Comprehensive solutions to catastrophic wildfires in California

July 25, 2018

MICHAEL WARA

Wildfires are a catastrophic risk to California

Fundamental Problem: Current system for allocating and managing risks of wildfires in California is unsustainable.

- Unsafe (because all sides of the problem are not being worked).

- Unacceptable ratepayer impacts (unfair to renters, industrial customers, homeowners not in wildfire areas).

- Threatens climate goals (utility risks will increase ROE, foreclosing investment in EVs, RPS, etc.).

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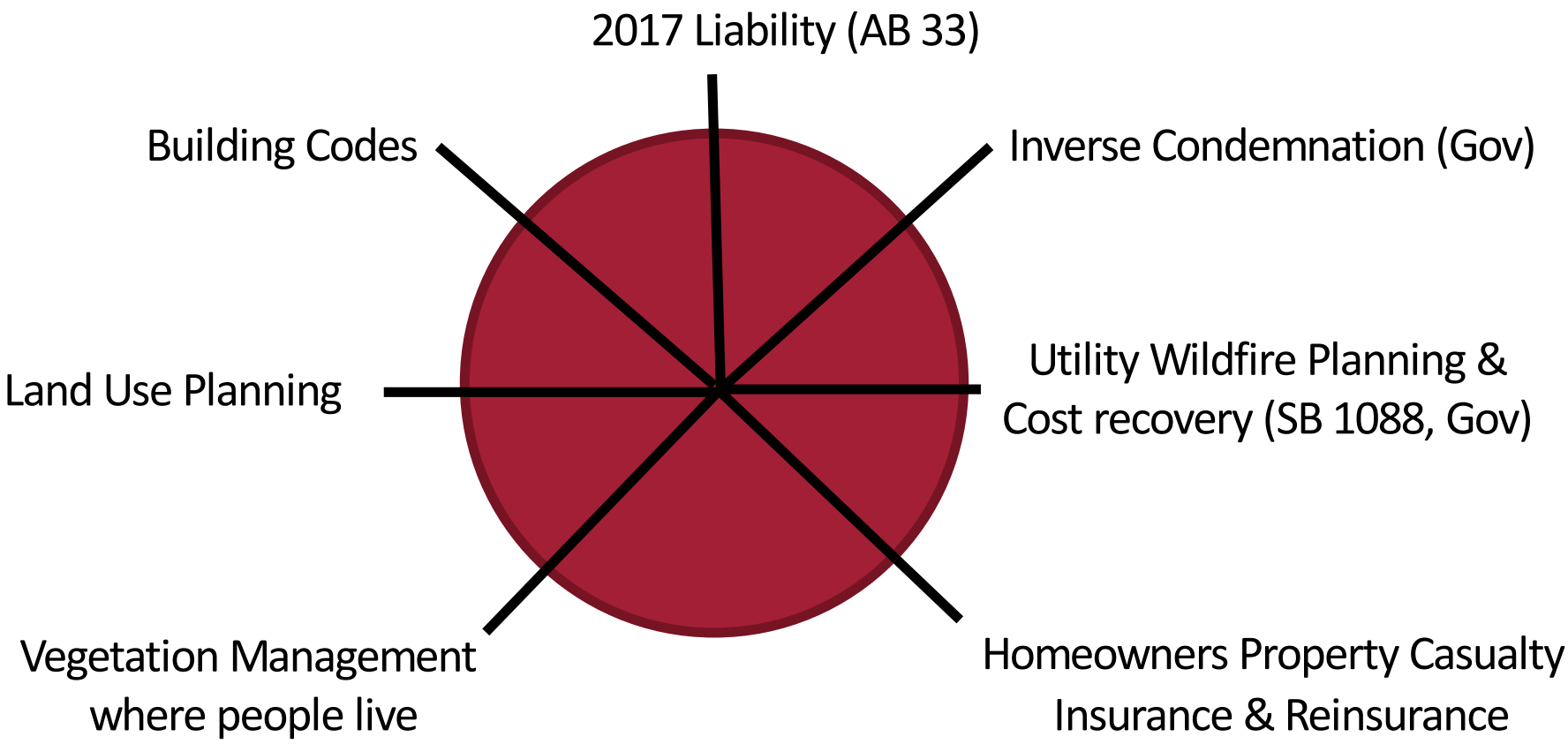
A solution addresses all dimensions of risk: Wildfire risk is not just a utility issue



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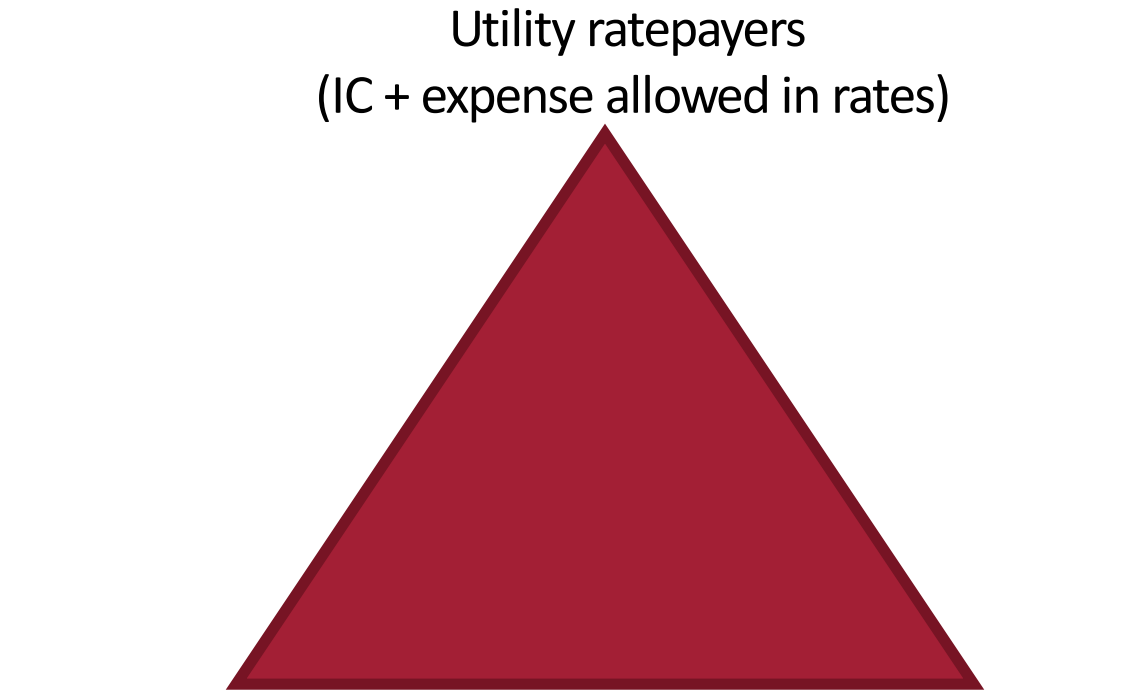
Effective risk management apportions risk to those that can manage it most efficiently



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The first step is to recognize two problems

Existing Liabilities	Future Liabilities
Created by past risk & actions combined with then existing laws and contracts.	Created by risk, current, & future actions combined with current law and private contracts.
Politics/law involve arguments regarding actual victims, ex-post facto, vested rights.	Politics involve reallocation of risk where private contracts can adjust to new regime.
Not critical to future of IOUs.	Critical to future of IOUs.

The 2017 (and earlier?) Liability

Coffey Park, Santa Rosa, 2017

Solution: Securitization (AB 33)

Pay settlement value of insured and uninsured losses from 2017 wildfires.

Key unanswered questions:

(1) Maximum amount securitized

(2) Process for crediting ratepayers if utility is at fault

(3) Guidance on limits to disallowance

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Go-Forward Cat Risk from Wildfires (1)

(1) Solution: IC Reform

Best option is move from strict liability to reasonableness std for ALL electric utility wildfire risks.

- Limited to wildfires
- Utilities still liable if negligent
- Is Constitutional action
- **Allocates additional risk to homeowners (insurers).**

2007 Fires in San Diego County

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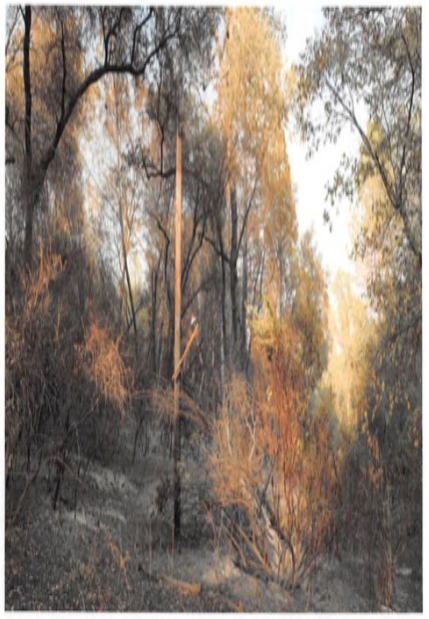
Go-Forward Cat Risk from Wildfires (2)

(2) Solution: Utility Wildfire Planning & Cost Recovery

Require utilities to take innovative steps to reduce risks in distribution system.

- To some degree already happening via CPUC process.
- SB 1088 will, if enacted, create centralized process.
- Two models:
  - Sarbanes Oxley (accountability)
  - Nuclear/oil industry (complex systems)



The GOA of the La Porte Fire, Butte County (2018, CalFire)

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Go-Forward Cat Risk from Wildfires (3)

(3) Solution: Homeowners Property Casualty Insurance

Take significant steps to reduce exit of major insurers from homeowners market via underwriting guidelines.

- Already a brewing crisis in CA.
- (1) and (2) make this much worse.
- Prop 103 complicates issues.
- **Accelerate rate filing timetable.**
- **Reinsurance/Cat. Bonds in rates.**
- **Financial incentives to create defensible space**
- **Other ideas from ins. industry stakeholders?**

Downtown Mill Valley, Marin County, view to Mt. Tamalpais.

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Go-Forward Cat Risk from Wildfires (4)

(4) Solution: vegetation management where people live.

Current non-utility vegetation management is disproportionately on public land in sparsely populated areas.

- Current ratio of emergency fund spending to fuel management is 3:1.
- Dramatically increase Fire Protection Grants (from $194m to $400m).
- Focus incremental funding on areas with high population/value at risk and severe wildfire threats.

The 1929 wildfire in Mill Valley viewed from Sausalito.

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Go-Forward Cat Risk from Wildfires (5)

(5) Solution: create defensible structures with lots of carrots and a few sticks.

Defensible space in many Very High Fire Hazard Severity Zones is nonexistent.

- Remove barriers to vegetation management on small parcels (tree removal permits).
- Inspect and educate often.
- Provide funds to remove vegetation.
- Require WUI building codes on all new permits in SRA and LRA.
- Create incentives via insurance

Sausalito: where State Farm Insurance fears to tread.

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Go-Forward Cat Risk from Wildfires (6)

(6) Solution: limit land expansion into WUI because of risks and costs. Require new WUI entitlement to meet fire safe land use requirements

- Sound climate adaptation and risk management would dictate retreat from areas that face greater risks due to climate change.
- Current land use policies tend to favor development in the WUI over infill.

Aftermath of the 1923 Berkeley Fire

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Solutions to catastrophic risks from wildfires

Solutions to California's Wildfire Catastrophe Risk can be addressed in stages.

(A) Separate 2017 from Go-forward

(B) Clarify AB 33 to facilitate more rapid payment to victims.

(C) Multi-prong, linked, Go-forward

- (1) Utility IC reform
- (2) Utility risk management
- (3) Homeowners Ins. Reform
- (4) Vegetation management
- (5) Building codes/land use

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Concluding remarks

Two sets of issues – one set is tractable in a month, another may take more time.

Two political conclusions from the electricity crisis – don't let utilities go bankrupt and beware the unintended consequences of complex changes. Both apply here.

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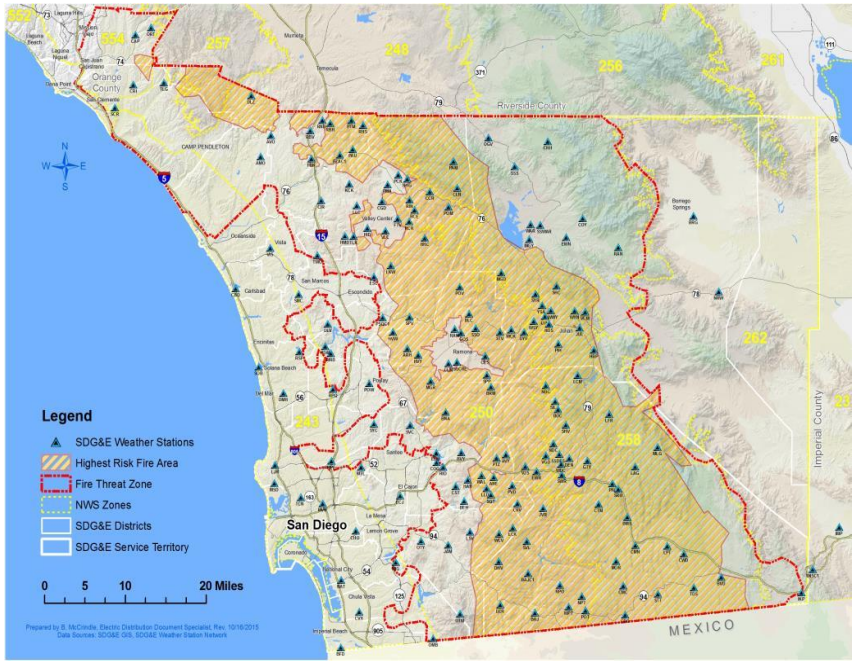
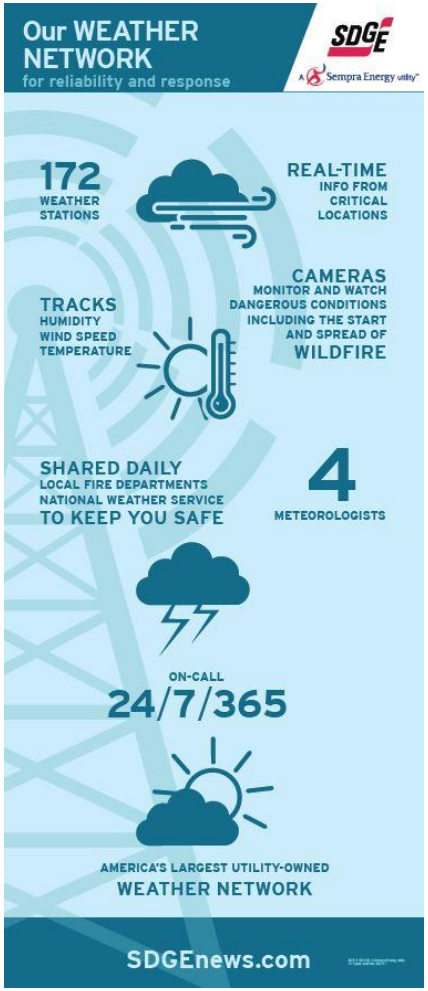
Questions?

Wildfire Risk Mitigation

July 25, 2018

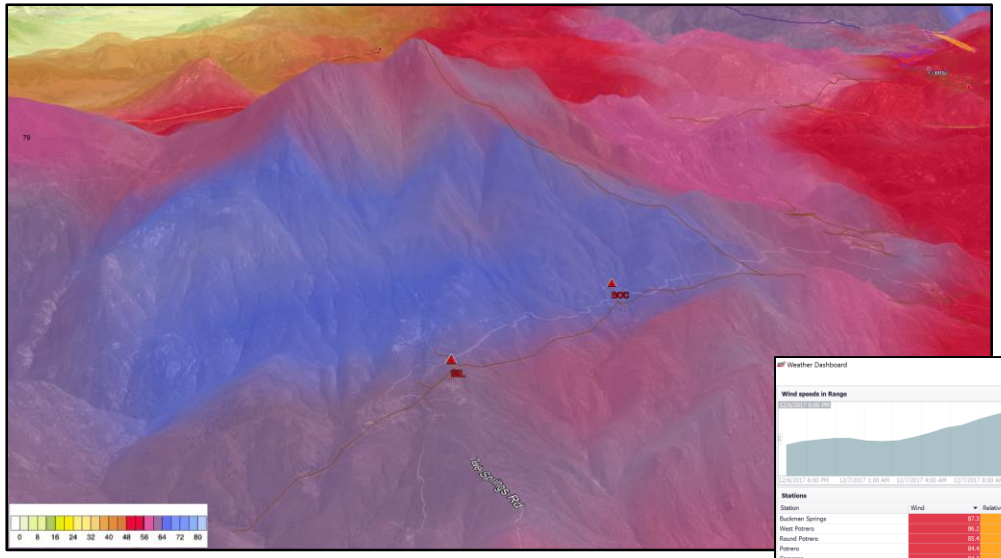
SDG&E's Premier Weather Network: 170+ Weather Stations



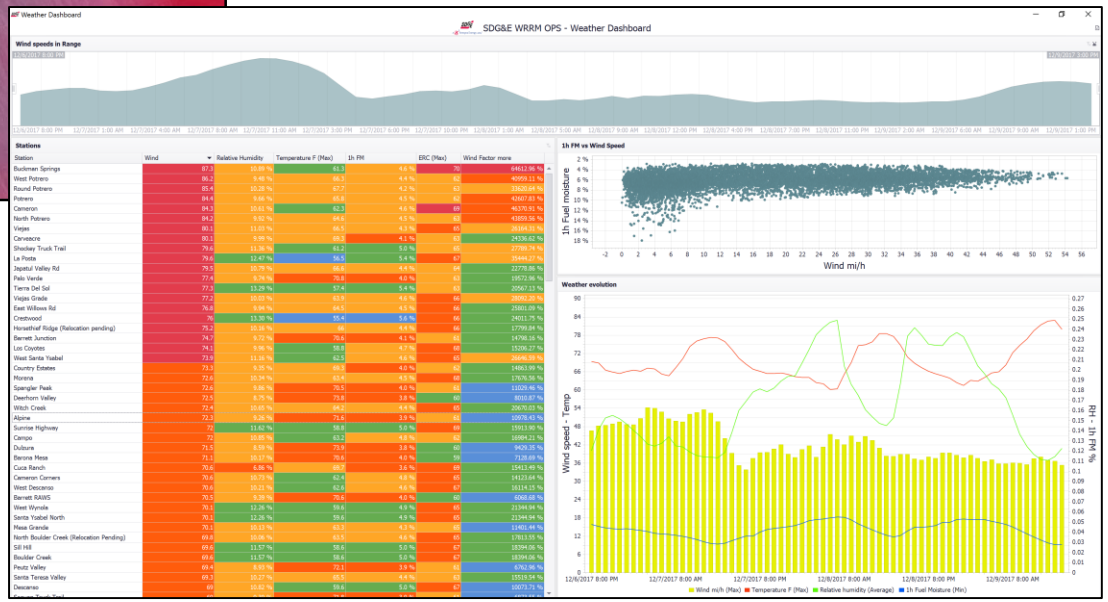


- SDG&E owns and operates the largest utility mesonet in the nation
- Team of meteorologists collect over 200,000 pieces of weather data daily
- Weather stations physically located on distribution and transmission poles
- Provides temperature, humidity and wind speed readings every 10 minutes
- http://sdgeweather.com/

SDG&E High Performance Computing Program: Using Big Data to Enhance Situational Awareness



- Two high-performance computing clusters leverage weather data to run forecast models tuned to the SDG&E service territory

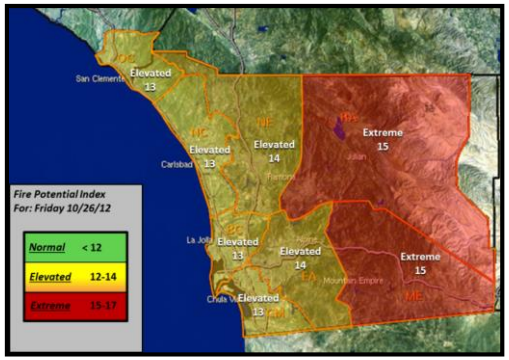


- Provides superior understanding of weather and vegetation moisture to support day-to-day and proactive emergency operations

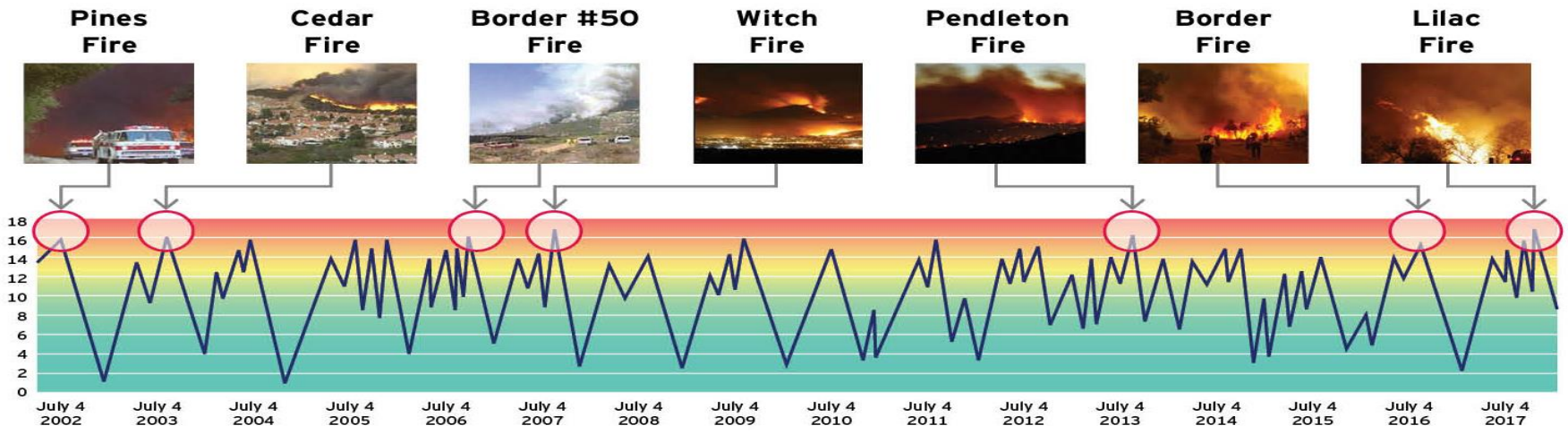
SDG&E's Fire Potential Index (FPI)

The Fire Potential Index is a planning and decision support tool designed to reduce the risk of a wildfire while improving efficiency and reliability

- Incorporates weather, live fuel moisture, dead fuel moisture, and greenness of the annual grasses
- Calculated at the district level
- Issued 12:30 pm daily
- Used to inform operational decisions, work restrictions, resource allocation
- Shared broadly within the community and fire agencies

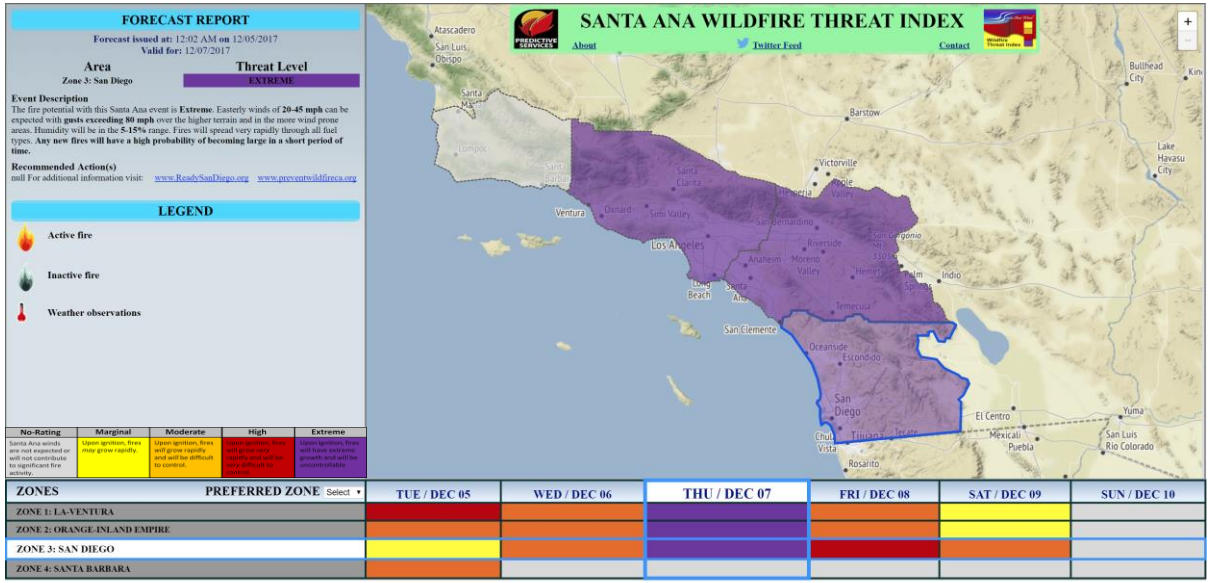


	Tue 12/05	Wed 12/06	Thu 12/07	Fri 12/08	Sat 12/09	Sun 12/10	Mon 12/11	Tues 12/12
Eastern District (Mt. Empire)	Extreme 15	Extreme 15	Extreme 17	Extreme 16	Extreme 15	Elevated 14	Elevated 13	Elevated 14
Eastern District (Ramona)	Extreme 15	Extreme 15	Extreme 17	Extreme 16	Extreme 15	Elevated 14	Elevated 13	Elevated 14
Eastern District	Extreme 15	Extreme 15	Extreme 16	Extreme 16	Extreme 15	Elevated 14	Elevated 12	Elevated 13
North Eastern District	Extreme 15	Extreme 15	Extreme 16	Extreme 16	Extreme 15	Elevated 14	Elevated 12	Elevated 13
Orange County District	Extreme 15	Elevated 13	Extreme 15	Extreme 15	Elevated 14	Elevated 13	Normal 11	Normal 11
North Coastal District	Elevated 14	Elevated 12	Extreme 15	Elevated 14	Elevated 13	Elevated 12	Normal 11	Normal 11
Central Coast District	Elevated 14	Elevated 12	Elevated 14	Elevated 14	Elevated 13	Elevated 12	Normal 11	Normal 11
Central/Southern District	Elevated 14	Elevated 12	Elevated 14	Elevated 14	Elevated 13	Elevated 12	Normal 11	Normal 11



Santa Ana Wildfire Threat Index (SAWTI)

- SDG&E collaborated with the US Forest Service and UCLA to create this decision support tool for fire agencies and the general public
- Calculates the potential for large wildfires based on the winds, humidity and dryness of vegetation
- Calculated values correlated to historical wildfires to rate the Santa Ana wind event on a scale from “Marginal” to “Extreme”



DECEMBER 2016 ROLINSKI ET AL. 1881

The Santa Ana Wildfire Threat Index: Methodology and Operational Implementation

TOM ROLINSKI

U.S. Department of Agriculture Forest Service, Riverside, California

SCOTT B. CAPPS, ROBERT G. FOVELL, AND YANG CAO

University of California, Los Angeles, Los Angeles, California

BRIAN J. D'AGOSTINO AND STEVE VANDERBURG

San Diego Gas and Electric, San Diego, California

(Manuscript received 19 October 2015, in final form 30 June 2016)

ABSTRACT

Santa Ana winds, common to Southern California from the fall through early spring, are a type of downslope windstorm originating from a direction generally ranging from 360°/0° to 100° and are usually accompanied by very low humidity. Since fuel conditions tend to be driest from late September through the middle of November, Santa Ana winds occurring during this time have the greatest potential to produce large, devastating fires upon ignition. Such catastrophic fires occurred in 1993, 2003, 2007, and 2008. Because of the destructive nature of such fires, there has been a growing desire to categorize Santa Ana wind events in much the same way that tropical cyclones have been categorized. The Santa Ana wildfire threat index (SAWTI) is a tool for categorizing Santa Ana wind events with respect to anticipated fire potential. The latest version of the index has been a result of a three-and-a-half-year collaboration effort between the USDA Forest Service, the San Diego Gas and Electric utility (SDG&E), and the University of California, Los Angeles (UCLA). The SAWTI uses several meteorological and fuel moisture variables at 3-km resolution as input to the Weather Research and Forecasting (WRF) Model to generate the index out to 6 days. In addition to the index, a 30-yr climatology of weather, fuels, and the SAWTI has been developed to help put current and future events into perspective. This paper outlines the methodology for developing the SAWTI, including a discussion on the various datasets employed and its operational implementation.

1. Introduction

From the fall through early spring, offshore winds, or what are commonly referred to as Santa Ana winds, occur over Southern California from the coastal mountains westward and from Ventura County southward to the Mexican border. These synoptically driven wind events vary in frequency, intensity, and spatial coverage from month to month and from year to year, thus making them difficult to categorize. Most of these wind events are associated with mild to warm ambient surface temperatures ≥ 18°C and low surface relative humidity ≤ 20%. However, during the late fall and winter months, these events tend to be associated with lower surface temperatures as a result of the air mass over the Great Basin originating from higher latitudes and other seasonal effects. There are a variety of ways to define a Santa Ana event through the analysis of local and synoptic-scale surface pressure and thermal distributions across Southern California (Raphael 2003). We view these offshore winds from a wildfire potential perspective, taking into consideration both the fuel characteristics and weather. As we have found, the index discussed herein provides a robust descriptor of both Santa Ana winds and the potential for wildfire activity. Used in conjunction with a mean sea level pressure (MSLP) map type, this is a powerful method for separating Santa Ana wind events from the more

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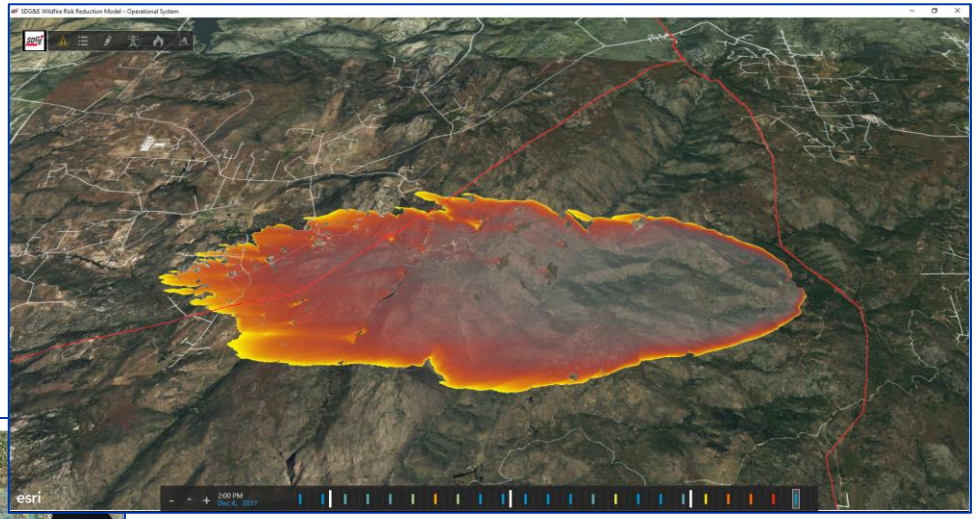
Corresponding author address: Tom Rolinski, U.S. Forest Service, 2524 Mulberry St., Riverside, CA 92501.
E-mail: thomasrolinski@fs.fed.us

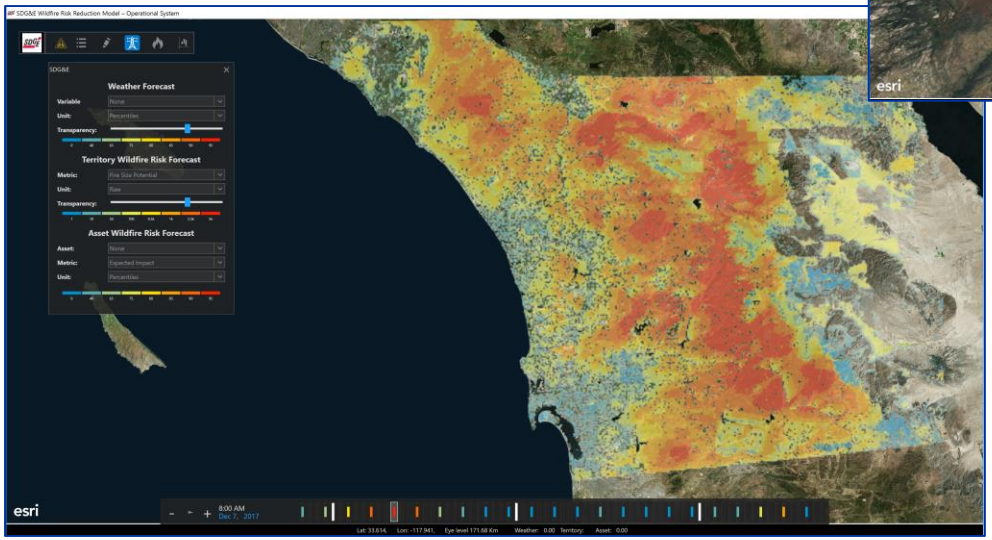
DOI: 10.1175/WAF-D-15-0141.1

[1] SAWTI is peer-reviewed and published in the American Meteorological Society (AMS) Journal of Weather and Forecasting. http://journals.ametsoc.org/doi/abs/10.1175/WAF-D-15-0141.1

SDG&E's Wildfire Risk Reduction Model (WRRM)

- Uses simulations generated from weather conditions, historical fires and outages, and vegetation data to assess wildfire risk across our system. This model is used to prioritize system hardening efforts.



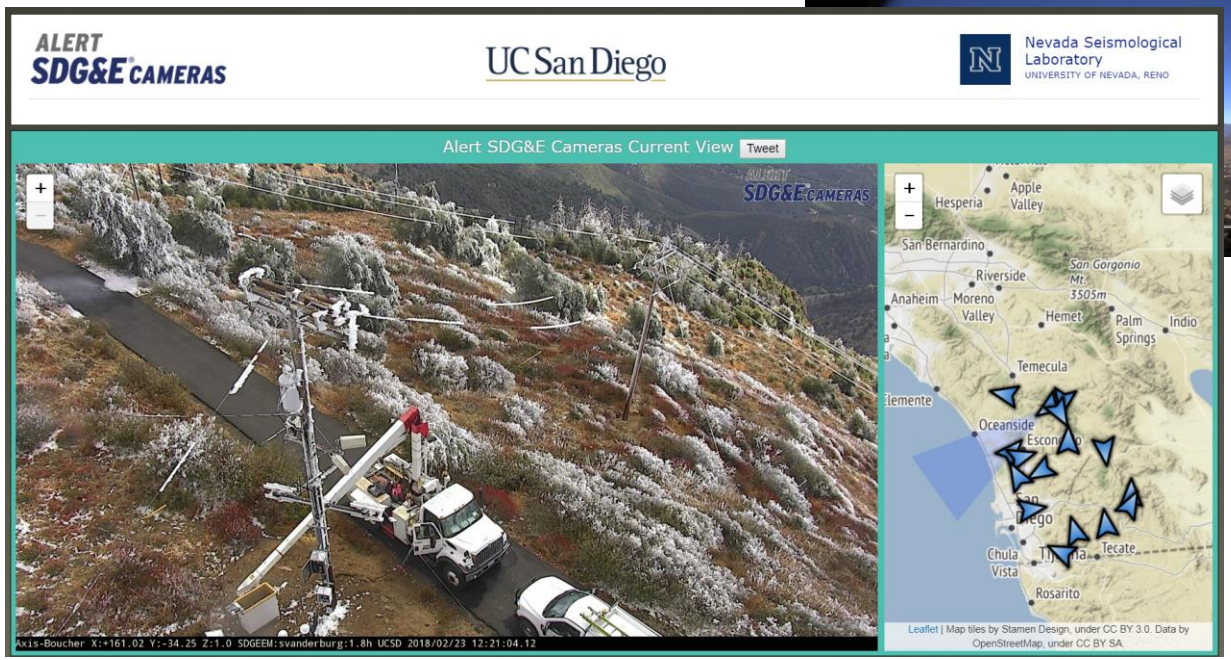


WRRM Ops

- Integrates current weather and vegetation information daily to simulate the growth of millions of virtual wildfires across the service territory.

Alert SDG&E Cameras and HPWREN Cameras

16 Pan-Tilt-Zoom (PTZ) mountaintop cameras available to fire agencies, SDG&E, and the public



http://www.alertwildfire.org/sdge/

80 fixed HPWREN-connected cameras on many major hilltops and mountaintops across San Diego County

Community Outreach and Collaboration

Fire Safety Stakeholder Collaboration: About 40 stakeholders representing local schools, water districts, disability rights advocates, consumer groups and fire departments – have worked with SDG&E for more than a year to develop a joint fire-prevention plan.

Firefighting Agencies: SDG&E partners with the San Diego County Fire Chiefs' Association, CalFire, and the San Diego County Fire Authority to address a range of fire prevention and emergency activities.

California Utilities Emergency Association (CUEA): SDG&E is a member of the CUEA, a collaboration between electric, natural gas, water, and telecommunications utilities in California. CUEA serves as a point of contact for critical infrastructure utilities and the California Office of Emergency Services and other governmental agencies before, during and after an event.

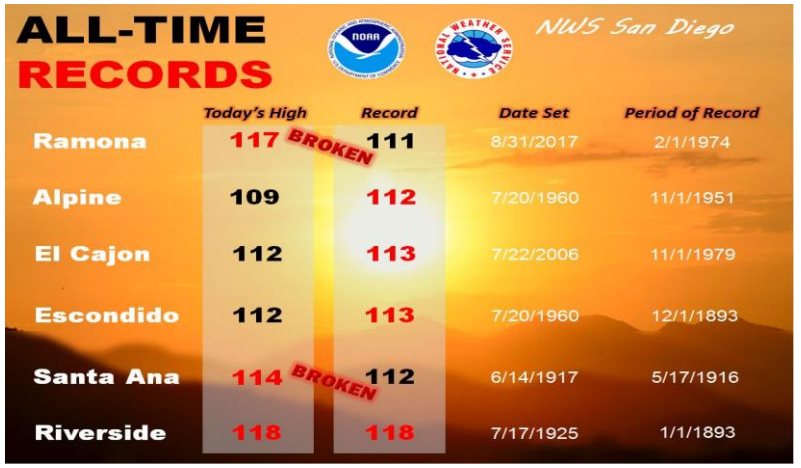
SDG&E Fire Safety Measures

July 2018 San Diego Heat and Fire Event

- Many all-time temperature records were broken on Friday, July 6 with temperatures ranging from 98 at Lindbergh Field to 108 at Miramar and 117 in Ramona.

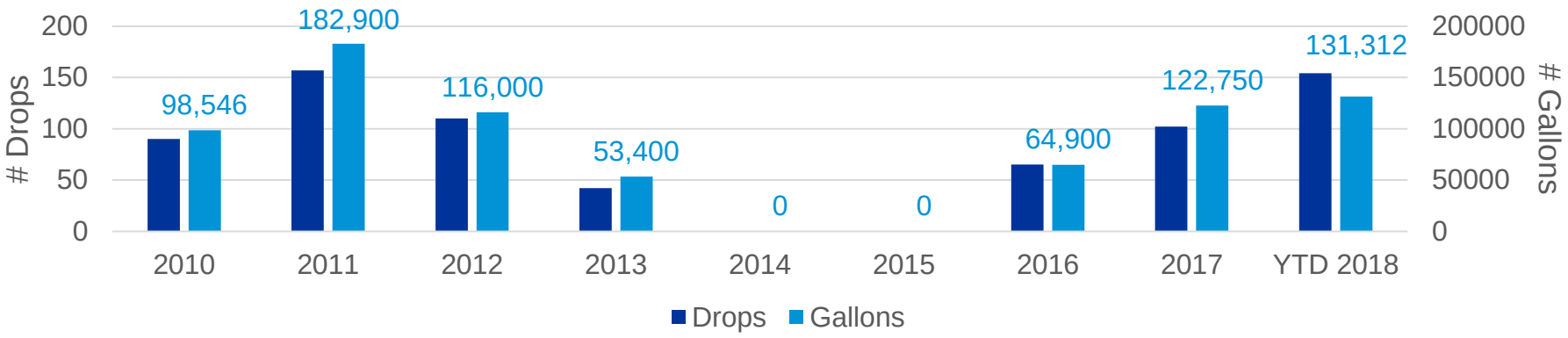
- A total of six active fires throughout the service territory resulting in:
  - 2,204 acres burned
  - 82 structures damaged or destroyed

- There were 3 outages related to the West Fire impacting a total of 2,980 customers.
  - 2 outages forced by the fire impact on the system
  - 1 outage requested for safety by the fire agencies



July 2018 San Diego Heat and Fire Event AirCrane Metrics

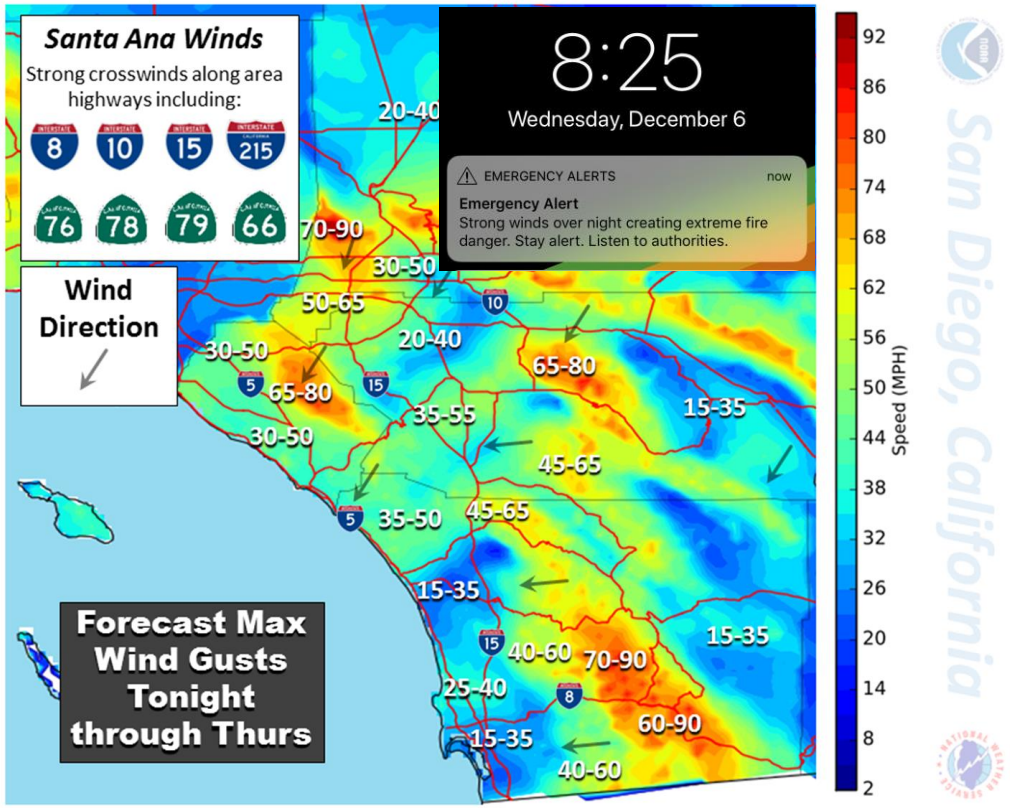
Flight Hours	# Drops	Gallons	Fire Name	Acres Burned
1.5	2	449	Building	10
4.1	57	48,950	West	505



December 2017 Santa Ana Winds

At the beginning of December, the dry conditions fueled by the lack of early season rain were met with an unusually long 13-day period of Santa Ana winds

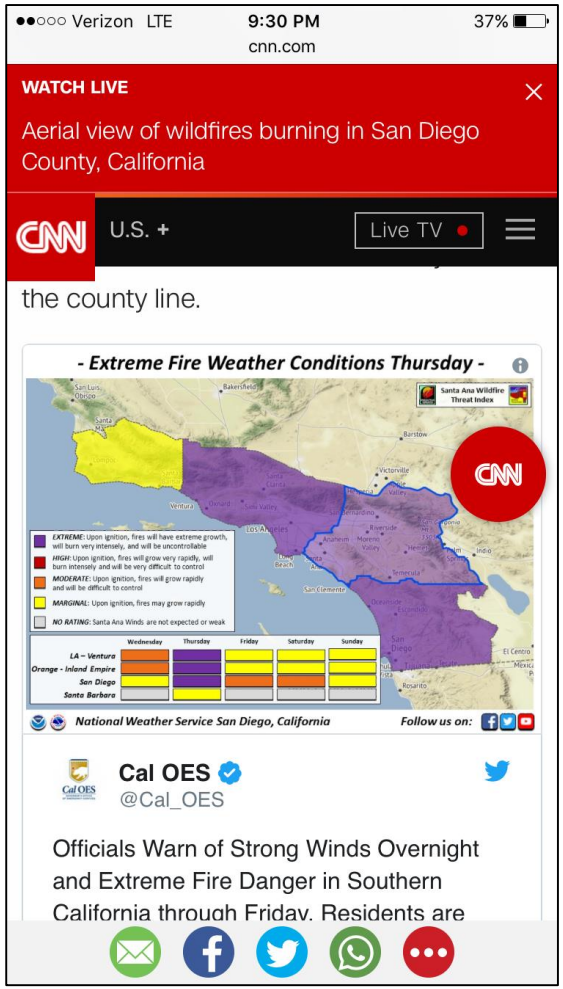
- High Wind Warnings indicated a damaging high wind event was expected with 90 mph gusts
- Multiple Red Flag Warnings
- The Santa Ana Wildfire Threat Index was rated Extreme
- Predictive Services (USFS) - “one of the strongest offshore flow events in recent years”
- Explosive fire conditions well past the normal time of year when fires cease to occur



Official NWS Forecast from Dec. RFW (12/5/17)

December 2017 Santa Ana Winds

- SDG&E Emergency Operations Center (EOC) activated
- Extra staffing at control centers
- Customer communications
- Stationary and roaming observers
- Held media event at EOC
- Enabled sensitive relay settings
- Canceled all work in fire risk areas
- AirCrane returned to San Diego
- Firefighting service contracted for event
- Mobile command trailers deployed for customer use



Sample Factors - Deenergizing for Public Safety

- Fire conditions
  - Red Flag Warnings
  - Fire Potential Index
  - Santa Ana Wildfire Threat Index
- Weather conditions
  - Temperature
  - Humidity
  - Wind gusts
- Vegetation fuel conditions
  - Both live and dead fuel moisture
- Wildfire activity in the region
- Availability of firefighting resources, especially aerial resources for initial attack
- Observations from the field
  - Flying debris and vegetation
  - Impacts to powerlines
- Reports from emergency responders

Ifran Khan / Los Angeles Times

Sample Factors - Deenergizing for Public Safety

Ken Pimlott, Director of Cal Fire: “We are in the beginning of a protracted wind event. ***There will be no ability to fight fire in these kinds of winds.***”
-LA Times, 12/7/17

Active fires in Southern California as of 6:45 a.m. on 12/7/17 as tracked by SDG&E Fire Coordination

Fire Name	Agency	Acreage	Contain	Comments
Thomas	VNC	90,000	5%	Has hit the ocean. Significant structure loss (approx 150 structures at last estimate). Mandatory evacuation still in place. 180 structures. Last updated at 2:19 pm yesterday.
Creek	Angeles NF	12,605	5%	5 firefighters injured. At least 30 structures lost. Long range spotting. Evacuations north of I-210, La Tuna Canyon Road and Glen oaks Blvd. Immediate threats to Transmission lines.
Rye	LAC	7,000	10%	Cal Fire IMT4. Mandatory evacuation still in effect. Near Valencia. Jumped I-5 and closed I-5 in both directions at Hwy. 126. Last update 20:04, 12/5
Skirball	LAF	475	5%	Getty Center. 405 closed by fire.

-Times of San Diego, 12/7/17

Factors when Re-Energizing Powerlines

- Ground patrols cannot occur until wind gusts have fallen below 40 mph and are forecast to remain below 40 mph
- Many backcountry circuits contain segments that require a helicopter patrol
  - Wind speeds must be below 35 mph
  - Cannot patrol by air at night
- If damage is found, repairs must first be made before the remainder of the circuit can be patrolled and re-energized
- In the event of a forced outage, a cause must be identified before the circuit can be re-energized
  - If no cause found, additional patrols are required before proceeding with re-energization
- Contract firefighting resources must be on scene before circuit can be re-energized

Appendix

SDG&E Fire Prevention Accomplishments

1. **Fire Hardening** - To date, SDG&E has converted approximately 16,000 wood poles in high fire risk areas to fire-resistant steel poles that can withstand wind speeds close to 85 miles per hour. These poles are taller and with increased spacing within the conductors reducing the risk of debris getting caught in between the wires. Our system now has 10,000 miles of underground power lines, a large portion of which are in the high fire risk areas.

2. **Vegetation Management Program** - Our work in vegetation management is a key component to how we are working to reduce fire risk. SDG&E maintains records for over 463,000 trees located near power lines. The trees are evaluated on an annual basis, and vegetation clearing is completed prior to the highest fire risk period.

3. **Situational Awareness System Development** - We have installed 172 weather stations throughout the eastern areas of the county. These stations are providing real-time information on wind speed, humidity, and temperature. Most of the data from these facilities is used to help fire departments prepare for weather conditions that can increase the risk of fires.

4. **Meteorologists.** SDG&E has three full-time meteorologists. They monitor data in real-time receiving over 200,000 pieces of data daily to provide fire weather forecasts and track the potential for fires in the service territory. This information is used by the region's fire departments, including Cal Fire.

5. **Created the Fire Potential Index (FPI).** The FPI was developed by our subject matter experts to communicate the wildfire potential on any given day to promote safe and reliable operations. This information is also shared with local fire agencies, emergency responders and the National Weather Service.

SDG&E Fire Prevention Accomplishments

6. **Installation of the *Alert SDG&E Cameras*** – In addition to the 100 high resolution cameras we already have access to, SDG&E has placed high-visibility, high-resolution rotating cameras on strategic structures throughout the highest fire risk areas. The cameras can be controlled remotely, rotate a full 360 degrees, and allow the fire service the ability to see and make an initial determination about a fire that is spotted.

7. Creation of the **Wildfire Risk Reduction Model**. This system, created by SDG&E personnel, is the first of its kind in the nation and uses simulations generated from weather conditions to assess the wildfire risk. This model provides our engineers and field crews with critical information so that they can plan for extreme weather conditions.

8. **Enhanced Wildland Fire Prevention Resources**. SDG&E has contracted for additional wildland fire-suppression equipment and trained firefighting personnel during the high fire risk months. Specifically, we have arranged for up to eight additional fire suppression trucks to be available to SDG&E throughout the fire season. These resources are also dispatched with SDG&E crews during days on which the threat of fire is high.

9. **Secured Aircrane Resource** – For the past 8 years, SDG&E has paid for the Erickson Aircrane, the world's largest heli-tanker, to be located in San Diego County during high fire risk season -generally September through November each year. This resource was dispatched nearly two dozen times between August and December 2017, and 110 times total since we made this contract arrangement.

10. **Fire Mapping**. SDG&E has mapped its entire system based on fire risk. This has allowed us to create the Fire Threat Zone and the High-Risk Fire Area maps, and has also helped guide our fire hardening efforts and activities.

SDG&E Fire Prevention Accomplishments

11. **Pulse Reclosers:** SDG&E has one of the largest deployments of pulse reclosers, focusing on FTZ and HRFA. Pulse reclosers allow SDG&E to operate its system with reduced energy flows when restoring power in areas that have experienced an outage, minimizing the risk of a spark occurring when the power is turned back on.

12. **Fire Detection:** Strategically installed 29 high-resolution, remote controlled cameras on key transmission poles. We own or use 120 cameras to enhance situational awareness.

13. **Inspection and Repair:** SDG&E employs additional monitoring and inspection activities in the FTZ and HRFA with annual inspections and corrections.

14. **Advanced Technologies and Standards:** SDG&E has modified its facilities-design manual, equipment specifications, and construction standards to harden circuits against fire risk. This includes changing wood poles to steel poles, changing copper or aluminum core wires to steel core wires (tensile strength is much higher), extending spacing between wires (reducing the risk of wires flopping together and sparking).

15. **PRiME:** A new program that will evaluate the loading of approximately 170,000 distribution poles over a 9-year period starting in the highest fire risk areas. PRiME will include mitigation and repair of poles that are deemed to have elevated risk.

16. **Cleveland National Forest (CNF):** SDG&E operates a network of electric facilities in the CNF. The CNF fire hardening project is underway and includes replacement of overhead facilities and some undergrounding of electric facilities throughout approximately 880 square miles in East San Diego County.

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LEGISLATIVE ANALYST'S OFFICE

July 25, 2018

Overview of Wildfire-Related Funding

L E G I S L A T I V E A N A L Y S T ' S O F F I C E

Presented to:
Conference Committee on SB 901
Hon. Bill Dodd, Chair
Hon. Chris R. Holden, Chair

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LEGISLATIVE ANALYST'S OFFICE

Response and Recovery Costs for 2017 Wildfires

Costs and Offsets for Major Wildfires in 2017

(Dollars in Millions)

	2017-18	2018-19	Two-Year Totals
Costs			
Northern fires (October 2017)	$1,879.3	$86.9	$1,966.2
Southern fires (December 2017)	815.4	75.7	891.1
Total Costs	**$2,694.7**	**$162.6**	**$2,857.3**
Offsets			
State Emergency Fund and CDAA	$162.8	$19.7	$182.5
Federal/local cost share	2,240.3	49.7	2,290.0
Total Offsets	**$2,403.1**	**$69.4**	**$2,472.5**
Net State Costs (General Fund)	**$291.6**	**$93.2**	**$384.8**

CDAA = California Disaster Assistance Act.

LAO LEGISLATIVE ANALYST'S OFFICE

Wildfire-Related Budget Augmentations in 2018-19 Budget

2018-19 Budget Act Augmentations

(Dollars in Millions)

Program	Amount
2017-18 Fire Recovery	**$162.6**
Emergency operations and public assistance	55.0
California Disaster Assistance Act	53.6
Backfill of local property taxes	53.3
Other programs	0.7
Forest Carbon Plan	**$96.0**
Watershed Improvement Program	30.0
Prescribed fires and fuels reduction	26.8
Regional forest restoration projects	20.0
Forest health in state parks	15.0
Encourage markets for wood products	2.3
Watershed coordinator grants	1.9
Other Forest Health and Fire Prevention Activities	**$170.0**
Healthy and resilient forests	160.0
Community based fire prevention	10.0
Firefighting	**$244.7**
Helicopter replacement	101.2
Emergency Fund	71.2
Mutual aid technology and equipment	25.0
Local fire response	25.0
Climate change fire severity	10.9
CalFire/Conservation Corps crews	7.3
McClellan Airbase year round staffing	4.0
Total	**$673.3**