

San Diego Gas & Electric's Fire Awareness & Community Fire Safety Program (CFSP) Creating Wildfire Resilience through Preparedness

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Overview of SDG&E's Service Territory

- SDG&E supplies power to 1.4 million business/residential accounts in a 4,100 square-mile service area
- SDG&E overhead facilities ~ 1,800 miles of electric transmission lines and 7,000 miles of electric distribution lines
- SDG&E has developed a **Community Fire Safety Program** that improves power line safety, increases reliability and helps our region's overall emergency preparedness

Identifying Risk

Increased wildfire activity

The map below shows portions of San Diego County that have burned since 2000, including the Cedar Fire and all major 2007 fires.



2003 (Cedar Fire)

- Acres burned: 280,278
- Electric facilities destroyed: 2,820

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- Electric facilities damaged: 63
- Vehicles destroyed: 148
- Deaths: 14
- Injuries: 104

2007 (all major fires)

- Acres burned: 368,566
- Electric facilities destroyed: 2,665

- Electric facilities damaged: 117
- Vehicles destroyed: 239
- Deaths: 7
- Injuries: 127

Fire Statistics

May 13-16, 2014

- 14 wildfires (coastal)
- 26,000 acres
- 65 structures destroyed
 46 homes
- 1 fatality
- \$60+ million in damages
- 82 outages affecting 80,094 customers
- 5 circuits proactively de-energized for safety affecting 1,193 customers
- Replaced 135 poles damaged by wildfire





Fire Name/Size	Start Date
Bernardo Fire: 1,548 acres	5/13/14 11:00 AM
Tomahawk Fire: 5,367 acres	5/14/14 09:45AM
Poinsettia Fire: 600 acres	5/14/14 10:30 AM
River Fire: 105 acres	5/14/14 12:12 PM
Highway Fire: 380 acres	5/14/14 1:00 PM
Cocos Fire: 1,995 acres	5/14/14 04:00 PM
Sterling Fire: 6 acres	5/14/14 4:59 PM
Freeway Fire: 56 acres	5/14/14 05:43 PM
Pulgas Fire: 15,000 acres	5/15/14 04:45 PM
San Mateo Fire: 1,500 acres	5/16/14 11:24 AM

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Prevention Measures

In summary

2015 PHC

- Developed the largest and most concentrated weather network of any utility. Provides 24/7 redundant 10min data stream.
- Expanded QA/QC inspection and repair program covering all of FTZ
- Since 2007, over 2,300 wood transmission poles and over 5,100 wood distribution poles have been replaced with steel poles in the highest risk fire area
- Utilizing LiDAR technology to survey transmission system and incorporate data obtained into building a more robust system

Prevention Measures

In summary

- Installed and operate 202 of the latest technology for sectionalizing and safer reclosing (IntelliRupter "Pulse Closers")
- Installed and operate numerous SCADA capacitors in HRFA and continue to add newest technology wireless fault indicators
- Aggressive vegetation management providing for the inventory and management of over 465,000 trees within proximity to OH power lines

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- Modified and improved operating procedures (such as recloser policy for fire safety)
- Created a web based communication tool to inform communication infrastructure providers of potential issues for correction

Prevention

Added expertise & actions

- Added four fire coordinators to examine and report on fires as they occur and provide meaningful insight as to conditions on a real time basis
- Formed a Reliability Improvements Team (RiRAT) to focus on fire risk reduction improvements from an engineering analysis standpoint
- Hired three meteorologists to monitor and forecast all weather
- Set up seasonal staging yards for faster response during high fire threat season
- Using comprehensive analytics obtained through engineering analysis to develop a program (FiRM) that will address overload of poles together with conductor examination
- In the FTZ, copper conductor will be replaced with aluminum, wood poles found to be inadequate will be replaced with steel

Weather Network Enhancements

- 166 weather stations
- Reports every 10 minutes
- Redundant communications
- Supports forecasting capability
- All data is made public





• Additional weather stations have been strategically located in an effort to safely and reliably operate the electric system

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



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Created the Fire Potential Awareness System

Red Flag Warning: Oct. 4th-6th, 2013

- 09/26/2013 (8 days prior) SDG&E Meteorologists provide advanced notice of Santa Ana winds for October 4-6, 2013
- 09/30/2013 (4 days prior) SDG&E Meteorologists forecast an "extreme" fire potential and mention the possibility of a Red Flag Warning
- 10/01/2013 (2 days prior) The National Weather Service issues Fire Weather Watch
- 10/03/2013 (1 days prior) The National Weather Service issues Red Flag Warning

	EDO Forecast	NWS Forecast	Actual Gust	EDO Error	NWS Error
Sill Hill	68 mph	43 mph	70 mph	-2 mph	-27 mph
Boulder Creek	57 mph	40 mph	58 mph	-1 mph	-18 mph
Below are the circuit	s and weather static	ons that are forecast	ed to exceed 50 mp	h:	
Weather Station	EDO Forecast	NWS Forecast	Actual Gust	EDO Error	NWS Error
Buckman Springs	56 mph	34 mph	56 mph	0 mph	-22 mph
Crestwood	54 mph	39 mph	53 mph	+1 mph	-14 mph
Dye Mountain	54 mph	41 mph	50 mph	+4 mph	-9 mph
Hellhole Canyon	54 mph	32 mph	59 mph	-5 mph	-27 mph

Santa Ana Wildfire Threat Index SANTA ANA WILDFIRE THREAT INDEX 2 Fran at Level Los Ange Long Beach Wildfire Threat Index ZONES DRI Desert Research Institute SDGE CAL U≜S A & Sempra Energy PREDICTIVE AEGIS

~	Normal Condition Fire Potential Index 1.11 Field and weather conditions are no longer conducte to significant free growth. Based on free indices and Fire Coordinator / Meteorologist Recommendation		Elevated Condition File Potential Index 12:14 The burn environment of a specific area or district has become conducive for a large widthe within the SDG&E service territory.		Extreme Condition Fire Potential Index 15 and above An externe operating condition will be declared when the burn environment of a specific area or district has become conductive for a catastrophic widther within the SDG&E service territory.		Red Flag Condition (NWS) RFW: Relative Humdby s 15%, with sustained winds = 25 mph and/or frequert guests = 35 mph (duration = 6 hours) Declared by NWS		
ONDITION									
0	Distribution	Transmission	Distribution	Transmission	Distribution	Transmission	Distribution	Transmission	
			All reclosers w	All reclosers will be turned off.		All reclosers will be turned off.		All reclosers will be turned off.	
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			All reclosers will be turned off.		All reclosers will be turned off.		All reclosers will be turned off.		
			TES	TING	TES	TING	TEST	NG	
Fire Threat Zone	No change to reclosing policy.		SGF Targets: Patrol entire line or line segment before energizing. Non-SGF Targets: Patrol line segment to load-side sectionalizing device before energizing.	Patrol entire line or line segment before energizing.	SGF Targets: Patrol entire line or line segment before energizing. Non-SGF Targets: Patrol line segment to load side sectionationg device before energizing.	Patrol entire line or line segment before energizing	SGF Targets: Patrol entire line or line segment before energizing. Non-SGF Targets: Patrol line segment to load side sectionalizing device before energizing.	Patrol entre line or line segment before energizing	
	Line will b reclose	Line will be tested by recloser action.		If Control Center Management, SDG&E FC and/or Makerologist adamme that wataffer conflores for etc. Adamme that wataffer constant special constantions (such as write), and the special one, before it a publicle. If a Distribution orders is caused by a Transmission/Studieton outcope, Distribution may revenging without a patio, as detected by Control Center Management, SGG&E TC, and/or Makemonguit.		If Control Center Management, SOGAE FC and/or Metionicajot disemme that weather containing to including the second second once, before it is patiented the Distribution ordiage is canned by a Transmission/Statisticn oxidage, Distribution may re-energise Whoto a patiot, as oriented by Control Center Management, SIGAE FC and/or Meteorologist.		For Coastar Zone 243 CALY (witkland) If Control Center Management, SICAE FC, controls of one search special conservations as send, relative humidit, etc.), the line may toe test once, before it is patibiled.	

Proactive Operational and Developmental Measures

- Turn-off reclosing during specified times
- · Mobilizing crews to pre-determined locations
- · De-energize for safety when necessary
- Staging of washing rigs and fire crews to pre-determined locations
- Prior to and throughout the event, SDG&E provides situational awareness and forecasts to Independent System Operator
- Take operational actions as needed to optimize power flows







Vegetation Management Program (VMP)

Overview

- State and Federal requirements for minimum vegetation clearances year-round
- The Vegetation Management Program (VMP) manages an inventory of 465,000 trees and 244,000 poles, of which 35,000 are "subject" poles
- Approximately 260,000 trees pruned or removed annually
- Approximately 100,000 trees located within the Highest Fire Risk Area (HRFA)
- Additional off-cycle tree inspection and pruning in HRFA
- Systematic, schedule-based approach to work activities
- VMP goals: safety, compliance, and reliability





Enhanced Readiness and Response

Air support

- SDG&E has renewed agreements to continue to make a heavy-lift air-crane available to support fire suppression
- The Air-Crane is the largest heli-tanker in the world (2,500 gallon tank or 2,000 gallon bucket. Refills in less than 45 seconds
- In support of its ground forces, the CAL FIRE emergency response air program includes 23 Grumman S-2T 1,200 gallon airtankers, 11 UH-1H Super Huey helicopters, and 14 OV-10A airtactical aircraft. From 13 air attack and nine helitack bases located statewide, aircraft can reach most fires within 20 minutes.





Enhanced Readiness and Response

Ground support



- **Utility fire prevention teams**
 - Accompanies SDG&E crews during high fire-risk conditions
 - Early detection and response

Industrial fire brigade and flammable liquid firefighting trailers

• Specialized fire suppression for SDG&E infrastructure including transformers, capacitor banks, underground vaults and other equipment



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Enhanced Readiness and Response



- 24x7 dedicated Emergency Operations Center
- More than 84 activations in 12 years
- Energy crisis Red Flag Warnings -
- Winter storms terrorism threat –
- Special events firestorms 2003 and 2007 –





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Entergy Profile

- Headquarters New Orleans
- 2.8 million electric customers
- 192,000 gas customers
- Arkansas, Louisiana, Mississippi and Texas
- 15,500 transmission miles
- 100,000 distribution miles
- 30 fossil and nine nuclear plants
- 115,000 square miles of service territory
- 15,000 employees



Entergy's Restoration Experiences

- Ike (Sept., 2008) 705,000 customers # 4
- Gustav (Sept., 2008) 964,000 customers # 2
- Humberto (Sept., 2007) 118,000 customers
- Rita (Sept., 2005) 800,000 customers # 3
- Katrina (Aug., 2005) 1,100,000 customers # 1
- Cindy (July, 2005) 270,000 customers # 5
- Lili (Oct., 2002) 243,000 customers
- Andrew (Aug., 1992) 250,000 customers
- Ice Storm (Feb., 1994) 240,000 customers
- Georges (Sept., 1998) 260,000 customers





Entergy Profile

- Received the Edison Electric Institute's Emergency Response or Emergency Assistance award every year for the last fourteen years
- Only utility to win every year since the awards have been presented



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Lesson 1: Prepare for the worst

- <u>Annual drills:</u> *April, 2005 drill scenario was CAT4 impacting New Orleans with 20' flooding*
- <u>Meetings with state and local officials/media</u> (May)
- <u>Plan improvements</u> Spring 2005
 - Upgraded evacuation process
 - Internal "StormNet" launched
 - Upgraded external web site
 - Improved outage mapping applications
 - Improved T&D coordination
 - Incorporated lessons of 2004 Florida storms







Katrina – Impacts on Entergy Service Territory







224,000 Bed Nights, 2,000 Cots, Sleeping Bags/Linen Sets



Lesson 6: Take Care of Employees

- Resources pre-dedicated to Florida
- Corporate HQ evacuated
- Massive business continuity implications
- Employees' homes destroyed
- Inoculations for workforce
- Inaccessibility
- Communications knocked out
- Security issues
- Gasoline / diesel shortages





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<u>Lesson 7:</u> Identify and address your weaknesses... and those of others

- Reluctance to accept reality of worst case scenarios
- Plan for vulnerability of resources to confiscation
- Address <u>worst case</u> business continuity scenarios
- Expand mutual aid concept to logistical support and reduce competition for limited resources
- Improve Local/State/Federal government/industry collaboration
- Better manage customer expectations/understanding of restoration process; particularly for "worst case" scenarios
- Plan for magnitude and duration of impact to business processes
 - Invoice processing

Key Success Factors

• <u>SAFETY TRUMPS SPEED!!</u>

- <u>Plan</u> Detailed advance planning for "worst case scenarios," every employee assigned role
- <u>Practice</u> Formal drills conducted
- Perform Organization experience & culture
- Focus on *communications*, not just infrastructure repair
- Clear command structure assignment of decision making at appropriate level, empowerment at "front lines"
- Ability and willingness to make quick decisions, improvise, and take risks

Claims Adjustment Lessons Learned

- Understand how the adjuster(s) listed in your policies will adjust cat losses. It's best to have only one to adjust all of your damages and interview them prior to your renewal so that you know what to expect.
- Try to gain agreement from the loss adjuster to issue Partial Proofs of Loss so that cash flow isn't hampered by the claims process.
- Prepare cost codes to use in the event of loss and communicate the cost codes to folks as soon as damages are incurred for their use in collecting costs.
- Communicate claims status regularly to internal company stakeholders in group emails. Otherwise you will lose a lot of time explaining it over and over.
- Property claims are usually adjusted using an accounting process where a sampling of invoices are reviewed but an engineering approach works better.









May 22, 2011

- Tornado strikes Joplin at 5:41 pm
- Storm path
 - 13 miles long
 - Up to 3/4 mile wide
- EF-5 Rating by NWS
 - Winds in excess of 200 mph
- 20,000 customers without power





Lives Affected

- 50,000 residents
- 240,000 daytime population
- 400,000 live in 40-mile radius
- 162 lives lost
- 1,150 injured

Major Structures Destroyed

- St. John's Hospital
- Joplin Schools
 - 6 of 17 schools destroyed / damaged
 - **-** 7,700 students
 - In excess of \$150 million
 - 44% of students now in temporary schools
- Home Depot
- Academy Sports
- Wal-Mart



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EDE Facility Damage



EDE Facility Damage

- Transmission
 - 10 transmission lines out of service
 - 135 structures affected
- Substations
 - Six initially impacted
 - Sub 59 destroyed
 - Subs 422 and 430 damaged
- Distribution
 - 100 miles of line down
 - Approx. 3,900 poles damaged
 - 31 of 60 circuits off
- Fiber
 - 30 cuts repaired / replaced





Restoration Process



Immediate Restoration Tasks

- Mobilize all local personnel
 - De-energize lines
 - Make safe for public, emergency and Empire personnel
 - Make safe for roads to be cleared



Restoration Issues

- Communication issues
 - Cell phones had limited functionality
 - Texting was more reliable
 - Radios still functioned well
- Difficulty contacting employees
 - Employees showed up even those personally impacted





Critical Infrastructure Assessment

- Freeman Hospital
 - Primary substation
 - De-energized but minimal damage
 - Transmission down for more than ¹/₂ mile both directions
 - Primary circuit
 - Distribution down from substation to hospital
 - Alternate substation
 - Destroyed
 - Alternate circuit
 - Damaged and no connection to energized substation

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Critical Infrastructure Assessment

- St. Johns Hospital
 - Destroyed
 - Requested energization of salvageable buildings
- Major water and sewer services
 - Water treatment limited damage to alt. circuit
 - Water intake limited damage to alt. route
 - Water wells varying degrees of damage
 - Sewer services varying degrees of damage

Outage Management System

- OMS ineffective in this event due to
 - Extreme damage to physical power system
 - Impaired communications
 - Restoration was inaccurate
- Relied solely on field verification
- Mapping was updated from field information after major restoration complete

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Critical Infrastructure Restoration

- Main feeders restored
 - Hospitals
 - Freeman Hospital power restored before sunrise
 - Engineered and constructed alternate circuit
 - Major water and sewer services
 - Water treatment restored within 24 hours
 - Water intake restored before sunrise
 - Water wells restored within 72 hours

Mutual Aid

- Call upon mutual aid from other companies and contractors to get workers headed to Joplin
 - 247 lineman from six companies (KCPL, City Utilities, four contractors)
 - 144 tree trimmers or debris removal personnel from four companies
 - Some were on-site Monday, May 23, almost all by May 24
 - 435 law enforcement, fire, ambulance agencies

Material Supply

- Vendors notified Sunday evening
 - Irby, Bell Pole & Lumber, Frontier, ABB
- EDE Stores / Irby
 - Mobile storeroom at Sub 59
 - 12 material / pole staging areas
 - 24-hour operation
 - Pole drops at night to avoid traffic
 - Material pulled and ready at 7 am
- ABB
 - Transformers began arriving one day after order (normal three weeks)



Logistics

- 2,400 room nights
 - Water trucks Holiday Inn to facilitate meals
- 13,000+ meals
 - Box lunches sent w/crews each morning
- Laundry
 - 2,700 pounds nine days



Environmental Response

- Response teams in place Monday morning
 - Substation #59
 - Primary transformer leak secured and contained to site
 - 1,450 transformers recovered



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Restoration Process

- 16-hour work days
- Assessments one week
- Established 12 pole and material yards
 - Throughout town
 - Close to work
 - Avoid traffic
- Poles dropped over night
- Materials filled and kitted over night
 - Storm material kitting plan revision

Preservation – Results Within three days – Rangeline Rd. Highly visible Renewed hope Within one week – St. Johns Temp. Hospital Within ten days – service restored to all who could receive service Met requests for service to businesses (pharmacies, home depot, etc.) While reconnecting neighborhoods

Expedited Debris Removal Empire worked hand in hand with City State

- FEMA
- USACE
- Empire committed
 - Not to hinder
 - Met daily
 - Six field staff to manage empire / EDR
- Days ahead of normal response

Lessons Learned

- Improved system reliability increased sectionalization to reduce customers affected during outages
- Mobilize storeroom operations around the clock
- Book hotel rooms, provide box lunches and laundry services for crews
- Communication difficulties texting and radio
- OMS may be ineffective in large scale events; should have field assessment
- Retrained construction designers to assess damage and write jobs

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Lessons Learned

- Underground construction and reconstruction has difficulties
- Storm material kitting plan revision
- Retrained construction designers to assess damage and write jobs
- Installed larger feeders and poles to resist future damage from small storms
- Standardized line design for the entire system
- New design philosophy incorporates flexibility



