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Estimating Summer Peak Demand Impacts of BTM PV

Distributed Generation Forecast Working Group

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Summary

- In response to stakeholder requests, the ISO has updated its 2016 analysis that informed the methodology used by the ISO to estimate summer peak load reductions from BTM PV as part of the long-term forecast
  - The original presentation is available in the Appendix of this presentation
- The updated analysis incorporates all BTM PV and load data covering the years 2012-2019, including several more recent summer peak load days
  - Original analysis was based on years 2012-2015
- Based on the results, ISO is proposing a new model to estimate summer peak load reductions based on future PV penetrations indicated by the annual long-term PV forecast

Background

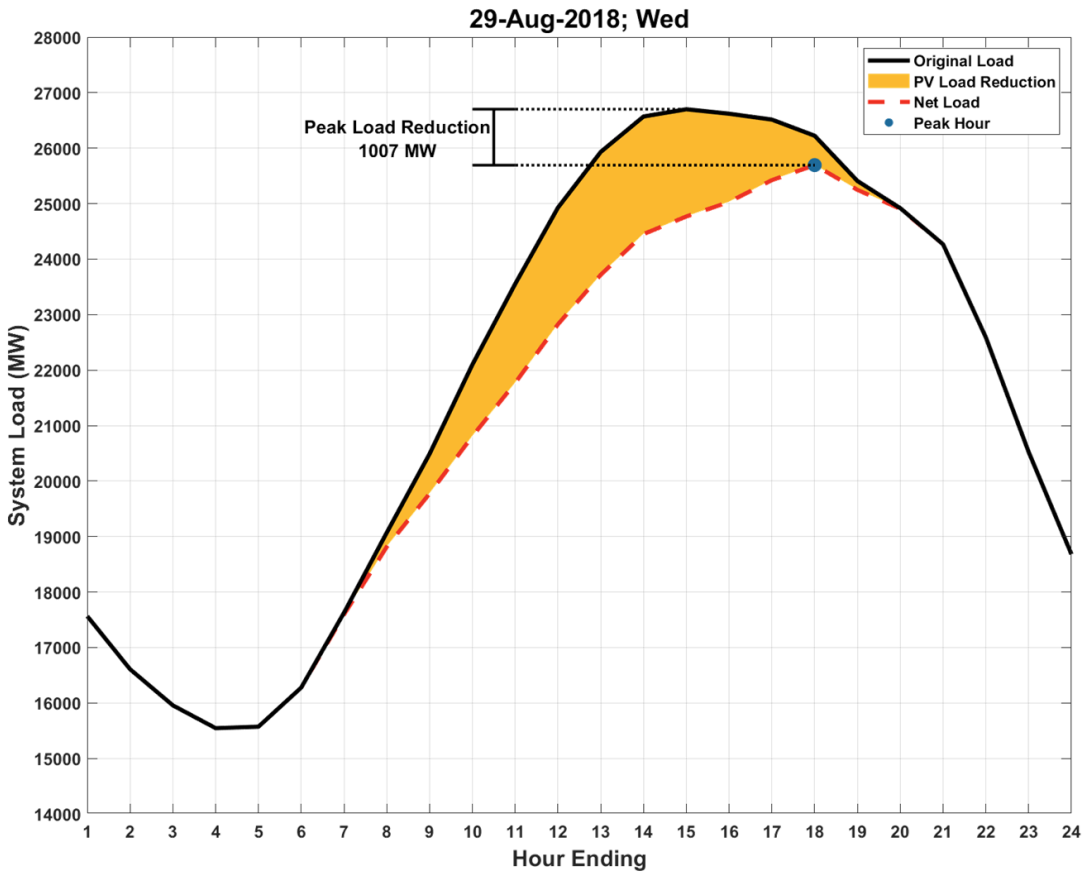
Estimating BTM PV Performance

- ISO-NE uses an *upscaling* process to estimate the aggregate performance of all BTM PV systems from:
  1. Town-level performance data obtained from a sample of BTM PV sites located throughout the region (supplied by a 3rd party vendor)
  2. Town-level installed PV capacity data (provided by regional Distribution Owners)
- Hourly BTM PV fleet performance is estimated by combining the town-level performance and installed capacity data
- More information and an example of how the upscaling process is used to estimate BTM PV production can be found within slides 18-28 of this presentation

Summer Peak Period Considerations

- PV performance is expected to differ across peak hours and across the variety of weather conditions that elicit summer peak load
- As PV penetration grows, the hour of the peak load (net of PV) is shifting later in the afternoon as PV performance is decreasing
  - Summer peak load reductions are calculated as the difference between the peak load reconstituted for BTM PV and the peak load net of BTM PV, regardless of hour
- The following slides summarize ISO's analysis of historical load and PV data to update the estimated relationship between PV penetration and estimated summer peak load reductions due to PV (i.e., the new peak load reduction model)

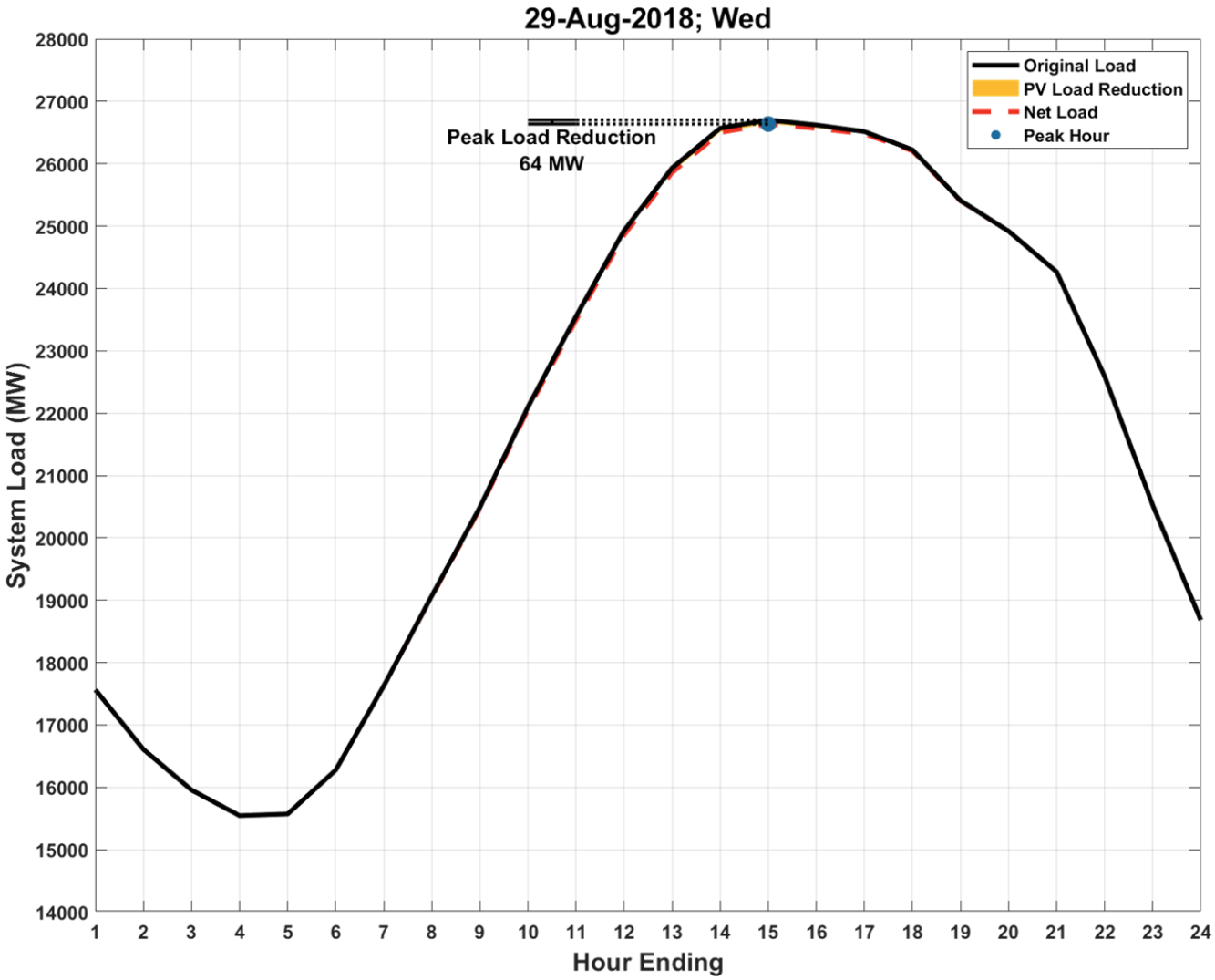
Terms Defined



- The top **black** curve is the PV reconstituted load
- The shaded yellow region represents the estimated PV load reduction
- The dashed red line is the net load profile associated with the installed PV capacity (3000 MW in figure shown)
- The blue dot indicates the hour of the net load peak

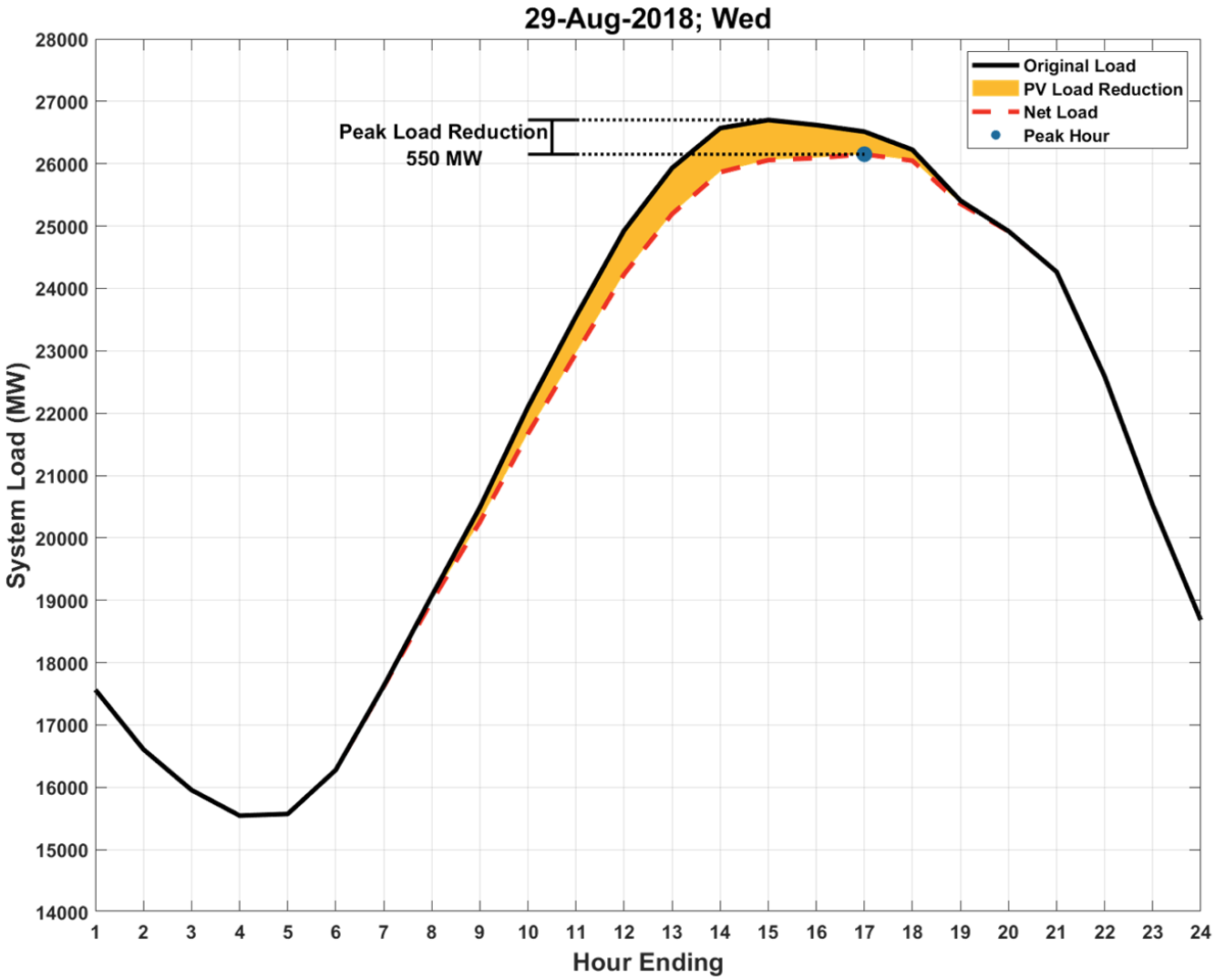
August 29, 2018 Net Load Profile

100 MW PV



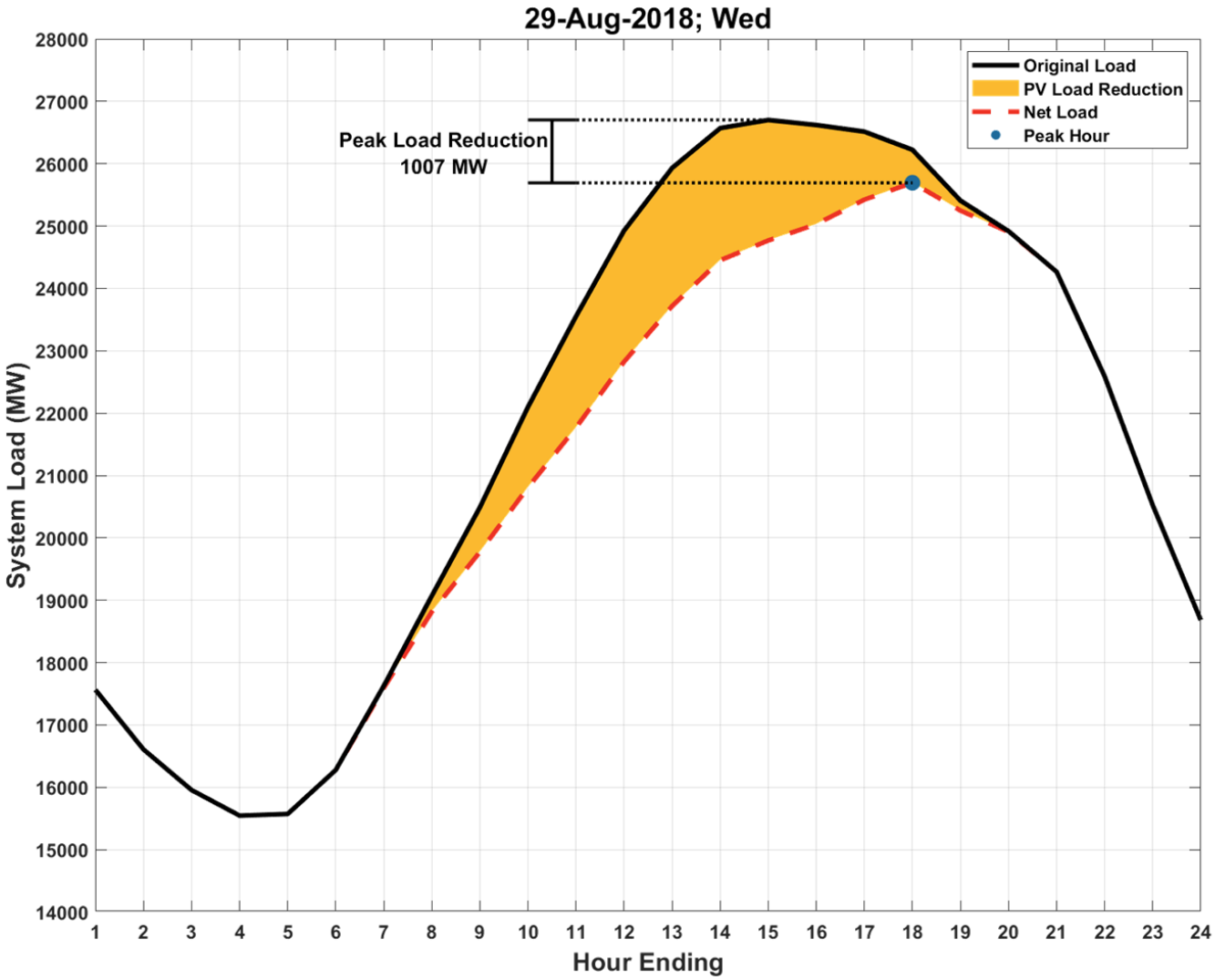
August 29, 2018 Net Load Profile

1,000 MW PV



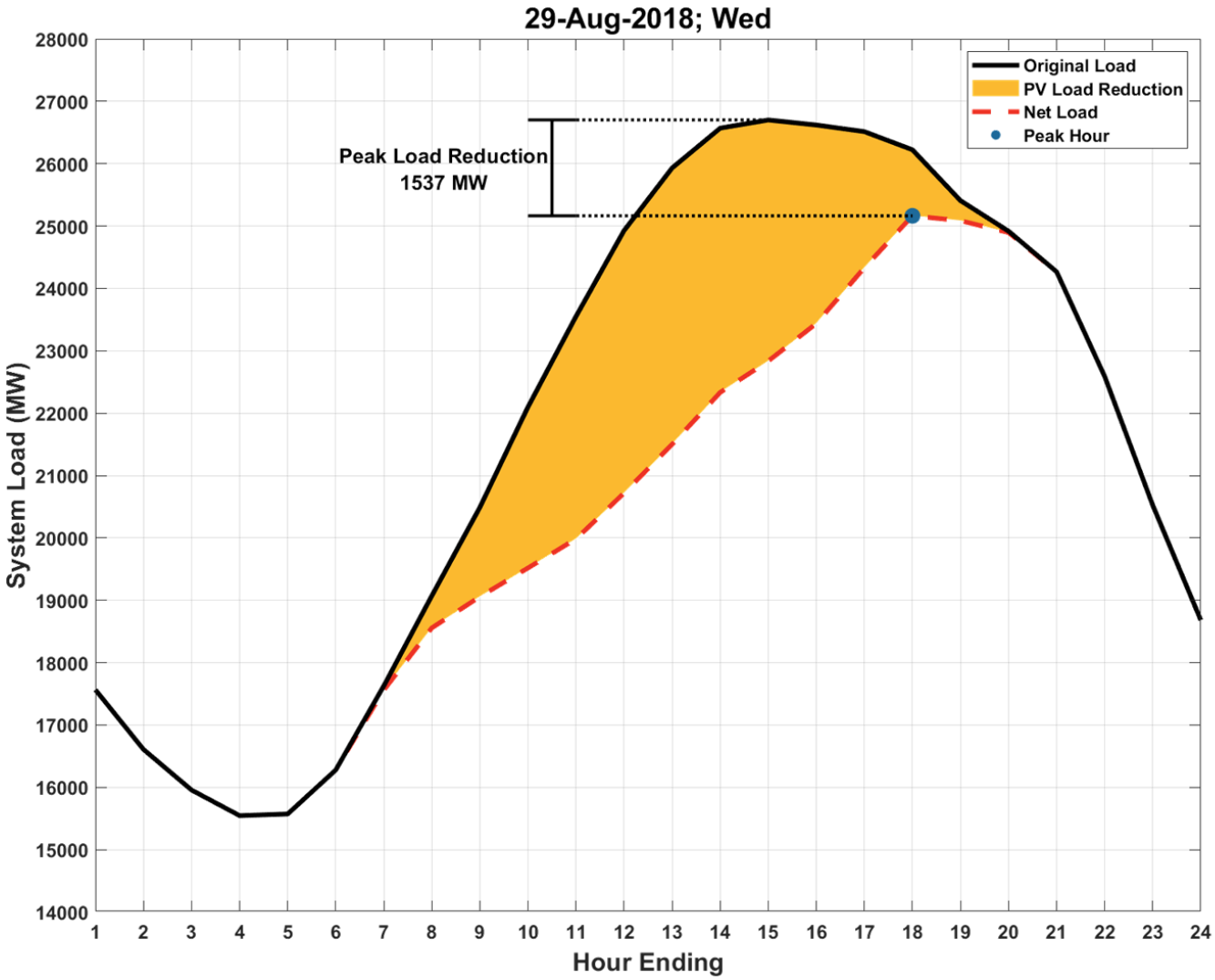
August 29, 2018 Net Load Profile

3,000 MW PV



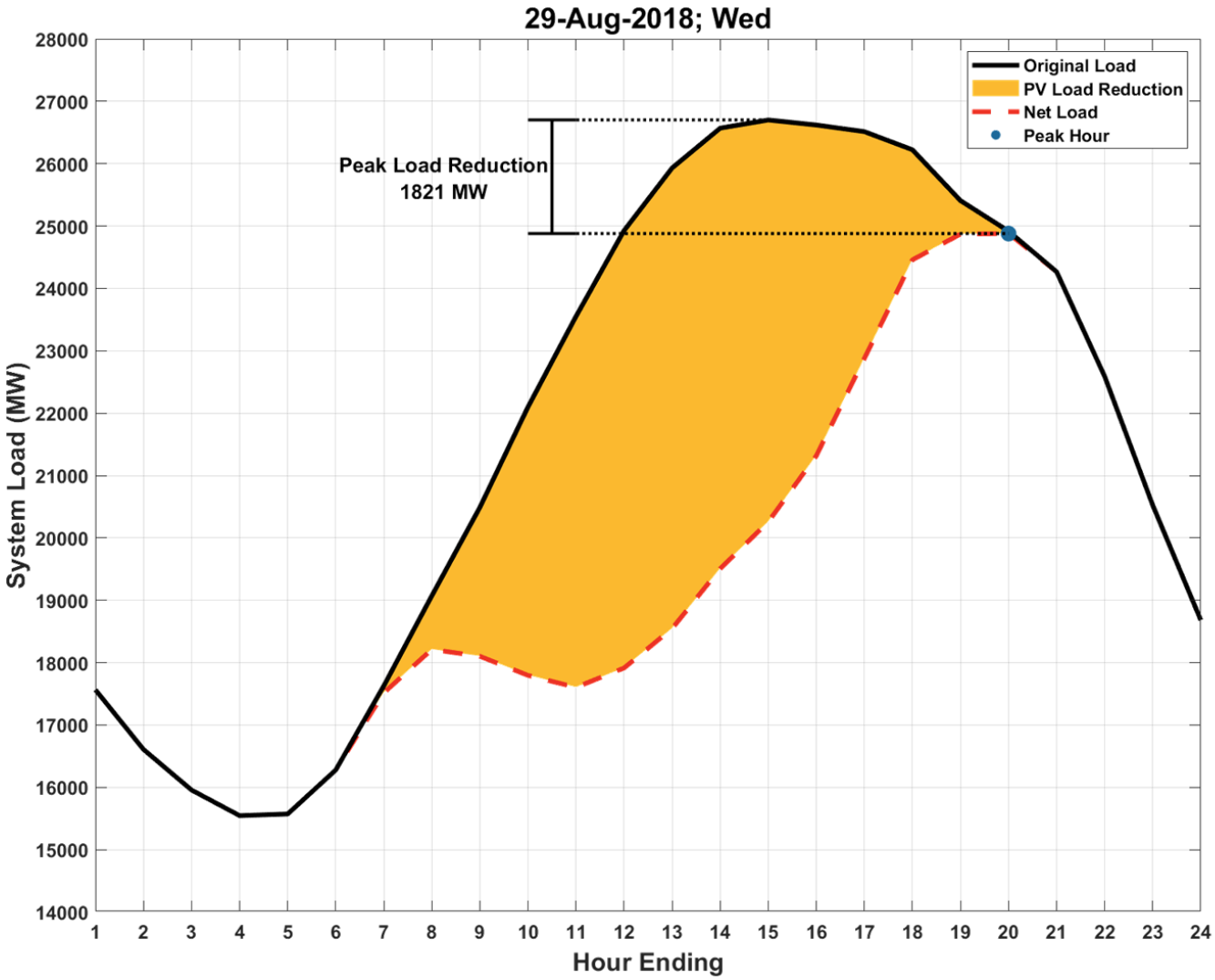
August 29, 2018 Net Load Profile

6,000 MW PV



August 29, 2018 Net Load Profile

10,000 MW PV



August 29, 2018 Peak Load Reductions

- Table lists the incremental peak load reductions as PV penetrations increase
- As the installed nameplate capacity increases, the percent (of PV nameplate capacity) peak reduction decreases
- These values are for August 29, 2018
  - 15 peak days were analyzed and are discussed on the following slide

Installed PV Nameplate Capacity (MW)	Cumulative Peak Reduction (MW)	Cumulative Peak Reduction (% of nameplate)
0	0	0.0%
100	64	64.4%
500	322	64.4%
1000	550	55.0%
1500	732	48.8%
2000	831	41.5%
2500	919	36.8%
3000	1007	33.6%
3500	1095	31.3%
4000	1184	29.6%
4500	1272	28.3%
5000	1360	27.2%
5500	1449	26.3%
6000	1537	25.6%
6500	1625	25.0%
7000	1669	23.8%
7500	1696	22.6%
8000	1722	21.5%
8500	1749	20.6%
9000	1776	19.7%
9500	1803	19.0%
10000	1821	18.2%

Selection of Peak Load Days

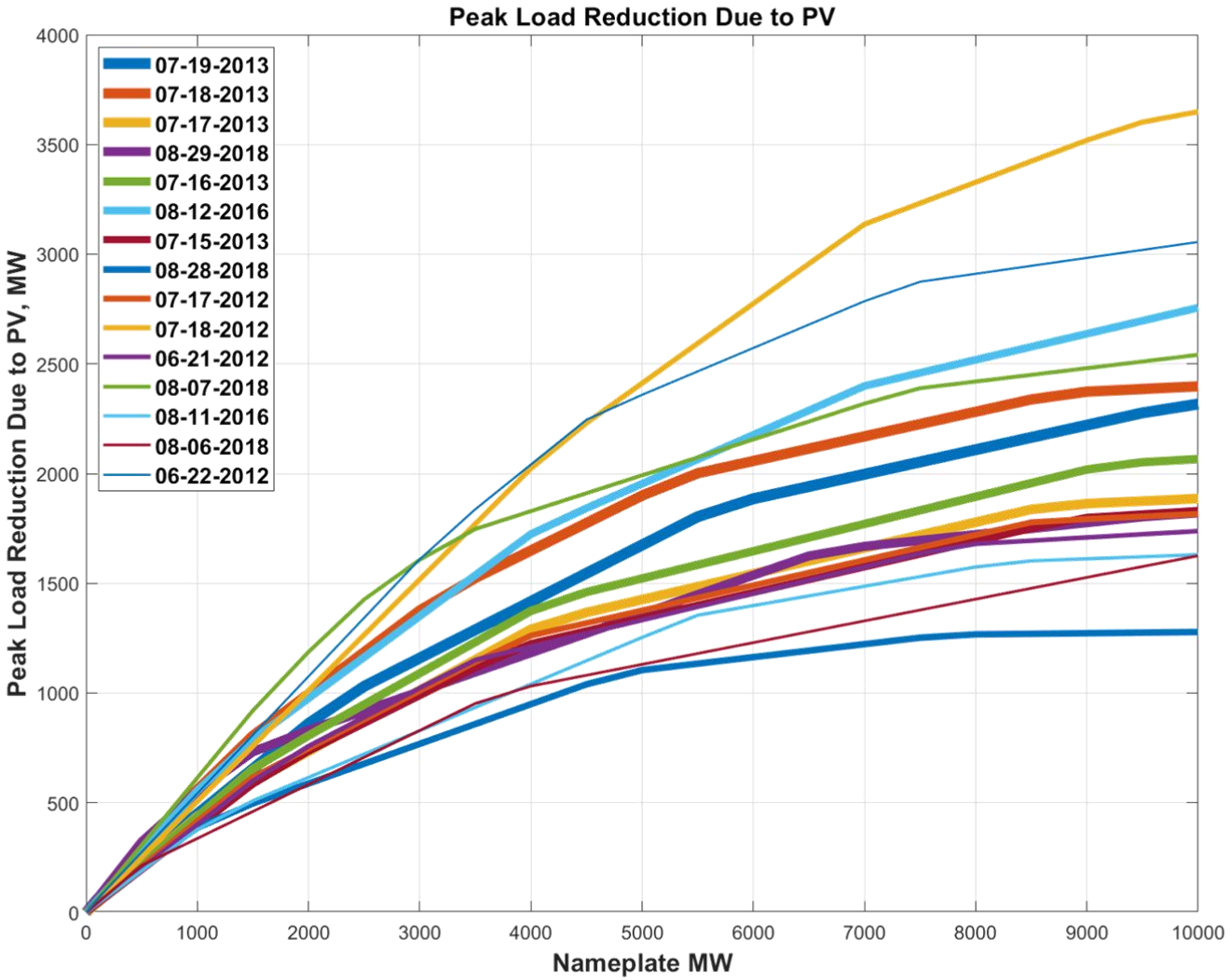
Top 15 Peak Load Days

- 8 years of history were analyzed and the days with the 15 highest peak loads were selected
  - Based on load reconstituted with BTM PV
- The resulting days (tabulated to the right) are all non-holiday weekdays in June, July, and August
  - Days in table are sorted in descending peak load value
  - All days have a peak reconstituted load greater than 25,000 MW

Rank	Day
1	Jul 19, 2013
2	Jul 18, 2013
3	Jul 17, 2013
4	Aug 29, 2018
5	Jul 16, 2013
6	Aug 12, 2016
7	Jul 15, 2013
8	Aug 28, 2018
9	Jul 17, 2012
10	Jul 18, 2012
11	Jun 21, 2012
12	Aug 07, 2018
13	Aug 11, 2016
14	Aug 06, 2018
15	Jun 22, 2012

Top 15 days: Peak Load Reduction

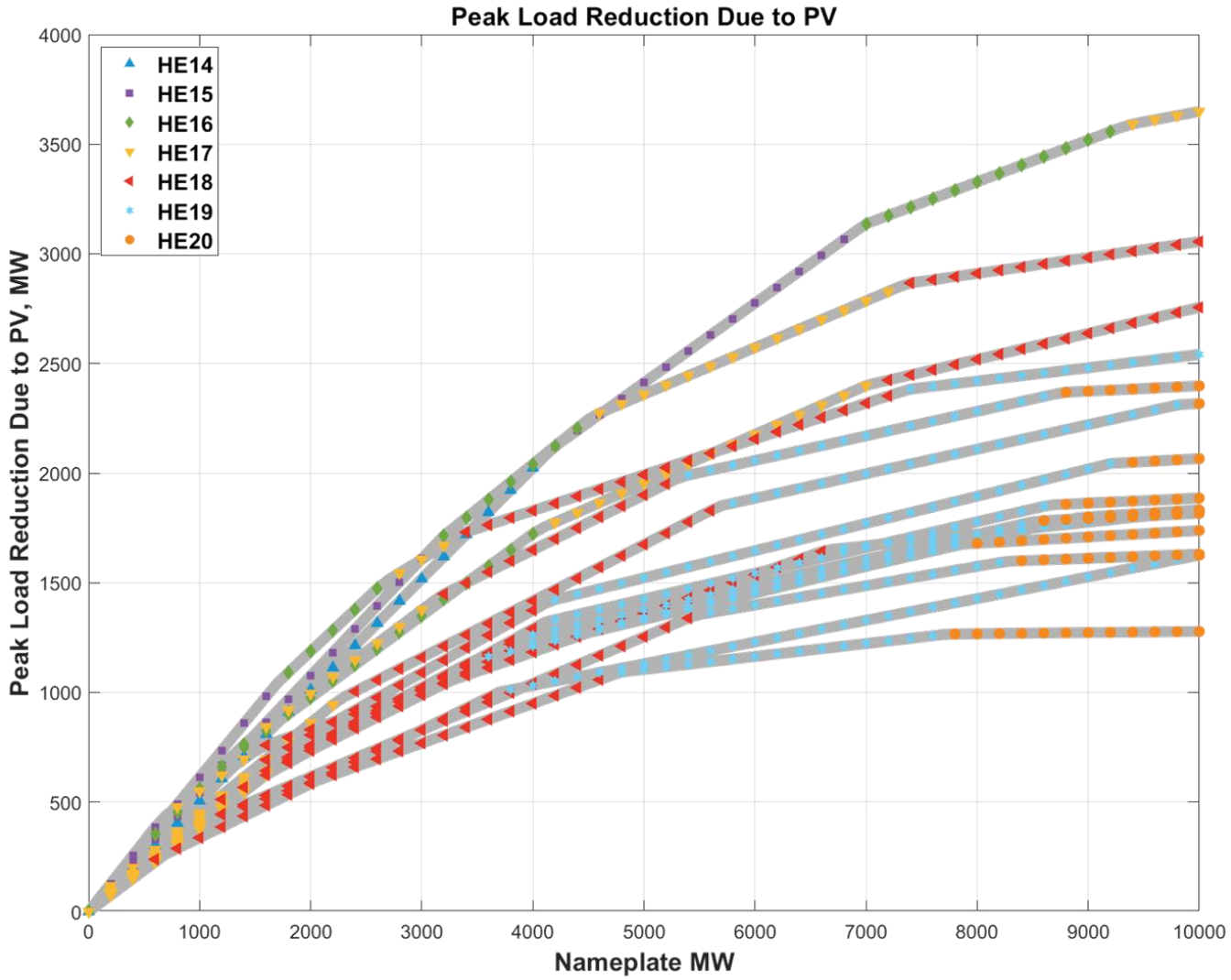
Peak Load Reduction (MW) with Increasing PV Penetration



Note: Line weights represent magnitudes of reconstituted daily peaks

Top 15 days: Peak Load Reduction

Peak Net Load Hour with Increasing PV Penetration



PV Peak Load Reduction Model

- Based on the results, a peak load reduction model can be developed to reflect the relationship between PV penetration and estimated summer peak load reductions
  - For any PV penetration, the model outputs a MW value used in “net of BTM PV” load forecast values reported in CELT
- The results indicate there is a distribution of summer peak load reductions from PV
  - Variation is likely attributable to a variety of factors that affect either load shape or PV performance, including specific weather conditions, length of daylight, day of week, etc.
- For long-term peak demand forecasting, it is reasonable to use the middle of the distribution for estimating peak reductions due to PV
  - Should reflect an approximately equal chance for the actual values to be slightly higher or lower on any particular day

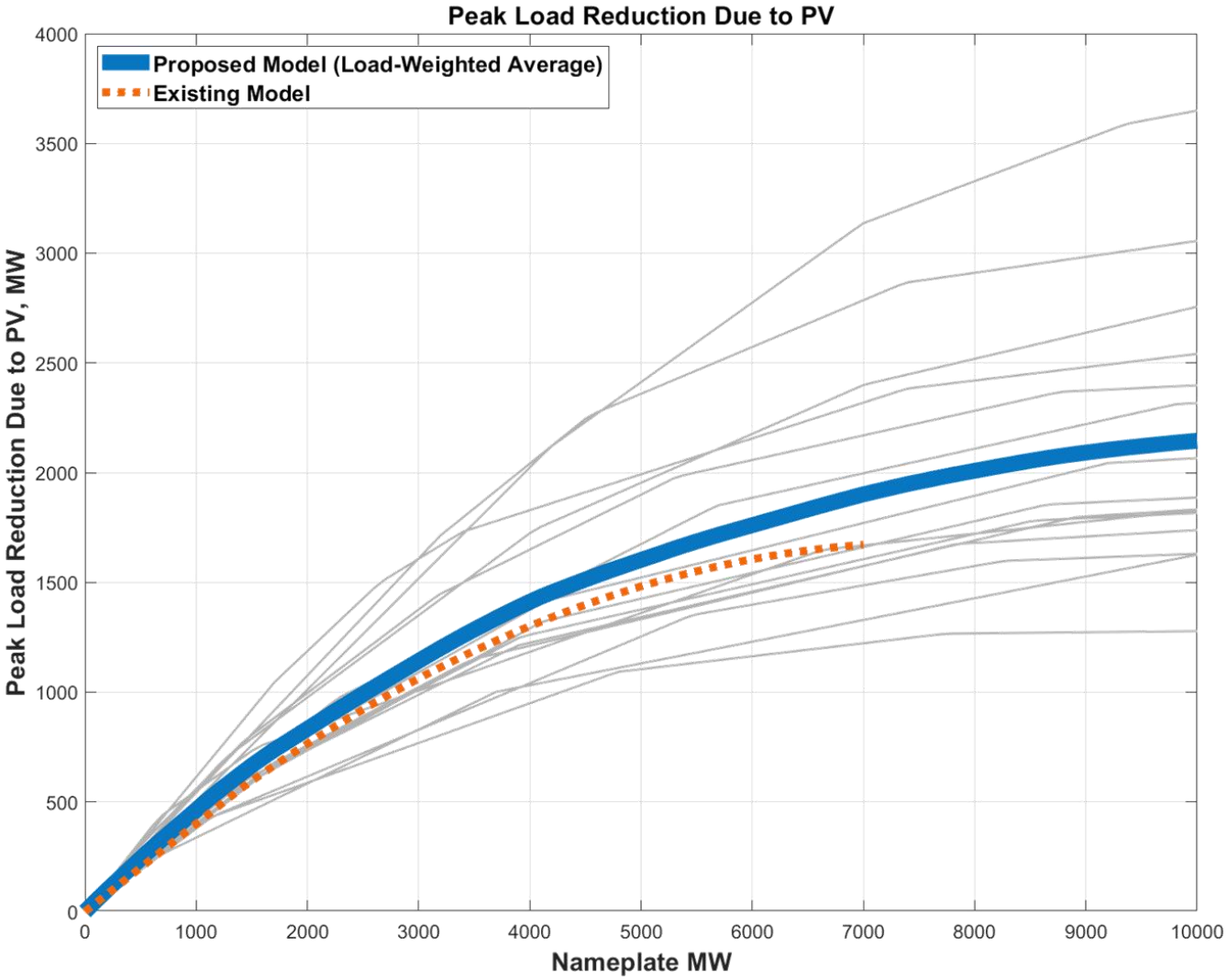
Peak Load Reduction

Existing and Proposed

- Using the results shown for the top 15 peak days, a model curve based on the load-weighted average peak reduction is shown in **blue** on the next slide
  - This curve is calculated by using the magnitude of net peak for each day to weight the peak reduction for each increment of PV nameplate
- The solid **gray** lines on the next slide indicate the distribution of results for the top 15 load days analyzed
- To compare these results with those of the 2016 analysis, the dashed **red** line on the next slide represents the existing model

Estimated Peak Load Reductions

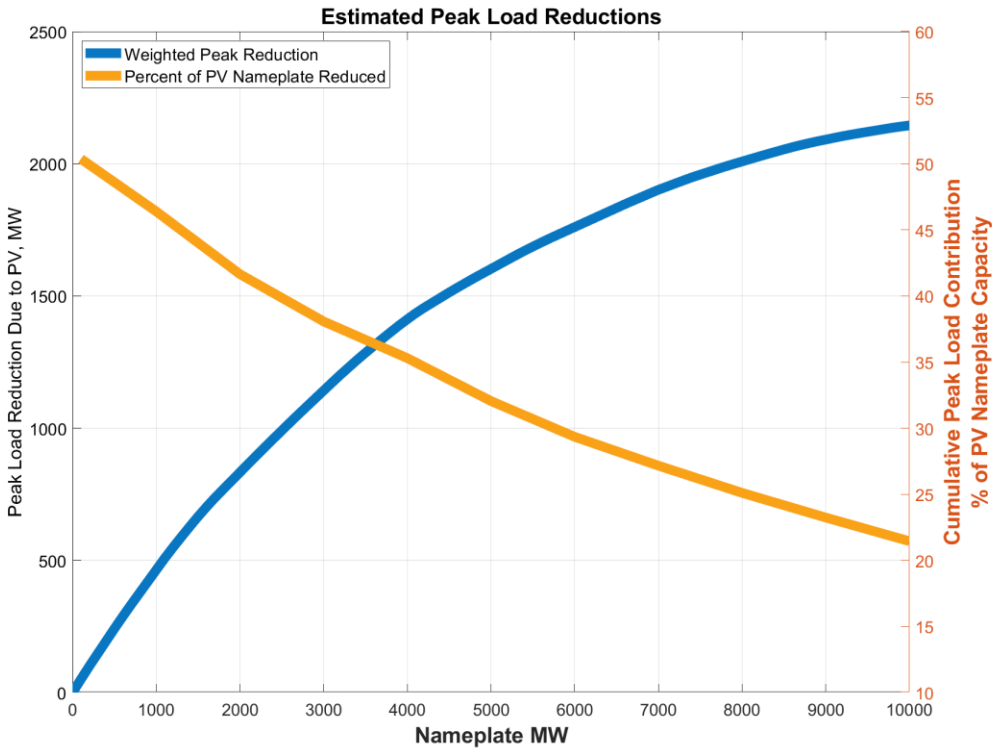
Comparison of Existing and Proposed Models



Expressing Estimated Peak Load Reductions

MW vs. Percent of Nameplate Capacity

- The orange line is the load-weighted peak load reduction as a percent of PV nameplate capacity
  - These percent values are used to calculate BTM PV peak load reductions according to the equation below
  - Percent values are reported in tab 3.2 of CELT
- Percent values are calculated by dividing the peak load reduction MWs (blue line) by the cumulative PV nameplate capacity (values on horizontal axis)



- Equation to estimate BTM PV summer peak load reductions (in MW) is as follows:

BTM PV Peak Load Reduction, MW = (BTM PV Installed Capacity) * (% PV Nameplate)

Next Steps

- Stakeholders are encouraged to provide comments on the proposed PV peak load reduction model as part of the comment period for the draft 2020 PV forecast
  - ISO requests written comments by February 24, 2020 @ 5:00 p.m.
  - Please submit comments to DGFWGMatters@iso-ne.com

Questions