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Using Long-Duration Storage to Reduce Portfolio Carbon Emissions Risks

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Executive Summary

Future system conditions present risks and opportunities to CAISO market participants

To support California's decarbonization goals, the California Public Utilities Commission (CPUC) requires Load-Serving Entities (LSE) to satisfy CO2 emission reduction targets for 2030 and 2035.

LSE's demonstrate compliance by submitting their procurement plans using the CPUC's Clean System Power (CSP) workbook. To facilitate this, the commission pre-defines most inputs in the CSP workbook based on the CPUC's forecast of system conditions.

This study demonstrates how an alternative forecast of future system conditions presents both risks and opportunities to CAISO market participants.

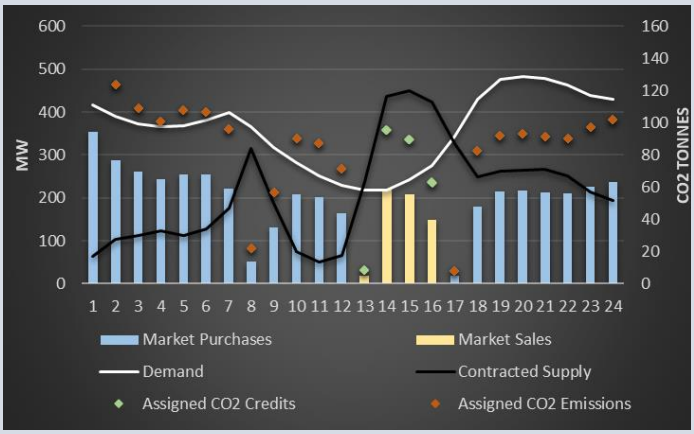

Figure ES-1: 24-Hour Sample Period of Net Market Transactions and CO2 Emissions for a Representative Portfolio

Key Findings

- The *Alternative Case* model built for this study indicates areas where the future system conditions may differ from those in the Commission's *Base Case*.
- In the Alternative Case, a previously compliant LSE's CO2 emissions are projected to be 20% higher in 2035 compared to the Base Case, exceeding the portfolio's assigned benchmark.
- Adding 115 MWs of 8-hour storage to a sample representative LSE portfolio can reduce emissions sufficiently to bring it back into compliance with the portfolio's assigned benchmark.

Alternative Case

In order to assess the risks of differing future system conditions, the authors define an *Alternative Case* based on their own forecasting models.

The Alternative Case expects that a

a) surge in solar and wind development will result in more curtailments
b) grid operators will require higher minimum thermal generation to ensure resource adequacy.

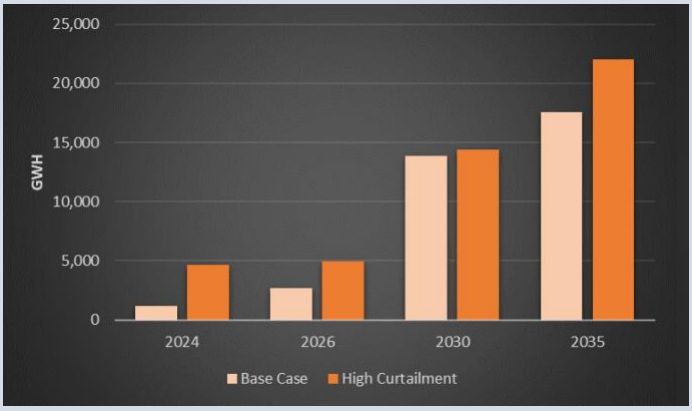

Figure ES-2: Annual Forecasts of System Curtailments. CPUC Base Case vs Authors' High Curtailment Model

Quantifying Risk to LSEs

Using a representative sample portfolio, this study investigates the changes to projected carbon emissions in the Alternative Case.

LSEs face the risk of elevated curtailment levels in two ways:

1) As system curtailment levels rise, the contracted renewable supply produces less emission-free energy than originally anticipated.
2) With more curtailment hours, LSEs are allocated additional carbon emissions from dispatchable fossil fuel generation, known as "System Power."

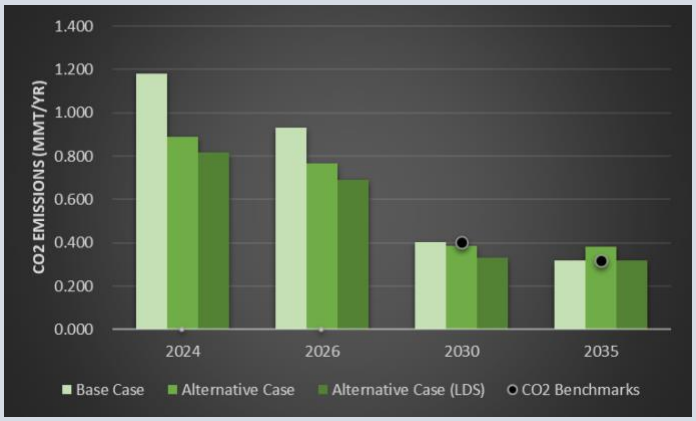

Figure ES-3: CO2 Emissions Footprint of Sample Portfolio

In the Alternative Case, a previously compliant portfolio experiences a 20% increase in its 2035 emissions compared to the Base Case and exceeds its assigned benchmark.

Impact of Long-Duration Storage (LDS) on Emissions Goals

A well-structured portfolio can utilize the excess supply of emission-free energy provided by *other* market participants to reduce *its* CO2 footprint through longer duration storage.

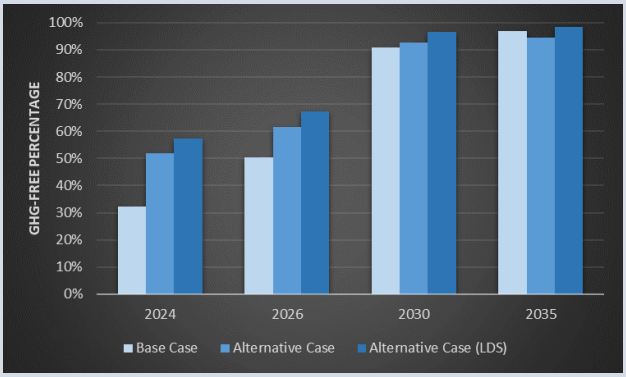

Figure ES-4: Percentage of Sample Portfolio's Retail Demand Served by GHG-Free

By adding 115 MWs of 8-hour storage to the sample LSE portfolio, CO2 emissions are sufficiently reduced to satisfy the portfolio's assigned benchmark.

LDS allows the portfolio to serve an additional 5% of its retail demand with CO2-free energy in any given year.

Foundational Analytic Framework

To effectively manage the intricacies of LSE portfolios and the changing grid, a comprehensive decision-making framework is needed. This framework should encompass portfolio optimization software, access to various forecasting models (including machine learning and fundamental techniques), and the ability to analyze scenarios and apply probabilistic reasoning.