Smart Grid Introduction
PSERC Executive Forum
General agreement was reached among the major “thought leading” groups – GridWise Alliance, Electric Power Research Institute, Edison Electric Institute, Galvin Initiative, and the Modern Grid Strategy – on the seven major characteristics.

A properly planned, designed, implemented, and operated smart grid will:

1. Optimize asset utilization and operating efficiency
2. Accommodate all generation and storage options
3. Provide power quality for the range of needs in a digital economy
4. Anticipate and respond to system disturbances in a self-healing manner
5. Operate resiliently against physical and cyber attack and natural disasters
6. Enable active participation by consumers
7. Enable new products, services, and markets

Sample U.S. SG Programs

**Sempra**
OpEx 20/20 reinvents key systems (GIS, OMS, DMS, CBM, customer), and processes (work management, dispatch). Also drives new initiatives (PHEV, meter automation, SG design, advanced conductor R&D)

**Oncor**
Advanced metering with a comprehensive consumer education program and in home displays. Also installing world’s largest cluster of Static Var Compensators (SVCs) to provide high-speed voltage support and increased transmission capacity and efficiency, enabling generation options

**AEP**
gridSMART is a strategic initiative to address environment concerns, aging workforce, customer service and programs, and operational effectiveness. A three model city program will demonstrate viability of smart grid and AMI technologies, build regulatory and consumer acceptance an confidence, verify the cost-benefit model, and establish a foundation for integrating technologies.
What drives the introduction of smart grids?

Increasing electricity consumption

Environmental concerns - Reduction of CO₂

Security of energy supply
Reduced dependency on fossil fuels from sensitive regions

Growing share of renewable power generation
Wind will grow from 111TWh in 2005 to 1’300-1’800TWh in 2030
Solar will grow from 3TWh in 2005 to 160-350TWh in 2030

Significant shares of the renewable power will be distributed and intermittent

Energy efficiency
T&D losses – target reduction of 2% in 2020 (EU)

Open energy market
Consumer pricing to foster Demand response

Impact on grid stability and efficiency

Introduction of Smart Grids
- Information & control technologies to achieve required stability
- Requires regulatory support (only exceptional business cases) and development of standards

Reliability of electricity supply
- Aging infrastructure
- Aging workforce
- IT security
Smart Grid includes applications supporting the whole electricity supply chain

- Renewable energy integration
- Consumer gateway, home automation
- Energy storage integration
- Increasing grid reliability: fault management
- Efficient long distance transmission
- Plug-in vehicles for grid
- Decision support for operations
- Grid operation with distributed generation
- Load management/demand response
- Local balancing of distributed resources
- Conventional power generation: increased flexibility
- Increasing grid capacity: asset utilization, power flow control
Impact of smart grids – main challenges

General
- **Efficient operation** in line with new and changing regulatory framework
- **Reliable power system** with both centralized and decentralized generation
- Increased **integration** with maintained security
- **Energy efficiency** with improved power quality
- Manage **consumer choice** and increased service requirements
- Improve **asset utilization** with aging infrastructure
- Maintain **system integrity** with aging workforce

Generation
- Optimize ‘spinning reserves’ with increased amount of renewable energy and demand response

Transmission grids
- Maintain grid stability with increased amount of renewables
- Reduce transmission losses

Distribution grids
- Maintain protection system integrity with increased amount of distributed renewable energy
- Demand response (regulatory demand) - Real time price information

Consumers
- Demand Management
- Optimize electricity consumption – home automation
## Smart Grid Maturity Model – Levels, Descriptions and Results

### Level 1: Exploring and Initiating
- Contemplating Smart Grid transformation. May have vision, but no strategy yet. Exploring options. Evaluating business cases, technologies. Might have elements already deployed.

### Level 2: Functional Investing
- Making decisions, at least at functional level. Business cases in place, investments being made. One or more functional deployments under way with value being realized. Strategy in place.

### Level 3: Integrating – Cross Functional
- Smart Grid spreads. Operational linkages established between two or more functional areas. Management ensures decisions span functional interests, resulting in cross functional benefits.

### Level 4: Optimizing – Enterprise Wide
- Smart Grid functionality and benefits realized. Management and operational systems rely on and take full advantage of observability and integrated control across and between enterprise functions.

### Level 5: Innovating – Next Wave of Improvements
- New business, operational, environmental and societal opportunities present themselves, and the capability exists to take advantage of them.

### Vision
- Experiments

### Strategy
- Proof of Concepts

### Transformation
- Real time corrections
- Broad reuse

### Systemization
- Repeatable practices
- Shared information

### Cross LOB Champions
- Innovators

### Perpetual Innovation
- Self-healing operations
- Autonomic business

### Missionaries

### Innovators

### Prophets, Heroes

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**An evolution through a phased-in approach**
The Smart Grid Will Provide Opportunity for the Utility to Achieve Their Key Business Strategic Goals

- Optimize CAPEX Spend
- Optimize OPEX Spend
- Improve Reliability
- Improve Operating Efficiency
- Reduce Operating Risk
- Improve Security & Compliance
- Improve Customer Satisfaction
- Increase Shareholder Value
Smart Grid Value

- **System Reliability**
  - Maximize customer service quality
  - Maximize grid reliability

- **Operational Efficiency**
  - Minimize distribution system line losses
  - Maximize network performance
  - Optimize resources, time and repair actions

- **Asset Utilization**
  - Minimize risk of failures
  - Deferred capital spending
  - Prioritize equipment and facility for repairs

- **Generation Flexibility**
  - Renewables
  - Energy storage
  - Demand response
  - Distributed generation
  - Transmission technologies