Battery Arbitrage Economic Case (Sezibwa)

> [!info] Conservative basis: UEDCL Code 10.2 **Q3 2026** tariff (Peak 666.5 / Shoulder 562.1 / Off-Peak 429.7 UGX/kWh), real load. The tariff schedule is a configurable model input so later ERA/UEDCL revisions can be substituted directly. No solar and no capex, so weather and PV price do not affect this case.

Headline

The battery NFE already owns can create **incremental value from sunk hardware** with no solar, by charging during the cheap off-peak window and discharging through the expensive evening peak. On the real load and the **current** tariff this saves about **22,000 to 40,000 UGX per month** (about **6 to 11 percent** of the bill) depending on how much reserve is held for backup. Modest, and smaller than it used to be, because the tariff spread has compressed. Solar is the real story (see Solar Plus Battery Economic Case).

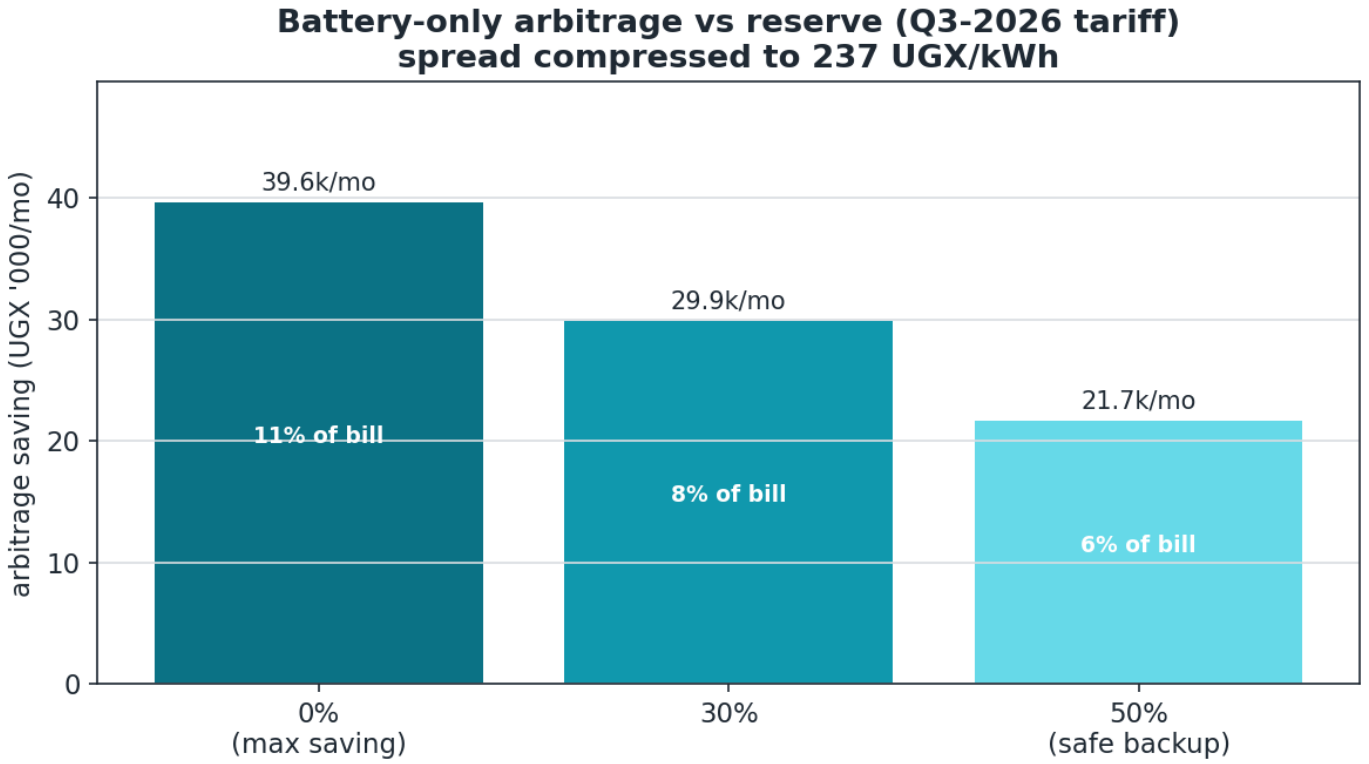
> [!warning] The arbitrage margin has roughly halved on the current tariff The old Sept-2025 tariff had a peak-to-off-peak spread of **410 UGX/kWh** (753 vs 343). The current Q3 2026 spread is only **237 UGX/kWh** (666.5 vs 429.7). After the battery's 90 percent round-trip efficiency, gross arbitrage value falls from roughly 372 to about **189 UGX/kWh** — so these numbers are about half the earlier draft's. Do not quote an older 43k-79k figure.

Method

Transparent scoping model on the real load. Battery 8.9 kWh usable, 90 percent round-trip, 12 kW inverter cap (never binding at these levels). Charge off-peak toward full, discharge to cover the evening peak down to a reserve floor. Tariff is a configurable input (Q3 2026 used here).

Results

Reserve held for backup	Saving per month	Percent of energy bill
0 percent (max saving)	about 39,600	about 11 percent
30 percent	about 29,900	about 8 percent
50 percent (safe backup)	about 21,700	about 6 percent



Investment metrics

No money is invested (the battery is owned), so there is no IRR or payback. The 20-year value of the arbitrage stream, discounted at 15 percent, is about **1.9M UGX** (2.6M at 10 percent, 1.3M at 25 percent). It is upside on owned hardware that declines as the battery ages.

Incremental value from sunk hardware

The hardware cost is sunk, but cycling still consumes a slice of the battery's finite life. Arbitrage therefore carries a real **marginal degradation and opportunity cost** per kWh cycled. On the compressed current spread that cost is no longer negligible relative to the ~189 UGX/kWh gross margin. The economically correct rule is therefore not "arbitrage whenever there is a price spread" but:

> Arbitrage only when the tariff spread is large enough to beat the marginal degradation cost and still leave the required backup reserve.

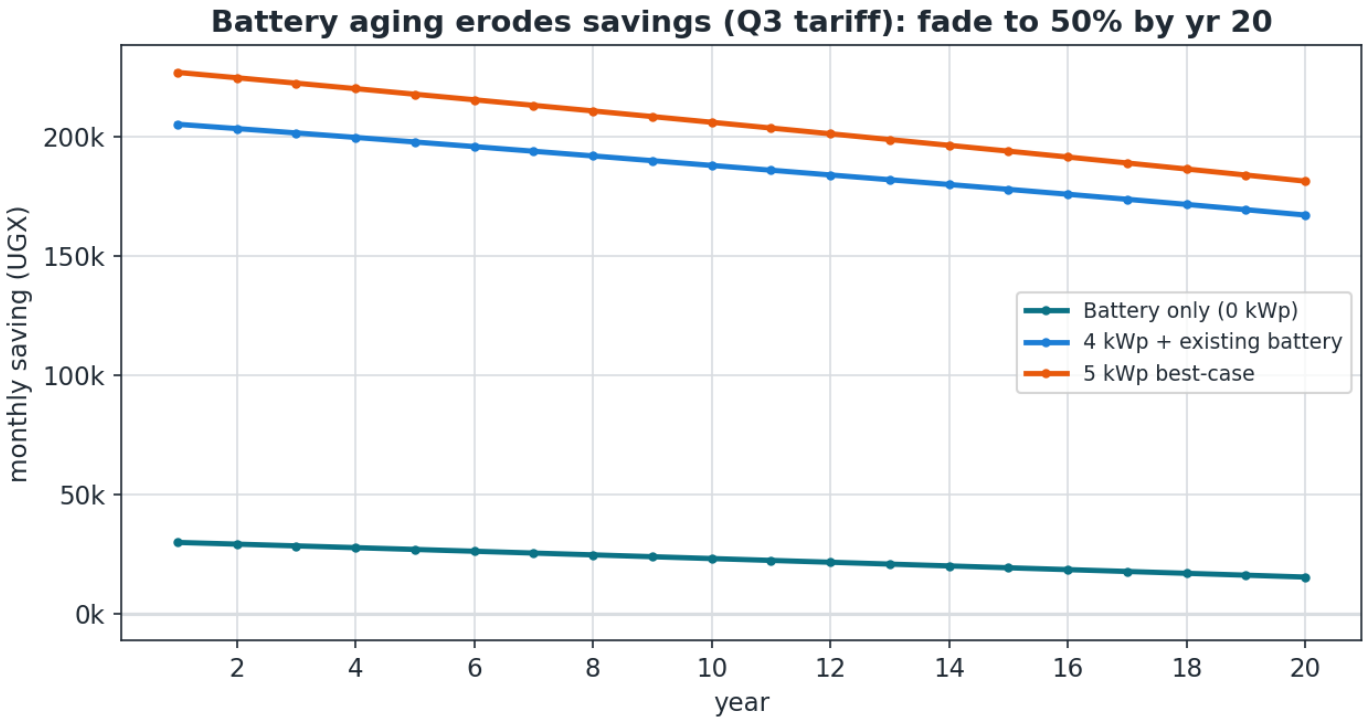
That makes optimal arbitrage a **Microgrid OS control problem** (net of losses and degradation, subject to reserve), not a fixed inverter setting.

What it means

1. Arbitrage alone saves about 22,000 to 40,000 UGX/month (6 to 11 percent of the bill) on owned hardware, and the margin shrinks further net of degradation.
2. The reliability dial is cheap on wear: 50 percent reserve roughly halves the saving versus 0 percent, but at under one cycle per day the battery lasts 15 years or more.
3. Strategic read: arbitrage is a minor ancillary benefit, not the money story. Solar is (see the Solar Plus Battery Economic Case, where 4 kWp offsets ~55 percent of the bill at ~48 percent IRR).

Battery aging over 20 years

Because this case is entirely battery-dependent, it is the most exposed to aging: with capacity fading to 50 percent by year 20, the 30-percent-reserve saving roughly halves over the horizon. Pairing the battery with solar makes the income far less sensitive to aging.



See also Optimal Solar and Battery Allocation and Battery Price Break-Even.

Caveats

Greedy policy; a forecast-driven, degradation-aware controller would arbitrage less often but more profitably. Ignores the fixed monthly service charge (not offsettable). Treats the battery as arbitrage-dedicated, whereas its real primary role is backup, which is why the reserve tradeoff matters.

Revision #11
Created 2026-08-17 21:59:00 UTC by hillary.arinda
Updated 2026-08-19 11:29:34 UTC by aaron.tushabe