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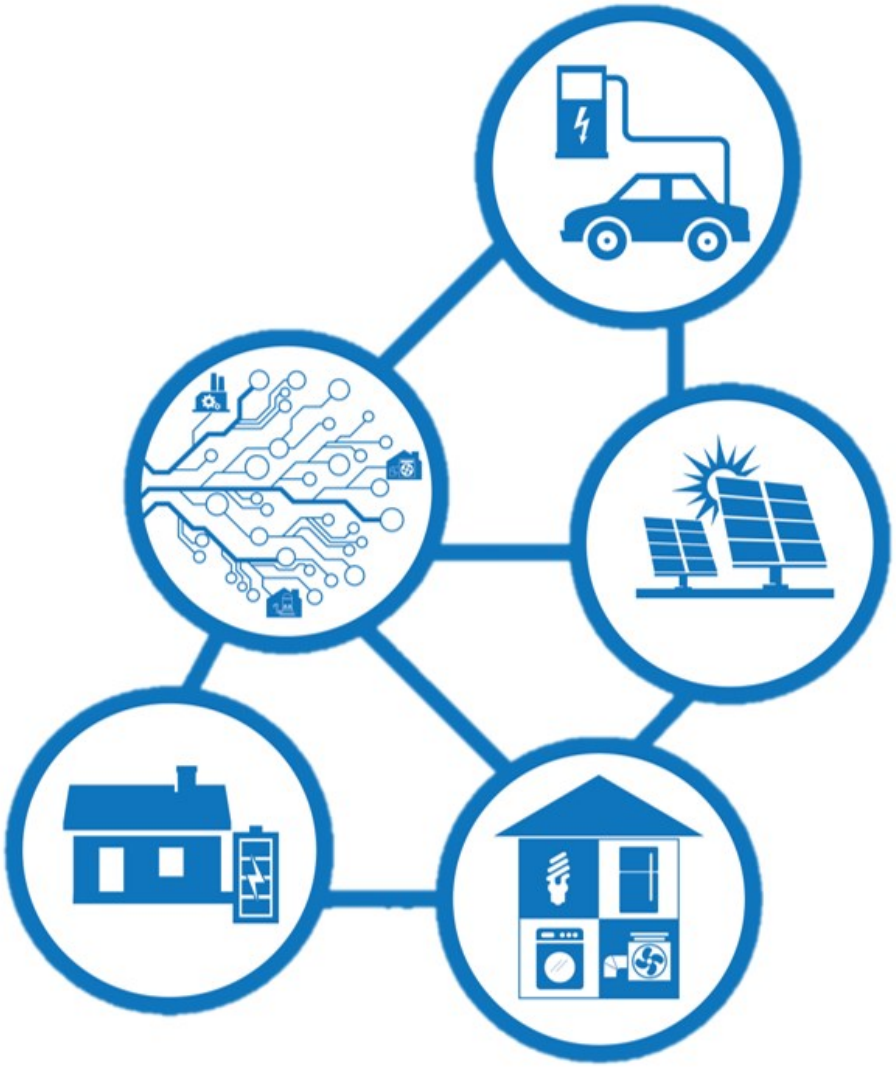
Distribution Resources Plan



July 24, 2015

9:00 A.M. – 11:30 A.M.

Agenda

9:00 am – 9:10 am	**Welcome and Introduction** • Webinar Objective • Background on AB 327 & Commission Guidance • SCE's Proposed Guiding Principles
9:10 am – 9:55 am	**Final Guidance Requirement 1** • Integration Capacity Analysis • Distributed Energy Resources Interconnection Map (DERiM) • Optimal Location Benefit Analysis • DER Growth Scenarios
9:55 am – 10:05 am	**Q&A Session on Final Guidance Requirement 1**
10:05 am – 10:35 am	**Final Guidance Requirements 2 – 5** • Demonstration and Deployment • Data Access • Tariffs and Contracts • Safety Considerations
10:35 am – 10:45 am	**Q&A Session on Final Guidance Requirements 2 – 5**
10:45 am – 11:20 am	**Final Guidance Requirements 6 – 9** • Barriers to Deployment • SCE's Grid Modernization Investments • DRP Coordination with Utility and CEC Load Forecasting • DRP Coordination with Utility General Rate Case • Phasing of Next Steps
11:20 am – 11:30 am	**Q&A Session on Final Guidance Requirements 6 – 9**

For the Q&A, please send us your questions through the WebEx and we will attempt to address the questions during the Q&A Sessions.

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Objective

SCE's Webinar is intended to provide an overview of SCE's Distribution Resources Plan (DRP) Application, A.15-07-002, that was filed on July 1, 2015.

This webinar will not provide any additional information or discussion beyond what is contained in SCE's DRP.

Important Notice: If decision makers, as defined by Rule 8.1(b) of the CPUC's Rules of Practice and Procedure, or Commissioners' personal advisors are attending this webinar, please notify Matthew Dwyer, at matthew.dwyer@sce.com and Dave Erickson, at john.erickson@cpuc.ca.gov.

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Background on AB 327 and CPUC Guidance

- AB 327 (2013) requires utilities to submit a DRP by July 1, 2015 to identify optimal locations for distributed energy resources (DERs)
- The Commission initiated the DRP proceeding (R.14-08-013) in August 2014 to establish policies, procedures, and rules for the development of the DRP
- The *Assigned Commissioner's Ruling on Guidance for Public Utilities Code Section 769 – Distribution Resource Planning* ("Final Guidance"), issued on February 6, 2015, describes the structure and requirements for the DRP
- SCE's DRP reflects the Commission's three objectives:
  - Modernize the distribution system to accommodate customer choice
  - Enable new technologies and services that reduce emissions and improve reliability
  - Animate opportunities for DERs to realize benefits by providing grid services

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SCE's Guiding Principles

1. Promoting customer choice and customer engagement are key objectives
2. The distribution grid can play a key role in reducing carbon in California
3. Safety, reliability, and resiliency must remain paramount objectives
4. Costs of electric service must remain affordable and equitably-apportioned to customers
5. Competitive processes for the selection of DERs should be utilized to the greatest extent possible

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Requirement 1

1a. Integration Capacity Analysis

1b. Optimal Location Benefit Analysis

1c. DER Growth Scenarios

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1a. Integration Capacity Analysis

Final Guidance required utilities to perform an integration capacity analysis (ICA), down to the line segment level

To determine the hosting capacity available for DERs, SCE conducted its initial ICA on a group of 30 representative distribution circuits (feeders) and extrapolated the results to all the distribution circuits

- Evaluated each circuit's DER hosting capacity by considering thermal ratings, protection system limits, and power quality standards to meet safety standards
- Evaluated hosting capacity related to DERs that produce energy (IC, Generation) and hosting capacity for DERs that consume energy (IC, Load)

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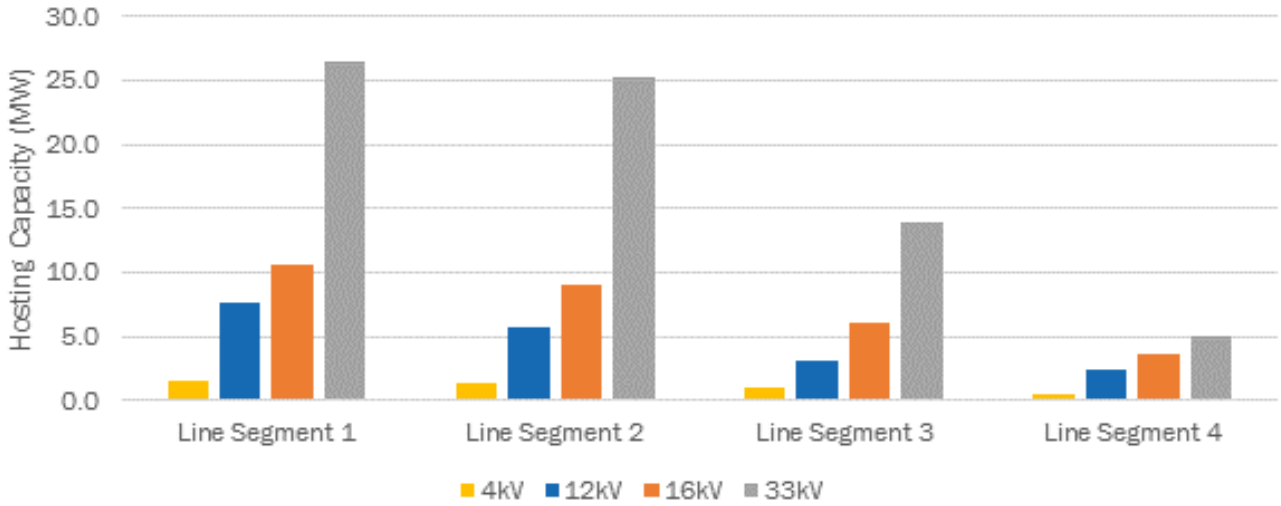
ICA Provides Valuable Information on Capacity for DERs

Average Discharging Hosting Capacity of the 30 Representative Distribution Circuits by Voltage Class



Key Takeaways:

1. The higher the distribution voltage, the higher the potential integration capacity. For example, the chart above shows that the 12kV line segments have more hosting capacity than the 4kV line segments.
2. The closer the line segment is to the substation, the more DERs it can accommodate. In the above chart, Line Segment 1 is closest to the substation.

Results displayed on SCE's new Distributed Energy Resource Interconnection Maps (DERiM)

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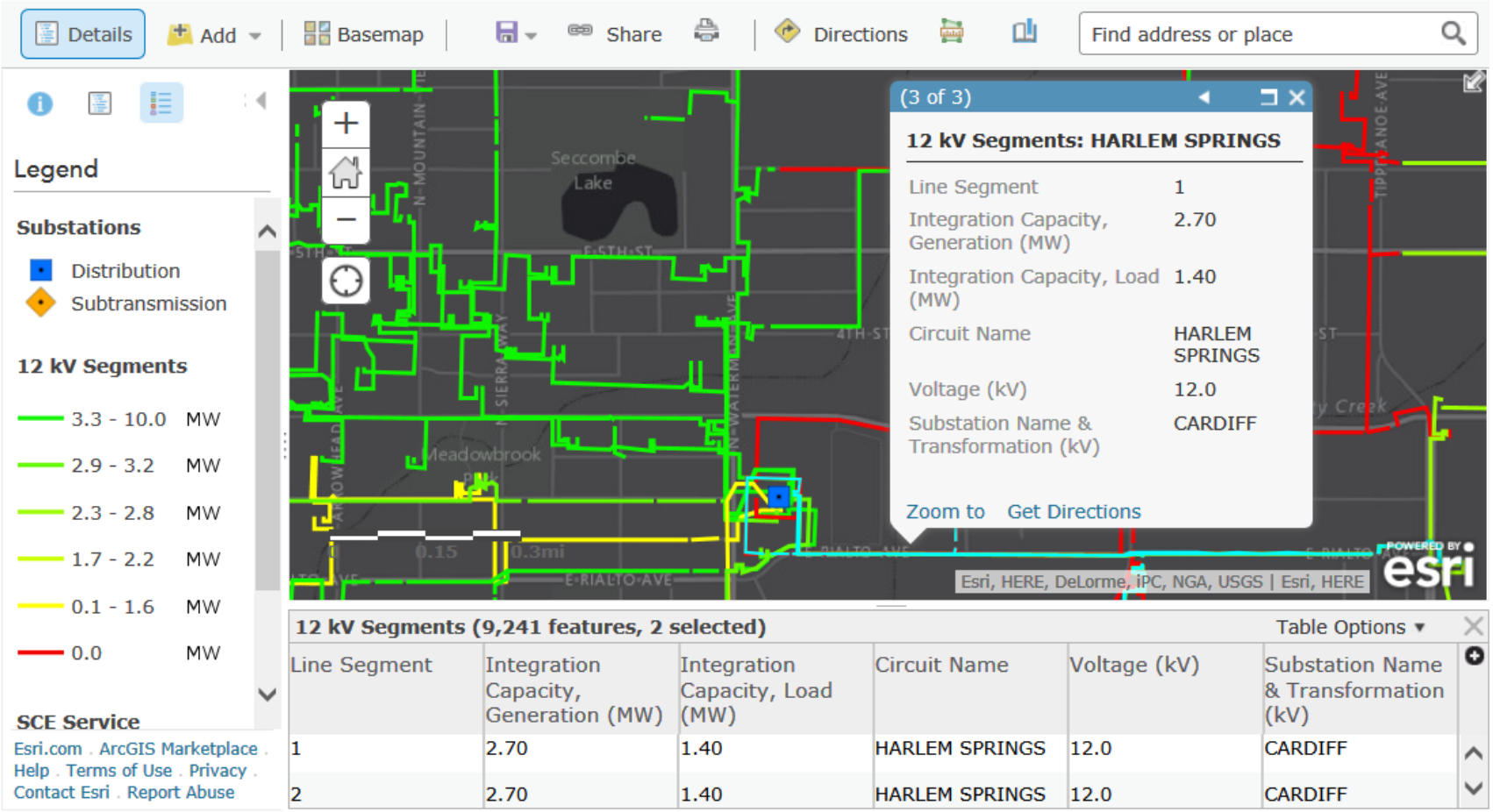
Distributed Energy Resource Interconnection Maps (DERiM)



Line Segment	Integration Capacity, Generation (MW)	Integration Capacity, Load (MW)	Circuit Name	Voltage (kV)	Substation Name & Transformation (kV)
1	2.70	1.40	HARLEM SPRINGS	12.0	CARDIFF
2	2.70	1.40	HARLEM SPRINGS	12.0	CARDIFF

SCE DERIM: on.sce.com/derim

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1b. Optimal Location Benefit Analysis

- SCE's objective is to identify optimal locations, likely in form of heat maps, where DERs could provide a high benefit value
- SCE's locational net benefits methodology (LNBM) identifies DER benefit components and describes how to quantify them
- List of benefit components for LNBM is based on E3's Distributed Energy Resources Avoided Cost (DERAC) calculator
    - For the LNBM, system-level values in the DERAC are replaced with location-specific values
    - Additional components were added based on the Final Guidance to the list from DERAC

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Identifying Optimal Locations and Maintaining Ongoing Updates

- SCE will conduct an indicative analysis using high value benefit components (e.g., distribution deferrals or energy value) to identify locations where DERs are likely to provide the most benefits
  - Such location areas may span multiple circuits or substations
- Locations would be categorized or ranked based on the relative benefits that DERs are likely to provide
  - SCE would publish a list of these optimal locations, potentially in the form of "heat maps"
  - SCE plans to update this list after the conclusion of its annual internal distribution planning process

Distribution Planning Review Group (DPRG)

- SCE is recommending that a distribution deferral framework should be developed in this proceeding, to establish upfront standards and criteria to determine which traditional grid investments would be considered for potential deferral
- SCE also recommends establishing a Distribution Planning Review Group (DPRG) process to review how SCE applies this framework and to promote transparency
  - DPRG would be comprised of eligible non-market participant parties who sign non-disclosure agreements
  - In general, this process would work similar to the Procurement Review Group (PRG) process to review utilities' procurement activities in the wholesale energy markets

1c. DER Growth Scenarios

SCE developed three 10-year scenarios that project growth of DERs through 2025, including forecasted geographic dispersion at the distribution feeder level and potential impacts on distribution planning:

Step 1: Develop three scenarios of increasing levels of DER penetration at SCE system level based on the Final Guidance

Step 2: Allocate the projected DERs values for each scenario and each technology at the circuit level

Step 3: Evaluate impact of the DERs on the distribution system based on the allocated projections

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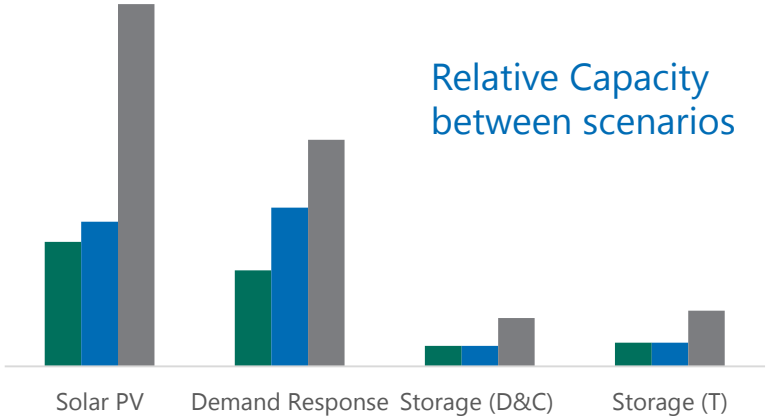
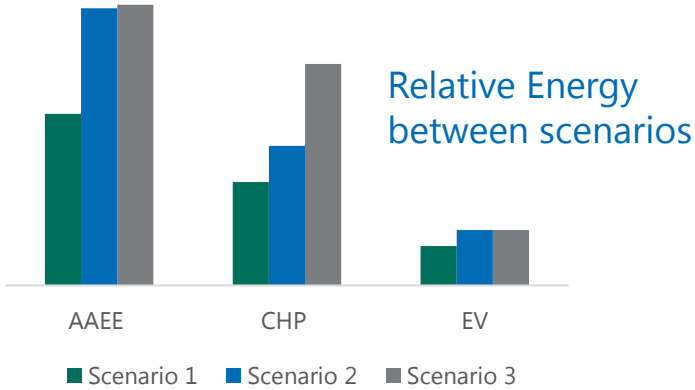
Step 1: Develop Three Scenarios

SCE Territory Amounts of Potential DER Deployment by 2025

Growth Type	Scenario 1	Scenario 2	Scenario 3
Base Load	27,019 MW	27,019 MW	27,019 MW
Solar PV (nameplate AC)	1,636 MW	1,905 MW	4,770 MW
AAEE (annual)	10,536 GWh	17,031 GWh	17,243 GWh
Demand Response	1,265 MW	2,087 MW	2,981 MW
CHP (annual)	6,350 GWh	8,576 GWh	13,612 GWh
EV (annual)	2,422 GWh	3,395 GWh	3,395 GWh
Storage (D&C)	270 MW	270 MW	637 MW
Storage (T)	310 MW	310 MW	731 MW





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Step 2: Allocate DERs

- SCE attempted to identify the types of customers who have the greatest economic potential and/or interest in installing the various forms of DERs (likely adopters).
- SCE's customer base was inventoried to determine the distribution of the likely adopters for each technology across individual circuits.
- The scenario system value was applied to the relative distribution of likely adopters to determine the magnitude by location.

Step 3: Assess Impact on Distribution

Growth Type	Current	Scenario 1	Scenario 2	Scenario 3
10-year Growth Rate	1.4%	1.0%	0.9%	0.2%

Impact of Each DER Scenario to the 10-Year Growth Rate at the SCE System Level

- Distribution System Load Growth
  - Decrease in system growth projected over the 10-year planning horizon
  - Traditional upgrades to meet load growth will still be required, but may be reduced
- Distribution System Load Growth
  - Grid reinforcement can increase integration capacity to accommodate high DER scenarios
- Planning Process
  - In order to more accurately assess DER impacts, a locational forecast of DERs is needed

Note: Initial effort to develop DRP DER Growth Scenarios includes general assumptions regarding DER availability and operation

Q&A Session on Requirement 1

Please send us your questions regarding integration capacity, optimal location benefit analysis, and DER growth scenarios through the WebEx and we will attempt to address the questions.

Requirement 2 – 5

2. Demonstration & Deployment

3. Data Access

4. Tariffs and Contracts

5. Safety Considerations

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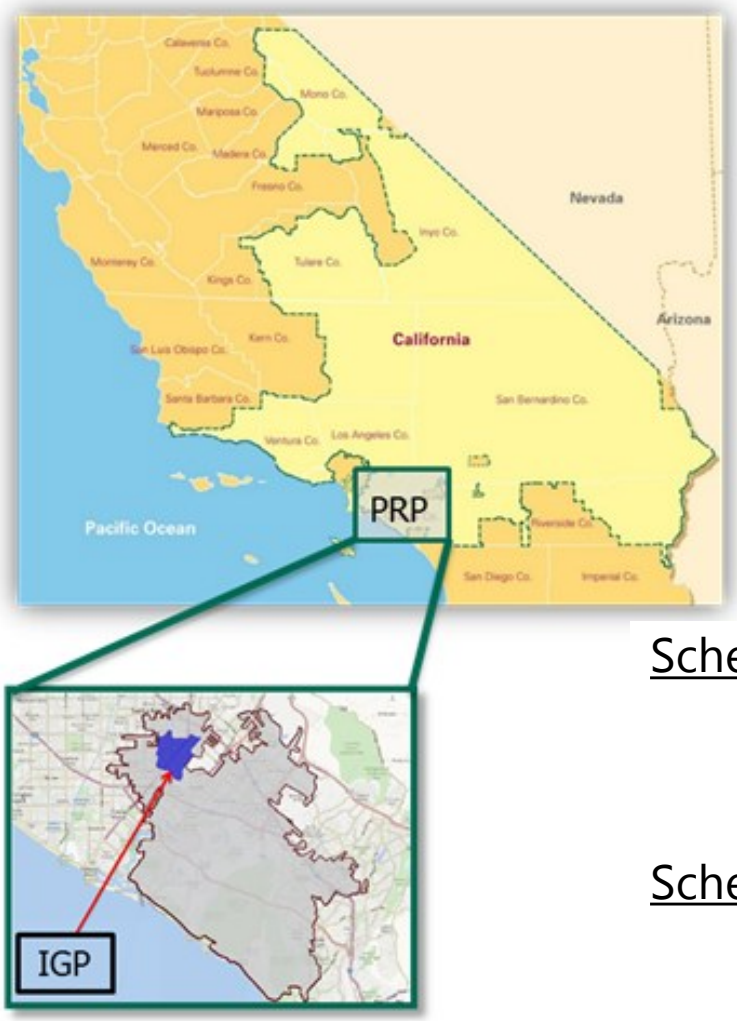
2. Demonstration and Deployment



Location for Demo A - D :

a. Orange County area of service territory/ongoing activities to modernize the grid for DER integration

b. Demo C & D – leverage existing projects, PRP & IGP

Location for Demo E :

a. Orange County area of service, or another suitable location

Schedule for Demo A & B:

a. Commence no later than one month after commission approval

b. Submit final report by Q1, 2017

Schedule for Demo C,D & E:

a. Commence no later than one year after commission approval

b. Submit final report by Q4, 2019

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Demo A

A Dynamic Integration Capacity Analysis

Objective

- Demonstrate dynamic integration capacity analysis

Approach

- Perform Power System Modeling to:
  a. Analyze the impacts of aggregated DER (without excess or reverse power flow) on the distribution, sub-transmission and transmission systems
  b. Analyze the impacts of aggregated DER providing reverse power flow from the distribution system to the sub-transmission and transmission systems

Project Location

- Within SCE's Preferred Resources Pilot (PRP) region

Timing

- Commence no later than one month after Commission approval
- Submit final report by Q1, 2017

Demo B

B Optimal Location Benefit Methodology

Objective

- Demonstrate the Commission-approved locational net benefit methodology (LNBM) approach

Approach

- Use the LNBM to calculate the distribution capacity investment deferral on two distribution infrastructure projects:
    a. One near-term project (<3 years)
    b. One longer-term project (>3 years)

Project Location

- To be determined

Timing

- Commence no later than one month after Commission approval
- Submit final report by Q1, 2017

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Demo C

C DER Locational Benefits:

Objective

- Demonstrate the ability of DER to achieve net benefits consistent with the optimal location benefit analysis
- Demonstrate how DERs will displace or operate in concert with existing infrastructure
- Operate multiple DER types in concert

Approach

- Operate DERs in concert to demonstrate if DERs can achieve optimal locational benefits
- Evaluate and analyze results to validate DERs ability to achieve optimal locational benefits

Project Location

- This will be performed in the PRP region (SCE's South Orange County region)

Timing

- Commence no later than one year after Commission approval
- Submit final report by Q4, 2019

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Demo D

D Distribution Operations at High Penetration of DERs

Objective

- Demonstrate and evaluate the impact of DERs in distribution planning
- Evaluate impact of increased penetration of DERs on traditional grid investment methodology

Approach

- Evaluate co-optimization of customer resources with grid assets
- Assess how high penetration impacts on grid operations and in particular switching
- Assess how high penetration of DERs can be operated for grid benefit and will influence distribution planning and investments

Project Location

- This will be performed by the Integrated Grid Project (IGP), which will be located in the PRP region; IGP will be served by the Johanna Jr. substation

Timing

- Commence no later than one year after Commission approval
- Submit final report by Q4, 2019

Demo E

E Demonstrate DER Dispatch to Meet Reliability Needs

Objective

- Demonstrate a utility-controlled microgrid system

Approach

- Identify how multiple 3rd Party and Utility-owned DER resources could be operated in a coordinated manner to support operational needs
- Identify how multiple customer/3rd party and utility-owned DER resources could maintain or improve grid reliability
- Assess needs and effectiveness of management system in the coordination of available DER
- Identify concerns related to data access or exchange

Project Location

- At an industrial/military base and/or residential/university housing

Timing

- Commence no later than one year after Commission approval
- Submit final report by Q4, 2019

3. Data Access

Guiding Principles

SCE supports sharing data with customers and third party DER owners and operators to facilitate DER integration. SCE believes that data should be shared when:

I. Doing so would not violate existing Commission rules, state or federal laws, regulations or any other applicable requirements protecting customer privacy, trade secrets, proprietary information, grid reliability and security, or public safety;

II. Parties have identified a purpose for the particular granularity of data requested such that the manner in which access to the data is granted is narrowly tailored to meet Commission-specified needs;

III. The data is already collected by SCE in the appropriate form or could be collected in such form without unreasonable costs or effort as weighed against the identified benefits of the data, as determined by the Commission;

IV. The Commission has decided the need for, the appropriateness of, and the methodology for sharing any data that may be market-sensitive or may be used to manipulate markets.

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Proposed Data Access Methods

- SCE proposes to provide data through a number of methods:
  - Distribution data is being made available through DRP process
    - Distributed Energy Resource Interconnection Map (DERiM)
  - Leverage existing forums where data is already being provided
  - Provide additional data that is currently non-public in an appropriate manner
- Collaborative stakeholder workshops should be held to discuss other data types
  - Identify requestors, purpose for data access, and data needs
  - Identify data transfer methods
  - Propose aggregation/anonymization techniques
- Utilize DPRG process to provide non-market participants a way to receive market-sensitive information

Data Sharing from Third Parties to Utilities

- Various data types related to third party DERs would provide benefits to SCE's distribution planning and real-time grid operations
  - Voltage, current, power factor, real and reactive power, and status of DERs
  - Data will be used to maximize DER benefits to the grid, and identify safety concerns
- Data sharing methods should be discussed at stakeholder workshops
  - Dedicated telemetry or other methods of transmitting data should be discussed

4. Tariffs and Contracts

- SCE outlined rate schedules and rules that offer incentives or govern DERs:
  - Distributed renewable generating facilities (e.g. NEM, Re-MAT, Rule 21)
  - Demand response (e.g. TOU-BIP, SDP)
  - Electric vehicles (e.g. TOU-EV-1,-2,-3)
- To the extent locational values could be incorporated into the existing tariffs (including any policy reforms to Rule 21), SCE believes such new tariff provision should be developed in the tariff's existing, active proceeding (as possible and appropriate) rather than in the DRP proceeding.

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Tariffs and Contracts, Cont.

- To facilitate SCE's proposed field demonstration project, SCE recommends to:
  - Leverage its existing distributed generation request for offer
  - Leverage existing energy efficiency (EE) portfolio to increase incentive levers for certain EE projects
  - Evaluate how demand response can be designed and implemented for local reliability needs
- Due to the significant Rule 21 interconnection policy reforms underway in the Rule 21 proceeding, SCE believes that it is premature to recommend any refinements to interconnection policies that account for locational values.

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5. Safety Considerations

- Final Guidance required SCE to catalog the potential reliability and safety standards related to DERs
- In the DRP, SCE sets forth several existing safety standards that ensure that equipment operates in a safe and predictable manner
  - Examples: NEC, 705: Interconnected Electrical Power Production Systems broadly covers any power-producing system connected to the utility through an inverter, regardless of the energy source
- SCE also describes its work with a number of other organizations to modify existing standards
  - Example: IEC 61850 (Power Utility Automation), re communications architecture and data transfer required for protecting relaying (opening a circuit breaker when a fault is detected)

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DERs and Grid Modernization May Enhance System Reliability and Safety

Potential enhanced grid capabilities that can be achieved from DERs, coupled with grid modernization investments include:

- Support grid reliability during system problems by providing power to the grid during significant voltage and frequency variations
- Local voltage support
- Microgrids

Potential grid modernization and grid reinforcement solutions are needed to enable these enhanced grid capabilities.

- Communications needed to fully integrate DERs
- Grid Reinforcement for resiliency
- Modernization of protection relays
- Mitigation of cybersecurity risks

Some Safety Considerations Could be Mitigated or Obviated by Technical Change

- Example #1:
  - Risk: Energy storage, if overcharged and over-discharged charged, may pose safety risks due to a rapid increase in temperature that cannot be halted
  - Technical solution: Implementation of voltage safety monitoring and controls and fault detection mechanisms at both the battery cell level and system level

- Example #2:
  - Risk: Unintentional islanding occurs when the PV system continues to energize a utility wire after being disconnected from the rest of the grid, which can potentially expose utility personnel, emergency responder, and the public to energized conductors.
  - Technical solution: This risk can be potentially mitigated by PV inverters with anti-islanding features built into the controls and certification under the requirements of IEEE 1547; In addition, additional telemetry for grid operators can provide situational awareness to support safety

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Education/Outreach Activities & Opportunities

- Final Guidance required SCE to describe its plan to engage local permitting authorities regarding DER safety
- In SCE's DRP, SCE explains that it already engages permitting authorities on energy efficiency through the California Statewide Codes and Standards Program
- SCE also plans to inform local permitting authorities on DER safety best practice procedures for DER installations in a cost-effective manner by:
  - leverage its sce.com website
  - utilizing contacts with local jurisdictions in SCE's Local Government Partnerships Program
  - using existing relationships with DER market contractors and vendors

Q&A Session on Requirements 2 - 5

Please send us your questions regarding demonstration projects, data access, tariffs, and safety considerations through the WebEx and we will attempt to address the questions.

Requirement 6 – 9

6. Barriers to Deployment

7. DRP Coordination with GRC and Grid Modernization Investments

8. DRP Coordination with Utility and CEC Forecasting

9. Phasing of Next Steps

6. Barriers to Deployment

- Final Guidance requires IOUs to identify barriers to the deployment of DERs and categorize the barriers as statutory, regulatory, grid insight, standards, safety, benefits monetization, or communications
- SCE's chapter focuses on barriers related to SCE's grid operations and customers
  - SCE describes the barrier, makes general recommendations, and identifies grid modernization investments that may help resolve the barrier.
- To better consider barriers experienced by third parties, SCE proposes to continue the process of identifying barriers with third parties through future DRP workshops

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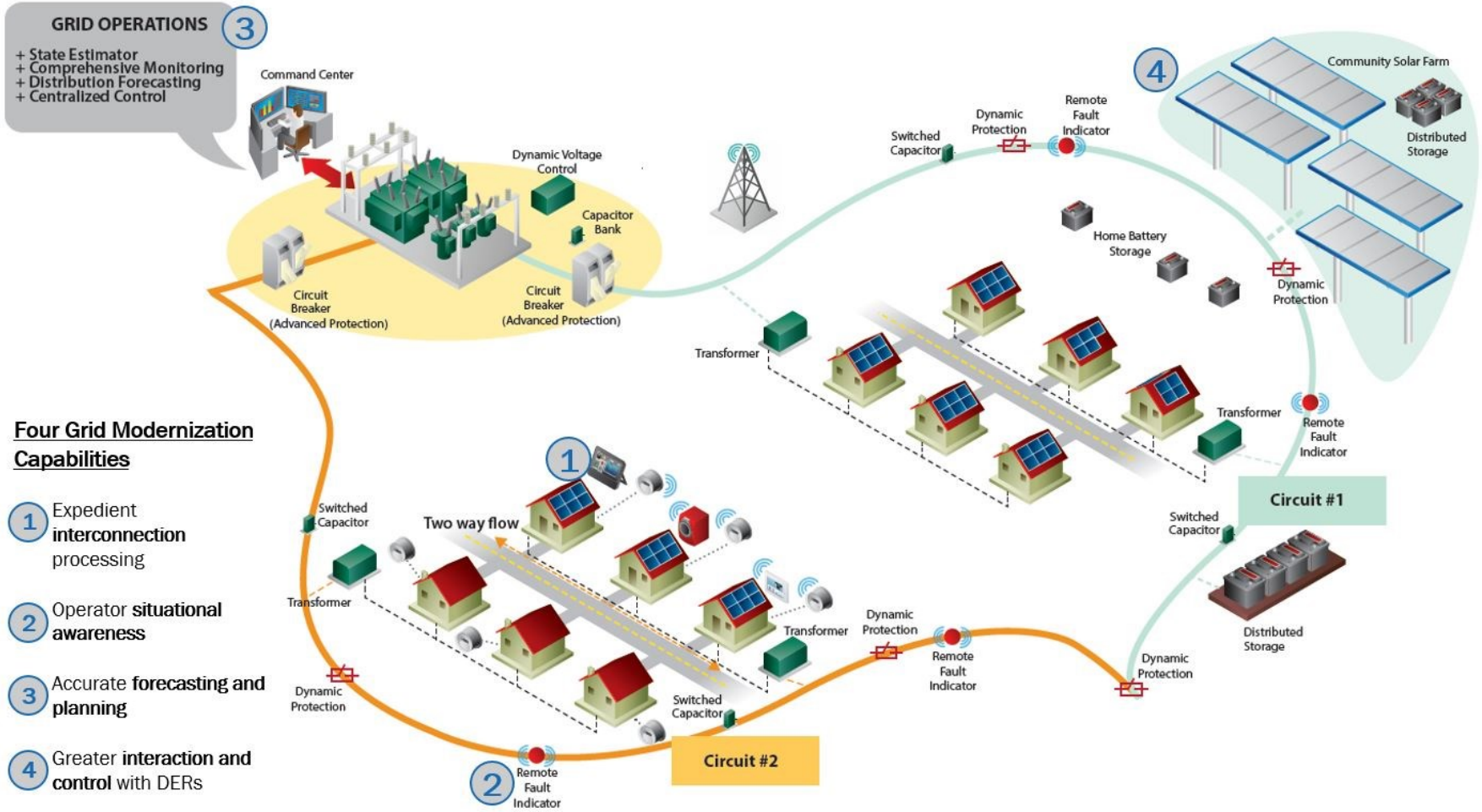
Examples of Barriers

- **Regulatory/Grid Insight:** Growing number of interconnection requests
  - Develop an online Application tool for NEM, WDAT, and Rule 21 to meet the growing number of interconnection requests
  - Upgrade software and modeling tools used for interconnection studies to speed up technical reviews
- **Regulatory/Benefits Monetization:** Certain DERs are limited in their ability to participate directly in the wholesale market
  - Initiatives, such as the CAISO's expanded metering and telemetry options, help reduce barriers for aggregated resource models
- **Safety:** High penetration of DERs may lead to poor voltage regulation, utility equipment overloads, and reliability concerns
  - Distribution investments in automated switches with telemetry and remote fault indicators improve situational awareness
  - Modern protection relays help enable two way flows; conductor upgrades would increase the capacity of the system

7. SCE's Vision for a 21st Century Power System



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Grid Modernization Requirements

Capabilities

- Expedient Interconnection Processing
- Increased Situational Awareness
- Accurate Forecasting and Planning
- Greater Interaction with and Control of DERs

Investments

- Distribution and Substation Automation
- Communications & Interoperability
- Technology Platforms and Applications
- Grid Reinforcement

Enabled By

People Strategy

- Increased manpower
- New skill sets
- Training process
- Workforce Evolution

Business Processes

- Work Management & logistics
- Evaluation of processes for suitability
- Design Standards moving forward
- Procurement & Planning Integration
- Construction and operational procedures

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Grid Modernization Investments and Preliminary Expenditure Estimates

Category	Specific Investments		2015	2016	2017	2018 GRC (2018-2020)
Distribution Automation	#1	Automated Switches w/ Enhanced Telemetry	$500K - $1M	$3 - $5M	$35 - $60M	$185 - $320M
	#2	Remote Fault Indicators				
Substation Automation	#3	Substation Automation	$1.3 - $1.6M	$5 - $10M	$25 - $45M	$185 - $320M
	#4	Modern Protection Relays				
Communication Systems	#5	Field Area Network	$100 - $200K	$2 - $5M	$5 - $10M	$270 - $470M
	#6	Fiber Optic Network				
Technology Platforms and Applications	#7	Grid Analytics Platform	$10 - $13M	$65 - $100M	$55 - $85M	$215 - $375M
	#8	Grid Analytics Applications				
	#9	Long-Term Planning Tool Set				
	#10	Distribution Circuit Modeling Tool				
	#11	Generation Interconnection Application Processing Tool				
	#12	DRP Data Sharing Portal				
	#13	Grid and DER Management System				
	#14	Systems Architecture & Cybersecurity				
	#15	Distribution Volt/VAR Optimization				
Grid Reinforcement	#16	Conductor upgrades to larger size			$140 - $215M	$550 - $1,100M
	#17	Conversion of circuits to higher voltage				

Table VII-9

Grid Modernization Investment Plan

- To meet the Commission's objectives, SCE plans to begin foundational grid modernization investments immediately
  - Investments to increase distribution grid capacity and resiliency for DERs in some areas
  - Integrated grid technologies necessary for the 21st century power system
  - Broad deployment over a number of years beginning with foundational and enabling deployment of tools, applications, and grid devices
- SCE will seek to establish the Distributed Energy Resources Memorandum Account (DERMA)
  - SCE would record the revenue requirement on capital and applicable O&M expenses during 2015-2017 that are incremental to authorized funding

8. DRP Coordination with Forecasting

- Better align and integrate SCE's system and distribution level forecasts
  - Explore the use of more granular data and build common database
  - Establish new reconciliation processes
  - Evaluate and develop different forecasting tools
  - Develop internal capabilities to estimate DER potential at granular levels
- Recommend transformation of both SCE's internal load forecast process and CEC's IEPR load forecast process
  - Recommend adopting A-Bank level as the common standard
  - Require all resource estimates to be provided at the more granular level consistently
  - Achieve a higher level of coordination among state agencies and proceedings
  - Expand the IEPR stakeholder groups to include distribution planners, third-party DER developers, local governmental agencies, etc.
- Implement SCE's forecast process changes in 3 to 5 years
  - Target to produce hourly forecast at the A-Bank level from the circuit level
  - Reconcile system and distribution level forecasts at the A-Bank level
  - Perform more scenario analyses to support future resource procurement and grid improvement decisions

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9. Phasing of Next Steps

- DRP will establish DER policies, tools and methodologies that will be incorporated into SCE's planning processes
- As mentioned earlier, the DRP should also develop a deferral framework to identify categories of utility investments that could be considered for deferral
- SCE's distribution system plan (updated annually) will utilize DER policies, tools and methodologies and identify utility investments and deferral determinations/DER opportunities
  - An independent review group (Distribution Planning Review Group or "DPRG") comprised of Commission staff and other non-market participant parties, similar to the Procurement Review Group, will review the results of distribution planning process
  - Feedback from DPRG will inform SCE's GRC forecast
- SCE will continue to work with the Commission to integrate and align relevant aspects of the DRP with other EE, DR, DG, ES, and EV proceedings, as applicable

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9b. Phased Approach to DRP Filings

SCE offers the following considerations for future phases of the DRP:

1. Results of the demonstration projects should be considered in future phases
   - Five demonstration projects were proposed as part of the DRP; lessons learned from these projects should help inform future DRP cycles and phases
2. Data sharing issues should be explored via SCE's proposed workshops
   - Future phases of the DRP will continue to have data sharing topics; SCE recommends using the open stakeholder process (discussed in Data Access) to address sharing of data types identified in future phases of the DRP
3. A Distribution Planning Review Group (DPRG) should be created

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Conclusion

- SCE is committed to fully embracing and implementing the Commission's DRP vision and meeting the changing customer expectations
- SCE will continue to transform distribution system planning and operations to meet current and future DRP goals
- SCE intends to partner with others to facilitate DERs and encourage customer value creation, including robust recommendations to overcome barriers to DER deployment
- The DRP is an important step towards a fully integrated, low-carbon electricity system, and utility grid modernization investments must keep pace with DER technology innovation

Q&A Session on Requirements 6 - 9

Please send us your questions regarding barriers, grid modernization, DRP coordination with forecasting, and Phasing through the WebEx and we will attempt to address the questions.

Thank you.

To access SCE's Distribution Resources Plan (DRP), SCE's Distributed Energy Resources Interconnection Map (DERiM), and additional information, please visit the CPUC's DRP website at: http://www.cpuc.ca.gov/PUC/energy/drp/

Important Notice: If decision makers, as defined by Rule 8.1(b) of the CPUC's Rules of Practice and Procedure, or Commissioners' personal advisors are present, please notify both Matthew Dwyer, at matthew.dwyer@sce.com and Dave Erickson, at john.erickson@cpuc.ca.gov.