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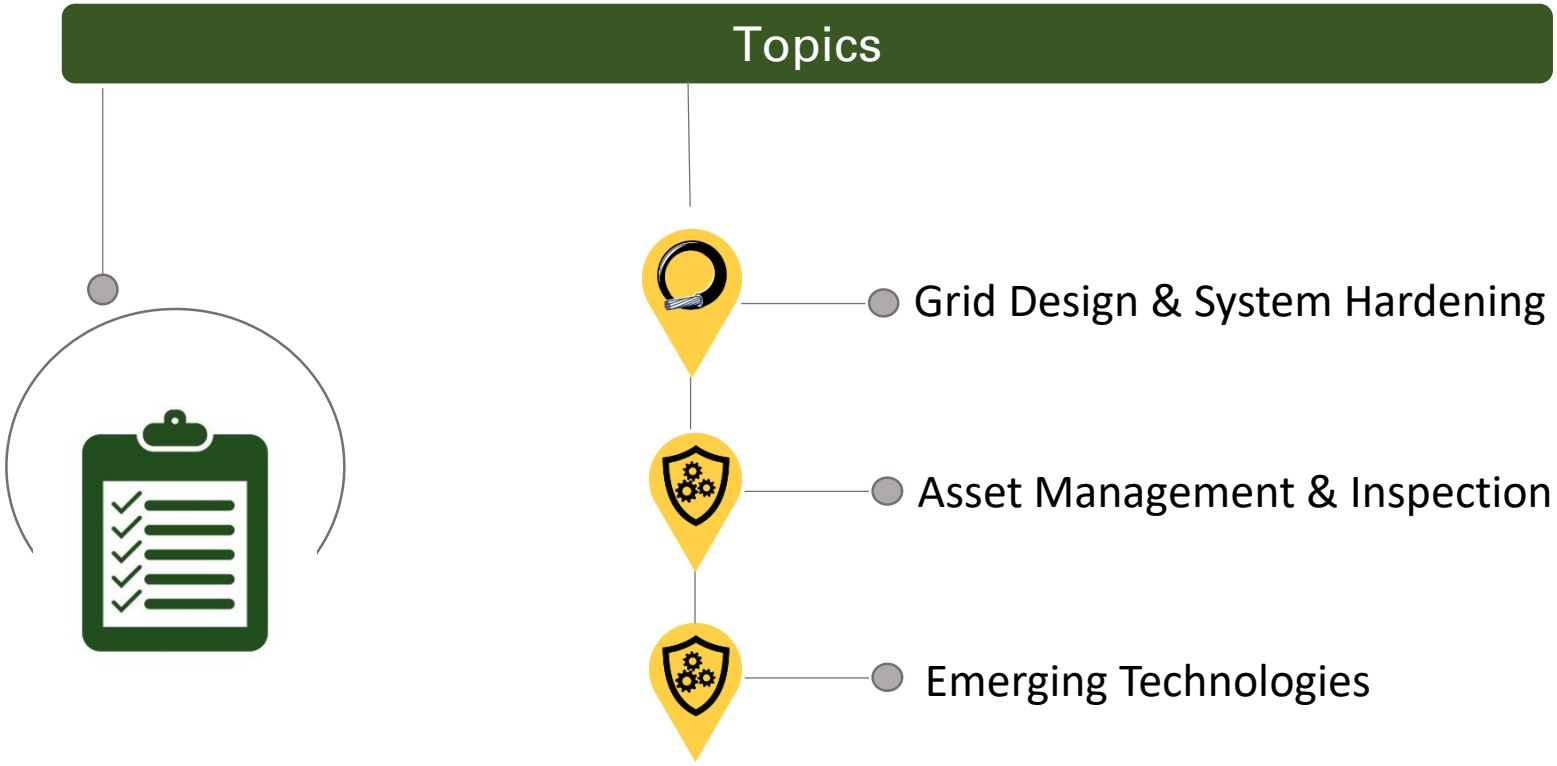
2021 WILDFIRE MITIGATION PLAN UPDATE

Grid Design and System Hardening, Inspections, Mitigation Choices, & Emerging Technologies

2021 WMP Update Technical Workshop
February 23, 2021

Agenda

Presenter: Russ Ragsdale, Director – Asset & Engineering Strategy



Grid Design & System Hardening Overview

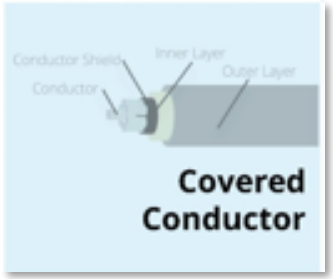
SCE's Grid Design & System Hardening mitigations are implemented to maintain, strengthen, and upgrade electrical equipment and infrastructure to reduce the risk of fire ignition in the HFRA

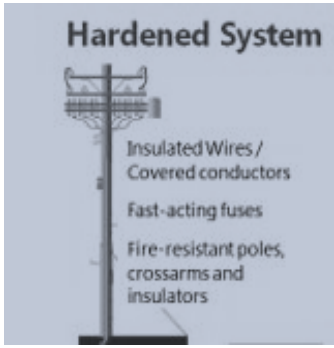
Ongoing

Covered Conductor	Risk reduction from system hardening efforts driven largely by installation of covered conductor *(2021 Target: 1,000 miles)*
Other Hardening Activities	Continued deployment of fuses *(replace/install 330 fuses)*, circuit breaker relay hardware *(replace/upgrade 60 relays)*, undergrounding *(4 miles)*, vertical switches *(20 switches)*, and other system hardening mitigations

New

C-Hooks	Proactively replace C-Hooks for structures that are not included in other planned work *(40 C-Hooks)*
Vertical Switches	Replacement of wood crossarm-mounted vertical switches in HFRA with factory built composite crossarm vertical switches *(20 switches)*
Long Span Initiative	Reduce probability of conductor clash, spans identified by aerial inspection and LiDAR *(Remediate ~300 highest risk locations)*
Microgrids	Evaluate the installation of a microgrid system to provide power to a circuit segment during PSPS event *(Assess locations and options)*





Grid Design & System Hardening: Examples of Prioritization

Deployment of SCE's system hardening initiatives uses latest advancements in SCE's risk modeling capabilities[1]

Covered Conductor

- Deployment primarily based on **highest to lowest risk** circuit segments
- **Operational efficiencies** in bundling work also considered; scope also considers permitting requirements, outage management, etc.
- New scope will be prioritized based on **Technosylva**[2]
- Evaluating **expedited deployment** to circuits most **impacted by PSPS**

Long Span Initiative

- **Reduces conductor clash** on distribution long spans
- **LiDAR performed** on high-risk locations to identify scope for field validation and remediation
- **Mitigations prioritized** based on **type of span issue** and **risk score**

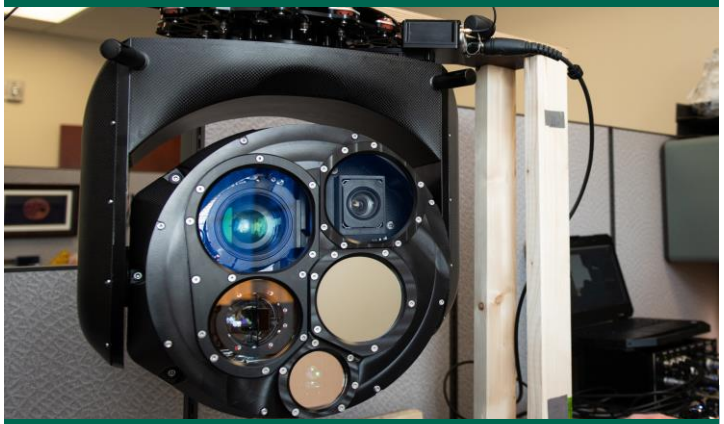
Undergrounding

- Circuit segments evaluated based on multiple criteria, including **risk scoring** from Wildfire Risk Reduction Model (WRRM), **PSPS impacts** (including circuits that have experienced multiple PSPS events), **terrain**, **construction complexity**, **community feedback**, **egress**, and **cost**

[1] Note, examples provided here are not exhaustive of SCE's System Hardening WMP activities
[2] 2021 scope may be based on prior risk models

Asset Management and Inspections Overview

Sensor Technologies



Aerial Inspections

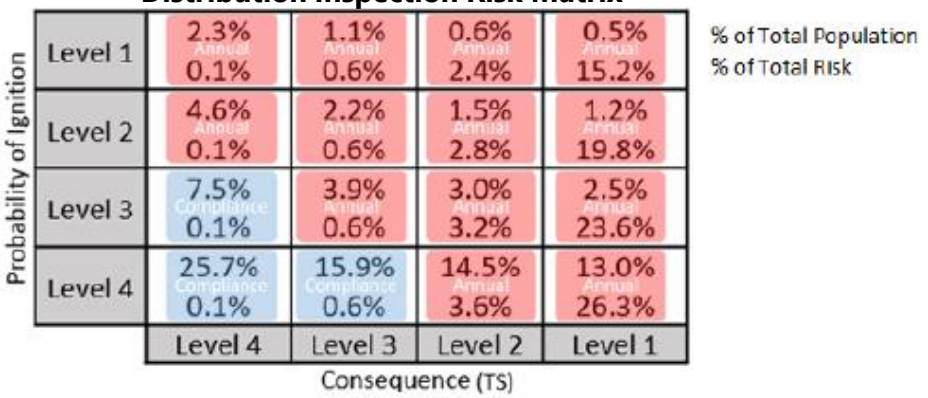
Ground Inspections

- Continue **360-degree distribution and transmission and inspections** of highest risk assets in HFRA and lower risk with compliance due dates
  - Inspect 59% of distribution and 53% of transmission structures in HFRA
  - Covers structures responsible for 99% of total wildfire risk
- Perform ground and aerial inspections on **163,000** Distribution and **16,800** Transmission structures
- Deploy various sensors and collect data **(infrared**, **corona scanning**, **LiDAR** and **HD images/videos)**
  - Leverage Unmanned Aerial Systems
- Leverage detection technologies using **artificial intelligence** and **machine learning** to complement manual inspections
- In addition to base inspections, including an option for approximately **30,000 additional distribution and 3,000 additional transmission** inspections based on emergent risks
  - Scope will be determined in Q2
- Implementing mobile inspection tools and data management systems to **improve inspection data quality** and **reduce inspection cycle time**

Asset Management and Inspections – Risk Prioritization

- **High Fire Risk Informed (HFRI) Inspections**
  (Transmission and Distribution, Ground and Aerial)
  - **Inspections prioritized** to those structures presenting **the greatest risk**
  - 4x4 matrix developed to **target inspections based on risk**; separately for Transmission and Distribution

Distribution Inspection Risk Matrix



- **Infrared Inspections**
  - **Distribution:** Structures in HFRA **Tier 3** and **Tier 2** will be **inspected once every two years**
    - Circuits inspected by district; highest risk districts inspected in first year; lower risk districts in the second year
  - **Transmission:** Uses **Technosylva consequence** and **Probability of Ignition scores** to select the **highest risk transmission circuit miles** in and adjacent to its HFRA
    - Final scope and prioritization adjusted based on operating constraints (e.g., circuit loading, ambient temperature)
    - Targeting to inspect 1,000 circuit miles in 2021; which will also include corona scans

- **Emergent Inspections for Areas of Concern (AOC)**
  - Areas posing **increased risk** (e.g., fuel-driven and/or wind-driven fire risk primarily due to elevated dry fuel levels)
  - Methodology to identify **AOCs based** on several factors: fire **history, weather conditions, fuel** type, exposure to **wind**, and **egress**, among others
  - **Scope** of AOC inspections to be **determined** based on **emergent risks** identified in **2021**

Emerging Technologies – Overview

- SCE is **exploring technologies** that, if successful, may be adopted as programmatic mitigations

- Process for **adoption of technologies** at SCE generally follows a **sequential flow consisting** of:
  1. Evaluation
  2. Pilot
  3. Small scale deployment
  4. Programmatic application

- In 2021 WMP, SCE is **evaluating** various **new technologies** for wildfire mitigation benefits, for example:
  - Rapid Earth Fault Current Limiter (REFCL) pilots
    - Ground Fault Neutralizer
    - Arc Suppression Coil
    - Isolation Transformer
  - Distribution Open Phase Detection (D-OPD)
  - Early Fault Detection (EFD)

REFCL

D-OPD

Early Fault Detection

Emerging Technologies – Examples of Current Projects

SCE initiates wildfire mitigation pilot activities when research, studies, benchmarking, etc. of new technologies, work methods, processes, etc. indicate there is a potential benefit to reduce wildfire risk

Rapid Earth Fault Current Limiter (REFCL)

- Reduce the energy released from ground faults to the point that ignition is unlikely
- Highly sensitive ground fault detection to help in avoiding hazards with energized wire down situations
- Three pilot programs to address cost effective options for a varying circuit conditions in SCE's HFRA

Distribution Open Phase Detection (D-OPD)

- Rapid detection and isolation of a separated or broken conductor while falling toward the ground level
- Minimizes the risk of ignition with certain conductor and splice failures by de-energizing a conductor before it contacts ground

Early Fault Detection (EFD)

- Technology to provide early alerts for remediation/repairs
- Technology that detects high frequency radio emissions which can occur from arcing or partial discharge conditions on the electric system

Thank You