

# Sub-Hourly Settlement

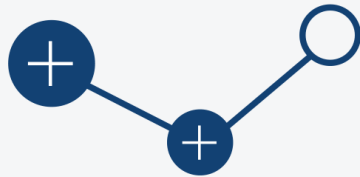
February 25, 2020

- Refreshments available in the room
- Please sign in at registration table
- Wi-Fi Network available





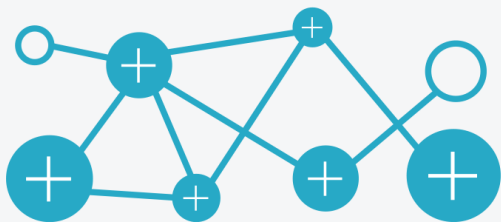




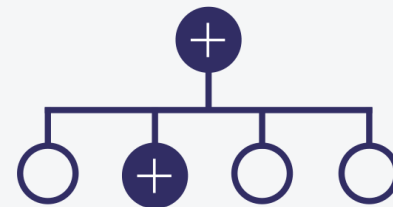
Connect  
**CUSTOMERS**



**PLAN**  
transmission



Operate the  
**GRID**



Plan and Operate the  
**MARKET**

- Responsible for safe, reliable, economic planning and operation of Alberta Interconnected Electric System (AIES)
- AESO is a not-for-profit, statutory corporation; independent of government and industry:
  - Governed by independent board appointed by Minister of Energy
  - Must operate in the public interest
  - No financial interest in any generation unit, transmission or distribution infrastructure
  - No government funding; costs recovered from Alberta ratepayers



## *OUR ENGAGEMENT PRINCIPLES*

**Inclusive and Accessible**

**Strategic and Coordinated**

**Transparent and Timely**

**Customized and Meaningful**

## Transition

Energy-only market sustainability & evolution

- Transmission planning (LTP)
- Tariffs & cost allocation
- DER & distribution

## Transformation

- How electricity is produced, consumed and exchanged
- Consumer expectations
- Industry disruptors & beyond
- Technology advancement





Topic	Presenter	Time	Duration
Intro and background	Murray Hnatyshyn	9:00 a.m.	20
Consultation plan and objectives	Thanh Nguyen	9:20 a.m.	30
Jurisdictional review	Brendan Jewitt	9:50 a.m.	30
Break	😊	10:20 a.m.	20
Current state and value for Alberta	Thanh Nguyen	10:40 a.m.	40
Discussion questions	All	11:20 a.m.	30
Next steps	Murray Hnatyshyn	11:50 a.m.	10

# Background

- During previous AESO stakeholder consultations regarding net demand variability in 2018 the following issues were raised in relation to the settlement interval:
  - More flexibility in the fleet may be required to manage the evolving generation mix
  - There may be a need to better recognize the value of flexible resources through sub-hourly settlement
  - A more granular settlement interval may enhance reliability, flexibility and investment
  - Price fidelity may be improved by aligning the settlement intervals to dispatch intervals
  - Better alignment of settlement intervals to other jurisdictions

- The AESO has a number of initiatives related to providing the right price signals and incentives to ensure the system has sufficient flexibility to ensure system reliability in the future
  - Price Framework: the AESO will be addressing pricing related topics through the pricing framework in response to the Energy Minister's direction letter
  - Renewables and storage integration
  - Ramping and dispatch tolerance
- This stakeholder engagement series will focus on sub-hourly settlement and how this may help with providing flexibility and improve price fidelity

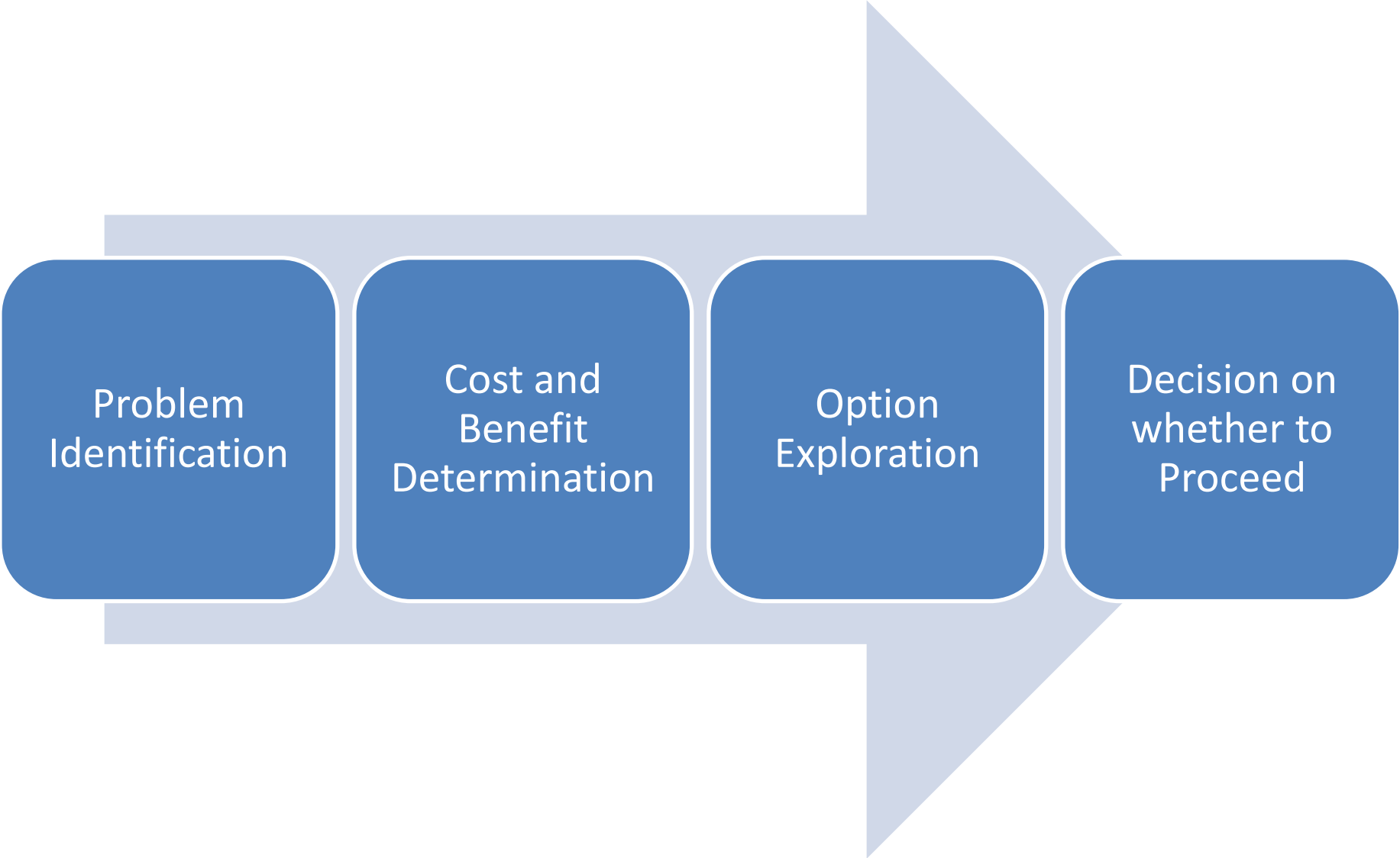
# Consultation Plan

## In scope

- Confirm opportunities and define the problem
- Review of the benefit and costs of moving to sub-hourly settlement and how it will incent flexibility and increase price fidelity
- Impacts to operating reserves and energy offers
- Develop and assess sub-hourly settlement options
- Identify potential rule changes required to implement sub-hourly settlement

## Out of scope

- Implementation of any needed dispatching and offer changes
- Implementation of any needed operating reserves changes
- Implementation of any needed rule changes - would follow AUC Rule 017 process



Problem  
Identification

Cost and  
Benefit  
Determination

Option  
Exploration

Decision on  
whether to  
Proceed

A process flow diagram consisting of three blue rounded rectangular boxes arranged horizontally. The boxes are labeled "Design", "Rule Language Development", and "AUC Process" from left to right. The boxes are set against a light blue background that features a large, stylized arrow pointing to the right, which is partially obscured by the boxes.

Design

Rule  
Language  
Development

AUC Process



- Stakeholder feedback solicited both verbally and written
  - Sessions to be held every 4-5 weeks with comment matrix provided after each session
  - Written feedback requested 10 business day after each session

Session 1 Feb 25, 2020	Session 2 April 2020	Session 3 May 2020	Session 4 June 2020
<ul style="list-style-type: none"><li>• Background</li><li>• Objectives</li><li>• Jurisdictional review</li></ul>	<ul style="list-style-type: none"><li>• Cost and benefit analysis</li><li>• Review of stakeholder feedback</li></ul>	<ul style="list-style-type: none"><li>• Options exploration</li><li>• Inter-connection with other areas</li></ul>	<ul style="list-style-type: none"><li>• Discuss items that were raised in prior sessions</li></ul>

# Objectives

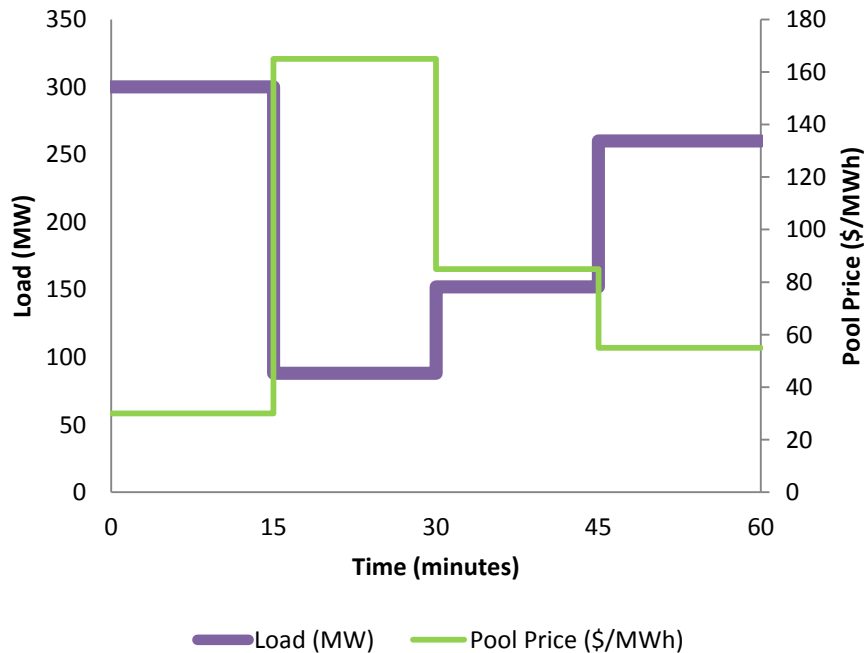
- Determine if there is value in moving towards a shorter interval and if yes, what interval?
- Through the stakeholder engagement the AESO is looking to better understand:
  - The expected enhancement in price fidelity and flexibility
  - The expected financial impact on loads and generators
  - Implementation costs for AESO and market participants
  - Timing required to transition to a sub-hourly settlement interval

# Explore enhancements to market due to sub-hourly settlement

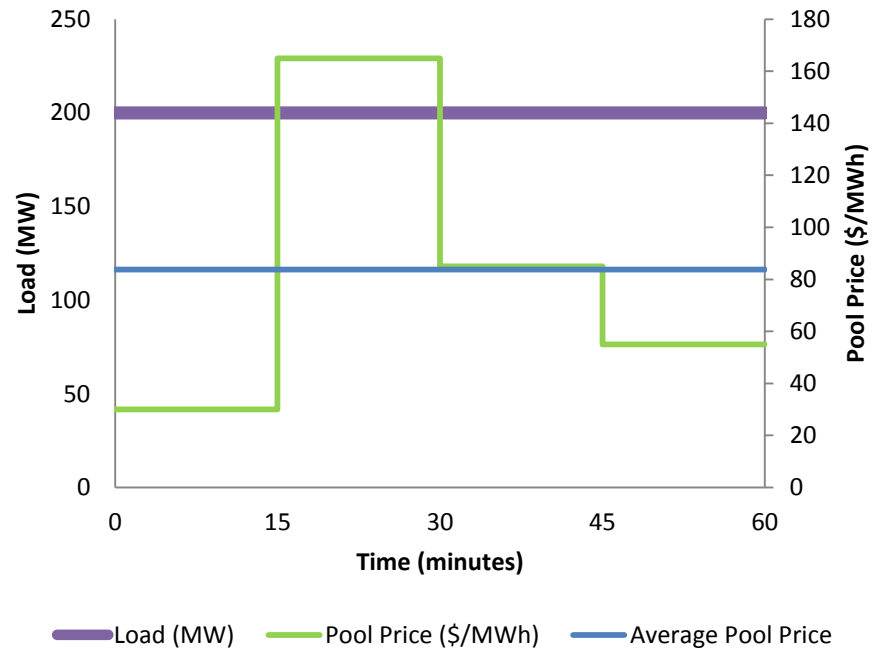
- Improve price fidelity
  - Improve the relationship between energy delivered or consumed within an hour with the price during the settlement interval
- Incent flexibility
  - Incent investment in flexible generation and load response in the province through a price signal with higher fidelity

- Efficient operation of the market relies upon access to accurate prices that reflect the marginal costs of generating and benefits of using electricity
- The more closely prices reflect the physical condition of the market, the more efficient the price signals
- The mismatch between dispatch and consumption and settlement intervals may limit the quality of the price signal, and potentially incentivizes adverse dispatch and consumption response
  - Efficiency loss occurs because the hourly price is averaged, and does not reflect the cost of meeting demand, or the willingness to pay of consumers
  - Load pays an hourly price regardless of their consumption during a particular hour

### Load: sub-hourly settlement



### Load: hourly settlement



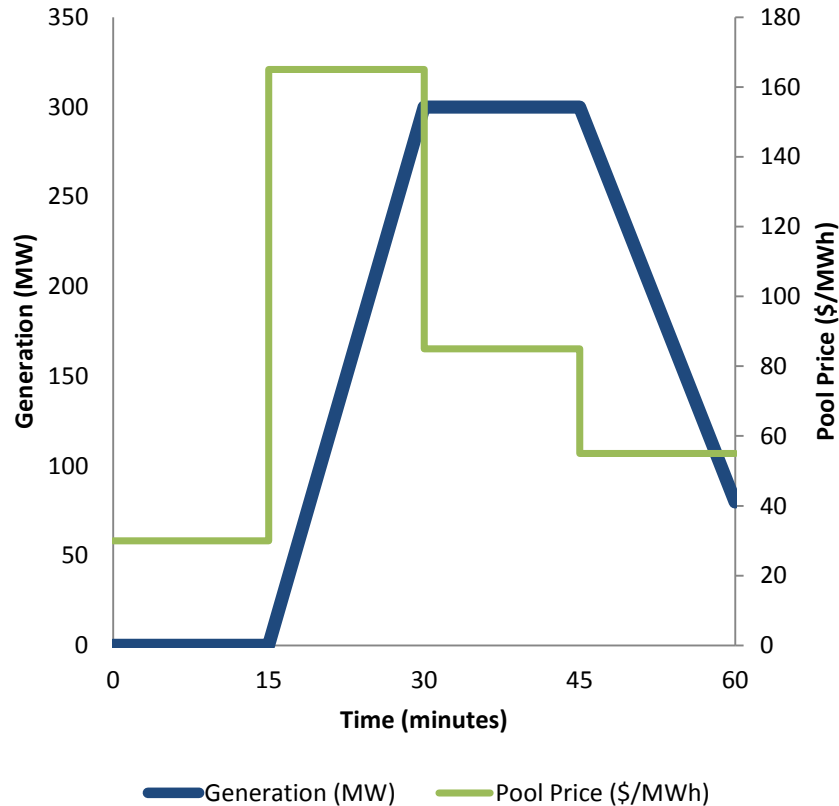
- Sub-hourly settlement provides a better incentive for consumption which reflects the conditions in the market
- Hourly settlement does not provide incentives to respond to pool price as the load would pay the average pool price

- Resource attributes:
  - Speed at which an asset can change output or demand up/down
  - The minimum level of output the asset can operate at: minimum stable output
  - The time an asset requires to remain online before being dispatched offline: minimum run time
  - The time an asset requires to come online after being offline : minimum start time

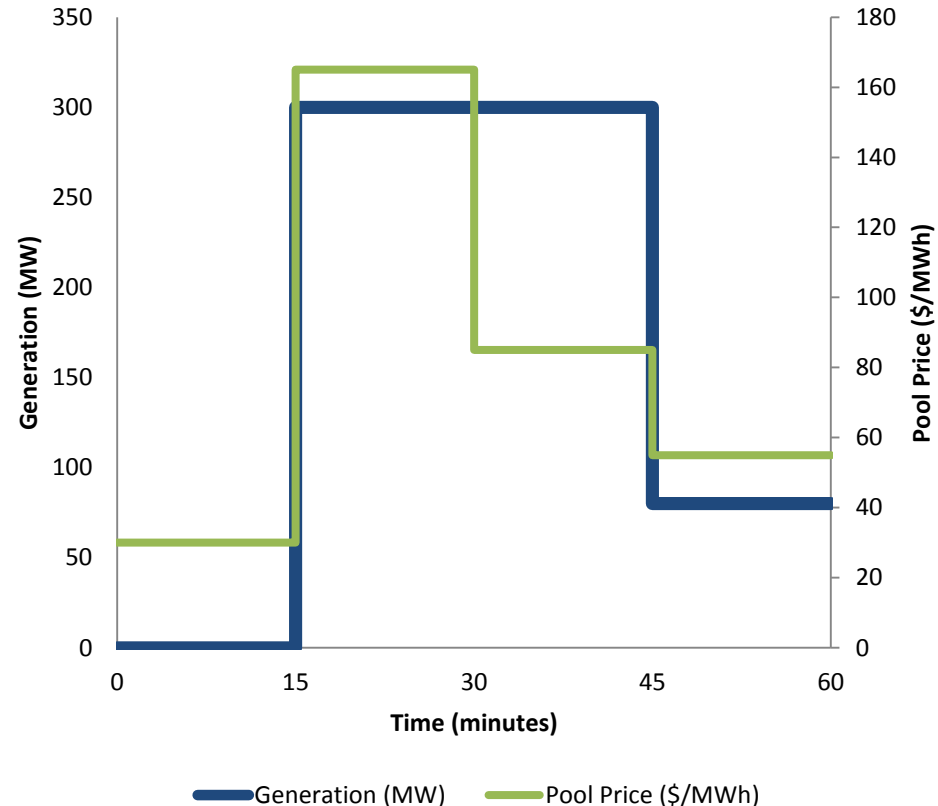
- Resources also must have access to accurate price signals to ensure that the **right incentives** are created for resources to respond to dispatch signals
- The AESO system controllers need to have an understanding of what these attributes are for all dispatchable and variable resources to be able to effectively meet changing net demand requirements (**dispatch certainty**)



## Generation: Slow Response



## Generation: Fast Response



- The fast response resource is more flexible than the slow response resource and is able to react to price more quickly

# Jurisdictional review

- Requires each ISO/RTO to align settlement and dispatch intervals by:
  - Settling energy transactions in real-time markets at the same interval it dispatches energy
  - Settling operating reserve transactions in real-time markets at the same interval it prices operating reserves; and
  - Settling intertie transactions in the same interval it schedules intertie transactions. (FERC 825, PDF 1)

**“Intended to address practices that failed to compensate resources at prices that reflect the value of the service resources provide to the system, thereby distorting price signals, and at times creating disincentives for resources to respond to dispatch signals”**

- The commission did not propose to apply the settlement interval to load
- Clarified that the adoption of the settlement interval requirements were not intended to change how load is metered – focus was on supply resources

**“However, we are not prohibiting settling load on a five minute basis and will evaluate any such proposals on a case by case basis.”**

# Jurisdictional Review – Energy dispatch & settlement intervals

Jurisdiction	Energy Dispatch Interval	Load Settlement Interval	Generation Settlement Interval	Transition Date
CAISO	5 minute	Dispatchable Resources – 5 min Non-dispatchable - hourly	5 minute	2014
ISO-NE	5 minute	Dispatchable Resources – 5 min Non-dispatchable - hourly	5 minute	2017
MISO	5 minute	Hourly	5 minute	2018
PJM	5 minute	Hourly	5 minute	2018
IESO	5 minute	Dispatchable Resources – 5 min Non-dispatchable - hourly	Dispatchable Resources – 5 min Non-dispatchable - hourly	NA
AEMO (Australia)	5 minute	5 minute	5 minute	2021

# Jurisdictional Review – OR & Intertie settlement intervals

Jurisdiction	OR Settlement Interval	Intertie Scheduling Interval	Intertie Settlement Interval
CAISO	15 minute	15 minute	15 minute based on 5 minute LMPs
ISO-NE	5 minute	15 minute	15 minute based on 5 minute LMPs
MISO	5 minute	15 minute	15 minute based on 5 minute LMPs
PJM	5 minute	15 minute	15 minute based on 5 minute LMPs
IESO	Hourly	Hourly	Hourly

- PJM transition to comply with FERC 825
- **Before transition:**
  - *All resources are dispatched in five-minute intervals no matter the resource type*
  - *Real-Energy Market, DAM, regulation, synchronized reserves and non-synchronized reserves are all settled on an hourly basis.*
  - *Intertie transactions dispatched on 15-minute basis and settled based on hourly integrated LMP.*
- **After transition:**
  - *Will settle transactions in the real-time energy market and the regulation, synchronized reserves and non-synchronized reserves markets on a five-minute basis.*
  - *Continue to schedule intertie transactions on a 15-minute basis. They will also be settled for each 15 minutes interval by utilizing the corresponding five-minute LMPs for that transaction interval.*

## Challenges experienced implementing sub-hourly settlement:

- Major technical changes to numerous systems, particularly those related to settlements, as well as substantial changes to its governing documents.
  - Cost and time to implement reforms: propose different scenarios for transition and estimate relevant costs for doing each; the most expensive procedure would take up to 38 months to implement and the estimated cost would be \$5.6M.
  - Changes required to market participants' metering: existing revenue quality metering did not have the capability to accept sub-hourly data



- Load will continue to settle hourly (flat profiling)
- PJM proposes to settle load on the same interval (five min.) as dispatch intervals by using a combination of state-estimator and telemetry data for each settlement interval and will implement a set of true-up calculations to reconcile the settlement calculations when the revenue quality metering data is available
  - Helps enable load participation with minimal incremental costs

- AEMO plans to move to five minute settlement effective July 1, 2021
- Transition would change the resolution for **bidding and offering** into central dispatch from a 30 minute to a five minute basis and sets out the metering requirements needed to provide five minute resolution data for settlement
- Rule change was proposed by Sun Metals (load customer), who submitted that the mismatch between the dispatch and settlement intervals led to inefficiencies in the operation and generation mix of the market, including the following:
  - accentuates strategic late rebidding, where generators have been observed to withdraw generation capacity in order to influence price outcomes;
  - impedes market entry for fast response generation and demand-side response; and
  - limits opportunities for batteries

- Five minute settlement is assumed to decrease the price over time because the improved price signals will result in more efficient use of and investment in flexible generation assets and demand response
- AEMC did not conduct a detailed benefit cost analysis, but rationalized that since ongoing NEM transactions are on the magnitude of \$16 billion/year, only a small improvement in price signals (as little as \$0.50/MWh reduction in average wholesale prices), would yield net benefits

## **Implementing five minute settlement will require:**

- Reviewing and updating existing financial and physical contract terms and conditions;
- Upgrading metering to provide five minute granularity data (where required);
- Upgrading IT systems to store and process five minute granularity data.
- Estimated costs \$10 – 15 million for implementation and \$2 – 7 million for ongoing procedures.

- Stakeholder concerns
  - Greater volume of response that is not visible to the system operator, namely batteries and DR, that can compromise frequency and voltage
  - Overall, some uncertainty regarding the impact of large volumes of unscheduled (below 5 MW) energy storage on both market and grid (power quality in particular)
- Stakeholder advocates
  - Energy storage advocates suggest that larger volume of storage may enhance rather than degrade power quality, as storage assets are capable of operating in such a way that they support voltage, frequency, etc. They also have short lead times and therefore support adequacy.
- AEMC believes that new initiatives related to distributed resources, including energy storage, will enhance visibility and minimize any operational impacts

- Stakeholder concerns:
  - Claim that peakers aren't quick enough to respond to five min. prices. Therefore, revenues are reduced and these assets will exit the market.
  - This reduction in peaker capacity will degrade reliability, as storage capacity is not as reliable as gas-fired capacity.
  - Move from gas-fired generation to storage will reduce inertia
- AEMC analysis concludes that efficient peakers are likely to remain financially viable under five minute settlement

## Further considerations:

- Commission position is that there will be mandatory five minute settlement for all wholesale market participants, including load
  - Aligns price signals and physical needs of the power system
  - Aligns settlement interval between generators and load
  - Minimizes administrative burden and complexity
- Settlement will use revenue metering data from primarily existing infrastructure, lowering implementation costs
  - Most meters installed in the past 15 years are currently capable of being configured for five min. intervals
  - May require storage upgrades for greater volume of data

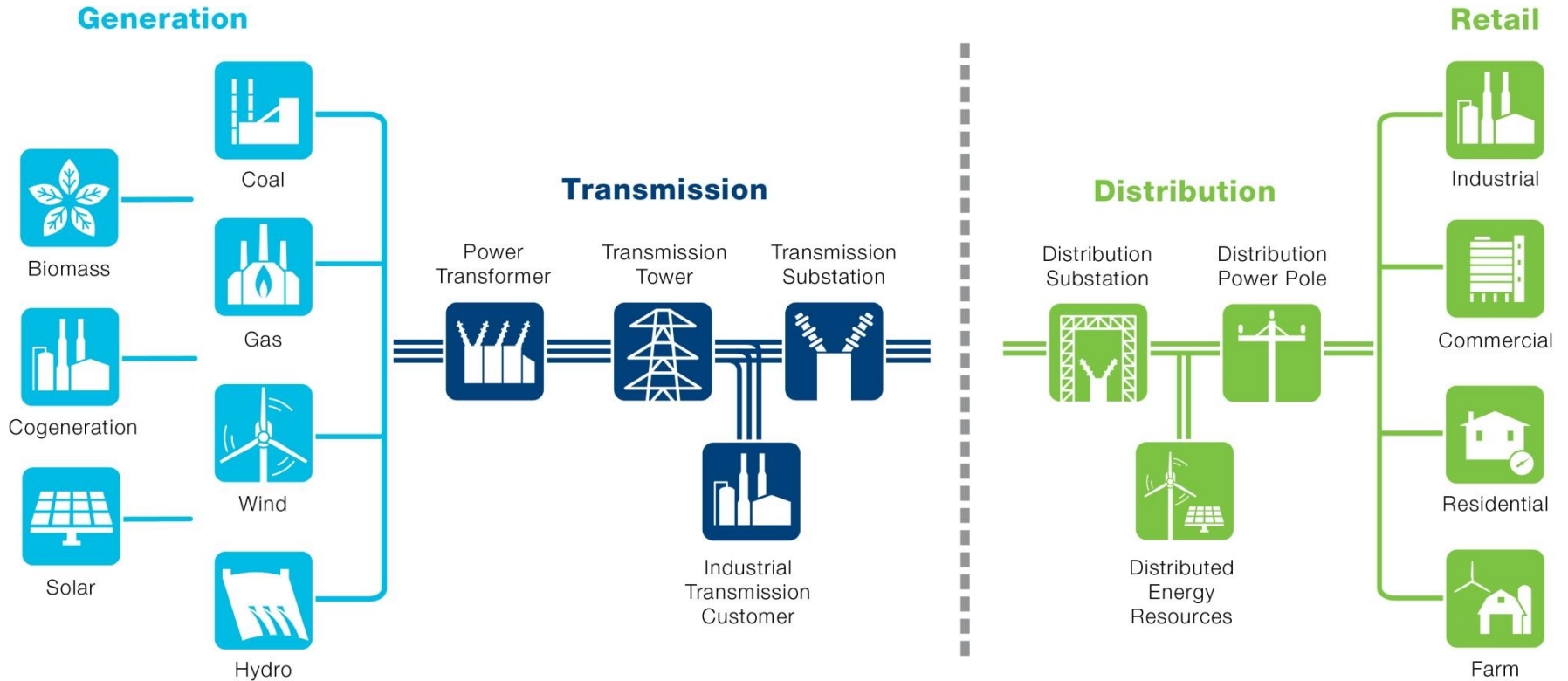
- Load, generation, intertie and OR settlement intervals can be different
  - Most jurisdictions are moving or have moved to five minute settlement intervals for generation and loads
  - Intertie and OR are at 15 minutes
- Benefits
  - Aligns price signals with consumption/generation
  - More efficient resource mix over time
- Challenges
  - Metering and IT infrastructure may need to be upgraded
  - Transition period can be long and costly
  - Operational management of small scale and flexible generation



**Break**

## Current state in Alberta

# How the system works



## Energy

- Dispatched as required to meet supply/demand balance
- System marginal price (SMP) set minute to minute
- Hourly merit order
- Generators receive the hourly pool price regardless of variability in intra-hour generation
- Uplift (additional payments) ensure that generators are kept whole – incentives to respond to dispatches
- Load pays the hourly price regardless of variability of intra-hour consumption

## Ancillary services

- Operating reserves procured day ahead. Active reserves indexed to hourly pool price. Standby reserves paid as offer
- Other ancillary services generally consist of an hourly variable payment and monthly component

## Intertie

- Scheduled on an hourly basis
- Imports and exports settled using hourly pool price

# Enabling sub-hourly settlement in Alberta

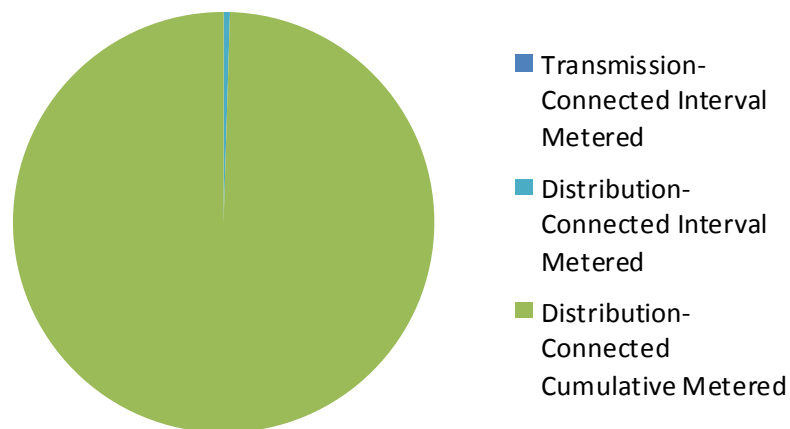
- Benefits from shortening the settlement interval can only materialize if market participants have direct exposure to the price signal
- Different entities are exposed to the price signal through different means:
  - Generation, imports, exports, and transmission connected loads settle directly with the AESO exposing them to hourly pool price
  - Loads connected to the distribution system settle through the settlement system code
    - This process involves many entities including load settlement agents, customer retailers and the AESO
  - Loads with cumulative meters (majority of distribution-connected customers) have a load profile applied to their monthly consumption. These loads have no ability to respond to real-time price signals without meter and retail contract changes
    - The majority of retail customers do not pay an hourly price but a retail per kwh rate.

- Interval metering is the first step necessary to have exposure to real-time price signals
  - Most customers, in particular, residential and small commercial customers, do not have interval metering. Instead, they have monthly cumulative meters
  - Transmission-connected loads and large industrial/commercial customers on the distribution network have interval metering that enables exposure to the financial incentives associated with shortening settlement
- Depending on distribution territory, some customers have advanced metering capable of collecting meter data at a more granular level.
  - This functionality is not currently in use but could be useful in a sub-hourly settlement regime

- Interval meters have the capability of reading production or consumption values on a pre-set basis
  - The current interval meters in Alberta read data on a 15 minute basis
  - 15 minute may be due to limitation of old thermal demand meters, which took 15 minutes to read and record actual metered data
  - New digital meters have the ability to read on any interval that has been determined
- Cumulative meters sum up total metered demand, typically on a monthly basis. Hourly load profiles are then established to determine how loads will be charged for their consumption based on the hourly pool price (or retail rate)

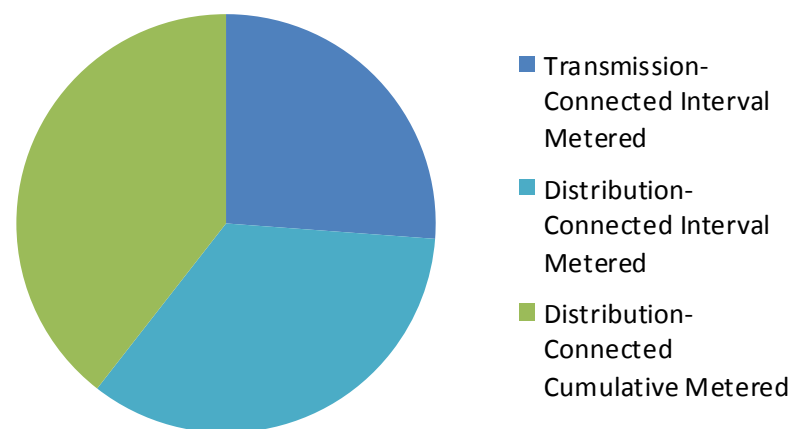


## Number of Services (Count)



Transmission-Connected Interval Metered	217	0.01%
Distribution-Connected Interval Metered	8,473	0.47%
Distribution-Connected Cumulative Meter	1,802,996	99.52%
<b>Total</b>	<b>1,811,686</b>	<b>100.00%</b>

## Volume of Energy (Annual MWh)



Transmission-Connected Interval Metered	15,897,052	26.17%
Distribution-Connected Interval Metered	20,873,458	34.37%
Distribution-Connected Cumulative Meter	23,969,154	39.46%
<b>Total</b>	<b>60,739,664</b>	<b>100.00%</b>

# Enabling sub-hourly settlement

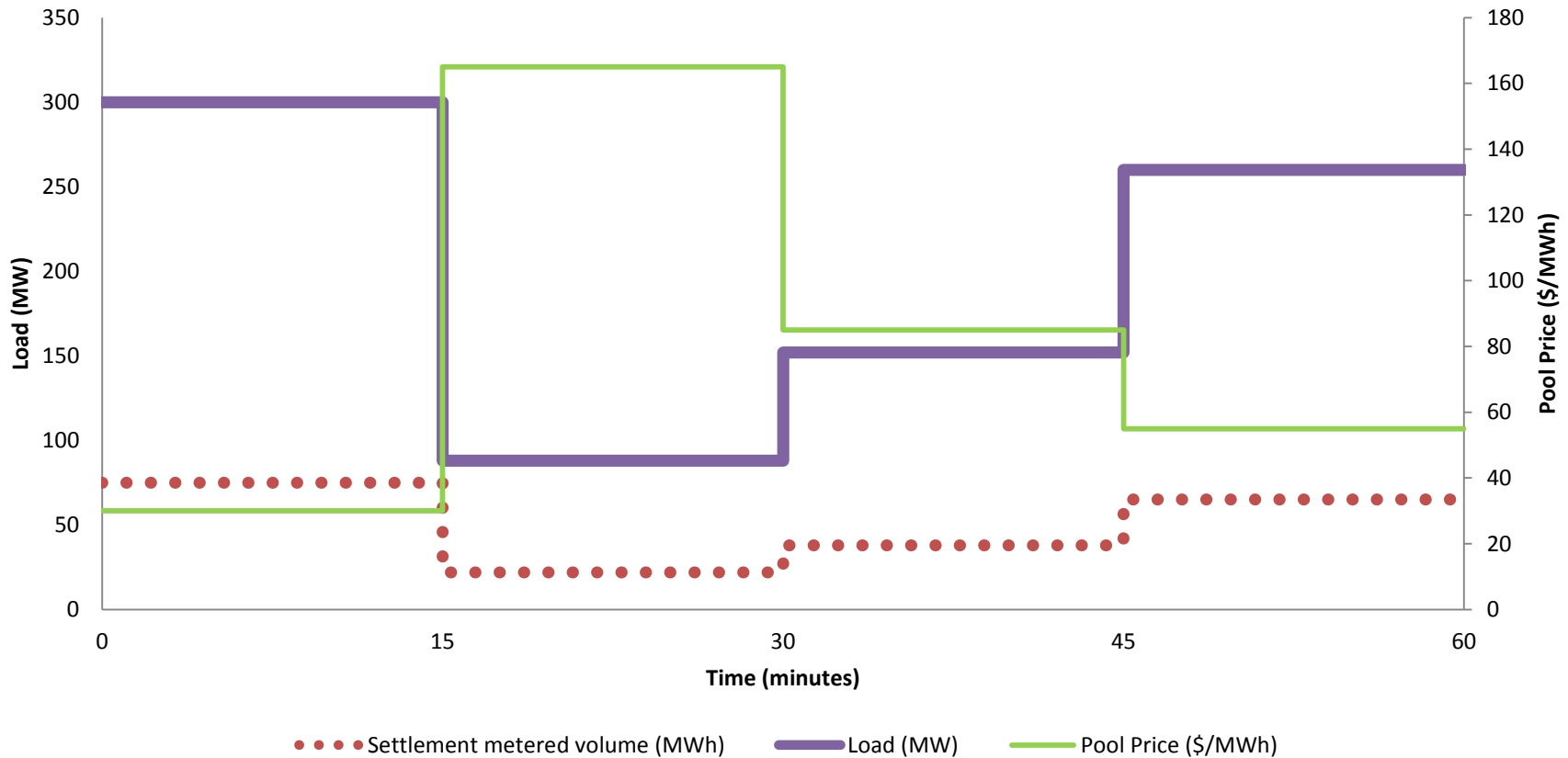
	Generation	Load	Intertie
Metering	May require changes <ul style="list-style-type: none"> <li>• Most have interval meters but may need to go to shorter interval</li> </ul>	May require changes <ul style="list-style-type: none"> <li>• Interval meters may be needed</li> </ul>	No change <ul style="list-style-type: none"> <li>• Interties are paid on e-tag schedule and not metered</li> </ul>
IT systems	Change required <ul style="list-style-type: none"> <li>• Settlement systems need to incorporate intervals</li> </ul>	Change required <ul style="list-style-type: none"> <li>• Settlement systems need to incorporate intervals</li> </ul>	Change required <ul style="list-style-type: none"> <li>• Settlement systems need to incorporate intervals</li> </ul>
Data storage	Change required <ul style="list-style-type: none"> <li>• Increased storage needs</li> </ul>	Change required <ul style="list-style-type: none"> <li>• Increased storage needs</li> </ul>	Change required <ul style="list-style-type: none"> <li>• Increased storage needs</li> </ul>

# Value of sub-hourly settlement for Alberta

# Price fidelity issues: The load customer perspective

- Illustrative example 1

### Load: Price Responsive

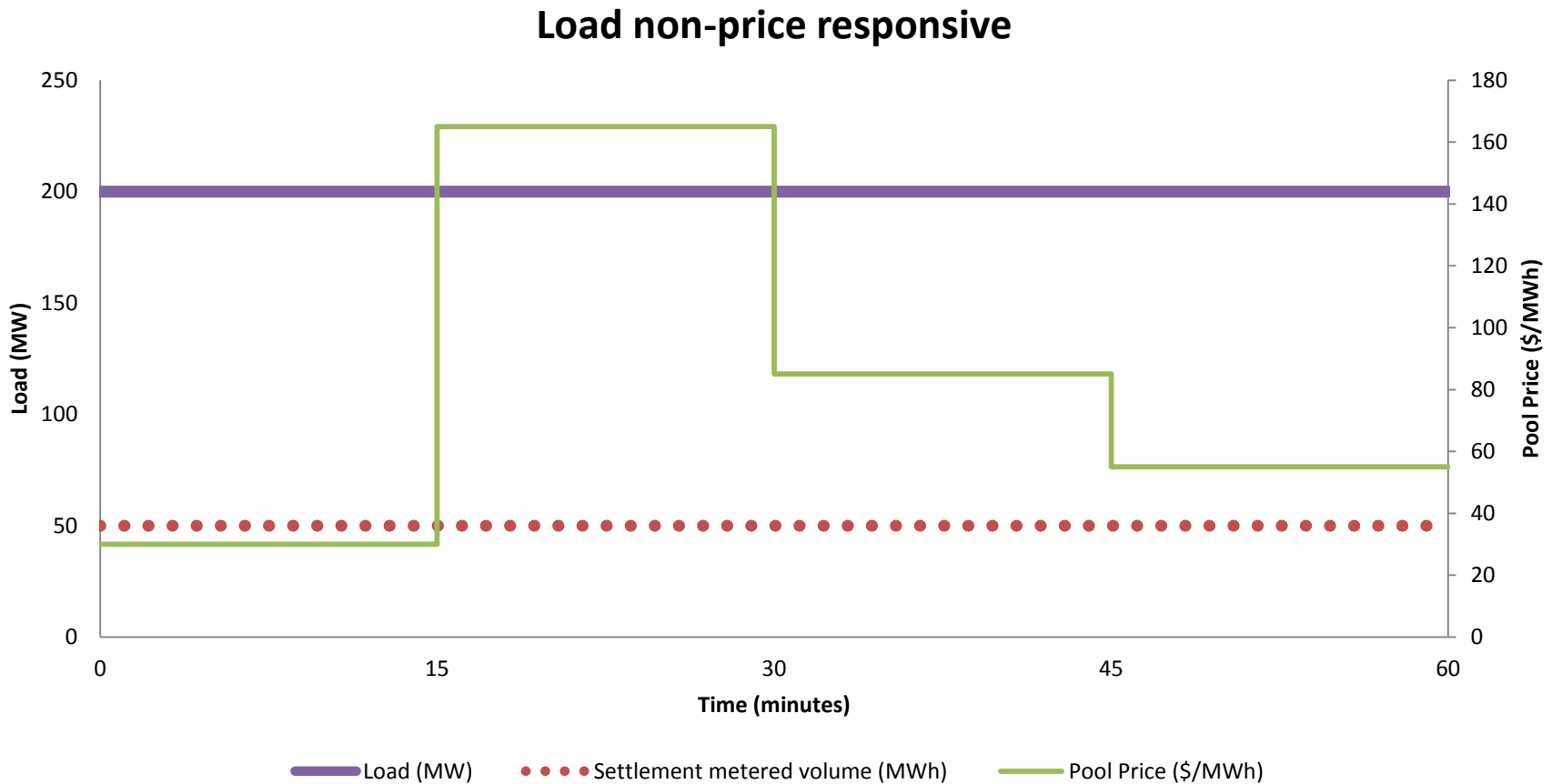


# Part 2: Load price-responsive

Hourly average pool price (\$)	Total settlement metered volume (MW)	Total hourly charge (\$)	Interval	Pool Price in interval (\$/MWh)	Load (MW)	Settlement metered volume (MWh)	Sub-hourly settlement (\$)
\$ 83.75	200	\$16,750	1	\$ 30	300	75	\$ 2,250
			2	\$ 165	88	22	\$ 3,630
			3	\$ 85	152	38	\$ 3,230
			4	\$ 55	260	65	\$ 3,575
						Total: 200	\$ 12,685

- Currently, the practice is to charge the customer at the hourly pool price on their consumption through the hour. In our example, the hourly cost would be \$16,750
- If load was charged for consumption at the prices during each consumption interval, the total cost would be \$12,685
- The savings to load for the better price settling practices is over \$4,000

- Illustrative example 2



# Part 4: Load non-price responsive

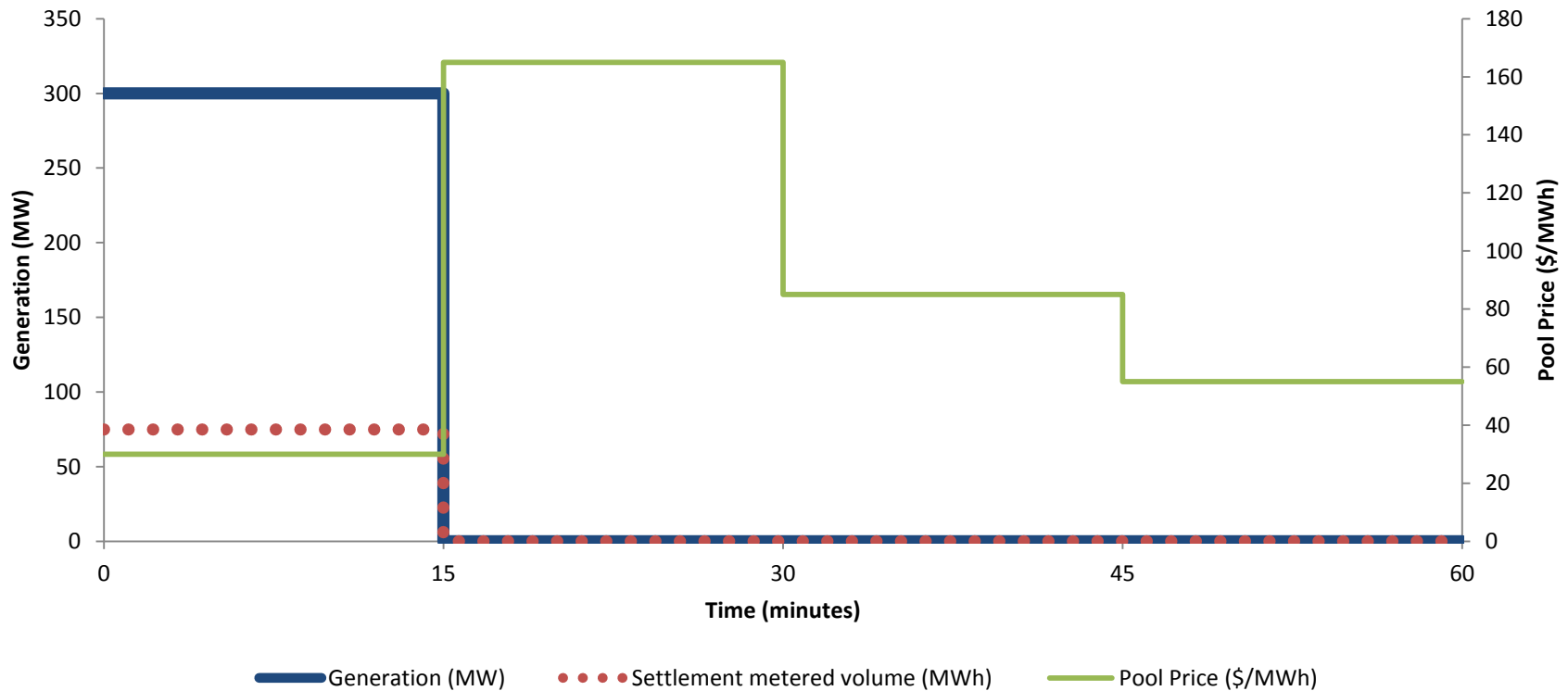
Hourly average pool price (\$)	Hourly total load (MW)	Total hourly charge (\$)	Interval	Pool Price in interval (\$/MWh)	Load (MW)	Settlement metered volume (MWh)	Sub-hourly settlement (\$)
\$ 83.75	200	\$ 16,750	1	\$ 30	200	50	\$ 1,500
			2	\$ 165	200	50	\$ 8,250
			3	\$ 85	200	50	\$ 4,250
			4	\$ 55	200	50	\$ 2,750
						Total	\$ 16,750

- There is no difference in charges to load if the consumption remains steady
- There is no variability in the consumption throughout the hour and thus due to the magic of averages, it works out to the same value

# Price fidelity issues: The generator perspective

- Illustrative example 3

### Generation: non-price responsive





# Part 2: Non-price responsive generator

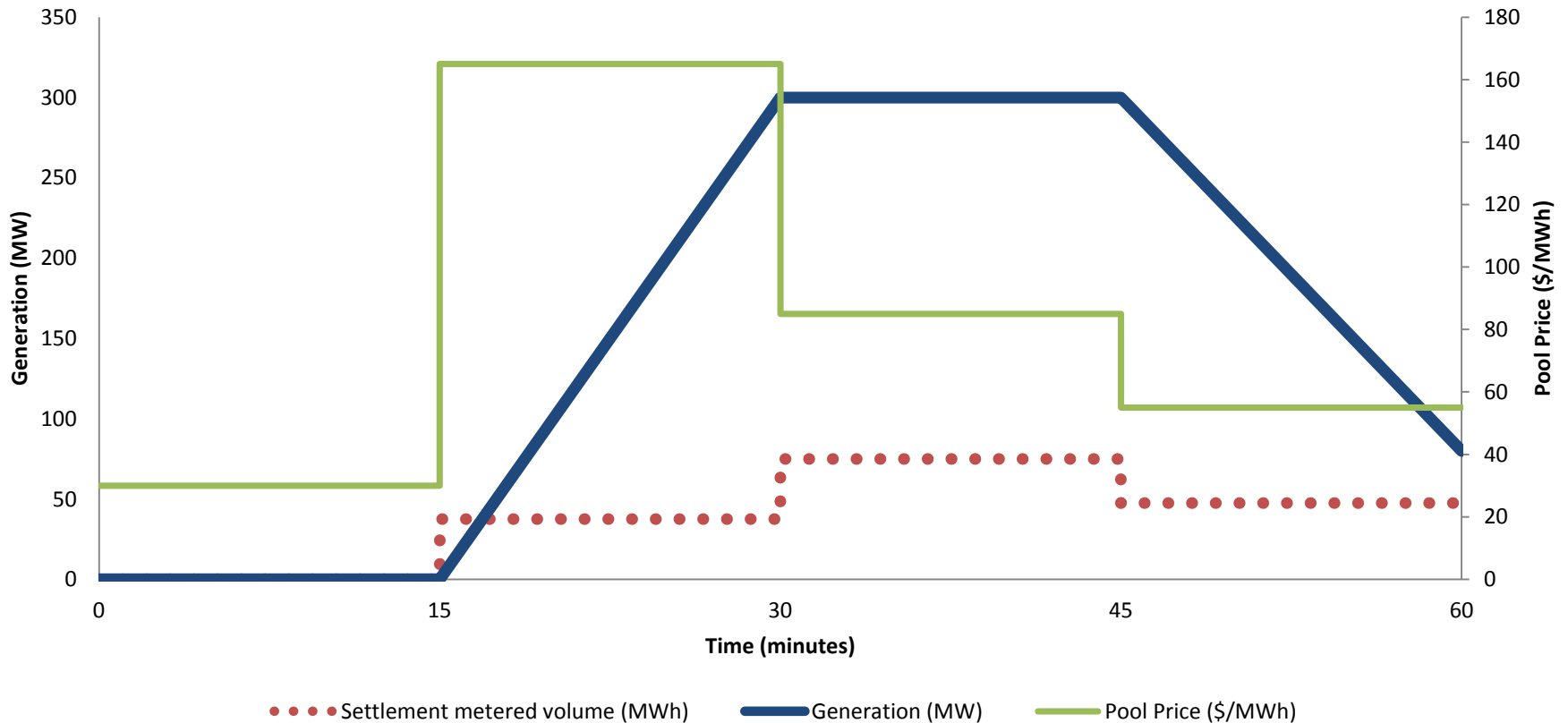
Hourly average pool price (\$)	Total settlement metered volume (MW)	Total hourly revenue (\$)
\$ 83.75	75	\$6,281.25

Interval	Pool Price in interval (\$/MWh)	Generation dispatched (MW)	Settlement metered volume (MWh)	Sub-hourly settlement (\$)
1	\$ 30	300	75	\$ 2,250
2	\$ 165	0	0	\$ 0
3	\$ 85	0	0	\$ 0
4	\$ 55	0	0	\$ 0
			Total	\$ 2,250

- A generator that is forced offline receives the hourly pool price for its production, benefiting from higher prices during the period when it was offline
- A more granular settlement would see the generator paid the price when it was online
- The example would have total revenue of: \$2,250, a reduction of \$4,031 relative to current practices

- Illustrative example 4

### Generation: price responsive



# Part 4: Price responsive generator

Hourly average pool price (\$)	Total hourly settlement metered volume (MW)	Total hourly revenue (\$)	Interval	Pool Price in interval (\$/MWh)	Generation (MW)	Settlement metered volume (MWh)	Sub-hourly settlement (\$)
\$ 83.75	160	\$ 13,400	1	\$ 30	0	0	0
			2	\$ 165	150	37.5	\$ 6,187.50
			3	\$ 85	300	75	\$ 6,375.00
			4	\$ 55	190	47.5	\$ 2,612.50
						Total	\$ 15,175

- Sub-hourly settlement aligns revenue with actual production, increasing revenue for an asset that can respond to price changes, by over \$1,500

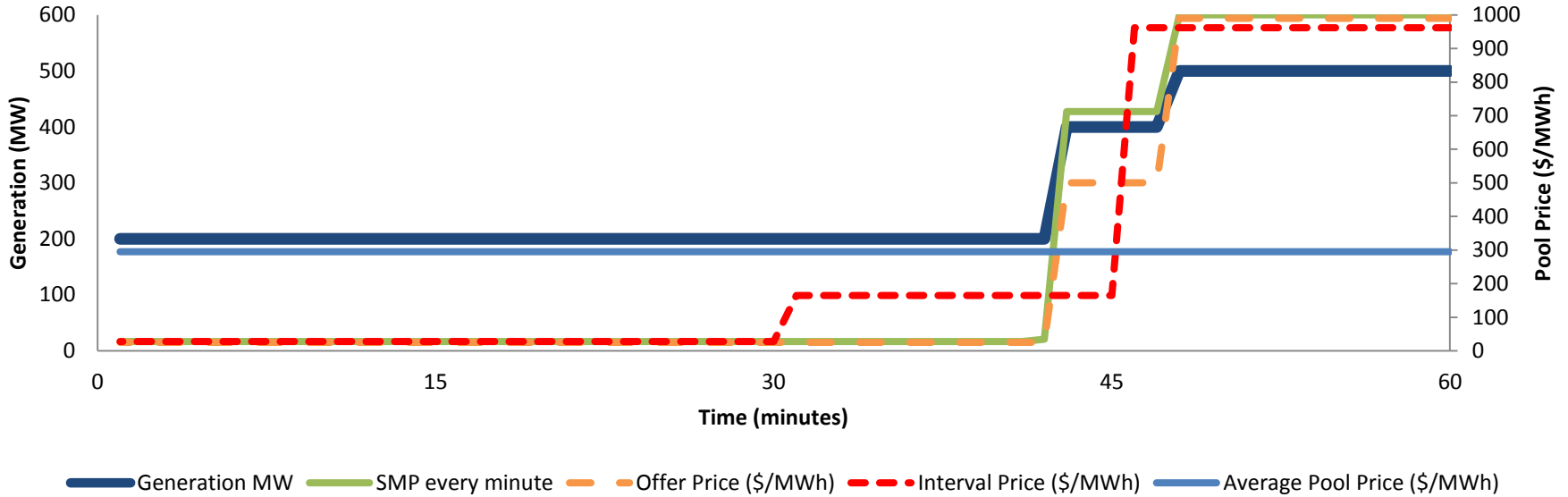
- PSM or “uplift” introduced in December 2007 as a measure to address the mismatch between settlement and dispatch intervals
- Uplift is an after the fact true-up to ensure that generators are kept whole if their offer is dispatched at a price above the hourly pool price
- If settlement interval is shortened, the requirement for uplift may no longer be required

# PSM revenue in an hourly vs 15 minute settlement interval



- Illustrative example 5

Generation: PSM



Generator's energy market offers:

Price (\$)	MW level
990	500
500	400
100	300
25	200
10	100

SMP changes during the hour:

Time	SMP (\$)
:00 to :41	27.77
:42	34.49
:43 to :47	712.21
:48 to :60	999.99

# PSM example continued

Hourly Pool Price (\$/MWh)	Energy Production (MWh)	Revenue based on Hourly Pool Price (\$)	Payment to Supplier on the Margin (\$)	Total Revenue (\$)
295.57	281.67	83,251.18	82,044.77	165,295.95

Interval 1 Price	Interval 1 Energy Produced	Interval 2 Price	Interval 2 Energy Produced	Interval 3 Price	Interval 3 Energy Produced	Interval 4 Price	Interval 4 Energy Produced	Revenue based on 15-min Prices	PSM	Total Revenue
27.77	50	27.77	50	165.11	60	961.62	121.67	129,680	9,772	139,452

# PSM example conclusions

	Hourly Settlement Interval	15 minute Settlement Interval	Difference (\$)
Energy Revenue	\$ 83,251	\$ 129,680	\$ 46,429
PSM Payment	\$ 82,045	\$ 9,772	(\$ 72,273)
Total Revenue	\$ 165,296	\$ 139,452	(\$25,844)

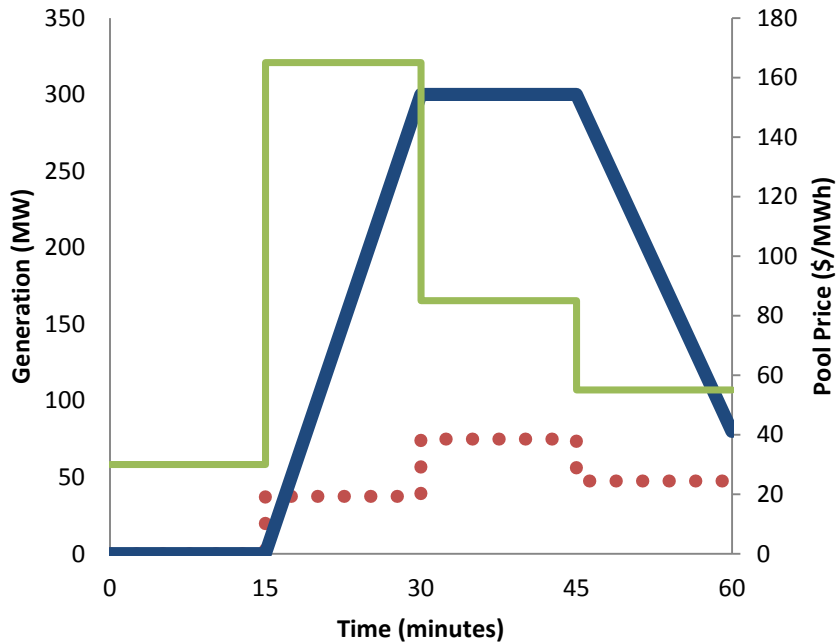
- Total difference in revenue of \$25,844 moving from hourly to sub-hourly settlement
- In this example, energy revenue increased and payment to supply on the margin declined when moving from hourly to 15 minute settlement
- This improves price fidelity as more revenues are reflected in energy vs uplift payments

# Flexibility example - slow vs fast generation



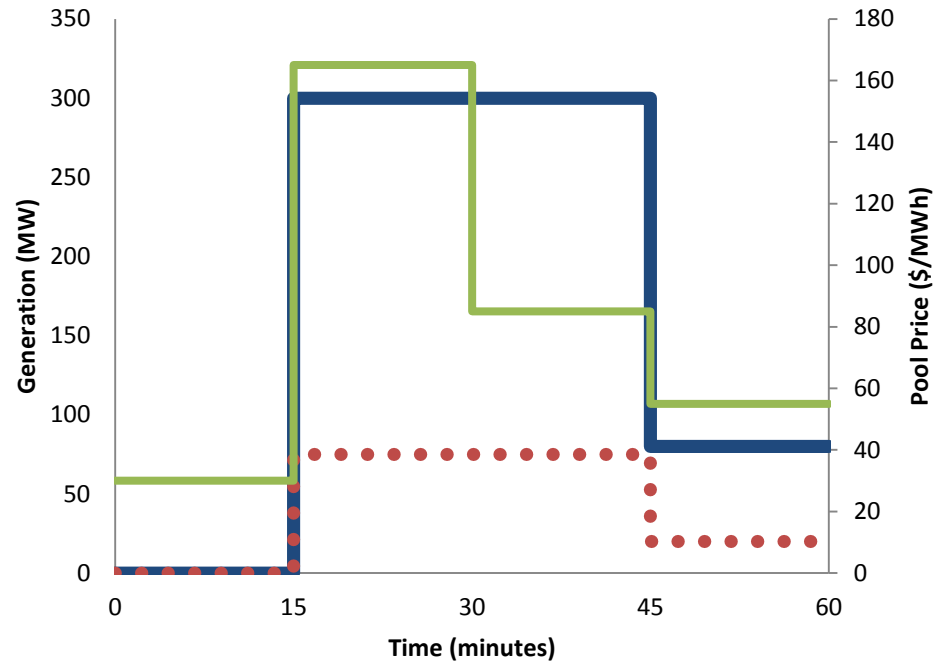
- Illustrative example 6

Generation: slow response



- • • Settlement metered volume (MWh)
- Generation (MW)
- Pool Price (\$/MWh)

Generation: fast response



- Generation (MW)
- • • Settlement metered volume (MWh)
- Pool Price (\$/MWh)



# Part 2: Price responsive generator

## Slow Generation

Interval	Pool Price in interval (\$/MWh)	Generation (MW)	Settlement metered volume (MWh)	Sub-hourly settlement (\$)
1	\$ 30	0	0	0
2	\$ 165	150	37.5	\$ 6,187.50
3	\$ 85	300	75	\$ 6,375.00
4	\$ 55	190	47.5	\$ 2,612.50
			Total	\$ 15,175

## Fast Generation

Interval	Pool Price in interval (\$/MWh)	Generation (MW)	Settlement metered volume (MWh)	Sub-hourly settlement (\$)
1	\$ 30	0	0	0
2	\$ 165	300	75	\$ 12,375
3	\$ 85	300	75	\$ 6,375
4	\$ 55	80	20	\$ 1,100
			Total	\$ 19,850

- Slow generation revenues are \$15,175 compared to fast generation revenues of \$19,850
- A difference of \$4,675, the faster resource benefitted from being able to respond to price changes in a more timely manner
- Sub-hourly settlement improves the signals for flexible resources

- Improved price fidelity
  - Improves alignment of consumption/production with price as demonstrated by the examples provided earlier
  - Decrease in uplift payments such as payments to supplier on the margin. This is beneficial to the market as it reduces the distortionary effects of out of market payments which are not reflected in pool price
- Incentives flexibility
  - Resources that can respond to price (i.e. more flexible) benefit from the sub-hourly settlement interval as demonstrated by the examples provided earlier

# Discussion questions

- We would like market participants' help as we do not have information on market participants' costs and time requirements
- We'll be looking for formal stakeholder feedback after the session and discussion on the slides that follow

- Defining the problem
  - Are we looking at the issue correctly?
- Have we framed the objective correctly?
  - Improve price fidelity
  - Incent flexibility
- Are there other considerations that should be taken into account to determine value in moving to sub-hourly settlement interval?
  - The expected enhancement in price fidelity and flexibility
  - The expected financial impact on loads and generators
  - Implementation costs for AESO and market participants
  - Timing required to transition to a sub-hourly settlement interval

- Understanding the benefits to market participants
  - Would you be changing your behaviour to optimize the benefits of sub-hourly settlement and how would we quantify this benefit?
- Are there benefits that have not been identified that may be unique to the participant or in general?

- Understanding the challenges to market participants
  - We would like to better understand the costs to participants. Can you explain the costs you'd incur for the following elements?
    - Metering
    - IT systems
    - Data storage
    - Other
- Are there challenges that have not been identified that may be unique to the participant or in general?

## Next steps

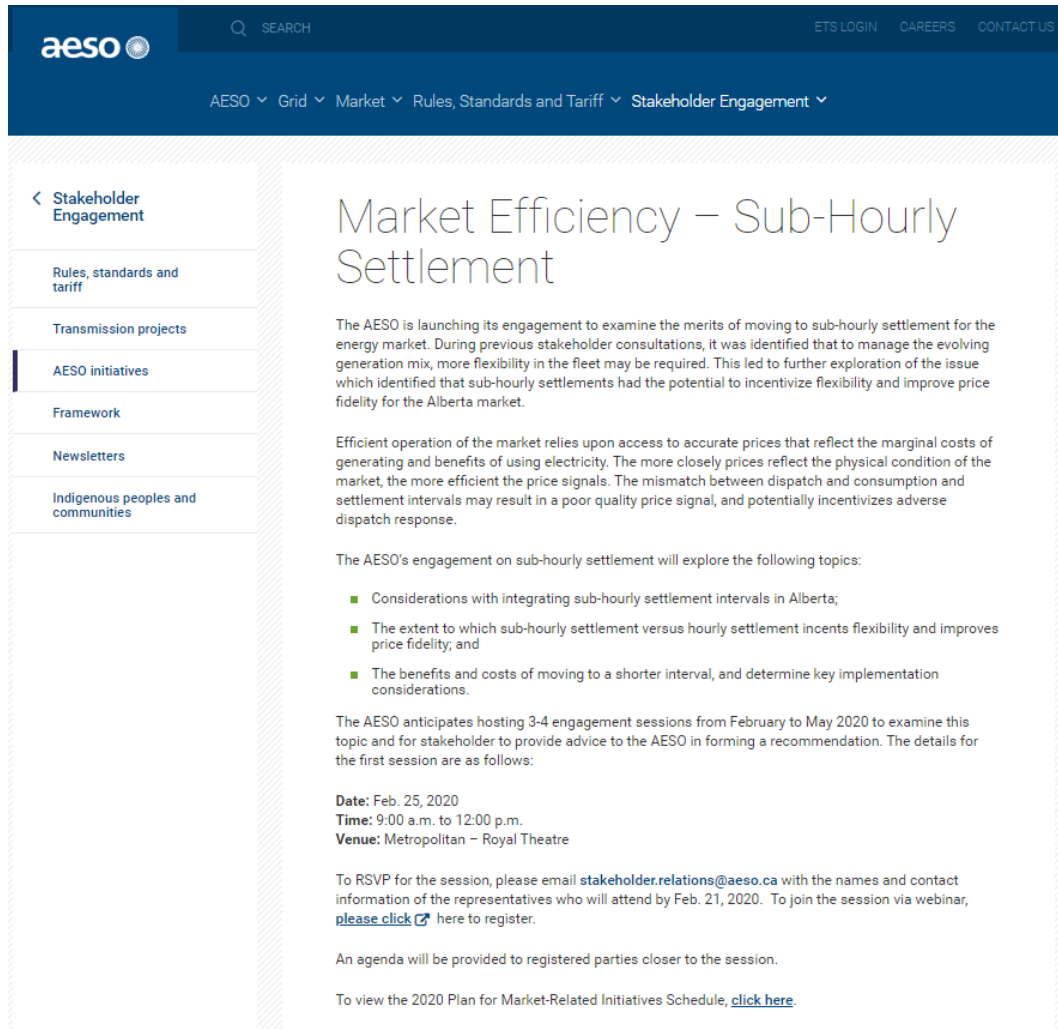


## Session 2

- Comment matrix to be completed prior to session 2
- Topics of discussion:
  - Review feedback from stakeholder comment matrix
  - Benefits
  - Costs



- Comment matrix will be posted on our website



The screenshot shows the AESO website's navigation menu and a page titled "Market Efficiency – Sub-Hourly Settlement". The navigation menu includes "AESO", "SEARCH", "ETS LOGIN", "CAREERS", "CONTACT US", and a dropdown menu with "AESO", "Grid", "Market", "Rules, Standards and Tariff", and "Stakeholder Engagement". The left sidebar lists "Stakeholder Engagement" with sub-items: "Rules, standards and tariff", "Transmission projects", "AESO initiatives", "Framework", "Newsletters", and "Indigenous peoples and communities". The main content area features the title "Market Efficiency – Sub-Hourly Settlement" and the following text:

The AESO is launching its engagement to examine the merits of moving to sub-hourly settlement for the energy market. During previous stakeholder consultations, it was identified that to manage the evolving generation mix, more flexibility in the fleet may be required. This led to further exploration of the issue which identified that sub-hourly settlements had the potential to incentivize flexibility and improve price fidelity for the Alberta market.

Efficient operation of the market relies upon access to accurate prices that reflect the marginal costs of generating and benefits of using electricity. The more closely prices reflect the physical condition of the market, the more efficient the price signals. The mismatch between dispatch and consumption and settlement intervals may result in a poor quality price signal, and potentially incentivizes adverse dispatch response.

The AESO's engagement on sub-hourly settlement will explore the following topics:

- Considerations with integrating sub-hourly settlement intervals in Alberta;
- The extent to which sub-hourly settlement versus hourly settlement incents flexibility and improves price fidelity; and
- The benefits and costs of moving to a shorter interval, and determine key implementation considerations.

The AESO anticipates hosting 3-4 engagement sessions from February to May 2020 to examine this topic and for stakeholder to provide advice to the AESO in forming a recommendation. The details for the first session are as follows:

**Date:** Feb. 25, 2020  
**Time:** 9:00 a.m. to 12:00 p.m.  
**Venue:** Metropolitan – Royal Theatre

To RSVP for the session, please email [stakeholder.relations@aeso.ca](mailto:stakeholder.relations@aeso.ca) with the names and contact information of the representatives who will attend by Feb. 21, 2020. To join the session via webinar, [please click](#) here to register.

An agenda will be provided to registered parties closer to the session.

To view the 2020 Plan for Market-Related Initiatives Schedule, [click here](#).

# Contact the AESO

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Twitter: [@theAESO](https://twitter.com/theAESO)

Email: [stakeholder.relations@aeso.ca](mailto:stakeholder.relations@aeso.ca)

Website: [www.aeso.ca](http://www.aeso.ca)

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**Thank you**

# Appendix

# Timeline – Market Related Initiatives

## 2020 Plan for Market-Related Initiatives

Classification	Market-related Initiatives	2020 Q1			2020 Q2			2020 Q3			2020 Q4		
		J	F	M	A	M	J	J	A	S	O	N	D
Technology Integration	<b>Distributed Energy Resources (DER)</b> Review of DER participation in the energy and ancillary services markets considering must offer, must comply (MOMC), minimum asset size and aggregation	A	A	C	C	C	D	D	D	R	R	R	R
	<b>Short-Term Storage</b> Integrate energy storage in the short term	Progress will be aligned with the Energy Storage Roadmap											
	<b>Long-Term Storage</b> Integrate energy storage in the long term	Progress will be aligned with the Energy Storage Roadmap											
System Reliability	<b>Dispatch Tolerance</b> Investigate implementing tighter dispatch tolerance threshold in Section 203.4 of the ISO rules				A	A	C	C	C	C	D	D	D
	<b>Ramp Table Submissions</b> Investigate a ramp table submission requirement in Section 203.1 of the ISO rules				A	A	C	C	C	C	D	D	D
	<b>Mothball Rule Review</b> Conduct a review of Section 306.7 of the ISO rules	C	C	C	C	D	D	D	D	D	R	R	R
Market Efficiency	<b>Sub-hourly Settlement</b> Determine if sub-hourly settlement will improve price fidelity and incent flexibility	A	C	C	C	C	C	C	D	D	D	R	R
	<b>Priced Interties</b> Enable intertie transactions to submit a non-zero dollar offer	C	C	D	D	D	D	R	R	R	R	R	R
	<b>Price Cap, Price Floor and Shortage Pricing</b> Evaluate the sustainability of the existing pricing structure in maintaining resource adequacy and efficiency in both the short and long term. A review of the price cap, offer cap and floor levels, and a determination if shortage pricing is required.	C	C	C	C	G	G	G	D	D	D	D	R

Market design process phases: Analysis (A), Conception (C), Development (D), Regulatory (R), Implementation (I), Government Policy Advice (G)