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A Review on Control and Automation based Smart Grid System and its impact on Conventional Grid

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Abstract— **The development and implementation of an intelligent energy supply network is one of the urgent problems of the modern energy economy, given the high national priority and the huge investments, although the whole issue is still in its infancy. The smart grid provides electricity from manufacturers to consumers using bi-directional digital technology and enables home appliances to be controlled in consumer homes and factory machinery to save energy, reduce costs and increase reliability and transparency dueto application of smart meter andcontrol automation technics. PV panels absorb solar radiation and generate electricity its inherent temperature increases and to control this increased inherent temperature, a coolant system of circulating water has been developed. This cooling unit is mounted to back surface of the commercial panel and consists of rectangular reservoir. Modified panel has been tested for several water flow rates and optimized for minimum operating temperature of panel and thus results higher PV panel efficiency. Solar photovoltaic cell's efficiency is negatively affected with increase in its temperature. It is necessary to take measure to increase PV cell efficiency and decrease accelerated wear by controlling the operating temperature of PV cell. This thesis represent the new way or new direction for India's power grid that is smart grid, this thesis including introduction of smart grid, benefits, need, challenges**

Keywords— Smart Grid,Smart Meter,Automation,Control,PV Cell

I. INTRODUCTION

This In electrical transmission and distribution, India is the third largest country in the world,so our country need a efficient and strong system for distribution.smart grid is combination of electrical and digital technologies, information and communication.It transfer electrical power to the consumers using tow way digital technology and also monitors the supply to the consumers and measurement .existing grid has limited delivery system and high cost of power outage and power quality interruption and the communication of grid has too slow, so that smart grid was developed. A smart grid provides electricity from suppliers to consumers who use bi-directional digital technology to control appliances in consumer homes in order to save energy, reduce costs and increase reliability and transparency. He is able to evaluate his health in real time, predict his behavior, anticipatory behavior, and adaptation to new environments, management of distributed resources, stochastic demand and optimal response to smart devices. It is a tool that allows utilities to center of attention on the growth of true production drivers by enabling cost control, end-to-end energy delivery control and a safer infrastructure. The network is considered to have observation capabilities with integration and analysis of node data to allow for progress in the operation and control of the system. Smart Grid includes power grid, digital control device and intelligent monitoring system. All this can supply electricity from producers to consumers, control the flow of energy, reduce the loss of this and make the performance of the electricity network more reliable and controllable. The key features of smart grid are energy efficiency,direct load control,distributed generation and cogenaration,automated demand response.

A. Smart Grid Concept

The smart grid system is automated to track the consumption of electricity in the entire position. The basic concept of Smart Grid consists in adding monitoring, analysis, and control and communication functions to the national electricity supply system. The smart grid concept is shownn in Fig. 1.

B.Components of Smart Grid

Smart Grid uses intelligent transmission and distribution networks that use bi-directional communication to increase efficiency, reliability and security of energy supply. Several technologies are used to enable the operation of the intelligent network. These key technologies can be grouped into five key areas of technology i.e.

- Integrated communications
- Sensing and measurement
- Advanced Metering Infrastructure (AMI)
- Advanced components
- Advanced control methods
- Improved interfaces and decision support

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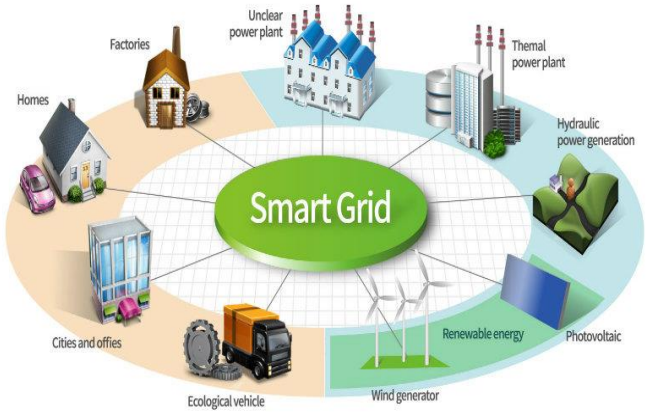

Fig.1 Smart Grid

These technologies are used for the evaluation and control of equipment health, the prevention of energy theft and for the support of control strategies. These technologies are used for the evaluation and control of equipment health, the prevention of energy theft and for the support of control strategies.The various components of smart grid are shown in Fig.2.

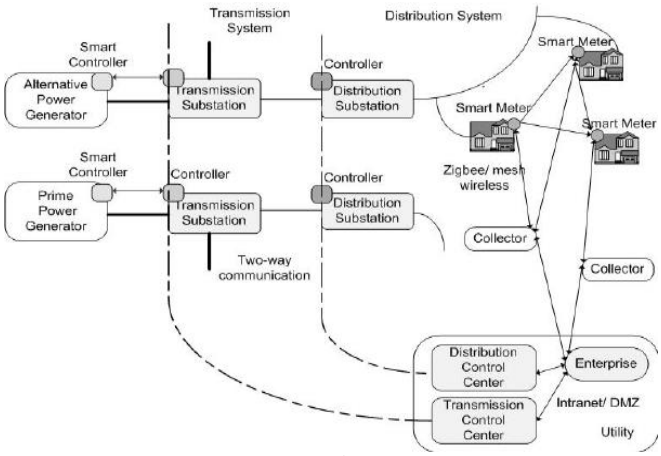

Fig.2 Components of Smart Grid

II. SUBSTATION AUTOMATION

The meaning of substation automation consists in obtaining the monitoring and data collection capabilities of supervision and data acquisition (SCADA) in the substation. The function and operation of the substation can be controlled and controlled from a remote location. Communication can be done through modems, high-speed communication lines and fiber optic cables. The automation of substations is used to obtain microprocessor-based relays to perform online monitoring and control operations. This eliminates the need to build a separate SCADA network to perform this task, eliminating redundant sensors, wiring and transducers By converting the traditional electrical panel into a graphical user interface (GUI) accessible through the PC station. It is perform of automatically controlling the supply system with the help instrumentation and control devices. Substation automation provides the use of intelligent electronic device (IED) data for control and automation of the substation, and control commands given by users to control power system devices.

Complete automation of the substations is based on the combination of the substation and automation. The automation of the energy system consist the processes connected with the generation and supply of energy.Substation automation provides the monitoring and controlling of power supply in the substation and reduces the amount of interruptions and reduces the duration of the interruptions that happen.The communication devices and the communication ways work together as a system to perform the automation of the energy system.The scheme of substation automation in shown in Fig.3.

III. ENERGY MANAGEMENT SYSTEM(EMS)

Energy Management System (EMS) is a set of automated tools that are used to observe, control and optimize the presentation of generation and transmission systems. This energy management software is a control system and it is designed to decrease power consumption, increasing the consistency and predicting the performance of the electrical system as besides optimizing the use of energy to reduce costs.

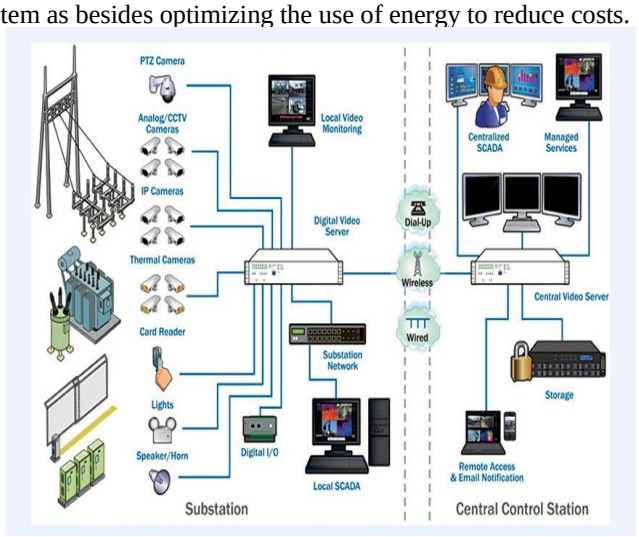

Fig.3 Substation Automation

The electricity management system refers to a large extent to an IT system that is specifically designed for automated control and monitoring of electricity and utility system. The scope can be extended from a dispatch center to a group of electrical networks. The majority these energy management systems also provide decision-making services for the operator in the operation and control in real time. The data obtained from these actions are used for training operators in a control center and to carry out engineering studies for futuristic actions such as planning, optimization and maintenance planning, etc. frequently and modern production analysis and forecasts of annual consumption. Energy management systems can also provide Measurement, sub metering and monitoring of functions that allow the administrators of structures and buildings collect data and information to enable them to make more informed decisions about energy activities through their sites. EMS is an integral part of any power supply system. It is used as a part of the automation system of the substation (SAS), demand side management (DSM), security, and distribution management systems (DMS) for renewable energy, etc. In the coming years, EMS-DMA will change the role of energy, monitoring and control systems. The basic example of the system architecture is depicted in Fig.4 the

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entire smart energy network is inspired from the Internet of Things (IOT),which establishes a connection for real time communication between system components and system . In order to meet the consumer's requirements of energy consumption and control based on feedbacks of the user profiling module.It can provide them with certain adequate energy control with respect to energy resources and consumers. Thus, the information of passive consumption behaviors can be transformed into an active optimization of energy consumption.Smart energy solution with the visible and responsible energy feedbacks can change their energy use behaviors and attitude, which describe the character of application of an open architecture, significant changes in consumer behavior of energy use.

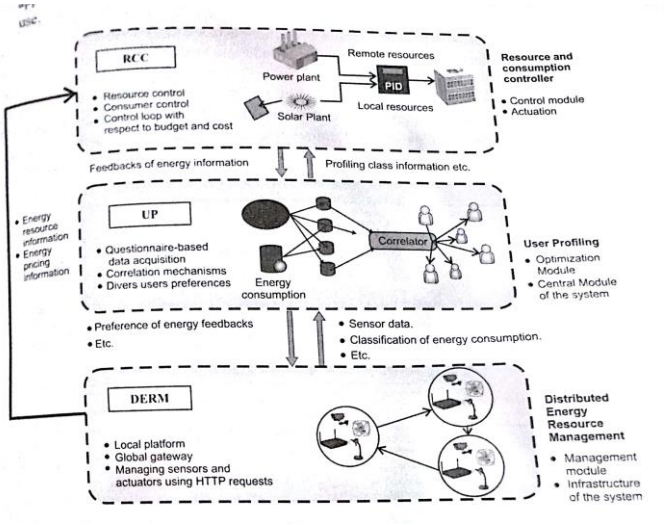

Fig.4 EMS Design Architecture

A. Appliances used in smart grid

In smart grid many smart appliances are used for smart distribution.

- Smart meter
- Advanced metering Infrastructure(AMI)
- Phasor Measurement unit (PMU)
- Global Positioning Satellite (GPS) system
- Intelligent Electronic Devices (IED)
- Electromagnetic Compatibility (EMC)
- Power Quality monitoring (PQM)

An intelligent meter is based on electronic method. Smart meter records the utilization of electrical energy and communicates the information to the distribution center to consumer for monitoring and billing. Per hour consume energy is recorded by smart meter with more accurately and at least daily [188]. Smart meters provide bidirectional communication between the meter and the central system. Such advanced measurement infrastructure (AMI) differs from automatic meter reading in that it allows bidirectional communication between the meter and the supplier.

AMI (Advanced Metering Infrastructure) is the combined word that describes the whole infrastructure, from the Smart Meter to the bidirectional communication network, the collection and transfer of energy allows by the control center apparatus and all the applications. AMI enables bidirectional communications with customers and is the backbone of the intelligent network.The objectives of the AMI can be the remote reading of counters for data without errors, identification of network problems, load profiles, energy audit and partial load containment instead of load shedding.AMI is combination of existing ones and new processes and applications of utility.

PMU technology provides information on phasors in real time. The advantage of the reference phase angle with respect to a global reference time is useful for capturing the large area image of the delivery system. The effective use of this technology is very useful to reduce blackouts and learn the real-time behavior of the energy system. Time synchronization allows you to perform real-time synchronized measurements from multiple remote measurement points in the grid.[218] In energy engineering, these are also commonly called synchrophasors and are considered one of the most important measurement tools in the future of the energy system.

The GPS system consists of 24 satellites in six orbits at an approximate altitude of 10,000 miles above the earth's surface. Therefore, they are approximately half the altitudes corresponding to a geosynchronous orbit. The position of the orbital plane and the positioning of the satellites in the orbits is such that at any moment you can see at least four satellites from any point on the surface of the Earth. In addition, more than six satellites are visible.

International electro technical commission defines EMC as the ability of an equipment or system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment.

Electromagnetic disturbances can radiate and electronic equipment is potentially sensitive to one or both types of disturbances. Monitoring the quality of the power supply is the process of collecting, analyzing and interpreting the raw measurement data into useful information, the process of data collection is usually done by continuously measuring voltage and current for a prolonged period. The analysis and interpretation process has traditionally been carried out manually, but recent advances in signal processing and artificial intelligence have enabled the design and implementation of an intelligent system to automatically analyze and interpret raw data in useful information with interventions minimum human.

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IV. COMPARATIVE STUDY OF TRADITIONAL POWER GRID TO SMART GRID

TABLE.1 COMPERATIVE STUDY

Traditional Power Grid	Smart Grid
Analogue controlled	Digital/microprocessor controlled
Reactive (prone to failures and blackouts)	Proactive
One pricing	Real time pricing
No/limited consumer choice	Multiple consumer products
One-way communication (if any)	Two-way/integrated communication
Few sensors	Many monitors and sensors
Manual restoration	Condition -performance-based maintenance
Limited transparency with customers and regulators	Transparency with customers and regulators
Limited control over power flows	Pervasive control systems
Estimated reliability	Predictive reliability

V. SMART GRID SCENARIO IN INDIA

Vision of India Smart Grids is “transforming the Indian energy sector into a safe, adaptable, sustainable ecosystem and providing digital quality and reliable power for all enabled with the active participation of stakeholders” In 2015, the Indian Ministry of Energy put up the National Intelligent Grid Mission (NSGM) to plan and observe the completion of policies and programs connected to the actions of smart grids in India. There is most unused latent in the electricity sector in India. The significance of Smart Grid and Micro- grid for the nation was underlined by government officials and council from the power sector, developing a promising production chance. The Ministry of Energy has allocated 14 pilot projects for smart grids which will be implemented by the state public distribution services in India under the limited development of accelerated energy and initiative of the reform program for distribution reforms.

VI. CONCLUSION AND FUTURE SCOPE

In this paper,it is examined that the state of the traditional electricity grid and the realization of a new era Smart Power Grid with new communication technologies for Smart Grid and Smart Meter This document represents the investigation on the intelligent network in India and illustrates the challenges, features and the introduction on the intelligent network. This document also presents a general description of the intelligent network. If the smart grid is fully established in India, then many electricity problems are overcome, but it will take time. This thesis also present overview on smart grid .if smart grid is completely established in India so there is many problems are overcome related to Electivity, but it will take time. Research continues to find to do everything desired possible properties the optimal and new solution technologies.

Through the use of the intelligent network Technology, the energy can be used and it would be doing not miss this technology also helps save the earth from global warming. How should new technologies be invented and strengthened those in the desired specifications satisfy the intelligent network would be the reality and change the whole scheme of energy in the world

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