SmartGrid

(System-of-the-Future, Intelligent Grid, IntelliGrid . . .)

State of New York, Department of Public Service
Advanced Metering Infrastructure Technical Conference

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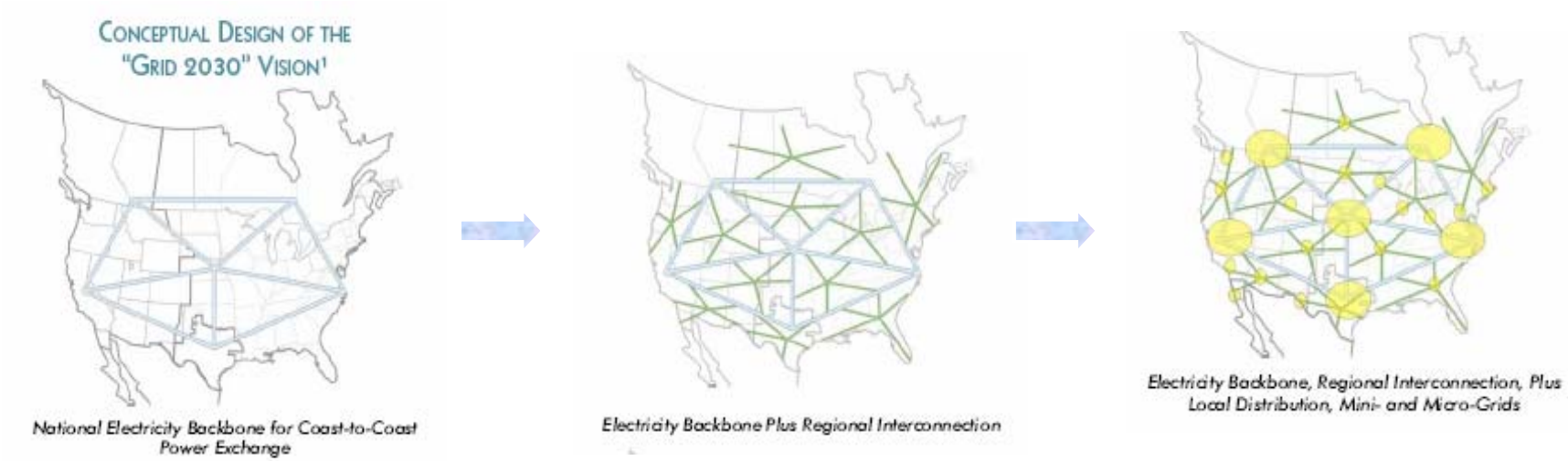
U.S. DOE Vision for the Intelligent Grid

GRID envisions a fully automated power delivery network that monitors and controls every customer and node, ensuring two-way flow of information and electricity between the power plant and the appliance, and all points in between



Source: GRID 2030: A National Vision for Electricity's Second 100 Years US DOE, Office of Electric Transmission and Distribution

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SmartGrid

- **Collect interrelated information that you can immediately do something with . . .**
- **Why do it?**
  - Customer benefits - carbon footprint; control energy consumption; energy “smarts”
  - Reliability and improved service
  - Streamline operations
  - Accuracy
  - $$$$$ Benefits

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SmartGrid Design

- Common Communication infrastructure integrates all SmartGrid functions
- Ability to interface with high- and low-speed data needs
- System versus equipment functionalities
- Allow the use of standard power system equipment
- Employ standard protocols
- Value-added features
- Smart Grid design versus special purpose design
- Future-proof

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SmartGrid Design

We hear a lot about AMI, DR, OMS, DA, but what about:

- Restoration confirmation
- Real-time load monitoring
- Fault location
- Theft of service detection
- Auto-GIS update
- Pre-pay metering and load limiting
- Dynamic equipment ratings
- Power quality monitoring
- Adaptive relaying
- Home automation
- Response to adverse weather conditions
- Many others . . . . Now, and in the Future

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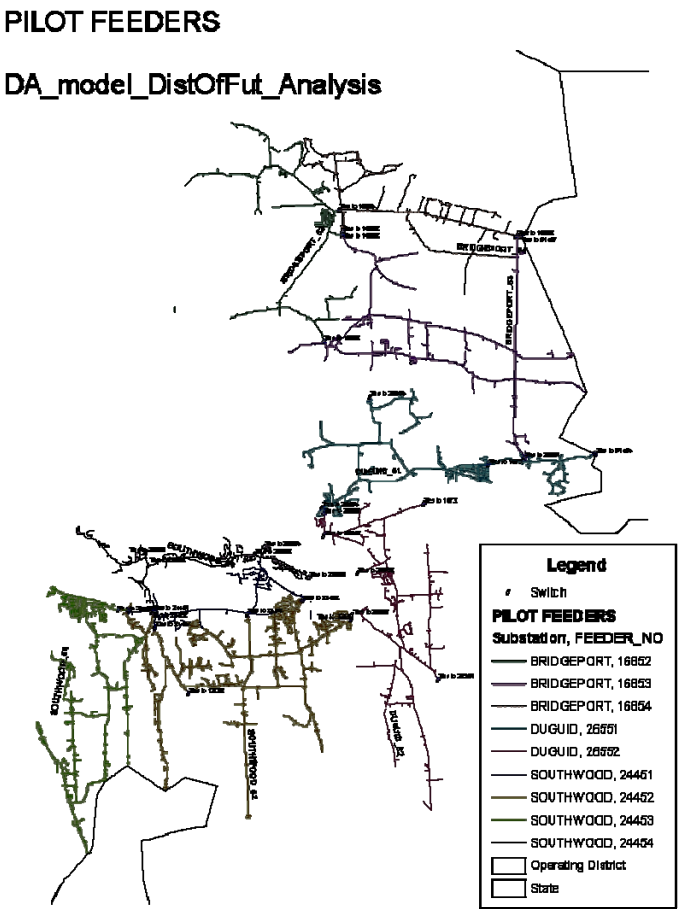
Potential SmartGrid Demonstration Project



- **Location selected based on reliability**
- **Three Distribution Substations; One Bulk Power Station**
  - Twelve 13.2kV Feeders
- **Approximately 20,000 customers connected to the three stations**
- **Approximately 60,000 area customers**

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Potential SmartGrid Demonstration Project

Integrated project featuring:

- **SmartGrid communication system**
  - Common data collection and analysis platform for all field devices
  - Distribution system monitoring
- **Advanced Meter Infrastructure**
- **EMS Communications**
- **Distribution Automation**
  - Automated reclosers
  - Capacitor & regulator control
- **Direct load control (Demand response)**
- **Distributed generation**
- **Fault location indicators**
- **Substation & Transformer monitoring & EMS**
- **Street light monitoring**

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SmartGrid Communications Architecture

- Specs – what does the system need to do and what equipment is needed to support?
- EMS – high-speed status & analog scans for reclosers and other field devices
- Read meters “often” to support TOU & RTP
- Grid monitoring devices as part of the communications system
- How to get information to customers (so they see it without having to log-in)

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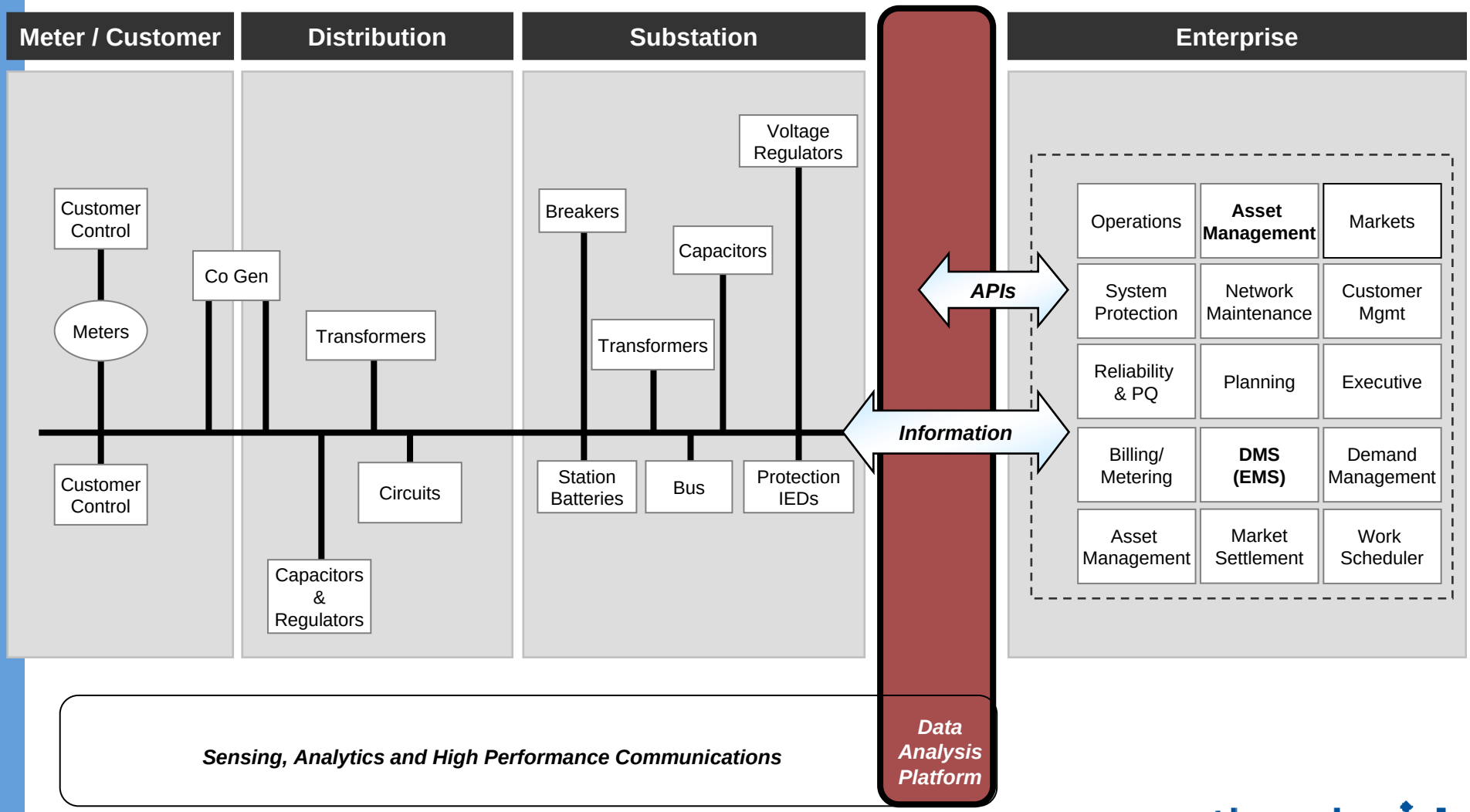
SmartGrid Architecture



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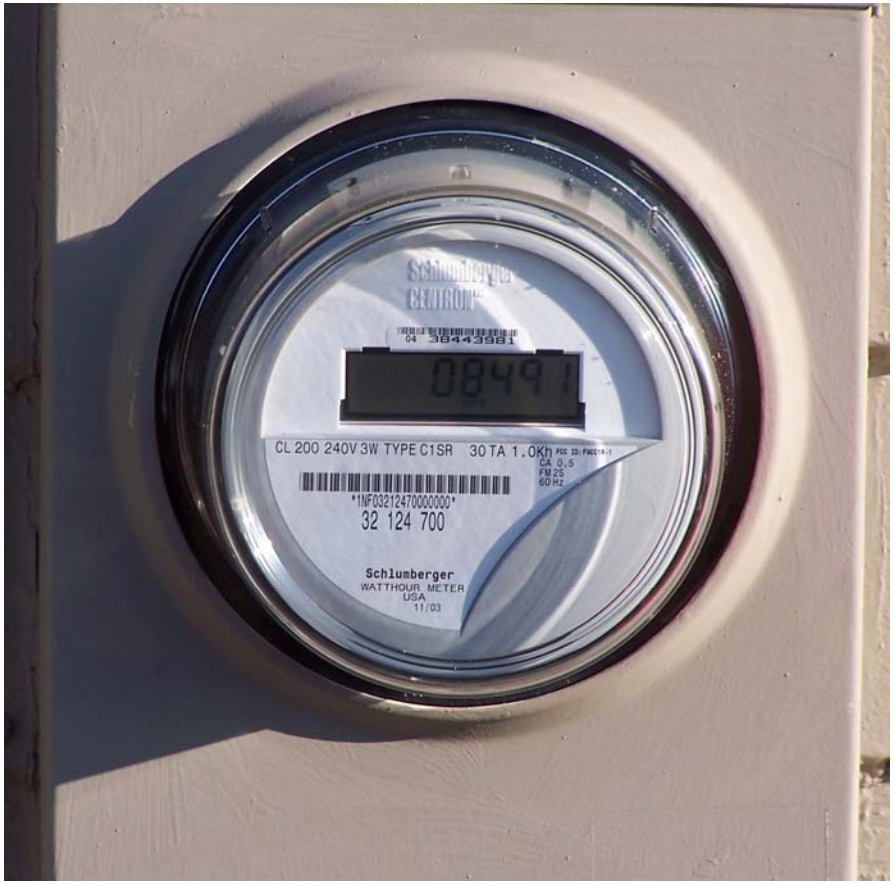
Advanced Metering Infrastructure

Guiding Principles:

- Provide customers and the utility with energy-use information needed to make informed decisions
- Enable rate structures and tariffs that complement energy efficiency programs
- Develop Global ‘Smart’ Metering Solutions for the US and UK
- *Provide information for other SmartGrid applications*



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Advanced Metering Infrastructure:

Approximately 20,000 electricity & gas meters

Functionality to test/evaluate:

- Two-way communication with electric meters
- One-way communication with gas meters
- Reading meters at prescribed intervals; real-time; on-demand
- Integration with Meter Data Repository, the Customer Billing System, Outage Management System, and customer data access applications

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Advanced Metering Infrastructure

Functionality to test/evaluate (continued):

- Support time-based and real-time rates
- Automated outage and restoration reporting
- Remote programming and demand reset
- Voltage and current measurements at the customer premises – maximum, minimum, average . . . .
- Remote disconnect
  - 200 Ampere switch in the meter
  - Soft read-off and monitoring of usage (seasonal dwellings)
- Service limiting function; pre-pay
- Tamper detection; theft-of-service

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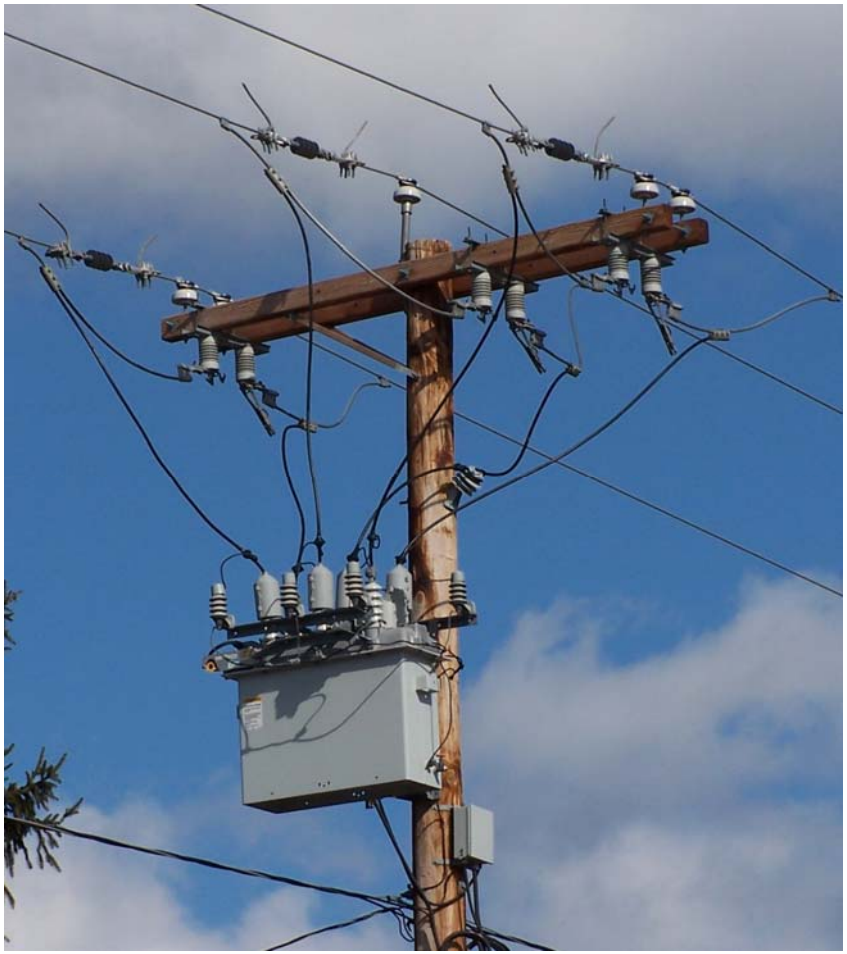
Distribution Automation: *Automated Reclosers*

Guiding Principles:

- Improve distribution system reliability performance
- Increase system efficiency – automated devices
- Provide more accurate data for studies
- DA not a substitute for standard approaches such as
  - Tree trimming
  - Lightning mitigation
  - Animal deterrents
- *Provide information for other SmartGrid applications*



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Distribution Automation:

Capacitor & Regulator Control

Guiding Principles:

- Feeder studies to optimize size and placement of capacitors and regulators
- Identify control scenarios
  - Normal daily load swings
  - Contingency loading
  - Emergency recloser operations
- Dynamically optimize efficiency, voltage, and power quality
- Provide upstream reactive support
- *Provide information for other SmartGrid applications*

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Utility & Customer Load Control

Guiding Principles – Utility:

- Control system loading during emergencies
- Reduce load growth on feeders to reduce local distribution upgrade and expansion costs
- *Provide information for other DSF applications*

Guiding Principles – Customer:

- Provide tools to control energy usage
- In-home displays; new services
- Identify automatic load control mechanisms which will not affect the customers' standard of living

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Substation Monitoring

Guiding Principles:

- Provide cost effective monitoring for distribution substations (non-EMS)
- Improve security
- Assess the health of expensive assets
- Provide information for improved operation and maintenance
- *Provide information for other DSF applications*

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SmartGrid - Conclusions

- **Lots of interrelated information:**
  - Meters, reclosers, capacitor controls & regulators, communication system, substation, environmental . . . .
- **Lots of users:**
  - Engineering, operations, planning, GIS, EMS/DMS, OMS, MDS, customer service, billing, customers . . . .
- **Lots of integration:**
  - Common information model, API's to existing systems, new applications, security . . . .
- **Lots of money:**
  - Cost recovery, material and labor, cost/benefit analyses, biggest bang-for-the-buck deployment . . . .
- **Commitment:**
  - All those who benefit need to buy-in to the concept – utilities, customers, regulators, investors, government . . . .

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QUESTIONS?

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