

AESO 2020 Preliminary Forecast and Budget Information

November 29, 2019

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2020 Preliminary Forecast Transmission Operating Costs

Transmission Operating Costs Forecast Summary

(\$ millions) ~ by production year	2020 Forecast ¹	2019 Projected ²	2019 BRP ³	2018 Actual
Wires Costs	1,916.0	1,851.8	1,834.6	1,724.8
Ancillary Services	257.8	228.2	313.8	277.9
Transmission Line Losses	113.5	108.9	126.1	96.7
TOTAL	2,287.4	2,188.9	2,274.5	2,099.4

Pool Price (\$ /MWh)	57.81	55.83	57.52	50.35
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Differences are due to rounding

¹ Forecast : Cost estimates for AESO Board approval for 2020

² Projected: Update of previous cost estimates for 2019

³ 2019 AESO Budget Review Process (BRP) approved numbers for 2019

2020 Preliminary Forecast Wires Costs

Wires Costs Summary

2020 Forecast



(\$ millions) ~ by production year	2020 Forecast	2019 Projected	2019 BRP	2018 Actual	2017 Actual
Wires	1,911.2	1,847.1	1,830.1	1,720.1	1,680.4
Invitation to Bid on Credit (IBOC)	2.3	2.1	2.1	2.0	1.7
Location Based Credit Standing Offer (LBC SO)	2.5	2.5	2.5	2.7	3.0
TOTAL	1,916.0	1,851.8	1,834.6	1,724.8	1,685.1

Differences are due to rounding

- Wires costs are the amounts paid to TFOs in accordance with their AUC-approved tariffs and are not controllable costs of the AESO
- IBOC and LBC SO programs are long-term contracts that were initiated in 2001 and 2002 as incentives for generation to locate closer to major load centres

2020 Forecast Pool Price

- The hourly pool price forecast is an integral input for calculating the forecasted costs of ancillary services and transmission line losses
- For the 2020 BRP, the September to December 2019 and 2020 hourly pool price forecast is obtained from EDC Associates' Quarterly Forecast Update – Third Quarter 2019, released on August 12th 2019
- EDC is a commonly utilized industry information source

Pool Price Forecast

September to December 2019 and 2020

- Key assumptions in the EDC Associates' Quarterly Forecast Update – Third Quarter 2019 include:
 - Recent market fundamentals such as the carbon pricing regimes, mothballs/retirements of coal assets, natural gas prices, and Renewable Electricity Program (REP) round one additions
 - The forecast used a single seed from a sample of 50 seeds. The single seed that had an average annual price closest to the EDC summary annual price was chosen as the representative price curve
 - Single seed produced a price duration curve more representative compared to average of all seeds

Pool Price Forecast

September to December 2019 and 2020

- As of August 30th, 2019, the forward market price is consistent with the EDC forecast for 2020

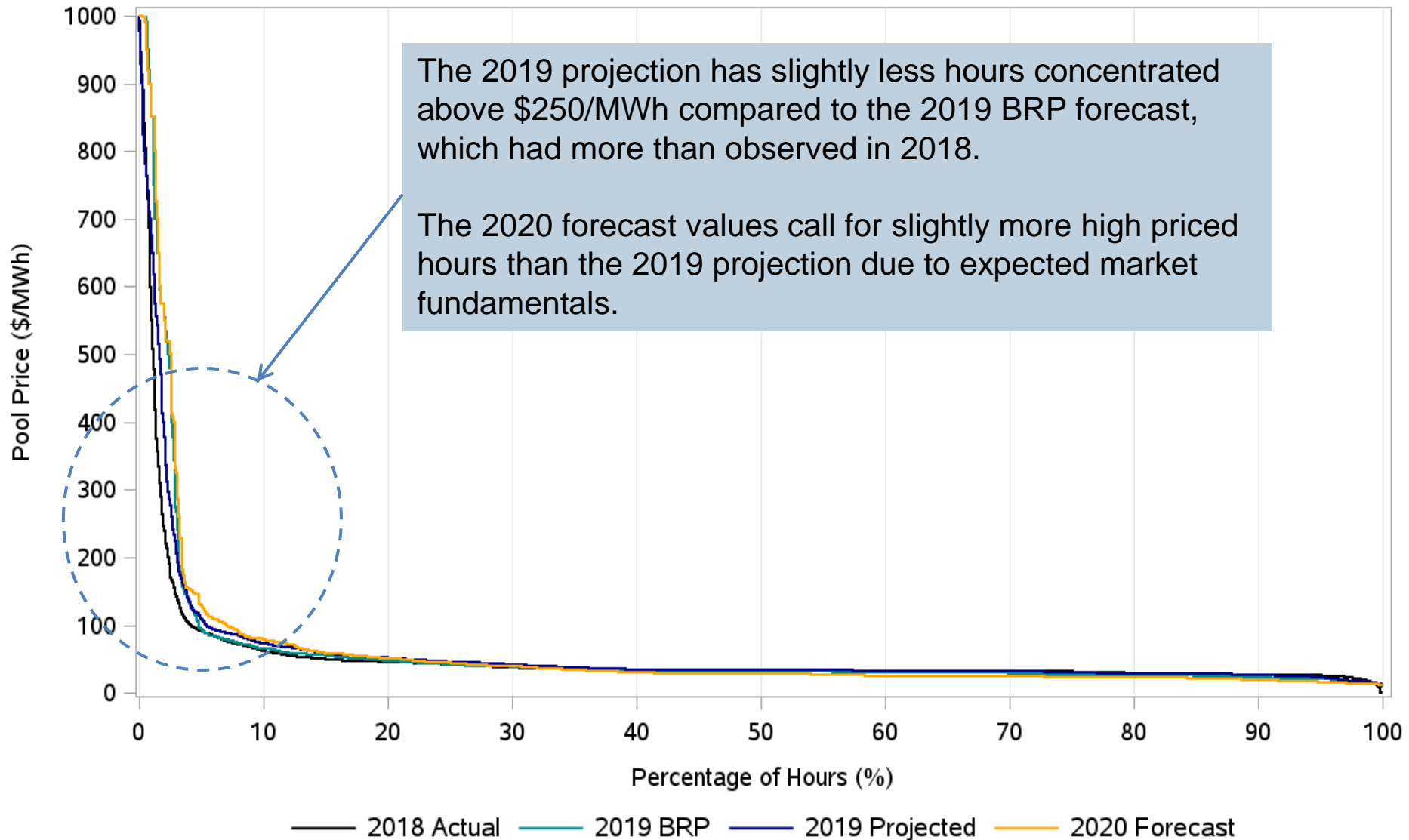
2019	EDC Forecast RoY	Forward Market RoY *	2019 Projected	2019 BRP
Average Hourly Pool Price (\$ /MWh)	51.66	58.75	55.83	57.52
AECO-C Natural Gas Price (\$ /GJ)	1.61	1.58	1.59	1.65

2020	EDC Forecast	Forward Market*
Average Hourly Pool Price (\$ /MWh)	57.81	56.25
AECO-C Natural Gas Price (\$ /GJ)	1.53	1.69

RoY – remainder of year - corresponds to September to December 2019

* Source: NGX (Aug 30th, 2019)

Pool Price Duration Curves



2020 Load Outlook

- As part of the BRP process, the AESO prepares a near term load outlook as context for the AESO's cost forecasts
- 2019-2020 load outlook considers:
 - Alberta real GDP, population, and labour predictions from the Conference Board of Canada Summer 2018 Outlook
 - Oilsands production from the 2018 CAPP forecast
 - Historic weather patterns (normal weather)
- Alberta Internal Load (AIL) is estimated to grow:
 - 0.2% from 2018 to 2019
 - 2.8% from 2019 to 2020
 - This compares to load growth of 3.3% observed from 2017 to 2018

- In 2020 load growth is expected due to:
 - forecasted economic and population growth, forecasted oilsands production growth and additional load drivers (including cannabis and cryptocurrency)

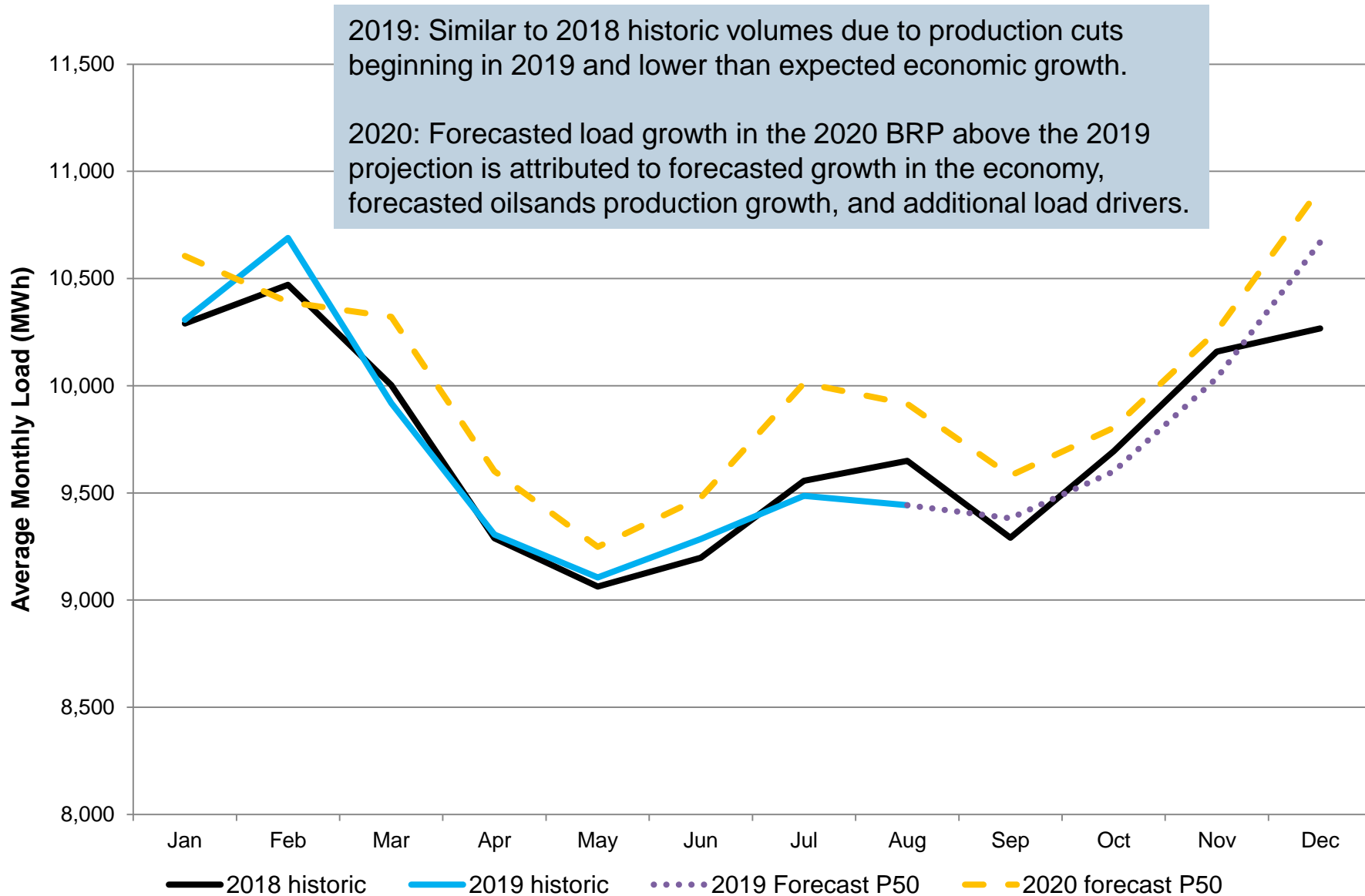
(GWh)	2020 Forecast	2019 Projected	2019 BRP	2018 Actual	2017 Actual
AIL* Volumes	87,948	85,536	85,785	85,330	82,572
Per cent change (YoY)	2.8%	0.2%**	0.5%	3.3%	N/A

YoY = Year over Year

* AIL – Alberta Internal Load

** 2019 projected compared to 2018 actual

Load Outlook (continued)



2020 Preliminary Forecast Ancillary Services Costs

Forecast Methodology: Operating Reserves (OR)

- All OR products are forecast
 - Active: spinning, supplemental and regulating,
 - Standby: spinning, supplemental, and regulating (including activations)
- Forecast OR costs is the sum of forecast hourly volumes multiplied by the hourly OR price

$$cost = \sum_{\substack{hour, \\ product}} volume * OR\ price$$

- **Volumes:** set by Alberta Reliability Standard requirements and dependent on forecast generation, load, and imports
 - Using a forecast of net-to-grid load and generation consistent with the AESO's day-ahead forecast, and import level assumptions, all contingency reserves are forecast based on ARS requirements
 - Using the formulas that outline regulating reserves volumes in each hour, all regulating reserve volumes are forecast
- **OR price:** hourly price of operating reserves determined for each product type
 - Based on the relationship between pool price levels and OR premiums (discounts) of the previous four years

2020 Forecast Ancillary Services Cost Summary



(\$ millions) ~ by production year	2020 Forecast	2019 Projected	2019 BRP	2018 Actual	2017 Actual
Operating Reserve (OR)	229.1	200.5	270.6	236.0	80.7
Load Shed Service for Imports (LSSi)	20.6	18.0	32.8	30.9	22.9
Contracted Transmission Must-run (TMR)	2.4	3.1	3.2	3.1	3.0
Conscripted Services (OR and TMR)	0.4	0.4	0.2	0.4	0.5
Reliability Service	2.9	2.9	2.9	2.9	2.9
Poplar Hill	-	0.9	1.7	2.4	2.8
Black Start	2.3	2.3	2.3	2.2	2.1
Transmission Constraint Rebalancing (TCR)	0.1	0.1	0.1	0.0	0.0
TOTAL	257.8	228.2	313.8	277.9	115.0
Pool Price (\$ /MWh)	57.81	55.83	57.52	50.35	22.19
Gas Price (\$ /GJ)	1.53	1.59	1.65	1.45	2.05

Refer to the Supplementary 2020 Forecast and Budget Information document for additional details including forecast methodologies and variance explanations.

2020 Preliminary Forecast Transmission Line Losses Costs

- Forecast transmission line losses costs is the sum of hourly volumes multiplied by hourly pool prices

$$cost = \sum_{hour} volume * pool price$$

- **Volumes:** derived from an updated statistical model that utilizes economic drivers, weather, and calendar effects
 - This model maps out the relationship between historic load drivers and losses
- **Pool price:** hourly; pool price provided by EDC

Transmission Line Loss Costs Summary

(\$ millions) ~ by production year	2020 Forecast	2019 Projected	2019 BRP	2018 Actual	2017 Actual
Cost (\$ million)	113.5	108.9	126.1	96.7	50.7
Volume (GWh)	1,870	1,874	2,110	1,869	2,212
Pool Price (\$ /MWh)	57.81	55.83	57.52	50.35	22.19

- Transmission losses volumes in 2019 are projected to be lower than the 2019 BRP. This is likely attributed to changes in generation dispatches resulting from more gas-fired generation in conjunction with less coal-fired generation
 - Less coal-fired generation is a result of mothballs/retirements and market fundamentals
- Despite significant load growth, losses volumes are expected to stay flat in 2020 assuming similar conditions to 2019

2020 Preliminary General & Administrative Budget

AESO Own Cost Summary

(\$ millions) ~ by production year	2020* Budget	2019 Projected	2019 BRP	2018 Actual	2017 Actual
General & Administration	97.4	103.6	109.7	111.1	103.0
Interest	7.1	5.3	3.6	1.4	0.5
Amortization	22.1	24.7	21.2	26.1	20.4
Total	126.6	133.5	134.5	138.6	123.9

Differences are due to rounding

*Preliminary

- AESO prepares its Own Cost budget based on the business planned for the budget year
- The AESO's business initiatives were discussed at the October 30, 2019 BRP meeting
- Assessments of required resources both internally and externally are evaluated on various criteria. These include, but are not limited to:
 - resource requirements to deliver on key business initiatives
 - consideration of specialized knowledge, skills or cost effective resources
 - resource constraints due to workflow and timing of initiatives; and
 - risk mitigation requirements

- Subsequent to Government of Alberta (GoA) decision to not continue with the REP and Capacity Market initiatives, AESO Management undertook a detailed review of its resources (staff and consulting)
- Department and individual staff positions were reviewed to assess if excess capacity existed from the GoA decision
- In addition, a high level assessment was undertaken of the AESO's organizational structure to identify opportunities for efficiencies and how the AESO should be structured going forward to achieve its objectives (e.g. operations and transmission departments were combined to form grid reliability)
- As a part of Management's review, resources were assessed to determine if they were adequate, on an overall basis, to deliver on the AESO's base business and initiatives for 2020
- The 2020 proposed budgeted costs were based on this process

- Ensuring reliability of AIES is critical
- Focus on delivery of key initiatives:
 - Market Sustainability and Evolution
 - Tariff
 - Long-term system developments
 - Distribution engagement
 - Stakeholder Engagement Framework
 - External Technology Plan
 - Grid Market Operations (GMO) System
- Driven by the successful delivery of the key corporate initiatives while maintaining our high standards of reliability

- Market Sustainability and Evolution
 - Supply adequacy assessment required to determine what, if any, changes are required to the market structure for long-term sustainability
 - Stakeholder consultation and design required on any recommended changes
 - Creation of reports requested by the Minister of Energy – delivery in February 2020 and July 2020.
 - Initiate design based on any changes in policy direction
 - Continue with the flexibility initiatives including implementation of the dispatch tolerance and ramp rate rule changes and initiate stakeholder engagement for shorter settlement
 - Continue with technology integration market design work to align with the Energy Storage Roadmap and the Distributed Energy Resources (DER) Roadmap
- Tariff
 - Implementation of the 2018 tariff decision
 - Review and application to the AUC of bulk and regional transmission tariff design

- Long-term system developments
 - Obtain AUC approval for the system projects needed to provide long-term benefit to Albertans, including enabling competitive generation included in the AESO's published 2020 Long Term Plan
- Distribution engagement
 - Continue implementation of the DER roadmap
- Stakeholder Engagement Framework
 - Finalize stakeholder engagement framework
 - Initiate organization-wide implementation activities to provide stakeholders a more transparent and meaningful experience

- External Technology Plan
 - Advance technology plan for integrating new electricity value chain technologies, including enhancing AESO awareness, engaging industry, and progressing technology integration plans for energy storage and distributed energy resources
- Grid Market Operations (GMO) System
 - Deliver a sustainable EMS investment plan and a long-term market tools transition plan supporting future energy and AS market plans

- Capacity Market
 - Significant reductions in staff and consulting as a result of direction by the GOA in July of 2019 that Alberta will not transition to a Capacity Market
 - Reduction in planned vacancy rate due to staff reductions and to reflect recent actual vacancy rates
- Renewable Electricity Program (REP)
 - Ongoing administration of the REP program
 - No new competition rounds under a June 2019 direction by the GOA to discontinue the program
- Proposed staff compensation increase to adjust compensation to align with market (subject to separate AESO Board approval)
- Continued focus on Critical Infrastructure Protection (CIP) and cyber security requirements and assessments

- Trading charge for 2020 is consistent with 2015 and 2014 before REP and capacity market initiatives (excluding deferral account shortfall recovery)
- Budgeted general and administrative staff levels for 2020 are consistent with budgeted 2016 staff levels (before adjusted budget for REP in 2016)
- Changes in AESO business from 2016 to 2019 impacting AESO costs:
 - Implemented CIP standards October 1, 2017 (internal and external compliance requirements)
 - Implemented new EMS system June 2017
 - REP rounds 1, 2 and 3 procurement processes completed, but still require support in 2020 and beyond (settlement, legal, project connections, commercial management)
 - SCC expansion project completed in Q4 2019 - operating costs new for 2020
 - Strategic shift to SAAS products, moving costs from capital software to general and administrative
 - Inflationary cost impact (e.g. software licenses and subscriptions, managed services from third parties, etc.)

General & Administrative Costs

(\$ millions) ~ by production year	2020 Budget	2019 Projected	2019 BRP	2018 Actual	2017 Actual
Staff Costs	67.9	76.6	72.8	74.3	67.3
Contract Services & Consultants	7.4	6.1	11.5	12.1	13.3
Administrative	4.8	4.0	4.5	7.6	3.9
Facilities	4.3	3.9	7.8	4.4	6.9
Computer Services and Maintenance	11.6	11.4	11.5	11.2	10.2
Telecommunications	1.5	1.5	1.5	1.5	1.4
Total	97.4	103.6	109.7	111.1	103.0

Differences are due to rounding

*Preliminary

2020 Reconciliation to 2019 Budget

	\$ Million		
2019 Approved Budget			109.7
Staff Costs		(4.9)	
Reduction in staff (48 FTE ↓)	(7.2)		
Proposed salaries adjustment	2.0		
Other	(1.1)		
Decreased vacancy rate (reduced from 8% to 6%)	1.4		
Contract Services and Consultants (reduced for REP and capacity market activities)		(4.1)	
Administration		0.2	
Facilities, Computer Services, Maintenance and Telecommunications		0.1	
Transfer of costs to Amortization and Depreciation in accordance with IFRS 16		(3.6)	(12.3)
2020 Preliminary Budget			97.4

2020 General & Administrative Direct Costs by Function

	*Direct Costs (\$ Million)	* % of total
Transmission	39.6	65.8
Energy Market	18.3	30.4
Renewable Electricity Program	1.8	3.1
Load Settlement	0.4	0.7
Total Direct Costs	60.2	

*Cost estimates by function are currently under review and assessment. They are subject to modification prior to issuance of the final Business Plan and Budget.

*Direct cost estimates includes staff, contract services and consultants, legal and material subscriptions. It excludes overhead allocations and other corporate service costs.

Preliminary Other Industry Costs

(\$ millions) ~ by production year	2020 Budget*	2019 Projected	2019 BRP	2018 Actual	2017 Actual
AUC Fees – Transmission	11.5	11.5	12.2	11.6	11.8
AUC Fees – Energy Market	8.3	7.9	6.5	6.3	6.0
Regulatory Process Costs ***	2.0	4.3	2.9	3.7	1.2
WECC/ NWPP/NERC** Costs	2.8	2.1	2.4	2.1	2.2
Total Costs	24.6	25.9	24.0	23.8	21.2

Differences are due to rounding

* Preliminary

** Western Electricity Coordinating Council / Northwest Power Pool / North American Reliability Corporation

*** Reduction from capacity market activities that occurred or were planned to occur in 2019

2020 Preliminary Energy Market Trading Charge

Trading Charge Components (¢ per MWh)	2020 Budget	2019 Actual	2018 Actual	2017 Actual	2016 Actual	2015 Actual	2014 Actual
AESO Costs	29.8	34.7	23.7	26.2	26.2	27.0	29.1
Energy Market Deficit (Surplus)*	6.6	3.0	(5.5)	-	-	3.2	3.1
Total AESO Component	36.4	37.7	18.2	26.2	26.2	30.3	32.3
AUC's Portion of Energy Market Administration Fee	6.2	4.8	3.2	5.3	5.3	5.5	5.6
Total	42.6	42.5	21.4	31.5	31.5	35.8	37.9

Differences are due to rounding

This information does not include the Market Surveillance Administrator (MSA). The MSA cost recovery amount is approved by the Chair of the AUC in an independent budget process.

* Energy market deferral account shortfall (current and prior year) to be recovered over 3 years (2020 to 2022)

2020 Preliminary Capital Budget

Preliminary Capital Budget Summary

(\$ millions)	2020 Budget	2019 Projected	2019 Budget	2018 Actual	2017 Actual
Key Capital Initiative - Capacity Market	-	9.1	11.0	1.7	-
Key Capital Initiative – EMS Sustainment	4.8	7.0	13.0	-	-
Key Capital Initiatives - Other	8.7	4.2	4.5	2.8	4.4
Other Capital Initiatives	8.9	4.1	5.0	7.4	3.6
Life Cycle Funding	4.9	7.4	6.2	5.2	6.1
Major Project – EMS*	-	-	-	-	6.6
Total IT Related Capital	27.3	31.8	39.8	17.1	20.7
Major Project – SCC**	-	11.7	9.0	8.1	1.8
Facilities	2.1	0.9	0.6	0.1	1.3
Total Facilities Related Capital	2.1	12.6	9.6	8.2	3.1
Total Capital	29.3	44.3	49.4	25.3	23.7

Differences are due to rounding

* Energy Management System (EMS) - Major project implemented in 2017. Ongoing sustainment activity for years 2018-2020.

** System Coordination Centre (SCC) Expansion - Major project completed Q4 2019. Ongoing operation thereafter.

Key Capital Initiatives – Most critical projects that the AESO believes must be completed within the timeframe identified

Other Capital Initiatives – Other projects that have more flexibility in planning or delivery so timing is not as critical

Life Cycle Funding – Leasehold improvements, hardware replacements (end of useful life) and recurring software upgrades

Major Project – Significant multi-year project requiring separate Board approval

Preliminary Capital Budget

(\$ millions)	2020 Budget	2019 Projected	2019 Budget	2018 Actual	2017 Actual
Key Capital Initiative - Capacity Market	-	9.1	11.0	1.7	-
Key Capital Initiative – EMS Sustainment	4.8	7.0	13.0	-	-
Key Capital Initiatives - Other	8.7	4.2	4.5	2.8	4.4
1. Critical Infrastructure Protection (CIP)	1.0	0.5	1.0	0.3	0.1
2. Cyber and Physical Security Advancements	1.9	1.2	2.0	1.4	1.3
3. Market Evolution – Other	1.6	2.5	1.5	0.5	0.1
4. Productivity Applications and Tools	3.3	-	-	-	-
5. Critical Systems External Interface Modernization	0.8	-	-	-	-
6. Reliability - Other (non-EMS)	-	-	-	0.4	-
7. MSR* – Sustainment	-	-	-	0.2	2.9
Other Capital Initiatives	8.9	4.1	5.0	7.4	3.6
Life Cycle Funding	4.9	7.4	6.2	5.2	6.1
Major Project – EMS	-	-	-	-	6.6
Total IT Related Capital	27.3	31.8	39.8	17.1	20.7
Major Project – SCC	-	11.7	9.0	8.1	1.8
Facilities	2.1	0.9	0.6	0.1	1.3
Total Facilities Related Capital	2.1	12.6	9.6	8.2	3.1
Total Capital	29.3	44.3	49.4	25.3	23.7

Differences are due to rounding

*Market System Replacement and Reengineering

Preliminary Capital Budget

Other Capital Initiatives – Summary

- Other application or infrastructure upgrades
 - Reliability other (non-EMS)
 - Energy storage project
 - Facilities – end of life renewals and replacements
 - System Enhancements Program
 - Business technology solutions – productivity
 - Records management
 - Forecasting software
 - Financial systems
 - Market participant portal
 - Various other

Preliminary Capital Budget

Life Cycle Funding - Summary

- Ongoing investment in general infrastructure
 - Communications
 - Database
 - End-user computing
 - Enterprise services
 - Monitoring
 - Network
 - Non-project capital
 - Servers
 - Storage

- 2018 EMS sustainment initiated
 - Completion of definition work for EMS Core and project validation work for EMS Application upgrade (formed part of general capital budget in 2018)
- 2019 EMS sustainment continued
 - Continue design and implementation of EMS Core upgrade to maintain sustainability of the EMS system
- 2020 EMS sustainment continued
 - Continue implementation of EMS Core upgrade to maintain sustainability of the EMS system
 - Initiate design and implementation of EMS application upgrade to advance the application layer of EMS: to support reliability and operation of market and electric systems

Management Controls and Contingency

Results of Forecast	Related Budget Process
If the forecast is <u>below or in line</u> with the previously approved budget amount	At management’s discretion, any under-budget amounts will be used to advance future year business priorities or will be accumulated in the deferral accounts
If the forecast is <u>above</u> the previously approved budget amount and the amount is determined to be a ‘manageable variance’	Management would request approval from the AESO Board and subsequently issue a stakeholder communication
If the forecast is <u>above</u> the previously approved budgeted amount and the amount is in excess of a ‘manageable variance’	Management will review the new funding requirements with stakeholders, followed by a request for approval from the AESO Board

A ‘**manageable variance**’ is a forecast to actual variance that would be:

- Less than 10% of budgeted general and administrative expenditures
- Less than 20% of budgeted capital

Thank you