broadbit Batteries

Sodium-Salt batteries for daily-seasonal hybrid energy storage

The perfect companion to renewable energy!

The proper choice of grid-storage battery is key to achieving reliable and economically attractive renewable energy production. When renewables supply the bulk of electric energy, a properly designed battery back-up solution must be in place to buffer against catastrophic supply failures, such as the nation-wide black-out of Spain during April 2025.

The hybrid operation of our Na-salt battery provides 3 complementing usages:

- ✦Daily buffer/arbitrage for day-night variations in renewable energy production
- ✦Seasonal buffer/arbitrage for summer-winter variations in renewable energy production
- ✦Uninterrupted power supply (UPS) battery capacity to buffer grid failures

Our Sodium-salt battery can be cost-effectively manufactured from locally sourced materials. It provides over 90% efficiency of energy storage, extremely long calendar life, and operability in both hot and cold environments. The following pages introduce its capability for the above scenarios.

BroadBit Batteries, Orapihlajatie 37, 00320 Helsinki, Finland

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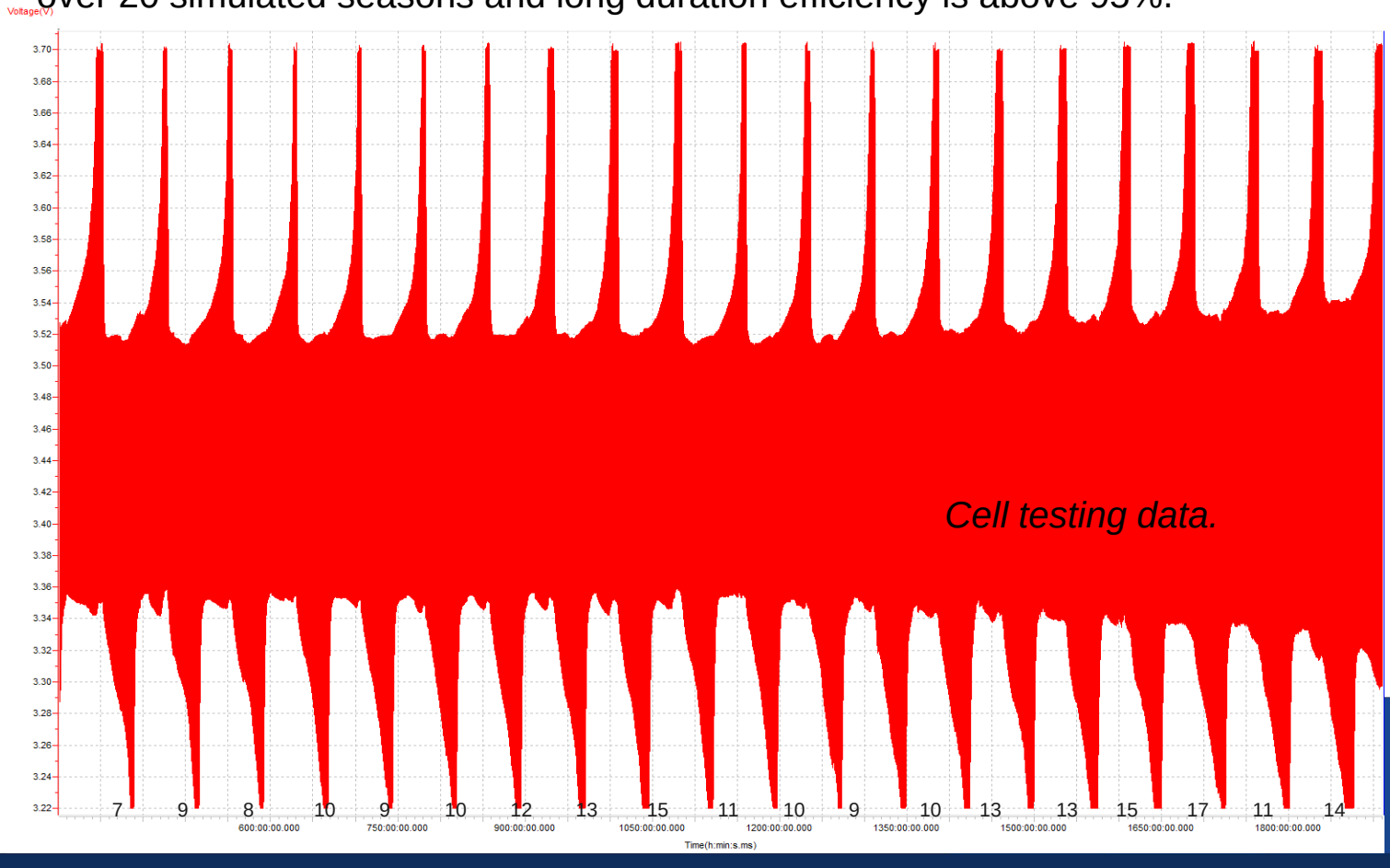
Daily cycling of 5% capacity with Seasonal cycling of 95% capacity

Hybrid daily/seasonal storage use case:

- 3000 daily cycles performed (~5% of total capacity charged/discharged per day)
- “Summer season”: 1% excess charge per day.
- “Winter season”: 1% excess discharge per day.
- “Seasonal” distance between repeating seasonal peaks: 136 daily 5% cycles.

The below data shows 20 repeating seasons

- Round trip energy efficiency in case of 8 h charge + 8 h discharge: 93%
- Metric of degradation: The gradual widening of lower plateau at 3.22 V gauges the number of cycles with reduced capacity near season end. The associated numbers show the cycles that have reached the 3.22 V cut-off, indicating any battery slowing. The data shows a very slowly increasing trend, indicating that the battery has a long remaining cycle life. There is no appreciable capacity loss over 20 simulated seasons and long duration efficiency is above 95%.

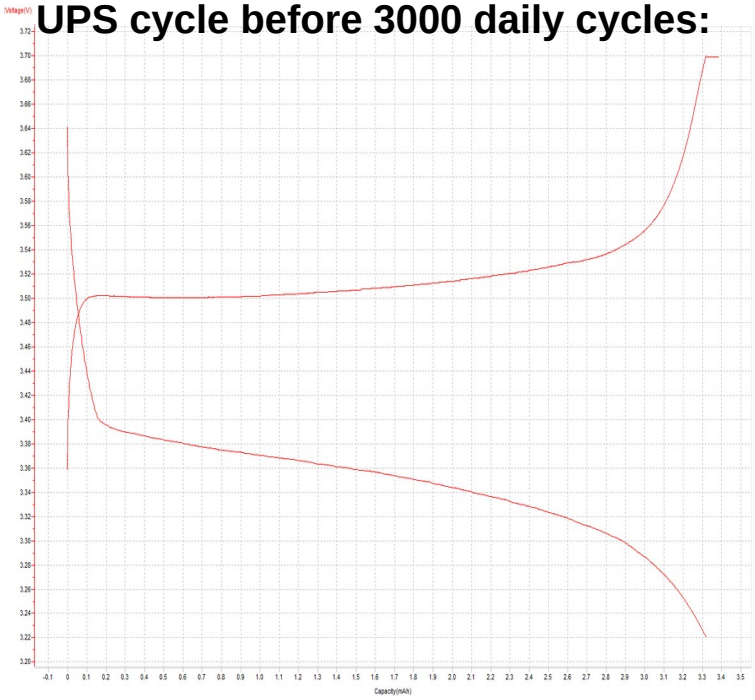


Cycling of 100% capacity within a few days when a need for UPS arises

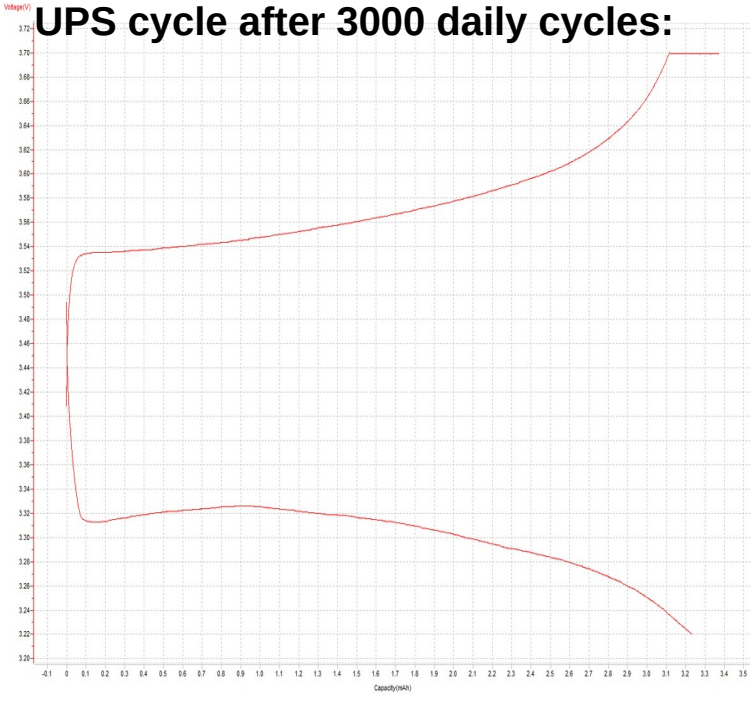
Uninterrupted power supply (UPS) use case:

- In the event of a blackout or grid instability, the full reserve battery capacity can be discharged to maintain power to homes and businesses over extended periods.
- Low cost: Sodium-Salt batteries are the most cost-effective technology for large scale back-up power supply: < 25$/kWh volume production target cost.
- Versatile: The full battery capacity can be discharged over the course of 1-2 days if required.
- Efficient: UPS mode round trip energy efficiency: > 90%
- Robust: No appreciable loss in capacity and only 1.5% change in discharge voltage after over 20 simulated years of continuous operaton

UPS cycle before 3000 daily cycles:



UPS cycle after 3000 daily cycles:



Cell testing data.

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