ISO Tariff Design Update

July 16, 2016

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Agenda

Time	# min	Agenda Item	Presenter
9:00 am – 9:05 am	5 min	Housekeeping and overview of session	Matt Gray
9:05 am – 9:20 am	15 min	Tariff design engagement process	Doyle Sullivan
9:20 am – 9:30 am	10 min	Update on tariff design for bulk and regional transmission cost allocation	Doyle Sullivan
9:30 am – 10:45 am	75 min	Update on tariff design for capacity market cost allocation	John Martin
10:45 am – 11:00 am	**15 min**	**Break**	
11:00 am – 11:55 am	55 min	Questions and discussion	
11:45 am – 11:50 am	5 min	Next steps	Matt Gray

Tariff Design Engagement Process

About the AESO's Approach

- Legislation introduced to enable the capacity market prescribed that capacity market costs be allocated through the ISO tariff
- As a result the ISO tariff now has two parts:
  - Allocation of capacity market costs
  - Allocation of transmission system costs
- The AESO recognized the importance of keeping tariff signals aligned and decided to combine these matters into a single consultation

Engagement Process Overview

- Tariff Design Advisory Group (TDAG) launched August 2018
- Objectives:
  - AESO and industry to work together to develop recommendations for allocating costs of:
    - The capacity market
    - Bulk and regional transmission
  - AESO would then consider these recommendations when developing their filings
- Approach
  - Advisory group, working groups
    - Industry-nominated and AESO members
    - Broad industry has opportunities to raise issues through TDAG representative or directly to the AESO
- Timelines
  - Capacity market cost allocation: Filing July 26, 2019
  - Bulk and regional transmission cost allocation: Filing March 31, 2020

Terms of Reference

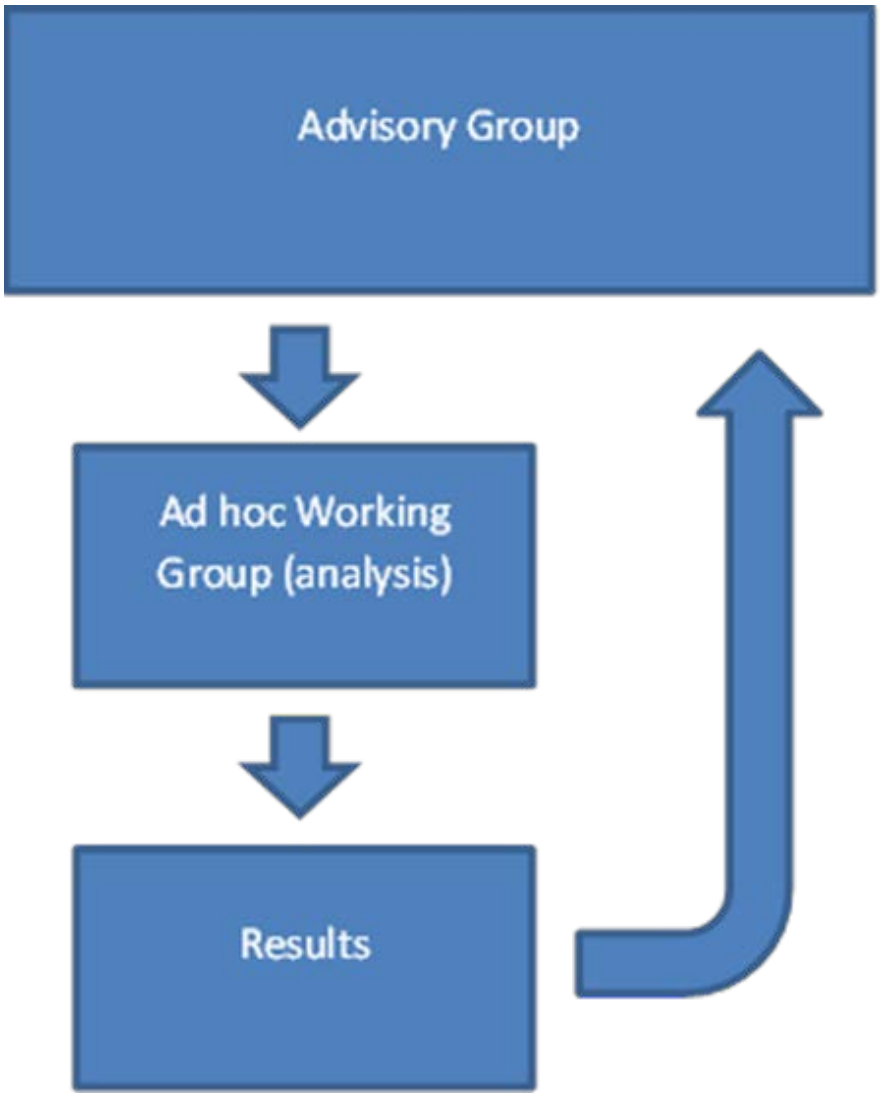
- Developed by TDAG
- Key attributes
  - Meeting the requirements of legislation
  - Identifying, developing and evaluating a comprehensive list of options for allocating capacity costs and bulk and regional transmission costs
  - Minimize the long-term costs of transmission and capacity, and optimize overall costs to consumers
  - Limit undue cross subsidization
  - Defined scope

Terms of Reference (continued)

- Key attributes (continued)
  - Achieving consistency among tariff components (e.g., consistency across energy, capacity, transmission and distribution such that different tariff provisions remain aligned as much as possible)
  - The fair distribution of costs, in a manner that provides incentives for economic efficiency (meaning for e.g., in the case of the capacity market cost allocation, incentives to reduce the volume of capacity that needs to be procured, and in the case of bulk and regional transmission cost allocation, incentives to reduce the amount of transmission infrastructure that will be required over time).
- Terms of Reference amended to address implementation aspects of ISO capacity market tariff.

Tariff Design Advisory Group (TDAG)

- Role of the TDAG is ultimately to develop recommendations for AESO's consideration
- To achieve this, the TDAG establishes work groups, directs their activities, receive updates and reviews and approves any working group recommendations for AESO's consideration



Governance and Transparency

- Governance
  - Recommendations are developed by TDAG or by working groups
    - Typically by WGs, after analysis and discussion
    - Consensus or not
- Transparency
  - Posting TDAG materials to the website
  - Posting TDAG meeting notes
  - Publishing notices in AESO stakeholder newsletter

Questions

Transmission Tariff Design Update

Update

- Bulk and regional transmission tariff work has been constrained by preparation for 2018 tariff proceeding and by capacity market cost allocation
  - Post capacity market tariff filing, TDAG's focus will shift to transmission
- Studies underway
- Tariff Design Overview study
  - Historical ISO tariff design overview
  - Other industry pricing and tariffs review
  - Jurisdictional review including functionalization, classification, allocation and opportunity services review
  - Consultant supporting some of this work; decision week of July 15.

Questions

Capacity Market Cost Allocation Tariff Development Update

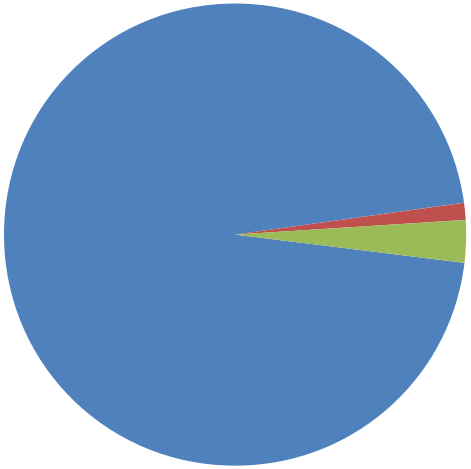
Topics

- Determination of time blocks
  - Use of resource adequacy model and net-CONE procurement volume
- Determination of weights
  - Potential adjustments by applying multipliers to average unserved energy
  - Economic efficiency analysis
- True-up using quarterly adjustment rider
- Proposal to “gross up” POD volumes for distributed generation
- Allocation to transmission line losses

All quantities are preliminary and subject to adjustment

AESO must allocate costs of capacity market using weighted energy method

- Costs of capacity market for obligation period are to be allocated to all classes of system access service whose members receive electricity from transmission system and to transmission line losses [§12(4) of *Regulation*]
  - Includes demand services and export services
  - Includes isolated communities “as if the isolated community were being provided with system access service via the interconnected electric system”



Percentage of annual energy forecast for first capacity market obligation year (Nov 2021 – Oct 2022)

AESO will base cost allocation on net-CONE procurement volume

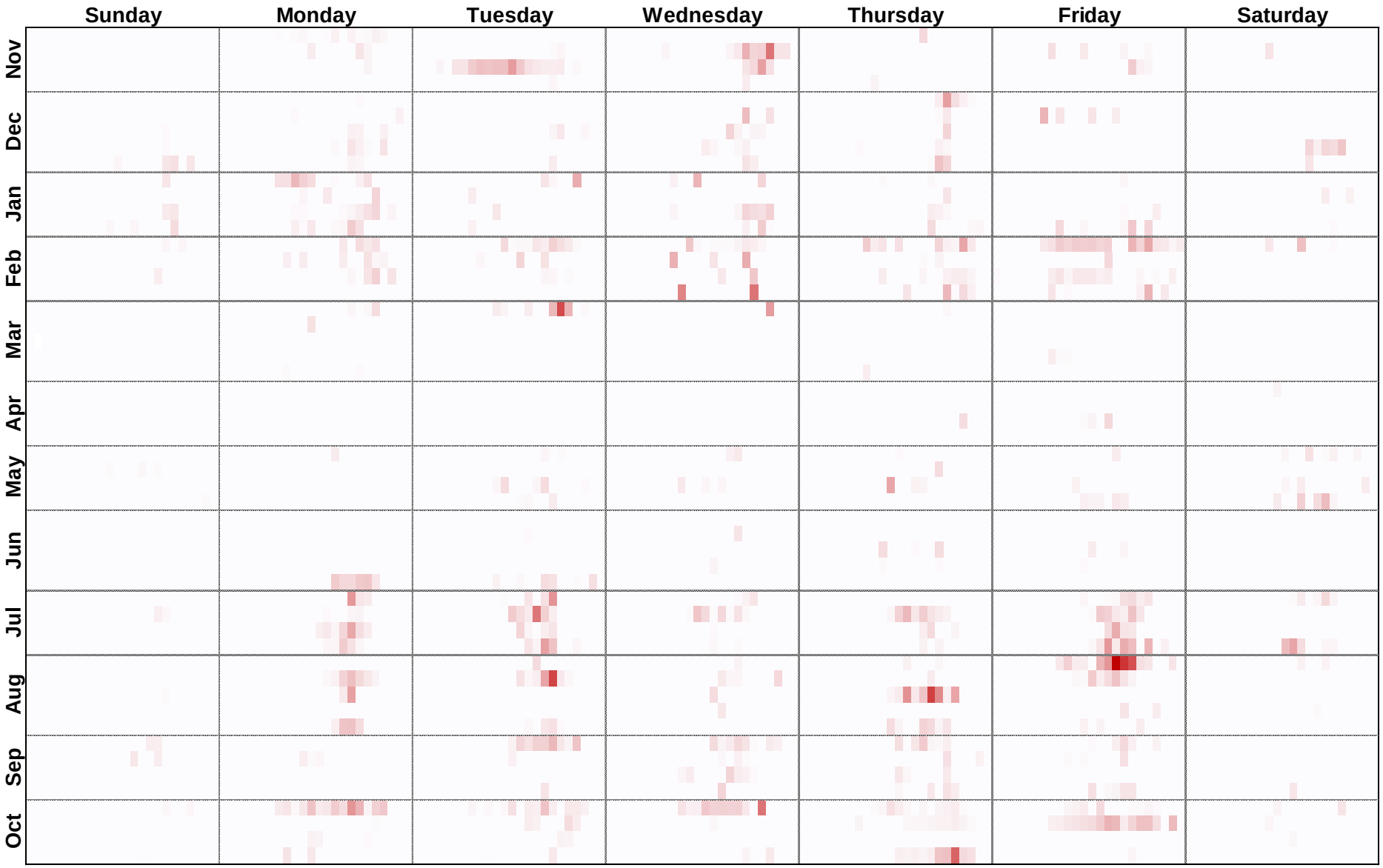
- Alberta's resource adequacy standard is a minimum that must be continually met
- Expected unserved energy for cost allocation will be determined at the procurement capacity volume associated with the net-CONE price level (rather than at the gross minimum procurement volume)
  - Capacity volume at net-CONE price level is equal to 106% of net minimum procurement volume, which can be interpreted as the long-run equilibrium
  - Capacity volume at net-CONE price level is the quantity that is consistent with the estimated marginal cost of supply
  - It is expected that the capacity market will clear at various points along the demand curve as capacity resources enter and exit the market

Updated resource adequacy model used to establish time blocks and weights

- Resource adequacy model (RAM) is a forward-looking probabilistic simulation model that uses hourly distributions and inputs of supply and demand variables to quantify the impact of capacity on supply adequacy

- Resource adequacy model identifies relationship between expected unserved energy and total installed maximum capability of assets that supply capacity
- Unserved energy distribution based on updated RAM filed on May 31 following RAM Technical Meeting

Expected unserved energy (EUE) is distributed throughout obligation period



Unserved energy at net-CONE volume supports same high-weight time blocks

HE	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Sum
Nov	-	-	-	-	-	1	1	2	1	1	1	3	1	1	2	2	3	**6**	**3**	3	3	1	1	-	36
Dec	-	-	-	-	-	-	1	-	1	-	-	-	2	-	-	2	1	**4**	**6**	1	2	-	-	-	20
Jan	-	-	-	-	-	-	-	1	1	-	1	2	-	1	-	1	4	**5**	**4**	7	3	-	-	-	30
Feb	-	-	-	-	-	-	1	3	4	3	6	3	3	4	4	2	2	**5**	**8**	6	4	4	-	1	63
Mar	-	-	-	-	-	-	-	1	1	-	1	1	-	-	1	-	-	1	1	1	1	-	-	-	9
Apr	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	-	-	-	2
May	-	-	-	-	-	-	-	-	-	1	-	2	-	-	1	2	3	2	-	-	-	-	-	-	11
Jun	-	-	-	-	-	-	-	-	-	-	1	-	1	-	1	1	3	3	1	1	-	-	1	-	13
Jul	-	-	-	-	-	-	-	-	-	-	-	1	3	6	8	**8**	**13**	**11**	5	2	-	-	-	-	57
Aug	-	-	-	-	-	-	-	-	1	1	1	1	2	5	5	**8**	**10**	**6**	3	2	1	1	1	-	48
Sep	-	-	-	-	-	-	-	-	-	-	2	1	3	2	3	**5**	**9**	**3**	6	1	2	-	-	-	37
Oct	-	-	-	-	-	-	-	1	3	2	2	5	5	4	5	**3**	**5**	**6**	2	8	6	1	1	-	59
Sum	**-**	**-**	**-**	**-**	**-**	**1**	**3**	**8**	**12**	**8**	**15**	**19**	**20**	**23**	**31**	**34**	**53**	**52**	**39**	**32**	**23**	**7**	**4**	**1**	**385**

Values are count of hours with unserved energy contribution greater than 0.0830% per hour, on non-holiday weekdays

Unserved energy at net-CONE volume also supports same weekday time blocks

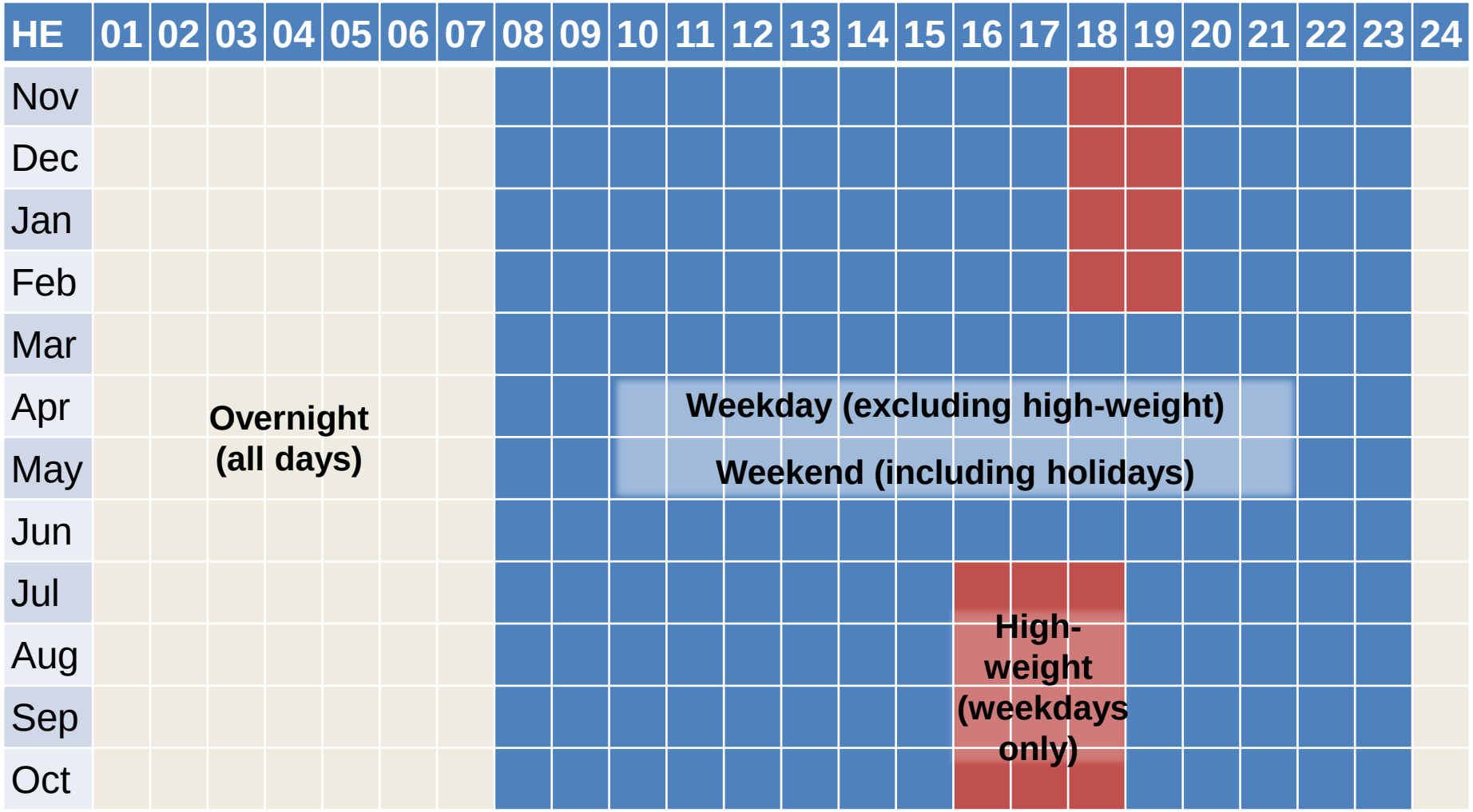
HE	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Sum
Nov	-	-	-	1	-	-	-	2	1	3	2	-	1	1	-	2	1			2	1	1	-	-	18
Dec	-	-	-	-	-	-	-	1	-	2	-	1	-	2	1	1	5			2	3	2	1	-	21
Jan	-	-	-	-	-	-	-	2	2	2	4	1	1	-	1	2	6			-	2	2	1	-	26
Feb	1	-	-	-	-	-	-	-	2	3	-	1	2	3	2	3	5			5	3	3	2	-	35
Mar	-	-	-	-	-	-	-	1	2	1	-	1	-	1	-	-	-	1	1	-	-	1	-	-	9
Apr	-	-	-	-	-	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-	-	-	-	4
May	-	-	-	-	-	-	-	-	-	-	3	1	3	3	3	3	1	-	2	-	-	1	-	-	20
Jun	-	-	-	-	-	-	-	-	-	-	2	1	-	3	2	-	2	1	-	-	1	-	-	-	12
Jul	-	-	-	-	-	-	-	-	-	-	3	4	5	6	4				1	1	1	1	-	-	26
Aug	-	-	-	-	-	-	-	-	-	-	1	3	-	2	6				2	2	-	-	-	-	16
Sep	-	-	-	-	-	-	-	-	-	2	3	3	6	3	4				3	1	1	1	1	1	29
Oct	-	-	-	-	-	-	1	3	-	5	3	3	2	4	2				6	3	3	3	-	-	38
Sum	**1**	**-**	**-**	**1**	**-**	**-**	**1**	**9**	**7**	**18**	**22**	**20**	**21**	**29**	**25**	**11**	**20**	**2**	**15**	**16**	**15**	**15**	**5**	**1**	**254**

Values are count of hours with unserved energy contribution greater than 0.0001% per hour, on non-holiday weekdays excluding high-weight hours

Analysis of unserved energy distribution results in four time blocks

Time Block	Days	Months	Times
High-weight	Non-holiday weekdays	Nov to Feb	17:00:00 to 18:59:59
		Jul to Oct	15:00:00 to 17:59:59
Weekday	Non-holiday weekdays	Nov to Feb	07:00:00 to 16:59:59 19:00:00 to 22:59:59
		Mar to Jun	07:00:00 to 22:59:59
		Jul to Oct	07:00:00 to 14:59:59 18:00:00 to 22:59:59
Weekend	Weekends and holidays	Year-round	07:00:00 to 22:59:59
Overnight	All days	Year-round	00:00:00 to 06:59:59 23:00:00 to 23:59:59

Each time block includes hours with “reasonably similar” unserved energy



High-weight: 411 hours
Weekend (light-weight): 1,856 hours

Weekday (medium-weight): 3,573 hours
Overnight (light-weight): 2,920 hours

Working group examined and rejected shorter weekend time block

- Shorter weekend (light-weight) time block affected rates in multiple time blocks
  - Small increase (≈$1/MWh) in weekday rate
  - Material increase (≈$3–5/MWh) in weekend rate, over fewer hours
  - Small increase (≈$0.5–1/MWh) in overnight rate, over more hours
- Shorter weekend time block did not improve hours having “reasonably similar” expected unserved energy in time blocks

Weights must correspond to unserved energy in each time block

- AESO must assign weights corresponding to anticipated contributions that demand for and supply of energy in hours in time block have on amount of capacity needed in obligation period to meet resource adequacy standard [§12(5)(c) of *Regulation*]
- AESO considers that meaning of “corresponding to” is different from meaning of “equal to”, particularly when considered in context of legislative scheme as a whole
- AESO considers that adjustments to the weights must maintain a reasonable relationship or correlation with expected unserved energy, but does not have to be equal to expected unserved energy

Weights could be adjusted by applying multipliers to average unserved energy

Time Block	Hours	Average EUE/hour	EUE/hour Multiplier	Weight	Energy (GWh)	Costs ($ 000 000)	Rate ($/MWh)
High-weight	411	0.0853%	1×	0.0853%	3,477.3	$364.0	$104.70
Weekday	3,573	0.0155%	1×	0.0155%	28,708.4	$546.5	$19.00
Weekend	1,856	0.0048%	1×	0.0048%	14,406.0	$81.7	$5.70
Overnight	2,920	0.0003%	1×	0.0003%	20,839.7	$7.8	$0.40
All hours	8,760	0.0114%	—	—	67,431.4	$1,000.0	$14.80

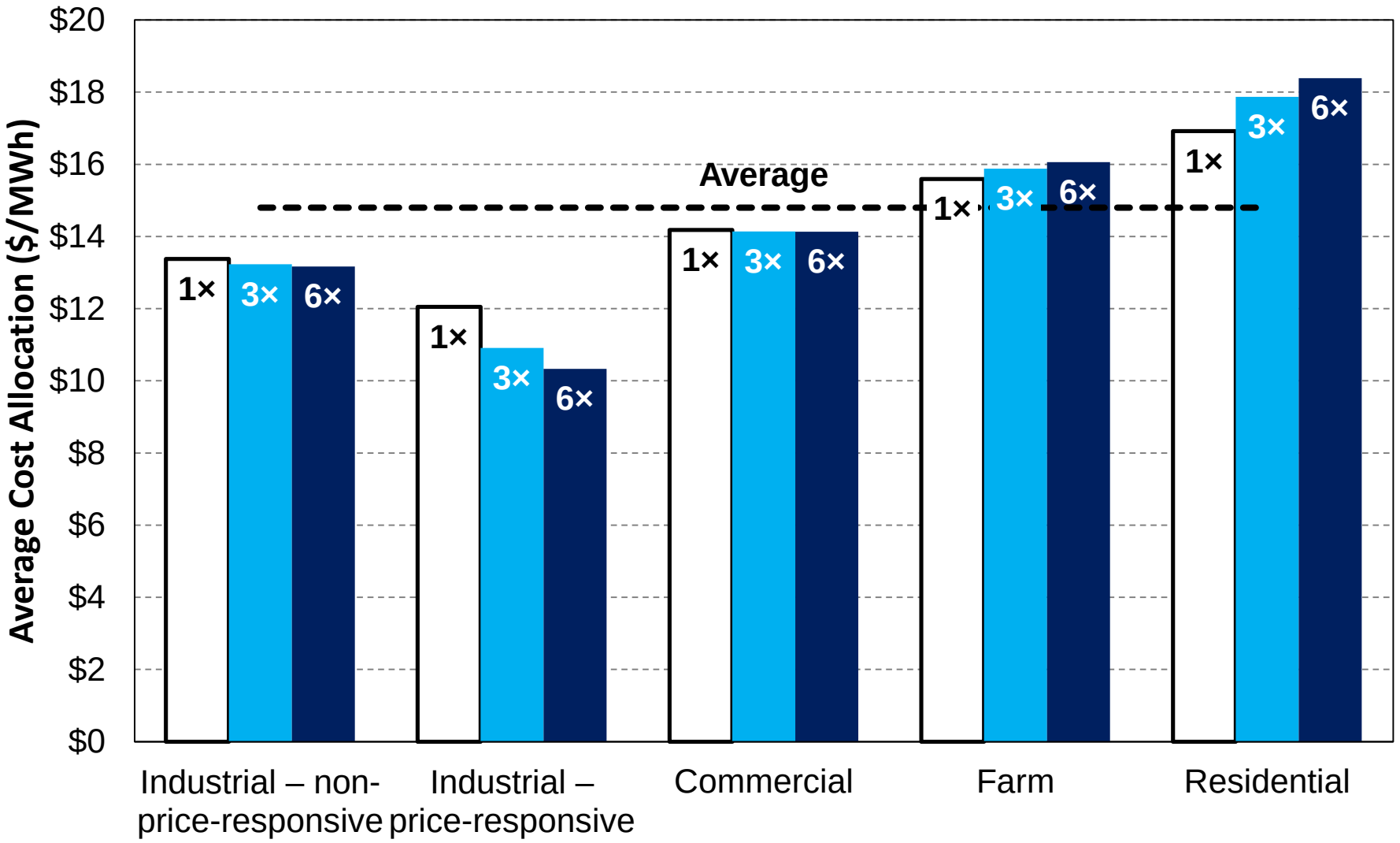
- *Rate based on capacity market costs of $1.0 billion for first obligation period*

Different EUE/hour multipliers result in significantly different rates

Time Block	Base (1×) Rate Range	3× High-Weight EUE/hr		6× High-Weight EUE/hr	
		Multiplier	Rate Range	Multiplier	Rate Range
High-weight	$52-157	3×	$91-273	6×	$111-334
Weekday	$10-29	1×	$6-17	1×	$3-10
Weekend	$3-9	1×	$2-5	1×	$1-3
Overnight	$0-1	1×	$0	1×	$0
All hours	$7-22	—	$7-22	—	$7-22

- *Rate ranges based on capacity market costs ranging from $0.5 billion to $1.5 billion for first obligation period*

Different EUE/hour multipliers also impact consumer groups differently



- *Impacts based on capacity market costs of $1.0 billion for first obligation period*

Load reduction scenario had limited impact on procurement volume

- Resource adequacy model was re-run with 300 MW load reduction in every high-weight hour
  - Based on updated resource adequacy model
  - Load was increased by 42.2 MW in every overnight hour to maintain same total annual energy
- Reduced gross minimum procurement volume by 77 MW compared to base analysis
- Provides directional and indicative support for high-weight time block
  - Indicates higher probability that unserved energy will occur during weekdays rather than weekends and during high-weight hours rather than other weekday hours

Working group did not agree on which weights satisfied rate design criteria

Cost Allocation Rate Design Criteria	1× Multiplier on High-Weight EUE/hr	3× Multiplier on High-Weight EUE/hr	6× Multiplier on High-Weight EUE/hr
(1) Capacity Market Regulation requirements	fully satisfied	fully satisfied	fully satisfied
(2) Recovery of revenue requirement	fully satisfied	fully satisfied	fully satisfied
(3) Appropriate price signals	fully satisfied/ not satisfied	fully satisfied/ not satisfied	fully satisfied/ not satisfied
(4) Fairness, equity, and minimization of inter-customer subsidies	fully satisfied/ not satisfied	fully satisfied/ not satisfied	fully satisfied/ not satisfied
(5) Stability and predictability	fully satisfied	fully satisfied	fully satisfied
(6) Practicality	fully satisfied	fully satisfied	fully satisfied

AESO plans to propose cost allocation with 1× multiplier for all time blocks

- Proposal based on economic efficiency considerations for different multiplier alternatives
- Weights based on 1× multiplier for all time blocks achieve cost causation by aligning price signals with the contribution to capacity market costs in each time block
  - Capacity procurement is based on expected unserved energy
- 1× multiplier for all time blocks results in combined energy and capacity prices that are similar on average to historic energy market prices in each time block
  - Loads have historically reduced consumption at price levels expected under the 1× multiplier for all time blocks
  - High-weight multipliers greater than 1× result in combined energy and capacity peak prices substantially higher than historic energy market levels in the high-weight time block

AESO plans to propose cost allocation with 1× multiplier for all time blocks (cont'd)

- Expected unserved energy is already concentrated in the high-weight time block
  - High-weight multiplier greater than 1× is not necessary to incentivize efficient behaviour
- Working group could not reach consensus on multipliers to apply to unserved energy in time blocks

AESO considers 1× multiplier for all time blocks results in reasonable prices

Time Block	Historic Pool Price ($/MWh)	Mitigated Pool Price ($/MWh)	Cost Allocation Rate ($/MWh)	Combined Price ($/MWh)
2014				
High-weight	$129	$51	$52-157	$103-208
Weekday	$67	$41	$10-29	$51-70
Weekend	$49	$36	$3-9	$39-45
Overnight	$27	$26	$0-1	$26-27
2018				
High-weight	$99	$71	$52-157	$123-228
Weekday	$65	$53	$10-29	$63-82
Weekend	$43	$40	$3-9	$43-49
Overnight	$34	$33	$0-1	$33-34

- *Cost allocation rate ranges based on capacity market costs ranging from $0.5 billion to $1.5 billion for first obligation period*
- *Weights based on 1× multiplier for all time blocks*

Cost allocation will require true-up for variances of volumes from forecast

- Capacity market cost allocation rate will be determined after capacity procurement volume and clearing price are known, using forecast of hourly load volumes
- Variances of actual load volumes from forecast will result in imbalances that will be addressed through adjustment rider
- Working group supported recovery of variances through prospective rider applied over a future period, if variances are small
- AESO examined variances that would result from historical forecast and actual load volumes to assess possible approaches

AESO modelling suggests quarterly recovery on allocation to end-of-year

Quantity	Quarterly Balance Over Next Quarter	Quarterly Balance Over End-of-Year	Quarterly Balance Over 12 Months
Q1 Rider D	0.90%	0.22%	0.74%
Q2 Rider D	1.14%	0.48%	0.75%
Q3 Rider D	0.95%	0.96%	0.92%
Q4 Rider D	(1.33%)	(0.35%)	0.25%
Average During Year	0.06%	0.06%	0.25%
End-of-Year Estimate	($626,655)	($609,880)	($2,456,801)
EOY Estimate – % of Annual	(0.06%)	(0.06%)	(0.25%)
End-of-Year Actual	($8,277,547)	($8,336,761)	($10,230,207)
EOY Actual – % of Annual	(0.84%)	(0.84%)	(1.03%)

- *Rate based on capacity market costs of $1.0 billion for first obligation period*
- *Weights based on 1× multiplier for all time blocks*

Quarterly recovery on balance to end-of-year best satisfies adjustment criteria

- Adjustments for truing-up variances should be small and stable, result in small end-of-year balances, and support the matching of timing of cost incurrence and recovery

Criteria	Quarterly Balance Over Next Quarter	Quarterly Balance Over End-of-Year	Quarterly Balance Over 12 Months
Small rider	0.42%	0.33%	0.67%
Stable rider	(1.33%) to 1.14%	(0.35%) to 0.96%	0.25% to 0.92%
Small balance at end of year	(0.84%)	(0.84%)	(1.03%)
Match timing between cost and revenue	3 months	3-9 months	9 months

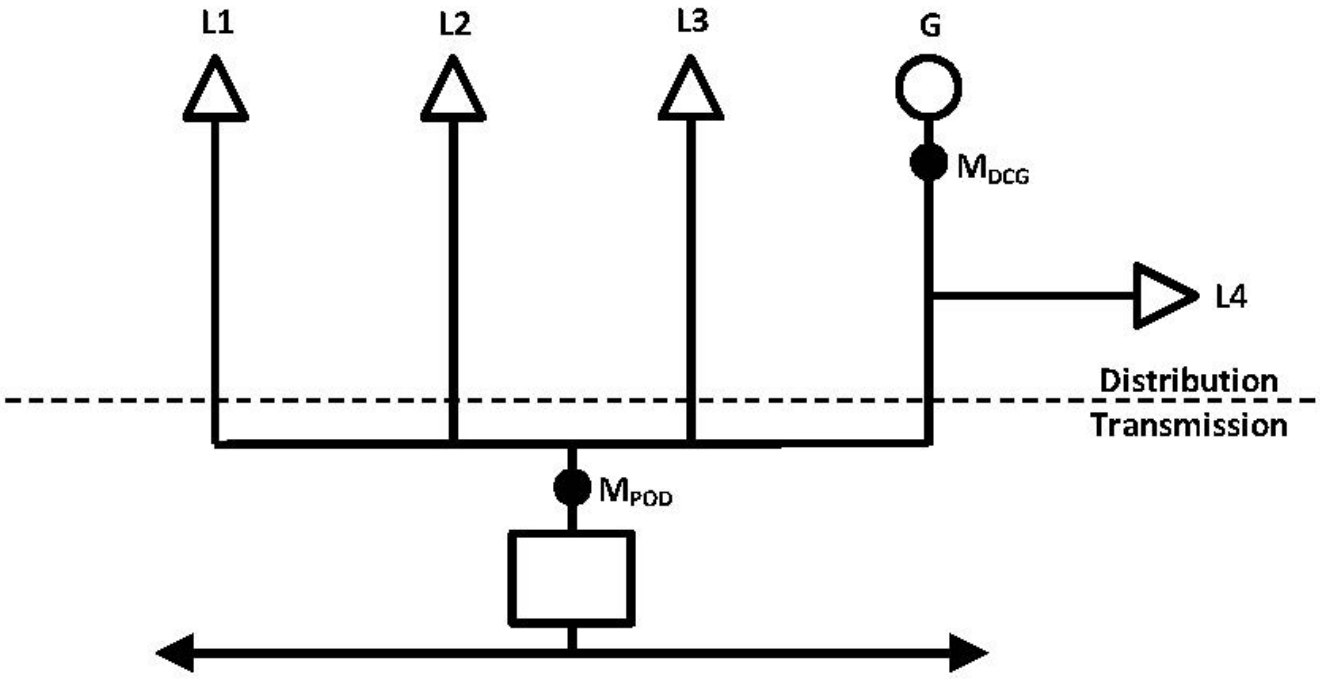
- *Rate based on capacity market costs of $1.0 billion for first obligation period*
- *Weights based on 1× multiplier for all time blocks*

AESO considers that measurement points may differ for capacity market

- AESO position is that capacity market costs can be allocated at different measurement point than point of delivery (POD) used for transmission settlement of system access services
- *Electric Utilities Act* requires that rates "must reflect the prudent costs that are reasonably attributable to each class of system access service"
- As AESO is procuring capacity on behalf of all non-self-supply loads in Alberta, capacity market costs would be reasonably attributable to all non-self-supply loads

AESO proposes to “gross up” POD volumes for distributed generation

- System access service metered volume = M_{POD}
- Distribution-connected generation metered volume = M_{DCG}



- Cost allocation volume = M_{POD} + M_{DCG}

Implementation of time block volumes will be coordinated with other parties

- AESO will work with distribution utilities, metering stakeholders, and Commission to coordinate implementation of time block energy billing determinant
- AESO considers approach to be compliant with Measurement Canada requirements for metering

Capacity market costs will be allocated to transmission line losses

- $29.7 million of capacity market costs will be allocated to and included as costs of transmission line losses
- Costs of transmission line losses are also expected to reflect reduction in energy market costs

Time Block	Hours	Losses (GWh)	Rate ($/MWh)	Amount ($ 000 000)
High-weight	411	103.7	$104.70	$10.9
Weekday	3,573	850.3	$19.00	$16.2
Weekend	1,856	423.8	$5.70	$2.4
Overnight	2,920	611.1	$0.40	$0.2
All hours	8,760	1,988.9	—	$29.7

- *Rate based on capacity market costs of $1.0 billion for first obligation period*

Questions and discussion

Next Steps

- Capacity Market Cost Allocation Filing: July 26, 2019
- Bulk and regional transmission cost allocation
  - TDAG and WG discussions will continue
  - Filing March 31, 2020
- TDAG member comment matrices will be posted July 26, 2019
- August TDAG session will be cancelled
- Information related to stakeholder engagement on capacity market cost allocation is posted on AESO website (link)
  - Path: Rules, Standards and Tariff ► Stakeholder engagement ► ISO Tariff Design for Allocating Costs of Capacity Procurement and Bulk and Regional Transmission

Thank you