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Smart Grid Technology for Intelligent Power Use

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Abstract—The existing Power Grids is antiquated, congested and inefficient in many ways and it does not take full advantage of new automation technologies that for example can prevent an outage or restore power much faster after an outage. It does not take advantage of new materials which can make the equipment throughout the grid more efficient. It was not designed for integrating large amounts of renewable energy generation into the grid which is necessary in order to reduce greenhouse gas emissions and prevent climatic changes. This paper proposes a method for better implementation of smart grids that integrates technologies of advanced sensing, control methodologies and communication capabilities into the current power grids at both the transmission level and distribution levels.

Keywords- Smart Grids, Intelligent Monitoring System (IMS), Sensors, Smart Meters, Data Centres.

I. INTRODUCTION

Most of the world relies on electricity system built around 50 years ago. These are inefficient and cannot offer an appropriate response to today's urgent global challenges. There is an estimated $13 trillion investment required in energy infrastructure over the next 20 years. This poses an imminent need and opportunity to shift towards a low carbon, efficient and clean energy system. Smart Grids will be a necessary enabler in this transition. Smart grid is a developing network of transmission lines, equipment, controls and new technologies working together to respond immediately to our 21st Century demand for electricity. It facilitates efficient and reliable end-to-end intelligent two-way delivery system from source to sink. In this way the system brings efficiency and sustainability in meeting the growing demandsof power with reliability and best of the quality.Smart Grids also enables real time monitoring and control of power system. The basic objectives of Smart Grids is to initiate active participation of customers, accommodate renewable energy generation and storage options, enable new products and services which would provide a better economy, optimise asset utilisation and operate efficiently, address disturbances through automated prevention, containment and restoration and operate resiliently against all hazards.

II. ROLE OF SMART GRIDS

Existing grids were designed to deliver electricity to the consumers and bill them once a month. The energy demands have been rising and it has become difficult for the existing grids to cope up with it. Smart Grids introduces a two-way communication where electricity and information can be exchanged between the customers and utilities. Smart Grids integrates advanced new technologies, Smart meters and there is a provision for data monitoring and control. It also integrates renewable energy such as the wind and solar energy to the grids. Besides that, the consumers can manage their electricity usage by measuring the electricity consumption through the Smart meters installed at their homes. Smart appliances can be designed which would adjust their run schedules to reduce electricity demand on the grid at critical times and lower the energy bills. Electricity is more costly during peak times because additional and often less efficient power plants must be run to meet the higher demand. Smart grids will enable utilities to manage and moderate electricity usage with the cooperation of their customers. Operators can manage the electricity consumption in real-time. The current distribution system is inefficient and any break in this system due to bad weather or storms or sudden changes in electricity demand can lead to power outages. Smart Grids distribution intelligence counters these energy fluctuations and outages. By automatically identifying problems and re-routing and restoring power delivery.

III. PROPOSED ARCHITECTURE

Smart meters installed at customer's side would control and monitor the energy consumption. The meter would then send this data to the energy supplier wirelessly through the internet. Data centers can continuously monitor the energy consumption of each and

every house. Decisions about increasing or decreasing electricity generation could be taken immediately depending on the consumption of the energy by the grids. This real-time information can be used to locate power failure, reroute electricity or avoid overheating power lines. Smart meters also provide detailed power usage information to the customers so that they can lower their monthly bills. This provides opportunities to save more. Similar to smart meters there would be new components integrated into the electric grid that would allow better communication and operations throughout the system. These improvements would help to better manage the delivery of electricity to where it is needed and improves restoration capabilities after an outage. Besides that, the utility companies can directly cut off the power supply if a customer has not paid their electricity bills on time and there is no need for the operators to physically visit the customer' house.

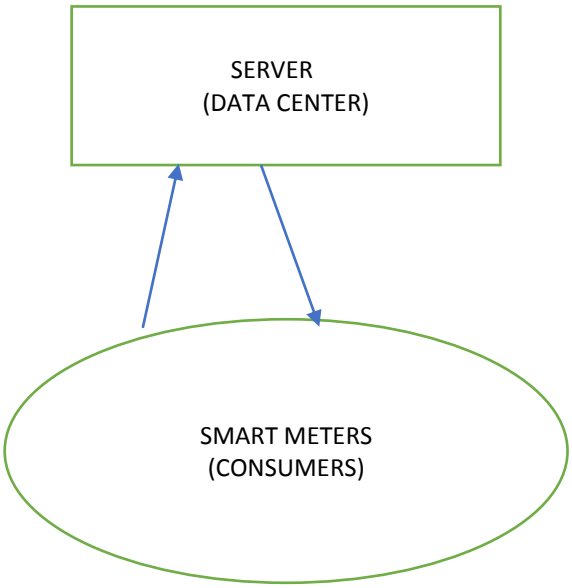

Fig 1 : Proposed Architecture

IV. DESIGN COMPONENTS OF SMART GRIDS

The proposed architecture gives design view of Smart Grid which includes the following components:

1) Smart Meters.
2) Intelligent Monitoring System.
3) Server or Data Center.

V. ADVANTAGES OF SMART GRID

1) Reduces Carbon Foot-Prints.
2) Improves distribution management and decision support software.
3) Smart Grids are self-healing.
4) Automated control for distribution.
5) High Quality Power.
6) Optimizes assets.
7) Resist attacks.
8) Accommodate generation options.

CONCLUSION

The aging electricity system infrastructure is inefficient and increasingly unreliable. While innovation and technology have dramatically transformed other industrial sectors the electric system has continued to operate in the same way for decades. So there is an urgent for the transformation of the electricity system and Utilities Industry. The proposed architecture would help us solve all the problems faced by the current Power Grids. Implementation of Smart Grids would revolutionise the energy sector which is the need of the hour.

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