



DESIGN OF FIBER OPTIC CABLING FOR HYBRID INTERCONNECTED SMART GRID SYSTEM

Dr.A.SENTHIL KUMAR

Professor and Principal,
Sanskriti School of
Engineering
Puttaparthi, INDIA
vastham@gmail.com

S.ANJALI

Assistant Professor,
Dept of ECE
Sanskriti School of
Engineering
Puttaparthi, INDIA

S.GUNASEKAR

Assistant Professor,
Dept of ECE
Sanskriti School of
Engineering
Puttaparthi, INDIA
guna.eie@gmail.com

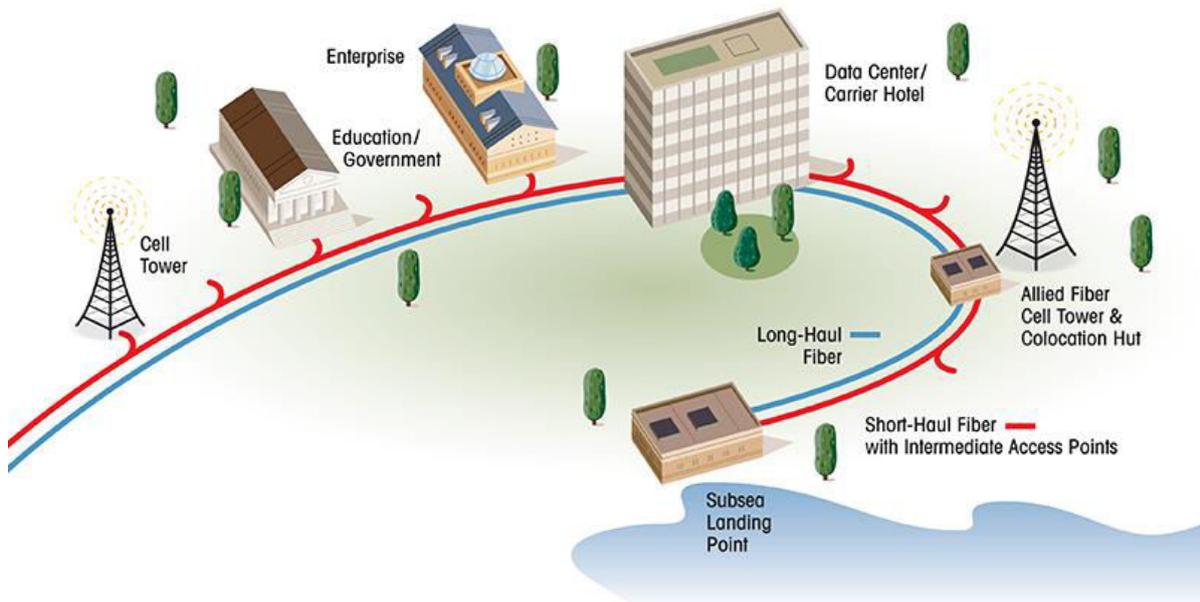
ABSTRACT

A standout amongst the most difficult issues that each nation faces today is developing interest of vitality for different modern, business and social exercises. There is a developing enthusiasm of sustainable power source the world over. Since most sustainable power sources are discontinuous in nature, it's a testing undertaking to cross breed interconnect these assets. Likewise one of the testing issues is a dangerous atmospheric deviation and shortage of fills. Keeping in mind the end goal to address these issues for giving consistent power we focus on incorporating more than one 'green' vitality sources into control lattice framework. Among all the accessible sustainable power source assets mix of wind – sun based RES gives the most dependable utility as them two are compliment to each other. In this paper, we center around fiber optic correspondence for acknowledging interoperable and future confirmation brilliant matrix/metering systems, keen lattice security and protection, and how a portion of the current systems administration advances can be connected to crossover interconnect the vitality assets for vitality administration.

Key words: Renewable energy sources, Hybrid, Green energy sources, power grid, fiber optic communication, smart grid metering networks, smart grid security, energy management.

I. INTRODUCTION

Today electricity has so much got engrossed in our life that a life without electricity is unimaginable. The electricity sector has been exciting over past few years. But in the present scenario the electricity is more being wasted than utilised and this showcases a real problem in front of us for its efficient utilization and storage. Of the renewable energy resources that are available freely environment friendly and omnipresent which can be used for producing electricity are wind energy and solar energy. The wind energy is more unpredictable and cannot be technically available at all sites because of low wind speeds.

**Figure.1**

The combined utilization of these renewable energy sources are therefore becoming increasingly attractive and are being widely used as alternative of oil-produced energy. Economic aspects of these renewable energy technologies are sufficiently promising to include them for rising power generation capability. A renewable hybrid energy system consists of two or more energy sources, a power conditioning equipment, a controller and an optional energy storage system. These hybrid energy systems are becoming popular in remote area power generation. Research and development efforts in solar, wind, and other renewable energy technologies are required to continue for, improving their performance, establishing techniques for accurately predicting their output and reliably integrating them with other conventional generating sources. Fiber optics is a major building block in the telecommunication infrastructure. Its high bandwidth capabilities and low attenuation characteristics make it ideal for gigabit transmission and beyond. The field of fiber optics, especially with respect to telecommunication, is a rapidly changing world in which, seemingly, each day a new product or technology is introduced.

II. FIBRE OPTIC TECHNOLOGY

Fiber optics is a medium for conveying data starting with one point then onto the next as light. Unlike the copper type of transmission, fiber optics isn't electrical in nature. A fundamental fiber optic framework comprises of a transmitting gadget that changes over an electrical flag into a light signal, an optical fiber link that conveys the light, and a beneficiary that acknowledges the light flag and changes over it again into an electrical flag. The many-sided quality of a fiber optic framework can go from exceptionally straightforward (i.e., neighbourhood) to amazingly refined and costly (i.e., long separation phone or satellite TV). For instance, the framework appeared in figure could be manufactured cheaply utilizing an obvious LED, plastic fiber, a silicon photo detector, and some straightforward electronic circuitry. The general cost could be under \$20. Then again, atypical framework utilized for long-distance, high-data transfer capacity media transmission that employs wavelength-division multiplexing, erbium-doped fiber intensifiers, outside regulation using DFB lasers with temperature pay, fiber Bragg gratings, and rapid infrared photo detectors could cost tens or even a huge number of dollars.

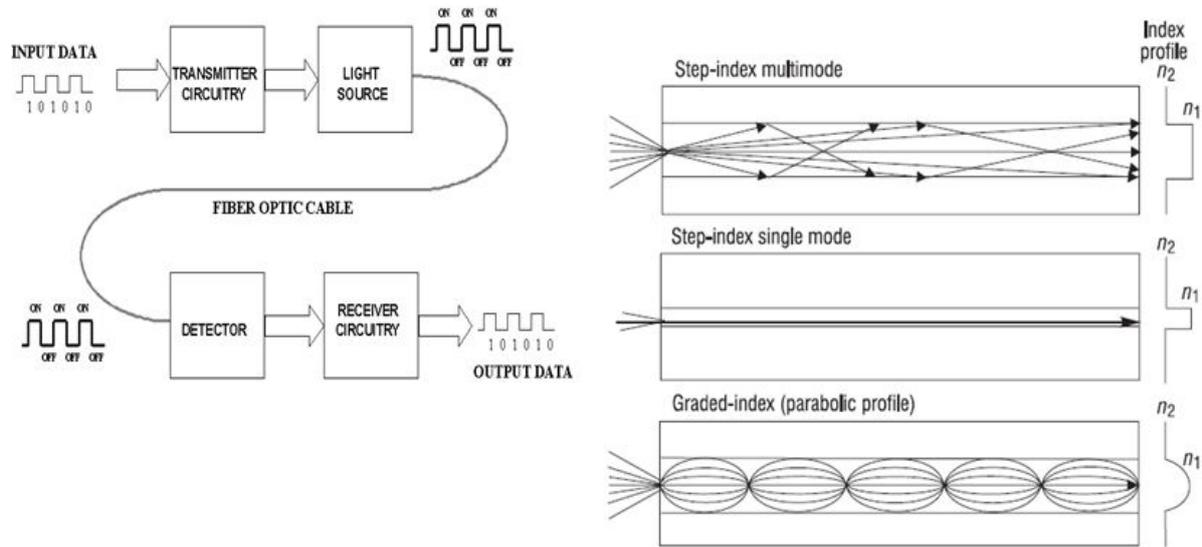
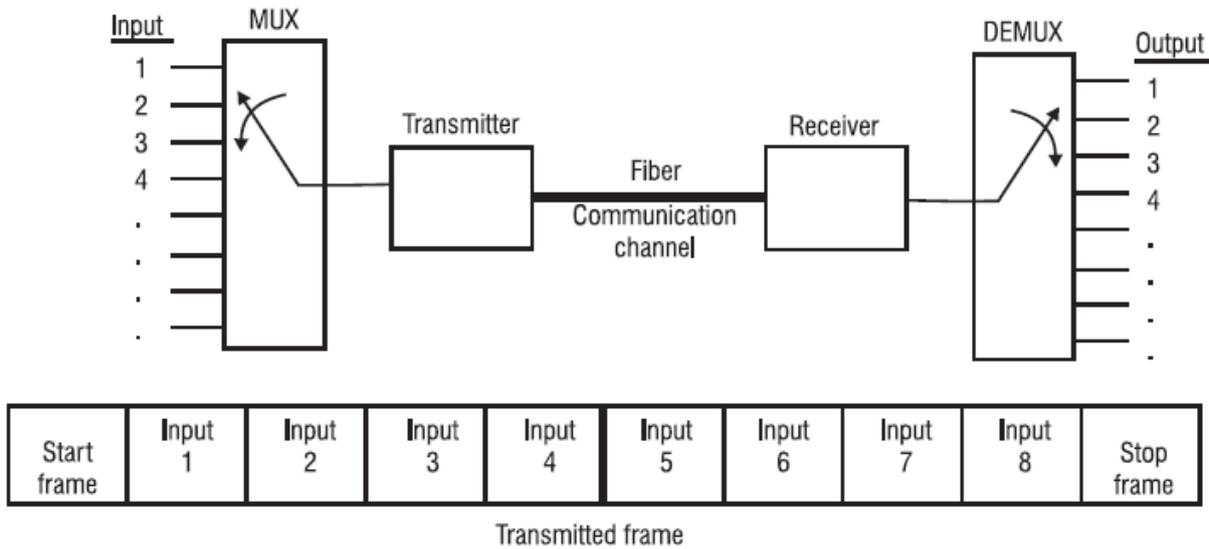
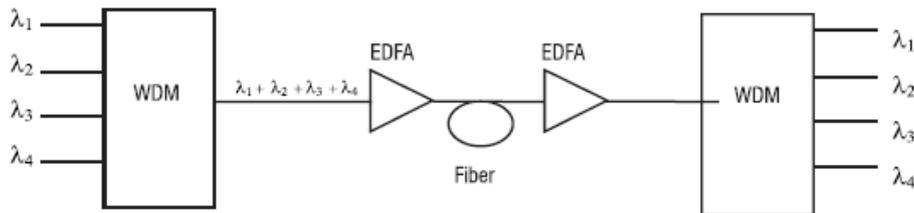


Figure.2 Basic Fiber optic communication systems

There are three fundamental kinds of fiber optic link are utilized as a part of correspondence frameworks, Viz., Step-file multimode, Step-list single mode, Graded-list. Kinds of multiplexing in fiber optics: TDM and WDM. In time-division multiplexing, time on the data channel, or fiber, is shared among the numerous information sources. The multiplexer MUX can be depicted as a sort of "turning switch," which pivots at a fast, independently interfacing each contribution to the correspondence channel for a settled timeframe. The procedure is switched on the yield with a gadget known as a demultiplexer, or DEMUX. After each channel has been consecutively associated, the procedure rehashes itself. One finish cycle is known as an edge. Fiber optics utilize Synchronous Optical Network (SONET) models. The underlying SONET assignment is OC-1 (optical bearer 1). This level is known as synchronous transport level 1 (STS-1). It has a synchronous edge structure at a speed of 51.840 Mbps. The synchronous casing structure makes it simple to separate individual DS1 signals without dismantling the whole edge. OC-1 grabs where the DS3 flag (28 DSI signals or 672 channels) leaves off. With SONET norms any of these 28 T1 frameworks can be stripped out of the OC-1 flag. In wavelength-division multiplexing, every datum channel is transmitted utilizing a marginally unique wavelength (distinctive shading). With utilization of an alternate wavelength for each channel, numerous channels can be transmitted through a similar fiber without obstruction. This strategy is utilized to expand the limit of existing fiber optic frameworks commonly. Each WDM information channel may comprise of a solitary information source or might be a blend of a solitary information source and a TDM (time-division multiplexing) as well as FDM (recurrence division multiplexing) flag.



TIME DIVISION MULTIPLEXING - TDM



WAVE LENGTH DIVISION MULTIPLEXING - WDM

Figure.3 TDM and WDM

III. PRESENT TECHNOLOGY

For a signal to move from one place to another there should be a channel. Examples of these communication channel is copper which is relatively soft, reddish metal that conducts heat and electricity as well Resistance and interference are the most important electrical properties of copper cable. As the distance of the medium increases the signal flowing loses its characteristics because of the electrical properties of the copper wire. The electrical resistance created due to the electrical properties of copper wire weakens the signal. Thus the electrical properties of copper limit the transmission speed and distance of the signal travelling. There are two types of copper wire used for communication that is Twisted Pair and Coaxial.

A. Twisted Pair: The primary communication signal sent over copper wire is primarily a direct current (DC) which is modulated to represent frequency. Any other electrical current or signals near the wire can give way to interference and noise. Multiple communication wires within a single bundle can introduce interference and cross-talk.



Figure.4 Twisted cable

This happens when one signal within the cable is so strong that it introduces a magnetic field into an adjacent wire, or communication pair. Energy sources such as power transmission lines, or fluorescent lighting

fixtures can cause electromagnetic interference. This interference can be minimized by twisting a pair of wires around a common axis, or by the use of metallic shielding, or both. The twisting effectively creates a magnetic shield that helps to minimize "crosstalk". Twisted pair is the ordinary copper wire that provides basic telephone services to the home and many businesses.

B. Coaxial Cable: A primary type of copper cable which is used by cable TV companies for signal distribution between antenna and user homes and business. Twisted pair copper wire and optical fibre used are alternatives to coaxial cables depending upon the carrier technology used. To secure a video transmission network and to prevent interference coaxial cable is used.



Figure.5 Coaxial copper cable

C. SCHEMATIC DIAGRAM:

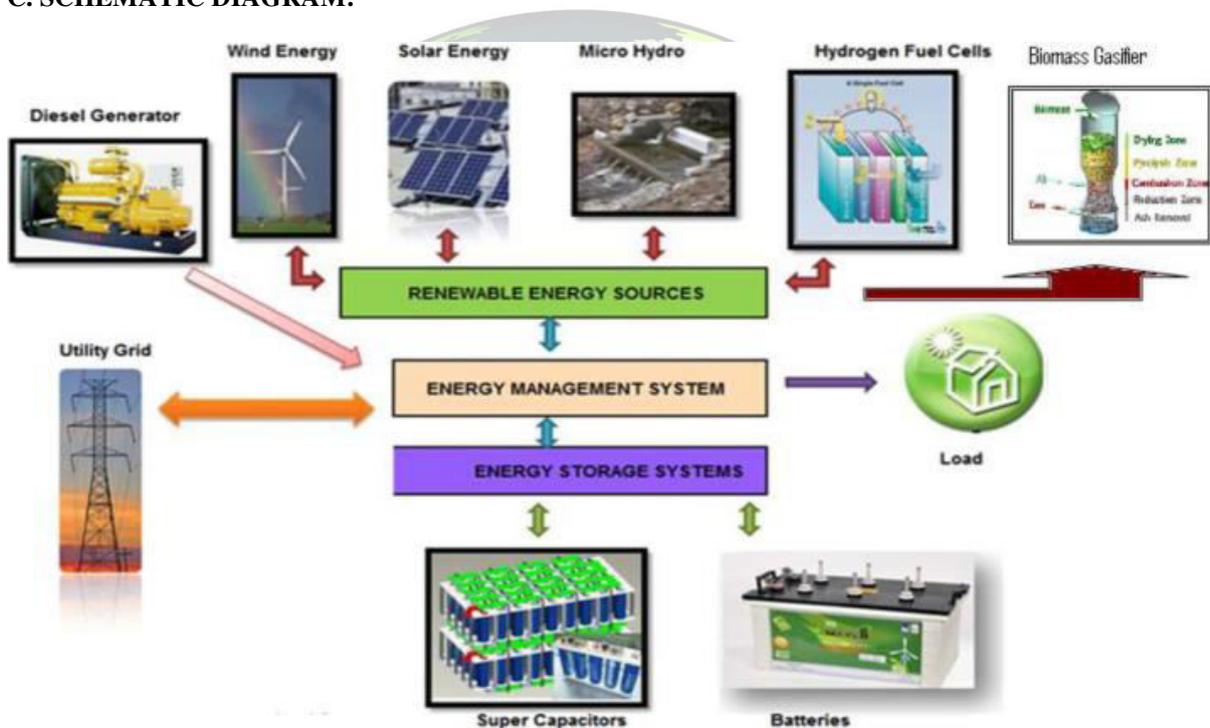


Figure.6 Present Resources in Power production and management

D. LIMITATIONS OF COPPER:

Table .1 Differences

	Distance	Bandwidth	Voice Channels
Copper	2.5 km	1.5 Mb/s	24
Fiber	200 km	2.5 Gb/s	32, 000 +

1. Copper has less security for information transmission
2. It has restricted data transmission
3. Data isn't solid in copper links.
4. Copper links have weight as an impressive factor and combustible.

- Copper cabling, if not introduced appropriately is powerless against the impacts of EMI, for example, bothersome reactions, corruption, or finish framework disappointment.

IV. PROPOSED TECHNOLOGY

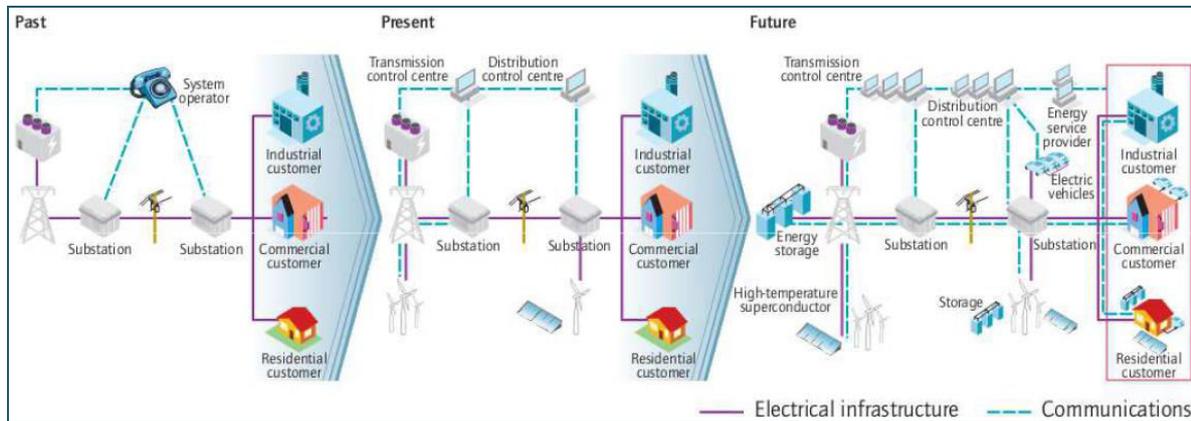


Figure.7 Proposed Technology with Fiber optics

In the proposed innovation, fiber optic cabling will be utilized for cross breed interconnection of sustainable power source assets with brilliant framework system. The motivation behind picking fiber optics is because of its preferences over copper links. Fiber optics has more points of interest like long separation flag transmission (100 kilometres or around 62 miles). It has bigger transfer speed, less weight, littler distance across. Another preferred standpoint of optical filaments is their dielectric nature. Since optical fiber has no metallic parts, it can be introduced in zones with electromagnetic obstruction (EMI), including radio recurrence impedance (RFI). The dielectric idea of optical fiber makes it difficult to remotely distinguish the flag being transmitted inside the link. Thus, it will be more secure. Fiber optics is reasonable today, as hardware costs fall and optical link evaluating stays low. Much of the time, fiber arrangements are less expensive than copper. As transmission capacity requests increment quickly with mechanical advances, fiber will keep on playing an indispensable part in the long haul accomplishment of media transmission. Commonplace optical transmission wavelengths are 850 nm, 1310 nm, and 1550 nm. The two lasers and LEDs are utilized to transmit light through optical fiber. Lasers are typically utilized for 1310-or 1550-nm single-mode applications. LEDs are utilized for 850-or 1300-nm multimode applications.

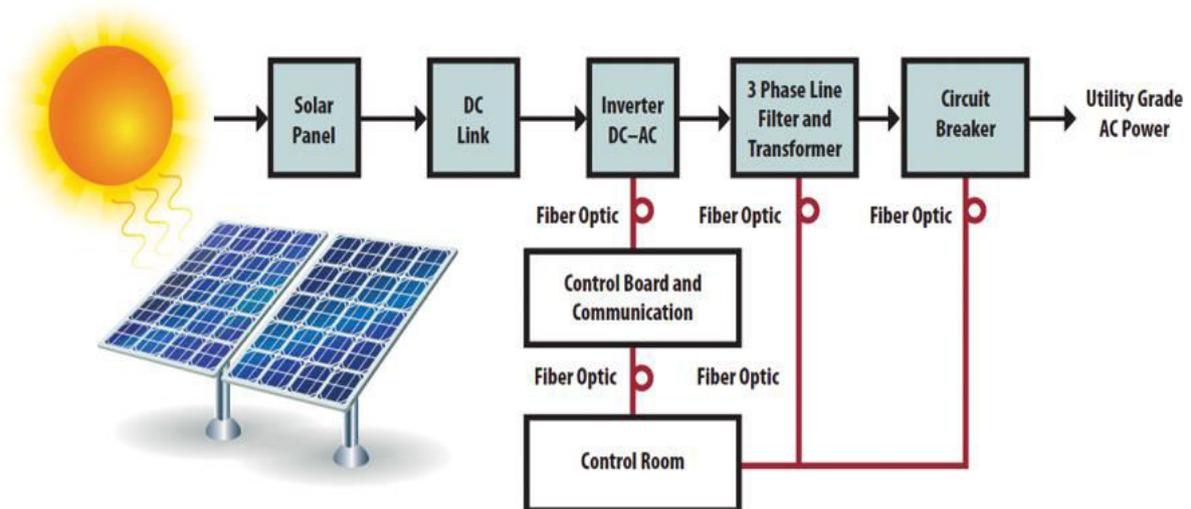


Figure.8 Proposed Technology Block diagram

A savvy lattice is a power arrange for the 21st century and past. It contains a huge number of sensors that send data about utilization, quality and stream. Because of the amount of data, modern information displaying



systems can give early notices of potential issues and pinpoint exactness on utilization designs. Going further, gadgets fitted in homes and workplaces enable clients to screen and alter their utilization propensities and settle on more quick witted choices about how they expend their power. This advanced stream of information just can be empowered by a fast, dependable and secure interchanges framework. Utilizing a 100% fiber-optic system in savvy lattice giving expanded power dependability, more prominent operational effectiveness and more power-administration apparatuses for the utility's clients, and also lessening client blackout minutes by 40%. Moreover, the decision of fiber for the correspondences spine opened up an abundance of monetary, authoritative and group benefits, some of which were not anticipated toward the beginning of the venture. In those days, it was difficult to predict the gigantic changes that the vitality markets would witness: the oil emergency; the worry about petroleum derivatives and a worldwide temperature alteration; the resulting ascent of sustainable power source; and, obviously, the world's ravenous hunger for power. Electric organizations are perceiving the need to adjust their systems to these progressions and discover approaches to enhance administrations to clients, which is driving some to consider exhaustive modernization programs. Brilliant networks exist most importantly to enhance the provisioning of power to clients. To do this, a savvy framework depends on information caught all through the power organize. The more endpoints that can be estimated all the while, and the quicker that the information can be exchanged for examination, the speedier an utility can react to organize issues. A fiber-optic system gives the most astounding conceivable speed to this reason. Fiber likewise is to a great degree strong. In this way, for operational reasons alone, fiber is a sound venture. In particular, it wasn't quite a bit of a jump to start offering extra administrations to business and customers over the savvy lattice arrange. For example, private administrations, for example, the triple play, and virtual LAN and transfer speed renting to organizations. A people group wide fiber-optic system additionally pulls in venture; organizations are setting up shop to a limited extent due to the advantages of high-transfer speed Internet access all through the group. Today the greater part of the keen lattice's 1,500 shrewd sensors and 170,000 residential savvy meters have been introduced. While arrangement has been generally smooth, there definitely are a few lessons to be gained from a change of this scale.

1. Software bugs and crimps in the inventory network are not all that bad.
2. The assessment of one's current foundation assumes a key part in arranging.
3. From the start, keeping up precise records of all the fiber strands stays away from numerous cerebral pains later on.
4. Trusted associations with key accomplices are urgent.
5. Educating the group on the advantages of a keen network encourages acknowledgment of this new innovation.

CONCLUSION

Progressed metering framework (AMI) is an incorporated arrangement of brilliant meters, correspondences systems, and information administration frameworks that empowers two-route correspondence amongst utilities and clients. The Smart Grid is an electrical matrix that imparts. The thought behind Smart Grid is to make our electrical framework significantly stronger to issues like power outages, better oblige flighty power sources, and simplicity vitality request by giving moment data about retail costs to shoppers. Future correspondence prerequisites for Smart Grid targets can be met with Fiber optics

REFERENCES

- [1] Md. Nasir Uddin, Dr M. Mahbubur Rahman, Md. Sadek Ali, Performance Analysis of Different Loss Mechanisms in Optical Fiber Communication, Computer Applications: An International Journal, Vol.2, No.2, May 2015
- [2] Ammar A. Saleh, Dr. Amin B. A. Mustafa, Dr. Ashraf A. Osman, Feasibility of Laying Fiber-Optic Cables underwater along River Nile Basin- Sudan Study Case, IOSR Journal of Computer Engineering (IOSR-JCE) e-ISSN: 2278-0661,p-ISSN: 2278-8727, Volume 17, Issue 1, Ver. V (Jan – Feb. 2015), PP 48-52
- [3] Nick Massa, Fiber Optic Telecommunication, University Of Connecticut, Springfield Technical Community College Springfield, Massachusetts Fundamentals Of Photonics, Module 1.8 PP 293-347
- [4] Abba Mohammed, suleiman Babani, zakariyya Hassan Abdullahia, Comparative Analysis of the Differences Between Fiber Optic and Copper Cables in Communication System, International Journal of Industrial Electronics and Electrical Engineering, Issn: 2347-6982 Volume-3, Issue-9, Sept.-2015
- [5] Communication Technologies and Networks for Smart Grid and Smart Metering, White Paper, 450, alliance.org
- [6] Ataul Bari, Jin Jiang, Walid Saad and Arunita Jaekel, Challenges in the Smart Grid Applications: An Overview, International Journal of Distributed Sensor Networks, Volume 2014



ISSN2394-3777 (Print)

ISSN2394-3785 (Online)

Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology

(IJARTET) Vol. 5, Special Issue 14, April 2018

- [7] Manikandan P, Govardhan D, Arul KiruthikaM, A Review of Hybrid Renewable Energy Interconnected with Biomass International Journal of Advance Electrical and Electronics Engineering ISSN (Print): 2278-8948, Volume-5 Issue-3, 2016
- [8] Marco Liserre, Thilo Sauter and John Y. Hung, Integrating Renewable Energy Sources into the Smart Power Grid Through Industrial Electronics, IEEE Industrial Electronics Magazine pp18-37 March 2010
- [9] R. Luna-Rubio, M. Trejo-Perea, D.Vargas-Vazquez, G.J. Rios-Moreno, Optimal sizing of renewable hybrids energy systems: A review of methodologies pp 1077–1088 Elsevier Solar Energy 86 2012
- [10] Zhong Fan, Parag Kulkarni, Sedat Gormus, Costas Efthymiou, Georgios Kalogridis, Mahesh Sooriyabandara, Ziming Zhu, Sangarapillai Lambotharan, and Woon Hau Chin, Smart Grid Communications: Overview of Research Challenges, Solutions, and Standardization Activities

