DER-VET Task Force

08/03/2023

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Agenda

- Iron-Air Long-Duration Energy Storage for Energy Time Shifting

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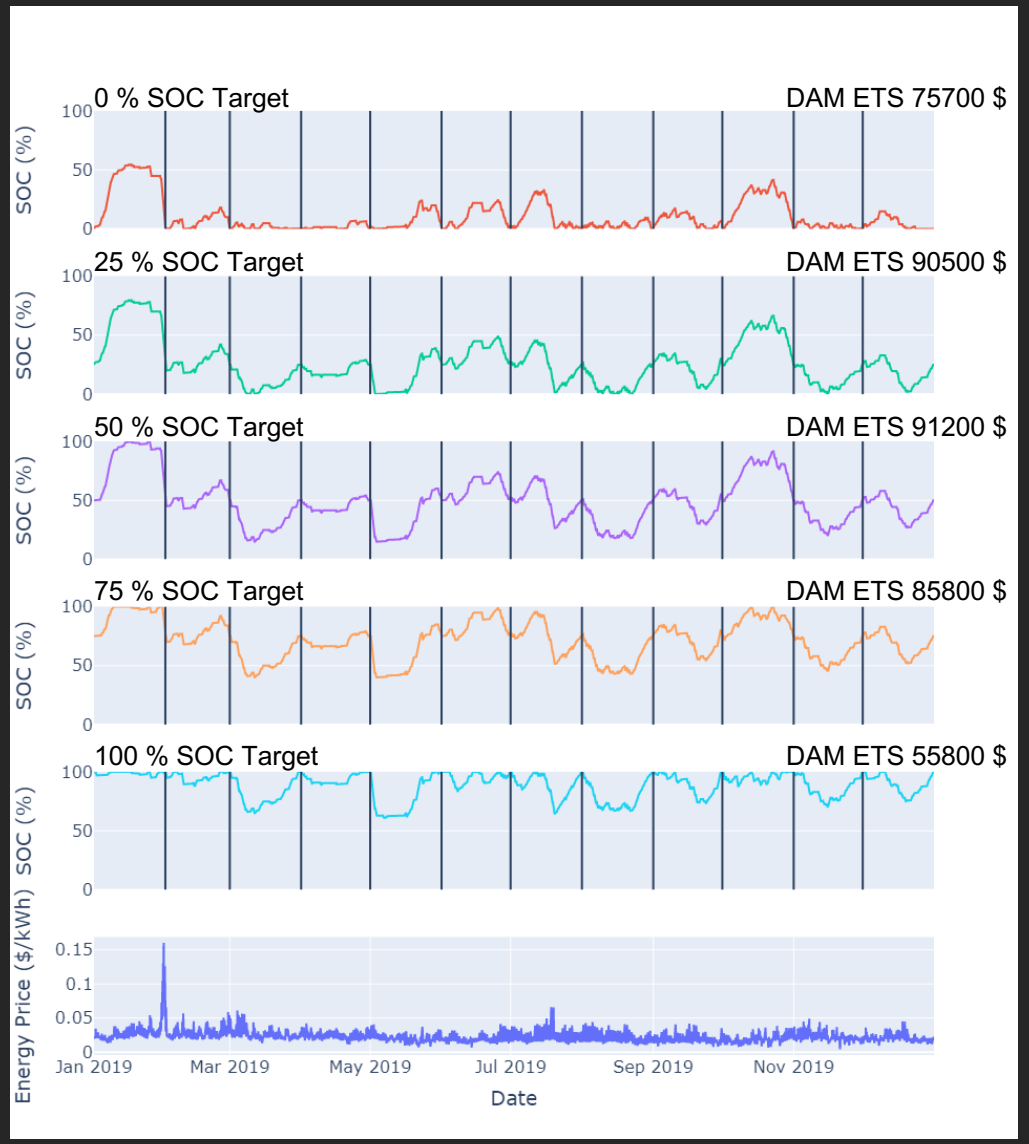
Iron-Air LDES - Overview

- Recently, a set of iron-air battery projects have been announced for 100 h, long-duration energy storage (LDES)
- This metal air battery technology converts metallic iron to rust on discharge and reverses the process during charging
  - Costs for this technology have been quoted at $30/kWh with a target of $20/kWh
  - Round trip efficiency (RTE) estimates range from 40-50%
- With these technological assumptions, what sort modeling challenges and considerations arise when using DER-VET
- 1 MW, 100 h, 50 % RTE, $20/kWh, operating in Day Ahead Market (DAM) Time Shifting, 20-year lifetime

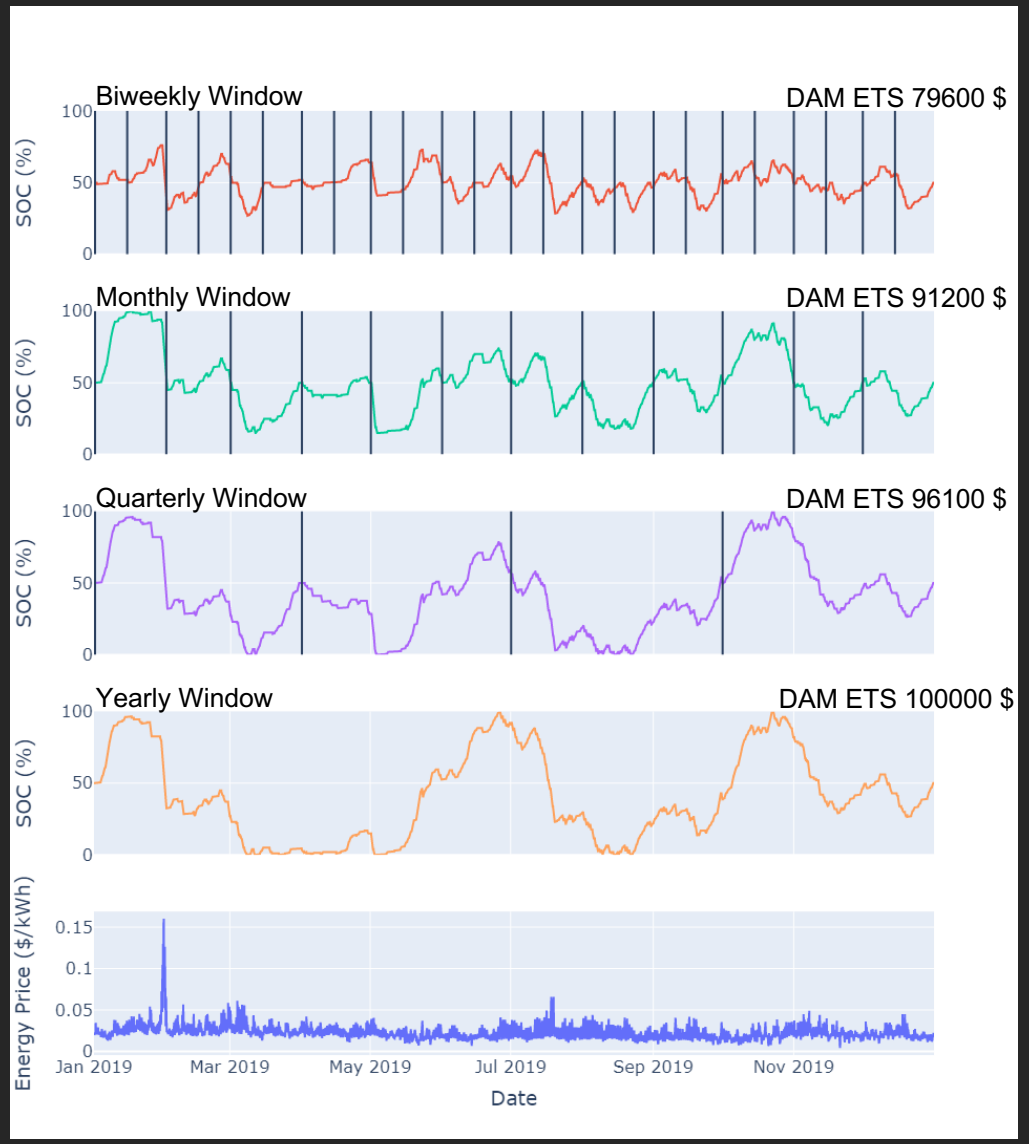
Iron-Air LDES – SOC Target

- DER-VET allows for a year-long timeseries of inputs to be divided into a series of optimization windows (Scenario, n)
  - 1 hour – 1 year
- To ensure continuity between optimization windows, a target SOC (Battery, soc_target) must be constrained at the beginning and end of each window
- This plot shows the LDES SOC with a month-long optimization window and target SOCs ranging from 0 %-100 % in 25% increments

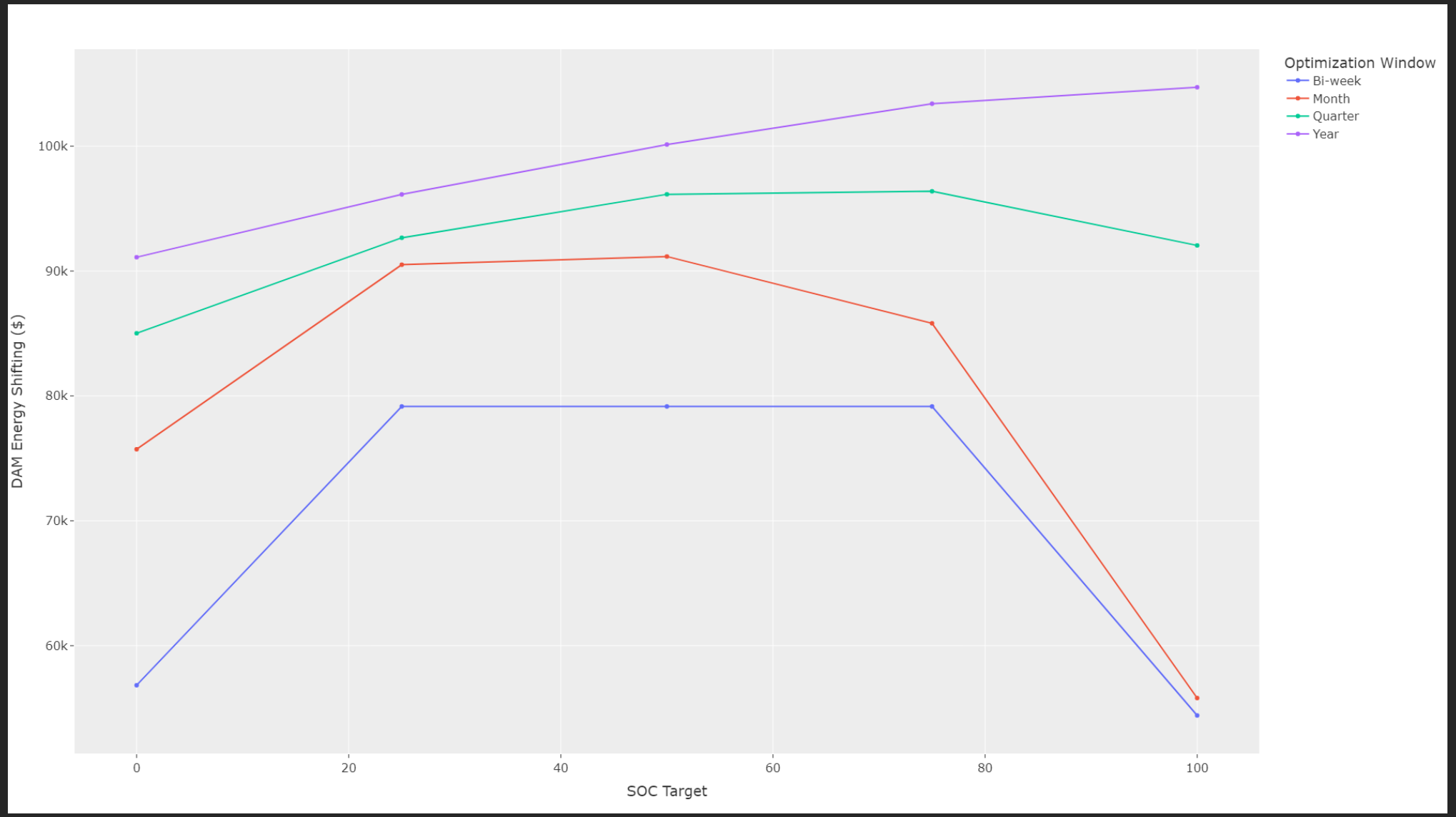


Iron-Air LDES – Optimization Windows

- 100 h system with 50 % RTE
  - 200 h charge, 100 h discharge at peak power capacity
  - Minimum of ~300 h optimization window to evaluate full range of SOC
- Year-long optimization window will result in the greatest estimated revenue (all else equal)
- Larger optimization windows typically require more computation time
- This plot shows the LDES SOC with a target SOC of 50 % and optimization windows from two weeks to one year



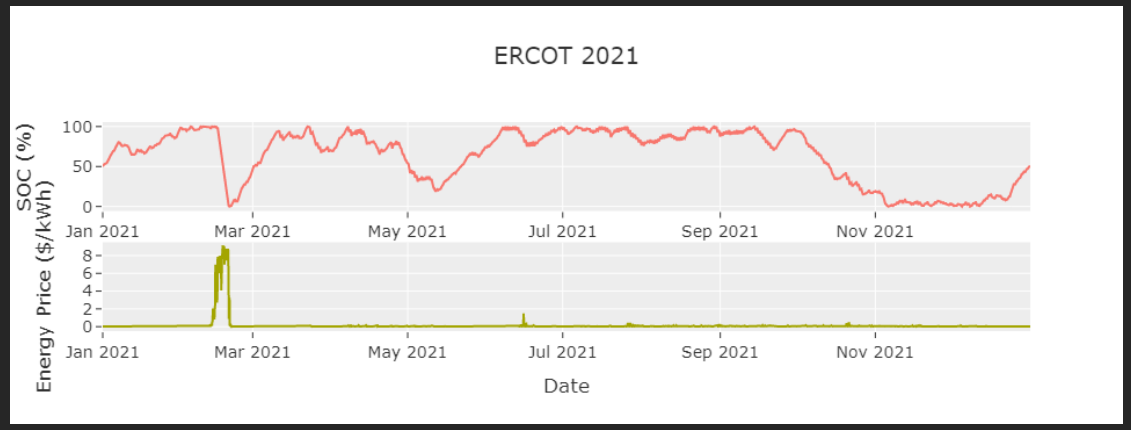
Iron-Air LDES – Optimization Window Summary

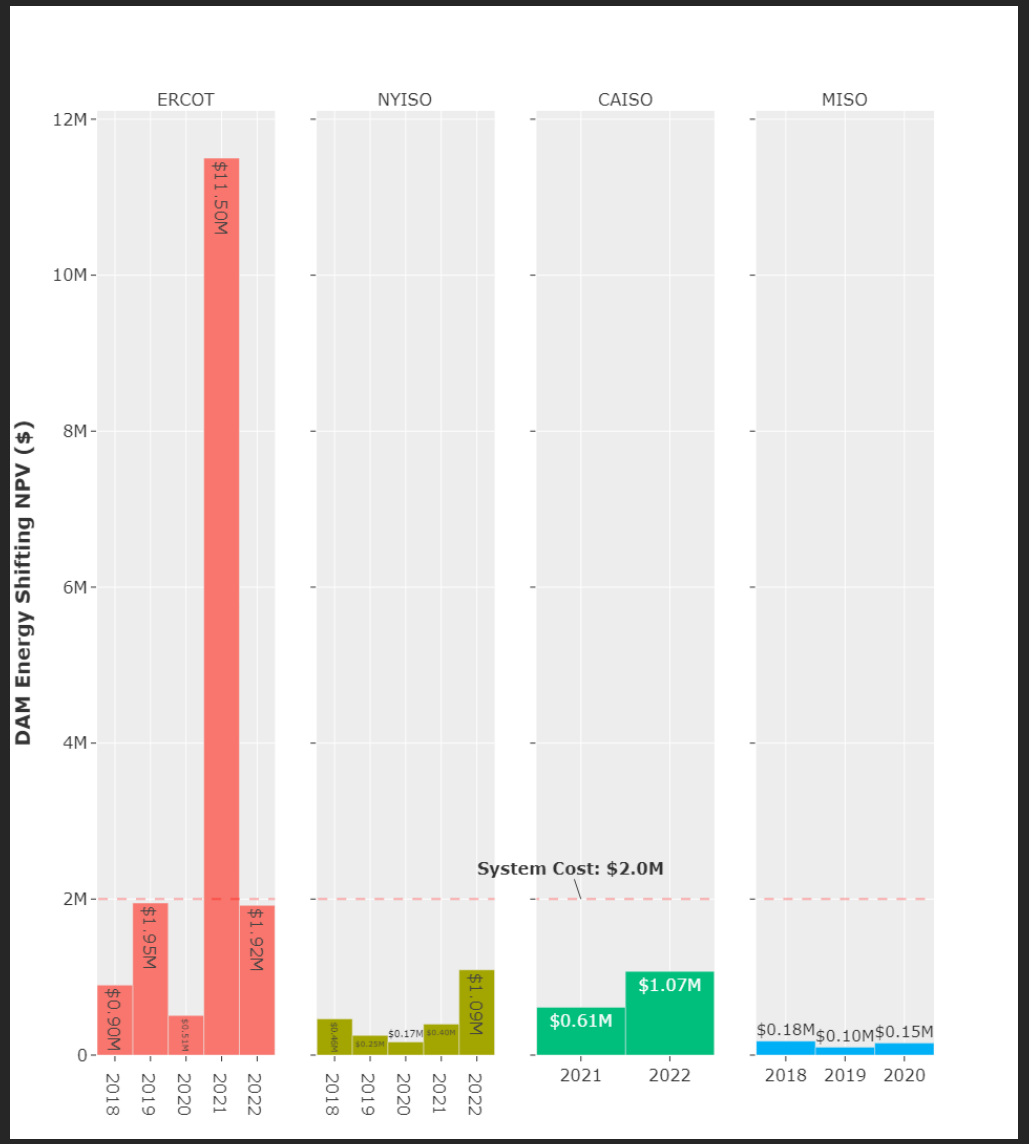


Iron-Air LDES – Regional Comparison

- The total system cost is $2M ($20/kWh)
- Year-long optimization window at 50% target SOC with 20-year lifetime

- ERCOT 2021
  - Winter storms led to DAM prices up to $9/kWh
  - 5-day period (~120 h)





Iron-Air LDES – Discussion

- Discussion Topics
  - LDES
    - Degradation
    - Ancillary Services
    - Scheduling LDES in 24 h markets (e.g. perfect foresight)
  - Iron-Air Battery Technology
    - Degradation
    - Assumptions
      - Cycle Life
    - Auxiliary Power
    - Real-world calibration