Modeling Behind the Meter (BTM) Photovoltaic (PV) Uncertainty in ICR Calculations

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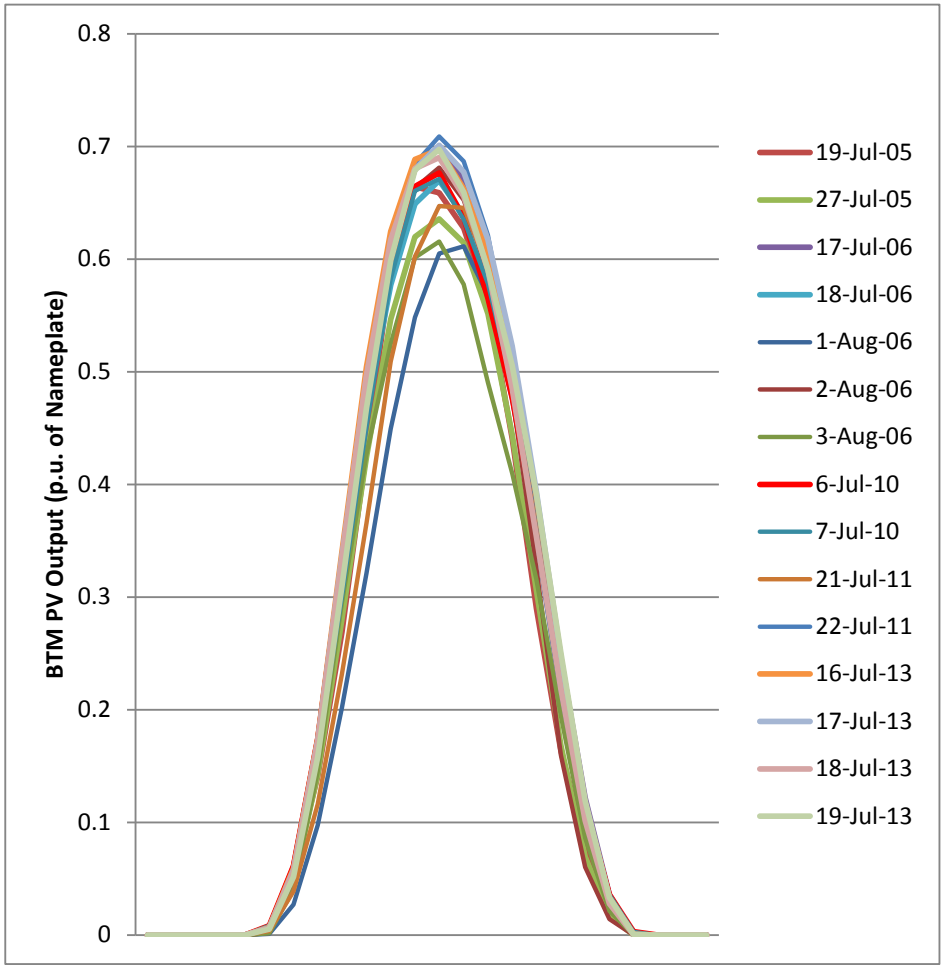
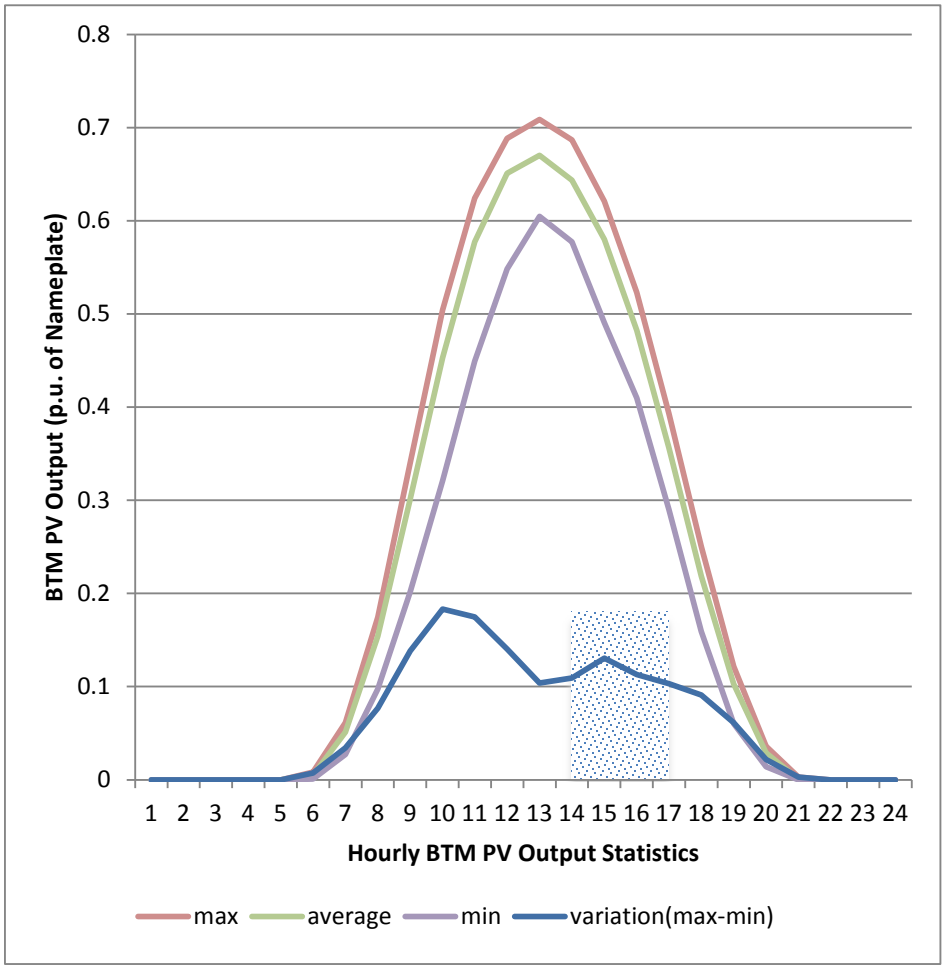
Background

- At the April 28, 2018 PSPC meeting, the ISO initiated an effort to investigate the uncertainty associated with BTM PV that is currently modeled in a deterministic hourly profile in the ICR calculations, and the possibility of capturing such uncertainty probabilistically utilizing a new capability of GE MARS.
- Some PSPC members requested more background information of this analysis, and the quantified impacts on ICR for additional scenarios.
- Topics for today's presentation include:
  - BTM PV output variability observed under the historical peak load conditions
  - Quantification of PV output uncertainty
  - Modeling of the uncertainty in ICR model
  - Quantified impacts on ICR

Simulated BTM PV Profiles on Peak Days

All-Time Highest 15 Peak Days





The plot is regenerated from slide 10 of this presentation:
https://www.iso-ne.com/static-assets/documents/2017/06/pspc_6_22_2017_2002_PV_profile.pdf

Observations of BTM PV Output on Peak Days

- The BTM PV outputs simulated during the all-time 15 highest peak load days indicate that, while high BTM PV outputs are consistently associated with New England peak load conditions, a certain level of variability exists
  - Varies for different hours
  - Variation slightly over 10% during the period of HE14 – HE17 where actual peaks occurred

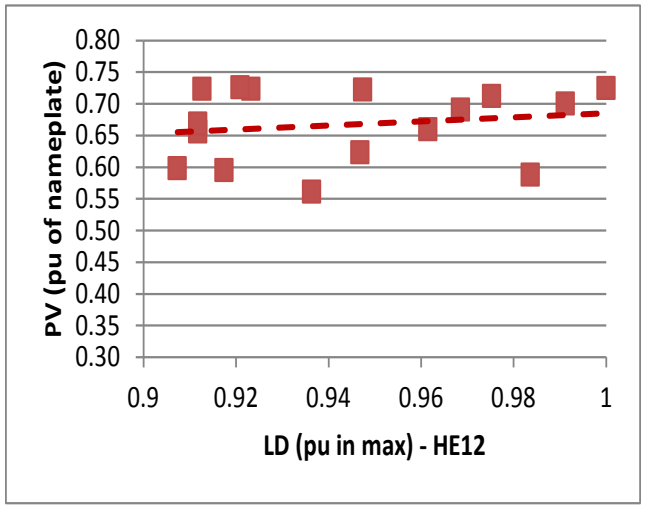
- Since these 15 highest peak load days occurred in a span of time from 2006 to 2013, BTM PV output within a more homogeneous period was also analyzed
  - where the weather condition is the main variable, and other underlying assumptions are similar

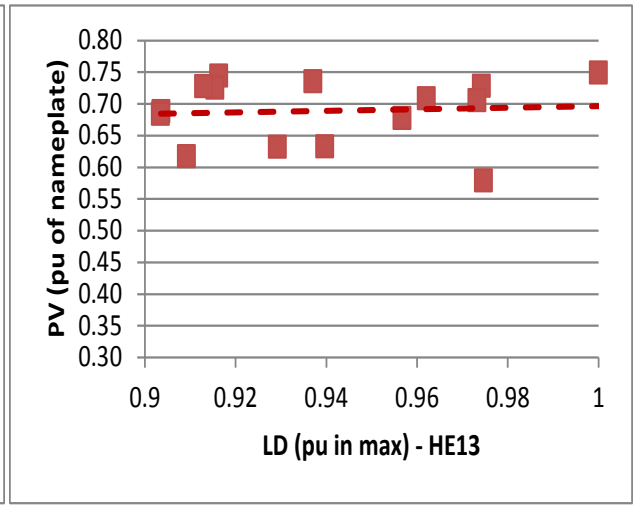
BTM PV OUTPUT IN JULY/AUGUST 2002

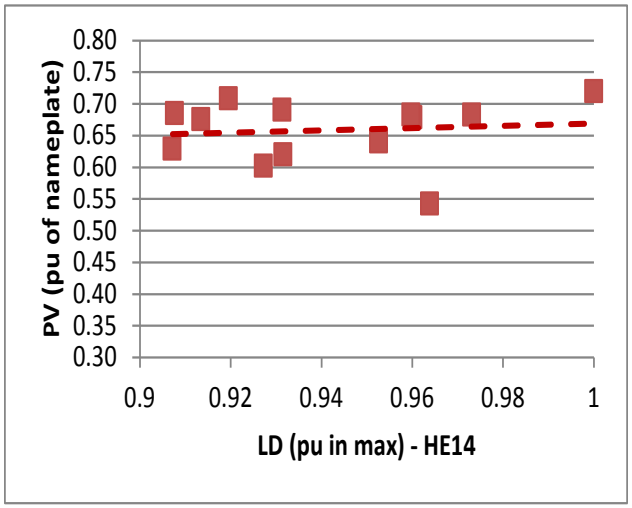
BTM PV vs Load in 2002 Hourly Profile

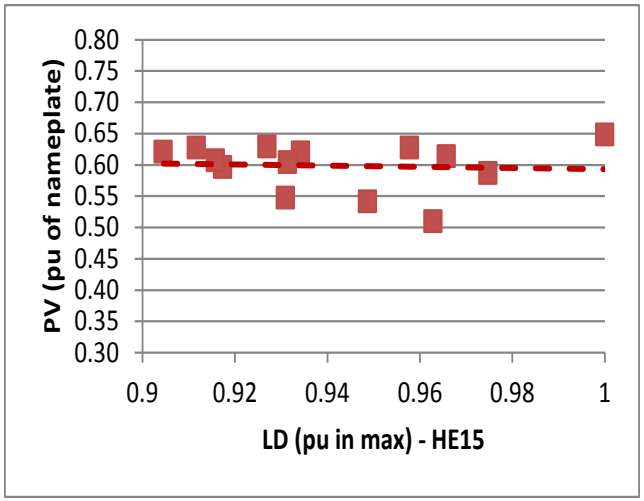
- Data sources: 2017 CELT hourly load forecast and hourly BTM PV for 2021 (FCA 12)
- Data set analyzed: July and August
- Method: examine the BTM PV output for each hour between HE12 – HE17
  - Focus on the high load days (within 90% of the peak)

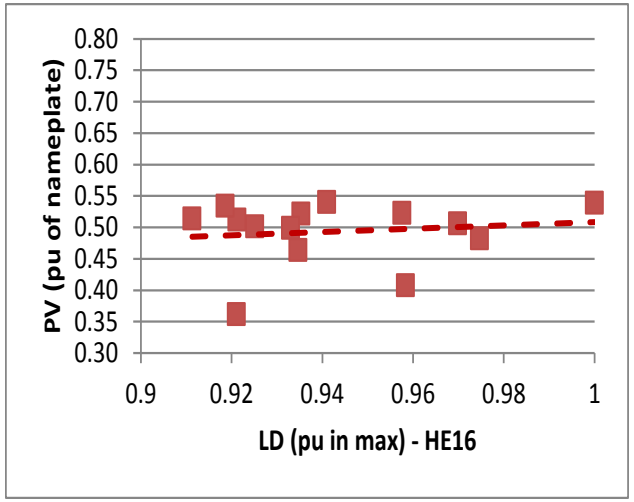
BTM PV vs Load in 2002 Hourly Profile, *cont.*

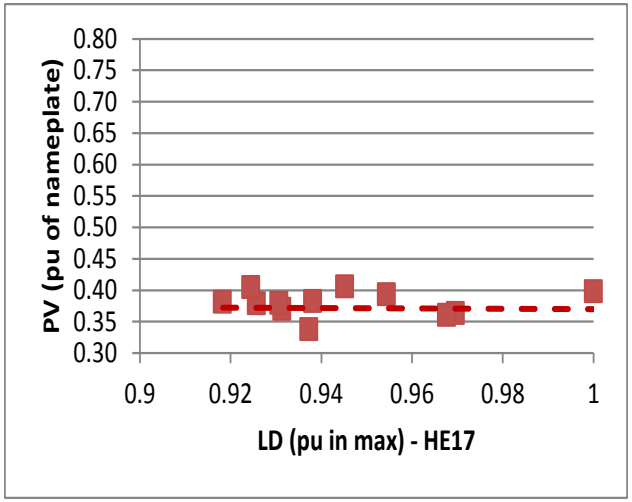








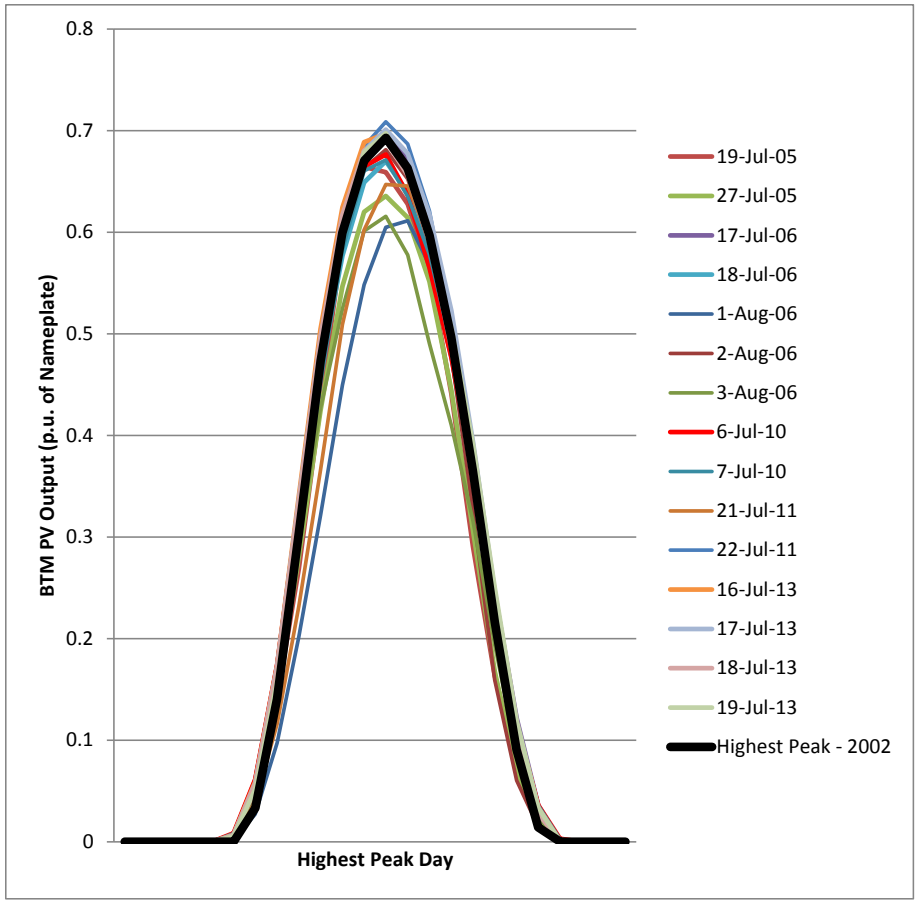


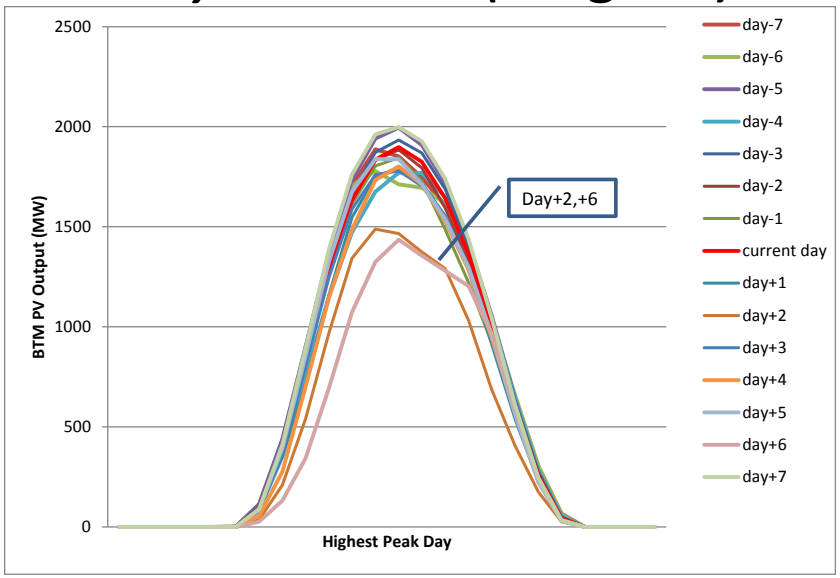


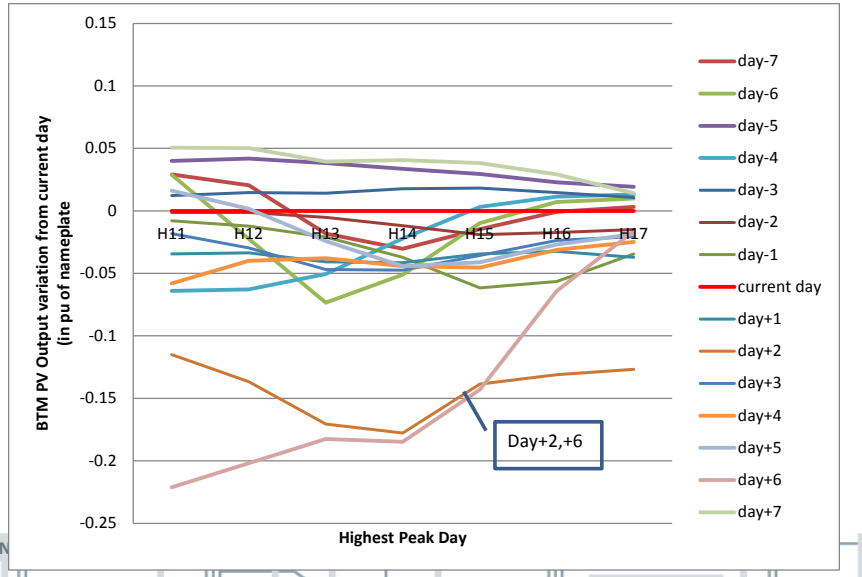
BTM PV vs Load in 2002 Hourly Profile, *cont.*

- Observations
  - BTM PV output is primarily determined by time of day, and generally trends with load
    - Different degree of variations for different hours within ~10% bandwidth
    - Likely attributed to load and BTM PV having slightly different sensitivity to various weather variables

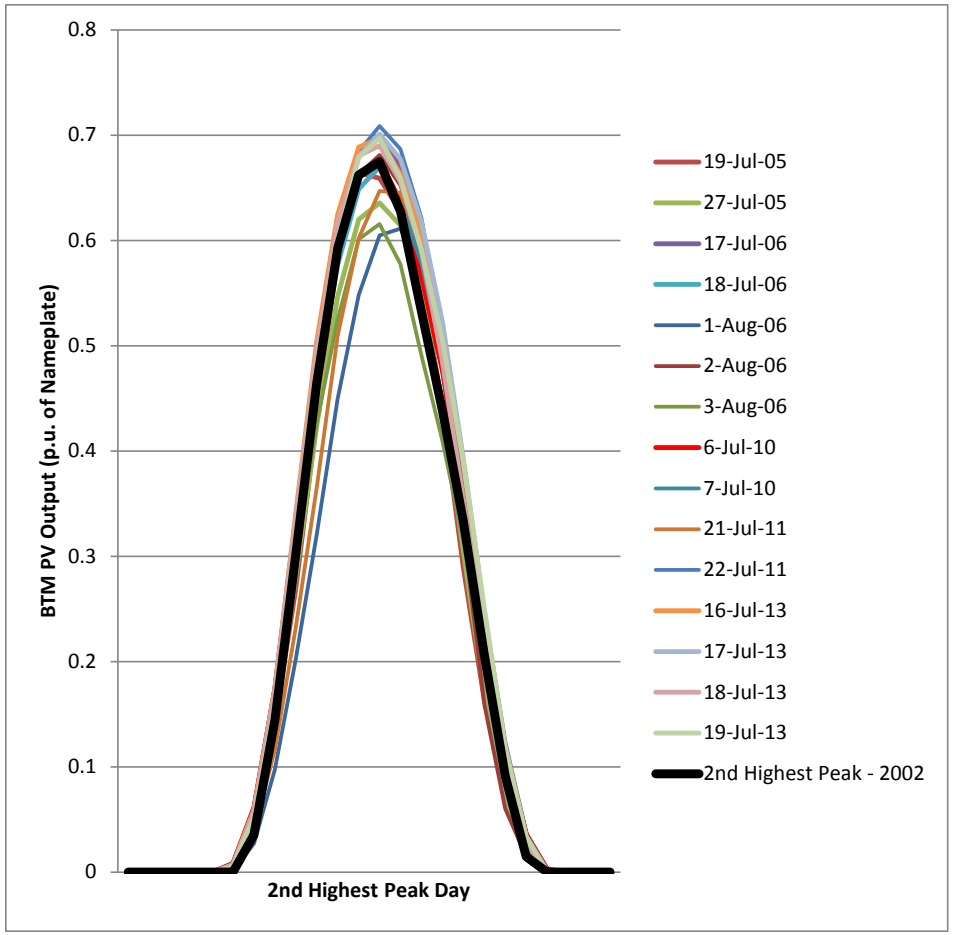
BTM PV Daily Profiles Surrounding the Top 5 Peaks in 2002 – *Highest Peak Day in 2002 (Aug 14)*

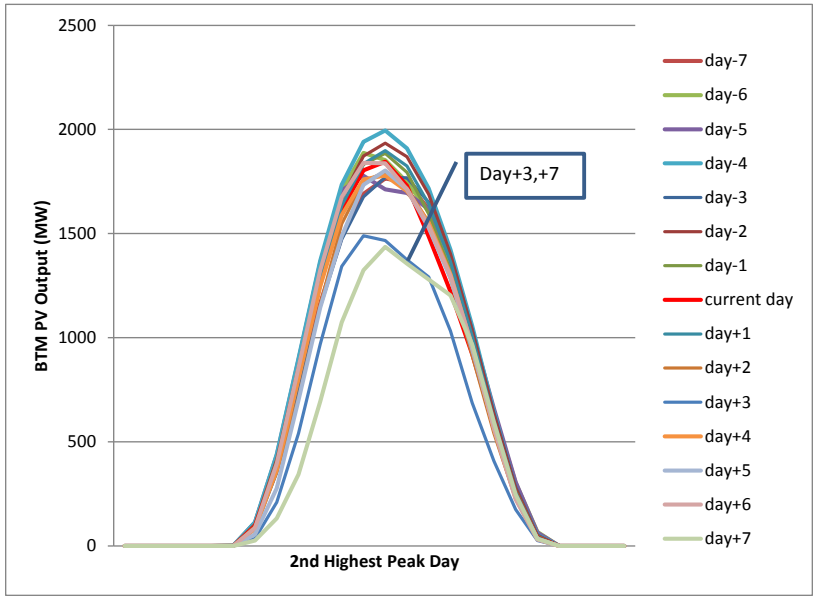


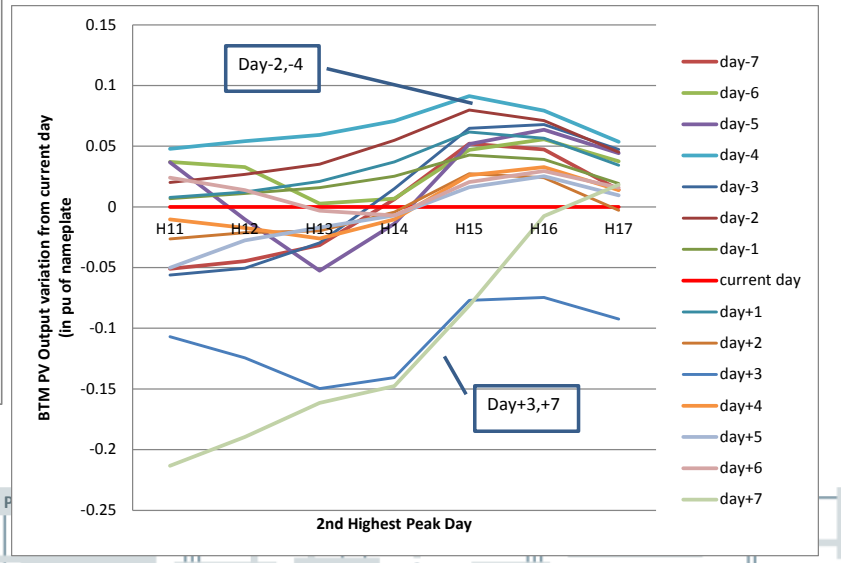




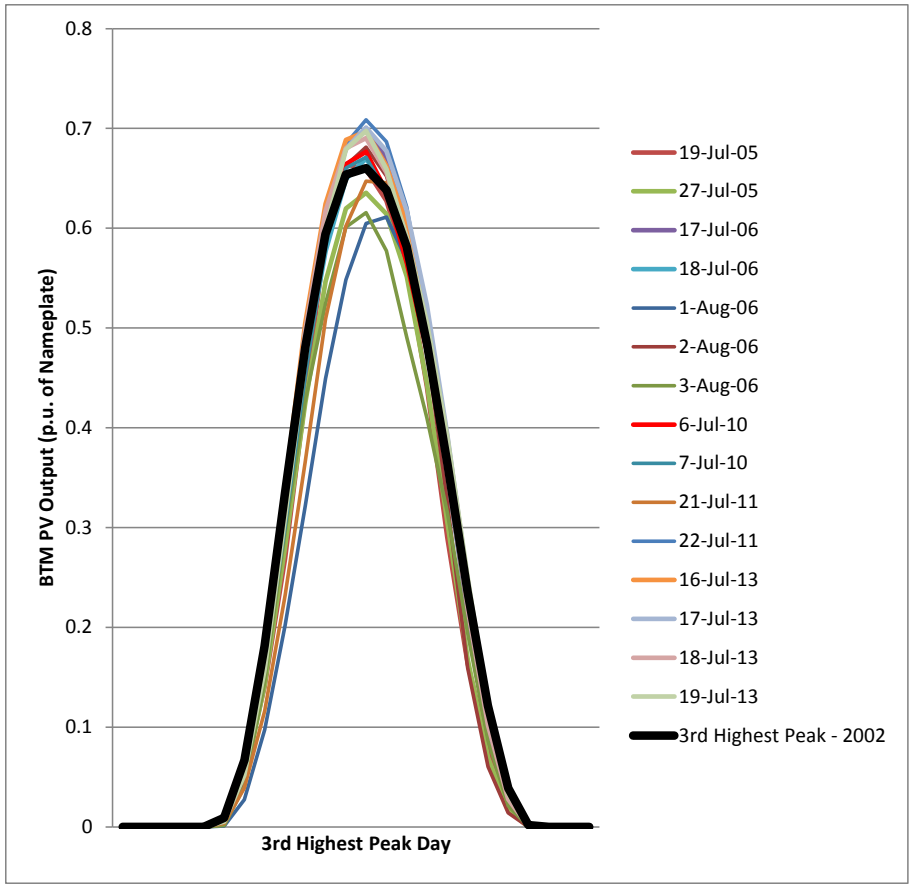
BTM PV Daily Profiles Surrounding the Top 5 Peaks in 2002 – *2nd Highest Peak Day in 2002 (Aug 13)*

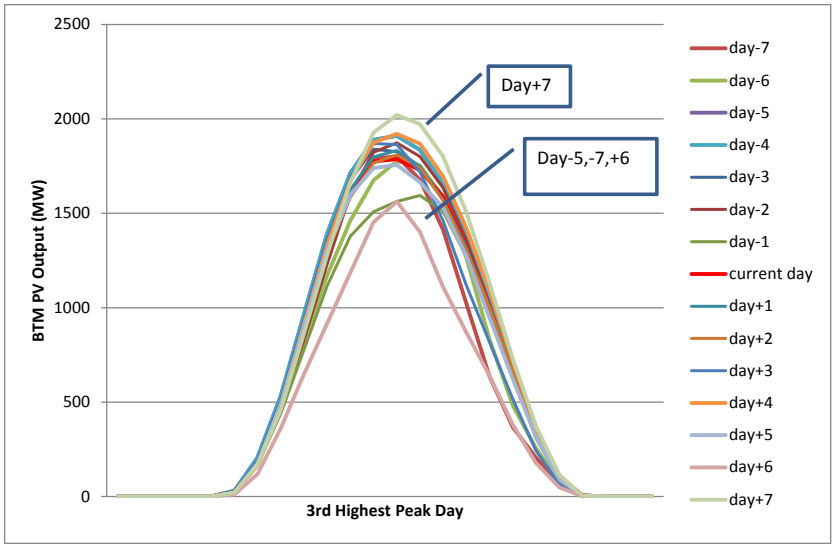


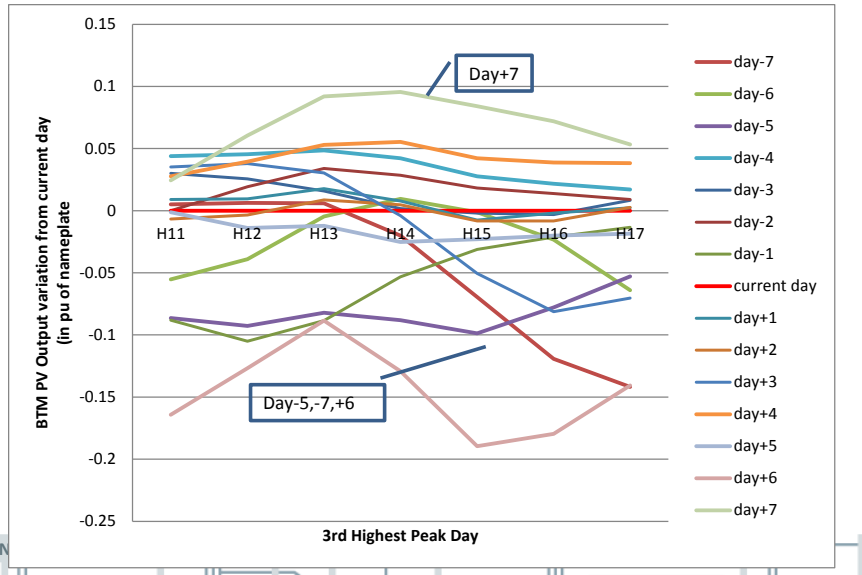




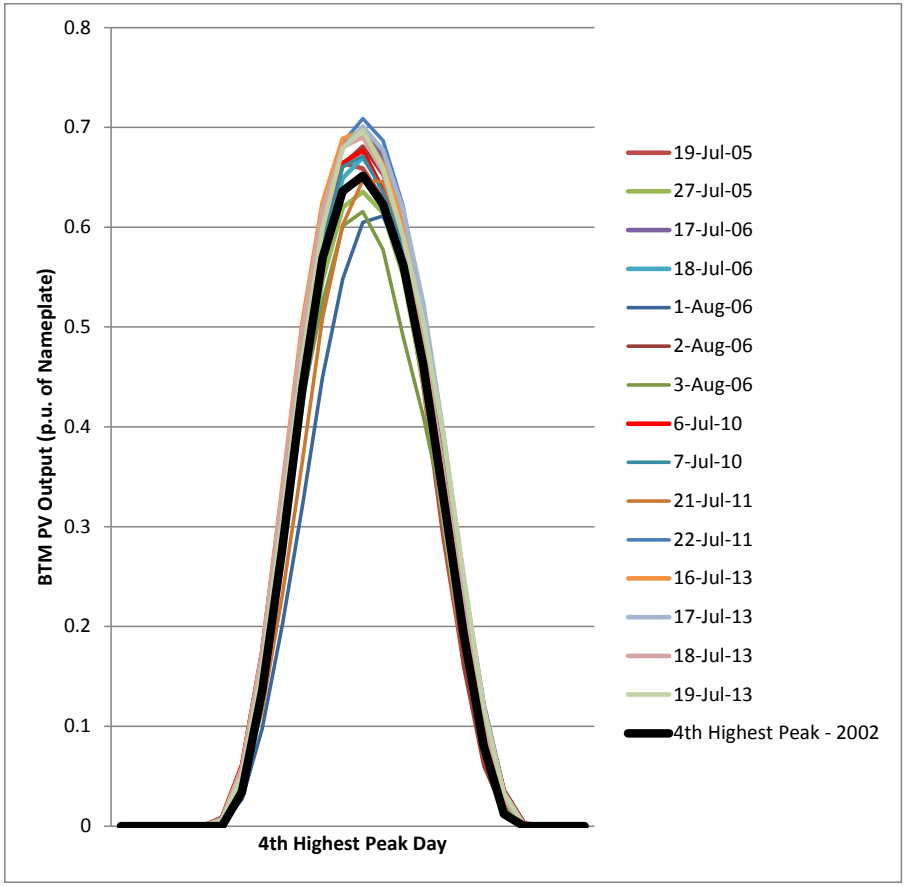
BTM PV Daily Profiles Surrounding the Top 5 Peaks in 2002 – *3rd Highest Peak Day in 2002 (July 3)*

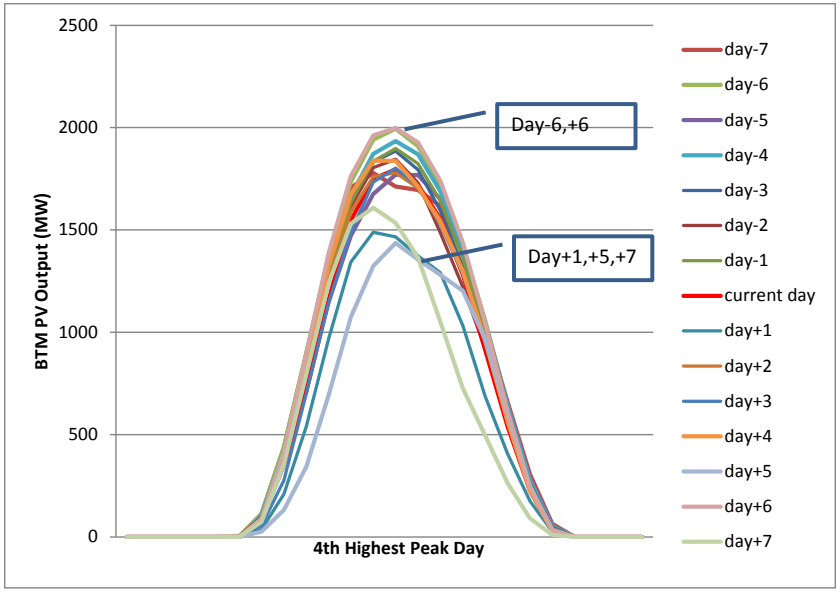


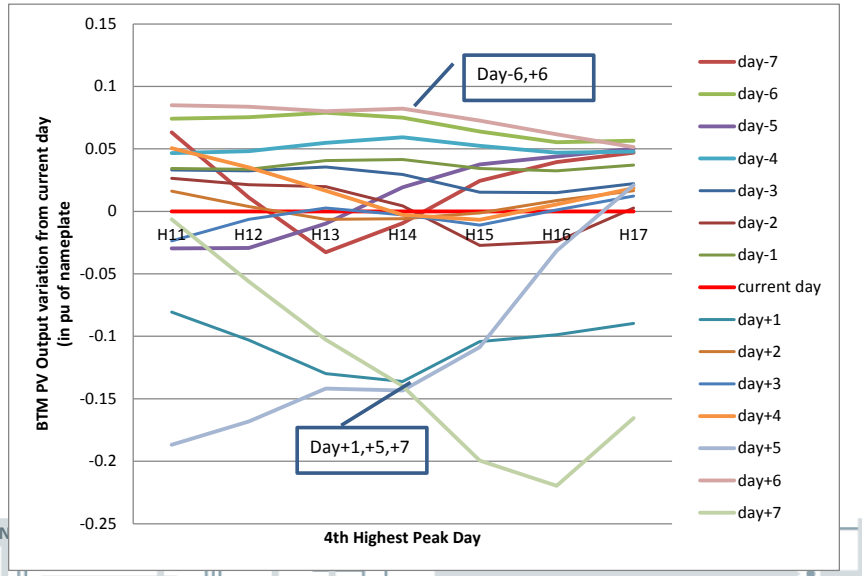




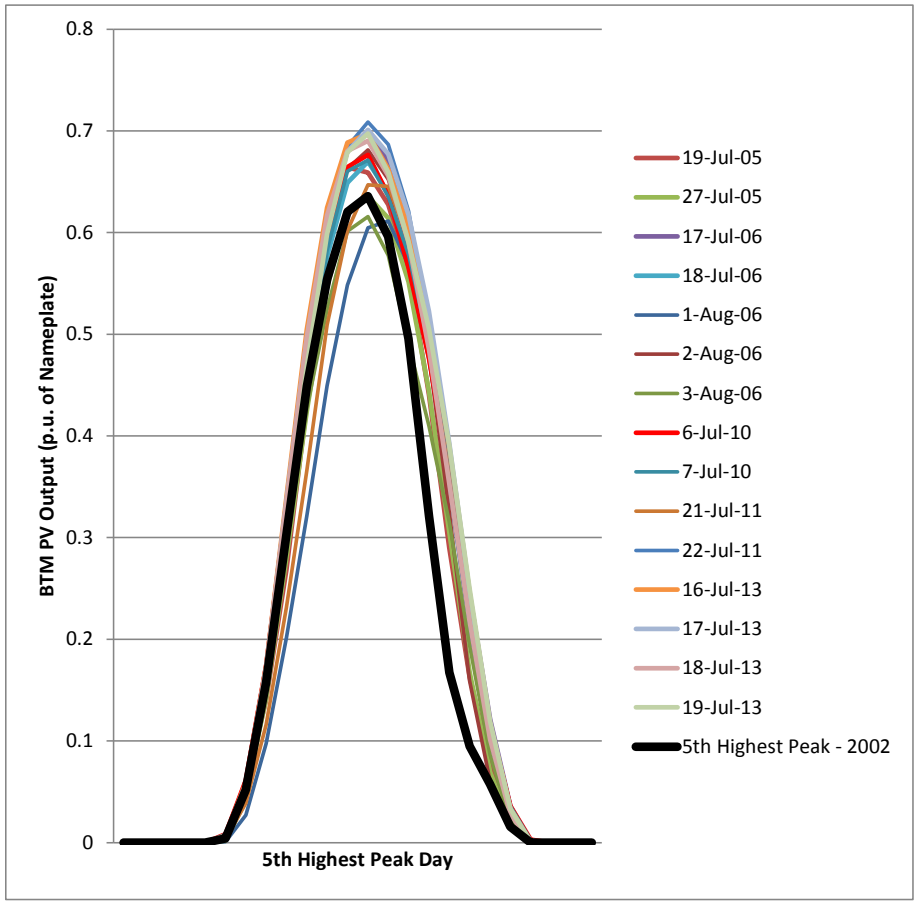
BTM PV Daily Profiles Surrounding the Top 5 Peaks in 2002 – *4th Highest Peak Day in 2002 (Aug 15)*

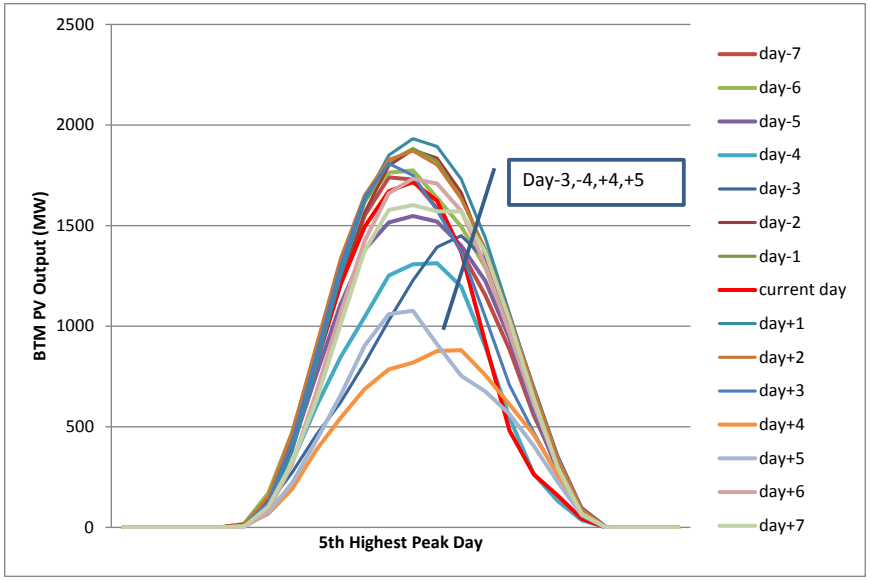


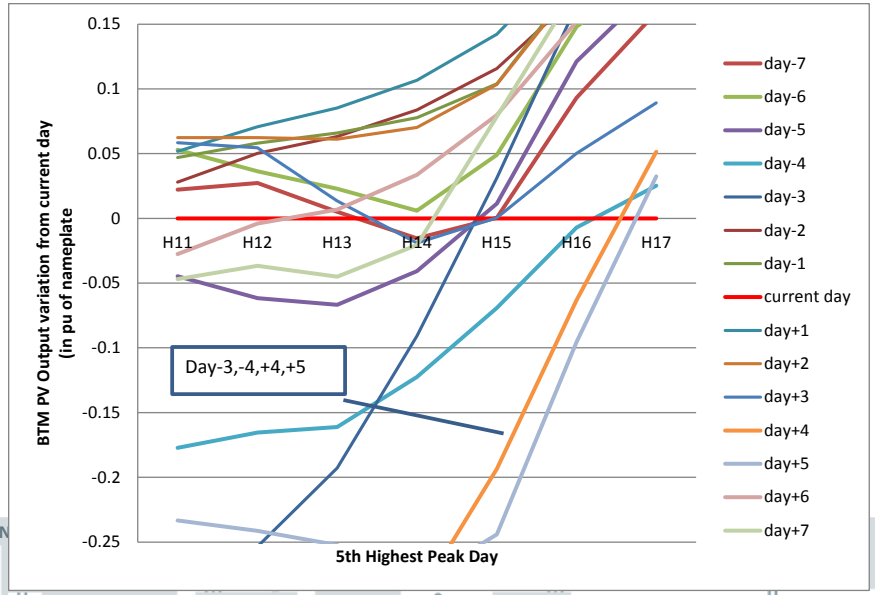




BTM PV Daily Profiles Surrounding the Top 5 Peaks in 2002 – *5th Highest Peak Day in 2002 (July 23)*







BTM PV Daily Profiles Surrounding the Top 5 Peaks in 2002, *cont.*

- Observations
  - The daily BTM PV output profiles surrounding the 2002 peak days are representative of the BTM PV performance under the weather conditions driving the historical peaks
    - Less outliers within 7-day window (3 days prior and 3 days after)
  - The ISO proposes to model the BTM PV by randomly selecting a daily profile within a 7-day window surrounding the day under study.
    - The ISO believes that this is a reasonable way to capture the uncertainty associated with the BTM PV performance

Quantified Impacts on ICR

- Impacts on ICR resulting from different windows for random selection of the daily shape of BTM PV

Window for random selection of BTM PV daily shape	Net ICR (MW)	Delta (MW)
Base: FCA 12 ICR BTM PV modeled deterministically	33,725	-
3-day window	33,740	15
5-day window	33,750	25
7-day window	33,755	30
9,11,13,15,17-day window	33,760	35
19-day window	33,765	40
21,23-day window	33,780	55
25,27-day window	33,785	60
29,31-day window	33,790	65
Within current month	33,830	105

Summary

- The analysis based on the BTM PV outputs simulated during the all-time 15 highest peak load days and July/August of 2002 shows that, while high BTM PV outputs are consistently associated with peak load conditions, certain level of variability exists
  - Variation is slightly over 10% for the afternoon hours where peaks likely occur
- The daily BTM PV output profiles surrounding the 2002 peak days are representative of the BTM PV performance under the weather conditions driving the historical peaks
    - Less outliers within 7-days window (3 days prior and 3 days after)
- The ISO proposal to model the BTM PV by randomly selecting a daily profile within a 7-day window surrounding the day under study is a reasonable way to capture the uncertainty associated with the BTM PV performance
  - Using the FCA 12 ICR model, this corresponds to an increase in ICR of 30 MW

Questions