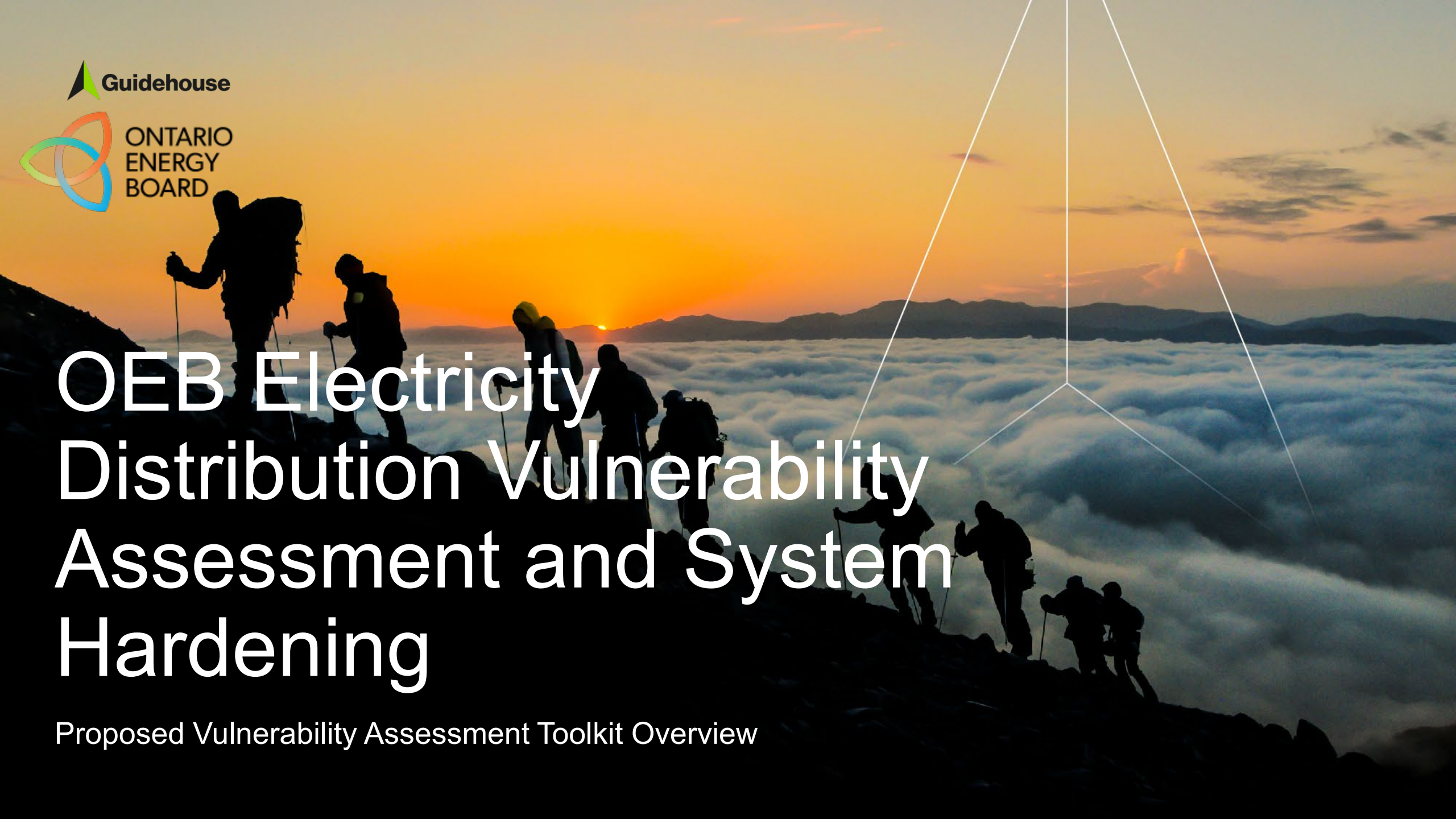


Guidehouse

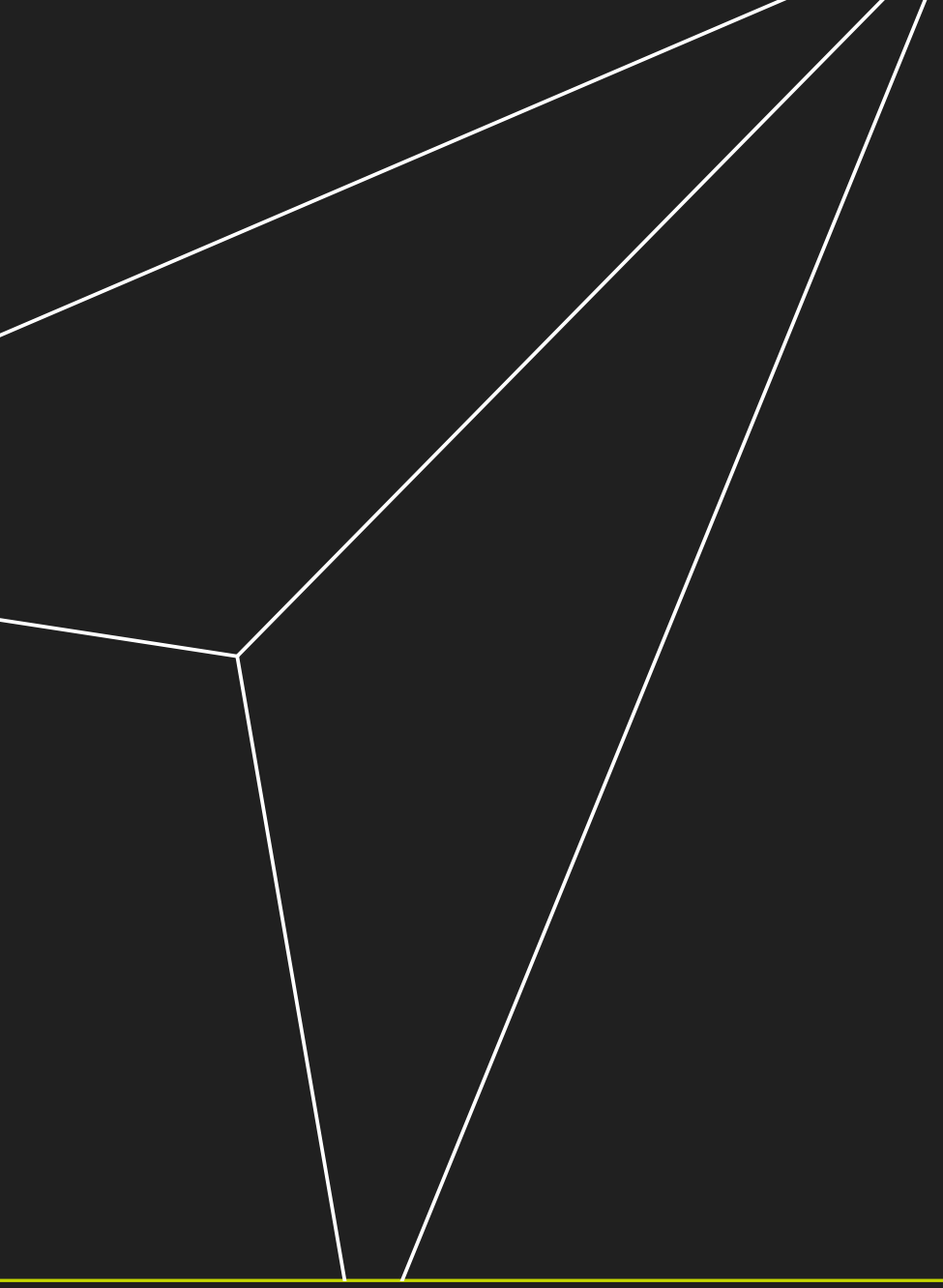
ONTARIO ENERGY BOARD

OEB Electricity Distribution Vulnerability Assessment and System Hardening

Proposed Vulnerability Assessment Toolkit Overview

Agenda

OEB Introduction **15 Minutes**	Kick-off meeting. Discuss findings from discussions with LDCs already performing vulnerability assessments.
VASH Overview **20 Minutes**	Summary of previous stakeholder meeting feedback and proposed incorporation into VASH considerations. Review each of the six components and timeline in context of this feedback.
VA Tool Overview **60 Minutes**	Overview of the proposed vulnerability assessment toolkit including example workflow and LDC inputs.
Next Steps **10 Minutes**	Discussion of next steps



1. VASH Overview

Summary of September Stakeholder Meeting Feedback

The stakeholder group reiterated key points of discussion during the September meeting with a focus on the vulnerability assessment, summarized below.

- **Benefits of resiliency planning requirement:**
  - Vulnerability assessment enables identification of risk before benefit cost analysis is conducted
  - Benchmarking assessment and planning procedures with leading jurisdictions
- **Flexibility with low level of effort for basic analysis:**
  - Provide standard framework and toolkit for use if LDCs do not have an internal process
  - Allow alternative approaches with documentation
  - Outline possible data sources, however, do not prescribe sources or inputs
- **Alignment with current filing requirements:**
  - Consider lessons learned from asset condition assessments
  - Be clear about how the Z-factor interacts with updated requirements

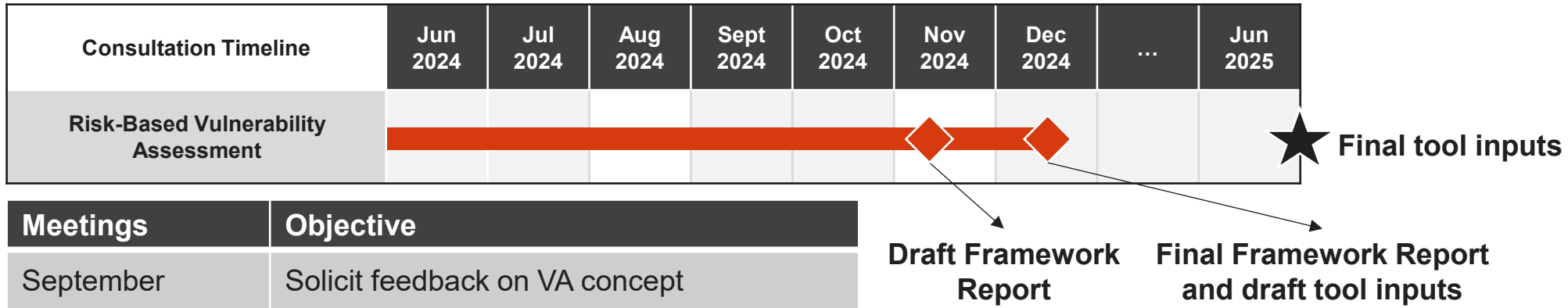
Project Components – Objective Remains

Six components combine to inform the final ED VASH Report and are supported by a scan of 3-5 leading jurisdictions.

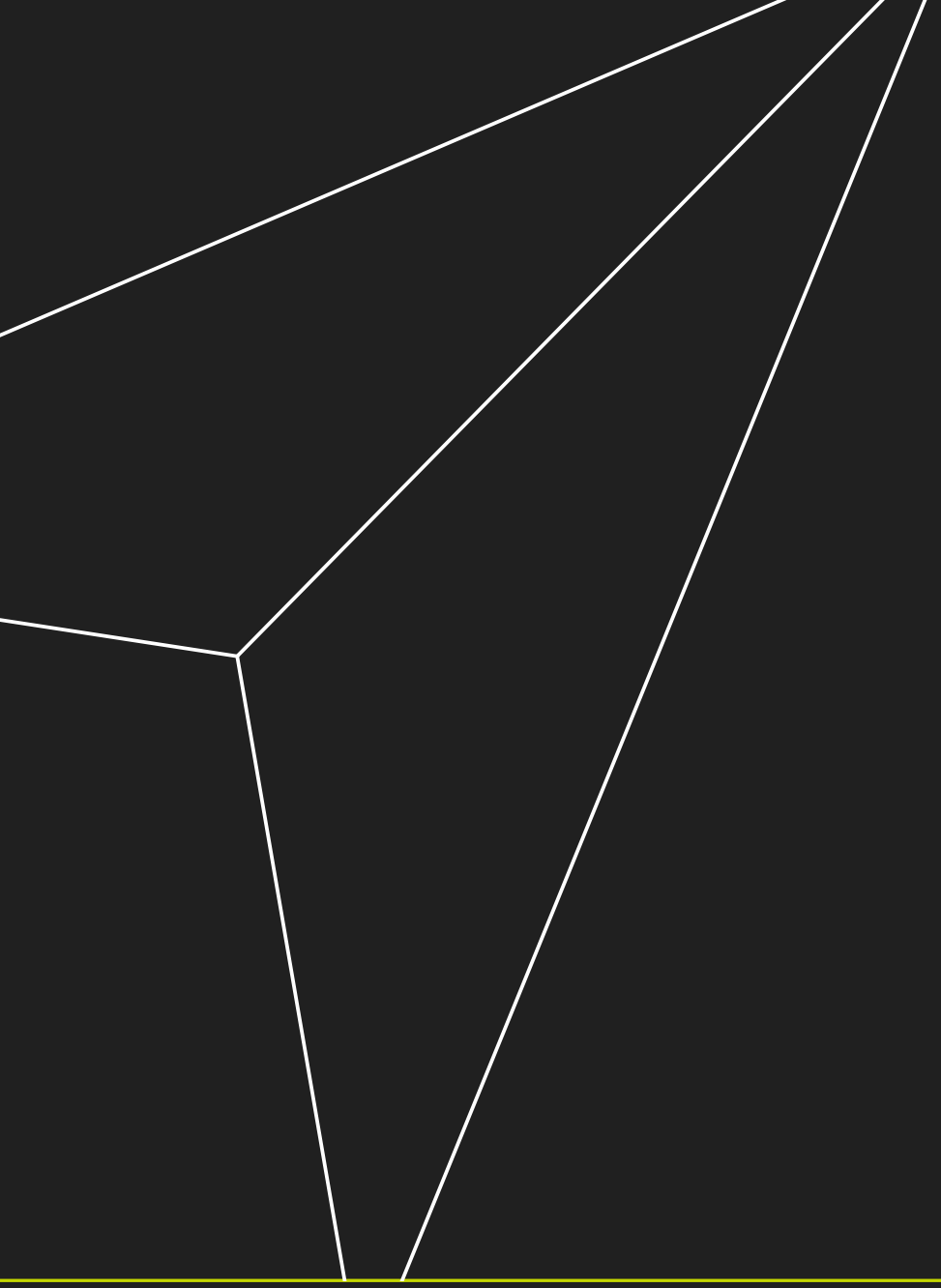
Component	*Definition*
1. Risk-Based Vulnerability Assessment	A risk-based Vulnerability Assessment that includes the probability/impact of events. The frequency and time-period of the Vulnerability Assessment should also be included.
2. Standardized Vulnerability Assessment Data Sources	The sources for any standardized input variables to be used in the Vulnerability Assessment (including, for example, the use of a common forecast or model that estimates how climate change is likely to alter the frequency and severity of adverse weather conditions; a common set of equipment impacted; etc.).
3. Value of Lost Load Methodology	A value of lost load methodology to quantify risk reduction value from the Vulnerability Assessment.
4. Benefit-Cost Analysis	A benefit-cost analysis to evaluate whether an LDC should pursue an investment based on the cost of the investment in comparison to the value of lost load mitigated and other applicable benefit streams.
5. DSP Integration Methodology	Methodology for incorporating System Hardening into an LDC's system planning as an additional investment driver within their integrated system planning process.
6. Filing Requirement Updates	Recommend updates to the Chapter 2 and 5 Filing Requirements for Electricity Distribution Rate Applications or develop policies resulting from Report. The recommendations for the Filing Requirements should be included as part of Report.

Vulnerability Assessment Deliverables and Timeline

The Risk-Based Vulnerability Assessment (VA) framework will be developed by the end of 2024 with input alignment ongoing as other data sources, including CSA guidelines, become available.



Meetings	Objective
September	Solicit feedback on VA concept
October	Review proposed VA toolkit methodology
November	Provide draft report
December	Review finalized report



2. VA Tool Overview

Vulnerability Assessment – Tool Features

The model focuses on identifying a level of vulnerability defined as the annual probability of an asset being exposed to a weather event that exceeds its design standards.

Applicable Event Definition

Establish a definition for VASH applicable events

- Align with HILF definitions across OEB work streams for consistency
- Defines level of event that investments will address through risk mitigation

Climate Peril Identification

Identify historical severe weather events

- Determine list of weather types and severities that have been observed as components of applicable HILF events
- Use discrete climate perils to map risk to evaluated asset classes

Climate Peril Forecast

Provide expected annual probability of climate perils

- Review publicly available climate data for each climate peril
- Forecast climate peril frequency at HILF severities with spatial granularity suitable to peril characteristics

Asset Class Failure Modes & Thresholds

Identify climate perils that each asset class is vulnerable to and their associated failure threshold

- Develop list of asset classes and failure modes
- Provide expected failure thresholds for asset classes and specifications by climate peril
- Treat asset vulnerability identification in a similar manner to asset condition assessments

Climate Peril Probability Tool

Asset Class Failure Mode & Threshold Tool

Vulnerability Assessment Toolkit Heatmap

The Vulnerability Assessment Toolkit is designed to support LDCs as an option for streamlining the identification of vulnerable asset classes and locations. The toolkit illustrates a standard assessment methodology option meeting the OEB's expectations for evaluation of resiliency risk, resulting in a heatmap narrowing assets for further review.

Location	County 1

	Low	Medium	High
Annual Probability Bin	0.010	0.100	0.200

		Asset Risk Heatmap					
Asset Class	Sub Class	2025	2030	2035	2040	2045	2050
Pole	Class 5	Medium	Medium	High	High	High	High
Pole	Class 4	Medium	Medium	Medium	Medium	Medium	Medium
Pole	Class 3	Low	Low	Medium	Medium	Medium	Medium
Pole	Class 2	Low	Low	Low	Low	Low	Low
Overhead Conductor	Covered	Medium	Medium	Medium	Medium	Medium	Medium
Overhead Conductor	Uncovered	High	High	High	High	High	Very High
Pole	Class 5	Medium	Medium	High	High	High	High
Pole	Class 4	Medium	Medium	Medium	Medium	Medium	Medium
Pole	Class 3	Low	Low	Medium	Medium	Medium	Medium
Pole	Class 2	Low	Low	Low	Low	Low	Low
Overhead Conductor	Covered	Medium	Medium	Medium	Medium	Medium	Medium
Overhead Conductor	Uncovered	High	High	High	High	High	Very High

NOTE: *The OEB recognizes that pre-existing vulnerability assessment methodologies exist and, therefore, this toolkit is meant to be an optional resource.*

Vulnerability Assessment Toolkit Data Requirements

The toolkit combines climate data, design standards, and asset location summaries. Inputs may be developed by LDCs using a variety of sources including the LDCs internal data, CSA guidelines, publicly available climate data, and proprietary climate data. The OEB does not specify a data source expectation. LDCs may leverage data commensurate with their planning granularity and needs.

Toolkit Data Requirements:

LDC Asset Summary

Summarizes asset counts by analysis location. Locations with no assets of a specific class will have no vulnerability for that class regardless of climate projections. For locations and class combinations with higher vulnerability, an LDC may review its asset counts to understand the pervasiveness of the resiliency challenge.

Asset Class Failure Thresholds

Characterizes the expected resilience of LDC assets identified in the Asset Summary to specific climate perils. Sub classes may be included to better estimate failure thresholds across a variety of perils. The total annual probability of failure is the summation across climate perils. LDCs may leverage design standards to quickly review vulnerability or refine failure thresholds with additional condition data of field equipment.

Climate Peril Probability

Projects the annual probability of specific events (relevant to assets in the Asset Summary) occurring at targeted grid locations through time. Climate perils and severity thresholds are linked to specific asset failure modes and thresholds. For example, wind gusts may be evaluated at 80, 100, and 120 kph as these relate to different class pole failures.

Example: Assesses wind risk for Class 3 poles in County 1

A failure threshold of 80 kph gusts is identified and compared to the annual probability of this event occurring in County 1. Based on the vulnerability category definition (highlighted yellow), vulnerability transitions from low to medium in 2035 for this asset class and location.

Asset Class Failure Thresholds

Climate Peril Probability

Vulnerability Assessment Heatmap

Asset Class	Sub Class	Climate Peril	Severity Threshold	Unit Basis
Pole	Class 5	Wind	60	kph (1 min gusts)
Pole	Class 4	Wind	70	
Pole	Class 3	Wind	80	
Pole	Class 2	Wind	90	

Climate Peril	Severity Threshold	Unit Basis	Location	Annual Event Probability Forecast					
				2025	2030	2035	2040	2045	2050
Wind	100	kph (1 min gusts)	County 1	0.001	0.001	0.001	0.002	0.002	0.002
Wind	90		County 1	0.003	0.003	0.004	0.005	0.005	0.006
Wind	80		County 1	0.008	0.009	0.011	0.012	0.014	0.016
Wind	70		County 1	0.030	0.035	0.040	0.046	0.052	0.060
Wind	60		County 1	0.080	0.092	0.106	0.122	0.140	0.161

Annual Probability Bin	0.010	0.100	0.200

		Asset Risk Heatmap					
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Pole	Class 3	Low	Low	Medium	Medium	Medium	Medium
Pole	Class 2	Low	Low	Low	Low	Low	Low

Vulnerability Assessment Toolkit Walkthrough Demo

Open Discussion

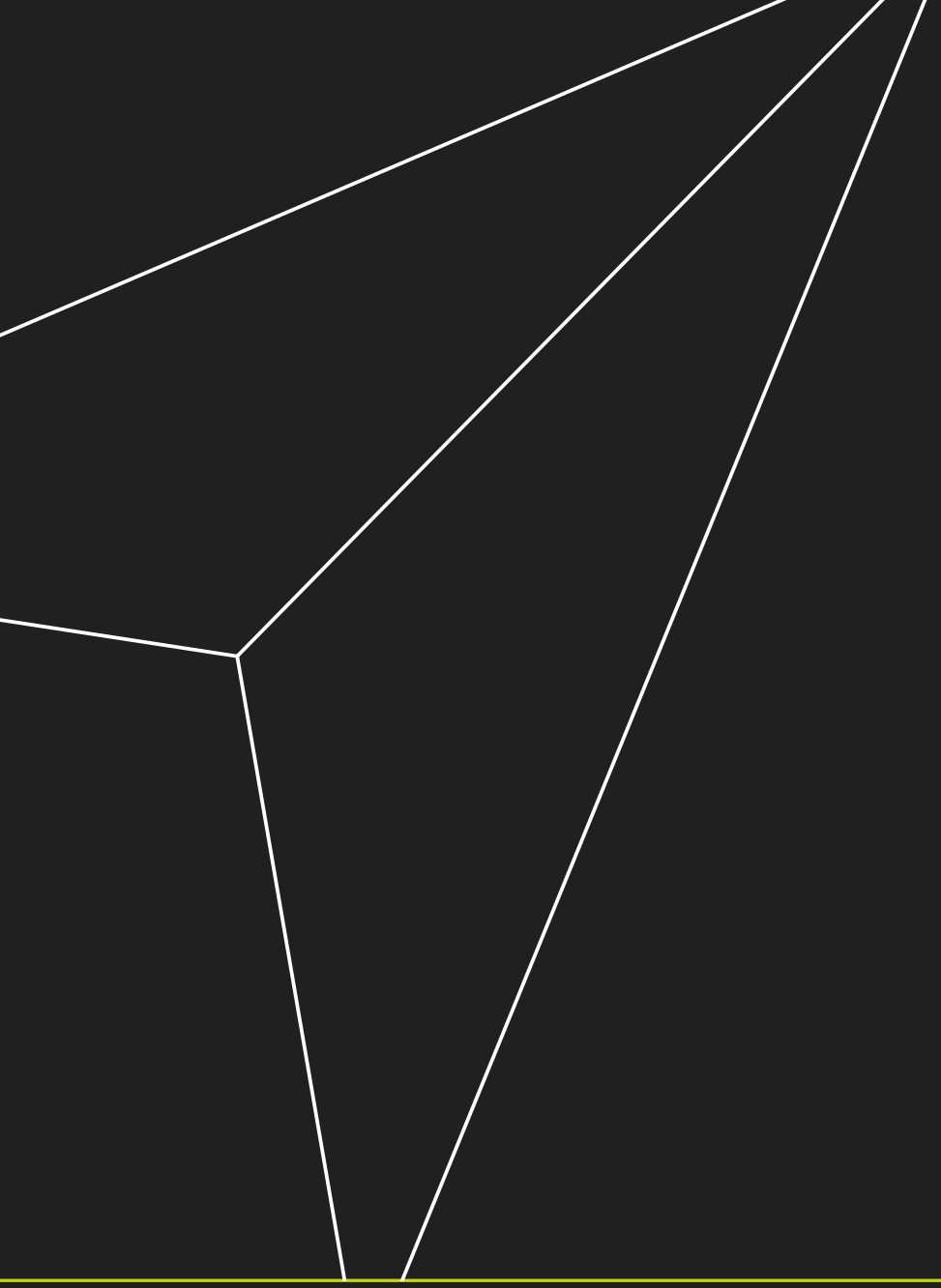
What requirements on the approach to vulnerability assessment will best support efficient proceedings, appropriate consistency in OEB decisions, and lower regulatory uncertainty for applicants?

- TBD
- TBD
- TBD

Open Discussion

To what extent will expectations for standardized climate inputs help to achieve the outcomes above, and how should standardization be balanced against the requirement for asset owners alone to manage risks associated with their assets?

- TBD
- TBD
- TBD



3. Next Steps

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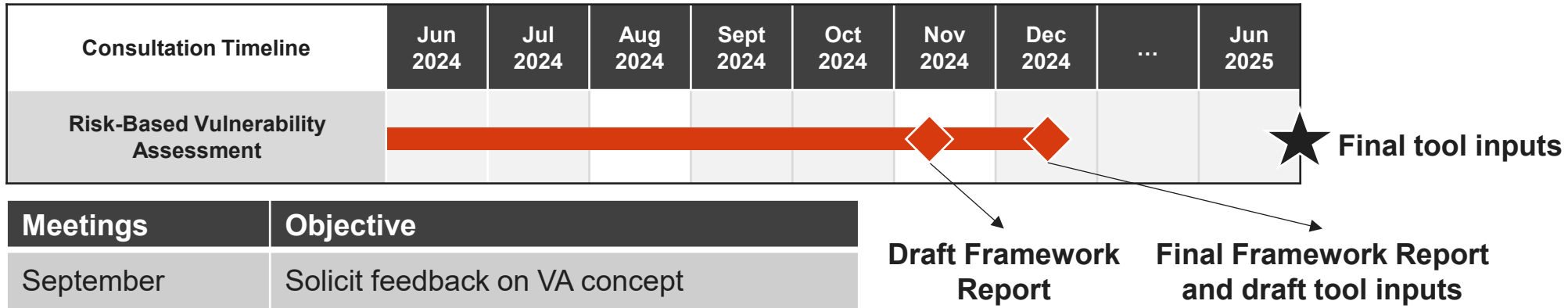

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