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CEC Demand Response Working Group

E3/CAISO Perspective

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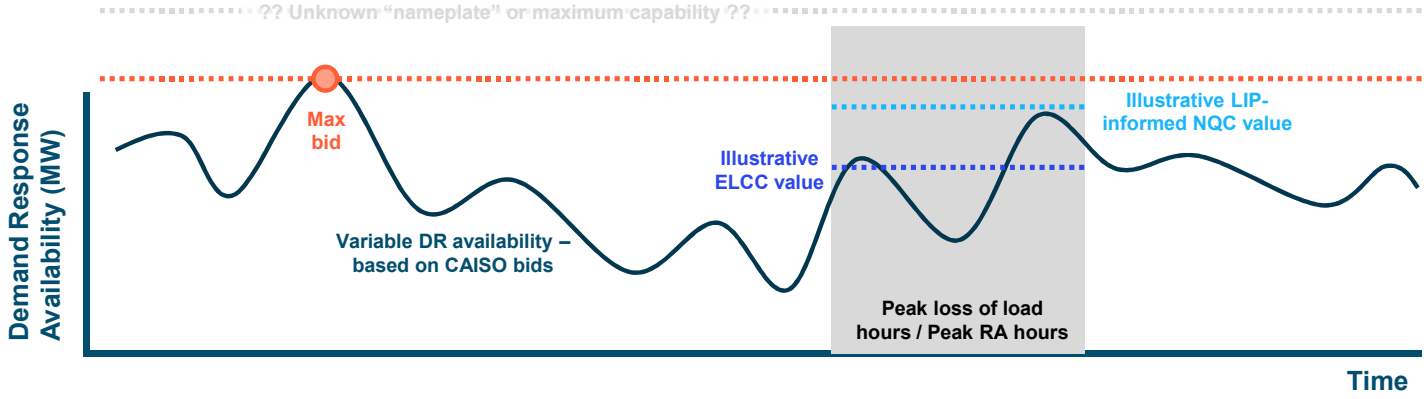
Energy+Environmental Economics

Zach Ming, Director

LIP vs. ELCC vs. Nameplate

- **DR resources have variable hourly availability profiles**
  - Hourly availability profiles are a reduction below the "maximum" capability of DR resources since hourly availability represents the expected aggregate response and not all resources respond at their maximum capability at the same time
- **"Nameplate" capacity of demand response is both an unknowable an unnecessary value to calculate DR ELCC**
- **Both the load impact protocol (LIP) informed net qualifying capacity (NQC) and effective load carrying capability (ELCC) methodologies attempt to quantify NQC of DR resources (i.e. capacity during hours of highest importance for system reliability)**
- **ELCC is calculated using bids measured in MW and results in an ELCC MW output**
  - This is true for all resources: solar, wind, storage, DR
  - For resources with a "nameplate" capacity like wind or solar, an ELCC % can be calculated by dividing the ELCC MW by the nameplate MW
- **The % de-rates that E3 has calculated represent how much the LIP-informed NQC estimates overvalue the ELCC of demand response**

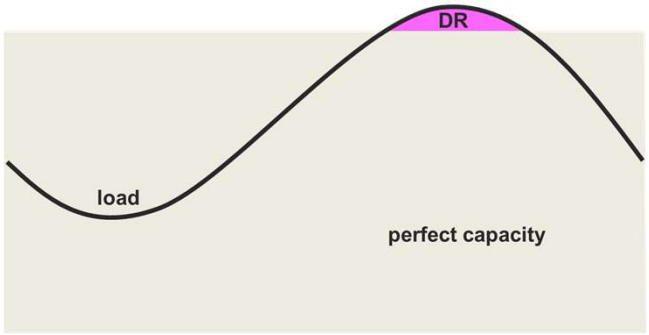


Examining "First-In" vs "Last-In" ELCC

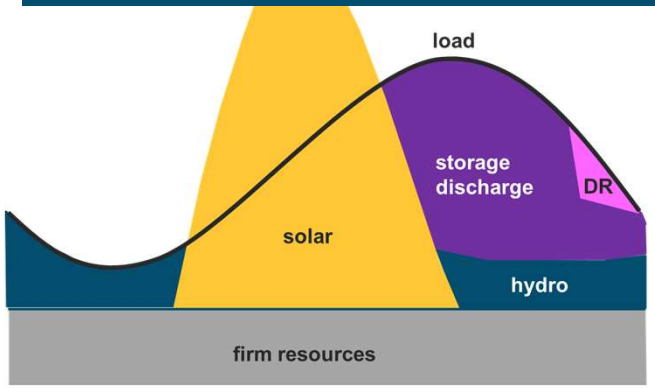
+ **Any ELCC calculation must make an assumption about the background portfolio that the ELCC resource is being added to**

"First-in" ELCC is the ELCC that results from adding a resource to a fictional portfolio of perfect resources (one with no solar, wind, storage, or even gas resources with forced outages)

First-In ELCC



Last-In ELCC



"Last-in" ELCC is the ELCC that results from adding a resource to the actual portfolio for a given year (with all expected solar, wind, storage, etc.). Last-in ELCC is the equivalent of "marginal" ELCC

+ **Common misconceptions**
  - "First-in" and "Last-in" nomenclature are simply different measurement techniques and have nothing to do with the California loading order that preferences demand-side resources
  - "First-in" and "Last-in" have nothing to do with the "order" in which resources are dispatched – in all cases, resources are dispatched optimally to provide maximum reliability given their capabilities. DR always dispatches "last" in the stack given its high cost and use limitations
    - DR Dispatches differently in last-in because the hours of importance are different (i.e. in the evening instead of mid-day)
  - "Last-in" ELCC is actually how DR is dispatched since it *is* dispatched in conjunction with all other resources
+ **"First-in" and "Last-in" measurements are each necessary because neither on their own can be used to characterize the aggregate portfolio ELCC of all resources working and interacting together**
+ **E3 measured "first-in" and "last-in" for 2020 and 2030**
  - The 2030 "first-in" DR ELCC is largely the same as 2020 since it does capture any impact from a changing portfolio
  - The 2030 "last-in" ER ELCC is lower than 2020 since it captures the significant quantity of expected storage that provides a similar and competing service as DR

Evaluating DR ELCC Across Multiple Weather Years

- **Assessing DR performance across a range of weather years provides a more robust assessment of its true capability toward reliability**
  - Just looking at a median "1-in-2" demand year may underestimate DR's ability to provide more load reductions in more extreme conditions
- **DR availability profiles for today's programs and performance must be simulated under historical weather conditions (or better yet climate-adjusted synthesized weather conditions) because historical DR availability is not representative of today's programs**