

3. Cost Metrics and Economic Analysis

When evaluating battery technologies, total cost of ownership (TCO) is a critical consideration. The following table outlines the costs of various battery Chemistry across different metrics, including upfront costs, recycling costs, and lifecycle costs.

Comparison Table: 1MWh Battery Energy Storage System (BESS)

Cost Comparison Metric (inc. 1.5 MW inverters)	Zenaji LTO	Lithium-Ion (NiMh)	Lithium Iron Phosphate (LFP)	Solid-State	Vanadium Flow	Aluminium-Air	Sodium-Ion	Graphene
Cost in USD	\$1M	\$0.8M	\$0.7M	\$0.2M	\$0.8M	\$0.6M	\$0.5M	\$1.1M
Upfront Cost	High	Moderate-High	Moderate-High	Low	Moderate-High	Moderate	Moderate	High
Cost in USD per MWh (1 cycle/day for 15 years)	\$196	\$150	\$160	\$200	\$1250	\$300	\$250	\$100
Cost in USD per MWh (2 cycles/day for 15 years)	\$99	N/A – Can only Cycle once a day	N/A – Can only Cycle once a day	N/A – Can only Cycle once a day	N/A – Can only Cycle once a day	N/A – Can only Discharge once	N/A – Can only Cycle once a day	N/A – Can only Cycle once a day
Cost of recycling (15 years @ \$10/kg)	\$230,000	\$250,000	\$300,000	\$150,000	\$200,000	\$100,000	\$120,000	\$250,000
Cost of decommissioning (15 years, amortised)	\$5,000	\$15,000	\$20,000	\$10,000	\$15,000	\$10,000	\$10,000	\$10,000
Actual Warranty Period	20 years or 22,000 cycles	10 years	15 years	10-15 years	3 years	Single-Use	10 years	15 years
LCOE over Warrantied Period (USD/MWh)	\$50	\$150	\$160	\$200	\$1250	\$300	\$100	\$110
Pricing per kWh (Warrantied Period)	\$0.05	\$0.15	\$0.16	\$0.20	\$1.25	\$0.30	\$0.10	\$0.11
Lifecycle at Max DoD	60,000	1,000	2,500	1,000	500	Single-Use	2,000	1,500
LCOE over Lifecycle (USD/MWh)	\$23	\$150	\$160	\$200	\$1250	\$300	\$70	\$110
Pricing per kWh (Lifecycle)	\$0.023	\$0.15	\$0.16	\$0.20	\$1.25	\$0.30	\$0.07	\$0.11
Total Cost of Ownership	Extremely Low	High	High	High	Extremely High	High	Low	Moderate

While Zenaji LTO batteries have a higher initial cost, their low lifecycle cost makes them a cost-effective choice for high-cycle applications such as grid storage and industrial backup power.