FUTURE SCADA SYSTEM WITH SMARTER GRID A SMART VISION FOR INDIA

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ABSTRACT

This paper describes a view of SCADA system for future power infrastructure. SCADA is used for distribution of electricity generation on wide area and smart grid is used in integration of information into distribution network. Decentralized energy systems may play an important role for future power systems. SCADA focuses on development of infrastructure, which must support the integration of existing conventional power systems with renewable energy resources. In developing countries, renewable power systems are more complex and use the conventional resources like coal because of which they are widely dispersed power sources. This paper first provides a view of future power delivery and smart grid systems in India and then reviews the present infrastructure of power grid. Based on this review, future grid and future SCADA systems cope with the significant penetration of distribution generation, communication and aged power assets is proposed for wide area monitoring, emergency protection, control demand area, and secure communications. There are many devices connected to the grid and enable us to exchange the information with power system. This will enable the future Indian Smarter Grid and Future of SCADA system.

Keyword : Distribution Generation, Future SCADA, Maintenance, Protection, Smart Grid

I. INTRODUCTION

The main purpose of the Supervisory Control and Data Acquisition (SCADA) system is taking real-time data, monitoring and controlling equipments and processes in the infrastructure with the help of sensors and controllers. A SCADA system for power distribution application is typically a PC- based software package and grid is a term used for transmission of data from distributer to consumer. Few functionalities provided by the software make it smart; that's why it known as smart grid. These functions are self-healing, tolerant to attacks, empower and incorporate the consumer, provide power qualities etc. Energy generation and no storability of electricity is one of the most discussed issues in India. And today's technology is not suitable enough for 21st century. A small scale power generation technology that supplies electric power to the consumer, located on the distribution system near to the consumption place is called Distribution Generation (DG) [1]. India's spending on power infrastructure is growing year by year. According to some surveys India estimated spending $250 billion on power sector generation and $447 billion on infrastructure [2]. The exponential growth of small scale power generation in the last few decades getting more attention, not only has economic advantage, but also environmental impacts [1]. India is a developing country, that's why power sector plays an important role for the Indian economy. Distribution generation consists of dispersed generation including renewable resources like solar, wind, fuel cell and biomass. In the solar energy sector in India, some large projects have been proposed; one of them is running in Thar Desert which generates 700 to 2100 GW [3]. The capacity of wind power in India approx 21200 MW [4].

This paper first discusses about SCADA system for distribution generation with SCADA system in Smart Grid. Then how one can integrate this geographically dispersed generation to the existing power generation plants. And this extendable infrastructure becomes more and more complex. Future SCADA system should handle this so as to ensure the reliability of the clean electricity.

II.DISTRIBUTED GENERATION WITH SCADA IN SMART GRID AND ADVANTAGES AGAINST CENTRALIZED SCADA SYSTEM

In India electricity generation depends mostly on large power plants, mainly using coal (primary energy resource). Raised utilization and demand of primary energy resource is a big issue. The scarcity of the primary energy resource has raised the cost of electricity generation. In the recent decades, small and medium size generation has been gaining more attention. These distribution generations are connected to the distributed system close to the consumer's location and with the emergence of technologies DC grid has changed to AC grid, reducing the loss in the transmission line [9].

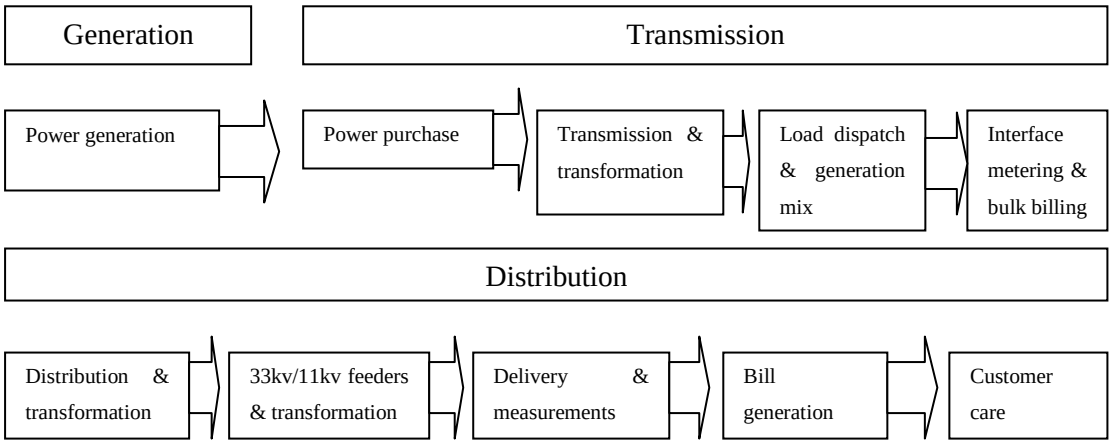

Figure 1: Electricity Value Chain

Large generation station with the vast transmission and distribution grid has come to existence. This interconnection helps to solve the demand and supply problem. Distribution generation can also be defined as a small scale power generation is structural benefits and market related. Structural benefits means how to minimize the cost of the transmission and market benefits means deal with the electricity price volatility, improving power quality and reliability. Restructuring of electric power system creates three major categories, power generation, transmission and generation. There are lots of advantages of distributed generation against the centralized generation. In centralized system in emergency state, only specific area can be under investigation and in decentralized or distributed system make entire control system reliable.

In centralized control system, all the information exchanged between control center and different nodes will be a short period of time. In this case the communication between controllers should work with no error margin, if the error occurs the entire system will collapse. Which means if the some controllers are not working properly, the entire SCADA system will shut down. In distributed control system, the entire system is divided into different control area. And each area owns a local or virtual control system to monitor and control on real time

basis. Which means if a failure occurs on particular area, that area local control system improves that failure and that time only that area will be shut down? So a failure occurred in one control area have less effect on others. That makes it reliable.

SCADA is widely geographically dispersed, we know that. In centralized system the huge database and complex computation make the processing slower. And in distributed system, the task divided into subtasks and these are carried by the local area control center according to control area. These subtasks are processed in distributed computation and this improves the response time.

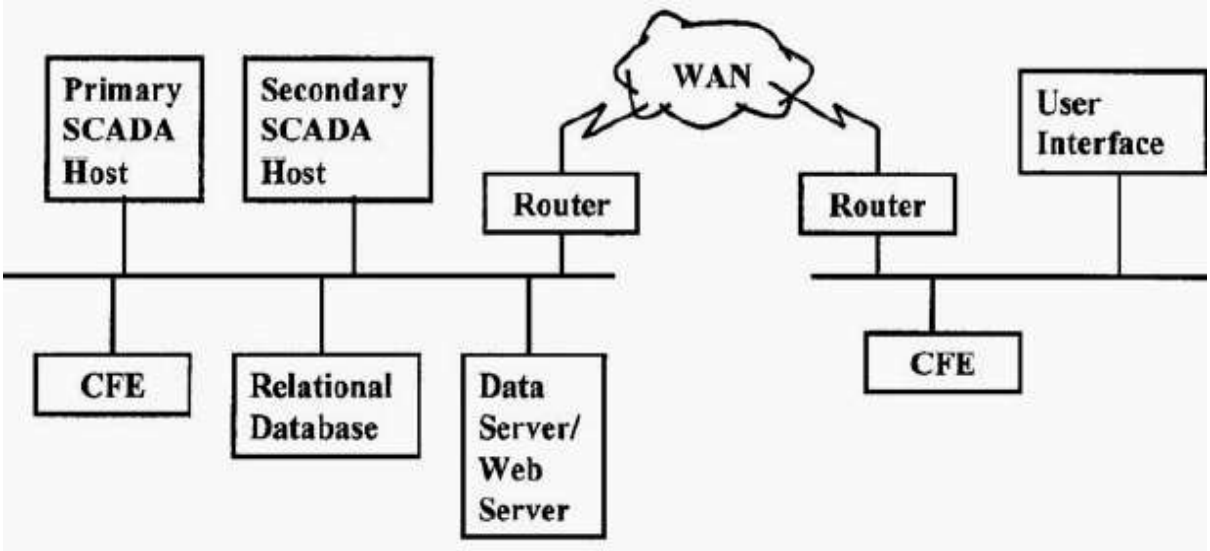

Figure 2: Centralized Control System

If any problem occurs in the main communication system in centralized control system, the whole SCADA does not function properly. And in distributed control, the exchange of data will be within the local area control center. This makes information exchange faster and the data processed locally.

Centralized control system also has High electrical loss, limitation with infrastructure that's why it is not useful for future expansions, vertical structure, in case of failure there is a power cut, high infrastructure cost and unidirectional power flow. Decentralized control system reduce the electrical losses, best for future expansions, failure in one control area covered by central control system and continue from the power grid, bi-directional power flow.

III.INTEGRATION OF DISTRIBUTED GENERATION AND RENEWABLE ENERGY SOURCE

A large amount of our country's infrastructure is dependent on the electricity power. And for generation of electricity we still use the primary energy source that is coal. But from last decade or two, due to scarcity of the primary energy resource has raised the cost of production. Because without this energy source how can we generate electricity? So now we also use the renewable energy source for the electricity generation. So in today's era we use both conventional resource and renewable resource together but the main problem is that how we can integrate this distributed generation and renewable energy source with existing control system? Due

to big change in world climate, rapid increasing of power demand risks the future power systems in general and specially the SCADA system [11].

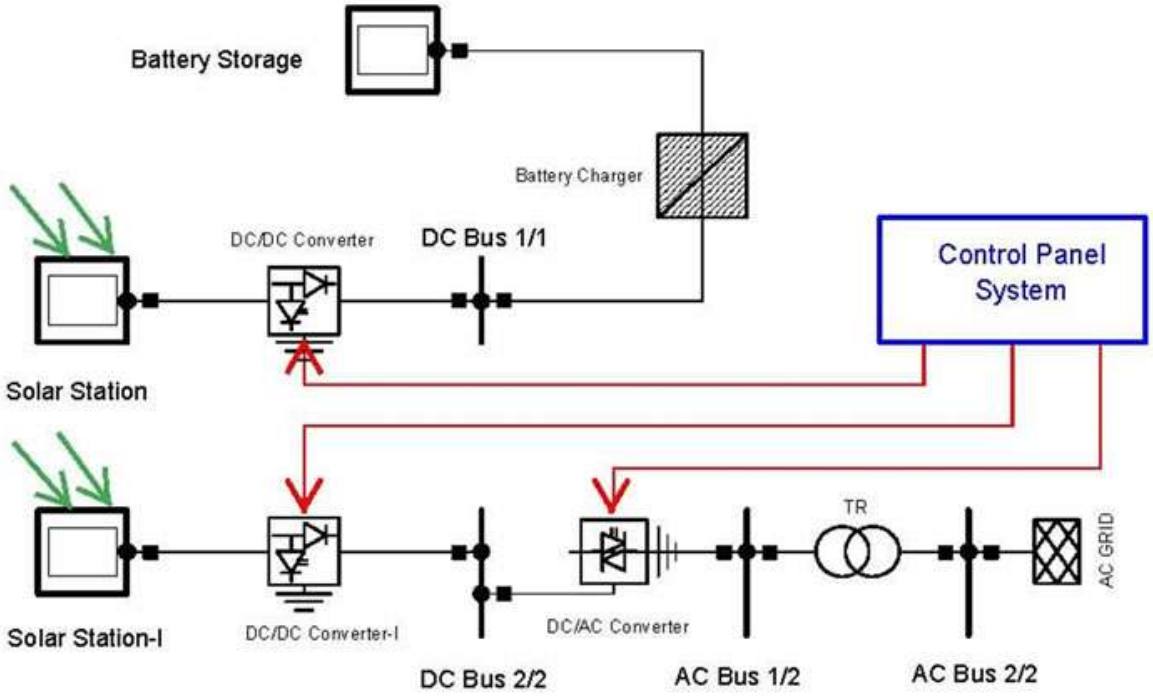

Figure 3: Decentralized Control System in Renewable Energy Source

Renewable energy source is to get the green power generation. These power sources are small in size and located in different places, that makes them to be known as distribution generation [5]. The main aim of the integration is to reduce the cost of energy while increasing the share of renewable energy. The future power grid is a smart grid which can integrate and is able to manage Distributed and Renewable energy source. Using more renewable energy will put upward pressure on unit costs. Renewable energy doesn't have the same operating characteristics, load factors, cost-volume drivers, or dispatch ability as conventional energy, especially base load plants. Renewable energy will stress transmission grids differently and significant investment will be needed to reconfigure bulk power networks.

IV.SMART GRID VISION IN INDIA WITH RENEWABLE ENERGY SOURCE

There are six main factors that will drive the adoption of the smart grid in India. Supply shortfalls, in India, according to official estimates show that the short falls are 12% for total energy and 16% for peak demand. Loss reduction, manage human element in system operations, peak load management, renewable energy. Transform the Indian power sector into a secure, adaptive, sustainable, and digitally enabled ecosystem that provides reliable and quality energy for all with active participation of stakeholders [7]. To support system operators by providing the real time information to make decision on selection generation from renewable energy resources. Indian official estimates increased renewable generation enabled by smart grid could reduce greenhouse gas emission.

In India, some solar plants are running in Rajasthan, Gujarat, Maharashtra, and Madhya Pradesh. In Rajasthan, a 700 to 1200 GW solar power plant is situated. Gujarat contributes 2/3 of the 900 MW in the country [3][6].

Wind power development has been started in 1990s in India. Installed capacity of Indian wind power is nearby 21200MW [4]. Tamil Nadu, Maharashtra, Gujarat, Rajasthan, Andhra Pradesh, Kerala, Orissa are the major wind power plants of India.

V.FUTURE SCADA SYSTEM AND SMART GRID IN INDIA AND CONCLUSION

Distributed computation, monitoring and control will offer an efficient method for power system operators. Distributed generation systems use decentralized control system where local generation plants own a SCADA system. SCADA technology helps the power companies to exchange information and data between different nodes in the entire network. This network comprises of energy management system and distributed management system. The smart grids have computerized systems that give efficient and smooth information exchange for monitoring [8].

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