besides it can accept energy from virtually any fuel source including solar and wind as easily and conspicuously as coal and natural gas.
- **Motivating** – It motivates real-time communication between the consumer and utility so that consumers can tailor their energy consumption based on individual requirements.
- **Opportunistic** – It creates new opportunities and markets by the aid of its ability of capitalizing plug-and-play innovation wherever and whenever felicitous.
- **Quality-focused** – It is proficient of delivering the power quality necessary (free of sags, spikes, disturbances and interruptions) to power our increasingly digital economy and the data centers, computers and electronics necessary to make it run.
- **Resilient** – Being more decentralized and reinforced with Smart Grid security protocols it can efficiently resist natural disasters and attacks.
- **"Green"** – It is providing a genuine path toward significant environmental improvement by loitering the advance of global climate change.

D. CHALLENGES FOR DISTRIBUTION SYSTEM

Electricity distribution networks create a market place for small-scale power producers and for customers (consumers). Here, the role of distribution networks is of highest priority. There are many challenges for distribution system to aggrandize its functionality as the real market place, as stated below:

- ➢ Improvement of the capability to serve the increasing amount of distributed generation.
- ➢ Sanctioning the electricity market development at the customer level.
- ➢ Safe and cost-efficient operation of distribution networks in all prospects.

Consistently power generation, distribution network management and loads have been considered as quite independent processes. Along with increasing amount of distributed generation there is a gradual change in the traditional approach. One of the main barriers for the penetration of active energy resources like loads, storages and plug-in hybrid vehicles at distribution network level is the intricacy of the interconnection process. From the point of view of network management increasing amount of distributed generation is often considered with reluctance as it brings the convolution of transmission network to distribution network level. The main reason for the intricacy is caused by the present methods for management of the distribution networks as well as the features of different active resource components themselves, which are not adequately developed to enable easy interconnection. So far from the network point of view loads and customers have been considered passive. Thus by making the customer connection point more adjustable and interactive the demand response functions becomes more achievable and the use of existing network and energy resources by market mechanisms can be improved efficiently.

E. CHALLENGES TO SMART GRID DEPLOYMENTS

Among the most important challenges that the development of a smart grid is facing are the cost of implementing a smart grid, with estimates for just the electric utility advanced metering capability ranging up to $27 billion (Kuhn 2008), and the regulations for allowance of recovery of such investments. For objectivity, the Brattle Group estimated the budget as much as $1.5 trillion (Chupka et al. 2008) to upgrade the grid within 2030. Another hurdle for state and federal regulators is the confirmation of interoperability of smart-grid standards.
Among the major technical barriers the development of economical storage systems is of great importance. These storage systems can help solve other technical issues, such as harmonizing distributed renewable-energy sources with the grid, addressing power-quality problems that would otherwise exacerbate the situation, and enhancing asset utilization. Without a smart grid, high penetrations of variable renewable resources may become more difficult and expensive to manage due to the greater need to tantamount these resources with expeditious generation and demand.

Another challenge faced by a smart grid is the uncertainty of the path that its development will take over time with changing technology, changing energy mixes, changing energy policy, and developing climate change policy. Attempting to regulate the development of a smart grid or its related technologies can severely criticize the benefits of the virtual, adjustable, and conspicuous energy market it strives to provide. Thus, the challenge of development of smart grid becomes a matter of contention for provision of flexible regulation that leverages desired and developing technology through goal-directed and business-case-supported policy that promotes a positive economic payoff.

F. ACTIVE GRID

An active grid is a network which not only play the passive role of supplying the final consumers, but also a significant role in which the operator controls and/or rules the power required or generated by the loads or the generators, the bus voltages and the branch power flows. It is possible to ascertain the maturation in three different phases:
First-phase: A simplified localized control of generation at the connection point;
Second-phase: An integral control system for all the distributed energy resources in the controlled area, realizing a combined delivering and a voltage profile optimization.
(See Figure 1);

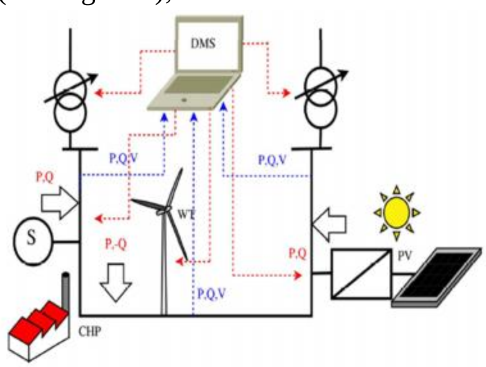


Figure 1. Decentralized control: coordinated dispatching and voltage profile optimization.

Third-phase: This phase consists of creating a strongly interconnected structure with a subdivision in cells responsible of their own management (protection, voltage regulation, etc.) that take part in the market, selling or buying energy to/from adjacent cells or from /to the transmission system(See Figure 2).

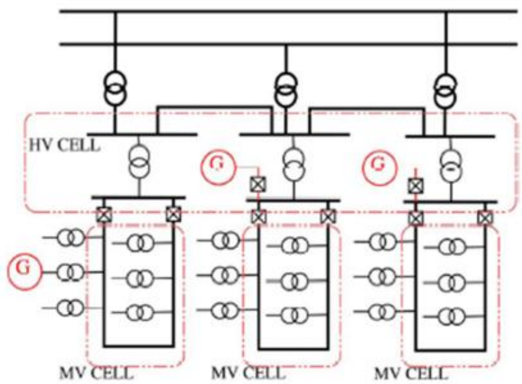


Figure 2. Distribution system organized by cells (local areas).

G. MICRO GRID

A micro grid comprises a set of generators, loads and storage systems connected and able to operate independently from the electrical grid and that internally recreates the energy production and distribution system. In Figure 3 an example of a micro-grid projecting a micro-grid separation device to perform the islanding operation, an energy manager connected to several power flow controllers and protection coordinators to control and manage the energy flowing in the micro grid branches and many different type sources to inlet energy not only from the main grid, but also to allow distributed generation is given.
It can be contemplated similar to the active network cell, as it is provided with a local control system that rules the exchanges of energy among the loads, generators and external network. Moreover it can remain in intentional islanding configuration, crippling the loads that accept to be part of a "load curtailment" program.

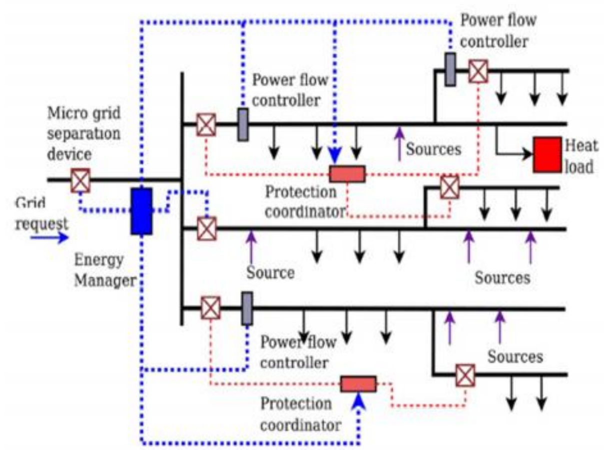


Figure 3. Example of a micro grid.

H. CONCLUSION

This paper is discussing the aspects of smart grids in general and gives some examples on smart grid features studied and developed. The paper presents some smart grid features at distribution level dealing with interconnection of distributed generation and active distribution management. Different kind of advanced functions based on local intelligence and power electronic applications as a part of active distribution networks are in the process of implementation. The interactive customer gateway will be based on the use of modern power electronics, advanced digital technology and two-way communication between date bases and applications of the distribution system operator (DSO), transmission system operator (TSO), service providers and electricity energy market players (e.g. aggregators). Thus the introduction of the smart grid technology efficiently fulfilled the primary objective to spread the use of green energy among the consumers, promotion of periods of low consumption thereby introducing a solution to the customers to get rid of the use of their greedy devices during peak periods.

I. REFERENCE

- "Active Smart Grid Analytics™: Maximizing Your Smart Grid Investment" by Sharelynn Moore Director, Product Marketing Itron, Stephen Butler Managing Partner – Industry Consulting Teradata.

- U.S. Energy Information Administration, "Electricity Explained: Use of Electricity,"
- W. Steinhurst, "The Electric Industry at a Glance" (Silver Spring, MD: National Regulatory Research Institute, 2008).
- S. W. Blume, Electric Power System Basics: For the Nonelectrical Professional (Hoboken, NJ: Wiley–IEEE Press, 2007).
- A. V. Meier, Electric Power Systems: A Conceptual Introduction (Hoboken, NJ: Wiley–IEEE Press, 2006).
- I. J. Pérez-Arriaga, H. Rudnick, and M. Rivier, "Electric Energy Systems. An Overview," in Electric Energy Systems: Analysis and Operation, Eds. A. Gomez-Exposito, A. J. Conejo, and C. Canizares (Boca Raton, FL: CRC Press, 2009), 60.
- F. Schweppe, M. C. Caramanis, R. D. Tabors, and R. E. Bohn, Spot Pricing of Electricity (Boston, MA: Kluwer Academic Publishers, 1988).
- "SMART GRID IN INDIAN POWER SYSTEM" by Sanjeev Kumar Director (Distribution) Ministry of Power.
- "SMART GRID TECHNOLOGY AND APPLICATIONS" by Janaka Ekanayake - Cardiff University, UK; Kithsiri Liyanage - University of Peradeniya, Sri Lanka; Jianzhong Wu-Cardiff University, UK; Akihiko Yokoyama - University of Tokyo, Japan; Nick Jenkins - Cardiff University, UK.
- "A game theory approach with dynamic pricing to optimize smart grid operation" by Makhlouf Hadji (Technological Research Institute - IRT SystemX,8 avenue de la vauve, 91120, Palaiseau, France), Marc Girod-Genet (Institut Mines-Telecom, telecom SudParis, 17 rue charles fourier, 91010, Evry, France), Hossam Affifi.
- Pertti Järventausta*, Sami Repo*, Antti Rautiainen* (*Tampere University of Technology, P.O.Box 692, 33101 Tampere,) Jarmo Partanen** (**Lappeenranta University of Technology, P.O. Box 20, 53851 Lappeenranta).
- "Communications and Control in Smart Grid" by Dr. Hamed Mohsenian-Rad) (Rad Texas Tech University).
- "Smart Grid Vision and Route map" by of gem (Department of Energy and climate Change).
- "Smart Grid System Report" by US. Department Of Energy.

TO STUDY THE VARIOUS TECHNOLOGIES OF LED IN LIGHTING INDUSTRY

AVIJIT KARMAKAR

Lecturer of Electrical Engineering Department

Technique Polytechnic Institute, Hooghly, West Bengal, India

Email id: avijit.karmakar.ee@gmail.com

ABSTRACT

Light Emitting Diode or LED Technology in lighting can be traced back to 1927 although it didn't make an entrance into commercial applications till much later. Having taken a back seat for many years largely owing to its high production cost LED lighting is rapidly gaining gr ound in the lighting space in more recent times. LED lamps have a lifespan and electrical efficiency which are several times longer than incandescent lamps, and significantly more efficient than most fluorescent lamps, with some chips able to emit more than 300 lumens per watt. The LED lamp market is projected to grow by more than twelve-fold over the next decade, from $2 billion in the beginning of 2014 to $25 billion in 2023, a compound annual growth rate (CAGR) of 25%. As of 2016, LEDs use only about 10% of the energy an incandescent lamp requires. The demand of new technologies of LED like SMD, COB, OLED is also increases with respect to the time.

KEY WORDS – LED, SMD, COB, OLED

A. INTRODUCTION

LED Chips comes now in different form depending on the use and technology used by the LED manufacturer. The most common LED is used for indicator lights (conventional DIP-Dual in-line package structure) which have very low lumens per watt. The development of SMD-Surface Mounted Device Structure LEDs pave the way for a better or higher lumens per watt that reaches 50 to 80Lm/W and having a lifespan of 20,000 to 50,000 burning hours however the only problem is, it has a high manufacturing cost. Another development in LED light chips is the COB or Chips on board, a new technology in LED packaging. Multiple LED chips are package as one lighting module that also increased the heat dissipation to 70%. The latest LED development is the S-COB LED (Stereoscopic Chips on Board). S-COB LED have a simple structure (LED Chips are directly embedded on the heat sink) that made lower manufacturing cost but giving a better quality by having a faster heat dissipation of up to 97% and a higher lumens that can reach 90 Lumen to more than 140 Lumen per watt. S-COB LED has a burning hours of 40,000 to 100,000 hours. Faster heat dissipation prolong the life of internal electrical components, because of lower heat operation and lower energy consumption while giving a superb lighting, S-COB LED lights change the way how we see lights. LED Lights have no Toxic materials, longer life span and lower energy consumption but is brighter 3 times than a CFL and more than 10 times that an incandescent light. Because of the many advantages of LED's and having a lower energy consumption that can drastically lower down carbon emission of our planet that in turn help solve global warming.

B. SMD LED

SMDs (Surface Mounted Device) are the new generation of LED lighting, the majority of our bulbs contains SMD chips allowing our bulbs to be much brighter than older generations of LED. The LED is soldered directly onto the PCB therefore requiring less space and improves the thermal connection. The competent design of an SMD LED has resulted in better heat dispersion with high lumen output. The SMDs have single-handedly abled the manufacturers to mechanize LED production along with improved quality control.

SMDs are easier to maintain in comparison with other LEDs and have a longer life.

❖ SMD LED BASICS

Surface mounted device light emitting diodes (SMD LEDs) are the most common type of LED lights right now - these consist of a LED chip that is permanently fused to a printed circuit board, resulting in solid units that can be connected in a simple circuits to create various lighting configurations (including light bulbs and strip LED lights).

Up to 3 diodes can be fused onto a single SMD chip - this gives SMD LEDs the ability to output a huge range of colors when a chip is built using blue, red and green diodes (while the old-style DIP LEDs are mono-colored).

SMD LEDs are available in a range of dimensions - tuners might be familiar with the two most common sizes, SMD 3528 and SMD 5050; those are the two most common sizes used for 12V LED light strips.

❖ APPLICATIONS

SMD LED modules are widely used, in LED lamps, for backlighting, home illumination, shop-windows, advertising, automobile interior lighting, Christmas lights, and numerous lighting applications.

❖ FAILURE OF SMD LED LIGHTS IN SOME PROJECTS ACROSS INDIA

- 1100 SMD LED Street Lights were installed in Kanpur (U.P), out of which the KMC states that nearly 72% are non-functional
- Various SMD LED lighting installations were made in Bangalore (Karnataka). The authorities complain that nearly 45% are having problems, while minimum 10% have to be replaced annually
- Guwahati (Assam) got LED’s equipped in perspective departments, but they are not pretty pleased with their performance as due to moisture herald & other climatic conditions some of the SMD LED’s in the lighting units turned faulty. Thus, making the lighting unit look awkward & low on performance
- The demo project at Kalka (Haryana) was a disaster, as the SMD LED’s lighting units blew up due to high junction temperature caused as the lighting was left on for 1 whole day.

C. COB LED

Chip on Board (COB) is the most recent development in LED technology using chips with multiple diodes (typically 9, or more).

There is no casing with COB technology which enables a much denser LED array of light compared to SMD. A consistent and controlled light beam is given off, without any visible individual light points, thus offering great optics. COB offers a greatly improved lumen per watt ratio compared with other LED technologies such as DIP and SMD. COB technology gives the best conditions for optimal cooling, which in turn will increase efficiency and lengthen the overall life of the lamp.

Chip-on-Board or COB LEDs, as opposed to SMDs are segmented into **numerous tiny pieces of semi-conductor crystals and are directly placed over a substrate.** COBs are popular for their heat efficient behavior. They ensure minimum heat production and emit homogeneous light. The behavior is enhanced with the addition of a ceramic substrate which induces a cooling effect in addition to the homogeneous light production. COBs' assembling is relatively cheap and the LEDs have a longer life span.

LED lighting technology is also growing rapidly; there are now three major types of LED lights available; DIPs (a.k.a. old-school LEDs), SMDs and COBs. Here's a brief rundown on the two most common types of LED lights currently in use today – COB LEDs and SMD LEDs.

❖ COB LED BASICS

Chip on board light emitting diodes, **aka COB** LEDs, are the newest type of LED lights to hit the market. Like SMD LEDs, COB LEDs consist of multiple diodes that are soldered directly onto a microchip, however, unlike SMDs, COBs typically use 9 or more diodes per chip - this produces a light that looks like a glowing panel (rather than a bunch of tiny little lights as with SMDs).

COB LEDs are extremely ' heat efficient'; they produce very little heat, thanks in part to their cooling ceramic substrate. Unlike SMD LEDs, COB LEDs do not have the ability to emit different light colors, however, the light temperature (such as warm or cool) can be controlled.

COB LEDs can produce a higher lumen-per-watt ratio in comparison to both SMD and DIP LEDs. COB LEDs use a single circuit and just two contacts, regardless of how many diodes are on each chip.

Because they are relatively cheap to manufacture, consumers can look forward to lower prices on COB LEDs as production of this latest generation of LED lights ramps up.

❖ APPLICATIONS:

- COB LED light sources
- LED lighting fixture which use COBLED light source

D. OLED

An organic light-emitting diode (OLED) is a light-emitting diode (LED) in which, the emissive electroluminescent layer is a film of organic compound that emits light in response to electric current. This layer of organic semiconductor is situated between two electrodes; typically, at least one of these electrodes is transparent. OLEDs are used to create digital displays in devices such as television screens, computer monitors, and portable systems such as mobile phones, handheld game consoles and PDAs. A major area of research is the development of white OLED devices for use in solid-state lighting applications.

❖ **OLED BASICS**

There are two main families of OLED: those based on small molecules and those employing polymers. Adding mobile ions to an OLED creates a light-emitting electrochemical cell (LEC) which has a slightly different mode of operation. OLED displays can use either passive-matrix (PMOLED) or active-matrix (AMOLED) addressing schemes. Active-matrix OLEDs (AMOLED) require a thin-film transistor backplane to switch each individual pixel on or off, but allow for higher resolution and larger display sizes.

An OLED display works without a backlight; thus, it can display deep black levels and can be thinner and lighter than a liquid crystal display (LCD). In low ambient light conditions (such as a dark room), an OLED screen can achieve a higher contrast ratio than an LCD, regardless of whether the LCD uses cold cathode fluorescent lamps or an LED backlight.

❖ **APPLICATIONS**

OLED technology is used in commercial applications such as displays for mobile phones and portable digital media players, car radios and digital cameras among others. Such portable applications favor the high light output of OLEDs for readability in sunlight and their low power drain. Portable displays are also used intermittently, so the lower lifespan of organic displays is less of an issue.

OLEDs have been used in most Motorola and Samsung color cell phones, as well as some HTC, LG and Sony Ericsson models. Nokia has also introduced some OLED products including the N85 and the N86 8MP, both of which feature an AMOLED display. OLED technology can also be found in digital media players such as the Creative ZEN V, the iriver clix, the Zune HD and the Sony Walkman X Series.

Textiles incorporating OLEDs are an innovation in the fashion world and pose for a way to integrate lighting to bring inert objects to a whole new level of fashion. The hope is to combine the comfort and low cost properties of textile with the OLEDs properties of illumination and low energy consumption.

E. CONCLUSION

The selection of LED is depends upon the uses. If it is required for color-changeable interior and/or exterior accent lighting, then need to go with SMD LEDs; if requirement is the maximum lumens per Watt for a mono-colored light (such as a fog light, headlight or dome light) then COB LEDs is the best choice.

Where SMDs demand a low maintenance cost, COBs have a low production cost. However, both being energy efficient, COBs produce better results with respect to heat emission. Where SMDs alleviate heat dispersion, COBs minimises the heat output altogether. Both the types of LED lights have a long life span and generally speaking both can prove to be of advantage in differing circumstances.

However, where both SMDs and COBs fail is in terms of shape and design. Till now they have been unable to imitate the exterior design of a conventional incandescent bulb. But with the advancement in LED technology, there now is available the LED filament bulb. The LED filament bulb successfully structures itself around the conventional shape of a regular bulb while being energy efficient and having longer life span, where OLED is used only in display screen of different electronics devices.

F. REFERENCE

1. Shinar, Joseph (Ed.), *Organic Light-Emitting Devices: A Survey*. NY: Springer-Verlag (2004). ISBN 0-387-95343-4.
2. *Kamtekar, K. T.; Monkman, A. P.; Bryce, M. R. (2010). "Recent Advances in White Organic Light-Emitting Materials and Devices (WOLEDs)". Advanced Materials.* ***22*** *(5): 572–582. doi:10.1002/adma.200902148. PMID 20217752*
3. SMD-LED-Module-Dimensions 5050 SMD LED Module Dimensions" 2835 SMD LED Module
4. Jacques, Carole (28 January 2014) LED Lighting Market to Grow Over 12-Fold to $25 Billion in 2023, Lux Research
5. *Bergesen, Joseph D.; Tähkämö, Leena; Gibon, Thomas; Suh, Sangwon (2016). "Potential Long-Term Global Environmental Implications of Efficient Light-Source Technologies". Journal of Industrial Ecology.* ***20*** *(2): 263. doi:10.1111/jiec.12342.*