

Distributed Energy Resources Engagement and Progress Update Session

February 23, 2021

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- All attendees join the webinar in listen-only mode and the host will have attendee cameras disabled and microphones muted
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 - **The organization you work for and your first and last name**
- Two ways to ask questions if you are accessing the webinar using your computer or smartphone
 - If you would like to ask a question during the Q&A portion, click the icon to raise your hand and the host will see that you have raised your hand. The host will unmute your microphone, you in turn will need to unmute your microphone and then you can ask your question. Your name will appear on the screen but your camera will remain turned off.
 - You can also ask questions by typing them into the Q&A window. Click the “Q&A” button next to “Raise Hand.” You’re able to up-vote questions that have been already asked.

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- Phone controls for attendees
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- The participation of everyone here is critical to the engagement process. To ensure everyone has the opportunity to participate, we ask you to:
 - Listen to understand others' perspectives
 - Disagree respectfully
 - Balance airtime fairly
 - Keep an open mind

Welcome & Introductions

OUR ENGAGEMENT PRINCIPLES

Inclusive and Accessible

Strategic and Coordinated

Transparent and Timely

Customized and Meaningful

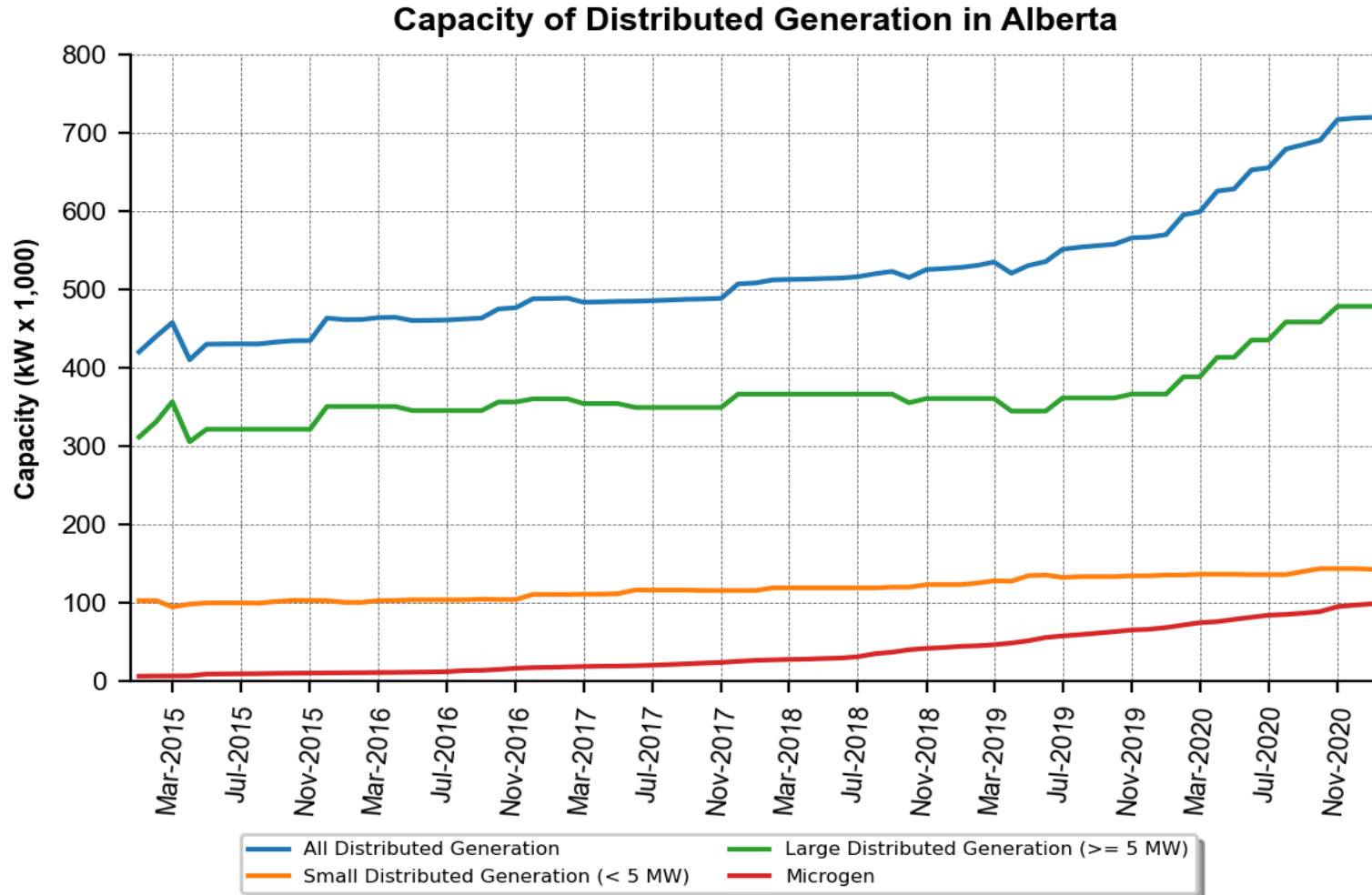
Time	Agenda item
9:00 – 9:10 am	Welcome and introduction
9:10 – 10:40 am	DER Roadmap Update and discussion <ul style="list-style-type: none">• Questions will be taken throughout the presentation
10:40 – 10:45 am	Break
10:45 – 11:55 am	Review of DER Market Participation Recommendation Paper <ul style="list-style-type: none">• Review of issues and options presented in recommendation paper• Questions will be taken throughout the presentation
11:55 -12:00 pm	Closing remarks and next steps

DER Roadmap Update

Robert Davidson, Director, Customer Grid Access

- Provide a quarterly progress update on AESO DER Roadmap Integration Activities:
 - Share progress on the DER Roadmap integration activities since October 2020 update
 - DER Activities in focus
 - Other DER activities update
 - What's Next?
 - Provide an opportunity for stakeholders to ask questions and provide feedback on the information shared

- DERs statistics at the end of Jan 2021



- The DER Roadmap outlines a plan to proactively prepare the AESO for a future state characterized by a higher penetration of DERs on the AIES
 - There are 4 areas of work: Reliability, Markets, Tariff, Regulatory
 - 2020/2021 Plan for DER Roadmap Integration Activities
 - Prioritized activities and published our latest plan in Dec 2020
 - Refer to AESO DER website for more details

DER Activities In Focus

- Activities In Focus
 - Forecast
 - Modeling
 - Under Frequency Load Shedding (UFLS)
 - SCADA data
 - Technical Interconnection Requirements
- Other DER Activity Progress

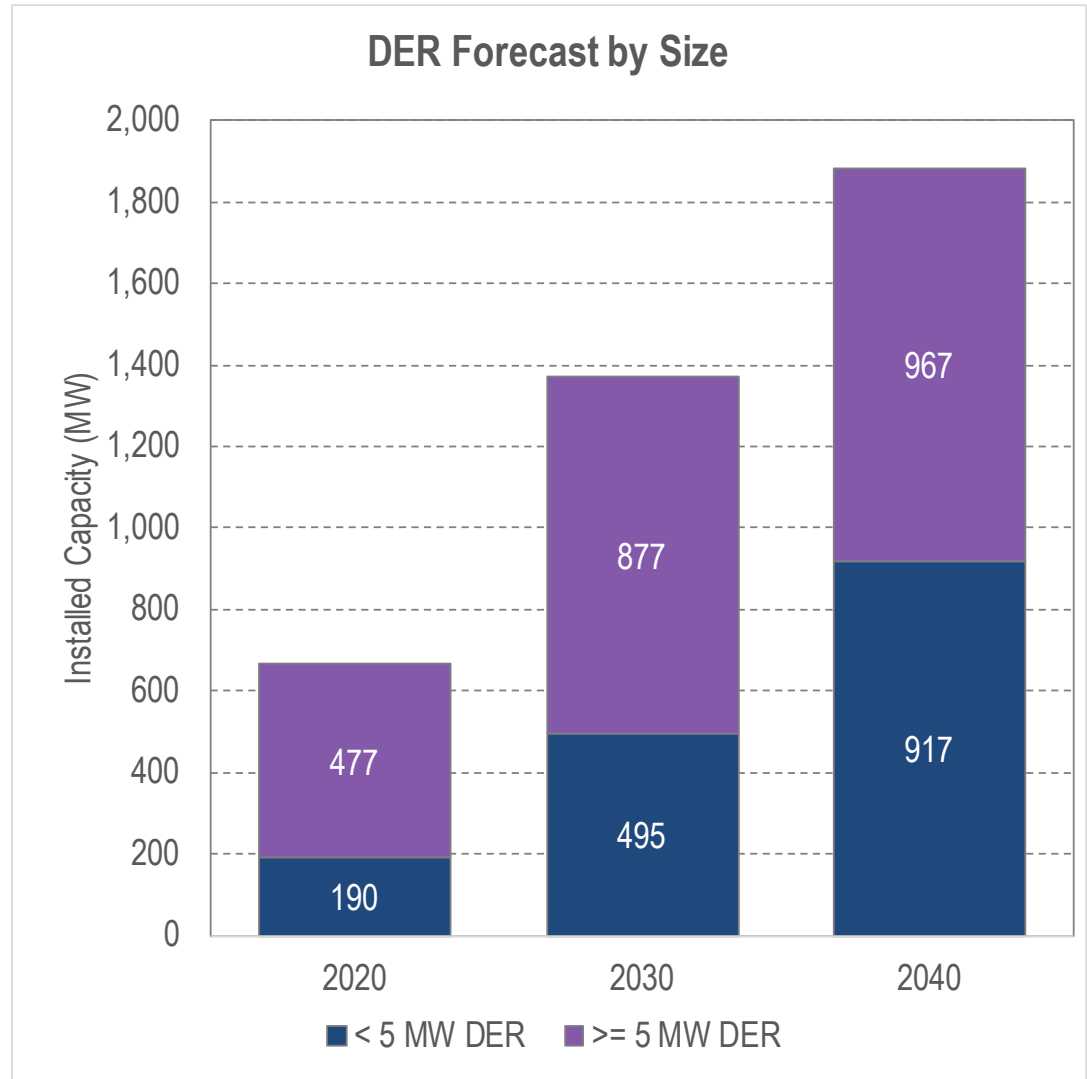
- Background
 - Multiple load forecasting products are used at the AESO – from grid planning to real-time operations
 - Each load forecasting product had varying levels of DER integration
- Goal
 - Expand DER integration within the long-term load forecast – supports long-term system assessment and planning
 - Enhance weather forecast and refine DER generation in short-term load forecast – supports real-time operations and reliability simulations
 - Engage and build a community of DER forecasting knowledge sharing with DFOs

- Why is this important
 - Long-term forecast enhances robustness and reasonability of AESO's system planning needs assessment
 - Short-term forecast improves real-time dispatch operations and contingency planning
 - Promote proactive assessment of future DER impact on grid and distribution network operations by cross-referencing information with DFOs
- Scope of Work
 - Long-term forecast – expand to DCGs (solar, wind, gas) and electric vehicles
 - Short-term forecast – refine DER generation from solar PVs
 - DFO engagement – regular meetings/surveys with DFOs

- Status and Next Steps
 - Long-term forecast – internal AESO studies in early 2021, publish results externally in summer 2021
 - Preliminary results from the reference case were shared publicly so stakeholders could provide comments on potential further scenarios
 - Short-term forecast – live implementation scheduled for summer 2021
 - DFO engagement – began meetings in 2020, will continue going forward

2021 Long-term Outlook Reference Case – Preliminary DER Forecast: Penetration Levels

- Total distributed generation* capacity is expected to triple by 2040: from 666 MW to 1,884 MW
 - Split between sub-5MW and over-5MW distributed energy resources (DER) will even out by end of forecast period
- Growth is expected across all DER technology types, notably:
 - Sub-5MW rooftop solar growth – from 79 MW to 712 MW by 2040
 - 5+ MW gas DCG – from 364 MW to 531 MW by 2040



* Excluding biomass, gas cogen, hydro, other DCG types

2021 Long-term Outlook Scenarios will test different penetration levels

- The AESO consulted with stakeholders on the assumptions for the upcoming the 2021 LTO scenarios
- Broad consensus that DER penetrations for the scenarios should be higher than the preliminary results shown in the Reference Case

Assumption	Reference Case	Clean-Tech	Robust Global Oil & Gas Demand	Stagnant Global Oil & Gas Demand
DER < 5MW – solar, wind and gas	Based on economics and historical trends	Higher than RC: higher adoption rates	<i>Same as RC</i>	<i>Same as RC</i>
DCGs > 5MW – solar, gas	Based on economics and historical trends	Higher than RC: higher adoption rates	<i>Same as RC</i>	<i>Same as RC</i>
Electric vehicle – only residential profiles	Based on economics and historical trends	Higher than RC: higher adoption rates	<i>Same as RC</i>	<i>Same as RC</i>

- Background
 - DER CPS models feed into numerous AESO and Market Participant studies that support long term system planning to near time/real time operation analysis
- Goal
 - Model Interconnected Electric System to include all offering generating assets (> 5MW) for real time operations and long term studies
 - Provide a simple modelling methodology to assist market participants in providing modelling data to the AESO.

- Why is this important
 - Improve CPS DER modelling to support AESO planning and reliable operation of AIES with increasing DER penetration
- Scope of Work
 - Document the rational and DER modelling requirements in a guideline for market participants to provide modelling data for DER > 5MW
 - Simplify approach with a library of typical models
 - Build appropriate aggregated DER models by fuel technology using DER static data for DER < 5MW
 - Establish AESO internal criteria for inclusion of feeder in transmission system model

- Status Update & Next Steps
 - Enhanced Facility Modelling Data ID 2010-001R – complete and pending post in 2021
 - Defined a simplified process for MP to select and submit DER models for DER > 5MW. AESO will publish generic typical models per DER technology
 - Project Data Update Package (PDUP) – complete and posted
 - AESO Internal guideline on inclusion of feeder in transmission system model – complete

- **Background:**
 - UFLS program: OPP804, minimize the risk of total system collapse
 - Varying DER output would affect the net load on the connected UFLS feeder
- **Goal & Why is this important:**
 - AESO needs to better understand DER impact on UFLS load availability and UFLS program effectiveness
- **Scope of Work:**
 - Assess the DER impact on Alberta UFLS program with one DFO using historical hourly load data
 - Investigate the need to further enhance Alberta UFLS annual review process, considering WECC and Alberta practices
- **Status Update:**
 - Completed

- AESO Conclusions:
 - Remind DFOs on UFLS ‘net demand’ reduction; avoid selecting feeders that have large DER for UFLS program
 - No change to Alberta UFLS annual review process based on current DER penetration
 - ~every 3 years, perform assessment to determine DER impact on Alberta UFLS program (depending on priority/resources)
 - Remain connected to WECC UFLS work group

- Background
 - Supervisory control and data acquisition (SCADA) data provides real time visibility to AESO's real time system operation to allow for reliable operation of the AIES
 - AESO SCADA Rule 502.8 only applies to DER \geq 5MW
 - DER $<$ 5 MW SCADA requirements are defined by DFOs and not visible to the AESO
- Goal
 - Assess the need to lower DER SCADA trigger level to expand the AESO's real time visibility of DER smaller than 5 MW.
- Why is this important
 - To ensure continued reliable operation of the AIES with increasing DER penetration
 - Enhance real-time DER forecast capability

- Scope of Work
 - Assess the need to lower the size of DER in consultation with DFO's and TFOs
 - Implement the recommendation from the assessment
- AESO Assessment
 - AESO maintain 5 MW minimum SCADA data trigger for resources (aligned with Market Participation level)
 - DER follow the SCADA requirements set by their connecting DFOs, if more stringent local requirements applied
 - Leverage existing SCADA data from DFOs for DER <5 MW (no additional costs on DERs), establish DFO communication on SCADA data exchange

- Status Update & Next Steps
 - Assessment completed
 - 2021: work with each DFOs to establish connectivity to transfer DER real-time SCADA < 5MW

- Background
 - Increasing DER penetration may impact AIES reliability similar to transmission connected generation
 - Currently no technical requirements set for DER at AESO
- Goal
 - Adoption of appropriate industry standards and working process to meet system reliability needs
 - Align with industry standards
- Why is this important
 - Ensure continued reliable operation and system planning of AIES with increasing DER penetration

- Topics and Scopes of Work
 - Review current DER technical interconnection requirements in consultation with DFOs/TFOs
 - Frequency and Voltage Ride-Through
 - Transmission protection coordination
 - Islanding and anti-islanding

- Status Update and Next Steps
 - Completed exploration discussion with DFO/TFO on the
 - Frequency/Voltage Ride Through capability criteria
 - Transmission Protection and Coordination
 - Effective Grounding
 - Islanding and Anti-Islanding
 - 2021
 - Publish AESO DER Integration papers in 2021 and seek stakeholder feedback
 - Implement recommendation according to AESO DER Integration papers as appropriate in 2021

Other DER Activities Progress

- Continue to progress other reliability activities
 - Static data
 - Coordinated planning
 - Coordinated operation
 - Incorporate DER into net demand forecasting process
 - Enhance real-time operator's supply/demand requirements and displays
 - Determine minimum DER size for triggering significant outage coordination

- DER AESO website
- Publish AESO DER Roadmap Integration papers in 2021
 - Static Data
 - Frequency/Voltage Ride Through
 - Transmission Protection and Coordination
 - Effective Grounding Guideline
 - DER Anti-Islanding Screening and Study Guideline
- Continue with planned exploration and implementation activities in 2021

Questions

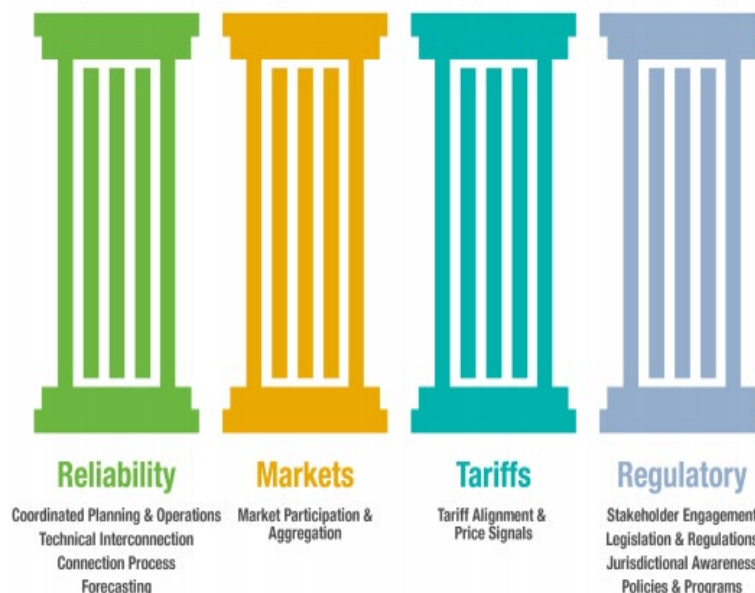
Break

Small Distributed Energy Resource (DER) Market Participation Draft Recommendation

- **DER Roadmap**

- The DER Roadmap integrated plan (June 2020) was created to enable the AESO to help proactively lead the industry forward with DER integration as DER penetration in Alberta grows.
- The Markets pillar will focus on the review of the current market participation thresholds in the energy and operating reserve market, options for further aggregation of DERs, as well as any other market-related matters that arise.
- Any recommended changes to market rules identified will be consulted on as part of the AESO's market initiatives.

DISTRIBUTED ENERGY RESOURCE



- Review to consider market participation changes to the energy and operating reserve markets
 - Market participation requirements need to consider Fair, Efficient, and Open Competition (FEOC) principles
 - Changes must balance potential benefits of increased competition against the considerations for implementation and additional regulatory/compliance requirements for the AESO and market participants
 - Reduce barriers to participation where possible and appropriate to do so
- For purposes of this presentation, all DERs between 1-5 MW, irrespective of the technology deployed, are referred to as “Small DERs”.
 - DERs 5 MW and above are not considered in this review as their market participation is clearly defined in the ISO rules.

- Present the AESO's draft recommendations for Small DER market participation
 - Approach that balances value, benefit, implementation considerations, market transparency, operational effectiveness, timing of need
- Address clarifying questions from stakeholders in today's session in advance of receiving written stakeholder feedback on or before March 17th, 2021

Principle	Considerations
Market Efficiency	<ul style="list-style-type: none">• Increased competition enhances market efficiency<ul style="list-style-type: none">• Assets below 5 MW are currently not allowed to submit offers• This may prevent potential competitors from entering the market• A lower “must-offer” requirement may not materially affect competition<ul style="list-style-type: none">• Renewable generating units likely offer at zero dollars (currently acts as negative load)• Small gas respond to price but not sole factor in output decision• Total volume of dispatchable Small DER currently small – but could grow• Aggregation may allow more assets to participate in the market.
Cost	<ul style="list-style-type: none">• The cost of participant rule compliance and AESO implementation must be weighed against the market benefit<ul style="list-style-type: none">• Increased infrastructure and administrative costs could present an additional barrier to participation

Small DER Market Participation Draft Recommendations:

- 1) Maintain Section 203.1 of the ISO rules, *Offers and Bids for Energy* (must-offer) requirement for energy submissions for source assets 5 MW and greater
- 2) Allow voluntary participation in the energy market for small DERs 1 MW and greater
- 3) Lower operating reserve (OR) asset qualification thresholds to provide operating reserves for regulating reserve, spinning reserve, and supplemental reserve from the current requirement of 15 MW, 10 MW and 5 MW, respectively, to 1 MW
- 4) Allow Small DER (1 to 5 MW) participation in the OR market without a requirement to submit offers in the energy market
- 5) Discontinue exploration of aggregation options for small DERs in the energy market
- 6) Discontinue exploration of aggregation options for small DERs in the OR market

The AESO currently has two participation models in the energy market

Direct Participation:

Section 203.1 of the ISO rules, *Offers and Bids for Energy* (“Section 203.1”), requires offer submissions for source assets with a maximum capability of 5 MW and greater.

Indirect Participation:

Source assets with a maximum capability less than 5 MW are prohibited from submitting offers in the energy market, and as a result, the participation of Small DERs in the energy market is limited to registration and settlement.

Current State:

Section 203.1 *Offers and Bids for Energy*, requires offer submissions for source assets with a maximum capability of 5 MW and greater.

Issue:

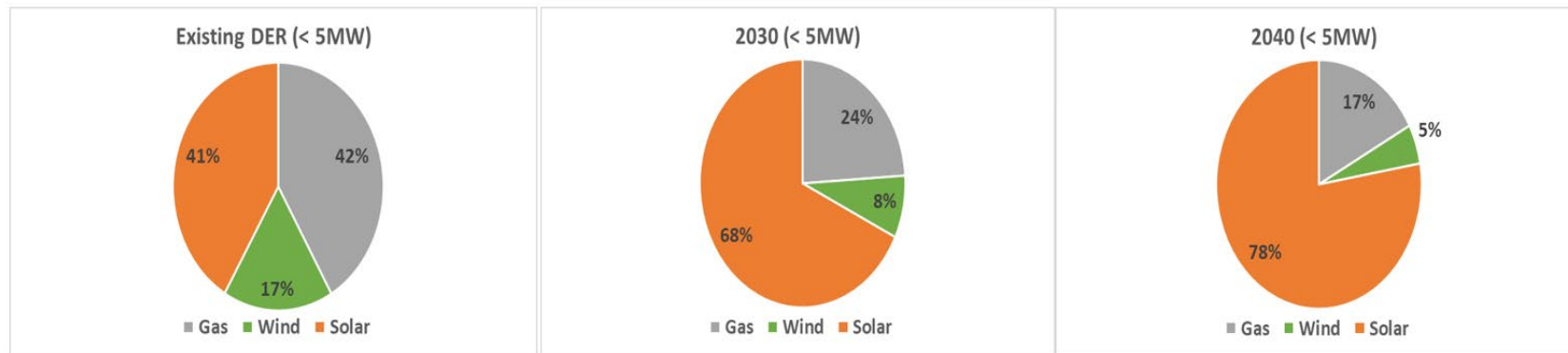
Increased Small DER penetration on the AIES has the potential to impact both system reliability and the FEOC operation of the market.

When assessing whether Small DERs should submit offers in the energy market, the AESO considered the following factors:

- Current installed capacity
 - The number of DERs currently connected to the Alberta Interconnected Electric System (AIES)
- Operational Characteristics
 - Resource characteristics (fuel source, controllability)
 - Price responsiveness to energy market price signal
- Future installed capacity
 - Long term forecasts
 - Growth rates by asset size and fuel type

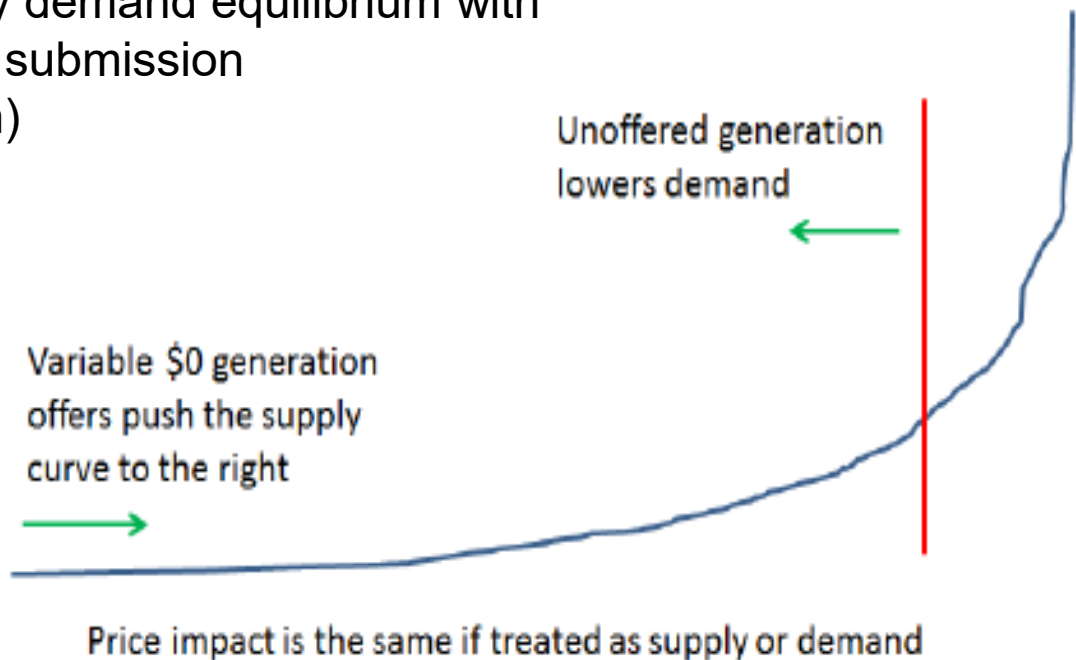
Small renewable variable DERs on the AIES:

- More than 50% of current installed capacity is solar and wind
- By 2040 the AESO forecasts small solar and wind to account for >80% of all < 5 MW DERs



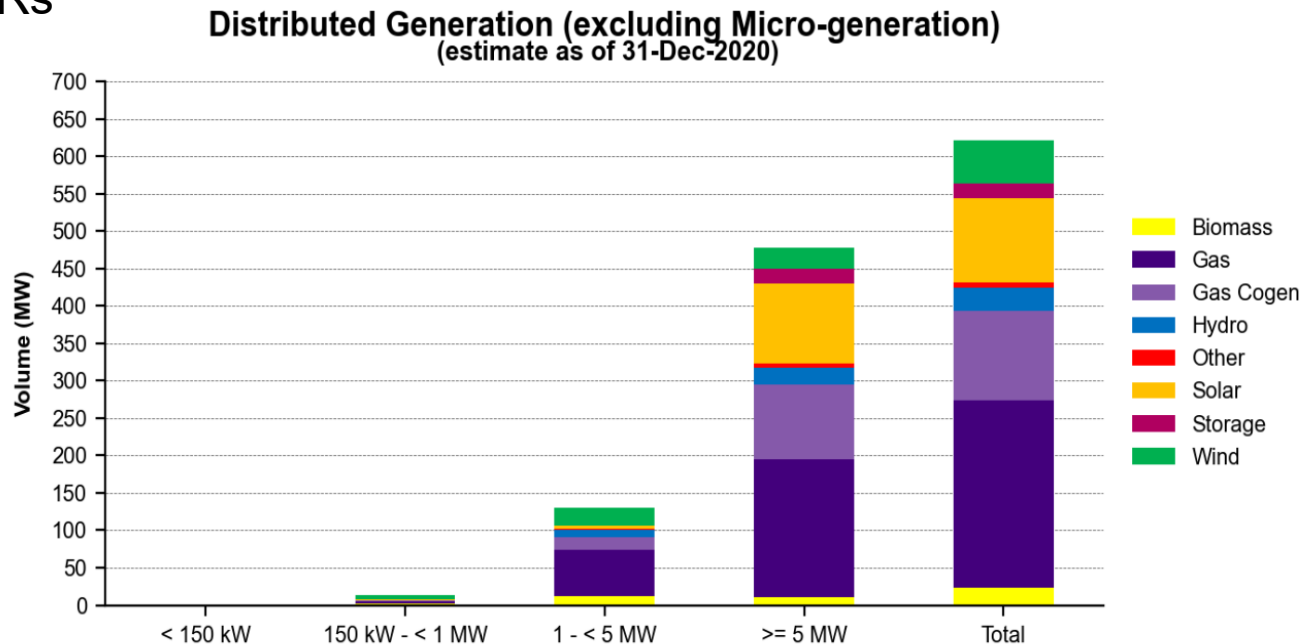
Small renewable variable resource participation in the energy market:

- Non-controllable (dispatchable downwards, not dispatchable upwards)
- Zero cost fuel likely results in zero dollar offer submission (assumption)
- Minimal price impact on supply demand equilibrium with or without energy market offer submission (assuming \$0 offer submission)



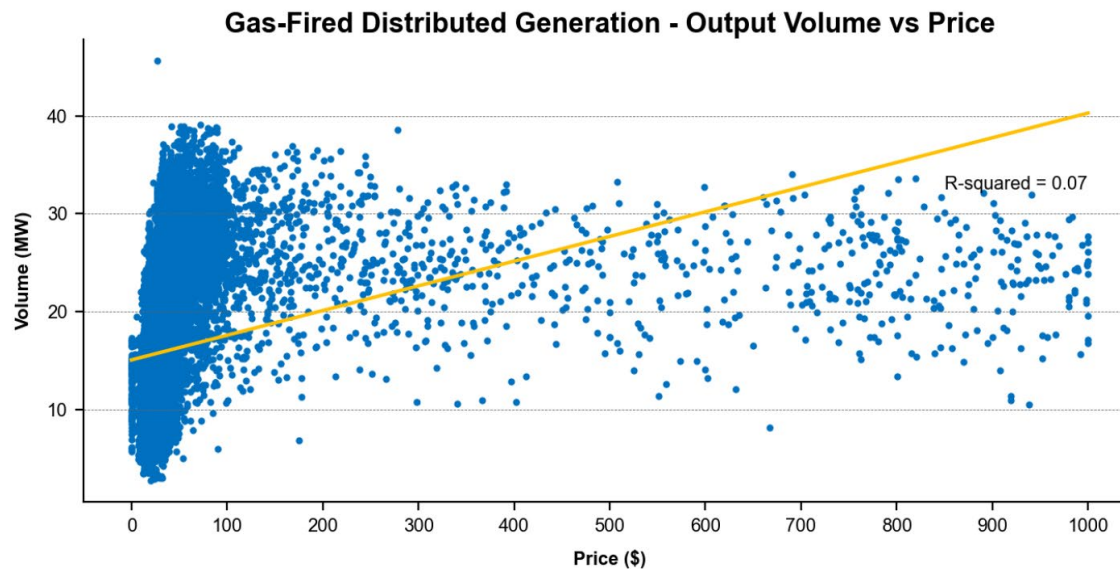
Distributed Generation (excluding Micro-generation) on the AIES:

- Small gas generation (~84 MW) currently accounts for less than half of Small DERs installed capacity, representing approximately 40% of all Small DERs
- By 2040 the AESO forecasts gas generation to account for less than 20% of all Small DERs



Small gas fired generation participation in the energy market:

- Controllable (dispatchable up and down)
- Low correlation to energy market price signal – not primary price signal
- Other factors that may influence output decisions include environmental regulation compliance (flare gas), environmental economics (credits or penalties), cogeneration efficiencies (heat), reliable back-up power, voltage, wires cost avoidance, as well as individual supplemental DFO tariff incentives such as coincident peak calculations



Recommendation:

Maintain ISO Rules Section 203.1 *Offers and Bids for Energy* (must offer) requirement for offer submissions in the energy market for source assets 5 MW and greater

Rationale:

- Current installed capacity is more than 50% renewable variable fuel generation, (mostly solar) with assumed \$0 offer (price taker). Minimal effect on supply demand equilibrium whether these assets are offered into energy market merit order or treated as negative demand.
- By 2040 forecasted installed capacity of Small DERs predicted to be greater than 80% renewable variable generation (mostly solar)
- Small DER dispatchable gas generation has low correlation to energy market price signal (non-price responsive indicating other factors in commercial operational decisions (environmental credits, DG credits, cogeneration, etc.)
- The installed capacity and behavior of Small DERs is not expected to significantly alter competitive outcomes in the energy market. Efficiency benefits from direct participation of Small DERs in the energy market is not expected to outweigh the cost of participant rule compliance and AESO implementation for Small DERs.
- Subject to achieving visibility through other means and setting out required technical standards, the AESO doesn't see a reliability need for which to lower the market participation threshold

Current State:

ISO Rules Section 203.1 *Offers and Bids for Energy*, prohibits source assets with a maximum capability of less than 5 MW from submitting offers in the energy market. As a result, the participation of Small DERs in the energy market is limited to registration and settlement

Issue:

Prohibiting source assets with a maximum capability of less than 5 MW from competing in the energy market through the submission of offers may be a barrier to Small DER participation in the energy market

Recommendation:

Allow voluntary participation in the energy market for Small DERs 1 MW and greater

Rationale:

- Current rule is a barrier to participation for Small DERs in the energy market
- Offer submissions from Small DERs in energy market is unlikely to impact system reliability or market operations
- Inclusion of small DERs is consistent with the FEOC operation of markets
- Recommended change could be implemented without costly IT system upgrades
 - The AESO's operational IT systems do not currently dispatch in fractions and as such, lowering the threshold below 1 MW would require costly IT system upgrades

Current State:

OR qualification: Section 205.4, 205.5, and 205.6 of the ISO rules require that the asset must be capable of providing a minimum of 15 MW of regulating reserve, 10 MW of spinning reserve, and 5 MW of supplemental reserve, for each individual product.

Issue:

The minimum asset size requirements to qualify to provide OR in Alberta may be a barrier to participation for Small DERs.

A recent AESO technical study indicates that OR market thresholds in Alberta could potentially be lowered to similar thresholds in the U.S.

Minimum U.S. asset size requirements for OR Participation compared to AESO:

Ancillary Reserves Market	PJM	CAISO	NYISO	NEISO	AESO
Minimum Asset Size Requirement(s)	100kW	500kW (in process of lowering to 100 kW)	100kW	0.1MW to 5MW (pending asset configuration)	15MW Regulating 10MW Spinning 5MW Supplemental

Recommendation:

Lower OR asset qualification thresholds to provide operating reserves for regulating reserve, spinning reserve, and supplemental reserve from the current requirement of 15 MW, 10 MW and 5 MW, respectively, to 1 MW.

Small DERs intending to participate in the OR market will still be required to meet appropriate technical and SCADA standards/requirements for the purposes of qualification.

Rationale:

- Current rule a barrier to participation for Small DERs in the OR Market
- Reducing threshold may increase competition in the OR Market
- Inclusion of small DERs consistent with FEOC operation of markets
- Recommendation limit of 1 MW or greater due to current IT system limitations (market participants cannot submit fractional offers and AESO cannot dispatch in fractions). IT system upgrade not recommended at this time due to anticipated low participation from market participants under 1 MW

This recommendation is to be included in the OR Review market initiative. Any changes to the ISO rules will be consulted on with stakeholders in accordance with AUC Rule 17.

Current State:

Section 203.1 of the ISO rules, *Offers and Bids for Energy* states that source assets with a maximum capability of 5 MW or greater are required to submit offers into the energy market. The current minimum asset capability requirements for qualification in the OR market are at least 5 MW.

Participation in the OR market is voluntary, whereas, participation in the energy market is mandatory for all source assets with a maximum capability of 5 MW or greater. Consequently, those voluntarily participating in the OR market are also currently required to submit offers in the energy market.

Issue:

If the AESO recommends that the requirement to submit offers in the energy market remain at the current minimum size threshold of 5 MW or greater and the minimum asset capability requirement for qualification in the OR market be lowered to 1 MW, the combined effect of these two recommendations is that Small DERs voluntarily participating in the OR market will not be required to submit offers in the energy market.

Recommendation:

Allow Small DERs (1 to 5 MW) participation in the OR market without a requirement to submit offers in the energy market

Rationale:

- The ISO rules do not require concurrent bids and offers in the energy market when participating in the OR market and a new rule requirement is not needed
- Mandatory energy market participation if participating in the OR market may be considered barrier to participation in the OR market for Small DERs
- Increases competition in the OR market; little benefit from increased competition in energy market

Current State:

The ability to aggregate for participation in the energy market is limited by the requirements of *ISO Rules Section 501.10 Transmission Loss Factors*. For DERs, the requirements of the Loss Factor Rule mean that such resources may offer either as individual source assets or as an aggregated source asset as long as the resources are downstream of a single substation and can be metered through a single measurement point on the transmission system.

Issue:

Minimum asset size requirements to submit offers into the energy market are a barrier to participation for DER with a maximum capability below 1 MW.

Recommendation:

Discontinue exploration of aggregation options for Small DERs in the energy market

Rationale:

- Expected that the recommendation to allow voluntary participation in the energy market for Small DERs 1-5 MW will enable most DERs that are capable and willing to compete in the energy market the opportunity to do so
- Low support and/or interest from industry stakeholders
- Further exploration may be initiated if stakeholders identify the need and priority to proceed

Current State:

- Minimum size threshold to qualify in the OR market is 5 MW
- Aggregation in the OR market was primarily being reviewed for the purposes of meeting minimum size thresholds
- Sink assets participating in SUPL are currently permitted to aggregate subject to operational proximity

Issue:

If minimum size thresholds are reduced to 1 MW for the OR market, there may be a barrier to participation for assets under 1 MW as new technologies continue to emerge such as electric vehicles, and home & commercial energy storage

Recommendation:

Discontinue exploration of aggregation options for small DERs in the OR market

Rationale:

- The recommendation to lower the OR asset qualification thresholds to 1 MW will significantly reduce the need for aggregation in the OR market for most Small DERs
- Stakeholder interest in advancing these changes was limited.
- The AESO will be conducting stakeholder sessions in 2021 regarding OR Market Design

- Stakeholders provide written feedback – March 17, 2021
- AESO response to stakeholder feedback and final recommendation – April 2021
- ISO rule development process to be coordinated with other market initiatives

Questions?

- We want to thank you for attending the Joint Stakeholder Engagement Session for Distributed Energy Resources and we would appreciate your feedback on the session
- We value stakeholder feedback and we invite all interested stakeholders to provide their input on this session and the questions set out in the DER Comment Matrix, both are available by following the path:
www.aeso.ca > Distributed Energy Storage
- To limit stakeholder fatigue, we are modifying how we collect your initial feedback on the session by conducting a Zoom poll during the session rather than emailing you a short session survey following the session.

Thank you



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