

# 3 Calculation of Unforced Capacity (UCAP)

*This section addresses the methodologies for calculating unforced capacity (UCAP) of capacity assets*

## 3.1 Calculation of UCAP

- 3.1.1 The reliability contribution (UCAP) of a capacity asset will be evaluated based on set methodologies, as described below. The UCAP determined for a capacity asset is representative of the capacity asset's physical reliability during tight supply market conditions.
- 3.1.2 Before every base auction and rebalancing auction, the AESO will calculate and assign an annual UCAP and UCAP range for each prequalified capacity asset.
- 3.1.3 The AESO will not calculate UCAP for those assets identified in subsections 2.1.4 and 2.1.5 of Section 2, *Supply Participation* (i.e., Renewable Energy Program round 1, 2 and 3 resources, and energy efficiency).
- 3.1.4 The capacity market participant may elect a UCAP within a range of the AESO calculated UCAP. Prior to a capacity auction, the AESO will provide each prequalified capacity asset a UCAP range equal to the greater of the following:
- (a) the asset-specific UCAP range set out in subsection 3.1.6 below;
  - (b) +/- 2% multiplied by the asset's maximum capability. These values will be added and subtracted to the UCAP of the asset; or
  - (c) +/- 1 MW of the asset's UCAP.
- The AESO will not provide a UCAP range that will enable the legal owner of the capacity asset to select a UCAP above the maximum capability of the asset or below 1 MW of UCAP.
- 3.1.5 The UCAP range will not be applicable to external capacity assets, demand response capacity assets or new capacity assets.
- 3.1.6 The AESO will calculate asset-specific UCAP ranges using the following methodology:
- The upper limit for the UCAP range will be determined by removing 5% of the 1250 tightest supply cushion hours in which the asset's availability factor or capacity factor was the lowest, and averaging the remaining data. This value will be multiplied by the assets maximum capability to determine the UCAP upper limit.
  - The lower limit for the UCAP range will be determined by removing 5% of the 1250 tightest supply cushion hours in which the asset's observed performance was the highest, and averaging the remaining data,. This value will be multiplied by the assets maximum capability to determine the UCAP lower limit.
- 3.1.7 The AESO will automatically qualify all prequalified capacity assets that have a UCAP greater than or equal to 1 MW. If the UCAP of a prequalified capacity asset drops below 1 MW prior to a base or rebalancing auction, the capacity market participant will not be required to delist the capacity asset in accordance with subsection 2.3 of Section 2, *Supply Participation*. However, the capacity asset will not be qualified to participate in a subsequent capacity auction except as may be required to buy back a previously sold obligation volume.
- 3.1.8 Final asset level UCAPs will be shared publicly during the preauction activities described in section 5.2. UCAP values will be published on the AESO's website.

**UCAP for capacity assets with availability or production data that meet the minimum threshold for calculating UCAP per section 3.1.11**

3.1.9 A UCAP for a capacity asset with historical generation or consumption data in Alberta will generally be based on one of two methodologies:

- (a) **Availability factor.** Generally, a straight average availability factor approach will be used to calculate UCAP for capacity assets whose generation or load metered volumes align with the dispatch levels in the energy market.

An hourly availability factor will be calculated using duration weighted available capability as observed in the Energy Trading System divided by maximum capability for each of the 250 tightest supply cushion hours per year for the past five years. Availability factors will incorporate historical derates, forced outages, planned outages and force majeure outages. Distribution system constraints and transmission outages that result in an asset being electrically disconnected from the transmission system will not be excluded from the availability factor.

$$AF_t = \frac{\left( \frac{\sum_{i=1}^n w_{it} AC_{it}}{\sum_{i=1}^n w_{it}} \right)}{MC_t}$$

Where  $AF_t$  is the availability factor for hour t, and  $MC_t$  is the capacity asset's maximum capability in the hour.  $w_{it}$  is the duration of time that the availability of the asset has been equal to  $AC_{it}$ . The numerator (in parenthesis) represents duration-weighted average of available capability over all available capability declarations within the one-hour settlement interval. The hourly availability factors will be averaged to create a straight average availability factor for the capacity asset:

$$SAAF = \frac{\sum_{t=1}^N AF_t}{N}$$

Where  $SAAF$  is the straight average availability factor and N is the number of observed hours. The straight average availability factor multiplied by the capacity asset's maximum capability anticipated for the obligation period will yield the UCAP:

$$UCAP = SAAF \times MC$$

- (b) **Capacity factor.** In the majority of cases, a capacity factor approach will be used to calculate UCAP for a capacity asset whose generation or load metered volumes do not align with the dispatch levels in the energy market. Capacity factors will incorporate historical derates, forced outages, planned outages and force majeure outages.

An hourly capacity factor ( $CF_t$ ) will be calculated using historical metered volumes, plus any applicable ancillary services volumes of the capacity asset, divided by maximum capability for each of the 250 tightest supply cushion hours per year for the past five years:

$$CF_t = \frac{MV_t + AASV_t}{MC_t}$$

Where  $MV_t$  is the metered volume at hour t that represents the amount of energy delivered to the grid over a one-hour settlement interval.  $AASV_t$  is the Applicable Ancillary Services Volume within the hour.

The hourly capacity factors will be averaged to create a straight average capacity factor for the capacity asset:

$$SACF = \frac{\sum_{t=1}^N CF_t}{N}$$

Where *SACF* is the straight average capacity factor and *N* is the number of observed hours. The straight average capacity factor, when multiplied by the capacity asset's maximum capability anticipated for the obligation period, will yield the UCAP of the capacity asset:

$$UCAP = SACF \times MC$$

***UCAP for capacity assets that do not meet the minimum threshold hours for calculating UCAP as per Section 3.1.11***

3.1.10 Until operating history becomes available, the AESO will use one of the following approaches to supplement data for the UCAP calculation for a capacity asset that does not meet the minimum threshold hours for calculating UCAP:

- (a) ***Class-averages.*** Class averages are based on operating data for similarly designed or geographically located environmental assets (such as wind or solar). The class-average will be based on average energy production or available capability declarations as observed during the 250 tightest supply cushion hours per year. The AESO will calculate class-average capacity factors for each of the previous five years.
- (b) ***Production or load estimates.*** In the absence of comparable assets to form a class average, the AESO will review production and/or load estimates based on engineering data and historical meteorological studies (for wind and solar assets without geographically located comparators) submitted by the legal owner of the capacity asset, if appropriate, to determine an availability or capacity factor.
- (c) ***Jurisdictional Review.*** In the absence of a class average or comparable class estimate, the AESO will examine how similar assets or an asset class has performance in other capacity market jurisdictions during tight system conditions.

3.1.11 As operating history becomes available, the AESO will calculate UCAP using a combination of class-average data, production or load estimates, or data based on a jurisdictional review and the capacity asset's observed capability (or production data for capacity factor assets) during the tightest supply cushion hours until the point in time the asset reaches the required minimum number of tight supply cushion hours for calculating UCAP using solely the capacity asset's historical data, as follows:

- Variable capacity assets, such as wind, solar and run of river hydro assets, are required to have production data in a minimum of 300 tightest supply cushion hours.
- All other capacity asset types, apart from variable capacity assets, will require production or available capability data, depending on if the asset is a capacity factor or availability factor asset, in a minimum of 250 tightest supply cushion hours.

***Asset-specific UCAP methodologies***

3.1.12 Table 1 below contains the asset-specific UCAP methodologies and considerations for the calculation of UCAP.

**Table 1 – Asset-specific UCAP Methodologies<sup>1</sup>**

Asset Type	Asset-specific UCAP Methodology
Wind, solar and run of river hydro	<ul style="list-style-type: none"> <li>A capacity factor will be established for wind, solar and run of river hydro assets.</li> </ul>
Thermal (including coal-to-gas conversions and net-dispatched cogeneration)	<ul style="list-style-type: none"> <li>An availability factor will be established for thermal assets.</li> </ul>
Storage	<ul style="list-style-type: none"> <li>An availability factor will be established for storage assets.</li> <li>The UCAP of a storage asset will be capped at its maximum sustainable 4 hour discharge capability.</li> </ul>
Self-supply dispatched net-to-grid	<ul style="list-style-type: none"> <li>An availability factor will be established for self-supply assets that are dispatched net to grid.</li> </ul>
Self-supply dispatched gross-to-grid	<ul style="list-style-type: none"> <li>An availability factor determined through a linear regression approach will be established for self-supply market participants that are dispatched gross to the grid using the following approach:               <ul style="list-style-type: none"> <li>The AESO will perform a linear regression of the net to grid metered output of the self-supply site relative to the weighted average energy market dispatches issued to the generating asset(s) on the self supply site as observed in each of the 250 tightest supply cushion hours per year for the past five years.</li> <li>The AESO will establish a gross UCAP for the generating asset(s) as described above in 3.1.9.a. This value will be the x variable to be used in the linear regression formula <math>y=M*X + B</math></li> </ul> </li> <li>The AESO will determine the availability factor linear regression UCAP value for the asset using the output from the linear regression formula and the slope calculation.</li> </ul>
Hydro	<ul style="list-style-type: none"> <li>An availability factor will be established for existing hydro assets the Bow River system, Brazeau and Big Horn assets.</li> </ul>
Demand response Firm consumption level	<ul style="list-style-type: none"> <li>Until FCL capacity assets have performance data in a minimum of 250 tightest supply cushion hours, the UCAP level will be calculated as follows:               <math display="block">UCAP = CC * (1 - \text{derate factor})</math> </li> <li>The capacity contribution (CC) of new firm consumption level assets will be measured as the difference between the qualified baseline (QB)<sup>2</sup> and the firm consumption level of the demand response capacity asset:               <math display="block">CC = QB - FCL</math> </li> </ul>

<sup>1</sup> References to “existing” and “new” in Table 1 mean capacity assets with and without 5-year historical generation or consumption data in Alberta, respectively.

<sup>2</sup> As described in subparagraph 2.1.7(c) of Section 2, *Supply Participation*, new FCL loads with no consumption history in Alberta will declare their qualified baseline to the AESO during the prequalification period.

Asset Type	Asset-specific UCAP Methodology
	<ul style="list-style-type: none"> <li>• Derating Factor:               <ul style="list-style-type: none"> <li>○ Until Alberta capacity market performance data can be observed, demand response assets will have a derating factor of 9% or an availability factor of 91%.</li> <li>○ When Alberta capacity market performance data is available, a new firm consumption level capacity asset will receive the class-average availability factor for all demand response assets.</li> </ul> </li> <li>• Once an FCL capacity asset has had a capacity market obligation in a minimum of 250 tightest supply cushion hours, UCAP will be calculated as:               <math display="block">\text{UCAP} = \text{QB} - \text{FCL}</math> </li> <li>• The value the AESO will use to determine the qualified baseline in each tight supply cushion hour will use the following methodology:               <ul style="list-style-type: none"> <li>a. Average the load consumed in “like” hours on:                   <ul style="list-style-type: none"> <li>• the 15 day non-holiday weekdays prior to the tight supply cushion hour ; if tight supply cushion hour fell on non-holiday weekday.</li> <li>• the 10 day weekend and holiday days prior to the tight supply cushion hour. If tight supply cushion hour fell on weekend or holiday.</li> </ul> </li> <li>b. Days with tight supply cushion hours and performance event days will be excluded from the adjusted qualified baseline:</li> </ul> </li> </ul> <p>The FCL will be declared by the owner of the asset during prequalification.</p> <ul style="list-style-type: none"> <li>• The asset must demonstrate the ability to reduce down to its firm consumption level during a performance event.               <ul style="list-style-type: none"> <li>○ If the asset is not capable of demonstrating an ability to reduce down to its firm consumption level the AESO will physically test the asset.</li> <li>○ If after the first obligation period there have not been any performance events then the asset is to demonstrate a reduction down to its firm consumption level via a physical test, the capacity asset will need to demonstrate load reduction at or below the firm consumption level value, and maintain the reduction for 1 hour. Failure to perform to meet the physical test successfully will result in UCAP reduction for subsequent capacity auctions. The firm consumption level will be adjusted to reflect the observed load reduction.</li> </ul> </li> </ul>
<b>Demand response Guaranteed load reduction</b>	$\text{UCAP} = \text{CC} * (1 - \text{derate factor})$ $\text{CC} = \text{GLR}$ <ul style="list-style-type: none"> <li>• The capacity contribution (CC) for new guaranteed load reduction demand response is the guaranteed load reduction declared by the legal owner during the prequalification period.</li> </ul>

Asset Type	Asset-specific UCAP Methodology
	<ul style="list-style-type: none"> <li>• Derating Factor:               <ul style="list-style-type: none"> <li>o As with FCL assets, in the first three obligation periods demand response assets will have a derating factor of 9% or an availability factor of 91%.</li> <li>o When Alberta capacity market performance data is available, a new guaranteed load reduction capacity asset will receive the class-average availability factor for other Alberta guaranteed load reduction assets.</li> <li>o When Alberta capacity market performance data is available,, individual asset performance will be established using availability factor methodology.</li> </ul> </li> </ul>
<b>Aggregated assets</b>	<ul style="list-style-type: none"> <li>• Depending on the fuel-type of the aggregated capacity asset, an availability factor or a capacity factor may be established. If the assets are both availability factor assets, an availability factor UCAP methodology will be used. If the assets are capacity factor or a combination of capacity factor and availability factor assets a capacity factor methodology will be applied.</li> <li>• The UCAP for an existing aggregated capacity asset will be based on the combined historical performance of the individual component resources during the 250 tightest supply cushion hours during the previous five years.</li> <li>• The UCAP for an aggregated capacity asset that is combining two or more new assets will be based on the individual assets combined asset class-average production during the 250 tightest supply cushion hours during the previous five years.</li> </ul>
<b>External assets</b>	<p><i>Determination of capacity limit of each Alberta intertie</i></p> <p>During a capacity auction, the capacity procured from external capacity assets will not exceed the capacity limits of the BC intertie, MATL intertie, the combined BC/MATL path, and the Saskatchewan intertie.</p> <p>The capacity limits are determined as follows:</p> <ul style="list-style-type: none"> <li>(a) The hourly capacity limits of the BC intertie will be determined using the minimum of the hourly BC to Alberta import ATC and the total firm transmission service on the BC intertie for each of the 250 tightest supply cushion hours per year for the past five years. The capacity limit of the BC intertie will then be calculated by averaging the hourly capacity limits for the BC intertie.</li> <li>(b) The hourly capacity limits of the MATL intertie will be determined using the minimum of the hourly MATL to Alberta import ATC and the total firm transmission service on the MATL intertie for each of the 250 tightest supply cushion hours per year for the past five years. The capacity limit of the MATL intertie will then be calculated by averaging the hourly capacity limits for the MATL intertie.</li> <li>(c) The hourly capacity limits of the combined BC/MATL interties will be determined using the minimum of combined firm transmission for the BC and MATL interties, and the combined BC/MATL ATC prior to LSSi arming for each of the 250 tightest supply cushion hours per year for the past five years. The capacity limit of the BC/MATL interties will then</li> </ul>

Asset Type	Asset-specific UCAP Methodology
	<p>be calculated by averaging the hourly capacity limits for the BC/MATL intertie.</p> <p>(d) The hourly capacity limits of the Saskatchewan intertie will be determined using the minimum of firm transmission service on the Saskatchewan intertie, and the Saskatchewan to Alberta import ATC for each of the 250 tightest supply cushion hours per year for the past five years. The capacity limit of the Saskatchewan intertie will then be calculated by averaging the hourly capacity limits for the Saskatchewan intertie.</p> <p><i>External asset UCAP determination</i></p> <ul style="list-style-type: none"> <li>• The following methodologies apply for determining the UCAP of external capacity assets. <ul style="list-style-type: none"> <li><i>New external assets</i> <ul style="list-style-type: none"> <li>o New external assets must declare the external capacity volume it is willing to sell, and demonstrate that the external asset has firm transmission in the amount of the volume declared. The declared capacity volume must be from a non-recallable source equal or greater in size than the volume declared. The AESO will derate the declared volume to reflect the frequency of time during historical supply cushion hours that the respective intertie was out of service with 0 available transfer capability, to determine the UCAP volume of the external asset.</li> </ul> </li> <li><i>Existing external assets</i> <ul style="list-style-type: none"> <li>o For existing external assets, an availability or capacity factor approach will be used to determine UCAP, in the same manner as an internal capacity asset.</li> <li>o Until Alberta capacity market performance data is available,, the UCAP for all external resources will be determined based on the UCAP methodology for new external assets.</li> </ul> </li> </ul> </li> </ul>
<p><b>Mothballed or temporary delisted assets</b></p>	<ul style="list-style-type: none"> <li>• The UCAP for capacity assets that have been mothballed pursuant to Section 306.7 of the ISO rules, <i>Mothball Outage Reporting</i> or temporarily delisted in accordance with the process outlined in subsection 2.3 of Section 2, <i>Supply Participation</i> will be determined using the following methodology: <ul style="list-style-type: none"> <li>(a) The AESO will require at least 250 hours of observed asset performance during tight supply cushion hours to calculate the UCAP for all assets, apart from variable assets (wind, solar, run of river hydro), for which 300 hours are required. <ul style="list-style-type: none"> <li>i. If the delisted capacity asset has the minimum hourly amount of observed asset performance data available, the AESO will average the asset's availability or capability during each hour to determine the UCAP for the asset.</li> <li>ii. If the delisted capacity asset has data available for less than the minimum hourly amount of observed asset performance data available, the AESO will use the asset's actual availability or capability over the observed tight supply cushion hours to determine the UCAP for the asset.</li> </ul> </li> </ul> </li> </ul>



Asset Type	Asset-specific UCAP Methodology
	<p>The hours that the asset's performance could not be observed will be supplemented with a class average for similarly-designed assets during each of the unobserved hours such that a total of 250 data points is obtained. A simple average of the asset-specific and class average availability or capability will be used to determine the UCAP of the asset.</p>
<p><b>Long Lead Time Assets, Type 2</b></p>	<ul style="list-style-type: none"> <li>• The AESO will calculate UCAP for a long-lead time asset type 2<sup>3</sup>, based on the asset's availability during the 1250 tightest supply cushion hours. An availability factor methodology will be utilized, as applicable to the capacity asset.</li> <li>• Hours where availability was reduced due to a long lead time configuration for economic purposes will be excluded from the sample set used to create the final asset capacity value.</li> <li>• To confirm that availability was reduced due to a long lead time claim for economic purposes, the AESO will review the following:               <ul style="list-style-type: none"> <li>(a) The participant comment in ETS indicating that the unit was offline for a long lead time configuration.</li> <li>(b) The cost assessment for the asset in comparison to pool price during that period.</li> </ul> </li> <li>• The number of hours to establish a statistically significant UCAP for thermal assets will be equal or greater than 250 hours.</li> <li>• If a long lead time asset has less than the 250 tight supply cushion hours the asset's availability will be supplemented with a class average for similarly designed assets.</li> </ul> <p>In order to avoid underestimating the reliability of long lead time type 2 assets, the availability factor calculation will only include hours that were not impacted by the long lead time configuration.</p>

## 3.2 UCAP refinement process

- 3.2.1 In advance of a capacity auction, the AESO will publish on its website the tightest supply cushion hours it will use to calculate UCAP and provide a preliminary UCAP and UCAP range to each capacity market participant.
- 3.2.2 The capacity market participant may review the preliminary UCAP and UCAP range provided by the AESO and submit a refinement request, along with supporting evidence, to the AESO for the following exemptions:
- (a) the metering or Energy Trading System data during the tight supply cushions hours that the AESO evaluated does not accurately reflect the available capability of the capacity asset due to:
    - i. events such as market suspension, limited markets operations, war, invasion, armed conflict, blockade, act of public enemy, riot, revolution, insurrection, act of

<sup>3</sup> As defined in the AESO CADG definition of "long lead time asset" and clarified in Information Document #2012-007 (R), *Long Lead Time Energy*.



terrorism, sabotage, act of vandalism, fire, lightning, explosion, earthquake and flood; or

- ii. reductions to available capability due to Alberta bulk electric system constraint;
- (b) the capacity asset has or will undergo physical changes before the start of the obligation period that will increase or decrease the operational capability of the capacity asset compared to how it performed historically. The minimum change in operational capability of the capacity asset must be at least 1 MW; or
- (c) the class average data, production or load estimates and/or jurisdictional assessment used in calculating the UCAP for an asset that does not meet the minimum threshold as per section 3.1.11, does not create a comparable representation of the capacity asset's future performance.

Any request must be supported with sufficient evidence to support the refinement request.

- 3.2.3 The AESO will review UCAP refinement requests and, if the AESO is satisfied with the evidence provided by the capacity market participant, provide a revised UCAP and UCAP range to the capacity market participant. If a capacity market participant does not agree with the AESO's determination or revised UCAP, the capacity market participant may file a dispute through the dispute resolution process as described in subsection 5.3 of Section 5, *Base Auction*.