

“Shape of You”: The Electricity Load Curve

CAMPUT Webinar

September 16, 2020

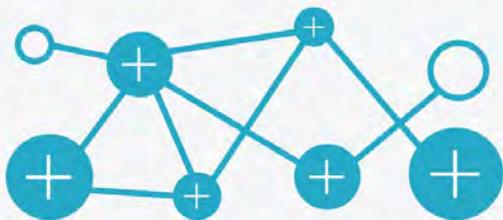
Kevin Dawson, Alberta Electric System Operator (AESO)



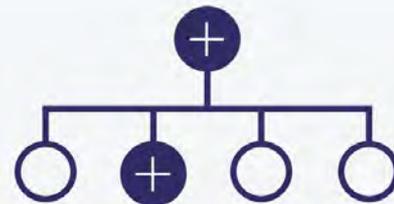
Connect
CUSTOMERS



PLAN
transmission



Operate the
GRID



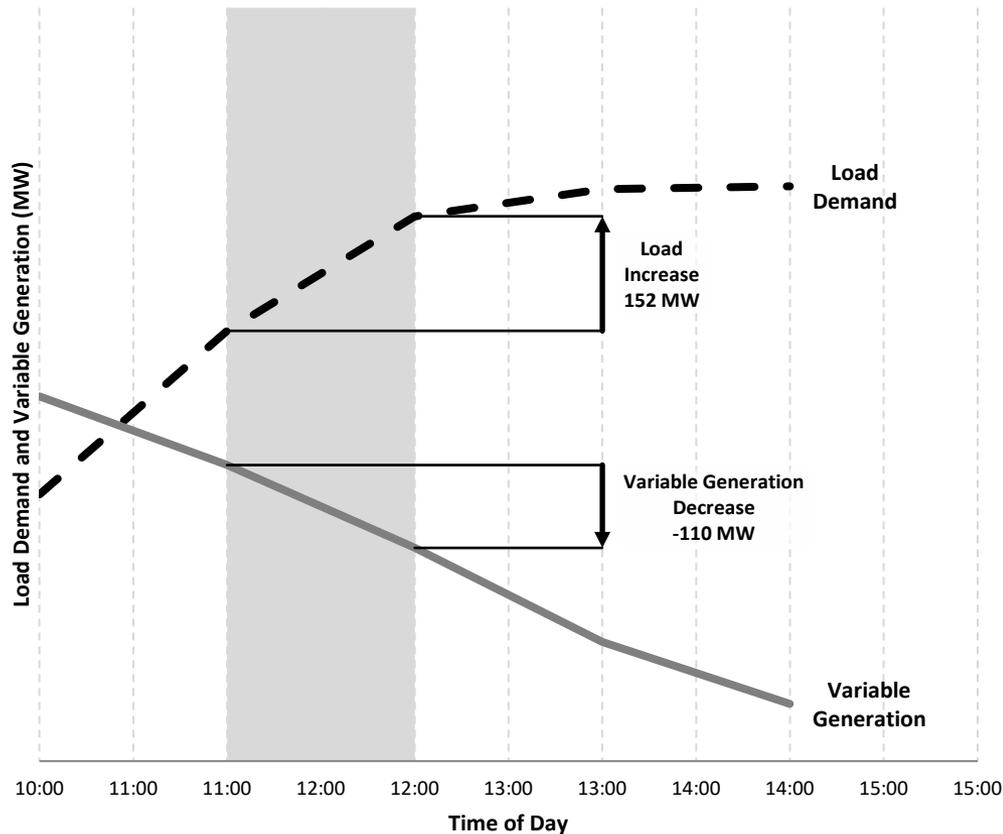
Plan and Operate the
MARKET

- 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
- Highest visibility of Alberta electricity sector



Evolution of demand shape: Net Demand Variability

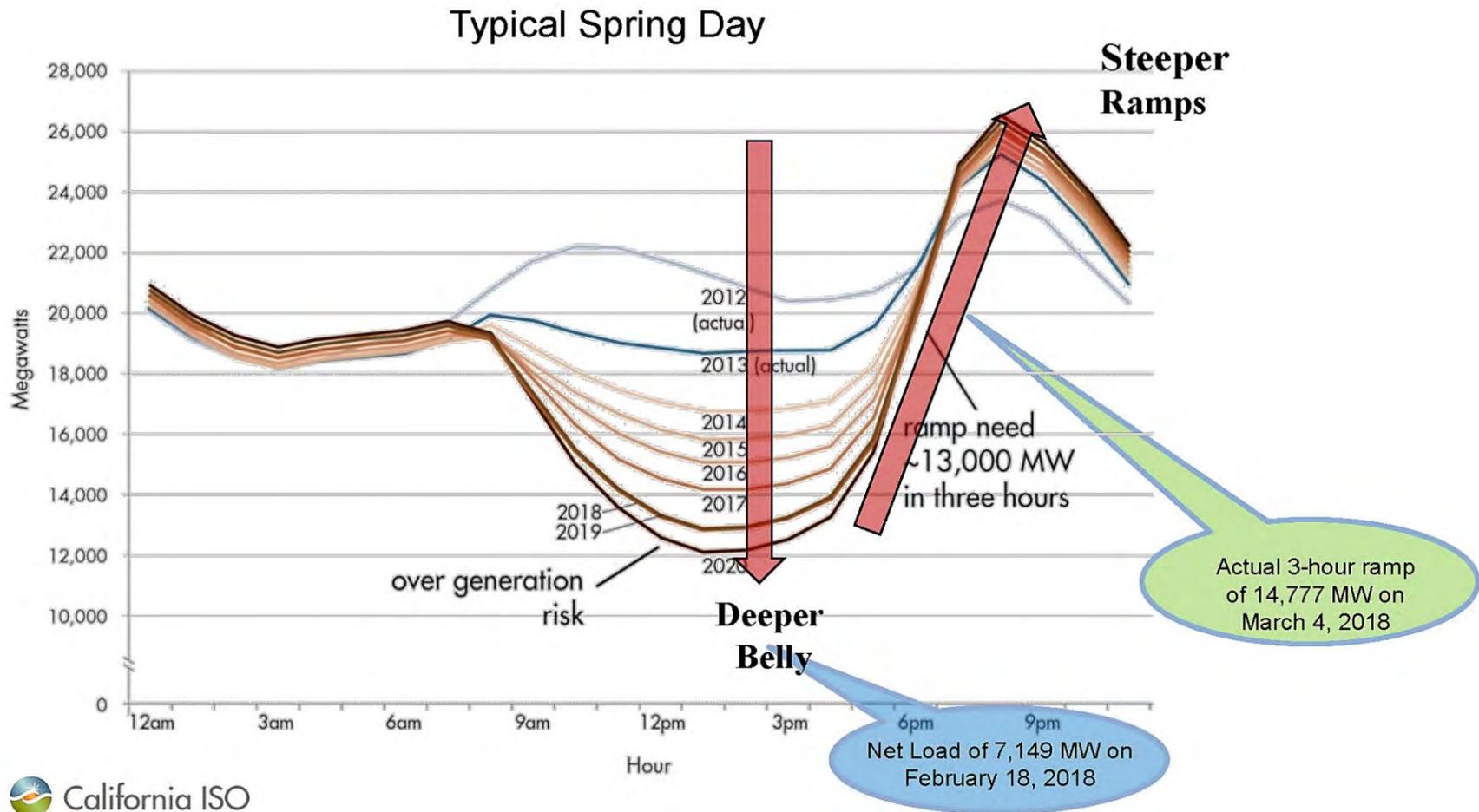
NDV = Demand minus production from variable generation



3 approaches to provide flexibility:

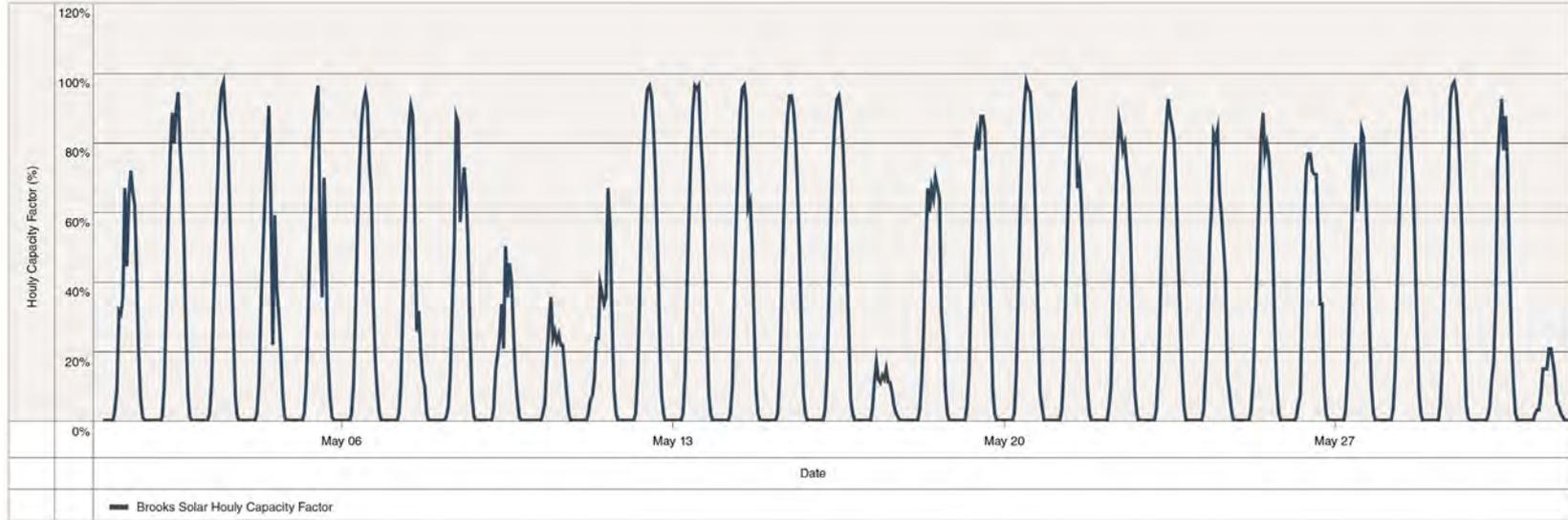
1. Energy market dispatch
2. Regulating reserve
3. Wind power (and, in future, solar power) management

Is Alberta like California with a solar driven 'duck curve'?

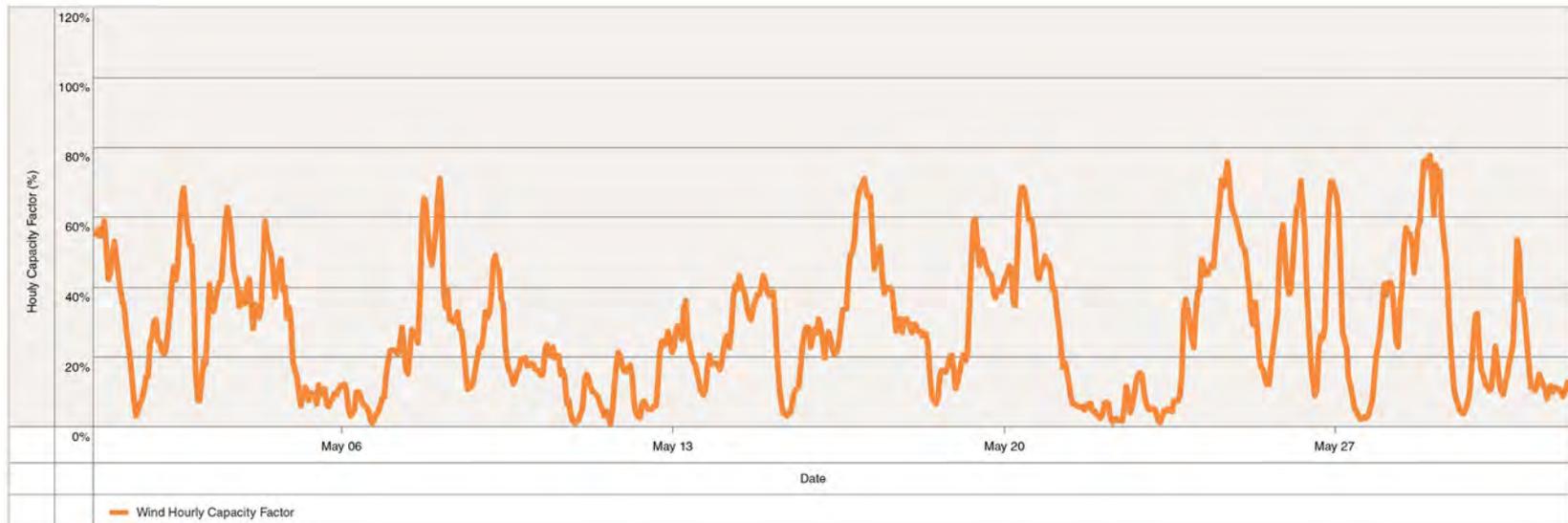


Solar is predictable; wind...not as much

Solar

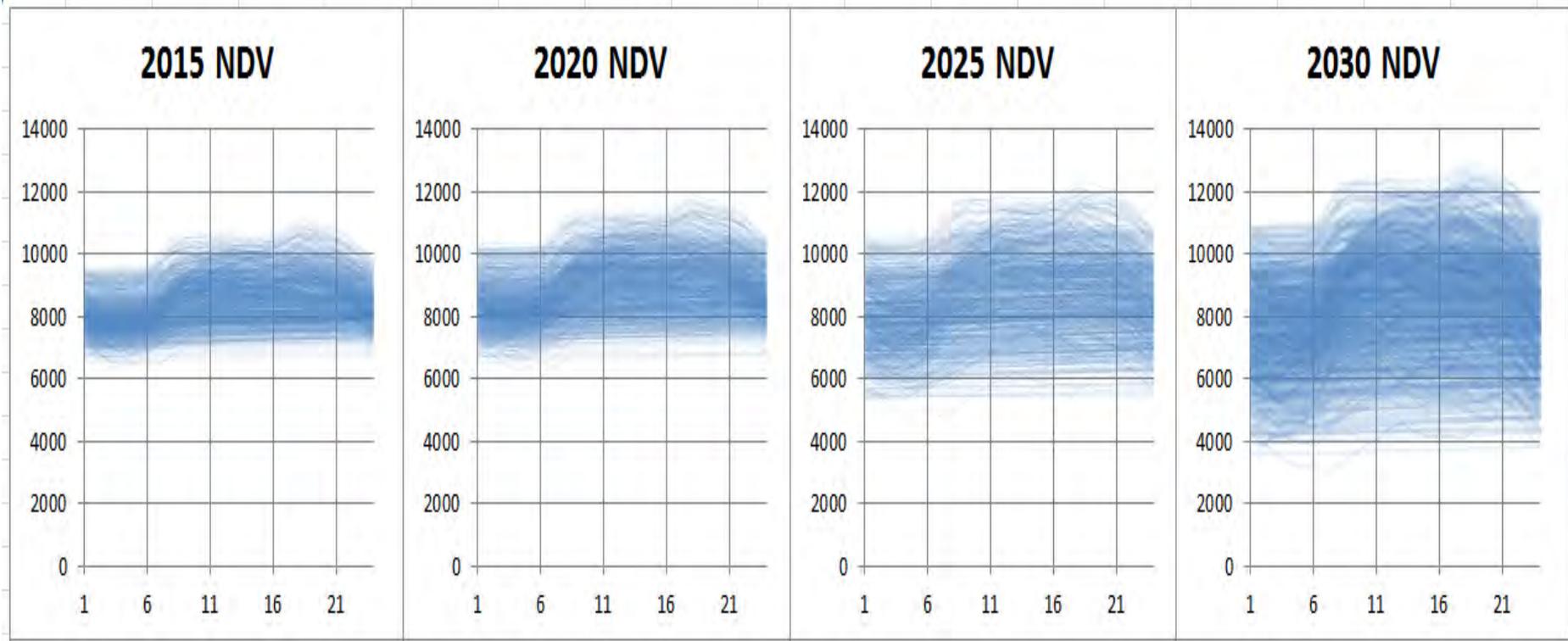


Wind

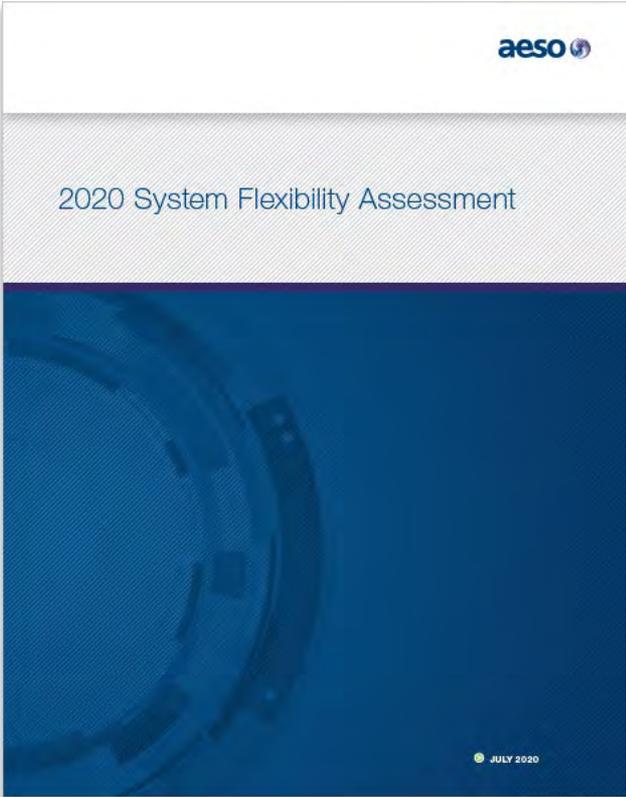
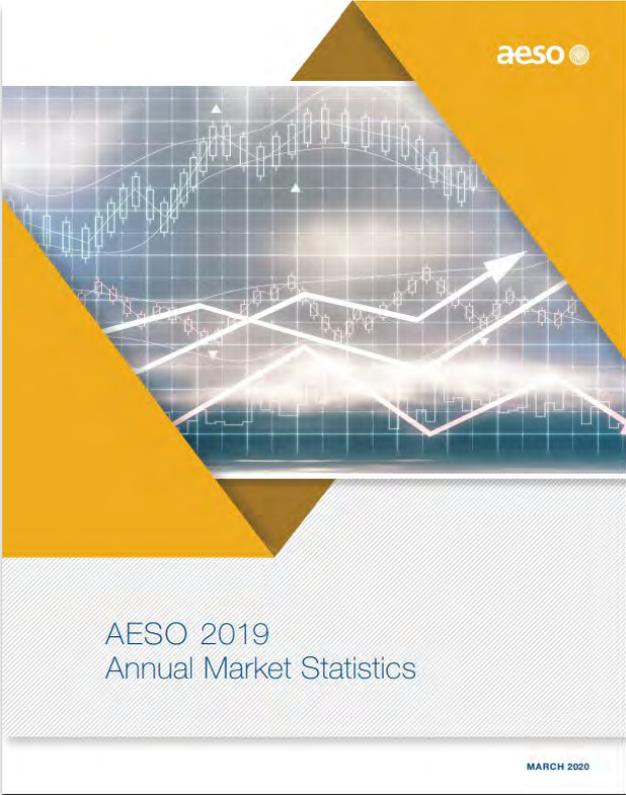


Unlike California, Alberta has a wind driven 'spaghetti plot'

Net Demand profiles, one per day

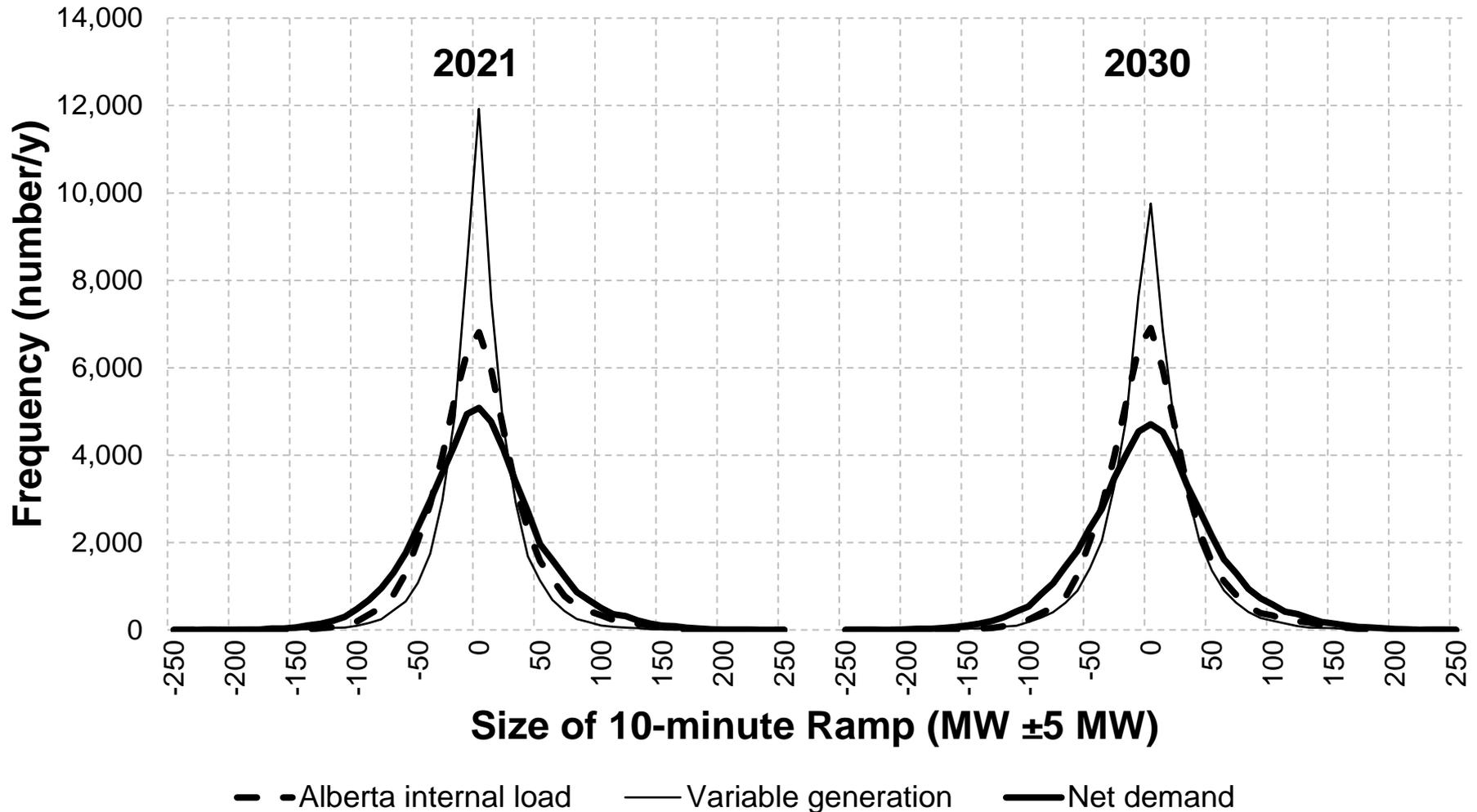


Ongoing activities to assess grid's flexibility requirements

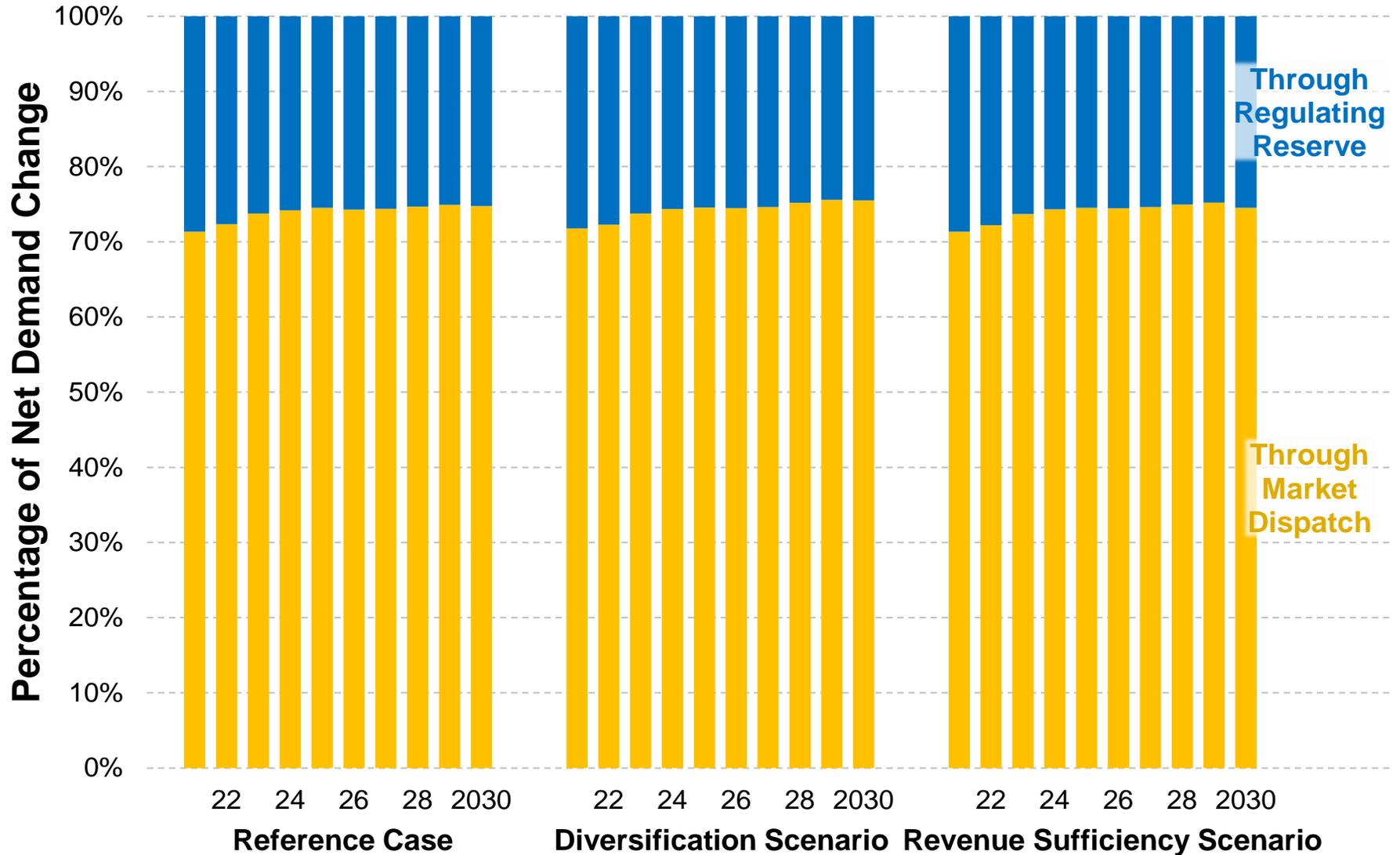


Larger net demand ramps increase in frequency over forecast period

Reference Case



71% to 76% of net demand change is responded to through market dispatch

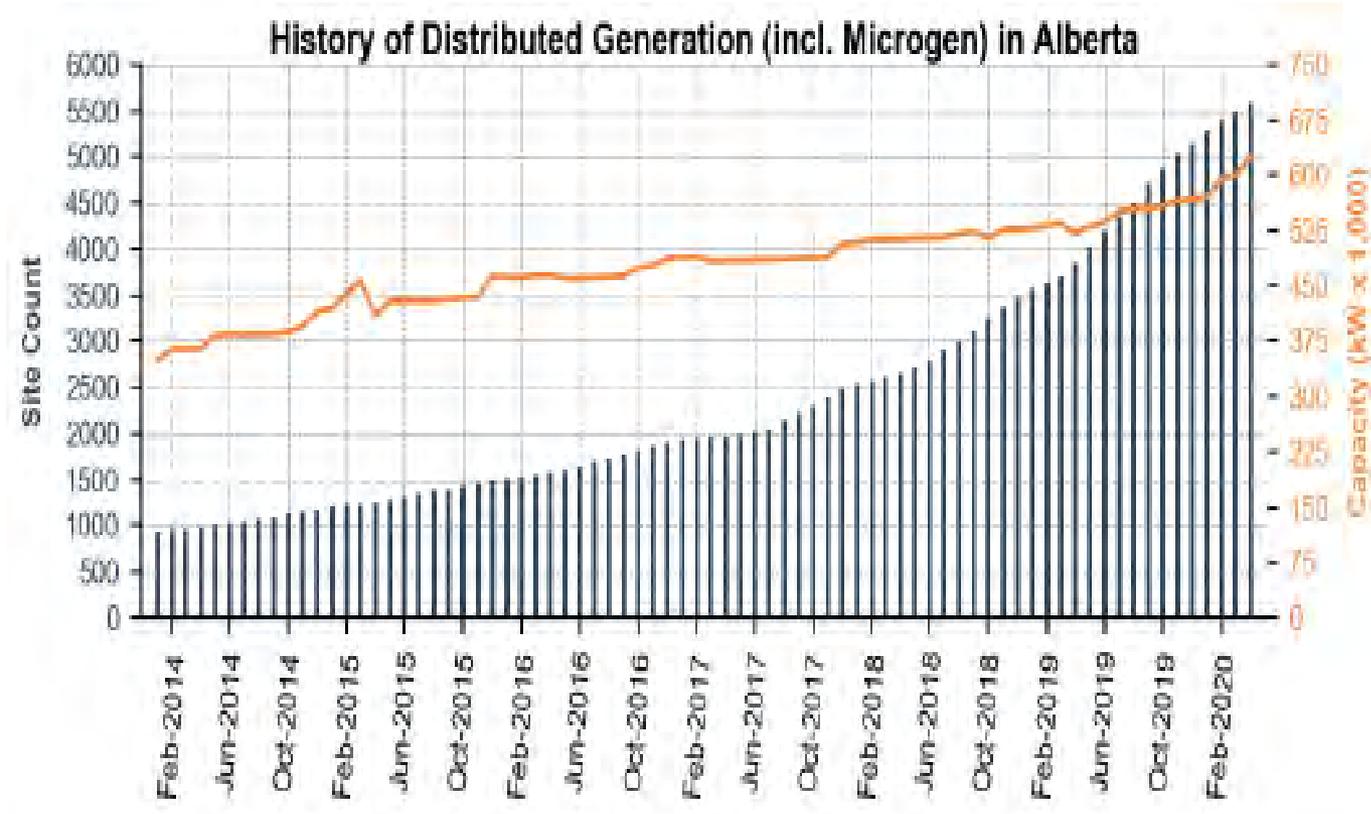


No emerging needs for immediate flexibility enhancements were identified

- Trends observed over the forecast period:
 - Ramps increase in size; larger ramps become more frequent
 - Cumulative asset ramping increases by about 50%
 - On/off cycling increases for coal-to-gas conversions
 - Simulated area control error increases in size and duration
- Energy market dispatch and operating reserve are expected to be sufficient to respond to increasing variable generation over the next decade
 - No emerging needs for immediate flexibility enhancements
 - Longer-term trends suggest potential additional approaches to provide system flexibility should be considered for exploration
- Results support continued monitoring and periodic assessments of system flexibility

Other drivers – Distributed Energy Resources (DERs)

History of Distributed Generation (incl. Microgen) in Alberta



Drivers are both technological and economic

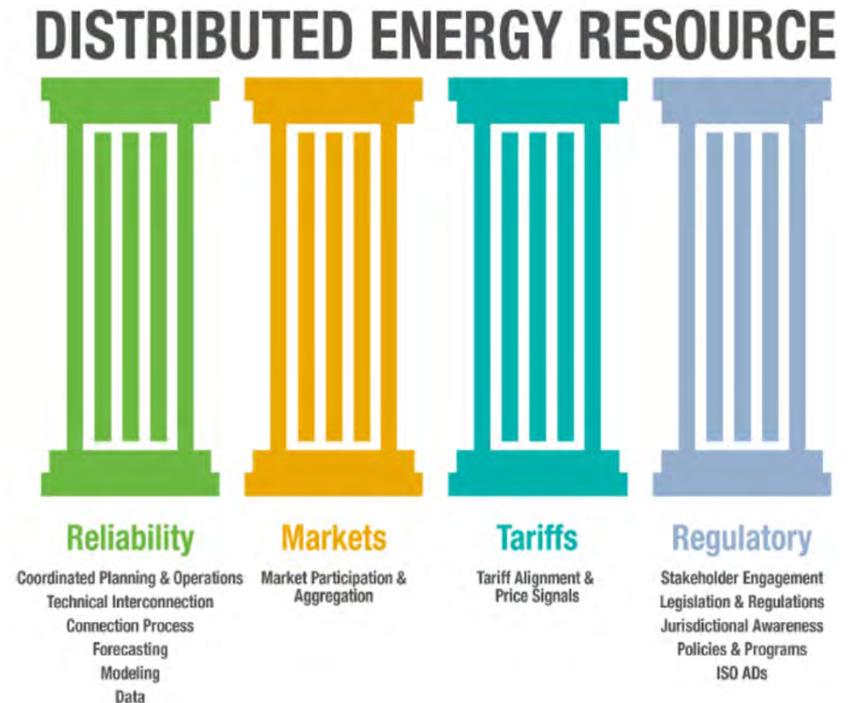
- Technological advancements
 - Cost reductions
- Consumer preference
 - Green options
- Credits such as Option “M” and similar create an economic incentive to connect on distribution system

- Potential Opportunities

- New additional competitive energy and ancillary resources
- Deferral on build of Dx, Tx infrastructure
- Enhanced Dx reliability
- Reduced Dx, Tx losses

- Challenges

- Reliability
- Market
- Tariff
- Regulatory - Policy



Storage – not just for energy arbitrage

7 storage projects on AESO project list

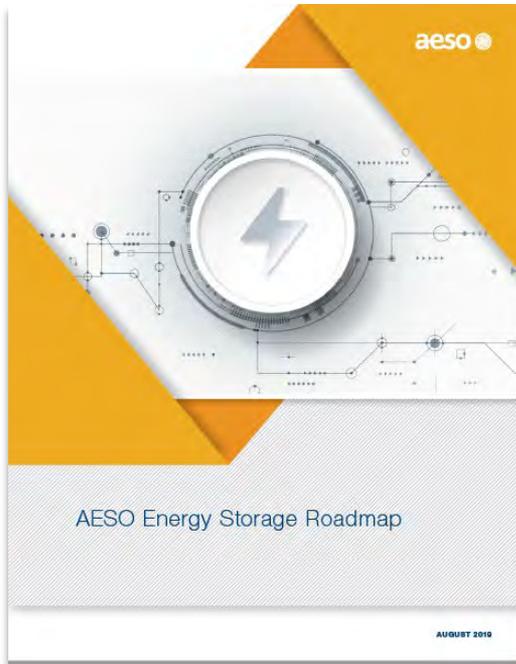
- Batteries
- Pumped hydro
- Mix of grid connected and behind the fence
- Variety of drivers



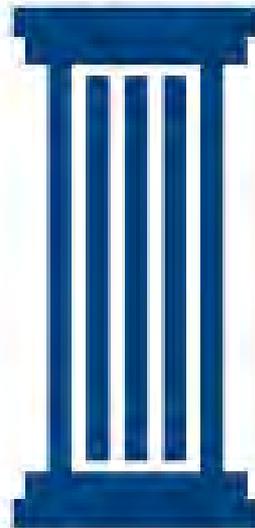
GE Renewable Energy and ENMAX to implement Canada's First Hybrid Electric Gas Turbine

November 05, 2019 / San Diego

award-winning Hybrid Electric Gas Turbine technology. Using GE's proven Battery Energy Storage System (BESS) and patented hybrid controls, the turbine will be equipped to **provide operating reserves without burning fuel**, enabling significant Green House Gas (GHG) emissions reductions. GE will provide

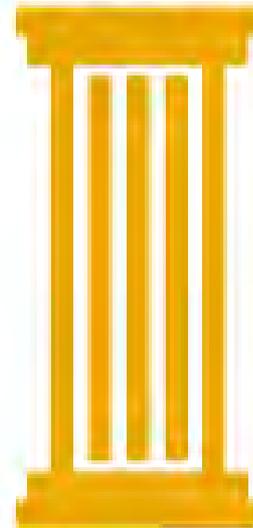


ENERGY STORAGE



Transmission

- Forecasting & Market Analysis
- Transmission Planning
- Transmission Engineering
- IE Standards
- Technological Innovation



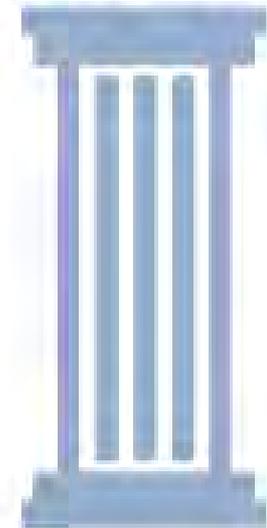
Markets

- Market Design
- Tariff Design
- Operational Planning
- & Engineering



Tools

- Operational Systems
- Grid & Market Operations
- Finance & Settlement
- IT Systems

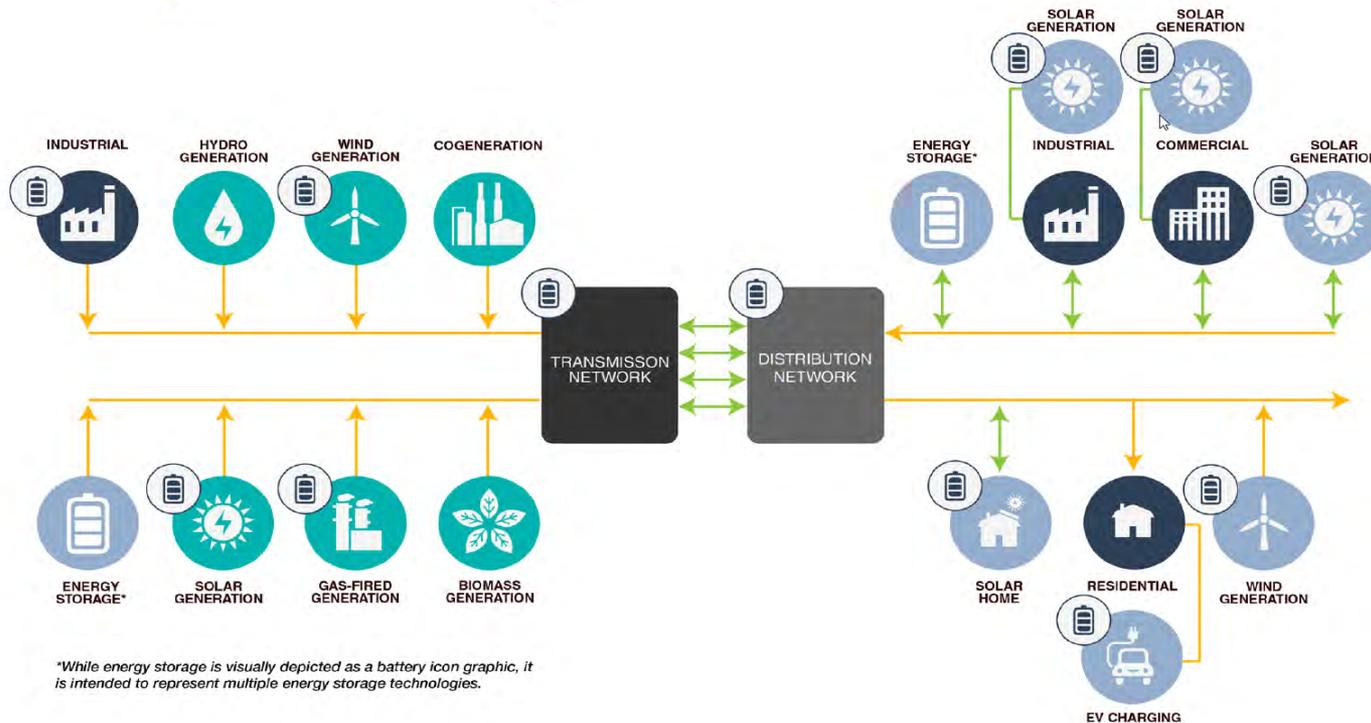


Regulatory

- Legal & Regulatory

Important to consider costs and markets

Two way power flow, much more variability



**While energy storage is visually depicted as a battery icon graphic, it is intended to represent multiple energy storage technologies.*

- Load and gen blurring
 - Does this matter for cost allocation?
- Grid connection has value
 - How is this recognized?
- Efficiency will still rely on well functioning markets to enable and integrate these new technologies
 - New products?



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