3. Overall vision of smart grid

The so called smart grid should be

- Intelligent

  - capable of sensing, rerouting power, and minimizing a potential outage
  - work autonomously and respond faster than humans

- Efficient

  - capable of meeting increased consumer demand without adding infrastructure

- Opportunistic

  - create new opportunities and markets
  - capitalize on plug-and-play innovation whenever and wherever appropriate

Vision of smart grid continued

- Accommodating

  - accept energy from virtually any source

  - capable of integrating any better idea and technology easily

- Motivating

  - enable real-time communication between consumer and utility

  - facilitate tailoring of energy consumption based on price and other environmental concerns

- Quality focused

  - deliver high quality power without sags, spikes and disturbances

  - ability to power the increasingly digital economy

Vision of smart grid continued

- Resilient

- increasingly resistant to attack and natural disasters as it becomes more decentralized

- reinforced with smart grid security protocols for enhanced security

- resilience versus reliability

IEEE definition: reliability [engineering] is “a design engineering discipline which applies scientific knowledge to assure that a system will perform its intended function for the required duration within a given environment, including the ability to test and support the system through its total lifecycle.”

Vision of smart grid continued

- Green

  - slowing the advance of global climate change and

  - offering a genuine path toward significant environmental improvement.

4. Scope of smart grid

Areas that cover the scope of the smart grid include

- The delivery infrastructure

- e.g., transmission and distribution lines, transformers, switches

- The end-use systems and related distributed-energy resources

- e.g., building and factory loads, distributed generation, storage, electric vehicles

- Management of the generation and delivery infrastructure at the various levels of system coordination

- e.g., transmission and distribution control centers, regional reliability coordination centers, national emergency response centers

Scope of smart grid continued

- The information networks themselves

  - e.g., remote measurement and control communications networks

  - inter- and intra-enterprise communications, public Internet

- The financial and regulatory environment

  - that fuels investment and motivates decision makers to procure, implement, and maintain all aspects of the system

  - e.g., stock and bond markets, government incentives, regulated or non-regulated rate-of-return on investment

5. Benefits of smart grid

- Increased power efficiency

  - reduce transmission, distribution and customer load losses

  - increase efficiency of electrical generation

- Optimized asset utilization and efficient operation

  - manage existing plant generation using real-time demand prediction instead of constructing new plants

  - increase utilization of line capacity

Benefits continued

- Accommodating all generation and storage options

  - accommodate various power generation sources

  - offer net-metering, reduce imported fuel and develop storage technologies

- Facilitating integration of distributed generation

  - Provide small-scale on-site generation opportunity as an alternative approach to reduce energy losses in transmitting electricity

- Facilitating integration of renewable resources

  - integrate all means of renewable sources

  - help meet the states' RPS (renewable portfolio standard) standards

Benefits continued

- Increased system reliability

  - predict & respond to system disturbances and reduce outage times

  - be resilient to attack and natural disasters by self healing

- Improved outage management

  - quickly and precisely : identify, locate and respond to fault

- Improved power quality

  - reduce losses caused by power quality issues

  - offer flexible level of power quality based on different customer demand.

Benefits continued

- More effective consumer load control

  - Implement effective demand-side management, offer the opportunity of dynamic pricing

  - allow customers to tailor their energy consumption

- More effective distribution monitoring

  - utilize advanced sensing and measurement technology in power distribution system, more effective SCADA system

- Increased national and information security

  - protect data and information privacy, and enhance cyber security.

Benefits continued

- Reduced environmental impact

  - reduce emissions, CO2, SO2 & NOx, ensure sustainable development

- Improved national and regional competitiveness

  - Result in lower electricity rate and energy bills, enable new jobs, services and markets

- New customer service benefits

  - Provide the digital channel for two-way communication and better fulfill customer demands

- New governmental and regulatory benefits

  - better global intercommunication, more engagement from government and regulatory agency, provide better services