Resiliency Planning and Evaluation: 4-Pillar Methodology Use Cases

San Diego Gas and Electric (SDG&E) and Sonoma County Junior College District

Grid Resiliency and Microgrids Team, Energy Division

October 19, 2023, 9:00am – 12:30 pm

California Public Utilities Commission

WebEx and Call-In Information

Join by Computer:

- https://cpuc.webex.com/cpuc/j.php?MTID=m4a02ded97011cc1bc8f28494dcbfd395

Join by Phone:

1-855-282-6330 (U.S. Toll Free)

1-415-655-0002 (U.S. Toll)

Access Code: 2481 199 6474

(Staff recommends using your computer's audio if possible.)

Notes:

- Today's presentations are available in the meeting invite (follow link above) and will be available shortly after the meeting on https://www.cpuc.ca.gov/resiliencyandmicrogrids.
- The presentation portion of this meeting will be recorded and posted on https://www.cpuc.ca.gov/resiliencyandmicrogrids.
- While one or more Commissioners and/or their staff may be present, no decisions will be made at this meeting.

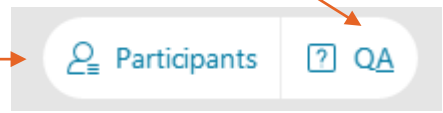
WebEx Logistics

- All attendees are muted on entry by default.
- Questions can be asked verbally during Q&A segments using the "raise hand" function.
  - The host will unmute you during Q&A portions [and you will have a maximum of 2 minutes to ask your question].
  - Please lower your hand after you've asked your question by clicking on the "raise hand" again.
  - If you have another question, please "re-raise your hand" by clicking on the "raise hand" button twice.
- Questions can also be written in the Q&A box and will be answered verbally during Q&A segments.
- Closed Captioning can be turned on by clicking the "cc" button the lower left of your screen.

WebEx Tip

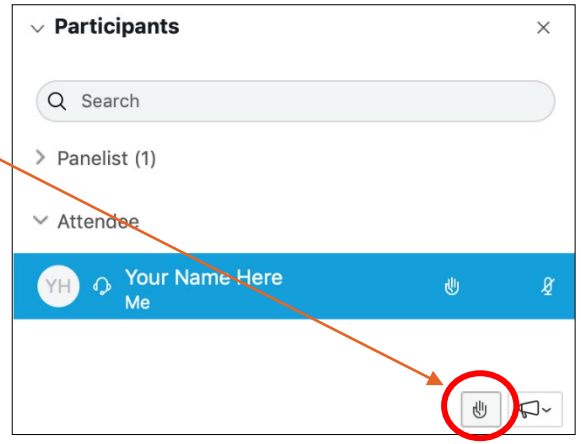
Access the written Q&A panel here

1. Click here to access the attendee list to raise and lower your hand.



2. Raise your hand by clicking the hand icon.

3. Lower it by clicking again.



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Energy Division Workshop Series on Resiliency

- ✓ **May 10, 2022** - Interruption Cost Estimate (ICE) Calculator/Power Outage Economic Tool (POET)
- ✓ **July 7, 2022** – Sandia National Labs – Resiliency Node Cluster Analysis Tool (ReNCAT) and the Social Burden Index
- ✓ **May 10, 2023** – Lumen Energy Strategy (CEC EPIC funded) – 1st of 3 workshops – Resiliency Standards: Definitions
- ✓ **July 26, 2023** – SCE/Sandia (DOE funded) Kickoff ReNCAT/Social Burden Index Pilot Project (Phase 1)
- ✓ **August 22, 2023** – LBNL (DOE funded) – Final Reporting on Data Schema Pilot project
- ✓ **September 5, 2023** – Lumen Energy Strategy – 2nd of 3 workshops – Resiliency Metrics
- ❑ **October 19, 2023** – SDG&E and Sonoma County Junior College District - Use Case Demonstration of 4-Pillar Methodology ← **today's event**
- ❑ **November 8, 2023** – Lumen Energy Strategy (CEC EPIC funded) – 3rd of 3 workshops – Resiliency Standards: Methodologies
- ❑ **November 28, 2023** – Final Report: SCE/Sandia (DOE funded) ReNCAT Pilot Project (Phase 1)

Agenda

I.	**Introduction** *(CPUC Staff)*	**9:00a – 9:05a**
	• WebEx logistics, agenda review	
II.	**Opening Remarks, Commissioner Shiroma**	**9:05a – 9:10a**
	• **Background and Context** *(CPUC Staff)*	**9:10a – 9:15a**
III.	**Use Case 1: Borrego Springs Microgrid** *(SDG&E)*	**9:15a – 10:15a**
	• **Q & A**	**10:15a – 10:45a**
	<Break>	**10:45a – 10:50a**
IV.	**Use Case 2: Santa Rosa Junior College Campus Microgrid** *(Sonoma County Junior College District)*	**10:50a – 11:50a**
	• **Q & A**	**11:50a – 12:20p**
V.	**Closing Remarks, Commissioner Shiroma**	**12:20p – 12:25p**
	• Provide information on upcoming workshops *(CPUC Staff)*	**12:25p – 12:30p**

Opening Remarks

Background and Context

4-Pillar Methodology – Guiding Principles in Resiliency Valuation

I. **Baseline Assessment**
- What/Whom do we want to protect and where is it/are they?
- What threatens it/them?
- How well are we doing now to protect it/them?

II. **Mitigation Measure Assessment**
- What protection options do we have?
- What does the best job at protecting the most?
- What does it cost?

III. **Resiliency Scorecard** – scoring resiliency configuration characteristics including those that support State policy goals

IV. **Resiliency Response Assessment (post-disruption or modeling)** –
- How well did the investments do in reaching resiliency targets?
- Did the investments reduce impacts on the community?

4-Pillar Methodology of Equitable Resiliency Evaluation and Planning

I. Baseline Assessment:

1) Define Geographical area of study
2) Define Load Tiers or Consequence Categories (Critical, Priority, Discretionary)
3) Identify Resiliency Targets within Load Tiers (e.g. 100% Critical, 30% Priority, 0% Discretionary)
4) Define Hazards to consider (All-Hazard assessment, analysis, ranking, weighting)
5) Conduct assessment of current Resiliency when disrupted from Hazard 1, Hazard 2, Hazard 3 (according to Hazard assessment)
6) Results of Resilience Assessment – Identify Resiliency deficits and priorities and Resiliency Metric Reporting of Baseline levels

II. Mitigation Measure Assessment

1) Identify potential mitigation measure options
2) Assess ability of each mitigation option to reach Resiliency Targets for Hazard 1, Hazard 2, Hazard 3
3) Compare costs of each mitigation option to reach Resiliency Targets for Hazard 1, Hazard 2, Hazard 3

4-Pillar Methodology of Equitable Resiliency Evaluation and Planning

III. Resiliency "Scorecard"

1) Resiliency Scorecard is a suggested tool that provides a basic benchmark of achievement but recognizes that more can be done.
2) Scoring reflects resiliency configuration characteristics.
3) Scoring system provides for different areas of improvement (e.g. 100% resilience targets are met, but configuration uses 70% fossil fuel resources to meet those targets, improvement would be to decrease fossil fuel resources while maintaining targets. Would result in a higher "score."

IV. Resiliency Response Assessment (computer modeling or post-disruption approach):

1) Conduct Baseline Assessment (1-6).
2) After implementation of chosen mitigation measure option, conduct annual data collection of Resiliency Metrics,
3) Assess achievement of Resiliency Targets and any changes in Community Impacts

SDG&E's Borrego Springs Microgrid: CPUC's Value of Resiliency - 4 Pillar Methodology

October 19, 2023

Borrego Springs Microgrid

Creating a state of the art, multi-circuit, multi-resource microgrid in a remote desert community

Extreme Climate

High temps (90s-110s ºF), thunderstorms, flooding, high wind region

Rural and Remote

Distant, isolated load pocket surrounded by state park

Low Inertia

Town of Borrego Springs is at the end of a single, long radial transmission line

High PV Penetration

Over 40 MW of PV generation

- *26 MW transmission connected*
- *6.5 MW distribution connected*
- *8.6 MW NEM generation*

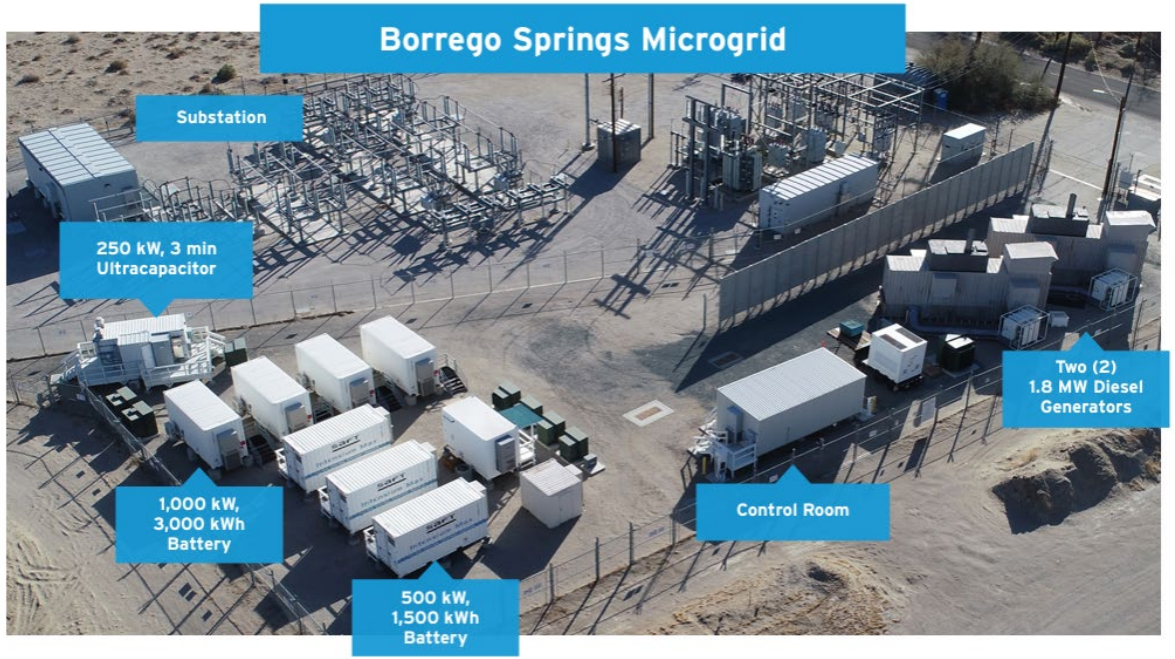
Customer Mix

Critical loads (healthcare, schools, emergency services), business and residential loads, agricultural loads contributing to peak demands of 8 – 12 MW.

Borrego Springs Microgrid

Increasing reliability & resiliency by providing back-up power to critical facilities & customers within the remote community of Borrego Springs.

- In 2013, the Borrego Springs Microgrid was the first utility-owned, community-scale microgrid in America to demonstrate the full capabilities of renewable generation and new technologies to enhance energy reliability.
- **Borrego Today**:
  - Two 1.8 MW Diesel Generators (Borrego 1.0)
  - 0.5 MW/1.5 MWh BESS (Borrego 1.0)
  - 1 MW/3 MWh Battery Energy Storage System (BESS) (Borrego 2.0)
  - 3 MW Load Bank (Borrego 2.0)
  - 0.3 MW Ultracapacitor (Borrego 3.0)
  - PXiSE microgrid controller for batteries, ultracapacitor and generators, as well as microgrid frequency and voltage monitoring (Borrego 3.0)
- **Future Borrego (Borrego 3.0)**:
  - 7.3 MW/14.6 MWh BESS
  - 0.25 MW/4 MWh Hydrogen Energy Storage System (HESS)
  - PXiSE microgrid controller for BESS & HESS, as well as microgrid frequency and voltage monitoring



Value of Resiliency – 4 Pillar Methodology

I. Pillar 1 – Baseline Assessment
II. Pillar 2 – Mitigation Measure Assessment
III. Pillar 3 – Resiliency Scorecard
IV. Pillar 4 – Resiliency Response Assessment

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Pillar 1 – Baseline Assessment

1. **Define geographical area of study**
   A. Circuit 2 – Approximately 1,200 customers (resiliency not provided for circuits 1 and 3)
   B. Circuit 1, 2 and 3 – Approximately 2,800 customers
   C. Average household income in Borrego Springs is $69,850 with a poverty rate of 6.92% and the average age is 62.7[1]
2. **Define load tiers or consequence categories (critical, priority, discretionary), as defined by IOU**
   A. Circuit 2 (priority load)
      i. Critical (50% of Fall peak load): customers on life support, library (cool zone), fire station, local water utility (control center & equipment), telecommunications
      ii. Priority (15% of Fall peak load): schools, grocery stores, gas stations, public EV chargers
      iii. Discretionary (35% of Fall peak load): retail stores, restaurants, hotels, residential
   B. Circuit 1
      i. Critical (30% of Fall peak load): customers on life support, sheriff station, local water utility (equipment), telecommunications
      ii. Priority (0% of Fall peak load): none
      iii. Discretionary (70% of Fall peak load): agricultural, country club golf course, residential
   C. Circuit 3
      i. Critical (40% of Fall peak load): customers on life support, county airport (including medical evacuation), health clinic (including medical evacuation), local water utility (equipment), telecommunications
      ii. Priority (1% of Fall peak load): schools
      iii. Discretionary (59% of Fall peak load): golf course; hotels, private airport; residential

[1] https://worldpopulationreview.com/us-cities/borrego-springs-ca-population

Pillar 1 – Baseline Assessment (cont.)

3. Identify resiliency targets within load tiers

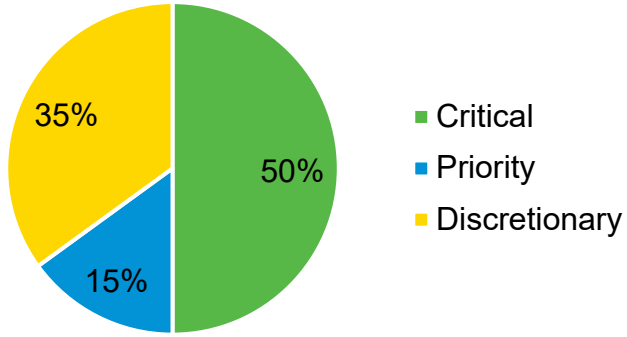
Circuit 2

1. Indefinite coverage designed for the Fall season's load conditions
2. Longest historical outage is 20 hours (2013)
3. 47 Critical meters, 15 Priority meters, 1126 Discretionary meters
   - i. 2 critical facilities: fire station, library (cool zone)
   - ii. 1 emergency service: fire station
   - iii. 2 critical infrastructure: local water utility (control center & equipment), telecommunications
   - iv. 0 community resource centers
   - v. 0 essential services
   - vi. 8 priority facilities: (x2) schools, (x2) grocery stores, (x2) gas stations, (x2) electric vehicle charging stations

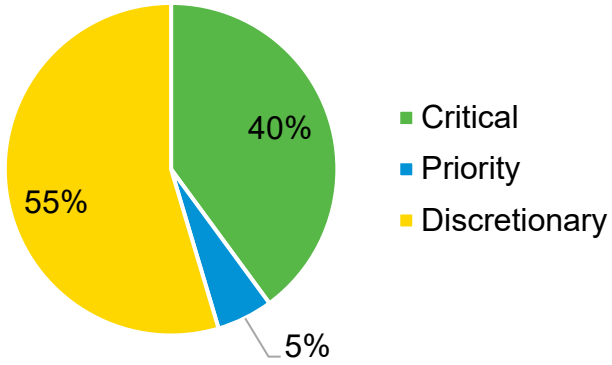
Circuits 1, 2, and 3

1. A standard of 12-hours of continuous duration designed for the Fall season's load conditions
2. Longest historical outage is 12 hours (2023)
3. 108 Critical meters, 16 Priority meters, 2664 Discretionary meters
   - i. 3 critical facilities: fire station, library, sheriff station
   - ii. 2 emergency services: fire station, sheriff station
   - iii. 2 critical infrastructure: local water utility, telecommunications
   - iv. 0 community resource centers
   - v. 3 essential services: medical clinic, (x2) medical evacuation helipads
   - vi. 8 Priority facilities: (x2) schools, (x2) grocery stores, (x2) gas stations, (x2) electric vehicle charging stations

Circuit 2 - Fall Peak Load



All Circuits – Fall Peak Load

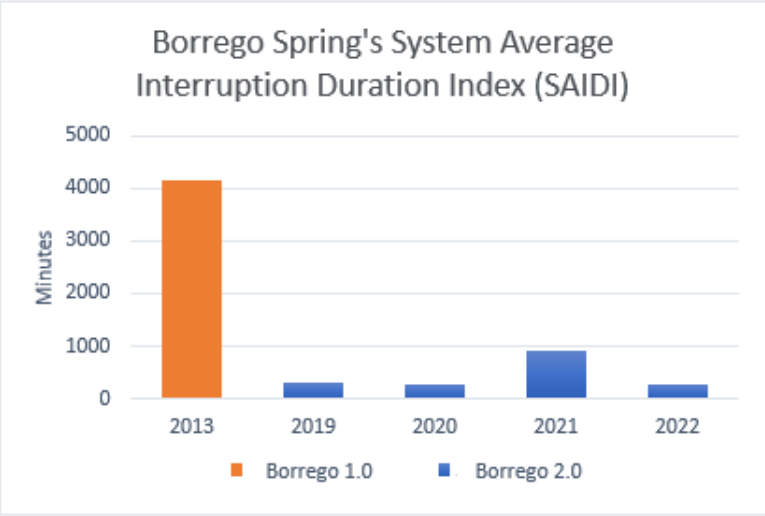


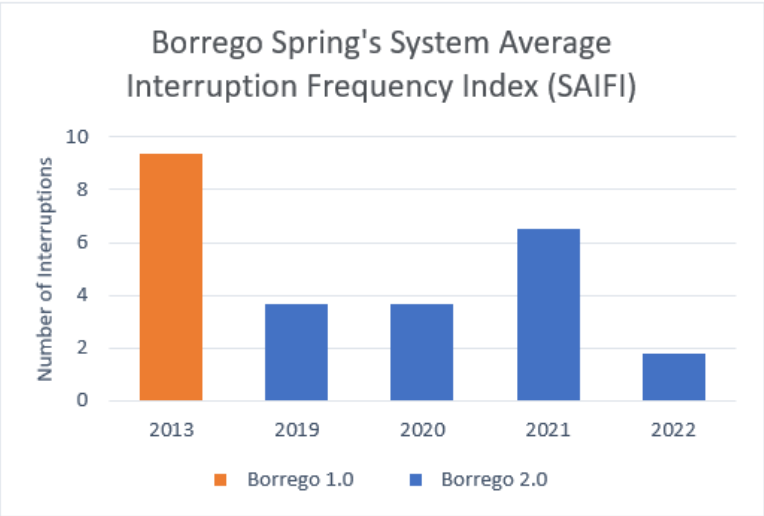
Pillar 1 – Baseline Assessment (cont.)

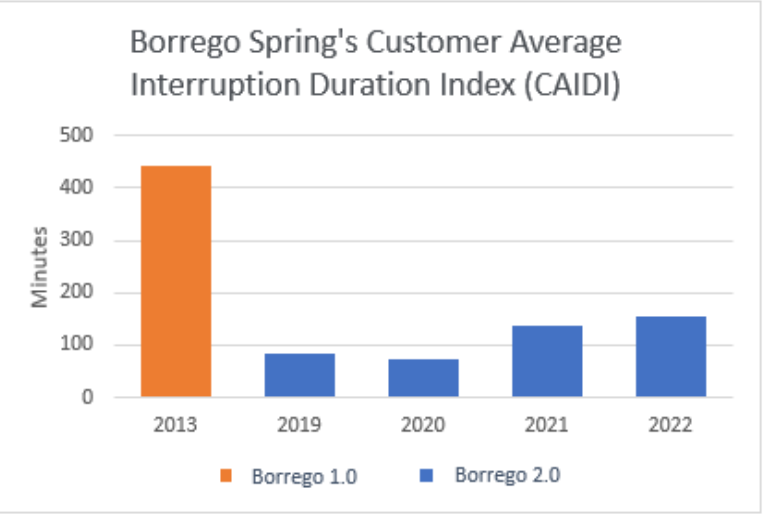
4. Define hazards to consider

Hazard/Other	Probability	Caused Outages	Historic Majority
High Wind	Highly likely	Yes, unplanned	No
Lightning	Highly likely	Yes, unplanned	Yes
Heavy Rainstorm/Flood Damage	Likely	Yes, unplanned	No
Single Source Transmission Line/Equipment Risk	Yes	Yes, planned	Yes

5. Conduct current resiliency assessment: Borrego Springs's SAIDI/SAIFI/CAIDI comparing Borrego 1.0 (2013) versus Borrego 2.0 (2019 - 2022)







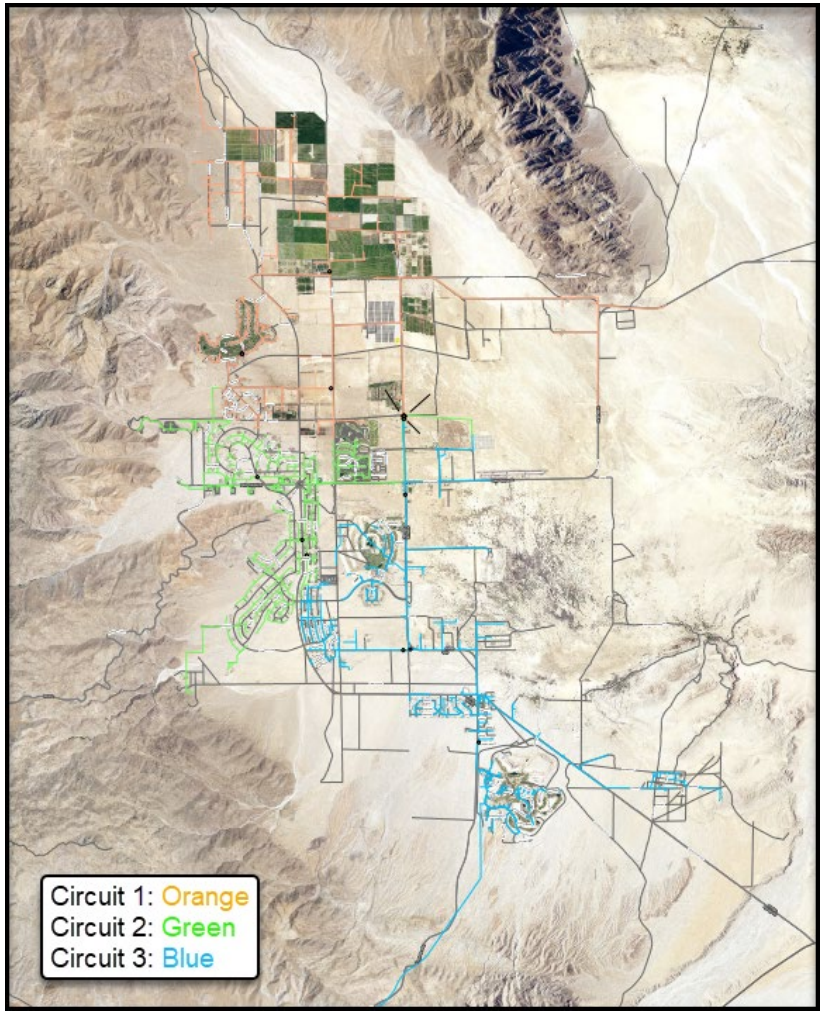
Pillar 1 – Baseline Assessment (cont.)

6. **Results of resilience assessment**
   - A. **Resilience deficits:**
     1. Inability to provide service under N-1 transmission contingencies
     2. Harsh Weather - extreme temperatures, thunderstorms, desert monsoon season, flash floods, etc. Above ground poles exposed to these risks and high compliance maintenance activity
   - B. **Resilience priorities:**
     1. Decreasing customer impact from outages (both in frequency and duration)
     2. Running the Microgrid:
        a. All 3 circuits in Borrego Springs (i.e., all customers)
        b. If needed, prioritizing circuit 2 only
        c. Effectively balancing load and generation
   - C. **Resiliency metrics to assess mitigation impacts**
     1. Compare SAIDI/SAIFI/CAIDI from Borrego 1.0 to later versions of the Borrego Springs Microgrid
     2. Community engagement and satisfaction
        a. Socioeconomic of the aging and vulnerable community
        b. Access to basic needs, like food (i.e., approx. 1h drive to any “full service” town)

Pillar 2 – Mitigation Measure Assessment

1. **Identify mitigation measure options**

Mitigation Measure Characteristics	Metric
Start-up or islanding crossover transition time	Planned Outage: <1 minute Unplanned Outage: up to 4.5 hours
Notification time/Advanced notice needed for backup available at specified load/duration	Planned Outage: 10-14 days for switch plan Unplanned Outage: up to 4.5 hours
Duration of backup – with no other inputs	Indefinite hours (circuit 2) 12 hours (circuit 1, 2, and 3)
Load Capacity (Critical, Priority, Discretionary)	Total Peak Load (*Assumption: October) Circuit 2: 2.8 MW Circuits 1-3: 8.2 MW
Fuel Type/Fuel Availability	Diesel (1,200 gallons per unit), Battery Energy Storage/closed loop, Hydrogen electrolyzer & fuel cells/closed loop
Emissions level	50 PPM NOx limit per diesel generator
Geographic boundary	1,188 meters on circuit 2 2,798 meters on circuit 1, 2, and 3



Pillar 2 – Mitigation Measure Assessment (cont.)

2. **Compare costs of mitigation measures options that achieve highest level of resilience**

Measure	Mitigates Hazard	Ranking	Cost	Resiliency Trapezoid
A: Borrego Microgrid (1.0, 2.0 and 3.0)	Electric service variability due to extreme weather conditions	1	SDG&E CapEx: ~$40M DOE: $8.9M CEC: $7.5 M SDG&E O&M: ~$400K/yr	Preparation, Magnitude, Adaptation, Recovery
B: 2nd Transmission Line from Imperial Irrigation District (IID)	Electric service variability due to extreme weather conditions	2	CapEx: ~$460M O&M: ~$25.3K/yr	Preparation, Magnitude, Adaptation, Recovery

Pillar 3 & 4 – Resiliency Scorecard

Resiliency Scorecard: Mitigation Measure Characteristics (SDG&E's scores are based on Fall load)	Points Possible	Score - Borrego 1.0 (Circuit 2 only - 2.80 MW)	Score - Borrego 2.0 (All Circuits – 8.24 MW)	Score - Borrego 3.0 (All Circuits - 8.24 MW)	Score - Borrego 3.0 Priority Circuit (Circuit 2 only - 2.80 MW)
Duration of Backup					
4 hrs	**1**	-	-	-	-
8 hrs	**2**	-	2	2	-
24 hrs	**3**	-	-	-	-
48 hrs (2 days)	**4**	-	-	-	-
96 hrs (4 days)	**5**	-	-	-	-
Indefinite	**6**	6	-	-	6
Load Capacity - Critical - MW of critical load		**1.40 MW**	**3.29 MW**	**3.29 MW**	**1.40 MW**
90 - 100%	**9**	-	9	9	-
50 - 90%	**8**	-	-	-	-
0 – 50%	**7**	7	-	-	7
Load Capacity – MW of Priority Load		**0.42 MW**	**0.45 MW**	**0.45 MW**	**0.42 MW**
90 - 100%	**6**	6	6	6	6
50 - 90%	**5**	-	-	-	-
0 – 50%	**4**	-	-	-	-
Load Capacity – MW of Discretionary Load		**0.98 MW**	**4.50 MW**	**4.50 MW**	**0.98 MW**
90 - 100%	**3**	-	3	3	-
50 - 90%	**2**	-	-	-	-
0 – 50%	**1**	1	-	-	1
Total Score	**24**	**20**	**20**	**20**	**20**

Pillar 3 & 4 – Resiliency Scorecard (cont.)

Resiliency Scorecard: Mitigation Measure Characteristics (SDG&E's scores are based on Fall load)	Points Possible	Score - Borrego 1.0 (Circuit 2 only)	Score - Borrego 2.0 (All Circuit)	Score - Borrego 3.0 (All Circuits)	Score - Borrego 3.0 Priority Circuit (Circuit 2 only)
Fuel Availability					
Onsite, intermittent	**3**	3	3	3	3
Onsite, produced	**3**	3	3	3	3
Piped infrastructure	**2**	-	-	-	-
Wired infrastructure	**2**	2	2	2	2
Transport	**1**	1	1	1	1
Emissions level – GHG and particulates					
Non-GHG emitting	**4**	-	-	4	4
Partial Non-GHG emitting	**3**	3	3	3	3
Meets CARB emission standards	**2**	2	2	2	2
Cap n Trade	**1**	-	-	-	-
Total Score	**21**	**14**	**14**	**18**	**18**

Pillar 3 & 4 – Resiliency Scorecard (cont.)

Resiliency Scorecard: Mitigation Measure Characteristics (SDG&E's scores are based on Fall load)	Points Possible	Score - Borrego 1.0 (Circuit 2 only)	Score - Borrego 2.0 (All Circuits)	Score - Borrego 3.0 (All Circuits)	Score - Borrego 3.0 Priority Circuit (Circuit 2 only)
Start-up / Islanding / Crossover Transition Time					
0 - 1 min	**5**	-	5	5	5
2 – 5 min	**4**	-	-	-	-
5 – 30 min	**3**	-	-	-	-
30 – 120 min	**2**	-	-	-	-
< 120 min	**1**	1	-	-	-
Notification Time / Advanced Notice for backup					
0 - 1 min	**5**	-	-	-	-
2 – 5 min	**4**	-	-	-	-
5 – 30 min	**3**	-	-	-	-
30 – 120 min	**2**	-	-	-	-
< 120 min	**1**	1	1	1	1
Blue Sky Services					
Demand Response	**2**	-	-	-	-
Voltage / Frequency	**1**	1	1	1	1
Wholesale Participation	**2**	-	-	2	2
Total Score	**15**	**3**	**7**	**9**	**9**
Grand Total Score	**60**	**37**	**41**	**47**	**44**

Pillar 4 – Resiliency Response Assessment

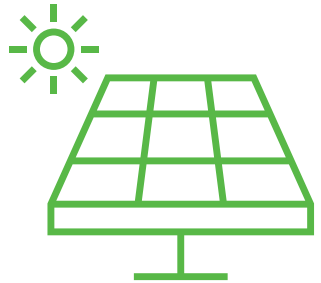
3. Assess achievement of Resiliency Targets

	Borrego 1.0	Borrego 2.0	Borrego 3.0
Geographical Area	1,188 meters	2,788 meters	2,788 meters
Microgrid Resources	Two 1.8 MW Diesel Generators 0.5 MW/1.5 MWh BESS	Two 1.8 MW Diesel Generators 0.5 MW/1.5 MWh BESS 1 MW/3 MWh BESS 3 MW Load Bank	Two 1.8 MW Diesel Generators 0.5 MW/1.5 MWh BESS 1 MW/3 MWh BESS 7.3 MW/14.6 MWh BESS 0.25 MW/4 MWh HESS 3 MW Load Bank 0.3 MW Ultracapacitor
Microgrid Operation	Manual	Generator and Diesel controller with manual inputs	Microgrid controller with remote capabilities
Microgrid Goal	Demonstrate peak shaving, islanding support with batteries. Integrate a basic outage and distribution management system	Enhance emergency readiness, increase grid resiliency, decrease outage response times, increase load capacity, increase operational flexibility	Add distribution circuit to allow increased storage, blackstart and operate the microgrid without fossil fuel (inverter battery as island master).
Load Capacity	2.8 MW (50% Critical Load/15% Priority Load/35% Discretionary Load)	8.2 MW (40% Critical Load/5% Priority Load/55% Discretionary Load)	8.2 MW (40% Critical Load/5% Priority Load/55% Discretionary Load)
Microgrid Islanding Duration	Indefinite	12 hours	12 hours
Capital Costs	$19.4M (SDG&E= $10.5M; DOE = $6.1M; CEC = $2.8M)	$10.5M (SDG&E = $5.8 Million; CEC = $4.7M)	$26.4M (SDG&E = ~$23.6 Million; DOE = $2.8M)

Pillar 4 - Lessons Learned

Lessons Learned for SDG&E's Borrego Springs Microgrid

1. **Nascent Technology:**
   - No off the shelf solution - each microgrid requires customization.
   - Interoperable communication capabilities between microgrid components.
2. **Dynamic system modeling:**
   - Lab testing or modeling for microgrid and microgrid resources (e.g., battery, fuel cell, etc.) to analyze power quality data and likely points of failure and/or troubleshooting issues.
3. **Energy Storage specifications and standards:**
   - Technologies are still developing and evolving.
   - Building a microgrid in tandem with developing specifications and standards presents challenges.
   - Documenting for future use the lessons learned, and standards developed.
4. **Operational coordination:**
   - Local community engagement, including notices of planned outages on social media or the local newspaper.
   - Cross-functional activities with all operational teams to maintain compliance with all pertinent rules and regulations.
5. **Cyber and physical security challenges**



Pillar 4 - Areas to Explore

Areas to Explore for the 4 Pillar Methodology – SDG&E specific

1. SDG&E's scorecard needed to account for lowering GHG emissions with subsequent updates of the microgrid
2. SDG&E's scorecard could benefit from a 'personnel requirement' for islanding and maintaining islanding events
3. Impacts of duration capabilities from using renewable generation versus fossil fuel sources
4. SDG&E's comparative analysis to performance versus goals

Areas to Explore for the 4 Pillar Methodology

1. Customization for each use case; not all steps will be applicable to each mitigation solution
2. Detailed descriptions of each step and/or template to follow
3. Scorecard could benefit from further refinement, like SDG&E's recommendations above (e.g., lowering GHG emissions from microgrid updates and 'personnel requirement' for microgrid operation

SDGE™

Q&A

Break

4-Pillar Methodology Use Cases

How the 4-Pillars of Resiliency Planning were applied intentionally (and unintentionally) by the Sonoma County Junior College District

October 19, 2023

David Liebman
Sonoma County Junior College District

Demetra Tzamaras, P.E.
Christopher Vogel
Center for Sustainable Energy

SANTA ROSA JUNIOR COLLEGE

Center for Sustainable Energy®

About CSE

Mission-driven national nonprofit

Center for Sustainable Energy® (CSE) is a national nonprofit that accelerates adoption of clean transportation and distributed energy through effective and equitable program design and administration.

- Administer cutting-edge programs valued at over $4 billion for governments, utilities and the private sector across the U.S.
- Leader in data-driven incentive program design and administration for:
    - Electric vehicle and EV charging incentive programs
    - Renewable energy incentive programs (solar and storage)
- Headquartered in San Diego with more than 250 employees across the nation

Objective and trusted

- Governments, utilities and the private sector trust CSE for its data-driven and software-enabled approach, deep domain expertise and customer-focused team.
- CSE's fee-for-service business model frees it from the influence of shareholders, members and donors, and ensures its independence.
- CSE's data and insights have informed policy at the local, state and federal level.

One mission —

DECARBONIZE.®

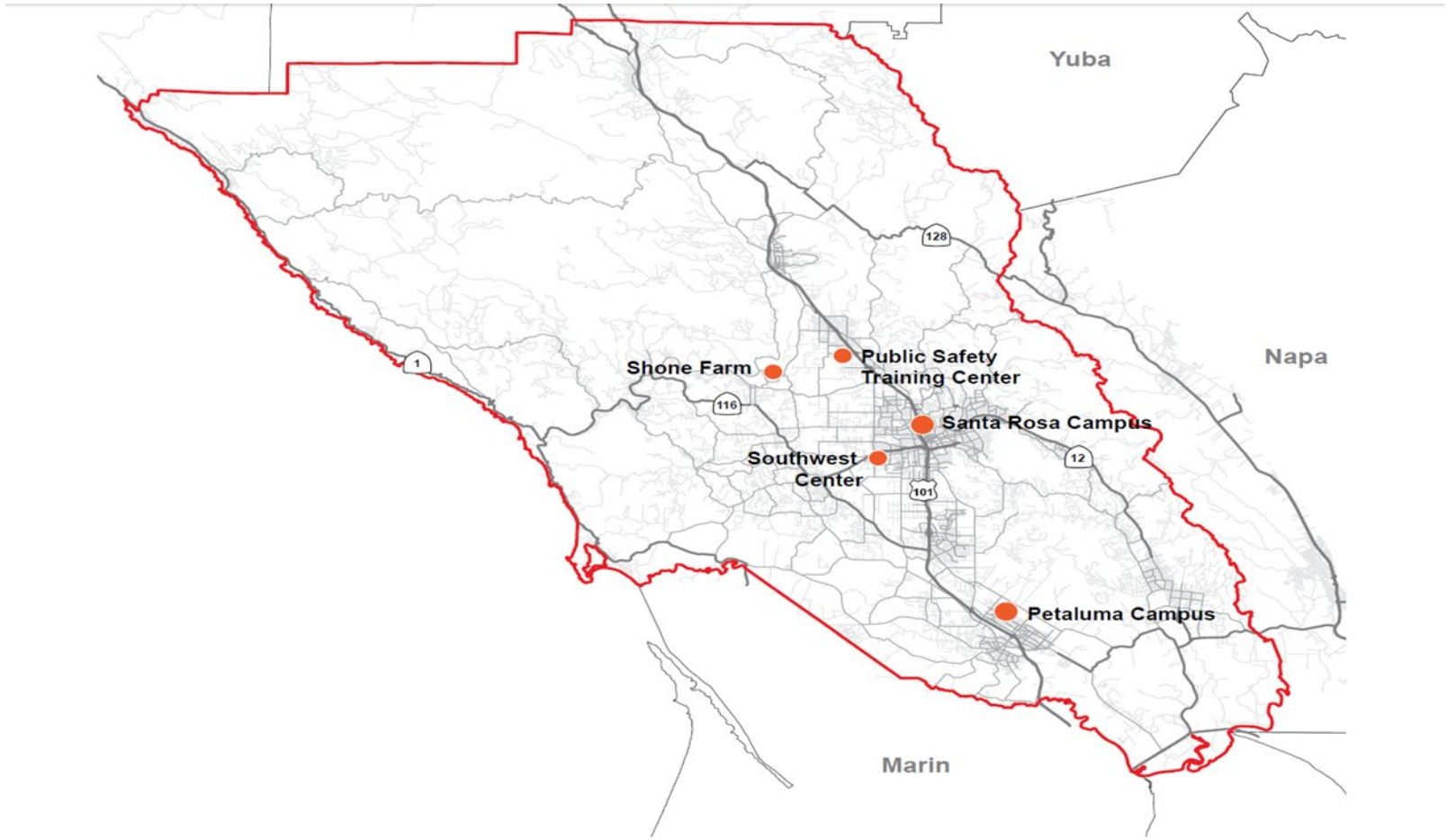
Our vision is a future with sustainable, equitable and resilient transportation, buildings and communities.

Center for Sustainable Energy®

About SRJC

California Community College located in Sonoma County. Founded in 1918.

Establishing a Culture of Sustainability



SANTA ROSA JUNIOR COLLEGE

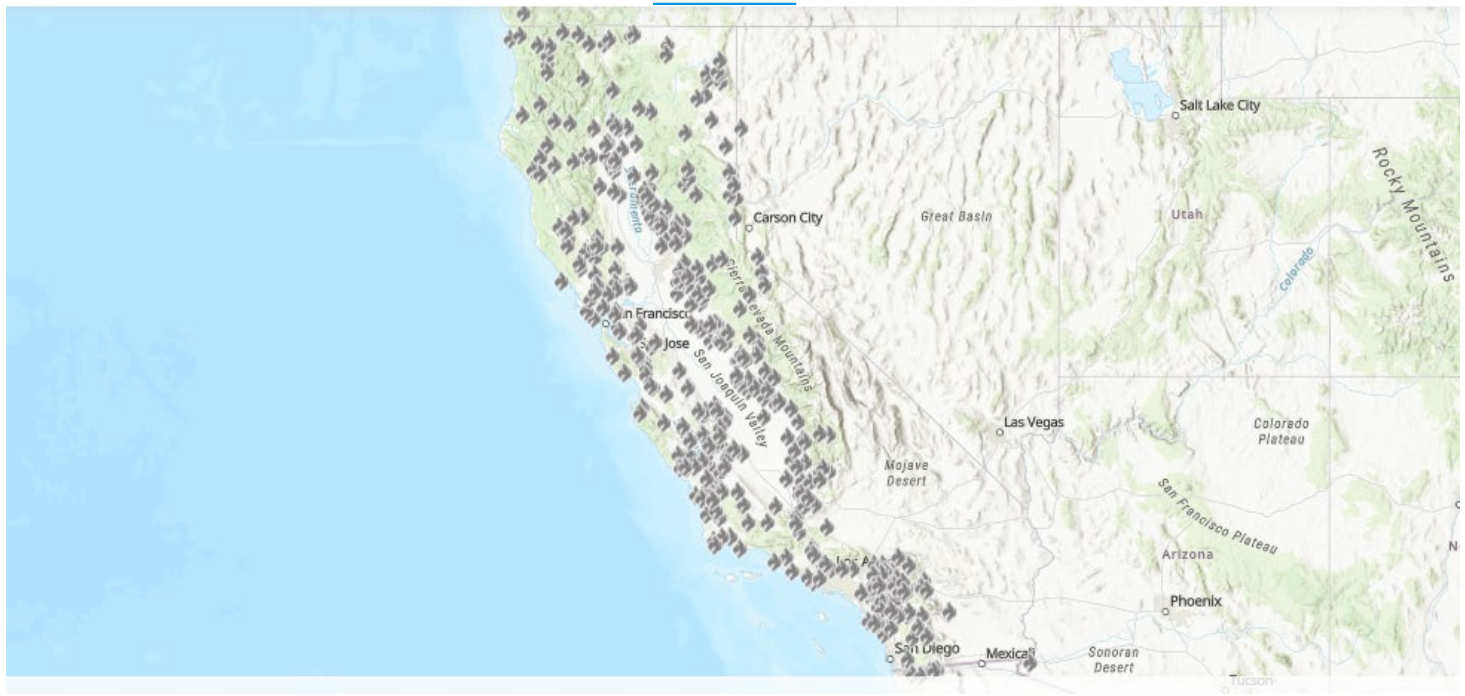
Agenda

1.	Introductions – Center for Sustainable Energy and Sonoma County Junior College District	5 min
2.	Santa Rosa Microgrid Project Context	10 min
3.	How the Microgrid Project Incorporated the 4-Pillars Methodology	15 min
4.	Reflection on How the Campus Already Uses the 4-Pillars Concepts • Determining load prioritizations • Tying resiliency values to campus goals (GHG emissions, small criteria pollutants, energy efficiency, etc.)	30 min
5.	How the 4 Pillars Methodology will be Applied in Future SJCD Projects	15 min
6.	Discussion and Questions	30 min

Goals of this Presentation

- Discuss the Santa Rosa Microgrid demonstration project
- Discuss how the Santa Rosa Microgrid project applied the 4 Pillars Methodology
- Discuss how 4 Pillars concepts were already incorporated into the microgrid project
- Discuss how resilience planning can tie into a site's broader environmental and economic goals
- Discuss how the 4 Pillars framework will be applied to future projects (on campus and beyond)
- Prompt discussion around resilience planning

Driving Motivations



2017 Incident Archive

A summary of all 2017 incidents, including those managed by CAL FIRE and other partner agencies.

1,548,429 Acres
Estimated Acres Burned

9,270 Incidents
Number of Wildfires

47 Fatalities
Confirmed Loss of Life

10,868 Structures
Structures Destroyed

Obtained from Cal Fire Website on 2/14/2023

Top 20 Most Destructive California Wildfires

	FIRE NAME *(CAUSE)*	DATE	COUNTY	ACRES	*STRUCTURES*	DEATHS
1	**CAMP** *(Powerlines)*	November 2018	Butte	153,336	**18,804**	85
2	**TUBBS** *(Electrical)*	October 2017	Napa & Sonoma	36,807	**5,636**	22
3	**TUNNEL - Oakland Hills** *(Rekindle)*	October 1991	Alameda	1,600	**2,900**	25
4	**CEDAR** *(Human Related)*	October 2003	San Diego	273,246	**2,820**	15
5	**NORTH COMPLEX** *(Lightning)*	August, 2020	Butte, Plumas, & Yuba	318,935	**2,352**	15
6	**VALLEY** *(Electrical)*	September 2015	Lake, Napa & Sonoma	76,067	**1,958**	4
7	**WITCH** *(Powerlines)*	October 2007	San Diego	197,990	**1,650**	2
8	**WOOLSEY** *(Electrical)*	November 2018	Ventura	96,949	**1,643**	3
9	**CARR** *(Human Related)*	July 2018	Shasta County, Trinity	229,651	**1,614**	8
10	**GLASS** *(Undetermined)*	September 2020	Napa & Sonoma	67,484	**1,520**	0
11	**LNU LIGHTNING COMPLEX** *(Lightning/Arson)*	August 2020	Napa, Solano, Sonoma, Yolo, Lake, & Colusa	363,220	**1,491**	6
12	**CZU LIGHTNING COMPLEX** *(Lightning)*	August 2020	Santa Cruz, San Mateo	86,509	**1,490**	1
13	**NUNS** *(Powerlines)*	October 2017	Sonoma	44,573	**1,355**	3
14	**DIXIE** *(Powerlines)*					
15	**THOMAS** *(Powerline)*	December 2017	Ventura & Santa Barbara	281,893	**1,063**	2
16	**CALDOR** *(Human Related)*	September 2021	Alpine, Amador, & El Dorado	221,835	**1,005**	1
17	**OLD** *(Human Related)*	October 2003	San Bernardino	91,281	**1,003**	6
18	**BUTTE** *(Powerlines)*	September 2015	Amador & Calaveras	70,868	**965**	2
19	**JONES** *(Undetermined)*	October 1999	Shasta	26,200	**954**	1
20	**AUGUST COMPLEX** *(Lightning)*	August 2020	Mendocino, Humboldt, Trinity, Tehama, Glenn, Lake, & Colusa	1,032,648	**935**	1

Obtained from Cal Fire Website on 9/6/2023

Top 20 Most Destructive California Wildfires

	FIRE NAME *(CAUSE)*	DATE	COUNTY	ACRES	*STRUCTURES*	DEATHS
1	**CAMP** *(Powerlines)*	November 2018	Butte	153,336	**18,804**	85
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Obtained from Cal Fire Website on 9/6/2023

Santa Rosa Junior College Microgrid

Environmental

Support 40% of campus electricity use with solar and offset the use of diesel back-up generators in an outage

Economic

Reduce peak demand charges and tap into value stream of demand response programs

Resiliency

Island through a planned or unplanned grid outage without disrupting campus activities and load shed as needed to support critical loads for longer duration outages

Energy Efficiency

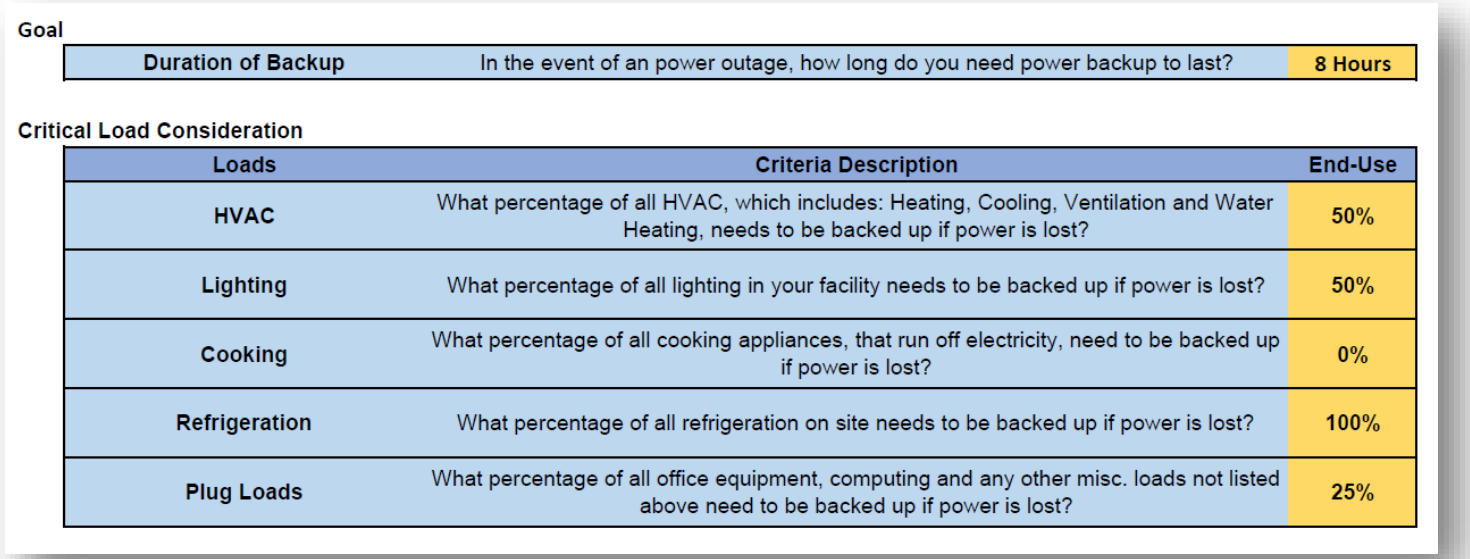
Collective energy efficiency projects such as LED lighting retrofits and electrification of space heating and cooling are expected to reduce campus load by 15%

Industry Impact and Value of Resiliency

- First of its kind project that can help inform future projects
- Coordinate with CPUC 4 Pillars of Resiliency concept
- Contribute public comments to microgrid proceedings

Site Equity Resiliency Analysis (SERA)

- Excel-based tool using REopt Lite for modeling and sizing of equipment
- Technical sizing inputs
  - ✓ Utility consumption & billing
  - ✓ Facility type
- Resiliency based inputs
  - ✓ Site vulnerability ranking
  - ✓ Critical loads
  - ✓ Load backup requirements
- Equity based inputs
  - ✓ Site location is used for several energy equity metrics



Goal

Duration of Backup	In the event of an power outage, how long do you need power backup to last?	**8 Hours**

Critical Load Consideration

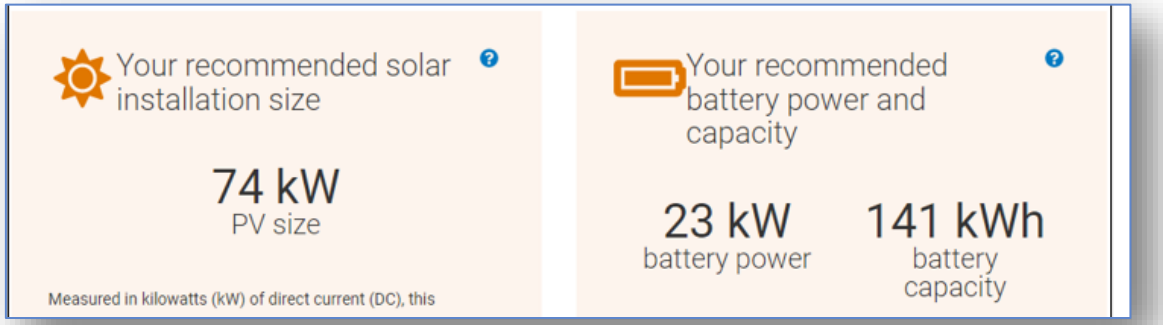
Loads	Criteria Description	End-Use
HVAC	What percentage of all HVAC, which includes: Heating, Cooling, Ventilation and Water Heating, needs to be backed up if power is lost?	**50%**
Lighting	What percentage of all lighting in your facility needs to be backed up if power is lost?	**50%**
Cooking	What percentage of all cooking appliances, that run off electricity, need to be backed up if power is lost?	**0%**
Refrigeration	What percentage of all refrigeration on site needs to be backed up if power is lost?	**100%**
Plug Loads	What percentage of all office equipment, computing and any other misc. loads not listed above need to be backed up if power is lost?	**25%**

REopt

Effective & Actionable Results

Technical & Financial Results

1. Generator and storage system size (kW / kWh)
2. Potential Life Cycle Savings 25 Years ($)
3. Payback Period (Years)
4. Emissions Metrics (Tons CO2)

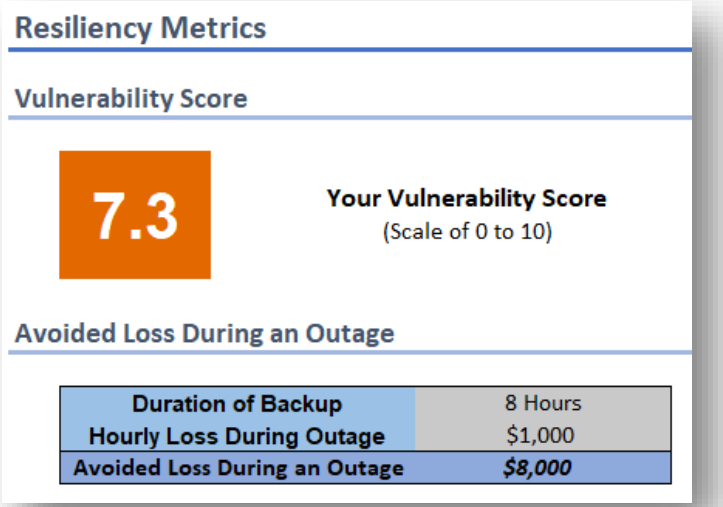


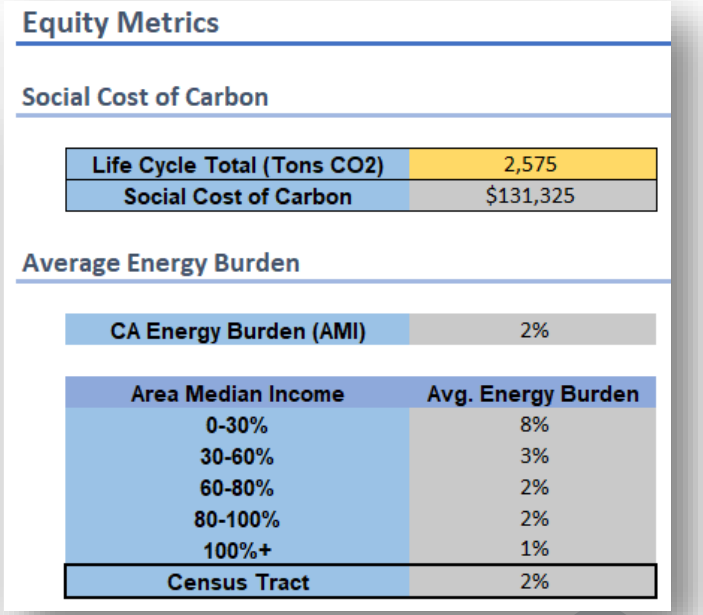
Resiliency Results

1. Vulnerability Score (Scale 0 to 10, 10 being most vulnerable)
2. Avoided Financial Loss During an Outage ($)
3. Potential Resiliency Duration (Hrs of Outage)

Equity Metrics

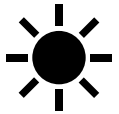
1. Social Cost of Carbon ($)
2. Average Energy Burden (%)
3. Disadvantaged Communities Designation
4. Low-Income Communities Designation





Hazards SRJC Is Facing






Wildfires, Smoke (Unhealthy Air), Flooding, Extreme Heat Days, Increase in Cooling Degree Days (a measure of how hot the temperature was on a given day or during a period of days.)

Resiliency/Adaptation Measures Implemented

-Utilize CalAdapt data in the creation of Facilities Master Plans as well as Educational Master Plans

-Conduct load prioritization planning to prioritize buildings, services or loads

-Analysis on electrical feeders accounting for future electrification, increase peak load demand from extreme heat days/increase in cooling degree days, energy efficiency

-Wildfire smoke building management system programming

-Accounting for fire/smoke days in the academic calendar

-Develop Building Standard specifications around adaptation and resiliency

-Mechanical Equipment is rated for new extreme heat days temp limits 113-120F

-New Building Specifications to include use of CalAdapt Datasets

-Geothermal Ground Source Heat Pump

-Microgrid Installation*

-New Bioswales and Drywells to enhance existing stormwater infrastructure

-100% Outside Air Units with Energy Recovery and Merv 13 filters

Microgrid as an Adaptation/Resiliency Measure

Microgrid is a resiliency & adaptation measure for energy systems that help maximize sustainability & energy efficiency goals.

The first step in this process is mapping out electrical infrastructure from meter to loads (building or entire campus)

Second step is load prioritization

Reminder once you have a finalized microgrid design you have to apply the baseline risk assessment to the intended design.

Load Prioritization at SRJC

Load Prioritization at SRJC began with the following;

-Identify existing emergency circuits and emergency power assets

-Department meetings discussing what are the impacts when the power goes out for outages periods (1hr, 2hr, 3hr, 5 days)

-As a public entity Operational Continuance is top priority

1)What needs to run for basic services to continue

2) What needs to run before classes can resume

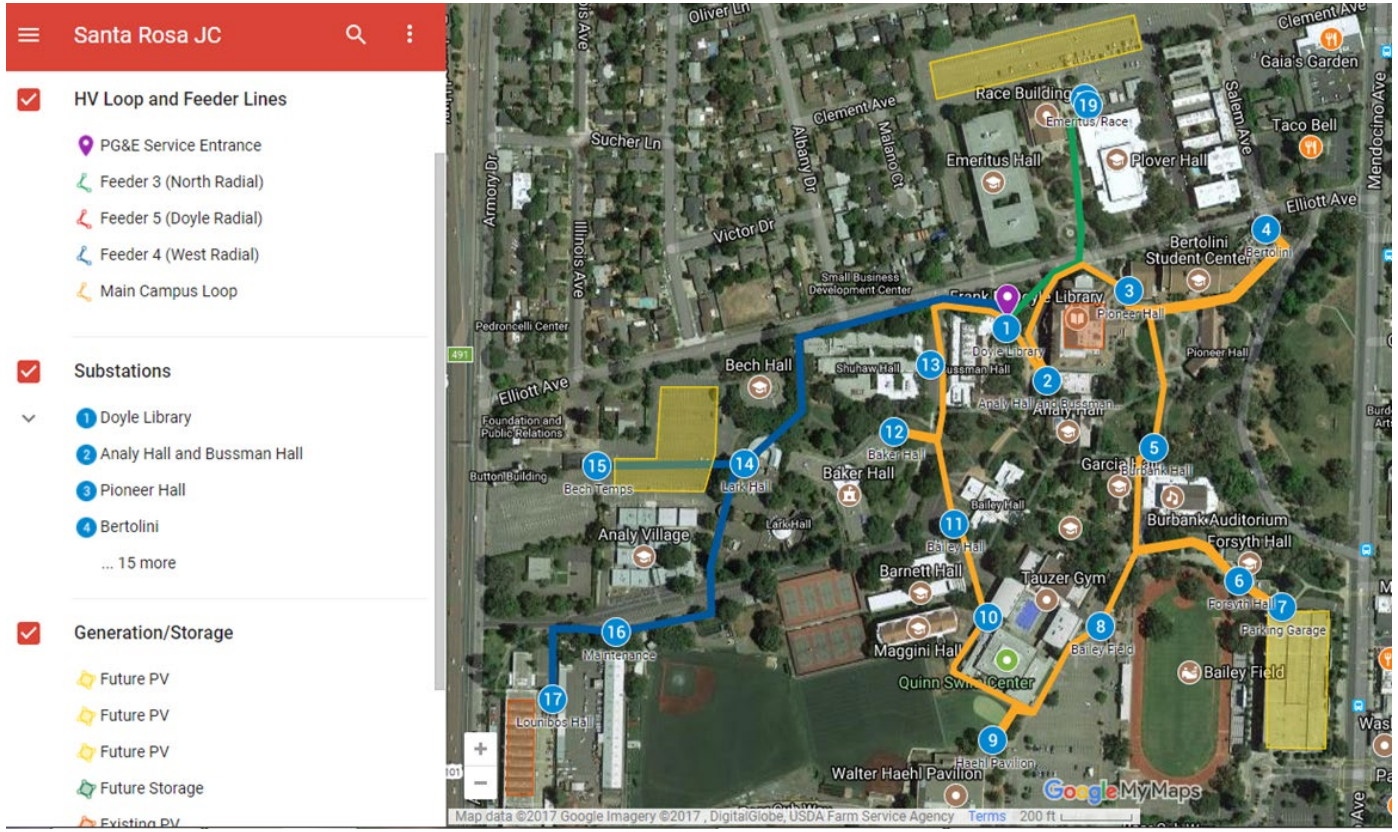
3) If academic continuance is achieved what is the prioritization (buildings that house the most classes, lab buildings?)

Hazard Impact on Specific Resiliency Measures

- PSPS are very difficult and really lithium ion doesn't cut it for long duration energy storage (need 10 hour discharge solution)
- Fire means smoke which means a 10-15% drop in PV production which means a need for more energy storage or other generation
- How does flooding impact physical electrical assets
- Extreme Heat Days impact peak load and electrical equipment

Space Use Adaptation Examples

- Best protection options – space utilization – building ranking.



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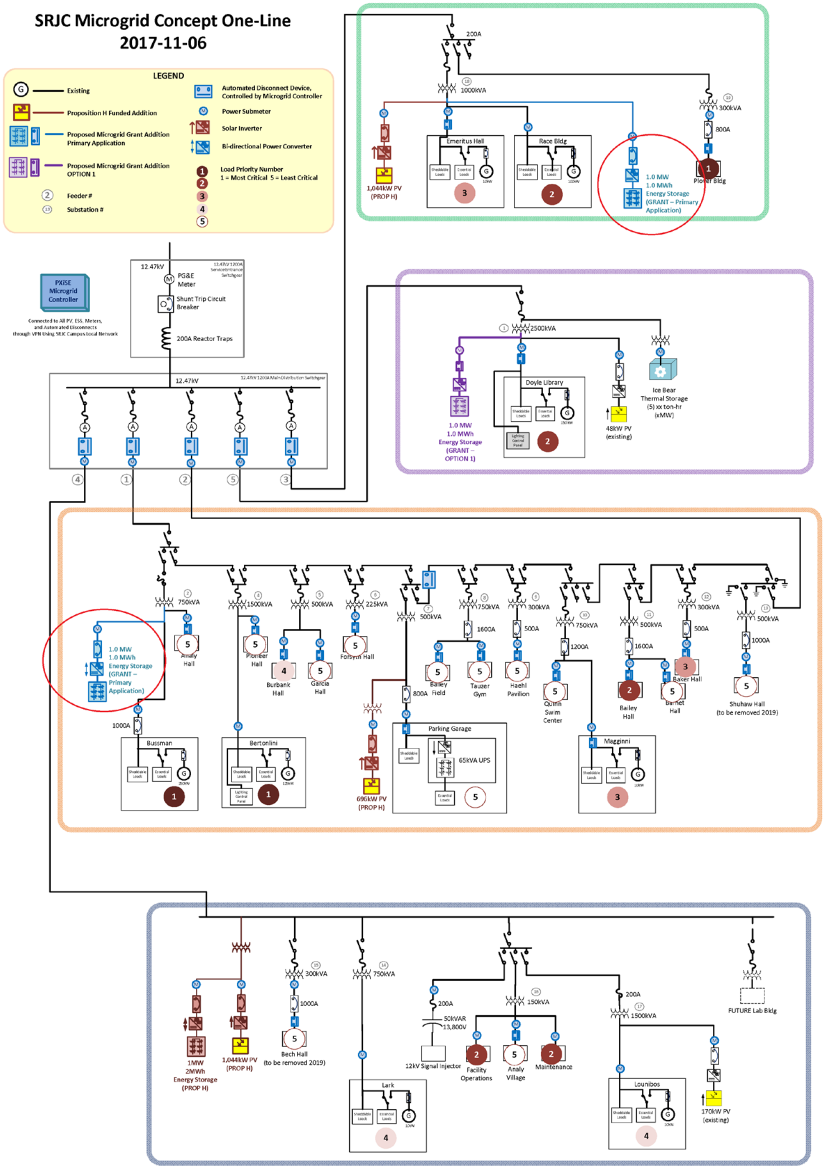
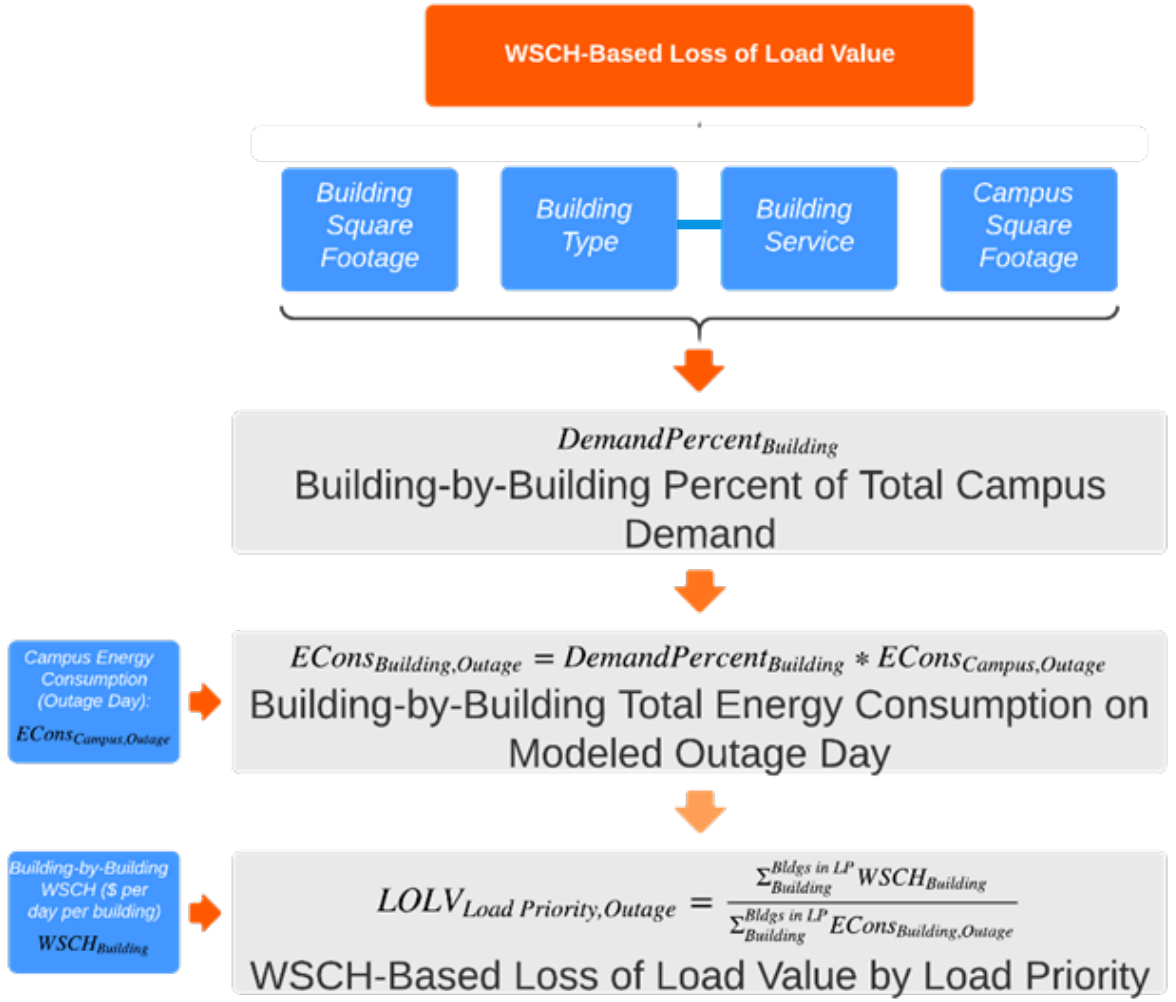
Pillar 2 Mitigation Measure Assessment

SRJC Microgrid Concept One-Line
2017-11-06



Utilizing Modeling Software to Create the $ Value of Resiliency (Techno-Economic model)

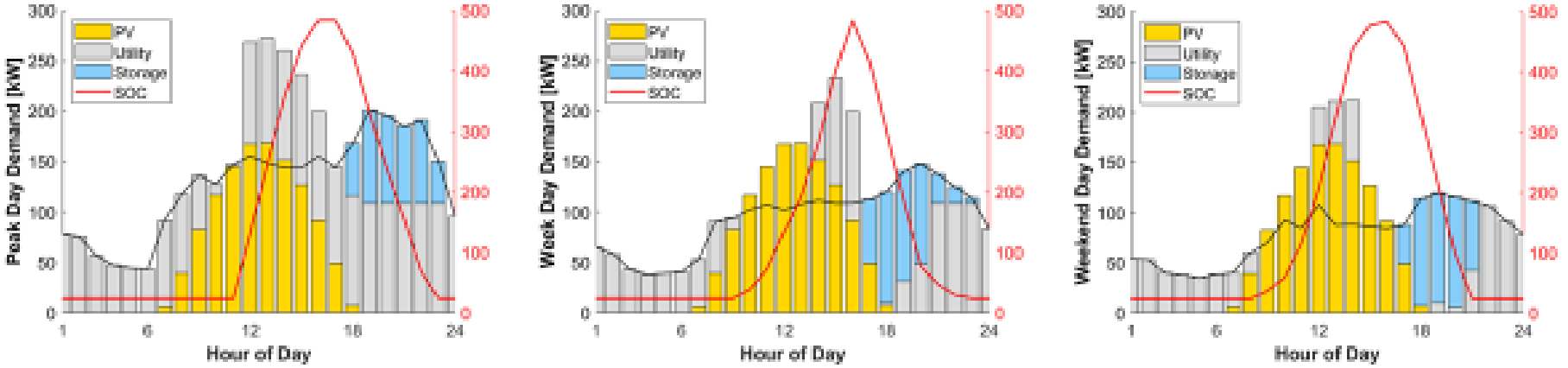
- What value should be put on building functions/services?
- Create Loss of load values
- What Battery State of Charge must be maintained for daily charging and running of prioritized loads (really important with just solar and battery alone)
- Energy Efficiency especially Passive Design becomes extremely valuable for Resiliency



Flowchart showing steps for calculating the cost of unserved load for each load priority level, using the WSCH for individual campus buildings

2&3

Modelling Updates: XENDEE Daytypes

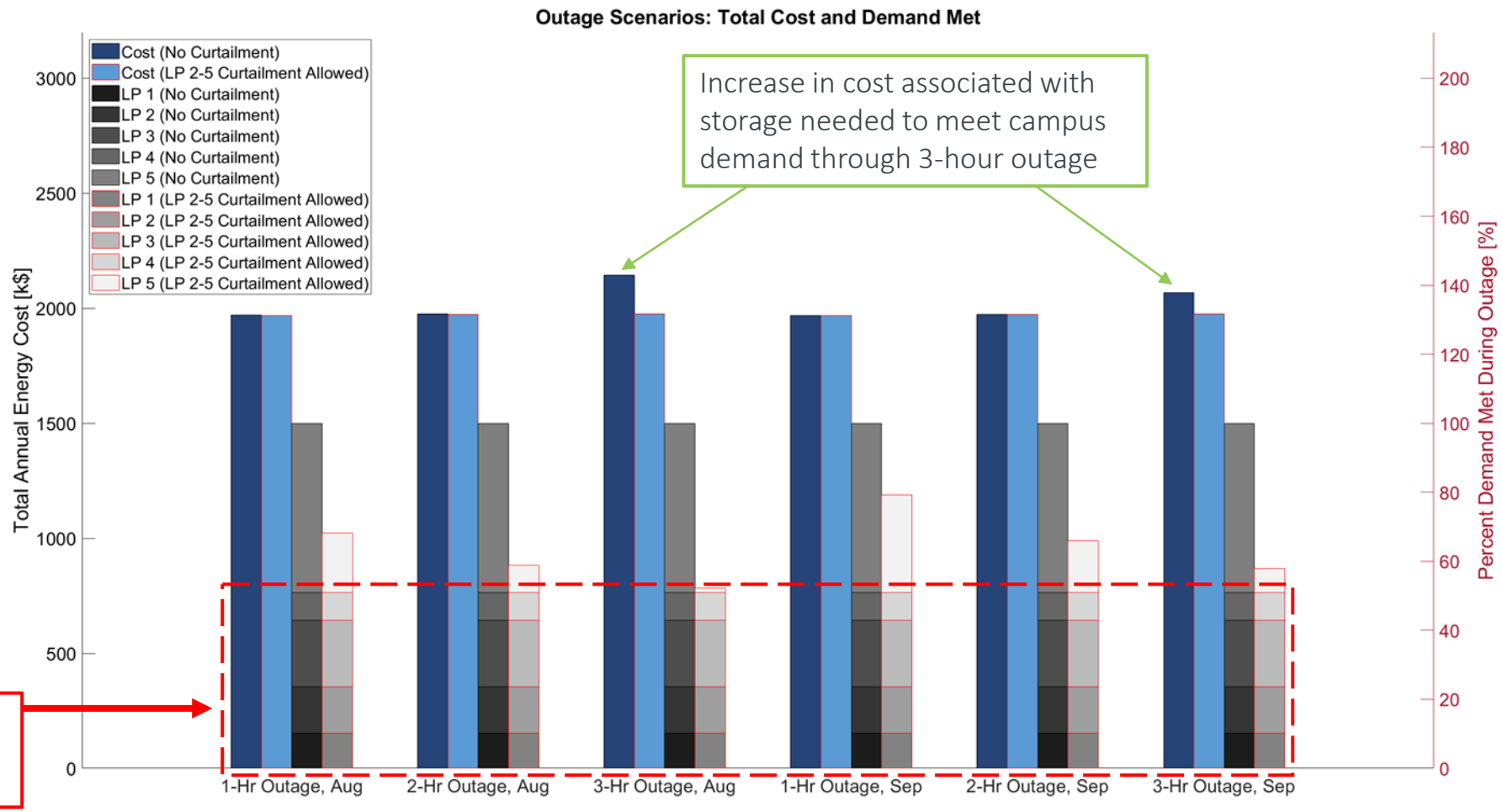


- Three distinct daytypes per month: hourly resolution
- Dispatch optimized for each hour
- Storage SOC constraint: end of daytype to beginning of daytype

Curtailment Results for Brief Outages
Costs, Sizing, Load Priority Loads Met

Optimal Storage Sizing:

- 5.6 MWh for 3-Hr outage in August *if no curtailment allowed*
- 4.9 MWh for 3-Hr outage in September *if no curtailment allowed*
- 4 MWh across all other scenarios

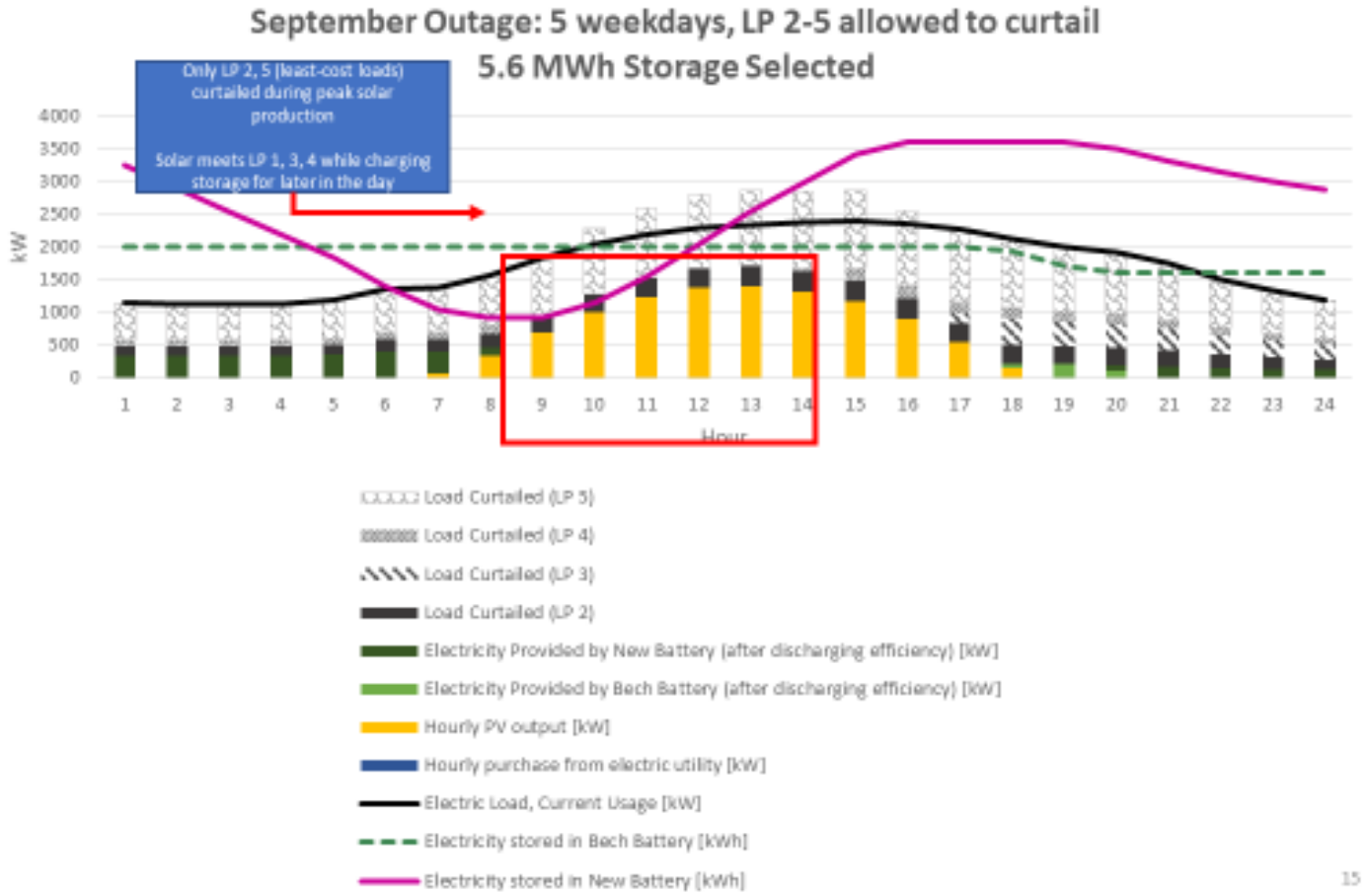


LP 1-4 not curtailed

2

Resiliency Dispatch:

September multiday outage with curtailment: Day 1 of 5

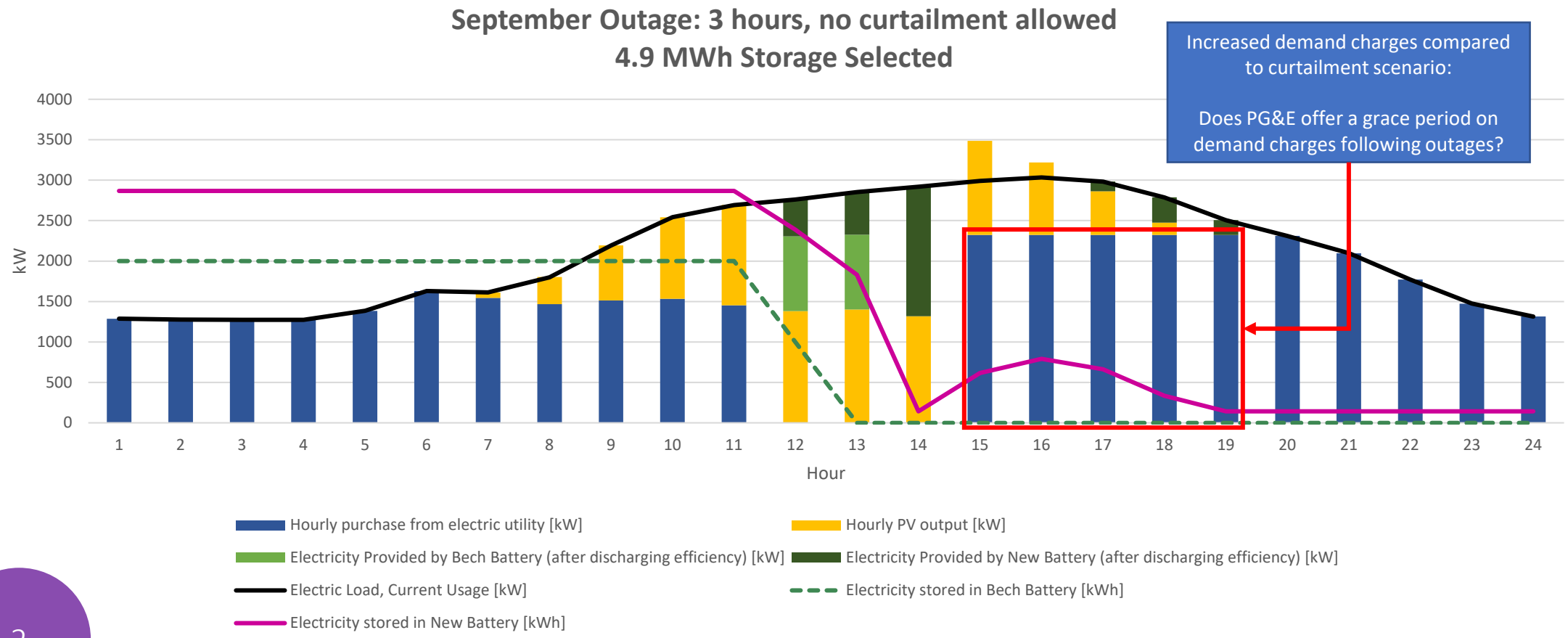


2

Pillar 2 Mitigation Measure Assessment

Resiliency Dispatch:

September 3 hour outage without curtailment



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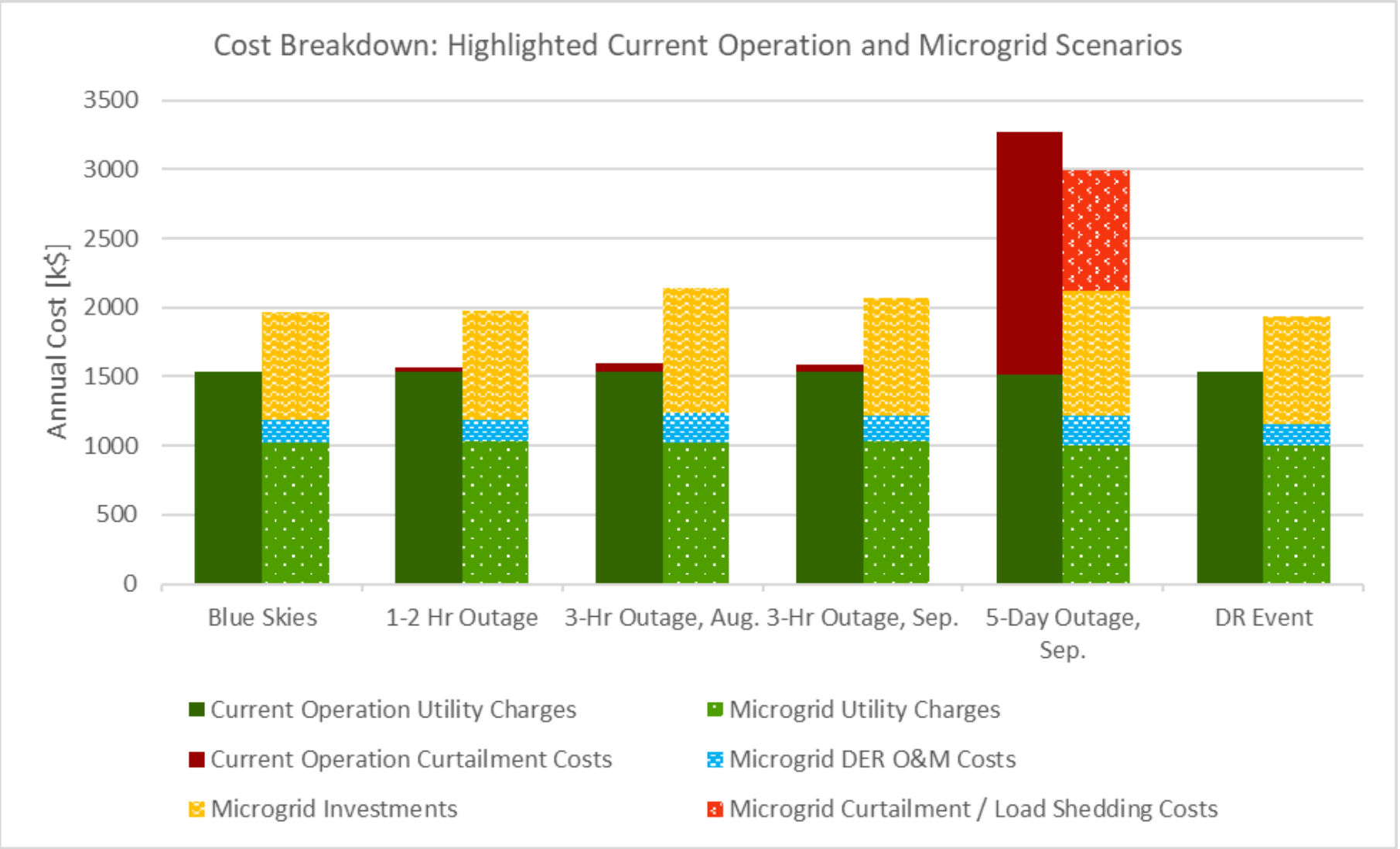
Pillar 2 Mitigation Measure Assessment



2&3

Pillar 2 & 3 Mitigation Measure Assessment

How to scorecard/measure success

4-Pillar Methodology
III. Resiliency Scorecard (draft)

Resiliency Scorecard: Mitigation Measure Characteristics	Points	Score
Duration of backup – with no other inputs Depends		
4 hrs	1	0
8 hrs	2	0
24 hrs	3	0
48 hrs (2 days)	4	0
96 hrs (4 days)	5	0
Indefinite	6	6 priority 1
Load Capacity (which loads are backed up and how much load (Critical, Priority, Discretionary) Depends		
Critical		
90 - 100%	9	
50 - 90%	8	
0 – 50%	7	7
Priority		
90 - 100%	6	6
50 - 90%	5	
0 – 50%	4	
Discretionary		
90 - 100%	3	
50 - 90%	2	
0 – 50%	1	1

Resiliency Scorecard: Mitigation Measure Characteristics	Points	Score
Fuel Availability		
Onsite, intermittent	3	
Onsite, produced	3	3
Piped infrastructure	2	
Wires infrastructure	2	2
Transport	1	
Emissions level – GHG and particulates		
Non-GHG emitting	4	4
Meets CARB emission standards	3	
GHG emissions < xxx	2	
Cap n Trade	1	

Resiliency Scorecard: Mitigation Measure Characteristics	Points	Score
Start-up/ islanding /isolation/ crossover transition time (intermittent downtime before specified backup is available)		
0 - 1 min	5	5 Bluebless
2 - 5 min	4	
5 - 30 min	3	
30 - 120 min	2	
< 120 min	1	
Notification time/Advanced notice needed for backup available at specified load/duration		
0 - 1 min	5	5
2 - 5 min	4	
5 - 30 min	3	
30 - 120 min	2	
< 120 min	1	
Workforce Requirements		
Onsite	2	
Remote	4	4
Blue Sky Services		
Demand Response	2	2
Voltage/Frequency	1	1 - no program
Wholesale participation	1	

California Public Utilities Commission

3

Pillar 3 Resiliency Scorecard

Future Applications

- Southwest Santa Rosa Center – Equity Center
- California Community Colleges Resiliency Centers
- Review, Assessment, Improve and Build Capacity

-Integration with County Hazardous Mitigation Plan

-Integration with District Emergency Management Protocols/Procedure

-Ongoing Operations & Maintenance (Funding/Total Cost of Ownership)

Q & A

Closing Remarks

Energy Division Workshop Series on Resiliency

- ✓ **May 10, 2022** - Interruption Cost Estimate (ICE) Calculator/Power Outage Economic Tool (POET)
- ✓ **July 7, 2022** – Sandia National Labs – Resiliency Node Cluster Analysis Tool (ReNCAT) and the Social Burden Index
- ✓ **May 10, 2023** – Lumen Energy Strategy (CEC EPIC funded) – 1st of 3 workshops – Resiliency Standards: Definitions
- ✓ **July 26, 2023** – SCE/Sandia (DOE funded) Kickoff ReNCAT/Social Burden Index Pilot Project (Phase 1)
- ✓ **August 22, 2023** – LBNL (DOE funded) – Final Reporting on Data Schema Pilot project
- ✓ **September 5, 2023** – Lumen Energy Strategy – 2nd of 3 workshops – Resiliency Metrics
- ✓ **October 19, 2023** – SDG&E and Sonoma County Junior College District - Use Case Demonstration of 4-Pillar Methodology
- ❑ **November 8, 2023** – Lumen Energy Strategy (CEC EPIC funded) – 3rd of 3 workshops – Resiliency Standards: Methodologies ← **Next Event**
- ❑ **November 28, 2023** – Final Report: SCE/Sandia (DOE funded) ReNCAT Pilot Project (Phase 1)

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https://www.cpuc.ca.gov/resiliencyandmicrogrids/