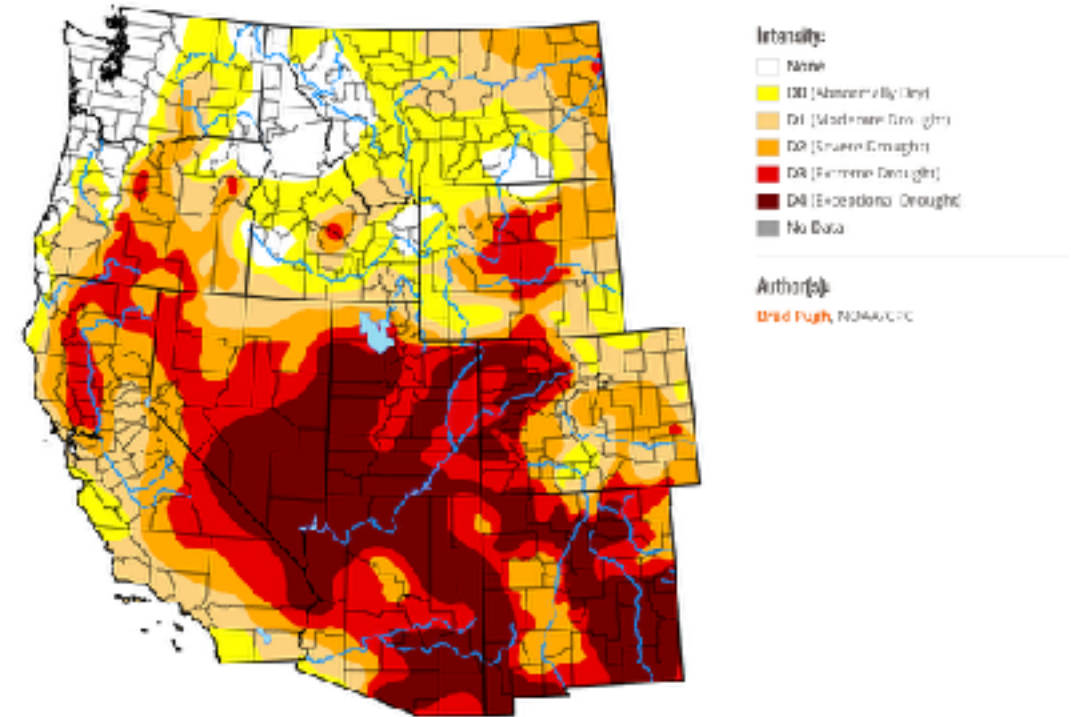
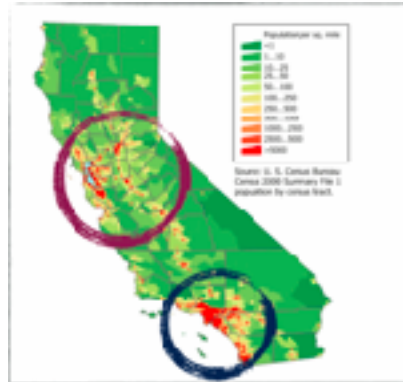


The Effect of Blocking Automatic Reclosing on Wildfire Risk and Outage Times

Carmen Haseltine and Line Roald
Presenter: Carmen Haseltine



Motivation



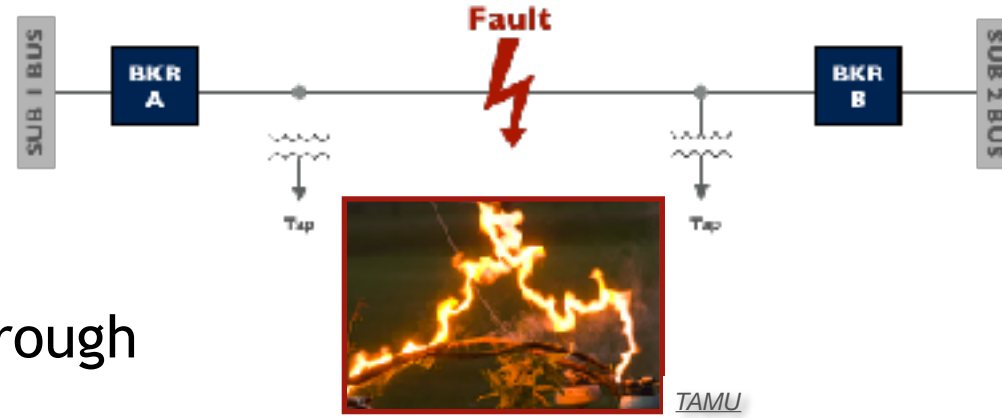
- Observable severe drought conditions are more present in recent years.
- Interaction between power grid growth and drought regions has increases.
- Following recent California wildfires caused by arcing, multiple utilities in the region decided make an operational change to remove all automatic reclosing

Fault Scenario:

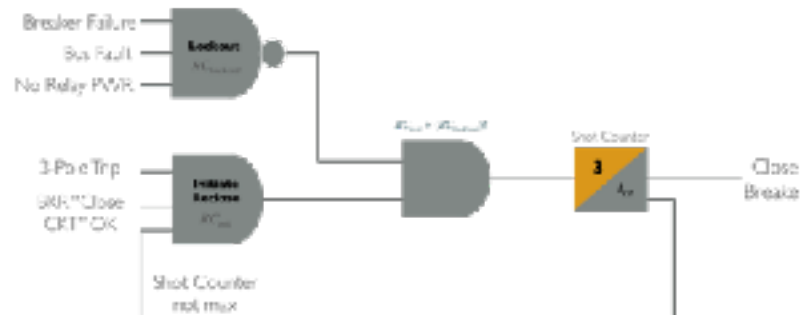


- Branch falls on the power line creating a short circuit
- This short circuit fault current will impact the system equipment as $I_{rms}^2 t$
- Fault current will continue to flow through path of least resistance

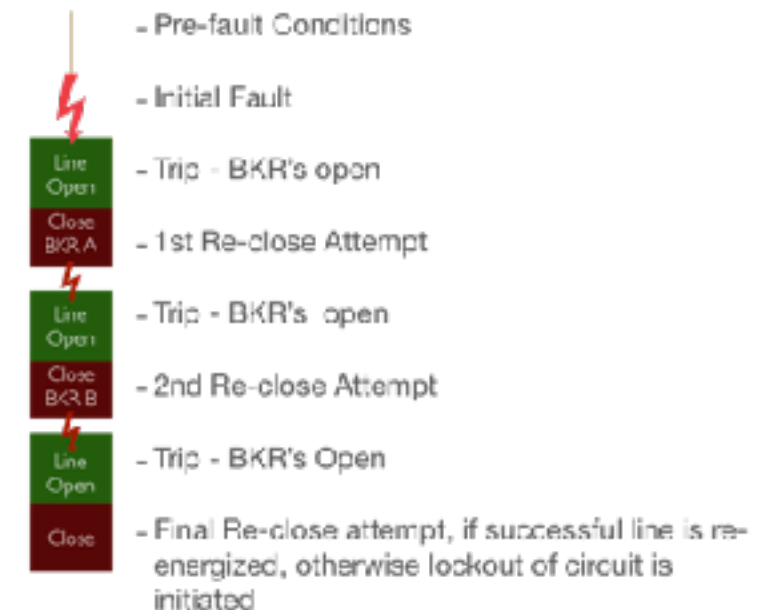
Fault Scenario:



- Fault current will continue to flow through path of least resistance
- Substation Relays at end nodes of the line detect the fault and trip local breakers
- Branch falls and faulted element is now clear of the line
- Automatic Reclosing schemes are initiated at both end nodes coordinated to re-energize the line

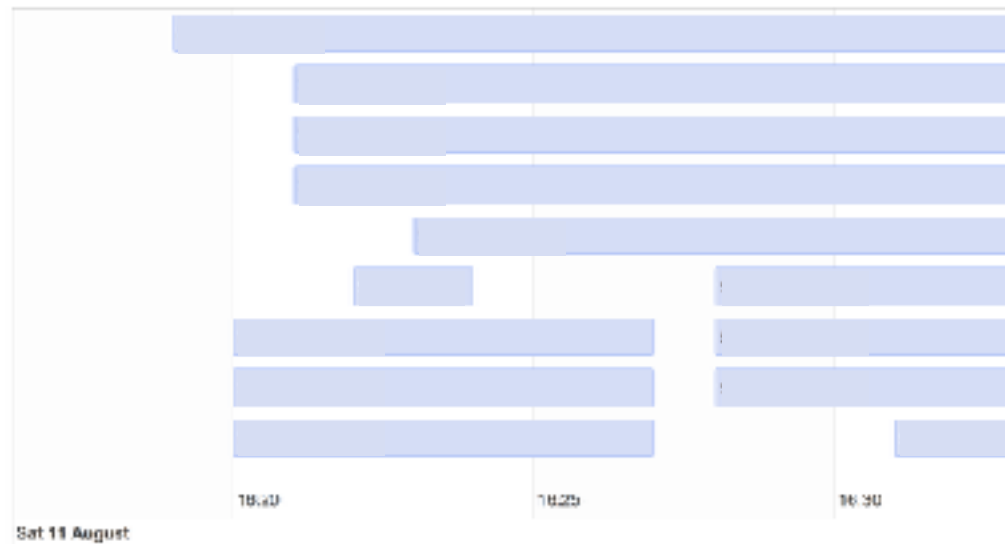


Re-Energization Sequence



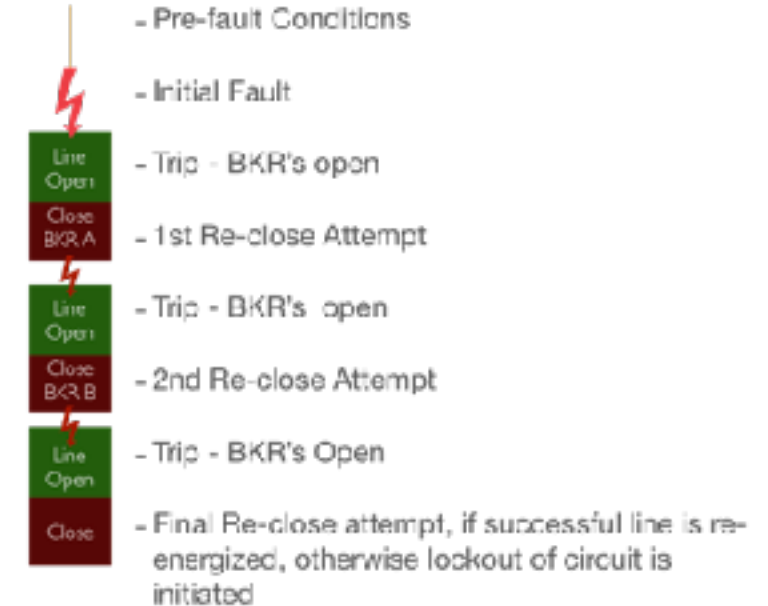
Temporal Data:

Bonneville Power Administration Outage Reporting Data



Range: 2009 to 2019

Re-Energization Sequence

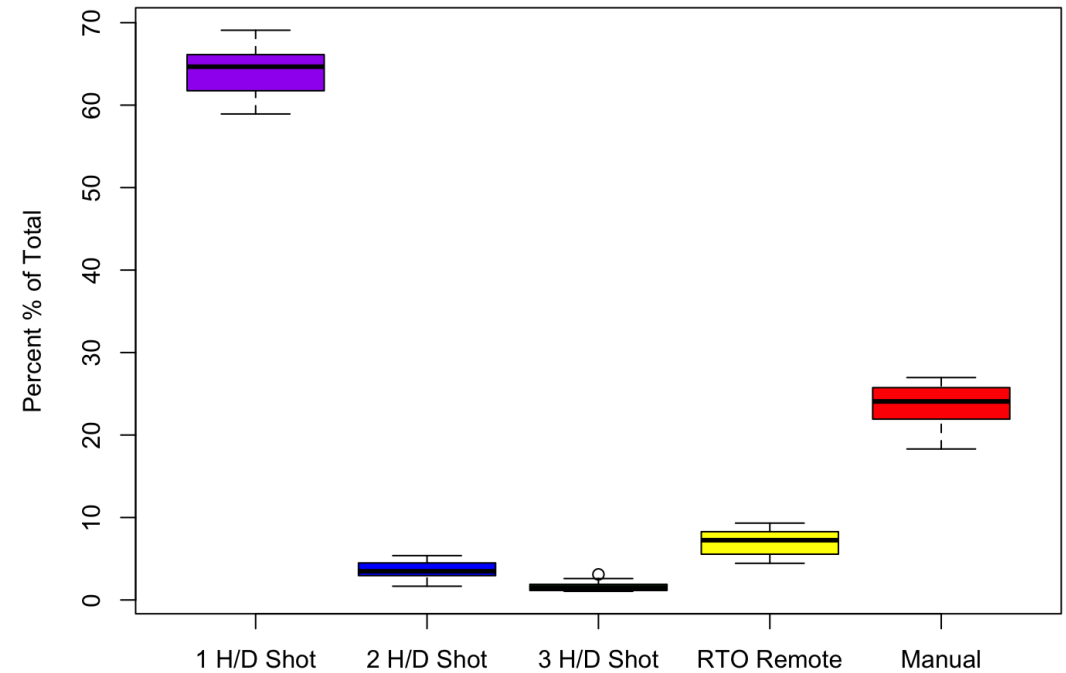
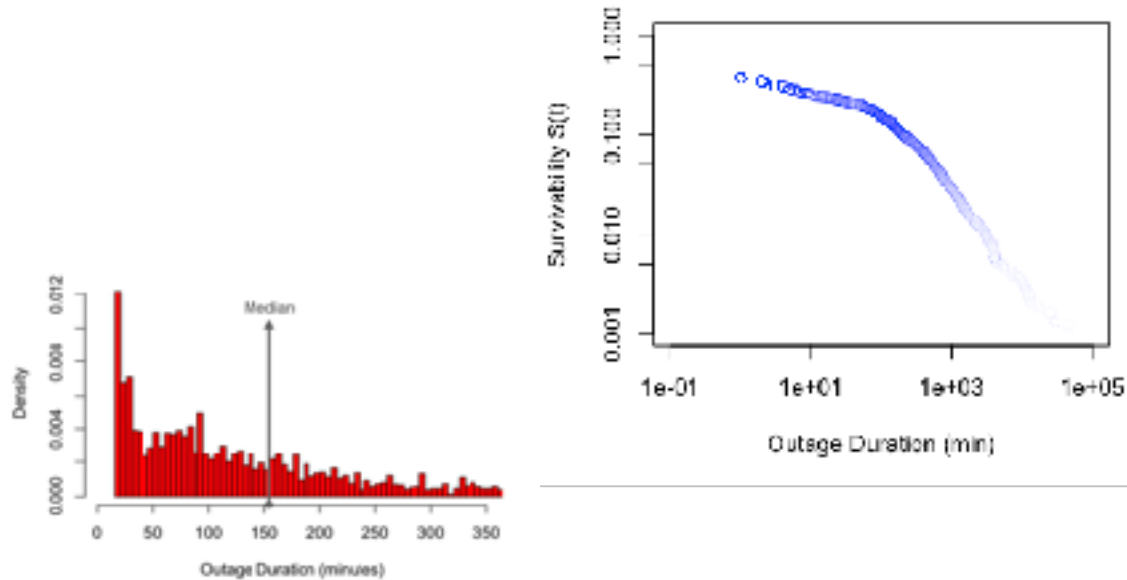


Dead Time Link to Outage Duration by Voltage

Label	Voltage Range	1 shot	2 shot	3 shot	RTO Remote	Manual
HVDC	900kV +	0 min	1 min	2 min	3-15	16+
EHV	200-900kV	0 min	1 min	2 min	3-15	16+
HV	100-200kV	0-1 min	2-3 min	4 min	5-15	16+
MV	50-100kV	0-1 min	2-3 min	4 min	5-15	16+

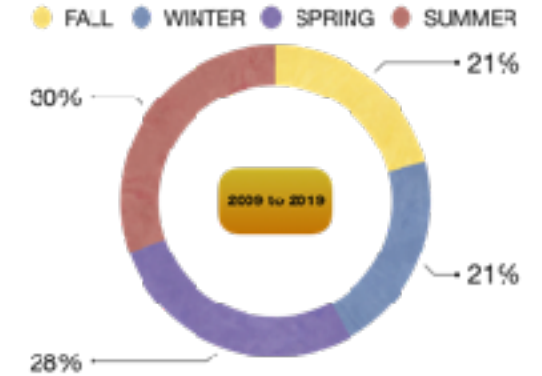
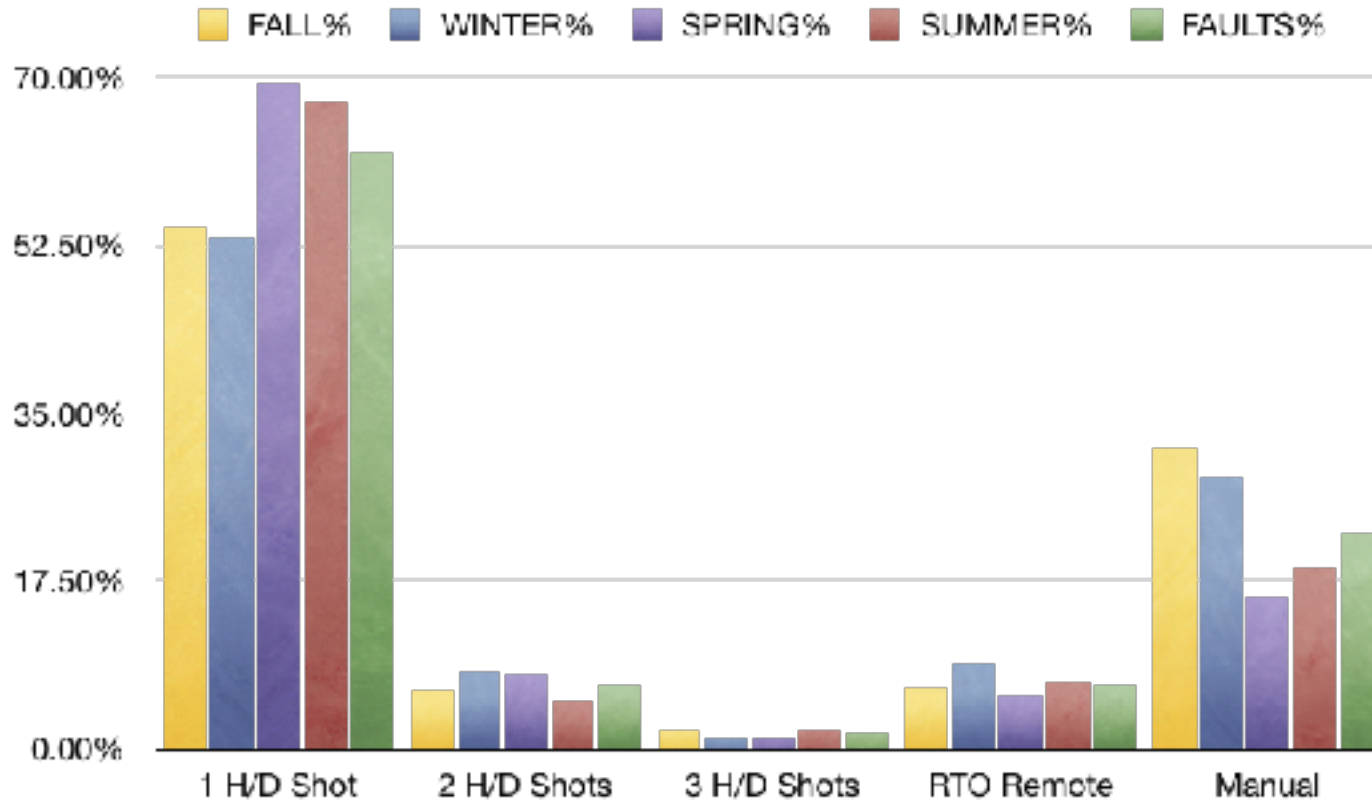
PES-PSRC: Guide for Automatic Reclosing
IEEE C37.104 and historical utility practices

Overview:



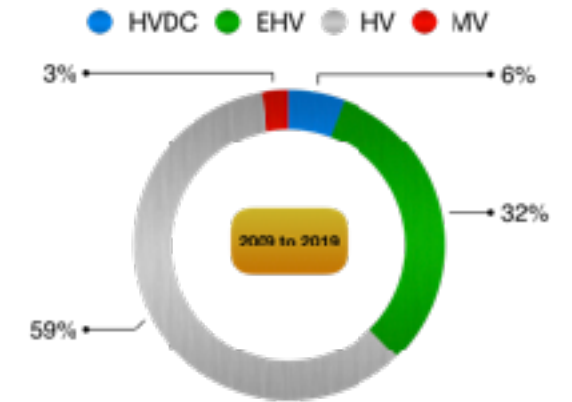
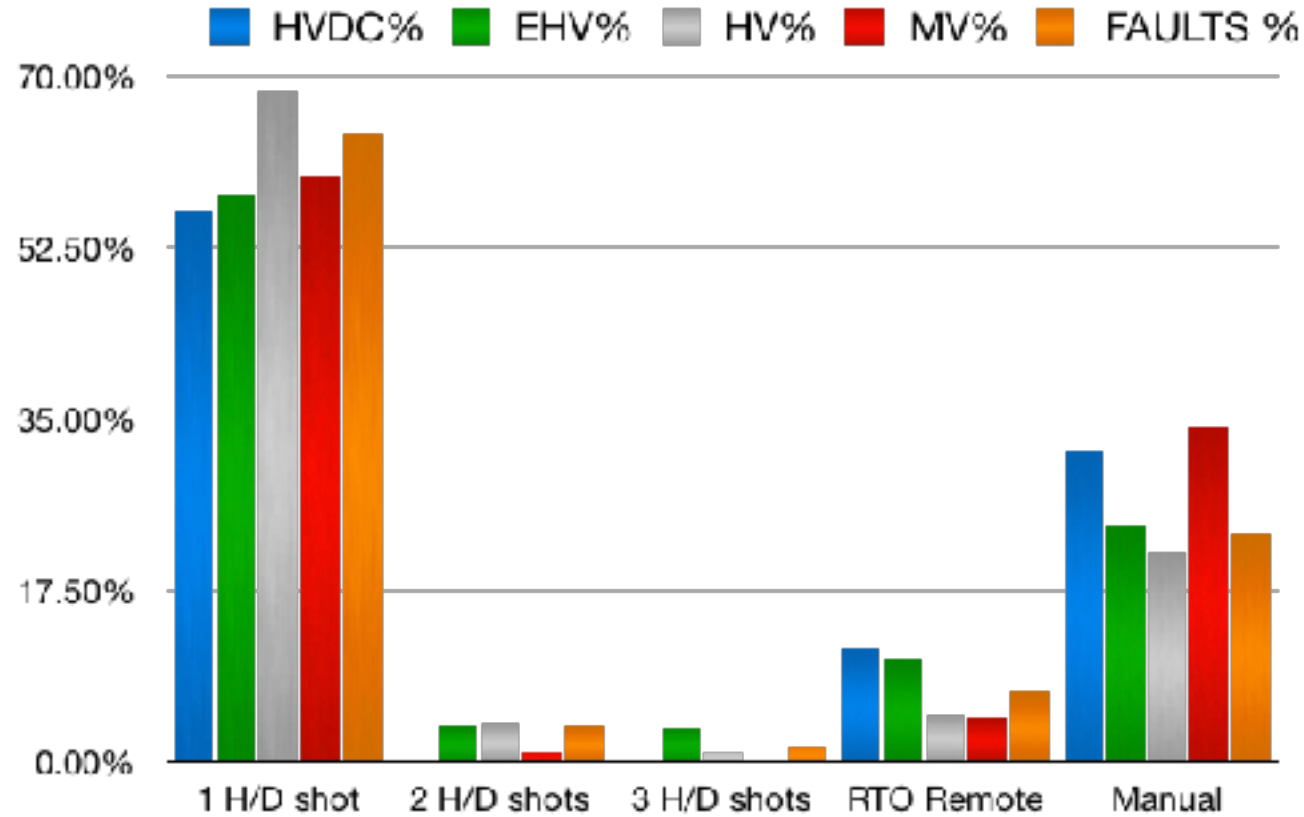
- Histogram and Survivability plot show that the majority of faults are at or less than 1 minute
- The initial reclose attempt is more effective in shortening the length of outage durations

Seasonal:



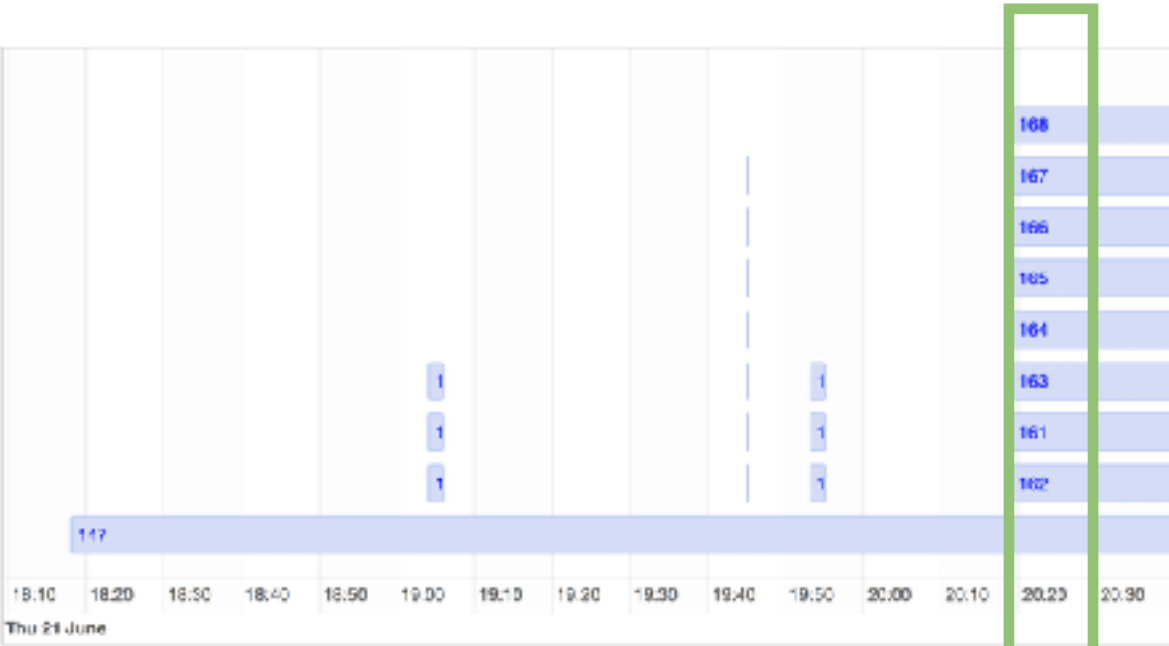
- Summer and Spring have slightly higher occurrences of single reclose attempts averaged over a decade.
- Overall trend holds for all seasons

Voltage Level:

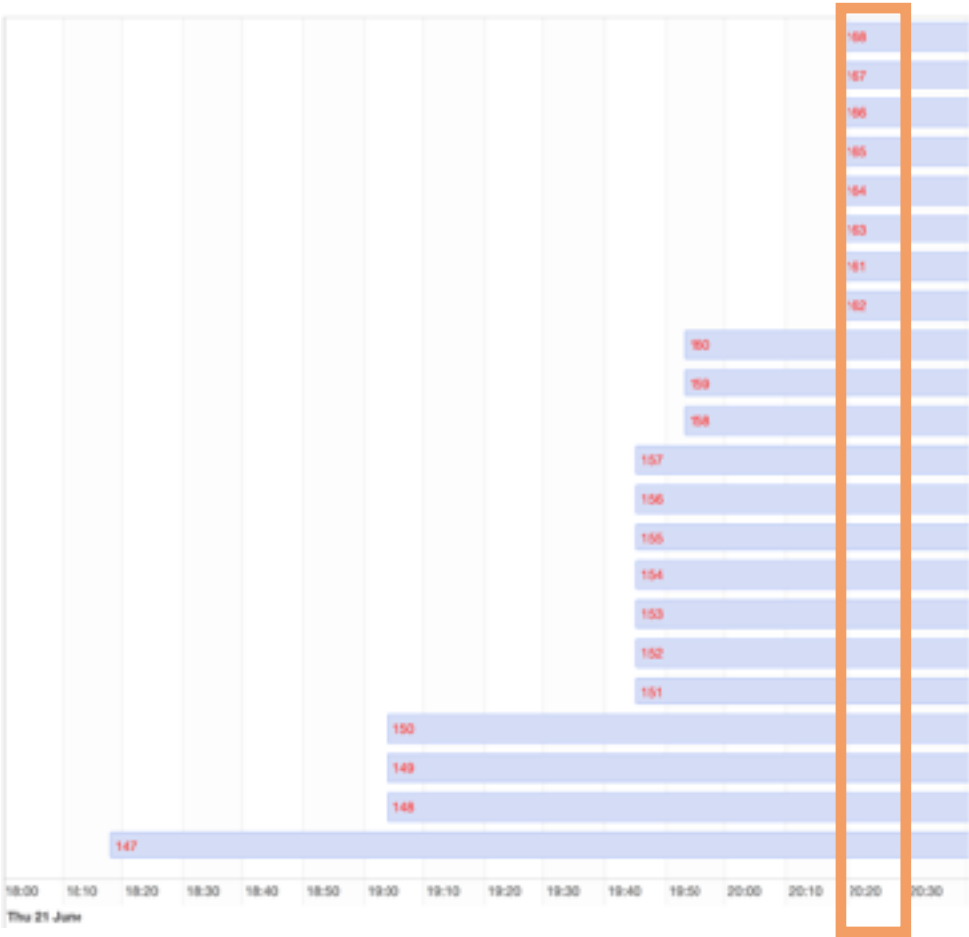


- Overall trend holds for all voltage levels
- All analysis shows clearly that the initial reclosing attempt is most critical

Impact of Removing All Auto.Reclosing



Max window: (N-9)



Max window: (N-22)

Finding Balance



Reclosing Operation State	Potential Arcs	Automatic Restoration	Outcome
Common Practice	4/4 100%	~75%	Status Quo
CA Utilities Wildfire Policy	1/4 25%	0%	Least Arc Risk, Longer Outages
Potential Wildfire Policy	2/4 50%	~60%	Retain some reliability whilst minimizing arc risk