How California’s Smart Grid will be Impacted by California’s Energy Goals

Michael Gravely
Manager
Energy Systems Research Office
California Energy Commission
mgravely@energy.state.ca.us / 916-651-0316
Overview

• California Energy Commission
  o Public Interest Energy Research (PIER) Program

• What is Smart Grid and What is the California Smart Grid

• Summary of Ongoing Smart Grid Research Efforts and Good Candidates for Economic Stimulus Demonstrations
• Forecasting future energy needs and keeping historical energy data.
• Licensing thermal power plants 50 megawatts or larger.
• Promoting energy efficiency by setting the state's appliance and building efficiency standards and working with local government to enforce those standards.
• Supporting renewable energy by providing market support to existing, new, and emerging renewable technologies; providing incentives for small wind and fuel cell electricity systems; and providing incentives for solar electricity systems in new home construction.
• Implementing the state's Alternative and Renewable Fuel and Vehicle Technology Program.
• Planning for and directing state response to energy emergencies.
• Supporting public interest energy research that advances energy science and technology through research, development, and demonstration programs.
The PIER Program Operates in the Context of Public and Private Programs

RD&D Projects Range from Early Research through Small-Scale Demonstrations

Funding

Stage of Development

Net Cash Flow

Basic Research
Proof of Concept
Prototype
Product Definition
Product Prototype and Business Plan
B unit and Revised Business Plan
Product Introduction
Early adopters Utility sponsored Demonstration
Commercial Sales
Utility Programs
CEC Incentives Programs
CEC – PIER
Large Corporations
Large corp. R&D
Universities & Labs
Venture Capital
PIER Research Ongoing at all Levels

Transmission
- Phasor Measurement
- Advanced displays
- Advanced comm & controls
- MRTU interface
- Energy Storage
- Renewables

Distribution
- Distribution Automation
  - AMI
  - Advanced C&C
  - MRTU
  - Energy Storage
  - Renewables
  - AMI

Integration
- Renewables
- Standards
- Protocols
- Reference designs
- Micro Grids
- Automation

Consumer
- Automating Demand Response
- AMI
- Dynamic Rates
- Home Area Networks
- Plug in Hybrids
- Renewables
What is a Smart Grid?
The Smart Grid includes:

- Optimizing grid operations and resources to reflect the changing dynamics of the physical infrastructure and economic markets
- Cybersecurity
- Using and integrating distributed resources, demand side resources, and energy efficiency resources
- Deploying smart technologies for metering
- Communications of grid operations and status
- Distribution automation
- Integrating “smart” appliances and other consumer devices
- Deploying and integrating advanced electricity storage and peak-shaving technologies
- Transferring information to consumers in a timely manner to allow control decisions
- Developing standards for the communication and interoperability of appliances and equipment connected to the electric grid
- Identifying and lowering barriers to adoption of smart grid technologies, practices, and services
Merging Two Infrastructures

**Electrical Infrastructure**

**“Intelligence” Infrastructure**
Why Smart Grid

- Good for the Environment
  - Provides new options to reduce emissions & improve overall efficiency
  - Makes Green Grid a Reality
- Cleaner, Lower Cost Operations, More Efficient
  - New cost lowering technologies
  - Increased efficiency in operating existing systems--higher utilization rates
- Improved Grid Operations
  - Higher reliability
  - Less outage time / shorter outages / smarter decisions
- More Options for Consumers
  - Lower overall energy costs
  - More choices on how to meet individual consumer needs
  - Dynamic rates to better integrate needs of grid and consumer
What is a Smart Grid for California?
California Energy Policy Targets

Greenhouse gas emission
- 11% reduction from current levels
  - 12,000 MW peak reduction
  - 40,000 GWh/year

Energy Efficiency
- 30% reduction from projected levels
  - 17,000 MW peak reduction
  - 63,000 GWh/year
- Zero net energy homes
- Zero net energy commercial buildings

Demand Response
- Economic DR at 5% of peak

Renewable Energy
- 11% penetration
- 20% penetration
- 33% penetration
# California Advanced Metering Initiative Summary

<table>
<thead>
<tr>
<th></th>
<th>Pacific Gas &amp; Electric</th>
<th>San Diego Gas &amp; Electric</th>
<th>Southern California Edison</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong># of Electric Meters</strong></td>
<td>5.1M</td>
<td>1.4M</td>
<td>5.3M</td>
</tr>
<tr>
<td><strong># of Gas Meters</strong></td>
<td>4.2M</td>
<td>0.9M</td>
<td>Gas Utility may connect to AMI</td>
</tr>
<tr>
<td><strong>Costs Approved</strong></td>
<td>$1.7B in July 2006</td>
<td>$0.6B in April 2007</td>
<td>$1.7B</td>
</tr>
<tr>
<td><strong>Costs Pending Approval</strong></td>
<td>$0.6B to upgrade</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Deployment Schedule</strong></td>
<td>2006 to 2012</td>
<td>2008 to 2011</td>
<td>2009 to 2012</td>
</tr>
</tbody>
</table>

- Note: The table pertains to meters for utility customers with maximum load less than 200 kW. Customers with maximum load greater than 200 kW already have advanced meters.
SCE Smart Grid Activities

- SCADA, Phasor Measurement, CRAS, FACTS, Advanced Conductors
- Substation Automation
- Distribution
- Advanced Metering, Demand Response, and Distributed Resources
- Distribution Automation
- Distribution Circuit of the Future

Generation
Transmission & Sub-transmission
Customer
What a Smarter Grid Means for Customers

- Enhanced utility service reliability
- More stable, higher-quality electricity supply
- Shorter customer outages, faster service restoration
- A “self-healing” grid
- New Customer program and service options
- Increased customer control of energy costs
California Smart Grid Factors

- California energy policy
- Ongoing California deployments
- California future energy growth needs
- California energy use profile
- Impact of rapid insertion of ARRA Smart Grid funding
Public Forum Recommendations to the PIER Program

• Provide leadership role in defining Smart Grid
  o Bring together key stakeholders
  o Serve as conduit for developing statewide definition
  o Develop coordinated and integrated definition

• Sponsor and develop key Smart Grid field demonstrations
  o Demonstrate key technologies by leveraging PIER funds
  o Help California entities compete for DOE Economic Stimulus Funds
  o Support open architecture to avoid future proprietary issues
  o Coordinate critical infrastructure interface regulations, codes, and reference designs
Upcoming Smart Grid Related PIER Research Activities

• PIER Request for Proposal:
  o *Defining the Pathway to the California Smart Grid of 2020*

• PIER Funded RD&D Activities:
  o Micro-Grid demonstrations of Smart Grid technologies
  o White Paper on defining the Smart Grid standards, codes and protocols
  o White Paper on the Smart Grid technologies that will accelerate the fielding or increase the penetration of renewables in California
  o White Paper on how Smart Grid technologies will make electricity energy storage more useful in meeting California’s goals

• Provide support to the CPUC Rulemaking on Smart Grid
California Smart Grid Codes and Standards
PIER Research Priorities

• Automated Demand Response for All Customer Classes (AutoDR)

• AMI Systems Interoperability

• Reference Design for Home Area Network Gateway

• Plug-In Hybrid Vehicle (PHEV) Grid Interoperability

• Synchrophasor Interoperability and Displays
How Smart Grid helps California Meet Future State Energy Goals

• Provides Green Grid that is more efficiency, produces less emissions, operates more reliably and lowers cost for all

• Provides vehicle to support move renewables, increased energy efficiency, better blend of distributed and central generation assets, higher penetrations of PHEVs and hybrids, and lowers dependence of foreign imports

• Increases data access at all levels and allows for quicker and more effective decisions at the appropriate level

• Fosters innovation, improvements and better services for the consumer
Follow-up Questions

Michael Gravely
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