SCE's 2020-2022 Wildfire Mitigation Plan



CPUC Informational Workshop

February 19, 2020

Energy for What's Ahead℠

SOUTHERN CALIFORNIA EDISON®

Agenda

- Wildfire Mitigation Plan (WMP) Objectives
- 2019 WMP Accomplishments
- Lessons Learned
- High Fire Risk Area Boundary Changes
- 2020-2022 WMP Forecasted Ignitions after WMP Execution
- 2020-2022 WMP Strategy & Programs
- Maturity Model Self Assessment
- 2020-2022 WMP Cost Forecast

Wildfire Mitigation Plan Objectives

SCE is dedicated to the safety of the communities we serve

- The primary objective of SCE's WMP is to **protect public safety**
- SCE's **second comprehensive WMP**
  - Covers years 2020-2022
  - Builds on 2019 plan accomplishments and lessons learned
  - Retains foundational strategy for wildfire mitigation, and
  - Is a natural extension and refinement of our 2019 WMP and 2021 GRC filing
- Our WMP includes an **actionable**, **measurable**, and **adaptive** plan to:
  - Reduce the risk of potential wildfire causing ignitions associated with SCE's electrical infrastructure in High Fire Risk Areas
  - Reduce the impact of PSPS to our customers and communities
  - Incorporate risk analysis to guide planning and prioritization
  - Improve coordination between utility, state, and local emergency management personnel
  - Advance new technologies and data analytics capabilities
  - Effectively engage the public about how to prepare for, prevent, and mitigate wildfires

SCE has made significant progress in 2019 to reduce wildfire risks and to enhance community engagement

Community Meetings

Conducted **over 350 meetings** and presentations with local government, tribal officials, **community organizations, & general public**

Covered Conductor

Installed **372** circuit **miles of covered conductor**

Total of 523 circuit miles installed

Composite Poles

Installed **1,421 Fire-Resistant Poles**

Enhanced Veg Mgmt

129,485 tree specific **threat assessments completed**

5,917 Hazard Trees removed

HD Cameras

91 HD Cameras installed

Total of 161 cameras installed providing 90% coverage of SCE's HFRA

Install Sectionalizing Devices

Installed and commissioned 55 additional sectionalizing devices

Branch Line Protection

7,765 Current Limiting Fuse locations installed

Over 10,000 fuse locations installed

Enhanced Overhead Inspections

100% of Distribution & Transmission **structures inspected in high fire risk area**

Weather Stations

Installed **357 weather stations**

Total of 482 weather stations installed

Pole Brushing

Inspected and cleared brush around **159,485 poles**

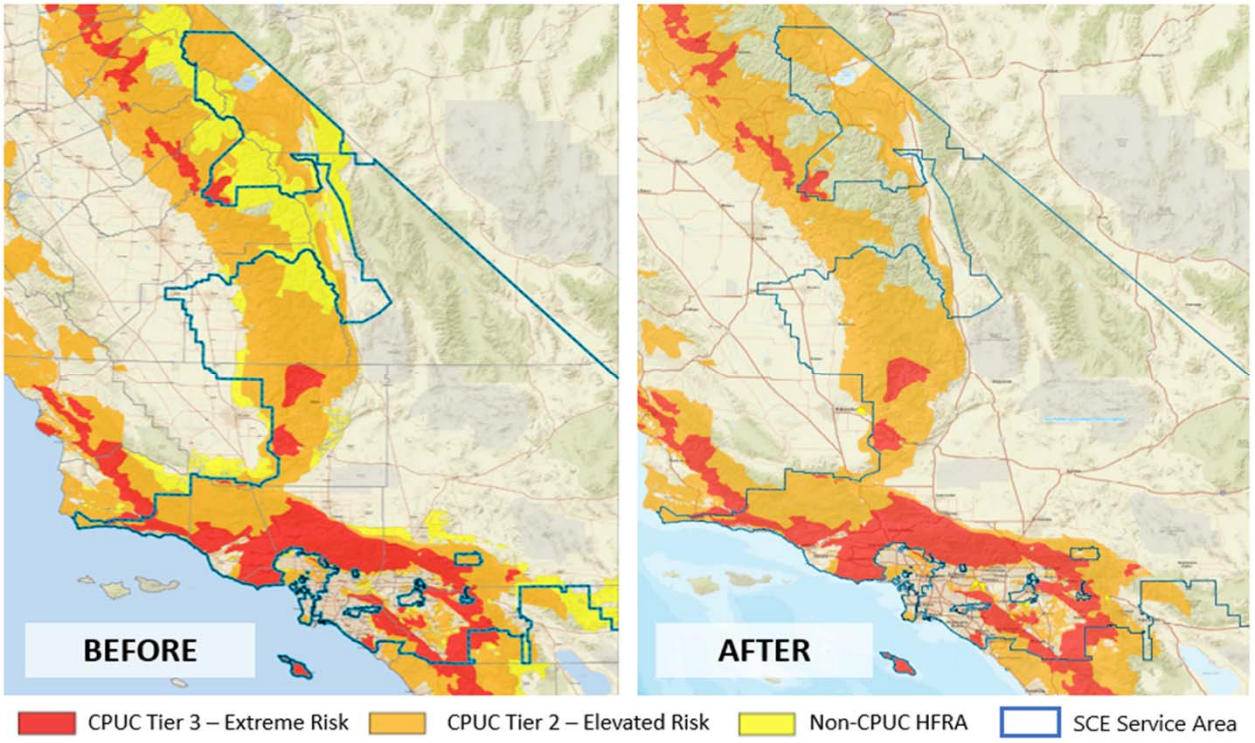
Lessons learned continue to inform and advance our WMP, but have not fundamentally changed our approach

Execution	Achieved target volumes of major programs and completed 54 of 58 WMP activities, but rapid scaling of programs to more quickly reduce risk—particularly with contracted resources—resulted in opportunities to improve efficiency
Resources	Added resources to manage increased pace of inspections, vegetation management, and infrastructure hardening programs; competition from statewide mitigation activities will continue to constrain pace of growth
Ignitions	Too early to see meaningful reduction in HFRA ignitions, but ignition cause analysis validated our foundational programs and is informing further updates; continues to support use of PSPS as we aggressively deploy covered conductor
PSPS	Rapid maturation of tools minimized customer impact while still effectively avoiding many hazardous conditions; continuing to identify ways to reduce customer impacts
Technology	Observed meaningful benefits of mobile technology in field, data analytics for prioritization, and other promising technology (e.g. drones) to detect system issues; increases adoption and demand for technology use across plan

SCE modified its High Fire Risk Area (HFRA) boundaries in 2019

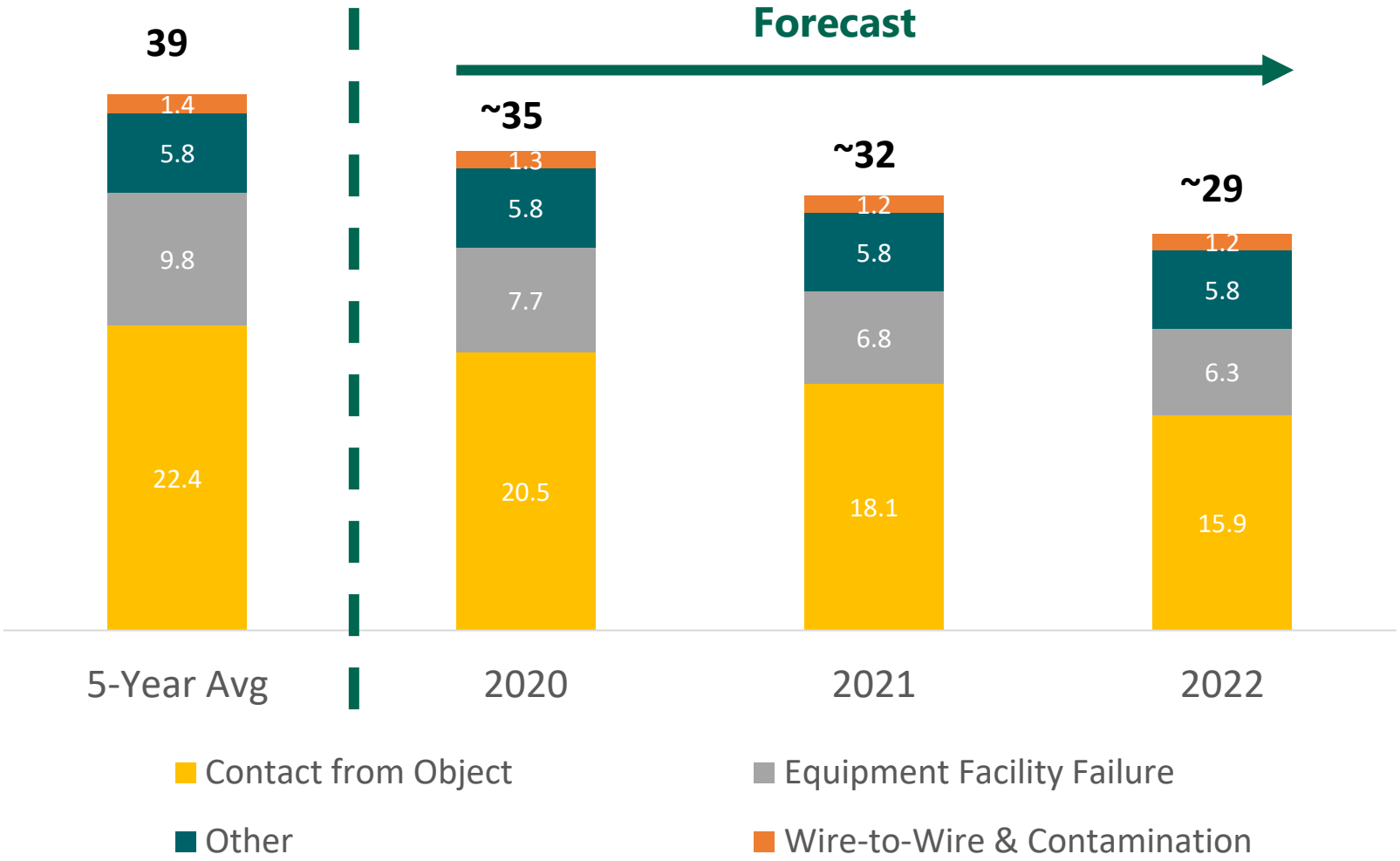
- In August of 2019, SCE filed a Petition for Modification (PFM) of D.17-12-024 in which SCE proposed retaining some areas (<1%) of the Non-CPUC HFRA to be treated as CPUC Tier 2 and requested that the Commission formally include these areas in its HFTD

- SCE's PFM is still pending approval and SCE continues to execute its WMP across the updated HFRA



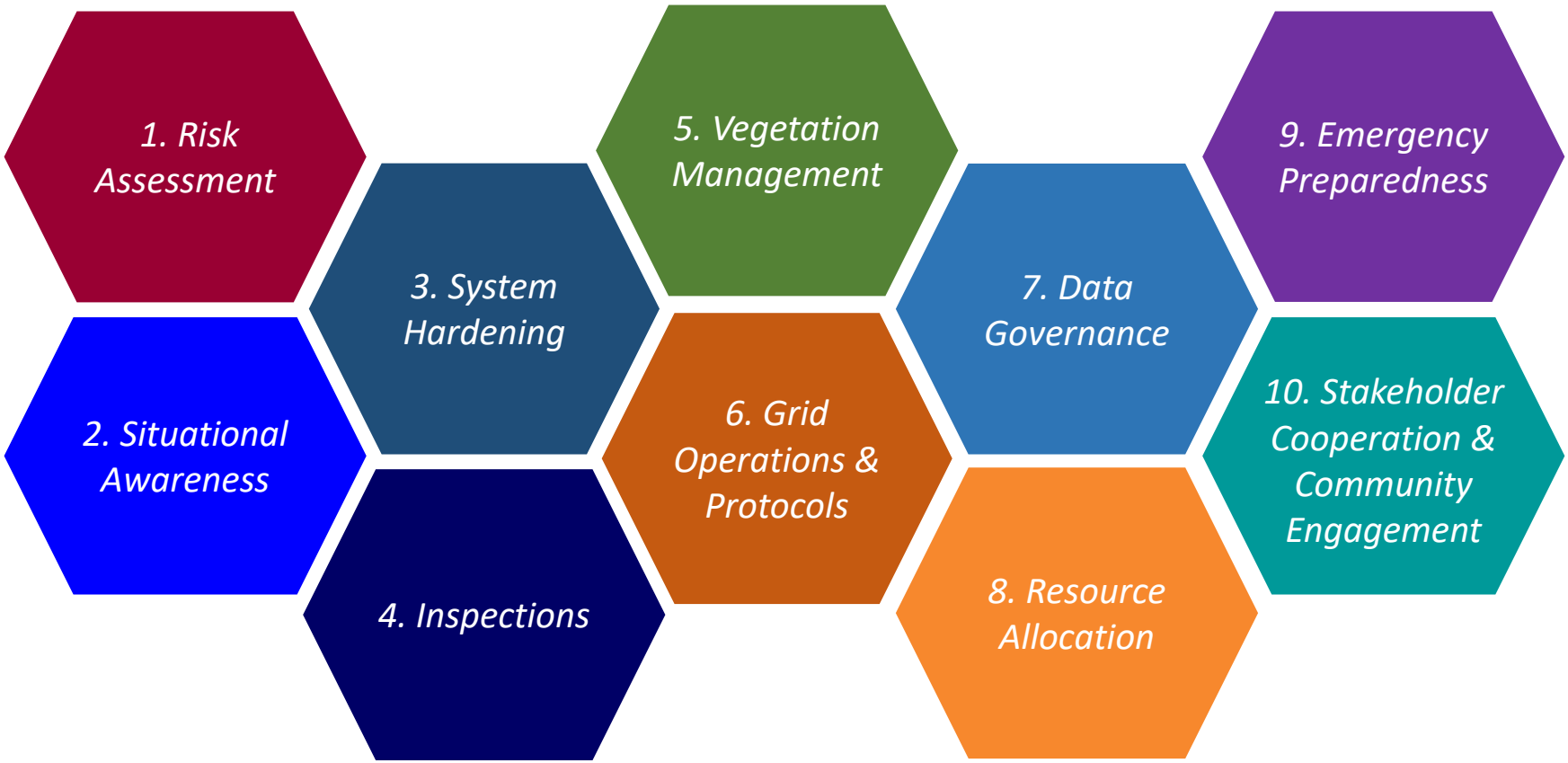
HFTD Tiers	Before HFRA Evaluation		After HFRA Evaluation	
	Area (Square Miles)	Percent of Service Territory	Area (Square Miles)	Percent of Service Territory
CPUC Tier 3 -- Extreme Risk	4,708	9%	4,708	9%
CPUC Tier 2 -- Elevated Risk	9,571	18%	9,571	18%
Non-CPUC HFRA	4,212	8%	124	<1%
Total	**18,493**	**35%**	**14,403**	**27%**

2020-2022 Forecasted HFRA Reportable Ignitions Per Year after Execution of WMP, Compared to 5-Year Historical Average



Sources: *SCE WMP 2020, Tables 18a, 18b, 31a and 31b*
Note: This forecast is based on cumulative mitigation effectiveness of each of the mitigation measures against the ignition drivers that form the baseline historical ignitions, and does not account for the impact of numerous exogenous factors beyond the control of the utility (e.g. weather conditions, suppression responses, etc.), and as such this forecast represents significant range of uncertainly around the expected value calculations.

2020-2022 Wildfire Mitigation Strategy & Programs



SCE's 2020-2022 WMP Programs are further described in Tables 21-30.

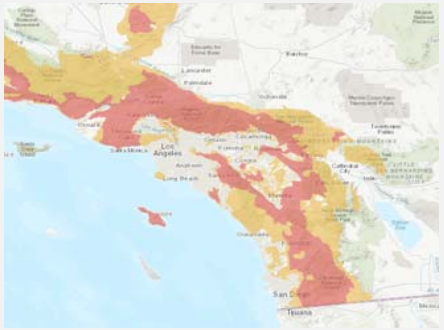
Risk Assessment

1. Risk Assessment and Mapping

SCE's wildfire risk model continues to evolve to more granular and accurate representation of fire risk (probability of ignition & consequence)

GSRP

- Fault-to-Fire Mapping
- Mitigation-to-Fault Mapping
- Mitigation Effectiveness / Cost Mitigation Ratios
- High Fire Risk Area (HFRA) Definition



SMAP / RAMP

- Bowtie (Drivers, Outcomes, and Consequences)

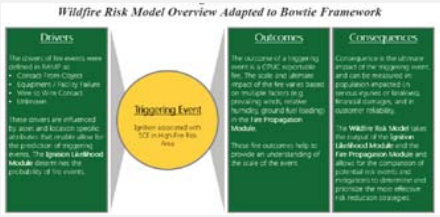


- Probabilistic Modeling
- Multi Attribute Risk Score (MARS)
- Mitigation Risk Spend Efficiency (RSE)

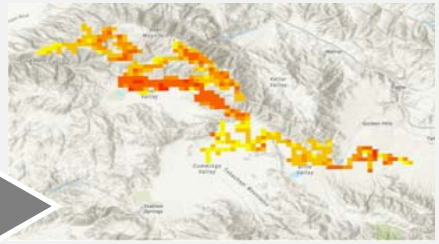
2019 WMP

2021 GRC

- Wildfire Risk Model Development
  - Probability of Ignition
  - Fire Propagation (Reax)
  - Fire Consequence (Reax+)

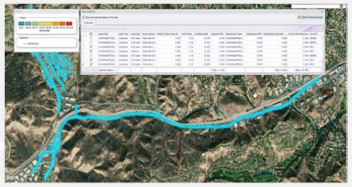


- Risk Prioritization at a Circuit and Segment Level



2020 WMP

- Ignition Analysis for Distribution and Transmission
- Enhanced Multi-Mitigation Assessments
- RSE Calculation Enhancements
  - Asset Useful Life
  - Discount Rates
  - Annual/Incremental RSE
- Evolving Fire Propagation Modeling (i.e., Technosylva)



Sept 2018 | Nov 2018 | Feb 2019 | Aug 2019 | Feb 2020

Situational Awareness

2. Situational Awareness and Forecasting

- **Deploy 375-475 weather stations per year**
- **Improve Weather Modeling** through:
  - Installation of additional weather stations Installation of 2nd High Performance Computing Cluster in 2020 and a 3rd after 2021
  - Performing updated fuel sampling in HFRA areas every two weeks (weather permitting)
- **Improve PSPS Operations** through:
  - Installation of additional weather stations
  - Fire Potential Index Enhancements
  - Deployment of Technosylva's FireCast & FireSim
  - Continuation of Pre & Post patrols
- **Detect and prevent potential faults** that could cause ignitions through:
  - Distribution Fault Anticipation
  - Early Fault Detection
  - Open Phase Detection

Weather Station



HD Camera



Weather Models



System Hardening

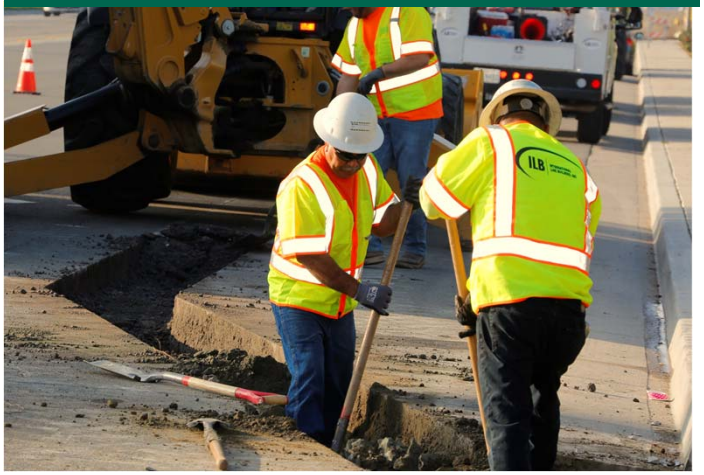
3. Grid Design and System Hardening (1/2)

- Ramp up covered conductor deployment efforts – install at least **700 circuit miles in 2020**
- Aggressive plan to **deploy up to 4,500** circuit miles of covered conductor by end of 2022
- **Targeted undergrounding** evaluation
- Continue to **target deployment** in the **highest risk and PSPS-impacted areas** based on risk-informed analysis

Covered Conductor



Targeted undergrounding evaluation



System Hardening

3. Grid Design and System Hardening (2/2)

- Other **infrastructure hardening** efforts in HFRA:
  - ❖ Composite poles and fire-resistant wraps
  - ❖ Fast-acting fuses
  - ❖ Remote controlled sectionalizing devices
  - ❖ Circuit breaker relay for fast curve

- Advancing various **detection and sensing technologies**
  - ❖ Deploy Rapid Earth Fault Current Limiter (REFCL) pilots
  - ❖ Open Phase down wire detection
  - ❖ Assess Distribution Fault Anticipation performance

Post Fire Event
Wood vs. Composite Poles



Remote Controller for RAR with Fast-Curve



Fast-acting Fuses

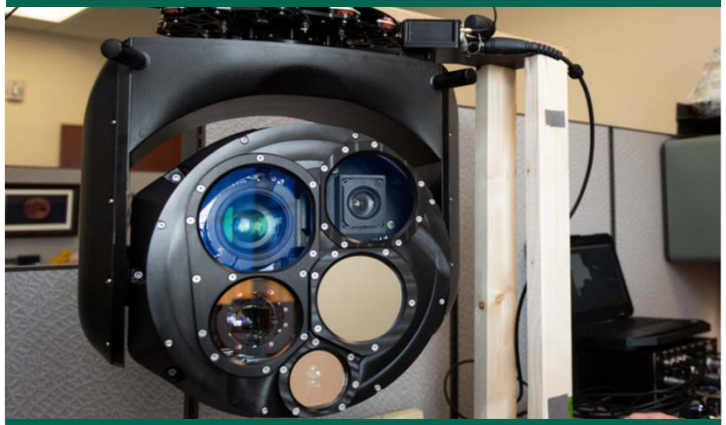




Inspections

4. Asset Management and Inspections

Sensor Technologies



Aerial Inspections



Ground Inspections



- Utilize both ground and aerial inspections to obtain **360° views** of structures and equipment
  - ❖ Lessons learned from crossarm failure in 2019
- Aerial inspections on **165,000** distribution and **33,500** transmission structures
- Deploy various sensors and collect data (**infrared**, **corona scanning**, **LiDAR** and **HD images/videos**)
  - ❖ Leverage **Unmanned Aerial Systems**
- Redesigned inspection program to perform more frequent inspections of higher risk structures (**105,000** distribution & **22,500** transmission structures)
- Leverage detection technologies using **artificial intelligence** and **machine learning** to complement manual inspections

Vegetation Management

5. Vegetation Management and Inspections



- Continue & expand key programs:
  - Expand brush clearance to **200,000-300,000** poles annually
  - Hazard Tree Management Program (HTMP) to assess **75,000** trees annually and timely mitigations
  - Continue Drought Relieve Initiative (DRI) inspections and timely mitigations
  - **Risk-based** HFRA vegetation management quality control inspections
- Integrated vegetation management platform to improve work planning, scheduling, notification, and reporting
- 2019 Lessons learned and challenges:
  - Resource shortage for qualified trimmers
  - Support from property owners and agencies

Grid Ops & Protocols

6. Grid Operations and Protocols

SCE expects to reduce the scope and impact of PSPS, however, PSPS will continue to remain available for extreme conditions in the long term

Multi-Prong approach to mitigate impacts of PSPS

- ***Switching Playbooks***
- ***Targeted Grid Hardening***
- ***Engineering & System Evaluation***
- ***Microgrids & Resiliency Zones***
- ***Customer Care***

Rapidly developing circuit-specific plans to reduce the impacts observed in 2019 by:

- Leveraging existing isolation equipment
- Targeting remediations
- Identifying small upgrades to reduce the number of customers impacted by PSPS
- Deploying more weather stations
- Pursuing microgrid opportunities when technologically and economically feasible
- Establishing Community Resource Centers
- Deploying Community Crew Vehicles
- Providing potable water
- Addressing food spoilage claims
- Conducting community outreach

Emergency Preparedness

7. Emergency Planning and Preparedness

SCE's emergency preparedness and response plans consider numerous hazards that potentially impact SCE's service territory and/or the electric grid

Customer Engagement & Education

- Provide customers with important and consistent messaging
- Participate in statewide multichannel and multi-lingual media campaign



- Send letters to customers in HFRA in non-HFRA with information about PSPS, emergency preparedness, and SCE's wildfire mitigation plan to customers in HFRA
- Host 8-12 community meetings in areas impacted by 2019 PSPS



Emergency Response Training

- Continue training ~540 existing and new SCE IMT members on de-energization protocols
- Determine additional staffing needs and train, exercise and qualify new staff



Data Governance

8. Data Governance



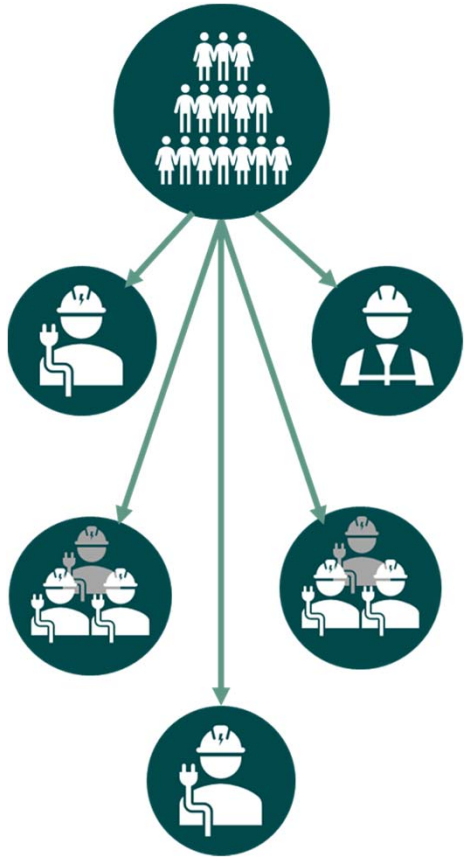
- Traditionally, organizations across SCE have addressed data governance at the system and activity level focused on data quality, security, and compliance
- In 2019, SCE established new processes and tools to help manage large datasets associated with its wildfire mitigation activities (e.g. iPads, mobile applications)
- In 2020-2022, SCE plans to invest in automation, machine learning, and artificial intelligence focusing on data architecture, management, and stewardship
- These refinements will help integrate wildfire mitigation data in areas like vegetation management, asset inspections, and PSPS allowing for greater insights from advanced analytics of asset health for improved risk modeling and prediction
- SCE will continue to develop foundational data governance strategy and a data quality framework / methodology to measure and manage master data quality

Resource Allocation

9. Resource Allocation Methodology

Human resources continue to be the binding constraint to accelerate more wildfire mitigation work

- Wildfire mitigation activities have considerably increased the overall scope of utility work and pose challenges for resource allocation
- In many cases, the same crews that support wildfire mitigation activities are responsible for executing SCE's traditional infrastructure replacement work
- Despite the importance of traditional infrastructure replacement work, SCE will pursue them at a slower pace in order to execute larger portions of higher safety risk reduction wildfire mitigation work
- SCE will continually monitor safety & reliability and, where necessary, adjust short- and long-term plans to optimize resource allocation and prioritization of work



Community Engagement

10. Stakeholder Cooperation and Community Engagement

SCE is committed to keeping its customers and key stakeholders informed of WMP activities, PSPS protocols, and general emergency preparedness

- Plan to concentrate efforts in 2020 on communities impacted by multiple PSPS events
- Collaborate and share best practices with trade associations, technical organizations and establish an international wildfire committee with national and international agencies
- Continue to partner with all wildland fire suppression agencies as part of SCE's overall fire mitigation efforts
- Explore virtual community meetings to increase the reach of the meetings

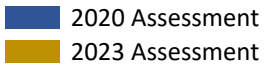
Community Meeting



Community Crew Vehicle



Maturity Model Self-Assessment



Category	Rating Scale (0 1 2 3 4)
A. Risk Mapping and Simulation	
B. Situational Awareness and Forecasting	
C. Grid Design and System Hardening	
D. Asset Management and Inspections	
E. Vegetation Management and Inspections	
F. Grid Operations and Protocols	
G. Data Governance	
H. Resource Allocation Methodology	
I. Emergency planning and Preparedness	
J. Stakeholder Cooperation and Community Engagement	

Key Takeaways

- SCE is compliant across all categories (score of 1) and has mature practices across multiple categories (score of 3 is best-in-class)
- SCE supplemented responses with robust commentary to establish context
- Substantial progress made in 2019 included in baseline 2020 assessment masks overall growth
- SCE's progress in analytical capabilities, enhancements in ability to assess wildfire risk, and prioritization of grid hardening initiatives will advance our maturity across multiple categories of this model

Rating Scale:
0=Below Regulatory Requirement; 1=Meets Regulatory Requirements; 2=Beyond Regulatory Requirement
3=Consistent with Best Practice; 4=Improvement over best practices

2020-2022 WMP Cost Forecast

Capital ($ Nominal Millions)	2019	2020	2021	2022	Total ('20-'22)
	Actuals				
System Hardening	$ 331.5	$ 549.1	$ 776.4	$ 924.8	$ 2,250.3
Inspection & Maintenance	302.9	244.1	61.8	39.4	345.4
Situational Awareness	14.1	13.2	15.0	24.1	52.3
PSPS	0.6	2.0	1.6	0.8	4.4
WMP 2020-2022	**$ 649.1**	**$ 808.5**	**$ 854.7**	**$ 989.1**	**$ 2,652.3**

O&M ($ Nominal Millions)	2019	2020	2021	2022	Total ('20-'22)
	Actuals				
Inspection & Maintenance	$ 299.2	$ 268.1	$ 145.5	$ 118.4	$ 532.0
Vegetation Management	188.8	137.2	130.4	139.8	407.4
PSPS	20.5	33.3	31.0	31.7	96.0
Emergency Preparedness	2.7	12.2	12.5	12.8	37.5
Operational Related	38.7	23.4	6.2	4.7	34.4
Situational Awareness	4.1	10.4	12.2	7.7	30.3
System Hardening	3.3	10.4	6.4	5.8	22.5
Alternative Technologies	0.0	4.7	5.8	0.3	10.9
WMP 2020-2022	**$ 557.1**	**$ 499.8**	**$ 350.0**	**$ 321.1**	**$ 1,170.9**

Discussion / Q&A