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Vision, Overview and Status of CPUC Distribution Resource Planning and Smart Inverter Implementation

2017 IEPR Joint Agency Workshop on Integration of Distributed Energy Resources on the California Grid

June 29, 2017

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Origin of Distribution Resource Planning Policy and Regulation

AB 327, Perea (2013) added PUC Sec. 769 (paraphrasing)

a) Defines DERs: EE, DR, renewable DG, storage, EVs.

b) IOUs file DRP proposals by July 1, 2015 to identify **“optimal” locations** for the deployment of DERs.

c) Approved DRPs must **minimize overall system costs and maximize ratepayer benefit** from investments in DERs.

d) IOUs shall propose any spending on distribution infrastructure necessary to accomplish the DRP in its GRC. Spending may be approved if ratepayers would realize **net benefits** and costs are **just and reasonable**.

CPUC DER Vision for Modern Distribution Grid: Plug and Play

CPUC guidance directed the utility DRPs to:

- Modernize the electric distribution system to accommodate two-way flows of energy and energy services throughout the IOUs' networks
- Enable customer choice of new technologies and services that reduce emissions and improve reliability in a cost efficient manner
- Animate opportunities for DERs to realize benefits through the provision of grid services.

Section 769(b) Jointly Implemented Through Two Proceedings:

Distributed Resource Plans (DRP) R.14-08-013
Integrated DER (IDER) R. 14-08-003

DRP

1) Evaluate locational benefits and costs of DERs;

IDER

2) Propose standard tariffs and contracts needed to source DERs that provide net ratepayer benefits;
3) Propose cost-effective means to coordinate existing CPUC programs related to distribution system planning and investment;

DRP

4) Identify additional utility spending necessary to integrate distributed resources; and
5) Identify barriers to deployment, including but not limited to safety standards and operational reliability.

DRP Tracks

- **Track 1**: Methodological Issues surrounding Integration Capacity Analysis (ICA) and Locational Net Benefits Analysis (LNBA)
- **Track 2**: Demonstration and Deployment Projects
- **Track 3**: Policy/Process Alignment Issues:
  1. DER Growth and Load Forecasting
  2. Grid Modernization Investment Framework
  3. Distribution Investment Deferral Framework

Integration Capacity Analysis

- Calculates available circuit hosting capacity to accommodate additional DERs w/o grid upgrades
- Results published in online "heat" maps and databases, likely updated on a monthly basis
- Three primary use cases:
  1. Inform DER developers of grid locations where DERs can interconnect without system upgrades;
  2. Streamline (and potentially automate) the Rule 21 interconnection process; and
  3. Inform annual distribution planning, e.g. where to proactively upgrade the grid to accommodate expected autonomous DER growth.
- **Status:** Full system roll-out by Q2 2018 (est)

Locational Net Benefits Analysis

- Determines optimal locations for DER deployment based on opportunities for DERs to cost-effectively defer or avoid traditional distribution (and transmission*) system investments.
- Provides indicative avoided costs of DER solutions for candidate distribution investment deferral opportunities
  - Results published in a Public LNBA tool and online circuit heat maps
- Helps prioritize candidate DER deferral opportunities for solicitation in Distribution Investment Deferral Framework (Track 3)
- Will help inform new rates and tariffs and future NEM 3.0 policy
- **Status:** Full system roll-out by Q2 2018 (est)

DER Growth and Load Forecasting

- Develop methodologies for spatially granular DER growth and distribution load forecasts, which inform:
  - ICA hosting capacity
  - LNBA optimal DER location determinations
  - Distribution deferral opportunities
  - Grid modernization investment determinations
- Process alignment with IEPR, IRP, LTPP, and TPP to ensure consistent forecasting assumptions across planning processes

Key Agency Alignment Issues for Adoption of DRP Growth Scenarios

- DRP is primarily concerned with developing methods to disaggregate state wide DER and load forecasts down to the circuit level to inform distribution planning.
- In 2017 some of the IOUs have proposed using more recent DER and load forecasts then the 2016 IEPR.
- Should the CPUC require the utility growth scenarios to be entirely based on the IEPR load modifier demand forecast?
- Under what conditions should the IOUs use different sources than the IEPR demand forecast to inform the DER growth scenarios?
- What should IOUs base their forecast on in the IEPR forecast year and the IEPR update year?

Timeline of DRP Growth Scenario Development

- June 2017: IOUs submit final Assumptions & Framework presenting their proposed Growth Scenario methodology for 2018
- July 2017: Party comments due → Key opportunity for Agency input on alignment
- July 2017: Ruling adopting and/or providing guidance on the application of growth scenarios for 2018
- Q4 2017: Track 3 decision adopting framework for ongoing updates to growth scenarios (2018 and future) → Key opportunity for Agency input on alignment
- Q2 2018: IOUs produce growth scenarios based on Track 3 decision guidance to inform 2018-2019 DRP
- DER growth scenarios could inform 2019 IRP Reference Plan

Distribution Investment Deferral Framework

- Determines opportunities to defer traditional grid infrastructure capital investments through competitively sourced DERs at lower cost.
- DERs, aka “non-wires” alternative solutions must serve same grid needs as “wires” solutions.
- Process alignment needed between the distribution planning process, capital planning process, and the General Rate Case process
- **Status:** Staff proposal in May 2017, Q4 2017 Proposed Decision

Distribution Investment Deferral Framework

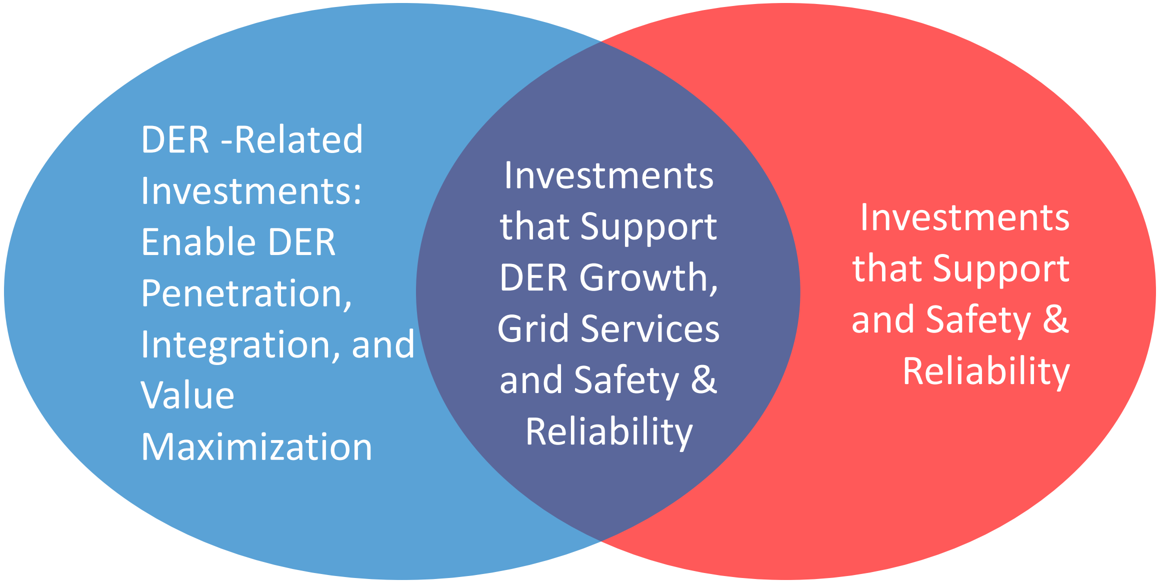
- Key elements in development:
  - Annual **Grid Needs Assessment** IOU deliverable
  - Distribution Planning Advisory Group
  - Competitive Solicitation (or future DER sourcing mechanisms developed in IDER)
  - IDER Shareholder Incentive Pilot
- **Next steps:** Staff Proposal for imminent release; Q4 2017 Track 3 Proposed Decision

Grid Modernization Investment Framework

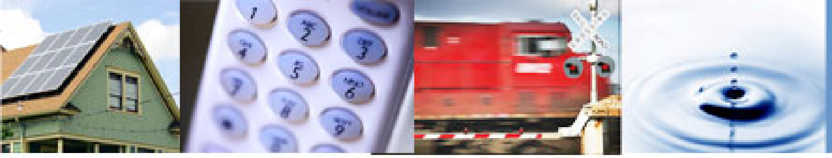
Primary objective is to guide GRC funding decisions on technology investments that enable utilities to:

- Accelerate the adoption of DERs that can cost-effectively provide GHG reductions and provide grid services;
- Connect DERs to existing and new markets to reduce costs and to create value for ratepayers;
- Facilitate the inclusion of DERs into distribution system planning to produce technological, economic and societal benefits; and
- Enhance customer choice and ensure DER-related Grid Modernization investments result in net benefits that are equitably distributed to all ratepayers.
- **Status:** Staff Proposal May 2017, Q4 Proposed Decision

Definition of Grid Modernization for Distribution Resource Planning



“A modern grid allows for the seamless interconnection of distributed energy resources while maximizing ratepayer benefits, minimizing impacts and risks of safety and reliability. A modern grid facilitates the efficient integration of these resources into all stages of distribution system planning and operations to fully utilize the capabilities that the resources offer, and enables distributed energy resources to participate in established and emerging markets to more fully realize the value of the resources.”



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FOR FURTHER INFORMATION

CPUC Smart Inverter Standards and the Smart Inverter Working Group (SIWG)

2017 IEPR Joint Agency Workshop on Integration of Distributed Energy Resources on the California Grid

June 29, 2017

Gabe Petlin, Supervisor

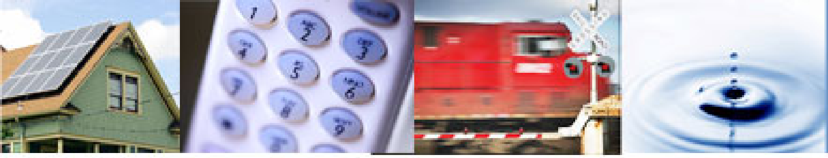
What is a Smart Inverter? What Problem Do They Solve?

- A inverter is a power electronic device needed by many distributed energy resources (DERs) to interconnect to the grid and a smart inverter is one with advanced capabilities.
- Smart inverters mitigate many of the traditional concerns associated with variable DER generation, enable greater penetration of DERs, and enhance DER value by enabling grid services.

What Makes an Inverter Smart?

Additional functionality beyond conversion of DC to AC:

- Autonomous response to grid conditions
- Bidirectional communication for monitoring and control
- Advanced functionality for DER dispatch



Smart Inverter Functionality Benefits

- Mitigates impact DERs may have on the grid (i.e. voltage and frequency fluctuations, power quality, islanding concerns, etc.)
- Increases hosting capacity
- Improves distribution operations and system efficiency
- Increases grid safety and reliability, especially in emergency situations
- Reduces distribution upgrades which would be used to integrate and utilize DERs as well as mitigate impacts of Zero Net Energy projects
- Provides gateway for provision of grid services

Projects demonstrating these benefits have been completed and many more are being tested currently.

History of the California Smart Inverter and the Smart Inverter Working Group

- Formed in 2013 to develop recommendations for technical steps needed to optimize inverter-based DERs to support grid operations.
- Weekly meetings led to recommendations for smart inverter functionality in three phases.

	Recommendations Completed	Tariff Revisions: Proposed and Approved	Required Date	DER Action Plan
Phase 1: Autonomous Functions	January 2014	January 2015 April 2015	September 2017	**By 2020,** fully operationalize advanced smart inverter functionalities to enhance the integration of DERs into the grid.
Phase 2: Communications	February 2015	December 2016 April 2017	Later of (a) March 2018 or (b) 9 Months Following a Test Standard	
Phase 3: Advanced Functions	March 2016 Revised March 2017	June 2017 TBD	TBD Likely Later of a Date in 2019 or a Time Period Following a Test Standard	

Smart Inverter Functions

Phase 1 Autonomous Functions	Phase 2 Communications	Phase 3 Advanced Functions

• Anti-Islanding
• Voltage Ride-Through
• Frequency Ride-Through
• Volt/VAR Control
• Default and Emergency Ramp Rates
• Fixed Power Factor
• “Soft-Start” Methods
	• Three Pathways:
	  • IOU – DER
	  • IOU – DERMS
	  • IOU – Retail Aggregator
	• Default Protocol: IEEE 2030.5 (aka SEP 2.0)
		• Monitor Key DER Data
		• DER Cease to Energize/Return to Service Request
		• Limit Maximum Real Power Mode
		• *Set Real Power Mode*
		• Frequency-Watt Emergency Mode
		• Volt-Watt Mode
		• *Dynamic Reactive Current Support Mode*
		• Scheduling Power Values and Modes

Smart Inverter Benefits by Phase

Phase 1 Autonomous Functions	Phase 2 Communications	Phase 3 Advanced Functions
• Reduces impact of DERs contributing to system disturbances and unnecessary disconnections • Mitigates DER voltage and power quality issues	• Enables active management, monitoring, and coordination of DERs with distribution equipment • Allows for updating of Phase 1 settings and Phase 3 functions	• Increases utility visibility and control of DERs • Enables DERs to assist grid operations under normal (ex. maintenance) and abnormal (ex. emergency) grid situations • Further reduces impact of DERs contributing to system disturbances and unnecessary disconnections