Cassils – Bowmanton – Whitla (CBW) Path Congestion Presentation

February 2023

Using Zoom – Asking questions

- Two ways to ask questions if you are accessing the webinar using your computer or smartphone
  - Click “Raise Hand” and the host will be notified that you would like to ask a question. The host will unmute your microphone, you in turn will need to unmute your microphone and then you can ask your question. Your name will appear on the screen, but your camera will remain turned off.
  - Click “Lower Hand” to lower it if needed.
  - You can also ask questions by tapping the “Q&A” button and typing them in. You’re able to up-vote questions that have been already asked.
- If you are accessing the webinar via conference call
  - If you would like to ask a question during the Q&A portion, on your phone’s dial pad, hit *9 and the host will see that you have raised your hand. The host will unmute your microphone, you in turn will need to unmute your microphone by hitting *6 and then you can ask your question. Your number will appear on the screen.

Agenda

- Background
- Key Assumptions
- Limits Identified for the CBW Path
- AESO’s Near-Term Initiative to Improve the CBW Path Limits
- Congestion Assessment Results
- AESO’s Long-Term Initiative to Address Congestion on the CBW Path
- Timeline of the AESO’s Initiatives to Address Congestion on the CBW Path

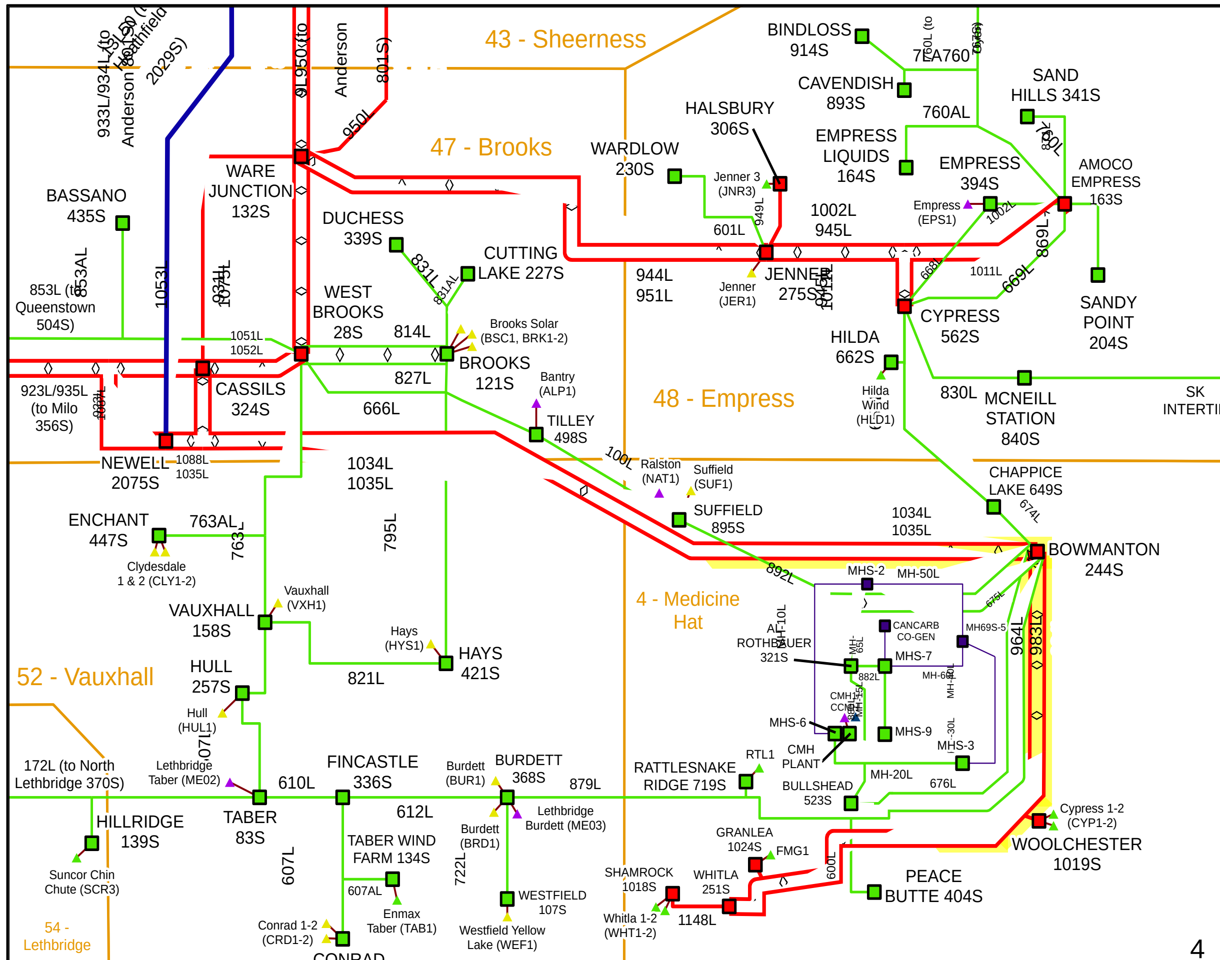
Background

- The Cassils/Newell – Bowmanton – Whitla (CBW) path is a double-circuit 240 kV path in the Southeast
- The AESO has received strong interest from generation developers in the Southeast

Existing/Future Generation on CBW Path

Category	Capacity (MW)
Existing	795
Met Inclusion Criteria	984
Other	> 4500

1779 MW



Key Assumptions

- Technical studies performed:
  - ✓ Deterministic studies → To identify the CBW path limits
  - ✓ Hourly congestion assessments → To identify the probability of congestion on the CBW path

List of Generation Projects Connecting to the CBW Path

Category	Project Name	MC (MW)	Total (MW)
Existing	Whitla 1 (WHT1)	202	1423
	Whitla 2 (WHT2)	151	
	Forty Mile Granlea (FMG1)	200	
	Cypress 1 (CYP1)	196	
	Cypress 2 (CYP2)	46	
Met Inclusion Criteria (**as of the end of October 2022**)	P2347 – Forty Mile Granlea Solar Phase 2	220	
	P0693 – Wild Rose 2 Wind Farm	192	
	P2337 – Dunmore Solar	216	
Met Inclusion Criteria (**after October 2022**)	P2237 – RESC Forty Mile MPC Wind	266	356
	P2137 – Enerfin Winnifred MPC Wind	90	

Included in the Technical Studies (existing projects and projects that met the inclusion criteria as of the end of October 2022)

Not Included in the Technical Studies (projects that met the inclusion criteria after October 2022)

Limits Identified for the CBW Path

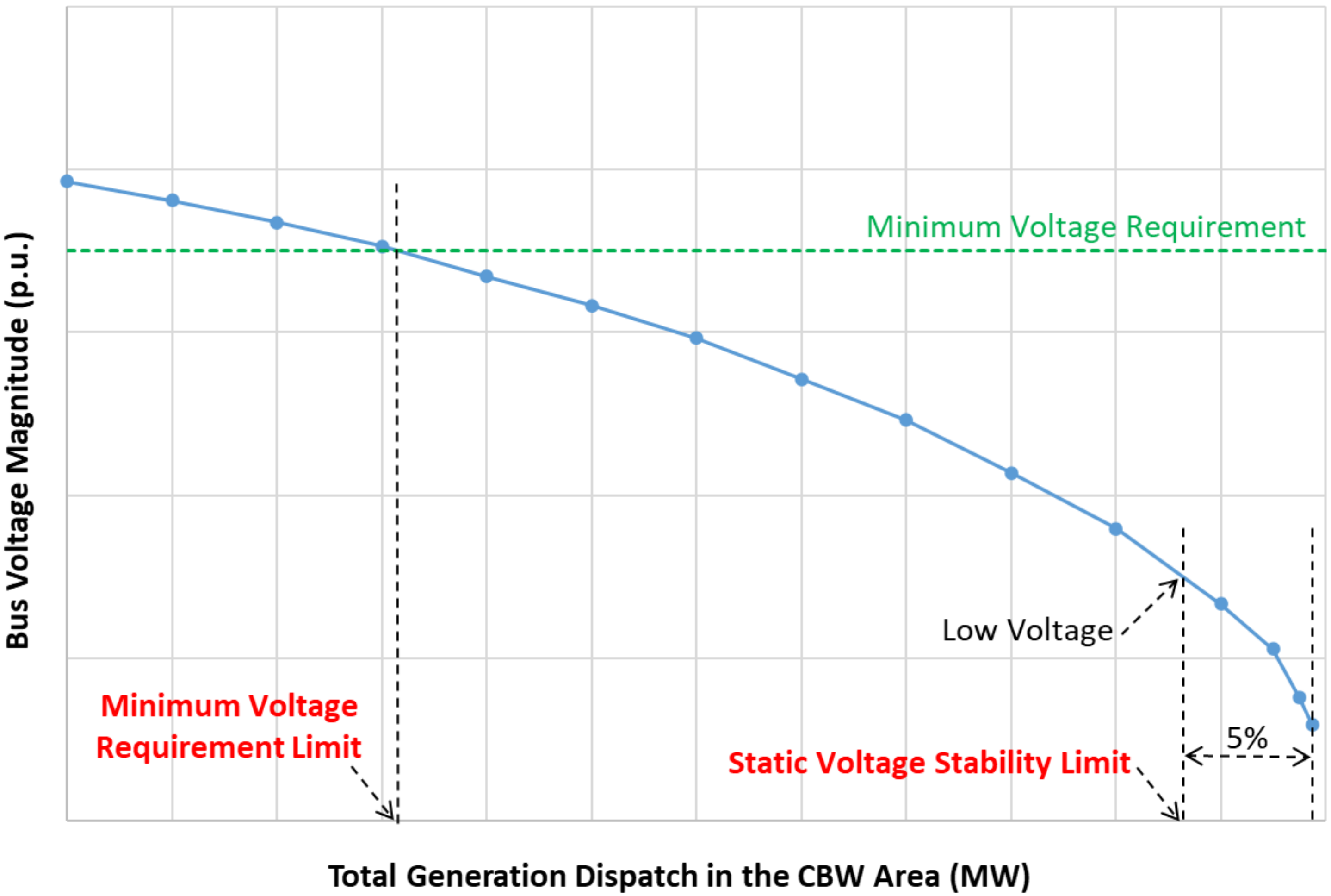
- Various limits identified for the CBW path

CBW Path Limits

- Thermal — Power Flow Analysis
- Static Voltage Stability
- Minimum Voltage Requirement
  - (Static Voltage Stability, Minimum Voltage Requirement) — P-V Analysis
- Dynamic Voltage Stability
- Angular Stability
  - (Dynamic Voltage Stability, Angular Stability) — Transient Stability Analysis
- Existing RAS 164/MSSC

Static Voltage Stability and Minimum Voltage Requirement Limits

- P-V analysis was performed to identify the Static Voltage Stability and Minimum Voltage Requirement limits



Dynamic Voltage Stability and Angular Stability Limits

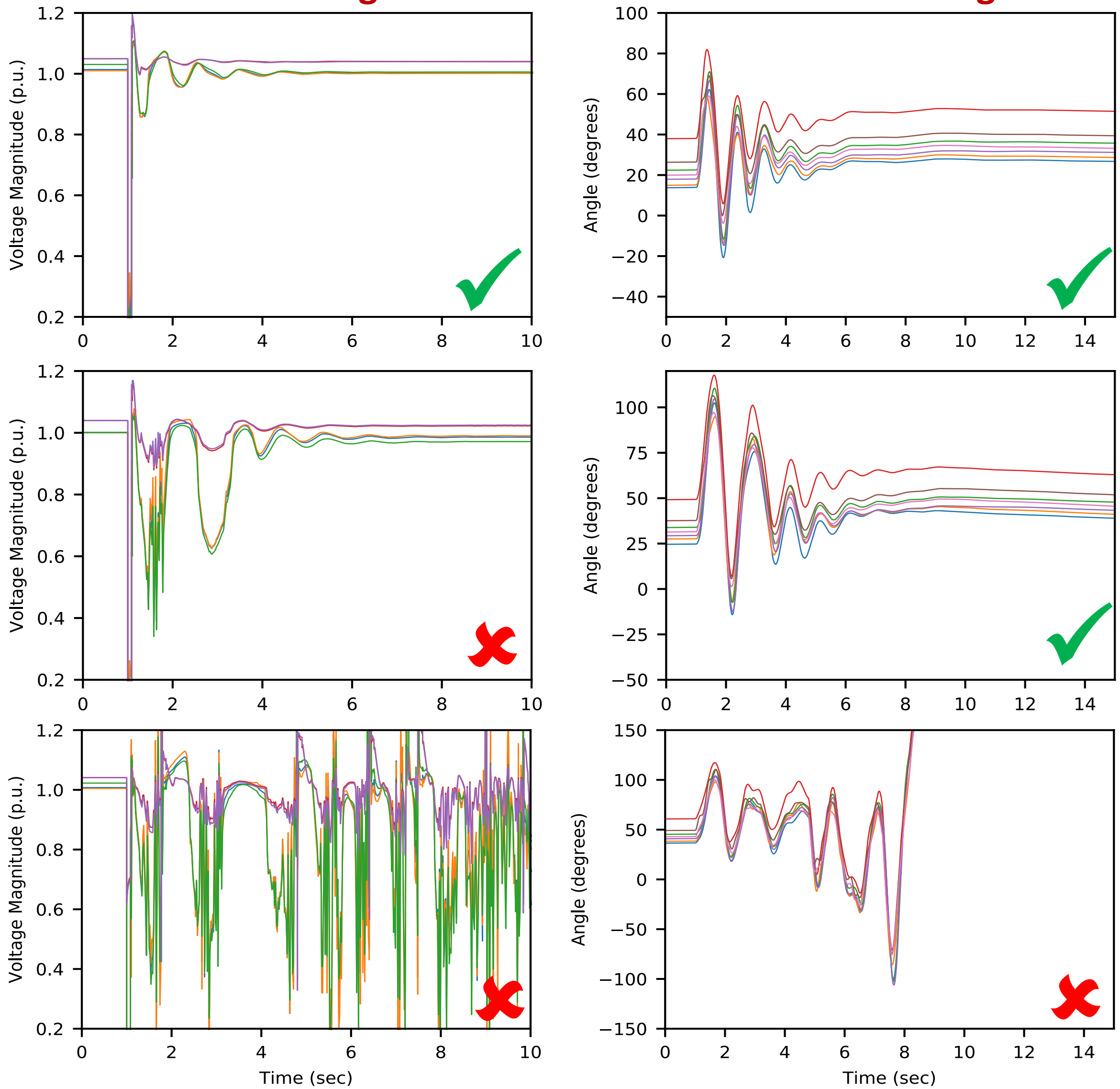
- Transient stability analysis was performed to identify the Dynamic Voltage Stability and Angular Stability limits

- The voltage ride-through requirements specified in Section 502.1 of the ISO Rules were used as the criteria for evaluating the dynamic voltage behavior of the system

Low Voltage Ride Through Duration	
Voltage (per unit)	**Time (seconds)**
< 0.45	0.15
< 0.65	0.30
< 0.75	2.00
< 0.90	3.00
≥ 0.90	Continuous operation

Examples of Dynamic Behavior of the System

Bus Voltages | **Machine Angles**



Exiting RAS 164 (Jan. 2023)

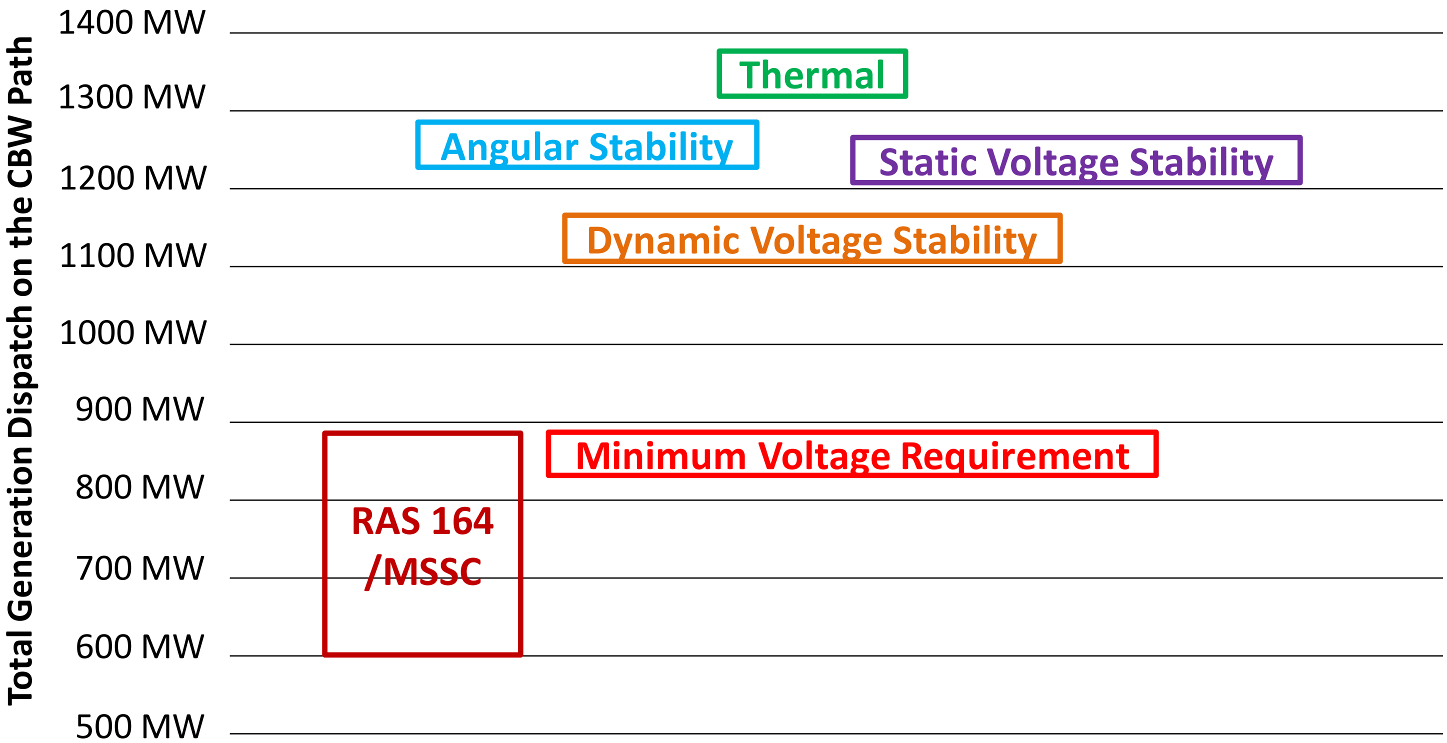
- Prevent instability after 240 kV contingencies

	Arming Setting	Trip Logics	Trip Actions
Trip Logic #1		Loss of 1034L AND 1035L	Trip gen on CBW path; Open 964L and 983L
Trip Logic #2	Flow on 1034L and 1035L out of 244S >= 600MW	Logic #2 Armed AND Loss of 1034L OR 1035L	Trip all gen on this logic
Trip Logic #3	Flow on 983L and 964L into 244S >= 700MW	Logic #3 Armed AND Loss of 983L	Trip all gen on this logic

- RAS helps optimize the use of existing transmission system
- Pre-contingency curtailments may be required to respect system MSSC limit

Summary of Limits Identified for the CBW Path

- Summary of various limits identified for the CBW path



Lowest Limit: 600 - 860 MW

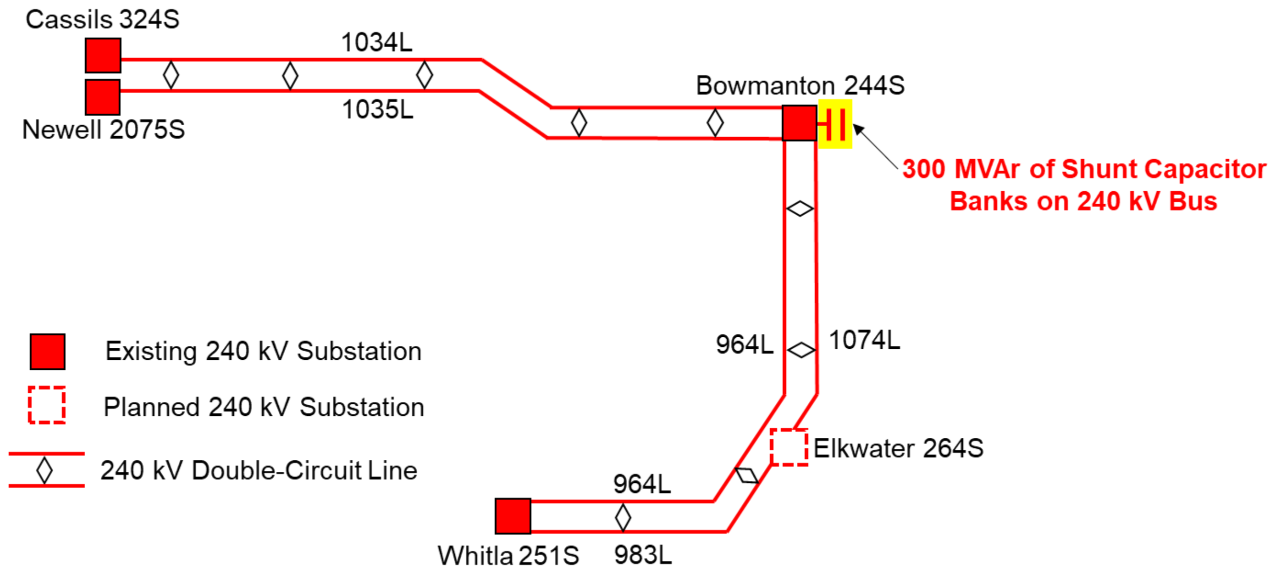
Near-Term RAS 164 Optimization

- Increase RAS 164 logic #2 arming level incrementally to help reduce curtailments
  - ✓ Target to implement in the coming weeks
- Explore smart RAS 164 implementation via a pilot project to help reduce curtailments, and to help improve other limits

  preliminary information:
  - ✓ Arm enough generation feeders close to and below MSSC limit
  - ✓ Rotate RAS arming among generation for fairness
  - ✓ Curtail generation not armed to respect area transfer limits
  - ✓ Target to implement in 2024 due to new application and complexity, based on discussion with TFOs and vendors

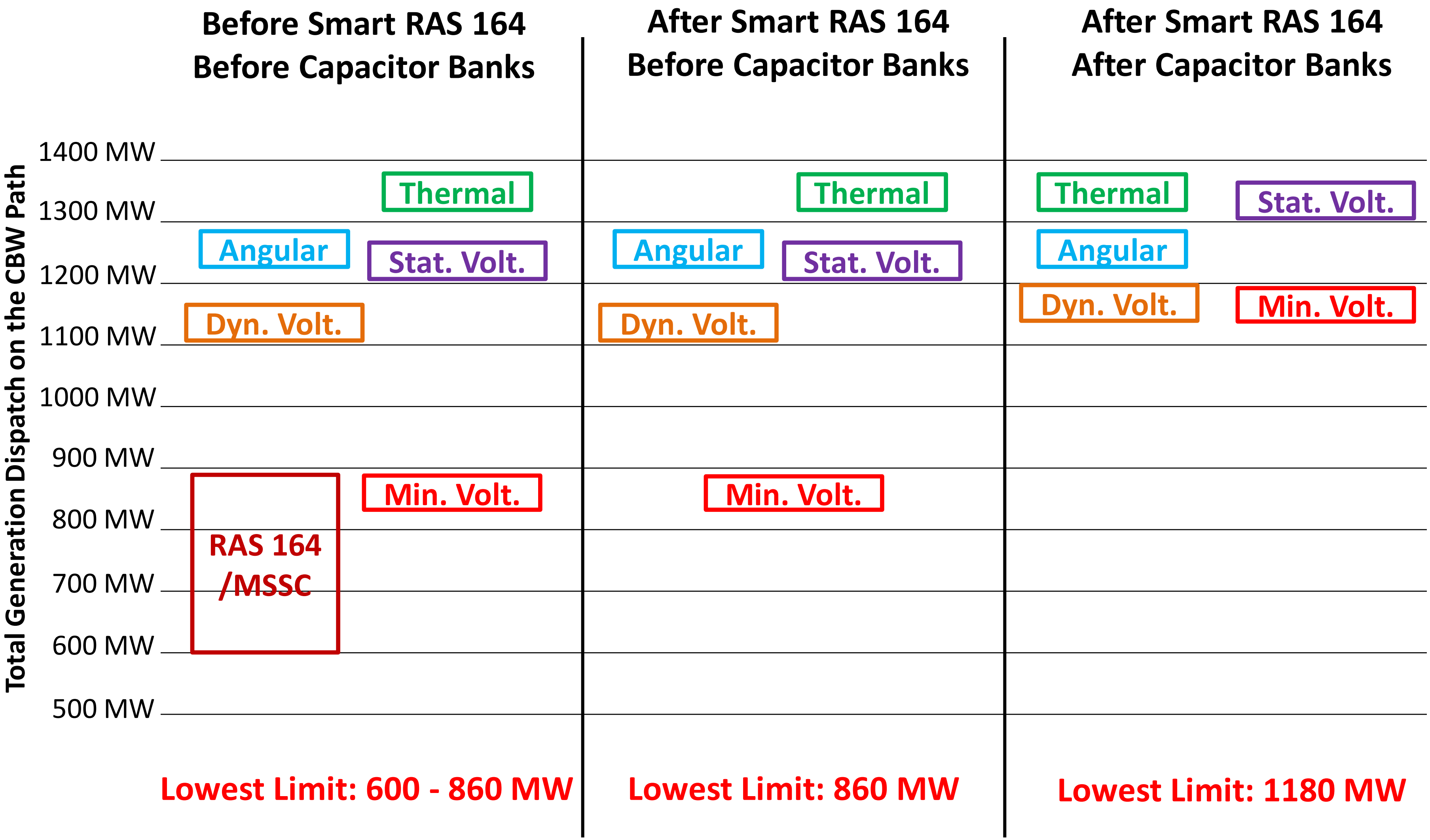
Near-Term Transmission System Development

- Adding voltage support devices to the CBW path can improve the Minimum Voltage Requirement limit and help reduce potential congestion in the near term
- The AESO investigated different voltage support alternatives and selected a preferred alternative based on the following considerations:
  - ✓ Cost
  - ✓ Additional generation integration capability
  - ✓ Environmental and land use impacts
- The preferred alternative involves adding three (3) 100 MVAr shunt capacitor banks on the 240 kV bus at Bowmanton 244S substation



Summary of Limits Identified for the CBW Path Before and After Shunt Capacitor Banks

- Summary of various limits identified for the CBW path before and after RAS 164 optimization and addition of shunt capacitor banks at Bowmanton 244S substation



Preliminary Congestion Assessment Results

- DC-power flow assessment each hour of a year.
- In this study, approx. 1450 MW installed capacity connected to CBW path.*
- Roughly 4,400 GWh of production in a year on the CBW path.*
- Identified high curtailment risk with the current RAS (before Smart RAS 164).

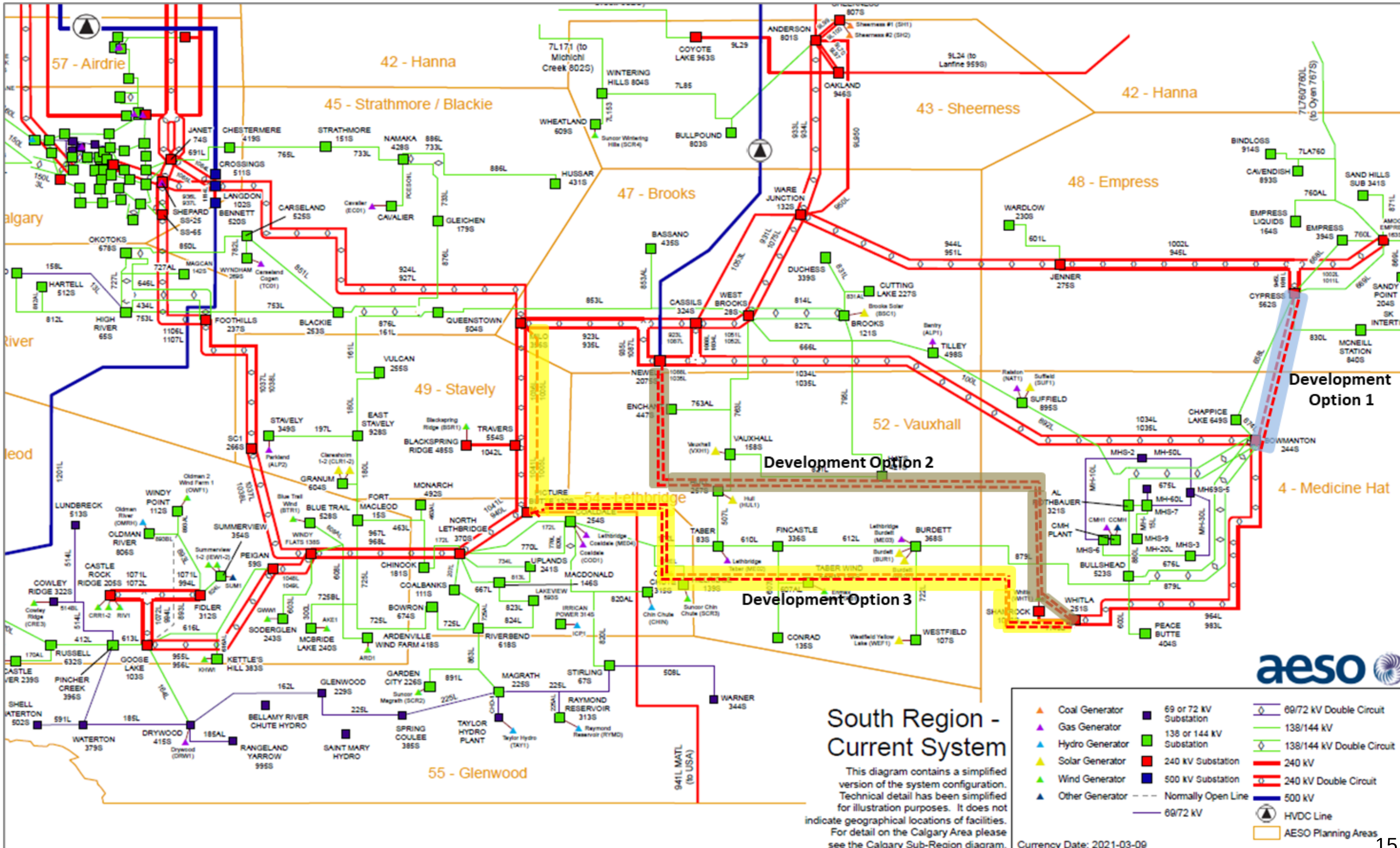
	Probability of Curtailment (%/hrs)	Annual Curtailed Energy (GWh)	Curtailed Energy as % of total energy
Before Smart RAS 164 Before Capacitor Banks	27.1/2,382	326.2	7.0
After Smart RAS 164 Before Capacitor Banks	21.2/1,858	244.6	5.5
After Smart RAS 164 After Capacitor Banks	1.7/149	10.1	0.2

- Smart RAS could reduce the curtailed energy by approximately 25%.
- Smart RAS with Capacitor Bank could reduce the probability of curtailment, and annual curtailed energy by 93% and 96%, respectively.

*Excluding CMH1 and CCMH

Long-Term Transmission System Development

- Three conceptual transmission development options are under consideration for the Southeast



Timeline of the AESO's Initiatives to Address Congestion on the CBW Path

- Near-Term RAS 164 optimization
  - ✓ Increase RAS 164 logic #2 arming level → targeting the coming weeks
  - ✓ Smart RAS 164 implementation → targeting 2024

- Near-term transmission system development → Shunt capacitor banks
  - ✓ The AESO is targeting to file a NID by the end of Q1 2023
  - ✓ The estimated preliminary ISD is Q2 2024

- Long-term transmission system development → New 240 kV transmission lines
  - ✓ The AESO is targeting to select a preferred option later in 2023
  - ✓ Potential ISD as early as 2027

Thank you