Energy Storage Assessment

as part of the LCR study

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Topics

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- Energy Storage Assessment approach
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Introduction

- Energy storage is an essential part of the resource mix. It compliments the development of renewable generation.

- As part of the annual LCR study, the ISO has been assessing the maximum amount of energy storage that can be added to a local capacity area from the charging restriction perspective.

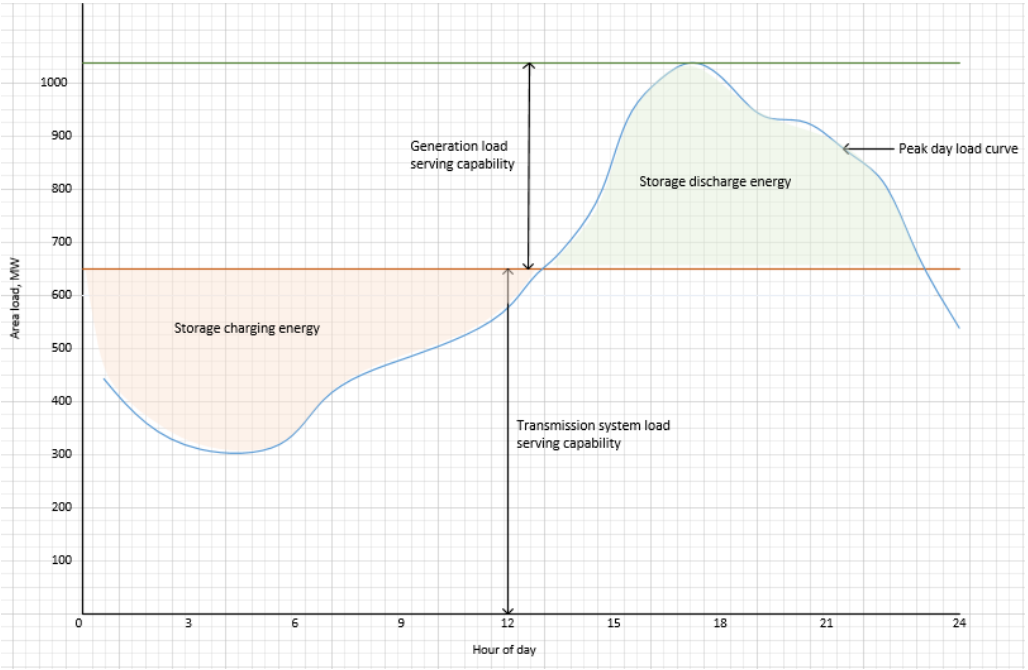
- The purpose of this presentation is to outline the approach of the energy storage assessment as part of the LCR study.

Energy Storage Assessment Approach

- Perform a 24-hour validation:

  - this to make sure that there will be sufficient window and system capacity to be able to charge the battery for the next day peak under the worst contingency condition

  - this includes hour-by-hour comparison of the net load versus the total (transmission + generation) load serving capability



Key assumptions used in energy storage assessment

Assumption	Rationale
Storage added displaces existing generation (all types) MW for MW in aggregation.	To maintain local RA capacity. Any incremental storage is assumed to be a local RA resource.
Maximum storage addition cannot exceed LCR amount.	To maintain local RA capacity. Any incremental storage is assumed to be a local RA resource.
Includes storage charging/discharging efficiency of 85%.	Based on general battery efficiency.
Storage is charged in all hours where the storage is not discharged. Maximum charging is capped at the amount of storage size (Pmin).	Under worst contingency condition, for battery to have sufficient discharge energy, it is assumed that battery is charged in all hours it is not discharged.
An hourly energy margin of 5% or 10 MW, the larger of the two, is applied to both charging and discharging need.	To add margin when battery is discharging so it does not have to follow load curve exactly. For charging same margin is added to discount available system capability each hour.

Load Data & Load Serving Capability

Net load profile

- For LCR areas that have load forecast from CEC, use the CEC hourly forecast directly.
- For LCR area that don't have load forecast from CEC directly, we will need to create one by using historical load profile.

Load serving capabilities

- Transmission-only load serving capabilities are calculated in power flow under the worst LCR contingency.
- For some local areas, we may need to rely on the spreadsheet based calculation using DC effectiveness factors.
- The transmission-only load serving capability is used uniformly for each hour within the 24-hour validation.
- Local generation load serving capability is calculated under the same worst LCR contingency condition considering effectiveness of the aggregate of local generation to the constraint.

Load Serving Capability (contd..)

Load serving capabilities

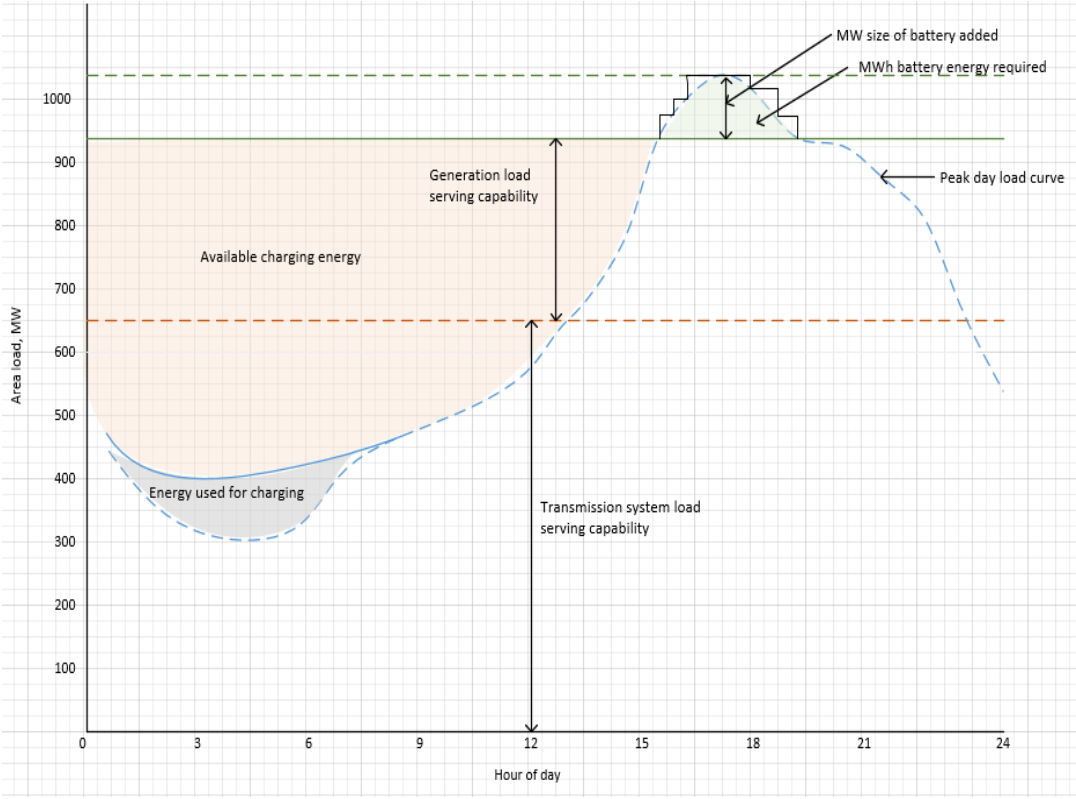
- Captured separately for different resource technologies due to different output profiles within the 24-hour period.
- The conventional thermal resources are assumed to have uniform capability throughout the 24-hour period, whereas, the renewables, like solar and wind are dispatched using appropriate output profiles.
- The use-limited resources, like storage and demand response are to be dispatched within the period of peak load hours staying within the available total energy.
- The transmission-only and the local generation load serving capabilities are then added together to get the total load serving capabilities for each hour.
- With the transmission-only load serving capability and generation load serving capabilities calculated using LCR resources, each hour should have sufficient load serving capability to serve the net load. This provides the setup for energy storage addition estimation.

Estimating Energy Storage Addition

- The additional amount of storage can be estimated by adding storage and displacing existing local area LCR resource by the same amount.

- The storage added then can be dispatched within the hours where the net load serving capability is less than net load (deficient hours). An hourly energy margin of 5% or 10 MW, the larger of the two, is added to the storage MW needed for each of the deficient hours. This is done to create a step dispatch in the storage operation instead of following the load curve perfectly.

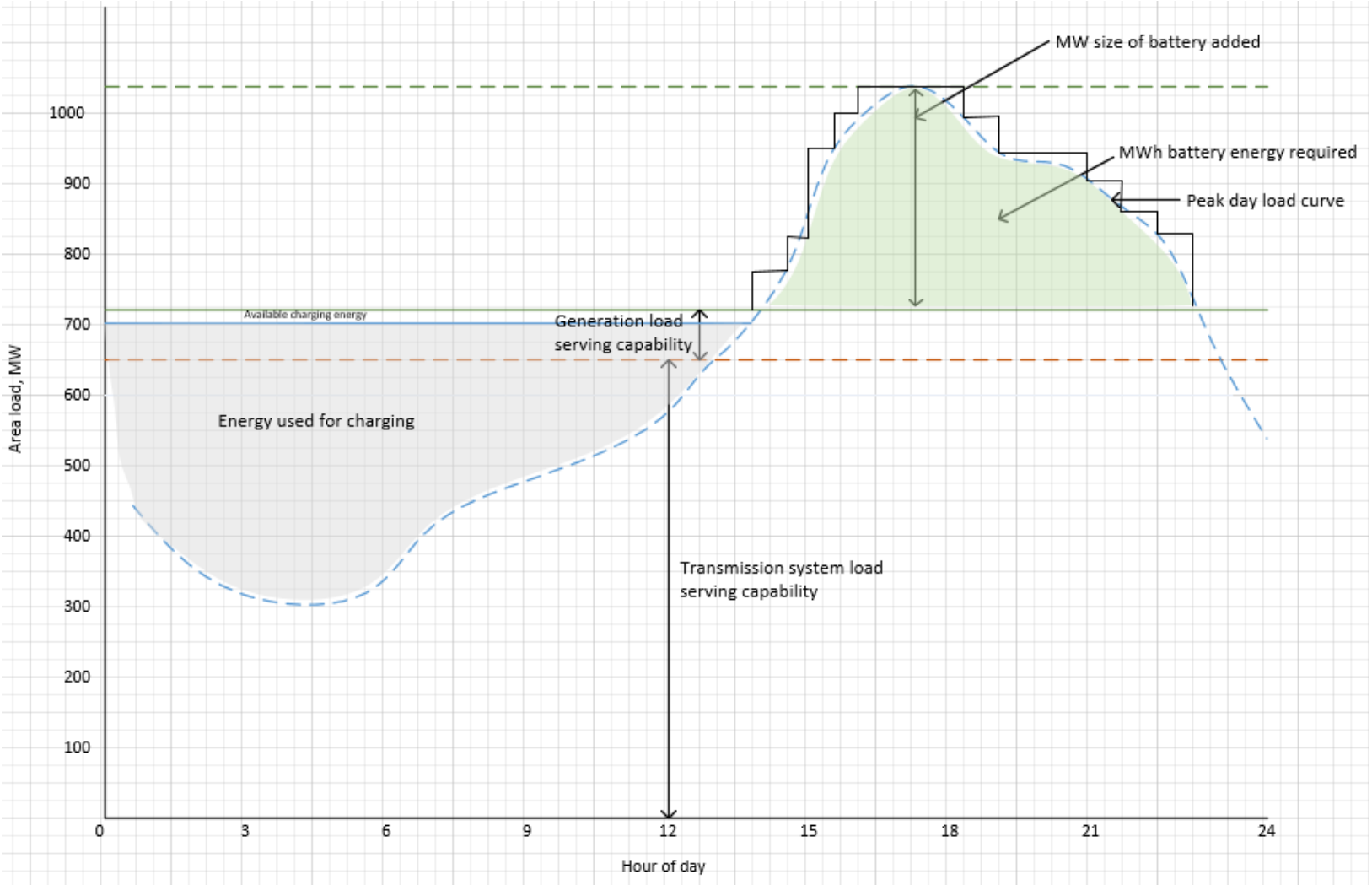
- Once the storage is dispatched for all the deficient hours with appropriate amount, the storage MW dispatched are added together to get the total storage energy (MWh) need associated with the storage MW chosen.



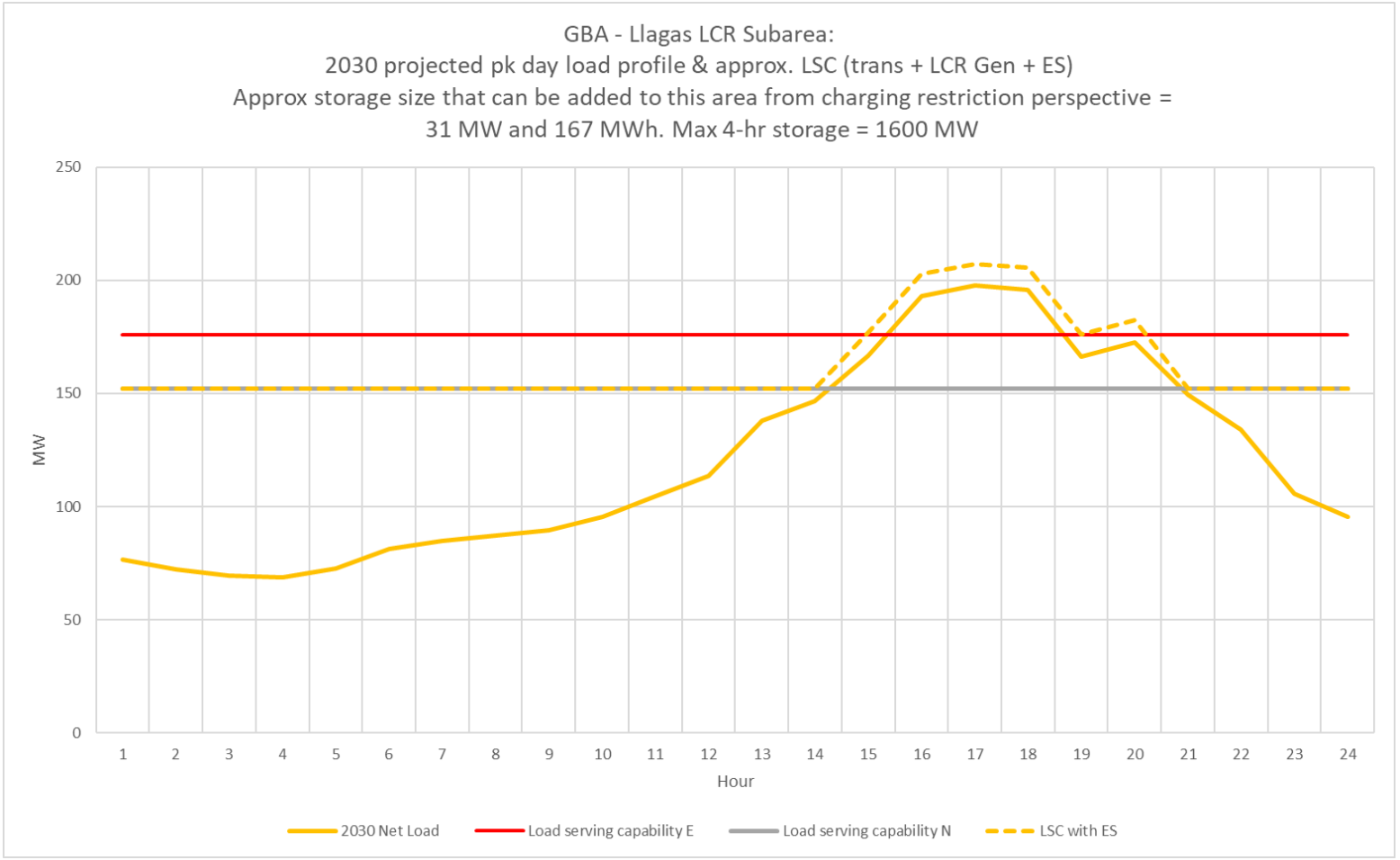
- The storage is charged within the hours that it is not discharged by using the surplus load serving capability. An hourly energy margin of 5% or 10 MW, the larger of the two, is reduced from the surplus load serving capabilities to account for potential inaccuracies in load forecasting and in calculating various load serving capabilities.

- The process is repeated by increasing or decreasing the chosen storage MW until the total discharging energy becomes equal to the total available charging energy, which establishes the maximum amount of energy storage that can be added to the local area from the charging restriction perspective.

Energy storage amount



Estimated energy storage amount reporting



1-to-1 Replacement with 4-hour Storage

Majority of LSEs are procuring (4 MWh for every 1 MW) batteries (due to current CPUC rules for system RA counting)

The ISO has introduced "Maximum MW quantity of (4 MWh for every 1 MW) battery as 1 for 1 replacement" of resources needed in that local area or sub-area

- Beyond this limit batteries may not reduce the need for other local resource on a 1 for 1 basis.

Iteration 1 – 100 MW energy storage added