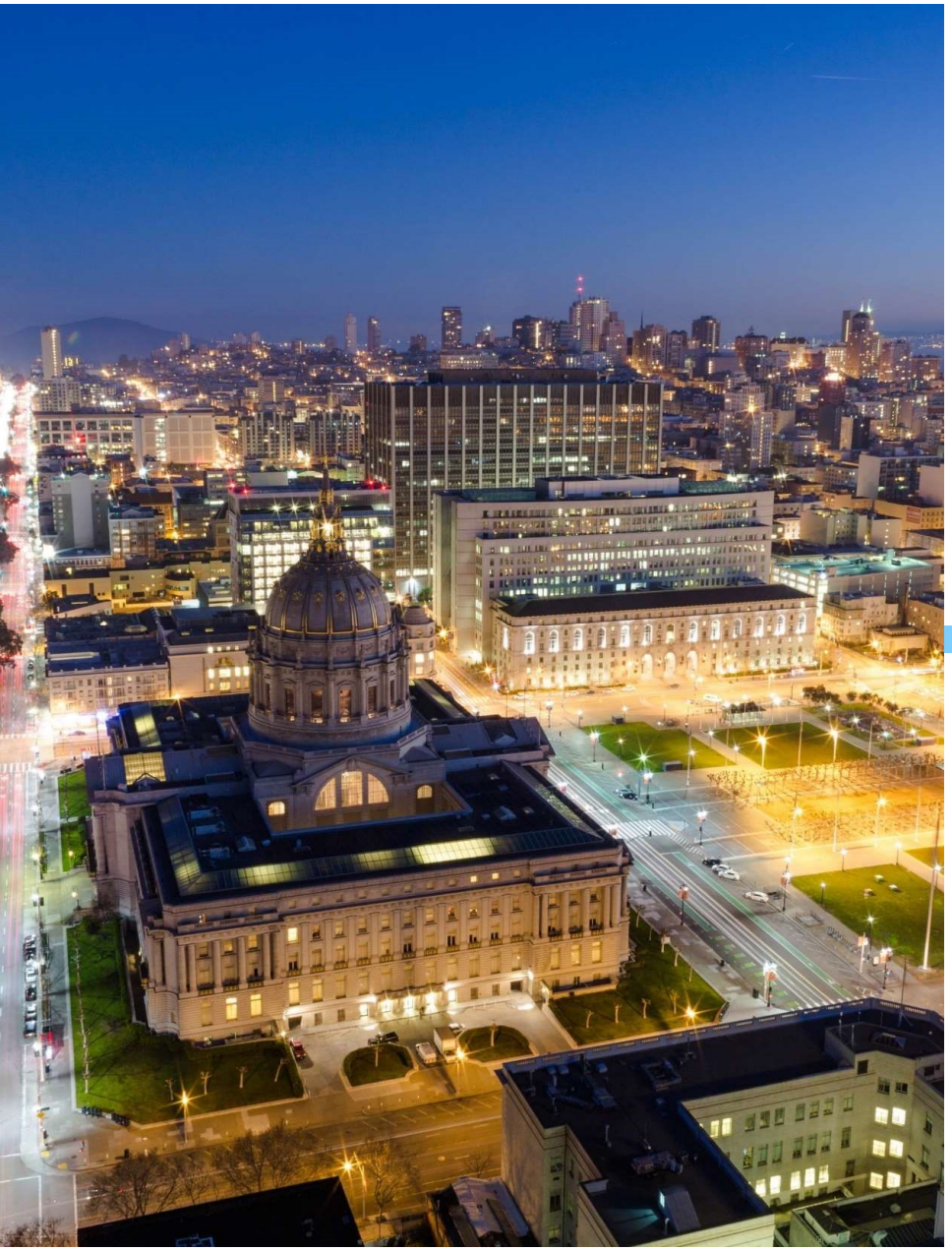

ENERGY RESILIENCE IN SAN FRANCISCO

APEC Energy Resilience Workshop

Brian Strong, Chief Resilience Officer
City and County of San Francisco

November 9, 2023

ONESF
Building Our Future

Office of Resilience and Capital Planning

A PLACE WHERE PEOPLE ARE RESILIENT AND THRIVE

Clean & Healthy Environments

Healthy Food Access

Healthy Public Facilities

Safe, Healthy & Affordable Homes

Physical Activity

Racial Equity & Empowered Neighborhoods

Climate Resilience & Justice

Equitable & Green Jobs

Source: Pxfuel, NextCity, Next Republic Bank, Vivien Kim Thorp, Archityreview, RWJF, SF Environment, SFGate

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Energy Resilience

Overview

- Critical to Citywide Resilience
  - Cities are on the Forefront
  - Climate Change is Making it Worse
  - Key to Disaster Recovery
- Complex Energy Framework
  - Government & Regulatory Environment
  - Managing Demand
  - Energy Grid, Sources & Transmission
- Opportunities & Challenges
  - Clean Transition and Energy Mix
  - Managing Demand
  - Alternatives Comparison
  - Funding

RESILIENT CITIES NETWORK

ENERGY RESILIENCE

Far too many people live without access to modern, affordable, reliable, and abundant power. Lack of power blocks their path to prosperity.

By investing in energy resilience cities can enable a climate-focused energy transition, bolster their local economies, create green jobs and improve quality of life for their most vulnerable urban residents.

Ending energy poverty is the key to global development and a vital component of urban resilience.

RESILIENT CITIES NETWORK

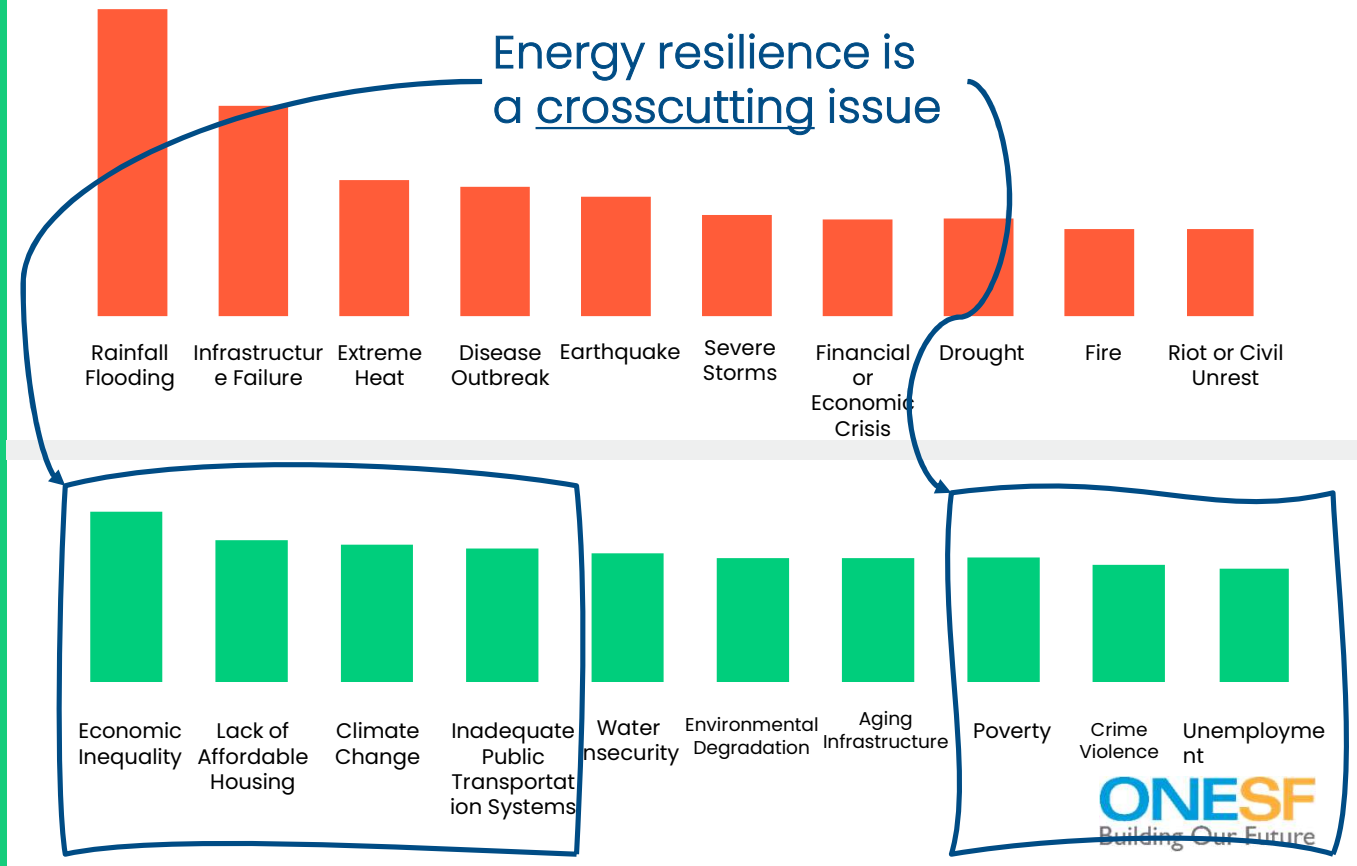
RESILIENT CITIES NETWORK

Cities face a common reality multiple shocks and stresses at the same time

Our network cities are actively responding, building knowledge through experience and harnessing their power to effect change.

RESILIENT CITIES NETWORK

Most common shocks and stresses



Energy Resilience

CHANGES IN THE GLOBAL CLIMATE INCREASE THE SEVERITY OF LOCAL HAZARDS			
	INCREASING TEMPERATURES	RISING SEA LEVELS	CHANGING PRECIPITATION PATTERNS
Extreme Heat	●		
Drought	●		●
Wildfire & Wildland-Urban-Interface Fire	●		●
Poor Air Quality	●		
Coastal Flooding		●	
Stormwater Flooding		●	●
Soil Liquefaction in an Earthquake		●	

Energy Resilience

Lifelines Restoration Performance Project

- How would we like lifelines to perform in an earthquake?
- How would lifelines perform if an earthquake happened today?
- What actions are needed to close the gap?

Report available at: onesanfrancisco.org/lifelines-program

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Energy Resilience -- Lifeline Interdependencies

None	No reliance on sector
Low	Minimal reliance on sector
Moderate	Large reliance on sector with significant backup available, or moderate reliance on sector with no back up available
Significant	Large reliance on sector with limited backup available

Reading the matrix across each row shows which sectors a particular sector relies on. For example, electric power has a significant reliance on natural gas, but a low reliance on the Port.

Reading the matrix down each column shows which sectors rely on the designated sector. For example, all systems, except for EFWS have a significant dependence on electric power.

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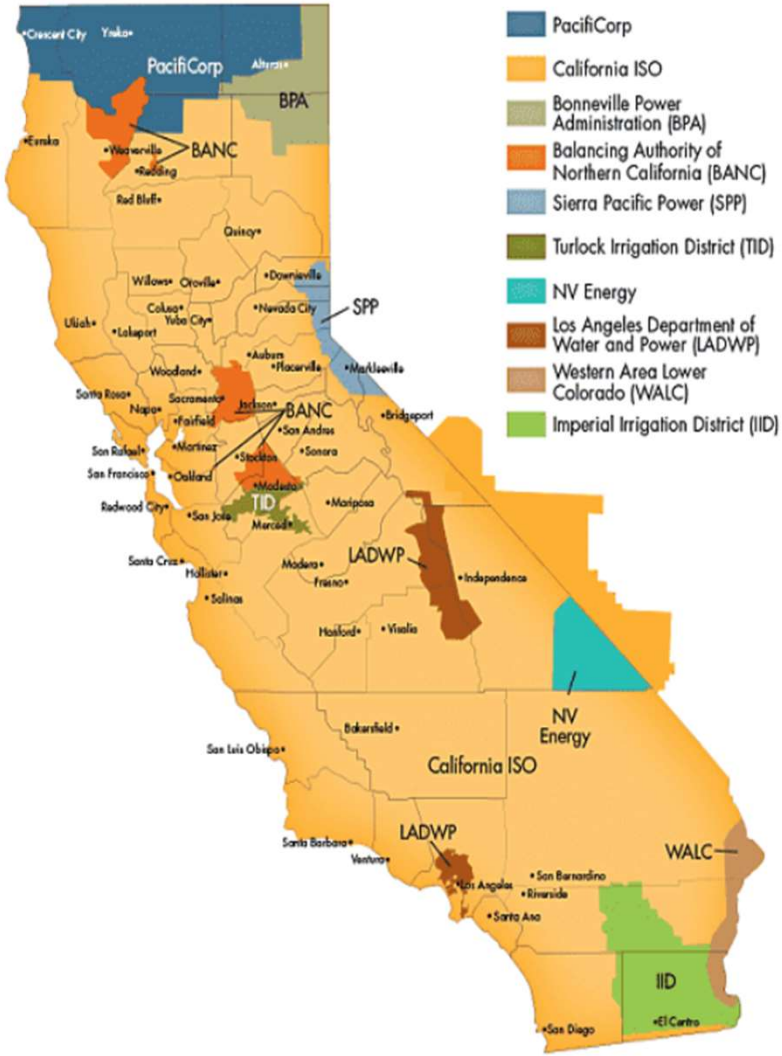
Energy Framework

California's Electric Grid



- California has one of the most advanced electric grids in the world
- The energy mix on the grid consists principally of natural gas, nuclear, geothermal, hydropower, solar and wind
- Solar and wind met 30% of California's power needs in 2022

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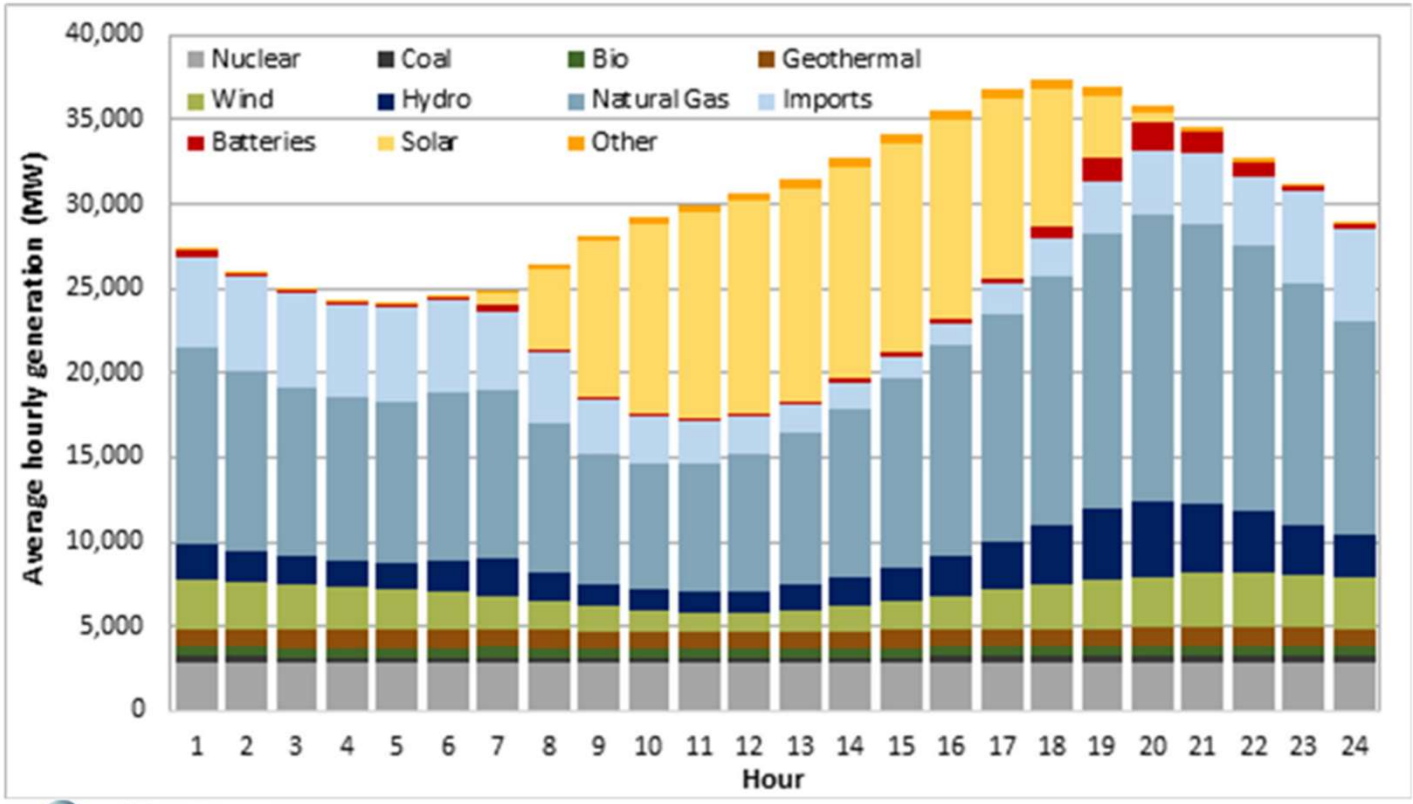
Energy Framework

Diverse Sources – Managing Demand



California ISO

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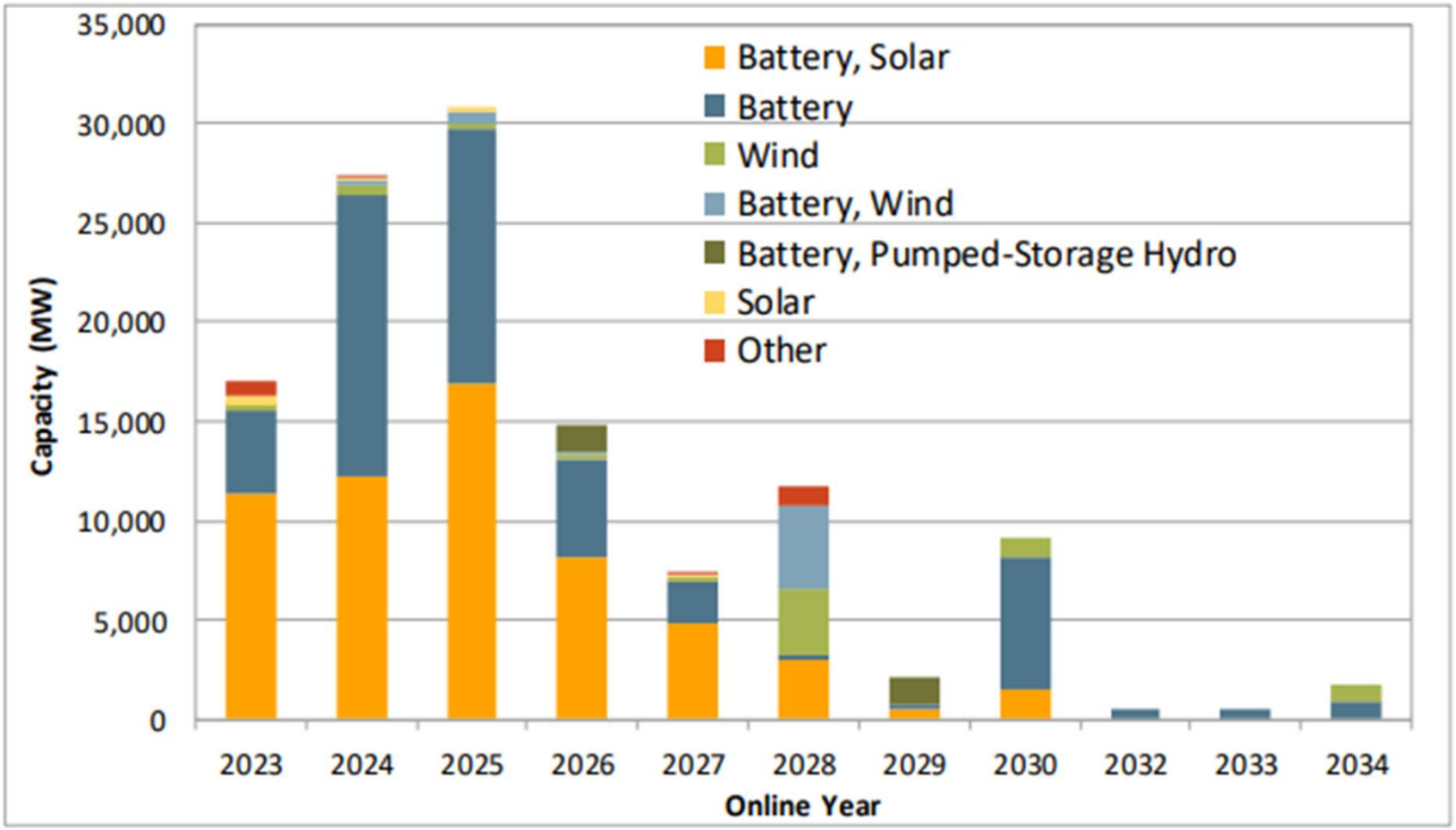
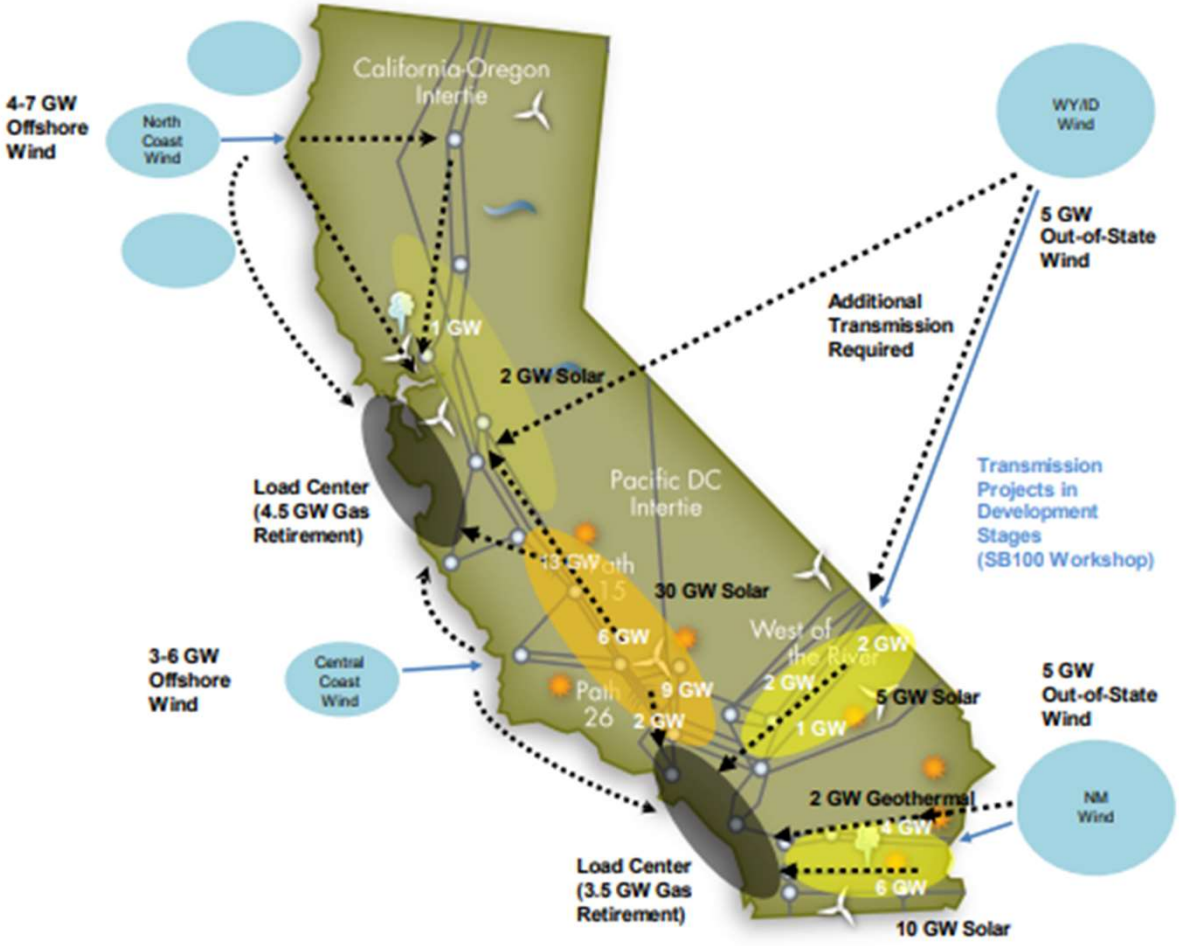
Energy Framework

New Capacity



Energy Framework

Transmission Capacity



Source: CAISO

CleanPowerSF

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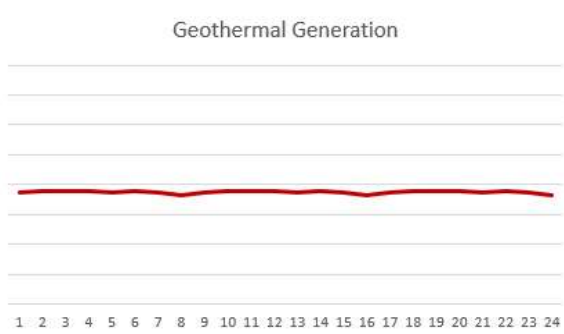
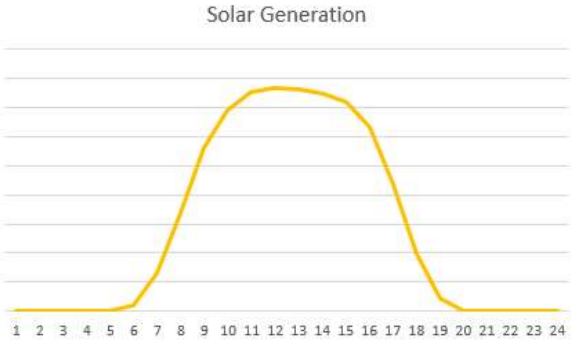
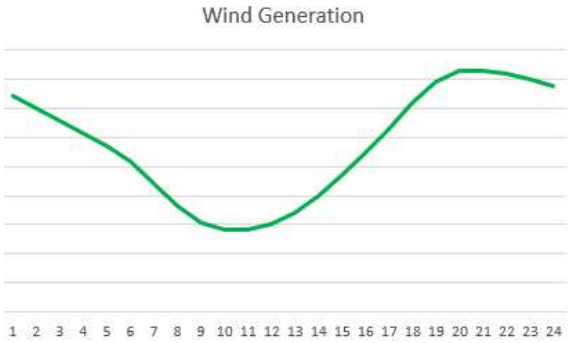
Energy Opportunities

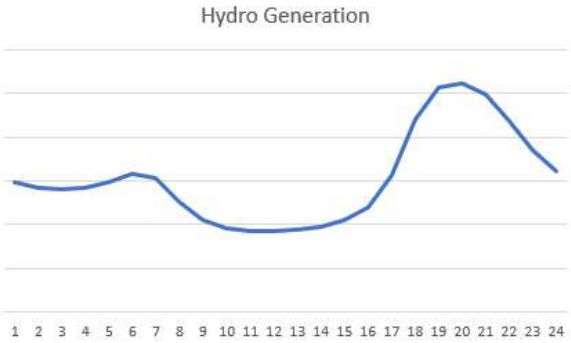
Clean Transition and Reliability Challenges

- Decarbonization means more renewables and less fossil fuels
- In addition, electrification means more demand for electricity overall
- Fossil fuels can produce electricity 24/7, many renewables do not
- Renewables also depends on location - need transmission!
- Transmission projects are expensive and take time to develop









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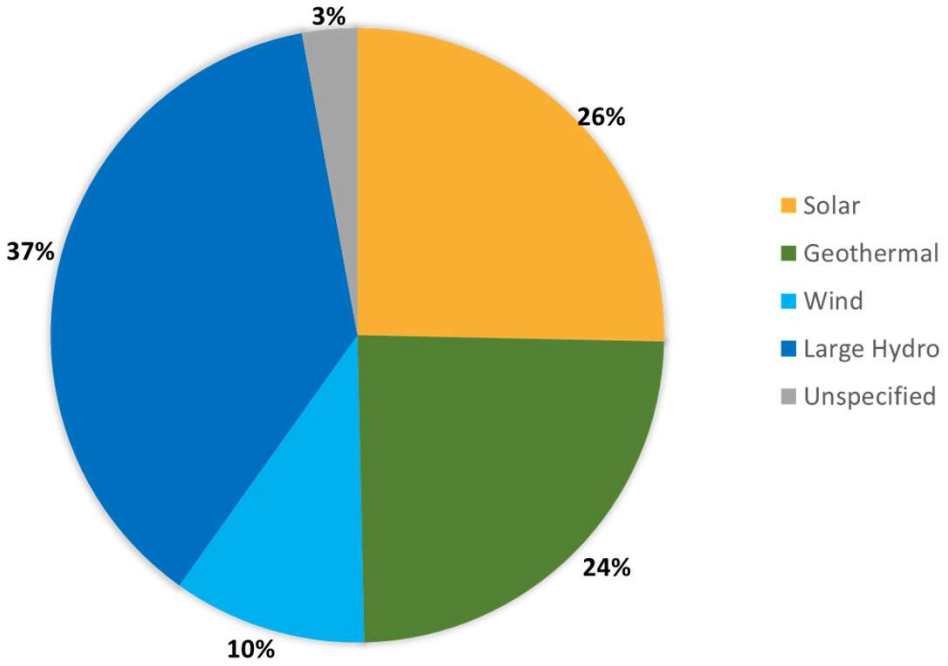
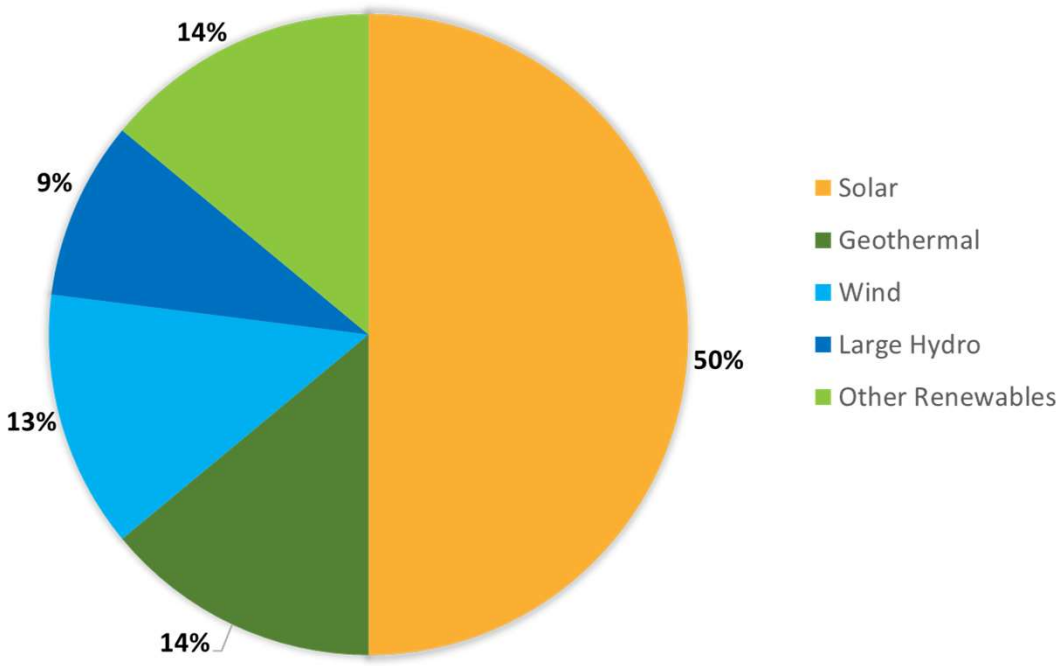
Energy Opportunities

CleanPowerSF Energy Mix (2022, 2035)





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スライド 14

0 How is Hydro "NA" on transmission? has to get to customers somehow...
, 2023-08-23T23:46:38.027

0 0 [@Abu-Sneneh, Firas] can you speak to this/update?
, 2023-08-24T00:27:15.290

0 1 is the point there that the hydro transmission is already developed/in place? Is this referring to "new transmission need"?
, 2023-08-24T16:10:39.022

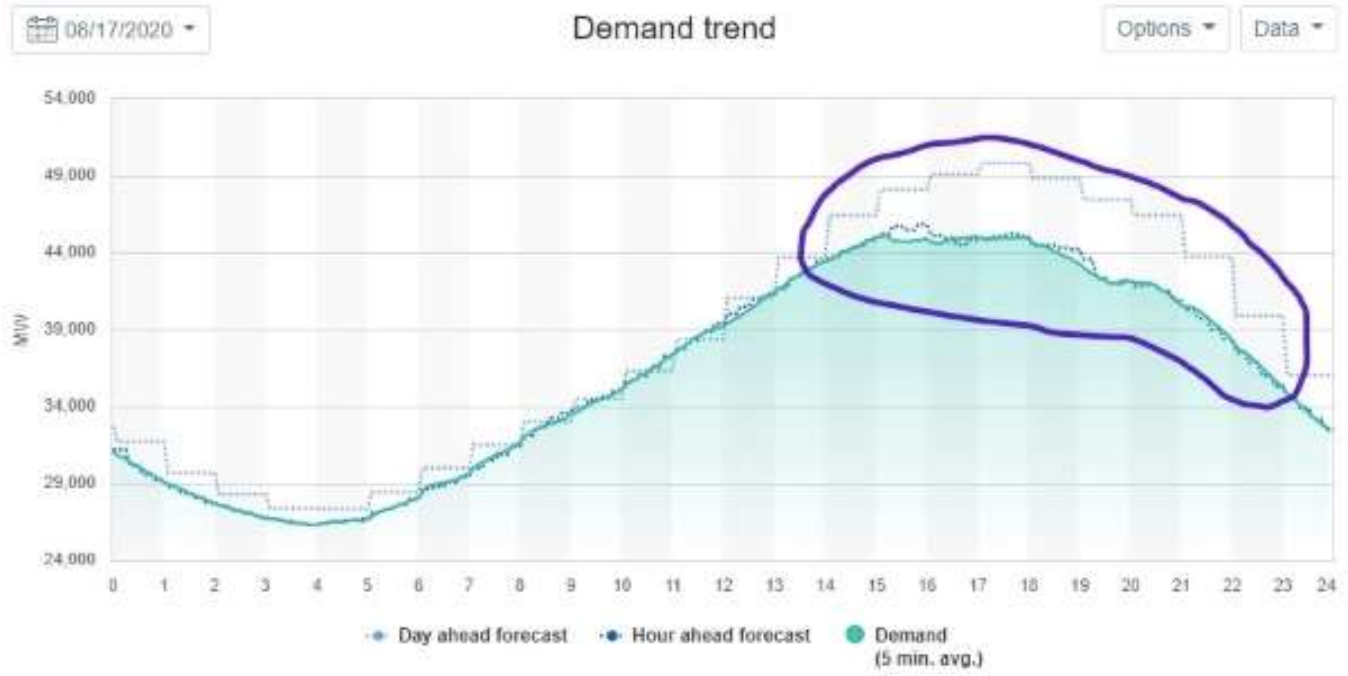
0 2 Thanks Mike (I made the changes discussed)
, 2023-08-24T16:12:58.347

Energy Opportunities

Reducing Demand

- Reducing demand in strained times can be a critical tool to achieve reliability

- Several things are being done to enhance demand-side reliability:
  1) Demand flexibility
  2) Energy efficiency
  3) Demand Response



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スライド 15

0 How is Hydro "NA" on transmission? has to get to customers somehow...
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Energy Opportunities

Comparison of Energy Alternatives -- Resilience

	Solar	On-shore wind	Off-shore wind	Hydro	Geothermal	Natural Gas
GHG emissions	None	None	None	None	Minimal	High
Cost	$	$$	$$$$	$$	$$$	$$
Availability	✓✓✓✓	✓✓✓	✓✓	limited	✓✓	✓✓✓✓
Reliability	Requires sunshine, limited in cloudy days	Seasonal, locational	Seasonal, locational	Depends on water-year	excellent	excellent
New transmission need	Medium	Medium	Very High	N/A (minimal new hydro expected)	Very High	Low

Good
Neutral
Challenge

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スライド 16

0 How is Hydro "NA" on transmission? has to get to customers somehow...
, 2023-08-23T23:46:38.027

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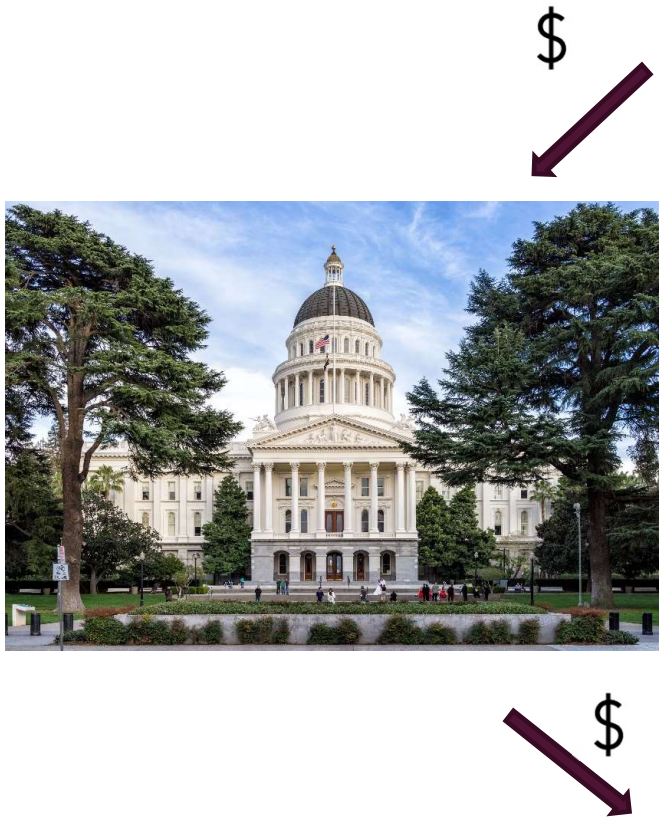
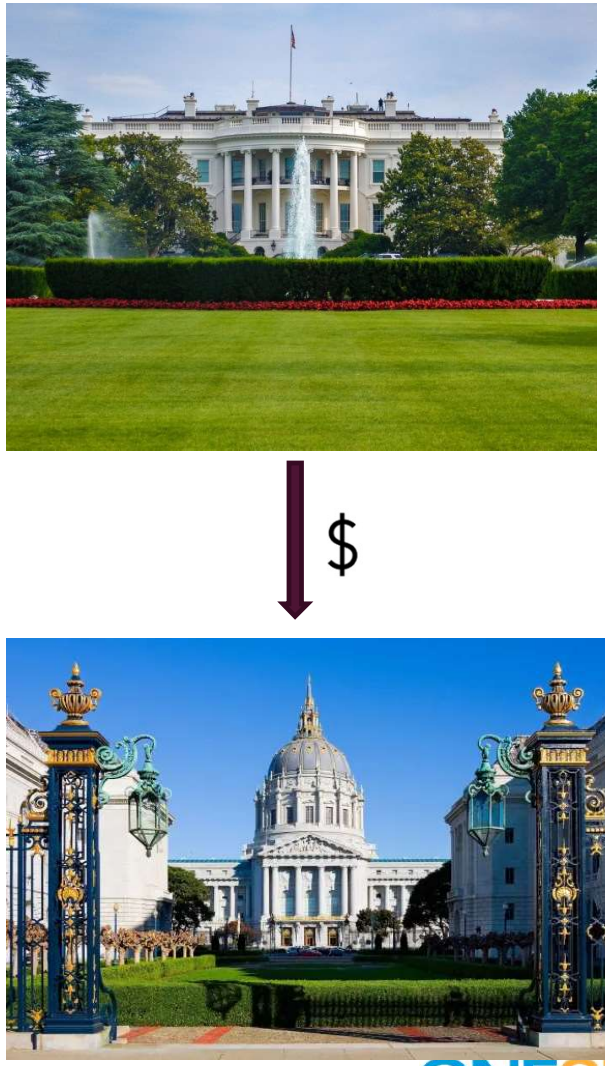
, 2023-08-24T16:12:58.347

Energy Opportunities

Funding

- Expediting development of transmission and generation
- Federal Inflation Reduction Act and Bipartisan Infrastructure Law provides significant funding
- State budgets offer significant funds to procure electricity to ensure reliability
- State and CAISO are enhancing transmission planning processes





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Questions?

Sources

- San Francisco Office of Resilience and Capital Planning: **https://onesanfrancisco.org/**
- San Francisco Public Utilities Commission: **https://sfpuc.org/**
- Resilient Cities Network / Urban Power Campaign: **https://resilientcitiesnetwork.org/energy-resilience/**
- Hetch Hetchy Power System: **https://sfpuc.org/HetchyPower**
- CleanPowerSF: **https://www.cleanpowersf.org/**
- CleanPowerSF's Integrated Resource Plan: **https://www.cleanpowersf.org/resourceplan**
- CAISO (CA Independent Systems Operator) supply and demand forecasts: **www.caiso.com/TodaysOutlook**

Thank You!

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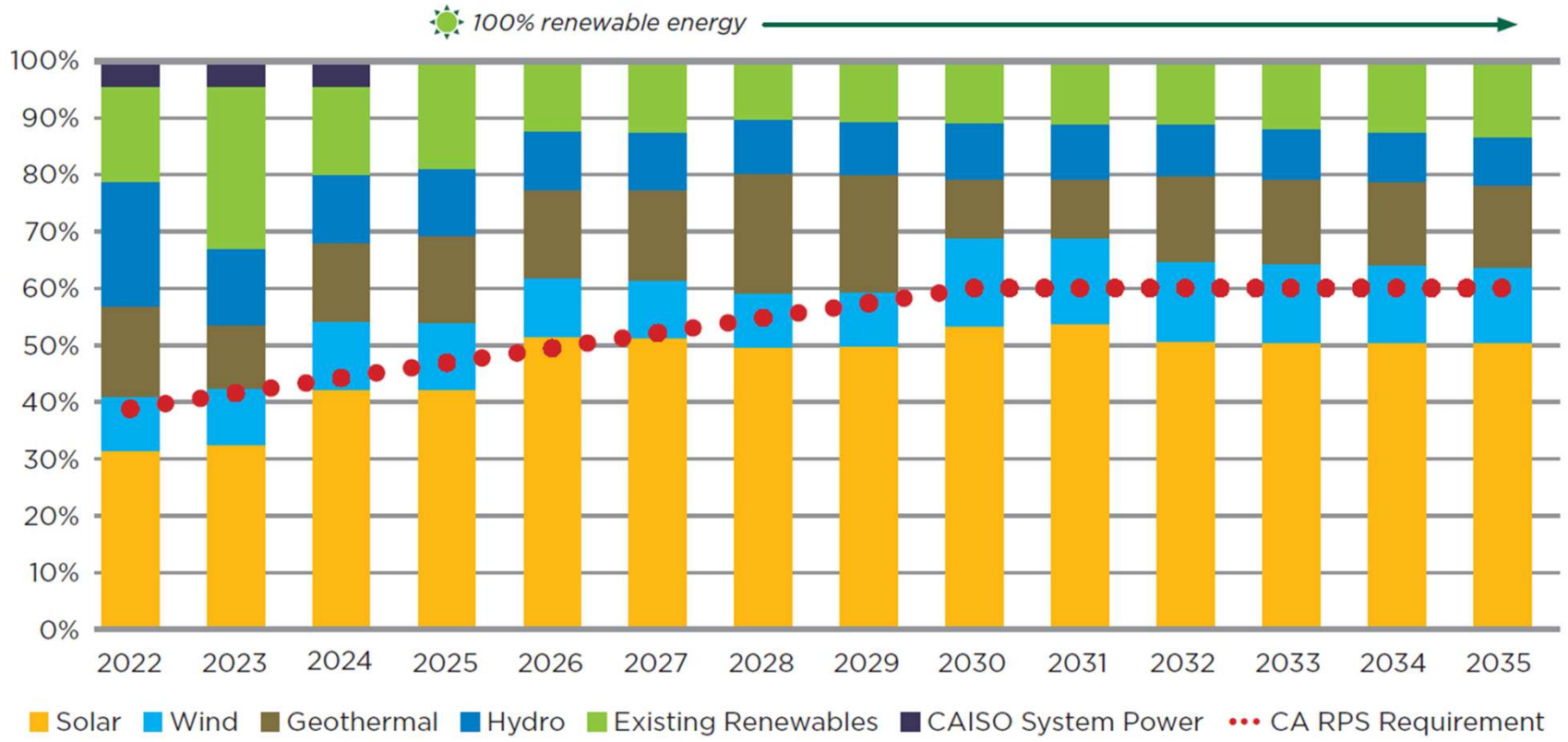
San Francisco is an Electricity Generator and Buyer

Hetch Hetchy POWER CleanPowerSF ONESF Building Our Future

Energy Opportunities

CleanPowerSF Energy Roadmap, 2022-2035



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スライド 21

0 How is Hydro "NA" on transmission? has to get to customers somehow...
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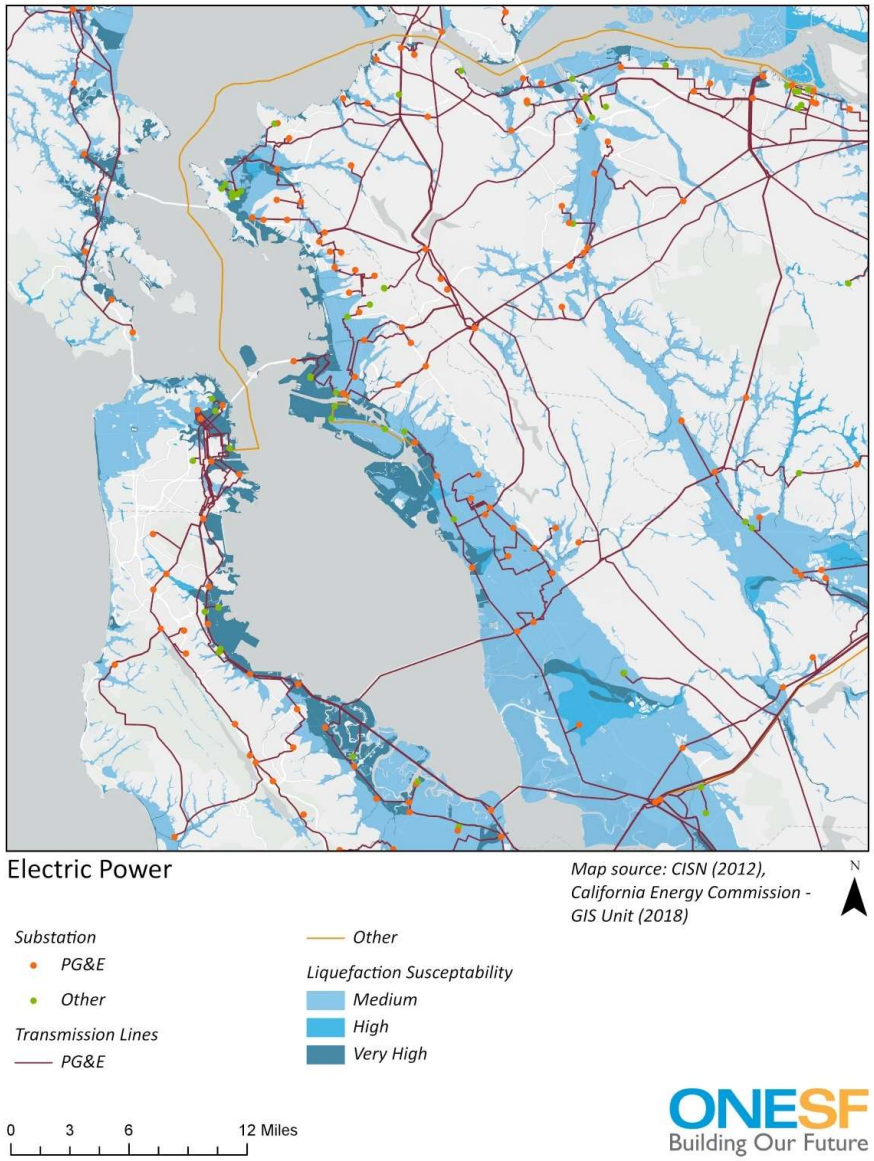
SF Lifelines Council Restoration Performance Project

Electric Power Key Findings

- Dependency on power rated as significant by all sectors, except AWSS
- Most sectors have a central control center that relies on communications and electricity
- Communications and electricity are functionally coupled. Few cell sites have back up generators.

Electric Power Key Actions

- PG&E needs to better understand reliance of other lifelines on power and the implications if they lose power to improve restoration prioritization.
- Municipal and private owners with critical electricity needs should have resilient onsite back up, e.g. solar + storage.
- Study implications of building electrification effort on electricity reliance.



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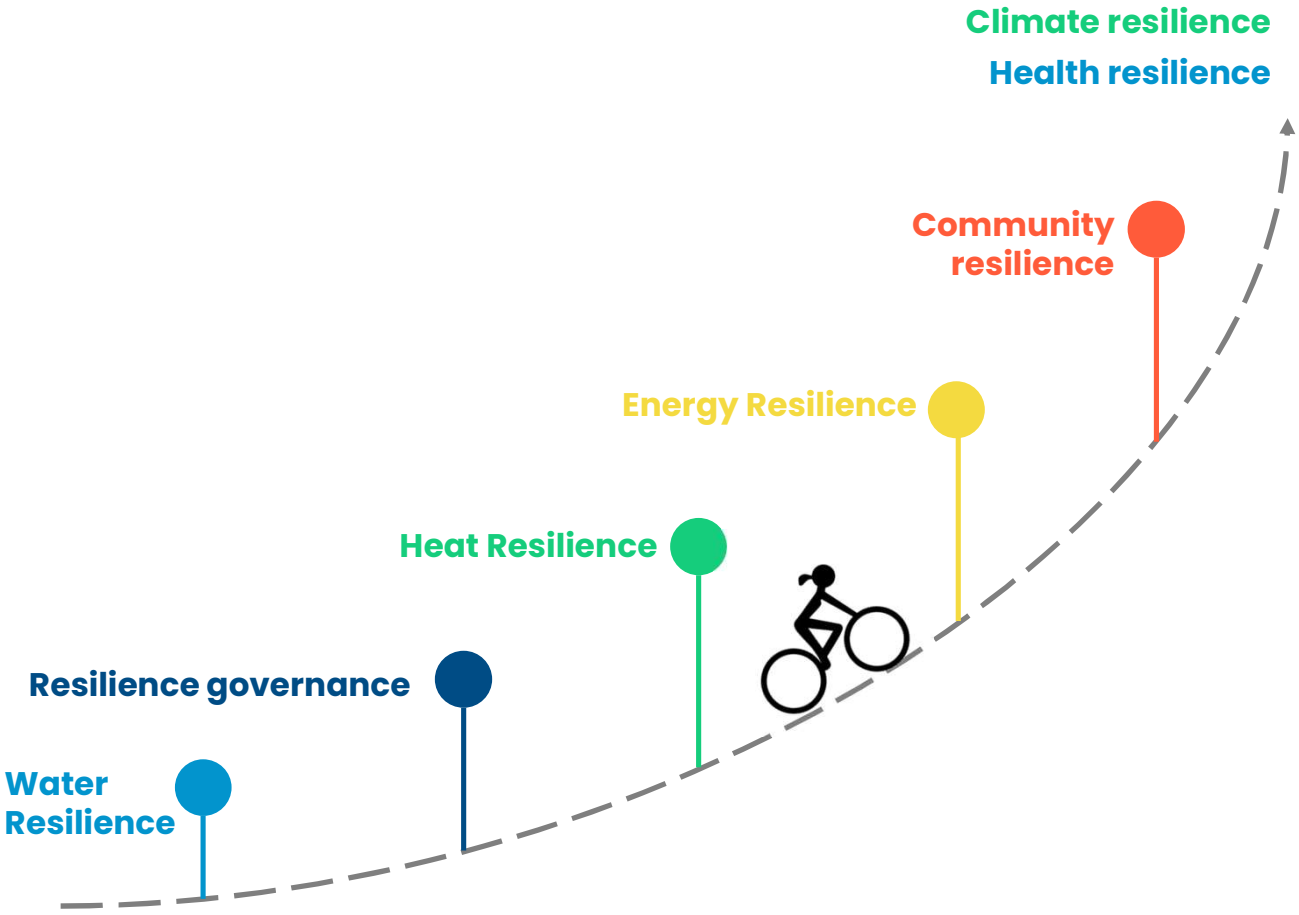
RESILIENT CITIES NETWORK

CITIES SOLVE, **CITIES** DELIVER

Is R-Cities' global campaign that showcases solutions to

- **Increase visibility** of the role of cities and the Chief Resilience Officers in advancing urban resilience every day, building a safe and equitable world for all.
- **Inspire cities** across and beyond the network with urban resilience solutions.
- **Leverage the collective experience** of cities to fundraise and build partnerships.



The goals are global in scope, but implementation happens largely in cities

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