



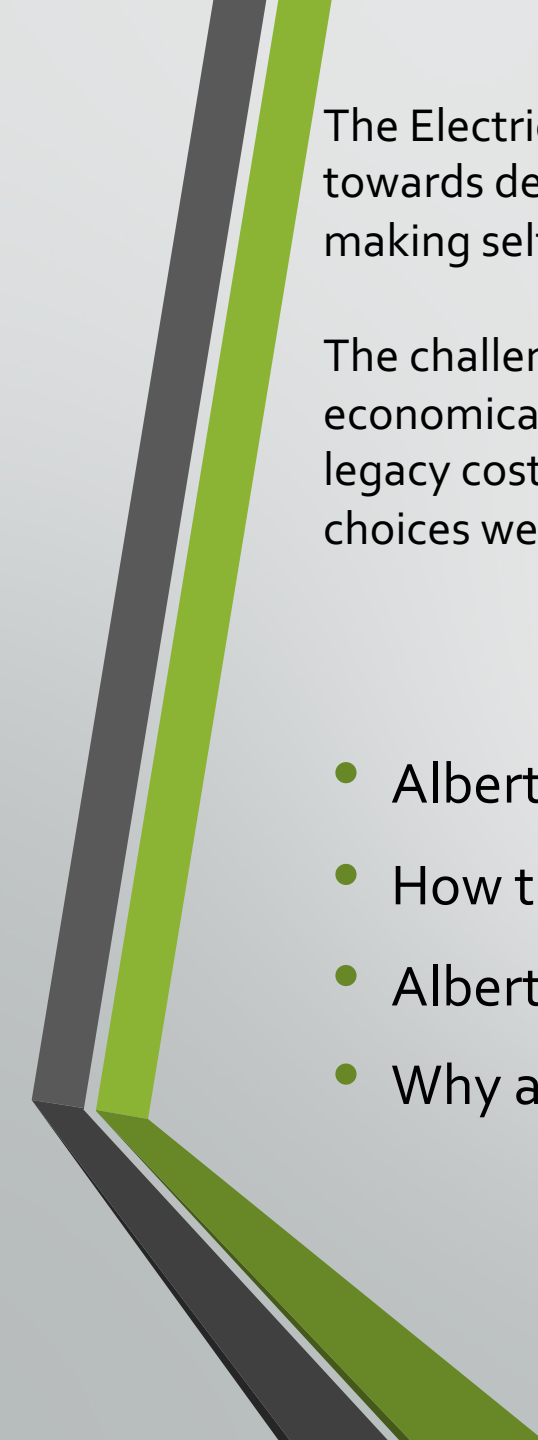
The Evolving Electricity System in Alberta

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To

The Canada Prairies Group of Chartered
Engineers



The Electricity Industry is in transition, driven in part, by climate change and the consequent push towards decarbonization of electricity supply as well as due to technological changes that are making self generation an increasingly viable economic choice for many customers.

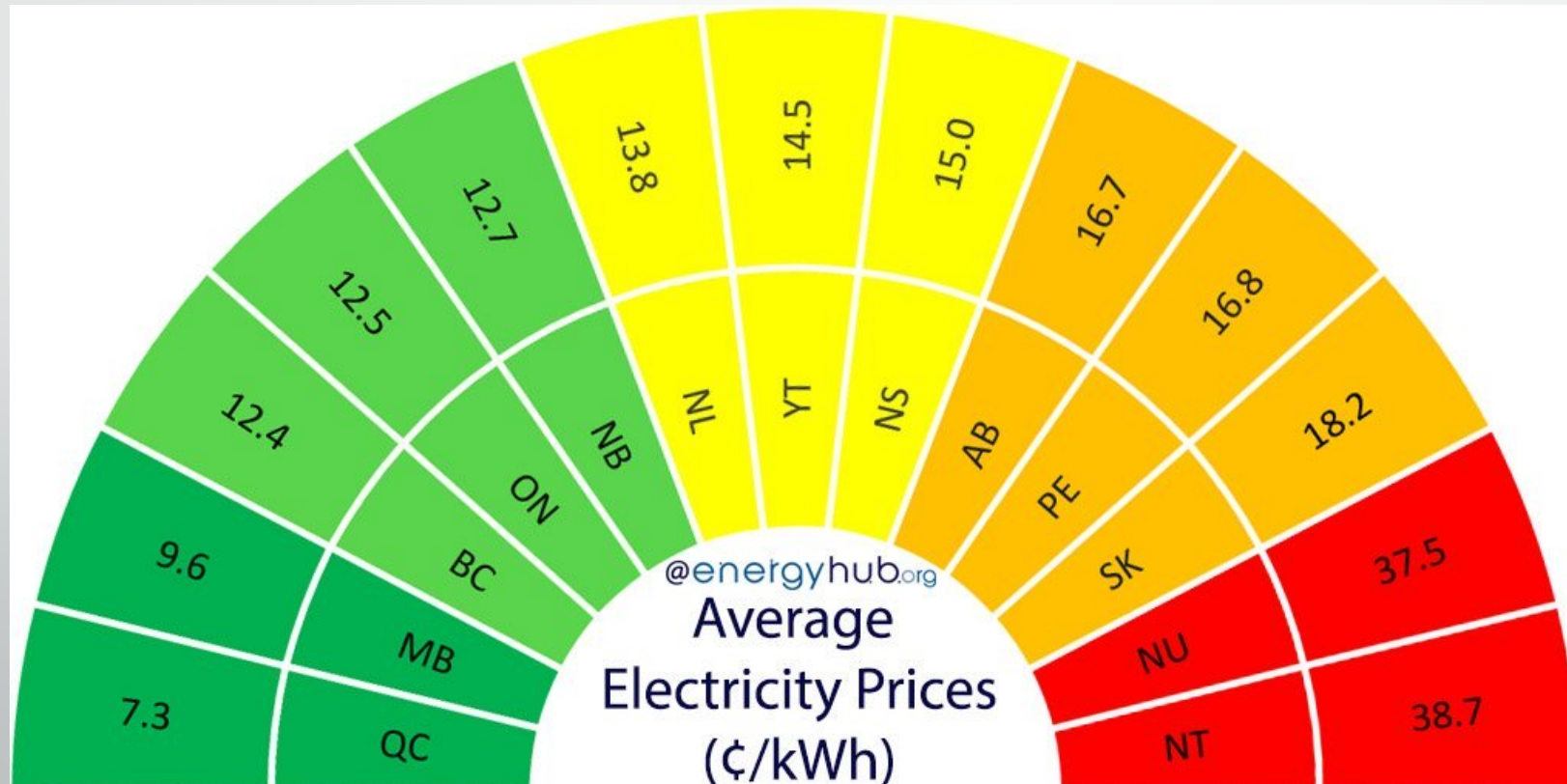
The challenge for the industry and the regulators is to manage the transition in the most economically efficient manner while balancing freedom of customer choice versus recovery of legacy costs of the system. As customers, we need to be informed as to the implications of the choices we make.

Agenda

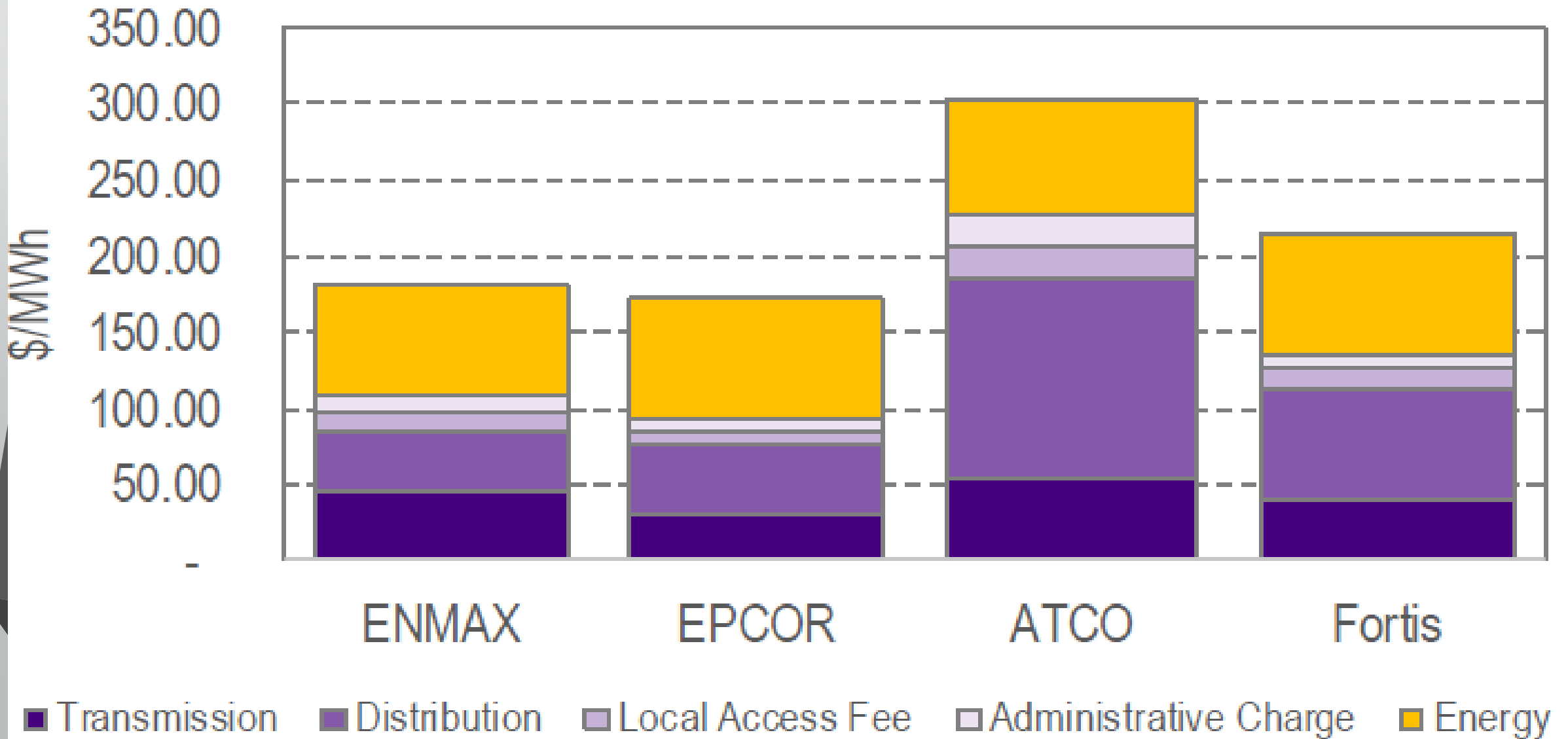
- Alberta's Regulatory Structure
- How the regulated and market based segments of the industry function together
- Alberta's Wholesale Market
- Why and how the industry is changing

Average Energy Prices

Source: Energyhub.org



Components of Residential Bill 2019-AESO Delivered Cost of Electricity Report



Policy, Oversight and Regulation	
<u>Entity</u>	<u>Function/Role</u>
Alberta Department of Energy	Policy development and legislation
Alberta Utilities Commission (AUC)- Regulation of Utilities	The Alberta Utilities Commission (AUC) regulates Alberta's investor-owned electric, gas, water utilities and certain municipally owned electric utilities to ensure that customers receive safe and reliable service at just and reasonable rates.
AUC-Facilities Approval	Companies who propose to construct or rebuild electric generation, transmission or distribution facilities in Alberta, must apply to the Commission for siting approval. When reviewing the utility's application, the Commission considers the social and environmental impacts, as well as any economic implications for the ratepayers.
AUC-Markets	Adjudicative function for issues arising in Alberta's electric and natural gas markets.
Market Surveillance Administrator (MSA)	Monitors the Alberta electricity and natural gas markets for fairness and balance in the public interest - checking that they operated in a fair, efficient, and openly competitive manner.
Utilities Consumer Advocate	The UCA has a mandate to educate and mediate for Alberta's small business, farm, and residential electricity, natural gas and water consumers, and advocate for energy consumers.

Retail, Power Pool & the AESO	
<u>Entity</u>	<u>Function/Role</u>
Regulated Retail Electricity Providers	Customers who do not sign a contract for natural gas or electricity are served by a Regulated Retailer (default rate). The Regulated Rates are reviewed and approved by the Alberta Utilities Commission (AUC) and can change from month to month.
Competitive Retail Electricity Providers & Self Retailers	Customers of competitive retailers are required to sign a contract and parties are bound by the terms of the contract. Most industrial and large commercial customers are self retailers.
Generation of Power	Fully deregulated since 1996. Alberta is an energy only market; generators recover their fixed and variable costs through energy sales in each hour
Power Pool	Retail electricity providers buy the electricity their customers need through a wholesale market called the power pool, Power pool is where the exchange of electricity between buyers and sellers occurs and where financial settlements are made
Alberta Electric System Operator (AESO)	<p>The AESO plans, maintains and operates the provincial transmission grid, controls the actual dispatch of power and ensures the reliable operation of the system.</p> <p>With regard to the financial market, the AESO manages the bid–offer process, schedules the dispatch of electricity and manages the financial settlements between purchasers and suppliers.</p> <p>The tariff charges of each Alberta transmission facility owner are paid by the AESO and are flowed through to load customers including Alberta distribution utilities and large industrials, through rates set out in the AESO's transmission tariff. The AUC is responsible for approving the rates and terms and conditions of service of the AESO's tariff</p>

Wholesale Energy Market

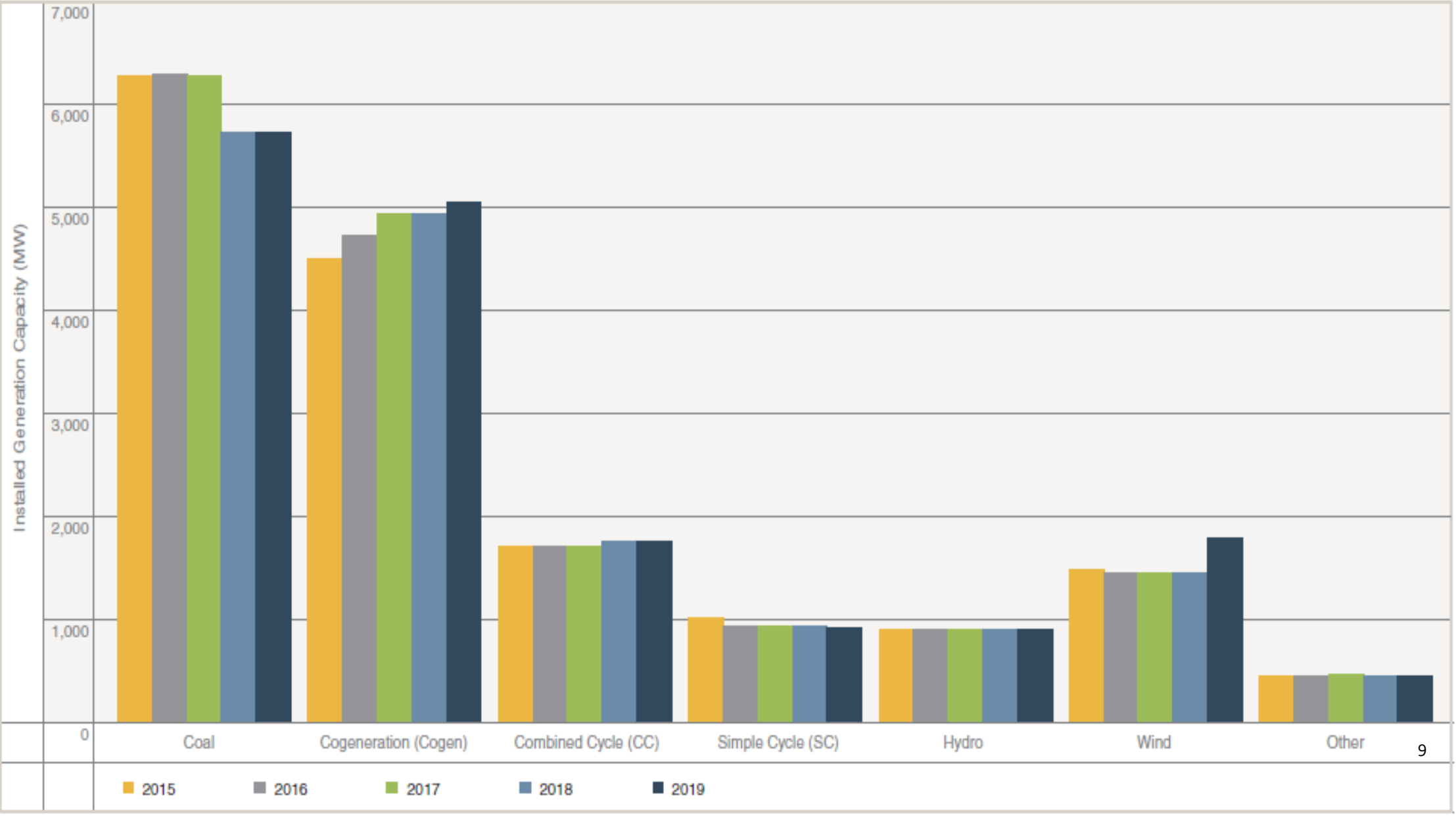
Ancillary Services Market

- Alberta's wholesale energy market (the power pool) is an open-access, energy-only competitive market for electric energy supply. The Electric Utilities Act stipulates that all electricity traded in the province will be bought and sold through the pool.
- All generators are obligated to offer their power into the pool and are paid the hourly pool price for the energy they produce. The price is determined through supply and demand and set by the power pool itself.
- This means that market forces, not regulators, drive the industry.
- Ancillary Services Market: those services procured by the AESO to ensure that the interconnected electric system is operated in a manner that provides a satisfactory level of service with acceptable levels of voltage and frequency. Includes operating reserves (regulating, spinning and supplemental), Transmission Must-Run, Black Start, and Load Shed Services for imports.

Annual Load Statistics-AESO Delivered Cost of Electricity Report

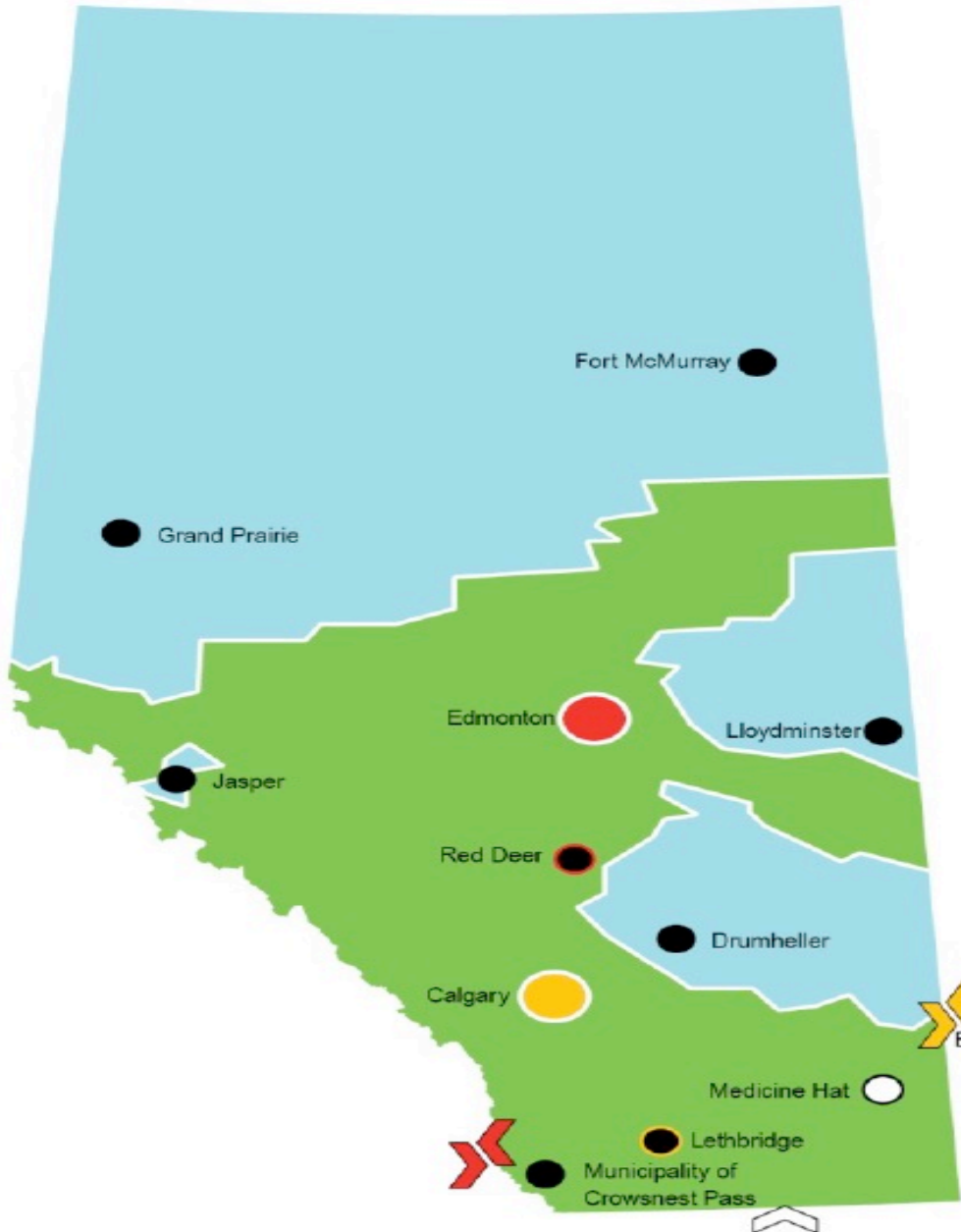
Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Alberta Internal Load										
Total (GWh)	71,723	73,600	75,574	77,451	79,949	80,257	79,560	82,572	85,330	84,925
Average (MW)	8,188	8,402	8,604	8,841	9,127	9,162	9,057	9,426	9,741	9,695
Maximum (MW)	10,196	10,226	10,609	11,139	11,169	11,229	11,458	11,473	11,697	11,471
Minimum (MW)	6,641	6,459	6,828	6,991	7,162	7,203	6,595	7,600	7,819	8,024
Average growth	2.6%	2.6%	2.4%	2.8%	3.2%	0.4%	-1.1%	4.1%	3.3%	-0.5%
Load factor	80%	82%	81%	79%	82%	82%	79%	82%	83%	85%
System load										
Average (MW)	6,450	6,593	6,620	6,778	7,024	6,998	6,919	7,121	7,183	7,027










Annual Generation Capacity by Technology-AESO Delivered Cost of Electricity Report



Delivery of Electricity		
<u>Entity</u>	<u>Facility Owners</u>	<u>Function/Role</u>
Transmission Facility Owners (TFOs)	Altalink, ATCO Electric, EPCOR, ENMAX	The AUC approves the rates TFOs charge for electric transmission service. These charges are allocated to the retail customers and applied to both regulated and non-regulated retail electricity bills. TFOs also file applications to the AUC when substations and transmission lines are needed after it has been determined in a separate application to the AUC by the AESO.
Distribution Facility Owners (DFOs)	ATCO Electric, Fortis, EPCOR, ENMAX	Provide electric distribution service. Responsible for planning and operating the distribution system. The AUC sets DFOs' rates and terms and conditions of service.
		In addition, DFOs are responsible for metering and Load Settlement (LS). LS information is provided to the AESO, so retailers and regulated rate providers can be invoiced for the electricity they purchase for their customers and exchange through the power pool. It is also provided to retailers and to regulated rate providers so customers can be billed for the electricity consumption as well as for transmission and distribution charges.

Service Territories-Govt of Alberta



-  ATCO Electric transmission and distribution territory.
-  AltaLink transmission territory and FortisAlberta distribution territory.
-  Edmonton transmission and distribution provided by EPCOR Distribution & Transmission Inc.
-  Calgary transmission and distribution provided by ENMAX Power.
-  Red Deer distribution provided by City of Red Deer.
-  Lethbridge distribution provided by City of Lethbridge.
-  Intertie between Alberta and BC, owned and operated by AltaLink.
-  Intertie between Alberta and Saskatchewan, owned and operated by ATCO Electric.
-  Intertie between Alberta and Montana, owned and operated by Enbridge.
-  The City of Medicine Hat is not part of the Alberta Interconnected Electric System; they operate like an intertie and transmission and distribution are owned by the city.

AltaLink serves 85 per cent of Albertans.
Fortis Alberta serves over 200 communities.

Regulation of TFOs and DFOs

- Regulation can act as a form of surrogate competition – attempting to ensure that regulated rates, profits and service quality are similar to what could be achieved in competitive markets.
- Regulated rates could be economically efficient if they result in outcomes that are optimal for society
- Alberta TFOs and DFOs are regulated on the basis of cost of service which includes a reasonable return on the prudent investment in plant as well as return of capital
- Regulated rates are designed to recover the utility's costs and to provide appropriate price signals to increase or decrease supply or demand. Example: peak time pricing is used to reduce demand during system peak times which in turn helps reduce or postpone new plant additions
- Alberta TFO rates are established on the basis of forward test year costs and revenues. TFOs experienced significant cost increases during the 2012 to 2017 period due to about \$18billion investment in high voltage lines connecting regions of the province including a 500 kV DC line
- Alberta DFOs' initial rates are established on the basis of base test year costs and revenues. These rates are allowed to increase annually based on an inflation factor (i) minus a productivity factor (x) under a 5 year Performance Based Regulation (PBR) regime.

Delivered cost of electricity: annualized rate of increase (2009 to 2019)

Customer class	ENMAX	EPCOR	ATCO	Fortis
Residential	2.1%	3.0%	3.7%	4.1%
Farm	N/A	N/A	1.4%	3.5%
Small commercial	1.8%	3.1%	1.7%	3.0%
Medium commercial	4.4%	3.9%	4.5%	3.9%
Large commercial	4.7%	4.6%	4.3%	3.4%
Industrial	4.9%	4.9%	4.9%	4.9%

Distribution costs: annualized rate of increase (2009 to 2019)

Customer class	ENMAX	EPCOR	ATCO	Fortis
Residential	5.6%	6.6%	7.2%	8.7%
Farm	N/A	N/A	3.5%	7.1%
Small commercial	5.0%	5.7%	7.7%	9.4%
Medium commercial	4.8%	10.2%	8.9%	3.8%
Large commercial	4.9%	8.6%	8.5%	5.2%
Industrial	5.3%	12.7%	2.7%	6.9%

Source: AESO Delivered Cost of Electricity Report May 2020

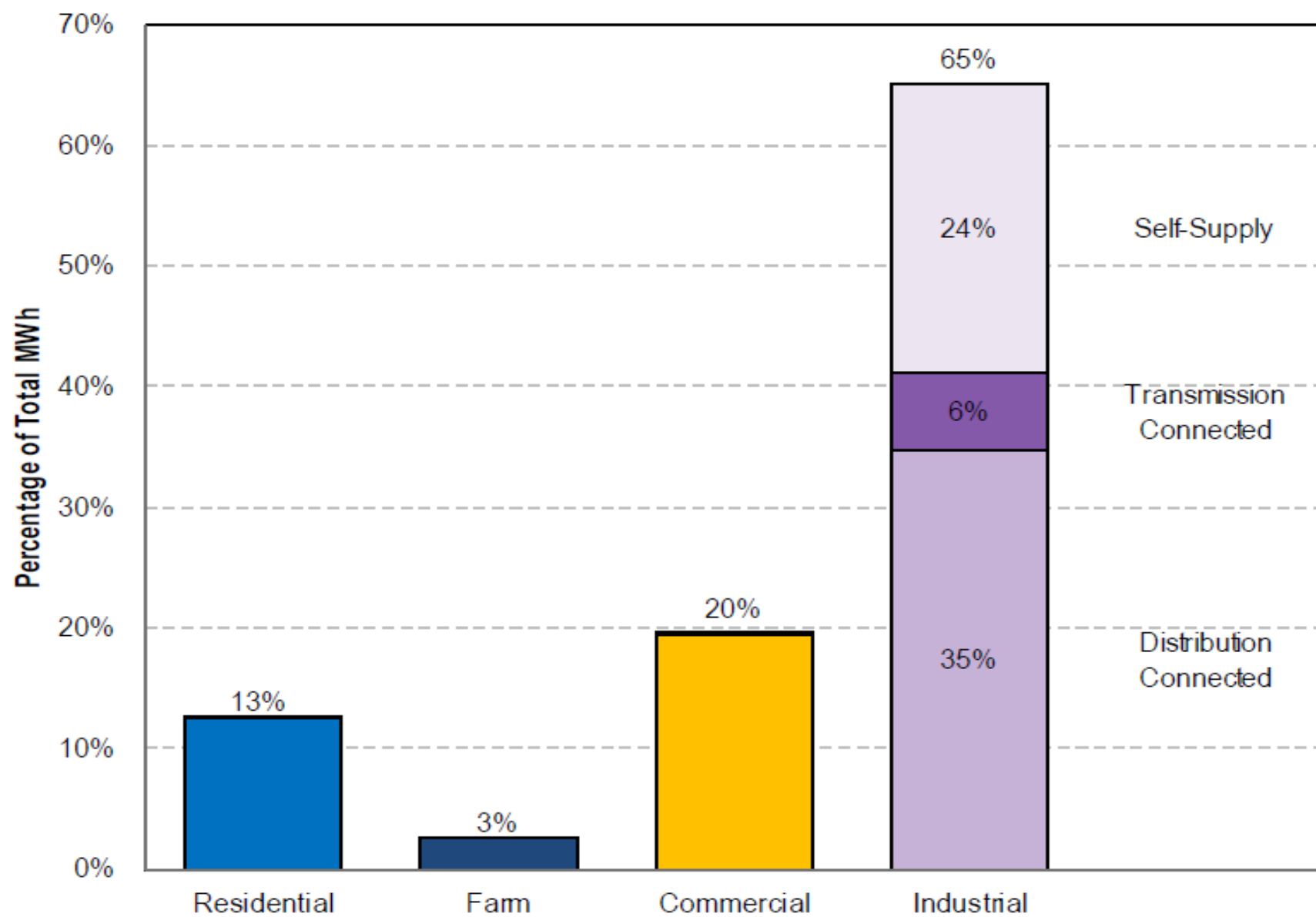
Transmission costs: annualized rate of increase (2009 to 2019)

Customer class	ENMAX	EPCOR	ATCO	Fortis
Residential	18.0%	18.8%	6.7%	16.8%
Farm	N/A	N/A	8.5%	16.4%
Small commercial	17.5%	17.7%	12.2%	13.0%
Medium commercial	20.3%	14.2%	13.8%	17.6%
Large Commercial	19.4%	27.1%	13.6%	12.6%
Industrial	24.2%	24.2%	24.2%	24.2%

Electricity Costs: Annualized Rate of Increase (2009 to 2019)

Customer Class	ENMAX	EPCOR	ATCO	Fortis
Residential	-1.2%	0.4%	-0.8%	0.2%
Farm	N/A	N/A	-0.5%	0.1%
Small commercial	-1.2%	0.4%	-0.6%	1.0%
Medium commercial	1.0%	1.0%	1.0%	1.0%
Large commercial	1.0%	1.5%	1.0%	1.0%
Industrial	1.4%	1.4%	1.4%	1.4%

Representative Load Profiles 2018



Source: AESO 2018 Annual Market Statistics Report

Drivers of Change

- Decarbonization:
 - Government policy on renewable energy -currently no renewable energy targets or incentives
 - Carbon policies impact the relative economics of renewable energy versus fossil fuel energy (TIER levy: Coal plants \$18.9/MWh; Simple Cycle gas \$3.9/MWh; Combined Cycle Gas Turbine (\$0/MWh)
- Decentralization:
 - Enabled by decreasing cost of Distributed Energy Resources (DER)-solar, wind, geothermal, natural gas, electricity storage, Demand response (DR)
 - Increasing two way flow of electricity-prosumers and consumers
 - Changes in pattern of load flows due to solar, wind and EVs-potential implications for balancing the system:
 - Locally: locational signals for new generator siting through contributions or credits
 - Wholesale level: Increased net demand variability due to intermittent renewables
- Digitization
 - Advanced Metering Infrastructure (AMI)

Distributed Energy Resources Business models

Decentralization

- Behind the fence generation by large industrial customers
- Smaller Prosumers could both consume and export power to the system pursuant to the Micro Generation Regulation
 - Small micro generation <150kW (Bi directional cumulative meters)
 - Large micro generation 150 kW to 5MW (bi directional interval meters)
- Community Generation-this does not involve transmission and distribution system bypass
- Micro grids-involves bypass of the system grid; generally not permitted in Alberta because of the potential for stranded transmission and distribution costs. Exception: Integrated industrial processes with an Industrial Systems Designation (ISDs)
- Energy Services Companies (ESCOs)-Many large industrial and commercial customers are assisted by ESCOs to improve efficiency of power use. The potential is there for ESCO's to assist residential and small commercial customers by aggregating load, supply and storage resources.

Efficient Integration of DER

Decentralization

- Coordinated and integrated planning of the transmission and distribution system
- Wider adoption of Non Wires Alternatives through use of Distributed Energy Resources
- Tariff design must minimize uneconomic bypass of the system. Uneconomic bypass occurs when it lowers the cost to individual customers but increases costs to society
- Tariff design that provides appropriate price signals for efficient consumption decisions (Example: time of use rates for EVs)

Advanced Metering Infrastructure (AMI)

Digitization

- AMI infrastructure could facilitate transitioning to an electricity system where consumers, prosumers, generators and providers of regulated platforms (transmission and distribution services) could interact seamlessly in real time
- AMI infrastructure could facilitate transitioning to integrated planning and operations of the transmission and distribution systems potentially resulting in cost efficiencies
- AMI Infrastructure consists of Smart Meters, Meter Communication Infrastructure and Data Management. The combination of all three elements is vital to the development of a smart grid
- Relatively high cost of “back-end data processing infrastructure” could be a barrier to implementation in the short term.

Data Driven Planning and Consumption Decisions

Digitization

- In a future electricity market system, consumers, prosumers and generators may interact in real time with each other through market signals, as well as the regulated platforms for transmission and distribution services provided by the AESO and distribution owners. The digitization of the grid, AMI, and the internet of things need to be structured to facilitate the flow of historical and streaming information and data so as to facilitate transactional efficiency.
- The collection and management of data and access to information should be viewed holistically to enable efficient system expansion and decision making by regulated platform providers, consumers, and prosumers.
- It is imperative that individual customer data is protected but aggregate data becomes open data

Priorities Going Forward

- Tariff reform to prevent uneconomic bypass of the system and for efficient consumption decisions
- Coordinated and integrated planning of the transmission and distribution systems for economic efficiency
- Locational price signals for all new generation based on payment of contributions for choice of locations that contribute to higher system costs and credits for favourable locations that help to relieve congestion
- Gradual introduction of AMI considering economies of scale arising from province wide systems