



Restoration Time Impact Analysis & High Impact Black Start Sites

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OC/MIC Special Session
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Stage 1 FRBSR Work

2019 – 2020

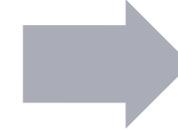
- Level of Fuel Assurance
- Universal Fuel Assurance Requirements
- Fuel Assurance Solutions by Primary Fuel Type
- Testing & Verification Requirements
- Compensation Mechanism
- Implementation Plan
- Solution Packages



Stage 2 Hiatus Work

2020 – 2021

- **Enhanced Restoration Time Analysis**
- Cost / Benefit Analysis Methodology
- Gas Supply Risk Assessment



Stage 3 FRBSR Considerations

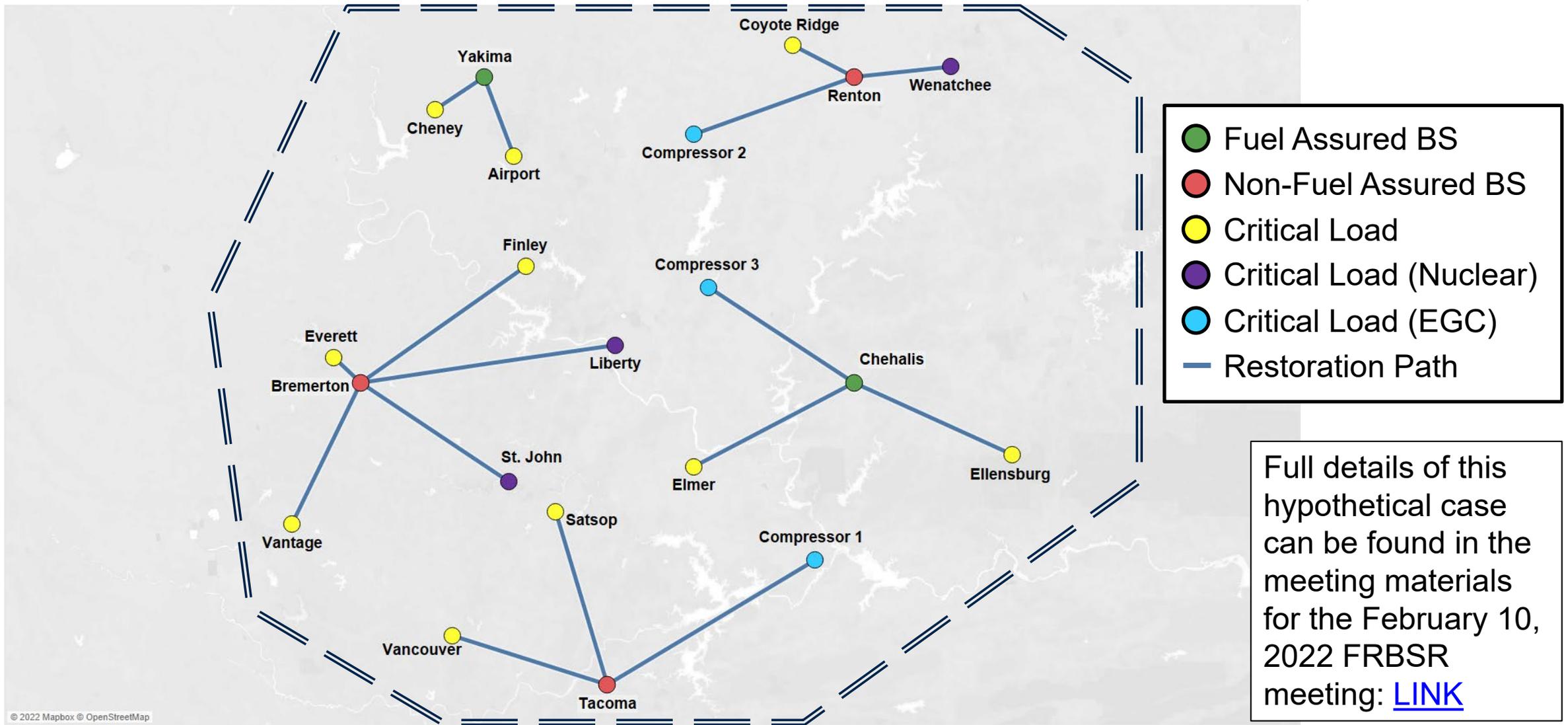
2022

- Updated Design Component Details and Solution Packages
- Enhanced Definitions of Fuel Assurance
- Hydro Packages to align with ELCC
- Inputs from FERC/NERC ERCOT Report

Incremental Restoration Time Increase: Additional time required to restore a TO zone due to the loss of one or more BS sites above and beyond the theoretical zonal restoration time with all BS sites available.

High Impact Black Start Site: A BS site which, when unavailable during a restoration scenario, results in an incremental restoration time increase of ten hours or more. This ten hour cutoff is a PJM suggestion and not tied directly to any standards.

Hypothetical Case: Standard Restoration



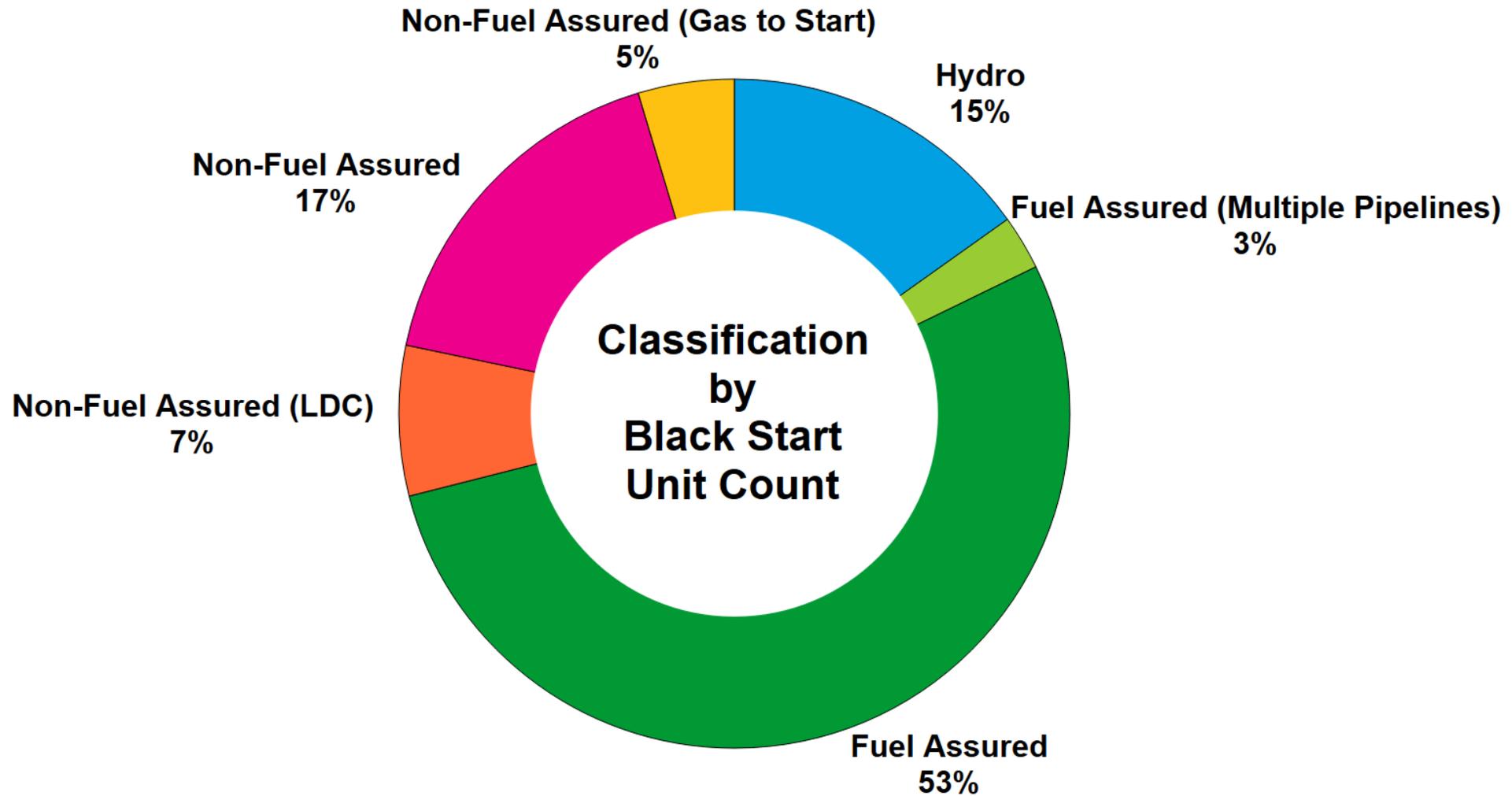
- Fuel Assured BS
- Non-Fuel Assured BS
- Critical Load
- Critical Load (Nuclear)
- Critical Load (EGC)
- Restoration Path

Full details of this hypothetical case can be found in the meeting materials for the February 10, 2022 FRBSR meeting: [LINK](#)

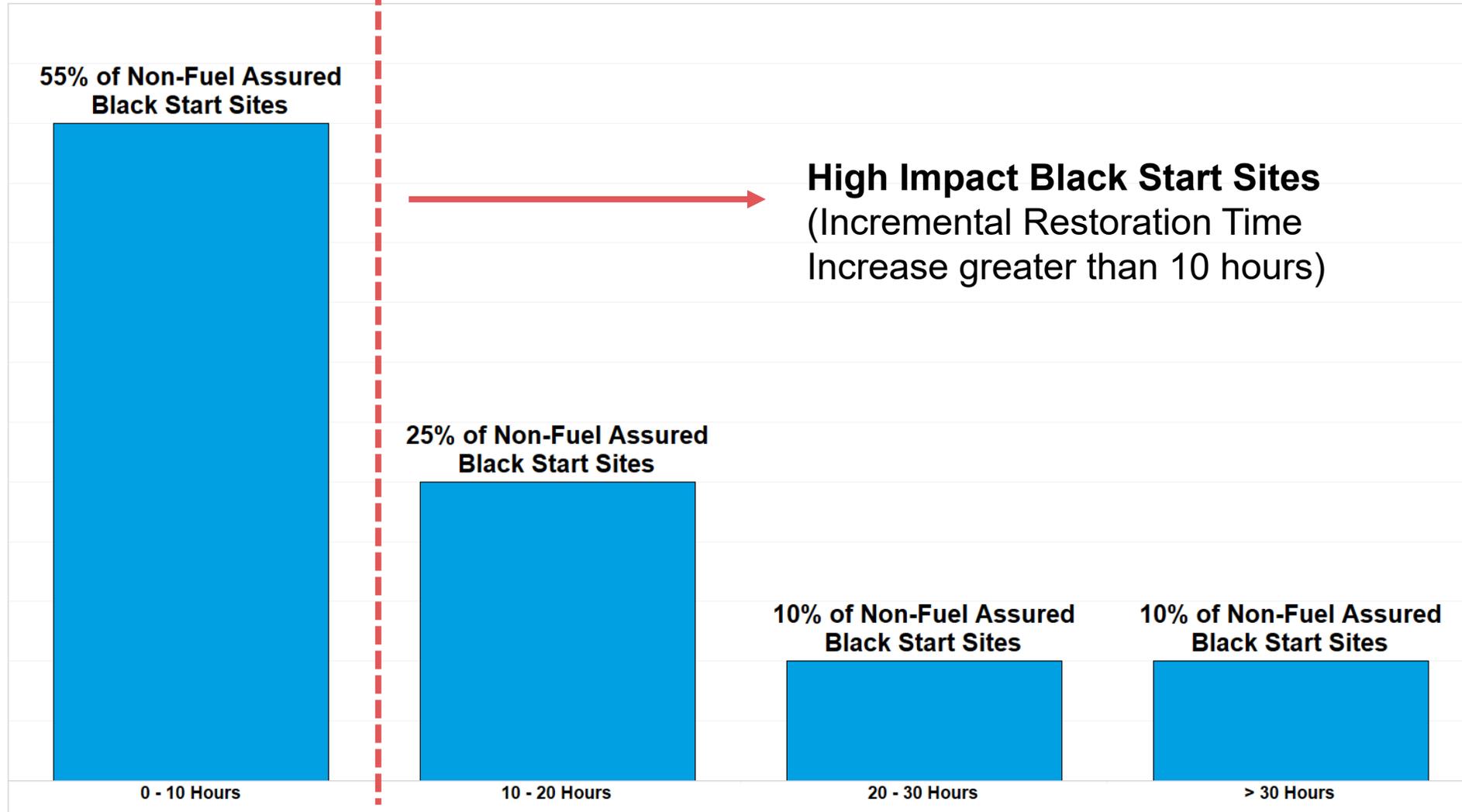
Hypothetical Case: Timing Comparison and High Impact Black Start Sites

Scenario	Hypothetical Zonal Restoration Time	Incremental Restoration Time Increase
Standard Restoration	9.0 Hours	-----
Scenario 1: Loss of Renton	11.5 Hours	2.5 Hours
Scenario 2: Loss of Bremerton	19.5 Hours	10.5 Hours
Scenario 3: Loss of Tacoma	14.5 Hours	5.5 Hours
Scenario 4: Loss of Bremerton & Tacoma	32.5 Hours	23.5 Hours

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Current PJM Non-Fuel Assured Black Start Site Incremental Restoration Time Increase



PJM is soliciting member feedback on the cutoff to identify High Impact Black Start Sites. The cutoff is currently set at 10 hours, but this is an initial suggestion and not tied to any standards or requirements. This number could be adjusted to account for additional factors:

- Acceptable incremental delay to restoration
- Technical limitations at transmission substations
- Technical limitations at Critical Loads

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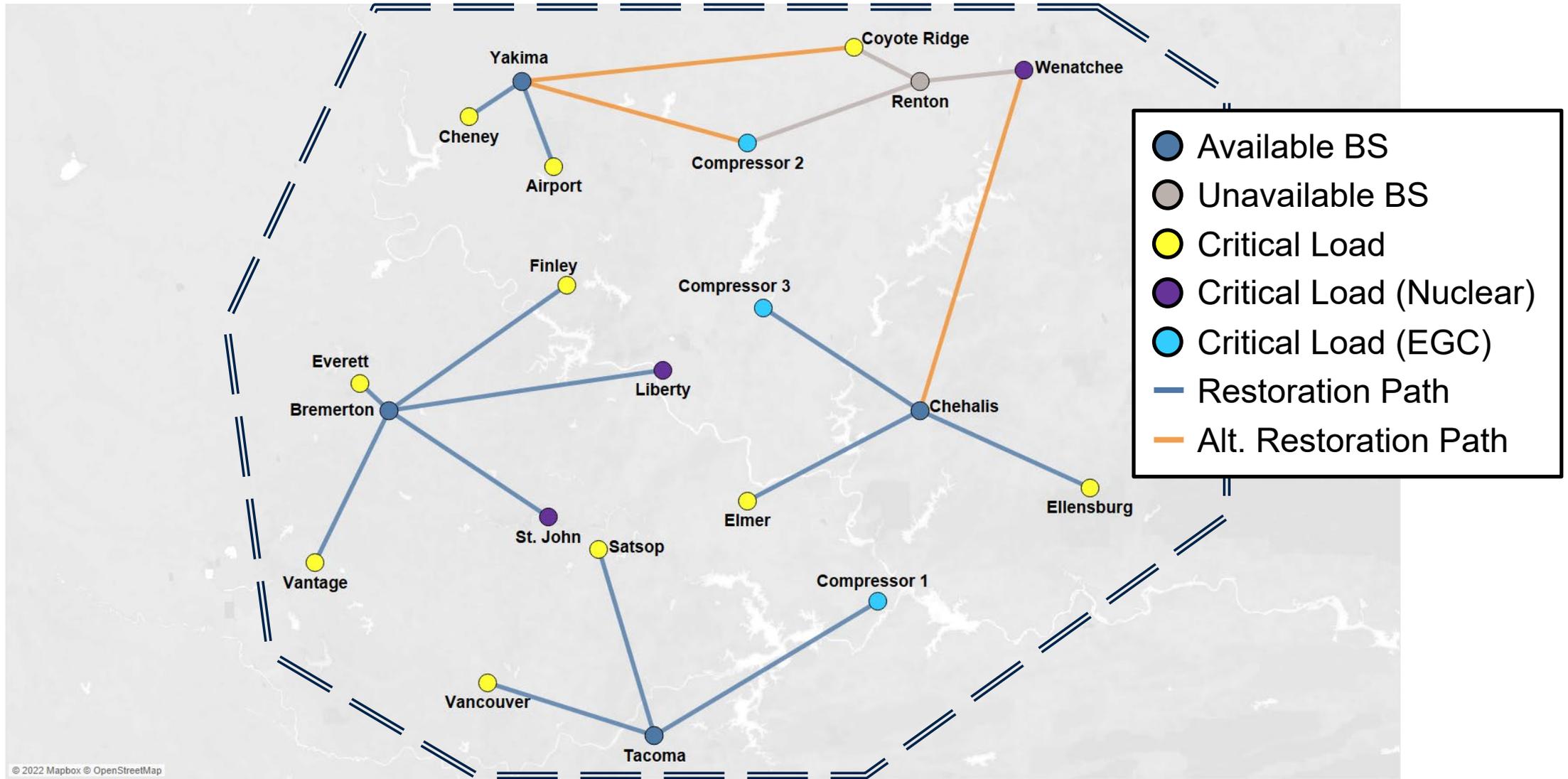
Fuel Requirements for Black Start Resources

Appendix

- BSR (Black Start Resource): A generation resource capable of providing black start service during a restoration event
- CL (Critical Load): A generator, nuclear reactor, or electric gas compressor identified in a TO's restoration plan that must be energized by a BSR as part of the restoration process
- FA BSR (Fuel Assured BSR): A Black Start Resource that meets the fuel assurance requirements identified in the table in Slide 4
- NFA BSR (Non-Fuel Assured BSR): A Black Start Resource that does not meet the fuel assurance requirements identified in the table in Slide 4

Classification	Description
Fuel Assured (FA)	Black Start sites that can operate using fuel that is stored on site, this includes oil units and dual fuel units with the capability to start without requiring gas
Fuel Assured (Multiple Pipelines)	Gas only Black Start sites that are connected to more than one interstate natural gas pipeline
Non-Fuel Assured (NFA)	Gas only Black Start sites with one interstate pipeline connection
Non-Fuel Assured (LDC)	Gas only Black Start sites that receive their gas supply via a LDC connection
Non-Fuel Assured (Gas to Start)	Black Start sites that have fuel storage on site but require natural gas for startup ignition
Hydro	Black Start sites that rely on natural river flow to generate electricity or store an inventory of water in an elevated reservoir

Hypothetical Case: Scenario 1 Loss of Renton



To account for the loss of Renton in a restoration, alternate black start sites must crank those critical loads in addition to what they normally crank.

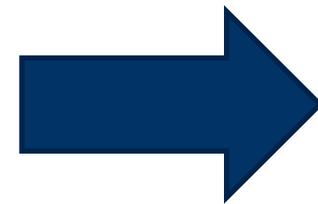
Bremerton Island: 9.0 Hours

Chehalis Island: 6.5 + 5.0 = 11.5 Hours

Renton Island: N/A

Tacoma Island: 8.0 Hours

Yakima Island: 5.5 + 1.5 + 2.0 = 9.0 Hours



Hypothetical Zonal
Restoration: 11.5 Hours
Time