

Smart Grid
Leff Clean Energy Seminar

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Powering Business Worldwide

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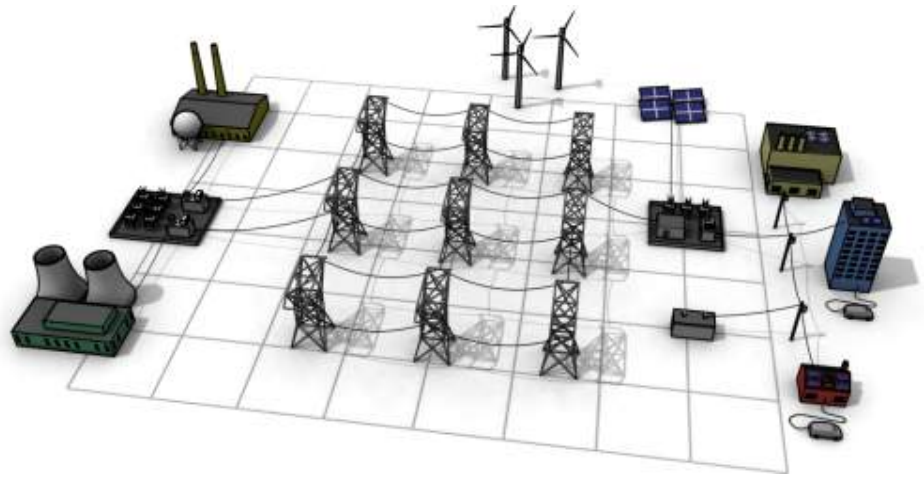
Celebrating 100 YEARS Ideals that Endure

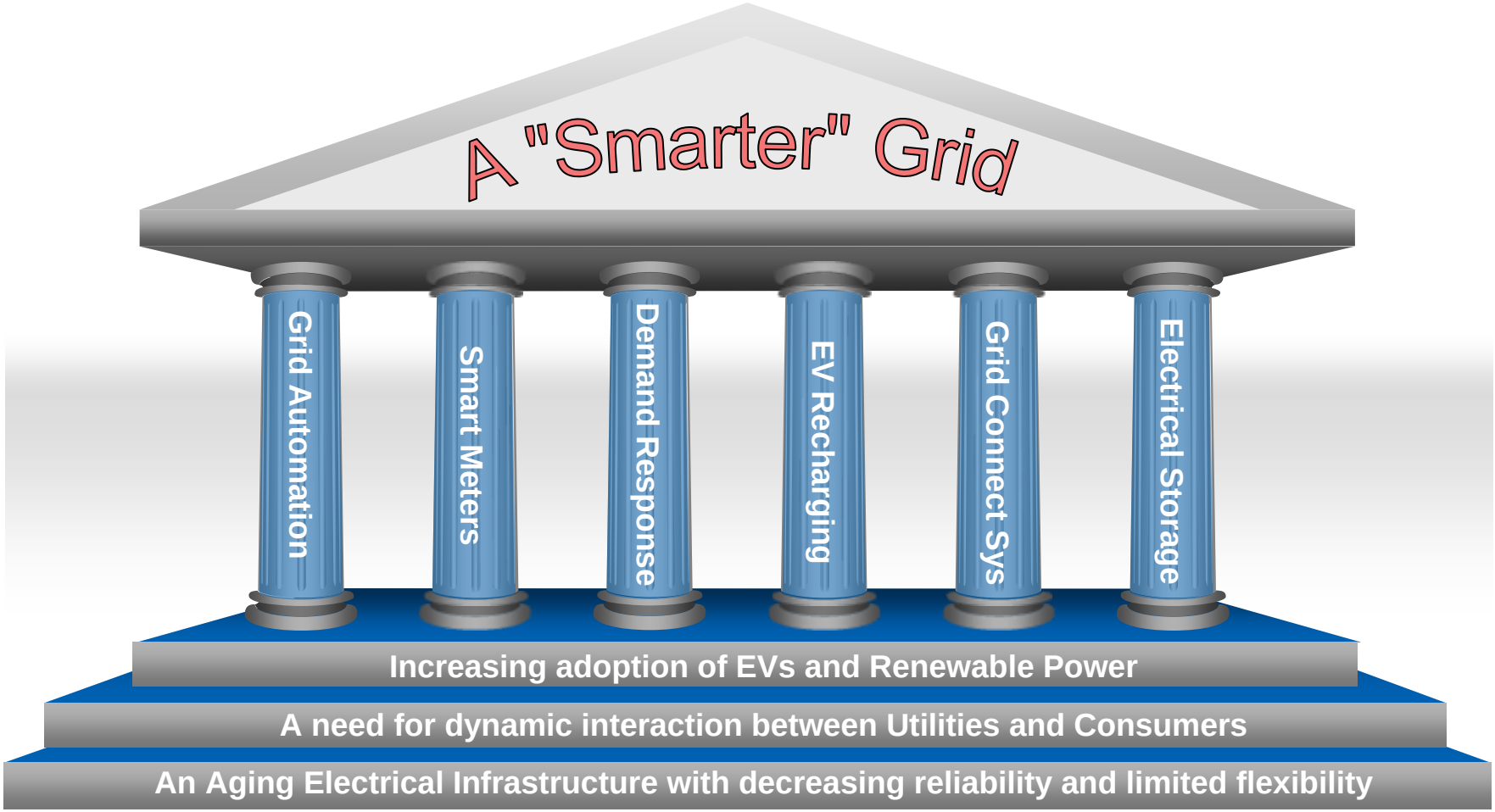
Defining ‘Smart Grid’

“Smart Grid” – A more intelligent power delivery system that provides increased reliability, efficiency, security and flexibility; from power generation through consumption



- Allows **active involvement of energy consumers** via real-time consumption data and pricing mechanisms
- Economically **accommodates all generation and energy storage options**, including renewable sources, microgrids and electric vehicles (V2G)
- Provides **increased of power quality and power reliability** as required by the digital economy of tomorrow
- Improves **grid efficiency through increased automation**
- **Automatically responds to system disturbances** to reduce the breadth and duration of outages
- Operates resiliently against attack and natural disaster to **ensure secure communications** system-wide

Building a Smarter Electrical System



Grid Automation

- Transmission, Substation and Distribution Automation
  - Increase SCADA adoption
  - Feeder management & control
  - Volt/Var Control

We've been doing this for years. Now it's just called "Smart Grid" – Utility Exec

- Utility back-office automation
  - Outage management
  - Advanced Billing Systems and Distribution Management
  - Asset management

Integrating Utilities IT and Operations



Smart Meters

- Smart Meters (AMI)
  - What makes a meter “smart”
    - 2-way communications with Utility
    - Usage (15 min intervals) from user
    - Pricing Signals from Utility (TOU)
  - AMI vs. AMR
  - Smart Meter “issues”
    - Communications to meters
      - RF, Cellular, PLC
    - Data management (MDM) evolving
    - PUC’s slow and cautious

Several high-profile Smart Meter pilot programs funded by Stimulus Act of 2009.

Controversy & issues surround some of the pilots

AMI – Automated Meter Infrastructure
AMR – Automated Meter Reading
TOU – Time of Use (pricing)
MDM – Meter Data Management



Demand Response

Changes in electric usage by end-use customers from their normal consumption patterns in response to changes in the price of electricity over time, or to incentive payments designed to induce lower electricity use at times of high wholesale market prices or when system reliability is jeopardized - FERC

- Residential = Home Automation
  - Communications? WiFi? Zigbee?
  - Smart appliances?
  - Who owns the meter data?
  - Convergence of home/personal systems

Should be an exciting few years ahead



- Comm/Ind – Energy Management
  - Demand Response 'providers'
  - Standalone vs. building systems
  - BMS-EMS-DR convergence

Demand Response is the Killer App for the Smart Grid – John Wellinghoff, FERC

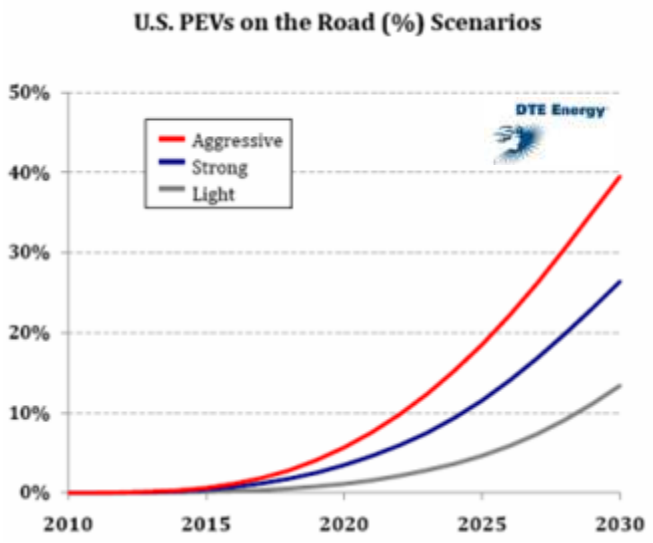


Electric Vehicle Recharging Infrastructure

- Electric Vehicles
  - Hybrids
  - Plug-in, Hybrids (PHEVs)
  - Battery Electric Vehicles (EVs or BEVs)

- EV Charger Types
  - Level 1 ~ 120Vac ~ 6-24hr (PHEV or BEV)
  - Level 2 ~ 240Vac ~ 2-8hr
  - DC Quick Charger ~ 3-5 miles/min charged

- Questions & Issues
  - Adoption rate
  - Battery Technology
  - Charging Infrastructure
    - Home or central charging?
    - Who owns the central chargers?
  - Vehicle-to-Grid?





Grid Interconnection & Electrical Storage

- Grid Interconnection
  - Renewable power, storage, Micro-grids
  - Grid-tie inverters
  - Military/Utility Microgrids

Evolving needs and standards





- Energy Storage
  - Batteries
  - Mechanical
    - Fly-wheels
    - Pumped Hyrdo
    - Compressed Air

Considered the "Holy Grail" of the Smart Grid



AEP Bluffton, OH 2MW Battery

Smart Grid – Eaton's solutions

Utilities

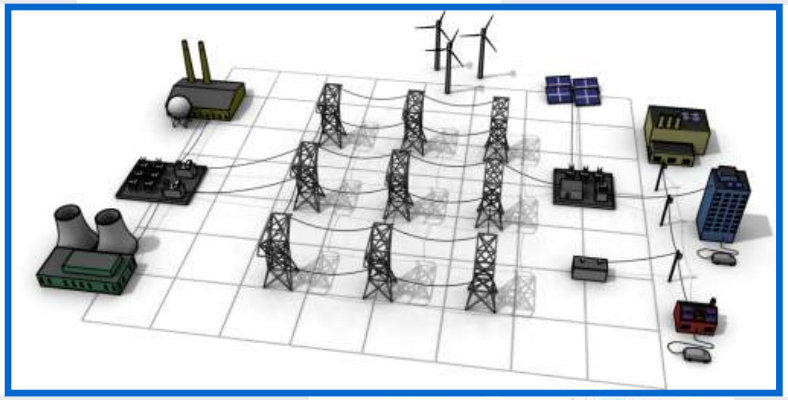
- MV/LV Switchgear
- Electrical Services (substations)
- Network Protectors
- EV recharging
- Solar / Wind connect



Municipalities

- Electrical infrastructure (buildings)
- Metering & Communications Infrastructure
- Energy Services
- EV infrastructure
- Microgrids







Commercial & Industrial

- Electrical Infrastructure
- Metering & Communications infrastructure
- Electrical automation solutions (Drives, Lighting)
- Energy Services / Demand Response
- EV recharging



Residential

- Electrical infrastructure
- Home Automation Solution
- Standby power
- EV recharging

What will affect “Smart Grid’s” future….

- Political Landscape
  - Large Federal funding programs for pilots likely over for now
  - Cap and Trade legislation is DOA for near term
  - Some states legislating change more aggressively than others (California and Texas)
- Regulatory Landscape
  - High profile Smart Meter pilots have increased regulators caution
  - Who should pay for Smart Meter….Consumer or Shareholder?
- Key Questions
  - Will Smart Meter pilots lead to full-scale implementation or will technology changes make many pilots obsolete? …and will regulator’s support TOU rates?
  - How fast will EV adoption occur?
  - Do we really care if we can save 3¢ by drying our close after 10:00pm?
  - Is there a battery technology break-thru on the Horizon?
  - Are we addressing Cyber-security issues early and fast enough?

Smart Grid will evolve at the ‘speed of value’. The value to the Consumer and to the Utility is paced by energy cost and price. The value to Society is the wildcard.