



# PATHWAY TO 100% CLEAN ENERGY

MAINTAINING RELIABILITY AND RESILIENCE

## UCI CALPLUG WORKSHOP

NOVEMBER 10, 2022

Louis Ting



Los Angeles  
Department of  
Water & Power

## LOS ANGELES' POWER GENERATION AND TRANSMISSION

If stretched end to end, LADWP's 15,000 miles of power lines and cable are longer than the distance from Los Angeles to Australia and back.



Customers – 1.55 Million

LA Population – 4 Million

Staffing – 11,000+

Budget - \$4.9 Billion

Power & Fuel Purchase, O&M, Capital Projects

Demand – 20,936 Gigawatt-Hours – 8,101 MW Capacity  
Commercial/Industrial/Residential

Transmission System

4,175 Miles Overhead and Underground

15,452 Towers

Distribution System

177 Distribution Substation

11,067 Miles of OH & UG Lines & Cables

130,703 Distribution Transformers

300,884 Distribution Poles

# LA 100 STUDY

THE LA CITY COUNCIL DIRECTED LADWP TO EVALUATE:

- What are the **pathways and costs to achieve a 100% renewable electricity supply** while electrifying key end uses and maintaining the current high degree of reliability?
- What are the potential benefits to **the environment** and **health**?
- How might **local jobs** and the **economy** change?
- How can communities shape these changes to prioritize **environmental justice**?



# LA 100 STUDY

## DIVERSITY, EQUITY, AND INCLUSION

### LA100 Advisory Group

American Wind Energy Association	Committee	Office of Public Accountability
Cal State LA	Earth Justice	Port of Los Angeles
Cal State Northridge	Environment California Research	RePower LA
Center for Energy Efficiency and Renewable Technologies	and Policy Center	Sierra Club
California Energy Storage Alliance	Environmental Defense Fund	South Coast Air Quality Management District
California Solar Energy Industry Association	Food and Water Watch	Southern California Gas
Center for Sustainable Energy	IBEW Local 18	Southern California Public Power Authority (SCPPA)
Central City Association	Los Angeles Business Council	University of California, Los Angeles
Chief Legislative Analyst	Los Angeles Chamber of Commerce	University of Southern California
City Attorney	Los Angeles Unified School District	Valero Wilmington Refinery
Communities for a Better Environment	Los Angeles World Airports	Valley Industry Commerce Association
Council Districts	Metropolitan Transportation Agency	
DWP Advocacy Committee	Natural Resource Defense Fund	
DWP-NC MOU Oversight	Neighborhood Council	
	Sustainability Alliance	
	Office of the Mayor	



# LA100 STUDY – BULK ELECTRIC SYSTEM

## ACROSS ALL LA100 SCENARIOS



Electrification  
Efficiency  
Flexible Load



Customer  
Rooftop Solar



Renewable  
Energy



Storage  
(including coupled  
with solar)



Distribution,  
Transmission



Renewably Fueled  
Combustion  
Turbines

**Solar: + >5,700 MW**  
**Wind: + >4,300 MW**

**+ >2,700 MW**

**+>2,100 MW  
(in basin)**

**Much More**

**New**

Natural gas

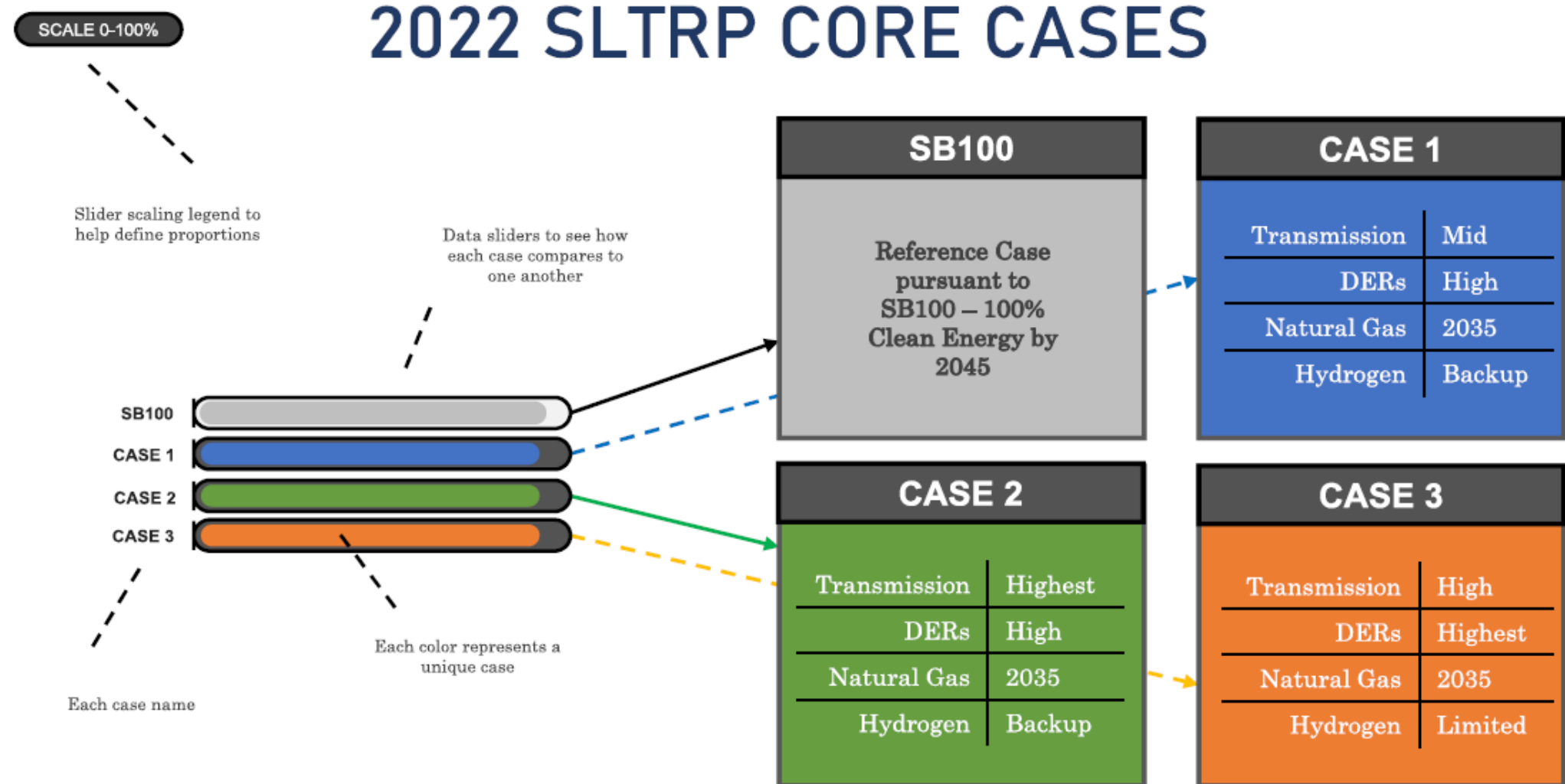
Today:  
Daily

Biofuel/ hydrogen

Future:  
Infrequently

**March 24, 2021 - Mayor announced 100% target by 2035**  
**City Council Motion followed Mayors announcement targeting 100% by 2035**

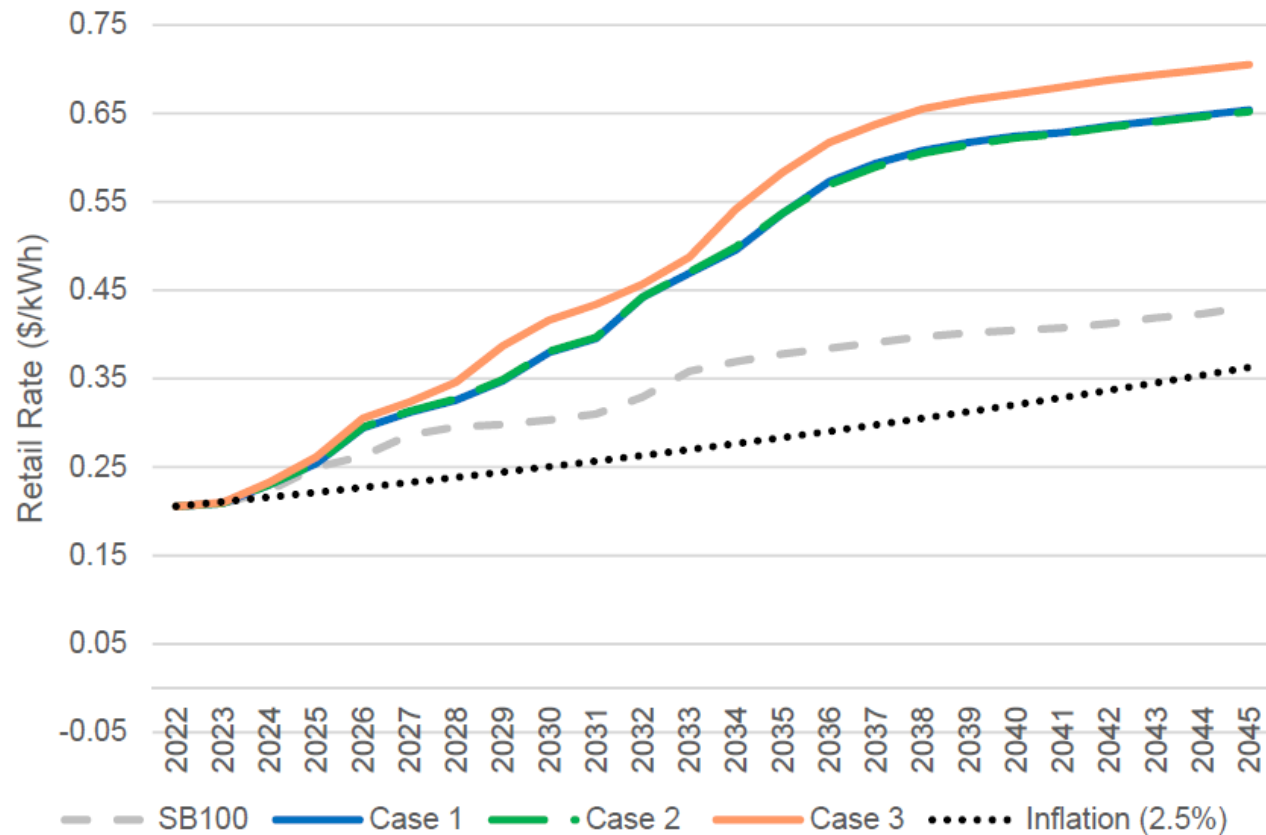
# 2022 Strategic Long Term Resource Plan



# 2022 Strategic Long Term Resource Plan

## KEY FINDINGS: RATE IMPACTS

2022 SLTRP Customer Rates (Nominal \$)



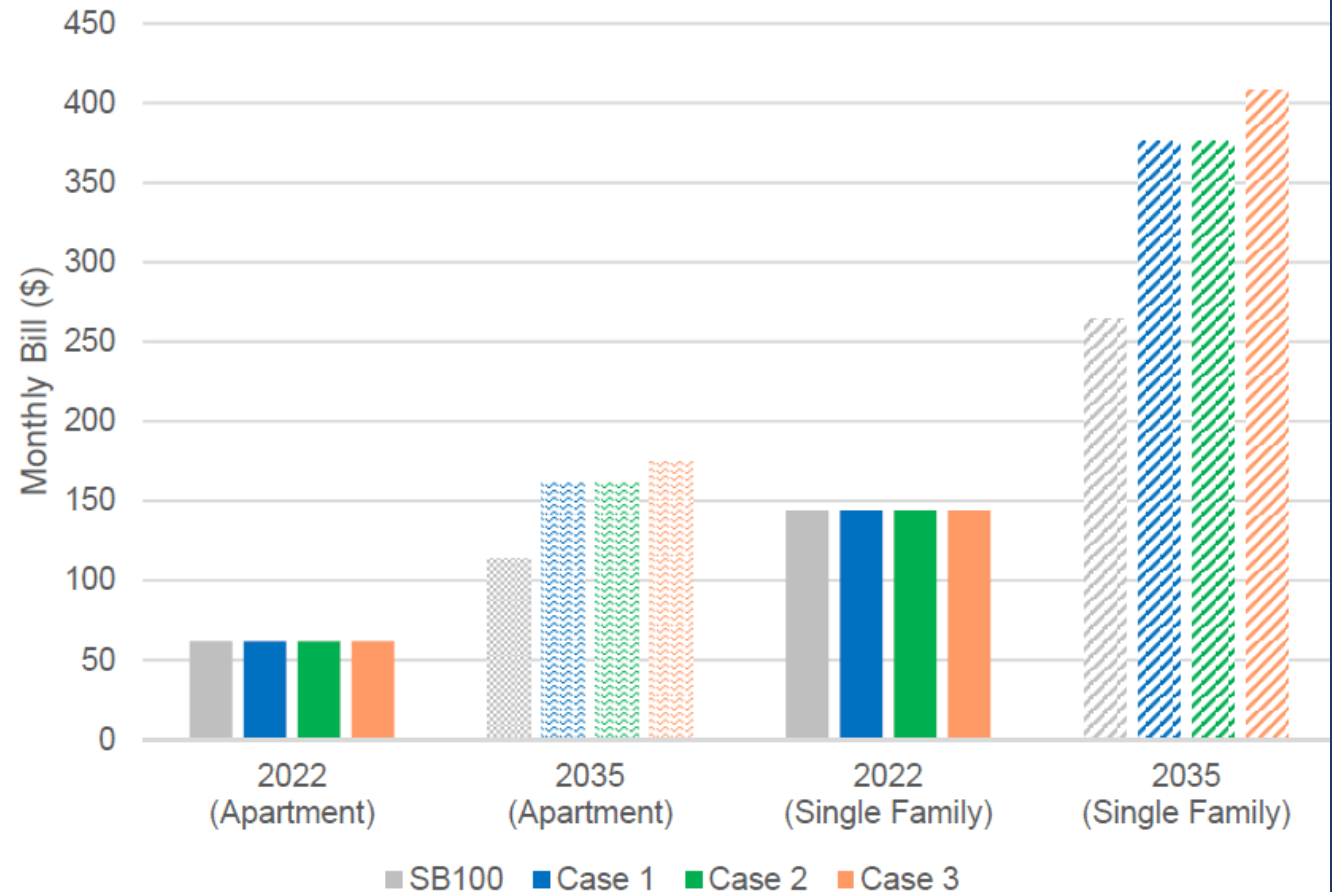
2022 SLTRP Scenario	Rate in 2030 and 2035 (cents/kWh)	Est. Avg. Rate Increase (2022-35)	Est. Avg. Rate Increase (2022-45)
SB100	30 (in 2030) 38 (in 2035)	4.8%	3.3%
Case 1	38 (in 2030) 54 (in 2035)	7.7%	5.2%
Case 2	38 (in 2030) 54 (in 2035)	7.7%	5.2%
Case 3	42 (in 2030) 58 (in 2035)	8.4%	5.6%

# 2022 Strategic Long Term Resource Plan

## KEY FINDINGS: MONTHLY BILL IMPACTS

2022 SLTRP Scenario	Average Customer Bill in 2035 (Apartment)	Average Customer Bill in 2035 (Single Family)	% Increase from 2022
SB100	\$112	\$262	84%
Case 1	\$160	\$373	161%
Case 2	\$160	\$373	161%
Case 3	\$174	\$405	184%

**Note:** Average monthly bill in 2022 is \$61.66 per month for apartment and \$143.86 per month for single-family home.





# WHERE ARE WE TODAY?

## LADWP INFRASTRUCTURE - PATHWAY TO DECRABONIZE



Electrification  
Efficiency  
Flexible Load



Customer Rooftop  
Solar – 513 MW



Utility Scale Renewable  
Energy – 4,458 MW



Storage (including  
coupled with solar) –  
**1,320 MW**



Distribution,  
Transmission



Combustion Turbines  
& Other Generation  
Assets – 5,606 MW

**Energy Efficiency –  
15% Per Decade**

**EV Adoptions – 60%  
increase in 2 years  
97,000 registered**

**EV Chargers – 93%  
increase in 2 years  
19,500 L2 and L3**

**NEM Solar – 36%  
increase in 2 years  
513 MW Total**

**25% of all NEM Solar  
adoption within last 2  
years, inception - 1999**

**Wind – 1,328 MW**

**Solar – 2,020 MW**

**Geothermal – 331 MW**

**Small Hydro – 257 MW**

**Construction – 522 MW**

**Customer – 31.7 MW  
3,877 BTM installations**

**Li-ion – 20 MW/10 MWh  
400 MW/1,200 MWh  
(Under Construction)**

**Pump Hydro – 1,265 MW**

**Power System  
Reliability Program  
– Inception 2007**

**Over \$1B budget  
yearly**

**In-Basin LA –  
3,225 MW**

**Out-of-Basin –  
2,381 MW**

**2021 Power Content Label – 35.2% RPS**

# HOW RESILIENT IS LA'S POWER GRID?

PATHWAY TO 100% RENEWABLE – MAINTAINING RELIABLE & RESILIENT GRID

- *Northridge Earthquake - 1994*
  - *Saddle Ridge Fire - 2019*
    - *Route Fire - 2022*
- *Past Summer Heat Waves 2020 & 2022*
  - *COVID - 19*

CAVEAT – PAST PERFORMANCE DOES NOT GUARANTEE FUTURE RESULTS



**LADWP**

**Power System**

**1994**

**Northridge  
Earthquake**

**January 17**

**4:30 AM**

**Monday**

*Magnitude 6.7 – Epicenter Reseda – 11.31 miles deep*

*1.8g acceleration – highest recorded urban area*

*Power System Damage – 10 mile radius - \$150 Million*

*Sylmar Converter Station – Rinaldi Receiving Station –  
Receiving Station E – 25% of Transmission System –  
Transmission Towers - Valley Customer Facilities*

*Entire Power System was de-energized – no service*

*Electricity demand was low – 1,900 MW*

*Within 24 hours – 93% of customers restored*

*14 days to return system to “Normal”*



The background image shows a power substation at night or dusk. A large, bright orange and yellow fire or explosion is visible in the center-left, with smoke rising. Several tall, thin utility poles with cross-arms are visible in the background. The sky is dark, and the overall scene is dramatic and somewhat chaotic.

# **LADWP**

**Power System**

# **1994**

## **Northridge Earthquake**

**January 17  
4:30 AM  
Monday**

*Distribution Station Hazard Mitigation Plan – Seismic upgrade of 40 substations completed in 2005*

*Receiving Station Hazard Mitigation Plan – Replacement of equipment with seismic qualified disconnects, transformers, circuit breakers, and other related equipment completed in 2009*

*Creation of Institute of Electrical and Electronic Engineers, or IEEE, document, “Recommended Practice for Seismic Design of Substations” with help of LADWP Structural Engineers*

*IEEE 693 – document recommends design criteria for various voltage classes and testing criteria or equipment*



# ***Saddle Ridge Fire***

***October 10, 2019***

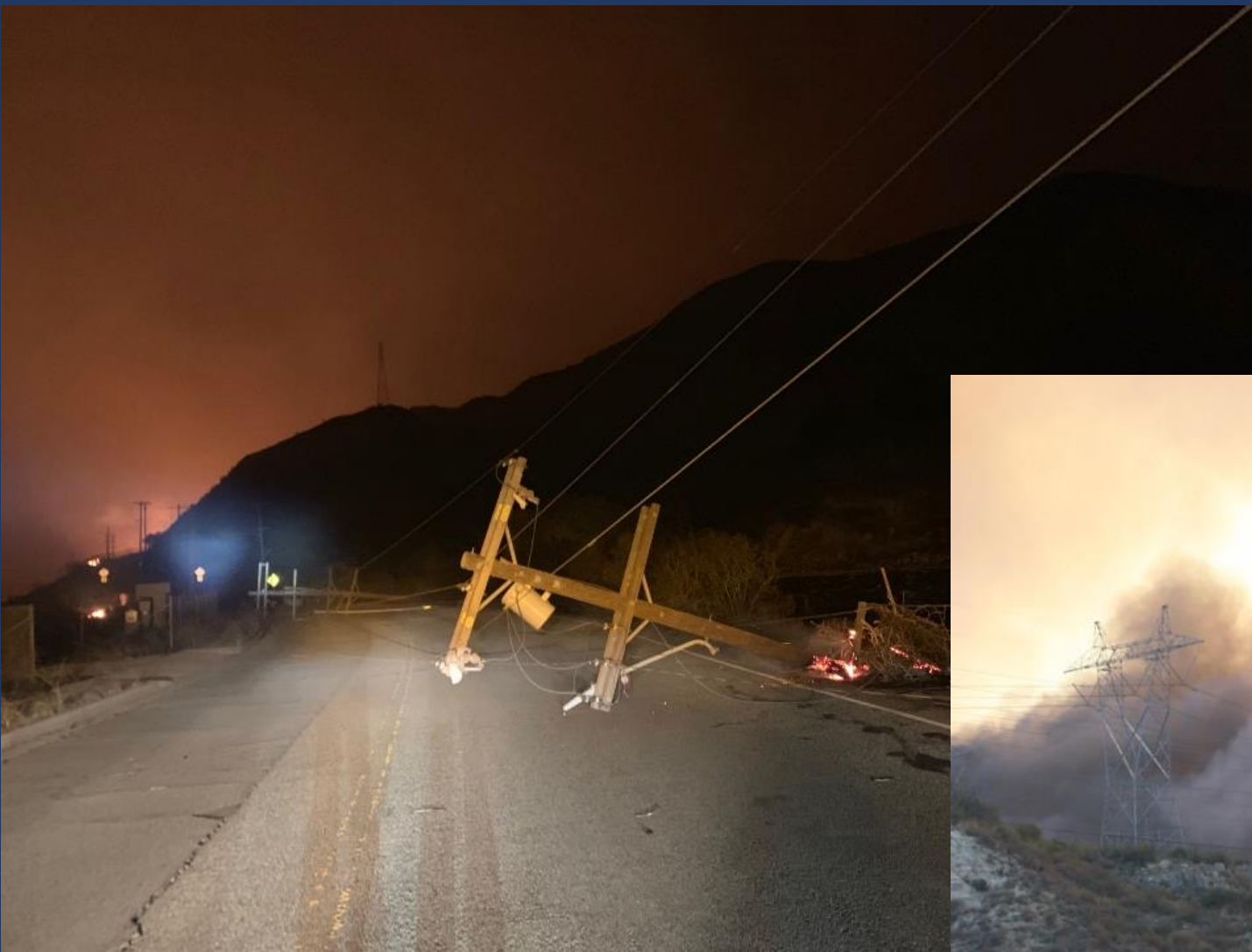
- Brushfire near Sylmar area
- 8800 acres were burned, 16 power poles destroyed
- Mobilized 45 Crews
- 17,244 Customers lost service
- 100% of Customers restored within 24 hours
- Activated Emergency Operation Center
- 40 poles replaced
- 4000 feet of overhead conductor replaced
- 150 feet of underground conductor replaced





# *Saddle Ridge Fire*

*October 10, 2019*





# *Saddle Ridge Fire*

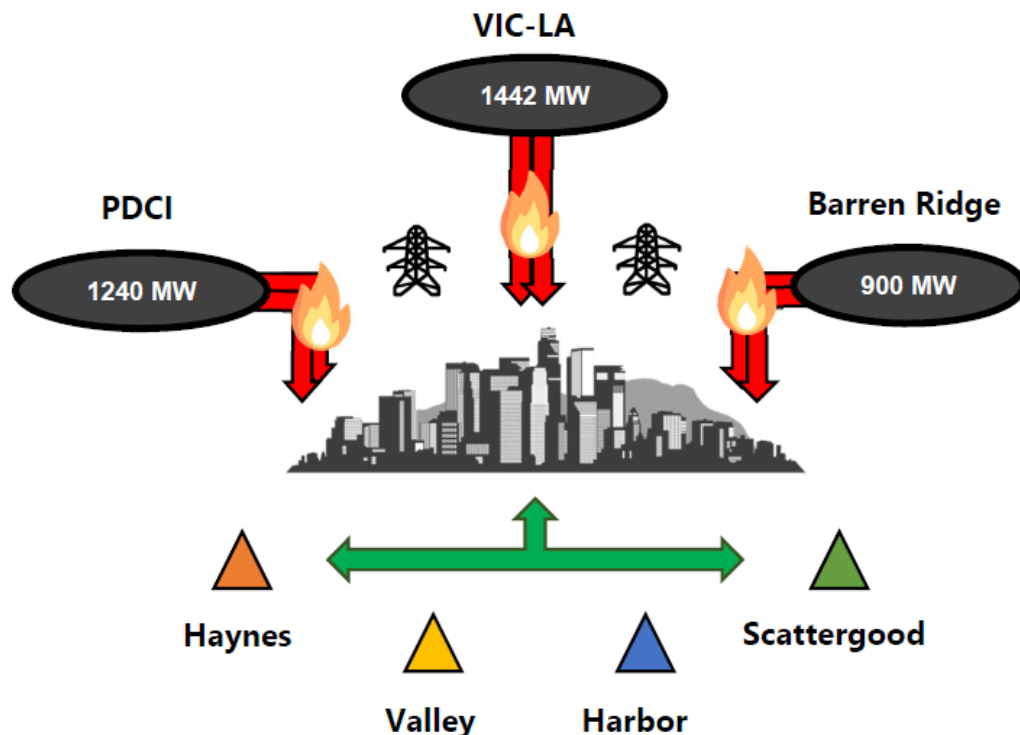
*October 10, 2019*



October 10, 2019

## IN-BASIN RESILIENCY

WHEN THERE IS A TRANSMISSION OUTAGE,  
WE WOULD RELY ON **GREEN HYDROGEN** TO KEEP CRITICAL POWER FLOWING



### LA100 Study – Key Takeaway

In-basin capacity must be maintained for **reliability** and **resiliency**, even in a decarbonized future Power System.

All 2022 SLTRP cases have been developed to maintain reliability and resiliency

### Example:

The 2019 Saddle Ridge Fire impacted the Pacific DC Intertie for **22 hours**, Barren Ridge corridor for **10 hours**, and VIC-LA path for **5 hours**.



## Route Fire

- Occurred on August 31, 2022
- Started adjacent to the Interstate 5 near Castaic which is located northwest of Santa Clarita
- Burned a total of 5,208 acres
- Now 100% contained

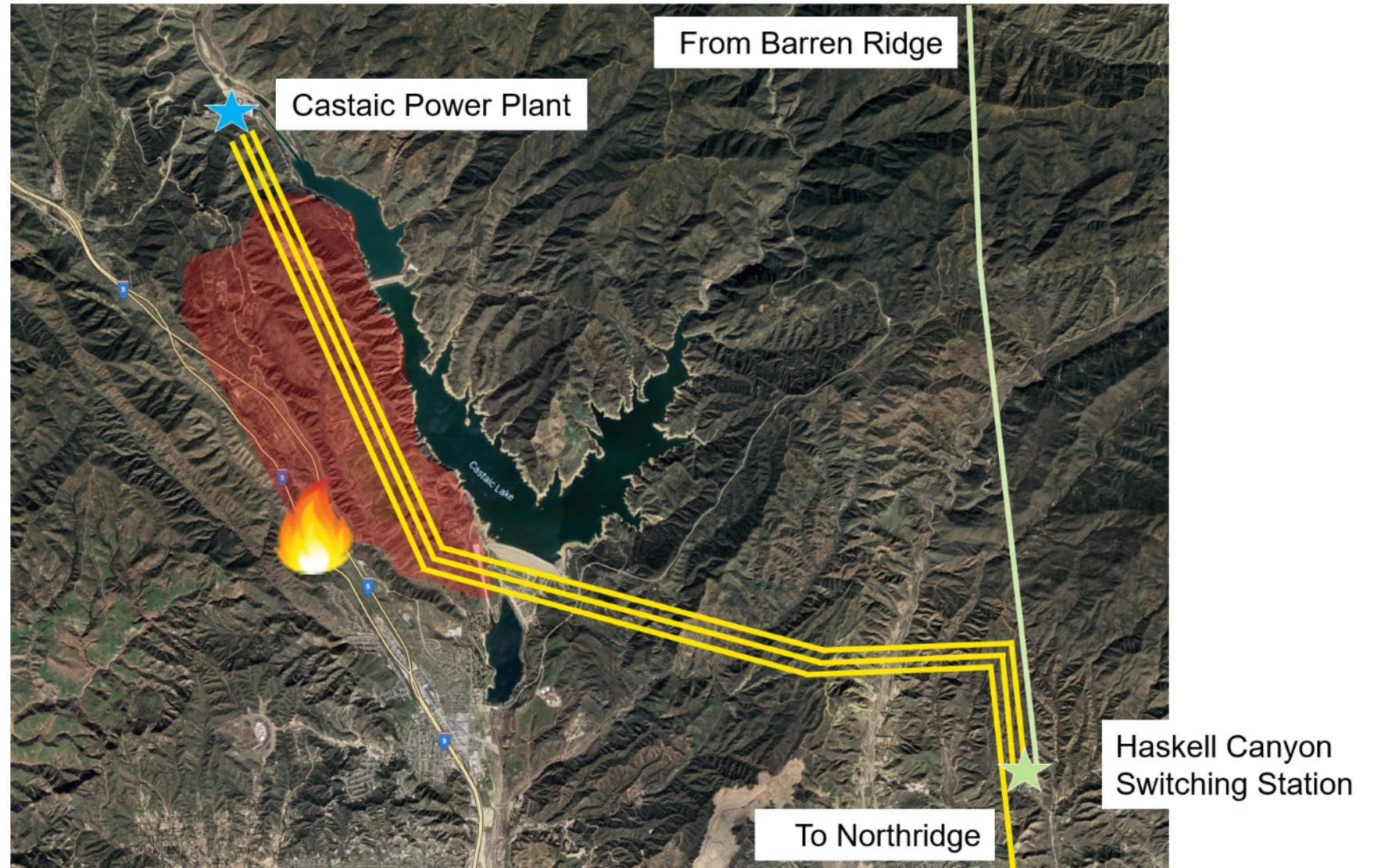
Transmission lines connecting to Castaic Power Plant *relayed*, effectively causing the complete **loss of Castaic generation.**



*Photo Taken From Castaic Power Plant*



# Route Fire Causes Complete Isolation of Castaic Power Plant

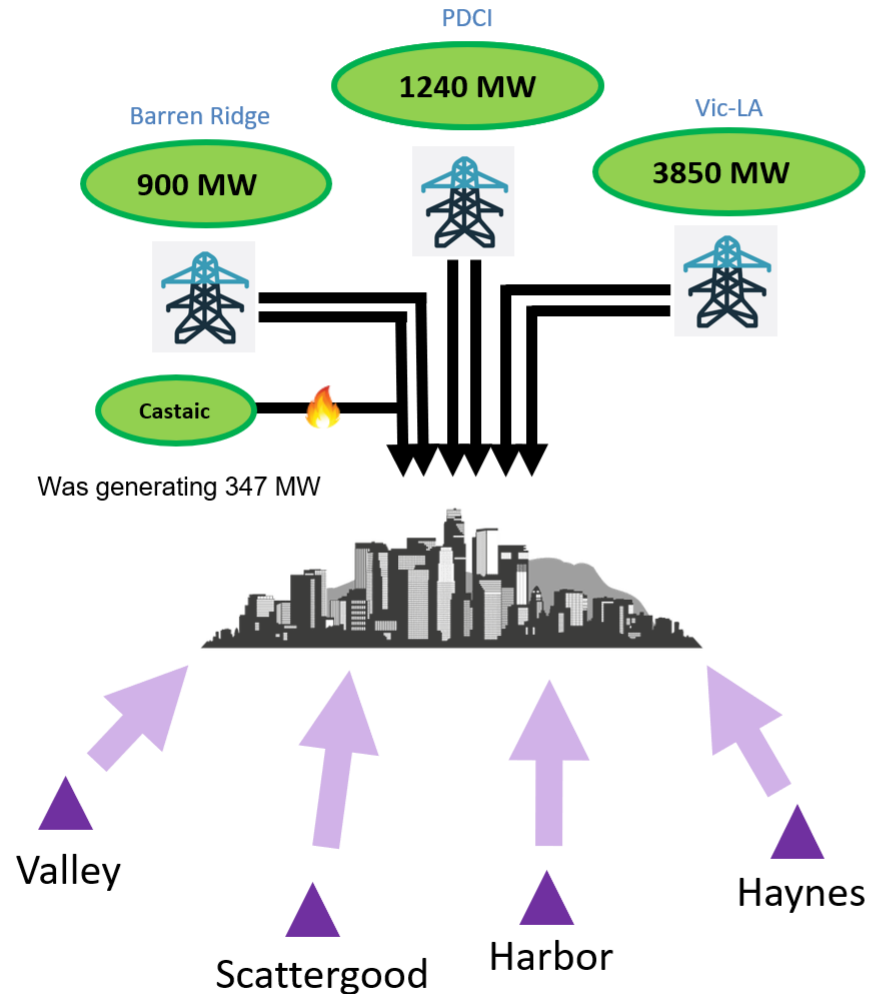




# Pictures Taken From Castaic Power Plant



# Route Fire Eliminated LADWP's to Use Castaic Power Plant



- Occurred on a high-load day
- Castaic Power Plant is capable of generating up to 1265 MW
- Demonstrates the importance of *system resilience*

**Import** = **3232 MW**

**In-Basin Generation** = **2206 MW**

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**Net Capacity** = **5438 MW**

**Total Load** = **5438 MW**



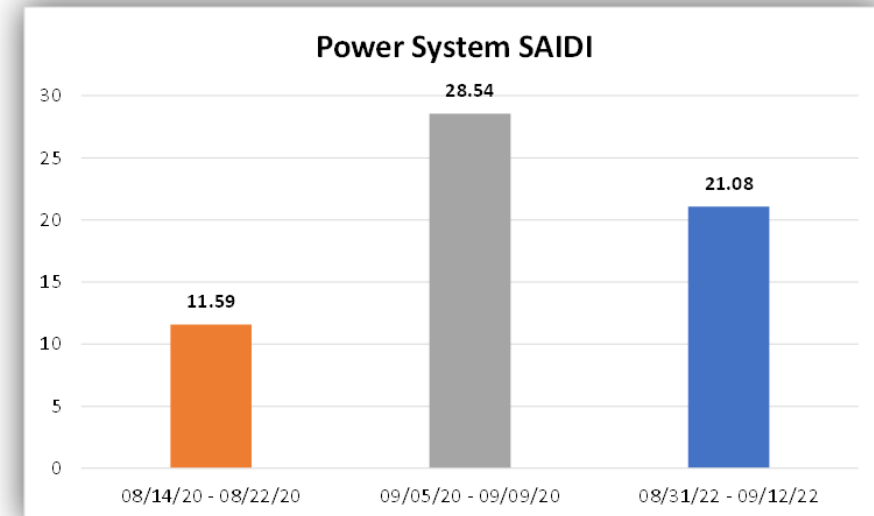
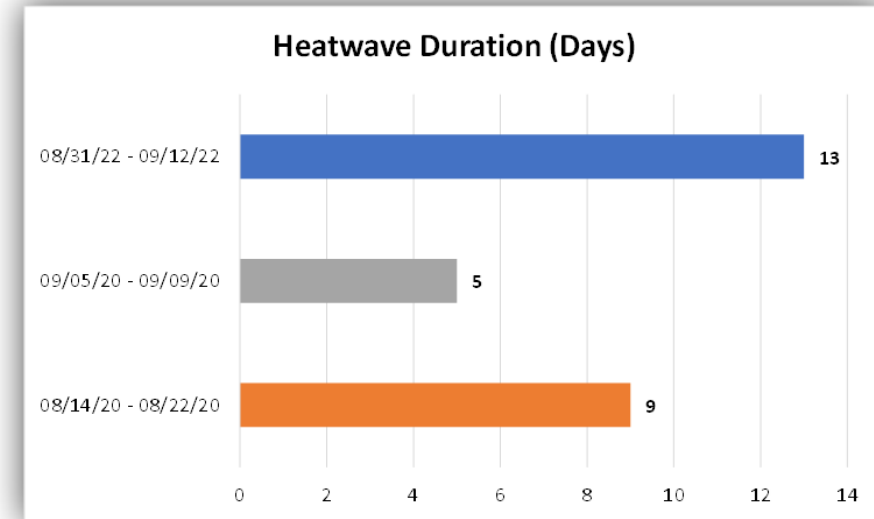
# 2022 & 2020 Heat Wave Comparisons

## 2022 Heat Wave

- August 31 – September 12
  - ETS Response Level: 1 -> 2
  - Peak Temp: **112°F**
  - Major Event Day (MED): **None**

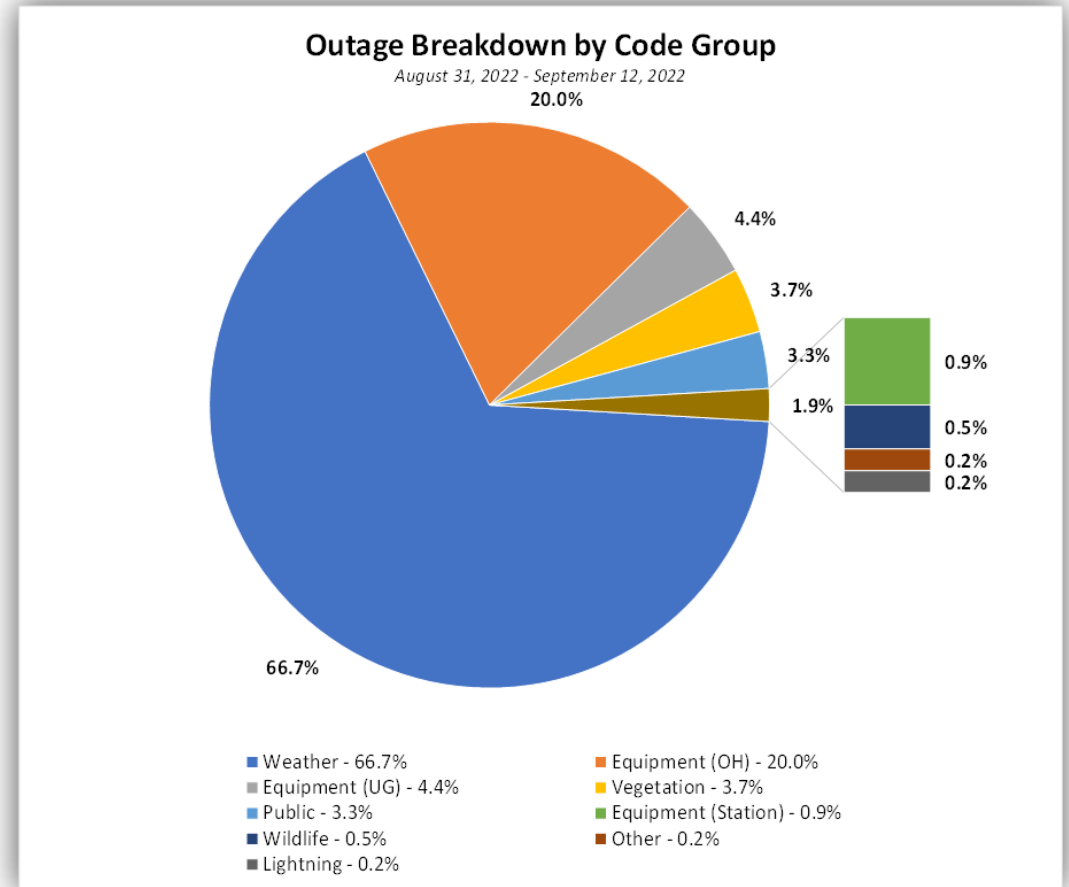
## 2020 Heat Waves

- September 5 – September 9
  - ETS Response Level: 3
  - Peak Temp: **118°F**
  - Major Event Day (MED): **Sep 5-6**
- August 14 – August 22
  - ETS Response Level: 1
  - Peak Temp: **112°F**
  - Major Event Day (MED): **None**



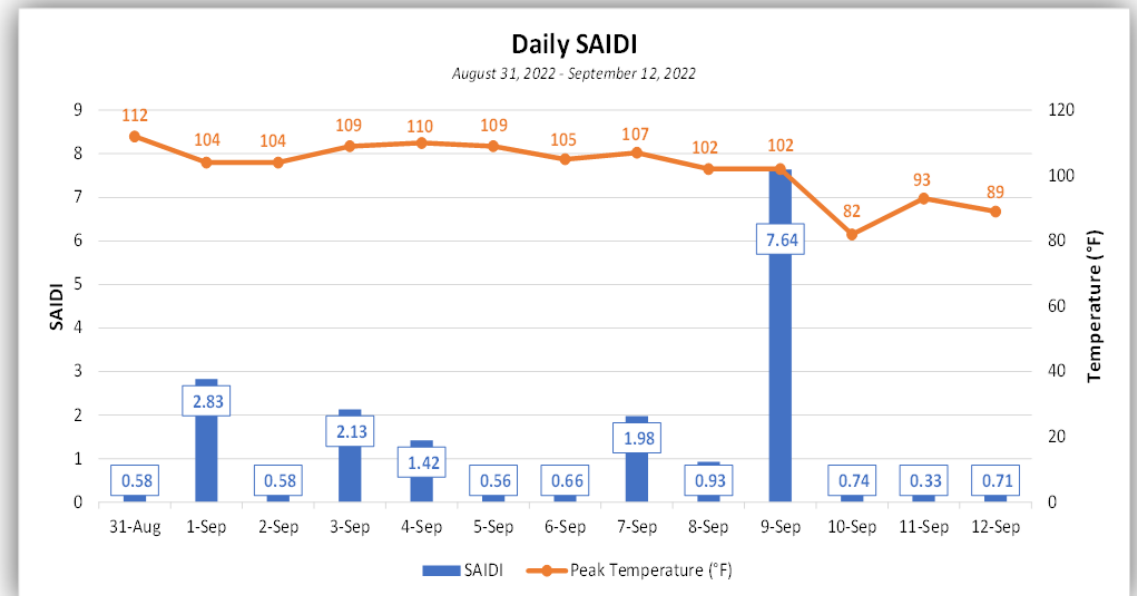
# Outage Breakdown by Code Group

- **67% (~304)** of outages were impacted by weather (extreme heat)
  - Transformers
  - Fuses
  - Cutouts
  - Jumpers
- Averaged **~195 outages/month** from Sept '21 – Aug '22
- **~150% increase** in outages due to extreme heat



# Power System Daily SAIDI

- System Average Interruption Duration Index
  - Average outage duration (minutes) a customer experiences per year
- SAIDI total during heat wave: **21**
  - **87%** of SAIDI from **8/31-9/30**
  - **17%** of rolling annual SAIDI (121.02)
- **5 of the 10 worst outages** during the heat wave occurred on **September 9**





# 2020 & 2022 HEAT WAVES

- In comparison, the **Sep 5 – 9, 2020 heat wave impacted more customers in a smaller period of time** than the 2022 heat wave
- The 2022 heat wave outages **were localized outages** affecting a smaller subset of customers for short durations of time
- Fuses, transformers, cutouts, and jumpers were the majority of the equipment failures during the 2022 heat wave
  - 72% of overhead transformer failures were 25KVA or less

***RESILIENCE – LADWP STAFF, INFRASTRUCTURE, TECHNOLOGY, ADEQUACY***



Questions?