Governance and Technical Demand Curve Parameters

May 4, 2018

Outline

- Demand in energy and capacity markets
- Capacity Market Demand Curve
  - What is it?
  - Why is it required?
- Principles to the Alberta Demand Curve development
- Overview of the Demand Curve components
  - Process and methodology being proposed
  - **Regulatory oversight and governance considerations**

Demand in energy and capacity markets

Energy-Only Market

- In the energy market, demand is instantaneous as energy needs change due to weather, season, time of day and due to industrial requirements
  - Energy demand is met by dispatch of capacity that is online

Capacity Market

- With the introduction of a capacity market, anticipated demand in future years is met by procuring capacity to serve that future need
- In the capacity market, demand reflects an expected unserved energy target (based on probabilistic modelling)
  - A capacity target is set to reflect a future forecast of energy needs in the future (example three year forward)

What is a capacity market demand curve?

- In Alberta capacity will be procured on a three year forward basis through the establishment of a demand curve by the AESO
- For each auction a demand curve will be released, indicating the price and quantity of capacity AESO is willing procure in the auction
- The AESO will be the counterparty to capacity obligations
- Loads will be charged for capacity procured
  - Option to self supply
- Auction will determine capacity price and quantity procured through intersection of demand and supply curve

Demand Curve Governance Considerations

- **Stability**: Stability in demand curve design needed for investor confidence
- **Oversight**: Oversight required to ensure resource adequacy, cost and market attractiveness are all achieved
- **Timeliness**: A demand curve will need to be created for each auction (base and re-balancing); limits the timeframe for review and approval creating time constraints for the overall process

Governance of the demand curve must find the balance between appropriate oversight and administrative and regulatory efficiency

AESO focused on:

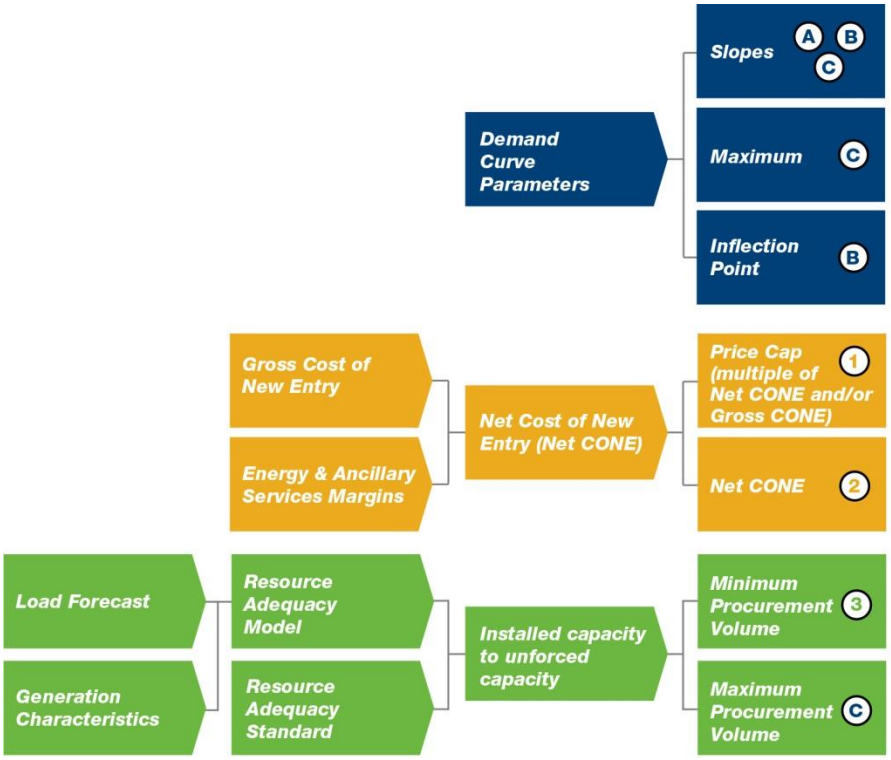
- Seek approval of processes and methodologies underpinning the development and implementation of components of the demand curve.
- Provide transparency to stakeholders and gather key feedback
- Suggesting the suite of processes/methodologies will be approved in aggregate on a periodic basis (i.e. every 4 years)

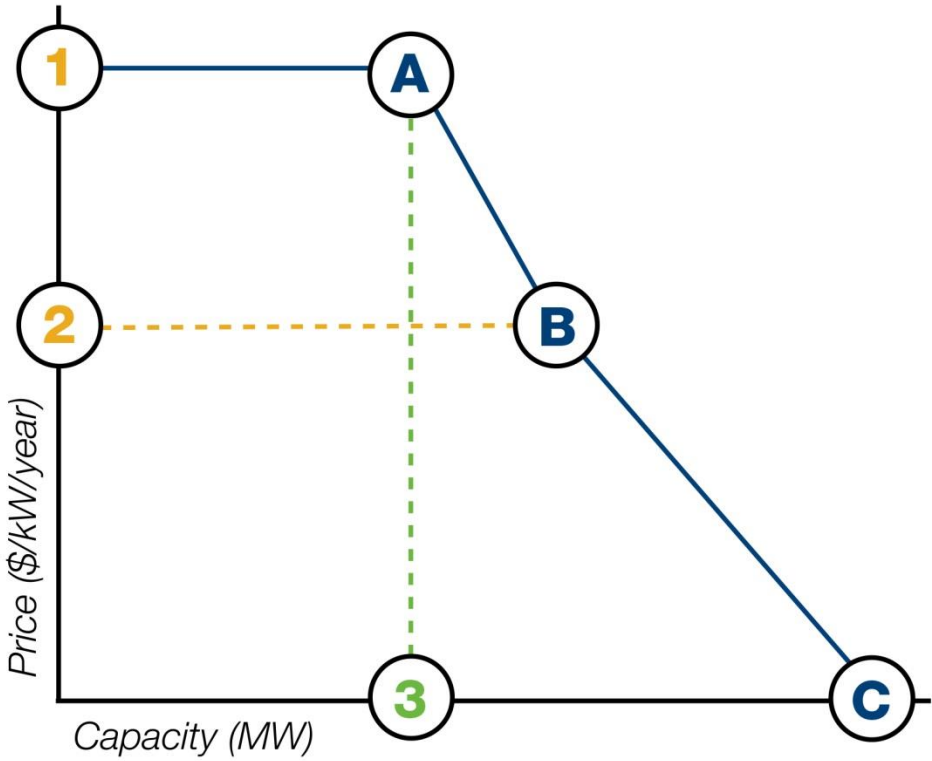
Demand curve development principles

1. Ensure Supply Adequacy
2. Efficiency and price formation
3. Balance between achieving resource adequacy and controlling cost to consumers
4. Alberta's market stays attractive to investors
5. Compatible and robust enough to reasonably foresee changes in supply, demand, transmission, and energy prices
6. Analysis should incorporate experience and lessons learnt from other jurisdictions

*A full list of the development principles will be listed in the final Comprehensive Market Design on www.aeso.ca

Demand Curve Overview





Load Forecast - Summary

What is it?

- A forecast of future gross Alberta demand
- An input into the resource adequacy model guiding the level of capacity required

Process/methodology to derive the component

- Using industry best practice approach
- Iteratively optimized standard linear regression model in leading edge SAS software
- Economic forecast information from the Conference Board of Canada a key input

Output created

- Range of hourly load profiles, capturing variability in weather and economic uncertainty

Why are we doing it this way? (CMD proposal)

- Follows industry best practice
- Derived linear regression has a very low mean absolute percentage error (MAPE) when compared to historical outcomes
- The variation on weather and economic inputs covers the full range of uncertainty

Governance considerations

- A variety of approaches and data sources can be used
- Load forecasts are currently approved by AESO executive, and then tested in AUC decisions (i.e. NIDs)
- Seek approval of overall process to be followed as a means of oversight of the load forecast
- Demand curve timelines need to be factored into each approval process
- Step changes in demand drivers need to be captured

Resource Adequacy Standard - Summary

What is it?

- Sets out the acceptable level of resource adequacy for the Alberta system
- Will be used to establish the amount of capacity that is required for the Alberta system
- The Government of Alberta (GoA) announced that it will legislate a minimum resource adequacy target of 0.0011% of expected unserved energy (EUE)

Process/methodology to derive the component

- Alberta has historically relied on an EUE target as a backstop to the energy only market (Rule 202.6)
- Other options to evaluate:
- historical performance
- standards in other jurisdictions
- economic efficiency level

Output created

- The minimum and target level are used in interpreting the results of the resource adequacy model and determining procurement volume

Why are we doing it this way? (CMD proposal)

- Government has provided policy level guidance
- AESO is evaluating if anything further is required (i.e. target level as well as minimum)

Governance considerations

- The minimum resource adequacy target is expected to be set out legislatively
- Society's tolerance for outages, and correspondingly the minimum and target levels, aren't expected to change frequently

Resource Adequacy Model & Procurement Volume - Summary

What is it?

- A probabilistic simulation of Alberta's supply and demand to determine the amount of capacity required to meet the resource adequacy standard
- It is used to determine capacity procurement levels

Process/methodology to derive the component

- **The AESO used an external SERVM model licensed from ASTRAPE**
  - Other clients include CPUC, ERCOT, SPP, PJM, MISO, FERC
- The working group process is being used to validate that AESO is using Reasonable assumptions and methodologies and Industry standard practices while provide transparency to the modeling process
- **AESO's expertise in this area gained form:**
- Long-term adequacy reporting, WECC & NERC long-term resource adequacy assessment

Output created

- Estimates of various resource adequacy measures under varying supply levels including:
- expected unserved energy (MWh)
- loss of load hours (# hours)
- loss of load expectation (# events)

Why are we doing it this way? (CMD proposal)

- Following industry best practices, a probabilistic analysis is considered to be more insightful than a deterministic analysis as it provides other information to inform the shape of the demand curve

Governance considerations

- Oversight of the procurement volume is required
- Output of a highly complex process with a large number of inputs, distributions, scenarios; expertise required to review
- Demand curve timelines need to be factored into each approval process
- Approval of volume for each demand curve required, model process can remain in place for a periodic basis

CONE (Gross CONE) - Summary

What is it?

- CONE is the total annual net revenues a new generation resource would need to earn on average to recover its capital investment and annual fixed costs
- CONE represents long-run marginal cost of meeting the resource adequacy target
- Used to guide capacity demand curve price levels (in conjunction with net CONE)

Process/methodology to derive the component

- Based on an estimate of developing a capacity resource in Alberta
- Considering Alberta specific considerations (i.e. costs, financing, location, environmental stds., etc.)
- Using qualified external party (Brattle/Sargent Lundy)

Why are we doing it this way? (CMD proposal)

- Capture a developer's considerations
- Augmenting AESO expertise, leverage the type of expertise a developer would use

Output created

- Estimate of CONE for several reference technologies

Governance considerations

- The detailed study can be applicable for several years
- CONE is an important component to determining price levels of the demand curve
- Need to balance overall cost considerations for consumers while ensuring the capacity market is attractive enough to incent the entry and exit of capacity
- External approval of the CONE level required, then use to develop the demand curve for a number of years (updating with cost indices)

EAS Offset Methodology/Net CONE - Summary

What is it?

- A methodology for estimating revenue the reference technology will earn from the energy and ancillary services market for contribution to the plants fixed costs
- Netted off of Gross CONE to estimate Net CONE

Process/methodology to derive the component

- The AESO is evaluating techniques used in other jurisdictions
- The AESO is consulting with the working groups on the selected approach

Output created

- The process to estimate the energy and ancillary services offset, which is netted off of CONE
- In combination with CONE determines demand curve price levels

Why are we doing it this way? (CMD proposal)

- The approach needs to be replicable by external parties and be representative of a developers assessment of future revenues

Governance considerations

- There are many approaches to forecasting future revenues, reasoning for chosen approach important
- Seek approval of the process as implicit approval of the output
- Important market signal, value can't be adjusted once market outcomes know or change
- Structure of energy & AS market of delivery period important

Demand curve shape - Summary

What is it?

- The parameters or formula that will define the demand curve once net CONE and the procurement volumes are determined
- Includes characteristics such as price cap, price floor, convexity, and width

Why are we doing it this way? (CMD proposal)

- The AESO was attempting to develop a curve that meets the demand curve principles
- In an effort to balance the trade-offs between reliability, market stability, and overall cost

Process/methodology to derive the component

- The AESO is relying on the Brattle methodology to iteratively test the feasibility of various demand curve shapes to meet the principles under a broad range of market outcomes
- Testing the evaluation and development through the capacity market working group stakeholder engagement process

Output created

- A formula for the development of a demand curve for each auction given the determined net CONE value and procurement volumes

Governance considerations

- The curve represents Alberta's willingness to pay for capacity at various levels, approval confirms shape is in public interest
- Oversight on curve required to ensure the trade-offs within the design of the demand curve are balanced
- Approval of shape can hold for several years, does not need to be revisited for each auction

Closing

- Are there any additional governance considerations the TWG thinks the AESO should be taking into account?
- Additional remarks?

Thank you