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Energy Storage:

The Regulatory Landscape in Alberta

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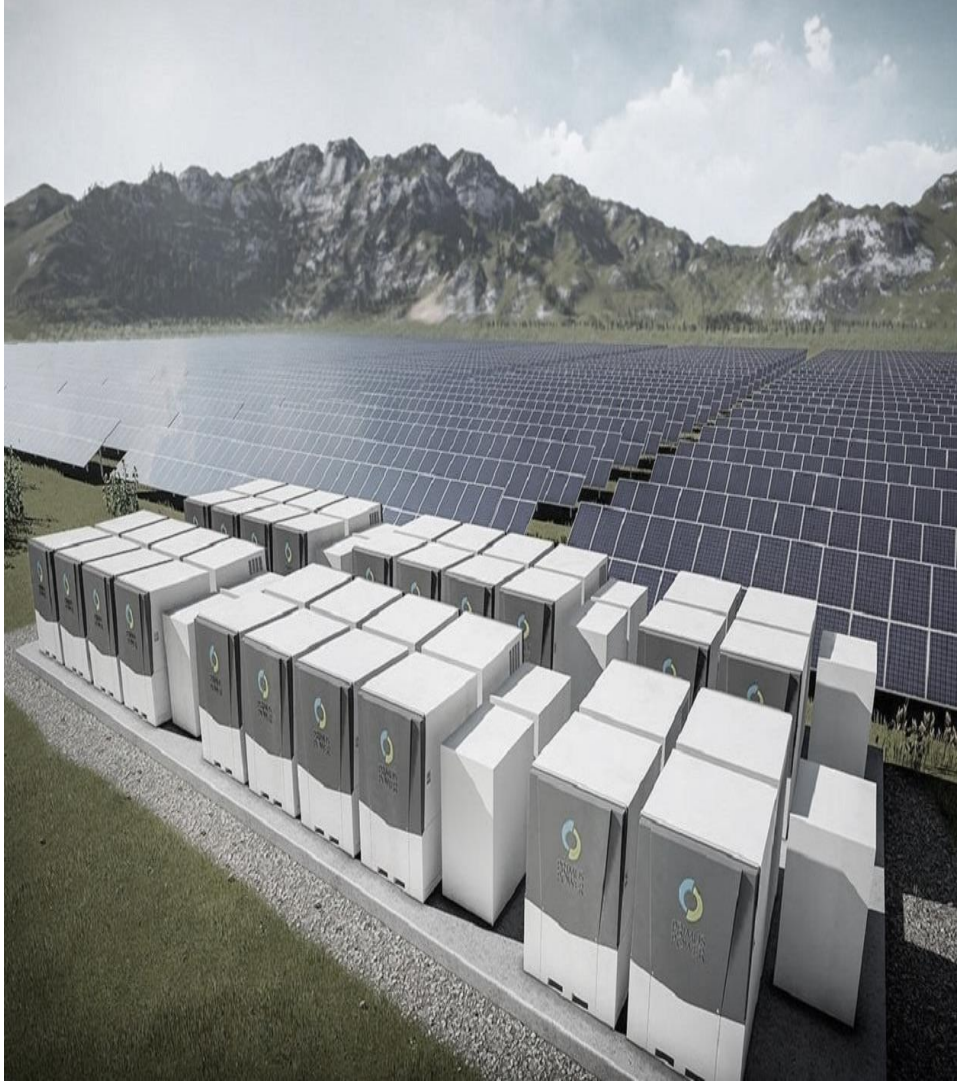


Outline

1. What is Energy Storage?
2. Applications of Energy Storage
3. Alberta Energy Storage Projects
4. Regulatory Treatment of Energy Storage in Alberta
    - Defining Energy Storage – Power Plants? Grid Assets?
    - Can Regulated Utilities Own Energy Storage?
    - Hybrid Market Participation and Grid Reliability

What is energy storage?

"Energy storage is any technology or process that is capable of using electricity as an input, storing the energy for a period of time and then discharging electricity as an output."

Types of Energy Storage Technology

Battery Energy Storage (BES)

Compressed Air Energy (CAES)

Pumped Hydro Storage (PHS)

Battery Energy Storage Systems (BES)

- ✓ No geographical constraints
- ✓ Small project sizes
- ✓ Lead-acid batteries are a mature technology
- ✓ High energy densities and low maintenance for lithium-ion batteries

- x More expensive than other technologies
- x High manufacturing costs for solid state batteries
- x Environmental, ethical, and economic issues of lithium mining

Applications of Energy Storage

Energy services

1. Pool Price Arbitrage
2. Integrating Renewables

System services

1. Ancillary Services
2. Non-Wires Alternatives

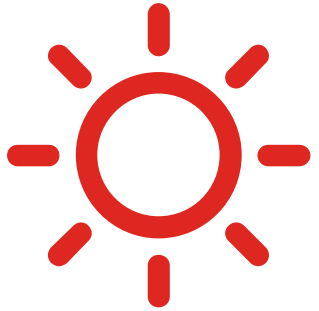
Load Customer services

1. On-Site Backup Power
2. Peak Shaving & Managing 12-CP Demand Charges

Energy Services

1. Pool Price Arbitrage – buy low, store, and sell high

2. Integrating Renewables – battery storage helps mitigate intermittency of variable renewable energy sources (wind, solar)



System Services

1. **Ancillary Services** – maintaining stability and ensuring the Alberta Interconnected Electric System is operated in a manner that provides a satisfactory level of service

2. **Non-Wires Alternatives** – deferring or replacing the need to build wire infrastructure by keeping loads below a specified maximum

Supporting Ancillary Services

- The Fast Frequency Response Technology Pilot (Alberta based)
- The two most lucrative ancillary services provided by energy storage are frequency regulation and spinning reserves
- A study by Natural Resources Canada shows that BES seems to be the most cost effective storage solution for providing ancillary services
- In the United States, the largest energy storage facilities are geared towards ancillary services rather than energy services.
- Scalability of energy storage and the required installation size for provision of ancillary services favours energy storage in this role

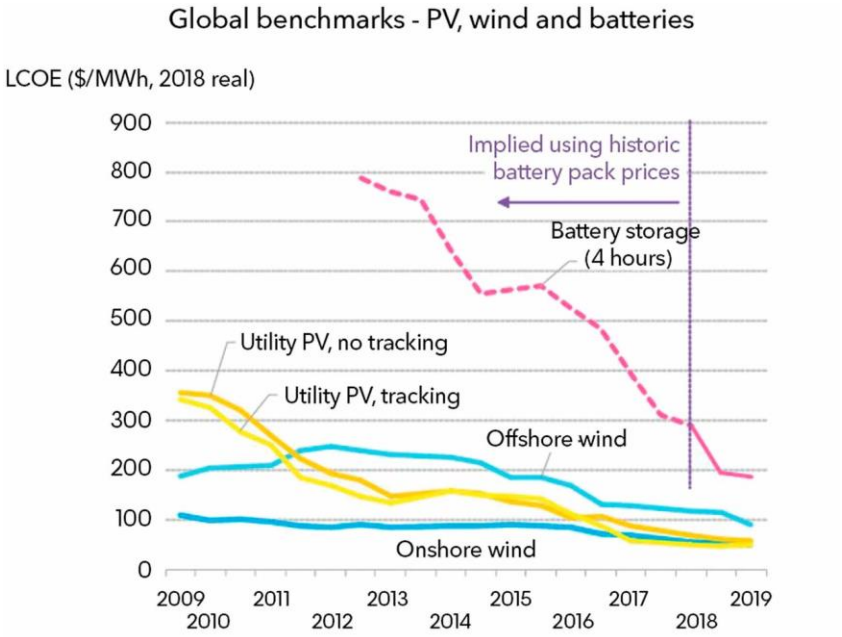
- The provision of ancillary services seems to be the most lucrative application of BES
- Early indications are that it outperforms traditional energy generation resources at a lower cost when providing ancillary services

Load Customer Services

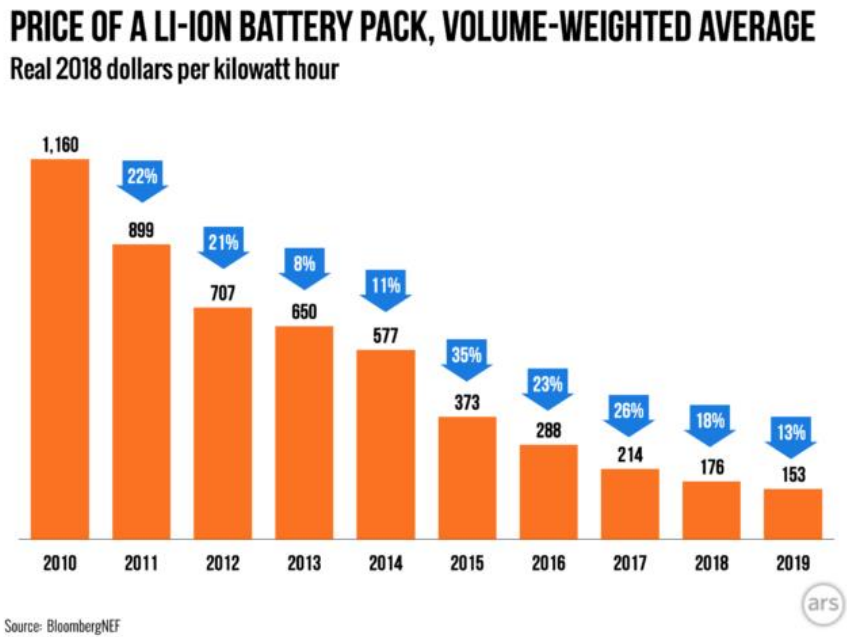
- Back-up

- Peak Shaving & Managing 12-CP Demand Charges
  - Avoiding peak period consumption
  - In the aggregate, there are concerns about shifting the recovery of the largely fixed costs of the transmission and distribution systems to other customers

Battery Prices are Falling



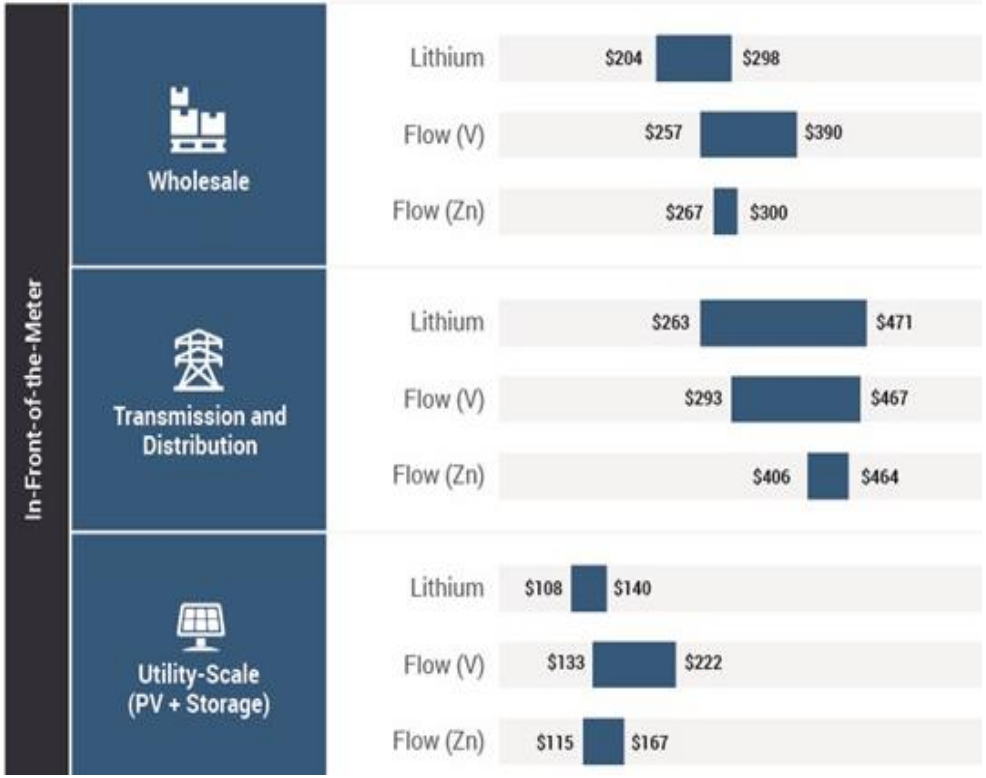
Source: BloombergNEF. Note: The global benchmark is a country weighed-average using the latest annual capacity additions. The storage LCOE is reflective of a utility-scale Li-ion battery storage system running at a daily cycle and includes charging costs assumed to be 60% of whole sale base power price in each country.



Levelized cost of energy (LCOE)

$$LCOE = \frac{lifetime\ costs}{energy\ production}$$

- Measures price per unit of electricity needed to recoup the lifetime costs of the system
- LCOE of lithium-ion BES has fallen 89% in ten years



Source: Lazards LCOE 2018 Analysis

Alberta Energy Storage Projects – An Overview

- There are many energy storage projects in development or in place in Alberta
- In total, more than 278 MW of storage capacity in operation or under development
- Alberta's storage project adoption rates are dependent on storage prices and the regulatory framework

ATCO's Fort Chipewyan Microgrid Energy Storage Project

Alberta Energy Storage Projects

- April 2021 – Alberta Electric System Operator (**AESO**) listed 8 of 13 projects as hybrid solar and storage projects
- Largest project is a ~140 MW CAES facility planned at a new Saskatchewan Alberta inter-tie
- Estimates have Alberta developing up to 1,860 MW of storage capacity by 2030

Artist's rendering of the TERIC eReserve1 Battery Project

Example: Crossfield Energy Centre

- Project installed a 10 MW BES to a gas turbine, creating a “hybrid gas plant”

- The project “Value Stacks” the following battery attributes:
  - Allows the gas turbine to meet the technical requirements to participate in the spinning reserve market
  - Improves the start-up characteristic of the turbine, thereby saving fuel

- Also will result in emissions reductions of ~45,000 tonnes / year

Constructing and Operating Energy Storage

- The base regulatory concern is determining whether a project is in the public interest
- While not particularly onerous, in terms of regulatory burden, there are some additional requirements in the regulatory process for constructing and operating
- The AUC has focused on requirements around safety (mainly concerns about fires associated with BES) and recycling of end of life storage assets (again focused on BES)
- Behind the meter energy storage systems do not require an application for construction and operation if they are smaller than 10 MW
- A connection order is required for energy storage that wishes to connect to the grid

Regulatory Challenges

- *Alberta policy, legislation and regulations lack clarity and specificity with regard to energy storage*
- *The unique attributes of energy storage facilities are not the same as loads or generators, as currently contemplated in the AESO Authoritative Documents, resulting in a lack of clarity in the application of those documents*
- *Energy storage does not currently enjoy the same ease of connection as other assets*

AESO Energy Storage Roadmap

Defining Energy Storage – Power Plants?

- A regulatory hurdle for energy storage are definitions that do not recognize its unique attributes

- Storage's ability to both consume and discharge electricity means that it doesn't neatly fit into traditional energy asset definitions – both supply and load

- Currently, when used for **pool price arbitrage**, energy storage largely rests on the definition of "power plant" under the *Hydro and Electric Energy Act* (**HEEA**), as the Alberta Utilities Commission (**AUC**) has ruled in numerous instances

- The classification of energy storage as a "power plant" complicates dealing with the current statutory prohibition on self-supply and export; this consideration affects technical design and regulatory strategy

Defining Energy Storage – Grid Assets?

- When used as a **non-wires alternative**, energy storage may rest under the definition of transmission or distribution systems under the *Electric Utilities Act* (**EUA**) or a substation under the *HEEA*.

- If energy storage is a transmission system it faces siting restrictions under the *Transmission Regulation*

- The AUC has previously accepted, in the Waterton Battery Decision, a BES as an alteration to a **distribution system**

Can Regulated Utilities Own Energy Storage?

- Whether and how regulated utilities can use energy storage is a tricky question that regulators worldwide are grappling with
  - e.g., double compensation and market distortion concerns

- Several ways to deal with these issues have arisen in Alberta:
  - Encourage energy transmission and distribution providers to procure energy storage services from non-regulated entities, through contracts, rather than own the assets themselves
  - Decide the question on a case by case basis through the use of permit & licence conditions, depending on what the storage system will be used for
  - Push for legislative refinement

NRF

Hybrid Market Participation and Grid Reliability

- Energy storage co-located with traditional or renewable generation and participating in the market as a single hybrid asset has the potential to increase “net demand variability” (as it creates dispatch variability issues for the AESO’s system controllers)
- Generation can be diverted to storage or to the grid - switching from charging to discharging
- The ability to divert to storage makes forecasting more difficult (i.e. no longer just relying on met data and potential energy), if not impossible, and creates issues in managing grid reliability (i.e. more difficult for system controllers to forecast behaviour and properly balance supply and demand)
- AESO has recently published recommendations regarding optional full-range participation (i.e. bidding both discharging and charging capability) to mitigate this issue

Conclusion

- Falling costs have spurred energy storage development in Alberta, with far more projects likely to come online in the next ten years

- The unique capabilities of energy storage resources are not yet fully captured by Alberta's utility regulatory regime

- The AESO and the AUC have made strides in updating and modernizing the regulatory regime….with more to come in the future

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