Electric Program Investment Charge
Joint IOU Stakeholder Webinar

Second Triennial Investment Plan Cycle

February 21, 2014
A Survey of California’s Energy Goals

Environmental

Renewable and Alternative Energy
- 3,000 MW of DG-PV (CSI)
- Additional 3,000 MW CHP
- 1100 MW of Rooftop PV
- 20% of renewables

Once Thru Cooling

GHG: 1990 levels
GHG: 80% Below 1990 levels

12,000 MW of DG
33% renewables
- Renewable Auction Mechanism (1225 MW statewide)
- California feed-in tariffs (750 MW statewide + 250 MW statewide for bioenergy)
Energy Storage Procurement Requirement (1325 MW)


Customers/Cybersecurity

Zero Net Energy Goal: ZNE performance for all new single and multifamily homes by 2020
NERC CIP Version 5: Stricter controls for infrastructure protection

1.5 Million Zero Emission Vehicles (ZEVs) by 2025
Zero Net Energy Goal: ZNE performance for all new commercial construction by 2030

California Electricity Policy Timeline

LEGEND: Mandate  Goal
Electric Systems Face Fundamental Changes

CURRENT
- Grid stability thru rotational inertia
- Dispatchable generation
- Passive/predictable loads
- Human-in-the-loop grid management
- Rigid and centralized system control

Drivers
- Policies
- Technologies
- Customers
- Competition

EMERGING
- Reduced stability due to generation mix change
- Stochastic generation
- Transactive loads
- Faster system dynamics by orders of magnitude
- Flexible and resilient distributed systems

Pacific Gas and Electric Company
SDGE
Southern California Edison
Photovoltaic Solar Intermittency

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# The Electric Program Investment Charge

## Funding & Allocation
- $162M/yr in ratepayer funding (2013-2020)
- CEC administers 80% of the authorized budget; IOUs administer 20%

## Approved Investment Areas
- **Applied Research**: $55M/yr (CEC only)
- **Technology Demonstration & Deployment**
  - CEC $45M, PG&E $15M, SCE $12M, SDG&E $3M (/yr)
- **Market Facilitation**: $15M/yr (CEC only)

## Electricity System Value Chain
- **Grid Ops / Mkt. Design**
- **Generation**
- **Transmission**
- **Distribution**
- **Demand-Side Mgmt**
Continuous Collaboration on the Development & Implementation of EPIC

• Starting June 2012, the IOU program administrators have generally met at least biweekly to discuss EPIC and their respective objectives for the program
• This collaboration resulted in the development of a common EPIC Framework to guide the individual EPIC plans and provide for meaningful discussion
• The Joint IOU EPIC Framework has been presented to stakeholders in a variety of public forums, as well as to the CEC, CPUC Staff and industry experts (including the Electric Power Research Institute) in an effort to seek input and avoid duplication
• These groups have validated that the Working IOU EPIC Framework correctly identifies current technology gaps and aligns with driving California policies and goals
• Importantly, the CPUC approved the common framework as part of each of the IOU EPIC Investment Plans in Decision 13-11-025
Investor Owned Utility EPIC Framework

<table>
<thead>
<tr>
<th>Safety</th>
<th>Affordability</th>
<th>Reliability</th>
<th>Key Drivers &amp; Policies</th>
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<tbody>
<tr>
<td><strong>Renewables and Distributed Energy Resources Integration</strong>&lt;br&gt;• Demonstrate Strategies &amp; Technologies to Increase Renewable Resources on the Grid&lt;br&gt;• Adaptive Protection Strategies&lt;br&gt;• Demonstrate Grid-Scale Storage Strategies &amp; Technologies</td>
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<td>• 33% RPS&lt;br&gt;• CSI&lt;br&gt;• Gov’s 12,000 MW DG Plan&lt;br&gt;• OTC retirements&lt;br&gt;• AB32&lt;br&gt;• Storage Mandate</td>
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<td><strong>Grid Modernization and Optimization</strong>&lt;br&gt;• Demonstrate Strategies and Technologies to Optimize Existing Assets&lt;br&gt;• Prepare for Emerging Technologies&lt;br&gt;• Design and Demonstrate Grid Operations of the Future</td>
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<td>• SB17&lt;br&gt;• Aging Infrastructure&lt;br&gt;• Workforce Development&lt;br&gt;• CA Economic Resiliency</td>
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<td><strong>Customer Focused Products and Services Enablement</strong>&lt;br&gt;• Leverage the SmartMeter Platform to Drive Customer Service Excellence&lt;br&gt;• Provide Greater Billing Flexibility &amp; Visibility&lt;br&gt;• Integrate Demand Side Management for Grid Optimization</td>
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<td>• ZNE&lt;br&gt;• CSI&lt;br&gt;• Net Energy Metering&lt;br&gt;• Peak Reduction&lt;br&gt;• Electric Transportation</td>
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Cross Cutting/Foundational Strategies & Technologies<br>Smart Grid Architecture, CyberSecurity, Telecommunications, Standards
Renewables and DER Integration

• Integration of Distributed Energy Resources (Generation and Storage)
  – Pilot Energy Storage End Uses to test capabilities of emerging storage technologies that lack widespread commercial operating experience
  – Demonstrate DER aggregation and control as a fleet to provide substantial reliability improvement at the circuit level, whether circuits have high or low penetration
  – Demonstrate the use of inverter based technology to achieve distribution circuit load balancing and other distribution-system-support functions
  – Demonstrate the use of a centralized controller to dispatch multiple energy storage systems and integrate with Distribution Management System
  – Demonstrate optimization strategies for energy storage on the distribution system (e.g., define optimal storage types, size, location, grid interaction requirements)
  – Demonstrations to investigate how much and in what locations distributed generation can be added to the grid before causing adverse effects
Renewables and DER Integration (Cont’d)

• Adaptive Protection Strategies
  – Safely provide for two-way power flows on the distribution system
  – Reliably integrate and safely operate with increasing levels of variable energy resources on the transmission system
  – Closed loop control for special protection schemes
  – Demonstrate active control of power flow on key lines in the system by modifying VAR resource control systems (e.g., series compensation)
  – Demonstrate the use of advanced power system simulator tools for special protection scheme development, testing, and training

• Generation Transparency and Flexibility
  – Pilot test data aggregation and signals from DER to determine and inform IOU and CAISO operations of aggregate output
  – Pilot new forecast methods (Micro-climates & automated load and distributed resources) to better predict aggregate output
  – Pilot modifications and systems for more flexible use of existing generation to reduce power system operating costs and environmental impacts
Grid Modernization and Optimization

• Strategies and Technologies to Optimize Existing Assets
  – Demonstrate promising new transmission and distribution technologies to address aging infrastructure needs & existing equipment/facility limitations
  – Demonstrate newer mobile technologies for first responders & crews to work more safely & efficiently in the field
  – Demonstrations to test strategies and technologies that improve utility security infrastructure (physical and/or cyber security controls)

• Preparing for Emerging Technologies
  – Demonstrate promising new transmission and distribution technologies to address aging infrastructure needs & existing equipment/facility limitations
  – Demonstrate next generation Distribution and Substation Automation that will integrate advanced control systems, modern wireless communications, and the latest breakthroughs in distribution equipment, software and sensing technologies
Grid Modernization and Optimization
(Cont’d)

• Designing Grid Operations of the Future
  – Demonstrate the integration of advanced substation and distribution automation, system intelligence & situational awareness capabilities with new DMS/EMS smart applications to support the operator and integrated operations of the future
  – Assess the potential for future “state measurement” v. state estimation in grid operations
  – Distributed Control for Smart Grids: Pilot control system infrastructure that can meet the needs of the current and future ever-evolving complex power system
Customer Products & Services Enablement

● Leverage the Smart Meter Platform to Drive Customer Service Excellence
  – Pilot energy usage data services for customers & approved third parties
  – Pilot Subtractive Billing with Submetering for Electric Vehicles
  – Demonstrate newer technologies offered on licensed spectrum for benefits that could include network capacity, new services to customers, increased flexibility, reliability, cost efficiency, and security
  – Demonstrate data analytics capabilities of the Smart Meter platform to improve distribution system safety and reliability

● Integrate Demand Side Management to Optimize the Grid
  – Demonstrate integration and automation strategies/technologies for various customer energy resources (storage, DER, PEV, PV, DR)
  – Demonstrate DSM resources that can be integrated and delivered in a targeted manner to provide reliable & sustained demand reductions
  – Appliance Level Load disaggregation for commercial customers
  – Demonstrate utility ability to facilitate the dispatch of DR capacity to meet CAISO needs
Customer Products & Services Enablement (Cont’d)

- Respond to Emerging Grid Integration Issues
  - Pilot and evaluate Zero Net Energy (ZNE) in specific building classes to test business models that support IOU customers
  - Pilot PEV Smart Charging and Vehicle to Grid technologies that encourage customer adoption of behaviors that further state goals
  - Evaluate costs, benefits and technical issues associated with vehicle to grid power supply
Cross Cutting Demonstrations

**Systems Architecture**
- Pilots distributed or hierarchical control systems infrastructure for T&D systems
- Communicate & coordinate new & existing field devices
- Smart Grid architecture: Pilot IOU demonstrations of electrical and communication system architecture configurations, protocols and standards
- Demonstrate system architectures with the potential to incorporate new and existing assets, including customer DER into a coordinated smart system using distributed control architectures

**Cybersecurity**
- Pilot new strategies and technologies to make the entire electrical system more secure
- Demonstrate Cyber Intrusion Auto Response and Policy Management System (CAPMS)
Cross Cutting Demonstrations
(Cont’d)

• Data Analytics
  – Demonstrate advanced analytics for grid management and optimization
  – Demonstrate best practices for filtering increasing data to make strategic use of data in evolving distributed control systems
  – Field test strategies and technologies that promote safe, reliable and affordable distributed control and automation

• Telecommunications & Standards
  – Pilot new communications architecture, standards, technologies, and strategies for addressing current and future needs
Additional Discussion Items

• Intellectual Property
  – The IOUs will adhere to existing Intellectual Property policies and procedures.
  – Enhanced Contractual terms and conditions are being developed, in compliance with the CPUC’s EPIC Decision
  – Additional discussion surrounding EPIC Intellectual Property rules and affiliate guidelines may be required to achieve the appropriate balance between ratepayer incentives, third-party commercial interests, and the desire to disseminate new ideas for broader industry consumption
# Next Steps in the EPIC Process

## Tentative Timeline

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<td>Stakeholder Comments Are Due</td>
<td>February 28, 2014</td>
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<td>EPIC Stakeholder Workshops</td>
<td>Northern California</td>
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<td>Southern California</td>
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<td>March 17, 2014</td>
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<td>March 21, 2014</td>
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<tr>
<td>Stakeholder Comments Are Due</td>
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<tr>
<td>File 2nd Triennial EPIC Investment Plan</td>
<td>May 1, 2014</td>
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Questions
IOU Contact Information

• SCE EPIC Information and Contacts:
  – Website:  https://www.sce.com/wps/portal/home/regulatory/epic/
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• PG&E EPIC Information and Contacts:
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