AESO 2019
Preliminary
Business Plan and Budget Information

Stakeholder Consultation

October 10, 2018

2019 Forecast
Transmission Operating Costs

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Transmission Operating Cost Forecast Summary

($ millions) ~ by production year	2019 Forecast [1]	2018 Projected [2]	2018 BRP [3]	2017 Actual
Wires Costs	1,767.7	1,712.7	1,723.0	1,741.8
Ancillary Services	313.8	294.3	179.2	115.0
Transmission Line Losses	126.1	105.2	96.8	50.4
TOTAL	**2,207.6**	**2,112.2**	**1,999.0**	**1,907.2**
Pool Price (per MWh)	$58	$50	$43	$22

Differences are due to rounding

[1] Forecast: Cost estimates for AESO Board approval for 2019

[2] Projected: Update of previous cost estimates for 2018

[3] 2017-2018 AESO Budget Review Process (BRP) approved numbers for 2018

2019 Forecast
Pool Price

Pool Price Forecast 2018 and 2019

- Hourly pool price forecast is an integral input into calculating the forecast costs for ancillary services and transmission line losses
- For the 2019 BRP, the August to December 2018 and 2019 hourly pool price forecast is obtained from EDC Associates' Quarterly Forecast Update – Third Quarter 2018, released on August 14th 2018
- Decision to use the EDC forecast was due to competing AESO priorities for staff resources
- EDC is considered a reliable industry information source

Pool Price Forecast August to December 2018 and 2019 (continued)

- Key assumptions in the EDC Associates' Quarterly Forecast Update – Third Quarter 2018 include:
  - Recent market fundamentals such as the Carbon Competitiveness Incentive Regulation (CCIR), tightening supply from retirements/mothballs, and Renewable Electricity Program (REP) round one additions
  - The forecast used is a single run from a sample of 50 runs. The single run that had the annual price closest to the EDC summary annual price was chosen as the representative price curve
    - Single run produced a price duration curve more representative of actual price duration curves compared to average of all runs

Pool Price Forecast August to December 2018 and 2019 (continued)

As of August 23, 2018, the forward market price is consistent with the EDC forecast

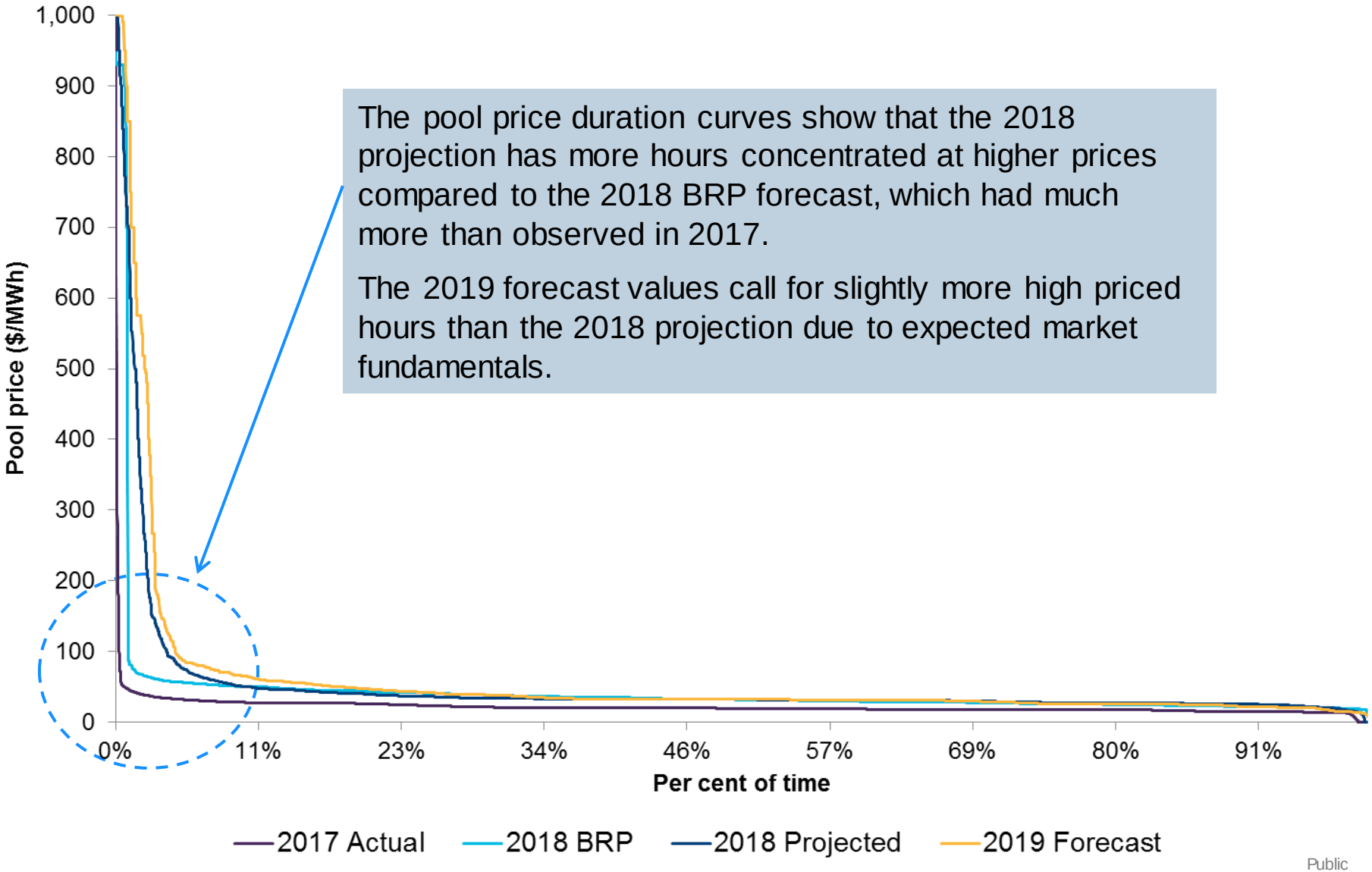
2018	EDC Forecast RoY	Forward Market RoY *	2018 Projected	2018 BRP
Average Hourly Pool Price (per MWh)	$53.47	$58.03	$49.95	$42.58
AECO-C Natural Gas Price (per GJ)	$1.54	$1.54	$1.52	$2.83

2019	EDC Forecast	Forward Market*
Average Hourly Pool Price (per MWh)	$57.52	$53.50
AECO-C Natural Gas Price (per GJ)	$1.65	$1.62

RoY – remainder of year - corresponds to August to December 2018

* Source: NGX (Aug 23, 2018)

Pool Price Duration Curves



The pool price duration curves show that the 2018 projection has more hours concentrated at higher prices compared to the 2018 BRP forecast, which had much more than observed in 2017.

The 2019 forecast values call for slightly more high priced hours than the 2018 projection due to expected market fundamentals.

2019 Load Outlook

Load Outlook

- The AESO in the BRP process prepares a near term load outlook for context to the AESO's cost forecasts
- 2018-2019 load outlook considers:
  - Alberta real GDP, population, and labour predictions from the Conference Board of Canada Spring 2018 Outlook
  - Oilsands production from the 2018 CAPP forecast
  - Historic weather patterns (normal weather)
- Alberta Internal Load (AIL) is estimated to grow:
  - 3.0% from 2017 to 2018
    - This is inline with load growth observed from 2016-2017, 3.8%, and year-to-date load growth from January to July of 3.6%
  - 0.8% from 2018 to 2019

Load Outlook (continued)

- Load growth is expected due to:
  - Forecasted economic and population growth
  - Expected Oilsands production growth
  - Forecasted load growth in 2018 from new sources

(GWh)	2019 Forecast	2018 Projected	2018 BRP	2017 Actual	2016 Actual
AIL* Volumes	85,785	85,079	84,607	82,572	79,560
Per cent change (YoY)	0.8%	3.0%**	2.5%	3.8%	N/A

YoY = Year over Year

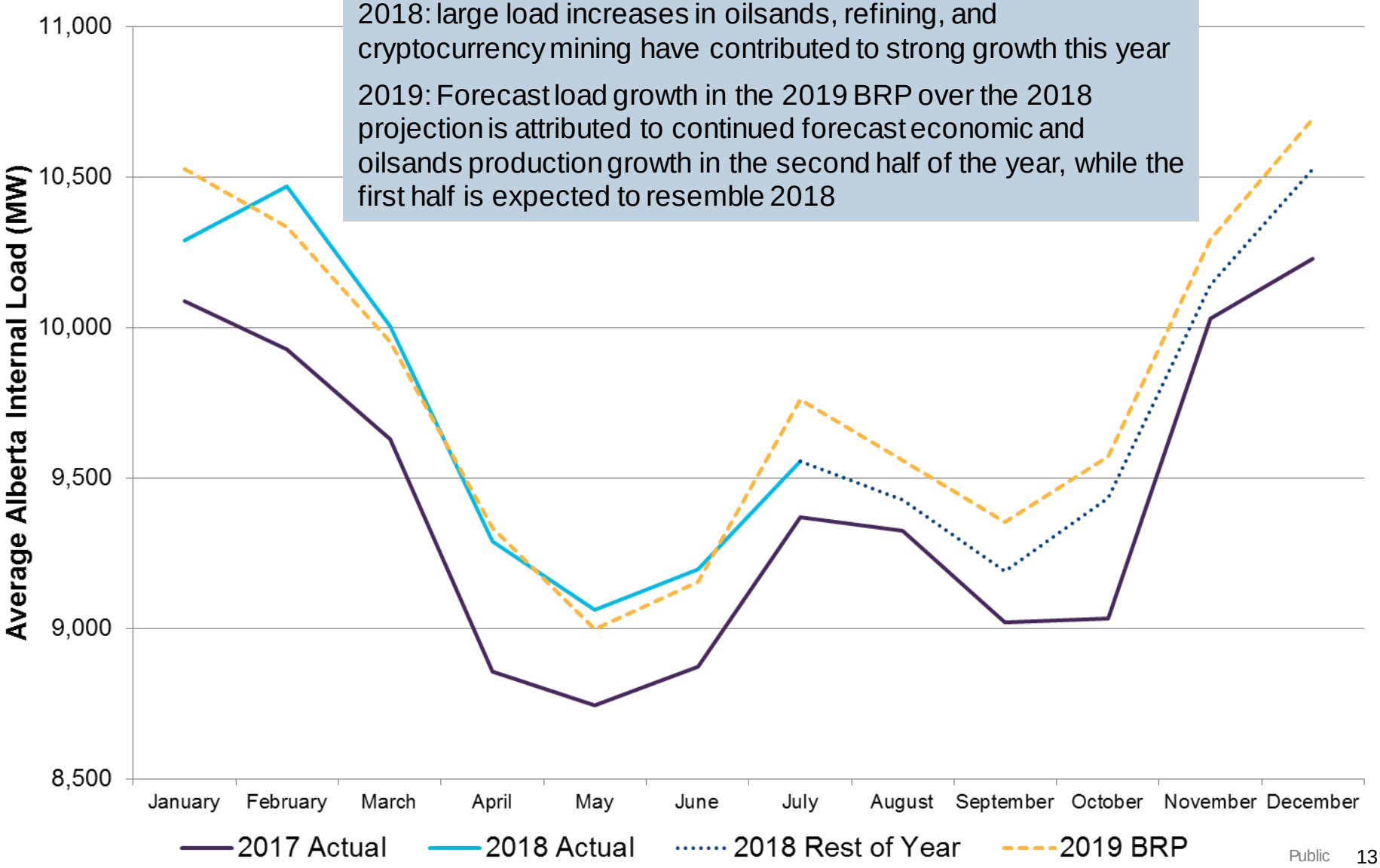
* AIL – Alberta Internal Load

** 2018 projected compared to 2017 actual

Load Outlook

2018: large load increases in oilsands, refining, and cryptocurrency mining have contributed to strong growth this year

2019: Forecast load growth in the 2019 BRP over the 2018 projection is attributed to continued forecast economic and oilsands production growth in the second half of the year, while the first half is expected to resemble 2018



2019 Preliminary Forecast
Wires Costs

Wires Cost Summary
2019 Forecast

($ millions) ~ by production year	2019 Forecast	2018 Projected	2018 BRP	2017 Actual	2016 Actual
Wires	1,763.0	1,707.9	1,717.6	1,737.1	1,719.4
Invitation to Bid on Credit (IBOC)	2.1	2.0	1.9	1.7	1.8
Location Based Credit Standing Offer (LBC SO)	2.5	2.8	3.5	3.0	3.2
TOTAL	**1,767.6**	**1,712.7**	**1,723.0**	**1,741.8**	**1,724.4**

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

2019 Preliminary Forecast
Ancillary Services Costs

Ancillary Services Cost Summary 2019 Forecast

($ millions) ~ by production year	2019 Forecast	2018 Projected	2018 BRP	2017 Actual	2016 Actual
Operating Reserve (OR)	270.6	250.4	146.6	80.7	66.4
Load Shed Service for Imports (LSSi)	32.8	32.8	17.3	22.9	18.2
Contracted Transmission Must-run (TMR)	3.2	3.0	3.3	3.0	n/a
Conscripted Services (OR and TMR)	0.2	0.2	2.0	0.5	0.7
Reliability Service	2.9	2.9	2.9	2.9	2.9
Poplar Hill	1.7	2.7	2.8	2.8	2.8
Black Start	2.3	2.2	4.3	2.1	2.1
Transmission Constraint Rebalancing (TCR)	0.1	0.1	0.1	0.0	0.0
TOTAL	**313.8**	**294.3**	**179.2**	**115.0**	**93.2**

Differences are due to rounding

Pool Price (per MWh) -	$57.52	$49.95	$42.58	$22.18	$18.28
Gas Price (per GJ) -	$1.65	$1.52	$2.83	$2.05	$2.06

Refer to the Supplementary 2019 Forecast and Budget Information document for additional details including forecast methodologies and variance explanations.

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 two years

2019 Preliminary Forecast
Transmission Line Losses Costs

Public

Transmission Line Loss Costs Summary

($ millions) ~ by production year	2019 Forecast	2018 Projected	2018 BRP	2017 Actual	2016 Actual
Cost ($ million)	$126.1	$105.2	$96.7	$50.4	$41.3
Volume (GWh)	2,110	2,012	2,225	2,222	2,165
Pool Price ($/MWh)	$57.52	$49.95	$42.58	$22.18	$18.28

- Transmission losses volumes are declining in 2018 despite significant load growth. This impact is likely attributed to significant changes in generation dispatches resulting from high imports and gas-fired generation in conjunction with lower coal-fired generation
- Increased load growth into 2019 is forecast to increase losses from 2018 projected levels

Forecast Methodology
Line Losses

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

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

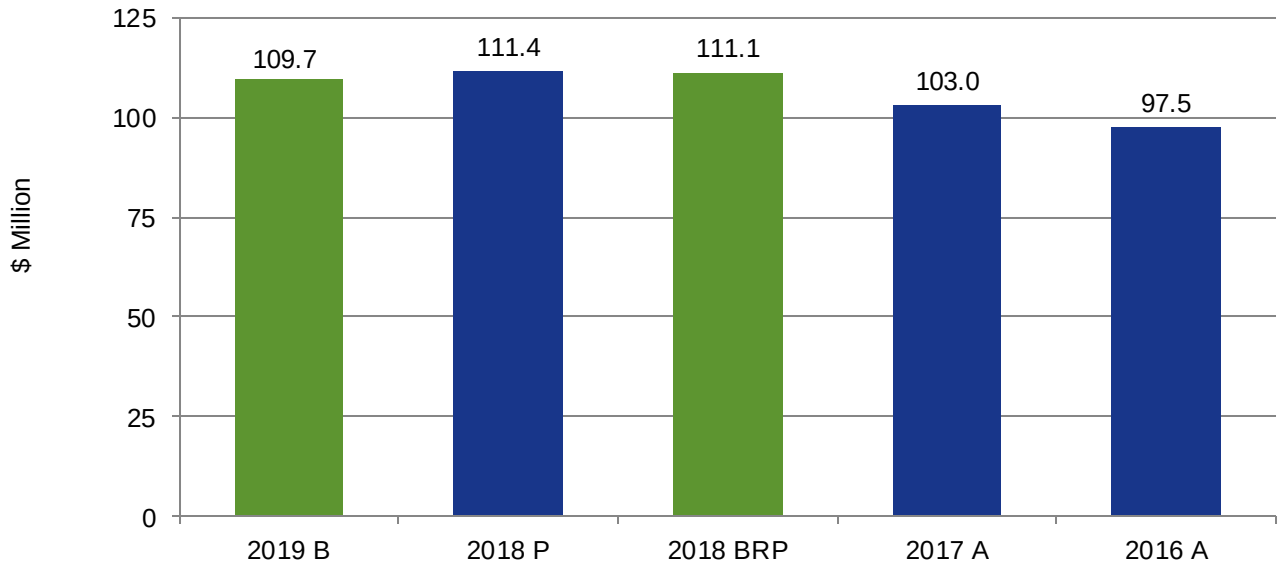
- **Volumes**: derived from an updated statistical model that utilizes forecast load, weather, and calendar effects
  - This model maps out the relationship between historic load and losses
- **Pool price**: hourly pool price provided by EDC

2019
Preliminary
General and Administrative Budget

Own Costs Summary

($ millions)	2019 Budget*	2018 Projected	2018 BRP	2017 Actual	2016 Actual
General & Administration	109.7	111.4	111.1	103.0	97.5
Interest	3.6	1.5	1.5	0.5	0.8
Amortization	21.2	22.4	19.9	20.4	24.3
TOTAL	134.5	135.3	132.5	123.9	122.6

* Preliminary



General and Administrative 2019 Budget Process

- AESO prepares its Own Cost budget based on the business initiatives planned for the budget year
- The AESO's business initiatives were discussed at the September 18, 2018 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

General and Administrative Budget Considerations

- Ensuring reliability of AIES is critical
- Focus on delivery of key initiatives:
  1. Capacity Market
  2. Tariff
     - General Tariff Application
     - Tariff cost allocation for Capacity Market
  3. Renewable Electricity Program (REP)
  4. Advancement of the Fort McMurray West project (energization in 2019)
  5. System Coordination Center (SCC) facility expansion (completion in Q4 2019)
  6. Advance intertie restoration
  7. Western Interconnection Reliability Coordinator (RC) Initiative (implementation of tools, as required)
- Driven by the successful delivery of the key corporate initiatives while maintaining our high standards of reliability

Budget Considerations

- Capacity Market
  - Capacity Market rules to be filed with the AUC - obtain regulatory approval
  - Focus on development and implementation of required IT tools
  - Position AESO to commence opening first capacity procurement process in Q4 2019
  - Continue development of process, guidelines and education
  - EMS assessment to integrate new Capacity Market rules and Energy Market & Ancillary Services changes from market transition as required
- AESO Tariff
  - Continue tariff approval process and implementation of the 2018 ISO tariff application
  - Tariff cost allocation facilitation

Budget Considerations

- Renewable Electricity Program (REP)
  - Advancement of REP Rounds 1, 2 and 3 program
  - Limited funding for REP initiatives (no specific funding for future REP rounds)
- Fort McMurray West
  - Requires project inspections and Independent Certifier work to be completed prior to energization
  - Completion of any internal processes and required tools
- System Control Centre Expansion
  - Project to be completed in Q4 2019 - operating costs included for Q4 2019
- Project validations (business case development)
  - EMS critical systems validation for system sustainment
  - Increase in validations directly correlated to increased capital initiatives in 2019 (see capital section of this presentation)
- Staff resources focused on capital projects in 2019 (Capacity Market and EMS Sustainment)

Other Budget Considerations

- 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
- Grid technology roadmaps (Flexibility and Storage) and engineering support studies
- Ongoing review of IT service-levels and rationalization of maintenance and license costs
- Ongoing focus on corporate-wide targeted approach to find best value while reducing costs for general expenditures (e.g. contractor versus employee)

Other Budget Considerations

- Other Industry Costs - AUC Proceeding 790 has resulted in the AESO being directed to recalculate loss factors and loss charges and credits for generators, importers, exporters, and demand opportunity services for the years from 2006 to 2016
  - A payment plan is to be made available, extending recovery of charges up to three years
  - Interest costs associated with the directive will be recovered from payment plan participants. Estimated interest in the amount of $1.5 million has been included in the 2019 forecast and will be offset by interest income (recovery of interest costs from market participants who qualify for the payment plan)

Other Budget Considerations

- Other Industry - Regulatory Process Costs
  - Bill 13 amends the ISO rules process under the EUA such that ISO rules do not take effect unless they are approved by the AUC.
    - It also gives the AUC greater powers with respect to the approval of ISO rules.
    - It creates a special provisional approval process for the ISO rules relating to the capacity market. The AUC is required to grant an order setting out which of the ISO rules relating to the capacity market, if any, it will consider for the provisional approval process. The AUC has opened the proceeding early to undertake the scoping exercise.
  - Regulatory process costs are anticipated to increase due to the additional AUC proceedings and required submissions.
  - Expected proceedings to occur or be initiated in 2019 are as follows:
    - Capacity Market - Provisional Proceeding
    - Capacity Market – Comprehensive Proceeding
    - Capacity Market - Tariff Cost Allocation Proceeding
    - 2018 Tariff Proceeding
    - Various Need Identification Document (NID) Proceedings

General & Administrative Costs

	2019 Budget*	2018 Projected	2018 BRP	2017 Actual	2016 Actual
Staff Costs	72.8	72.5	72.1	67.3	66.4
Contract Services & Consultants	11.5	14.0	15.3	13.3	9.0
Administrative	4.5	4.6	3.9	3.9	4.3
Facilities	7.8	7.7	7.4	6.9	7.0
Computer Services and Maintenance	11.5	10.9	11.0	10.2	9.3
Telecommunications	1.5	1.6	1.3	1.4	1.5
TOTAL	**109.7**	**111.4**	**111.1**	**103.0**	**97.5**

Differences are due to rounding

* Preliminary

2019 Preliminary Budget

	$ Million		
2018 Approved Budget			**111.1**
Staff Costs		0.7	
Proposed salary adjustment	1.2		
Additional staff (5.4 FTE ↑)	1.1		
Business resources focused on capital projects (11 FTE↑)	(1.5)		
General staff costs	(0.1)		
Contract Services and Consultants		(3.9)	
Administration		0.6	
Facilities and Maintenance		0.4	
Computer Services		0.8	**(1.4)**
2019 Preliminary Budget			**109.7**

2019 General & Administrative Direct Costs by Function

	*Direct Costs ($ Million)	* % of total
Transmission	49.3	57
Energy Market	15.2	18
Capacity Market – Design	4.7	6
Capacity Market - Implementation	10.6	13
Renewable Electricity Program	4.0	5
Load Settlement	0.8	1
Total Direct Costs	**84.6**	

*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. It excludes overhead allocations and corporate service costs.

Other Industry Costs

$ Million	2019 Budget*	2018 Projected	2018 BRP	2017 Actual	2016 Actual
AUC Fees – Transmission	12.2	11.7	12.8	11.8	12.1
AUC Fees – Energy Market	6.5	6.3	6.5	6.0	6.6
Regulatory Process Costs	2.8	2.4	1.5	1.2	1.4
WECC/NWPP/NERC** Costs	2.4	2.1	2.2	2.2	2.4
Total Costs	**23.8**	**22.4**	**23.0**	**21.2**	**22.6**

Differences are due to rounding

*Preliminary

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

2019
Preliminary Capital Budget

Public

Capital Budget

($ millions)	2019 Budget	2018 Projected	2018 BRP	2017 Actual	2016 Actual	2015 Actual
Key Capital Initiative - Capacity Market	10.5	2.1	0.5	-	-	-
Key Capital Initiative – EMS Sustainment	13.0	-	-	-	-	-
Key Capital Initiatives - Other	5.0	3.6	4.0	4.4	3.3	10.1
Other Capital Initiatives	5.0	7.8	7.5	3.6	2.6	3.5
Life Cycle Funding	6.2	5.2	6.5	6.1	7.2	3.1
Major Project – MSR	-	-	-	-	2.3	4.6
Major Project – EMS*	-		-	6.6	15.4	7.3
Total IT Related Capital	**39.8**	**18.7**	**18.4**	**20.7**	**30.7**	**28.6**
Major Project – SCC**	9.0	10.4	16.0	1.8	0.7	-
Facilities	0.6	0.0	-	1.3	-	-
Total Facilities Related Capital	**9.6**	**10.4**	**16.0**	**3.1**	**0.7**	-
Total Capital	**49.4**	**29.1**	**34.4**	**23.7**	**31.4**	**28.6**

Differences are due to rounding

* Energy Management System (EMS) Implementation spend approved by AESO Board September 2015

** System Coordination Centre (SCC) Expansion – AESO Board Approved December 2016

Capital Budget Categories

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

Capital Budget

($ millions)	2019 Budget	2018 Projected	2018 BRP	2017 Actual	2016 Actual
Key Capital Initiative - Capacity Market	**10.5**	**2.1**	**0.5**	**-**	**-**
Key Capital Initiative – EMS Sustainment	**13.0**	**-**	**-**	**-**	**-**
Key Capital Initiatives - Other	**5.0**	**3.6**	**4.0**	**4.4**	**3.3**
1. Reliability EMS and non-EMS	-	0.4	0.4	-	-
2. Critical Infrastructure Protection	1.0	0.3	0.5	0.1	0.7
3. Cyber and Physical Security Advancements	2.0	1.8	2.0	1.3	1.7
4. MSR – Sustainment	-	0.2	-	2.9	-
5. Market Evolution – Other	2.0	0.6	0.7	0.1	-
6. Interties	0.0	0.2	-	-	-
7. AESO Website Replacement	-	-	-	-	0.6
8. Technology Solutions	-	-	0.5	-	-
Other Capital Initiatives	**5.0**	**7.8**	**7.5**	**3.6**	**2.6**
Life Cycle Funding	**6.2**	**5.2**	**6.5**	**6.1**	**7.2**
Major Project – MSR	**-**		**-**	**-**	**2.3**
Major Project – EMS*	**-**		**-**	**6.6**	**15.4**
Total IT Related Capital	**39.8**	**18.7**	**18.4**	**20.7**	**30.7**
Major Project – SCC**	**9.0**	**10.4**	**16.0**	**1.8**	**0.7**
Facilities	**0.6**	0.0	**-**	**1.3**	**-**
Total Facilities Related Capital	**9.6**	**10.4**	**16.0**	**3.1**	**0.7**
Total Capital	**49.4**	**29.1**	**34.4**	**23.7**	**31.4**

Difference are due to rounding

Capital Budget
Other Capital Initiatives – Summary

- Other application or infrastructure upgrades
  - Reliability other (non EMS)
  - System Enhancements Program
  - Business technology solutions
    - Records management
    - Financial system
    - Various other

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

Key Capital – EMS Sustainment

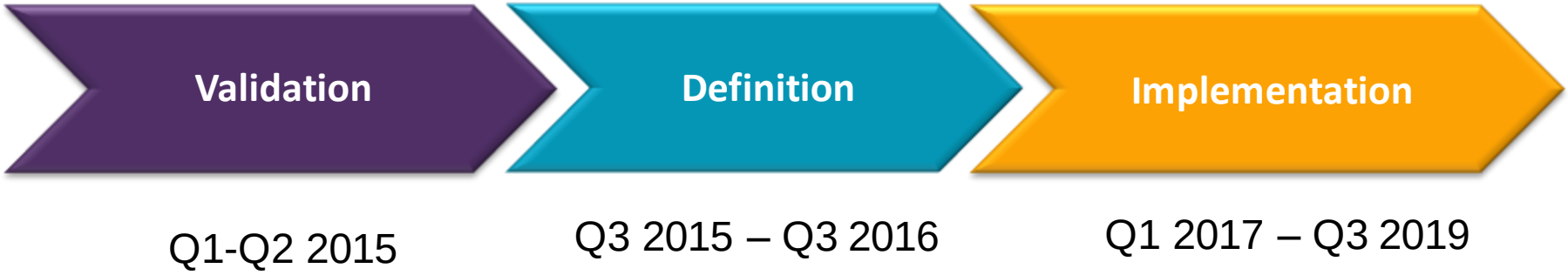
- 2018 EMS sustainment initiated
  - Completion of definition work for EMS Core and project validation work for EMS Application upgrade (formed part of general capital budget in 2018)
- 2019 EMS sustainment continued
  - Continue design and implementation of EMS Core upgrade to maintain sustainability of the EMS system
  - Initiate design and implementation of EMS application upgrade to advance the application layer of EMS: to support reliability and operation of the evolving, complex market and electric systems
- Estimated Cost: $35 to $40 million for 2019 to 2021

Key Capital – Capacity Market Implementation IT Systems and Solutions for Market Evolution

- 2018 Capacity Market IT systems work initiated
  - Initiated development of tools to support capacity delivery (settlement, performance measurement) and energy market changes for first capacity delivery period
  - Reliability model to support development of capacity market demand curve implemented. High level design for capacity market auction tools in development
- 2019 Capacity Market IT systems work continued
  - Continue major program to design and implement systems to support the capacity market, including projects for:
    - Calculation of Unforced Capacity (UCAP) for market participant assets
    - Capacity market auction solution(s) encompassing pre-auction, auction and rebalancing
    - Settlement and Performance of the capacity market in accordance with ISO Rules
    - Related Energy and Ancillary Service market changes as required
  - Required tools, enhancements, and process for market evolution and sustainment of existing systems
- Estimated Cost: $35 to $40 million for 2019 to 2021

Major Capital Project
SCC Expansion Program – Implementation

- Expand the System Coordination Centre (SCC) to accommodate the increase in staffing levels required to support new services and new control room applications/tools



- Implementation phase initiated Q1 2017
- Activities include: detailed design, permits, award of contract, construction, commissioning, and closeout
- Target completion Q4 2019; cost estimate for implementation phase $21.9M

Management Controls and Contingency

Management Controls and Contingency

Results of Forecast	Related Budget Process
If the forecast is below or in line 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 above 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 above 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