



# California's Public Interest Energy Research on Microgrids

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**California Energy Commission**



# PIER Microgrid Research

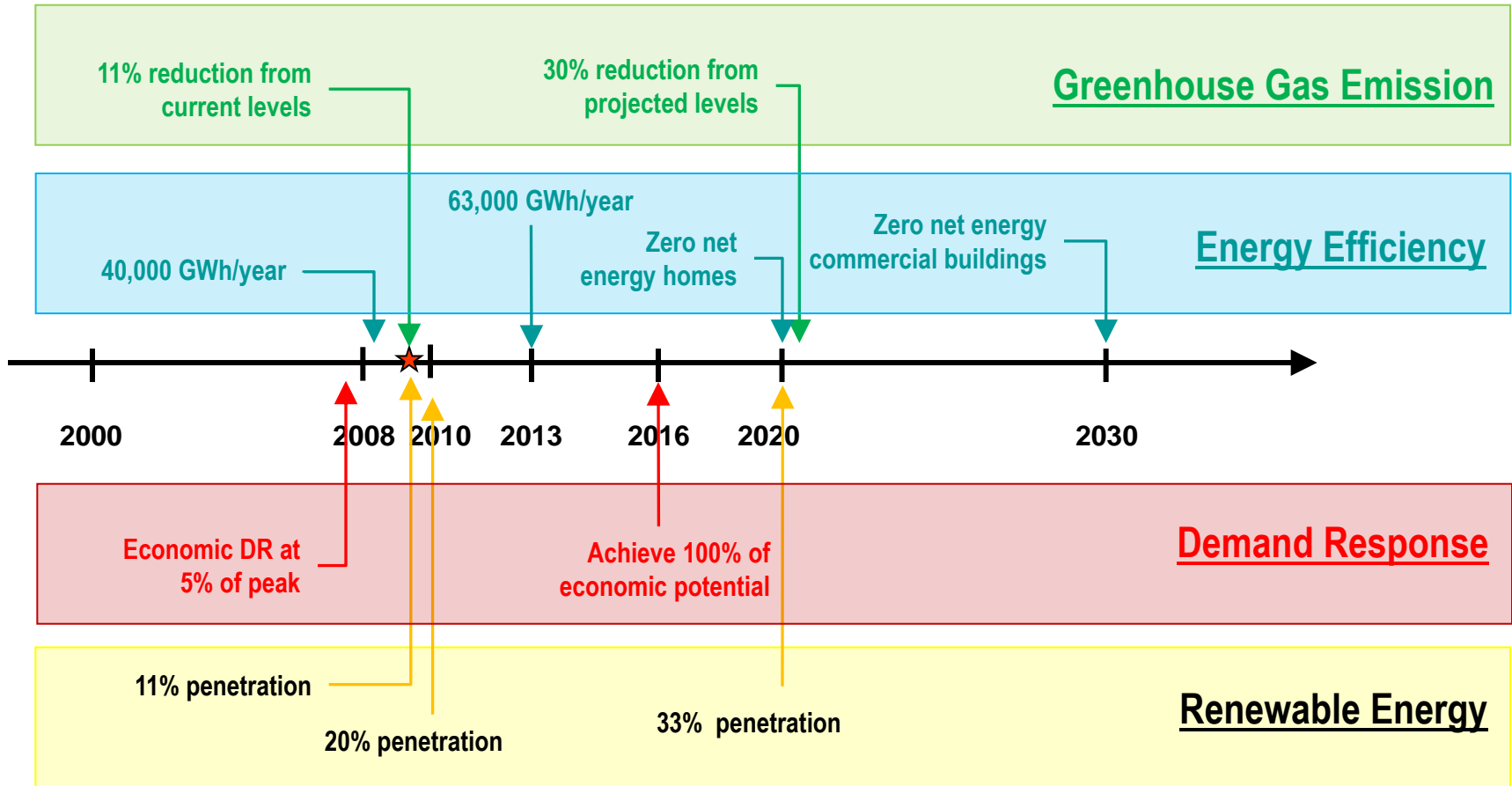
## PIER has supported microgrid research for nearly a decade

- Enables California's policy goals (efficiency/demand response first; renewables next; then conventional sources)
- R&D included testing microgrid concept; integration of component technologies; power electronics interface, and market/regulatory integration issues
- Microgrid concept and elements have endured the test of time. Projects have evolved as technologies mature and policies shift in emphasis
  - Initial focus more on reliability, customer choice, localized power quality improvements
  - Today, all those remain, with increased emphasis on community scale microgrids, focus on renewables, and popularity of "smart grid."



# California Policy View

## The Policies That Drive Our Research



# Research Evolution- 1<sup>st</sup> Phase

GRID ELEMENTS FOCUS

GRID ELEMENTS INTEGRATION

ELEMENT + INTEGRATION = SMART GRID

**Improving existing devices and developing new smart devices for the grid**

**Partner with:**

- Research laboratories
- Universities
- Individual researchers



Underground Cables



Phasor Measurement



T-Stats



Pole Top Transformers



Flywheel Energy Storage



Automated Metering Infrastructure



Demand Response



# Research Evolution-2<sup>nd</sup> Phase

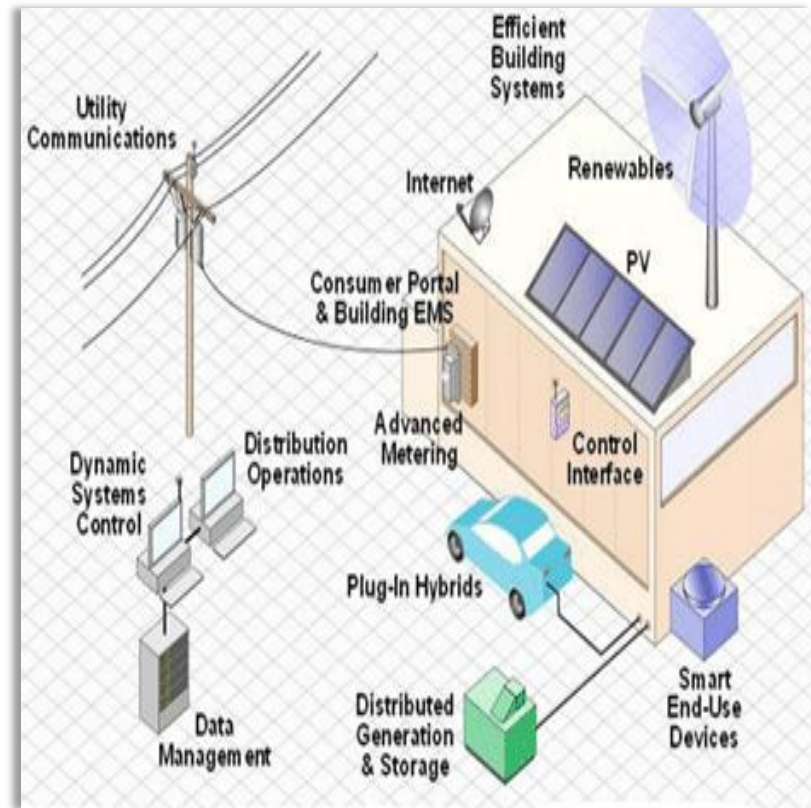
GRID ELEMENTS FOCUS

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## Research focus is on integration of devices

- Integration of renewables, PHEV's, and electric energy storage devices
- Testing component impact on grid
- Grid more reliable and efficient
- **Microgrid scale research**
- Partner with Utilities & National Laboratories



# Research Evolution- Today

GRID ELEMENTS FOCUS

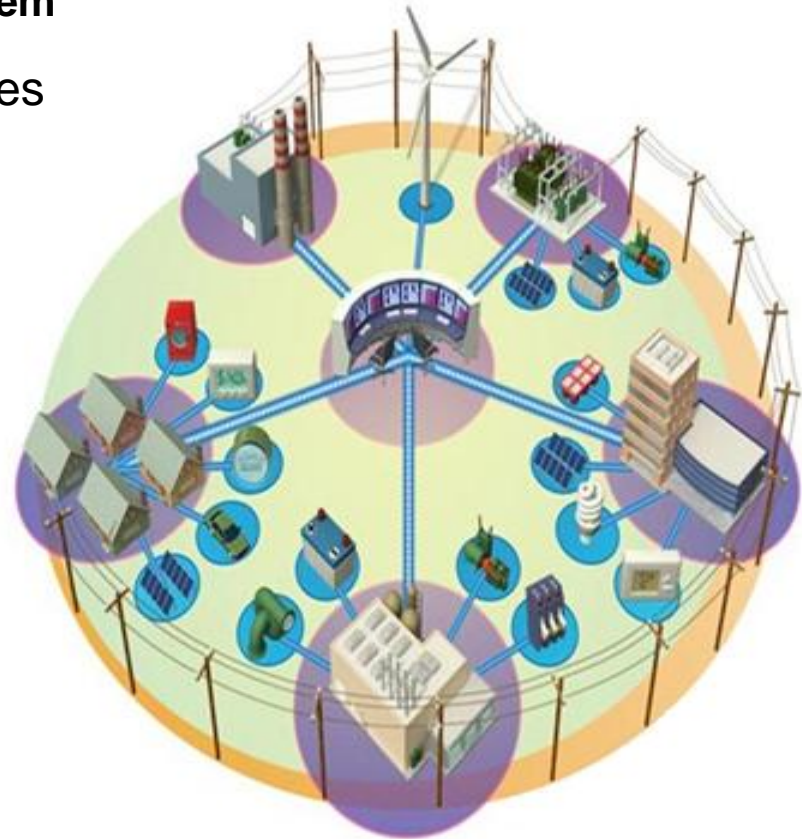
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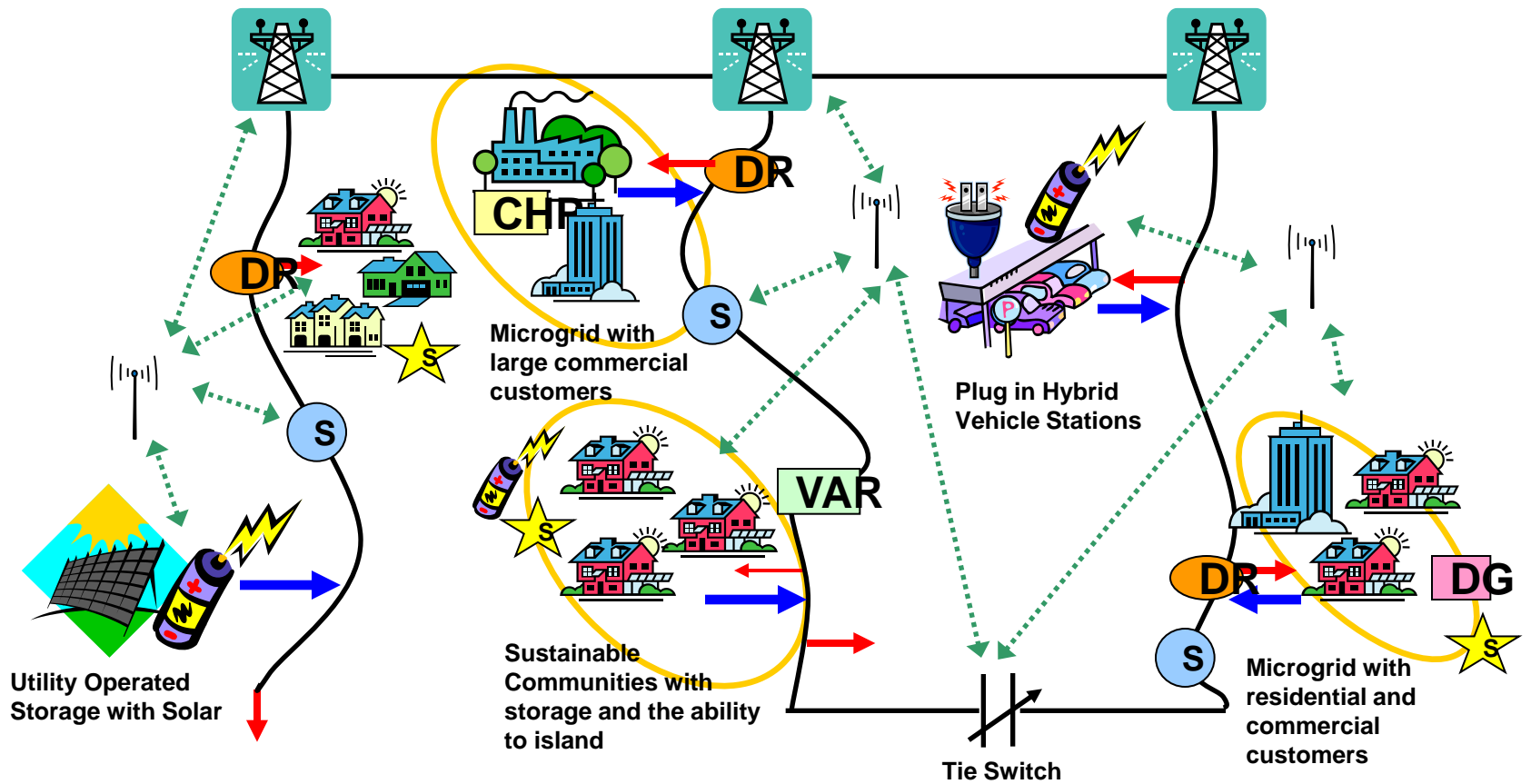
**Research focus is on entire grid system**











Large scale integration of renewables to meet RPS goals (33%)

- Plug-in-hybrids/electric vehicles and electric energy storage devices
- Grid more reliable and efficient
- Incorporate customer efficiency and demand response
- Community scale projects



# Tomorrow's "Smart Grid" interfaces with Microgrids



	= Distribution Substations		= Real Time Sensors
	= Load (Commercial, Industrial and Residential)		= VAR Compensator
	= Distributed Energy Resource Interconnection		= Distributed Generation
	= Smart Metering Technologies (AMI)		= Combined Heat and Power
	= Real Time Communications		= Demand Response Enabled



# On-Going Project

## SAN DIEGO GAS & ELECTRIC MICROGRID PROJECT

### What is it?

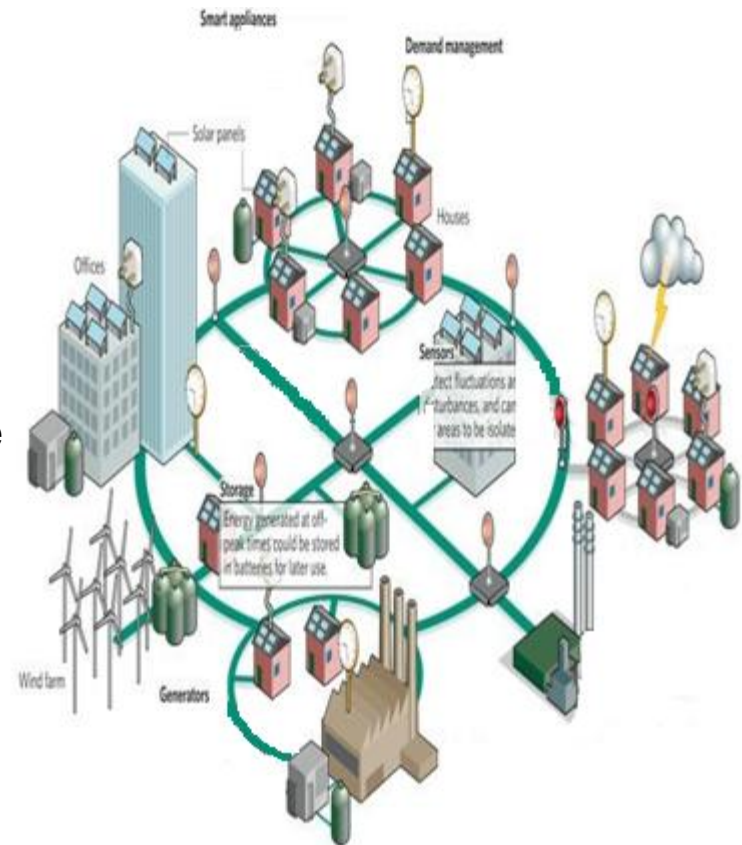
- Smart Grid implementation & integration for a “Smart Community “ in Borrego Springs, CA

### What are we doing?

- Integration of utility and customer based energy resources (PV/Wind/Storage)
- Improving power reliability and quality
- Enhance management of intermittent renewable resources
- Islanding effect
- Identify and evaluate technical and operational issues with operating a Smart Grid

### Project Cost

\$2.8M CEC + \$12.6M DOE = \$15.4M Total Project





# On-Going Project

## SMUD MICROGRID PROJECT

### What is it?

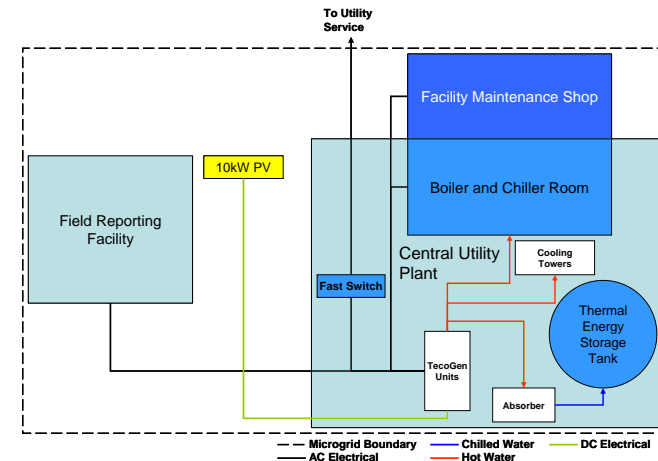
- 310kW field demonstration of a Microgrid (including a DG/CHP system) at the SMUD central utility plant

### What are we doing?

- Integration and interoperability with demand responsive load control, advanced reciprocating engines, PV, and thermal energy storage
- Seamless separation and isolation from utility grid and resynchronization
- Autonomous local control for fast events (No central controller)
- Feeder peak load reduction
- Technical and operational distribution system implications of exporting power from a Microgrid

### Project Cost

\$1.6M CEC + \$1.4M SMUD = \$3.0M Total Project



# On-Going Project

## UC SAN DIEGO *GREEN* SMART MICROGRID PROJECT

### What is it?

- An Advanced Master Controller for UCSD's Microgrid that will enable key Smart Grid functions

### What are we doing?

- Scheduler platform controls demand and supply resources for max. efficiency and cost reduction
- Real-Time data acquisition for analysis
- Integration of storage -- key to distributed generation, renewable energy, demand response and energy efficiency
- Create an unparalleled granularity of knowledge for dynamic and efficient operations
- Intentional Islanding capabilities when needed

### Project Cost

\$1M CEC + \$1M UCSD = \$2M Total Project



# Continuing Activities for Smart Grid/Microgrid

## PIER Solicitation Results:

- Two recent awards to define a roadmap for California Smart Grid research -- one from utility perspective and one from vendors
- Complements activities outside the State

### Project Cost

\$1M CEC (for 2 awards)

## American Recovery and Reinvestment Act (ARRA) Activities

- Up to \$20.8 million in Commission co-funding for smart grid projects
- Anticipate leveraging significant stimulus funding to advance smart grid deployment in California

