
INTEGRATION IS KEY TO SMART GRID MANAGEMENT

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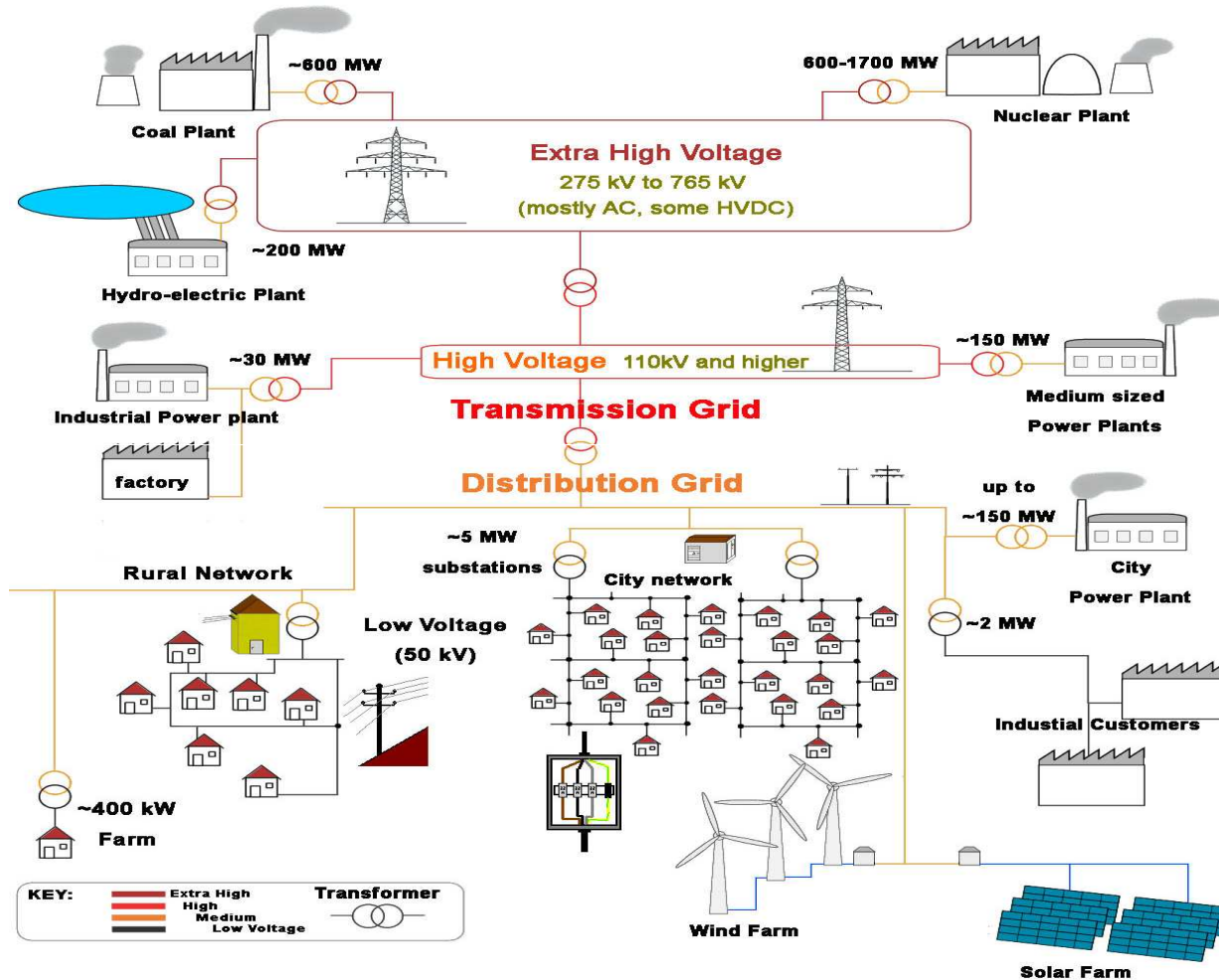
TOPICS

- Introduction
- What is Smart Grid?
- Principal Characteristics
- Technology
- Benefits



INTRODUCTION

Electrical Grid

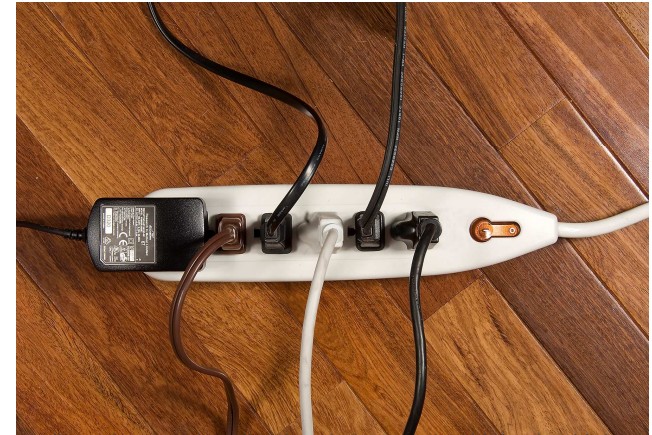


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INTRODUCTION

According to the US Department of Energy :

Since 1982, growth in peak demand has exceeded transmission growth by $\cong 25\%$ every year.



http://www.firesafety.gov/media/visuals/images/multiplug/multiplug_1.jpg

Power outages and interruptions cost at least \$150 billion each year.

OTHER CONCERNS:

- Environmental impact
- Customer choice

WHAT IS SMART GRID?

Integration of electricity and communications in an electric network.

Uses two-way digital technology.

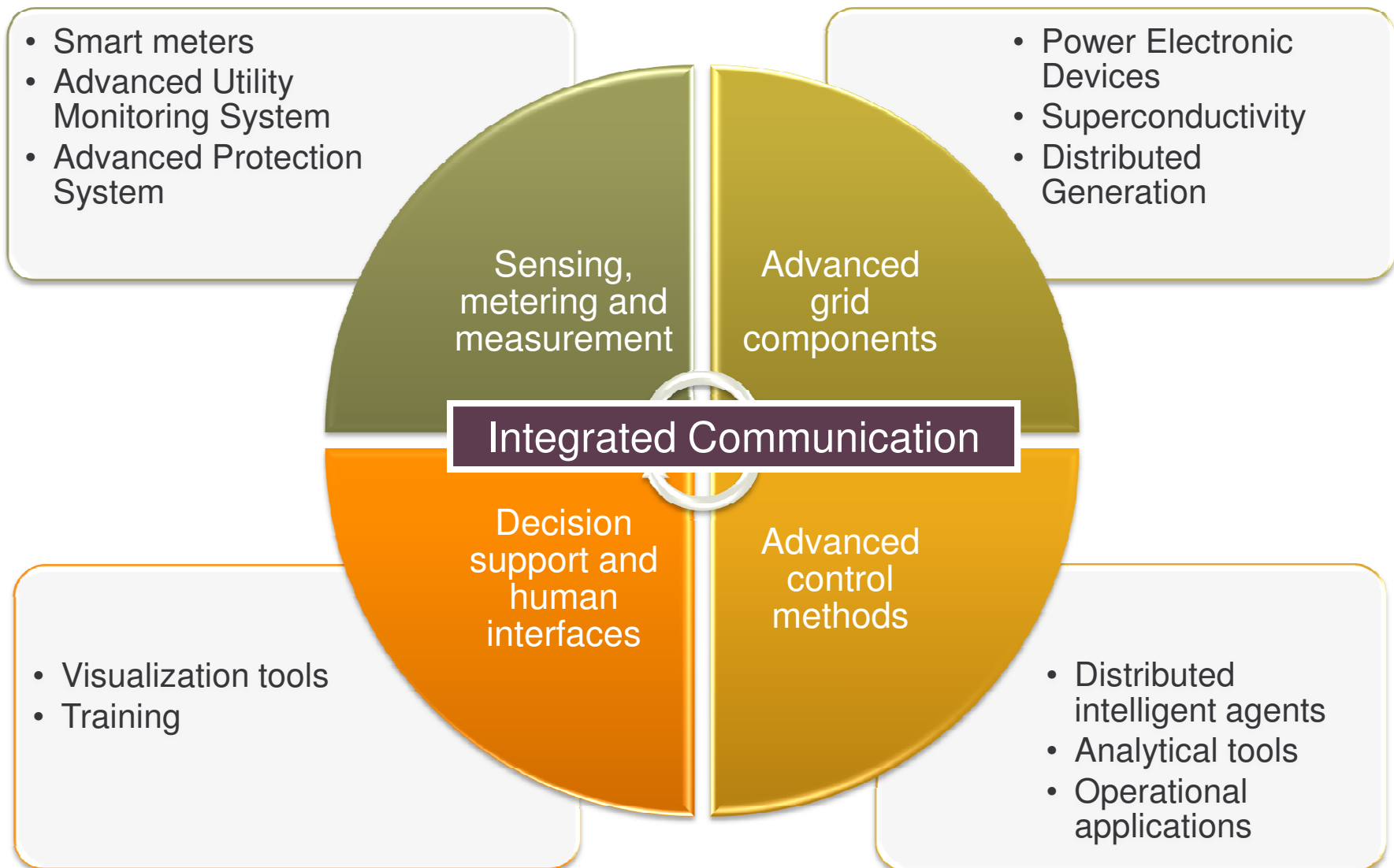
Includes intelligent monitoring systems that keep track of all electricity flowing in the system.



PRINCIPAL CHARACTERISTICS

- Self-healing.
- Empowers and incorporates the consumer.
- Tolerates security attacks.
- Provides enhanced power quality.
- Accommodates a wide variety of generation options.
- Fully enables electricity markets.
- Optimizes asset utilization and minimizes operations and maintenance expenses.

TECHNOLOGY



TECHNOLOGY

SENSING, METERING, AND MEASUREMENT

1. Smart meters

- Advanced electrical meter.
- Can connect and disconnect remotely.
- Communicates with the local utility.



http://en.wikipedia.org/wiki/File:Elster_I_type_R15_electricity_meter.jpeg

2. Advanced Utility Monitoring System

a) Phasor Measurement Units (PMU)

- Distributed throughout the network to monitor power quality.
- GPS based measurement of instantaneous magnitude of current or voltage at a particular location.

b) Wide-Area Measurement Systems (WAMS)

- Network of PMUs to monitor networks at regional and national level.



TECHNOLOGY

- c) Dynamic line rating technology
- d) Compression connector sensor
- e) Insulation contamination leakage current sensor
- f) Backscatter radio technology
- g) Electronic instrument transformer

3. Advanced Protection System

- a) Fault-testing recloser
- b) Special protection system



TECHNOLOGY

ADVANCED GRID COMPONENTS

1. Power Electronic Devices

- Various devices to measure maximum current, current sag.

2. Superconductivity

- Cables used – 1G, HTC, 2G.

3. Distributed Generation

- Electricity generated from solar panels, wind turbines.



TECHNOLOGY

ADVANCED CONTROL METHODS

1. Distributed Intelligent Agents

- Digital protective relay
- Dynamic circuit rating tool
- Energy management system
- Grid-friendly appliance controller
- Dynamic distributed power control devices

2. Analytical tools

- System performance monitoring, simulation, and prediction
- Phasor measurement analysis
- Weather prediction and integration
- Ultra-fast load flow analysis



TECHNOLOGY

3. Operational applications

- Substation automation
- Distribution automation
- Outage management
- Asset optimization
- Condition-based maintenance (CBM)
- Demand response



TECHNOLOGY - INTEGRATED COMMUNICATION

Broadband
over Power
Line

Wireless technology

- Multiple address system radio
- Paging networks
- Spread spectrum radio systems
- WiFi
- WiMax
- 3G
- TDMA
- CDMA

Other technologies

- Internet
- Fiber to the home
- Hybrid fiber coax architecture
- Radio frequency identification (RFID)



BENEFITS

- Reduction in congestion cost.
- Reduced blackout probability.
- Reduction in restoration time, operations and maintenance.
- Reduction in peak demand.
- Increased integration of distributed generation resources and higher capacity utilization.
- Increased security and tolerance to attacks.
- Power quality, reliability, and system availability and capacity improvement due to improved power flow.
- New options for consumers to manage their electricity use and costs.
- Environmental benefits gained by increased asset utilization.

CONCLUSION

- What is Smart Grid?
- Principal Characteristics
- Technology
- Benefits



SOURCES

- [http://www.oe.energy.gov/DocumentsandMedia/DOE_SG_Book_Single_Pages\(1\).pdf](http://www.oe.energy.gov/DocumentsandMedia/DOE_SG_Book_Single_Pages(1).pdf)
- http://en.wikipedia.org/wiki/Smart_grid
- <http://www.netl.doe.gov/moderngrid/>

