



## Item 8.1: Impact of Limited Duration Resources on Emergency Operations

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Board of Directors Meeting

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### Purpose

To inform the Board and Market Participants about an emerging issue that will impact several current initiatives which would otherwise be based solely on existing Energy Emergency Alert (EEA) Physical Responsive Capability (PRC) triggers.

### For information only

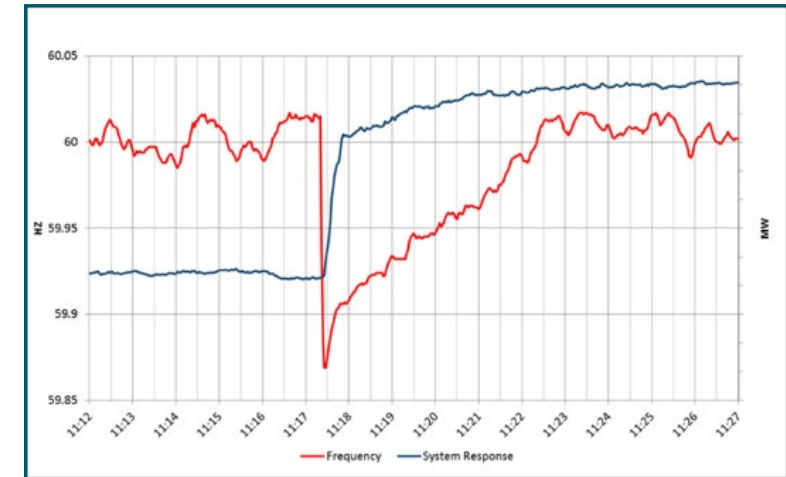
No action is requested; for discussion only.

### Key Takeaways

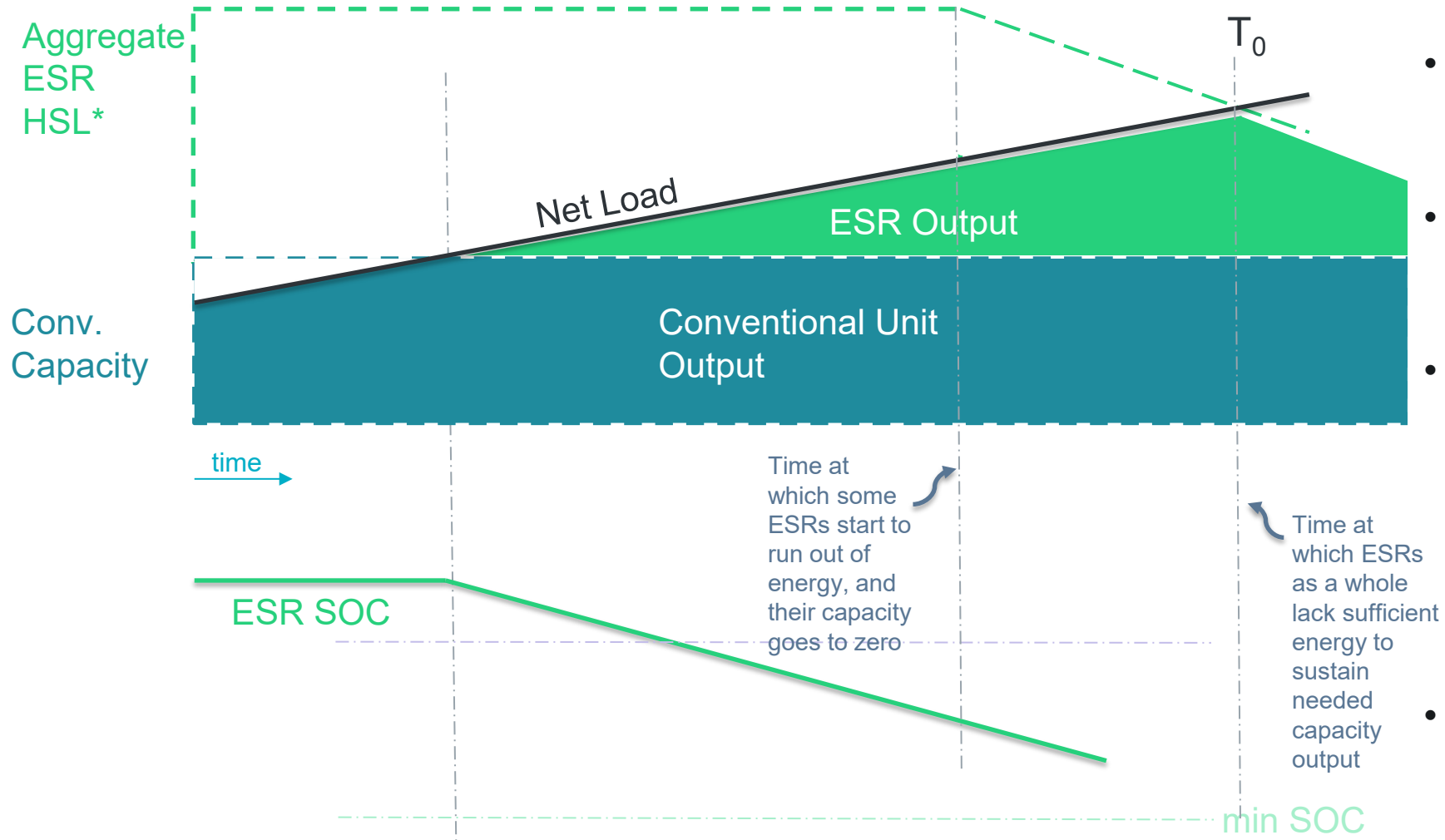
- With more Energy Storage Resources (ESRs) on the Texas power grid, understanding fleet ESR State of Charge (SOC) becomes critical when operating reserves start to decline.
- ERCOT will need to forecast when ESRs run low on SOC to ensure enough reserves remain to cover most severe single contingency (approximately 1,500 MW).
- This requires additional triggers for EEA 1, 2 and 3 processes and earlier implementation of EEA to use available emergency tools.

## Background: Energy Emergency Alert (EEA) Level 3 Criteria

- ERCOT must maintain sufficient frequency-responsive capacity (measured as PRC) to withstand loss of Most-Severe Single Contingency (MSSC) without hitting Under-Frequency Loadshed (UFLS) trigger
  - Studies have determined that at least 1,500 MW of PRC is needed to arrest frequency during system conditions when low PRC is likely to occur
  - ERCOT will declare EEA3 and shed Load to maintain 1,500 MW of PRC
  - If the largest unit were to trip and the reserves begin to be used to replace the lost capacity, there must be sufficient time to shed additional Load before the energy from those reserves is exhausted
  - Since TSPs have up to 30 minutes to implement loadshed, and may have some response time, NPPR 1273 changed calculation of PRC to ensure that reserves counted in PRC are able to be sustained for 45 mins
  - Recent events have illustrated that this change may not have been sufficient, as illustrated in the following example



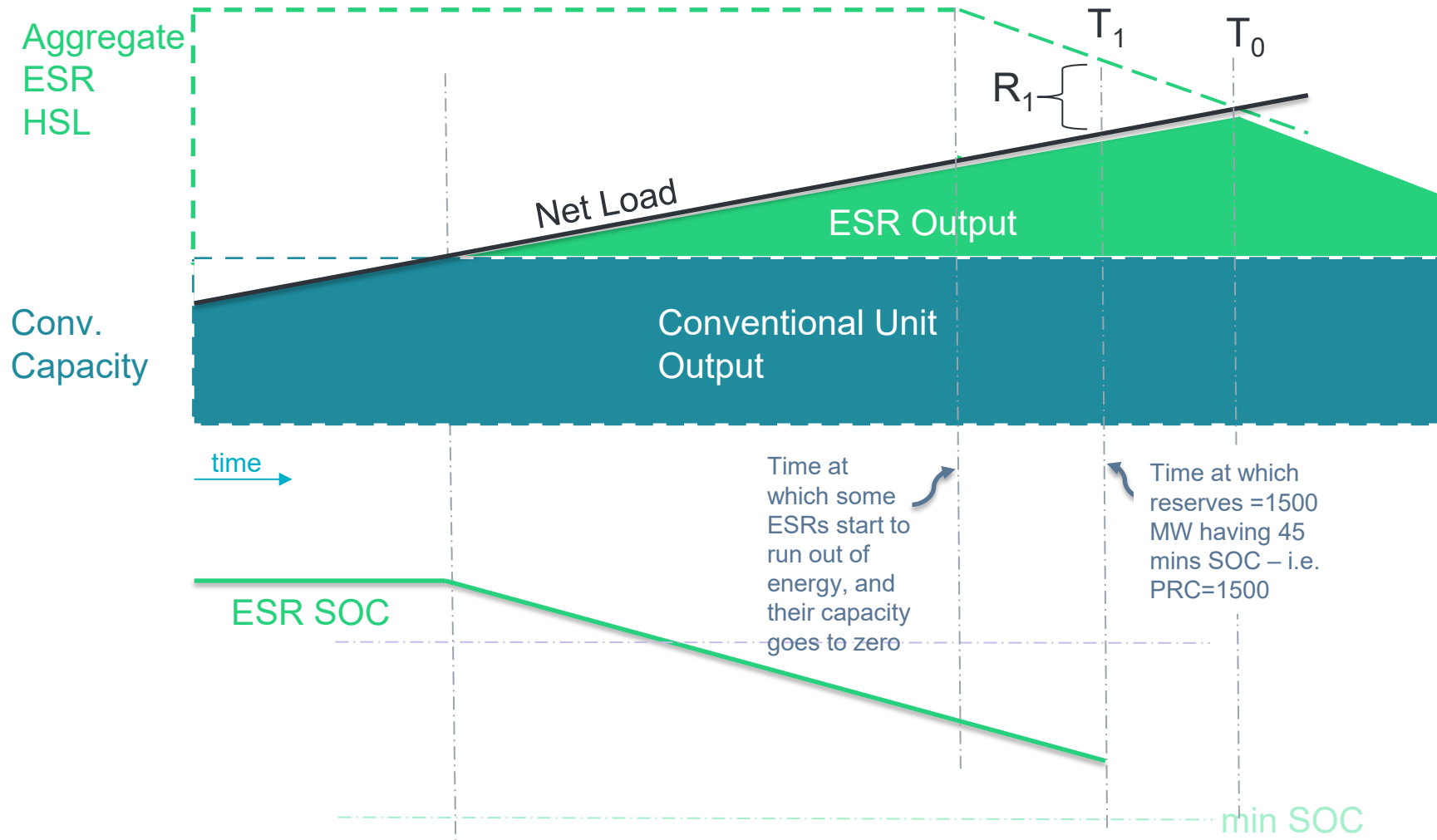
# Simplified Illustration of ESR Energy Depletion on Reserves



- Highly simplified example to facilitate illustration of concepts
- With sustained output, some ESRs will start to run out of charge
- At some point in time, defined as  $T_0$  for this example, the ESRs that have energy remaining cannot provide enough output (in MW) to match Load
- At this point, frequency on the system will start to decline unless other actions are taken

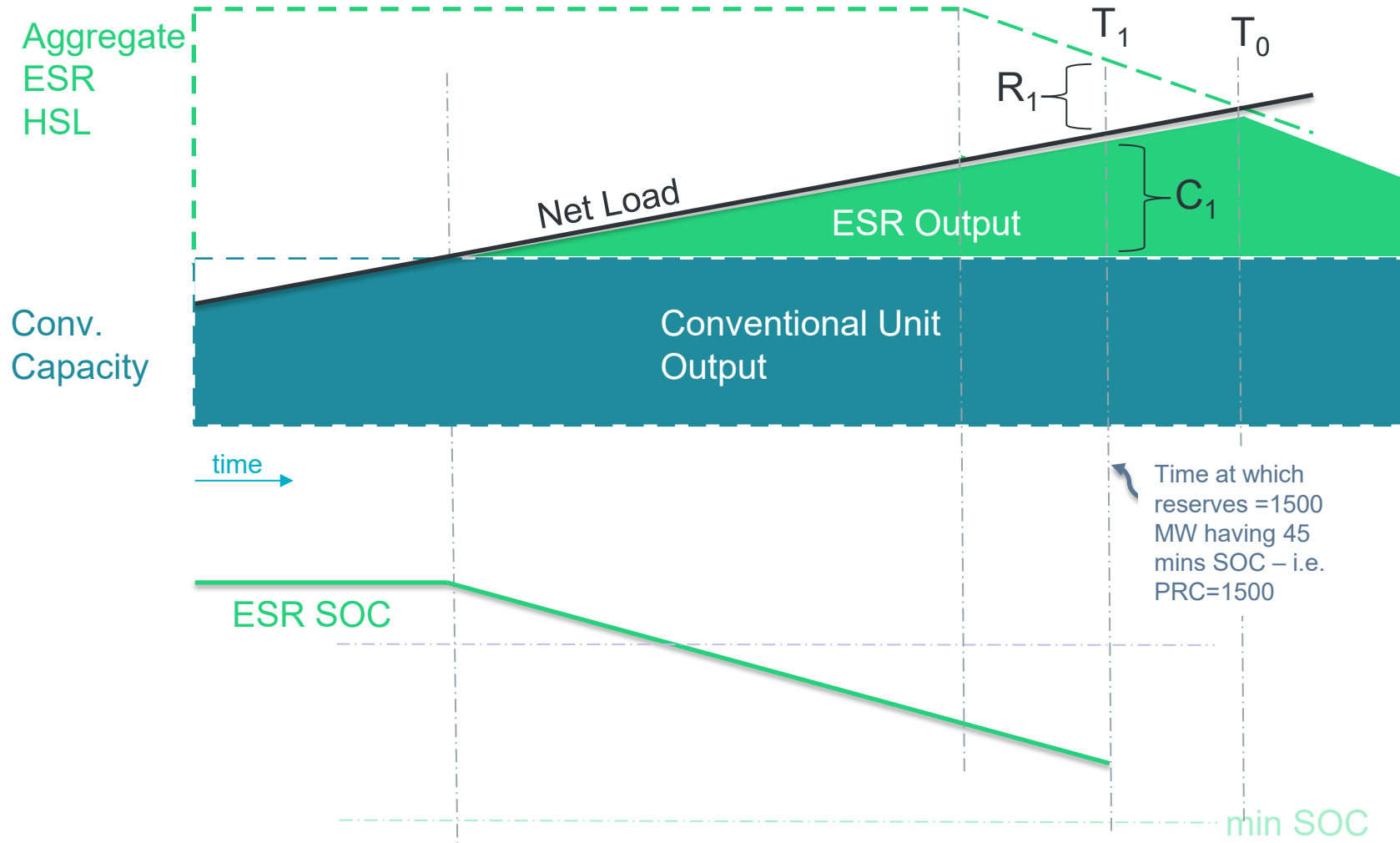
\* High Sustainable Limit

# Current EEA3 Trigger in this Example



- For this example,  $T_1$  is defined as the time at which the reserve capacity ( $R_1$ ) that can be sustained for 45 minutes is 1,500 MW. Assuming all reserve capacity is frequency-responsive and would count as PRC, then this is when EEA3 would be declared currently

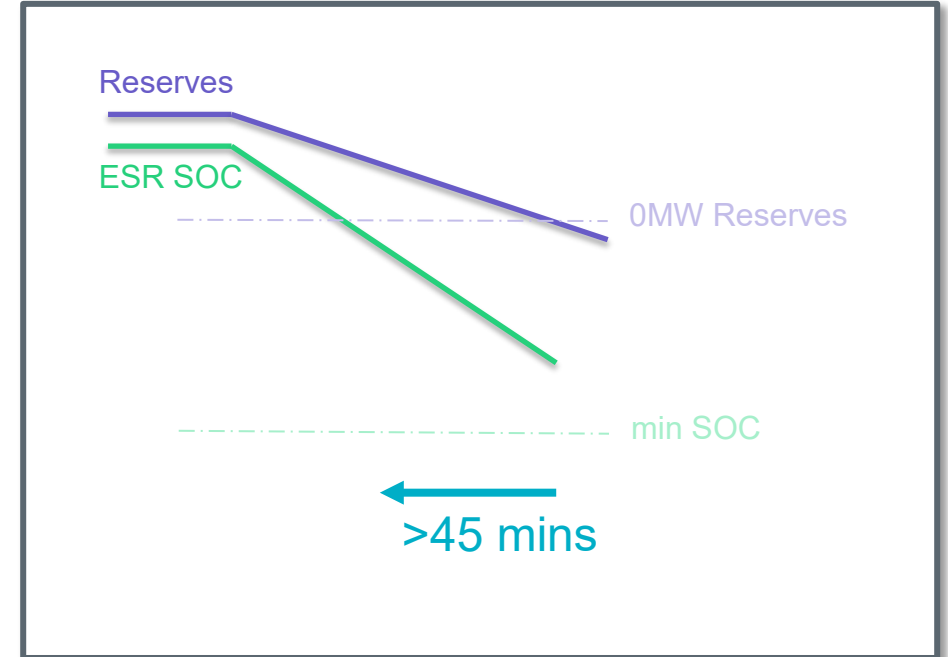
# Impact of Limited-Duration Capacity on Current EEA Trigger



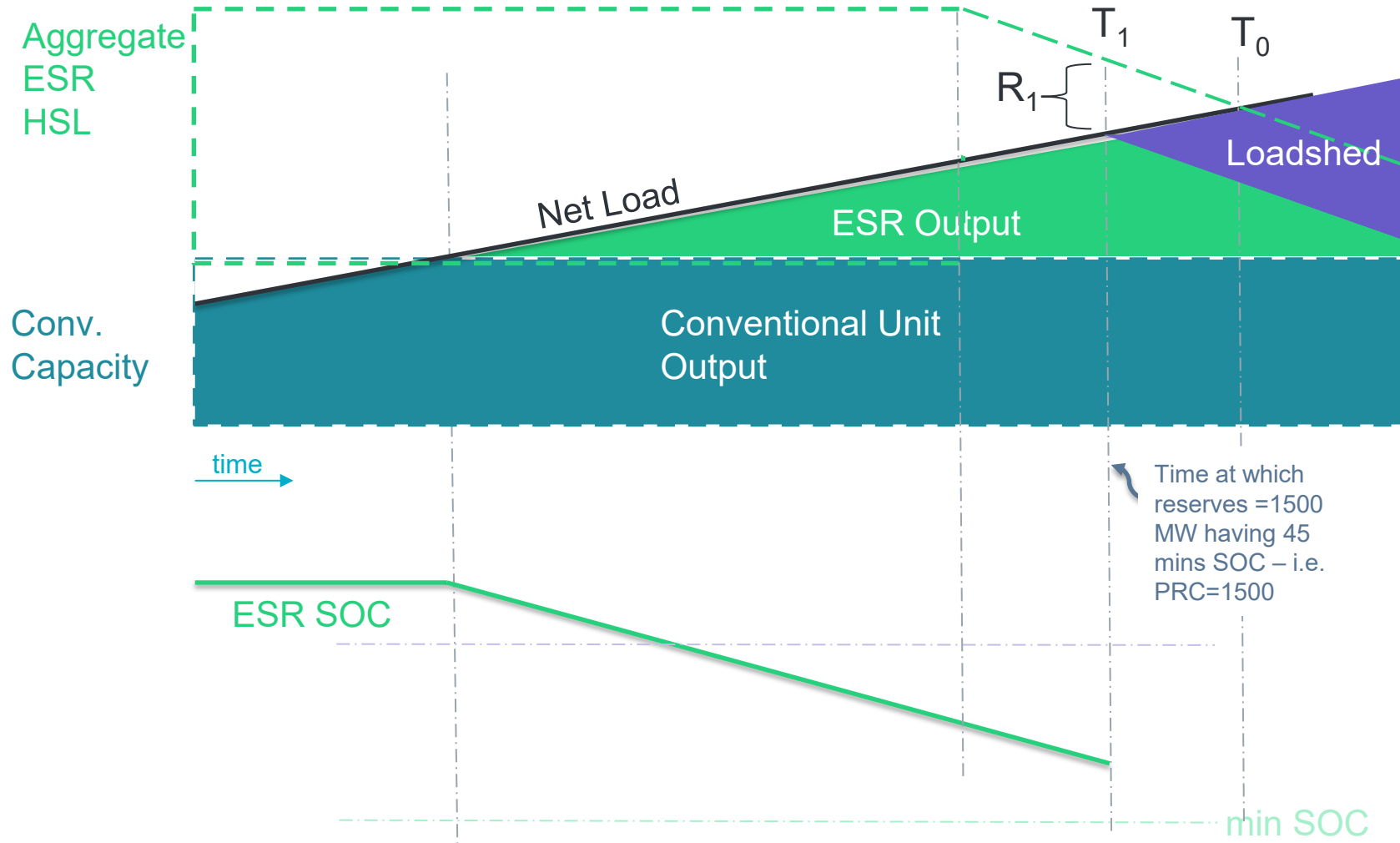
- However, there is no guarantee that the ESR output level being used to serve Load at that time (shown as  $C_1$ ) is capable of being sustained for more than 5 mins
- e.g., If >1,500 MW of ESR capacity that was included in  $C_1$  only had 5 mins SOC, then reserves would go negative in the next 5 mins
- Therefore, the system could go from barely reaching the EEA3 PRC level to being in significant frequency decline within 5 mins

## Need to Forecast Impact of SOC Depletion and Take Action in Advance

- To prevent that frequency drop, ERCOT would need to recognize this need and issue loadshed instructions *in advance* of when reserves drop to that level
- This means ERCOT must forecast, at least 45 minutes ahead of time, when the SOC on the ESRs (both those currently serving Load and those in reserve) will be depleted to the point that system reserves will drop
- If TSPs can commit to shed some amount of Load in less than 30 minutes, then that would reduce this 45-min lead time (and the potential higher uncertainty associated with it). Need to explore this possibility



# Accounting for Decreasing ESR SOC in Loadshed



- The amount and timing of loadshed must be sufficient to cover:
  - the increase in net Load;
  - replace the capacity from ESRs that run out of charge;
  - maintain 1,500 MW of reserves that can be sustained for 45 mins; and
  - reduction must start at about T1

## Conclusions from this Simple Example are Applicable

- Simplifications in this example are only intended to allow easy graphical representation of the impact of depletion of ESR's SOC
  - SOC is not depleted uniformly
    - Each ESR may start at different SOC
    - Different ESRs have different durations
  - Net Load is not a straight line
  - Conventional generation may not be “maxed out” under these circumstances; will need to implement other initiatives related to Reliability Unit Commitment (RUC) and Security-Constrained Economic Dispatch (SCED) to make this so
- ...but the conclusions still apply without these simplifications
  - ERCOT needs to forecast depletion of SOC over some near-term period
    - This is a complex and uncertain calculation
    - Potential to use existing look-ahead SCED, but may need to make some modifications
  - ERCOT needs to take action in advance to prevent total SOC depletion
  - ***PRC may not be at EEA levels when ERCOT needs to take emergency actions***

## Next Steps

- ERCOT will propose a new measure to assess the need for EEA. Currently considering to call this Limited Energy Capacity Reserve (LECR)
- LECR represents the forecasted reserve “headroom” in MW that can be sustained for 45 minutes, accounting for the impact of the depletion of SOC on the available capacity of ESRs
- PRC only measures the current, sustainable, frequency-responsive headroom, regardless of how ESRs may be dispatched. LECR, by contrast, will be a dispatch-aware metric that looks ahead in 5-minute steps over at least the next hour to estimate future sustainable headroom after accounting for projected SOC depletion
- LECR will serve as an additional trigger for each level of EEA, *e.g.*:
  - If LECR is expected to drop below 1,500 MW within the next 45 minutes, then ERCOT would declare EEA3; maintaining 1,500 MW of LECR at T+45 should result in sufficient PRC at that future time
  - LECR triggers for EEA1 and 2 will be set to allow sufficient time to implement action(s) so that, to the extent possible, they prevent depletion of the SOC to the point that the “next” trigger is reached
- ERCOT will propose an NPRR to implement these changes