

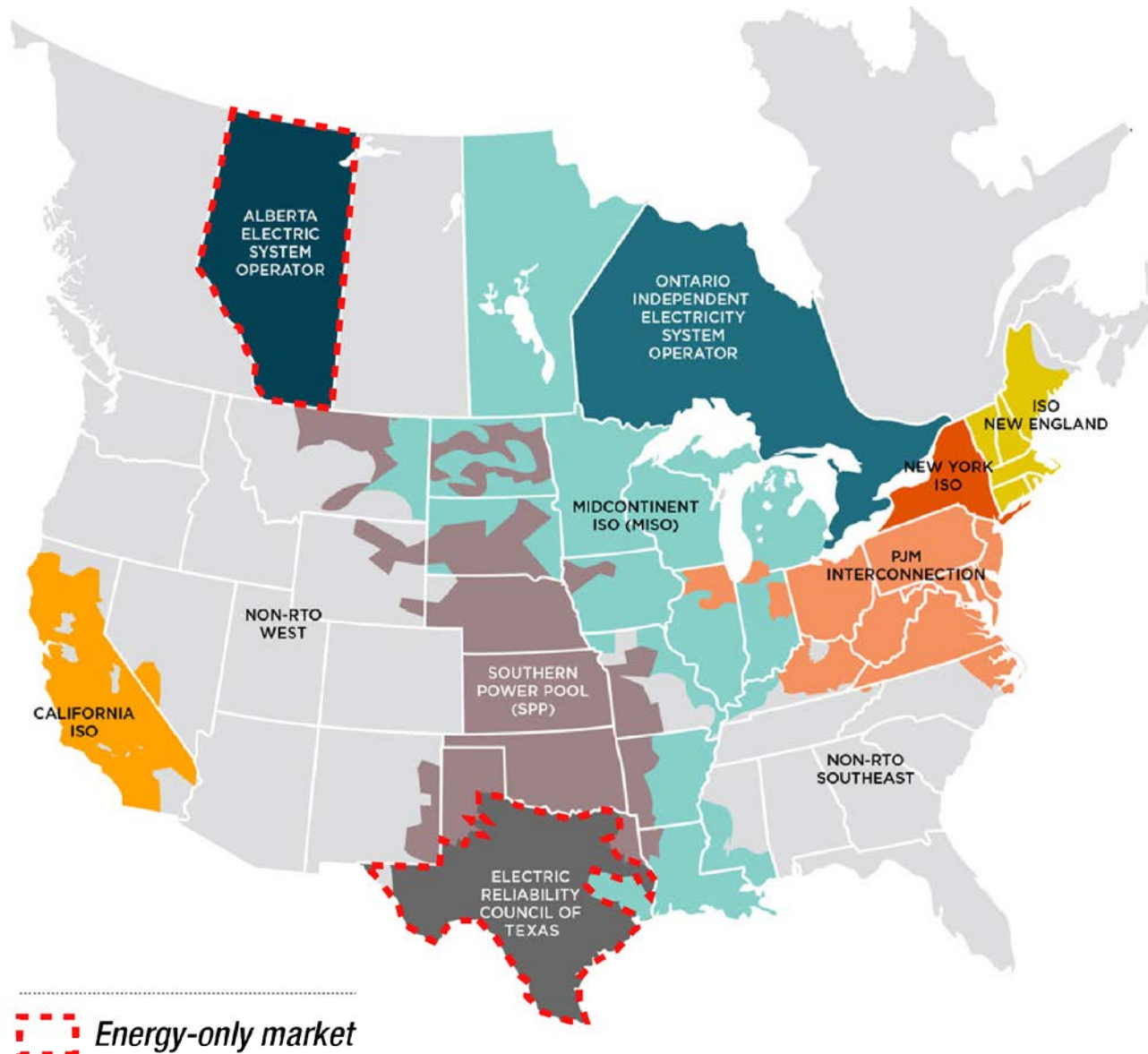
AESO Energy Storage Roadmap Update

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October 20th, 2020

- Introduction to Alberta
- Background and Overview of Energy Storage Roadmap
- Motivation for change & Principles
- Current State & Challenges
- Integrated Schedule
- Energy Storage Roadmap Update
- Next Steps

ISOs manage much of North America's electricity grid



Alberta's electricity regulatory structure

Minister of Energy
Appoints AESO Board, MSA & AUC Chair

*Electric Utilities Act
(EUA)*

*Alberta Utilities
Commission Act
(AUCA)*

Balancing
Pool

Independent
System Operator
(AESO)

Alberta Utilities
Commission
(AUC)

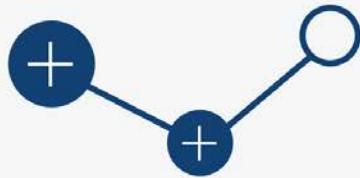
Market
Surveillance
Administrator
(MSA)

Generators

Transmission
Facility Owners

Distribution
Facility Owners

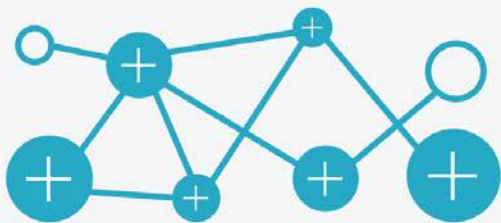
Retailers &
Self-Retailers



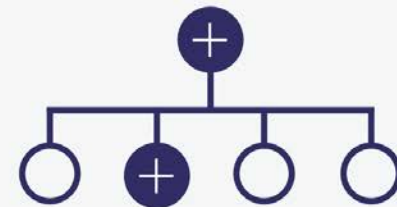
Connect
CUSTOMERS



PLAN
transmission

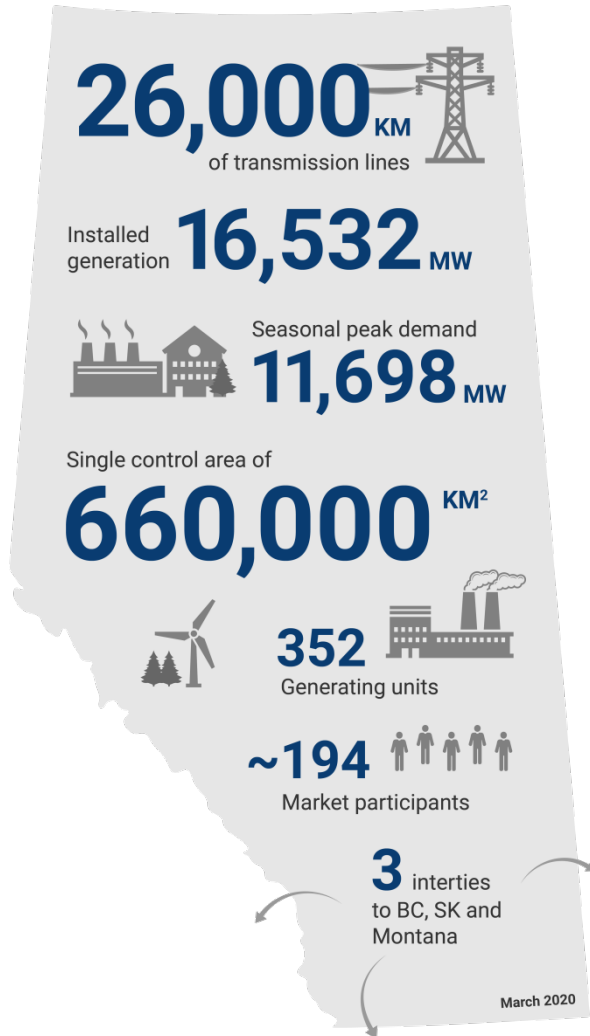


Operate the
GRID

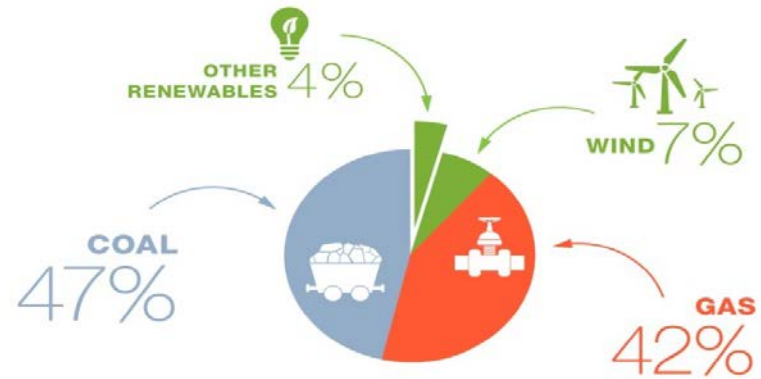


Plan and Operate the
MARKET

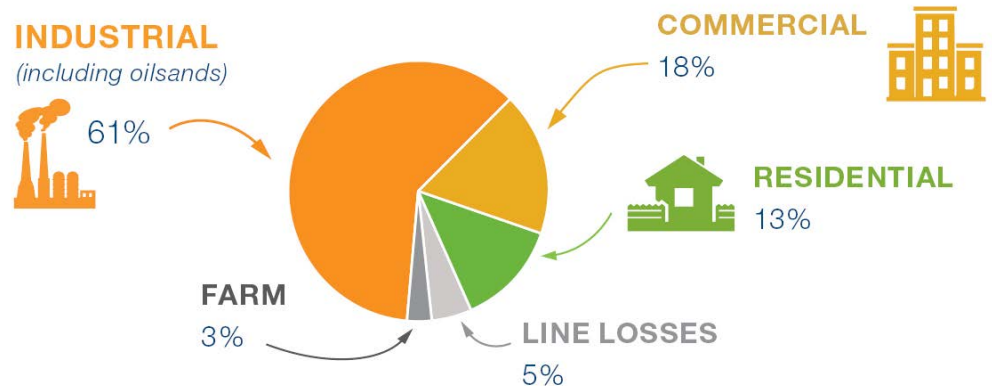
Alberta System Overview



NET TO GRID GENERATION



DEMAND

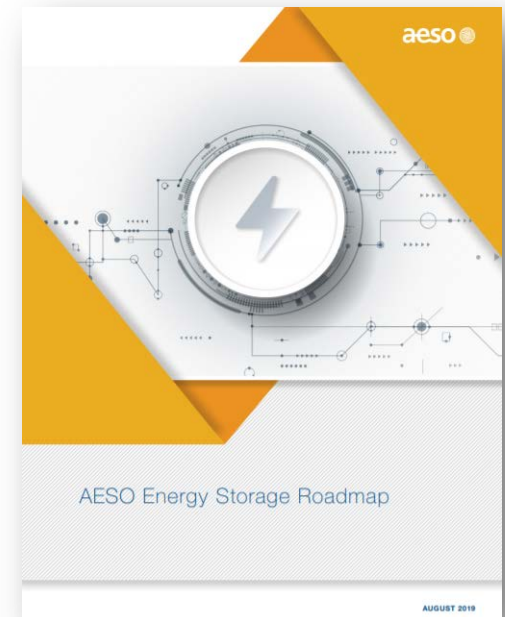


- AESO is mandated to promote the fair, efficient and openly competitive exchange of electricity
- *Dispatchable Renewables and Energy Storage report** published in September 2018
 - Recommended creating an energy storage roadmap and a flexibility roadmap
- Legislation, regulations and AESO Authoritative Documents do not fully contemplate the integration of energy storage
- AESO is committed to working through these issues

* www.aeso.ca/assets/Uploads/AESO-Dispatchable-Renewables-Storage-Report-May2018.pdf

- Published the AESO's Energy Storage (ES) Roadmap document in August 2019
- Sets out the AESO's plan to facilitate the integration of energy storage
 - Improves clarity required for market qualification and participation, enable efficient and effective connection as well as monitoring and control of energy storage facilities
- Aims to meet in-service dates starting in mid-2020
- The long-term integration of energy storage forms a key part of the Energy Storage Roadmap
 - Includes changes to AESO Authoritative Documents, Information Documents, and AESO grid and market systems

- Objective of the Principles:
 - Industry alignment
 - Guide the development of the Energy Storage Roadmap
- General Principles related to the Roadmap Objectives:
 - The AESO will facilitate the integration of energy storage
 - Energy storage will be approached as a **unique asset type**; it is neither a load nor a generator
 - The AESO will be impartial to energy storage technology, configuration and point of connection





Level the playing field



Value and benefits

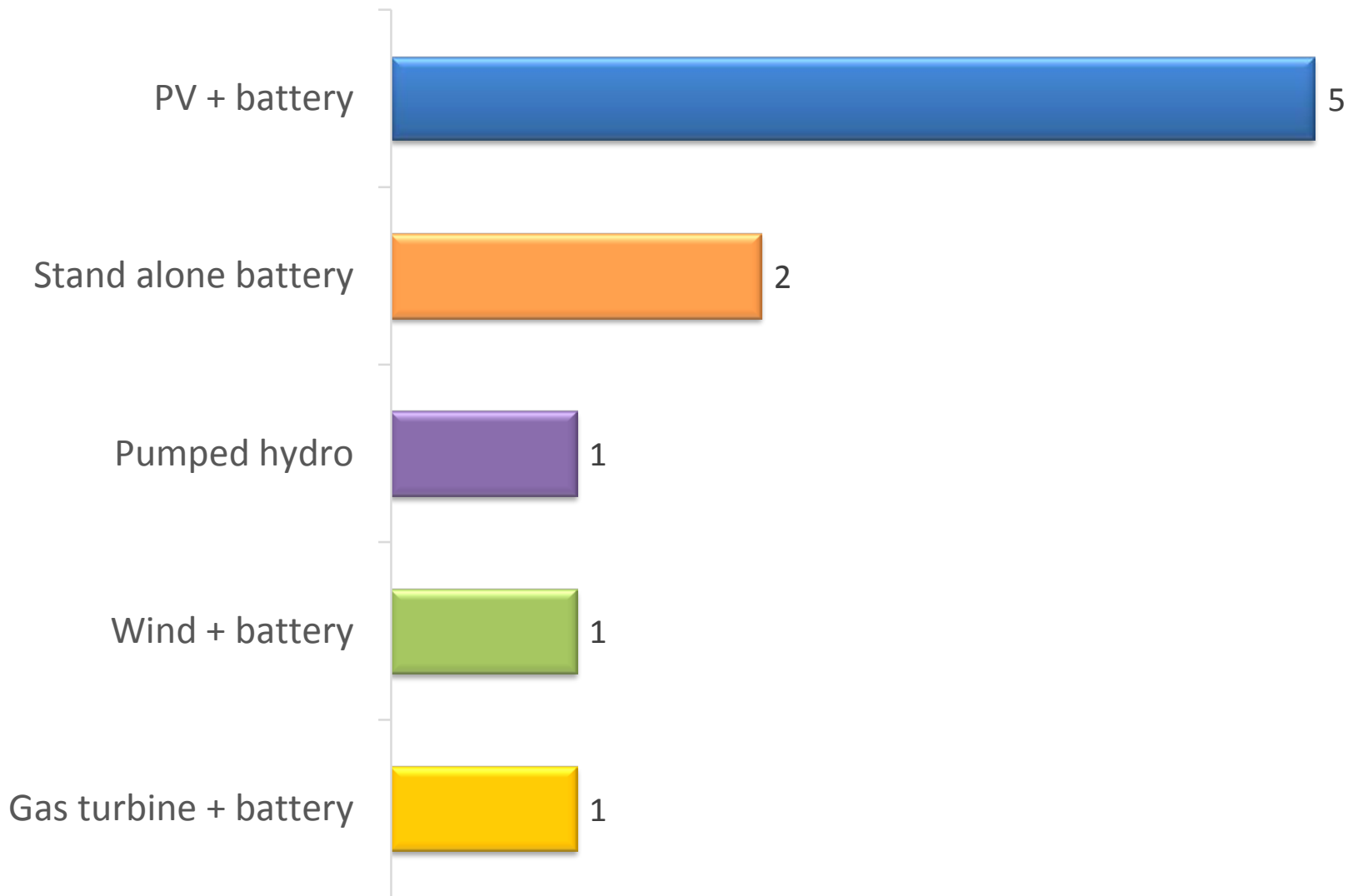


Looking to other jurisdictions

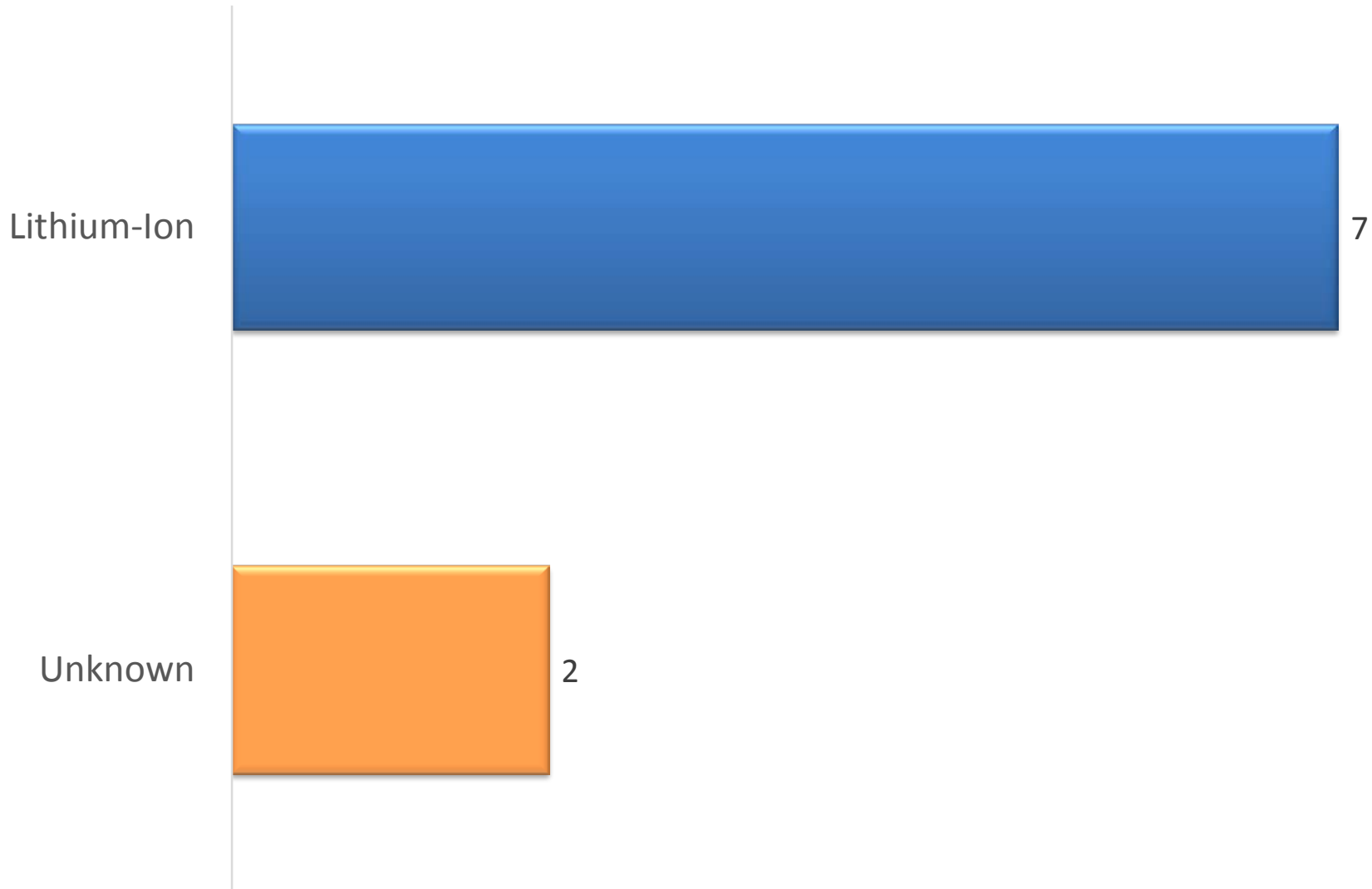
- Energy storage can participate in Alberta's electricity markets as two separate assets, a generator or a load
- Existing AESO Authoritative Documents and tools do not fully contemplate energy storage, resulting in a lack of clarity
- The AESO is currently engaging stakeholders in a review of the bulk and regional tariff design
 - Including review of the applicable tariffs or opportunity services as they relate to energy storage

- First transmission-connected energy storage project:
 - ✓ TransAlta Summerview 2 successfully implemented Sept 10, 2020
- There are 10 projects currently on the connection list
 - ENMAX Crossfield
 - ATCO Rycroft
 - Fortis Alberta Buffalo Creek
 - Fortis Alberta Killarney Lake
 - EDTI DG Solar
 - ATCO Longspur
 - Fortis Alberta Metiskow
 - Fortis Alberta Burdett
 - TPG Canyon Creek
 - TCE Saddlebrook
- Two of these projects currently have in-service dates (ISDs) in 2020
 - ENMAX Crossfield
 - ATCO Rycroft

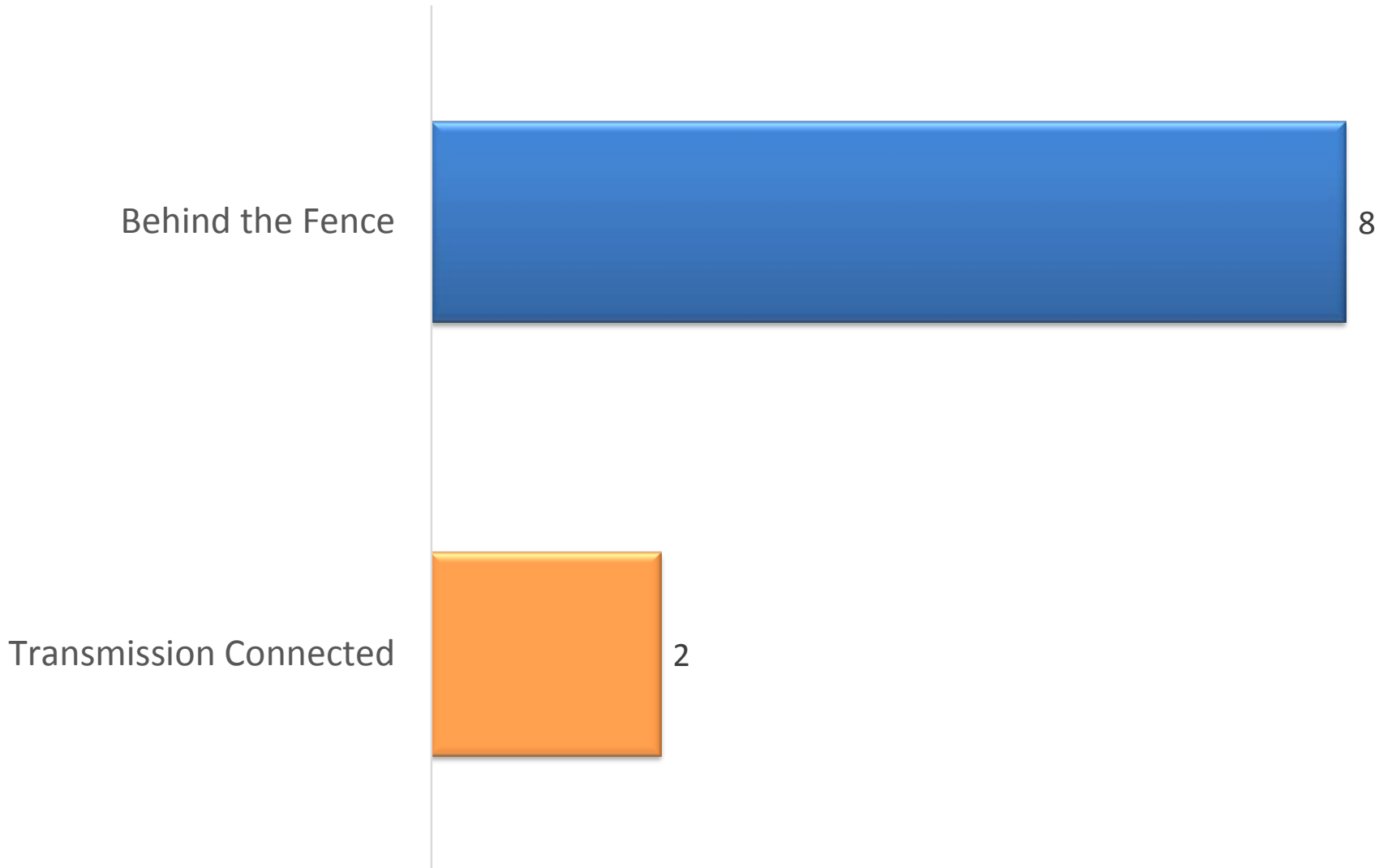
Energy storage projects by technology*



Energy storage projects by battery type*



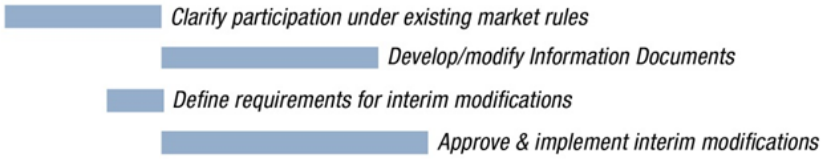
Energy storage projects by connection option*



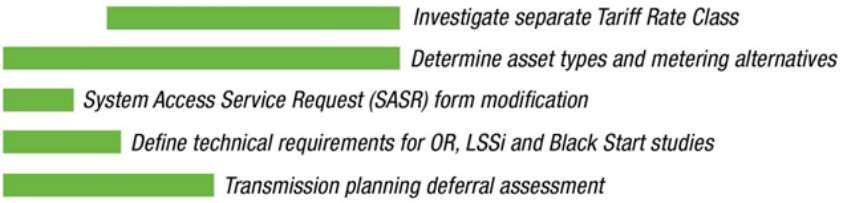
Integrated schedule



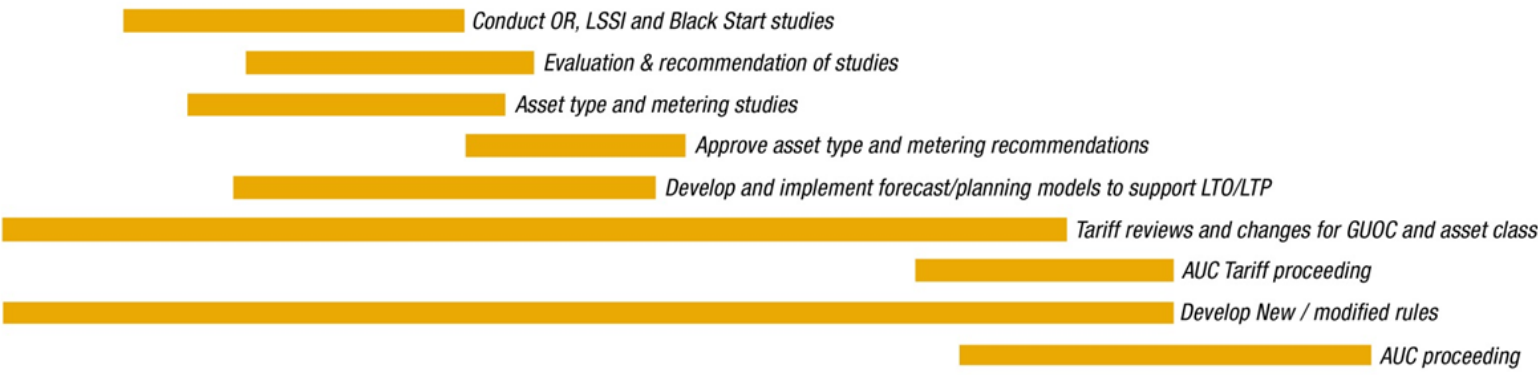
Active Connection Projects



Phase 1 Short-term Implementation



Phase 2 Long-term Implementation



- Short term solution: Energy Storage Active Connections Project
 - Integration of Energy Storage into the AIES in the interim
 - The project encompassed, but was not limited to, the following:
 - Current framework and resulting IDs
 - Active connections projects and configurations
 - Software solutions (EMS)
 - First transmission-connected energy storage project was energized in early September

- AESO cross-functional groups continue to work on:
 - Forecasting, planning and market reports
 - Configurations, market qualification and connection requirements
 - Market participation
 - Operations
 - Storage as a transmission alternative

- Integrate ES into the forecasting, planning and market reporting processes at the AESO
- Review of the Facility Modelling Data for ES was completed
- Reviewed the energy storage reporting practices for public facing market reports in other jurisdictions. Currently, reviewing reporting options with consideration for Fair, Efficient, and Openly Competitive (FEOC) regulation requirements
- Ongoing activities (priorities for Q4 2020)
 - Continue incorporating ES in the Long-term Outlook

- Reviewed potential configurations and determining associated connection and qualification options
- Establishing a consistent approach for technical considerations including:
 - modeling and studies, metering, qualification requirements to participate in markets and provide services, applicability of technical requirements
- Enabling the connection process for active ES projects
- Ongoing activities
 - Continuing to monitor active connection projects for learnings applicable to long-term recommendations
 - First ES project energized in September 2020
 - Establishing qualification and technical requirements for the energy and ancillary service markets
 - Determining technical requirements and ARS applicability

- AESO initiating stakeholder engagement on the long-term market participation
 - Market Participation Options Paper Released October 1st
 - The evaluation of the long-term energy market participation includes:
 - *Hybrid participation*
 - *Half-range energy offers versus full-range participation*
 - *Defining State of Charge*
 - *Commissioning requirements for storage*
 - AESO will be engaging stakeholders on Market Participation options and the draft recommendation; once the recommendation of ES Market Participation is finalized the process will shift to ISO Rule development process if required.

- Evaluate how ES assets can operate in the various markets to develop a framework to reflect various potential configurations in support of a reliable AIES
- Ongoing activities
 - Technical assessments on ES configurations and market participation options
 - Technical studies to understand ES performance capabilities and potential grid reliability impacts from ES participation in the long-term
 - Requirements for ancillary services (e.g., fast frequency response
 - LSSi, blackstart services)
 - SCADA requirements

- Ongoing activities
 - Review of policy, technical and economic assessments, market impacts, procurement, transmission planning process and associated requirements for regulatory processes related to SATA

- Energy Storage Industry Learnings Forum (ESILF)
- ESILF first workshop held on Sept 18, 2020 with the attendance of majority of the members, Alberta Energy, Market Surveillance Administrator (MSA) and the Alberta Utilities Commission (AUC)
- Scope of the workshop included presentations from ESILF members on their expertise and experiences in the selected topics
- Workshop topics included:
 - Market opportunities in the energy and ancillary services markets, or other potential revenue streams
 - Connection options;
 - ES configuration options
- Presentations and summary of the workshop will be posted on www.aeso.ca

- Future workshop topics are as follows:
 - **Workshop 2:**
 - Sharing learnings from other jurisdictions on legislation, regulation and policy
 - Storage as a transmission alternative (or a distribution alternative)
 - Market qualification parameters, process, models and data (SCADA) requirements
 - **Workshop 3:**
 - Sharing of experiences in commissioning and testing of new technologies or configurations
 - Economic modelling
 - Process efficiencies within existing framework

2020 Q3 → 2021 Q2 Plan – Timeline

Classification	ES Roadmap Integration Activities	2020 Q3			2020 Q4			2021 Q1			2021 Q2		
		J	A	S	O	N	D	J	F	M	A	M	J
Education and Awareness	ES Progress Updates – UPDATED Share progress on the Energy Storage (ES) Roadmap integration activities, interrelated initiatives as well as provide a forum to address stakeholder questions.	E			E			E			E		
	ES Industry Learnings Forum (ESILF) – UPDATED Organize forum to provide expertise and key learnings to the AESO on targeted matters related to the integration of energy storage in Alberta.			E		E			E				E
Phase 1 Short-term Implementation	ISO Tariff Design – RESUMED Work in concert with ISO tariff design to ensure ES is considered.	Progress will align with Bulk and Regional Tariff Design											
Phase 2 Long-term Implementation	Forecasting, Planning and Market Reports Develop and implement forecasting and planning models to support Long-term Outlook (LTO) and Long-term Transmission Plan (LTP).	A						C					
	Configuration, Qualification and Connection Requirements Develop appropriate functional specification documents; identify market participation options, permissible configurations and metering requirements.	A	C						D				
	Market Participation Evaluate long-term options for energy storage participation in the Energy and Ancillary Service markets.	A		C, D						D			
	Operations Perform technical studies for the review of the operating parameters and requirements for the different types and configurations of ES; identify the impact to the connection processes and system applications to enable full range of ES operation.	A		C						D			
	Storage as a Transmission Alternative (SATA) Develop evaluation criteria and quantification of benefits of SATA as a non-wire solution; identify technical parameters and configurations, asset ownership and market participation options for SATA.	A	C						D				

E – Engagement: inform and/or discuss topics with Stakeholders

A – Analysis: internal work phase for the AESO where an activity is researched, performed analytics, studies, etc.

C – Conception: after analysis, AESO will conduct an options analysis and may develop recommendations on the matter.

D – Development: AESO shares recommendations and works with stakeholders to create proposed ISO rules or changes to existing ISO rules.

- Engage with industry
 - Ongoing communication: sessions on bulk and regional tariff design as well as market participation requirements already underway
 - Quarterly update sessions
 - Complete work in remaining change areas before initiating industry engagement
 - Storage being considered as an option to provide fast frequency response along with LSSi
- Continue to enable active energy storage connection project
 - Currently there are 10 transmission-connected energy storage projects with in-service dates extending out to 2022

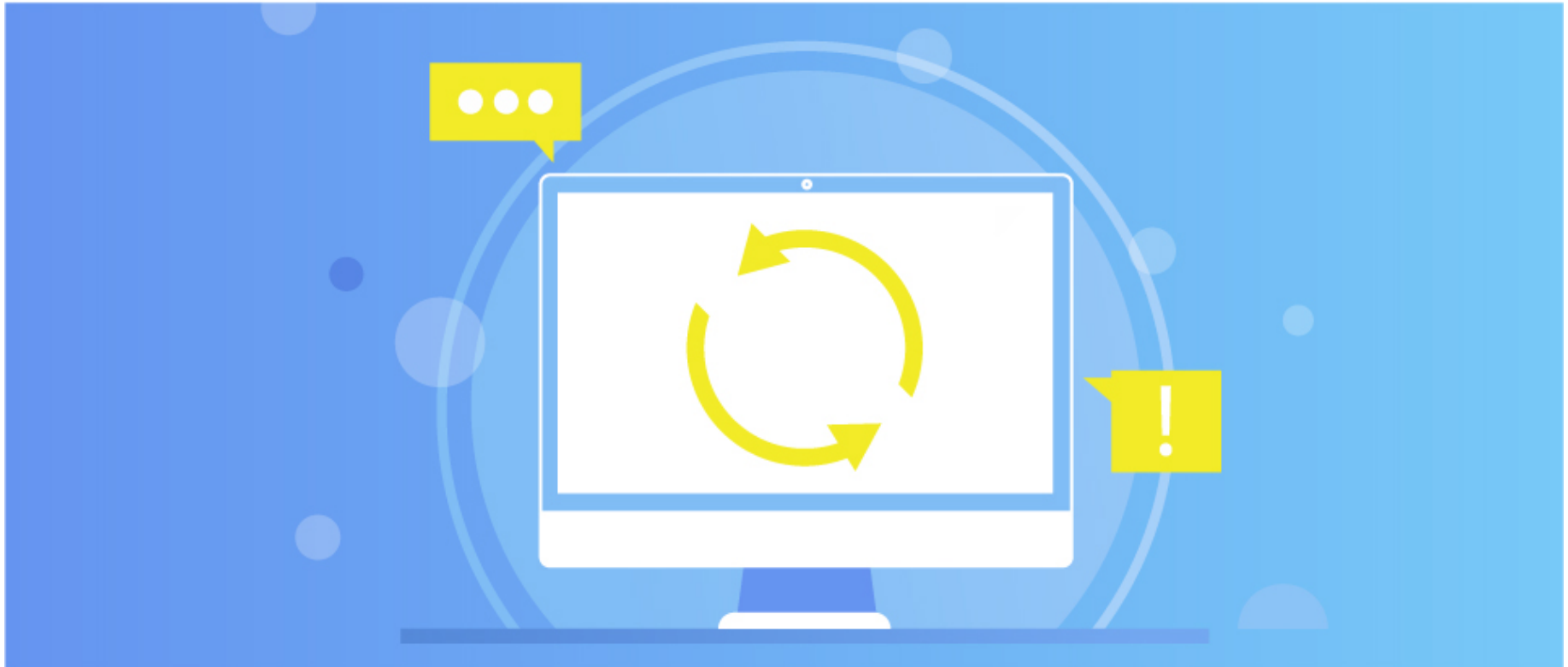
Transition

- Energy-only market sustainability and evolution
- Coal-to-gas and renewables transition
- Transmission planning (LTP)
- Tariffs & cost allocation
- DER & distribution

Transformation

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





- **Twitter:** @theAESO
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Thank You