BATTERY ENERGY STORAGE & ERCOT MERCHANT MARKET *WHERE'S THE MONEY?*

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Objective

Our objective is to evaluate the economics of standalone batteries in the ERCOT merchant (wholesale electricity) market based on historical price volatility at various system pricing nodes ("pnodes") under idealized assumptions. We also evaluate how a 30% investment tax credit (ITC) for such projects would increase their profitability. Finally, we evaluate the effect of various long-term price forecasts that assume high and low renewable penetration in the system over the next ten years.

Methodology

For all analyses, we assumed a project sized at 100MW/200MWh operating in the day-ahead and real-time energy markets. Project CapEx and OpEx were estimated using market prices for similarly sized projects. Battery cycling was limited to one per day, and profits were derated using typical annual degradation rates for Li-ion batteries.

First, profitability was evaluated for 687 of 728 pnodes. This analysis was based on historical locational marginal prices over the past year, and the yearly profit was assumed to repeat for next 9 years, minus the effects of battery degradation. Three scenarios, all of which assumed perfect foresight, were considered:

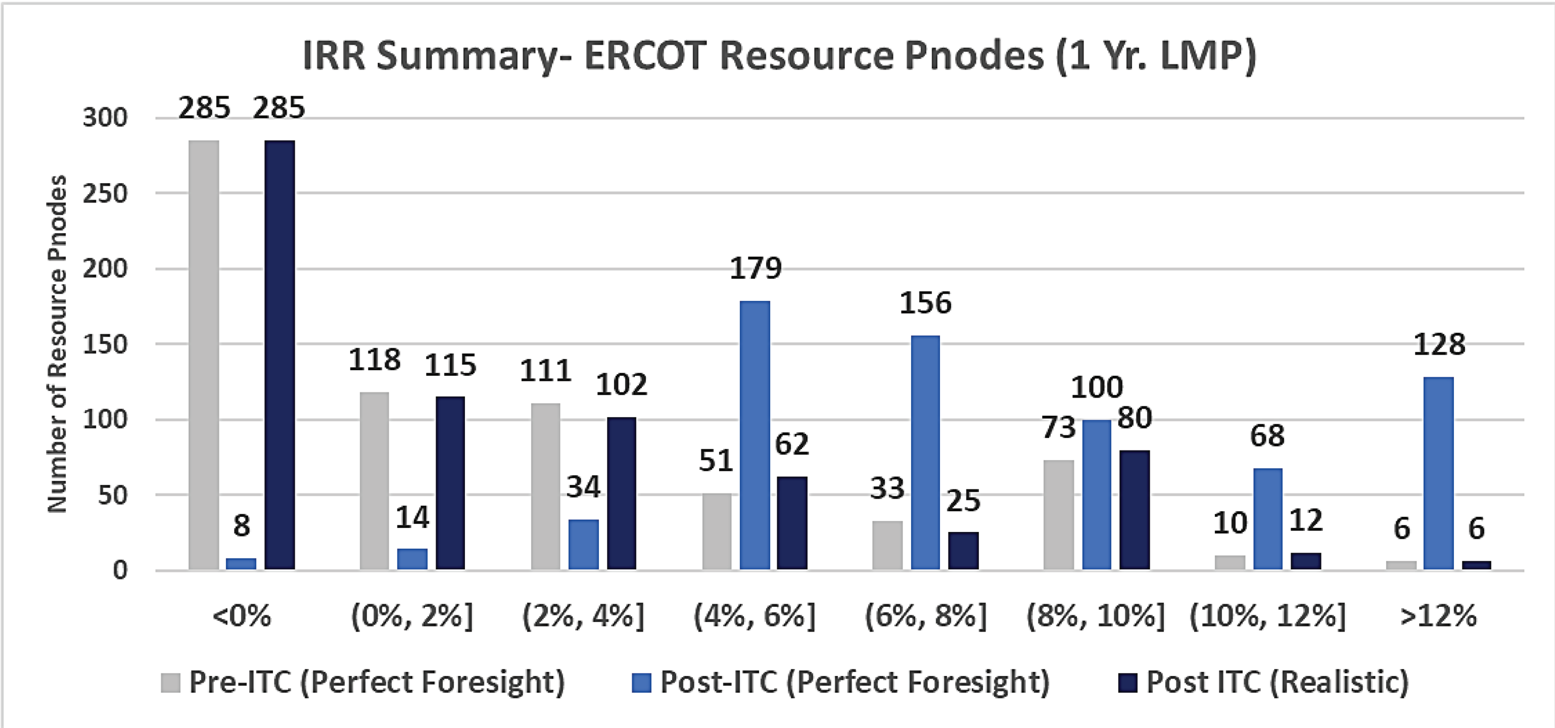
- Pre-ITC: based on perfect foresight on nodal prices
- Post-ITC based on perfect foresight on nodal prices
- Post-ITC(Realistic): which derates the profit of (2)

Additionally, the profitability of a pnode returning low (3%) project IRR, post-ITC, was evaluated using long-term price forecasts based on high and low renewable growth. Proprietary fundamentals and machine learning-based techniques were used to construct two additional ten-year forecasts of prices at this pnode:

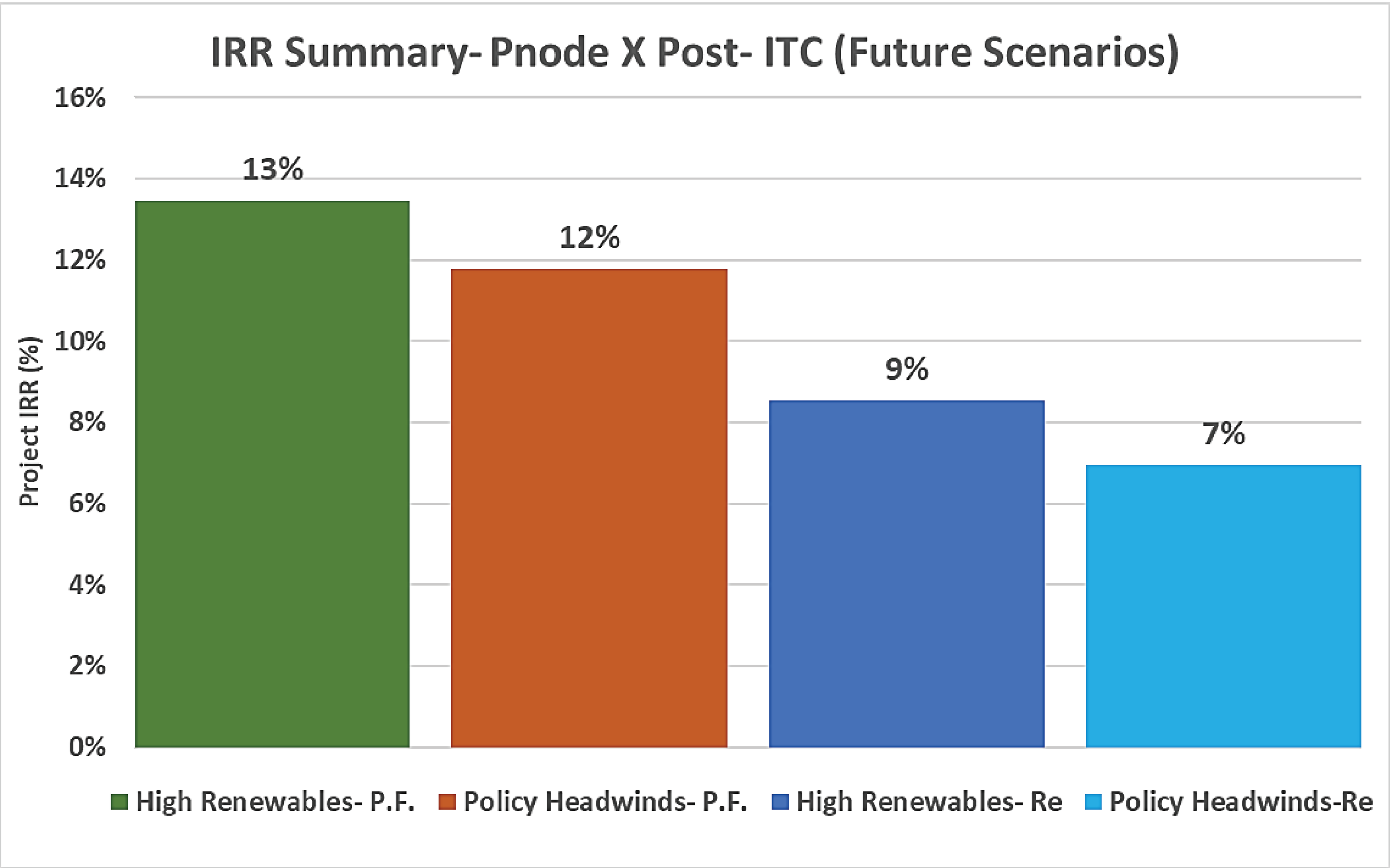
A. **Base case**: Modeled using estimates of demand growth, supply dynamics, renewable energy growth, and transmission flows (i.e., imports and exports).
B. **Policy headwinds**: Modeled with assumptions of less renewable generation growth in the future (roughly 10% less growth than the base case).

IRRs were calculated assuming a ten-year project lifespan. Revenues from ancillary services and federal policy shifts with negative impacts on renewables were not considered.

Results



- **Pre-ITC (perfect foresight)**: 13% pnodes with IRR > 8%
- **Post-ITC (perfect foresight)**: 39% pnodes with IRR > 8%
- **Post-ITC (realistic derate)**: 14% pnodes with IRR> 8%



- **High Renewables (perfect foresight)**: 13% Project IRR
- **Policy Headwinds (perfect foresight)**: 12% Project IRR
- **High Renewables (realistic derate)**: 9% Project IRR
- **Policy Headwinds (realistic derate)**: 7% Project IRR

Conclusion

Long-term profitability from battery storage merchant projects will largely rely on system volatility, which is a function of macro trends (e.g., load growth, renewable penetration, and gas prices) as well as nodal conditions (e.g., congestion, generators connected). Historical prices may not be a perfect indicator for future project profitability. Ancillary services can be an additional source of revenue, but their value is difficult to predict with high confidence. Detailed study of each project at a nodal level is necessary to understand long-term project economics.