California Society for Healthcare Engineering, Inc.

OCTOBER 20, 2022

Courtyard by Marriott Fairfield

Why Microgrids?

John Griffiths PE, Principal & Founder

CONTECH-CA

13TH ANNUAL NORCAL SEMINAR

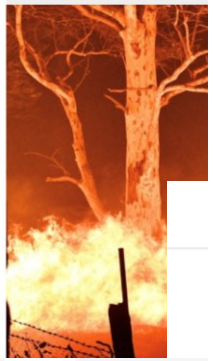
Agenda

- Why Microgrids
- HCAI Microgrids White Paper
- Technology & Supply Chain – Ryan De La Cruz
- HCAI Update – Jamie Schnick
- Products & Solutions – Seth Baruch
- Questions

Why Microgrids?

2020 Western U.S. Wildfire Season Gav
Gigafire, Several Massive Blazes

By Don Jergler | December



Unprece

California LEGISLATIVE INFORMATION

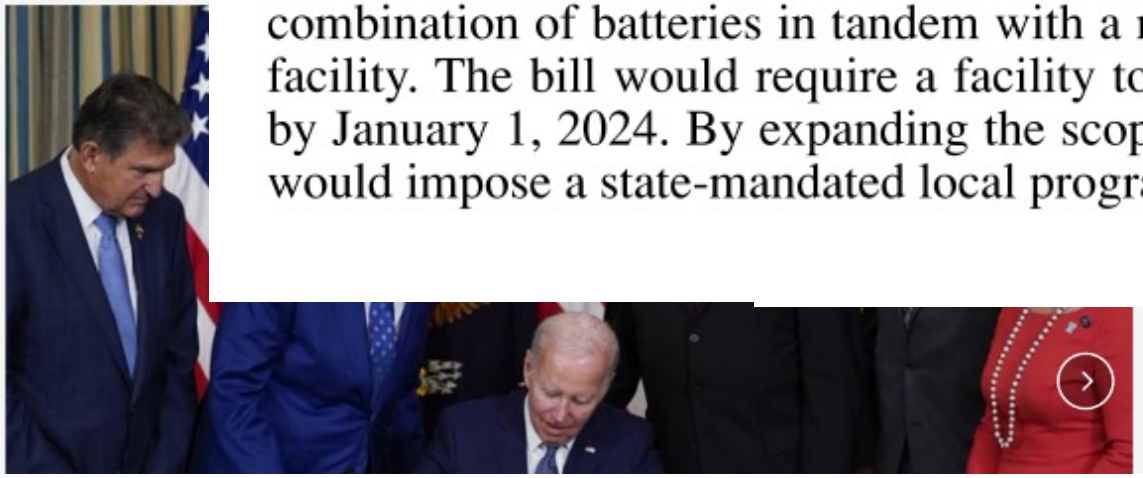
Assembly Bill No. 2511

This bill would require a skilled nursing facility to have an alternative source of power, as defined, to protect resident health and safety, as defined, for no fewer than 96 hours during any type of power outage. The bill would impose specific compliance requirements based on whether a skilled nursing facility uses a generator as its alternative source of power, or batteries or a combination of batteries in tandem with a renewable electrical generation facility. The bill would require a facility to comply with its requirements by January 1, 2024. By expanding the scope of an existing crime, the bill would impose a state-mandated local program.

AP U.S. Ne

Biden sig

By ZEKE MILLER and



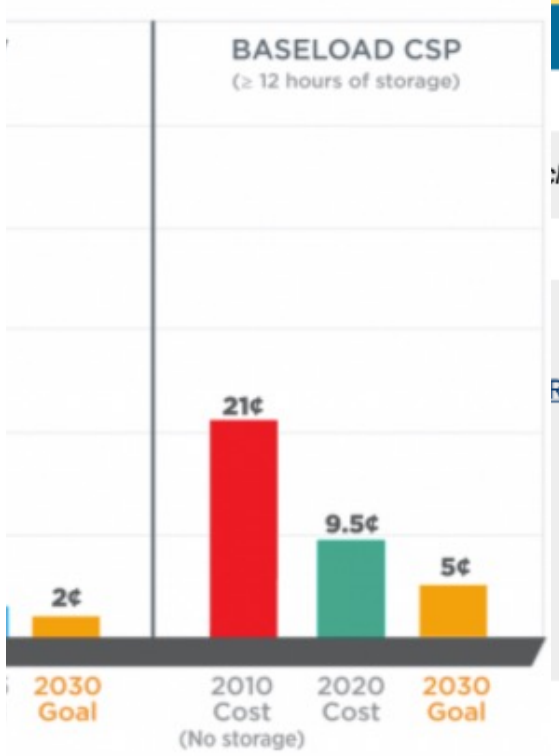
Partner Program

Customers Company Contact Us

s provided to SUNY at zero cost
the taxpayers while reducing

million lbs

of carbon emissions



Utilities Commission (CPUC) created an innovative program, the Emergency Load
o pilot a new Demand Response approach to help avoid rotating outages during peak
riods from May thru October. The ELRP started in 2021 with commercial customer
021, the CPUC expanded the program to include residential customers for Summer
2022 and beyond.

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Microgrid Whitepaper

California Society for Healthcare Engineering, Inc.

OCTOBER 20, 2022

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Technology & Supply Chain

Ryan De La Cruz, Director of Business Development

Ecom-Energy, Inc.

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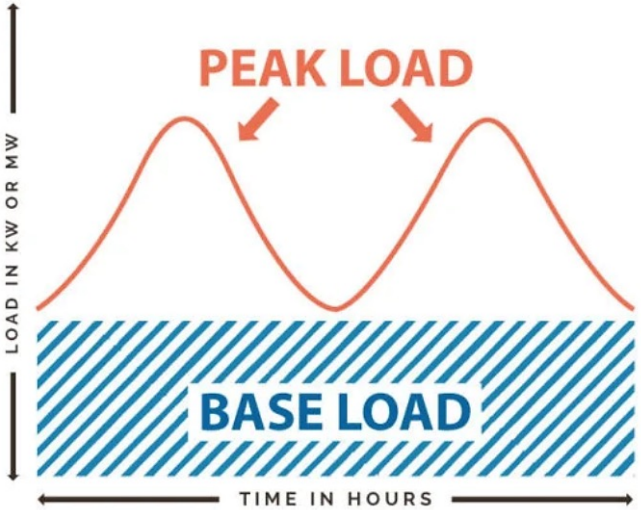
Technology Options

- Fuel Cells
- Cogeneration (CHP)
- Solar
- Energy Storage Systems (ESS)
- Geothermal / Wind

Fuel Cells & Cogeneration

- Provides Baseload Power
- 24x7 Generation (“Always On”)
- Useable Heat Load?
- Standalone Microgrid: Critical Load Support as Normal Source
- Limited Sustainability Benefits



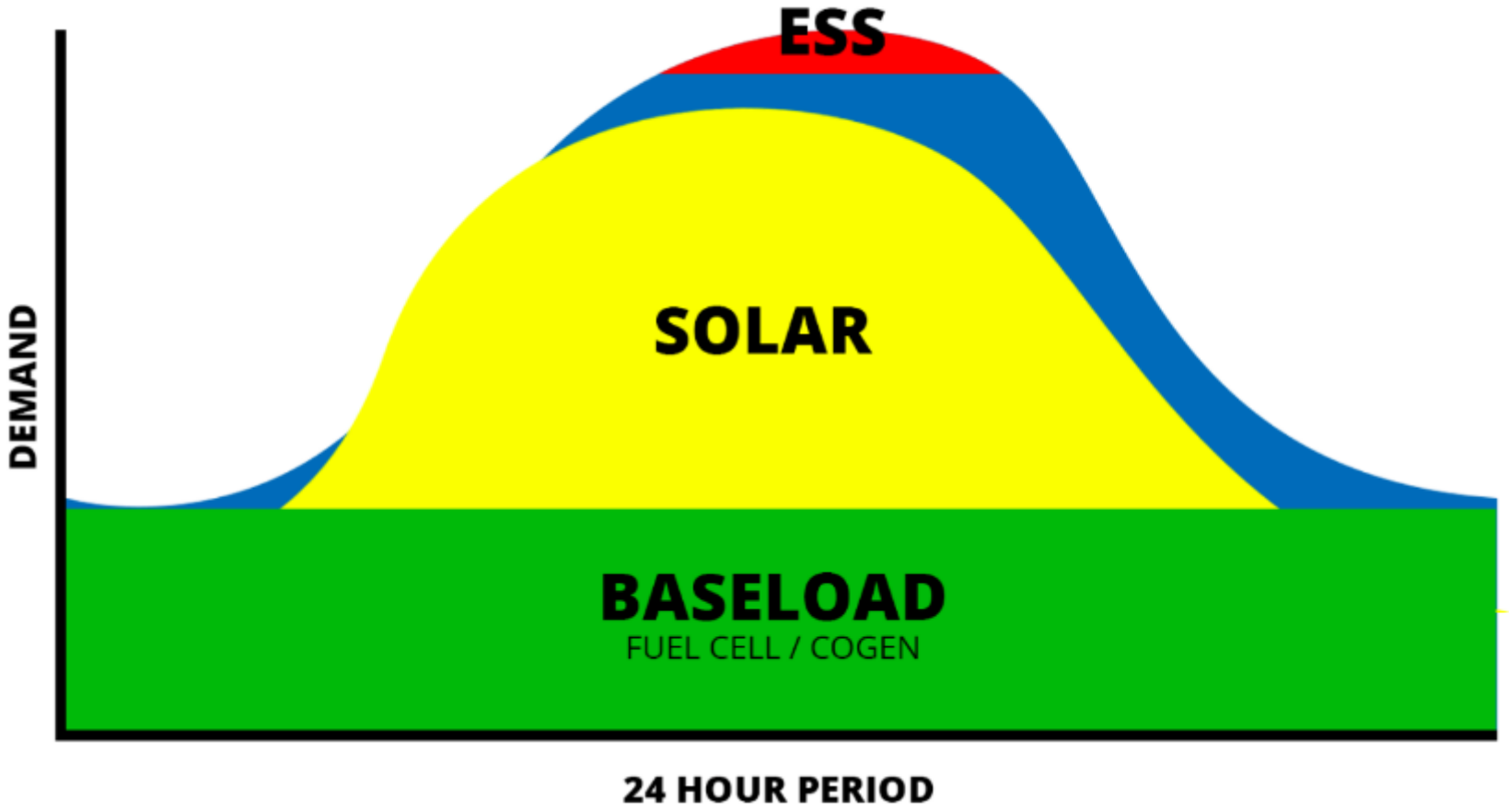
Solar

- Install Types:
  - Ground Mount
  - Rooftop
  - Carport
- Truly “Green” Technology
- Production Dependent on Sunlight

Energy Storage Systems

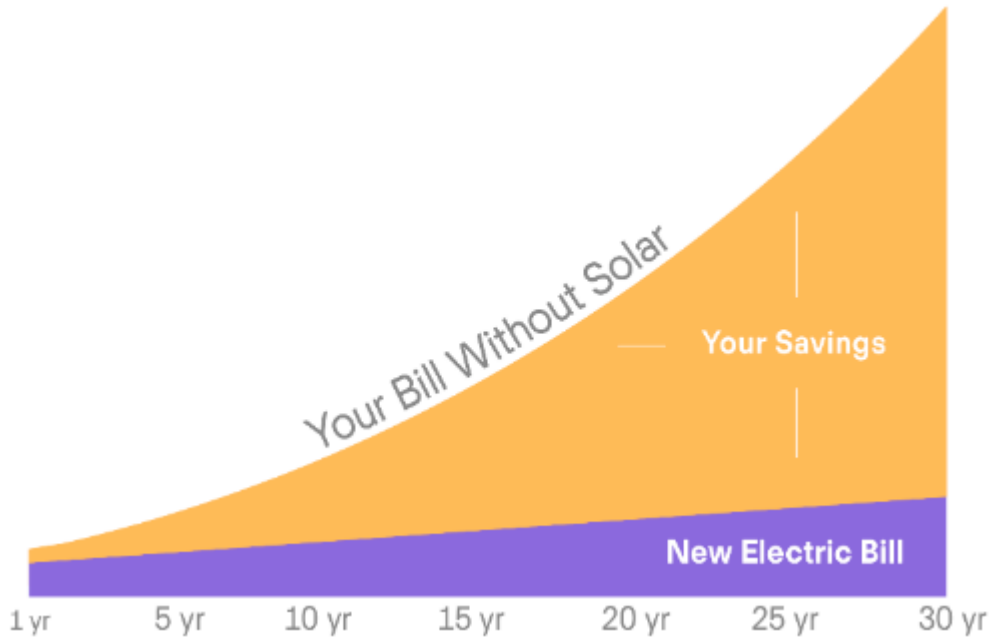
- Short Duration vs. Long Duration
  - Short Duration = Peak Shaving
  - Long Duration = Load Shifting
- Versatile Install
- Useful Life: ~10 Years

Putting It Together

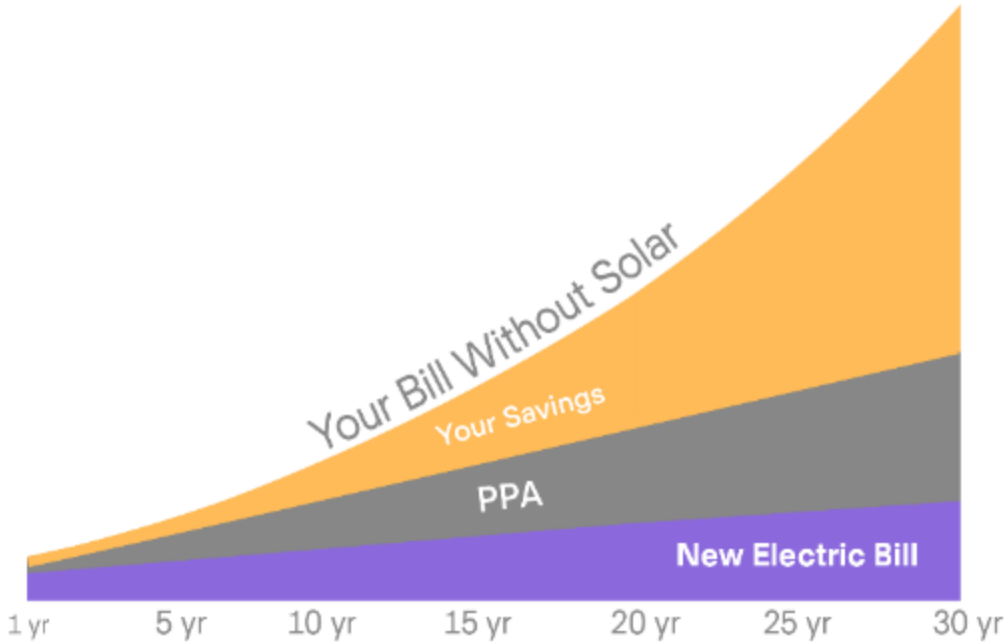


Microgrid Financing

1. Power Purchase Agreement (PPA)
2. Capital Purchase
3. Service Contract



Capital Purchase Financing



PPA Financing

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Rebates & Incentives

1. Inflation Reduction Act (IRA)
   - Investment Tax Credit (ITC)
2. Net Energy Metering (NEM)
3. Disadvantaged Communities
4. Grants & Donors

Years	Cash		State Taxes	Federal Taxes		Total Cash Flow	Cumulative Cash Flow
	Project Costs	Electric Bill Savings	Income Decrease (State (CA) 10-yr Depreciation)	Income Decrease (Federal - 100% Bonus Depreciation)	Federal Tax Credit		
Upfront	-$616,926	-	-	-		-$616,926	-$616,926
1	-	$41,929	$5,454	$110,121	$185,078	$342,581	-$274,345
2	-	$42,971	$5,454	-		$48,424	-$225,920
3	-	$44,037	$5,454	-	-	$49,491	-$176,429
4	-	$45,129	$5,454	-	-	$50,583	-$125,846

	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Credit Prior to IRA	26%	22%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Credit Under IRA	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	26%	22%	0%

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Key Takeaways

- Proven Technologies
- Creative Financing
- Resiliency, Cost Savings & Cleaner Environments

California Healthcare Microgrids

Jamie Schnick, Senior Electrical Engineer

Department of Health Care Access and Information (HCAI)

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Microgrid Implementation NOW

To get the word out that Microgrids can be implemented NOW.

To help speed up and simplify the processing of Microgrid projects.

- Early Discussions
- Consistent Team/Approach to Review
- Sharing Knowledge

To help with the process of delivering Microgrids as Emergency Power Sources (EPS's) for California Healthcare Facilities that are:

- Code Compliant
- At least as reliable as the current EPS's – Diesel Generators

Microgrid Definition

Department of Energy

A microgrid is a group of interconnected loads and Distributed Energy Resources (DER's) within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid. Microgrids can connect and disconnect from the "utility electric" grid to enable them to operate in both grid-connected or island mode.

Permitting of Microgrids

CODE COMPLIANT MICROGRIDS are ACHIEVABLE AT HCAI FACILITIES

- Many HCAI facilities have DER's installed that serve as supplemental source(s) for Normal Power (typically paralleled with the electric service and configured to disconnect during utility outage).
- Under current codes, microgrids CAN be installed at healthcare facilities to: cut costs on energy bills, reduce carbon footprint and protect facilities from power grid outages.

Permitting of Microgrids

MICROGRIDS for HEALTHCARE/HCAI FACILITIES

- Supplemental Normal Power Sources – If sized and controlled correctly microgrids can be designed so failure of the electrical utility service does not affect the Healthcare facility tenants.
- Essential Power – Additional requirements include: need to meet seismic requirements, equipment and controls listed for emergency power, required to have 4/6 or 72 hours of on-site fuel storage, CMS approval.

Permitting of Microgrids

MICROGRIDS for NORMAL POWER

CURRENT CODES

Will need to comply with:

- APCD
- The PUC
- Local Ordinances

Recommend that these designs can be submitted to HCAI for approval, to assist with future conversion to EPS.

Microgrids as EPS

MICROGRIDS for EMERGENCY POWER

CURRENT CODES

- 2019 CEC 517.30(A) two (2) independent power sources (B) Alternate source shall be:
  - (1) Generators
  - (2) Fuel Cells
- 2019 CEC 517.41(A) two (2) independent power sources (B1) Alternate source shall be Generators.

For CMS reimbursements, EPS will need to be Emergency Generators.

Microgrids as EPS

MICROGRIDS for EMERGENCY POWER

FUTURE CODES

2023 NEC 517.30(B) Alternate source shall be:

- Generators
- Fuel Cell Systems
- Energy Storage Systems
- Healthcare Microgrids – if “sufficiently reliable”

2023 NEC 517.41(A) Independent power sources:

Shall have two (2) or more independent sources (or sets of sources), one on-site, and another can be located off site.

Microgrids as EPS

MICROGRIDS for EMERGENCY POWER

IF "SUFFICIENTLY RELIABLE"

2023 NEC allows Microgrids as EPS if "sufficiently reliable to provide effective facility operation consistent with the facility emergency operations plan".

- Consensus is if Microgrids are used as EPS, should be at least as reliable as current "gold standard" of Diesel Generators.
  - CBC 1705A.13.3.1 requires special seismic certification for Emergency Systems.
  - CEC 700.12 requires on-site fuel storage for EPS.
- For CMS reimbursements, EPS still needs to be generator. Once 2023 NEC is issued, CMS can be approached to adopt this portion of new code.

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HCAI Microgrid White Paper

OSHPD Microgrids for Healthcare Whitepaper Team		
Categories	**Working Group Champions**	**Working Group**
Technology/ Supply Chain	**Ryan De La Cruz, Ecom-Energy**	David Smith, Bloom Energy
	Raymond De Callafon, UCSD	Fabian Kremkus, CO Architects
		Jeff Hankin, Stantec
		Justin R. Carron, Eaton
		Mike Voll, Stantec
		Nanci Timmins, OSHPD
		Paul Newman, Caterpillar Microgrids
		Robert W. Vandling, Dignity Health
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	Chad E. Beebe, ASHE	David Smith, Bloom Energy
		Giovanni Cayetano, tk1sc
		Jun Timbang, Kaiser Permanente
		Nanci Timmins, OSHPD
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		Shant Der-Torossian, ARUP
		Walt Vernon, Mazzetti
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	Kevin Long, UC Davis	Joe Brothman, UC Irvine
	Seth J. Baruch, Kaiser Permanente	Justin Carron, Eaton
		Rosa Vivian Fernandez, San Benito HF
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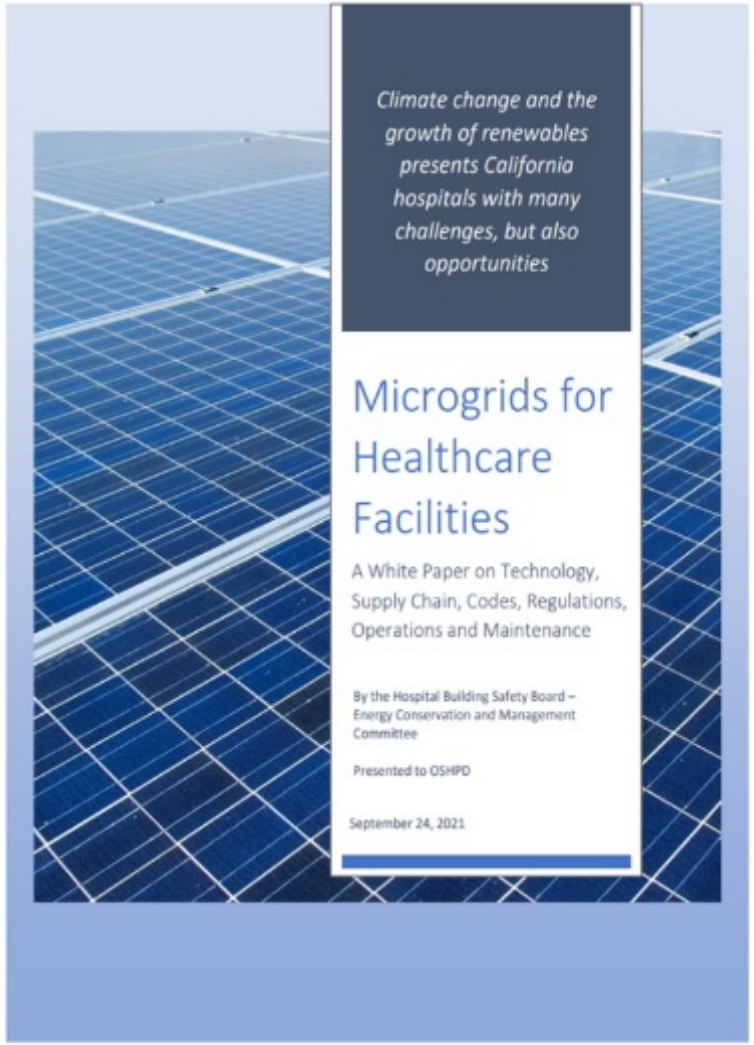


HCAI Microgrid White Paper

	Microgrid White Paper Codes/Regulations - Applicable Codes Matrix	Microgrid Power Source					
		Solar (PV's)	Wind	Fuel Cells	Cogen	Energy Storage	UPS
	Codes/Requirements						
1	CARB - California Air Resources Board - Air Quality Requirements				x		
2	CPUC - California Public Utility Comission (Rule 21)	maybe	maybe	x	x	maybe	no
3	OSHPD CAN 2-0 Local Approval	x	x	x	x	maybe	no
4	2019 CBC - California Building Code	Only if in OSHPD building and/or serving as alternate source					
5	2019 CFC - California Fire Code						
5a	1206 Electrical Energy Storage Systems					x	x
5b	1206.2 Stationary Storage Battery Systems					x	x
5c	1204 Photo Voltaics	x				x	
5d	1205 Fuel Cell (NFPA 53 addopted by reference)			x			
6	2019 CEC - Califonial Electrical Code						
6a	517 Healthcare Facilities	Only if in OSHPD building and/or serving as alternate source					
6b	690 PV Systems	x				x	
6c	692 Fuel Cell Systems			x		x	
6d	694 Wind Electric Systems		x			x	
6e	700 Emergency power					x	x
6f	705 Interconnected Electric Power Production Sources	x	x	x	x	x	
7	2018 NFPA 30 - Flammable and Combustible Liquids Code			x	x		
8	2015 NFPA 37 - Stationary Combustion Engines and Gas Turbines			x	x		
9	2015 NFPA 54 - National Fuel Gas Code			x	x		
10	2017 NFPA 58 - Liquid Petroleum Gas Code			x	x		
11	2016 NFPA 59A - Production/Storage/Handling of Liquified Natural Gas LNG			x	x		
12	2018 NFPA 99 - Healthcare Facilities Code	x	x	x	x	x	
13	2016 NFPA 110 - Emergency and Standby Power	x	x	x	x	x	
14	2016 NFPA 111 - Stored Electrical Energy Emergency and Standby Power Systems					x	
15	2016 NFPA 400 - Hazardous Materials Code			x	x	x	
16	NFPA 853 - Installation of Stationary Fuel Cell Power Systems			x			
17	NFPA 855 -Standard for the Installation of Stationary Energy Storage Systems					x	
18	Centers for Medicare & Medicaid Services (CMS)	x	x	x	x	x	
18a	2012 NFPA 99 - Healthcare Facilities Code						
18b	2012 NFPA 101 - Life Safety Code						

Figure 25. Applicable Codes Matrix for Microgrid Implementation

HCAI Microgrid White Paper

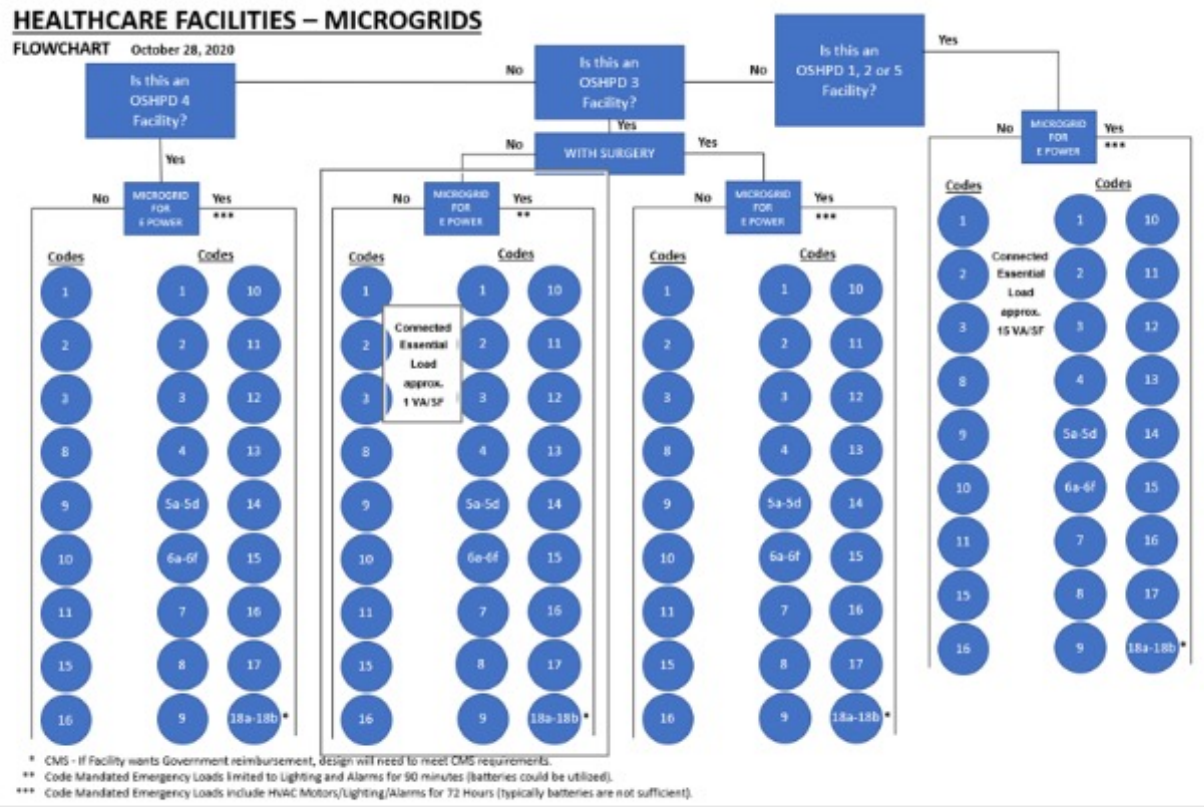


Figure 3 Healthcare Microgrids implementation flow chart

Important Fact

NOT ALL HEALTHCARE FACILITIES TYPES ARE ALIKE

Different power densities and/or emergency power requirements for:

- OSHPD 1 – Acute Care Hospitals
- OSHPD 2 – Skilled Nursing Facilities
- OSHPD 3 – Licensed Clinics and Surgery Centers
- OSHPD 4 – Correctional Treatment Facilities
- OSHPD 5 – Acute Psychiatric Hospitals

Not All Healthcare Facilities are the Same

NORMAL/EMERGENCY POWER REQUIRMENTS FOR VARIOUS CA HEALTHCARE FACILITIES

Code	**OSHPD 1** - Acute Care Hospital	**OSHPD 2** - SNF with no electric life support equipment	**OSHPD 3** - Licensed Clinics w/ no OR's)	**OSHPD 3** - MOB w/ Surgery Center	**OSHPD 5** - Acute Psych Hospitals w/ no critical or acute care services
CEC 700.12 - On site fuel storage	72 hrs	6 hrs	1.5 hrs	4 hrs	6 hrs
Generator required					
- by CMS (2012 NFPA 99)	yes	yes	no	no	yes
- by CEC	Gen or fuel cell	yes CEC 517.41(B1)	no	yes 517.45(E1)	yes CEC 517.41(B1)
# of branches	3 branches - Life Safety, Critical, Equipment	2 branches - Life Safety and Equipment	1 branch - emergency	3 branches - Life Safety, Critical, Equipment	3 branches - Life Safety, Critical, Equipment
Typical Total calculated VA/sf	25	15	15	20	25
Typical Emergency Calculated VA/sf	15	1	0.2	10	15
Typical Bldg size(s) - sf	150,000	18,500	40,000	75,000	11,650
Total calculated load rqmts- VA	3,750,000	277,500	600,000	1,500,000	274,416
Emergency load rqmts - VA	2,250,000	18,500	8,000	750,000	132,645
Utility Peak Demand - 1 yr (estimate)	1,800,000		480,000	900,000	174,750
Utility Peak Demand - 1 yr (metered)		142,000			
Connected Emergency load	2,250,000	37,500	8,000	750,000.0	150,000
- typical EPS configuration	(2) gens at 1MW ea.	(1) gen at 30 kW	(1) battery or gen @ 7.5kw	(1) gen @ 600kW	(1) gen @150kW
100% back-up	3,750,000	162,500	600,000	1,125,000	275,000

Projects Installing Microgrid Systems

SNFs in NORTHERN CALIFORNIA

Five (5) Facilities

KAISER ONTARIO MICROGRID

PILOT PROJECT

PV/BATTERY STORAGE SYSTEMS

MULTIPLE PROJECTS

Projects Utilizing Microgrid Systems

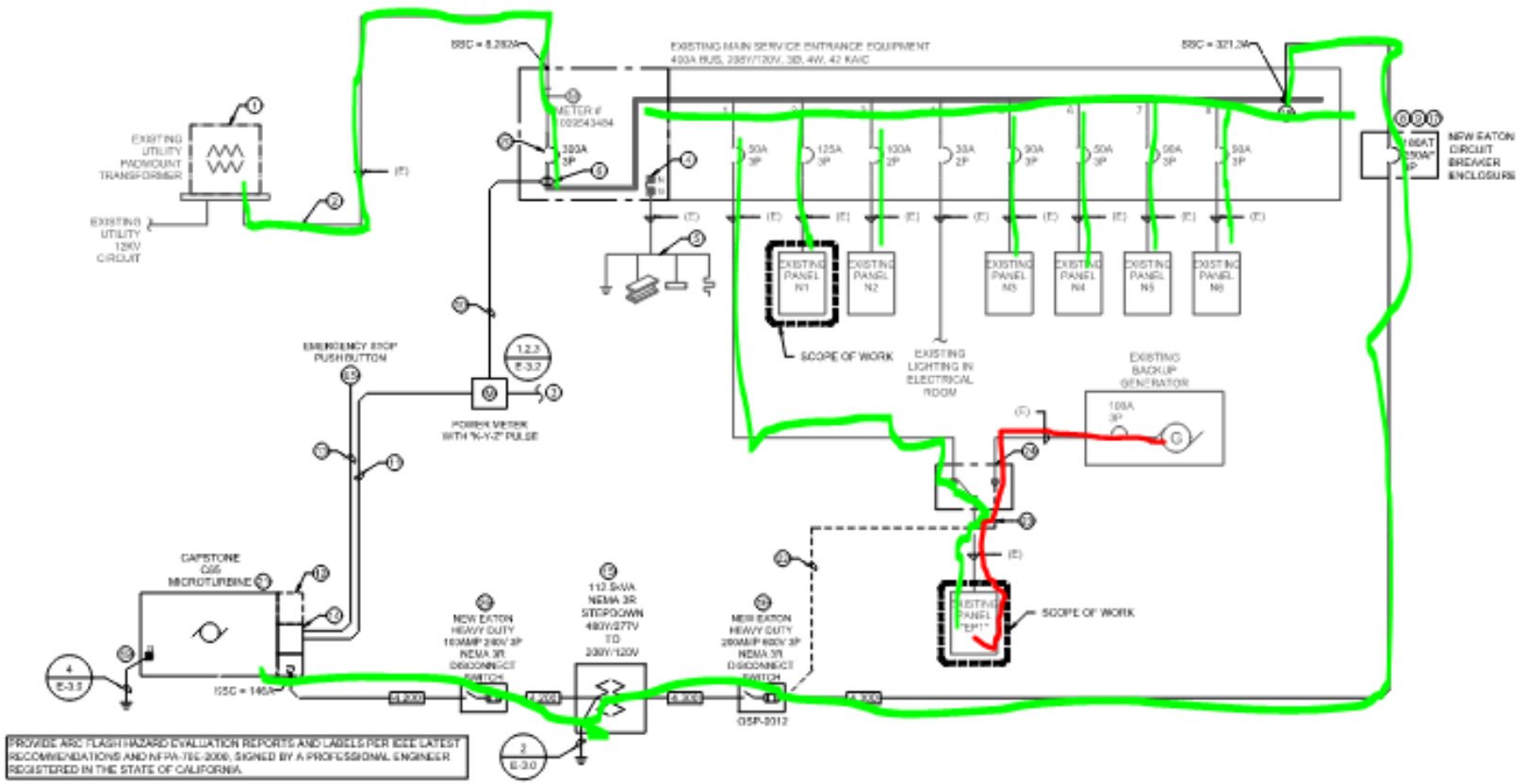
NORTHERN

CALIFORNIA

SKILLED

NURSING

FACILITIES



1 SINGLE LINE DIAGRAM

Projects Utilizing Microgrid Systems

MICROGRIDS as SUPPLEMENT TO NORMAL POWER

GOOD TO GO

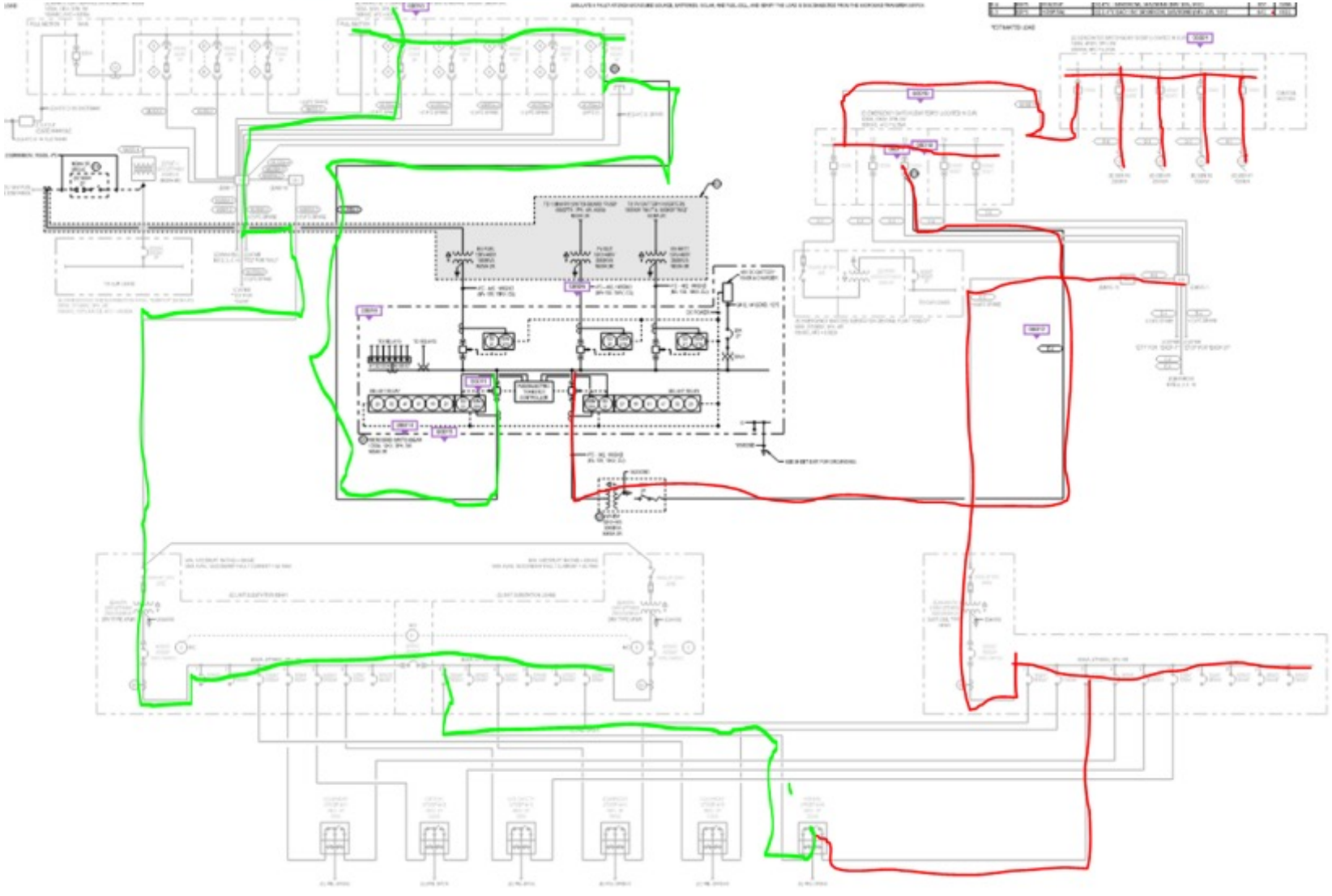
- ✓ Products readily available.
- ✓ Code Compliant Design - Achievable with current codes.
  - Will need to meet PUC requirements.
  - Will need Local approval for new equipment/enclosures on site.
- ✓ No issues with CMS.
- ✓ No need for 72 hours of on-site fuel storage.
- ✓ Potential Benefits
  - Resilience
  - Energy Cost Savings
  - Sustainability Gains

Projects Utilizing Microgrid Systems

KAISER

ONTARIO

MICROGRID



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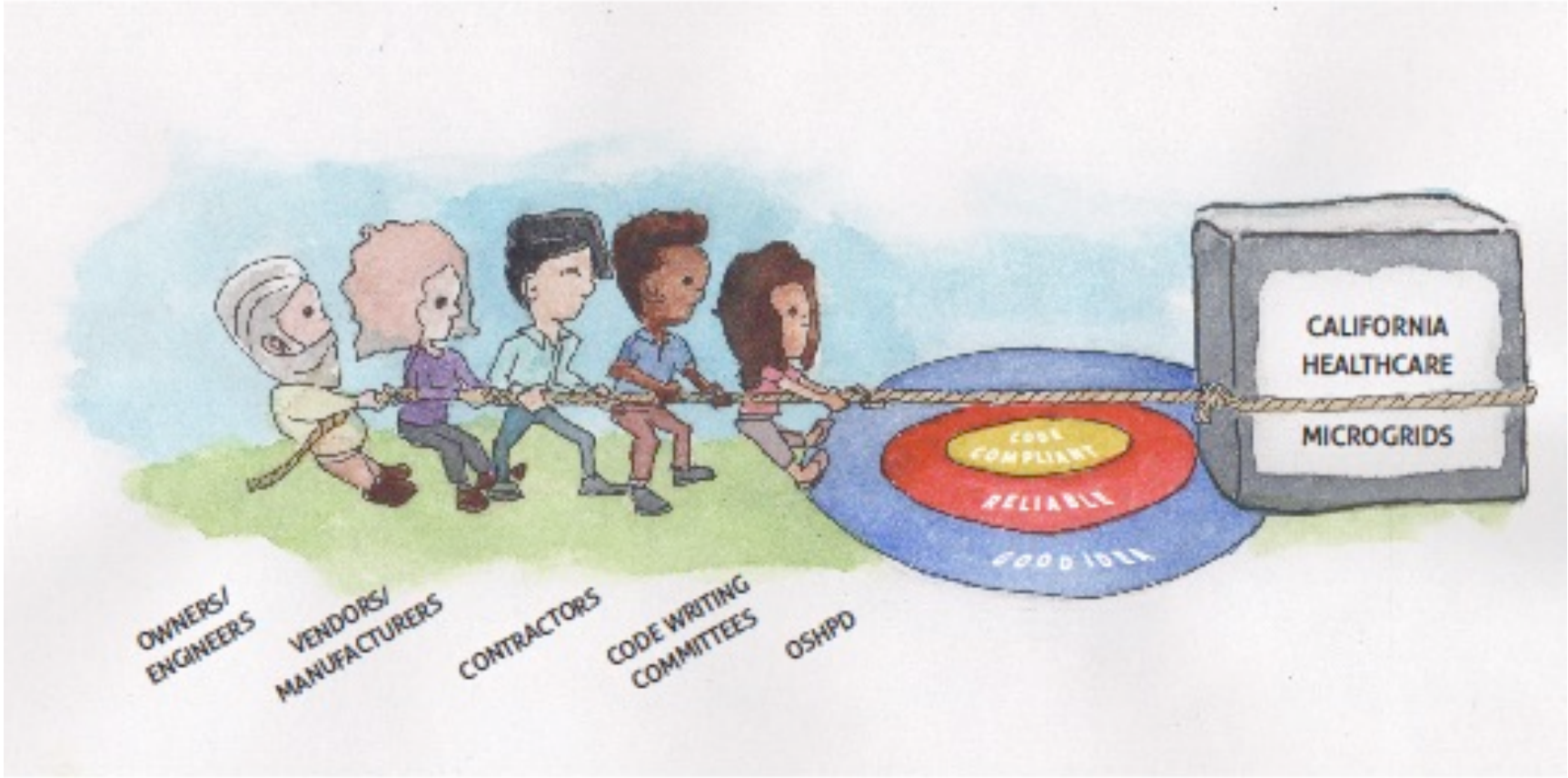
Next Steps

MICROGRIDS as EPSS

- HCAI to approach CMS to allow alternatives to Generators for EPS
- Special Seismic Certification for DER's and Components
- Use of Listed Products – UL 3001 (controllers)
- HCAI Review of DER's
- Solve 72 hours of on-site fuel storage for DER's challenge
- Commissioning/Retro Commissioning Requirements defined

Team Work Necessary

GROUP EFFORT



MICROGRIDS AS HOSPITAL EPS

WHAT MICROGRIDS as EPS AT HOSPITALS MIGHT LOOK LIKE

Hybrid of on-site power producers

- Fuel Cells – V kw/hrs
- Batteries – W Kw/hrs
- PV's – X kw/hrs
- Gas Turbines – Y kw/hrs
- Generators – Z kw/hrs

Total run time = V+W+X+Y+Z kw/hrs

TODAY – MICROGRID PROJECTS

WHAT MICROGRIDS PROJECTS CAN BE DONE TODAY

SNF: 100% back-up approach.

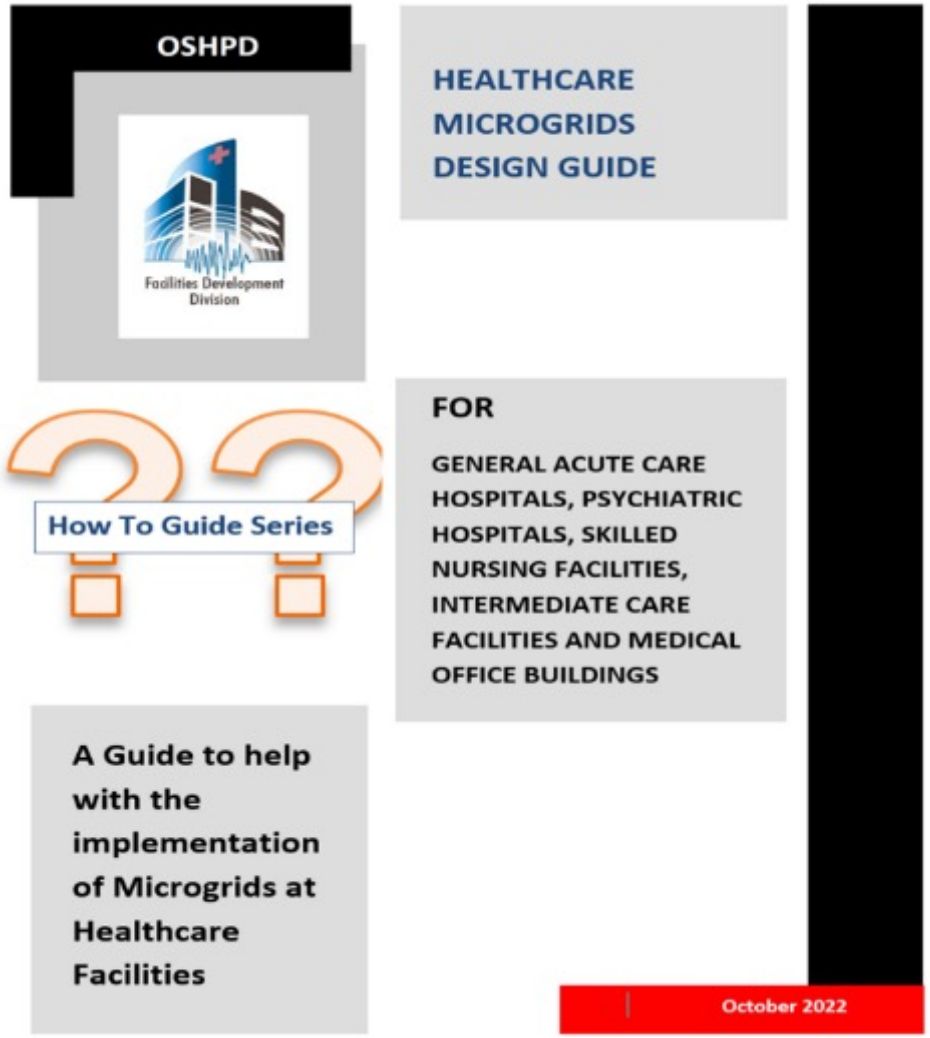
MOB: 100% back-up approach; Battery back-up systems.

Hospital:

- Reconfigure existing DER's as part of a new Microgrid (normal power).
- Look at HCAI review for all new DER projects (potential for EPS in future).
- Follow code updates – for Microgrid as EPS.

HCAI Resources

HOW TO HEALTHCARE MICROGRIDS DESIGN GUIDE



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HCAI Resources

UPCOMING MICROGRID PRESENTATIONS

Healthcare Facilities Symposium and Expo
September 27-29, 2022
Long Beach, California

HCAI Hospital Building Safety Board
Energy Conservation and Management Committee
October 4, 2022
Los Angeles, Sacramento, or Virtual

California Society of Healthcare Engineering (CSHE) Northern California
October 20, 2022
Fairfield, California

California Society for Healthcare Engineering, Inc.

OCTOBER 20, 2022

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Microgrid Development at Kaiser Permanente

Seth Baruch, National Director for Energy & Utilities

Santa Rosa, 2017

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Brief History of Microgrids at KP

- In 2017, KP worked with OSHPD to develop a project with DERs configured to support energy loads at the Richmond Medical Center. The project was funded through a $4.7 million grant from the California Energy Commission
- The project included 250 kW of on-site solar and a 1 MWH battery
- The solar/battery system was designed to be the “back-up to the back-up” – in case diesel generators failed during a power outage, a manual transfer switch could repath the DERs to provide enhanced resiliency to the hospital’s life/safety branch.
- Still very limited in application as the “second line of defense” although Richmond did spur interest at other KP facilities, particularly MOBs
- ***Now we are moving to the next stage of hospital microgrids in California at the Ontario Medical Center.***

Richmond Medical Center

Why Ontario Will Be Different

- ***It will be much larger*:** 2 MW of solar, 9.5 MWH battery
- Also CEC-grant funded but larger: approx. $8M
- The plan is to tie in an existing 1 MW fuel cell on the campus
- HCAI has worked collaboratively with the design team to assist and develop this novel approach.
- Code mandated emergency backup will be provided by existing diesel generators – microgrid will be configured to parallel with both normal and emergency power.
- During an extended power outage, only the generators required will operate, while the microgrid powers most of the emergency power needs.
- Ontario has four generators supporting around 75% of the hospital's total load. In most cases, we expect only one generator to be running at minimal load with the others shut down
- BUT all diesel generators are available whenever needed

Sequence of Operation

- Normal operating condition – everything is on-line solar/batteries/fuel-cells are at full output and Microgrid is paralleled with the utility service to supplement building load
- Normal power is interrupted
- Microgrid goes off-line
- Generators (EPS) start, parallel and pick up all hospital emergency loads
- After pre-determined delay Microgrid turns on, parallel to the emergency power bus
- Microgrid controller sequences the on-boarding of fuel cells/batteries/PV to parallel with EPS
- Paralleling switchgear evaluates load vs Microgrid contribution and shuts off generator(s) not needed
- If emergency power quality goes out of tolerance, the Microgrid will disconnect from EPS and generators will carry the entire emergency load.

CA Hospital Microgrid V.1: Richmond Configuration

Microgrid

Generators

1st line of defense

ATS 1	Critical Loads
ATS 2	Critical Loads
ATS 3	Critical Loads
ATS 4	Critical Loads
ATS 5	Critical Loads
ATS 6	**Life/Safety Branch**

Manual transfer switch

"Back-up to the Back-up"

CA Hospital Microgrid V.2: Ontario

Generators

Supplementary emergency power source parallels with generators

Microgrid

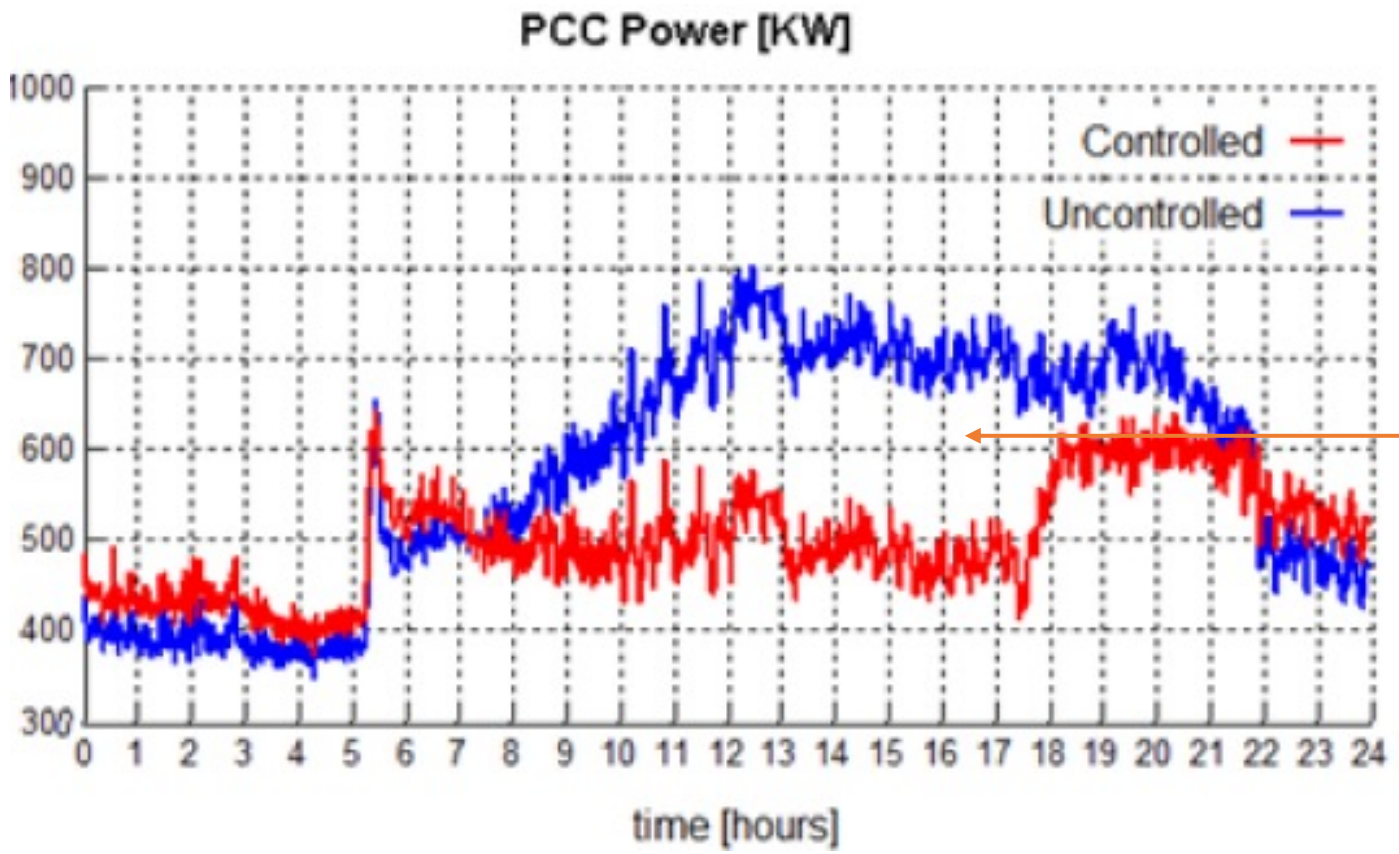
- ATS 1 — Critical Loads
- ATS 2 — Critical Loads
- ATS 3 — Critical Loads
- ATS 4 — Critical Loads
- ATS 5 — Critical Loads
- ATS 6 — Critical Loads


Microgrid
Site Plan
Battery Storage
Existing
Fuel Cells
Solar

Construction Photos

- Parking lot solar work continuing
  - Phase II install completed
  - Phase II landscaping
- Pond conversion for battery:
  - Trees removed
  - Excavation
  - Piping placed
  - Prepping for concrete

Other Benefits



Anticipated Savings

Peak Reduction

163 KW

The delta between the blue and red lines is saving Richmond tens of thousands of dollars per year in lower PG&E demand charges

Santa Rosa Microgrid

- Current Situation: The hospital campus has two MOBs with no backup generators. A major inconvenience during extended outages and PSPS events – procedures/appointments being rescheduled or even cancelled and not rescheduled.
- Technical Solution: Provide a 1+ MW islandable fuel cell (gas-powered) to provide primary power for the MOBs. (Note: the gas grid is generally more reliable than the electricity grid).

- Economic Summary:
  - Fuel cells will service hospital when low load at MOBs to avoid net metering.
  - $28,000 savings in Year One. Average $179,000 annual savings over 20 years; reflects the decline in fuel cell costs and the increase in utility rates (in part to pay for wildfire mitigation).
  - In addition, avoided capex related to resiliency equipment (UPS, generator, switchgear, etc.). One estimate puts this at $3 million.
- Environmental Impact:
  - Reduced SOX/NOX, equivalent GHG footprint compared to the grid
  - Potential to use Renewable NG in the future

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Future: It's the MOBs!

- Utility wildfire protection measures one of several resiliency drivers
- More and more facilities, particularly MOBs, are interested in backup because they want to continue to operate during longer-duration power outages (PSPS events)
- At least ten additional microgrids in the pipeline, including battery systems replacing diesel generators at MOBs
- Incorporating resiliency in the design standards: identify critical loads in design phase of new MOBs, ensure these loads are connected to one panel – make facilities ***"microgrid ready"***
- If KP can use renewables/fuel cells to displace – at least in part – diesel use, that could be replicable as most hospitals already have on-site solar and/or fuel cells

Microgrid Sizing Approach

<u>Solar + Storage</u> Powers ***small*** portion of facility load for a ***long*** period of time (Eg: Richmond Microgrid life safety branch and perhaps medical refrigeration)	<u>Solar + Storage + Fuel Cell/CHP</u> Power ***most*** of facility load for a ***long*** period of time (Eg: Full business continuity)
<u>UPS</u> Powers ***small*** portion of facility load for a ***short*** period of time	<u>UPS/Solar + Storage</u> Power ***most*** of facility load for a ***short*** period of time

Length of time in island mode

% of total facility's load

Facilities with critical loads in areas of high wildfire risk

Facilities with little critical loads in low-risk areas

Questions?