

Smart Buildings and Grid Modernization – Opportunities and Challenges

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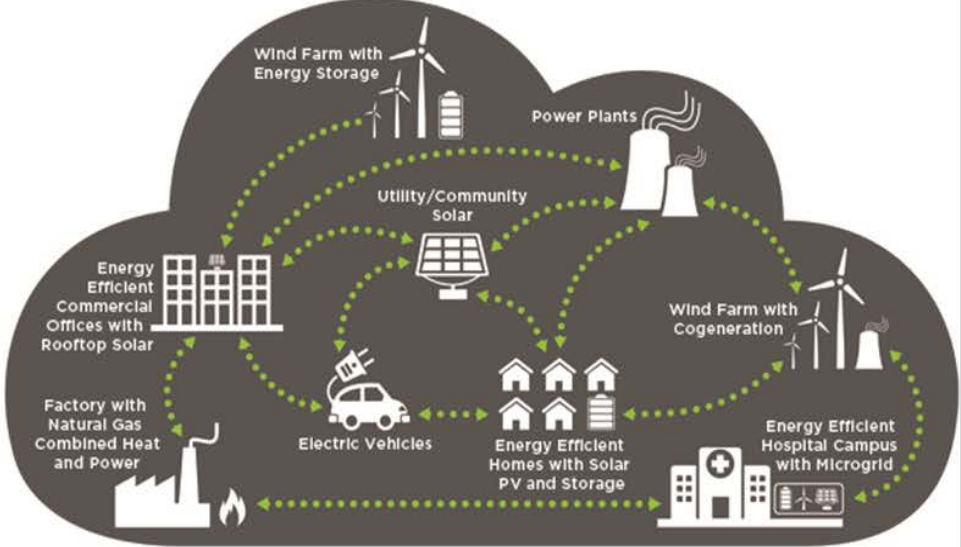
Evolved Electric Grid

- **Information / Energy flow** (One-way => Two-way)
- **Energy resources / Control** (Centralized => Distributed)
- **Market** (Simple => Dynamic)

TODAY: ONE-WAY POWER SYSTEM
Central, One-Way Power Systems



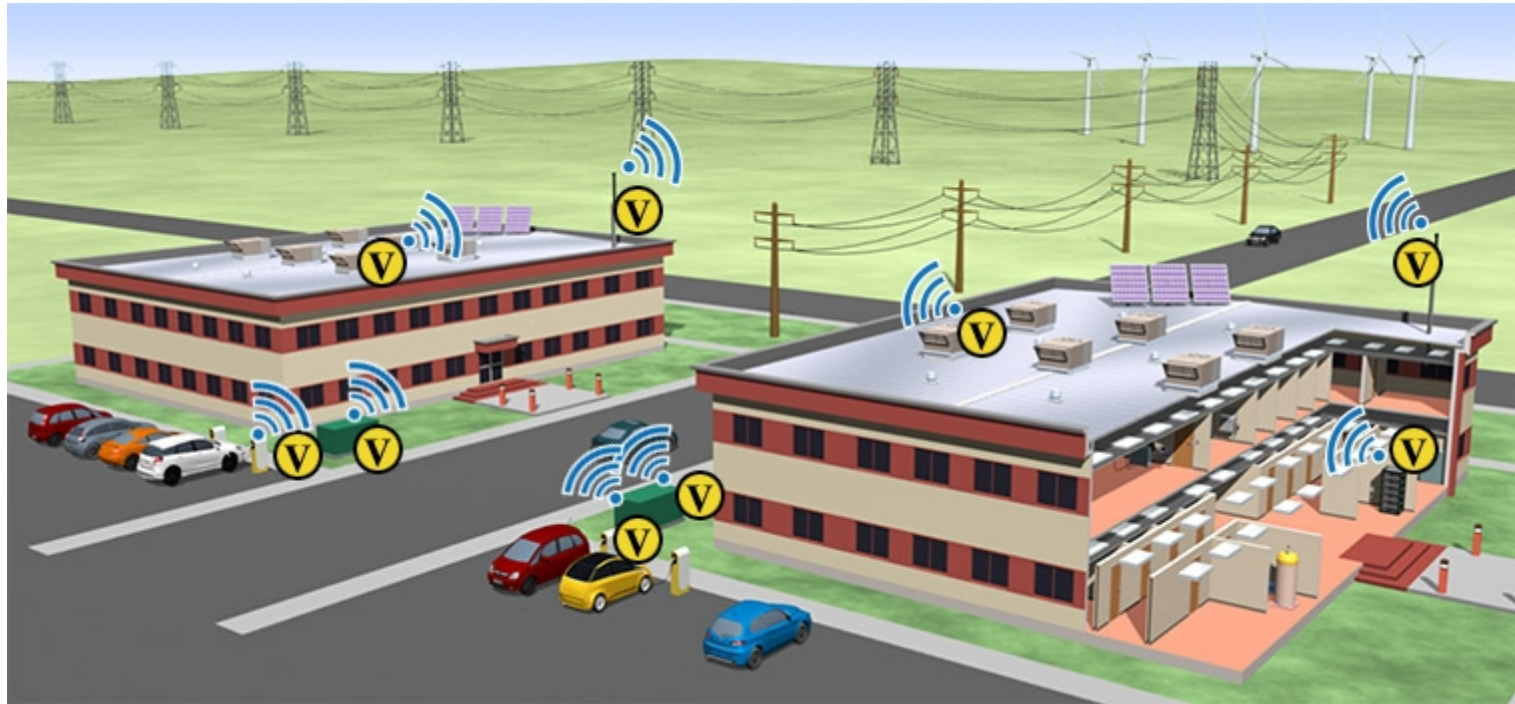
EMERGING: THE ENERGY CLOUD
Distributed, Two-Way Power Flows



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(Source: Navigant)

Smart Building Technologies



Source: <https://www.energy.gov/eere/buildings/buildings-grid-integration-0>

- Conventional Flexible Load
- Distributed Energy Resources
- New Load Resources
- Other Supporting/Enabling Technologies



Opportunities with Grid Integration



- **Buildings are an underutilized resource to grid**
 - **Operations:** Demand response, ancillary services
 - **Planning:** capacity investment, transmission congestion mitigation
- **Building owners, operators to access current energy markets**
 - **Short-term:** Electricity and ancillary services markets
 - **Long-term:** Capacity market
- **Support the opening of new markets/products**
 - **Wholesale:** Flexible ramping
 - **Retail:** Peer-to-Peer, Aggregator

Challenges with Grid Integrations

■ Building management

- Technologies adoption
- Aggregation and transactive control
- Multi-dimension energy management decision
- Occupancy preferences

■ Market/Incentive Mechanism

- Retail market
- Transaction management
- Wholesale market participation

■ Information Management

- Data management/analytics
- Cybersecurity
- Privacy

