A PATHWAY TO THE CALIFORNIA SMART GRID OF 2020

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Smart Grid

Smart Grid is the capability to know the location of an electron in the electric grid from kinetic potential or spark fuel, to end-use and the concept of leveraging the latent intelligence of the electric utility grid and associated business processes to benefit the environment, utility customers, and utility operations.

Currently, Smart Grid investment is focused on smart sub-stations, smart homes, and smart communications paired with smart thermostats, appliances, and in-home control devices that take advantage of smart rates, such as time of use and demand response.

At the cutting edge, Smart Grid also takes advantage of additional green power sources, provides the ability to handle plug-in hybrid vehicles, enables automated outage notification (or any two-way communications with the customers), and encourages environmental impact reduction and energy conservation.

The smart power grid will be amazing! Smart Grid technologies that bring new information and response capability that will change virtually every aspect of the electricity system and transform the utility; enabling everything from distributed demand-side management to wide-scale distributed generation.

Smart Grid is not just a technology evolution, nor a fad in utility operations management. It is, without hyperbole, a complete paradigm shift that will change the electric power industry from top to bottom.

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Smart Grid 2009

Drivers of Change

- Addressing environmental concerns and degradation is critical
- The economic and social costs of high priced energy are enormous and long-lasting
- Demand-side management requires advanced system controls and monitoring
- Customer-based demand response requires massive amounts of information
- Transferring larger amounts of power across the grid requires a greater "system awareness"
- The threat of terrorism and natural disasters requires securing critical infrastructure
- Market liberalization requires coordination between generators, power marketers and transmission operators, and power consumers

Barriers to Change

- Lack of adequate integration of distribution and transmission
- Lack of integration of different types of information from different sources
- Inability to accurately represent wide area behavior
- Inability to accurately represent appliance-level behavior
- Computation, analysis and communication slower than real time
- One-size-fits-all views that cannot be customized for different users, such as system planners, system operators, policymakers, or utility customers

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Smart Grid 2020

- **The grid will be "self-healing."** Sophisticated grid monitors and controls will anticipate and instantly respond to system problems in order to avoid or mitigate power outages and power quality problems.

- **The grid will be more secure from physical and cyber threats.** Deployment of new technology will allow better identification and response to manmade or natural disruptions.

- **The grid will support widespread use of distributed generation.** Standardized power and communications interfaces will allow customers to interconnect fuel cells, renewable generation, and other distributed generation on a simple "plug and play" basis.

- **The grid will give consumers better control** of the appliances and equipment in their homes and businesses. The grid will interconnect with energy management systems in smart buildings to enable customers to manage their energy use and reduce their energy costs.

- **The grid will achieve greater throughput lowering power production and transmission and distributions costs.** Grid upgrades that increase throughput and optimize power flows will reduce waste and maximize use of the lowest-cost generation resources.

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Critical Communications Infrastructure

Smart Grid mandates that the system be standards-based, designed to be transport-agnostic and of multi-application wrapped in a robust, and impenetrable web of the highest security.

- **Standards-based - A standards based network ensures that new utility and consumer devices can easily be incorporated into the Smart Grid and used as "network assets" not "network liabilities."**
- **Transport-agnostic – A communications media agnostic network that enables security, provides the ability to talk-across the network from open and proprietary systems and equipment and limits the need to connect to the back office is crucial to Smart Grid efficacy.**
- **Multi-application – A multi-application network providing appropriate bandwidth, and vertical integration capability is necessary to ensure that both today's and tomorrow's capabilities are easily accommodated.**
- **High security - An absolutely secure, fully redundant, tamper proof and self-healing network will ensure that capabilities, information, and the infrastructure itself is safe and performing according to specification.**

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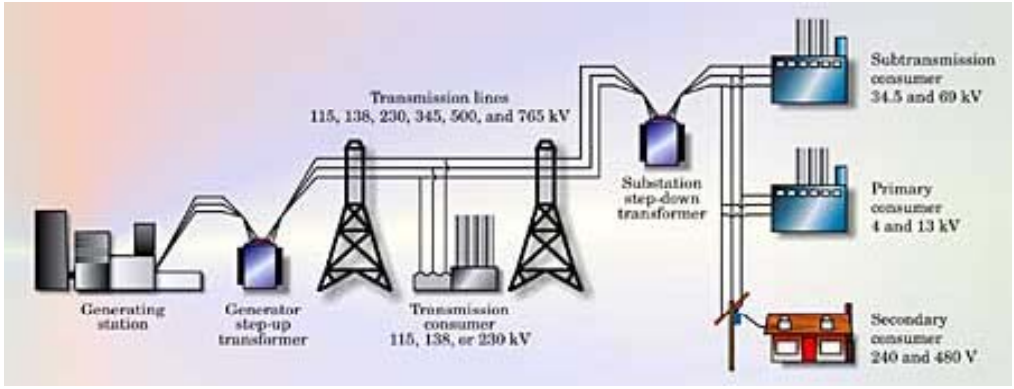
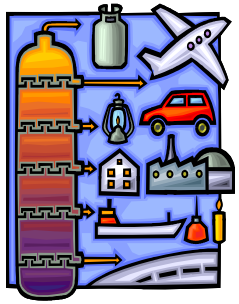
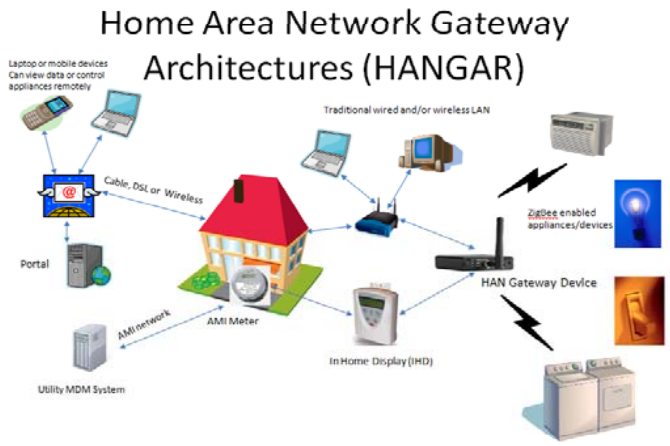
Smart Grid Must Embrace *Multi*-Layers of Technologies and Use Cases







Example Use Cases

- **Customer Service**
- **Field Service**
- **Operations**
- **Asset Management**
- **Generation**
- **T&D**
- **Finance & Accounting**
- **Rates & Pricing**
- **Marketing**

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UtiliPoint is a global research based management consultancy with roots in the energy and utilities industry spanning more than 75 years.

UtiliPoint is the founder of industry recognized AMI-MDM working group and a thought leader in Smart Grid technology, economics and business.

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