

# Energy Management System: Smart Grid and Advanced Metering

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**Abstract - The purpose of this paper is to represent advanced metering in smart grid for the efficient distribution of energy among the consumers. Smart grid is the result of integration of networks. Local grids will not be able to provide energy as per the demand because of its centralized architecture, so there is requirement of smart grid which uses a decentralized architecture for power supply. AMI (advanced metering infrastructure) allows consumers to keep track of their energy consumption and give them the ability to efficiently manage the usage of electricity.**

**Keywords : Smart Grid, decentralized architecture, AMI, efficiency.**

## I. INTRODUCTION

Because of the centralized architecture and failure in balancing the demand and supply of power the local grids are likely to be replaced by the smart grid. In the smart grid the information and the energy is supplied to the consumers by means of two-way flow. This two-way flow creates a distributed network. Using two-way flow helps to save energy, reduce cost and increases reliability. The components of smart grid are database management, the interconnecting network and smart meter [1]. For efficient energy consumption and integration of networks smart grid uses interoperation.

In a smart grid there are five levels in the process of distribution of energy from supplier to the consumer-

- (1) Utility level.
- (2) Transmission level.
- (3) Distribution level.
- (4) Neighborhood level.
- (5) Household's level.

The purpose of using AMI(advanced metering infrastructure) is to monitor the power usage, store the metering data and optimize the energy consumption. For this AMI uses advanced meters and implements data management system.

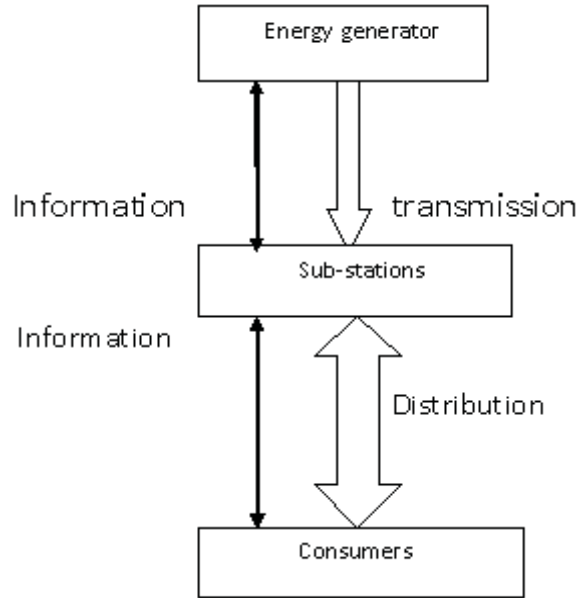


Figure 1 : Distribution of Engery in Smart Grid

## II. LEVELS OF SMART GRID

Utility level- It is the highest or primary level of smart grid responsible for the generation of energy. It stores the energy generated by the power grids. It helps to keep record of the energy consumption and helps to identify the demand of the consumers.

Transmission level- it is responsible for the transmission of the energy produced from the power generation plant to the sub-stations.

Distribution level- distribution level works for the process of distribution of the energy to the households from the sub-stations. It is the lower level communication network.

Neighborhood level- this level is the result of division of customer domain. It is attached with a local distribution center. This local distribution center is equipped with transceiver. This transceiver communicates with individual smart meters[2].

Household level- this is the lowest level of smart grid. It refers to the individual users which consumes the energy generated. All households are integrated to form a network. Through this network sub-stations communicate.

## III. WORKING OF SMART GRID

### 3.1 Smart Grid

Smart grids advocate the participant of consumers in the power business process including power generation, transmission, distribution and consumption [5]. Smart grid is technique for distribution of energy in efficient manner. It uses two-way communication between the energy supplier and the consumer. It does not refer to smart metering only, smart metering is one of its applications. It incorporates into the electricity grid the benefits of communications to deliver real-time information and enable the near-instantaneous balance of supply and demand [6].

### 3.2 distribution of energy

Distribution of energy in smart grid is decentralized that means it does not use a single large power generation grid in place of that it uses smaller power generation plants which generate power to be distributed among the consumers. Distribution of energy in smart grid is a two-way flow of electricity and information. Smart grid creates a widely distributed energy delivery network[3].

The energy generated is transmitted to the different sub-stations attached to it. These sub-stations receive energy according to their demand. This process is carried out by the transmission level of the smart grid.

Then from the sub-stations the energy is distributed among the individual households through the distribution level. To carry out this process there is a transceiver attached to the sub-stations, these transceiver communicates with the all individual households in the network of that particular sub-station. The individual consumers have the capability to manage their consumption of energy.

#### IV. BENEFITS OF SMART GRID

##### 4.1 Improved energy efficiency

Smart Grid manages energy efficiency due to its decentralized distribution of energy. In India the capacity of energy generation is 200 GW [1]. And the loss of energy in transmission and distribution process is 26% that is amongst the highest in the world. Smart Grid will be beneficial in managing the distribution of energy efficiently to optimize the loss.

##### 4.2 Manages demand-response

Smart Grid is capable of doing demand analysis, demand forecasting and demand management. There are two types of demand response 1. Price based DR, 2. Incentive based DR [4]. Demand-response management capability enables Smart Grid to provide the supply timely and in reasonable limits. The households generate the demand so due to prior knowledge of demand the peak loads can be reduced. It gives the balanced power supply by optimizing the demand of a particular region.

##### 4.3 Security

Since Smart Grid uses decentralized system for the distribution of energy it is resistant to the attack and natural disasters. Since it is decentralized its substations can be victim of disaster or attack not the whole system. The blackout in U.S. in 2003 was biggest blackout in history of U.S. at that time local grid system was in use there. Smart Grid uses secure distribution policy. The communication between households is stored in encrypted form for the privacy of data.

##### 4.4 Interoperability

Smart Grid provides interoperability amongst the different networks i.e. sub-stations for the better communication and transmission of data and energy. The interoperability provides the security and scalability.

#### V. CONCLUSION

After the survey we came to know how Smart Grid controls the energy consumption, storage and distribution. Smart Grid system can help to overcome with the global energy problem through reliable communication network. It is beneficial over the local grid system in aspects of interoperability, security, demand-response management and its efficiency due to its decentralized architecture.

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