ENERGISE Program Kickoff

DOE Award #: DE-EE0008004

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Electric Access System Enhancement (EASE) Southern California Edison

October 11, 2017

Electric Access System Enhancement - EASE

PROJECT Objective

Enhancing **interconnection** to the grid, access to **information**, ability to provide **services**, and **optimization** of resources by implementing an **interoperable** distributed control architecture **leading to higher penetration of DER**.

- ❖ The EASE project leverages existing SCE/SGS/AMS work (Integrated Grid Project (IGP)/Distribution Resource Plan (DRP) Demonstration D/LCR Contract)
- ❖ Increases communication and value amongst key stakeholders: Customer – Resource Provider – Local Jurisdiction - Utility
- ❖ Proposes and tests the business rules and evaluates the value of coordinated resource control
- ❖ Seeks to increase adoption of controllable DERs and enhance planning and operations in a high penetration DER environment

SOUTHERN CALIFORNIA EDISON

smarter grid solutions

NREL

Advanced Microgrid Solutions

Additional Team Members: Customers, City of Santa Ana, and research universities including UCLA, Cal Tech, UCR, and UCI

California Energy Policy

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Policy	Description
Distribution Resource Plan (AB-327)	• Evaluate locational costs and benefits of distributed resources • Identify standard tariffs, contracts, or other mechanisms for the deployment of cost-effective distributed resources • Maximize the locational benefits and minimize the incremental costs of distributed resources • Identify additional utility spending consistent with the goal of yielding net benefits to ratepayers and identify barriers to deployment of distributed resources SCE Plan filed July 1, 2015 - http://www.cpuc.ca.gov/General.aspx?id=5071
Integration of Distributed Energy Resources	• Enable customers to effectively and efficiently choose from an array of distributed energy resources and deploy DERs that provide optimal customer and grid benefits, while enabling CA to reach its climate objectives • Establish a Cost-Effectiveness Framework to evaluate distributed resources as a substitute for utility capital investment • Develop a Competitive Solicitation Framework and Utility Regulatory Incentive Pilot http://www.cpuc.ca.gov/General.aspx?id=10710

Background
California Energy Policy

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Policy	Description
Energy Storage Procurement Framework and Design Program	• 1,325 MW energy storage procurement (Transmission, Distribution and Customer) by 2020 (plus AB-2868) • Optimization of the grid, including peak reduction, contribution to reliability needs, or deferment of T&D upgrade investments • Integration of renewable energy • Reduction of GHG emissions to 80% below 1990 levels by 2050 • Utilize procurement protocols for assessing and selecting storage bids http://www.cpuc.ca.gov/General.aspx?id=10710
CAISO Distributed Energy Resource Provider (DERP) Market	• Facilitate participation of aggregations of DERs to bid into CAISO wholesale market • 500kw minimum aggregation, 1MW max on individual resource, 20MW max on aggregation, and single Sub-LAP (Load Aggregation Point – 6 in SCE area) • Resource provider disaggregates CAISO dispatch instruction to individual DERs • 30 Day utility review period being established (More Than Smart T-D Interface Working Group) • Operational date to be determined https://www.caiso.com/participate/Pages/DistributedEnergyResourceProvider/Default.aspx

October 3, 2017

Renewable Output

Renewable energy production from renewable resources broken down by resource type.

Current Renewables
12684 MW

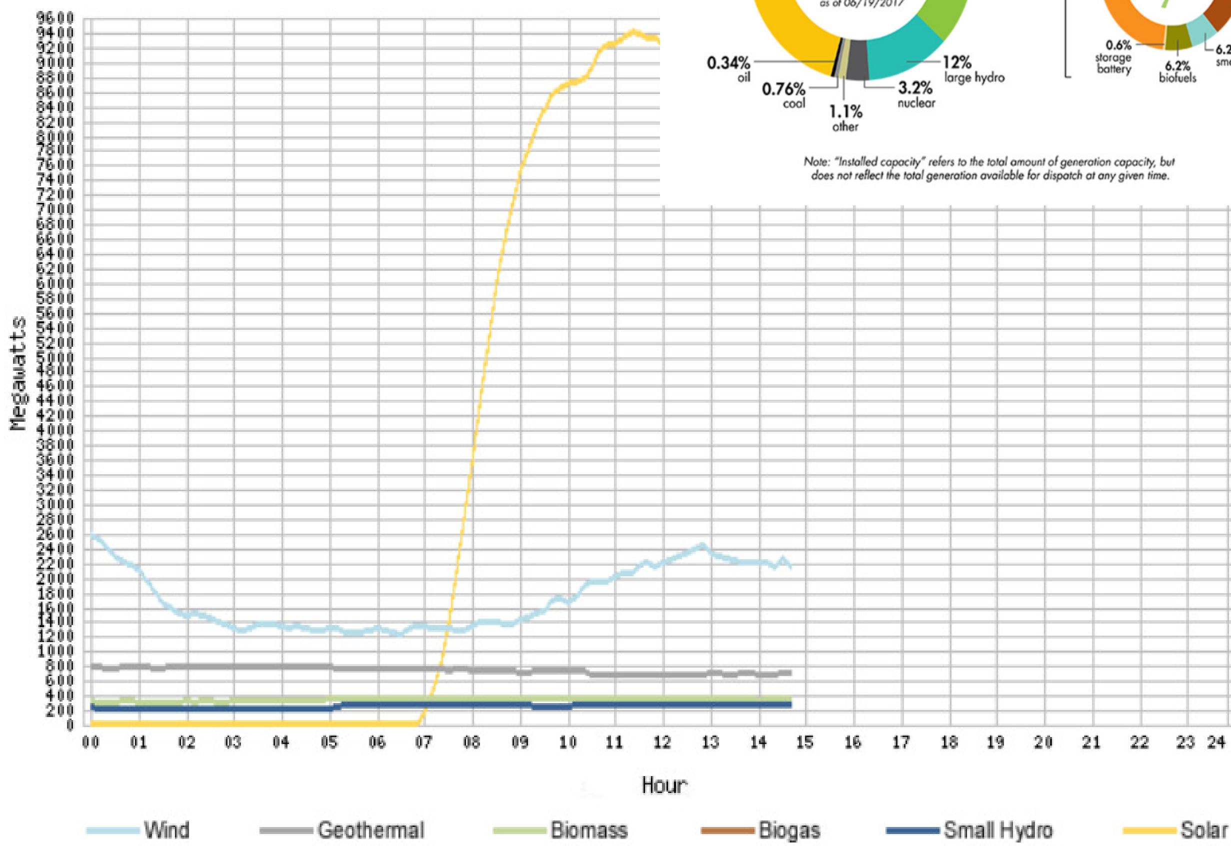
Percentage of load being served by renewables
47%

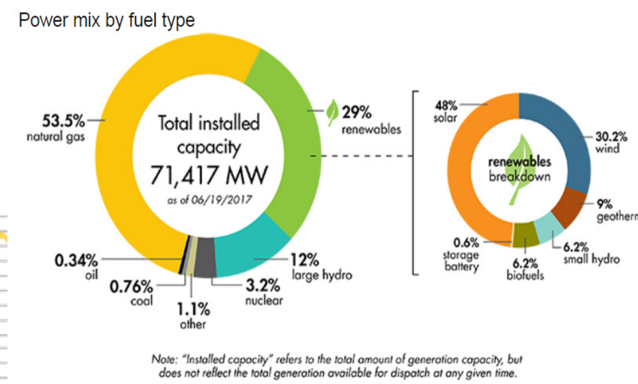
Current Solar: 9119 MW
Current Wind: 2131 MW

Renewables Watch
Click to see yesterday's actual renewable energy production

Wind and solar curtailment report
Click to see yesterday's wind and solar curtailments

Greenhouse gas emissions report
Click to see the greenhouse gas emissions reports





http://www.caiso.com

EASE PROJECT GOALS

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- Demonstrate how increased control of high penetration renewables may increase hosting capacity
- Demonstrate how DER integrate with the distribution system and be optimized both locally and regionally
- Demonstrate how to reduce customer interconnection time for DER
- Demonstrate how a scalable architecture that allows DER to access and share critical information can improve planning and operations and drive value for all stakeholders

Project Milestones/Deliverables

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EASE

Budget Period 1

Task 1:
- *Project Plans*
- *Framework for Distributed Control Architecture*
- *Scalability Strategy*
- *Use Cases*

Task 2:
- *Functional DER registration portal*
- *Automation of interconnection process demonstrated for aggregator and directly connected DER assets*

Task 3:
- *Prove interoperability between the DCA with directly controlled and aggregator controlled DER assets*

Task 4:
- *Successfully demonstrated DER self-provisioning and end-to-end control*

Budget Period 2

Task 5:
- *Successful HIL testing set-up*
- *HIL demonstration of end-to-end controls of thermal and voltage constraint management*
- *Demonstration of scalability of mix of PV and ESS management capabilities*

Task 6:
- *Services Commercial Model and Use Cases for exchange of these services.*
- *HIL demonstration of the provision of services by DERs to SCE, CAISO, and other third-parties.*

Task 7: Expanded Field Trial
- *Commissioning of DCA on substation feeders*
- *Full verification of communication and control capabilities.*
- *Refining of Commercialization Plan*

Budget Period 3

Task 8
- *HIL demonstration of communication between DCA and (A)DMS and integration with the topology shift and operational efficiency applications*
- *Implementation of DER population engineering and stakeholder dashboard deployments.*

Task 9
- *Field testing mid-point analysis and update to applications or design.*
- *Report field testing results and system performance.*

Task 10
- *Completion of Commercialization Plan and industry outreach activities*

PROVISION OF SERVICES

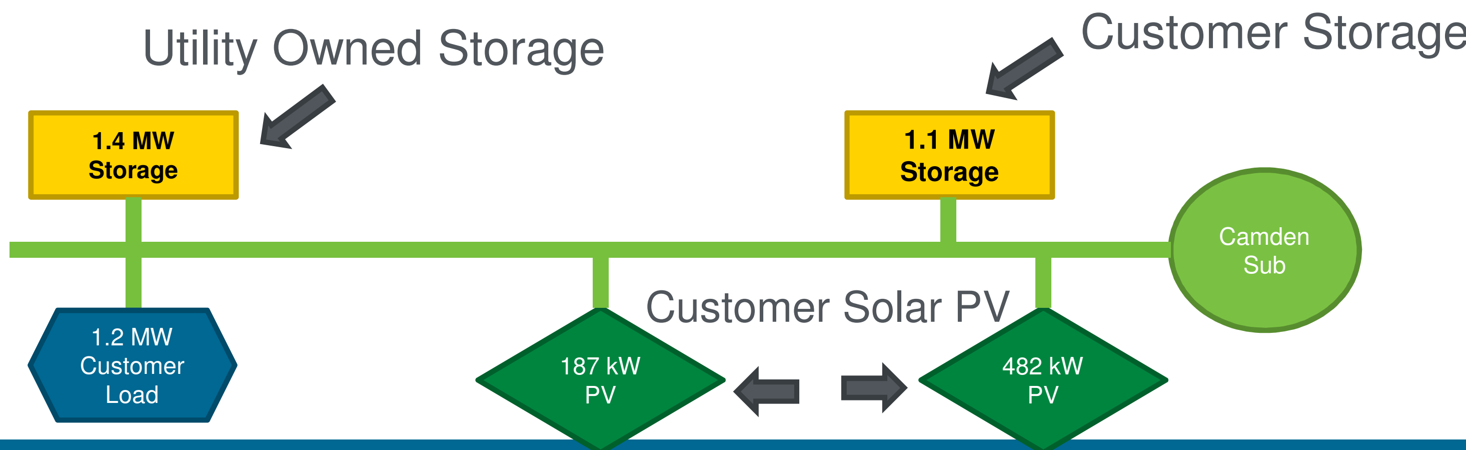
- Investigate multiple resource optimization paths and business rules to maximize the value of DERs including customer bill benefits, local capacity requirements, distribution reliability services, and access to wholesale energy market.
- Establish a framework for exchange of services of DER assets with multiple market participants: the DSO; the CAISO; and DER Providers
  - Enable additional services not currently available, leading to additional potential revenue streams for DER assets
  - Enable new mechanisms for the utility to plan and manage its assets
  - Enable additional market participants to possibly lead to lower energy costs for all customers
- Provide demonstration test area for determining how multiple objectives may be optimized and how all parties can verify performance and ensure that a resource is fully utilized without double-counting or under-counting services provided by the resource

Use Case

❖ Key Resources
  - Resources on Titanium circuit
  - Other Camden and Johanna Jr. PRP resources
  - Additional resources proactively interconnected through targeted adoption

❖ Key Services
  - Requirements to manage increased penetration of DERs
  - Operational capabilities to coordinate third party and utility owned resources
  - Test bed for emerging technologies (e.g. telecommunications and control)

- Key Technology
  - Device level monitoring and operations visualization
  - Smart Inverters and voltage control
  - Energy management and control
  - Energy services and incentive mechanisms
- Timeframe
  - 2018-2019



Project Architecture

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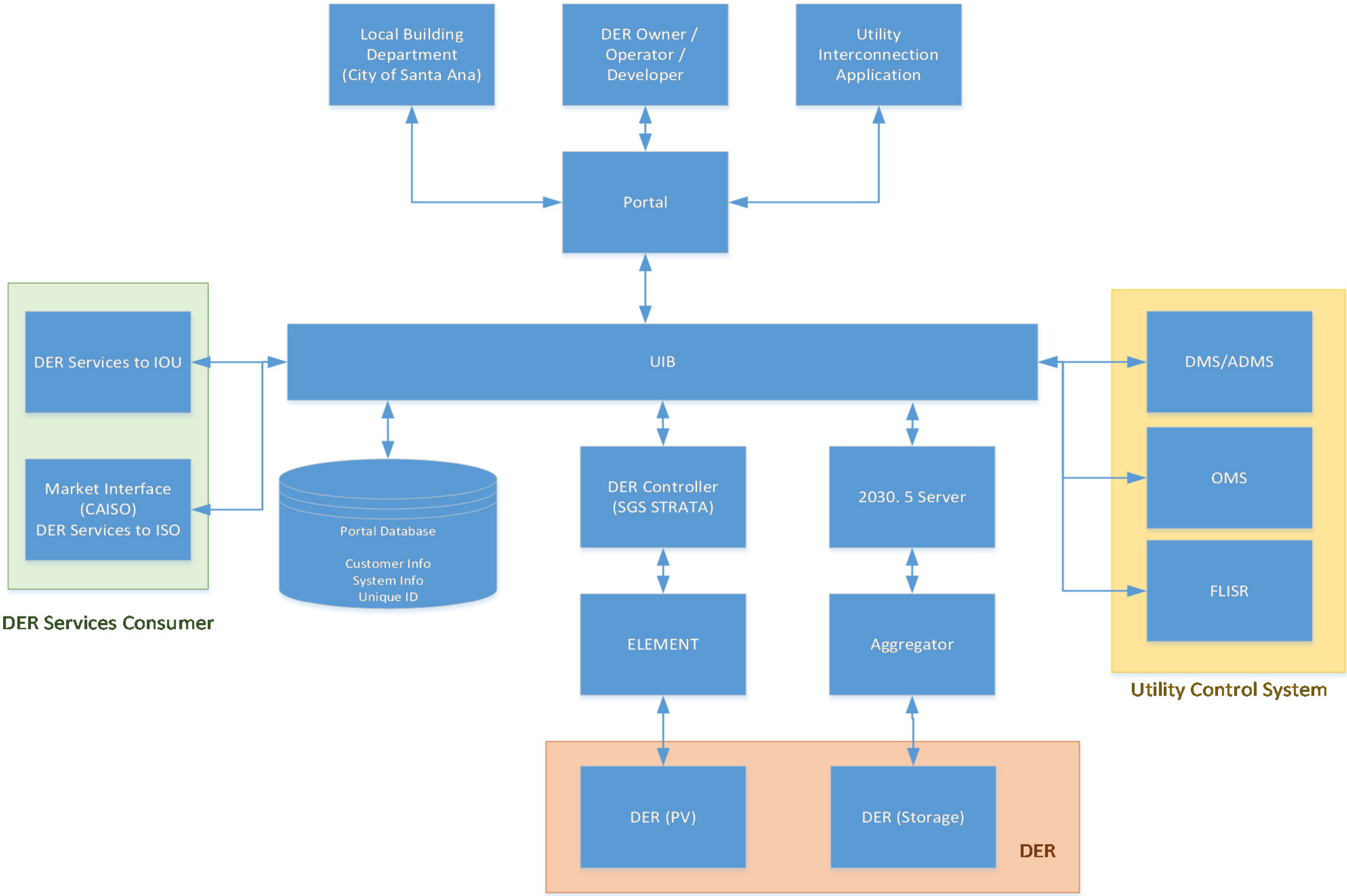

Test Setup for Controls Testing - Cost Share Contribution

To the test devices/apps via DNP, Modbus, ICCP, etc

Triangle Microworks SCADA Data Gateway

- Supports DNP, Modbus, 61850-SV, ICCP, and OPC
- Supports up to 250 sessions
- One second sampling and processing cycle
- Ongoing discussions on adding 2030.5 support

Open Platform Communication

Power Factory Real Time Simulation

- Distribution substation including all breakers and switches
- Distribution circuit including all lines, loads, DER, and capacitors
- Simulates the dynamic behavior of inverters and cap bank controllers

Application – Distribution Management System (DMS)

In Folder	Input Current, Mag... kA	Input Current, Mag... kA	Input Current, Mag... kA	Total Reactive Pow... Mvar
Feeders	0.2661954	0.2461079	0.2465634	0.730645

Power Factory measures the total feeder current and reactive power

P0	value=266.195 quality=0000
P1	value=246.108 quality=0000
P2	value=246.563 quality=0000
P3	value=0.730645 quality=000(

Triangle Microworks creates a DNP Server that functions like the substation HMI

IA	266.20 AMPS
IB	246.11 AMPS
IC	246.56 AMPS
IN	8.00 AMPS
MVAR	0.73 MVAR

The DMS reads the SCADA points

	kV	Angle	A	kW	kVAR	kVA
Phase A	6.927	89.944	266.195	1818.472	305.438	1843.945
Phase B	6.927	-30.052	246.108	1681.272	282.393	1704.823
Phase C	6.927	-150.052	246.563	1684.382	282.912	1707.976
Line To Line AB	11.998	Max/Total	266.195	5184.126	870.743	5256.745
Line To Line BC	11.998	Current N	19.863			
Line To Line CA	11.998					

The end result is the power flow in DMS driven by the power factory simulation

Risks & Mitigation

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Risk Title	Description	Likelihood (L, M, H)	Impact (L, M, H)	Potential Impacts	Strategy	Planned Preventive and Mitigation Actions
Stakeholder and Industry Buy In	The local jurisdiction is not willing to participate in the interconnection streamlining automation and the DER developers do not accept and use the system as intended	M	L	Impact to Tasks 2 and 4	Prevent/Mitigate	1. Communicate with the local jurisdiction 2. Seek feedback from DER developers about the desired process 3. Develop implementation plans that contribute values to both the project and the local jurisdiction 4. Develop a contigency plan using Simulation to prove the technology/process
Resource Participation	Lack of DER resources (including both new and existing resources) participation in the project within the demonstration area and during the demonstration period	M	M	Impact to Tasks 2, 7, 8 and 9	Prevent	1. Design proper incentives 2. Communicate with the local community 3. Communicate with DER developers
SEP 2.0 (IEEE 2030.5) Development	Vendor developing SEP 2.0 server cannot deliver functionality timely to project	M	H	Impact to all tasks utilizing SEP 2.0 (2030.5) communication protocol	Prevent/Mitigate	1. Plan project schedule to allow time for development issues 2. Utilize alternative protocols that are listed in SOPO to demonstrate the capability
Utility Integration Bus (UIB) Stability Issues	UIB Software is not stable	M	H	Impact to all tasks related to network communications	Prevent/Mitigate	1. Minimize footprint of UIB to reduce scope and complexity of UIB 2. Ensure service agreement with UIB vendor in place for trouble-shooting / support 3. Change vendor
Functionality of Integration and Complexity of Back Office Communication	System integration efforts of multiple vendors using new and legacy systems on EASE do not realize expected interoperability objectives	M	H	Impacts to Task 3 and all tasks in Budget Periods 2 and 3	Mitigate	1. See Interoperability Plan
Advanced Distribution Management System (ADMS) Availability	ADMS selection / procurement process is delayed. Or ADMS implementation / configuration is not ready for the project in time	M	L	Impact to Tasks 8 and 9	Mitigate	1. Utilize DMS instead

Questions

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