Hourly Demand Response: Baseline Methodology Review & Contributor Outage Management Issue

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Purpose

- Summarize stakeholder feedback on the September 23 Resource Adequacy engagement materials and IESO responses to that feedback

- Provide an update on the HDR contributor-outage management issue

- Present results of the Commercial & Industrial (C&I) Hourly Demand Response (HDR) contributor-level baseline analysis

- Discuss next steps

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Response to stakeholder feedback

Feedback Theme: Contributor-level baselines

Stakeholder Feedback

IESO should transition to applying the baseline method at the individual contributor-level to assess HDR performance.

Concern about application of a single baseline method to aggregations composed of both thermally-light (weather sensitive), thermally-heavy (non-weather sensitive), and batch loads. To this end, being able to assign baselines on a contributor-by-contributor basis should provide a more accurate view of HDR performance.

Feedback Theme: Contributor-level baselines (cont'd)

IESO Response

IESO leveraged contributor meter data provided by stakeholders to expand the baseline review to include comparing contributor- and resource-level applications of baseline.

Results of this analysis are presented in the third section of these materials.

The analysis includes an assessment of whether allowing optional application of the In-Day Adjustment Factor (IDAF) on a contributor-by-contributor basis increases baseline accuracy.

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Feedback Theme: Contributor-level qualification

Stakeholder Feedback

In addition to applying the baseline method at the HDR individual contributor-level, the IESO should also qualify HDR resource capacity for the Capacity Auction at the contributor-level.

Feedback Theme: Contributor-level qualification (cont'd)

IESO Response

The qualified capacity framework for all resource types is done at the resource level which aligns with how the HDR resource bids, is activated, and is settled by the market.

Demand Response stakeholders have previously communicated that requiring identification of HDR resource contributors prior to running the auction (and being unable to change them) would create business challenges and limit the scalability/flexibility benefits that HDR participation in the Capacity Auction offers.

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Feedback Theme: Shoulder season accuracy

Stakeholder Feedback

Suggestion that transitioning to a High 5-of-10 baseline may provide a more accurate assessment of HDR performance in shoulder seasons due to the shorter 10-day lookback window associated with this baseline method compared to the current High 15-of-20 baseline.

Feedback Theme: Shoulder season accuracy (cont'd)

IESO Response

IESO conducted additional analysis to assess the accuracy of the current High 15-of-20 with IDAF baseline compared to the High 5-of-10 with and without IDAF baselines during shoulder season months (May, June, October, November).

During these months, the current baseline with IDAF had a median accuracy score of 3.9%, while the High 5-of-10 with IDAF had a median accuracy score of 4.0% and the High 5-of-10 without IDAF had a median accuracy score of 6.1%.

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Feedback Theme: Use of non-standby days

Stakeholder Feedback

Caution against using only non-activation days to assess baseline accuracy, as actual behaviour during activation day could lead to dramatic impacts on the baseline and a reduction in baseline accuracy.

Baseline review analysis should focus on days when resources were activated and/or received standby notices as on non-standby days, loads do not have an incentive to maintain a high load.

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Feedback Theme: Use of non-standby days (cont'd)

IESO Response

The use of non-activation days is required to have a benchmark (actual load) against which to assess the accuracy of each baseline method at predicting load in the absence of an activation.

This review methodology was presented to stakeholders at April and June engagement sessions.

The limited number of standby days greatly limits the quantity of historic data available for analysis – precluding drawing rigorous conclusions.

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Feedback Theme: Contributor-level outages

Stakeholder Feedback

Each contributor should be able to schedule outages, with the resource reducing its offer into market accordingly, without risking an outsized impact to the entire resource's baseline.

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Feedback Theme: Contributor-level outages (cont'd)

IESO Response

An update on the contributor outage management issue is provided in the next section of this presentation.

Market participants are expected to update their energy market bids to reflect available capacity, and reduce available capacity in the event of a contributor on outage.

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Managing HDR resource contributor outages

Contributor forced outage: Potential impacts to baseline

- The HDR baseline review confirms that the status quo baseline is a generally accurate method for measuring HDR performance

- However; under very specific circumstances, an activation-day contributor outage may impact the baseline in a manner that results in an over- or under-measurement of assessed performance

Contributor forced outage: Contributor-level baseline

- Stakeholders have advocated to transitioning to the contributor-level application of the baseline as a means to address potential contributor outage impacts on performance assessment

- IESO's analysis indicates that this change would not resolve the issue and potentially exacerbate issues of over-measuring resource performance where the resource is on outage before an activation

  - Application of the IDAF at the contributor-level caps the magnitude of baseline adjustment relative to application at the resource-level

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Illustrative Example: Contributor-level baseline

- Application of the baseline at the contributor-level limits the extent to which the In-Day Adjustment can adjust the High 15-of-20 baseline to reflect the resource's reduced load on the activation day due to a contributor outage
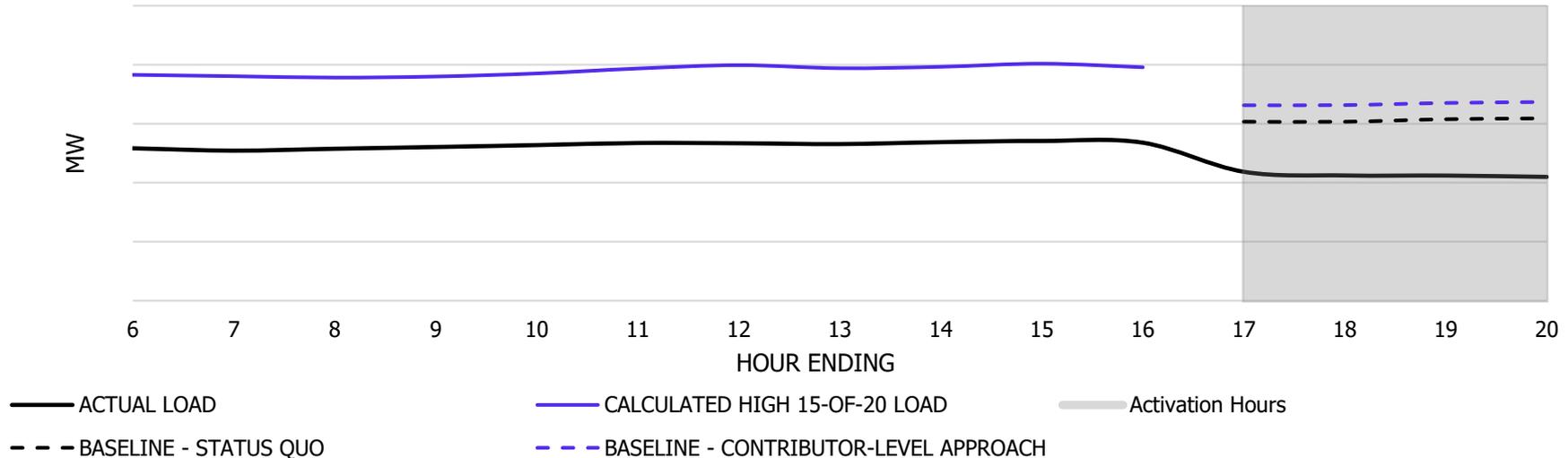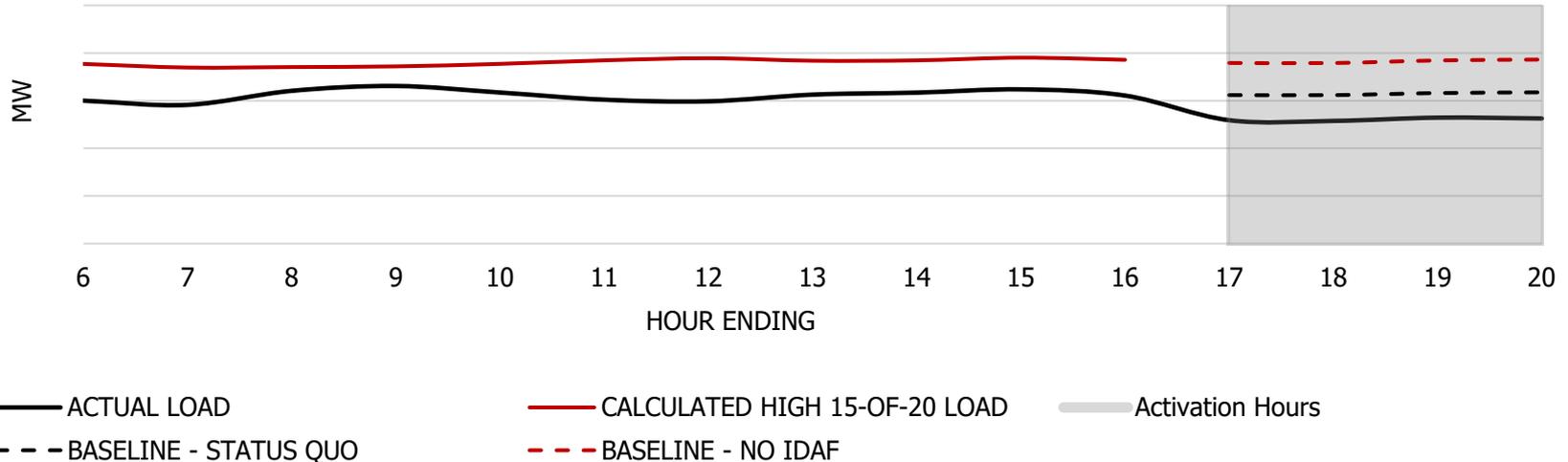
Contributor forced outage: IDAF removal

- Stakeholders have also advocated for removing the IDAF for the entire resource as a means to address potential contributor outage impacts on performance assessment

- Removing the IDAF for the entire resource to address a contributor outage would result in a failure to capture day-of activation behaviour of the remaining contributors to the resource in the baseline calculation, which would in turn lower overall baseline accuracy, as demonstrated on the next slide

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Illustrative Example: Contributor-level baseline

- If the IDAF is removed from the resource's baseline to account for potential impacts from the contributor on outage, the result would be an over-measurement of curtailed quantity compared to what the resource curtailed

ACTUAL LOAD   CALCULATED HIGH 15-OF-20 LOAD   Activation Hours

- - - BASELINE - STATUS QUO   - - - BASELINE - NO IDAF

Contributor forced outage: Proposed solution

- IESO is assessing a solution that would address impacts of the forced outage on performance assessment and settlement of the resource by removing meter data for contributors on outage entirely from the baseline calculation

- This is a complex solution which would require changes to IESO tools, process, and market rules/manuals

- IESO is identifying process/tool impacts to establish next steps and will engage stakeholders further in the new year at the earliest opportunity

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Contributor forced outage: Proposed solution

- Market Participants have raised particular concerns about contributor outages impacting capacity test assessed performance, impacting capacity qualification in the subsequent Capacity Auction

- Performance Adjustment Factors (PAFs) will be derived based on capacity test performance results under the new testing framework, where resources have the flexibility to self-schedule their capacity test within a 5-day testing window to avoid outages

- The new testing framework and the application of PAFs will begin for obligation periods going forward from the December 2022 Auction

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Analysis of contributor-level application of baseline

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Analysis overview

- The objective of the HDR baseline methodology review initiative is to assess performance of the current High 15-of-20 with IDAF relative to a set of alternatives

- The following analysis builds on the preliminary findings of the C&I HDR baseline methodology review, presented in September 2021, by including contributor-level approaches to assessing HDR performance[1]

- The methodology used to assess baseline performance was presented at the June 2021 stakeholder engagement days[2]

[1] Materials available https://www.ieso.ca/-/media/Files/IESO/Document-Library/engage/rae/ra-20210923-hdr-baseline-review.ashx
[2] Materials available https://www.ieso.ca/-/media/Files/IESO/Document-Library/engage/rae/ra-20210623-presentation.ashx

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Recap of preliminary findings

1. The current baseline methodology is a more accurate predictor of load than the majority of the 25 alternative baseline methods assessed; only the adjusted High 5-of-10 and variations of the adjusted High 15-of-20 improved accuracy and only marginally (0.3% at most)

2. Under no scenario did the unadjusted baseline methods increase accuracy compared to the adjusted methods

3. Relative baseline performance was consistent when the fleet was segmented by load size, weather, and variability meaning there is not a strong justification for introducing multiple baseline options

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Summary of contributor-level findings

1. For about half of the resources assessed, the status quo[1] approach was more accurate than the contributor-level application of the current High 15-of-20 baseline method with IDAF

2. For the overwhelming majority of resources assessed, the status quo approach was a more accurate predictor of load than contributor-level application of the current baseline with no IDAF

3. For about half of the resources assessed, the status quo approach was a more accurate predictor of load than applying the IDAF on a contributor-by-contributor basis

[1] Throughout the presentation, "status quo" refers to the resource-level application of the current High 15-of-20 baseline with IDAF

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Analysis approach

- Stakeholders provided a minimum of one-year of historic contributor load data for 13 HDR resources (2 to 11 contributors per resource)
- The data was used to compare the relative accuracy of:
  1. Status quo approach vs. contributor-level application of the current baseline with IDAF;
  2. Status quo approach vs. contributor-level application of the current baseline without IDAF; and
  3. Status quo approach vs. contributor-by-contributor application of the IDAF (i.e., applying the IDAF at the contributor-level only when it improves the contributor's baseline accuracy)

Analysis approach (cont'd)

- Similar to the preliminary analysis, a representative 4-hour activation window (HE17 to HE20) was used to compare estimated baseline to actual load

- The number of days on which each baseline was estimated differed across resources, depending on the time period for which data was submitted between January 1, 2018 and December 31, 2019, and the resource's energy market bid and activation history

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Performance metric

- The Relative Root Mean Squared Error (RRMSE) was used to evaluate the accuracy of each baseline approach assessed compared to the status quo

- As described previously, **the smaller the RRMSE, the better the baseline method performs** as a predictor of the actual hourly load

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Example: Relative Accuracy of Baseline Approaches

• For each proxy day included in the analysis, the four baseline approaches on the graph below were estimated and compared to the actual load on that day in order to generate the RRMSE accuracy metric
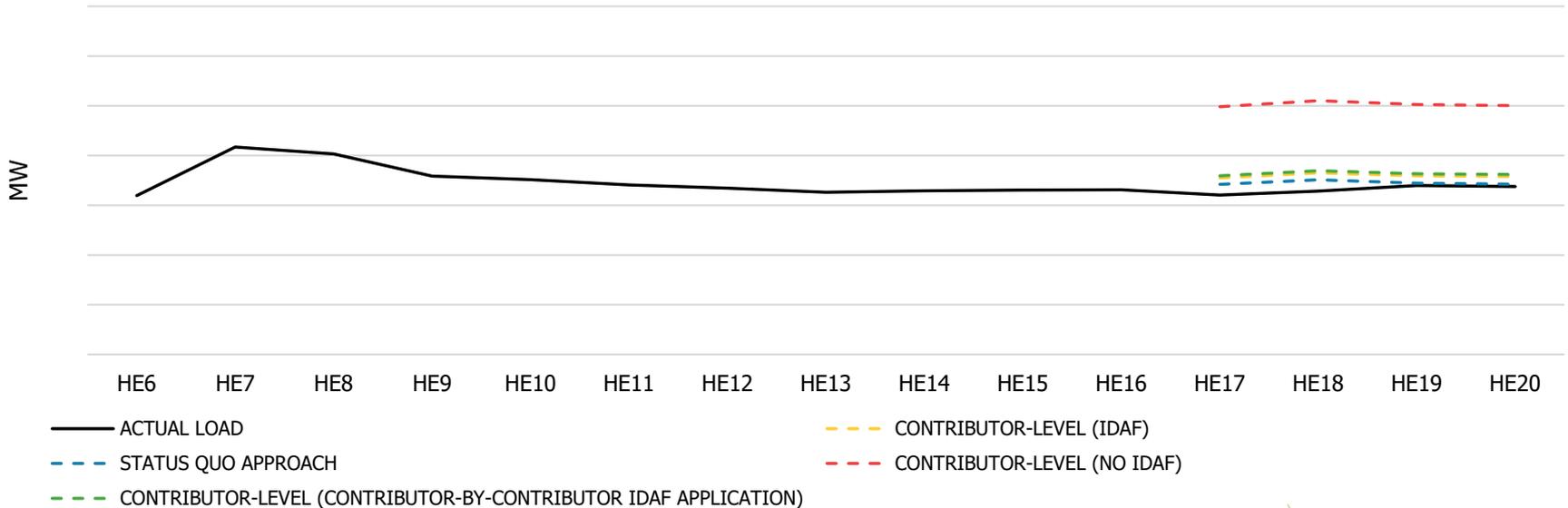
Key finding #1

For nearly half of the resources assessed, the status quo was more accurate than the contributor-level approach

Median RRMSE			
Resource #	Status Quo	Contributor-Level Approach (with IDAF)	Difference*
1	14.13%	14.07%	0.06%
2	15.06%	14.92%	0.14%
3	20.41%	20.63%	-0.23%
4	5.52%	5.27%	0.24%
5	10.35%	10.17%	0.18%
6	2.76%	2.55%	0.21%
7	2.84%	2.83%	0.01%
8	5.22%	6.24%	-1.02%
9	9.22%	9.95%	-0.73%
10	14.30%	14.20%	0.09%
11	9.29%	13.17%	-3.88%
12	4.64%	7.54%	-2.90%
13	7.61%	8.45%	-0.84%

*Highlighted rows indicate accuracy improvement compared to the status quo

- For resources for which the contributor-level approach was a more accurate predicator of load, the accuracy gains associated with moving from the status quo approach to the contributor-level approach were 0.01% to 0.2%

- Contributor-level application decreased baseline accuracy by as much as 3.9%

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Key finding #2

For the overwhelming majority of resources assessed, the status quo approach was a more accurate predictor of load than the current baseline with no IDAF applied at the contributor-level

Median RRMSE			
Resource #	Status Quo	Contributor-Level Approach (no IDAF)	Difference
1	14.1%	15.7%	-1.5%
2	15.1%	14.0%	1.1%
3	20.4%	22.8%	-2.4%
4	5.5%	7.5%	-1.9%
5	10.3%	12.0%	-1.6%
6	2.8%	5.7%	-3.0%
7	2.8%	4.5%	-1.7%
8	5.2%	10.3%	-5.1%
9	9.2%	14.2%	-4.9%
10	14.3%	19.0%	-4.7%
11	9.3%	6.8%	2.5%
12	4.6%	8.3%	-3.6%
13	7.6%	12.1%	-4.5%

*Highlighted rows indicate accuracy improvement compared to the current baseline with IDAF

- Removing the IDAF at the contributor-level decreased accuracy by as much as 5.1%

- There were two resources for which the contributor-level approach with no IDAF was more accurate than the status quo

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Key finding #3

Applying the IDAF on a contributor-by-contributor basis resulted in marginal accuracy gains over the status quo in some cases

Median RRMSE			
Resource #	Status Quo	Contributor-Level Approach (with IDAF)	Difference*
1	14.13%	14.07%	0.06%
2	15.06%	14.00%	1.06%
3	20.41%	21.16%	-0.76%
4	5.52%	5.27%	0.25%
5	10.35%	10.17%	0.18%
6	2.76%	2.55%	0.21%
7	2.84%	2.83%	0.01%
8	5.22%	6.24%	-1.02%
9	9.22%	9.95%	-0.73%
10	14.30%	14.20%	0.09%
11	9.29%	6.90%	2.39%
12	4.64%	7.54%	-2.90%
13	7.61%	8.36%	-0.75%

*Highlighted rows indicate accuracy improvement compared to the status quo

- A contributor-by-contributor application of the IDAF based on whether the in-day adjustment increased accuracy for each individual contributor, increased overall resource baseline accuracy between 0.01% and 2.4% for about half of the resources assessed

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Unadjusted baseline accuracy

- In the instances where the unadjusted baseline increased accuracy >1%, the resource includes highly unpredictable contributor loads, either due to daily volatility (i.e., RRMSE > 40%) or batch processes

- Additional sensitivity analysis indicates that for these resources, the unadjusted baseline does not increase accuracy on all proxy days, and decreases accuracy if the illustrative event window is shifted

- This indicates there is a high probability that the differences in accuracy results are due to random variability, and that a contributor-level application of the IDAF does not conclusively improve accuracy

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Implications of key findings

- The findings indicate there is not a compelling case for a contributor-level application of the baseline given inconsistent effects compared to the status quo) and marginal impacts where there are accuracy gains

- Increases in accuracy under a contributor-by-contributor application of the IDAF are largely dependent on how effectively the individual contributors to a resource can be modelled (i.e., variability)

- Removing the IDAF is contrary to the integrity criteria established in the initial scope of the baseline review as it could credit curtailments in advance of an activation that do not contribute to system-balancing

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HDR baseline review conclusions

- The status quo High 15-of-20 with In-Day Adjustment baseline method applied at the resource-level is an effective, accurate method for assessing C&I HDR resource performance relative to other options

- Under certain circumstances, contributor outages can skew assessed performance and a solution to this issue warrants further investigation

- The contributor outage impact issue is not unique to the status quo baseline and would not be resolved by transitioning to contributor-level baseline application

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HDR baseline review conclusions (cont'd)

- Baseline performance is relatively consistent across seasonal, size, and load variability segmentation meaning there does not appear to be a strong justification for introducing multiple baselines at this time

- The IDAF overwhelming has a positive impact on baseline accuracy and integrity, in both resource- and contributor-level applications

- Allowing an IDAF opt-out at the contributor-level may result in a minor accuracy improvement for some resources, but undermines integrity of the baseline method, and the impact of these accuracy gains is marginal in the context of established HDR performance dead-bands

Next Steps

- IESO will conclude the C&I HDR Baseline Methodology Review and publish an engagement summary

- IESO is evaluating a solution to control for contributor outage impacts on assessed performance and will engage stakeholders in Q1 2022

- The IESO welcomes feedback on the information presented today

Appendix

IDAF Scenarios

- The following slides illustrate the effect of the in-day adjustment factor under various scenarios using historical HDR activation data
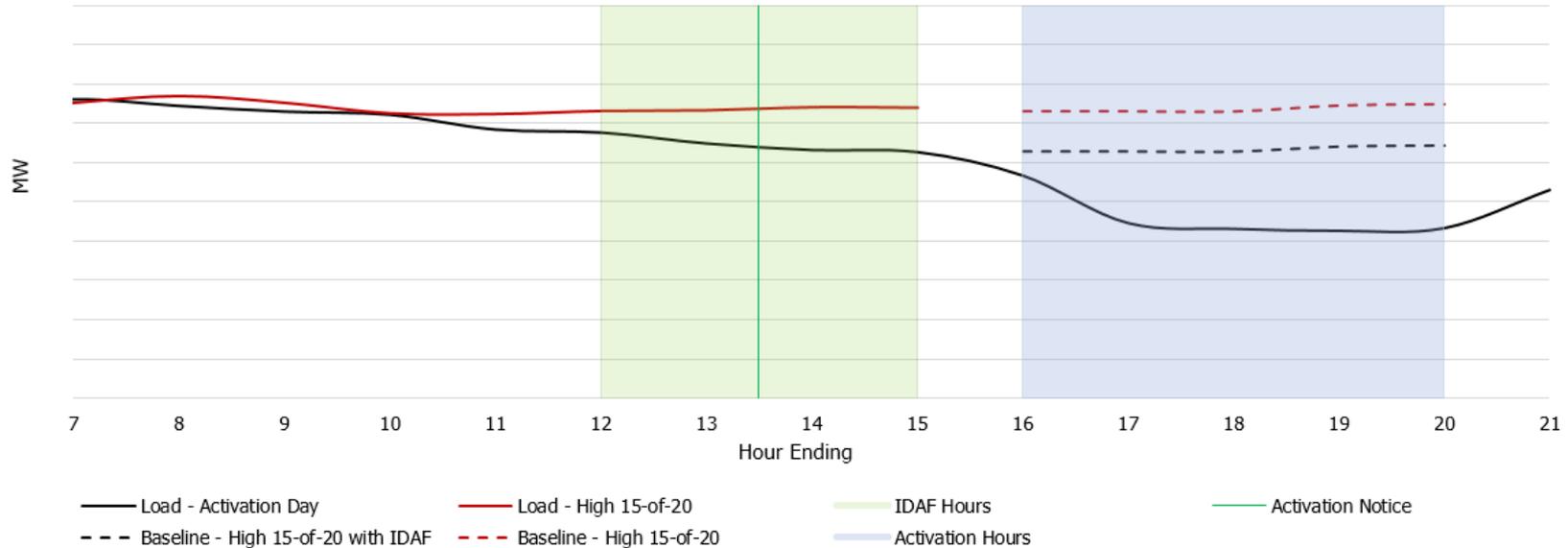
Scenario 1: High activation day load

Load on the activation day is higher than the High 15-of-20 baseline due to increased cooling load, battery charging, or other factors. The IDAF adjusts the High 15-of-20 baseline upward accordingly and better captures the quantity of load curtailed.
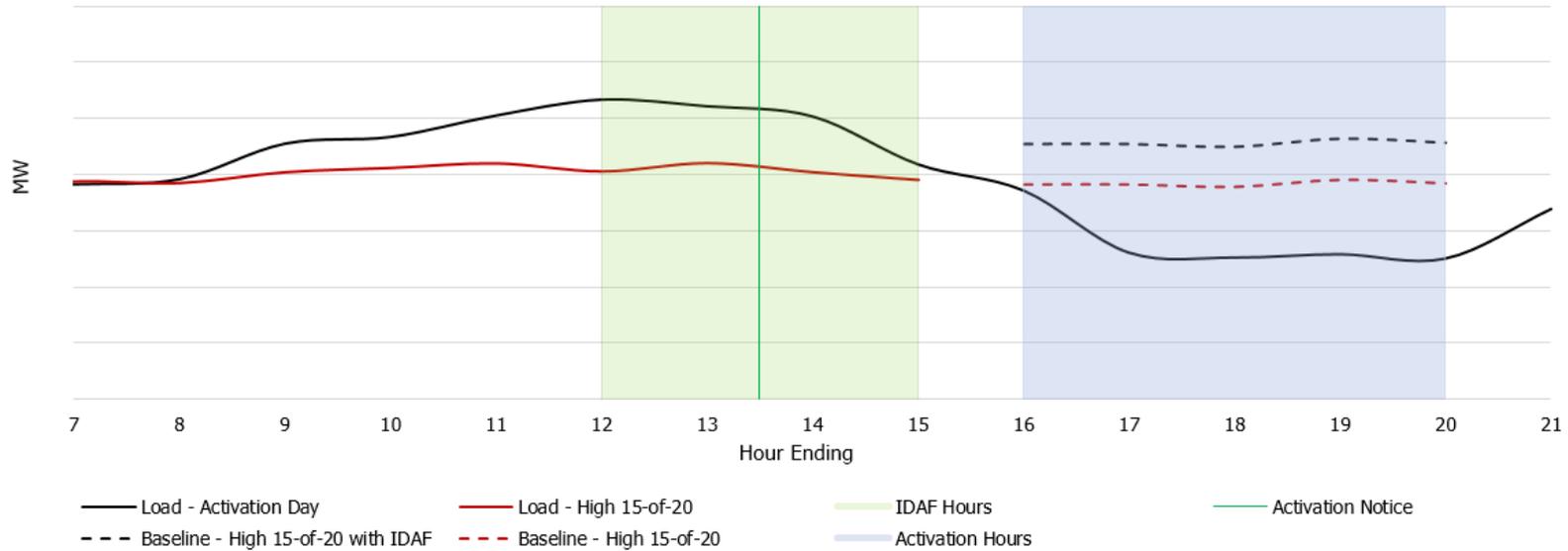
Scenario 2: Low activation day load

Load on the activation day trends low compared to High 15-of-20 load. The IDAF adjusts the High 15-of-20 baseline downward and better captures the quantity of load curtailed.

Legend:
- Load - Activation Day
- Load - High 15-of-20
- IDAF Hours
- Activation Notice
- Baseline - High 15-of-20 with IDAF
- Baseline - High 15-of-20
- Activation Hours

Scenario 3: Contributor outage managed by IDAF

If load is lower on the activation day due to a contributor forced outage, the IDAF adjusts the High 15-of-20 baseline downward in order to better capture the quantity curtailed.
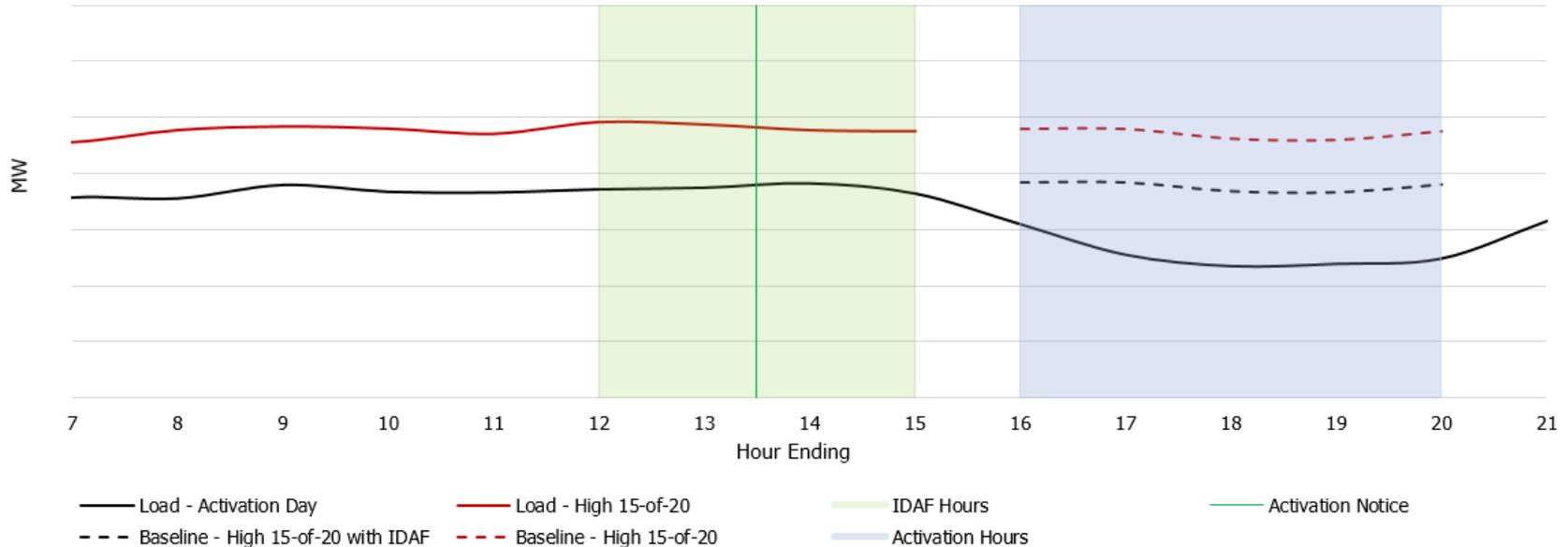
Scenario 4: Contributor outage not managed by IDAF

Depending on a number of factors (e.g. the size of the contributor relative to the size of the load), the IDAF adjustment to the High 15-of-20 baseline may not fully account for impact of the contributor outage on activation day load

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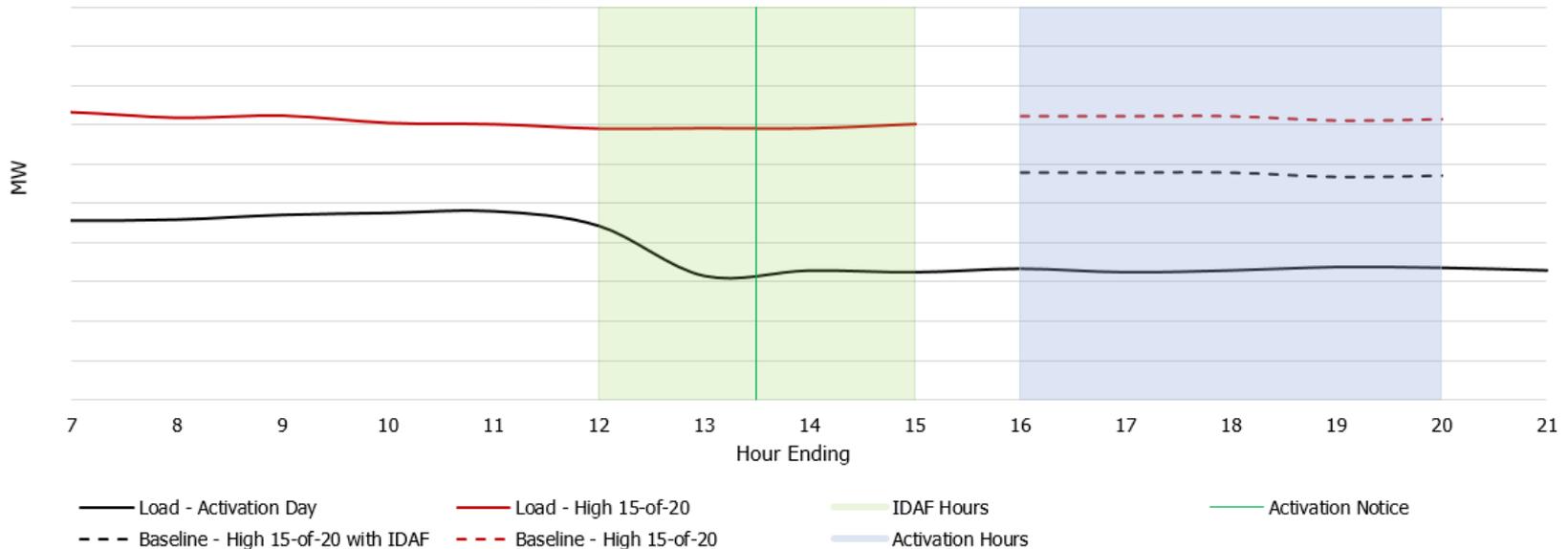
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