Generation Curtailment by Constraints during the 2021 February Winter Event

Congestion Management Working Group

Market Analysis & Validation

6/14/2021

Introduction

- Stakeholders requested an analysis of the amount of capacity curtailed by transmission constraints during the February 14-19 winter event.
- For this analysis, curtailed capacity is defined as the High Dispatch Limit (HDL) minus the SCED Base Point (BP)
- Reminder: curtailment can occur due to uneconomic offers as well as due to transmission constraints
- Part of this material was previously presented on the 5/10/2021 CMWG. This updated presentation includes additional material to address questions raised during the previous CMWG discussion

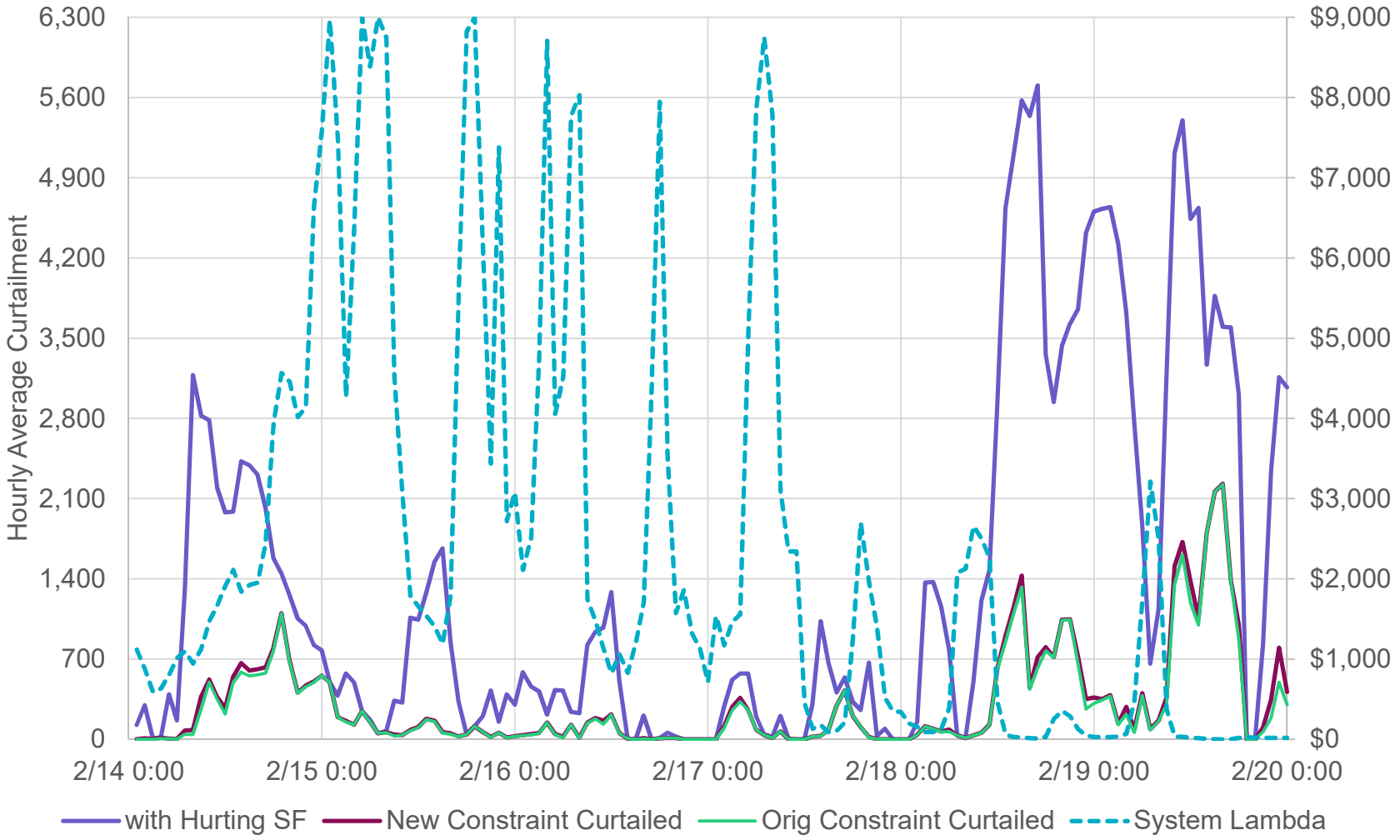
Follow-up Items from Previous CMWG

- New methodology for calculating constraint curtailment (addressing IMM's comments)
- Comparison of the monthly IRR Forecast report curtailment values to SCED curtailment values (addressing Advanced Power Alliance's comments)
- Comparison of constraint curtailment if non-Base Case constraints had the same shadow price cap ($9,251) as Base Case constraints (addressing DC Energy's comments)

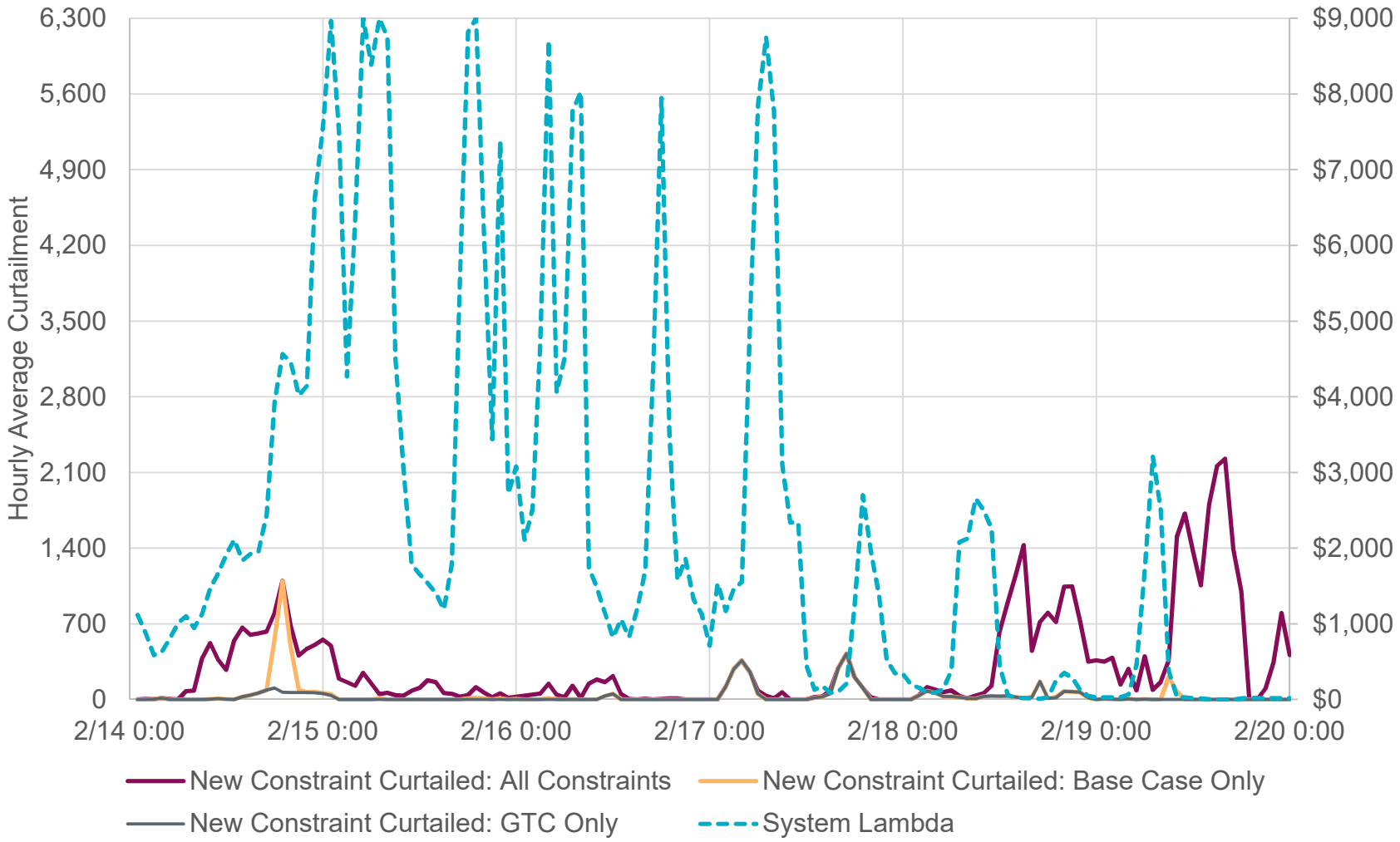
Methodology

- All Generation Resources operating with a dispatchable status were considered
  - Excluded offline or non-dispatchable online statuses were EMR, EMRSWGR, OFF, OFFNS, ONRR, ONTEST, OUT, SHUTDOWN, STARTUP
  - Nuclear resources were excluded
- Curtailed values were calculated using HDL - BP for each SCED timestamp and then averaged to delivery hour using appropriate SCED interval time-weighting
- The "with Hurting SF" category includes Resources that have greater than zero shift factor on a constraint with a non-zero shadow price
- The "**Orig** Constraint Curtailed" is a subset of the "with Hurting SF" category that only includes Resources that have a price point at HDL on their Step 2 SCED energy offer curve (post-mitigation) that is less than or equal to System Lambda
  - Intent is to exclude Resources that were dispatched below their HDL because they were out of the money compared to System Lambda (had uneconomic offers) rather than due to binding constraints
- The "**New** Constraint Curtailed" is a subset of the "with Hurting SF" category that includes capacity between the Base Point and the minimum of HDL and the point on the Step 2 offer curve at which System Lambda intersects
  - This improves upon the original constraint curtailed method by considering capacity offered at a lower price below HDL

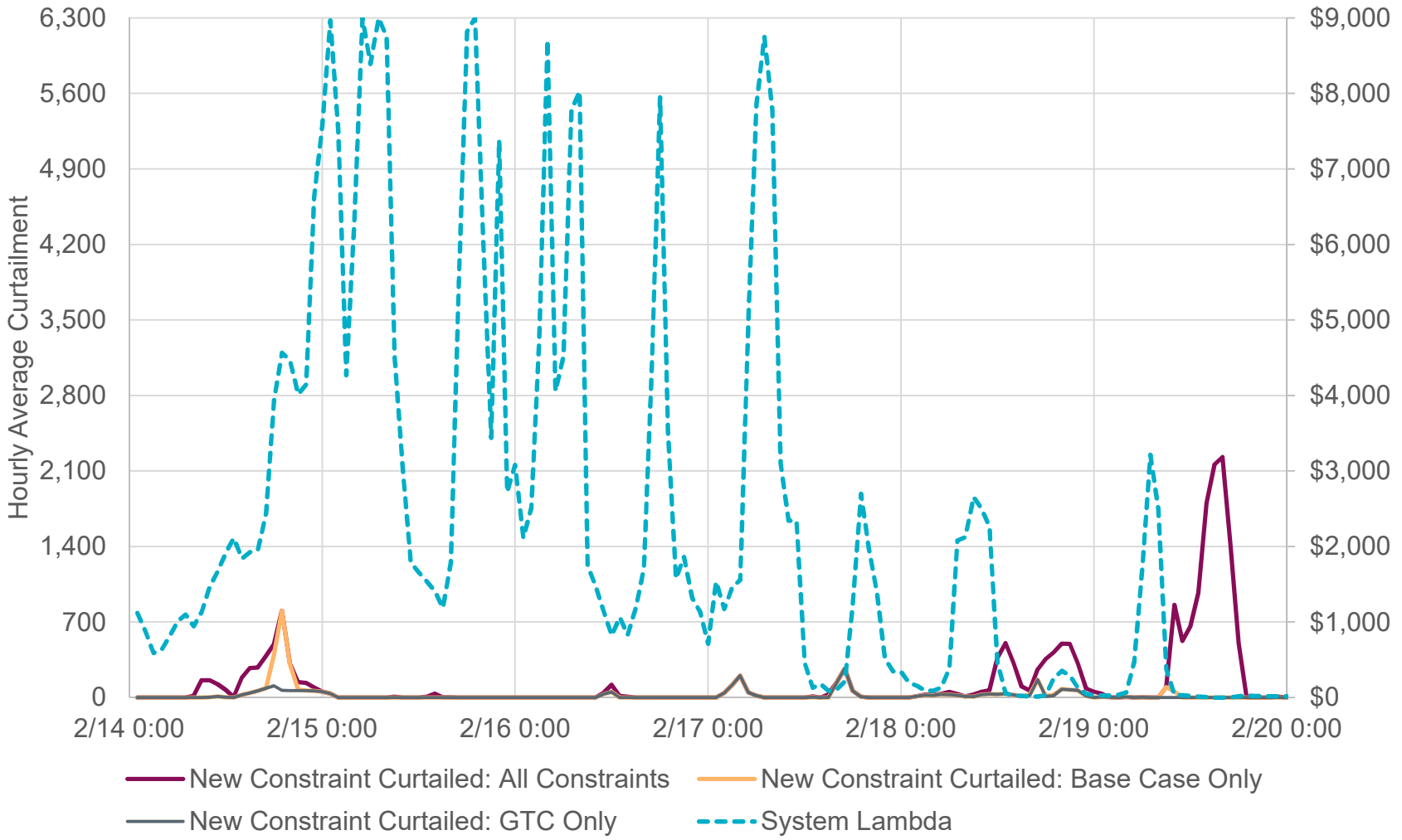
Comparison of System-Wide Constraint Curtailment with New Methodology



System-Wide Constraint Curtailment by Constraint Type



Wind and Solar Constraint Curtailment by Constraint Type



New Methodology Conclusion

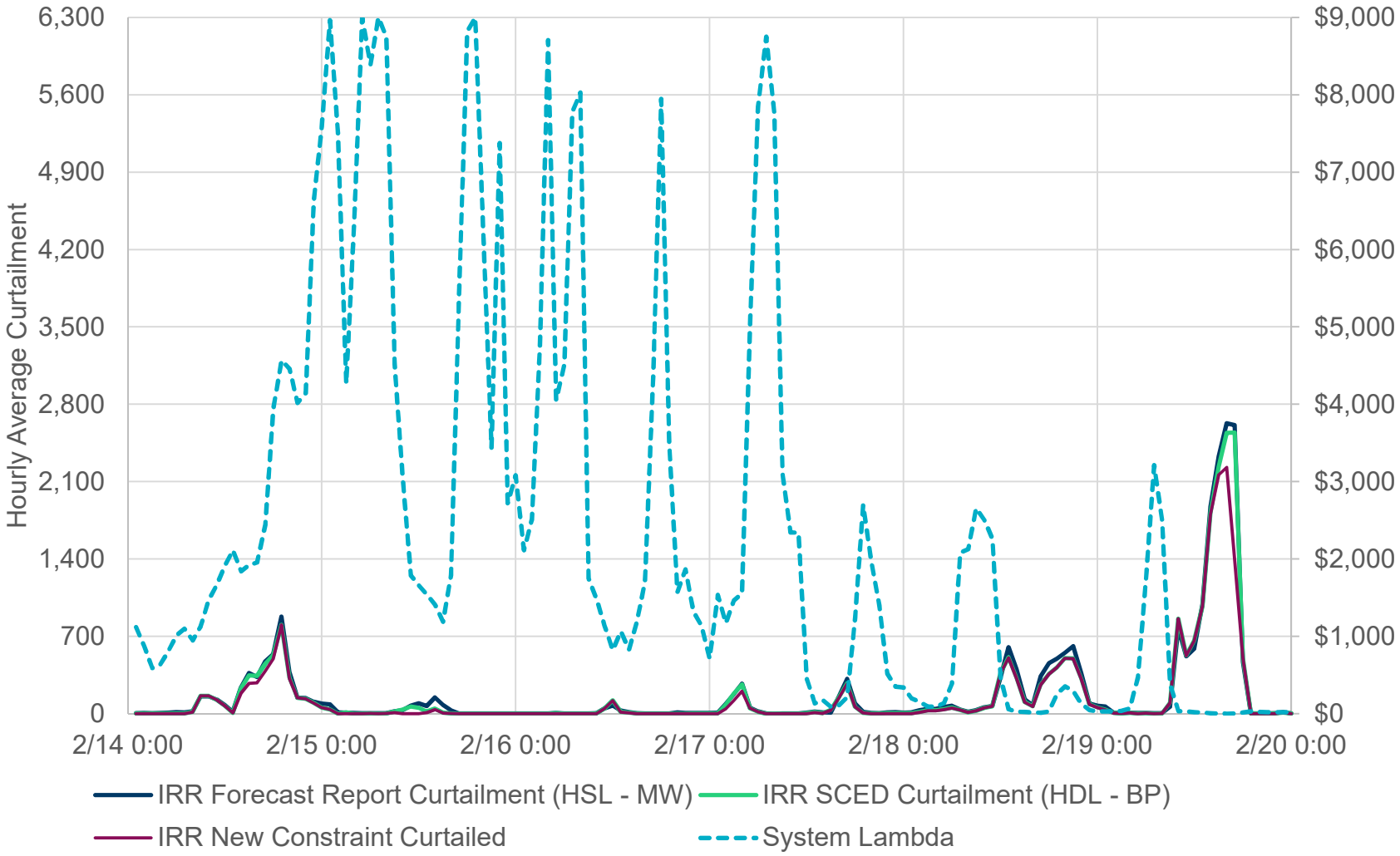
- With the new methodology, magnitude of constraint curtailments is very similar to previous values
- Curtailment due to constraints was low throughout the duration of the winter event
- Regardless of curtailed capacity, transmission limitations must be respected in order to maintain grid reliability and stability

IRR Monthly Forecast Report and Real-Time IRR SCED Curtailment

- The next graph will display differences between IRR SCED curtailment and the estimated curtailment value from the IRR forecast report posted to the monthly WMWG meeting page

- The SCED curtailment value displayed does not have the previous criteria applied for constraint curtailment to be more comparable with the IRR forecast report value
  - SCED curtailment is calculated using HDL minus BP
  - The forecast report curtailment is calculated using hour-ahead forecasted HSL minus hourly averaged telemetered generation (MW)

Comparison of IRR Monthly Forecast Report and Real-Time IRR SCED Curtailment



Comparison of IRR Monthly Forecast Report and Real-Time IRR SCED Curtailment

- The estimated curtailment values from the forecast report were very close to the SCED curtailment values from real-time

- The curtailment value reported in the IRR forecast report ("*RT Est. Curtailments*" column) is based off of the Hour-Ahead IRR Forecast HSL ("*Est. Uncurtailed Output*" column) minus Real-Time IRR Output ("*RT Aggr Wind/Solar Output*" column)
  - This makes it possible for the *RT Est. Curtailments* value to show negative if wind or solar output was under-forecasted for the operating hour

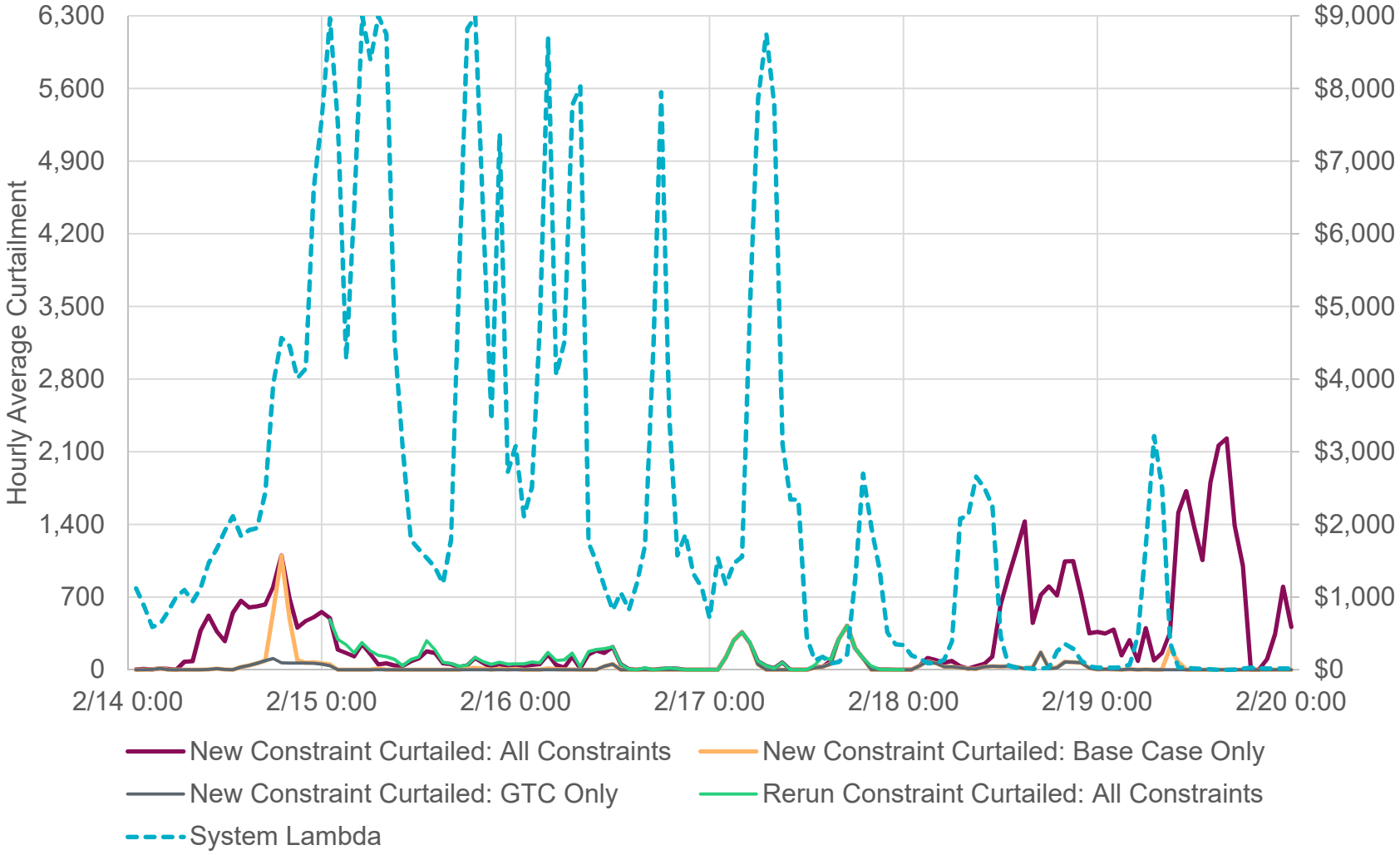
Higher Shadow Price Caps SCED Reruns

- Concern was expressed on potential “under-curtailing” of resources during particularly high price intervals of the winter event since system-wide price was often higher than the shadow price caps of non-base case constraints

- Reran SCED intervals between 2/15/2021-2/17/2021 with higher shadow price caps ($9,251) for non-Base Case constraints

- Used “new methodology” described on slide 4 to calculate constraint curtailment based on rerun system lambda, base points, and constraint shadow prices values

Higher Shadow Price Caps for non-Base Case Constraints Curtailment Comparison



Higher Shadow Price Caps SCED Reruns Conclusion

- With higher shadow price caps put in place for non-base case constraints, there was a very small amount of additional constraint curtailment

- There was also a small increase in GTC violations due to GTCs not being prioritized over contingency constraints