R.M.K

COLLEGE OFENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

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# TOPIC : Introduction to SMART Distribution Network

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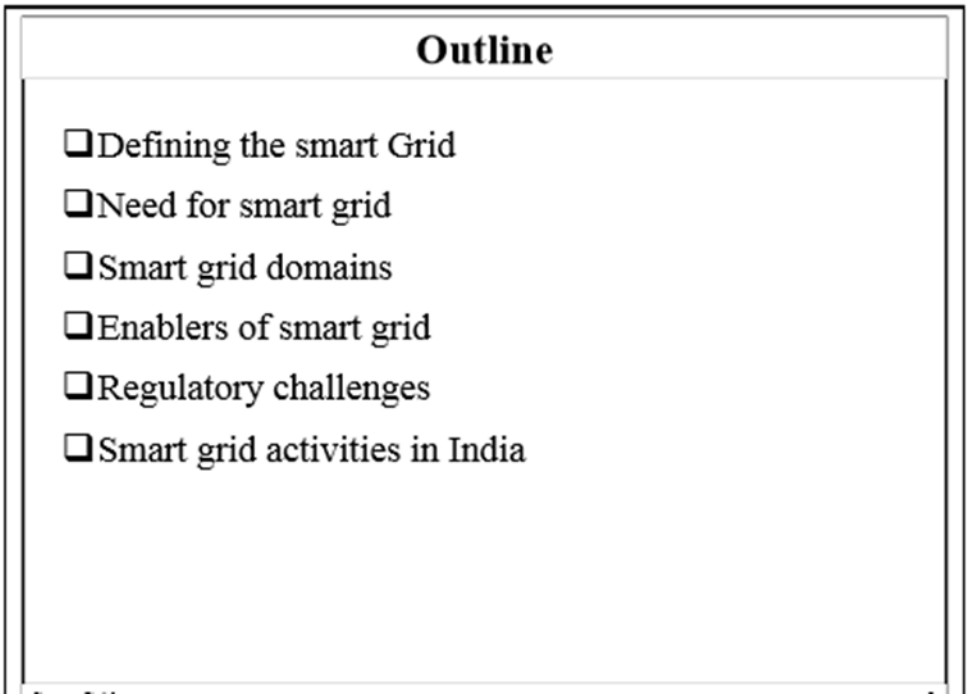
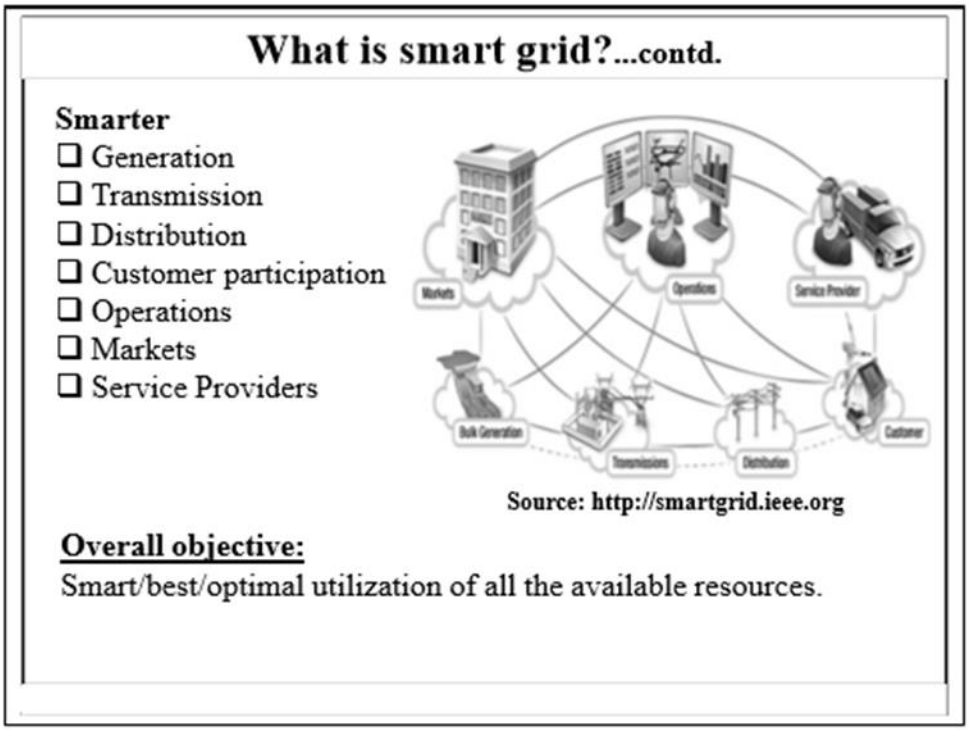
Power Systems FACTS devices Smart Grid

**During the presentation, professor shared and explained the following information.**



**Introduction:**

The demand for electrical energy is increasing rapidly. It is estimated that electricity demand will double between 2000 and 2030, with an annual growth rate of 2.4%, faster than the increase of any non-renewable energy source. Hence more renewable energy sources are needed in future energy systems.




**What is smart grid...**

**Definition by National Institute of Standards and Technology (NIST), USA**:

A modernized grid that enables bidirectional flows of energy and uses two-way communication and control capabilities that will lead to an array of new functionalities and applications.

**IEEE:**

Smart grid is a large 'System of Systems', where each functional domain consists of three layers:

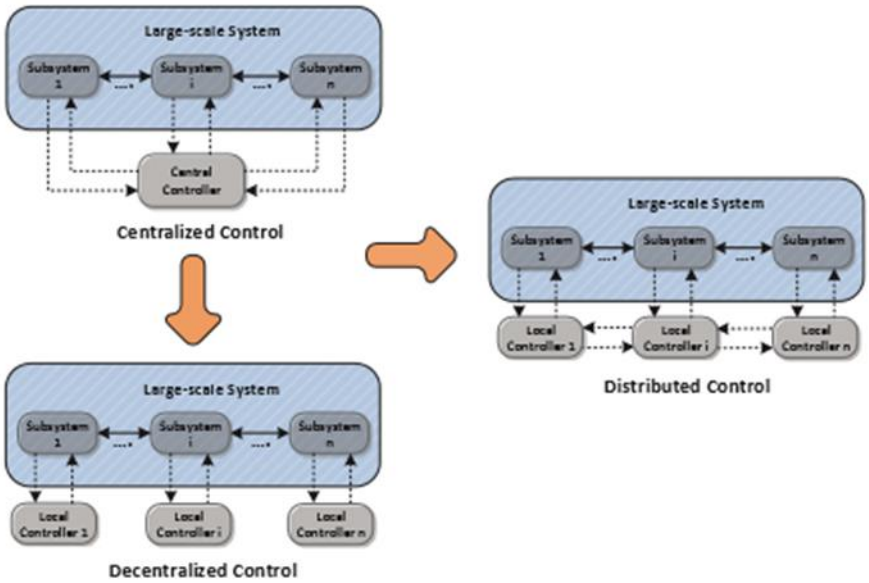
(i) the power and energy layer,
(ii) the communication layer, and
(iii) The IT/computer layer.
(iv) Layers (ii) and (iii) above are the enabling infrastructure that makes the existing power and energy infrastructure 'smarter'.

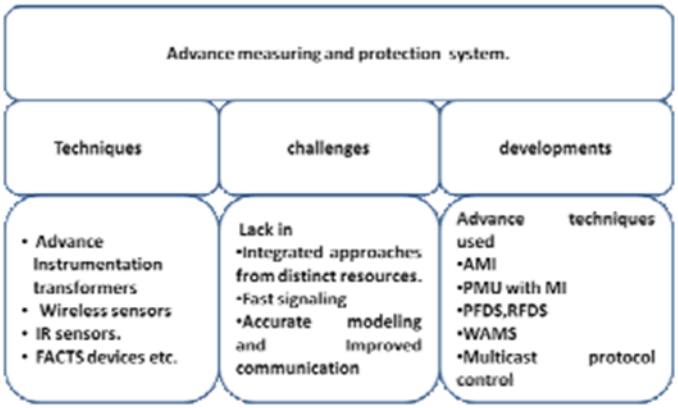
## II.COMPARISON BETWEEN THE CONVENTIONAL GRID AND SMART GRID

The traditional power grid is the network of interconnections of generating stations, high voltage transmission lines and distribution lines. It is electromechanical in nature which implies that the infrastructure comprises of mechanical devices that are electrically operated. It works very slowly by default. It lacks flexibility in the power source, just as in the transmission system. There is one-way communication between electricity providers and customers. Generally, when a smart grid comes into action, it ensures the better connections, maintains the efficiency and reduces the environmental effects.

Comparison between conventional and smart grid

| Conventional Grid | Smart Grid |
|---|---|
| One way communication | Two way communication |
| Centralized Generator | Distributed Generator |
| Manual monitoring | Self monitoring |
| Manual control | Pervasive control |
| Electromechanical | Digital |
| Less sensors | More sensors |






**A modern smart gird system which utilizes advance techniques as follows.**

(1) Integrated communication. This includes wired, wireless technologies, fiber optic and radio communication system with its techniques, challenges and developments.

(2) Advanced measuring and sensing system and protection system. This includes different metering, sensing devices with its techniques, challenges and developments.

(3) Improved grid control methods. This includes DAS, Phasor Measurement Unit (PMU) etc with its techniques, challenges and developments.

(4) Advance grid components. This includes Distributed Energy Resources (DER), Automatic Metering Reading (AMR) and Energy Management Systems (EMS), DR unit with its techniques, challenges and developments.

(5) Advance interface and decision support.

**The research objectives and scopes are detailed as follows:**

1. Based on the MG primary control model, develop distributed secondary control schemes for the islanded MG. This control structure allows each local controller to communicate with its neighbouring local controllers. The main function of the secondary control is to restore the frequency and voltage values to their nominal values while keeping the real power sharing accuracy no matter how the loads vary.

2. Develop a distributed secondary control scheme for the voltage quality enhancement problem such as voltage unbalance compensation. The proposed control scheme should be flexible and make the controller have the “plug and play” property.

3. Develop a distributed tertiary control structure to solve the economic dispatch and optimal energy scheduling problems in the smart grid system. Besides, as the energy system has become a interconnected large-scale system, a more proper multi-cluster optimization method should be developed.