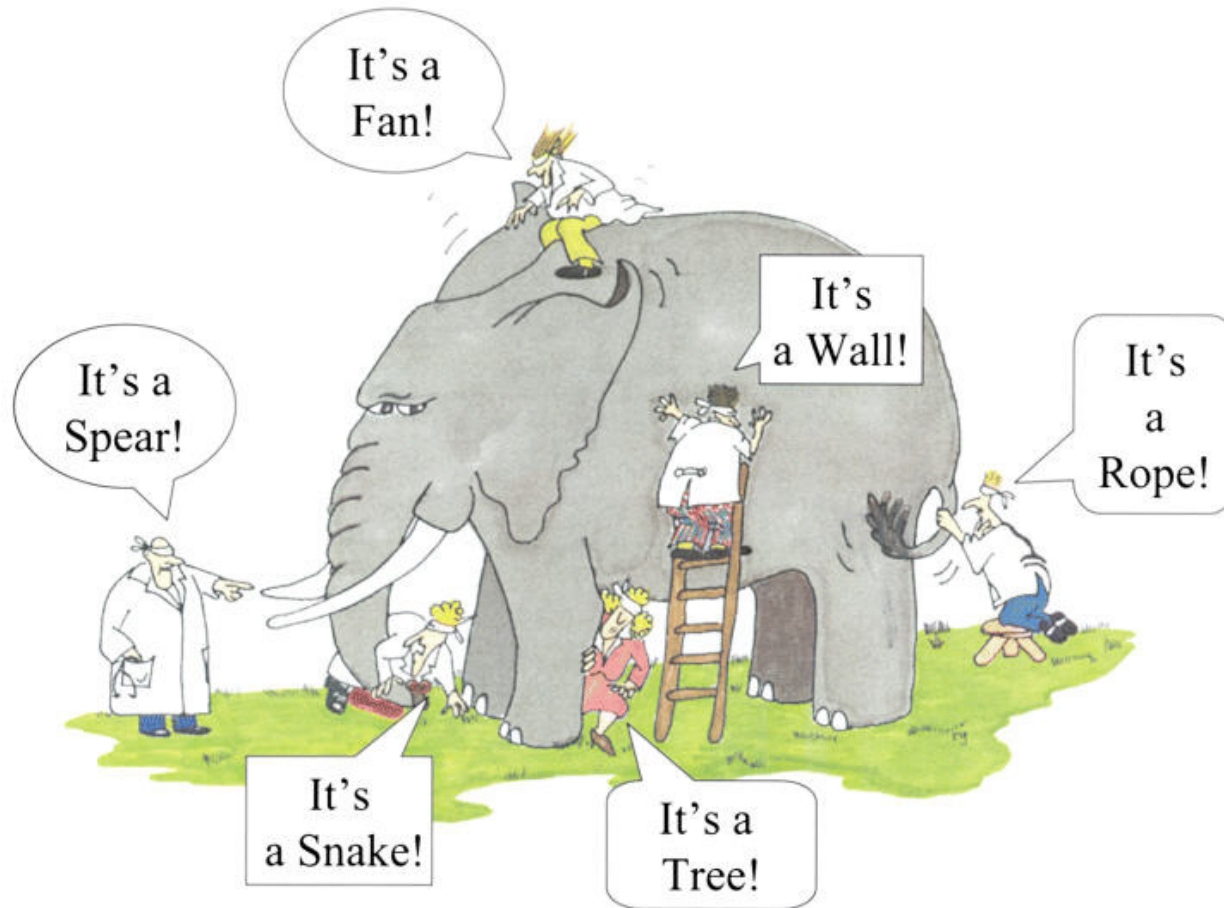


Introduction to the Smart Grid

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The Blind Men and the Elephant



Smart Grid

- To ensure sustainable energy future, all solutions that focus on energy efficiency, renewable energy, energy storage, plug-in electric cars, etc., will depend on Smart Grid to achieve scale and cost effectiveness.
- As foundation for sustainable energy future, actually Smart Grid will optimize whole energy value chain. The benefits driving energy grid to smart grid, not only for utilities grid operators, but also for consumers and society as a whole.



Smart Grid Must Provide Integrated Set of Functions

- Complete, Consistent and Balanced
- Able to add new Functions, Products, Services, and Markets
- Achieves highest level of Performance, Optimizes Asset Utilization and Operating Efficiency
- Enable active Participation by Consumers
- Operates resiliently against Physical and Cyber Attacks and Natural Disasters



What is driving current interest in Smart Grid?

- Environmental Factors
 - Global Warming
 - Pollution of air, water, land
 - Energy security
- Economic Factors
 - Industrial development
 - Improved standard of living
 - Energy efficiency
 - Operational efficiencies, and consumer choice
- Network Integrity
 - Reliability
 - Security



What is the impact of improved technology?

- Computer technology
- Communications technology
- Smart meters
- Open Integrated System Models (ISM)
- Real-time data centers
- High-accuracy, multi-function sensors (e.g. PMUs)
- Actuators (e.g. smart transformers)
- Monitoring, Control and Optimizing Software



Potential Smart Grid Pilot Projects in China

I. Smart meter two-way communications between utility and customer.

- Utility to Customer
 - Time of day pricing menu
 - Demand management signals
 - Internet, other services
- Customer to Utility
 - Billing data
 - Willingness to cut back demand
 - Optimal buying strategy
- Smart meters will integrate “behind-the-meter” devices such as Energy Storage Units, PHEVs, DG, intelligent apparatus and devices for controlling or influencing load.



II. Integration into grid of intermittent renewable generation sources

- Storage devices, smart transformers, open integrated system models, monitoring and control software
- Wind, solar, geothermal, other
- To maximize replacing non-renewable generation with renewable sources, smart grid will supply to control bidirectional power flows and monitor, control DG and Storage resources of generation.



III. Grid-wide Optimization

- Economic, environmental, network integrity factors
- Accurate modeling of all devices in grid (Integrated System Model)
- Sensors, actuators (e.g. smart transformers)
- Communications, computers, smart meters, data centers
- Monitoring and control software to optimize all generation assets including reduction of transmission and distribution losses, and based on synch-phasors, reducing transmission congestion.
- Automated diagnostic and self-healing capability prolongs the life of the electric infrastructure.

