ENERGY RESILIENCY

Study Session - August 29, 2019

SAN JOSE CLEAN ENERGY

A Program of the City of San José

INTRODUCTION AND COUNCIL DIRECTION

- **On June 12, 2019:**
  - **The San José Rules and Open Government Committee directed Community Energy Department staff to hold a Council study session about the threat of PG&E de-energizing their transmission and distribution lines which serve the City.**

- **On June 25, 2019:**
  - **City Council adopted a resolution establishing principles to guide advocacy regarding the restructuring of California's electric power system to ensure the electric generation, transmission and distribution infrastructure serving the City of San José is safe, reliable, clean, and affordable.**

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OUTLINE

- Energy Availability Threat Assessment
- Local Control Analysis
- Grid Resiliency
- Municipalization
- Next Steps

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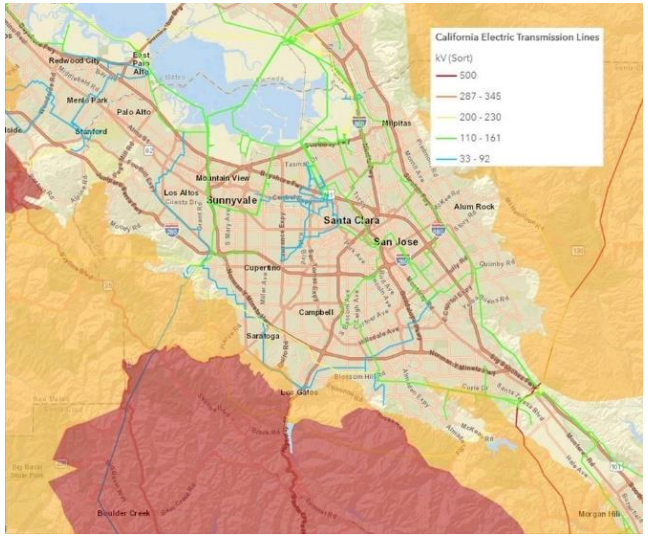
ENERGY AVAILABILITY THREAT ASSESSMENT

Understanding the Risks of the PG&E Public Safety Power Shutoff Program

PG&E DISTRIBUTION LINES FIRE RISK

- The California Public Utilities Commission (CPUC) authorized the Public Safety Power Shutoff program (PSPS) to allow PG&E to shut off distribution and transmission lines to prevent them from igniting wildfires.

- The most likely threat to San José is a de-energization of distribution lines, shutting off power to parts of the City.



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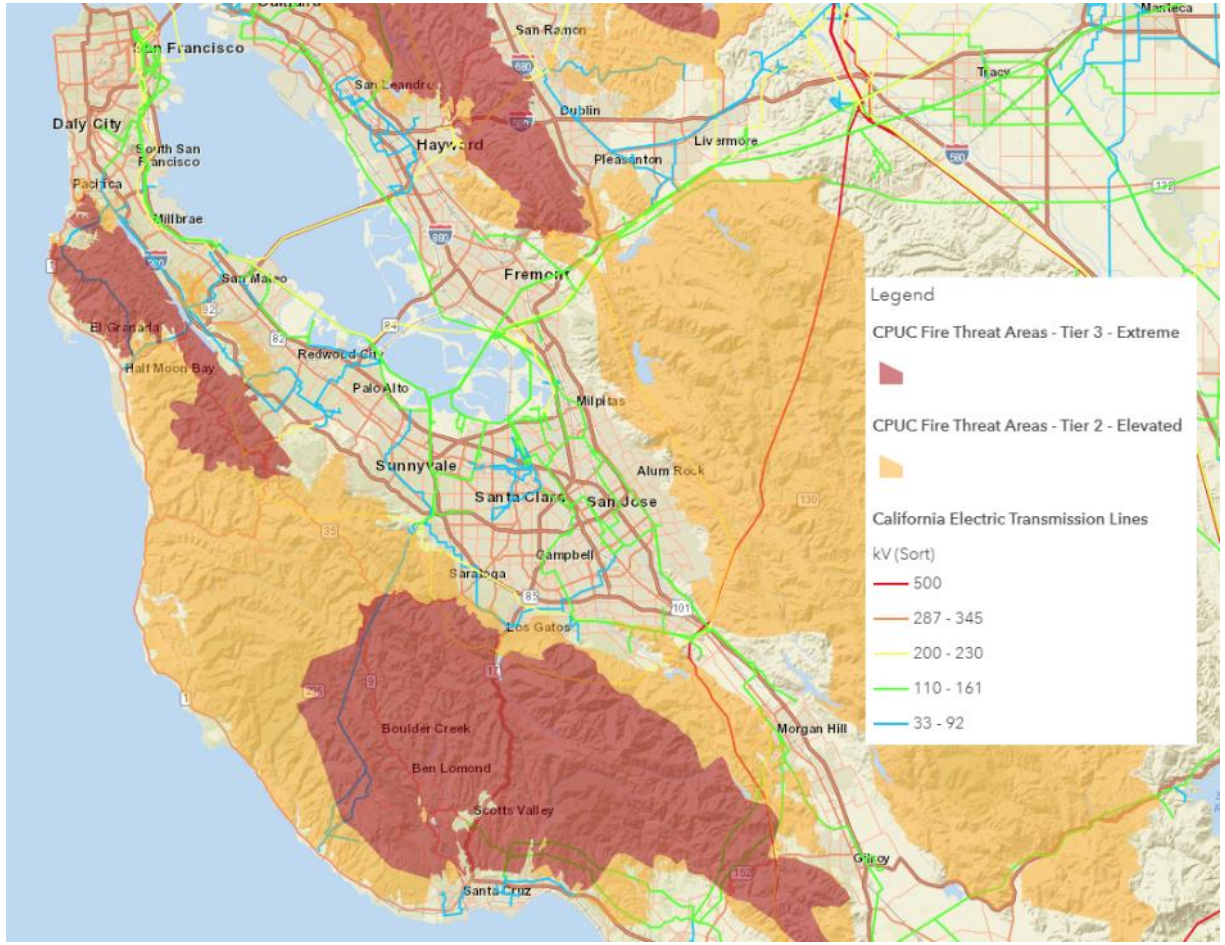
PG&E TRANSMISSION LINES FIRE RISK

- Transmission lines serving San José pass through High Fire Threat Districts (HFTD).

- PG&E may de-energize these lines, shutting off power to some or all of the City.



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EXPANDED RISK: CASCADING FAILURE

- PG&E's Wildfire Safety Plan calls out the risk of cascading blackouts during a PSPS event:

> "Thus, distribution lines far from HFTD areas that triggered the PSPS event, but which rely on the de-energized lines for power, such as lines in cities like San Francisco or San José, could be de-energized."

- City is engaging with PG&E and CAISO to minimize the risk of cascading failure

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LIFE SAFETY IMPACTS

- Electric wheelchairs and other devices put individuals with disabilities or limited mobility at risk
- Inability to power **life-supporting medical devices**
    - 7,365 PG&E registered "medical baseline" customers in San José
    - Likely many more unregistered
- Surgery and other operations compromised with hospitals on backup power
- Senior and other care facilities vulnerable
- Mobile home park metering issues

A 2003 blackout affecting US and Canada is estimated to have led to **100 deaths**

Source: Lights Out: Impact of the August 2003 power outage on mortality in New York, NY.

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LIFE SAFETY IMPACTS

- **Traffic controls** compromised
- **Security and video surveillance** systems down
- Lack of **refrigeration** for medicine, baby formula, food, etc.
- Limited **communications** with cell towers, internet access, and cell phone charging compromised
- Strains on **critical facilities** relying on backup power
- Risks from high heat weather conditions and **loss of air conditioning**
- **Air quality** issues

Photo: Dai Sugano, Bay Area News Group

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BACKUP GENERATION

- CPUC requires PG&E to provide emergency generators for critical facilities:

"The electric investor-owned utilities must help critical facility and critical infrastructure representatives assess the need for backup generation and determine whether additional equipment is needed, including providing generators to facilities or infrastructure that are not well prepared for a power shutoff."

-Decision 19-05-042, May 30, 2019

PG&E has not yet agreed to provide required backup generators to cooling centers and other critical facilities without backup power.

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ECONOMIC IMPACTS

- Lost productivity
- Commodity spoilage
- Supply chain disruptions and delays
- Increased staffing costs to local municipalities for police, firefighters, emergency services, etc.
- Medical costs
- Equipment and fuel costs for emergency backup generation

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ECONOMIC IMPACTS: EXAMPLES

2003 Northeast Blackout

- Impacted over **50 million customers** across eight states and Canada
- Lasted **~2 days**
- Estimated **$6 billion** economic impact

Source: Electricity Consumers Resource Council Report

2011 Southwest Blackout

- **1.5 million customers** in San Diego region
- Lasted **~12 hours**
- Estimated **$97-$118 million** economic loss to San Diego region

Source: NUS Institute for Policy Research Policy Brief

Investor Owned Utilities are recommending all Californians to prepare for 1-7 days without power.

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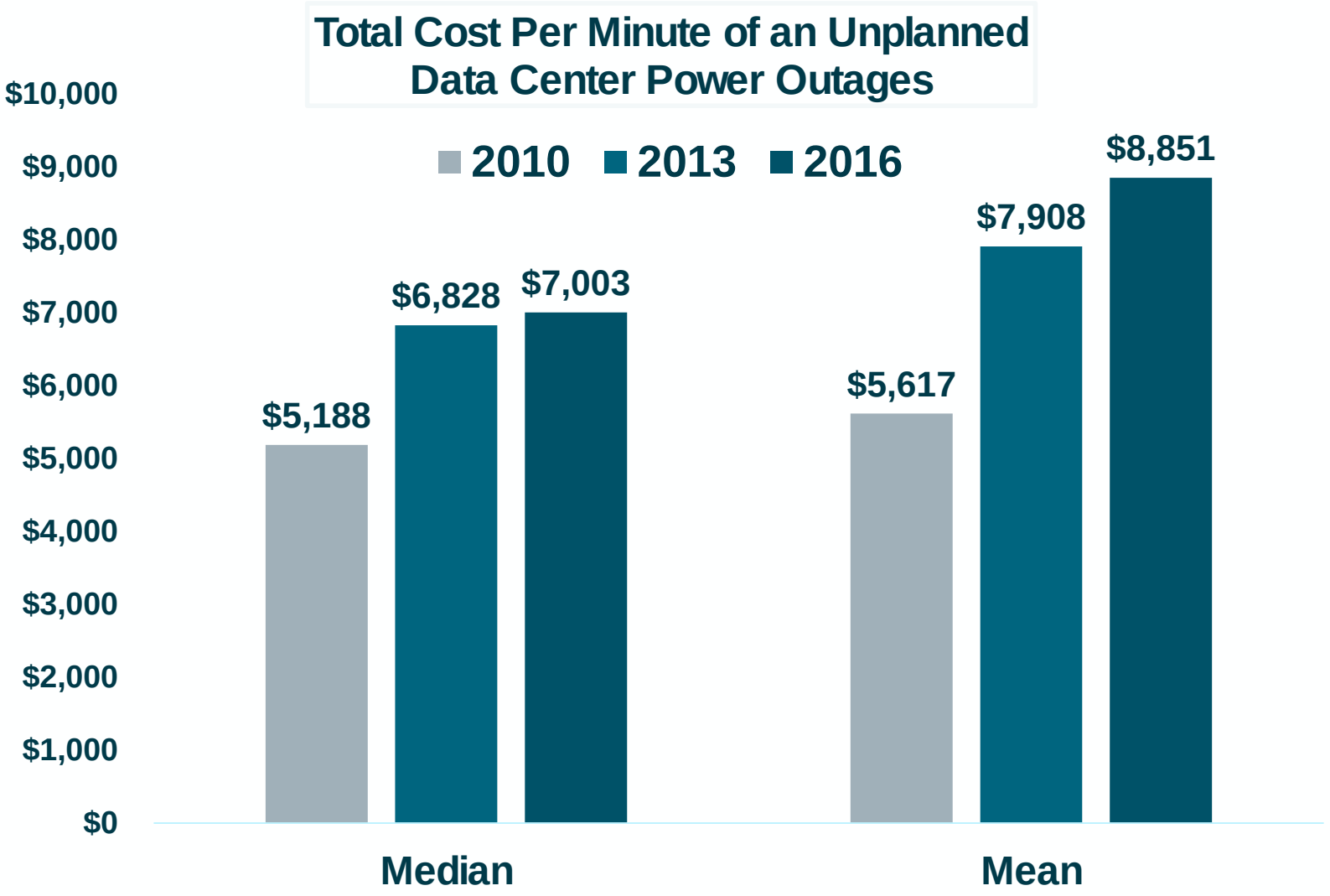
ECONOMIC IMPACTS: DATA CENTERS



- Data centers face high, increasing per minute costs from unplanned outages.
- San José's technology focused economy faces unique economic impacts.

Source: Ponemon Inst. 2016 "Costs of Data Center Outages"

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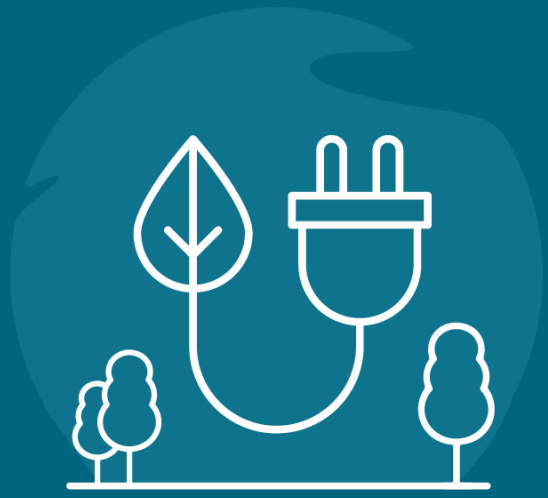
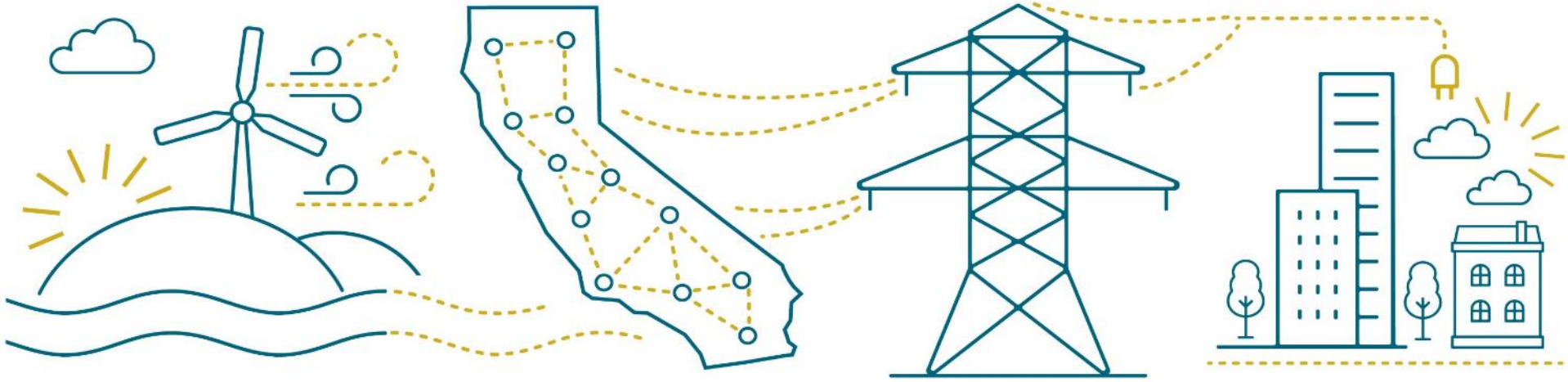


LOCAL CONTROL ANALYSIS

Understanding Public and Private Utilities

CURRENT STATUS



Generation	Transmission	Distribution
Pacific Gas and Electric Company	Pacific Gas and Electric Company	Pacific Gas and Electric Company
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SERVICE DIFFERENCES: IOU, CCA, AND POU

Investor-owned Utility (IOU) PG&E	Community Choice (CCA) SJCE	Publicly-owned Utility (POU) Santa Clara, Palo Alto, SMUD
IOU GENERATES, PURCHASES, AND SELLS POWER	CCA GENERATES, PURCHASES, AND SELLS POWER	POU GENERATES, PURCHASES, AND SELLS POWER
IOU OWNS AND MAINTAINS DISTRIBUTION LINES	IOU OWNS AND MAINTAINS DISTRIBUTION LINES	POU OWNS AND MAINTAINS DISTRIBUTION LINES
IOU PROVIDES BILLING SERVICE	IOU PROVIDES BILLING SERVICE	POU PROVIDES BILLING SERVICE
IOU PROVIDES CUSTOMER SERVICE AND CALL CENTER	CCA/IOU PROVIDE CUSTOMER SERVICE AND CALL CENTER	POU PROVIDES CUSTOMER SERVICE AND CALL CENTER

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IOU, POU, CCA DIFFERENCES

	Community Choice Aggregators (CCAs)	Publicly-Owned Utilities (POUs)	Investor-Owned Utilities (IOUs)
Number in California	19	40+	6
CA Total Generation	25%	25%	50%
CA Total Distribution	0%	25%	75%
Management	Non-profit, public Managed by locally elected or government appointed officials.	Non-profit, public Managed by locally elected officials or public employees.	For-profit, private Shareholder elected board appoints management team of private sector employees.
Rate Setting	CCA governing board or City Council	POU governing board or City Council	CPUC
Regulating Agency	California Energy Commission (CEC) and CPUC	CEC	CPUC

Sources: CalCCA, CMUA

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IOU, POU, CCA DIFFERENCES

	Community Choice Aggregators (CCAs)	Publicly-Owned Utilities (POUs)	Investor-Owned Utilities (IOUs)
Financing	Low-interest loans from member communities and financial institutions	Tax-free bonds and low-interest loans	Stockholders, the sale of bonds, and bank borrowing
Rate of Return	N/A	N/A	PG&E 2018 authorized rate of return: 10.25% PG&E requested rate of return: 14%
Profit/ Net Revenue	Rates are set to recover costs and earn additional return to invest in new facilities and fund local projects and programs.	Rates are set to recover costs and earn additional return to maintain bond ratings and invest in new facilities.	Rates are set to recover costs and earn a return as profits for investors.

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PUBLIC POWER IS MORE RELIABLE

Outage Duration	Public Power	National Average
Average	58 minutes	143 minutes
Median	40 minutes	126 minutes

PUBLIC POWER CUSTOMERS ON AVERAGE EXPERIENCE LESS THAN ONE HOUR WITHOUT POWER PER YEAR…

LESS THAN HALF OF THE NATIONAL AVERAGE.

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PUBLIC POWER IS LESS EXPENSIVE

California Municipalities	Residential Rates Compared to PG&E	Non-Residential Rates Compared to PG&E
Silicon Valley Power (City of Santa Clara)	48% Lower	26%-38% Lower
Sacramento Municipal Utility District	33% Lower	31.1%-47.6% Lower
Alameda Municipal Power	14.9%-31.5% Lower	11.3%-18.9% Lower
Los Angeles Department of Water and Power	31% Lower	7-27% Lower

Sources:
Silicon Valley Power, Sacramento Municipal Utility District, Alameda, LADWP 1, 2

	CA Public Power Costs vs IOUs (2017)
Residential rates	17.4% lower
Commercial rates	14.7% lower

Source: American Public Power Association

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HOW IS PUBLIC POWER LESS EXPENSIVE?

- Municipalities have a lower cost of capital and can leverage tax-exempt debt to finance system upgrades
- No dividend payments
- Lower executive pay
- Effective public oversight can create pressure for cost efficiencies

PG&E Return on Equity (2018)
10.25%

PG&E Requested Return
14%

Average Municipal Bond Yield
~3% - 5%

Sources: CPUC, PG&E

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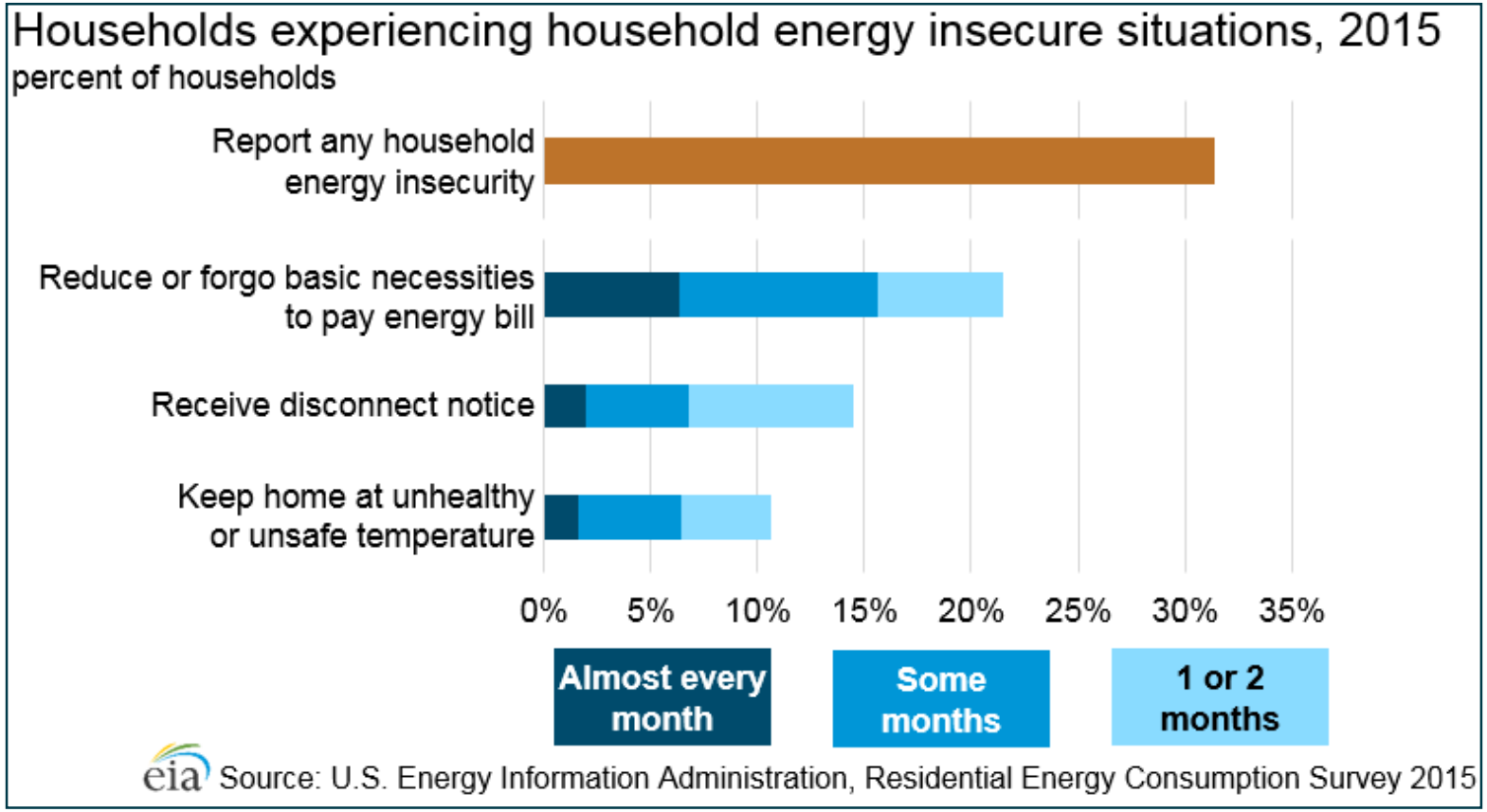
ENERGY AFFORDABILITY AND EQUITY

- One in three households in the U.S. face challenges in paying energy bills

- Financial resources limit ability to prepare for and recover from a loss of power



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LOW INCOME RESIDENTS

- CARE – 200% of Federal poverty guidelines, qualify for 30% rate discount
- San José – 80% of Area Median Income, no discount available

Example guideline	CARE (Federal)	City of San José
Annual income limit (example: household of 3)	<$42,660	<$85,050
Percent of San Jose households	20.6%	35.5-40%

~300,000-400,000 San José residents are low income and are economically vulnerable to sudden PG&E PSPS events.

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AFFORDABILITY AND EQUITY CHALLENGES

- Cost of spoiled food or medicine is more challenging for low-income residents
- Low-income residents are less likely to be able to afford backup generation
- Communications during PSPS events will be harder for Non-English speaking residents
- Disabled populations are especially vulnerable to power disruptions
    - Mobility issues with electric wheelchairs, chair lifts, elevators, lack of public transit, etc.

CA State Senate Hearing on De-Energization (August 14, 2019)

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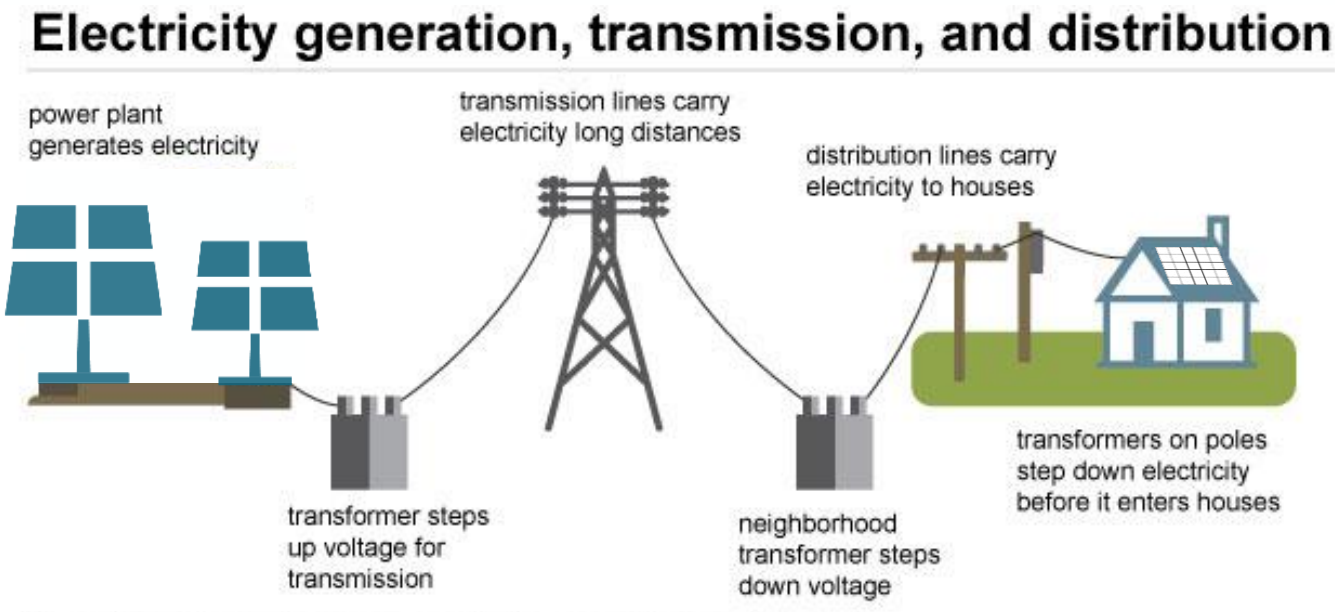
GRID RESILIENCY

LEVELS OF GRID INFRASTRUCTURE



Transmission

- High voltage wires carrying power across large areas
- Connects remote, centralized generation sources to load centers

Distribution

- Low voltage wires connecting buildings and homes

Onsite

- Generation located on premise

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DEFINITION OF RESILIENCY

- The Federal Energy Regulatory Commission (“FERC”) offers an understanding of resilience to mean:

  “The ability to withstand and reduce the magnitude and/or duration of disruptive events, which includes the capability to anticipate, absorb, adapt to, and/or rapidly recover from such an event.”

Photo: Mike Eliason/Associated Press 2017

Photo: Josie Lepe, Bay Area News Group

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ONSITE BACKUP INFRASTRUCTURE

Generators

- Burn fuel to generate electricity
- Produce emissions

Fuel cells

- Convert natural gas or hydrogen into electricity
- Natural gas fuel cells produce GHG emissions factors often higher than “grid electricity”

Solar + Battery storage

- Becoming a more common solution as prices fall
- Can help customers reduce utility costs, provide additional revenue streams, and meet sustainability goals

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DISTRIBUTION LEVEL INFRASTRUCTURE

- Transformers and electrical lines that receive power from transmission lines and lower the voltage to connect to buildings and homes
- Microgrids are sections of distribution infrastructure that can “island” and continue to operate when the grid loses power, usually with energy storage and local generation resources
- Only utilities can operate distribution infrastructure to serve customers or cross public right of ways

Photo: Maritza Cruz/ Bay Area News Group

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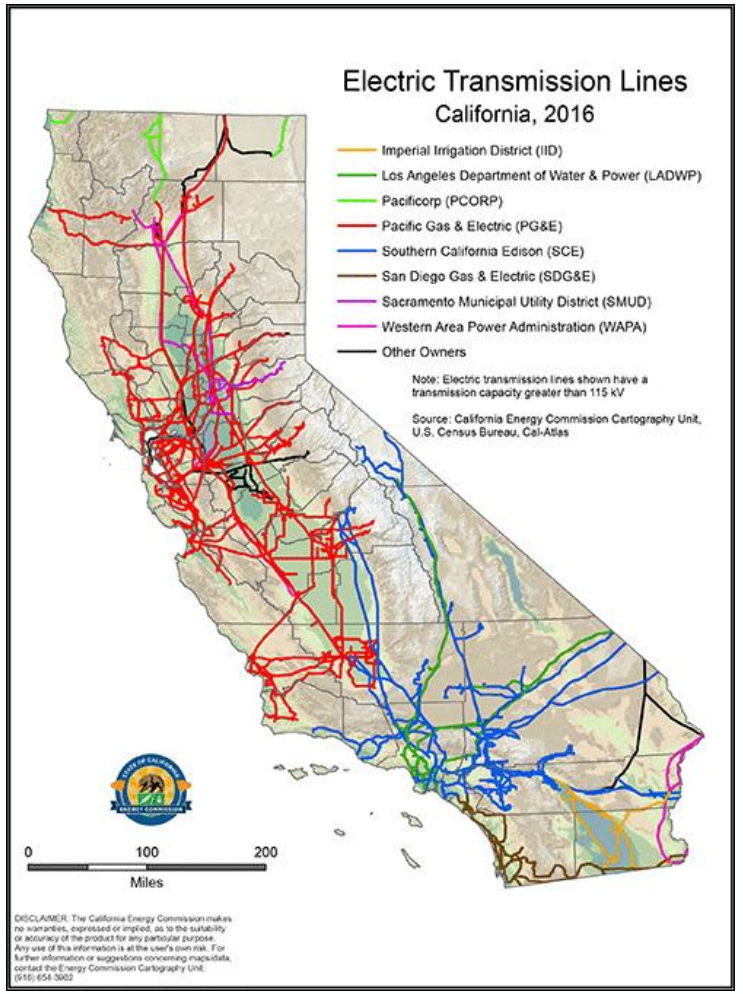
TRANSMISSION LEVEL INFRASTRUCTURE

- Primarily owned by the IOUs
  - Allows power to travel over large service territories
  - PG&E has largest CA network due to its service territory
- Transmission network operated by the CA Independent System Operator (CAISO)
- CAISO studying transmission infrastructure to evaluate potential PSPS scenarios
  - Goal of minimizing risk and impacts
  - SJCE staff is engaging CAISO and other third-parties on this process



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BATTERY ENERGY STORAGE

- Technologies that store energy and release it later in a usable form
- Customers can use battery storage to reduce peak demand charges and manage Time of Use costs
- Can also be deployed as large utility-scale installations

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BATTERY ENERGY STORAGE: “DUCK CURVE”

- Solar production depresses net demand during the day
- As the sun sets there is a sharp ramp in demand in the evening
- California has largely managed this sharp demand ramp through polluting natural gas fired peaker plants
- Battery storage and other energy resiliency solutions can shift solar production to meet that rise in demand and smooth out the “duck-curve”

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BENEFITS OF STORAGE

- Improved power quality and reliable delivery of electricity
- Improved stability and reliability of transmission and distribution systems
- Improved availability and increased market value of distributed generation sources
- Improved value of renewable energy generation

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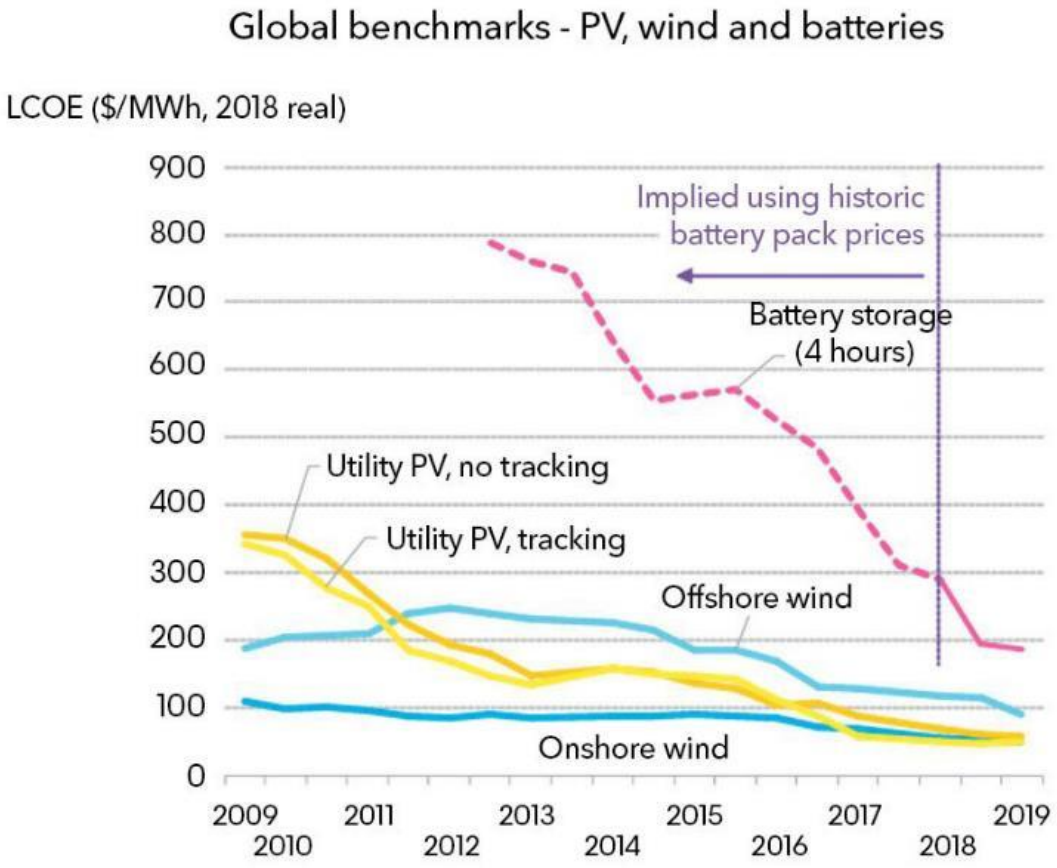
FALLING COSTS OF BATTERIES

- As battery costs improve, they become more viable for backup power, especially paired with renewable generation.
- The Levelized Cost of Energy (LCOE) of battery storage dropped 35% since the first half of 2018.
- Since 2012, the LCOE of batteries to supply four hours of grid power has fallen by 76%.



Source: BloombergNEF. Note: The global benchmark is a country weighed-average using the latest annual capacity additions. The storage LCOE is reflective of a utility-scale Li-ion battery storage system running at a daily cycle and includes charging costs assumed to be 60% of whole sale base power price in each country.

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EXAMPLE: MOSS LANDING

- CPUC approved PG&E's proposal to build the world's largest battery storage system in Moss Landing (Monterey County): 567.5 MW or 2,270 MWh

- Replaces an aging natural gas plant

- SJCE is considering opportunities to integrate storage with natural gas plants to meet our own Resource Adequacy needs and control costs

Moss Landing Dynegy Plant

Tesla "Megapack"

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MICROGRIDS: DEFINITION

"A group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid. A microgrid can connect and disconnect from the grid to enable it to operate in both grid-connected or 'island' mode."

-U.S. DOE Microgrid Exchange Group

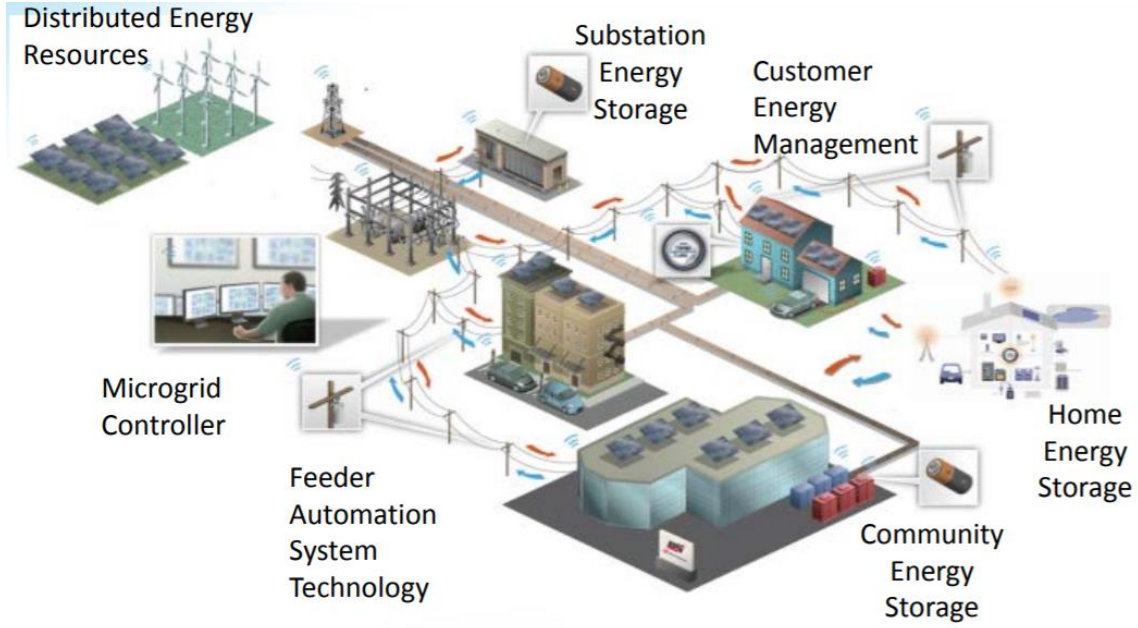

Photo SDG&E

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BENEFITS OF MICROGRIDS

1. Enable grid modernization and integration of Smart Grid technologies

2. Allow for more distributed and renewable energy sources

3. Ensure energy supply for critical loads

4. Support the “macrogrid” by handling the variability of renewables locally and supplying ancillary services

-U.S. DOE Microgrid Initiative

Blue Lake Rancheria microgrid

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FUNDING FOR MICROGRIDS

- California Energy Commission has given to date $84.5 million to build 20 new microgrids through ratepayer-funded Electric Program Investment Charge (EPIC) program.
- Projects focus on two use cases:
    1. Ensuring low-carbon power delivery at critical facilities
    2. Supporting a high penetration of renewables

Las Positas Community College Microgrid

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BORREGO SPRINGS MICROGRID

- Proof-of-concept test as to how information technologies and distributed energy resources can increase utility asset utilization and reliability

- Combination of utility and privately owned resources, including 125 residential storage systems

Photo: Borrego Microgrid [San Diego Gas & Electric Company]

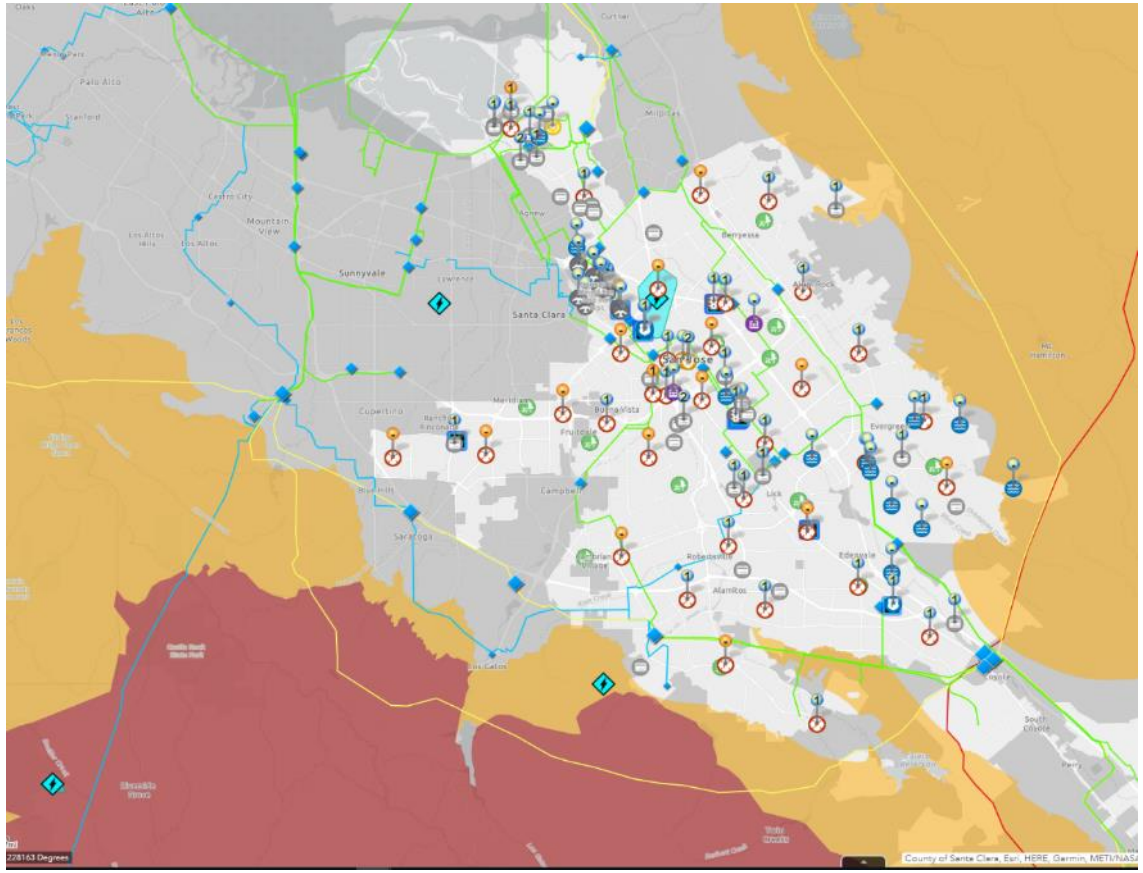
ENERGY RESILIENCY: CITY FACILITIES

CITY CRITICAL FACILITIES

- 129 out of 400 City facilities identified as critical
- A critical facility “Provides services and functions essential to a community, especially during and after a disaster”

  -Federal Emergency Management Agency

  - Examples include public safety service facilities, emergency operations centers, shelters and evacuation centers, drinking water facilities and wastewater treatment plants



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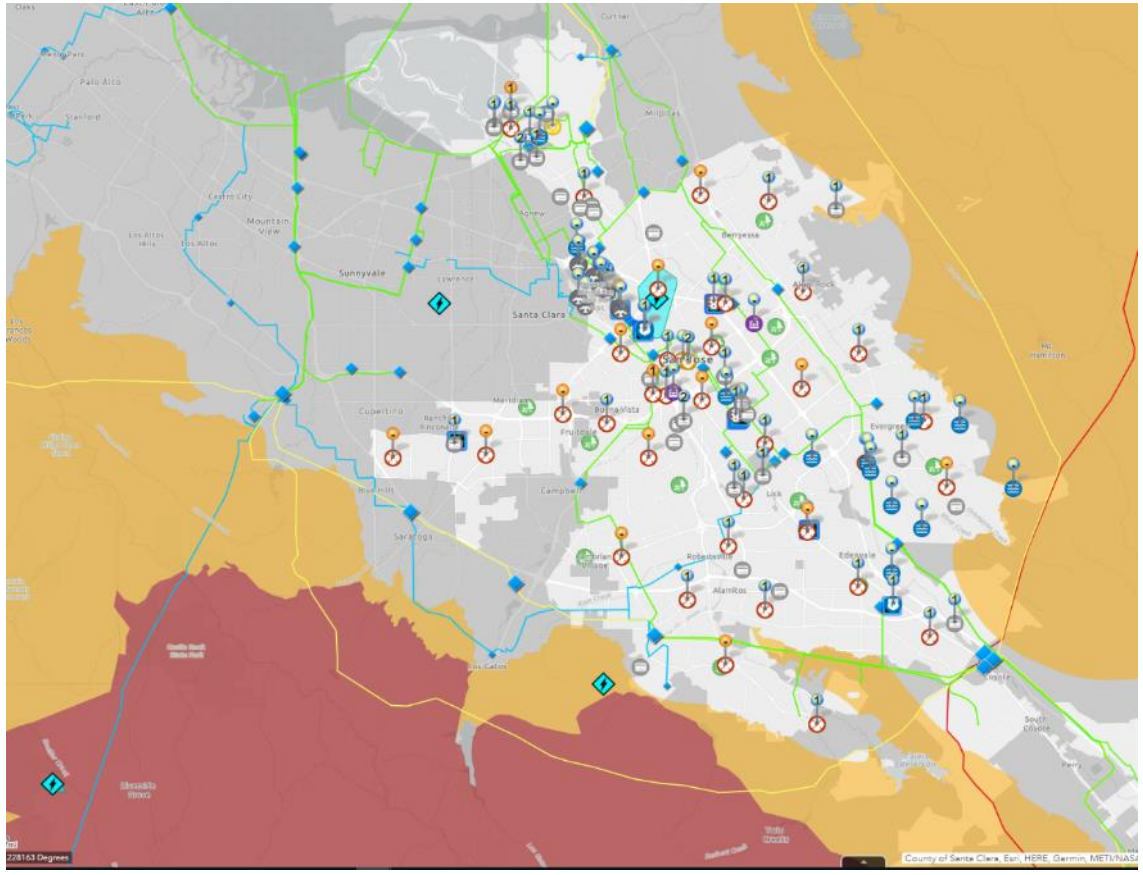
CITY CRITICAL FACILITIES: STATUS

- 97/129 City owned critical facilities have backup generators:
  - Airport, City Hall, Wastewater, municipal water, corporation yards, radio communications, and many fire stations
- 32 do not have backup generation:
  - 11 warming/cooling centers, 5 sanitary pump stations, 2 animal care facilities, and 14 fire stations



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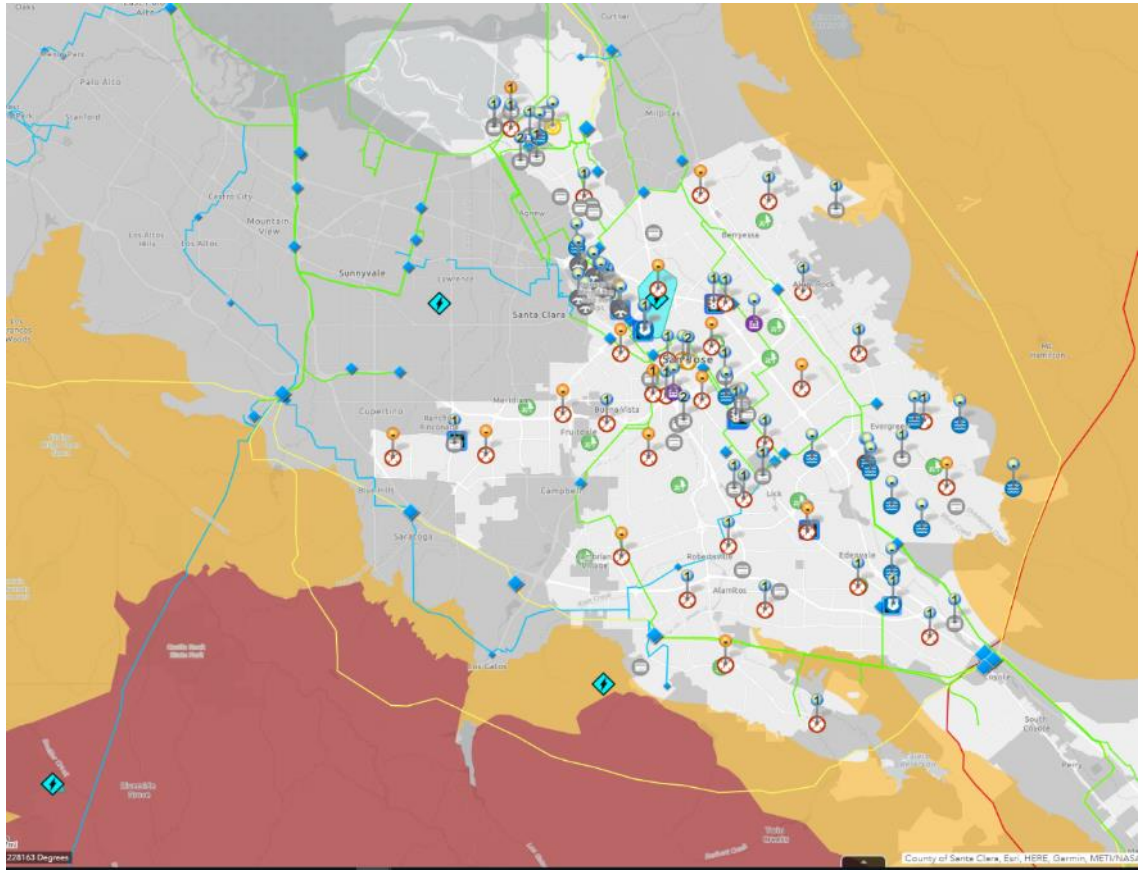
CITY CRITICAL FACILITIES: BACKUP COSTS

- For each critical site **without** backup generation:
  - $175,000 for "service kit" with portable generators, mobile AC, lights
  - $1 million for permanent emergency backup generator
- Total cost to back up 32 remaining critical facilities is:
  - $5.2 million (portable generators) to
  - $14.3 million (permanent backup)
  - Permanent renewable (solar + storage) options estimated at $15 million to $25 million



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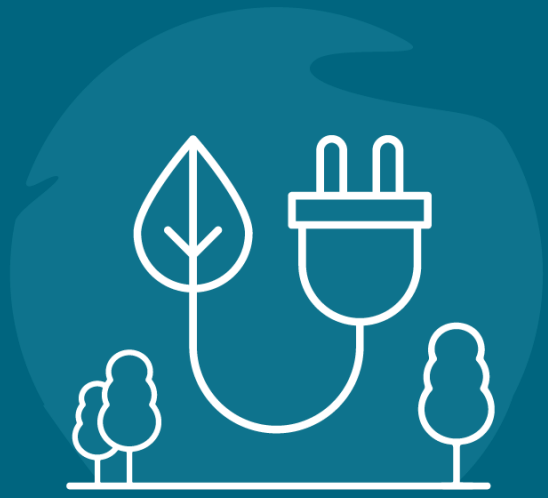


MUNICIPALIZATION

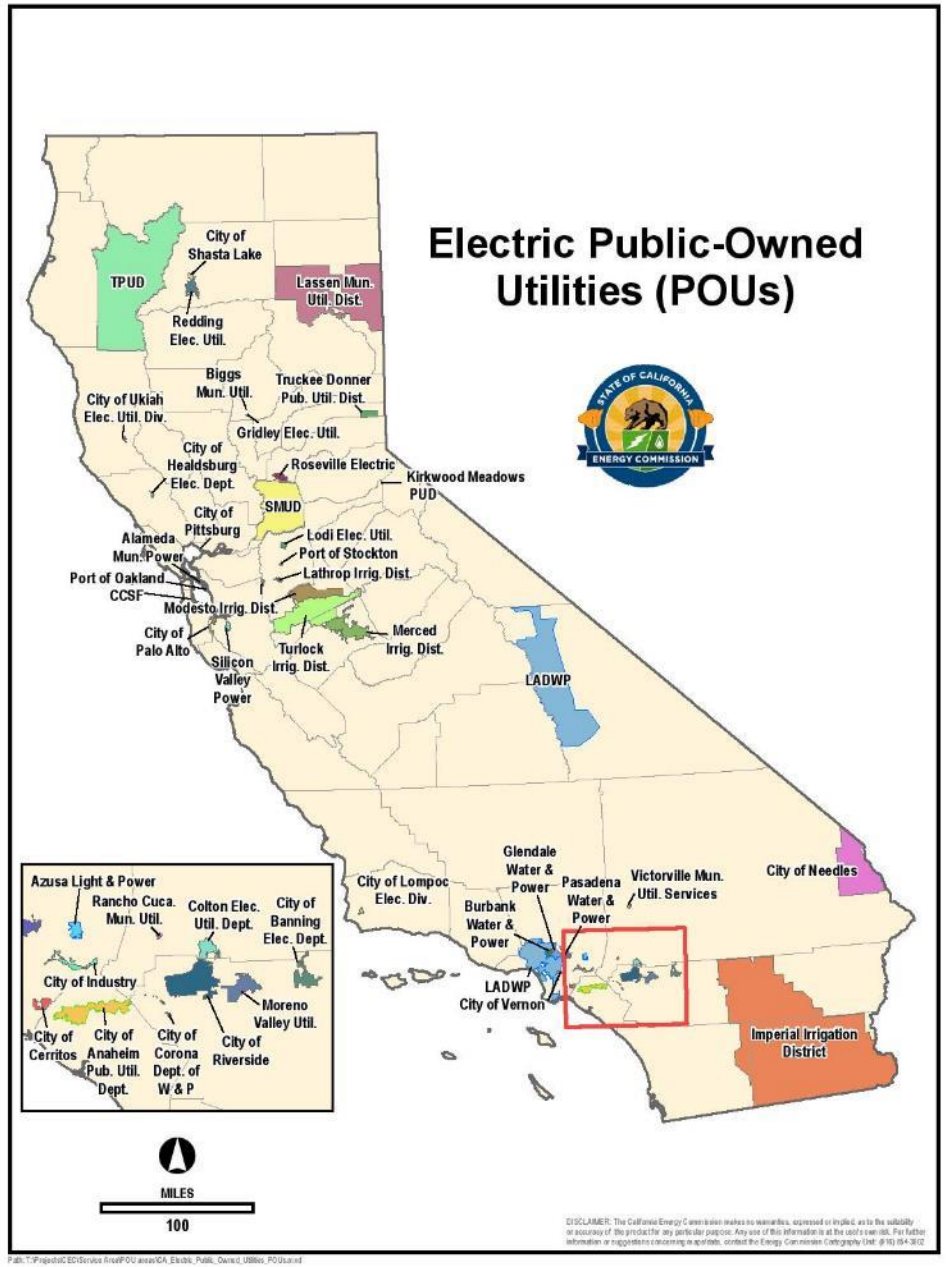
HISTORY OF CA MUNI'S

- 46 Publicly Owned Utilities (POU) in California
- 50% of total generation in CA is supplied by a POU or CCA
- POUs consistently have lower retail rates than the Investor Owned Utilities

Sources: California Energy Commission list of POUs

CPUC 2018 RPS Annual Report to Legislature

CalCCA



Source: California Energy Commission

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MUNICIPAL UTILITY MODELS

Departmental Model

- Municipal utility reports to City Council
- Santa Clara, Alameda, Palo Alto

Municipal Utility District

- Independently elected Board
- Serves more than one city
- SMUD

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MUNICIPAL UTILITY MODELS

Targeted Municipalization	Full Municipalization
• Partial control of select distribution systems • Incremental • Fewer regulatory hurdles	• Complete control of the city's full distribution infrastructure • Longer term strategy • Challenges to implement

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IMPACT ON RESILIENCY

- Forming a municipal utility allows the City to:
  - Own distribution infrastructure and increase autonomy
  - Potentially mitigate wildfire and extreme weather risk by making investments in hardening electricity infrastructure
  - Invest in larger scale microgrids
  - Must be balanced with operational readiness: staffing appropriately, operating and maintaining infrastructure, billing and customer service

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CONTEMPORARY EFFORTS AT MUNICIPALIZATION

CASE STUDY: SACRAMENTO MUNICIPAL UTILITY DISTRICT (SMUD)

- In 1923, citizens voted to create SMUD as a community-owned, not-for-profit electric service. PG&E strongly opposed the sale of its distribution system.
- Years of court filings, engineering studies, elections and political battles halted the purchase
- March 1946, CA Supreme Court denied PG&E's final attempt to thwart the sale
- During the municipalization process, the PG&E distribution infrastructure had not been properly maintained and a backlog of 3,000 customers were waiting for interconnection.

Source: SMUD


SACRAMENTO BEE

AMENTO, CAL., TUESDAY EVENING, JULY 3, 1923—18 PAGES

Electric Power District Created; Citizens' Club Director Ticket Wins

City Of Sacramento And Adjacent Territory Take First Step To Get Municipally Owned Electricity; Leonard, Jones, Elkus, Mc-Laughlin, Herndon Make Clean Sweep

MEACHAM'S FIFTY RESIDENTS HOSTS TO THE PRESIDENT

Littlest Town At Which He Has Made Stop On Tour Has Executive With It For One Of His Very Biggest Days

OREGON TRAIL FETE DRAWS PARTY THERE

President Pays Tribute To Pioneers Of Old West, In Speech

CASE STUDY: DAVIS

- 2006: Yolo County votes on measure to municipalize and join SMUD
- PG&E spends $11M in Yolo County to prevent a yes vote
  - SMUD, a non-profit and government agency, cannot spend funds on campaigns
  - Vote fails
- 2014: Davis studies municipalization
  - PG&E: "Our electric distribution facilities are not for sale"
  - PG&E and Davis value PG&E infrastructure differently

Source: Utility Dive

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CASE STUDY: SAN FRANCISCO

- SF voters consistently rejected ballot measures that proposed various methods of municipalizing city power:
  - Purchasing PG&E's distribution system in SF appeared on the ballot in 1930, 1937, 1939, and 1941.
  - A feasibility study was rejected in 1982
  - In 2001, voters rejected a proposition to create a municipal utility district.
  - In 2001 and 2002, voters rejected propositions to allow the issuance of revenue bonds to reconstruct or replace power facilities
- On June 5, 2018 San Francisco voters approved Proposition A (77.2% YES) revenue bonds for facilities needed to produce and deliver clean power.

Sources: SPUR, Ballotpedia

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APPA: GENERAL STEPS TO MUNICIPALIZE

1. **Legal Issues and Negotiation Strategy**

   Determine legal hurdles and pathway for sale

2. **Conduct Feasibility Studies; Determine Value**

   Determine economic viability and appraise value of infrastructure

3. **Pass a Referendum**

   Initiate public information campaigns in support of passing a ballot measure

4. **Issue a Revenue Bond**

   Once authorized, issue a bond to finance the purchasing of distribution assets

5. **Prepare for Operations**

   Construct facilities, purchase equipment, hire staff, and develop organizational plan to begin operations

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NEXT STEPS

NEXT STEPS

- Advocate for funding from PG&E and State to provide backup for balance of critical facilities
- Engage with legislature and Governor’s office for more regulatory oversight over the PSPS program and improving viability of municipalization option
- Evaluate options to install microgrid(s) to improve resiliency
- Continue to incorporate storage into SJCE resource portfolio mix
- Develop rates and outreach to incentivize customers to install onsite solar with batteries and reduce evening usage, improve resiliency and advance the City’s Climate Smart goals

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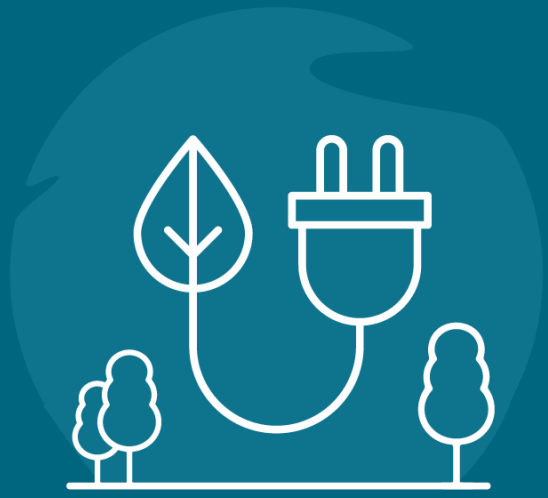

QUESTIONS AND DISCUSSION