Alberta Capacity Market

Comprehensive Market Design (CMD 1)
Design Rationale Document

Section 6: Physical and Bilateral Transactions and Self-Supply

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6.1 Physical Bilateral Transactions and Support for Self-Supply

In order for the capacity market to be fair, efficient and openly competitive (FEOC), the market must have liquidity. By not allowing resources and load to arrange for capacity outside of the market through physical bilateral arrangements, liquidity and competition are promoted. The design requires the capacity market to achieve the desired reliability objectives through a real and measurable supply adequacy product that still respects the unique aspects of Alberta's electricity system.

The concept of self-supply, a best practice found in other capacity market implementations, was leveraged to facilitate the need to properly incorporate the roughly 2,000 MW of cogeneration/onsite generation while ensuring the reliable operation of the electricity grid consistent with, and complementary to, other measures aimed at ensuring reliability. This also recognizes the unique nature of Alberta's system. The proposed mechanism for accounting for self-supply without risking reliability and addressing fairness issues caused by the free rider concern was a simple and straightforward initial implementation using cost allocation to incent self-suppliers to not consume energy in excess of what they self-supplied.

Asset substitution is a best practice found in other jurisdictions that has been adopted for Alberta's capacity market as a tool for stakeholders to manage their capacity obligation risk.

6.1.1 Physical Bilateral Transactions

Input from Working Group Members and Industry Stakeholders through SAM 3.0:

- The working group recommended that physical bilateral transactions not be permitted in the capacity market reservations (and the objection) at the time was related to the wording of the recommendation and insufficiently clear definitions. However, the concept was generally agreed to, as reflected in the vote.
- Industry feedback on SAM 3.0 indicated that most (nine of 11 comments related) agree to not allow physical bilateral procurement between load and generation.

AESO Rationale:

- The design is not materially different from what was described in SAM 3.0.
- Physical bilateral transactions are not permitted.
- Physical bilateral transactions, defined, take place outside of the centralized capacity market. Buyers and sellers find each other (i.e. self-matching) and report their matched commitments to the centralized market (the AESO) prior to the capacity auction. Contract prices are not reported to the AESO, and remain private information between the buyer and seller.
- The rationale for not including physical bilateral transactions is as follows:
  - Negatively impacts size of the centralized market by potentially reducing liquidity, thereby making the market less competitive.
  - Contract-for-differences (CfD) or other financial hedging mechanisms exist and do not require ISO administration eliminating the need for physical bilateral.
  - Legislation currently requires all energy be exchanged through the power pool. A legislative requirement may be extended to the capacity market as well in order to support a FEOC market.
  - Does not require individual loads to be allocated a capacity market volume obligation (consumption threshold) and be managed to that obligation.

6.1.2 Support for Self-Supply

Input from Working Group Members and Industry Stakeholders through SAM 3.0:

- The nature of the support for self-supply by the working group is reflected in three provisional recommendations, two of which are summarized below, and the other summarized in Section 2.1.5 Self-Supply Prequalification of this document:
- **Self-Supply Choice**: The working group recommended that self-supplied load may choose to participate as gross or net provided the appropriate metering is installed, they meet the eligibility criteria for self-supply, and an adequate connection to the electric system (transmission or distribution) exists to support gross or net participation; sites with onsite generation that cannot physically flow their gross volumes due to system connection limitations must self-supply (all 14 agree, two with reservations)
- Self-Supply Options:
  - Four options for how self-supply should be incorporated into the market were identified:
    - Require the self-supplier be curtailed by the AESO during performance events if not meeting their performance obligation.
    - Penalize the self-supplier at the value of lost load plus the curtailed loads capacity payment (penalties + liquidated damages).
    - Procure some capacity based on a probabilistic assessment of each self-supplier's dependence on the capacity market.
    - Apply the cost allocation formula to net load; if a self-supplier takes capacity in a prior year they pay for it in the future year.
  - Based on these four options, the working group recommended that, assuming the self-supplier does not choose to be curtailed during performance events, that the cost allocation formula be applied to net load. If a self-supplier "takes" capacity in a prior year they pay for it in the future year. This recommendation has the caveat that the cost allocation methodology adequately mitigates the risk of self-suppliers consuming their gross load as net during performance events and the following demand curve assumptions are true (all 14 agree, five with reservations):
    - The AESO will forecast Alberta Internal Load (AIL) and estimate how much capacity is required to meet adequacy standards based on a probabilistic assessment.
    - The AESO will reduce its procurement target by the forecast volume of self-supply. This is calculated as probabilistic determinations of forecast AIL minus forecast system load minus forecast system net load. The AESO will need to know who intends to self-supply in order to forecast the system net load.
    - Cost allocation for each self-supplier will be based on net-to-grid load of each self-supplier (e.g., during cost allocation hours). The methodology for cost allocation has yet to be determined.
    - It was widely recognized that the design for self-supply was dependent on the cost allocation methodology to be determined by government.
- Industry feedback on SAM 3.0 indicated that:
  - Most support behind-the-fence participation on either a net-to-grid or gross-to-grid basis based on the stated requirements (with modifications suggested).
  - Self-supply recommendations may require revisiting once cost allocation is decided by the Department of Energy.
  - Concerns that free ride scenarios for behind-the-fence (BTF) self-suppliers may result from design.
  - Concerns regarding design being workable for smaller, distribution connected self-suppliers.

Comparison to SAM 3.0 Position

- The design is not materially different from what was described in SAM 3.0

AESO Rationale:

A site may choose to self-supply capacity provided they meet the eligibility requirements in Section 2.1. Alberta's market does not have integrated utilities acting as load serving entities, as found in other capacity markets, but over 20% of the internal load is served by onsite generation. The market design must include consideration for this form of participant. Self-supply provides the market with a methodology to deal with BTF with limited transmission capability. In addition, the ability to self-supply allows cogeneration sites that are tied to a host customers' load to be exempt from offering all of its capability into the AESO-operated capacity market. The *AESO 2017 Long-Term Outlook* defines BTF: as "industrial load served in whole, or in part by onsite generation built on the host's site."

The allowance provided to certain customers to self-supply will be designed with these principles in mind:

1. ***Ensure Supply Adequacy:*** Net-to-grid treatment for self-suppliers supports achieving the desired reliability objectives.

2. ***Fairness, Equal Treatment and Market Efficiency:*** Self-suppliers' load and generation are treated fairly and equitably compared to the treatment of other loads and generators in the market.

3. ***Fair Cost Allocation:*** All customers pay their fair share of capacity costs.

4. ***Simplicity and Consistency:*** The approach for net-to-grid resource participation should be simple to administer, facilitate market transparency and participation, and be consistent with the overall market design.

What are the concerns related to self-supply?

An independent load and generator may pay, and is paid differently, from sites that are combined load and generation. Using a simple-settlement example for the capacity market, it can be demonstrated that a site that is self-supplied will be allocated less of the reserve margin than a similar load without the ability to self-supply. The following example demonstrates the payment difference when comparing gross settlement to net settlement.

Assume a simple system with four cogeneration sites (I1 through I4) and 1 pure load site (I5) and one new entrant pure generator (A1). This example assumes a reserve margin requirement of 15% as the additional amount to procure in the capacity market to ensure reliability. The internal load of this system is 44 MW, adding an additional 15% brings the procurement target for this system to 50.6 MW of capacity less 18 MW of self-supply equaling 32.6 MW. The volume of self-supply is calculated as the difference between the sites gross load and its net load. The size of the resource procured to serve this sample of load portfolio is calculated as difference of the necessary amount for the gross load minus the sum of the generators' UCAP.

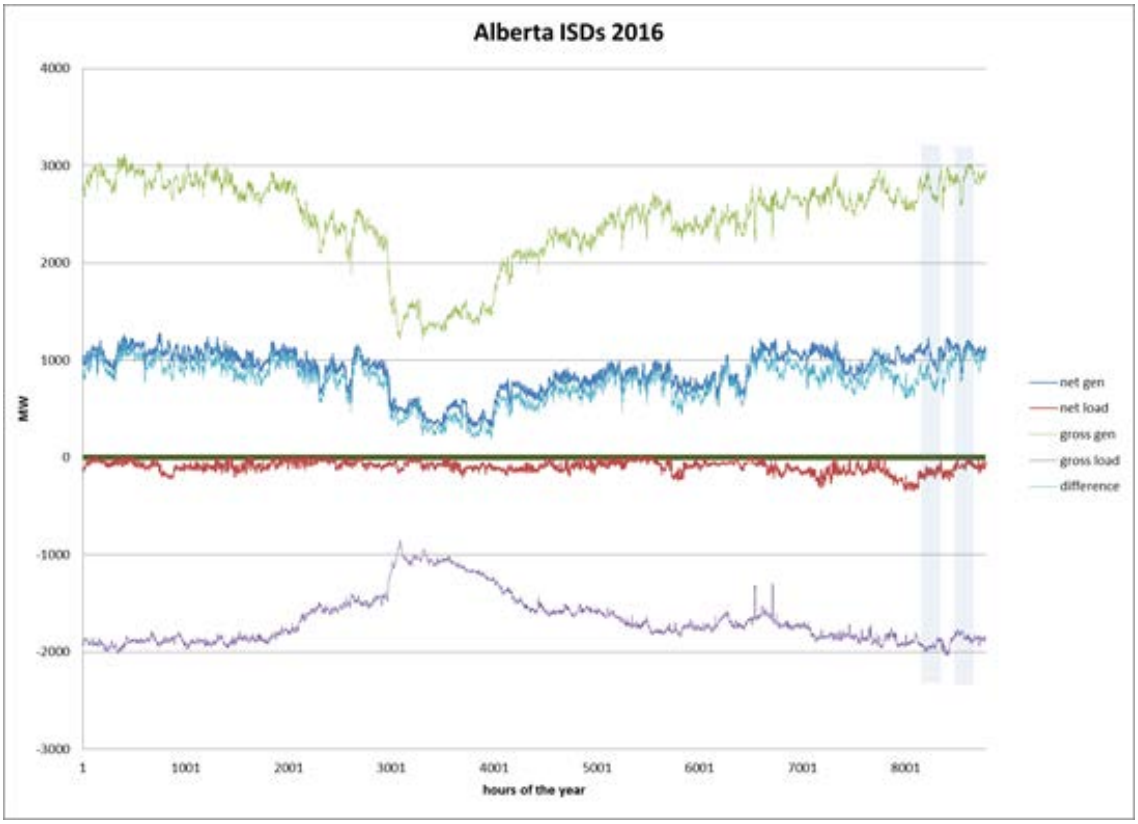
Once the AESO clears the capacity market, the load will be allocated the cost of the capacity procured. The cost allocation formula used here is the total payment to all capacity resources multiplied by the load of the site divided by the total load of all sites. The illustrative example includes both a gross load and a net load calculation. The payments that generators receive in this illustrative example is based on assumes a capacity market price of $40/MW (over a particular delivery period). The capacity payment is simply the capacity obligation multiplied by capacity market price. The example includes both a gross generation and a net generation calculation. When we look at the settlement totals is calculated, this illustrative example shows by allowing netting the generation out of the load, the rest of the load on the system (pure load represented by (I5) will pays more than it would otherwise if netting were not allowed,

and the loads that have cogeneration sites pay less if short of generation or the generators would be are paid more if long on generation. Currently in Alberta 20% of the gross load is self-supplied.

	Net		Gross		cost allocation				payments		totals		Volume of
sites	net load	net gen	gross load	gross gen	net	$	gross	$	net	gross	sum net	sum gross	Self-supply
I1	2	0	5	3	2.507692	$ 100	5.75	$ 230	$ -	$ 120	$ (100)	$ (110)	3
I2	0	3	3	6	0	$ -	3.45	$ 138	$ 120	$ 240	$ 120	$ 102	3
I3	4	0	8	4	5.015385	$ 201	9.2	$ 368	$ -	$ 160	$ (201)	$ (208)	4
I4	0	3	8	11	0	$ -	9.2	$ 368	$ 120	$ 440	$ 120	$ 72	8
I5	20	0	20	0	25.07692	$ 1,003	23	$ 920	$ -	$ -	$ (1,003)	$ (920)	0
Sum:	26	6	44	24	32.6	$ 1,304	50.6	$ 2,024	$ 240	960	$ (1,064)	$ (1,064)	18
A1	0	26.6	0	26.6					$1,064	$1,064	$1,064	$1,064	
Sum:		32.6	44	50.6	32.6	$ 1,304	50.6	$ 2,024	$ 1,304	$ 2,024	0		
	amount to procure:		32.6	26.6									

The difference between the gross and net calculation is an additional 2.08 MW is allocated to the pure load at a cost of $83 ($1003 to 920) in this illustrative example. This is because the netted load is not carrying their reserve requirement under the same level of reliability criteria as the rest of the system. The rationale submitted by the cogeneration owners for this acceptable difference is that cogeneration provides a reliability benefit due to the fact that the load and generation are tightly coupled. When looking in aggregate at Alberta industrial systems there is a correlation between the load and generation. In the following graph you can see as the generation at the site drops the load drops too. This correlation makes sense as, by definition, the electricity is a by-product of the steam used in the industrial process. If no steam is generated, then no generation output is provided and no industrial process supported by the cogeneration. The reduction in generation was roughly 500 MW greater than the decrease in load over the same period. This is partially due to the fact that some ISD sites are not cogeneration sites.

What is the rationale for non-cogeneration to be allowed to net?

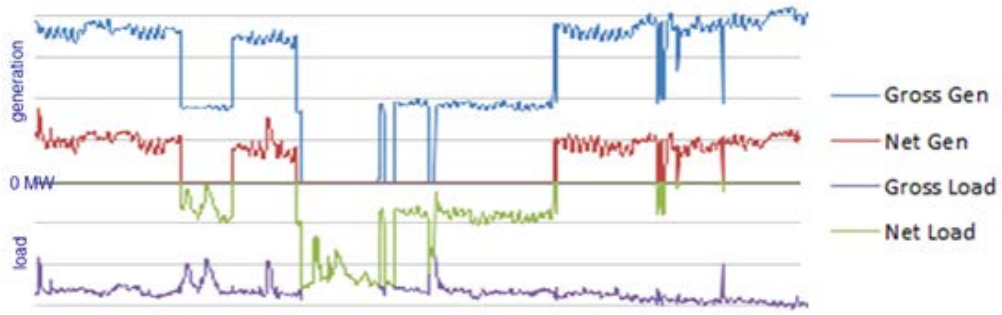


It has been stated in AESO's earlier documentation that our capacity market is a physical market. The original criteria and assumptions for the capacity market state that "a capacity obligation is a forward obligation on capacity suppliers that requires the capacity sold in the capacity market be available to provide energy production or reduced consumption when needed." Based on this statement, sites with onsite generation that are net-metered and cannot physically flow their gross volumes due to system connection limitations must self-supply. Not all sites under this configuration are cogeneration sites and some manage their load with their own generation investments to avoid transmission costs. It has been suggested that some of these customers would not be able to participate in the capacity market if they need to electrically reconfigure their metering and connection to the transmission system.

How should self-supply volumes be determined?

Self-supply volume is the difference between a site's gross load and net load. Depending on when that difference is measured the value can change dramatically.

If it can be assured that in the event of generation failure during a performance event the load will be at its' net-load volume levels, no reliability risk exists. Examination of historical individual net site behavior has not demonstrated this in all cases. Loads are not always reduced when the generation is down and we find net loads increase to gross load levels in some instances. In the example graph below, when the generation at the site (blue line) goes to or approaches zero, the net load at the site (green line) increases. The gross load at the site (purple line) remains relatively constant. Further analysis indicated seven of the 15 current ISD sites demonstrated a high correlation of their load and generation.



Due to this observation, the AESO proposed four options to industry for mitigating this risk in the form of the following question.

How the AESO determine how much capacity to procure for self-supplied load? Four options are listed below:

1. The AESO does not procure capacity for the netted-out load and require the net load to be curtailed by the ISO during performance events if not meeting their performance obligation.
2. The AESO does not procure capacity for the self-supplied load, but charge the load at the value of lost load plus the curtailed loads capacity payment (liquidated damages) if they rely on the system under shortage events.
3. The AESO procures some capacity based on a probabilistic assessment of each self-supplier's dependence on the system's capacity market
4. Apply the cost allocation formula to net load only. If a self-supplier takes capacity in a prior year they pay for it in the future year.

It was determined by the working group that option 1, curtailment, is a true form of opting out of the market and would not compromise reliability; however, there are very few self-suppliers that could utilize this option, and the cost of mandating this on all sites would be prohibitive. Option 2 and 4 are variations on a similar theme, providing a financial incentive for self-suppliers to make sure resources manage their consumption during performance events. The most important difference is that Option 2 sets a maximum load obligation that is assessed during performance periods, where the cost allocation method (option 4) is tied to cost allocation periods. Option 3 is a combination of option 4 plus an additional premium, equal to some fraction of the system reserve margin percentage, placed on the self-supplied load to cover the risk of the load exceeding typical net levels during performance events. This was seen by some stakeholders as incurring a double cost allocation and by the AESO as a highly administrative calculation requiring actuarial science to determine the right premium.

Option 4, applying the cost allocation formula to net load, was seen by a majority of the working group as the simplest method to manage self-supply as it is consistent with the current energy market treatment of generator station service load and net-measured sites. Some members felt this mechanism did not adequately address the reliability issue. The reliability concern comes from two places. 1) The method of cost allocation may not provide proper incentives for self-supplied load to not consume during system stress events if there is no alignment of performance events and the times where costs are allocated. 2) The net load is highly variable, and most sites can incur non-coincident peaks in the 100s of MW even though net loads are mostly in the 10s of MW range.

With the high variability of net loads combined with the fact that these loads are large, the treatment of self-supply must ensure the appropriate incentives are in place to discourage self-supply loads from consuming during the capacity performance periods. To not do so could present a reliability risk. The cost allocation methodology will be set by the Government of Alberta, and may or may not provide the appropriate incentives. Following the outcome of the cost allocation policy discussion, the AESO may have to reconsider Option 4 in favor of options 2 or 3.

Why does the City of Medicine Hat need to be considered a self-supplier within the capacity market?

- The City of Medicine Hat is a site with onsite generation that is net metered at the connection to the Alberta Interconnected Electric System (AIES), and cannot physically flow their gross generation volumes due to system connection limitations and therefore must self-supply.
- The City of Medicine Hat has special treatment within the *Electric Utilitities Act* with respect to energy market participation, however no such treatment exists for capacity market participation. Unless the City of Medicine Hat is exempted by law, they will be required to participate in the capacity market as a self-supplier as they meet the self-supplier definition.

6.2 Asset Substitution

Input from Working Group Members and Industry Stakeholders through SAM 3.0:

- The working group was directionally aligned that allowing asset substitution was good for the market by helping suppliers manage risk which should result in lower capacity market costs. The approach to managing performance risk should incorporate as much flexibility as possible and be allowed on an *ex ante* basis and possibly an *ex post* basis, between market participants and between resource types.
- Working group members were interested in learning more about the *ex post* approach that is employed in other markets, but felt they did not have enough information to support it at the time.
    - Some working group members and industry stakeholders raised concerns with substitution on an *ex post* basis as this could be considered a free option, or that it may dilute the penalty signal.

Comparison to SAM 3.0 Position

- The AESO's proposal is largely consistent with SAM 3 directional alignment with respect to *ex ante* substitution. No clear stakeholder position was taken on *ex post* substitution.

AESO Rationale:

The Comprehensive Market Design supports *ex-ante* asset substitution but not *ex-post* asset substitution.

Asset substitution allows a pool participant to assign the performance and availability assessments to another uncommitted capacity resource as a tool to manage performance risk while maintaining overall system reliability objectives.

The proposed *ex ante* asset substitution approach is modelled on the existing AESO approach found in the ancillary services market for operating reserve. Financial arrangements made are outside the AESO's purview. Asset substitution will not transfer the obligation from one customer to another, but rather transfer the performance and availability assessment to another qualified, but uncleared resource.

The potential benefits of *ex post* substitution for stakeholders to manage risk within their portfolios are minimal given the proposed structure for performance payment adjustments (see Section 8). In addition, *ex post* substitution may increase the risk of gaming availability measurements in an availability measure.

An uncommitted resource is one that was qualified to participate in the market but did not clear in the auction. The AESO must track performance and availability of all eligible resources whether they clear or not because of the must-offer requirement and for the purposes of future market UCAP calculations. In asset substitution we can simply point the assessments at any resource provided it is known which resources are expected to perform and when. Performance and availability payment adjustment mechanisms apply to the official obligation holder and not the owner of the substituting resource. This simplifies settlement, does not impact credit requirements, and allows counterparties to work out the terms of their agreement independently.

6.3 Capacity Obligations Tracking Infrastructure and Processes

Input from Working Group Members and Industry Stakeholders through SAM 3.0:

These details were not discussed by the working group through SAM 3.0.

AESO Rationale:

A system of record is required to track and manage qualification status, UCAP ratings, auction results including the capacity obligation volumes and associated prices for each obligation period. The systemwill also support self-supply and asset substitution arrangements among market participants.