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Wildfire Mitigation

September 17, 2019



Evolution of Wildfire Preparedness

Focused on **compliance** with CPUC regulations related to design, construction and maintenance of powerlines and facilities

Focused on **improving the integrity and reliability** of the transmission and distribution systems, emphasis on rural areas

Core Goal: No wildfire ignitions from SDG&E facilities

Focus on **effective and innovative risk management** necessary to minimize the risk of utility-related wildfires

- Meeting standards & regulations
- Aggressive Vegetation Management
- Emergency Operations Center serves as command center

- First dedicated Fire Coordinator
- Partnership with firefighting agencies
- Increased customer communication
- Recipient of Reliability Award (13 consecutive years)

- Aggressive infrastructure hardening programs
- Advanced situational awareness
- Dedicated contract firefighting resources
- Aerial fire suppression support
- De-energization to ensure public safety

- Active leadership role in shaping policy and standards
- Enhancing Vegetation Management
- Expand infrastructure hardening

2003 Fires **2007 Fires** **Today** **Future** 

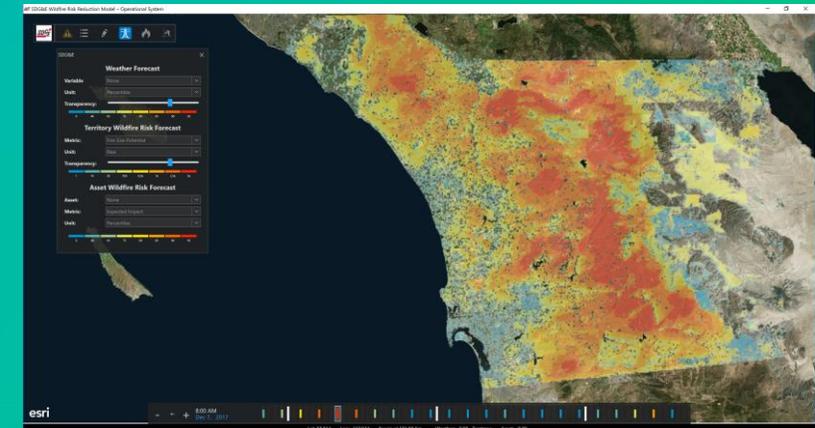
Compliance

Effective Risk Management

Wildfire Mitigation Programs

SDG&E is minimizing the risk of its electrical infrastructure causing wildfires by using an integrated three-pronged approach:

- **Operations and Engineering** - how SDG&E builds, maintains, and operates its electric system to be fire safe.
- **Situational Awareness and Weather Technology** - focuses on SDG&E's ability to monitor and understand the fire environment.
- **Customer Outreach and Education** - concentrates on SDG&E's communication and collaboration with regional stakeholders and customers.



Wildfire Mitigation Programs

Program Summary



Category	Mitigation	YTD Complete	Scope	% Complete	Program to Date	Program Targets	% Complete
Fire Hardening	FIRM	36 miles	80 miles	45%	357 miles	1450 miles	24%
Fire Hardening	Transmission Fire Hardening	3 miles	10 miles	30%	159 miles	290 miles	55%
Fire Hardening	CNF	35 miles	68 miles	51%	80 miles	160 miles	50%
Fire Hardening	PRiME	427 poles	700 poles	61%	427 poles	16,000 poles	3%
Fire Hardening	WiSE	3.62 miles	5.7 miles	64%	3.62 miles	TBD	TBD
Fire Hardening	Expulsion Fuse Replacement	872 fuses	2250 fuses	39%	872 fuses	7000 fuses	12%
Fire Hardening	Hotline Clamp Replacement	115 HLC	500 HLC	23%	115 HLC	4522 HLC	3%
Fire Hardening	PSPS Engineering Enhancements	1 switch	7 switches	14%	110 switches	TBD	TBD
Fire Hardening	Underground Circuit Line Segments	0 miles	1.25 miles	0%	0 miles	TBD	TBD
Fire Hardening	FTZAP	6 circuits	8 circuits	75%	6 circuits	73 circuits	8%
Inspections	Distribution QA/QC	10,000 poles	10,000 poles	100%	Ongoing	Ongoing	Ongoing
Inspections	Distribution Detailed	42,212 poles	47850 poles	88%	Ongoing	Ongoing	Ongoing
Inspections	Transmission	6,730 OH Structures	6,730 OH Structures	100%	Ongoing	Ongoing	Ongoing
Inspections	Substation	242 subs	300 subs	81%	Ongoing	Ongoing	Ongoing
Situational Awareness	Weather Stations	12 stations	13 stations	92%	190 stations	225 stations	84%
Vegetation Mangement	Off Cycle Patrols and Trimming	28 circuits	28 circuits	100%	Ongoing	Ongoing	Ongoing
Vegetation Mangement	25' Enhanced Clearance	5000 trees	11,000 trees	45%	5000 trees	55,000 trees	9%

Operations and Engineering Inspection Plan



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Corrective Maintenance Program (CMP)

- CPUC-governed prescriptive program of inspection and repair

QA/QC inspection of HFTD area

- Annually one third of the HFTD Tier 3 is inspected
- Above and beyond routine compliance program

Proactive inspections

- In advance of high-risk events focus on areas forecast to receive the strongest winds including coastal canyons and wildland urban interface

Update

- New distribution inspection program using drones in progress in HFTD
- 100% of QA/QC Inspections complete



Operations and Engineering

System Hardening Plan

Design Criteria

- Leverages the wind and meteorology data to design to known local conditions of the area

Installation of Stronger Conductor

- To prevent structural failure and reduce possibility of wires coming down

Increase Conductor Spacing

- To reduce the risk of a flash at all conductor levels

Install Steel Poles

- More reliable material attributes and resiliency

Install Covered Conductor

- In close proximity to dense vegetation

Strategically Underground Lines

- Where small amounts of undergrounding leads to significant benefits



Operations and Engineering

System Hardening Plan



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FiRM (Fire Risk Mitigation)

- Multi-year distribution program (2014-2025)
- Replace two types of copper conductors
- Replace wood poles to steel poles
- Install overhead SCADA sectionalizing switches and more advanced protection
- Reinforce or shorten spans over 500ft
- Replacement of wire spans
- Install CA Fire approved fuses
- **Update – 45% complete. 36 miles of miles hardened YTD**

Transmission Fire Hardening

- Addressing all 69kV transmission lines located in the HFTD
- **Update - On track to fire harden 10 miles of 69kV by December 2019**

Cleveland National Forest

- Multi-year fire hardening program involving 20 transmission and distribution lines.
- Includes 12kV and 69kV facilities located in Tier 3 fire areas in and around the Cleveland National Forest.
- Scope includes wood pole to steel pole replacement, underground conversion of select distribution lines and removal of one transmission line.
- **Update – 35 miles completed so far this year. 32 miles in construction to complete by December 2019. YTD 60% complete.**

Pole Risk Mitigation & Eng. (PRiME)

- Program to assess and remediate the highest risk poles in the HFTD
- The highest risk poles are those most likely to cause failure during a weather event.
- Designs to all current G.O. 95 standards and known local wind conditions to significantly reduce fire risk of the pole
- **Update – The PRiME program has remediated 427 poles in the Tier 3 area of the HFTD**



Operations and Engineering System Hardening Plan

WiSE (Wire Safety Enhancement)

- Multi-year distribution program to replace small copper conductors
- Fire harden circuits in the coastal canyons
- Fire harden circuits within the wildland urban interface
- **Update - Several miles completed; additional locations under construction.**

Expulsion Fuse Replacements

- Multi year program to replace branch expulsion fuses within the HFTD
- Install CAL FIRE approved power fuses
- **Update - Roughly 25% of the locations forecasted to be completed in 2019 are completed.**

Hotline Clamp Replacements

- Multi-year maintenance program to replace connectors within the HFTD
- Clamp failures have lead to downed conductor
- **Update - Roughly 25% of the locations forecasted to be completed in 2019 are completed.**

Public Safety Power Shutoff

- Engineering Enhancements
- Multi-year program to install sectionalizing devices reducing customer impact of PSPS events
- **Update - All locations forecasted for 2019 are in construction.**

New Cal Fire Approved Fuse



Remote Sectionalizing Device



Fire Hardening Challenges / Opportunities

Challenges

- Qualifying and training design and construction resources
- Material Delays with Steel Pole Manufacturers
- Land Rights Issues and Permits

Opportunities

- Leveraging data to prioritize highest risk areas with hardening programs

Operations and Engineering

Enhanced HFTD Vegetation Management Plan

Update

- Implementation of 25-foot post-trim clearance
 - 200,000 trees in HFTD down to 55,000 targeted trees (e.g., eucalyptus, oak, sycamore, pine)
 - 5837 trees pruned to 25 feet
 - 624 of targeted trees removed
- Community outreach events in impacted communities
- 100% audit of all completed tree work within HFTD
- Redundant hazard tree inspections in HFTD



Operations and Engineering

Fuels Management & Ignition Management

Fuels Management Program

- In partnership with fire departments, fire safe councils, and other stakeholders
- Lowers risk of catastrophic wildfires by reducing and removing wildland fuel accumulations
- Assessing 4,000 acres of SDG&E right of ways, easements, and fee-title lands for hazardous fuel reduction

Enhanced Ignition Management Program

- Gathers data from ignitions and near ignitions; performs root cause analysis of data to detect patterns or correlations
- Conclusions used to address and mitigate risk

Update

- Initiated wildland fuel reduction on BLM-owned land in June – 30% complete
- Identified top 13 high fire risk distribution circuits outside BLM
- Fuel reduction in progress



Vegetation Management Challenges / Opportunities

Challenges

- Customers challenges
- Qualifying and training resources
- Land and Environmental Agencies

Opportunities

- Leveraging Species Data to target highest risk trees for additional clearance
- Development of vegetation risk index to support real time operational decision making and to provide input parameters for covered conductor scoping

Operations and Engineering

Advanced Electric System Protection

Protection Philosophy

- Three types of protection functions in SDG&E's automated reclosers:
 - **Normal Profile:** Protects circuits under normal conditions
 - **Sensitive Profile:** Relay is very fast and highly sensitive to isolate faults faster than normal profile
 - **Sensitive Ground Fault:** This setting detects high impedance faults resulting from downed conductors.



Protective Devices

- **Sensitive Profile and Sensitive Ground Fault Protection**
 - Over 330 distribution circuit automated reclosers in the HFTD have the capability
- **Falling Conductor Protection (FCP)**
 - Developing technology to de-energize conductors prior to hitting the ground
 - *As part of SDG&E's fire hardening efforts, devices are being installed employment of falling conductor technology*



Update

Falling Conductor Protection (FCP)

100% Complete - Six circuits placed in service with FCP in test mode to monitor performance prior to enabling in production

Rapid Earth Fault Current Limiting (REFCL) Technology

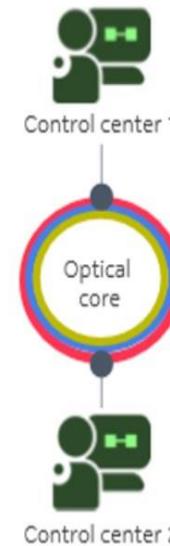
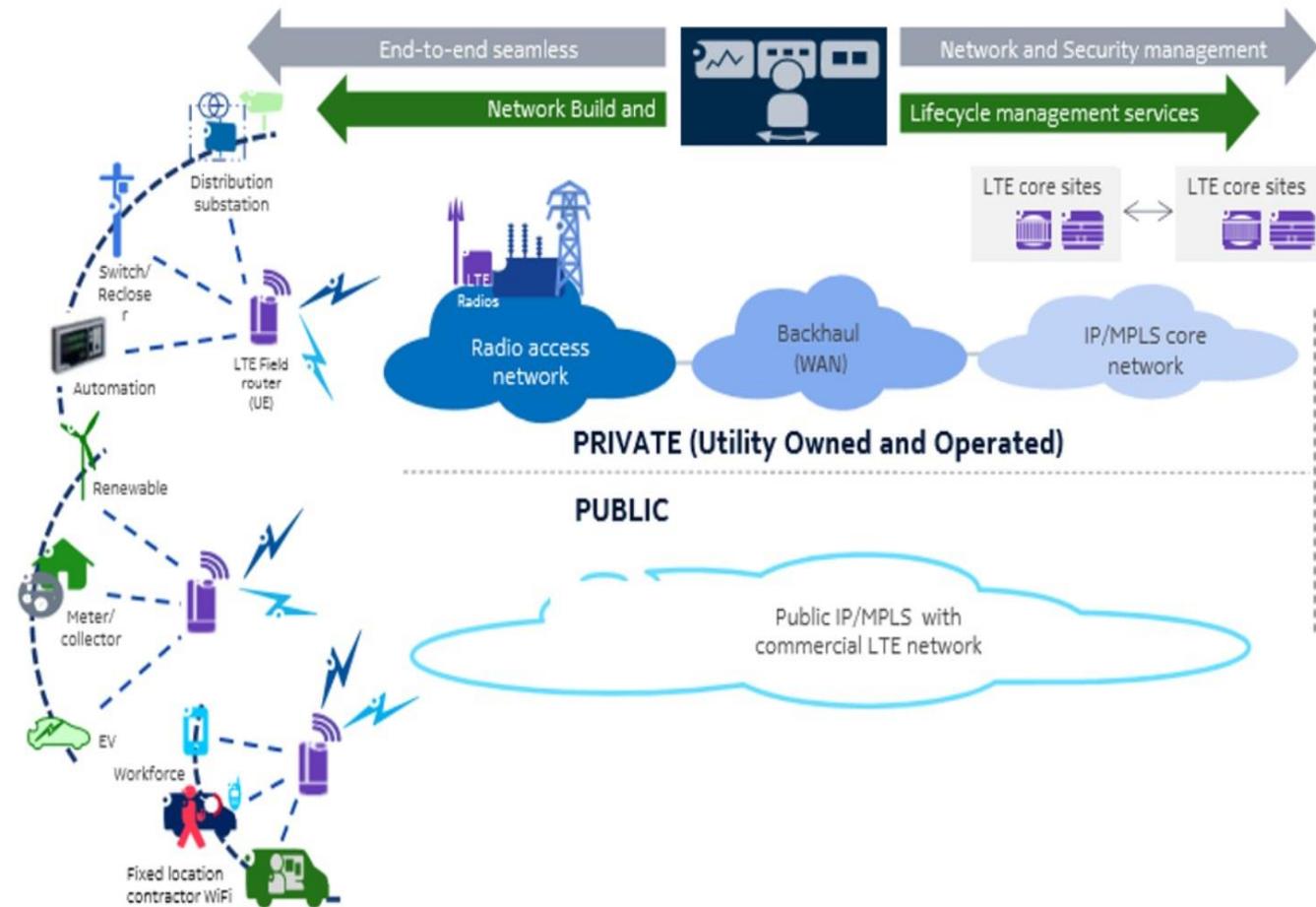
SDG&E is currently researching a new protection technology designed to reduce fault current levels down to near-zero levels. This technology may be feasible for our system and may reduce wildfire risk.

Operations and Engineering

Private Long Term Evolution (LTE) Communications



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Builds a communication network to enable:

- Improved mobile network during emergency events
- Expanded network coverage within the HFTD
- Enhanced cyber security capabilities

Update:

Push-to-Talk Voice Comms Design

- Georedundant Radio Core at Data Center
- WMP Radio Site Design
- 40% Complete

Operations and Engineering

Aviation Firefighting



Implementation of a 365 day aerial program to enhance fire suppression

Agreement with the County of San Diego, CAL FIRE, and the Orange County Fire Authority for aerial fire suppression support

Additional aerial asset secured, Sikorsky S-60 helo, which unlike the Aircrane, has night fly capability

Update:

- Aircrane operations: 14
- Sikorsky operations: 4
- Year to date water drops: 158,434 Gallons



Nation's largest water dropping helicopter



Available 365 days a year

Situational Awareness

Fire Science & Climate Adaption

In 2018, SDG&E established a Fire Science and Climate Adaption (FS&CA) department comprised of meteorologists, community resiliency experts & fire coordinators. The department's purpose is to respond & strategize for the ever-changing utility industry's fire preparedness activities & programs.

- Five full-time degreed and experienced meteorologists on call 24/7/365
- Five former firefighters with over 150 years of fire experience who serve as Fire Coordinators 24/7/365
- Fire Mitigation and Community Resilience Outreach division



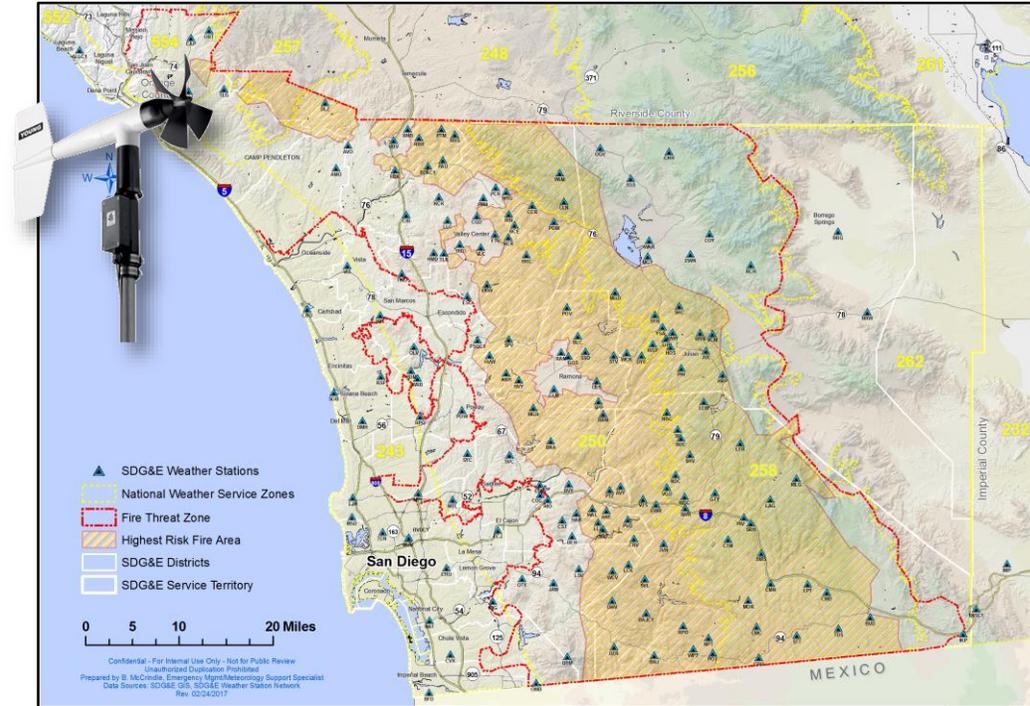
Wildfire Prevention Strategy and Programs

Situation Awareness Protocols & Determination of Local Conditions



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- SDG&E owns & operates a network of 190 weather stations
 - Located on electric distribution and transmission poles
 - Provide temperature, humidity & wind observations every 10 minutes.
- Update - Weather network upgrades
 - Added stations in the Wildland Urban Interface (WUI)
 - Enabled 30-second data to support emergency operations



Wildfire Prevention Strategy & Programs

Situational Awareness Protocols & Determination of Local Conditions



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- Over 100 high definition cameras improve fire detection.
- 16 pan-tilt-zoom Alert SDG&E cameras installed in 2017.
 - CAL FIRE and other fire agencies have priority to control cameras.
 - Triangulation of cameras allows agencies and SDG&E to accurately determine wildfire location.
 - Infrared capabilities for night vision.

Update: Additional cameras were installed in the coastal canyons & wildland urban interface areas

Wildfire Prevention Strategy & Programs

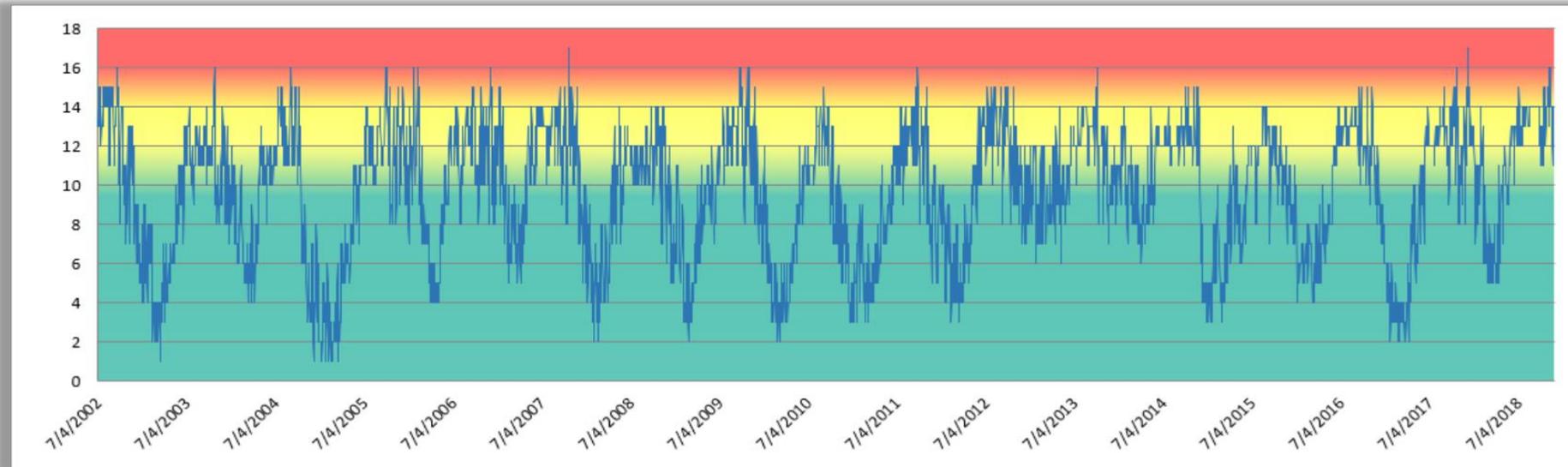


Situational Awareness Protocols & Determination of Local Conditions



- The Fire Potential Index (FPI) is a seven-day planning and decision support tool, developed to communicate the wildfire potential, classifying the fire potential within each of SDG&E's 8 operating districts.
- Used to inform operational decisions, work restrictions, resource allocation.
- The FPI has been back-tested and validated against historical wildfire occurrences.
- **2019 enhancements include integration of artificial intelligence into the fuels modeling.**

	Thu 10/25	Fri 10/26	Sat 10/27	Sun 10/28	Mon 10/29	Tue 10/30	Wed 10/31	Thu 11/01
ME	Normal 11	Extreme 15	Elevated 13	Elevated 12	Normal 11	Normal 11	Normal 11	Normal 10
RA	Normal 11	Extreme 15	Elevated 13	Elevated 12	Normal 11	Normal 11	Normal 11	Normal 10
EA	Normal 10	Elevated 14	Elevated 12	Normal 11	Normal 11	Normal 10	Normal 10	Normal 10
NE	Normal 10	Elevated 14	Elevated 12	Normal 11	Normal 11	Normal 10	Normal 10	Normal 10
OC	Normal 10	Elevated 13	Normal 11	Normal 11	Normal 10	Normal 9	Normal 9	Normal 9
NC	Normal 10	Elevated 13	Normal 11	Normal 11	Normal 10	Normal 9	Normal 9	Normal 9
BC	Normal 10	Elevated 13	Normal 11	Normal 11	Normal 10	Normal 9	Normal 9	Normal 9
CM	Normal 10	Elevated 13	Normal 11	Normal 11	Normal 10	Normal 9	Normal 9	Normal 9



Wildfire Prevention Strategy & Programs

Situational Awareness Protocols & Determination of Local Conditions



Santa Ana Wildfire Threat Index (SAWTI)

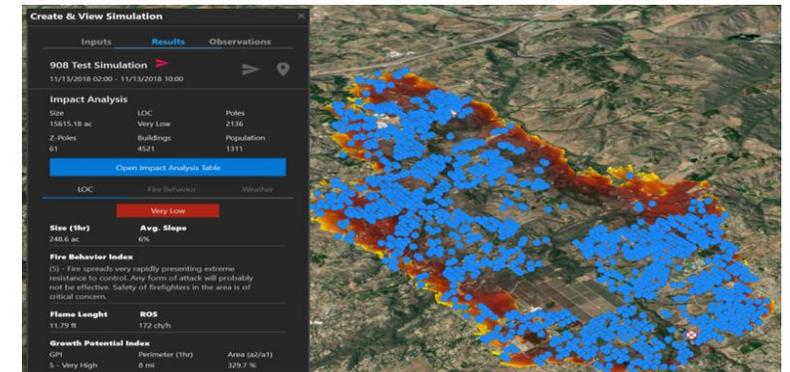
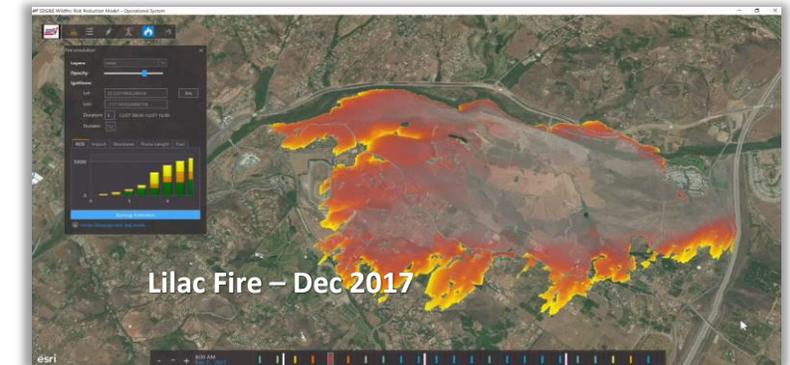
SDG&E collaborated with U.S. Forest Service and UCLA to provide this decision support tool to fire agencies & the general public

- Calculates the potential for large wildfire activity based on the strength, extent, and duration of the wind, dryness of the air, dryness of the vegetation, and greenness of the grass. Scale from “Marginal” to “Extreme”
- Similar to the Hurricane “Category” Rating Scale

Wildfire Risk Reduction Modeling (WRRM)

Two models have been developed by SDG&E and are the first of their kind in the nation:

- **The WRRM model** for risk assessment and prioritization of projects
- **The WRRM-Ops model** assesses the areas of highest fire danger before a blaze begins
 - Uses simulations generated from weather conditions, historical fire and outage history, and vegetation data to assess the wildfire risk to every component of our electric system
 - Synched with census data to further define the highest risk areas with respect to population density and structures



Wildfire Prevention Strategy & Programs

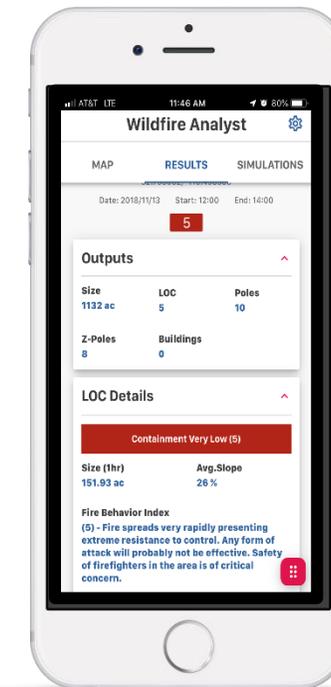
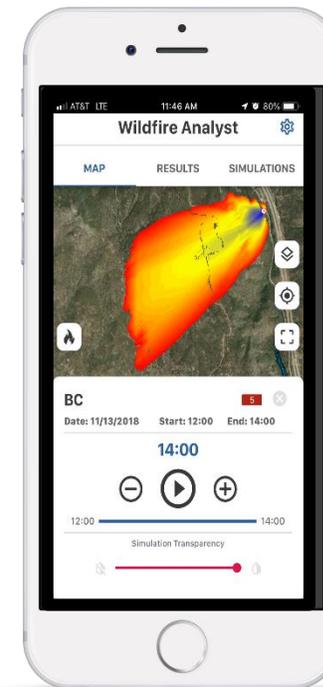
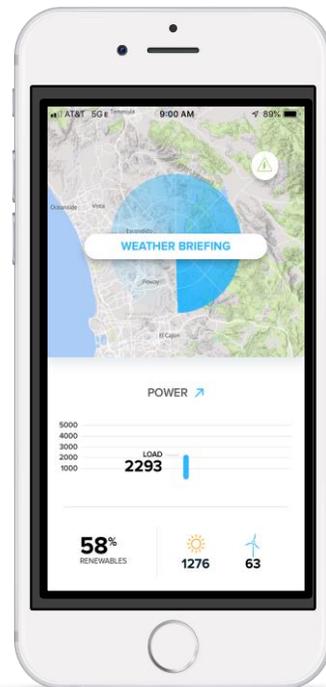
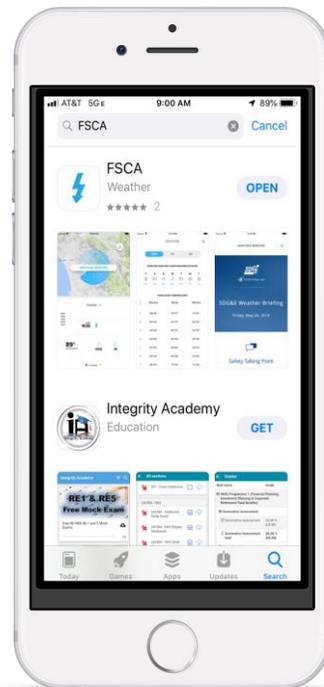
Situational Awareness Protocols & Determination of Local Conditions



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SDG&E continues to integrate mobile applications into its situational awareness platform to better monitor system safety and performance

- **Fire Science & Climate Adaptation Application** | Provides access to weather information and enables push notifications
- **WRRM-Ops Application** | Provides SDG&E Fire Scientists and Fire Fighters to ability to share real-time intel with operational leadership



Wildfire Prevention Strategy & Programs

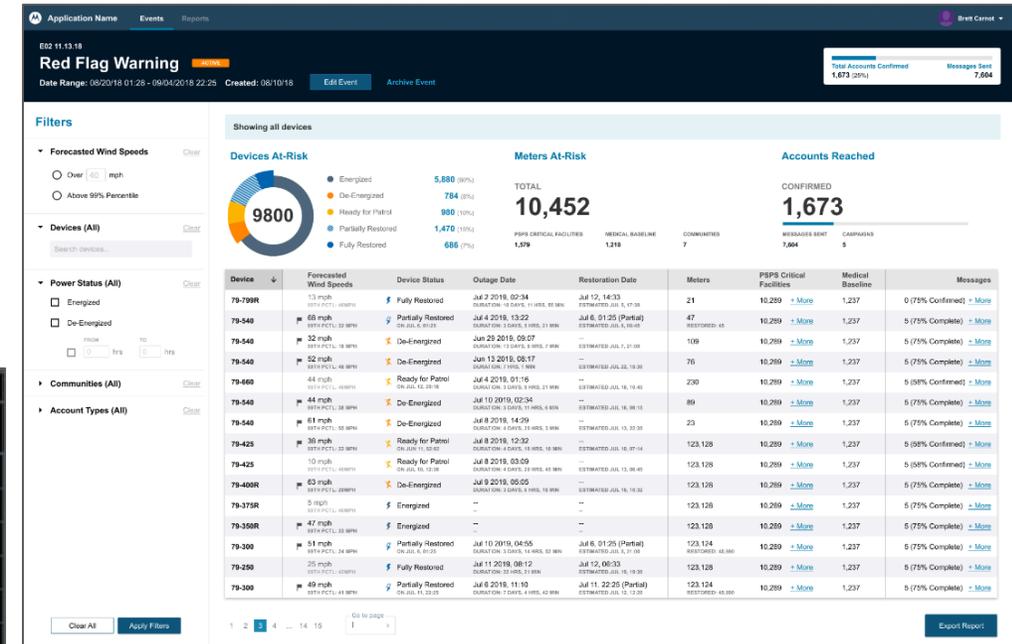
Situational Awareness Protocols & Determination of Local Conditions



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
 - Customer communication analytics

Anemometer	ID Data			Tie Line	Sub/Dist/FPI	Cust Impacts		Wind Data	
	VRI	Circuit				Cust # / % Out	Forecast	90/95/99 Percentile	Gust
Santa Ysabel North	X	220,221,222		625	ST/NE/14	5678 / 3%	78	60/65/70	25
School House Canyon	X	67,68,69		625	ST/NE/14	5678 / 3%	78	60/65/70	25
West Rancho Bernardo	N	220,221,222		625	ST/NE/14	5678 / 3%	78	60/65/70	25
School House Canyon	X	67,68,69		625	ST/NE/14	5678 / 3%	78	60/65/70	25
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Customer Outreach & Education —

Public Safety Power Shutoff (PSPS)

Notification processes significantly refined

- Outbound dialer now capable of faster dialing and larger volumes of calls including medical baseline customer communication
- Authorized to call cell phone numbers for emergency outreach
- Expanded use of social media
- SDG&E website serves as resource platform during high wind events
- External communications are initiated to customers, elected officials, agency representatives, first responders, **and newly required notifications to Cal OES, CALFIRE, CPUC, etc**

2019 Enhancements

- Adding two-way texting capabilities and synching the Enterprise Notification System (ENS) with our GIS and weather network
- SDG&E conducts extensive customer outreach and education campaigns

SDG&E is expanding and developing new programs and strategies

- Leveraging backup power for resilience to mitigate the risk associated with Public Safety Power Shutoffs
- Internet connectivity at fire stations
- Expanded Community Resource Center Network
- Communication in multiple languages
- Workshops and exercises with essential service providers (e.g., telecommunications and water) to address and augment PSPS preparedness
- Development of a portable generation grant program directed at residential medical baseline customers on life support

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
 - Fire Safe Councils
 - SD County Animal Services
 - San Diego Food Bank
 - SD Humane Society
 - Sheriff Departments
 - Sunrise Power Link Grant Program (Alpine Fair)
 - 2-1-1 San Diego
 - American Red Cross
 - Cal-Fire
 - California Highway Patrol
 - Community Emergency Response Team
 - Cleveland National Forest
 - County of San Diego OES
- **Operation Fire Safe** | A company and community-wide event to enhance wildfire preparedness



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New CPUC Requirements | 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, CAL FIRE + CPUC

SDG&E Website

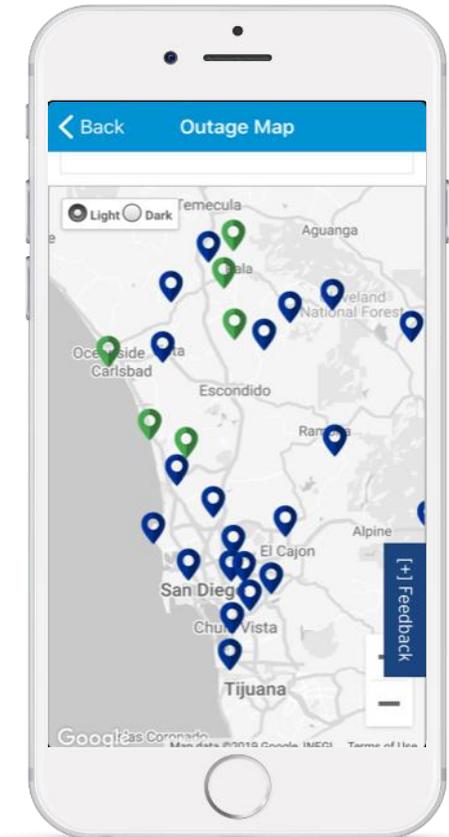
- Public Safety Power Shutoff dedicated web page during events

Communication Channels in Multiple Languages

- Email
- Text
- Phone

Joint IOU Message Coordination with Cal OES

- Direct GIS feed made available sharing PSPS information with Cal OES



Outage notifications delivered in 8 languages

- English
- Vietnamese
- Mandarin
- Tagalog
- Cantonese
- Spanish
- Korean
- Russian

Questions?