

# Is Your Data Enabling Real-Time Asset Management?

Utility Analytics Summit 2022



Together, Building a Better California

Fela Odeyemi, Ph.D.

Jonathan Glassman, Ph.D., P.E., CRE

Manuj Sharma

# Presenters



Fela Odeyemi, Ph.D.  
Senior Advising Engineer



Manuj Sharma  
Principal Technical Product Manager

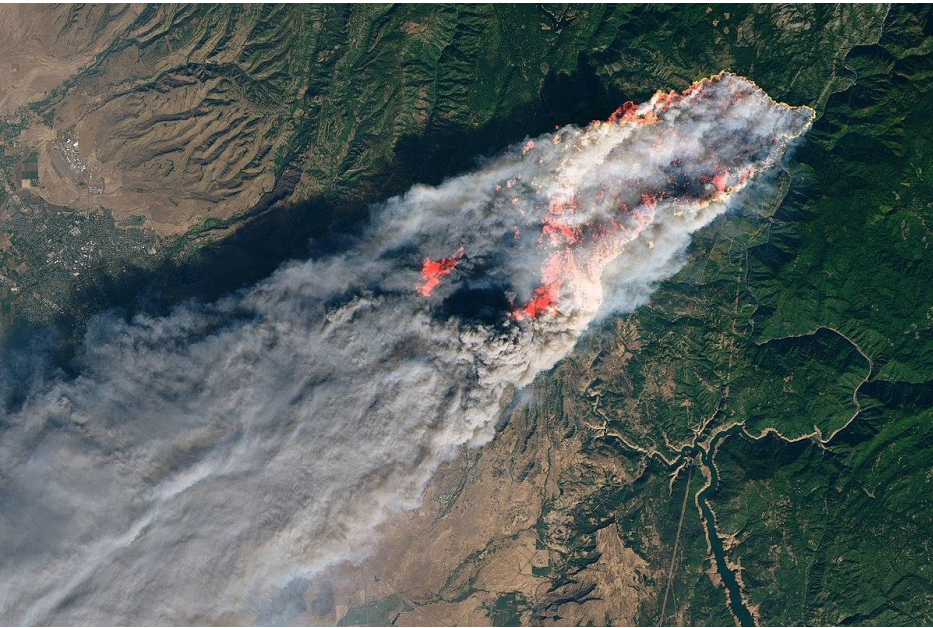


Jonathan Glassman, Ph.D.,  
P.E., CRE  
Managing Engineer, Data Sciences



# Where We Started

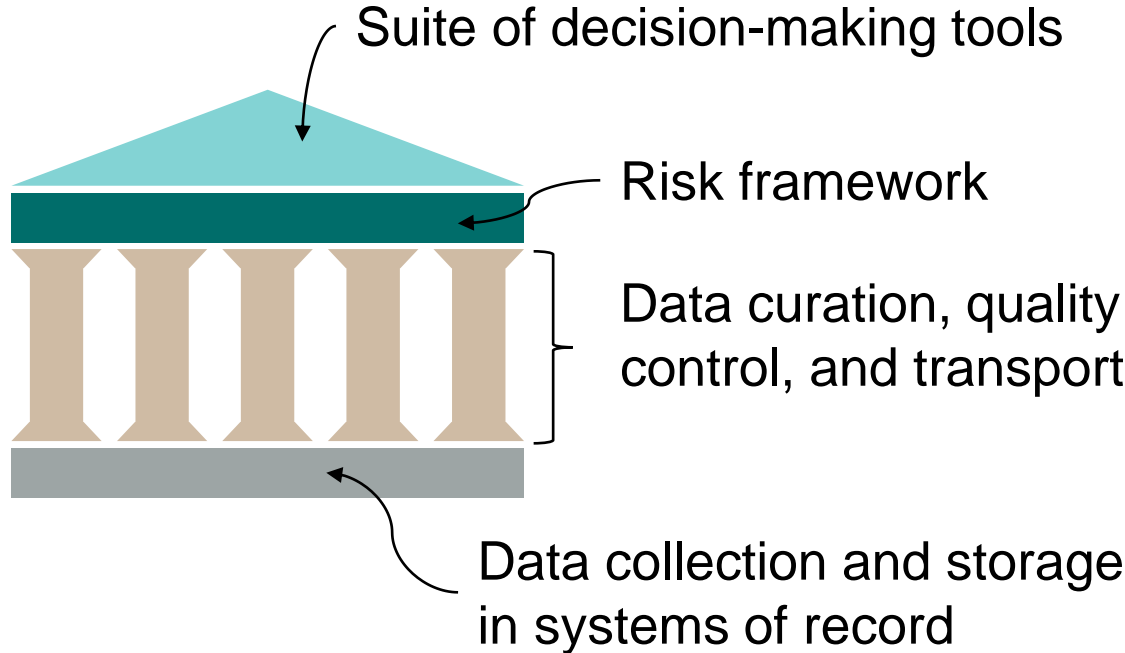
## Original motivation



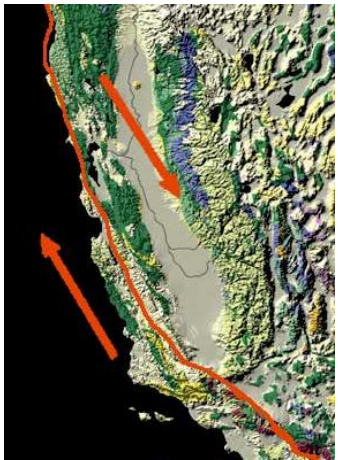
## Requirements

- (1) Any and all
- (2) Daily or on demand
- (3) Traceability
- (4) Measurable

## Solution Components



## Expansion

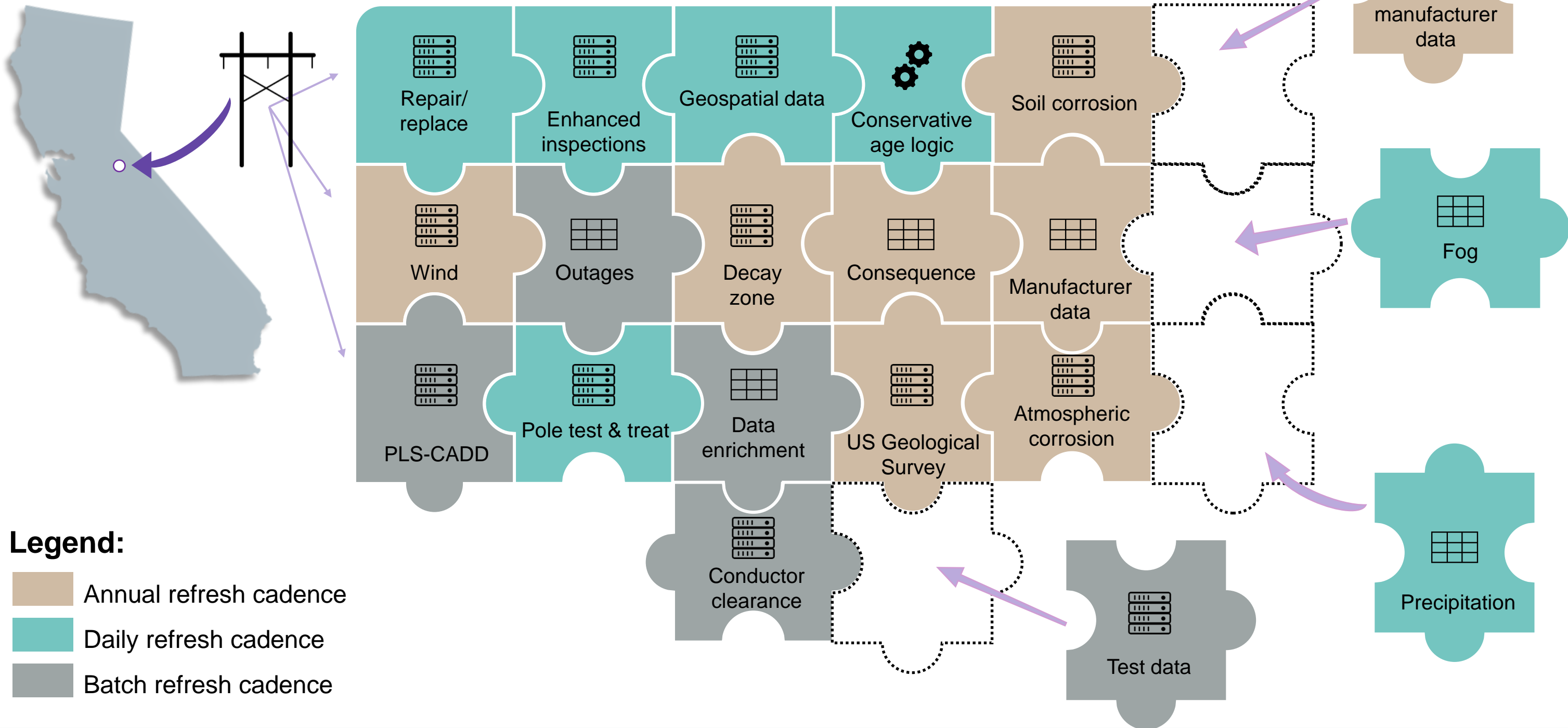


\*By NASA, Joshua Stevens - <https://earthobservatory.nasa.gov/images/144225/camp-fire-rages-in-california>, Public Domain, <https://commons.wikimedia.org/w/index.php?curid=74269291>

\*\*By Kate Barton, David Howell, and Joe Vigil - Archived source link, Public Domain, <https://commons.wikimedia.org/w/index.php?curid=1347277>

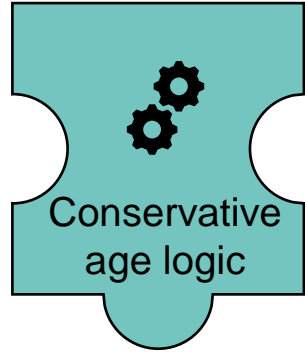
\*\*\*<https://newsroom.edison.com/stories/dont-let-power-outages-balloon-around-valentines-day>

# Data Puzzle



# Data Quality

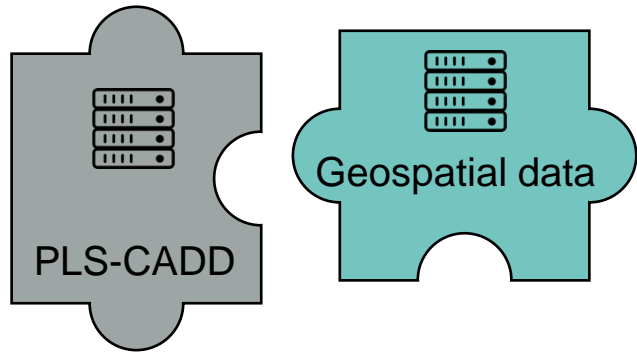
## Case I: Age data.



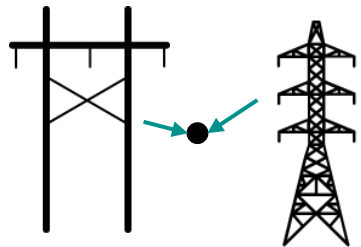
## Example:

Insulator assumed older than before it was used in the system.

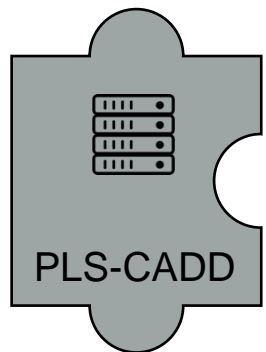
## Case II: Data consistency.



## Example:

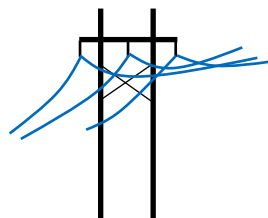


## Case III: Clearance penalty.



## Example:

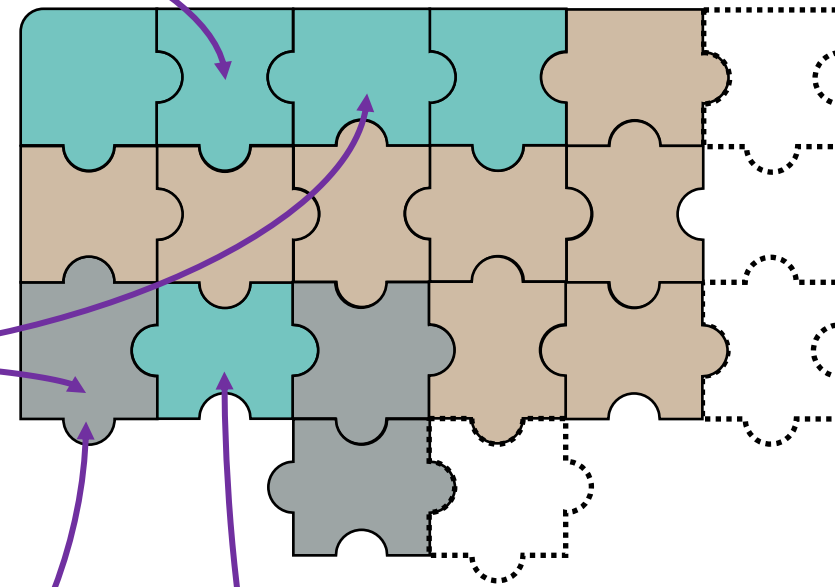
Conductor-to-structure clearances < tolerance.



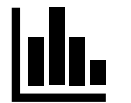
**Case V: Unexpected annual probability of failure (PF) values.**

## Examples:

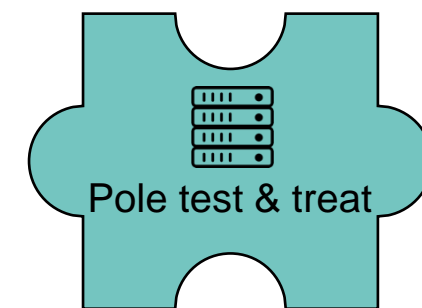
- (1) PF = 1.0 for a steel structure pole
- (2) PF = 0.88 for a brand new wood pole



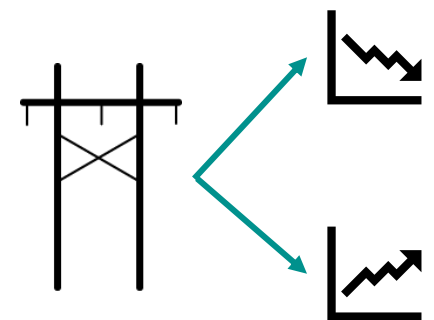
Use data in the risk models



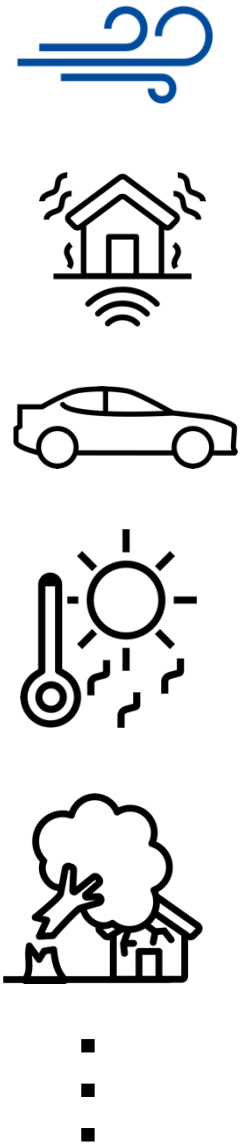
## Case IV: Data anomalies.



## Example:



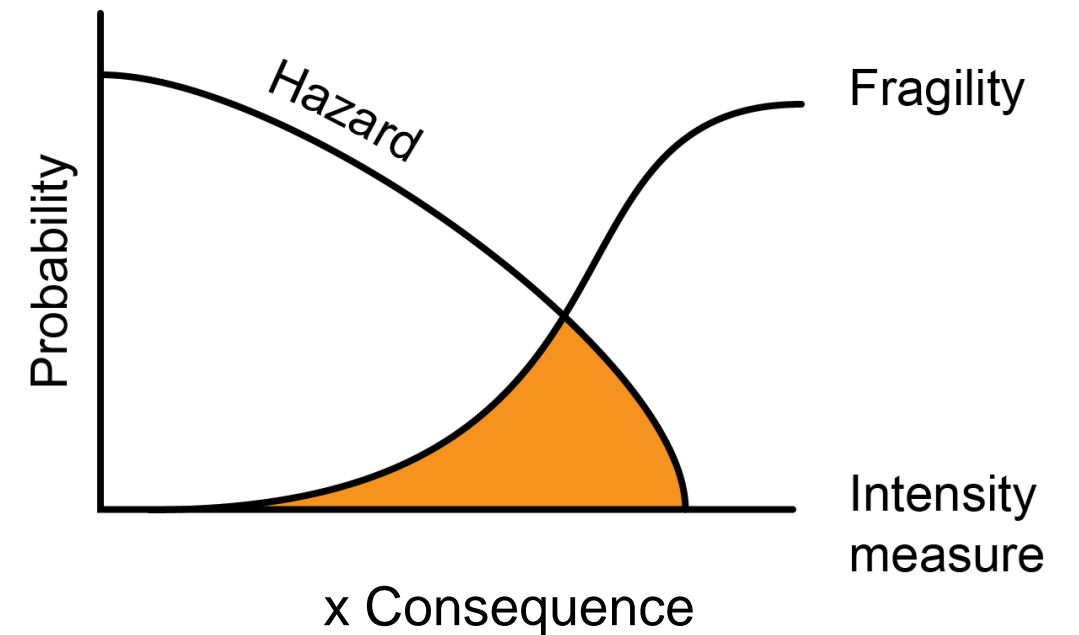
# Solution Framework



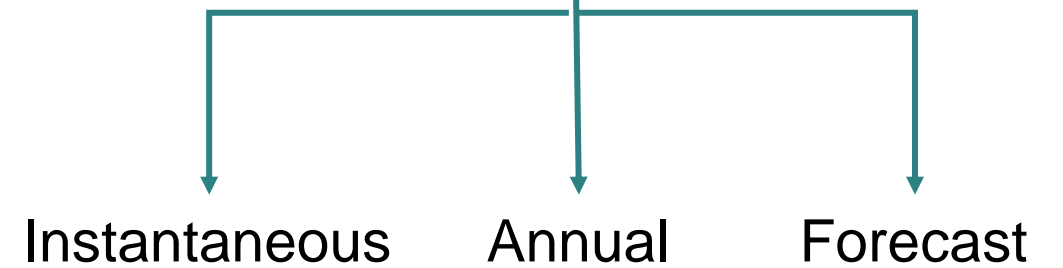
- Atm Corrosion
- Mechanical Wear
- Atm Corrosion
- Contamination
- Atm Corrosion
- Fatigue
- Wood Decay\*
- Atm Corrosion
- Soil corrosion



- + Condition scores (0, 1-5)
- + Maintenance/repair records
- + Numerical modeling
- + Bayesian updating

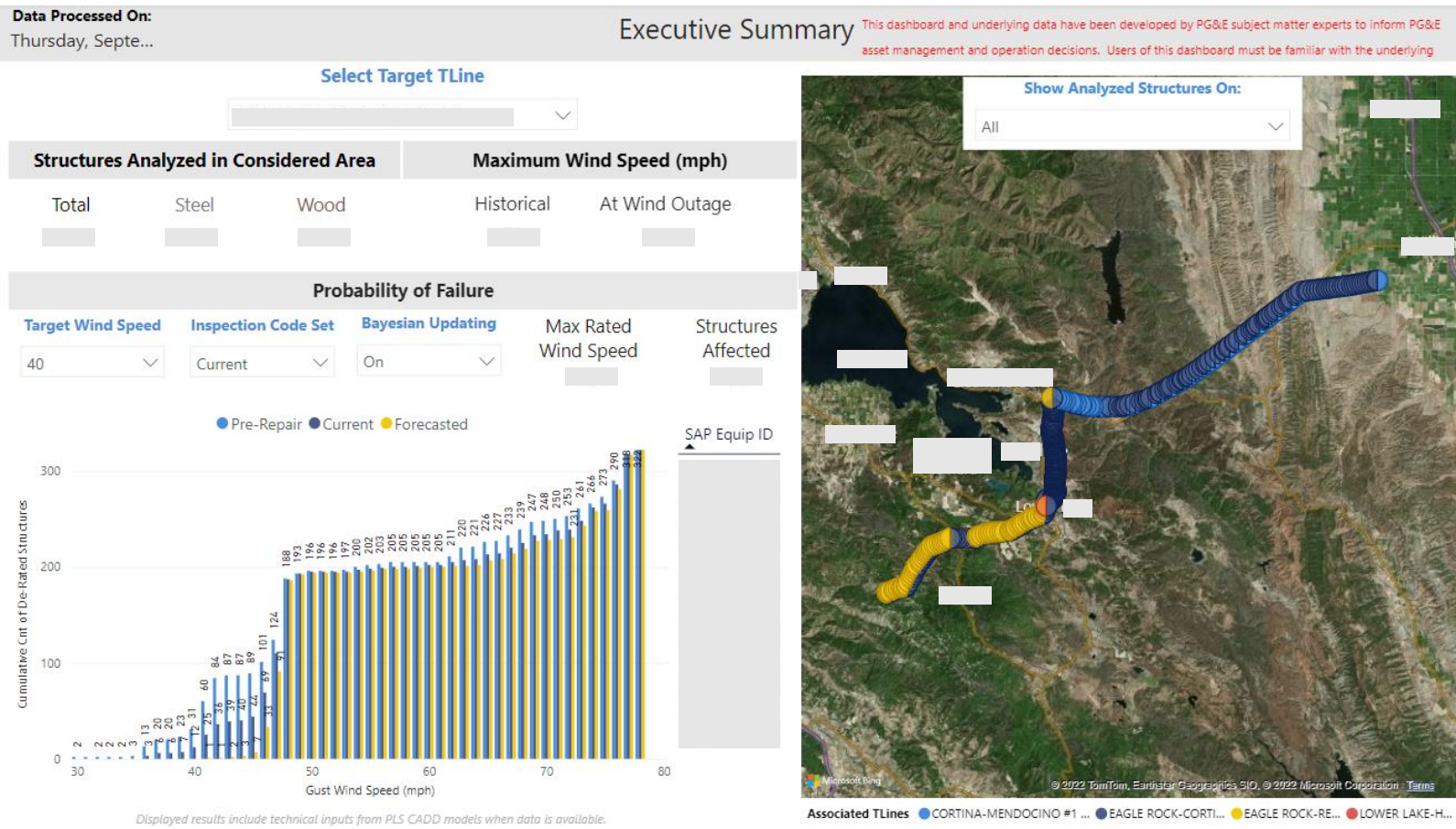


= Risk



# Common Operating Picture (COP)

- Operability Assessment (“OA”) Dashboard
- Annual and Forecast (“TCM”) Dashboard
- Year-to-Year Analyses



# Common Operating Picture (COP)

- Operability Assessment (“OA”) Dashboard
- Annual and Forecast (“TCM”) Dashboard
- Year-to-Year Analyses

**Wood-Pole Module** (data refreshed on 9/22/2022) This dashboard and underlying data have been developed by PG&E subject matter experts to inform PG&E asset management and operation decisions. Users of this dashboard must be familiar with the underlying models and

Forecast Time (years): 0, 5, 10, 25, 50

Age Data Source: All, Conserv Age Logic: All, Wind Hazard Data?: All, Cellon Treatment?: All, Reinforcement: All, Inspection Data Source: All

Structures Selected: **87203**

Buttons: Decay Only, Multi-Feature

SAP #, ETL Name filters: All, All

**Individual Structure Results**

SAP #	ETL Name	HFTD	99 Wind	Age	Cond	Cellon	S/So	Annual Pf *	Inspection Data	Reinf
Tier 1		38.76	8	1	1.00	4.08E-004	No Data			
Tier 1		38.76	8	2	1.00	4.08E-004	No Data			
Tier 1		38.76	8	1	1.00	4.08E-004	No Data			
Tier 1		38.76	8	1	1.00	4.08E-004	No Data			
Tier 1		38.76	8	2	1.00	4.08E-004	No Data			
Tier 1		38.76	8	1	1.00	4.08E-004	No Data			

\* Decay Only: if no wind hazard data, Annual Pf not calculated  
 \* Decay Only: if no PT&T data available, S/So assumed equal to 1  
 \* Multi-Feature: if no condition score or PT&T data or wind hazard data, S/So or Annual Pf not calculated

**Average per Line**

ETL #	ETL Name	Structures	Ave Age	Ave S/So	Ave Pf *	Max Pf *
		33	45.73	0.93	1.12E-003	1.66E-002
		176	59.70	0.95	1.93E-004	8.15E-003
		18	46.17	1.00	1.03E-001	2.06E-001
		25	35.68	1.00	4.41E-002	9.15E-002
		4	5.00	1.00	2.45E-003	2.45E-003
		18	31.56	1.00	1.31E-003	1.31E-003
		6	20.82	1.00	1.46E-005	2.22E-005
<b>Total</b>		<b>87203</b>	<b>38.88</b>	<b>0.98</b>	<b>5.65E-003</b>	<b>1.00E+000</b>

99 Wind Speed (mph): 21.91, 69.38

header: model parameter, header: additional data

Navigation: Wood Pole, Steel Structure, Foundation, Conductor, Splice, AGH, BGH, +



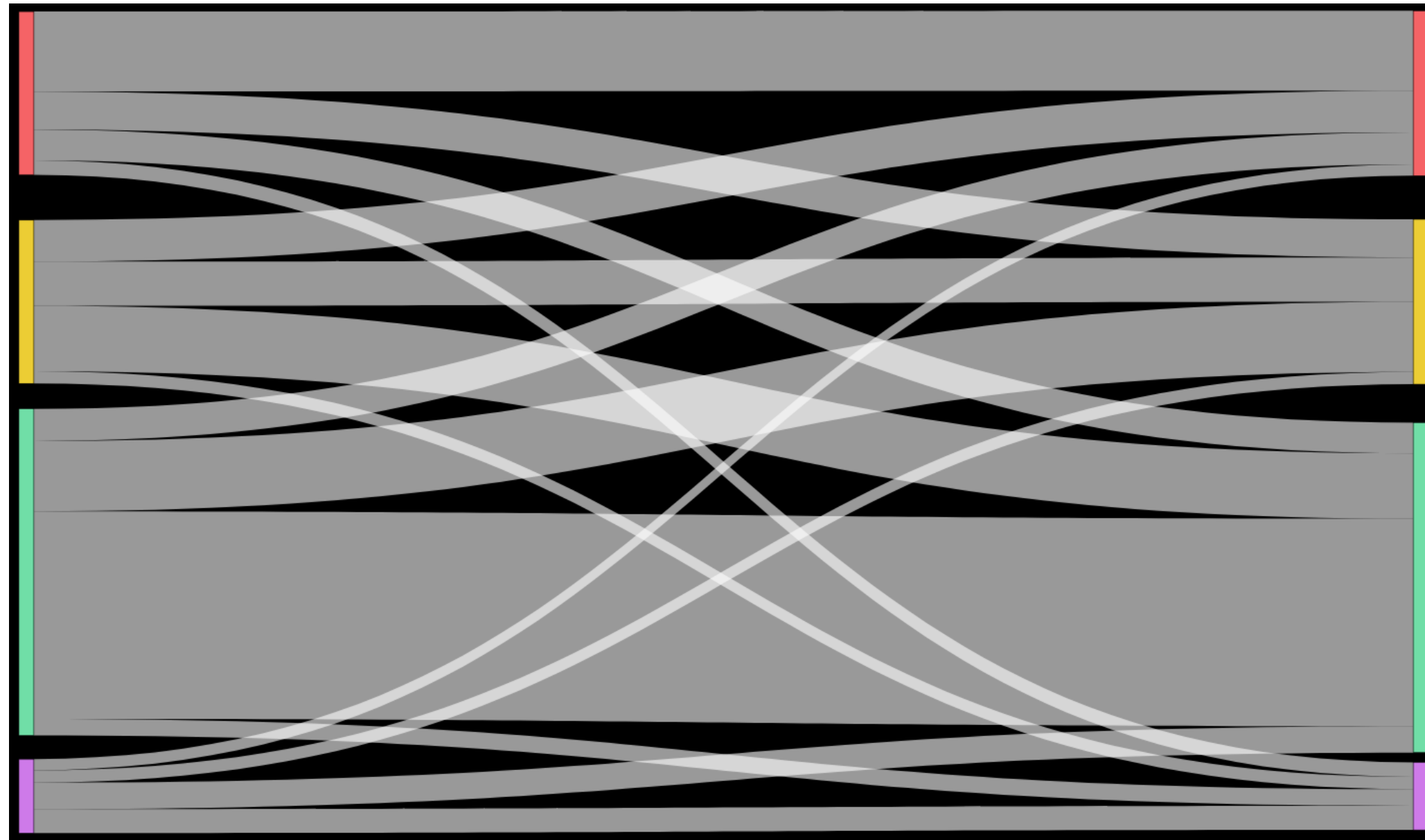
# Common Operating Picture (COP)

- Operability Assessment (“OA”) Dashboard
- Annual and Forecast (“TCM”) Dashboard
- Year-to-Year Analyses

**2021 Risk**

Transmission Structures

**2022 Risk**



## Legend

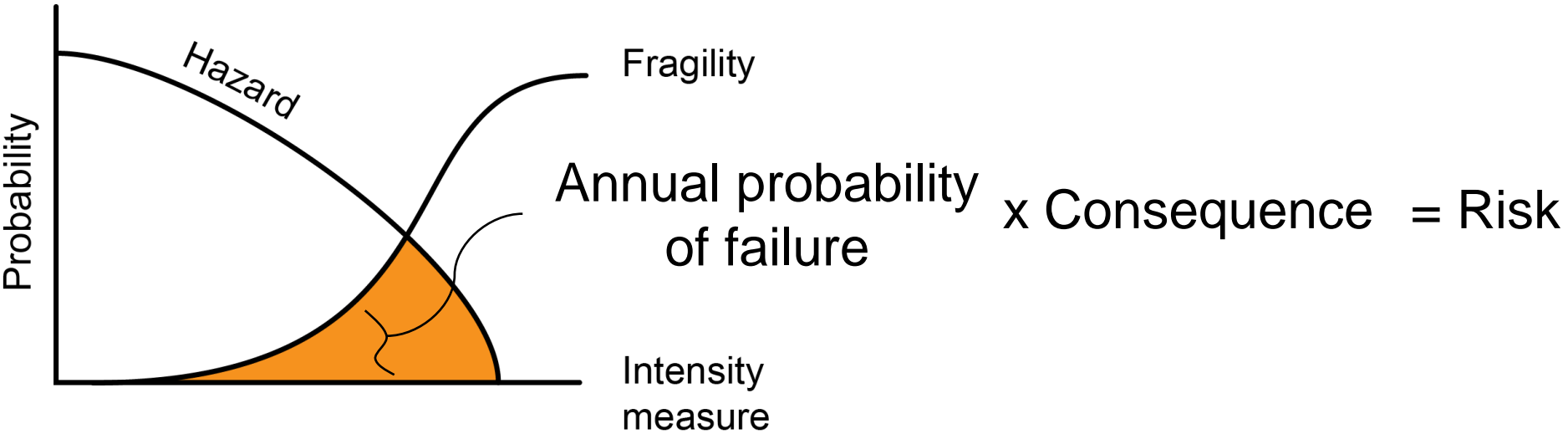
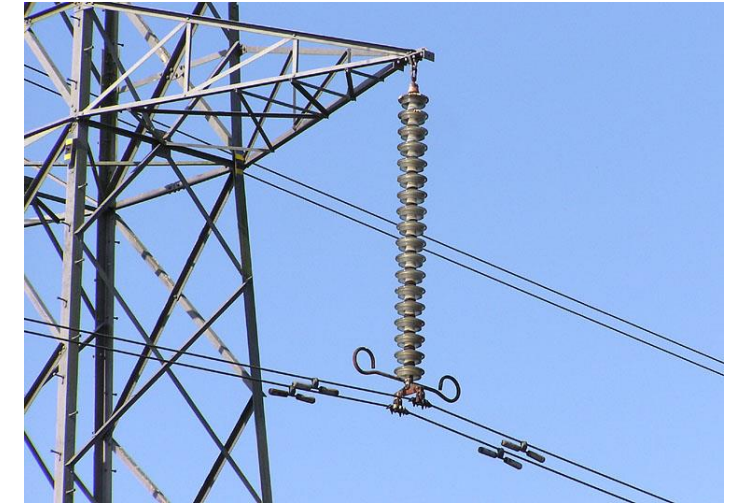
- 1<sup>st</sup> quartile risk
- 2<sup>nd</sup> quartile risk
- Lower half risk
- Missing

Illustrative plot

# Panel Discussion

$E^x$





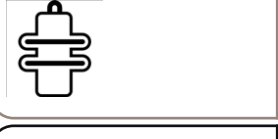




# Correlating Models with Field data



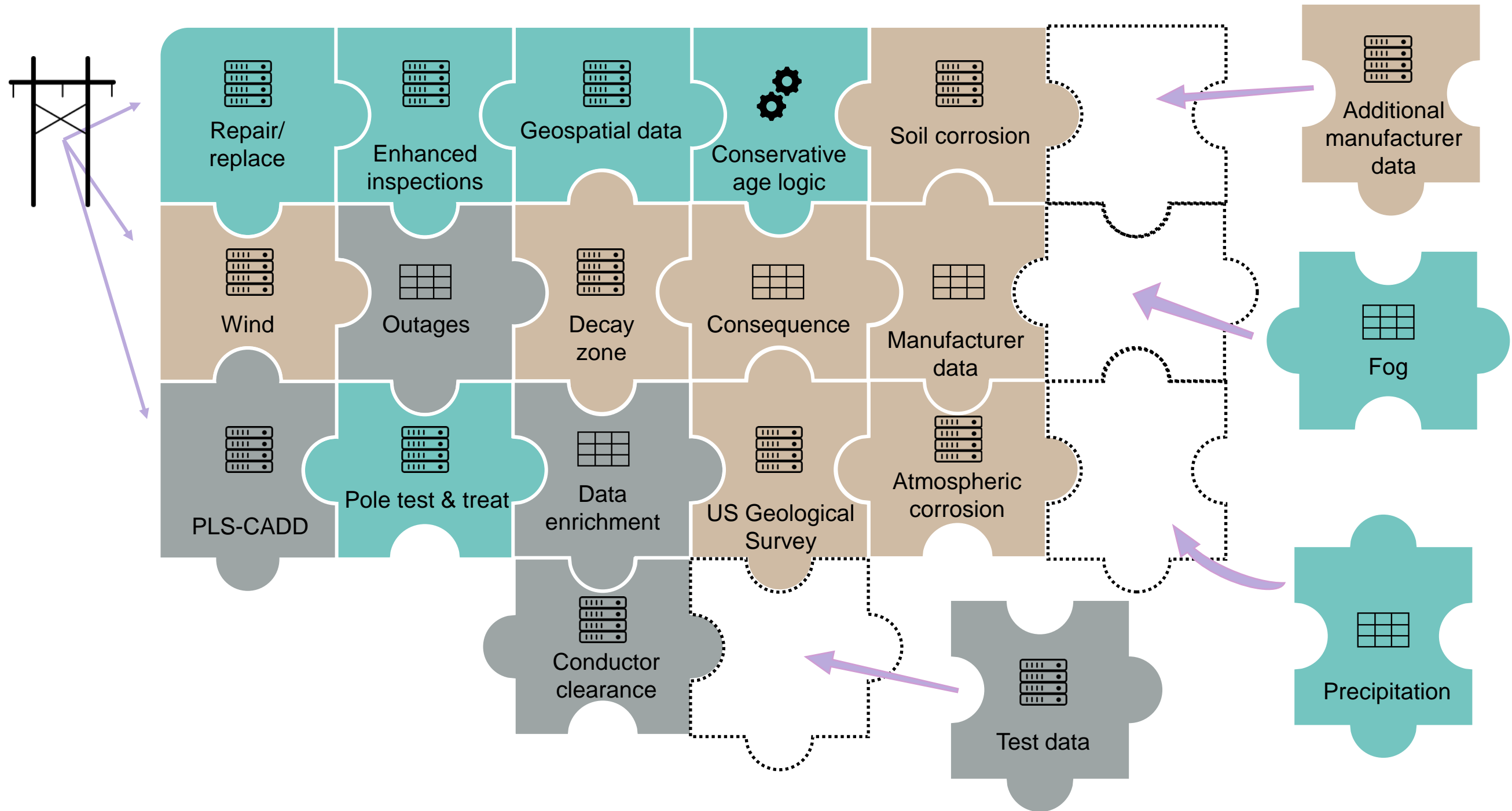
Lineview

# Threat-Hazard-Risk Framework [Present State]

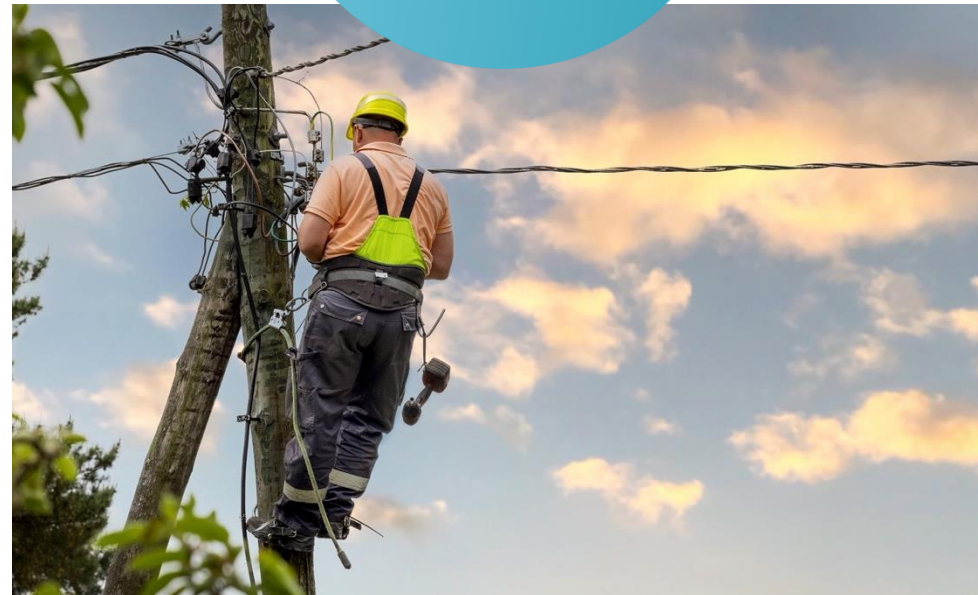
\*More threat and hazard models coming.

	Wind	Seismic	Flashover
 Conductor	Atmospheric corrosion Fatigue		
 Foundation	Underground corrosion		
 Steel structure	Atmospheric corrosion	Atmospheric corrosion	
 Wood structure	Wood decay	Wood decay	
 Insulator	Atmospheric corrosion		Contamination
 Above grade hardware	Atmospheric corrosion Fatigue		
 Below grade hardware	Underground corrosion		
 Splice	Atmospheric corrosion Fatigue		
 Machine learning	Vehicles, balloons, gunshots		

# Data Source Confidence



# COP Tool and Decision-making



# Presenters



Fela Odeyemi, Ph.D.  
Senior Advising Engineer  
[fela.odeyemi@pge.com](mailto:fela.odeyemi@pge.com)



Manuj Sharma  
Principal Technical Product Manager  
[manuj.sharma@pge.com](mailto:manuj.sharma@pge.com)



Jonathan Glassman, Ph.D.,  
P.E., CRE  
Managing Engineer, Data Sciences  
[jglassman@exponent.com](mailto:jglassman@exponent.com)

