

PSPS circuit analysis

December 1, 2020



Together, Building
a Better California



Overview

Key Questions to Address

Where do we focus our PPS mitigation efforts?

Which circuits are most impacted by PPS events?

How does PPS frequency compare to the Consequence Risk model?

Where are the 12 PPS Hardening projects with respect to PPS frequency?

High-level Conclusion

Using the 10-year historical weather lookback, focus on top 25% of PPS impacted circuits

Top PPS-impacted circuits do not have the highest consequence risk

Most of the circuits included in the 12 PPS Hardening projects have a low PPS event frequency and customer impact



Overview

Data inputs

- 2021 Consequence Risk Model – CPZ-level impact prepared by [REDACTED]
- 10-year historical weather model – circuit-level prepared by Meteorology
- 12 Hardening PSPS projects – CPZ-level prepared by [REDACTED]
- Actual PSPS events – circuit-level impact prepared by [REDACTED]



Overview

Caveats in the analysis

- The risk model examines risk on a year-by-year basis whereas the 10-year historical weather model looks 10-years back
- The risk model examines risk at a circuit-segment (CPZ) level. The risk was aggregated at a circuit level to have a comparison with the 10-year PSPS model which examines PSPS frequency at a circuit level.
- The 10-year historical weather model incorporates distribution only events



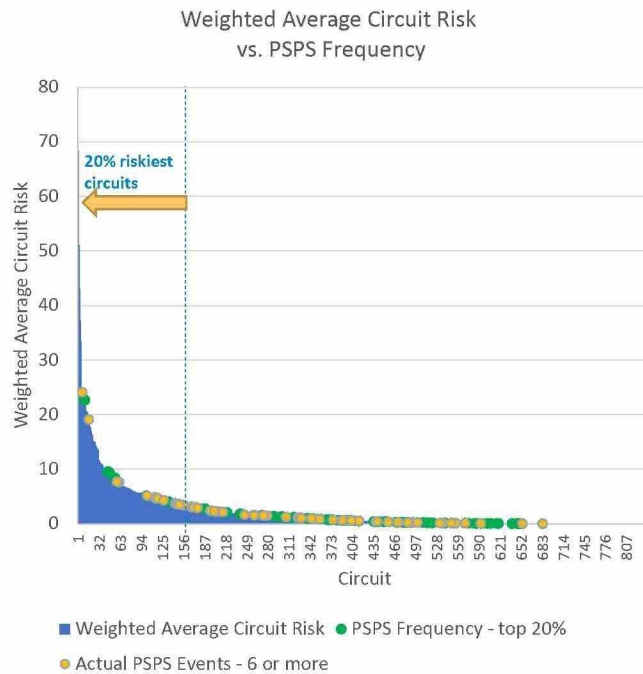
Differentiating likelihood of PSPS and Risk Models

Conclusion

- Highest risk circuits do not necessarily have the highest PSPS frequency

Data

- Weighted average circuit risk based on the approved 2021 Risk Model
- Frequency of PSPS events based on the 10-year historical weather model
- Actual PSPS events –
Circuits with ≥ 6 PSPS events between 2019 & 2020



Graph 1

Weighted average risk of all the CPZs within the specified circuit

Actual circuits - 83

WARS circuits - 813

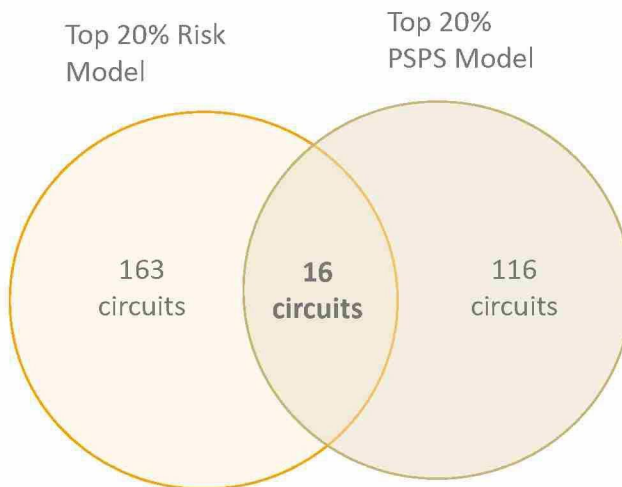
PSPS circuits - 569



Circuits identified by both models

| Circuit | Frequency of PSPS events |
|--|--------------------------|
| BIG BEND 1102* | 29 |
| BUTTE 1105* | 28 |
| DOBBINS 1101* | 26 |
| SILVERADO 2104* | 26 |
| NOTRE DAME 1104* | 24 |
| FORT SEWARD 1122 | 20 |
| APPLE HILL 2102* | 18 |
| CEDAR CREEK 1101* | 18 |
| FORESTHILL 1102 | 18 |
| WYANDOTTE 1107* | 18 |
| APPLE HILL 1103* | 16 |
| BUCKS CREEK 1101 | 14 |
| BUCKS CREEK 1102 | 13 |
| DESCHUTES 1101* | 13 |
| GRASS VALLEY 1103 | 12 |
| PUEBLO 1104 | 12 |
| *Top 25% of PSPS model, top 20% of Risk | |
| FULTON 1102 | 11 |
| HIGHLANDS 1103 | 11 |
| JAMESON 1105 | 11 |
| NARROWS 2102* | 11 |
| NARROWS 2105 | 11 |
| WHITMORE 1101 | 11 |
| DIAMOND SPRINGS 1107 | 10 |
| JAMESON 1102 | 10 |
| NAPA 1112 | 10 |

**Experienced more than 6 PSPS events during 2019/2020 PSPS season*



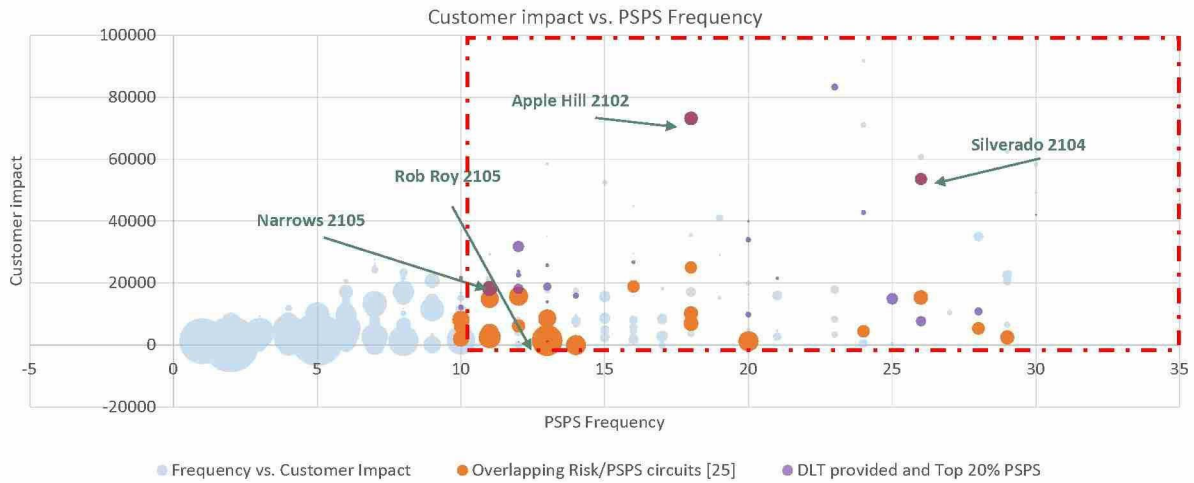
- 16 circuits were common across both the PSPS model and the Risk model
- An additional 9 circuits are in the top 20% of the risk model, and in the top 25% of the PSPS model
- 10 of the 25 circuits experienced more than 6 actual PSPS events during 2019/2020 PSPS season



Examining customer impact in relation to PSPS frequency and risk

Conclusion

- **Recommendation: Focus on top 25% of PSPS hit circuits – prioritizing customer impact and community input locations first.**
- To balance PSPS frequency and risk reduction, focus on 25 circuits which appear on top 20% of both models
- Most of the community suggested locations are in the top 20% of PSPS event frequency
- 4 circuits were flagged for PSPS work by the community **and** they fall into top 20% of both the risk model and PSPS frequency [Apple Hill 2102, Rob Roy 2105, Narrows 2105, Silverado 2104]



6 DLT-driven circuits in the top frequency/top customer impact



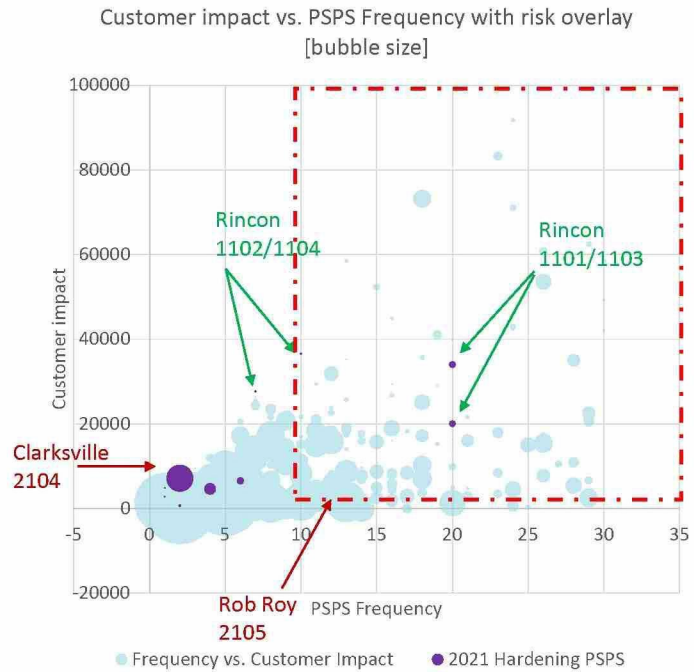
Comparing 12 Hardening PPS projects against the PPS Frequency and Consequence Risk

Analysis

- Projects were examined in isolation [prior to the full PPS circuit analysis was done] – not comparing them with other circuits which may have a higher PPS frequency and customer impact

Conclusion

- There is not a strong correlation between Consequence Risk and the PPS Event Frequency
- Recommend to focus on projects which have higher PPS frequency and customer impact
- Rincon 1101/1103** are approximately in the bottom 50% of risk but had 6 PPS events in 2 years and expect 20 events over a 10-year period.
- Rincon 1102/1104** are in the bottom 50% of risk but had 4 events, and expect 10 and 7 events, respectively, over a 10-year period.
- Clarksville 2104** has the highest risk-factor of the 12 projects but had only 2 PPS events, consistent with 10-year model.
- Rob Roy 2105** has moderate number of PPS events but a low customer impact.



Graph 3



Other PSPS analyses workstreams

There is an opportunity to align on PSPS circuit analyses workstreams

Asset Management

Lead: [REDACTED]

Scope: Long-term recommendation on how to reduce PSPS scope and customer impact through key technologies and an analytical framework to determine key PSPS locations

Timeline: December 2020

Deliverable: Report

Lead: [REDACTED]

Scope: Comparison of actual PSPS events and Risk Model

Timeline: December 2020

Deliverable: Quantitative analysis

EPP

Lead: [REDACTED]

Scope: Transmission-level PSPS mitigation

Timeline: Mid-2021

Deliverable: Analytical framework used to plan and invest of key PSPS mitigation related to Tx level temporary generation and microgrids

EPP / WSPE

Lead: [REDACTED]

Scope: Framework to determine PSPS locations on which to focus PSPS mitigation work, inclusive of local community input

Timeline: December 2020

Deliverable: Analytical framework to determine key PSPS circuits and recommended projects for PSPS mitigation

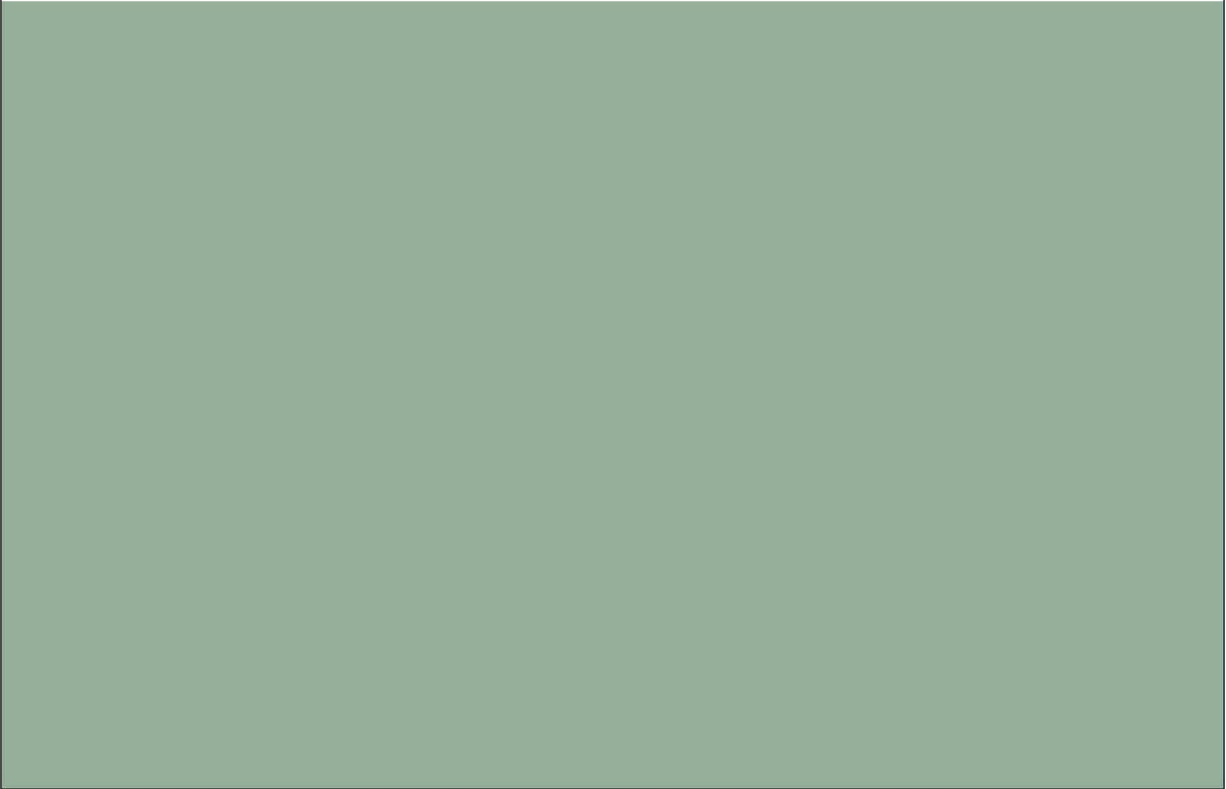


Further examination on the following topics

- Examining how to coordinate on Tx and Dx PSPS mitigation workstreams
- Incorporating customer impact into the PSPS circuit analysis
 - ICF analytical framework proposes a customer impact index which incorporates PSPS event frequency and two different types of customers (medical baseline and critical)
- Incorporating community feedback into the PSPS mitigation work
- Examine data at the circuit segment level



Appendix

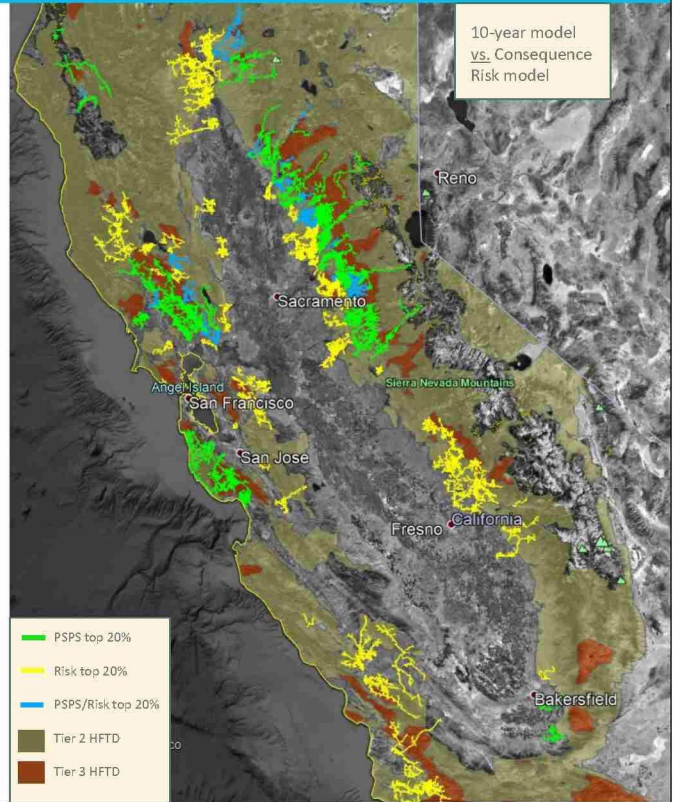




Appendix – Geospatial view of PSPS and risk at the circuit level

Conclusion

- Top 20% of circuits impacted by PSPS are not necessarily in the top 20% of riskiest circuits
- The geographic location of circuits expected to be most impacted by PSPS is mostly concentrated in areas where Tier 3 HFTD is most prevalent
- The geographic location of circuits with the highest risk is spread across Tier 2 and Tier 3 HFTDs

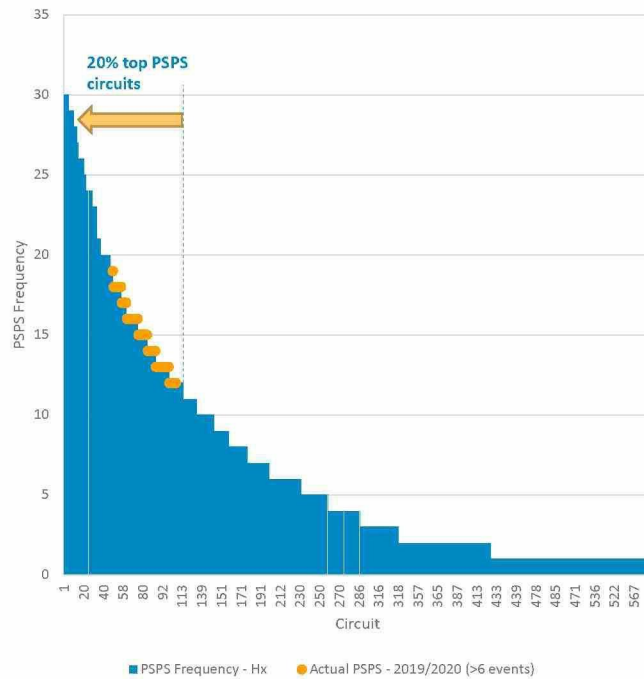
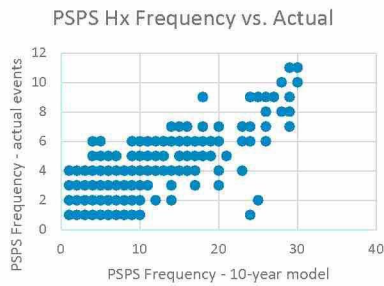




Appendix - Comparing actual PSPS event frequency with the 10-year PSPS event frequency likelihood

Conclusion

- Actual PSPS event frequency generally aligns with the 10-year historical weather model
- 60 circuits most hit by actual PSPS events are in the top 20% of PSPS circuits as predicted by the 10-year historical weather model





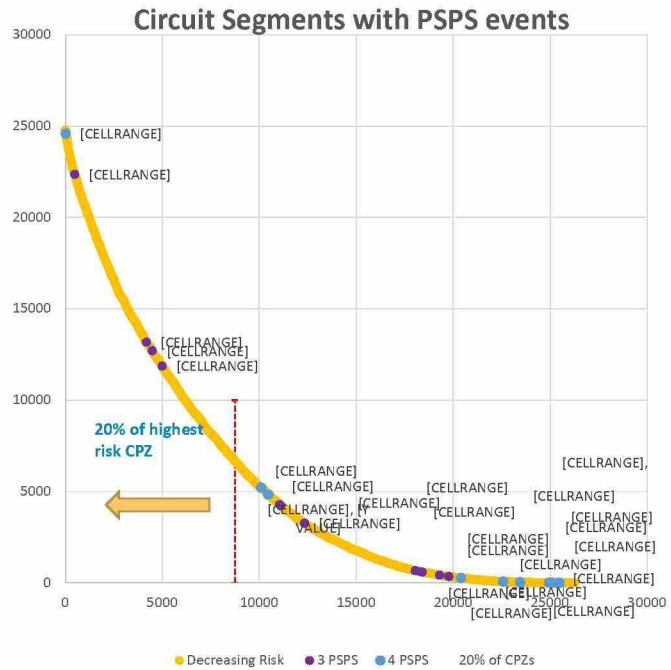
Appendix – Circuit Segment analysis Risk vs. PSPS events

Conclusion

- CPZs which experience 3-4 events over the 2019/2020 PPS season are mostly at the lower end of the risk buydown curve, suggesting there is not a strong correlation between risk and PPS event frequency

Data

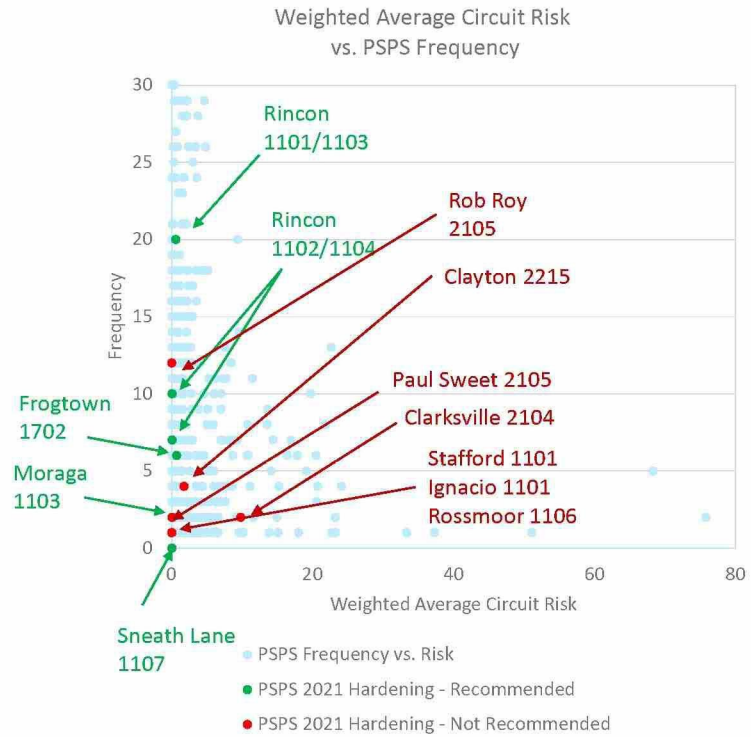
- Risk buydown curve with the CPZs that have been in PPS scope over 2019 and 2020 seasons highlighted
- Risk buydown curve uses the cumulative total MAVF risk to highlight how much risk is left across the system after a series of 1-N mitigations.





Appendix – 12 Hardening Projects

- **Clarksville 2104** has the highest risk-factor of the 12 projects but had only 2 PSPS events, consistent with 10-year model
- **Rob Roy 2105** has moderate number of PSPS events but a low customer impact.
- **Clayton 2215** had 4 expected and 3 actual PSPS events. Furthermore, switching could alleviate part of the PSPS scope for future events.
- **Stafford 1101** had only 1 expected and 1 actual PSPS event, and there may be a possible switching solution which could help alleviate scope of future PSPS events
- **Paul Sweet 2105** had 2 expected and 2 actual PSPS events. There also appears to have been significant switching work done in 2020.
- **Ignacio 1101** had only 1 expected and actual PSPS event.
- **Rossmoor 1106** had 1 expected and 2 actual PSPS events.
- **Rincon 1101/1103** are approximately in the bottom 50% of risk but had 6 PSPS events in 2 years and expect 20 events over a 10-year period.
- **Rincon 1102/1104** are in the bottom 50% of risk but had 4 events, and expect 10 and 7 events, respectively, over a 10-year period.
- **Frogtown 1702** had 6 expected and 4 actual events. Potential need to re-examine the UG work as proposed work would not have mitigated 2020 events.
- **Moraga 1103** had 2 expected and 3 actual events. Given the small scope of UG work, recommend to proceed.
- **Sneath Lane 1107** had no expected and 1 actual PSPS event. Given the small scope of UG work, recommend to proceed.



Graph 3