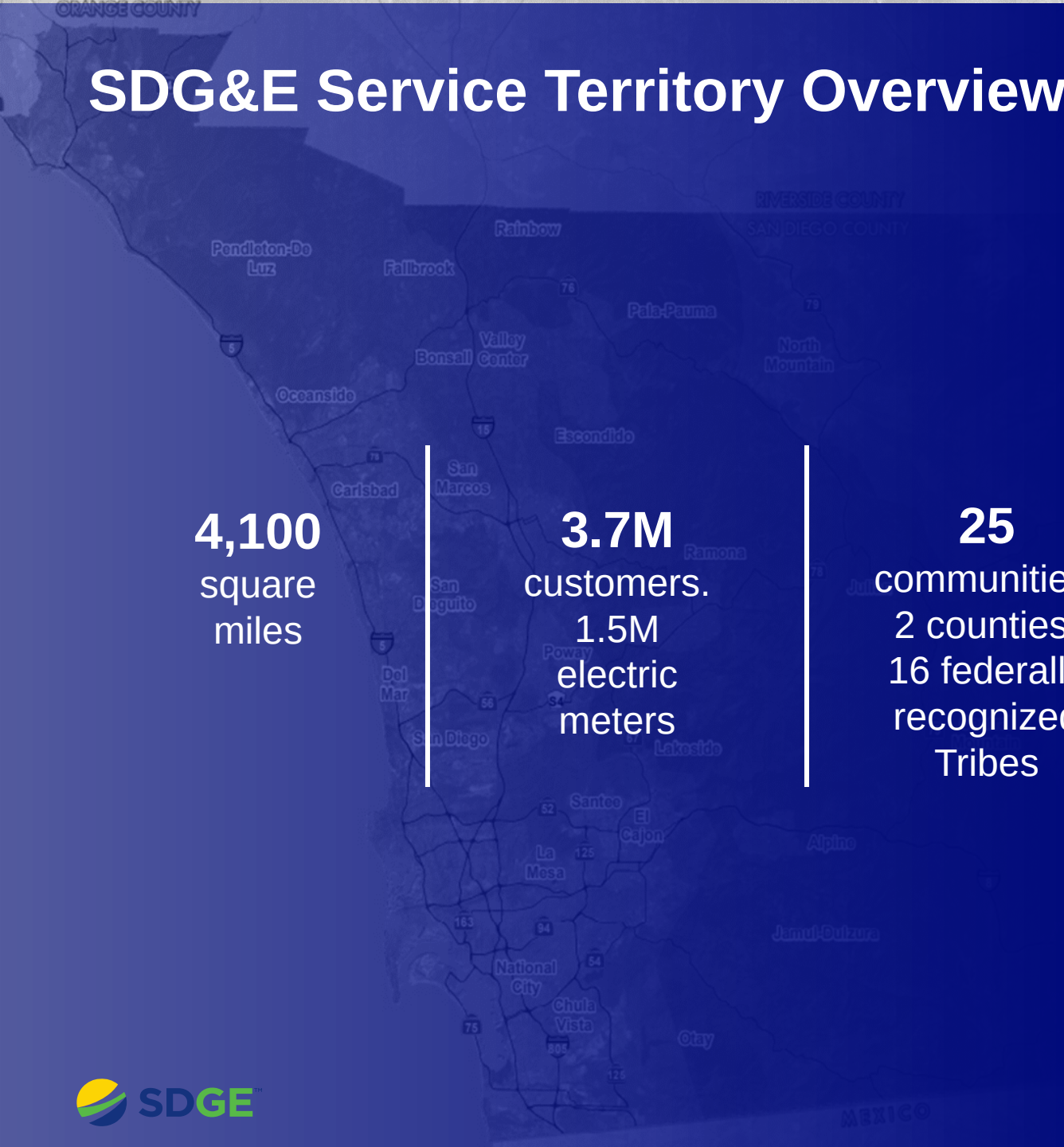
California Public Utilities Commission Workshop on 2022 Public Safety Power Shutoffs (PSPS)

April 18, 2023

SDG&E Service Territory Overview



4,100 square miles

3.7M customers. 1.5M electric meters

25 communities; 2 counties; 16 federally recognized Tribes

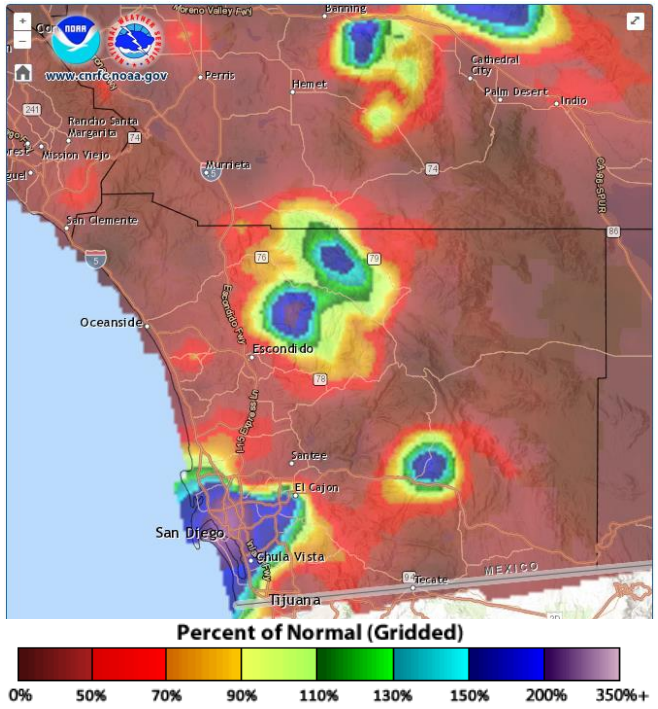
17,496 miles of Distribution; 2,003 miles of Transmission

64% of service territory within the High Fire Threat District (HFTD)

Comparison of Weather Conditions and Meteorology Forecasting

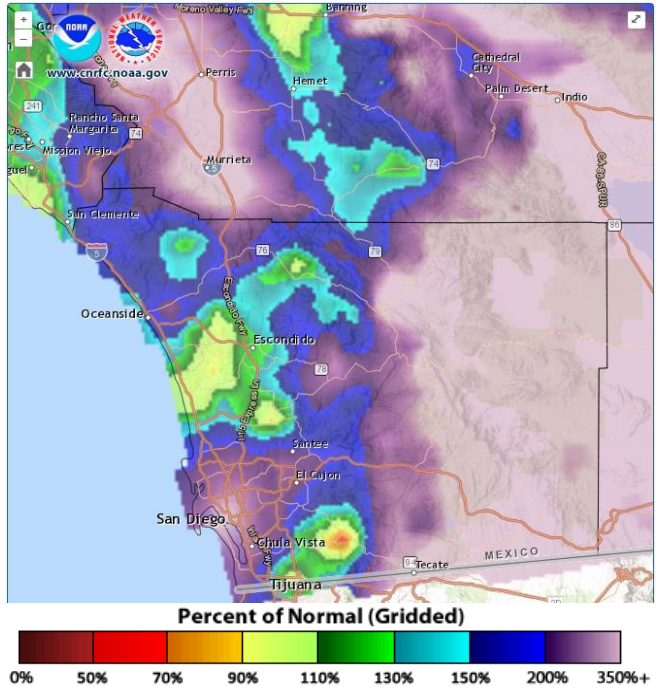
Chris Arends

Wildfire Risk Comparison – 2021 vs. 2022



2021

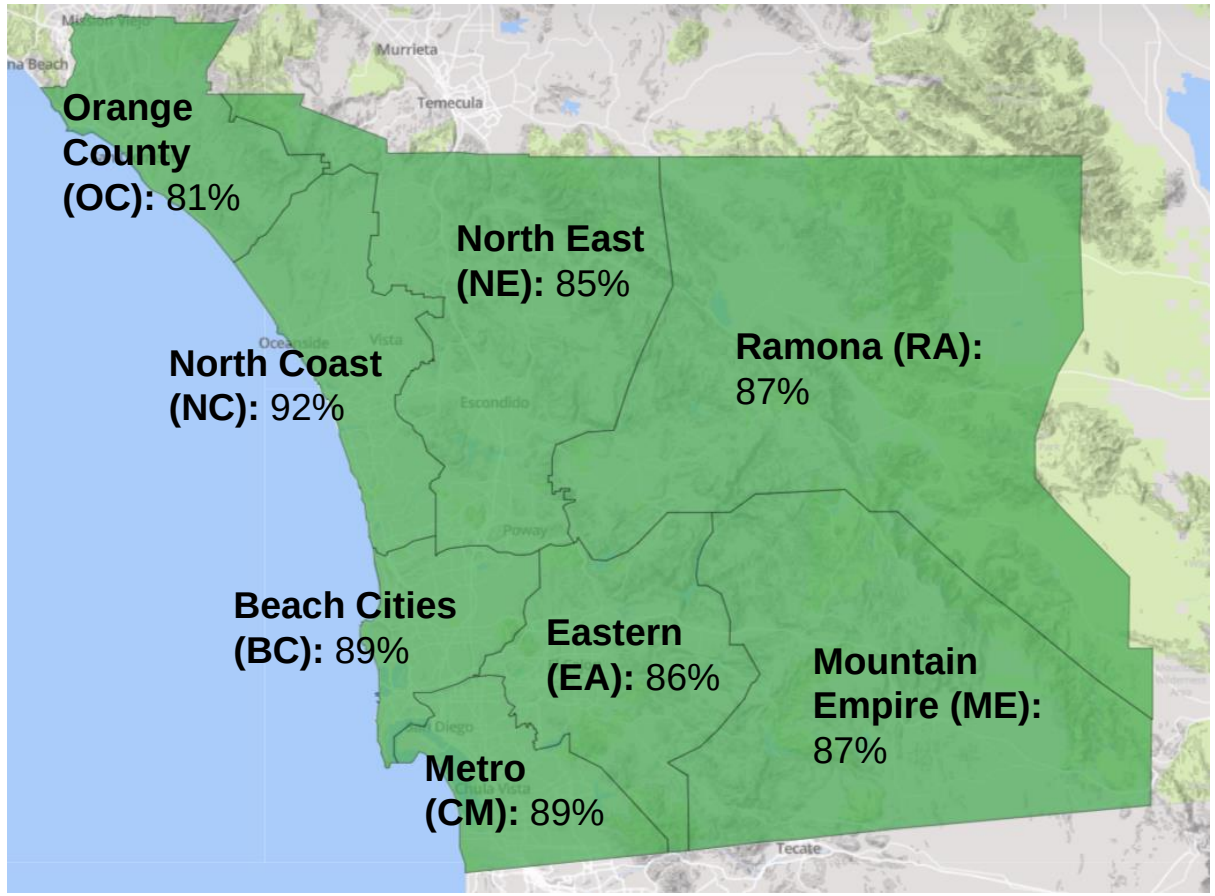
- Rainfall < 50% of normal across most of the HFTD as Santa Ana wind season began; fully cured grasses
- Active summer monsoon with 24 thunderstorm days; one late season event dampened fuels as Santa Ana wind season began.
- Relatively slow Santa Ana season; 10 Santa Ana wind days
- Substantial season-ending rainfall in December



2022

- Rainfall > 150% of normal across most of the HFTD as Santa Ana wind season began; substantial green-up
- Significant monsoon season with 41 thunderstorm days, including substantial rain from tropical storm remnants
- Relatively slow Santa Ana season; 13 Santa Ana wind days.
- Additional rainfall in December

Accuracy of Fire Potential Index (FPI)



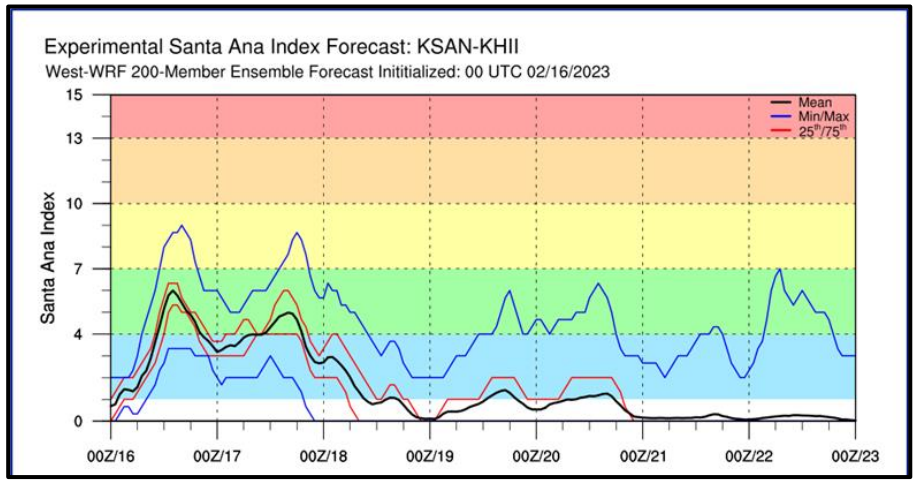
	ME	RA	EA	NE	OC	NC	BC	CM
Accurate	87%	87%	85%	86%	81%	92%	89%	89%
Over-Predicted	1%	2%	2%	1%	4%	2%	1%	1%
Under-Predicted	12%	12%	13%	13%	15%	6%	10%	10%

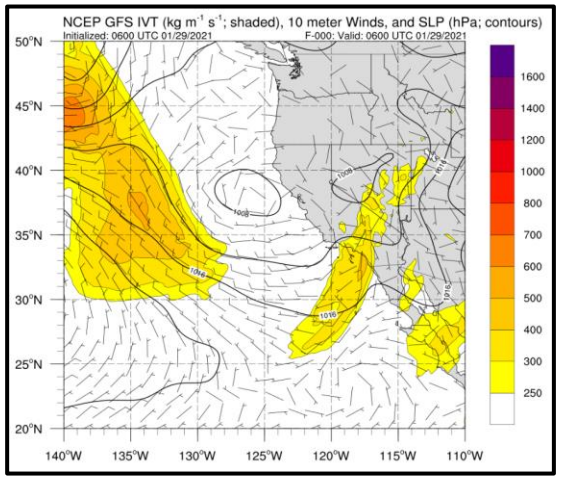
Results based on last 4.5 years

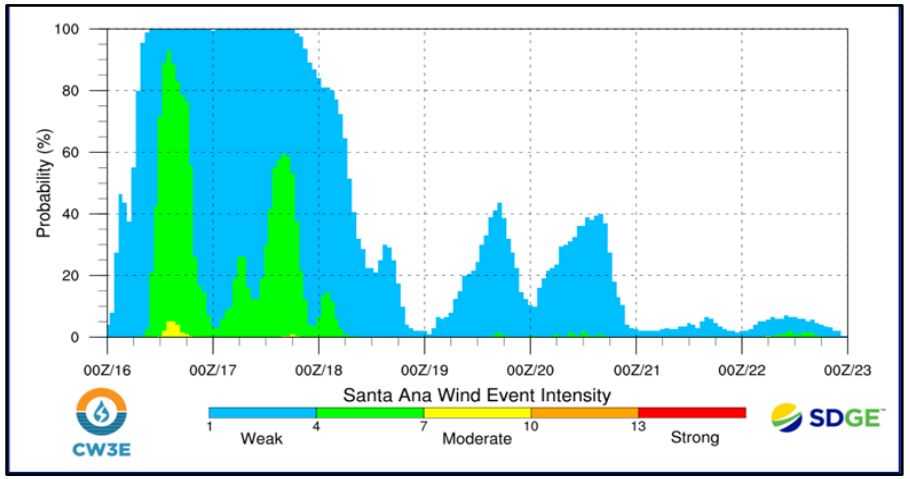
- Over-prediction most often due to planning for worst-case forecast scenarios that do not verify
- Under-prediction found to have two main sources:
  - Weather station choice for verification – use of stations with extreme conditions unrepresentative of majority of the district.
  - Limitations of the FPI formula – does not account for high soil moistures immediately after rainfall that limits the fire potential before grass green-up can occur

Academic Partnerships

Center for Western Weather and Water Extremes







Center for Western Weather and Water Extremes (CW3E), Scripps Institution of Oceanography, University of California San Diego

CW3E's mission is to better understand, predict and apply extreme weather forecasting capabilities tailored to the unique meteorological conditions of the western U.S.

Three initiatives for 2023

200-member weather model to predict extreme events by sampling a greater distribution of possible forecast outcomes:

- 7-day forecast tailored for SDG&E, predicting strength and probability of Santa Ana winds

Santa Ana (SA) Wind High-resolution Modeling:

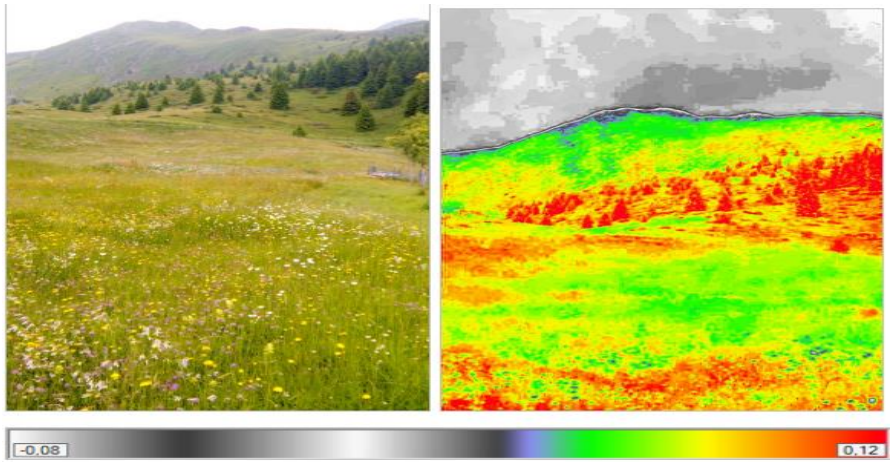
- Examine extreme SA winds to quantify the positive impact of a 333 m resolution weather model for better SA wind forecasts

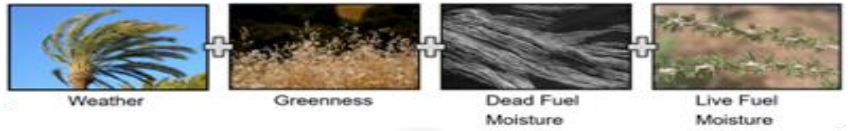
Weather Hazards Summary Product:

- Develop a forecasting summary of weather hazards over the SDG&E service territory

Academic Partnerships

SJSU | WILDFIRE INTERDISCIPLINARY RESEARCH CENTER





	Tue 10/29	Wed 10/30	Thu 10/31	Fri 11/01	Sat 11/02	Sun 11/03	Mon 11/04	Tue 11/05
ME	Elevated 14	Extreme 16	Extreme 16	Elevated 14	Elevated 14	Elevated 14	Elevated 14	Elevated 14
RA	Elevated 14	Extreme 16	Extreme 16	Elevated 14	Elevated 14	Elevated 14	Elevated 14	Elevated 14
EA	Elevated 12	Extreme 15	Extreme 15	Elevated 14	Elevated 14	Elevated 13	Elevated 13	Elevated 13
NE	Elevated 12	Extreme 15	Extreme 15	Elevated 14	Elevated 14	Elevated 13	Elevated 13	Elevated 13
OC	Normal 11	Extreme 15	Elevated 14	Elevated 14	Elevated 13	Normal 11	Normal 11	Normal 11
NC	Normal 11	Elevated 14	Elevated 14	Elevated 12	Elevated 12	Normal 11	Normal 11	Normal 11
BC	Normal 11	Elevated 13	Elevated 14	Elevated 12	Elevated 12	Normal 11	Normal 11	Normal 11
CM	Normal 11	Elevated 13	Elevated 14	Elevated 12	Elevated 12	Normal 11	Normal 11	Normal 11

San Jose State University (SJSU) Wildfire Interdisciplinary Research Center (WIRC):

The WIRC focuses on all aspects of wildfire science, conducting high-impact wildfire research so that improved tools and policies can be provided to the community and industry stakeholders around the world.

Two initiatives for 2023

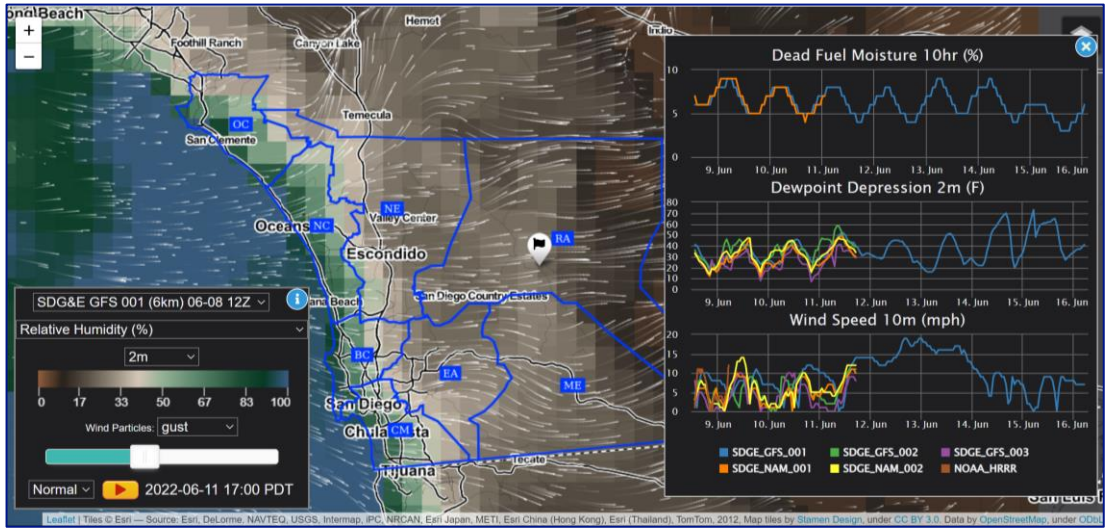
- Operationalizing the new machine learning live fuel moisture model (LFM) and integrate into WRF-SFIRE, a coupled atmosphere-wildfire model that can be queried for ignitions. Enable WRF-SFIRE simulations to serve Wildfire Analyst (WFA) desktop clients.
- Assess the accuracy of dead and live fuel moisture inputs into the SDGE Fire Potential Index (FPI). Explore methods for error reduction by assimilating in-situ and high-resolution satellite-based fuel moisture observations.

Academic Partnerships

San Diego Supercomputer Center (SDSC):

The SDSC ingests and stores SDG&E weather, fuels and post processed indices datasets, including the Outage Potential Index (OPI), Solar Potential Index (SPI), Fire Potential Index (FPI) and Santa Ana Wildfire Threat Index (SAWTI), to enable findability through web services and visual maps.

Two initiatives for 2023



- Enhance SDG&E Weather and Fuel Data Intelligence Visualization Portal with defined user experience requirements. Constantly consider new datasets and visualizations such as aircraft observations.
- Design Physics Guided Machine Learning (PGML) Techniques for Next-Generation Fire Modeling at high spatiotemporal resolutions. Develop innovative computational methodologies to anticipate ignition locations and fire spread.

PSPS Model Updates - WiNGS

Ashley Llacuna

Model Updates

PSPS Model

- 2023 WiNGS-Planning:
  - Updates to current PSPS likelihood assessment
  - Updates to PSPS consequence assessment
- 2023 WiNGS-Ops :
  - Create PSPS scenarios with different durations
  - Review and update existing Financial assumptions
  - Review and update existing Reliability assumptions

Consequence Model

- In WiNGS 3.0 model, SDG&E changed the MAVF constants to align with RAMP in these categories
  - Buildings Destroyed
  - Fatality per Structure
  - Cost per Structure
  - Suppression Cost per Acre
  - Pole Restoration Time
  - Top-Down Calibration Factors

PSPS Event Integration

- After an event, Post-PSPS Patrol team surveys for damage that occurred during the activation
- Data is recorded in the conductor model and interpreted as outage information

WiNGS Ops Usage

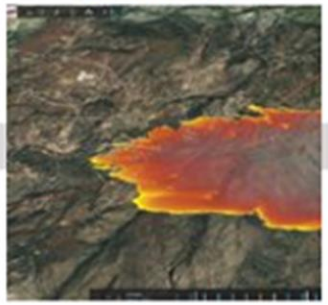
Assisting PSPS Decision-Making

WiNGS Ops results and high-level summary shared with Meteorology Team

Integration into PSPS decision dashboard via "Conductor Risk Index"

Post-event Patrols and Reporting

3 days ahead



72-Hour: EOC Activation; High-level weather briefing to provide two full days of daylight for pre-patrols

2 days ahead

48-Hour: Receive circuit list from Meteorology; Continue pre-patrol and gather damage assessments

1 day ahead

24-Hour: Placement of Observers

Day of power shutoff

Weather arrives: De-energization

Power restored

Weather passes: Post-patrol and re-energization

Notifications & Communications

Mona Freels

Coordination with Public Safety Partners & Critical Facilities & Critical Infrastructure

Public Safety Partners (PSP)

- Conducted 4 Emergency Plan Review and Wildfire Preparedness Workshops
- Developed Public Safety Partner Portal (PSPP) mobile application
- Enhancing PSPP to include All-Hazards
- Developing enhanced PSP notification platform
- Conducted presentations to all fire chiefs

Critical Facilities & Critical Infrastructure (CFCI)

- Updated the website educating customers on resilience and preparedness
- Conducted two preseason webinars (July and August)
- Provided targeted survey to 1500+ unique customers
- Updated 21k+ Critical Facility Accounts (contacts, BUG capabilities)

Coordination with Local & Tribal Governments

- Held **10** Emergency Operations Center tours
- Wildfire Preparedness Workshop – **June 21, 2022**
- Meaningful engagement with Tribal communities
- Listening sessions/working groups/trainings/surveys
- Refine & expand notification process & technology
- Coordination with Tribal communities and local governments to amplify messaging (i.e., social media toolkit)

Coordination with Local & Tribal Governments

Collaboration with stakeholders to enhance community preparedness & regional wildfire resilience

2022 Accomplishments:

- **4** In-person Wildfire Safety Fairs
- Second **joint SDG&E/tribal** partner Wildfire Safety Fair
- More than **339,556,000** marketing impressions
- Awareness of PSPS program increased significantly (67% ➔ 74%), reaching a new all-time high.
- Address level alerts, CRCs and PSPS alert language preference are the most known resources
- Customized access & functional needs (AFN) public education campaign

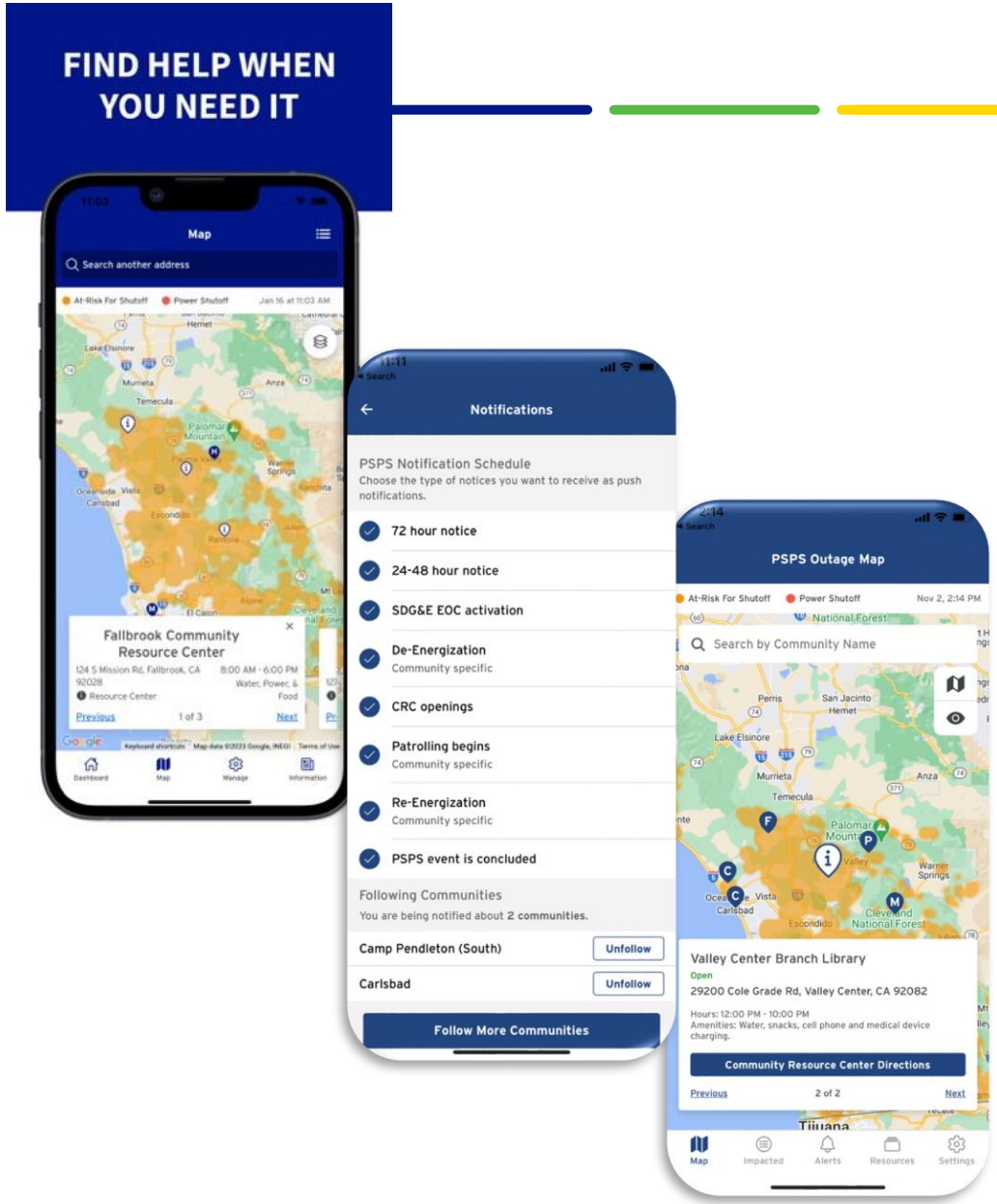
2023 Planning:

- Wildfire Safety Fairs and expanded Open Houses (Spring and Summer)
- Expanded customized outreach and communications to tribal communities & AFN customers
- Refreshed regional public-education campaign (PSPS and AFN components)
- Expand multi-channel AFN engagement strategy/new contracted AFN consultant

Mobile Applications

- Alerts by SDGE
  - Customer application
  - Community outage mapping
  - Address look-up tool
  - CRC locations

- Public Safety Partner Portal Mobile Application
  - Public Safety Partner application
  - Customized notifications
  - Ability to follow communities
  - Resource links
  - GIS mapping
  - Winner of California Emergency Services Association Silver Award
    - ► Nominated by the City of San Diego Office of Emergency Services



Medical Baseline, Access & Functional Needs, Battery Programs & Customer Survey Results

Danielle De Clercq, Jon Kochik, Robb Henderson

Support for Individuals with AFN

New and continued enhancements to further reach and support individuals with Access and Functional Needs

Access & Functional Needs

- Continued partnership with 211 to connect customers to 365/24/7 direct support in 200+ languages
- Key partnerships directly supporting AFN customers
- AFN Self-ID Data Automation and Updates
- Dedicated EOC AFN Liaison
- Dedicated accessibility / AFN email address for customer support
- Raised accessibility of external facing websites to WCAG 2.1 AA success criteria
- Added dedicated webpages for AFN services
- Providing Video Remote ASL Interpreting (VRI), at branch offices & Community Resource Centers
- Proactive targeted program outreach on resiliency resources through CBOs
- Enhanced accessibility support at Community Resource Centers

Medical Baseline Program

- ~69,000 customers enrolled in the MBL Allowance program
- Enhanced partnerships with In-Home Supportive Services & Regional Centers, Medical Suppliers and Clinics
- Continued outreach to enroll eligible customers in MBL for PSPS notifications (door-knocks)
- Distributed 650 MBL apps (English/Spanish) to California Association of Healthcare Facilities

Backup Generator & Battery Programs

Program	Generator Grant Program	Generator Assistance Program	Standby Power Programs
Overview	Portable backup battery provided to qualifying MBL & AFN customers in the HFTD with prior PSPS (active July-Dec)  	Portable fuel generator & portable power station rebates for HFTD customers with prior PSPS, additional rebate for CARE customers (active July-Dec)  	Provides a permanent generator to customers that have a high risk of experiencing a PSPS  
2022 Program Results	• Delivered 900+ units; 4,700+ total since 2019 • Implemented online request form • 95% of those in a PSPS used the unit	• Provided 140 rebates; 2100+ total since 2020 • Streamlined customer rebate process • Increased rebate amounts	• 390+ residential installed (870+ total since 2020) • 4 commercial installed (10 total since 2020) • 1 mobile home park installation (2 total since 2021)
2023	• Target: **1,000** batteries • Emergency, on-demand deliveries available • Customer follow-ups on unit performance	• Target: **700** rebates • Include more models with safety features to qualified product list • Cross-promotion with other programs	• **300** residential installations • **6** commercial / mobile home park installations • Integrate non-fossil fuel solutions • Continue to expand mobile home parks, schools, & Community Resource Centers candidates

2022 Customer Research

Accomplishments

- Pre-season research conducted in early Fall 2022
- No PSPS occurrences during 2022, no affected customers (notified or power shut off)
- 2022 Post-season survey content similar to pre-season
  - Post-season results to be compared to pre-season
  - Usually, annual comparison between pre- and post- results
  - Post-season effort in process, results to be shared in 2023 Pre-season Report
- PSPS notifications not tested as there was no PSPS in 2022

2023 Planning

- New notification testing exercise with customers
- PSPS notifications to be reviewed for any needed updates prior to 2023 PSPS season
- Continued coordination with regional public safety partners & CBOs to amplify messages

Fast Trip/ Sensitive Relay Profile & Lessons Learned

Shaun Gahagan

By-the-Numbers - Sensitive Relay Profile (SRP)

WILDFIRE IGNITIONS

ZERO

ignitions downstream of SRP-enabled devices

SYSTEM RELIABILITY

<1%

Total outages associated with SRP since 2017

TIME-TESTED PROGRAM

2011

Implemented over a decade ago with no operational issues

OUTAGE CAUSES

1.7%

Increase in undetermined outages when SRP was enabled in 2022

HIGH FIRE THREAT DISTRICT (HFTD)

100% COVERAGE

in highest risk areas during critical fire weather conditions

RESTORATION TIMES

0%

Increase in restoration times on outages when SRP was enabled in 2022

RARELY UTILIZED

< 2% OF DAYS

with SRP-related outages since 2020

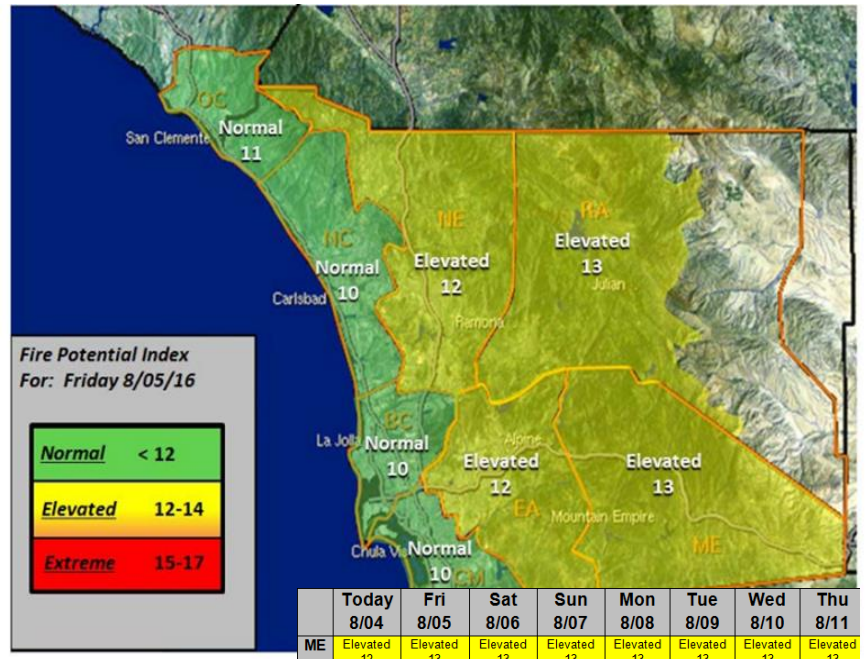
FIRE SAFETY

15 YEARS

without a large utility-caused wildfire

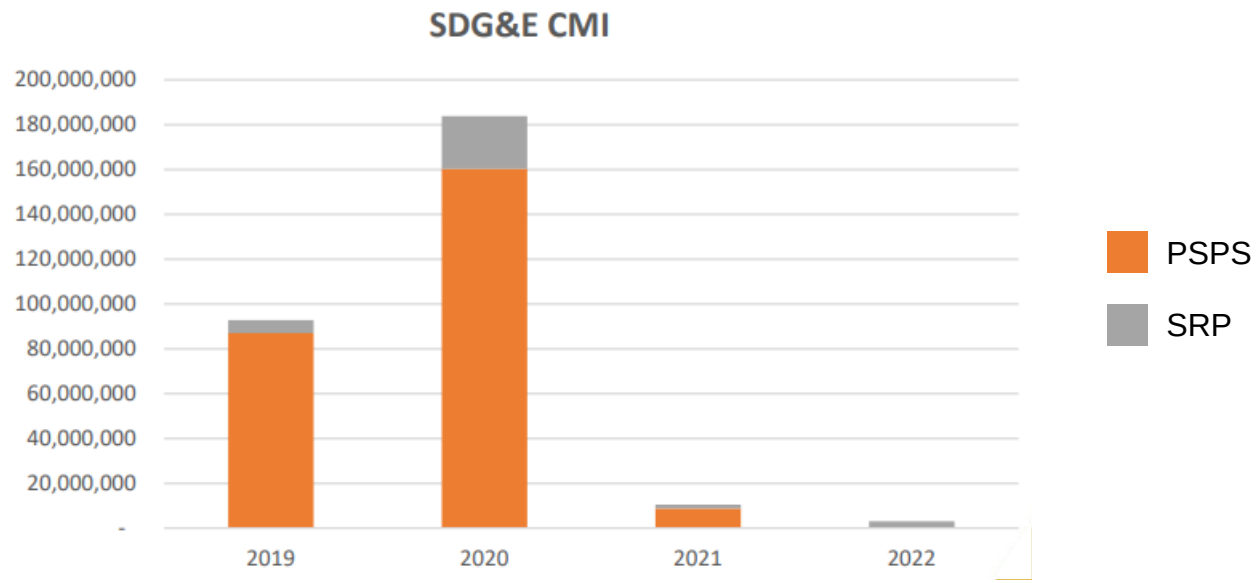
SRP Overview

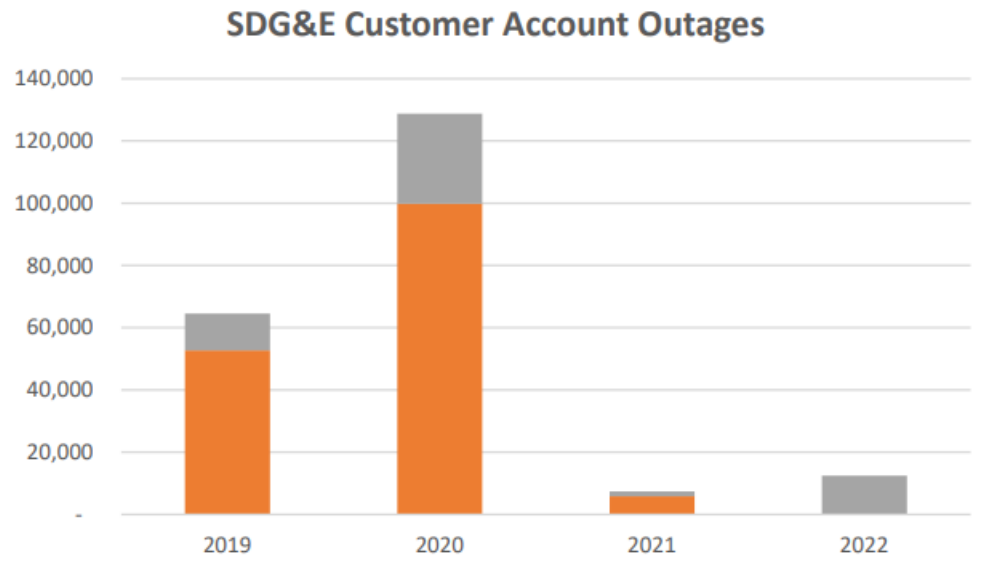
SRP Program	
Devices Used	• Circuit breakers • Line reclosers • Pad-mounted fault interrupters
Activation Criteria	• When extreme fire weather conditions or PSPS are forecasted • Implemented only throughout event duration – not applied seasonally • Only enabled in regions impacted by extreme weather
Protection Summary	• Setpoint for SRP is determined by reviewing a 5-year load trend for phase and ground • All reclosers lock out on initial trip • Devices are set to clear instantaneously with 0.5 cycle delay
Dedicated Response Crews & Resources	• Fully staffed during Extreme FPI / PSPS for restoration & readiness response • Line SCADA crews ready to respond 24/7 to collect relay records • Records are sent to System Protection Engineering for review to help determine proper operation & help with determining fault location • Feedback from Engineering provided to Ops teams for better situational awareness
Automatic Testing, Reclosing & Restoration	• Protocols are no different between SRP and non-SRP under Extreme FPI / PSPS conditions • Automatic testing not performed & reclosing is disabled • Patrol is required & step restore is performed for all outages
Outage Customer Support & Communications	• SDG&E does not alter communication to customers when SRP is enabled • Outage response is no different for SRP outages versus non-SRP outages • Outages are mapped with estimated restoration time and information on outage cause • SDG&E staffs 24/7 System Protection support to review all SRP outages in real time



	Today 8/04	Fri 8/05	Sat 8/06	Sun 8/07	Mon 8/08	Tue 8/09	Wed 8/10	Thu 8/11
ME	Elevated 12	Elevated 13	Elevated 13	Elevated 13	Elevated 13	Elevated 13	Elevated 13	Elevated 13
RA	Elevated 12	Elevated 13	Elevated 13	Elevated 13	Elevated 13	Elevated 13	Elevated 13	Elevated 13
EA	Elevated 12	Elevated 12	Elevated 12	Elevated 12	Elevated 12	Elevated 13	Elevated 13	Elevated 13
NE	Elevated 12	Elevated 12	Elevated 12	Elevated 12	Elevated 12	Elevated 13	Elevated 13	Elevated 13
OC	Normal 11	Normal 11	Normal 11	Normal 11	Normal 11	Normal 11	Normal 11	Normal 11
NC	Normal 10	Normal 10	Normal 10	Normal 10	Normal 10	Normal 10	Normal 10	Normal 10
BC	Normal 10	Normal 10	Normal 10	Normal 10	Normal 10	Normal 10	Normal 10	Normal 10
CM	Normal 10	Normal 10	Normal 10	Normal 10	Normal 10	Normal 10	Normal 10	Normal 10

PSPS Outages vs. SRP Enabled Outages





Year	SRP Enabled Outages	PSPS Circuit Events	SRP Customer Hours	PSPS Customer Hours	Total Unplanned Customer Hours + PSPS	SRP % Customer Hours	PSPS % Customer Hours
2020	34	514	348,929	2,631,426	4,948,699	7.0%	53.2%
2021	13	13	68,890	147,767	1,851,182	3.7%	8.0%
2022	13	0	51,374	0	1,765,794	2.9%	N/A
Avg.	**20**	**176**	**156,398**	**926,398**	**2,855,225**	**4.5%**	**20.4%**

Lessons Learned in 2022

Subject	Lessons Learned	Proposed Improvement
Situational Awareness & Forecasting	• AI infrared camera smoke detection algorithm helps identify fires soon after ignition • Machine Learning Wind Gust model for all HFTD stations (215 out of 222) is vital for situational awareness 72 hours prior to a PSPS or Red Flag Warning • Need for a technology strategy to support scalable complex modeling that performs dynamically to support operational decisions	• Planned improvements to environmental and grid monitoring systems and weather forecasting
Emergency Preparedness	• Implementation of process flow tools is necessary to improve the efficiency of notifications with public safety and other state partners • Pre-registering public safety partner information in coordination with other Investor-Owned Utilities on a secure website is critical to improve completeness of data • Safety stand-downs at all operating centers aid in enhancing preparedness	• Revised Company Emergency and Disaster Preparedness Plan (CEADPP). • Review Customer Communications and solicit feedback
Community Outreach & Engagement	• Surveying customers to assess campaign effectiveness and communication preferences is key to informing the development of future campaigns • Optimizing partnerships with 40 HFTD-focused Community Based Organizations (CBOs) and enhancing key partnerships (e.g., healthcare) can assist in promoting and amplifying PSPS-related preparedness information to vulnerable populations	• Continue to share best practices and strategize on effective methods to reach customers
PSPS	• WiNGS-Ops model enhanced by retraining existing models with new historical observations, incorporating AFN customer impact scaling factors and improving consequence calculations • Customer participation in PSPS resiliency programs is largely driven by the occurrence of PSPS'. SDG&E created a dedicated reserve of backup battery units to support qualified customers who have not yet participated in resiliency programs and prior participants who need additional capacity	• Evaluate PSPS risk reduction impacts on frequently deenergized circuits • Evaluate wind threshold changes on PSPS utilization • Continue to target and campaign resiliency programs to customers most impacted by PSPS

Mitigation Efforts on Frequently De-energized Circuits

Strategic Undergrounding	• **68.16** miles completed; **571** miles completed by 2032 • **650** customers mitigated; **5,000** customers mitigated by 2032
PSPS Sectionalizing	• **71** SCADA devices installed • **2,400-8,000** customers mitigated
Backup Resiliency Programs	• **1,540** customers participated

A CASE STUDY: successful mitigations of frequently de-energized circuits

Hell Hole Canyon – an area that has been de-energized for PSPS four times since 2018 – saw wind gusts of 61 MPH during the November 2021 PSPS event. The 39 customers on this portion of the circuit were able to avoid a PSPS de-energization due to strategic undergrounding efforts that were completed in June of 2021.

*Frequently de-energized circuit is defined by OEIS as a circuit experiencing three or more PSPS de-energizations in a calendar year. Using a timeframe of 2018-2022, 15 circuits totaling 8,320 customers have been identified as "frequently de-energized".


SDGE™
Thank you