

# Smart Microgrids – Powering the Electric Revolution

APEC 2011 – Ft. Worth

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*Jack Mc Gowan, CEM*



11 Smart Grid Companies to Watch in 2011  
www.smartgridnews.com



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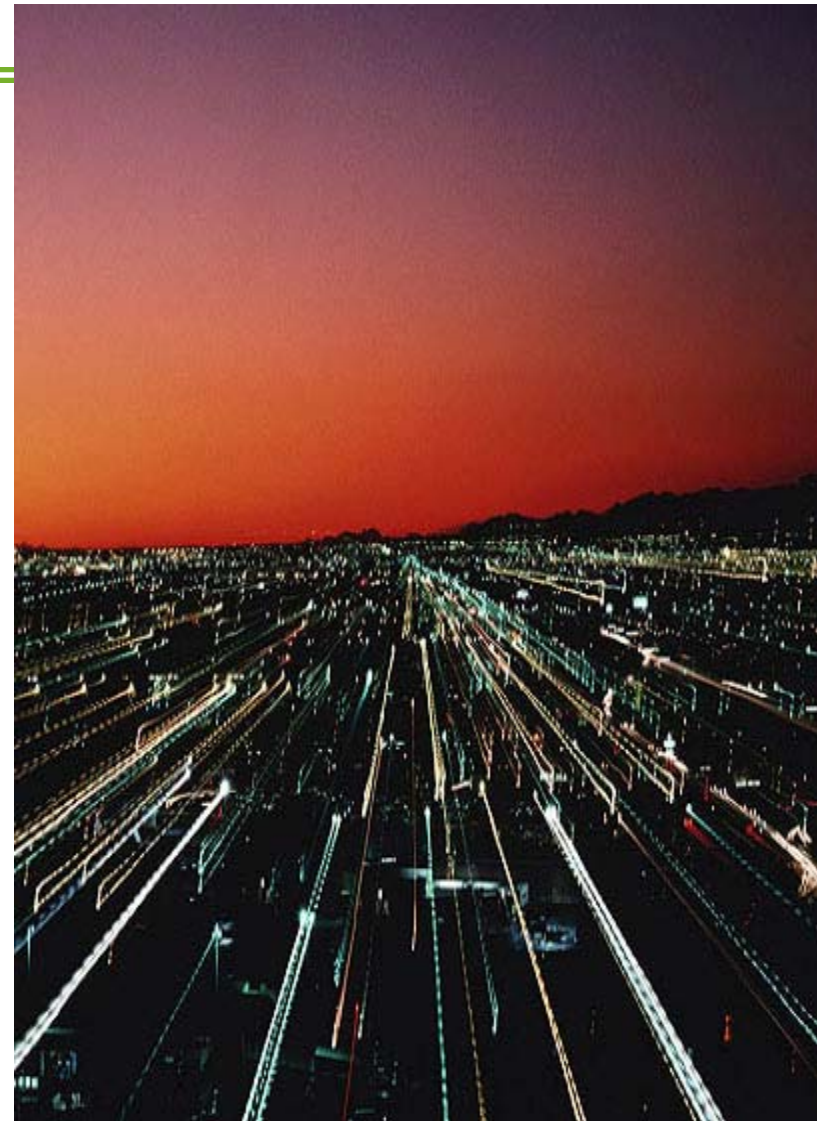
# Forward to Fundamentals

**Electricity is the engine of prosperity and quality of life**

**Electricity is a consumer service-based enterprise**

**Technology can relieve cost pressures through elevation of electricity service value**

**Realizing these opportunities requires transformation of the electricity infrastructure & business model**



# Transforming the Electricity Grid for the 21<sup>st</sup> Century

**Electronically monitor & control the power system**

**Integrate electricity & communications**

**Transform meter into a two-way consumer services gateway**

**Incorporate Renewable & Distributed Resources**

**Enable smart, efficient end uses**

**Reintroduce Direct Current (DC) Circuits/Microgrids**

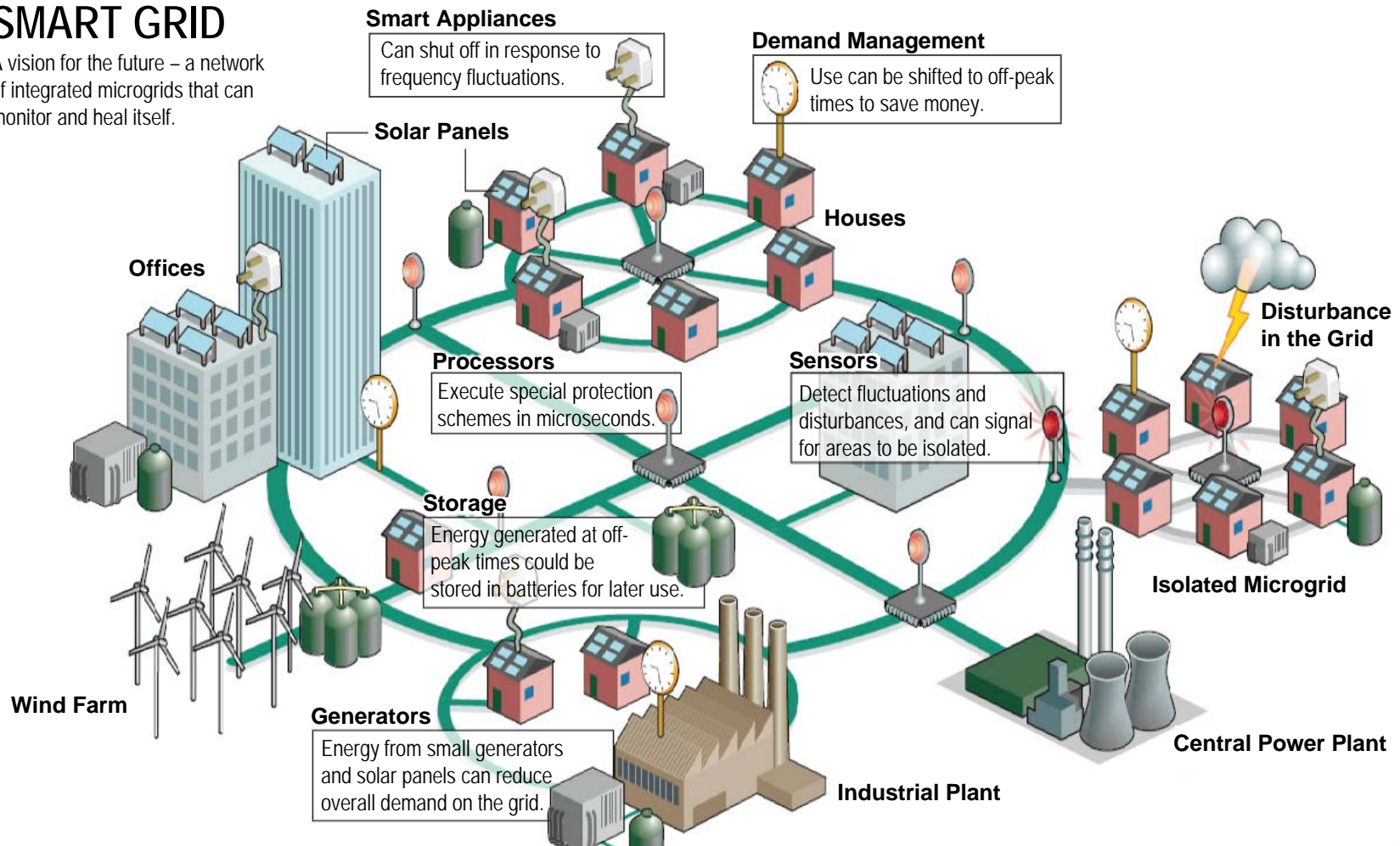


# Enable the Future

## Integrate microgrids, diverse generation and storage resources into a smart self-healing grid system

### SMART GRID

A vision for the future – a network of integrated microgrids that can monitor and heal itself.



# Unlocking Smart Grid Benefits Requires

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- **Intelligent Technology**
- **Intelligent Policy**
- **Empowered Consumers**

**INTELLIGENCE = the ability to understand and deal successfully with new situations**

# The Role of the Microgrid

- **Optimize distribution performance and service value**
- **Seamlessly integrate electricity supply and demand**
- **Convert buildings from Power Pigs to Power Plants**
- **Provide the most user-friendly consumer empowerment**
- **Open the door to entrepreneurial innovation**
- **Enable local green enterprise zones**

# Smart Grid: a Unified Vision



**Cost to keep  
the lights on:  
\$13 Trillion**

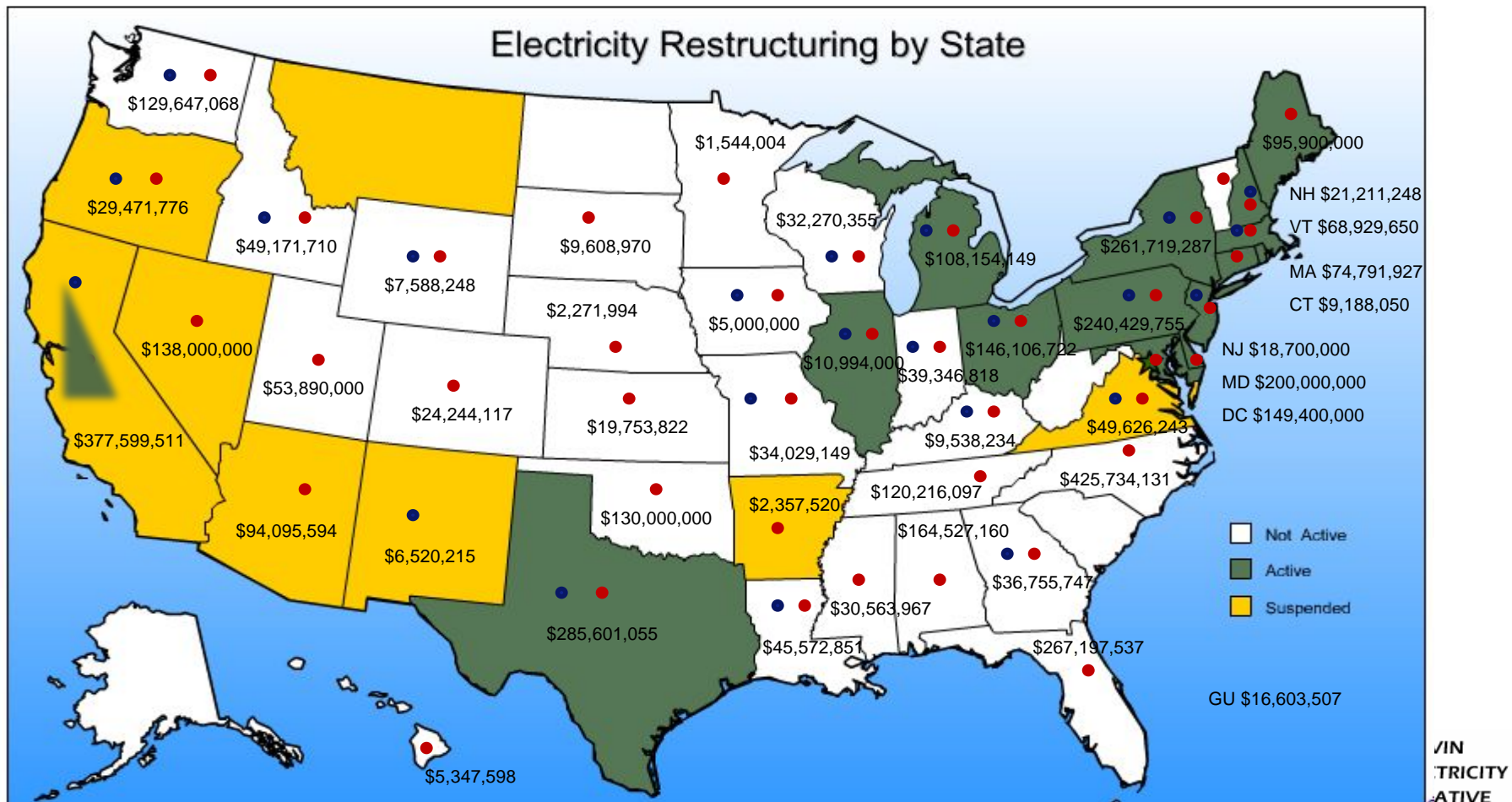
**Bits are  
Cheaper than  
iron**

**Leverage Markets & Buildings  
as Virtual Power Plants**

# Stimulus lottery: Who won? What are the Aps?

- ❖ Smart Grid topics: ARRA, Demand Response and Carbon
- ❖ Nearly every state got money: \$8+ billion!, but it's not over

- 1) Energy Efficiency opportunity is still hot: T-REC's & EEC's
- 2) Demand Response and Dynamic Pricing : **Monetize NegaWatts**



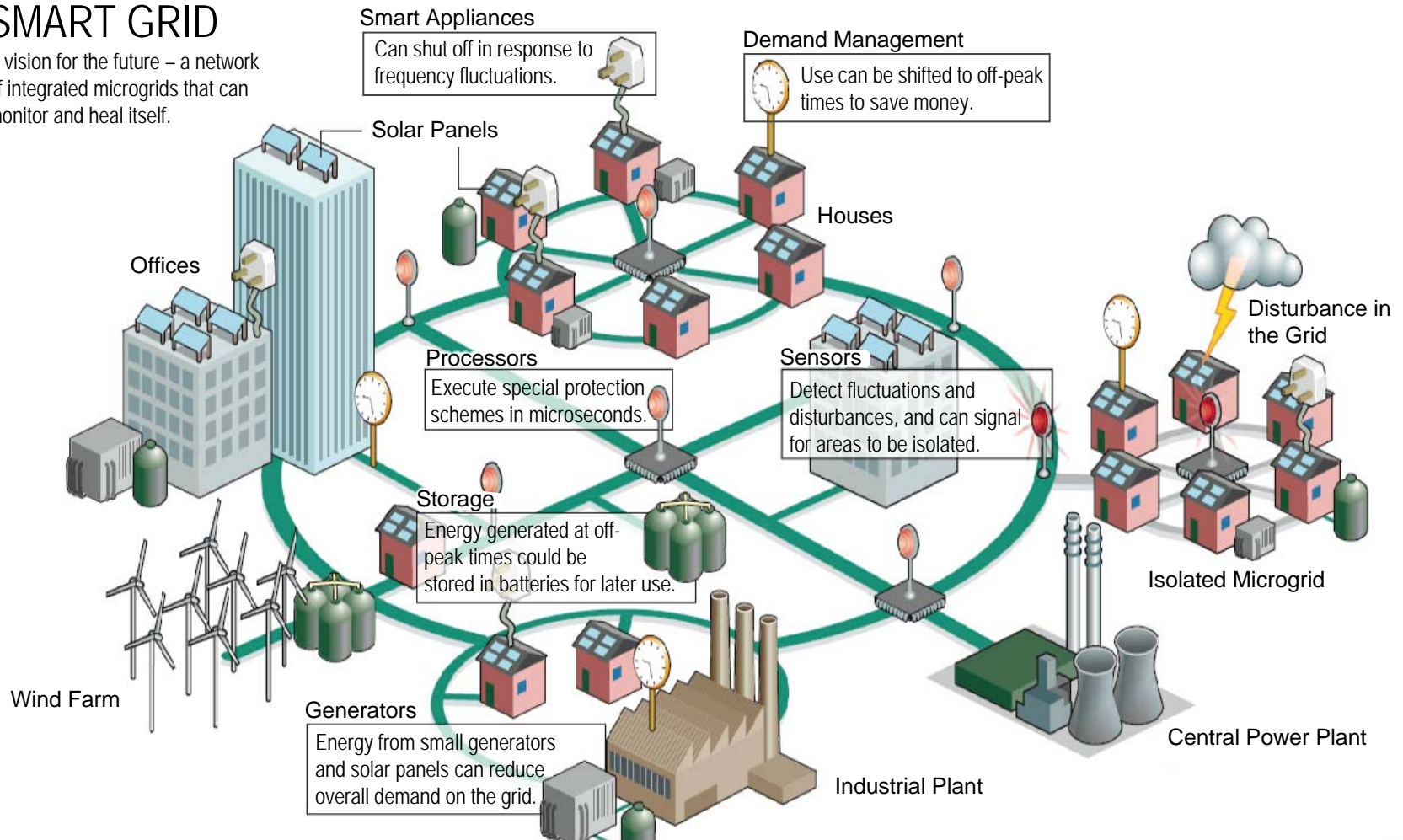


# Smart Grid Enabling the Future

Integrate microgrids, demand response, diverse generation and storage resources into a smart self-healing grid system

## SMART GRID

A vision for the future – a network of integrated microgrids that can monitor and heal itself.



# What Can Automated Load Control Offer?

Access to Data → Ability to Drive Decisions → Achieve Objectives & Impact Bottom-line

**Constellation Energy** The way energy works. for your business.

Home Bid Search Dashboard Energy Manager Contact Us Admin Help Need Help? 1-877-847-0007 Log Out

Constellation Energy | ABC Industrial | April 06, 2010

**Current Usage**  
 Current usage: **17.71 MW**  
 Current usage values as of Tue April 06, 2010 14:19

**Grid Load**  
 Current ISO Load : **84,508 MW**  
 Grid load as of Tue April 06, 2010 14:21

**Message Center**  
 System Message  
 ISO results last updated on Tue April 06, 2010 14:18 (EST)

**Current Weather**  
 Baltimore, 21202  
**85°**  
 Big Town, 21286 86°

**Dashboard**  
 Monitor energy

**Load Response**  
 Start a New Bid

- Create bid groups
- Submit bids in various Demand Response markets
- Track bid status and history

**Energy Manager**  
 Energy Manager

- View event details
- Select scenarios to reduce consumption
- Monitor consumption levels

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Energy Analytics

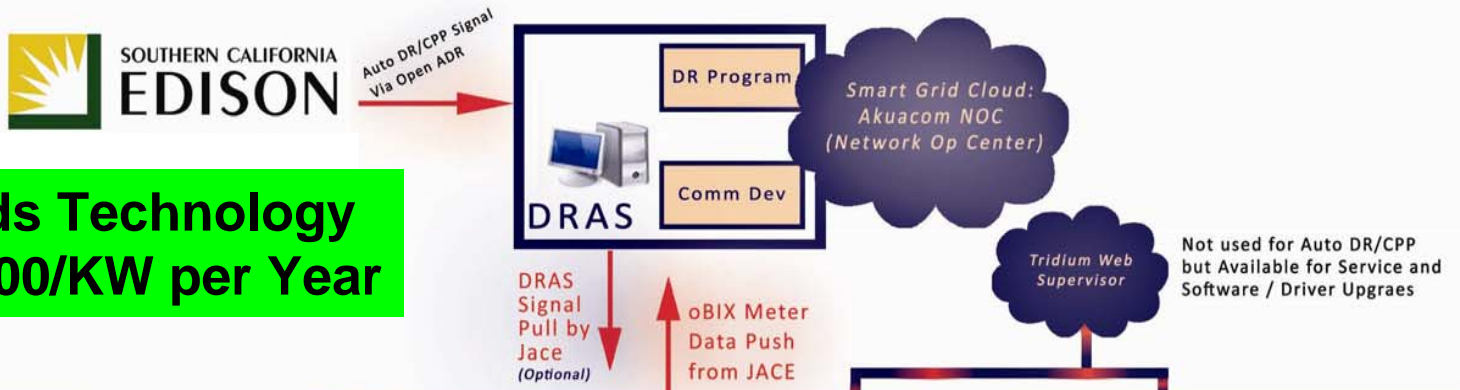
OpenADR

Today's Grid Op is equivalent to having a Cab idling at the curb...

Facility Managers should be able to Override Controls...

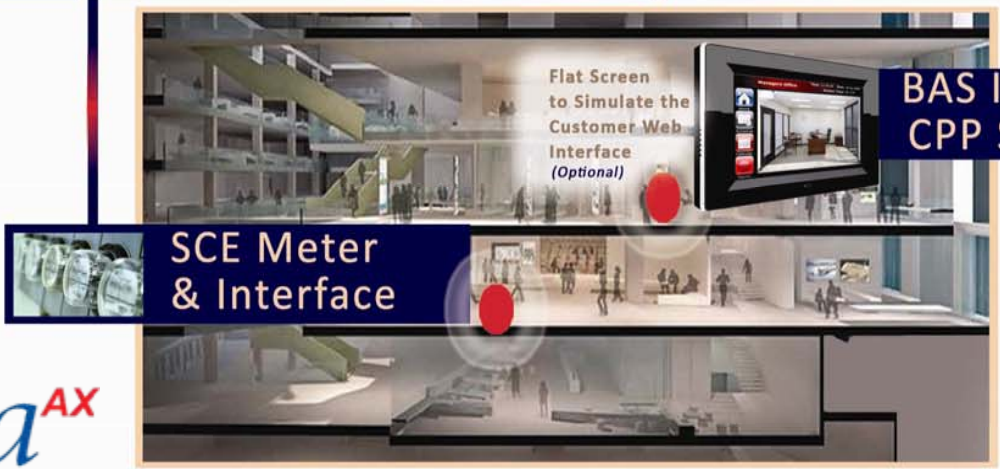
Day Trading for Energy

# Demand Response and Open ADR

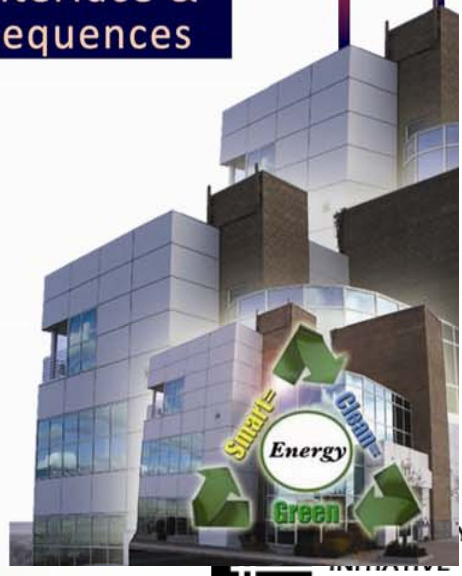


**\$ TATI: Funds Technology**  
**\$ DR Fee: \$300/KW per Year**

- Relay Output to non BAS Facility
- UPS



Powered by **niagara AX FRAMEWORK**



# Oklahoma's Smart Grid *Killer AP*



**OG&E**<sup>®</sup>

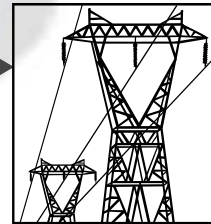
PV to  
Smart Grid  
Inverter

## A Smart Grid Inverter?

- ✓ DC to AC
- ✓ Revenue grade meter
- ✓ Ethernet Router for IP
- ✓ Gateway for Protocols
- ✓ Inputs / Outputs (I/O)
- ✓ Program I/O sequences
- ✓ Battery Interface/Control
- ✓ LCD Display

IP for  
Communication  
& Web Services

Web



Grid

- ✓ Oklahoma Gas & Electric exploring APs
- ✓ Consider a Smart Grid AP to **match Solar and DR** for firm renewable resources

# Contracting Business



# Best Design / Build in the US 2009



• UNM leverages smart buildings, smart meters, thermal Storage, renewable energy and distributed generation with a DOE funded project implemented by ECI and interfaced with PNM to develop Smart Energy strategies



• IT Interoperability collaboratively controls resources to make the Grid more reliable and efficient while creating new business and market opportunities



# Smart Building meets Smart Grid

# SMART GRID POLICY IMPLICATIONS

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- A Smart Grid is a *transactive* network, seamlessly connecting producers and consumers
- Price-responsive end-use devices enable autonomous consumer control: *empowerment*
- A Smart Grid requires looking beyond the regulated monopoly business model
  - Remove barriers to competitive retail services
  - Remove barriers to non-utility technology investments

The result significantly increases both consumer and producer benefits

# Intelligent Policy Recommendations

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- **Provide consumers with choice of access to transparent real-time electricity pricing.**
- **All customer-specific data belongs to the customer**
- **Establish strict distribution reliability and efficiency standards.**
- **Hold utilities publically accountable to specific system performance standards.**
- **Link utility earnings to service quality not quantity sales – performance-based rates.**

# Intelligent Policy Recommendations

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- **Expand net metering to include physical and virtual aggregation.**
- **Enable retail energy management service competition to incent entrepreneurial and utility innovation.**
- **Enable early adapters to easily demonstrate the benefits beyond doubt.**
- **Require absolute interoperability of smart grid components.**



# Principles of a New Electricity Constitution

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- **Provide all Consumers with Time-of-Use Electricity Rates & Incentives**
- **Require Fundamentally Higher Distribution Reliability Standards**
- **Compensate Utilities Based on their Reliability, Efficiency and Customer Service Quality**
- **Eliminate Regulated Monopoly Restrictions On Intelligent Microgrids and Distributed Generation**
- **Establish Truly Competitive Retail Electricity Service Markets**

HOW THE MICRO GRID REVOLUTION WILL UNLEASH CLEANER,  
GREENER AND MORE ABUNDANT ENERGY

# PERFECT POWER

TOP COMPANIES  
& TECHNOLOGIES  
TO WATCH

**ROBERT GALVIN  
AND KURT YEAGER**  
WITH JAY STULLER