Energy and Capacity Value of Solar (& Storage)

SMUD NEM Working Group
November 21, 2019

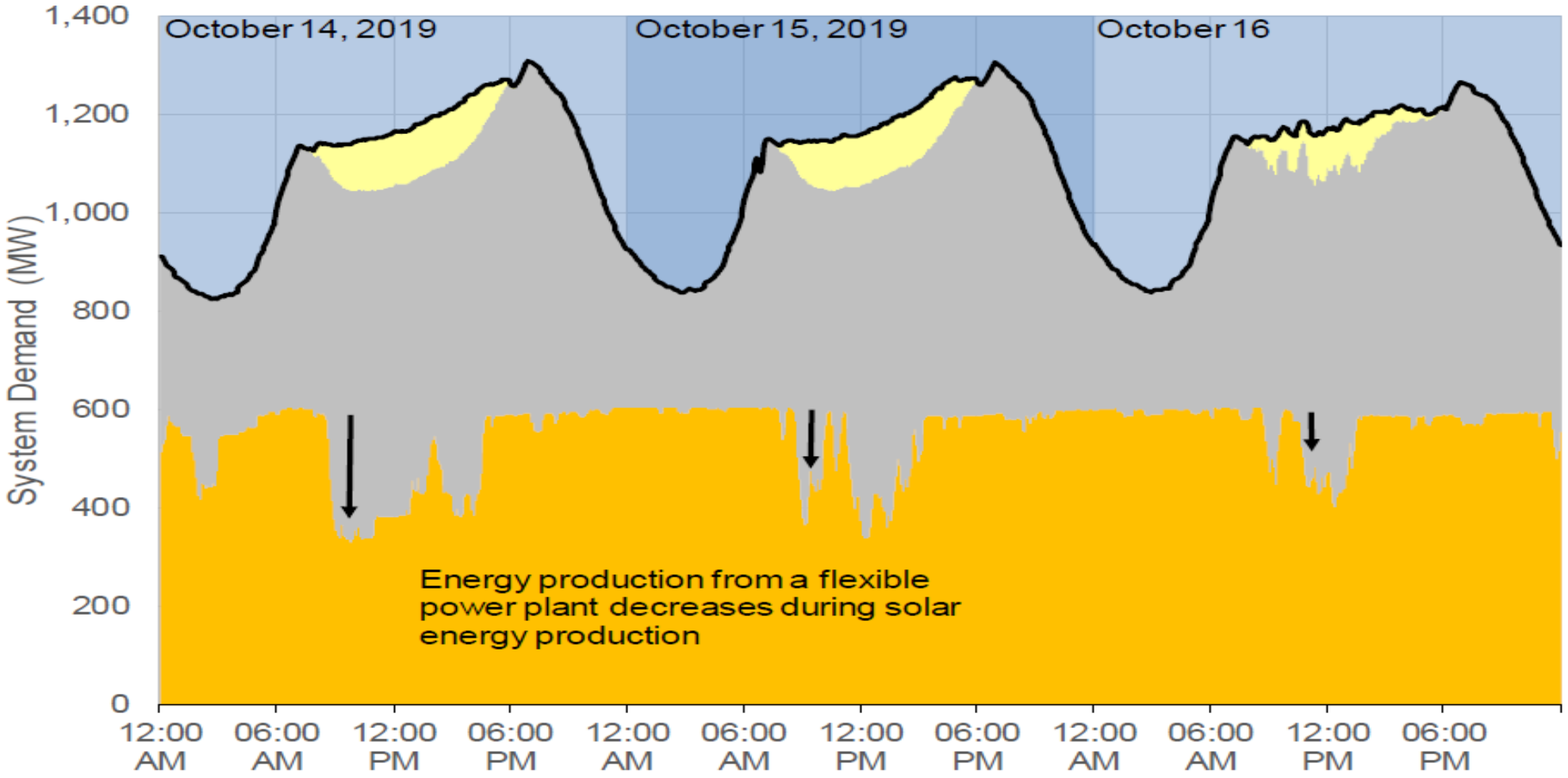
Scott Murtishaw
Senior Advisor

CALIFORNIA SOLAR + STORAGE ASSOCIATION
smart local energy

Operating Margin vs Build Margin Effects

- New renewable and efficiency resources do not offset generation from an average of the existing portfolio
- Resources that are inflexible (nuclear), have a fixed output potential (hydro), or variable and low-cost (existing) are rarely curtailed
- Operating Margin: reduction in output from **marginal** existing resources
  - Usually the last (and most expensive) plant dispatched to provide power at any moment
- Build Margin: effect of new resources on deferring or avoiding the need for new power plants

Operating Margin Example



Source: SMUD

CALIFORNIA SOLAR + STORAGE ASSOCIATION

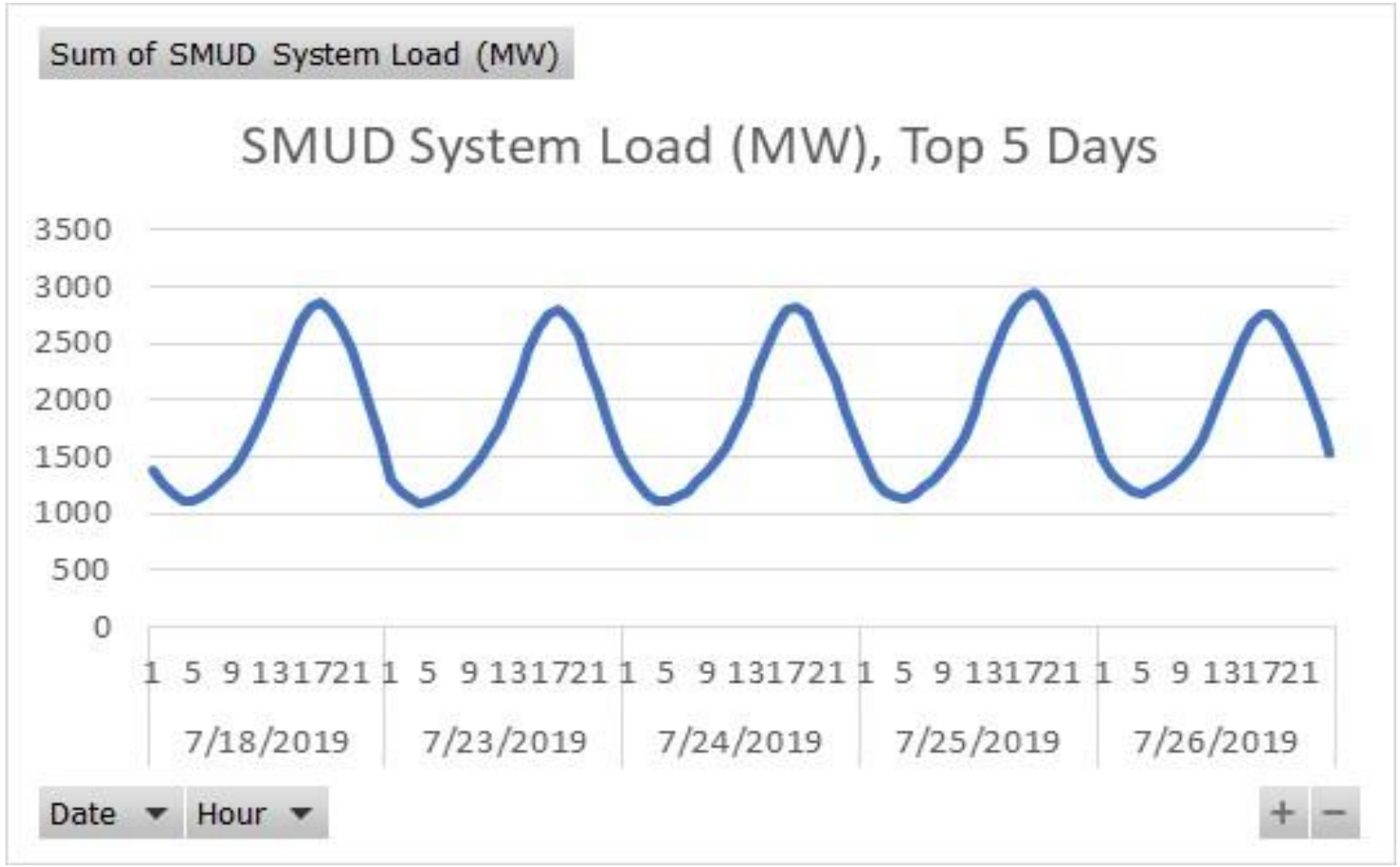
Build Margin Concepts

- Key question: do additional DERs affect decisions about new generation capacity in the future
- Is new generation needed? By when? What kind?
- Depends on load growth, plant retirements, portfolio requirements
- Ability to avoid growth-driven capacity depends on renewable resource's match to peak loads
- Renewable Portfolio Standard requirements may necessitate new capacity even if no load growth

Build Margin Examples

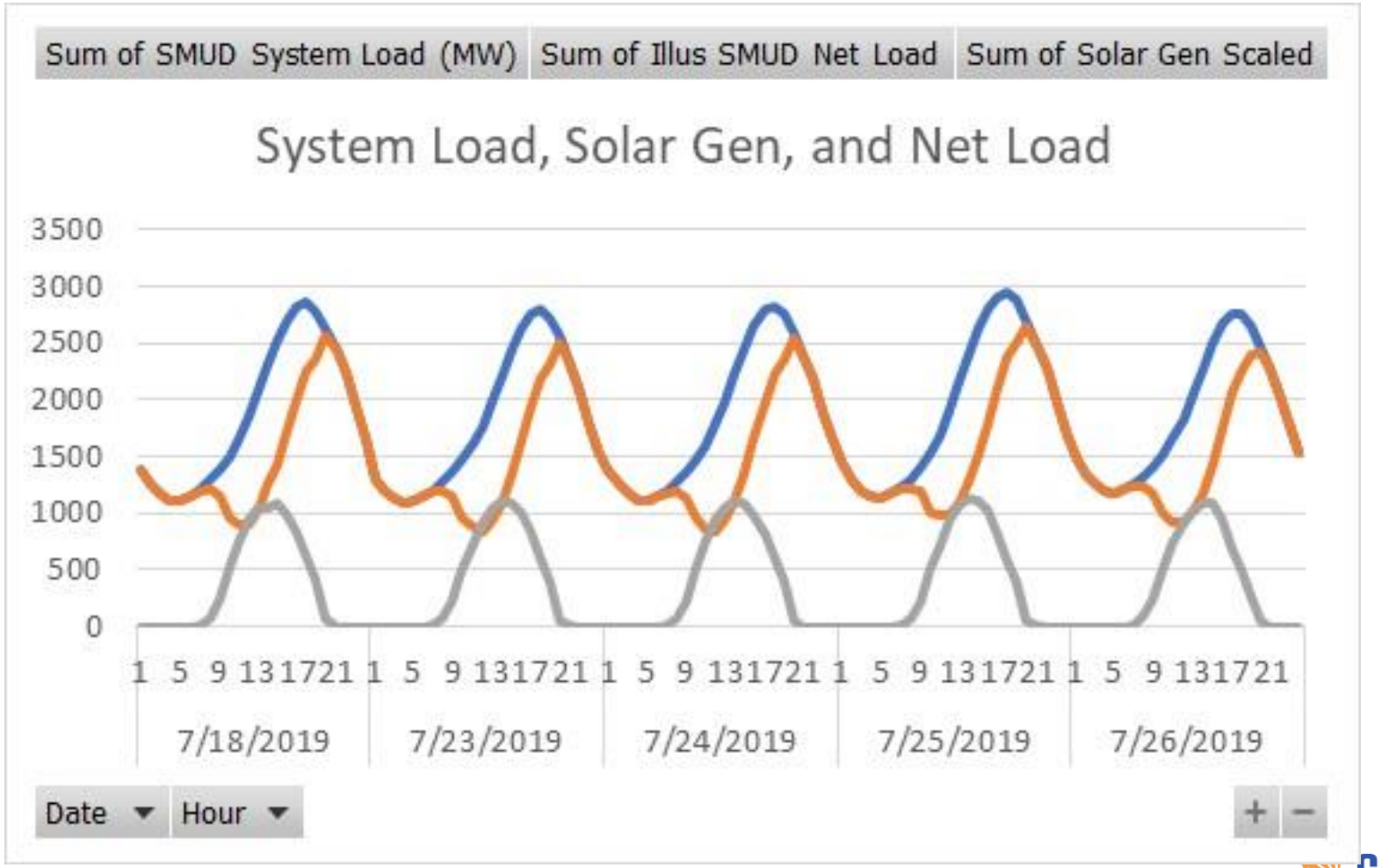
- Load growth triggers the need for new capacity
  - If DER output can match the need, DERs may avoid
  - With RPS in effect, part of the new capacity will be renewable
- Retirement of existing plant triggers need
  - DERs may avoid only new fossil-fired capacity
- Utility is committed to developing a certain amount of new renewables, regardless of RPS minimum requirements
  - No Build Margin effect, DERs operating margin effect continues indefinitely

Capacity Value: Primarily Driven by Peak Load Requirements



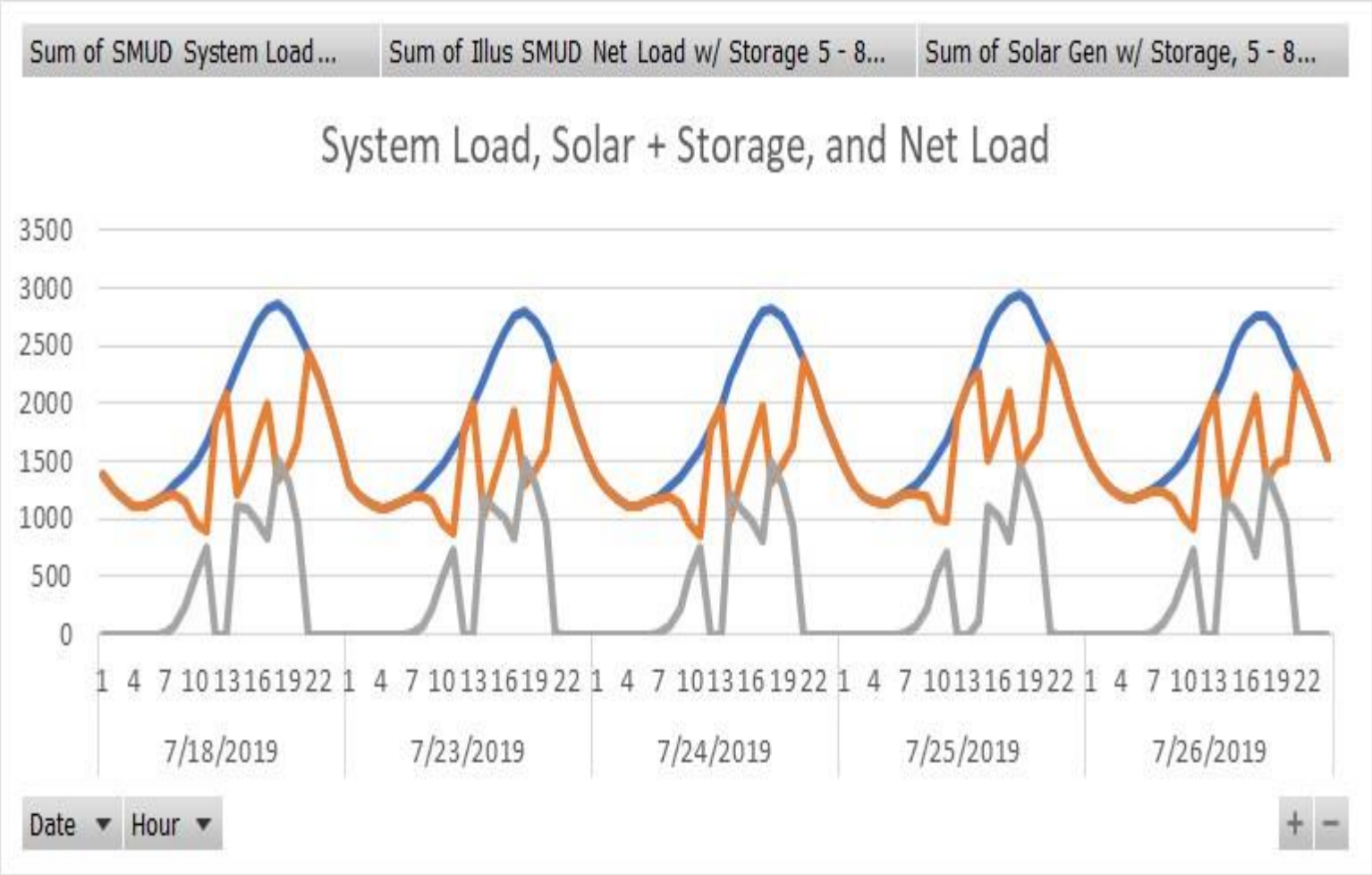
CALIFORNIA SOLAR + STORAGE ASSOCIATION

Example of Capacity Value of NEM Solar



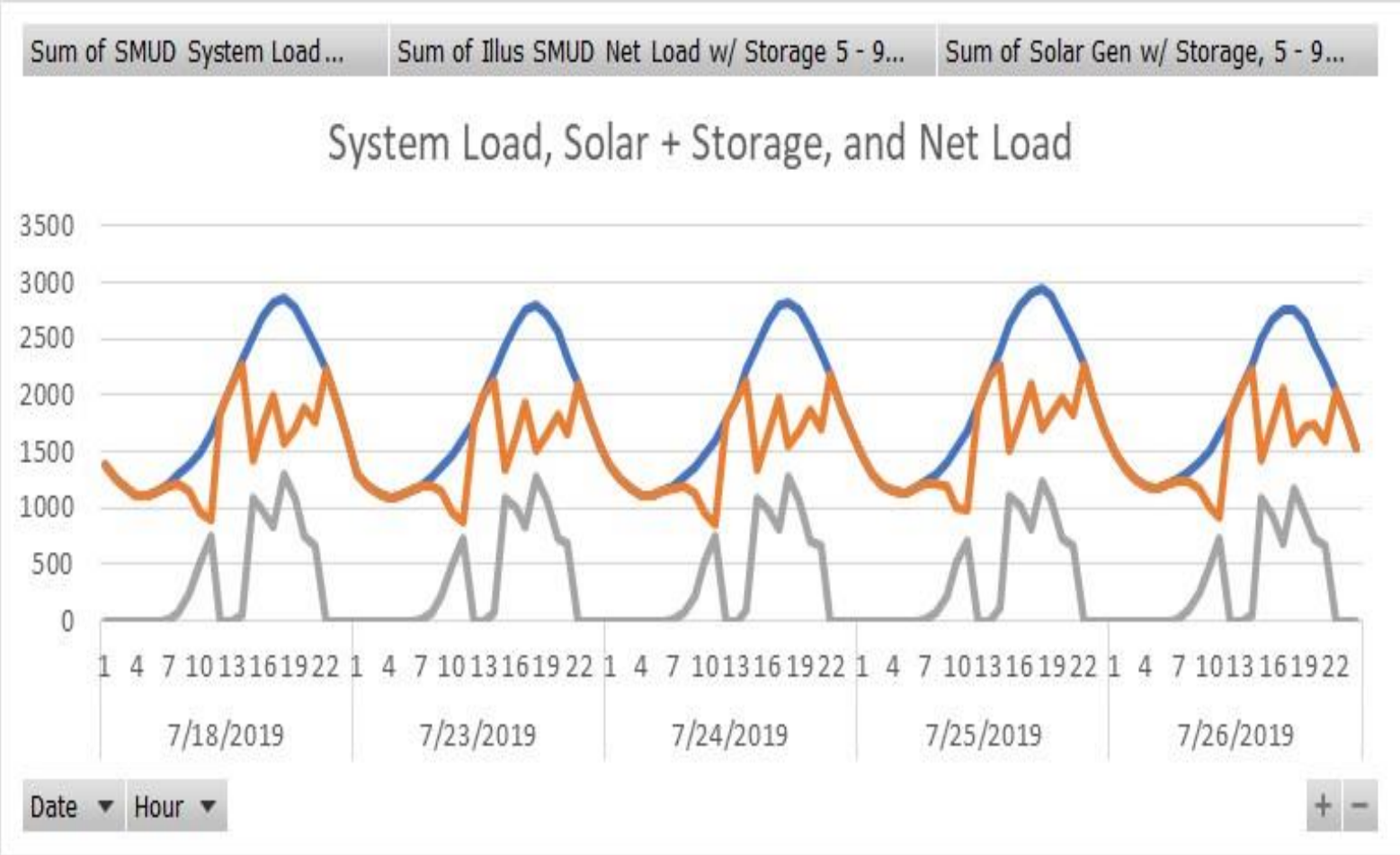
CALIFORNIA SOLAR + STORAGE ASSOCIATION

Capacity Value of NEM Solar + Storage, 5 – 8 Peak TOU Rate



CALIFORNIA SOLAR + STORAGE ASSOCIATION

Capacity Value of NEM Solar + Storage, 5 – 9 Peak TOU Rate



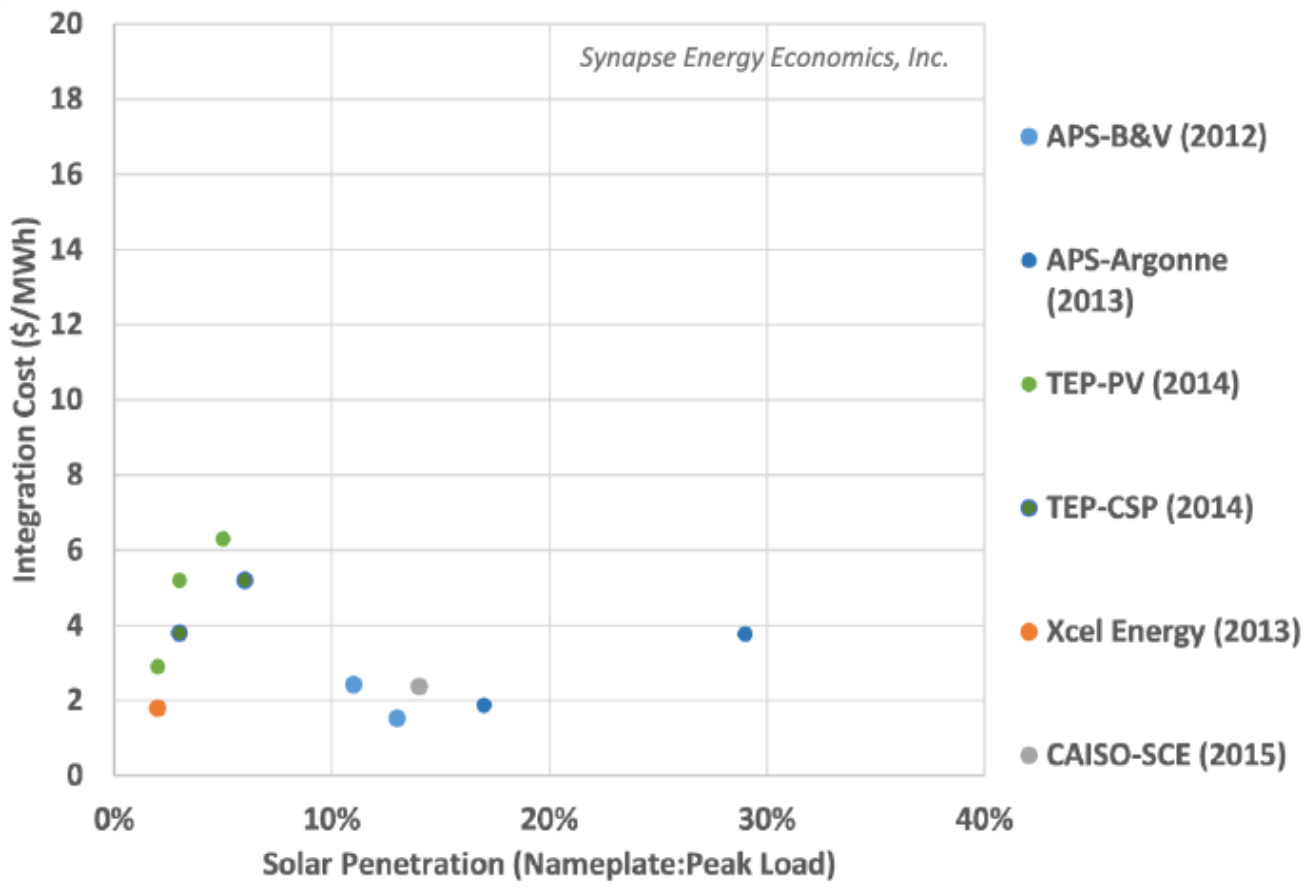
CALIFORNIA SOLAR + STORAGE ASSOCIATION

Effective Capacity of 1500 MW Solar on SMUD Peak Day

	Solar Only	S + S, 5-8 TOU	S+S, 5-9 TOU
Net Peak Load	2,649	2,498	2,276
Effective Capacity	295	446	668
Effective Capacity, % of Solar	20%	30%	45%
Peak Hour	7 - 8 pm	8 - 9 pm	2 - 3 pm

Solar Integration Costs

Figure 3. Solar integration cost by level of penetration



Synapse Energy Economics, "Remodeling the Grid." 2015.

https://www.synapse-energy.com/sites/default/files/Costs-of-Integrating-Renewables.pdf

CALIFORNIA SOLAR + STORAGE ASSOCIATION