Battery Energy Storage System

Economic Analysis Report

Report Date	February 12, 2026
Project	SCE Distributed Grid Asset - 15x1MW BESS
Assumption Library	Custom

RECOMMENDATION: APPROVE - Strong economic case

The project demonstrates robust economics with benefits significantly exceeding costs. The BCR of 1.74 exceeds the 1.5 threshold typically required for regulatory approval. The project is expected to create substantial value for ratepayers.

Key Financial Metrics

Metric	Value	Interpretation
Benefit-Cost Ratio (BCR)	1.74	Pass (≥1.0)
Net Present Value (NPV)	$25.1M	Value created
Internal Rate of Return (IRR)	24.9%	Exceeds hurdle rate
Simple Payback	3.7 years	Within analysis period
LCOS ($/MWh)	$196.2	Competitive
Breakeven CapEx	$703/kWh	Above current cost

Project Summary

Parameter	Value
System Capacity	15.0 MW / 60.0 MWh
Duration	4.0 hours
Total Capital Investment	$17.0M
Analysis Period	20 years
Discount Rate (WACC)	7.6%
PV of Total Costs	$34.0M

PV of Total Benefits	$59.1M

Project Configuration

Technology Specifications

The proposed system utilizes **LFP** battery technology, which offers favorable cycle life characteristics for grid-scale applications. The system is designed for 4.0-hour duration with a nameplate capacity of 15 MW, providing 60 MWh of energy storage capacity.

Parameter	Value	Notes
Battery Chemistry	LFP	LFP preferred for long-duration, high-cycle applications
Round-Trip Efficiency	85.0%	AC-to-AC efficiency including inverter losses
Annual Degradation	2.5%	Capacity fade per year of operation
Cycle Life	6,000	Full depth-of-discharge cycles to 80% capacity
Augmentation Year	Year 12	Planned battery module replacement
Cycles per Day	1.0	Average daily discharge cycles assumed

Financing Structure

The project assumes a capital structure of 60.0% debt and 40.0% equity. Based on the financing assumptions, the weighted average cost of capital (WACC) is calculated at 6.4%.

Parameter	Value	Source/Basis
Debt Percentage	60.0%	Typical utility project financing
Interest Rate	5.0%	Current market rates
Loan Term	15 years	Standard project finance term
Cost of Equity	10.0%	Required return on equity
Tax Rate	21.0%	Federal corporate tax rate
Calculated WACC	6.4%	Used as discount rate

Cost Analysis

Capital Expenditures

Total capital expenditure is estimated at $28.7M, consisting of battery system costs ($27.0M) and infrastructure costs ($1.7M). After applying the Investment Tax Credit of $10.8M, the net Year 0 investment is $17.9M.

Cost Component	$/Unit	Quantity	Total
Battery System ($/kWh)	$450	60,000 kWh	$27.0M
Interconnection ($/kW)	$90	15,000 kW	$1.4M
Land Acquisition ($/kW)	$3	15,000 kW	$45.0K
Permitting ($/kW)	$22	15,000 kW	$330.0K
Gross Capital Cost			**$28.7M**
Less: ITC (40.0%)			**($10.8M)**
Net Capital Investment			**$17.9M**

Bulk Discount Applied: A 5.0% fleet purchase discount has been applied to all costs (threshold: 50 MWh). This discount reflects economies of scale when purchasing multiple units.

Annual Operating Costs

Operating Cost	Annual Amount	Basis
Fixed O&M	$562.5K	$38/kW-year
Charging Costs	$651.5K	$35/MWh at 1.0 cycles/day
Insurance	$162.0K	0.6% of battery CapEx
Property Tax	$287.2K	1.0% of total CapEx (declining)
Total Annual OpEx	$1.7M	

Non-Recurring Costs

Cost Item	Year	Amount	Notes
Battery Augmentation	Year 12	$3.3M	Battery module replacement
Decommissioning	Year 20	$225.0K	End-of-life removal (net of residual value)

Benefit Analysis

The following benefit streams have been identified and quantified for this project. All values are shown as Year 1 amounts and escalated annually as indicated.

Benefit Category	Year 1 Value	Escalation	PV Total	% of Total
Distribution Deferral	$1.3M	0.0%	$14.3M	24.2%
Subtransmission Deferral	$330.0K	0.0%	$3.7M	6.2%
Resource Adequacy (SOD)	$1.2M	-2.5%	$10.7M	18.1%
Energy Arbitrage (TOU)	$837.7K	-2.5%	$7.8M	13.2%
Total Benefits	**$3.6M**		**$59.1M**	**100.0%**

Benefit Stream Descriptions

Distribution Deferral: No description available.

Subtransmission Deferral: No description available.

Resource Adequacy (SOD): No description available.

Energy Arbitrage (TOU): No description available.

Reliability (Avoided Outage): Avoided customer outage costs based on expected outage hours and value of lost load. Calculated as: outage_hours × customer_cost_per_kWh × capacity × backup_percentage.

Safety (Avoided Incident): Avoided safety incident costs from improved grid stability. Calculated as: incident_probability × incident_cost × risk_reduction_factor.

Speed-to-Serve (One-time): One-time value of faster deployment compared to alternative generation sources. BESS can be deployed in 12-18 months vs. 36+ months for gas peakers.

Financial Metrics Analysis

Benefit-Cost Ratio (BCR)

The Benefit-Cost Ratio is calculated as the ratio of present value of benefits to present value of costs. A BCR greater than 1.0 indicates that benefits exceed costs.

Calculation:
BCR = PV(Benefits) / PV(Costs)
BCR = $59.1M / $34.0M
BCR = 1.74

Net Present Value (NPV)

Net Present Value represents the difference between the present value of benefits and present value of costs, discounted at the project's cost of capital (7.6%).

Calculation:
NPV = PV(Benefits) - PV(Costs)
NPV = $59.1M - $34.0M
NPV = $25.1M

A positive NPV indicates the project creates value above the required rate of return.

Internal Rate of Return (IRR)

The Internal Rate of Return is the discount rate at which NPV equals zero. It represents the project's expected return on investment.

Result: IRR = 24.9%

The IRR of 24.9% exceeds the required return of 7.6%, indicating the project meets the minimum return threshold.

Levelized Cost of Storage (LCOS)

LCOS represents the all-in cost per MWh of energy discharged over the project lifetime, following the Lazard methodology.

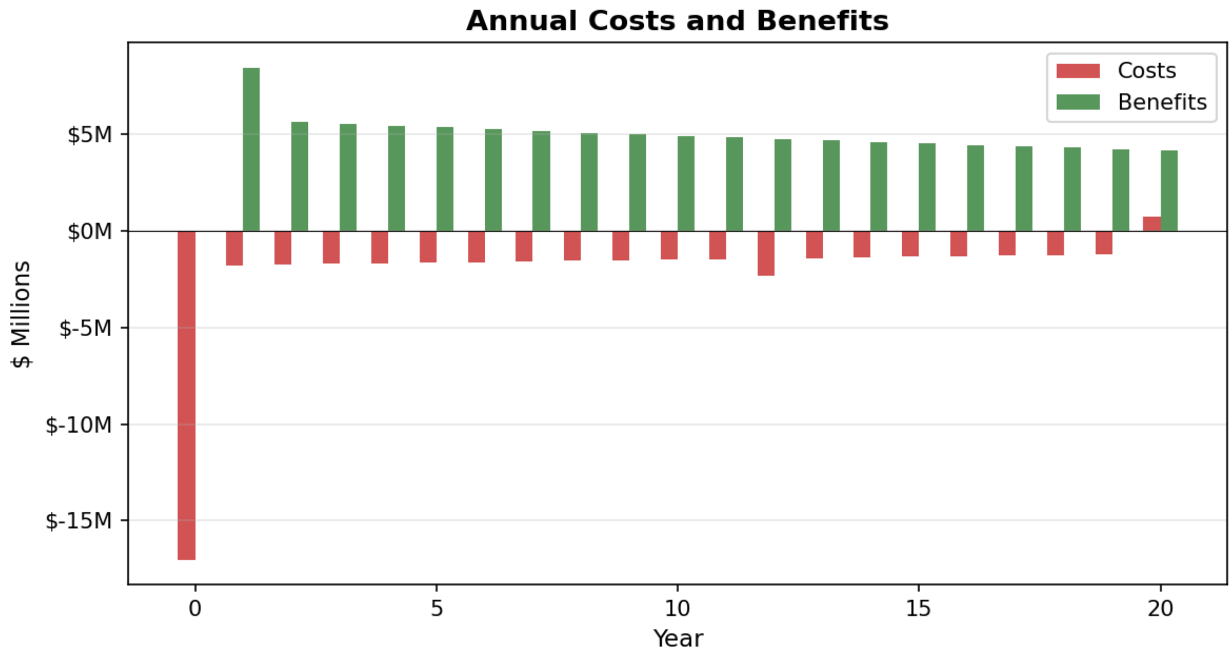
Result: LCOS = $196.2/MWh

This metric enables comparison across different storage technologies and project configurations. For context, current utility-scale battery LCOS typically ranges from $120-180/MWh.

Cash Flow Analysis

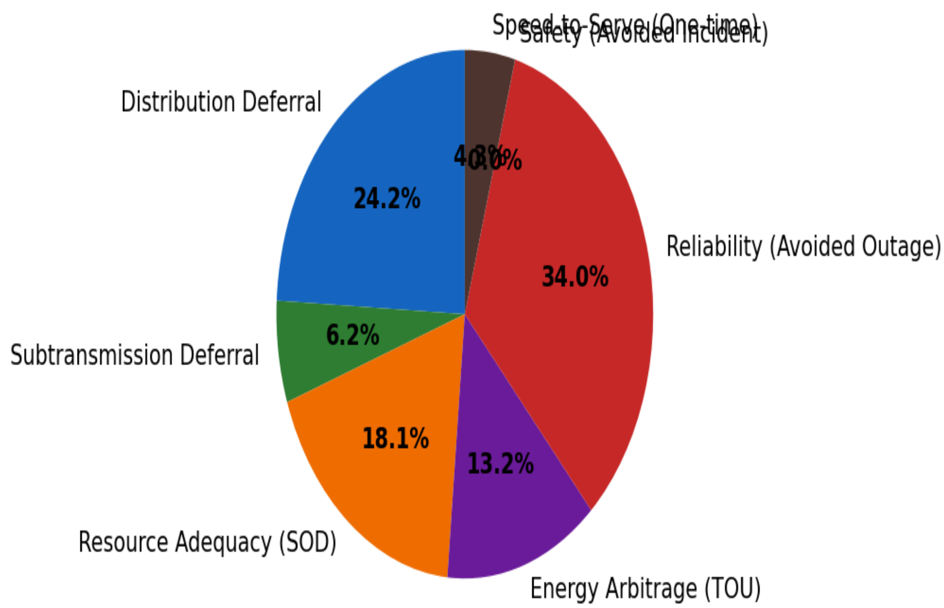
Annual Cash Flows

Year	Year 0	Year 1	Year 5	Year 10	Year 15	Year 20
Costs	$17M	$2M	$2M	$1M	$1M	$-757K
Benefits	$0	$8M	$5M	$5M	$5M	$4M
Net CF	$-17M	$7M	$4M	$3M	$3M	$5M



Benefit Distribution

Benefit Breakdown by Category



Sensitivity Analysis

The following tables show how key metrics change under different assumptions. This analysis helps identify the key value drivers and risk factors for the project.

BCR Sensitivity: CapEx vs. Benefit Levels

CapEx $/kWh	80% Benefits	90% Benefits	100% Benefits	110% Benefits	120% Benefits
$100	3.06	3.44	3.82	4.20	4.58
$120	2.86	3.22	3.57	3.93	4.29
$140	2.69	3.02	3.36	3.70	4.03
$160	2.54	2.85	3.17	3.49	3.80
$180	2.40	2.70	3.00	3.30	3.60
$200	2.28	2.56	2.85	3.13	3.42
$220	2.17	2.44	2.71	2.98	3.25

Green: BCR ≥ 1.5 (Strong) | Yellow: BCR 1.0-1.5 (Marginal) | Red: BCR < 1.0 (Fail)

Methodology & Formulas

Discounted Cash Flow Analysis

This analysis employs standard discounted cash flow (DCF) methodology as described in Brealey, Myers & Allen (2020) and consistent with CPUC Standard Practice Manual guidelines. All future costs and benefits are discounted to present value using the project's weighted average cost of capital (WACC).

Key Formulas

Present Value:

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PV = FV / (1 + r)^t
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where r = discount rate, t = time period

Net Present Value:

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NPV = Σ(CFt / (1 + r)^t) for t = 0 to N
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Sum of discounted cash flows

Benefit-Cost Ratio:

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BCR = PV(Benefits) / PV(Costs)
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Ratio of present values

Internal Rate of Return:

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Solve for r where: Σ(CFt / (1 + r)^t) = 0
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Discount rate at NPV = 0

LCOS:

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LCOS = PV(Costs) / PV(Energy)
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Levelized cost per MWh discharged

WACC:

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WACC = E/(D+E) × Re + D/(D+E) × Rd × (1-Tc)
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Weighted average cost of capital

Battery Degradation

Battery capacity is assumed to degrade at 2.5% per year. This affects both the energy output available for arbitrage and ancillary services, and the capacity available for resource adequacy. The analysis assumes battery augmentation (module replacement) in Year 12 to restore capacity.

Complete Assumption Set

Category	Parameter	Value	Source
Project	Capacity	15.0 MW / 60.0 MWh	Project specification
Project	Duration	4.0 hours	Project specification
Project	Analysis Period	20 years	Standard utility practice
Technology	Chemistry	LFP	Industry standard
Technology	Round-Trip Efficiency	85.0%	Manufacturer specifications
Technology	Annual Degradation	2.5%	NREL ATB 2024
Technology	Cycle Life	6,000 cycles	Manufacturer warranty
Cost	CapEx	$450.0/kWh	Market data
Cost	Fixed O&M	$37.5/kW-year	NREL ATB
Cost	Interconnection	$90.0/kW	Utility estimate
Tax Credit	ITC Rate	30.0%	IRA 2022 (26 USC §48)
Tax Credit	ITC Adders	10.0%	Energy Community/Domestic Content
Finance	Debt %	60.0%	Project financing structure
Finance	Interest Rate	5.0%	Current market rates
Finance	Cost of Equity	10.0%	CAPM estimate

References & Citations

[1] Brealey, R., Myers, S., & Allen, F. Principles of Corporate Finance (13th ed.). McGraw-Hill, 2020.

[2] CPUC D.23-06-029 SOD Framework; CAISO 2026 RA Report

[3] California Public Utilities Commission. Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects. October 2001.

[4] E3 (Energy + Environmental Economics). CPUC Avoided Cost Calculator 2024.

[5] E3 2024 ACC, Subtransmission Component, SCE

[6] Internal Revenue Code, 26 USC §48 (Investment Tax Credit as amended by IRA 2022).

[7] Lawrence Berkeley National Laboratory. Interruption Cost Estimate (ICE) Calculator. https://icecalculator.com/

[8] Lazard. Lazard's Levelized Cost of Storage Analysis, Version 10.0. March 2025.

[9] NREL. Annual Technology Baseline 2024. National Renewable Energy Laboratory. https://atb.nrel.gov/

[10] NREL. Storage Futures Study. NREL/TP-6A20-77449. 2021.

[11] SCE 2024 Grid Needs Assessment; D.25-12-003 ROR

[12] SCE TOU-GS-3; E3 2024 ACC energy value

[13] U.S. Environmental Protection Agency. Social Cost of Greenhouse Gases. 2024.

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