

ASSESSING THE IMPACT OF WILDFIRES ON THE CALIFORNIA ELECTRICITY GRID

Energy Commission Study: CCCA4-CEC-2018-002 August 2018 California's Fourth Climate Change Assessment

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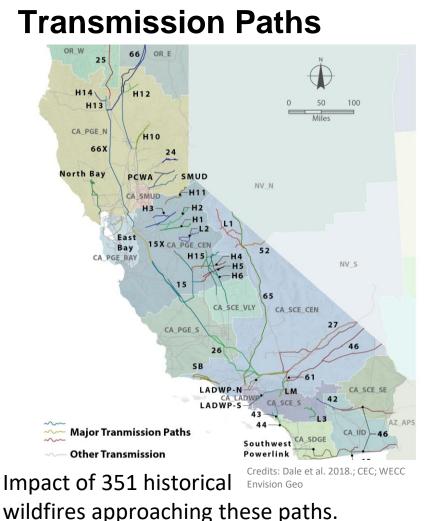


	Historical 2000 - 2016	Projected 2010 - 2050
Statewide	 Collect historical wildfire location and impact data (FRAP and REDBOOK) 	 Map projected wildfire risk by location statewide (UC Merced wildfire model, Leroy Westerling)
Transmission	 Identify major transmission paths (WECC and CEC) and analyze historic wildfire impacts 	 Calculate wildfire risk along existing transmission paths and several prospective transmission paths. Estimate wildfire costs with a grid power flow model (PLEXOS).
Distribution	 Ose the wildland-urban interface (WOI) as a proxy for distribution. Analyze distribution damage and 	 Project the growth of WUI areas (USGS Land Use model, Ben Sleeter), and calculate exposure to wildfire. Project future wildfire costs to distribution (historical damage and replacement cost).

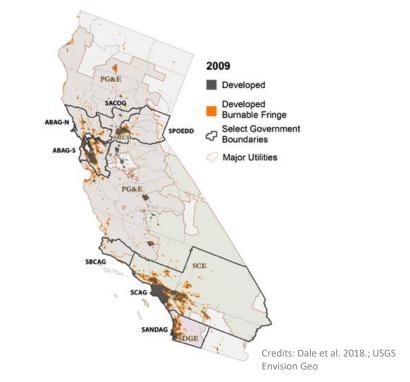
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We focused on selected parts of the transmission and distribution grid





Developed "Fringe" Areas



Impact of 236 historical wildfires wildfires approaching these fringe areas.

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Sample transmission path fire history (2000-2016)



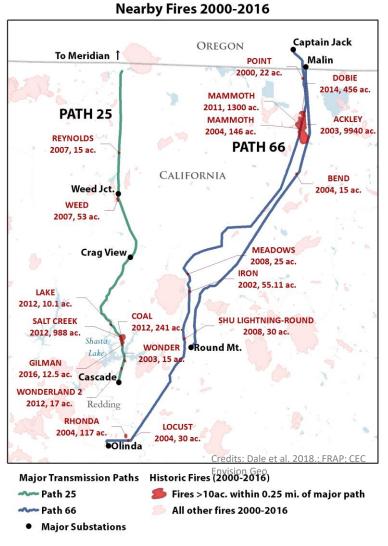
Path 25 (Meridian-Cascade)

Single 115kv line 6 Fires Within 0.25 mi

Path 66 (Malin-Round Mountain)

Three 500kv lines

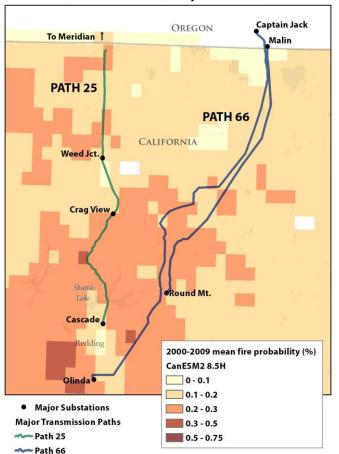
11 Fires Within 0.25 mi



Transmission Paths 25 & 66

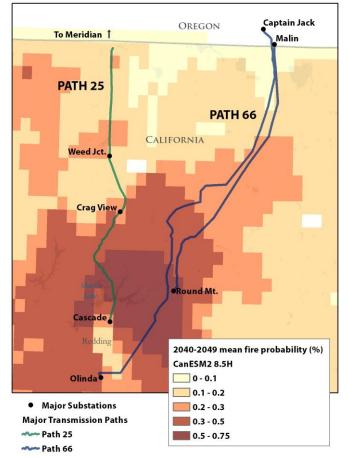
Projected rise in path fire exposure





Transmission Paths 25 & 66 Mean Fire Probability 2000-2009

Transmission Paths 25 & 66 Mean Fire Probability 2040-2049



Credits: Dale et al. 2018.; Westerling et al.; CEC Envision Geo

Determine path impacts of 351 fires 2000-2016

Unofficial CAISO Rating System



	Transmission Impact Severity Level						
		1	2	3	4	5	
	Number of Fires	Low Impact	Small line impact	Medium Impact	Large Impact	Very Large Impact	
		No CAISO action	Local Impact	Change Dispatch	Large Outage, Re- Dispacth	System Wide Threat	
Numbered WECC Paths	125	69%	2%	15%	13%	2%	
Other Transmission Paths	226	78%	3%	11%	2%	0%	

- Most had no impact
- A few had very large impacts

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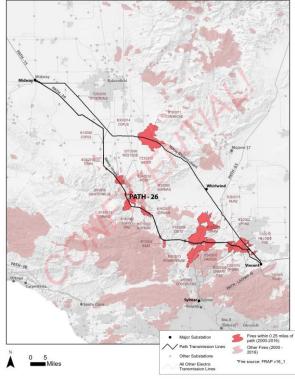
Modeled costs of impacts PLEXOS (TEPPC 2020 database)



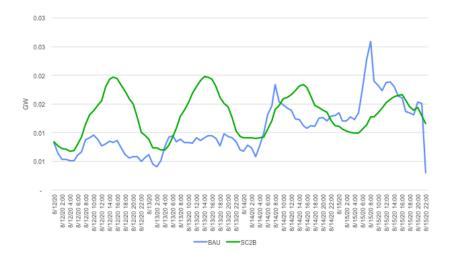
Path 26 Example

Path 26 (NorCal-SoCal)

2000-2016 Fires within 0.25 miles of a Major Path



Higher SCE generation costs during event

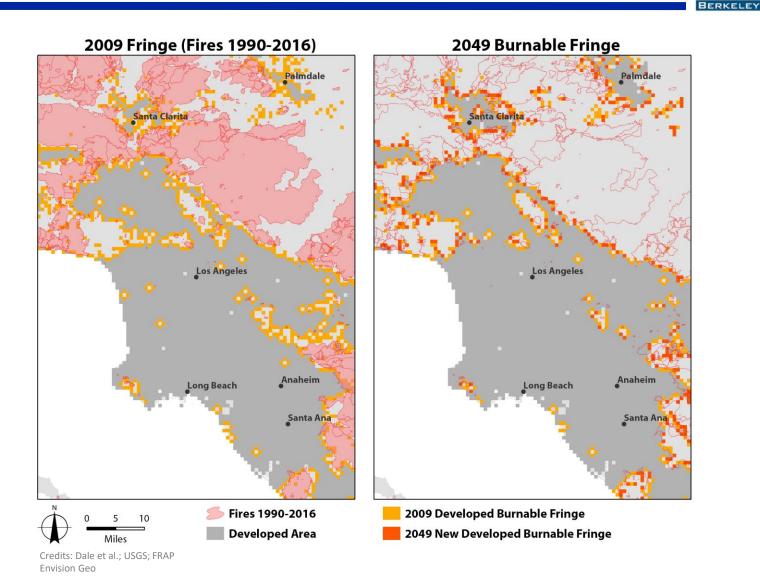


Credits: Dale et al. 2018.; FRAP; CEC Envision Geo

Total estimate: \$40-\$100 million annual all utilities

Identified distribution area fire history (LA Basin)

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		Low	Medium	High	Severe	Catastrophic
	Number fires evaluated	No Fringe Burned	Partial Fringe Cell	Between 2-5 Fringe Cells	Between 6- 10 Fringe Cells	Over 10 Fringe Cells
State	360	66%	10%	16%	4%	5%
Northern						
California	103	84%	5%	9%	2%	0%
Southern						
California	257	58%	12%	18%	5%	7%

Most fires had no impacts on fringe areas. A few had major impacts.

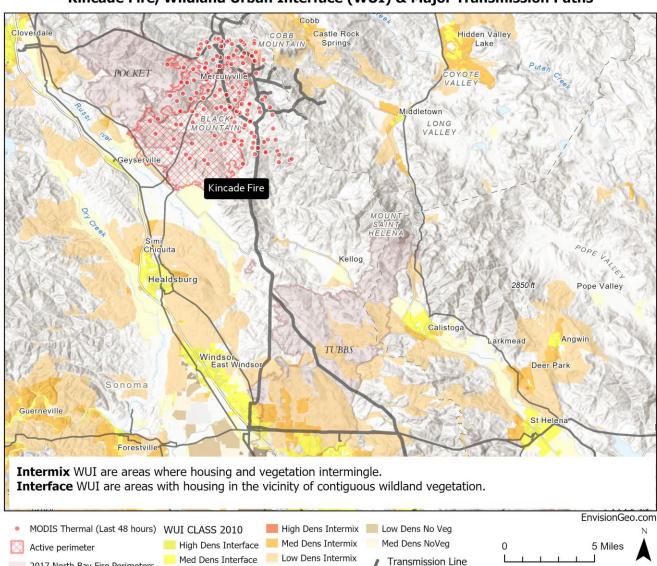
Source: GIS analysis applied to wildfire fringe data set (Cal Fire 2001-2016)

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Further WUI Analysis

2017 North Bay Fire Perimeters





High Dens NoVeg

Major Path

Sources: Silvis; CEC; Dale et al.; MODIS

Low Dens Interface

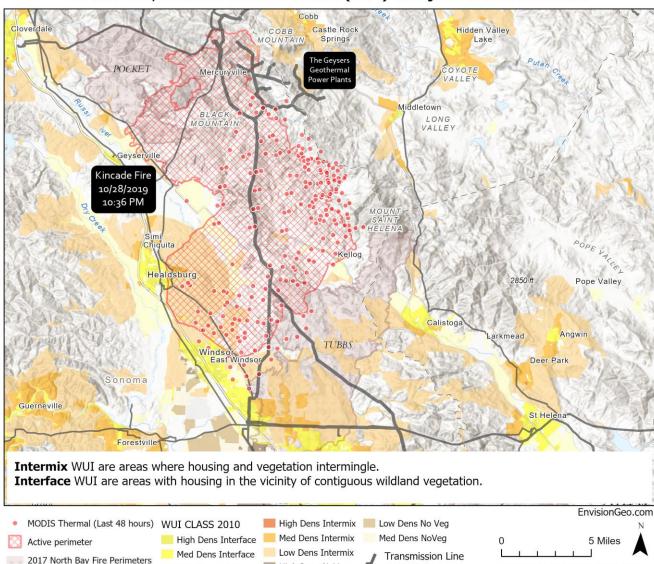
Kincade Fire, Wildland Urban Interface (WUI) & Major Transmission Paths

WUI Intermix, Interface, Density

Credit: **Envision Geo**

Further WUI Analysis





High Dens NoVeg

Major Path

Sources: Silvis; CEC; Dale et al.; MODIS

Low Dens Interface

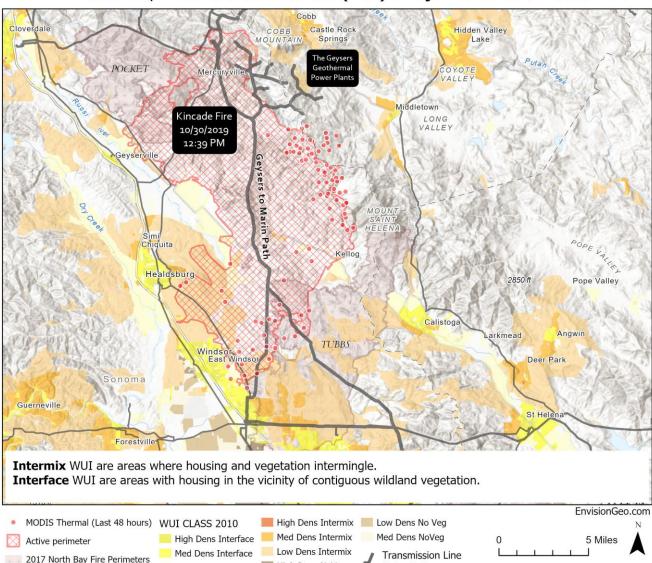
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Major Path

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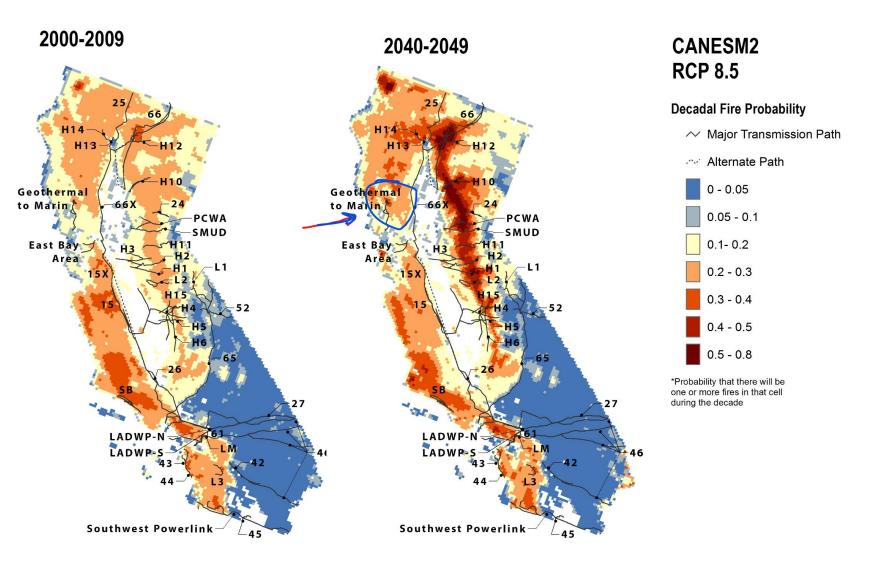
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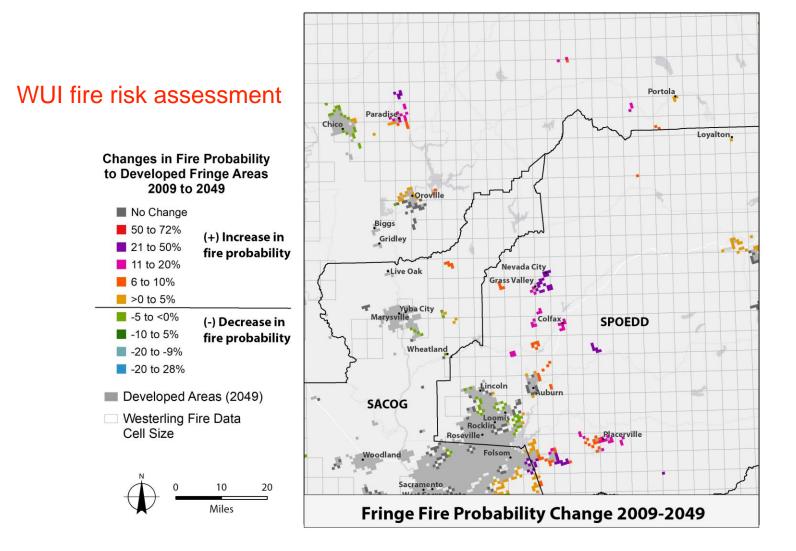
These methods have current value





Last year's risk assessment





Adaptation options



Transmission

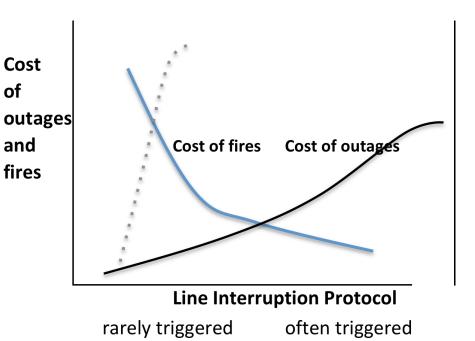
- Minimize transmission
 Micro grids
- Move transmission
 - Underground lines
 - Move lines to lower risk paths
 - WECC transmission capacity is often concentrated in high risk areas.
- De-energize transmission

Distribution

- Minimize fringe distribution —Encourage urban infill, limit sprawl
- Move distribution
 - Underground lines
 - Move lines
 - Particularly in WUI areas
 - Zoning
- De-energize distribution



- Tradeoff between fires • and power interruptions -How costly are outages?
- UCSB, LBNL LLNL UCSD **UCB** proposal
- Data needs
 - —Wind data
 - -grid interruption costs



of

More Info



Technical Reports

California Energy Commission 4th Climate Assessment

Wildfire

Assessing the Impact of Wildfire on California's Electricity Grid

Climate

Risk To California Energy Infrastructure From Climate Change

Insurance

Impact Of Changing Wildfire Risk On California's Residential Insurance Market



Lesley K. McAllister Symposium on Climate and Energy Law The Impacts of Wildfires

• Brian D'Agostino, Director – Fire Science & Climate Adaptation, SDG&E

• November 8, 2019

Executive Summary

The purpose of this presentation is to provide an overview of SDG&E's enhancements since last fire season that will help provide community resilience and mitigate wildfire risk and improve community and stakeholder awareness

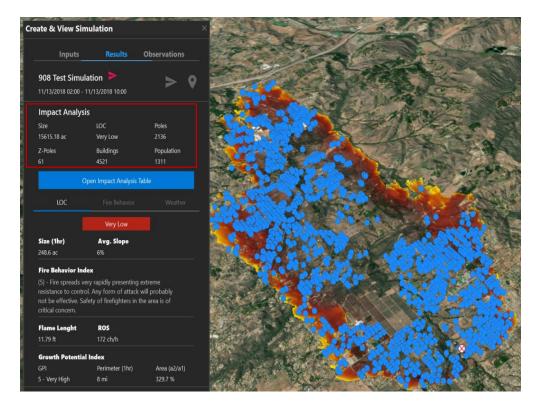
- Significant work has occurred in the implementation of SDG&E's Wildfire Mitigation Plan
- New tools to enhance operational decision making
 - Weather technology enhancements
 - New vegetation risk index
 - New inspection technology
- Additional hardening programs have been implemented
- Enhanced stakeholder awareness events and customer notifications



Weather Technology Enhancements

SDG&E continues to integrate big data, artificial intelligence and advanced analytics into meteorological operations through the analysis of additional data including tree trimming records and outage history

- Weather network is being upgraded to install additional stations in the Wildland Urban Interface (WUI) and enable 30second data to support emergency operations
- SDG&E's fire behavior models have been synched with census data to further define the highest risk areas with respect to population density and structures
- SDG&E's Fire Potential Index has been upgraded to include more granular weather data from internal super computing program

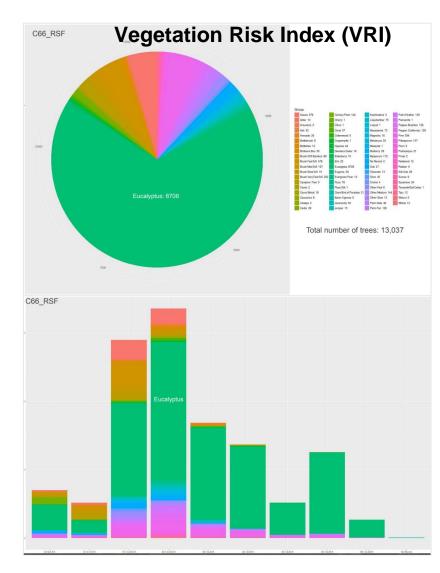




Improved Operational Decision Making Tools

SDG&E's Fire Scientists and Vegetation Managers have developed a new Vegetation Risk Index (VRI) to support decision making and improve operations during periods of high fire danger

- The new tool quantifies the risk associated with vegetation by analyzing:
 - Total number of trees in the vicinity of a circuit
 - Height of trees
 - Tree species
 - Historical tree related outages
- Key benefits:
 - Assist in operational decisions during fire weather events
 - Prioritize vegetation management efforts
 - Enable more data-driven enhanced vegetation management program



Improved Operational Decision Making Tools

Upgraded Situational Awareness Dashboards have been developed to support decision making

- Situational Awareness Dashboards include:
 - Circuit-level vegetation risk
 - Historical wind information including the identification of the 95th and 99th percentile wind speeds

VRI

x

X

x

x

Circuit

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Customer communication
 analytics

Anemometer

Santa Ysabel North

School House Canyon

West Rancho Bernardo

School House Canyon

Santa Ysabel North

School House Canyon

West Rancho Bernardo

School House Canyon

Santa Ysabel North

School House Canyon

West Rancho Bernardo

School House Canyon

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ab at that		Energized	79-799R	13 mph	Fully Restored	Jul 2 2019, 02:34 DURATION 19 DATE 11 HRS. 55 MIN	Jul 12, 14:33 ESTMATED JUL 5, 17:30	21	10,289 <u>+ More</u>	1,237	0 (75% Confirmed) + Mon
		De-Energized	79-540	F 68 mph	Partially Restored ON JUL 6, 01:25	Jul 4 2019, 13:22 DURATION: 3 DAYS, 5 HRS, 21 MIN	Jul 6, 01:25 (Partial) ESTIMATED JUL 8, 00:45	47 RESTORED: 45	10,289 + More	1,237	5 (75% Complete) + Mor
e wind		FROM TO 10	79-540	32 mph system PCTL: 18 MPH	🏌 De-Energized	Jun 29 2019, 09:07 DURATION: 13 DAYS, 8 HRS, 7 MIN	ESTIMATED JUL 7, 21:00	109	10,289 <u>+ More</u>	1,237	5 (75% Complete) + Mon
			79-540	52 mph 997H PCTL: 48 MPH 44 mph 997H PCTL: 40MPH	K De-Energized Ready for Patrol ON JUL 12, 20:11	Jun 13 2019, 08:17 DURATION: THRS. 1 MIN Jul 4 2019, 01:16	 ESTIMATED JUL 22, 10:31	76 230	10,289 <u>• More</u> 10,289 <u>• More</u>	1,237	5 (75% Complete) <u>• Mon</u> 5 (58% Confirmed) <u>• Mon</u>
		Communities (All)	79-660	99714 PCTL: 468PH	De-Energized	DURATION: 3 DAYS, 9 HRS, 21 MIN Jul 10 2019, 02:34	ESTIMATED JUL 18, 10:45	230	10,289 <u>• More</u> 10,289 <u>• More</u>	1,237	5 (58% Continued) • More 5 (75% Complete) • More
		Account Types (All)	79-540	92TH PCTL: 30 MPH 61 mph 92TH PCTL: 55 MPH	X De-Energized	Juli 8 2019, 14:29 Duration: 3 DAYS, 11 HRS, 6 MIN Juli 8 2019, 14:29 Duration: 4 DAYS, 20 HRS, 3 MIN	ESTIMATED JUL 16, 09:15	23	10,289 + More	1,237	5 (75% Complete) + More
n			79-425	B 38 mph	Ready for Patrol on Jun 11, 62.02	Jul 8 2019, 12:32 DURATION: 4 DAYS, 18 HRS, 10 MIN	ESTIMATED JUL 10, 07:14	123,128	10,289 + More	1,237	5 (58% Confirmed) + Mor
n			79-425	10 mph 99TH PCTL: 408PH	Ready for Patrol ON JUL 10, 12:30	Jul 8 2019, 03:09 DURATION: 4 DAYS, 20 HRS, 45 MIN	ESTIMATED JUL 13, 06:45	123,128	10,289 + More	1,237	5 (58% Confirmed) + Mon
			79-400R	F 63 mph 92TH PCTL: 29MPH 5 mph	X De-Energized	Jul 9 2019, 05:05 DURATION: 3 DAYS, 6 HRS, 19 MIN		123,128	10,289 <u>+ More</u>	1,237	5 (75% Complete) + Mon
				97TH PCTL: 46MPH	# Energized			123,128	10,289 <u>• More</u> 10,289 <u>• More</u>	1,237	5 (75% Complete) <u>• Mor</u> 5 (75% Complete) <u>• Mor</u>
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New Infrastructure Hardening Programs Infrastructure enhancements will reduce the risk of catastrophic wildfires

Pole Risk Mitigation + Engineering (PRiME)

- Documented pole loading calculations for all poles in SDG&E's service territory (starting in HFTD)
- Leverages improved methodologies including LiDAR⁽¹⁾ imaging, PLS-CADD⁽²⁾ modeling software, and weather data to perform pole loading assessments of SDG&E's service territory
- Poles requiring construction activities will be remediated as they are identified
- The team replaced over 375 poles in 2019⁽³⁾ and plans to remediate ~700 by year-end
- Additional ~1,700 poles targeted in

 Light Detection and Ranging (LiDAR)
 Power Line Systems Computer Aided Design and Drafting (PLS-CADD)
 As of June 2019

Wire Safety Enhancement (WiSE)

- Targeted replacement of small conductor in the Wildland Urban Interface and coastal canyon areas
- Rebuilding overhead infrastructure to fire hardened construction standards
- 9 circuits targeted in 2019





Increased Stakeholder Awareness

SDG&E has conducted several community events to promote wildfire preparedness, resiliency and safety

- **Open Houses** | Six events across high risk fire areas to educate customers and promote community preparedness
- Wildfire Resiliency Fairs | Three events with several community partners :
 - Feeding San Diego 2-1-1 San Diego ٠

 - SD County Animal Cal-Fire Services
 - San Diego Food Bank
 - SD Humane Society
 - Sheriff Departments
 - Sunrise Power Link Grant Program (Alpine • Cleveland National

- Fire Safe Councils American Red Cross

 - California Highway Patrol
 - Community **Emergency Response** Team
- Operation Fire Safe | A company and community-wide event to enhance widfire preparedness will take place August 7







Customer Notifications

New requirements have been incorporated into processes and technologies

Notifications for the following audiences:

- Affected Customers
- Access and Functional Needs (AFN) Populations
- Critical Businesses + Utilities
- Public Safety Partners + First Responders
- Cal OES⁽¹⁾, Cal FIRE + CPUC⁽²⁾

SDG&E Website

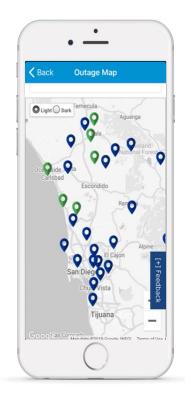
 Public Safety Power Shutoff dedicated web page during events

Communication Channels in Multiple Languages

- Email
- Text
- Phone

Joint IOU Message Coordination with Cal OES⁽¹⁾

Direct GIS feed made available sharing PSPS information with Cal OES⁽¹⁾



Outage notifications delivered in 8 languages

- English
 - Mandarin Tag
- Cantones
 e
- Korean

- Vietnamese
- Tagalog
- Spanish
- Russian SDG



California Office of Emergency Services (Cal OES)
 California Public Utilities Commission (CPUC)