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Quarterly Report for Q4 2023: Selected findings

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Presentation outline

- Scope of this presentation
- Energy market
 - Market events
 - Market power and offer behaviour
 - Carbon emissions
 - Storage analysis
- Power system
 - Trends in transmission congestion
 - Dynamic line rating
 - Line losses
 - Imports and exports
- Operating reserve markets
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Scope of this presentation

- This presentation provides a selection of findings contained in the MSA's Quarterly Report for Q4 2023
 - Only selected figures are included here
 - Readers are referred to the Quarterly Report itself for discussion of the figures
- All content in this presentation was copied directly from the Quarterly Report and no additional information, including by exclusion of any material, is provided here.



Energy market



Figure 1: Spark spread by year (2001 to 2023, inflation adjusted)





Figure 3: Pool price duration curves by year (2020 to 2023)





Figure 4: Average pool price by quarter (Q1 2018 to Q4 2023, inflation adjusted)





Figure 5: Daily average temperatures across Calgary, Edmonton, and Fort McMurray (December 2022 and 2023)



—2022 **—**2023



Figure 6: Maximum, average, and minimum of hourly wind generation by month (January 2018 to December 2023)





Market events



Figure 10: System demand, wind and solar generation, net demand, and SMP (November 10 to 13)





Figure 11: Actual wind generation and the 8-hour forecast (November 12)





Table 7: Supply surplus events declared by the AESO in Q4

From	То	Length (hours)	Curtailments	
Oct-04 03:00	Oct-04 04:37	1.6	SK imports curtailed by 45 MW Wind curtailed by up to 98 MW	
Oct-06 23:12	Oct-07 02:32	3.3	Wind curtailed by up to 165 MW	
Oct-20 14:03	Oct-20 15:13	1.2	SK imports curtailed by 90 MW	
Dec-21 00:16	Dec-21 03:34	3.3	None	
Dec-21 04:16	Dec-21 04:53	0.6	None	
Dec-23 00:05	Dec-23 01:00	0.9	None	
Dec-23 01:47	Dec-23 05:15	3.5	None	



Market power and offer behaviour



Figure 13: Monthly observed and SRMC-counterfactual pool prices (January 2022 to December 2023)





Figure 14: Quarterly average market markup (Q1 2020 to Q4 2023)





Figure 16: Monthly average static inefficiency (January 2022 to December 2023)





Figure 18: Market-level pivotality by month (January 2022 to December 2023)



Two Firms Collectively Pivotal
No Firm Pivotal



Figure 20: Quarterly average intermittent generation volumes by pivotality condition (Q1 2020 to Q4 2023)





Figure 24: Average non-hydro capacity offered above 3xSRMC or on long lead time (LLT) (Q1 2021 to Q4 2023)

1,800 1,600 1,400 1.200 LLT Type I 1,000 Other Firms ENMAX **Capital Power** Heartland Generation TransAlta

Average MW Offered above 3xSRMC, LLT

Q1 2021 Q2 2021 Q3 2021 Q4 2021 Q1 2022 Q2 2022 Q3 2022 Q4 2022 Q1 2023 Q2 2023 Q3 2023 Q4 2023



Figure 27: MW offers above 3xSRMC by firm, pivotality condition (Q1 2021 to Q4 2023)





Carbon emissions intensity



Figure 28: The distribution of average carbon emission intensities in Q4 (2017 to 2023)





Storage analysis



Figure 32: Annualized net revenues, capital costs (\$000's/MW) by energy storage asset, DTS tariff treatment, cycling treatment





Figure 34: Annualized DTS tariff cost impact (\$000's/MW) by DTS cost component, energy storage asset, cycling behaviour (CMD-Avoidant case)



Annualized DTS Tariff Cost Impact (\$000's/MW)



Figure 36: Average charging, discharging price impact (\$/MWh) by energy storage asset, cycling behaviour (CMD-Avoidant case)

Average Change in Pool Price (\$/MWh)





Figure 37: Average efficiency gain (\$/MWh of demand net of import supply, export demand) by energy storage asset, cycling treatment (CMD-Avoidant case)

Average Efficiency Gain (\$/MWh)





Power system: Trends in transmission congestion



Figure 39: Quarterly total constrained volumes for wind and solar generation (2022 and 2023)





Figure 45: Duration of wind and solar constraint volume (Q4 2022, Q3 2023 and Q4)





Figure 48: Wind and solar transmission constrained MWh by asset (Q4 2022, Q3 2023 and Q4)





Dynamic Line Rating



Figure 50: 610L Real capacity and theoretical DLR capacity comparison (August 1 to December 31, 2022)





Line Losses



Figure 51: Loss Factor intensity in Alberta for 2024





Figure 52: Average Loss Factor by fuel type





Imports and exports



Figure 54: Daily average import (+ve) and export (-ve) volumes on BC/MATL, and the average price differential between Alberta and Mid-C (Q4)





Figure 55: Alberta and Mid-C price differential and net BC/MATL flows (Q4)





Operating reserve markets



Figure 57: Annual operating reserve costs (\$ millions) and pool price (\$/MWh) (2019 – 2023)





Table 16: Annual OR received prices (2022 to 2023)

	2022 (\$/MWh)	2023 (\$/MWh)	Change (\$/MWh)
Regulating Reserves	\$95	\$106	\$11
Spinning Reserves	\$93	\$65	-\$28
Supplemental Reserves	\$52	\$27	-\$25
Pool Price	\$162	\$134	-\$29



Figure 62: Dispatched spinning reserves by fuel type (Oct 2022 to Dec 2023)



■Coal



Figure 64: Active, standby, and activated standby volumes for on-peak regulating (October 1, 2022 to December 31, 2023)





Forward market



Figure 65: Total volume by trade year (2013 to 2023)



■Annual ■Quarterly ■Monthly ■Bal Year ■Multi-Year ■Other



Figure 67: Traded volume, open interest and system load by hour (2021 to 2023)





Figure 68: Monthly forward prices compared to average pool prices (January to December 2023)





Figure 71: Annual forward prices since January 1 (CAL23 to CAL26)





Retail market



Figure 72: RRO customer net losses, residential customers (Q1 2021 to Q3 2023)





Figure 75: RRO retailer churn rates by service area, residential customers (January 2017 to September 2023)





Figure 78: Expected cost, fixed rate electricity contract, residential customer (January 1, 2022 to December 31, 2023)





Figure 80: 5-year fixed rate electricity contract prices, residential customers, ENMAX service area (September 1, 2022 to December 31, 2023)



