Eligibility Discussion

Design Work group

May 2, 2018

Agenda

- Assessment of UCAP approach AF/CF
- Period of UCAP determination: 100 – 1000 hours
- Intertie UCAP determination
- Self Supply
- Demand Response

UCAP Determination Principles

UCAP determination

- UCAP Principles
  - A reliability measure based on the observed behaviour of an asset during tight supply conditions
- Benefits of the approach
  - Captures the correlation of asset performance to the causes of tight supply conditions
    - Seasonal load, availability and derates
    - Planned and forced outages
  - A simple approach that can be easily replicated by market participants
  - Calculation approach is aligned with the performance assessment sending the right signals to asset owners to maintain and increase the UCAP rating of their assets

UCAP determination
Additional considerations

- UCAP range
  - The AESO will calculate a single UCAP value for all assets and allow the asset owner to declare the final UCAP for that asset within a range
  - The range is being determined and will likely narrow as capacity market data becomes available
  - This approach is intended to recognize
    - Incentives in the energy only market were different than those in the capacity market
    - Asset owners may have different expectations for their asset performance than the historical data the AESO uses to completed the UCAP calculation

UCAP Assessment hours
Ketan Lakhani

Effect of changing hours on performance factor

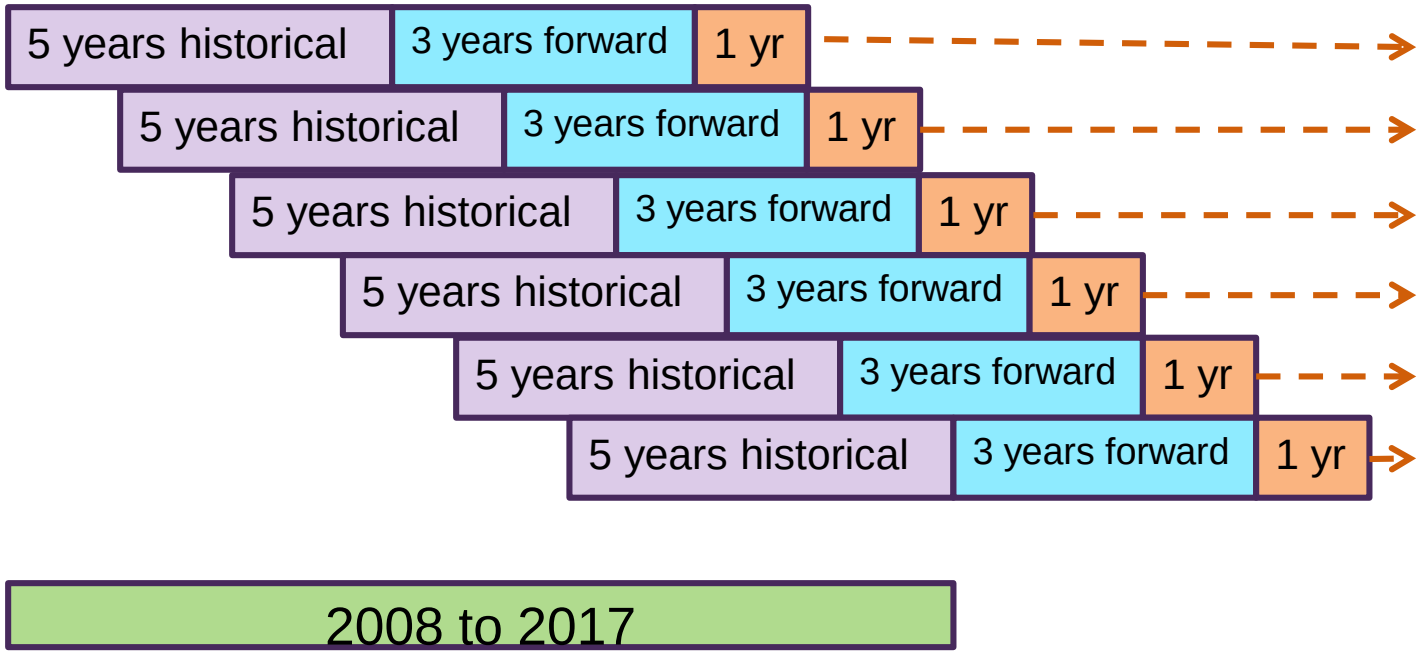
Hypothesis: Increasing the number of hours reduces the risk of Performance Factor swings year over year at the asset level

Evaluation criteria.

- Consistency: Would the change privilege one technology above others? **Yes**
- Stability: Would the change decrease variation in UCAP across delivery periods? **Depends on technology, no significant decreases observed**

The AESO does not see a compelling reason to change the number of tightest hours from 100.

Measuring Inter-Year Change



PF (%)	Inter-year change (%)
2	
5	+3
3	-2
4	+1
6	+2
4	-2

2008 to 2017

Performance factor was calculated for each asset for 6 years giving 5 years of differences

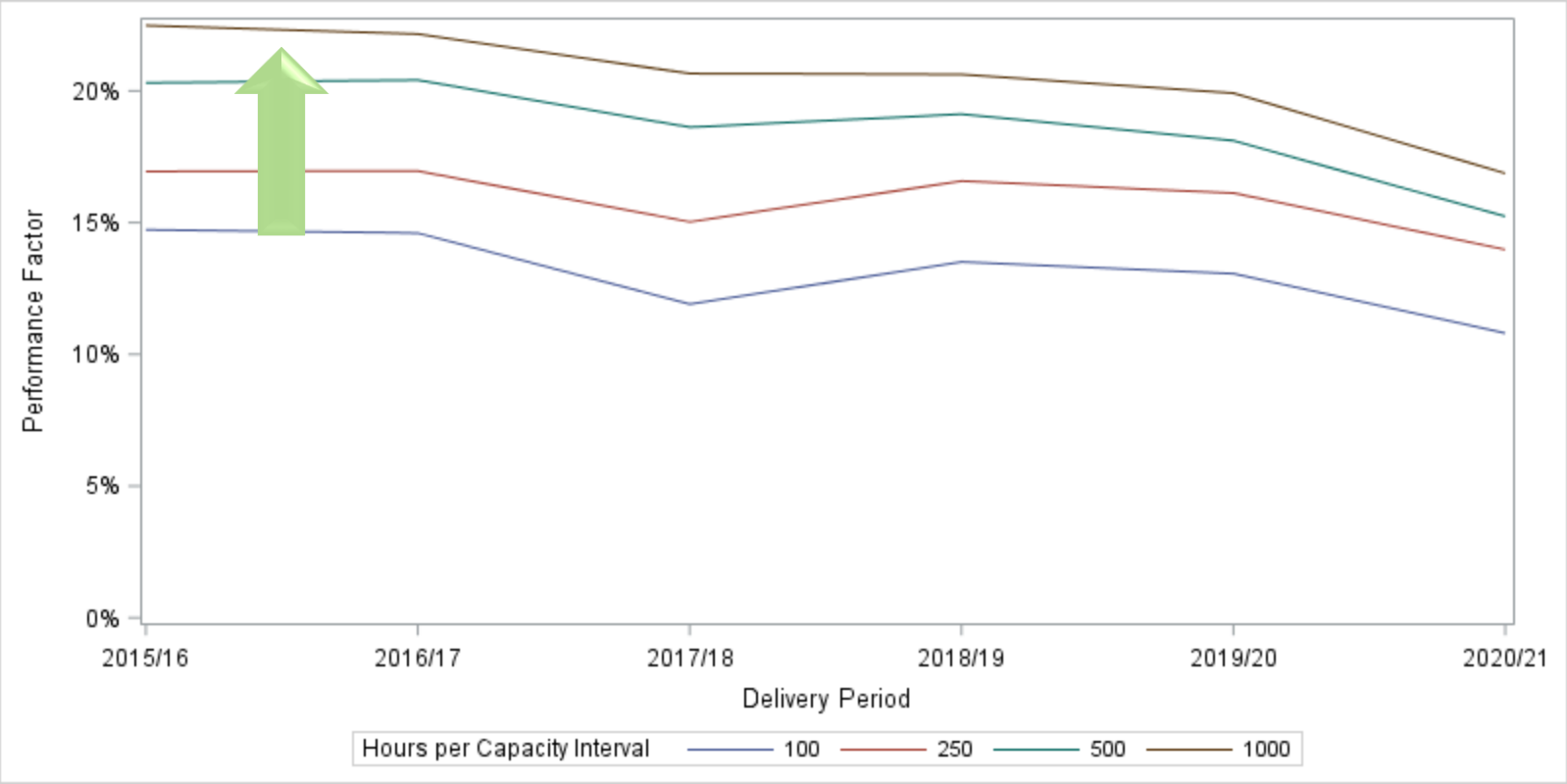
Consistency

- Evaluate consistency by varying the number of hours in each capacity year and examining the effect on the performance factor calculated for each delivery period
  - If increasing the number of hours exerted a consistent effect across generation technologies, we would expect to see a similar pattern of changes across capacity resources

- Evaluate four scenarios:
  1. 100 hours per capacity interval
  2. 250 hours per capacity interval
  3. 500 hours per capacity interval
  4. 1000 hours per capacity interval

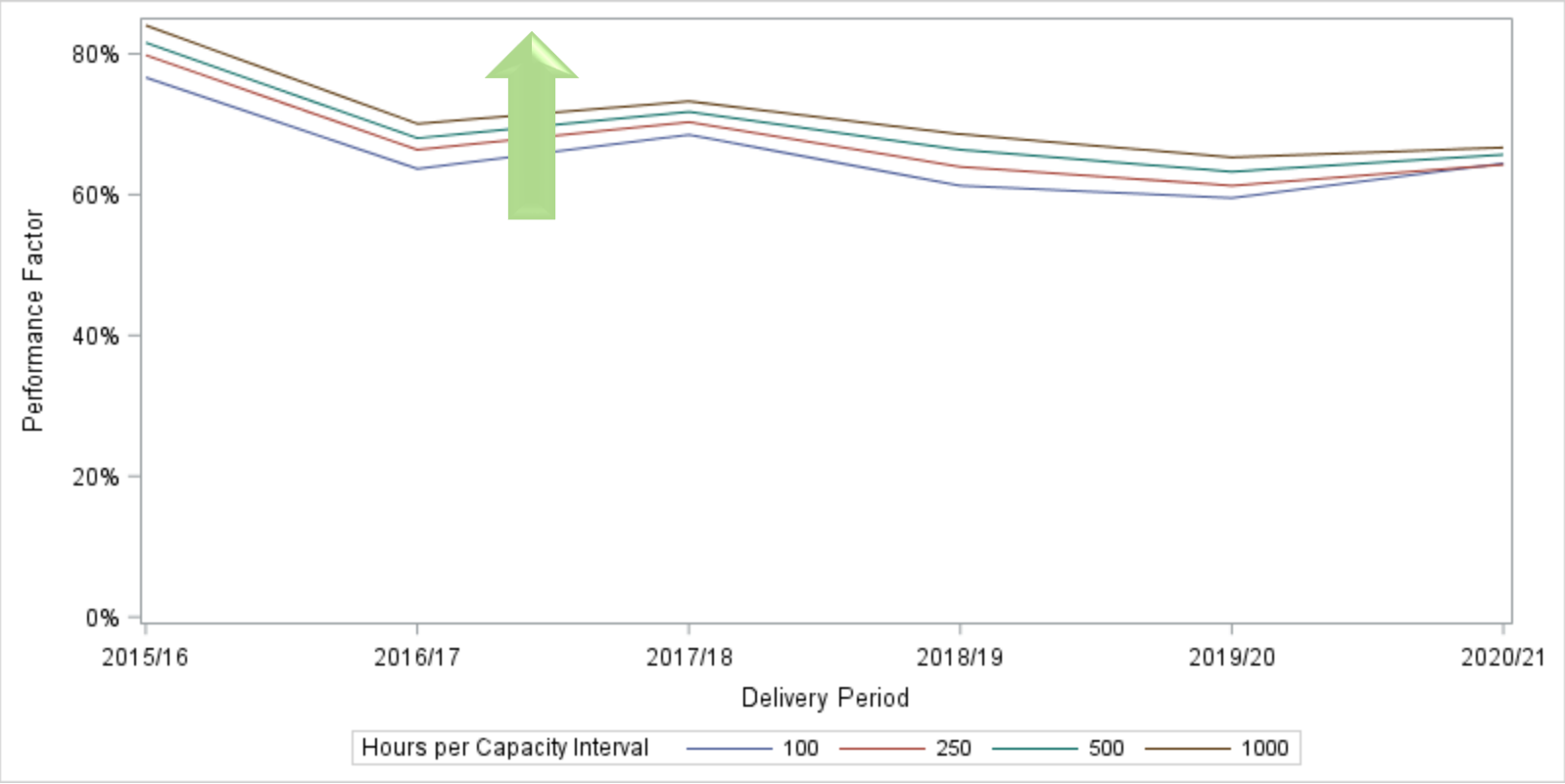
Consistency - Wind

- Increasing number of hours consistently increases performance factor for wind.



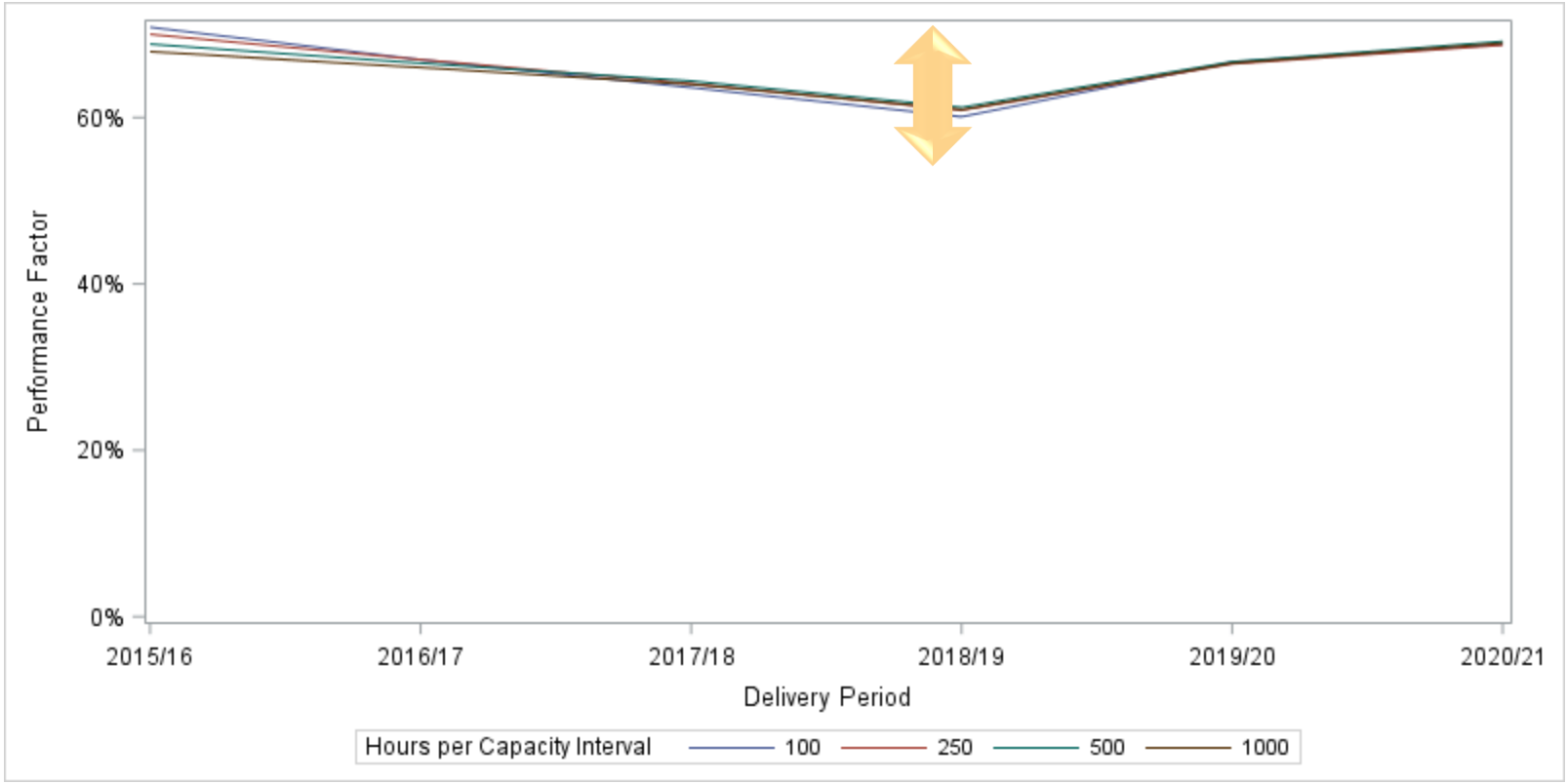
Consistency - Coal

- Increasing number of hours generally increases performance factor for coal



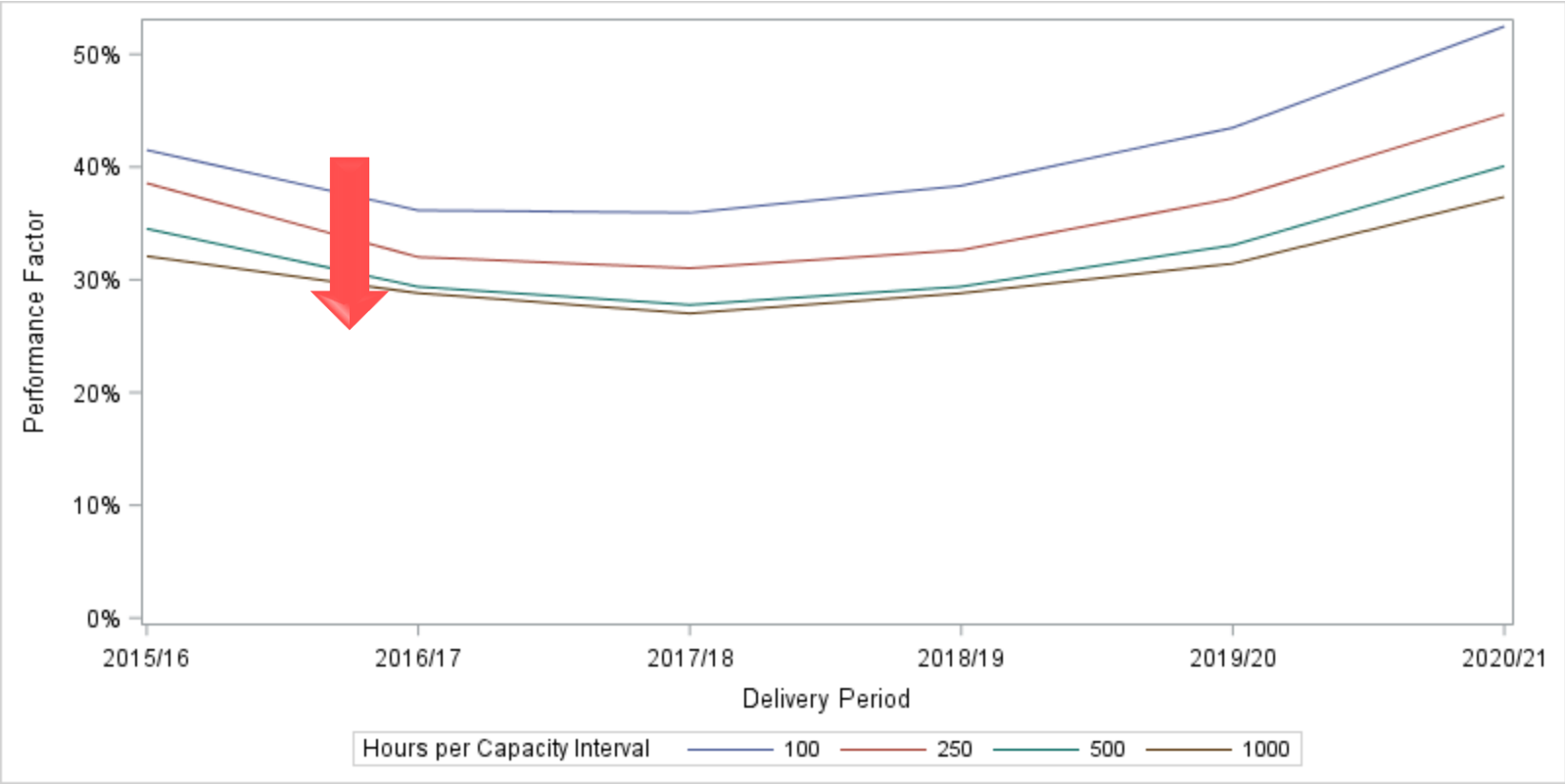
Consistency – large hydro

- Increasing number of hours has no consistent effect on performance factors for large hydro



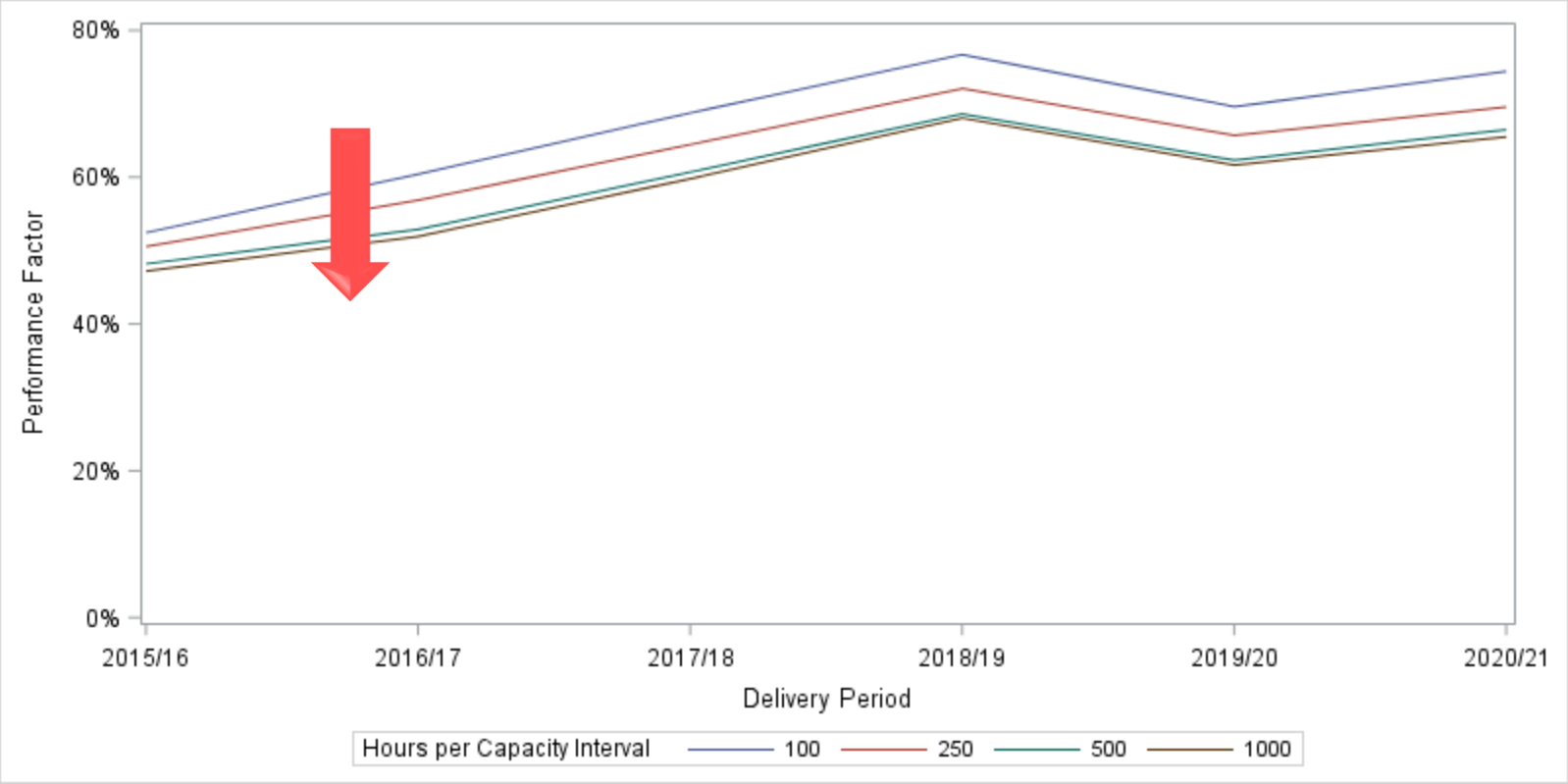
Consistency

- Increasing number of hours consistently reduced performance factors for small hydro



Consistency

- Increasing number of hours generally reduces performance factor for combined-cycle gas generation



Effect of changing hours on performance factor

Hypothesis: Increasing the number of hours reduces the risk of Performance Factor swings year over year at the asset level

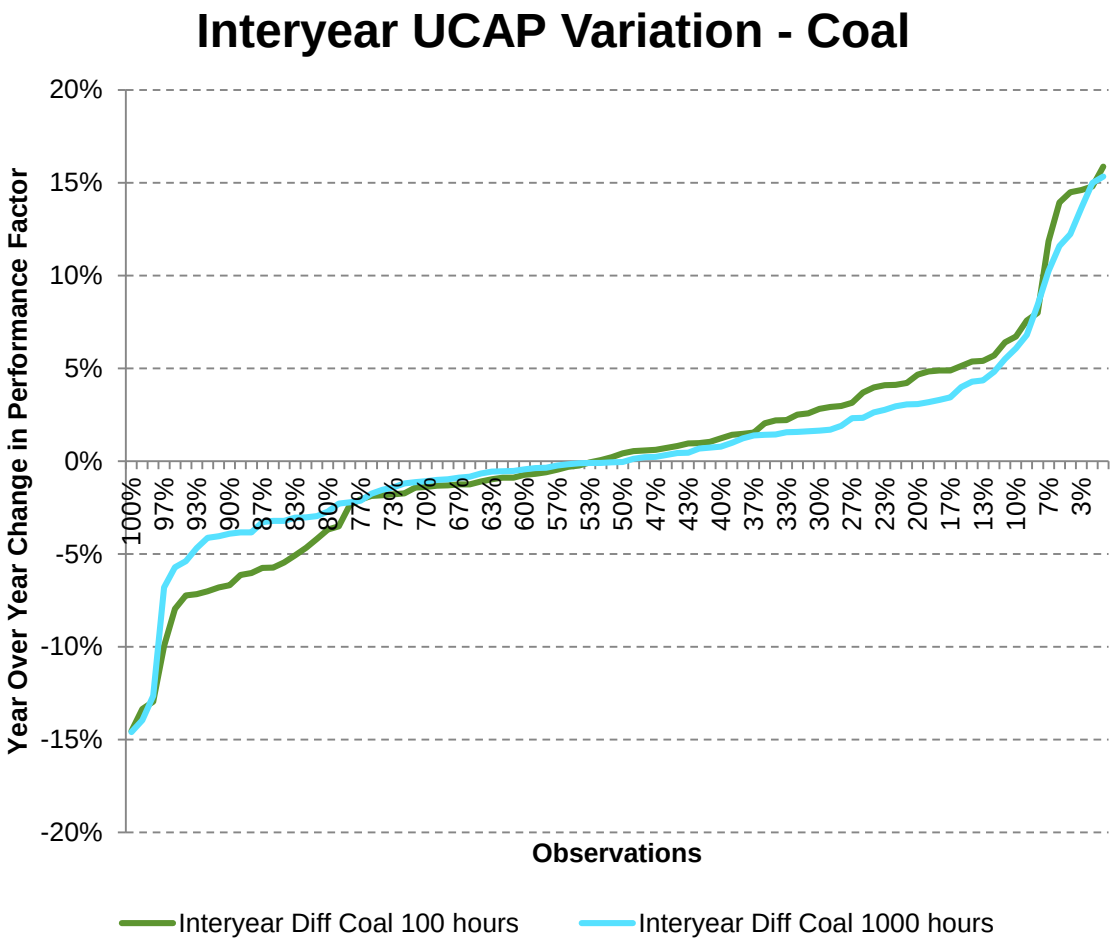
Evaluation criteria.

- Consistency: Would the change privilege one technology above others? **Yes**
- Stability: Would the change decrease variation in UCAP across delivery periods? **…next part of discussion…**

Stability

- Evaluate Stability by varying the number of hours in each capacity interval and examining the effect on the magnitude (i.e. the absolute value) of the changes in performance factor between each delivery period
  - If increasing the number of hours increased the reliability, *we would expect to see the magnitude of the inter-year change decrease as the number of hours increased*
- Evaluate four scenarios:
  1. 100 hours per capacity interval
  2. 250 hours per capacity interval
  3. 500 hours per capacity interval
  4. 1000 hours per capacity interval

Year over Year variation with increasing hours



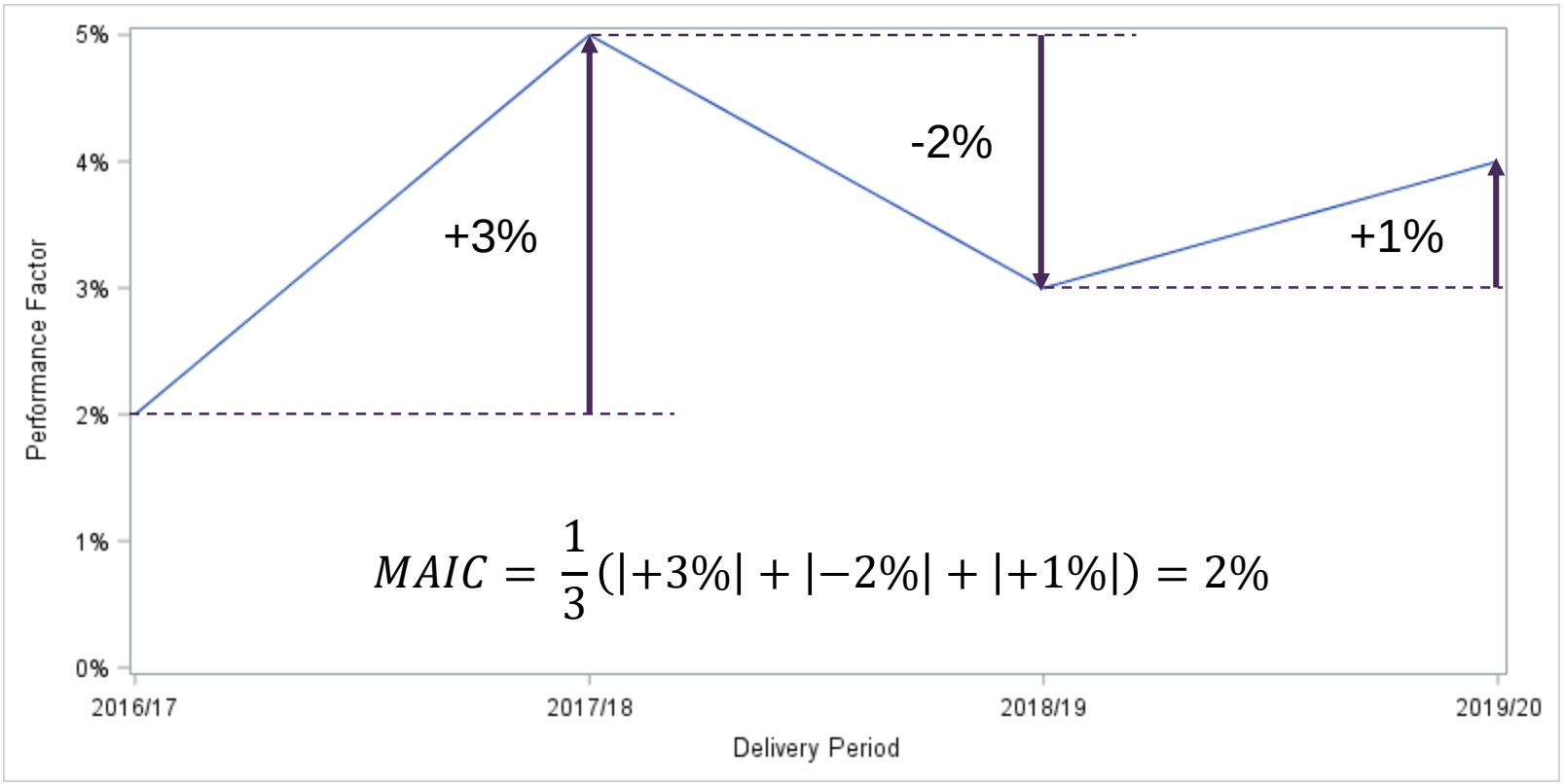
Interyear UCAP can vary 15% for coal.

Generally for coal, variations on the extremities are due to long term outages

Using more hours smooths out the mean, but variations remain.

Stability - Formula

- Mean Absolute Inter-Year Change (MAIC)
  - Example calculation:



- Calculated over six years of performance factor estimates

Interyear performance factor variation using individual asset data

Technology	Interyear PF difference range 100 hours	Interyear PF difference PF Range 1000 hours
Coal	-15% to +15%	-15% to +15%
Cogen	-13% to 13%	-15% to 13%
Combined Cycle	-7% to +8%	-6% to +8%
Simple Cycle	-15% to 17%	-15% to 15%
Hydro	-9% to 13%	-5% to 8%
Wind	-7% to 13%	-7% to 20%
Other	-20% to 14%	-20% to 12%

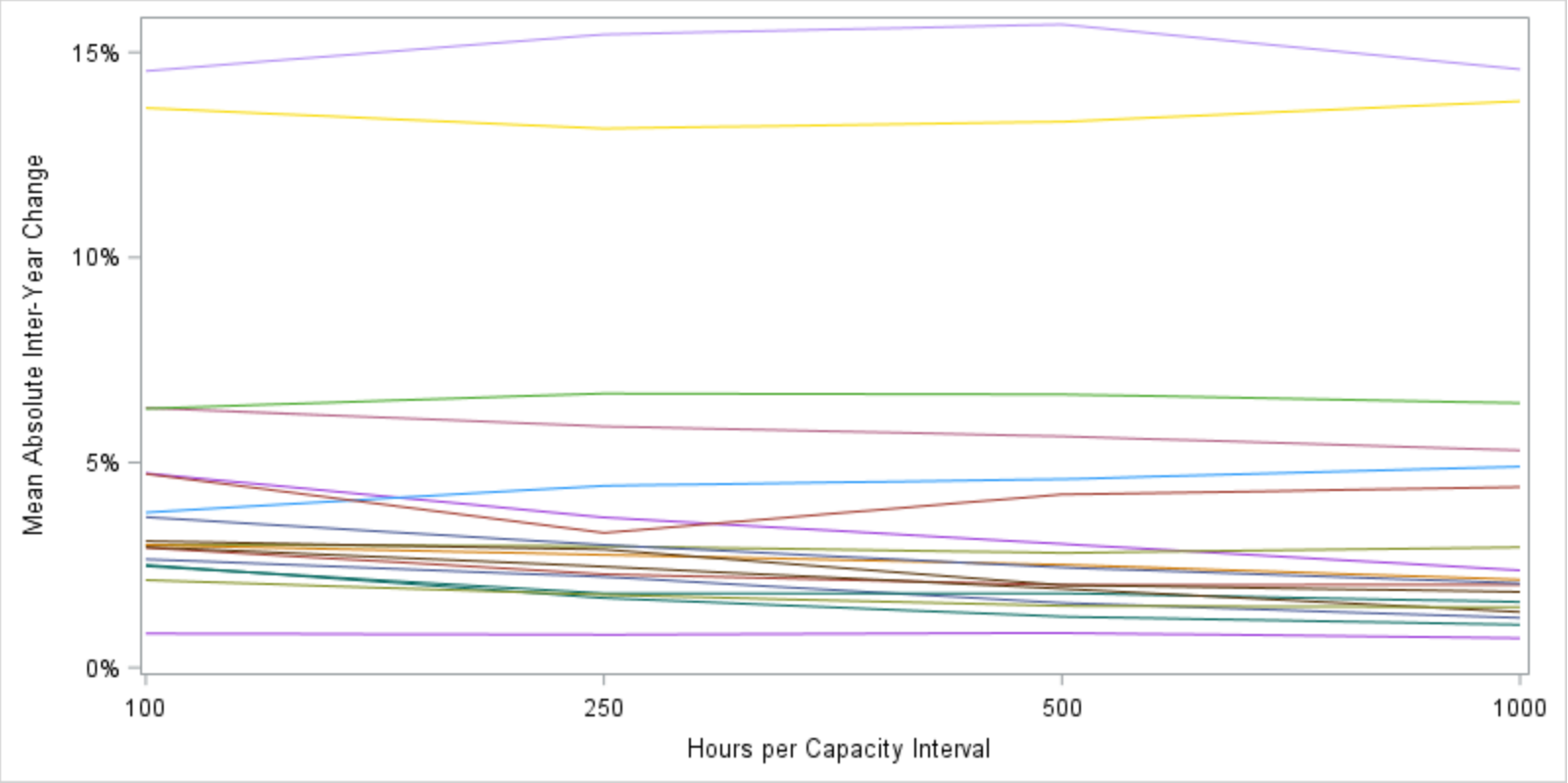
Technology	PF MAIC 100 hours	PF MAIC 1000 hours
Coal	2.2%	2.2%
Cogen	1.2%	0.9%
Combined Cycle	3.3%	3.3%
Simple Cycle	3.5%	3.2%
Hydro	1.3%	0.9%
Wind	1.1%	0.7%
Other	1.8%	1.6%

Generally for all technologies, variations on the extremities are due to; Retirements, Commissioning, long term outages, smaller plants (<30MW) that have relatively smaller MW changes but reflect larger percentage changes, and changes in metering configuration.
10 years of data includes extreme outliers and operational changes and is not representative. A more representative measure is MAIC

Using more hours smooths out the mean slightly, but variations remain similar. No compelling reasons to increase hours.

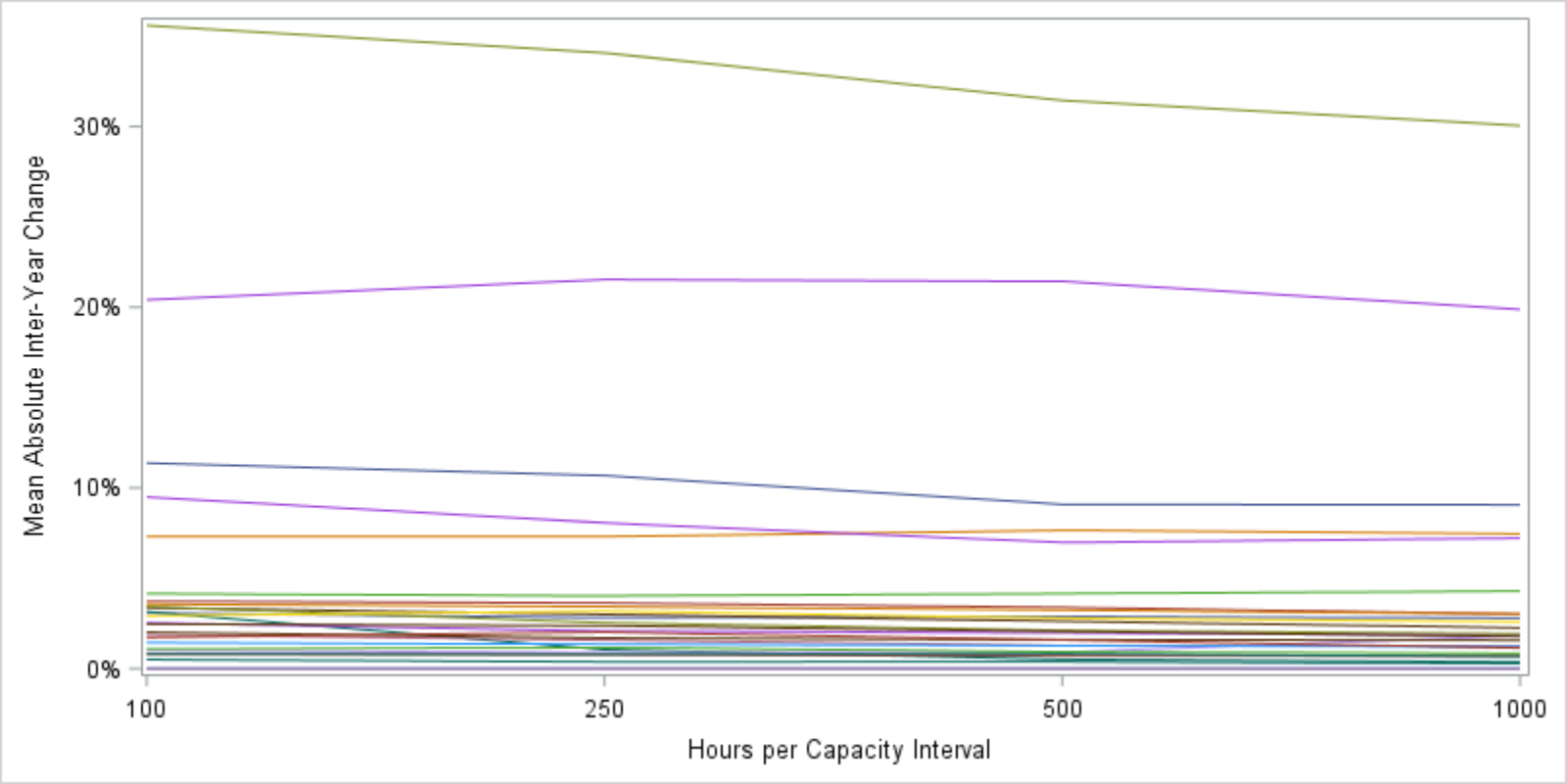
Stability
Individual Coal MAIC

- Proposed change has inconsistent/slightly increased stability effect on baseload generation technologies



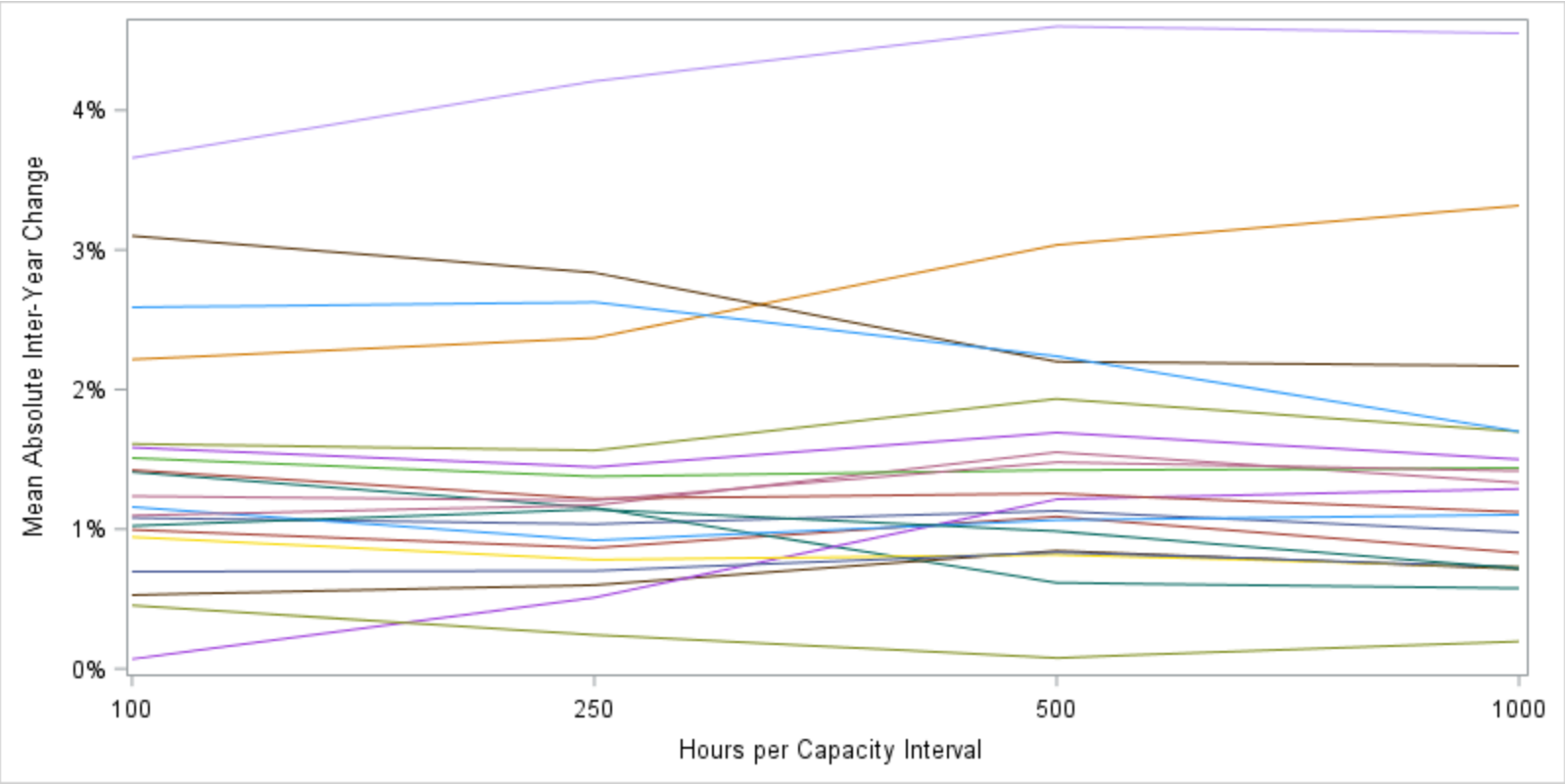
Stability
Individual Simple Cycle Gas MAIC

- Proposed change has inconsistent/no effect on peaking generation technologies



Stability
Individual Wind MAIC

- Proposed change has inconsistent effect/decreasing stability on intermittent generation technologies



UCAP determination
Interties and external resources

UCAP determination
Interties and external resources

- UCAP for external resources will follow a two step process:
  - Determination of the capacity limit of the intertie
  - Determination of the UCAP of the asset providing the capacity
- For BC and MATL interties the capacity limit will be determined by *the minimum of* (the average over the last 5 years, 100 tightest supply cushion hours)
    - Hourly BC/ MATL to Alberta ATC (an AESO value) and
    - Total firm transmission capability (a BCTC/ MATL value)
    - To recognize the combined limit on the BC/ MATL interties the capacity limit will be determined by Hourly Montana and BC ATC (an AESO value) *prior to* LSSi arming
- For the Saskatchewan intertie capacity limit will be determined by the minimum of (the average over the last 5 years, 100 tightest supply cushion hours)
    - Hourly Sask to Alberta ATC (an AESO value) and
    - Total firm transmission capability (a Sask value)

UCAP determination
Indicative intertie capacity limit

	Firm Transmission	Mean values over 5 year period (Nov 2012-Nov 2017)		
	Long term contracts/ sales	ATC	ATC - LSSi	Historical flows
BC/ MATL	780	471	437	253
BC	480	436		214
MATL	300	187		46
SPC	153	125		41

ATC = ATC - LSSi volumes in any hour

- AESO evaluated the following approaches for the interties during tight supply cushion hours
  - Firm transmission
  - ATC
  - ATC less LSSi
  - Historical flows
- Using this data, the AESO's recommended approach would establish the following capacity limit for interties
  - BC/MATL: combined 437MWs
  - BC/ Sask: 125MW
- Historical flows during tight hours were evaluated and not selected
  - this low level of capacity would under represent the reliability value the interties could provide

UCAP determination
External resources

- Qualification of external assets:
  - Firm transmission required to the AB border for the volume of the capacity asset sale
  - The external asset must demonstrate the delivery will be not recallable during a firm load shed event in the external BA
  - Once the asset has offer history into the AESO, the UCAP of an external asset will be determined in the same manner as an internal capacity asset - using an availability or capacity factor approach
  - The AESO is developing an approach to establish the UCAP of an external system

UCAP determination
Self supply

UCAP determination
Self supply

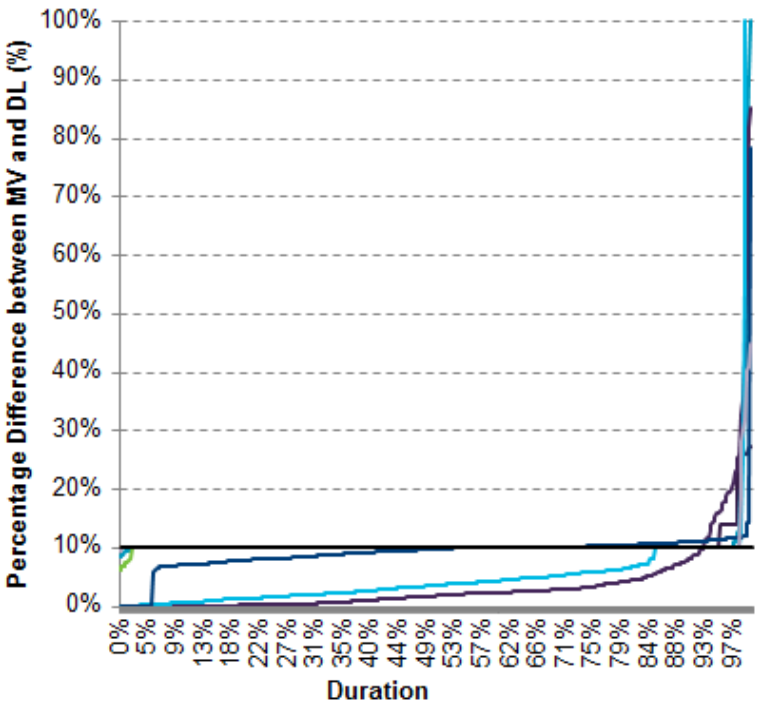
- There are two methods for determining UCAP for self supply locations with net supply to the AESO
- The approaches are determined based on the reliability of dispatched generation reaching the grid

- Availability factor
  - Metered volumes generally match energy market dispatches
  - Usually dispatched on a net basis – at the meter
- Capacity factor
  - Metered volumes do not generally match energy market dispatches
  - Usually dispatched on a gross basis – at the generator

Self supply
Approaches used to classify sites

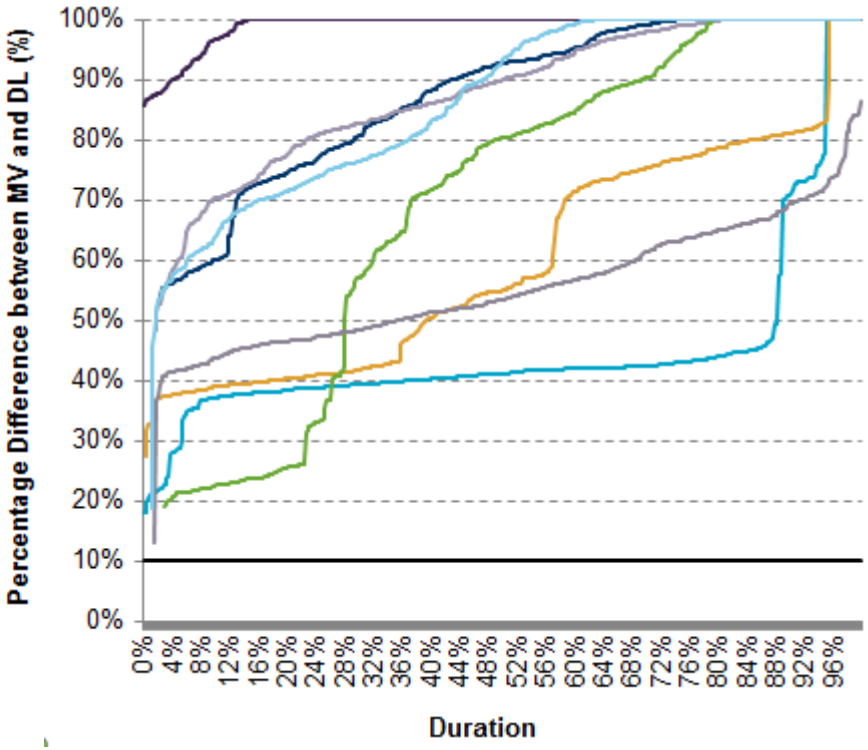
- Dispatch versus metered volumes
  - The AESO has completed analysis to review how well asset dispatches compare to net metered volumes
  - Analysis shows that there is a clear distinction between assets that flow the majority of the dispatched energy to the market compared to those that, when dispatched, serve both their own load and the load of the AESO
  - The following slides demonstrate the different asset categories

Self supply
The performance of availability factor sites



- The chart shows
  - Xaxis: the percent of time an asset follows the energy market dispatch
  - Yaxis: the difference between metered volume and dispatch level
  - Plot lines: sites that for the vast majority of time have dispatch variance less than 10%
- Why is this important
  - These sites reliability deliver their dispatched MWs to the grid
  - It's the confidence in the delivery of dispatched volumes that allows an availability factor approach to be used for these sites

Self supply
The performance of capacity factor sites



- This chart demonstrates the dispatch variance of sites that would have UCAP determined using the capacity factor approach
- The data shows that for the vast majority of time these sites have dispatch variances of 30% or greater relative to dispatched volumes
  - The MWs dispatched at these sites are used for a combination of on site load and delivery to the AESO
  - The lack of certainty that MWs dispatched don't reflect MWs delivered to the grid results in an capacity factor approach for these assets

Demand response
Approach and UCAP determination

Demand response
Approach and UCAP determination

- Two demand response capacity types will eligible for participation
  - Guaranteed Load Reduction – provide a defined reduction in load when required
  - Firm Consumption Level – commit to consuming to a maximum level when required

- The next slides will discuss the UCAP and performance measures for these assets

Demand response
GLR: UCAP, qualification

- UCAP determination
  - GLR assets will declare their load reduction during qualification
  - UCAP determination
    - For new assets the derating factor will be based on the average derating factor for all availability factor assets
    - For existing assets the derating factor will be based on the observed declared available capability of the asset in ETS / the declared load reduction
- Qualification
  - New demand response assets will be required to demonstrate load reduction through a physical test prior to the final rebalancing auction.

Demand Response
GLR: performance measurement

- Availability: measure AC
  - Availability will be based on the declared AC values in ETS during the tight supply cushion hours relative to the capacity commitment of the asset
- Performance: requires the creation of a recent period consumption baseline for each performance hour
  - Ten day average baseline: the previous 10 day average of the asset demand in the same hour in similar load days
    - Same hour: previous HE 10s will be used for an HE 10 performance hour
    - Similar day: on peak days will be used for on peak days, off peak days for off peak days
  - Performance will require a reduction in load from the ten day baseline equal to the capacity commitment of the asset. Load not reduced due to Operating Reserve or armed for LSSi will be used to reduce metered volumes

Demand Response
GLR performance baseline example

Date/Day			1-2 p.m	2-3 p.m	3-4 p.m	4-5 p.m	5-6 p.m	6-7 p.m	7-8 p.m
11-Apr	Wednesday	Day 1	21	21.75	22.5	21.75	21	18.75	18
12-Apr	Thursday	Day 2	23.25	24	23.25	23.25	22.5	19.5	19.5
13-Apr	Friday	Day 3	12	11.25	12	11.7	12	21.75	21
14-Apr	Saturday	Weekend	23.55	23.85	24.3	23.85	23.25	22.5	21.75
15-Apr	Sunday	Weekend	23.25	25.2	24.6	23.25	21	19.5	18
16-Apr	Monday	Event Day	15	15.75	15	16.05	15.9	15.6	15
17-Apr	Tuesday	Day 4	15.75	16.2	15.6	15.9	15.75	15	15.15
18-Apr	Wednesday	Event Day	21.75	22.5	21.75	21.75	21	20.25	19.5
19-Apr	Thursday	Day 5	12	11.4	11.7	11.25	11.7	22.5	21.45
20-Apr	Friday	Day 6	25.2	23.85	25.2	24	23.7	23.25	21.75
21-Apr	Saturday	Weekend	24.6	24.3	24.6	23.85	23.25	20.7	20.25
22-Apr	Sunday	Weekend	24	23.85	23.25	23.25	21	20.25	18.75
23-Apr	Monday	Day 7	15.75	15	16.05	15.9	15.9	16.05	15.9
24-Apr	Tuesday	Day 8	15.6	15.9	15.75	15	15.15	15.75	15
25-Apr	Wednesday	Day 9	23.25	25.2	24.6	23.25	21	19.5	18
26-Apr	Thursday	Day 10	23.25	23.55	23.25	23.25	22.5	22.2	21.45
Resource Baseline			**18.705**	**18.81**	**18.99**	**18.525**	**18.12**	**19.425**	**18.72**

- How the ten day average baseline is calculated
  - The baseline is the average of the last ten day's load in the same hours, excluding performance event days
  - The orange rows represent previous performance days and are omitted form the calculation
- Performance is measured as the reduction from the baseline, the reduction must be equal to or greater than the capacity obligation

Demand response
FCL: UCAP, qualification

- UCAP determination
  - FCL declare a maximum load level the asset will consumer during performance periods
  - UCAP determination
    - For new assets the derating factor will be based on the average derating factor for all availability factor assets
    - For existing assets the derating factor will be based on the observed delta between the load baseline established over the 100 most recent tight supply cushion hours and the firm consumption level relative to the qualifying baseline
- Qualification
  - New demand response assets will be required to demonstrate load reduction through a physical test prior to the final rebalancing auction.

Demand Response
FCL: performance measurement

- Availability: requires the creation of a baseline
  - Look back baseline will establish a capacity contribution of the asset using recent load patterns
  - The baseline also ensures the ongoing capacity contribution of the load: that is if the load qualified with a baseline of 20MWs the availability assessment will incent the firm to maintain a peak load level of 20MWs during the obligation period
  - The look back baseline will be established using the average of the 5 highest loads observed over the last ten days
  - The look back baseline less the firm consumption level should be equal to the capacity commitment of the asset
- Performance: based on actual consumption of the asset
  - Actual consumption of the asset should be equal to the firm consumption level. Load not reduced due to Operating Reserve or armed for LSSi will be used to reduce metered volumes

Questions