

Security and Privacy Challenges in the Smart Grid

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The Smart Grid

The Smart Grid

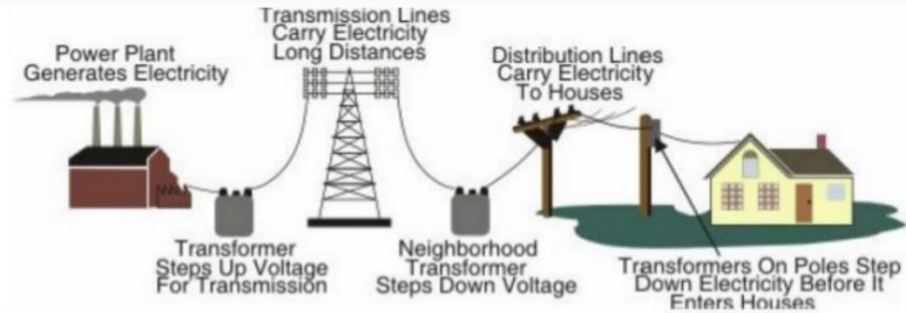
- Modernization of the existing electrical system
 - A vast network of computerized meters and infrastructure

Power Flow Comparison

Before Smart Grid:

*One-way power flow,
simple interactions*

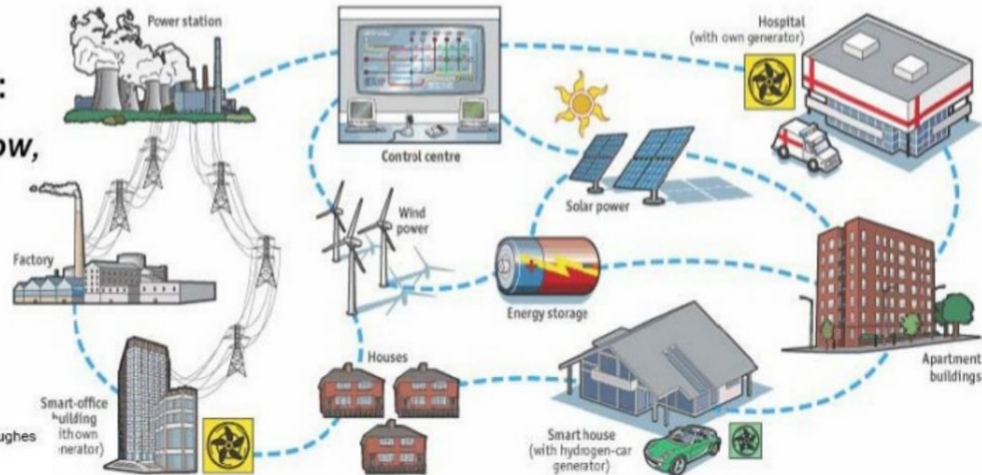
Traditional Grid



After Smart Grid:

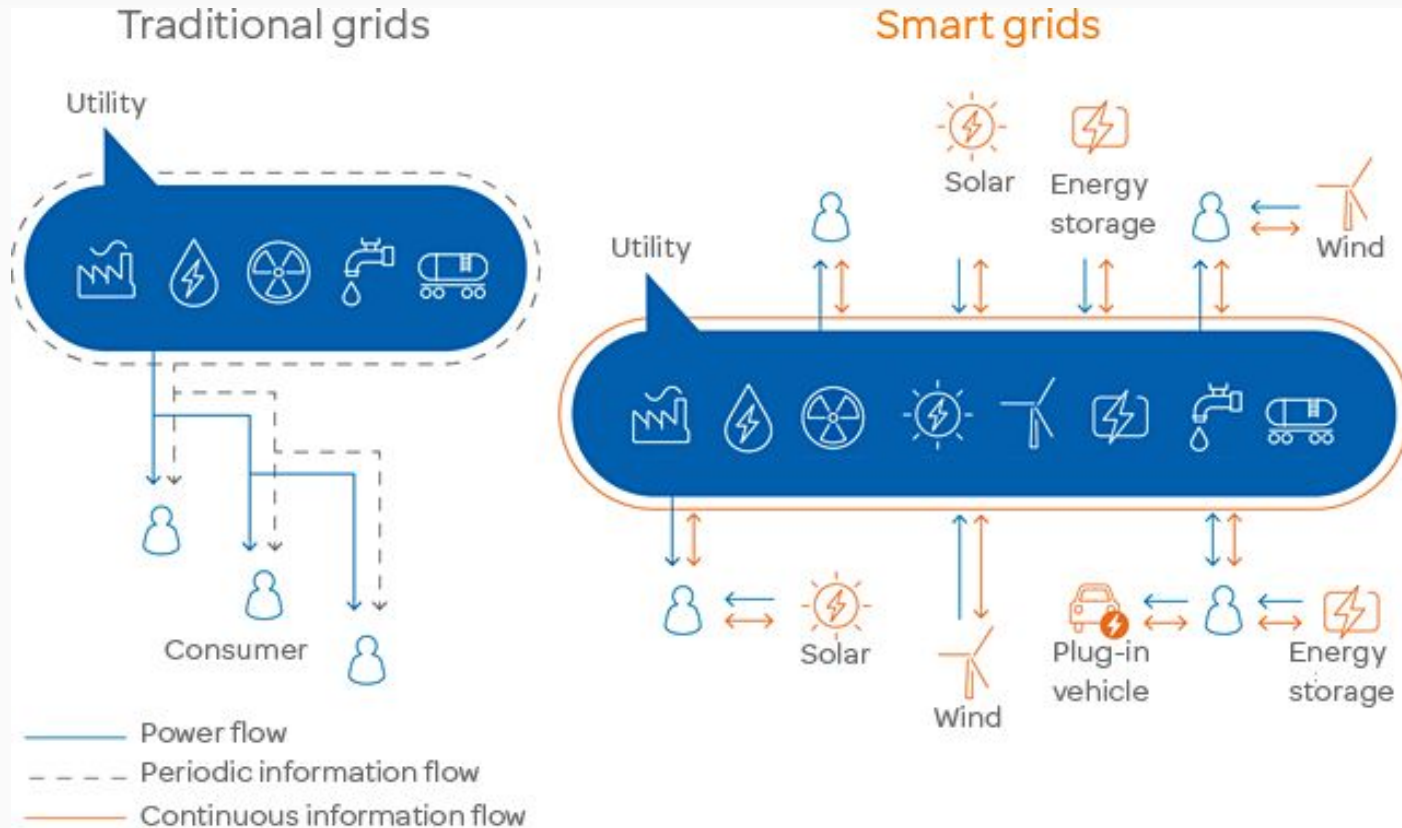
*Two-way power flow,
multi-stakeholder
interactions*

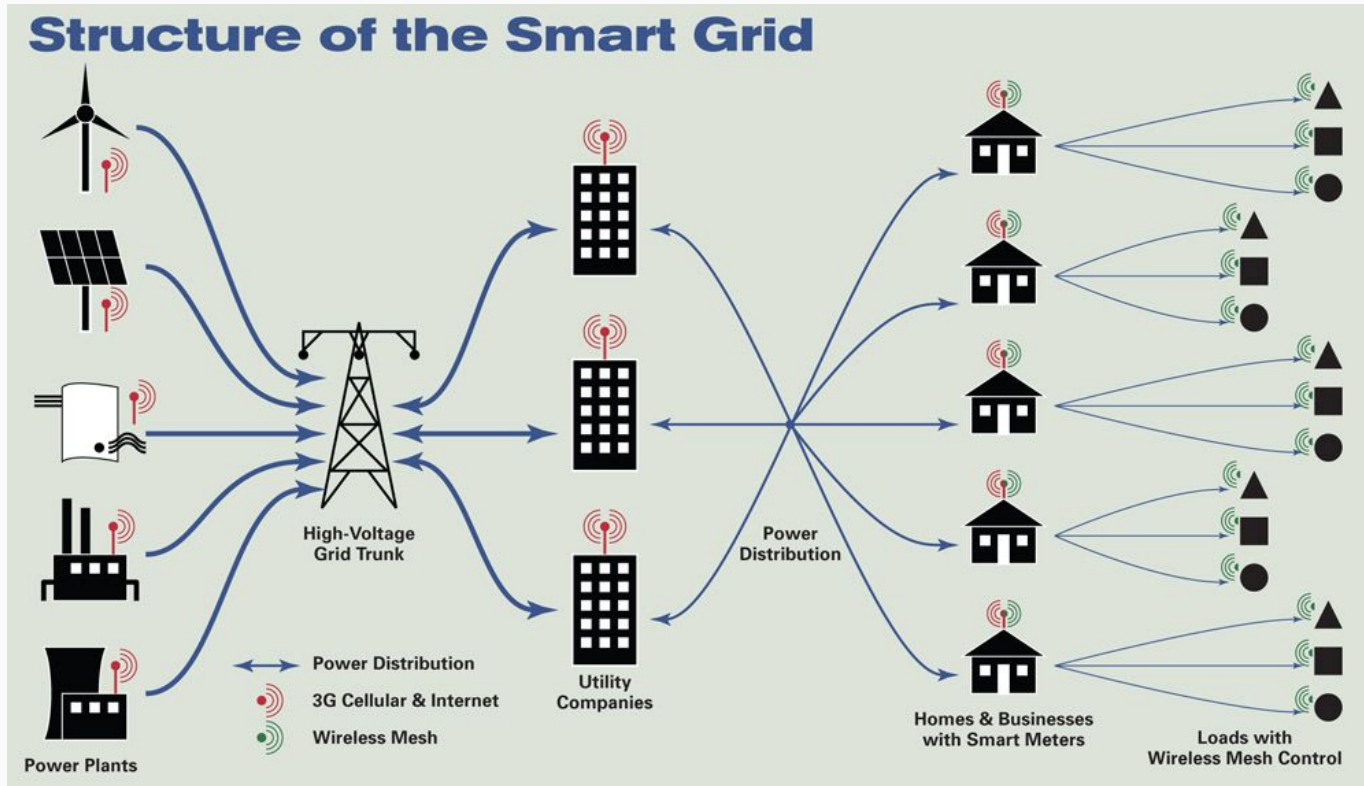
Smart Grid



Adapted from EPRI Presentation by Joe Hughes
NIST Standards Workshop
April 28, 2008

Information Flow Comparison





The Smart Grid

- Modernization of the existing electrical system
 - A vast network of computerized meters and infrastructure
- Benefits for consumers
 - More control over their energy use/utility costs
 - Improved reliability, outage response, and service convenience
- Benefits for industries
 - Time-of-use pricing (e.g. charging higher fees during peak hours)
 - Better capacity and usage planning
 - More malleable energy markets

Security and Privacy Concerns

Meter Manipulation

- Customer frauds
 - Fabricated meter readings (like meter inversion)
- False indictment

Network

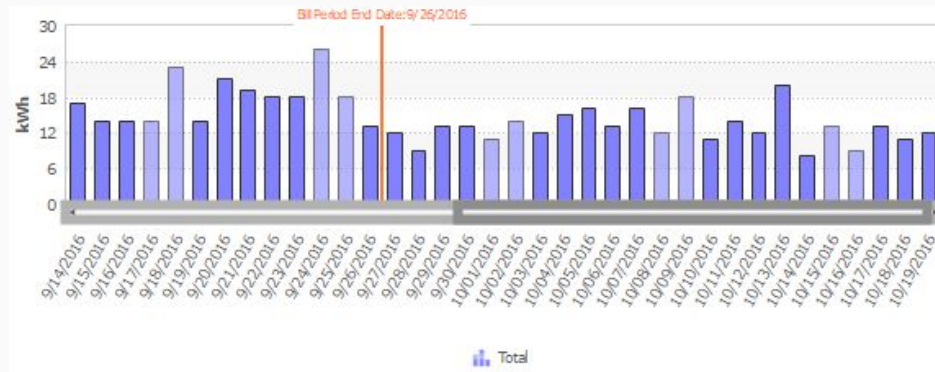
- Bidirectional communications
- Targets include meters and infrastructure
 - Meter bots
 - DDoS
- Communication protocols

Shared Information

- Energy usage patterns
- Google PowerMeter Service
 - Unclear laws, regulations, and guidelines

Current State of Smart Grids (Ameren)

- Upgrades in progress
 - “By 2019, more than half (62%) of electric customers will receive [smart] meters”
- Daily usage reports and time-of-use (real-time) pricing option available
- Still rely on meter reading in-person



Future of Smart Grids

- Long-term vision
 - Global energy management
 - Home area networks that can control smart appliances

What Now

- Laws, regulations, consumer protections
- More studies to mitigate the concerns
 - Approaches suitable for critical systems
- Plan for failure
 - Resilience
 - Reliability

Discussion

- Does the smart grid increase resilience to system failures and cyber physical attacks?
- The smart grid is going to happen. But what about the long-term goals of the smart grid? Are they realistic? Should we prepare defense strategies? Or do we need more realistic goals?
- Any other security and privacy concerns?