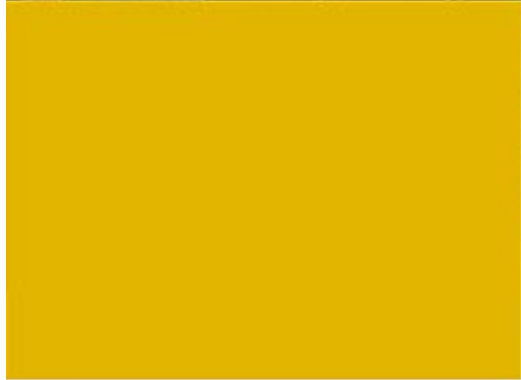
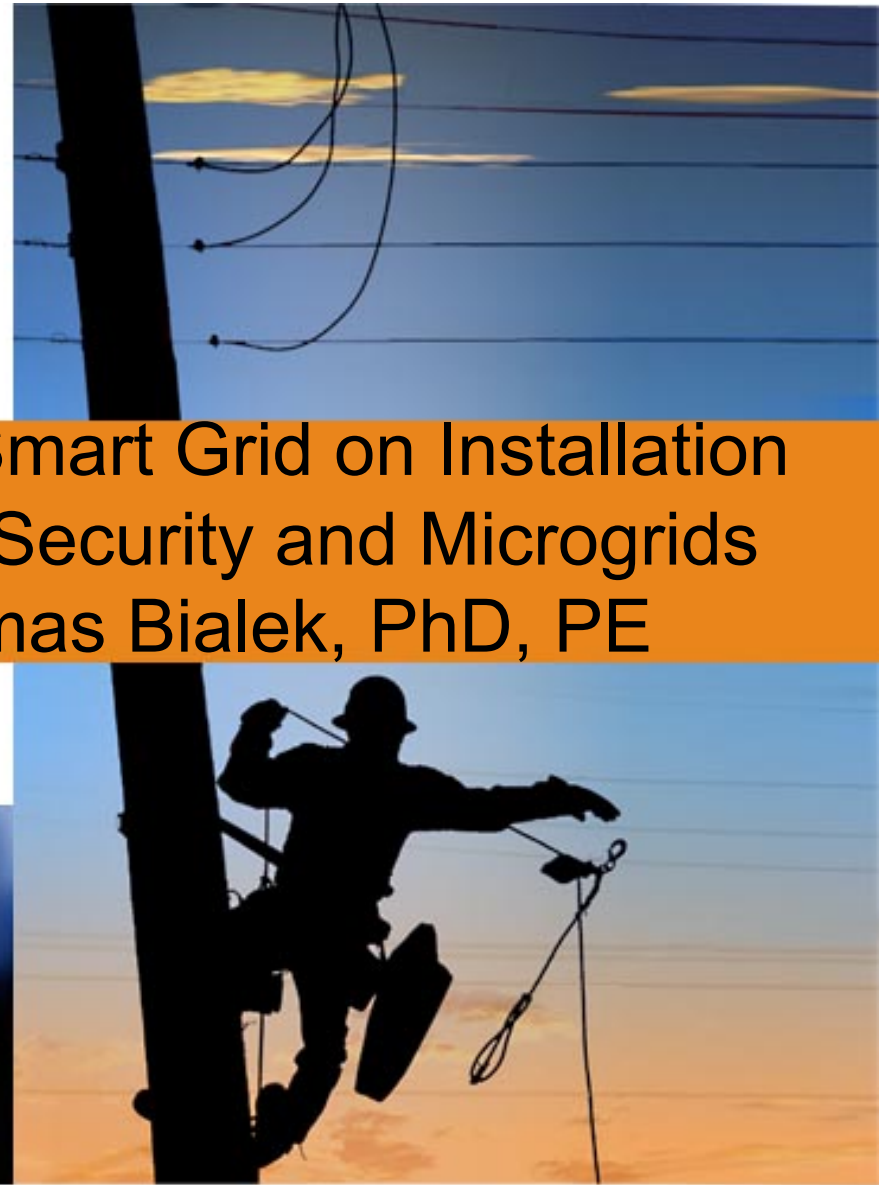




Role of Smart Grid on Installation Energy Security and Microgrids Thomas Bialek, PhD, PE



**Camp Pendleton Day 2011
June 23, 2011**

Introduction



- Smart Utility Vision
- Smart Grid Deployment Plan
- Installation Energy Security with Smart Grid
- Microgrids – An Alternative Service Delivery Model

Smart Utility Vision



- **Customer**
 - Information provided through their preferred communication channels
 - Develop T&D and IT infrastructure to enable and support customer DER
- **Transmission**
 - Implement project to improve speed of response to grid issues
 - Better utilization of data to proactively avoid issues
 - More efficient utilization of resources
- **Distribution**
 - Create a self-healing and resilient grid via real-time information
 - Expand communications and remote control of devices
 - Provision of balancing, storage, reliability and integration services to customers

Smart Grid Deployment Plan

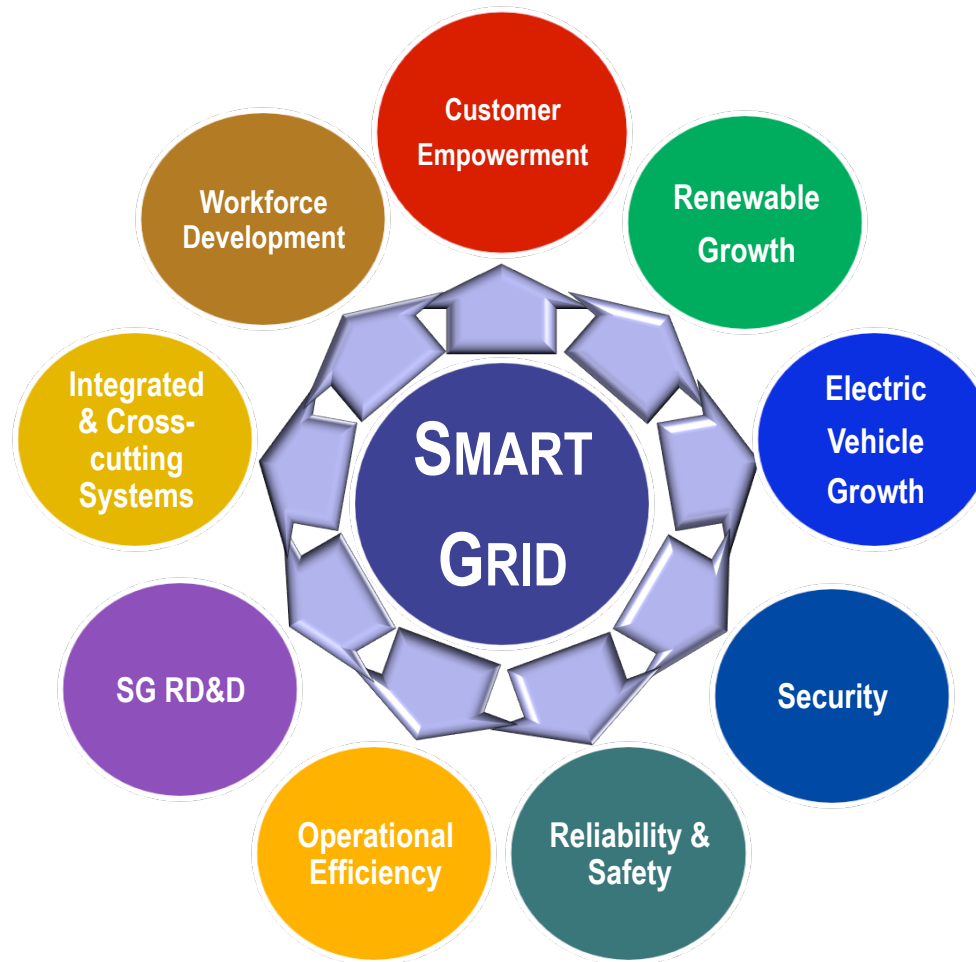


- Lays out the timeline for our 9 programs from 2011-2020 and their alignment to policy goals
- Shows by project, by year, and policy / value / pilot
 - Includes brief descriptions of all projects including “Enterprise” projects – those not being done because of smart grid, but including smart grid requirements.
- Total number of projects – 64
 - Enterprise – 18 (not included in costs/benefits)
- Includes 2015 and 2020 Vision statements in Program timelines for context

Smart Grid Deployment Plan



Roadmap includes smart grid investments in 9 programs:



Cost & Benefits Estimates



Category	Cost Estimates 2006 - 2020	Benefits Estimates 2011 – 2020 and Terminal Values
Previously authorized investments (Smart Meter, OpEx 20/20 Smart Grid projects)	\$1,042 MM	\$1,378 MM
2012 Test Year General Rate Case	\$1,424 MM	\$966 MM - \$2,263 MM
Other active applications (Demand Response, Dynamic Pricing)	\$237 MM	\$29 MM - \$139 MM
Estimated incremental investments – CPUC	\$299 MM - \$364 MM	\$253 MM - \$491 MM
Estimated incremental investments – FERC	\$466 MM - \$555 MM	\$434 MM - \$906 MM
Societal and Environmental Benefits (see following slide for details)		\$760 MM - \$1,939 MM
Totals	\$3,468 MM - \$3,622 MM	\$3,820 MM - \$7,116 MM



Grid & Cyber Security Vision



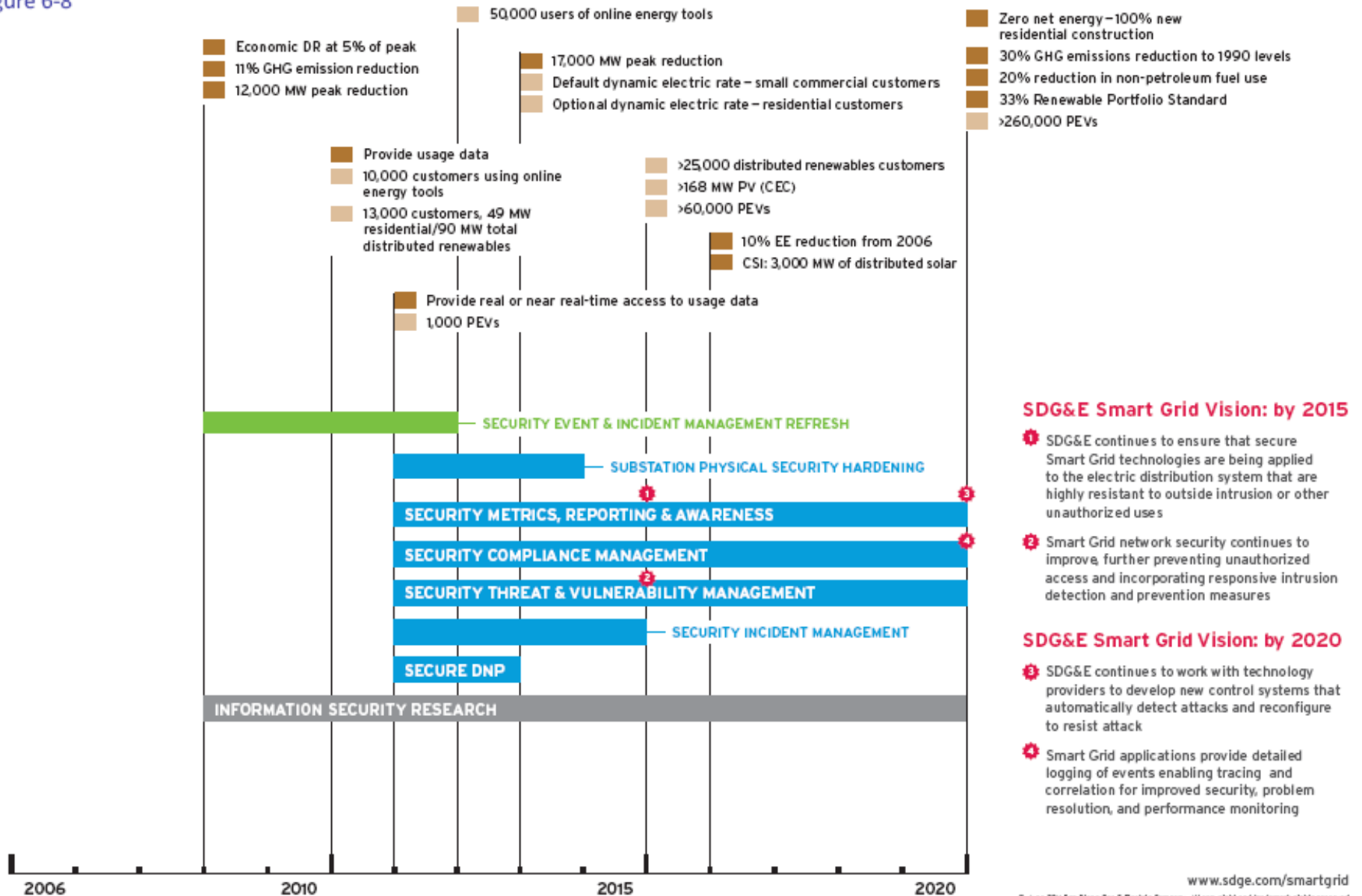
- All Smart Grid participants, such as customers, service providers, regulators and utilities, are able to:
 - Rely on the availability of the system
 - Trust the integrity of the information produced by the system
 - Confident that sensitive information is secure from unauthorized access or disclosure
- SDG&E's Smart Grid is resistant to physical and cyber security threats. It is resilient to attack and natural disasters, and aligned with industry standards and best practices.
- Because resources are finite, it is built on a security program that uses risk management methodologies to maximize its security investments.

Grid & Cyber Security – Strategic Objectives



- Set privacy as a foundational building block of our Security Programs
- Distribute security controls, make them more autonomous
- Integrate physical and cyber security capabilities

Figure 6-8



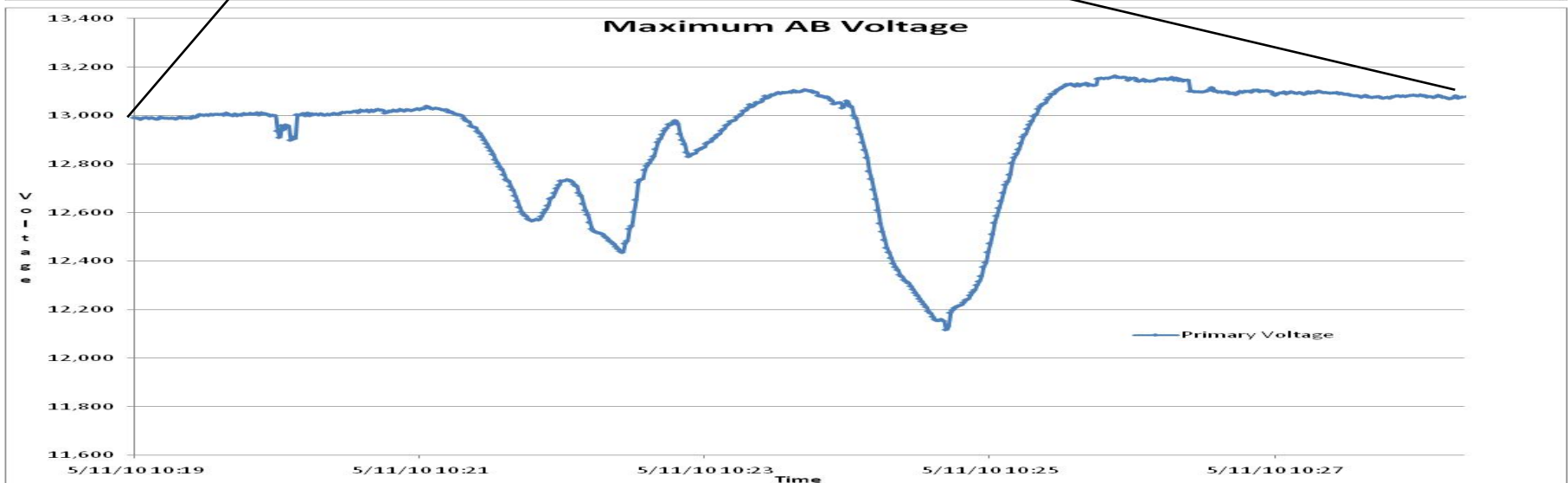
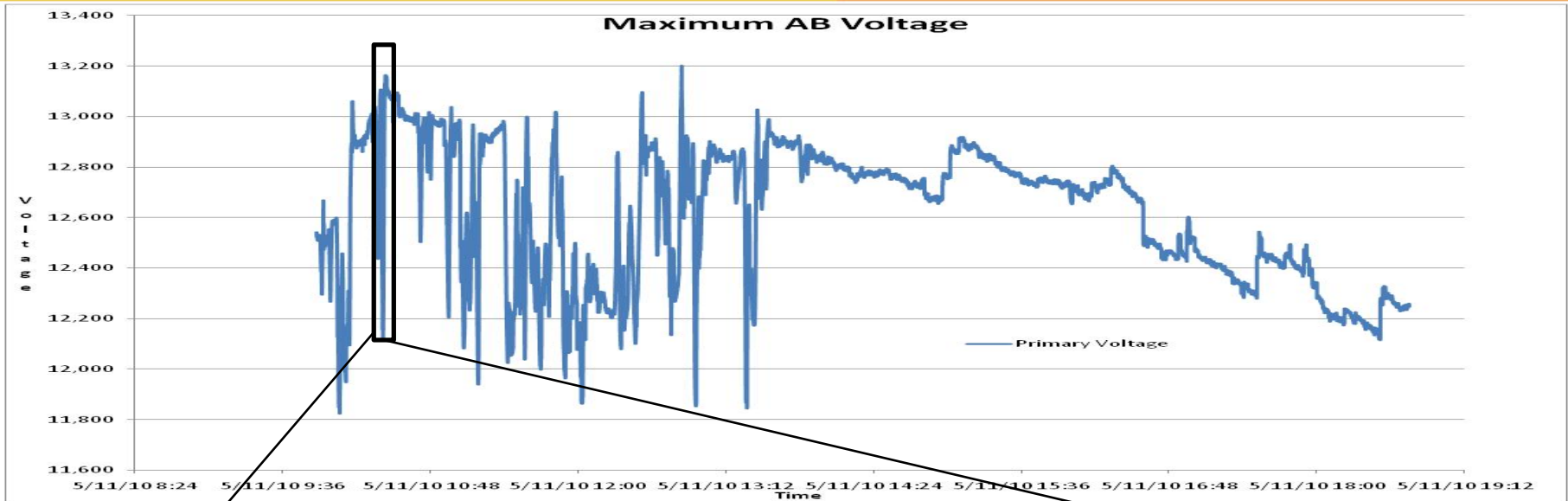
SDG&E Smart Grid Vision: by 2015

- SDG&E continues to ensure that secure Smart Grid technologies are being applied to the electric distribution system that are highly resistant to outside intrusion or other unauthorized uses
- Smart Grid network security continues to improve, further preventing unauthorized access and incorporating responsive intrusion detection and prevention measures

SDG&E Smart Grid Vision: by 2020

- SDG&E continues to work with technology providers to develop new control systems that automatically detect attacks and reconfigure to resist attack
- Smart Grid applications provide detailed logging of events enabling tracing and correlation for improved security, problem resolution, and performance monitoring

1MW PV: 10 Minutes on a Cloudy Day Extreme voltage fluctuation results



Solutions



- Circuit modifications
 - Impedance modification
 - Controls
- Demand response
 - Slower dP/dt events?
- 4 quadrant control
 - Utility dynamic VAr devices
 - Utility storage
 - Customer inverters/storage

Research, Development & Demonstration: SDG&E Borrego Springs Microgrid Project

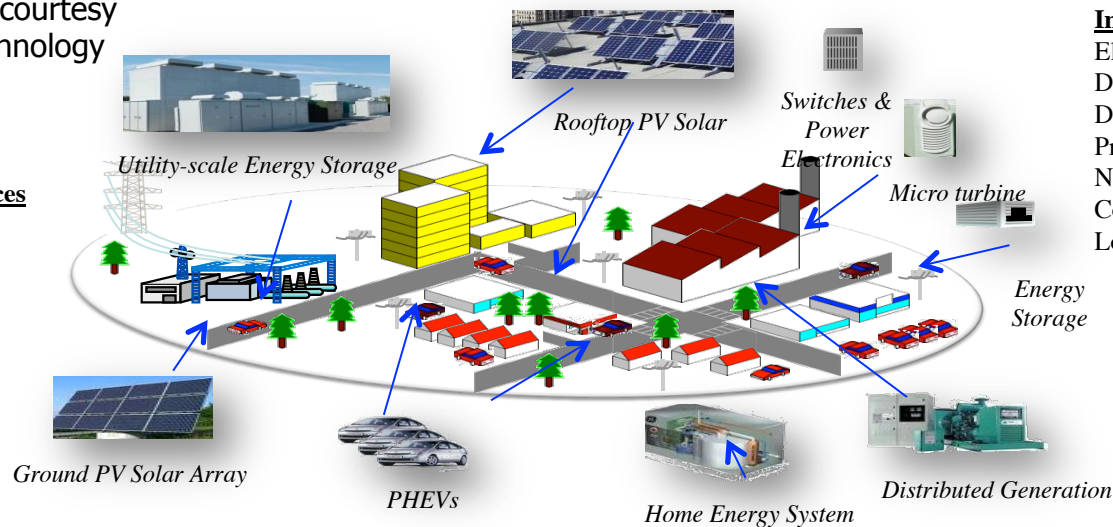


Project Description	<p>In cooperation with the US Department of Energy and the California Energy Commission, SDG&E and 10 public and private sector partners will develop a “microgrid” project - a small version of its electric grid which takes advantage of local distributed energy resources and state-of-the-art controls to enhance grid operations – to achieve a >15% reduction in feeder peak load and improve system reliability.</p>
Current Status	<ul style="list-style-type: none"> •Site Selection complete – Borrego Springs •Finalizing system requirements and high level design •Developing customer communication plan •Collaborating with environmental agencies to satisfy permitting requirements

Conceptual illustration courtesy of National Energy Technology Laboratory

Distributed Energy Resources

- Utility-scale Energy Storage
- Rooftop PV Solar
- Micro-turbines
- Building Energy Storage
- Community Energy Storage
- Distributed Generation
- Home Energy System
- PHEVs
- Ground PV Solar Array



Information

- Electricity Pricing
- DER status
- Demand Response Programs
- Network status
- Community Objectives
- Load and Resource Profiles

Grid Resources

- Capacitor Banks
- Voltage Regulators
- Automated Switches
- Power Electronics
- Communications

Questions ?



Thank you.

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