

— A BENCHMARK REPORT FOR THE OFFICE OF THE CFO

*The 2026 cold storage **energy** & **resiliency** benchmark.*

An industry at the intersection of grid fragility and operational excellence
— and the fiduciary case for converting the rooftop into the balance
sheet's most productive asset.

10-YR LIFT	YEAR 1	CAGR	INDUSTRY SPEND
\$12.16M	\$14.5M	9-15%	\$30B
Cumulative EBITDA · per facility	Valuation lift @ 6.25% cap	Through mid-2030s	Annual electricity

— PREPARED FOR

Office of the CFO

Tier-1 cold chain operators

— FILE

2026.01 · Vol. I

Boardroom distribution

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A seven-section thesis on why *energy infrastructure* has displaced rent and pallet velocity as the principal driver of *enterprise value*.

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THE BOTTOM LINE

*Cold storage with on-site solar captures a **\$12M+ EBITDA advantage** over 10 years — and an immediate **\$14.5M valuation lift** at a 6.25% cap.*

10-YR ADVANTAGE

\$12M+

Cumulative EBITDA · per facility

YEAR 1

\$14.5M

Valuation lift @ 6.25% cap

INDUSTRY CAGR

9–15%

Through mid-2030s

ANNUAL SPEND

\$30B

Industry electricity

The mandate has shifted.

The 2026 global market sits between **\$166B and \$204B**, with consensus forecasts of a **9–15% CAGR** through the mid-2030s. The CFO's mandate has shifted from managing pallet turns to managing electron costs.

Energy now accounts for **18–30%** of opex in chilled facilities and can **exceed 50%** in blast-freezing — the largest controllable line on the P&L.

What this report establishes.

Energy resiliency is no longer a green initiative but the primary determinant of enterprise value. We quantify the divergence between alpha operators and laggards, and provide a 24-month fiduciary roadmap for converting energy infrastructure into a permanent competitive moat.

Source ranges reflect Mordor Intelligence, Towards Healthcare, Grand View Research, Econ Market Research · Jan-Feb 2026.

THE STRATEGIC REFRAME

*The grid is no longer a utility; it is **a competitor**. To reclaim margin, the operator must move from a Consumer mindset to **a Producer mindset**.*

—

SECTION 01 · MACRO VIEW

The state of the industry.

2026 marks a structural paradigm shift in utility procurement. The era of energy-as-pass-through is over. We have entered the era of the Infrastructure Modernization Surcharge — and a permanent bifurcation of the cold chain.

PJM CAPACITY JUMP 22% July 2025 · clearing-price record	AGING TRANSMISSION 70% U.S. lines > 25 yrs old	COLD BUILD PREMIUM 3-4× vs. ambient warehouse
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1.1 · THE SILENT TAX

The fragility of the *status quo*.

The 2024–2026 period represents a structural paradigm shift in utility procurement. Historically, energy was a pass-through cost — predictable, ignored in long-term planning. **We have entered the era of the Infrastructure Modernization Surcharge**, in which the industrial sector is being forced to subsidize a national grid transition it did not ask for and cannot rely on.

Even when natural gas prices remain low, the cost to *deliver* that power is the primary driver of rising operating expense.

1.1.1

Electrification crowding-out.

AI-driven data centers and reshored manufacturing have created a zero-sum competition for grid capacity. **PJM cleared at the FERC-mandated cap of \$329.17/MW-day** in July 2025 — a 22% jump on top of the previous year's near ten-fold increase.

+15–20% BILL SURCHARGE

1.1.2

Infrastructure super-cycle.

Over 70% of U.S. transmission lines are more than 25 years old. Under FERC Order 1920, a **\$1.4 trillion grid-hardening cycle** is being socialized across industrial ratepayers.

+6–9% / YR DELIVERY

1.1.3

End of price predictability.

Winter Storm Fern saw record gas withdrawals and curtailments. Volatility has filtered into commercial bills via **Market-Based Adjustment Clauses** — turning industrial energy into a variable-rate mortgage.

VARIABLE-RATE EXPOSURE

STRATEGIC REFRAME

*The grid is no longer a utility; it is **a competitor**. Every kWh purchased from the grid subsidizes competitors' infrastructure.*

1.2 · THE BIFURCATION

Efficiency is the ultimate competitive moat.

ALPHA OPERATORS

Lineage · Americold · NewCold

Pivoted from real estate owners to technology platforms. Vertical-growth AS/RS facilities use 40% less land but require energy-hungry robotics — paid for by integrated solar, hydrogen forklift cells, and thermal batteries. Cost-per-pallet is **falling** as utility rates rise.

MARKET LAGGARDS

Local · Regional · Legacy

Trapped in inefficient box warehouses (20–30 yrs old) with poor insulation and aging ammonia systems. Margins are evaporating, making them **prime acquisition targets at distressed multiples**. Capex required to catch up exceeds available debt capacity.

1.2.2 · PHARMA CATALYST

The –20°C mandate.

GLP-1s, mRNA vaccines, and CRISPR therapies require ultra-low or deep-freeze environments. Per Mordor (Jan 2026), this segment grows at a **13.01% CAGR through 2031** — roughly triple traditional food.

Deep-freeze is **5–10× more energy-intensive** than ambient. Every degree of pull-down requires a non-linear increase in compressor work.

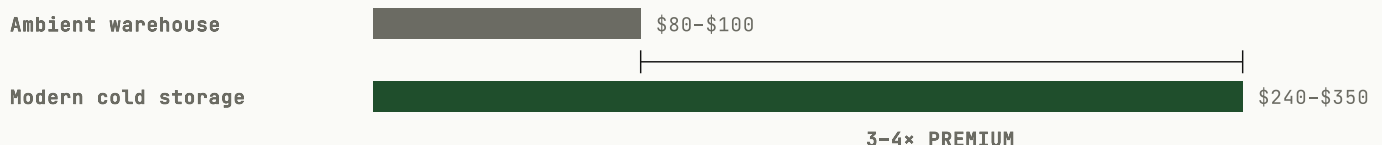
1.2.3 · THE CONSTRUCTION GAP

A high-stakes gamble.

Ambient: **\$80–\$100/sf**. Modern cold: **\$240–\$350/sf** — a 3–4× premium driven by:

- ✓ High-R IMPs and vapor barriers
- ✓ Heated, reinforced sub-slabs
- ✓ Natural refrigerant mandates (EPA AIM Act)

BUILD COST DIFFERENTIAL · \$/SQ.FT.



SECTION 02 · THE ENERGY NEXUS

A \$30 billion drain.

Cold storage is unique among industrial assets because its highest operational demand is perfectly — and unfortunately — correlated with the grid's highest stress points.

INDUSTRY SPEND

\$30B

Annual electricity

COST DELTA

400%

4 PM kWh vs. 4 AM kWh

DEMAND SHARE

**45–
55%**

% of total bill

THE WINDOW

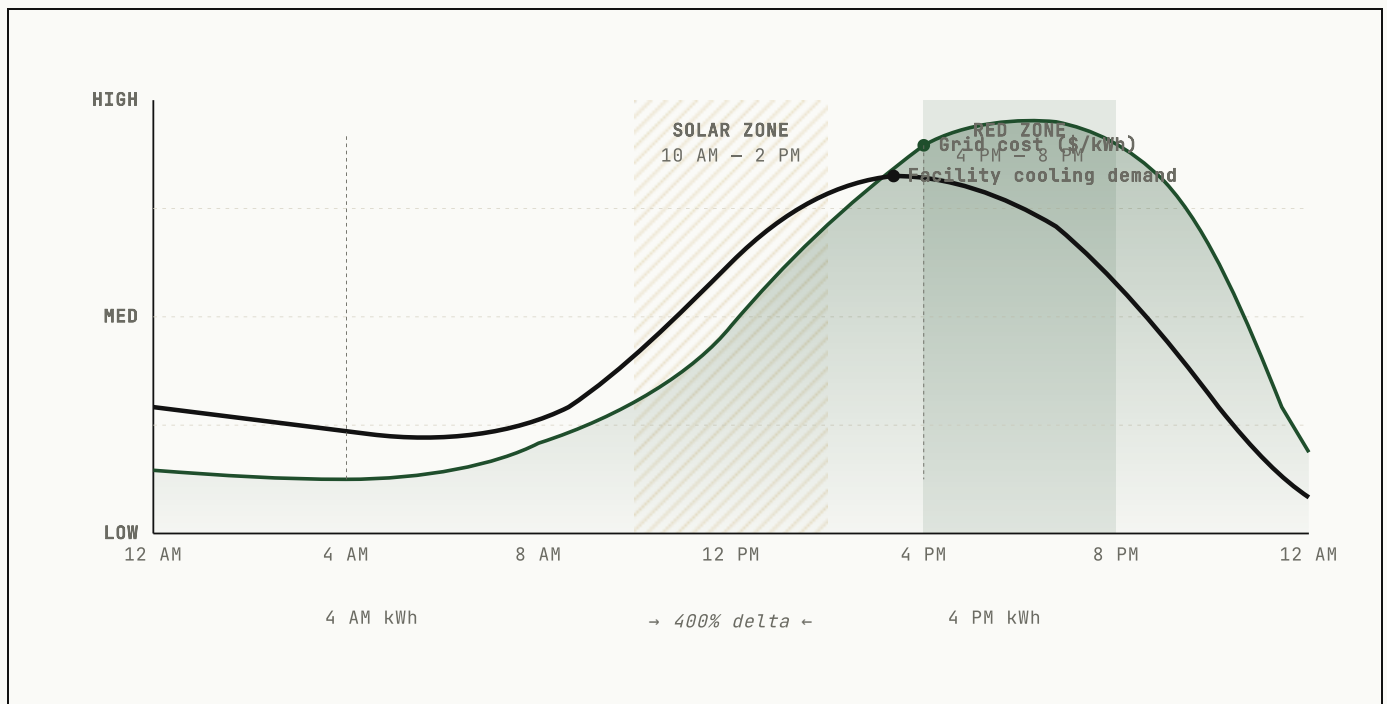
15min

Sets the monthly floor

2.1 · INVERSE LOAD PROFILE

The physics of buying power at *the wrong hour*.

Cooling demand peaks between **12:00 PM and 6:00 PM** — the same window when utilities face the highest net load from residential A/C and commercial office space. The result: cold storage operators buy the majority of their fuel during the most expensive hours of the day.



AMBIENT CORRELATION

As external temperatures rise, thermal pressure on the envelope increases. Compressors must work harder to maintain -20°F when the rooftop bakes at 110°F .

GRID CONFLICT

Peak cooling demand (12–6 PM) collides directly with peak utility net load — driving the most expensive kWh of the day.

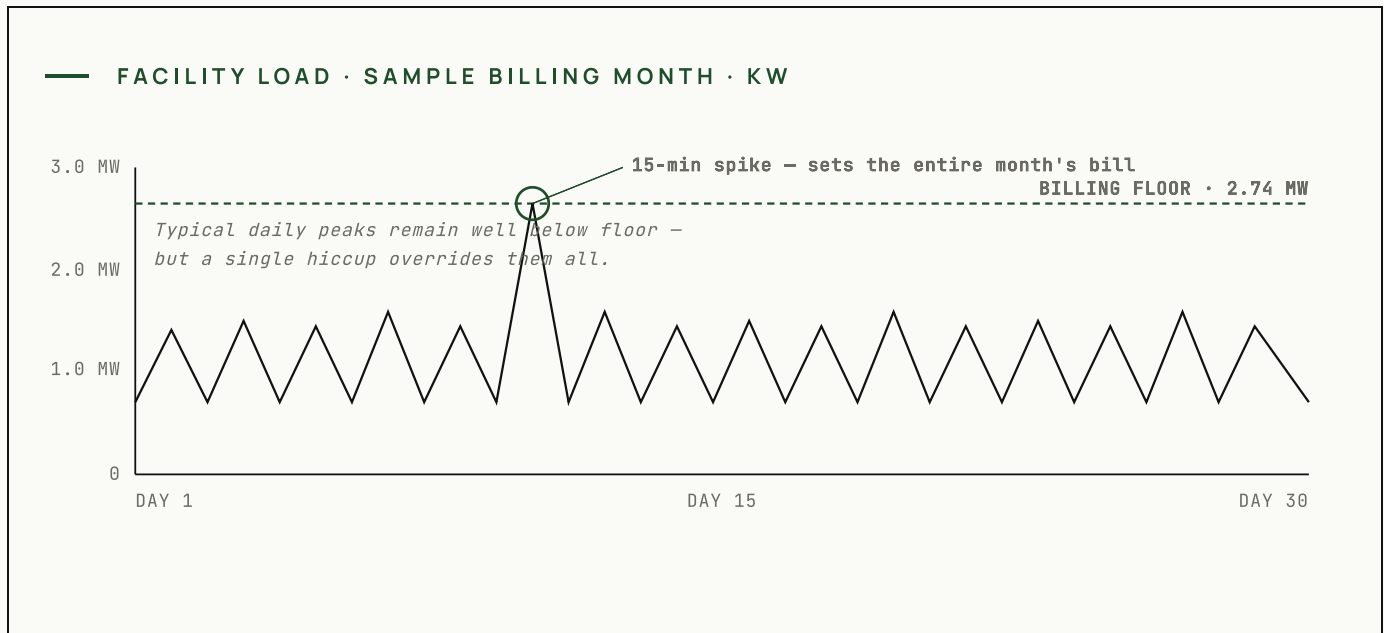
ARBITRAGE

The afternoon Red Zone justifies thermal load shifting (pre-cooling) — converting frozen inventory into a thermal battery.

2.2 · THE DEMAND CHARGE TRAP

A 15-minute financial disaster.

The most dangerous line item is not total kWh consumed — it is the **peak demand charge**. Utilities use ratchet clauses and Time-of-Use demand tiers to penalize industrial users who strain the grid.



HOW THE TRAP WORKS

The bill is calculated on the **single highest 15-minute window**. A loading dock left open too long, multiple compressors firing, and that 15-minute spike sets the floor for the entire month.

FINANCIAL TOLL

In SCE and PJM territory, demand charges account for **45–55% of the total bill**. A single hiccup can erase \$50,000 in monthly EBITDA.

WHY EFFICIENCY ALONE FAILS

Using fewer kWh only solves **~40%** of the problem. To fix the bill, the operator must solve for peak demand.

BENCHMARK · THE EFFECTIVE-RATE GAP

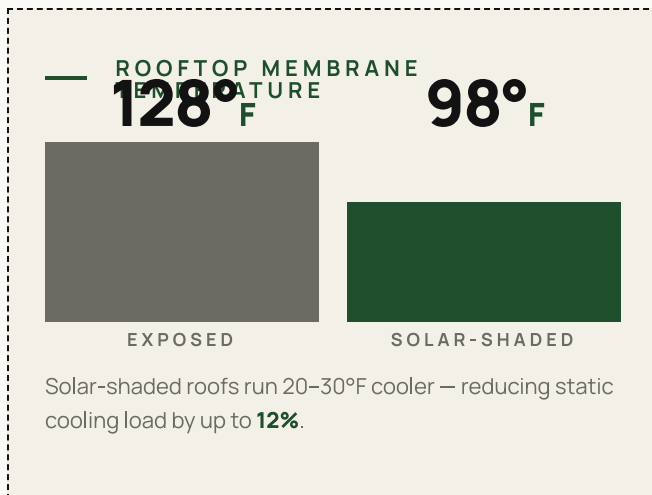
*Tier-1 facilities decoupled via on-site solar and thermal storage operate at **\$0.05/kWh**, while grid-dependent competitors pay **\$0.14–\$0.18**. The difference between a market leader and a bankruptcy candidate.*

2.3 · THE ALBEDO EFFECT

Heat-island *inefficiency*.

Most cold storage roofs are empty white TPO or PVC. Designed to reflect heat, they suffer from two flaws solar resolves.

- ✓ **Degradation & soiling** — cool roofs collect dust, lose reflectivity, and let heat through.
- ✓ **The missed shade benefit** — solar panels create a ventilated buffer between sun and membrane.



2.4 · THE MARGIN SQUEEZE

Why \$0.14 is the *death zone*.

In a low-margin 3PL business, the difference between \$0.06 and \$0.14 effective is the difference between a category killer and acquisition bait.

ALPHA FACILITY	LAGGARD
\$0.052 /kWh	\$0.16 /kWh
PER-PALLET ENERGY DELTA	
+\$1.80 to laggard cost-per-pallet	

On a 10,000-pallet contract, the alpha can **underbid by \$1.00 per pallet** and still keep a higher margin.

SECTION 03 · RESILIENCY

The grid is a point of failure.

The cold chain is caught in a pincer maneuver between decaying physical assets and an insatiable demand for power from competing sectors.

3.1 · FRAGILITY OF THE TRANSITION

AI vs. the cold chain.

A single 100 MW data center consumes as much power as **80,000 homes**. In Northern Virginia, Columbus, and Phoenix, hyperscale tenants outbid industrial players for grid priority.

As baseload power retires, grid inertia decreases. **Voltage sags** trip ammonia-compressor VFDs, requiring hours of manual restart.

Critical Peak Pricing rates can spike **2,000%** for the duration of a reliability event.

3.2 · THE SPOILED-ASSET RISK

The \$35B problem.

4_{hr}

The thermal-inertia threshold. A 4-hour outage in a high-density biologics facility is not downtime — it is a **\$5M–\$20M insurance claim**.

Globally, losses from cold-chain excursions exceed **\$35 billion this year**. Insurance carriers now adjust premiums based on Power Resiliency Scores: 100% grid-dependent facilities face premium hikes of 15–25%.

3.3 · CAPEX SUPER-CYCLE

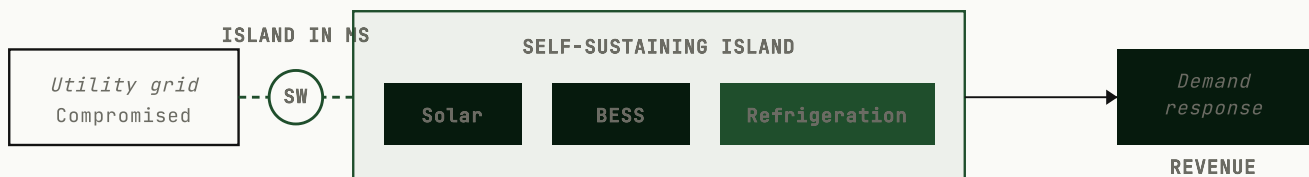
Infrastructure surcharges.

In MISO and Southeast jurisdictions, utilities are spending billions to harden grids and replace 50-year-old transformers. Recovered through rate cases — a **mandatory 6–8% annual increase** to base rates that cannot be negotiated away.

3.4 · THE SOLUTION

Micro-grid & islanding.

Solar + BESS + advanced micro-grid controllers achieve **islanding capability** — seamless detachment in milliseconds when the grid sags. The micro-grid sells back during stress, turning a resiliency tool into a profit center.



FIDUCIARY BOTTOM LINE

Being 100% grid-dependent is no longer standard operating procedure — 15

SECTION 04 · STRATEGIC LEVERS

Energy as infrastructure.

Four operational levers distinguish alpha facilities from laggards.

4.1 · THERMAL LOAD ALIGNMENT

Inventory as a battery.

AI-driven predictive modeling over-cools inventory in the morning (cheap solar) and drifts through the expensive afternoon peak.

10 AM – 2 PM · THE SURGE

Over-cool by 3–5°F using free solar production.

4 PM – 8 PM · THE DRIFT

Compressors throttle. Frozen mass coasts.

Up to 40% reduction in grid dependence.

4.3 · SOLAR & STORAGE ARBITRAGE

The highest-yielding asset class.

Federal tax credits (30% ITC) plus 5-year accelerated depreciation allow **60–70% recovery** of system costs within 24 months.

EBITDA → ENTERPRISE VALUE

Every \$100k saved adds ~\$1.6M to enterprise value at a 6% cap.

4.2 · STRUCTURAL INTEGRITY

Protecting the thermal envelope.

A cold storage roof is a high-performance machine. Vapor pressure between –20°F interior and 110°F exterior means any compromise leads to ice heaving or insulation rot.

- ✓ **Non-penetrative ballasted systems** preserve the NDL roof warranty.
- ✓ **Point-load analysis** spreads weight across structural steel.
- ✓ **Active shading** keeps the membrane up to 30°F cooler.

4.4 · ADVANCED REFRIGERATION

Natural over synthetic.

EU F-gas Regulation and EPA AIM Act mandates are forcing transition to ammonia (NH₃) and CO₂. Higher upfront capex, but **25–35% more energy-efficient** than legacy HFC.

NH₃ / CO₂

SECTION 05 · CENTERPIECE

The 10-year *pro-forma*.

Quantifying the financial impact of energy infrastructure ownership across a representative 10-year horizon — with conservative 2026 assumptions and a 200,000 sq. ft. facility profile.

5.1 · MODEL ASSUMPTIONS

FACILITY SIZE

200,000 sq. ft.

ENERGY INTENSITY

60 kWh/sf · 12M kWh

BASE UTILITY RATE

\$0.16 / kWh

UTILITY ESCALATION

4.5% / yr

SOLAR OFFSET

70% @ \$0.052 LCOE

CAP RATE

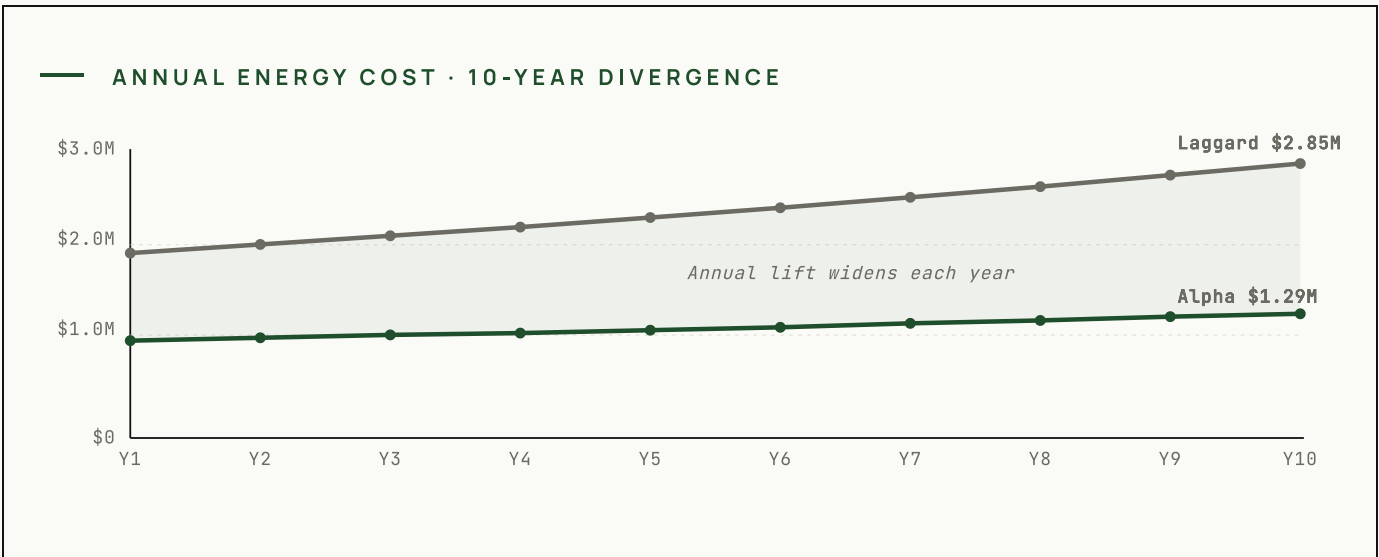
6.25%

Annual EBITDA Lift = avoided cost (Laggard - Alpha). Cumulative = running total. Valuation Lift = Annual Lift ÷ 6.25% cap rate.

5.2 · PERFORMANCE TABLE

Alpha vs. laggard.

YEAR	GRID RATE	LAGGARD	ALPHA	ANNUAL LIFT	CUMULATIVE	VALUATION LIFT
1	\$0.160	\$1.92M	\$1.01M	\$0.91M	\$0.91M	\$14.51M
2	\$0.167	\$2.01M	\$1.04M	\$0.97M	\$1.88M	\$15.48M
3	\$0.175	\$2.10M	\$1.07M	\$1.03M	\$2.91M	\$16.49M
4	\$0.183	\$2.19M	\$1.09M	\$1.10M	\$4.01M	\$17.55M
5	\$0.191	\$2.29M	\$1.12M	\$1.17M	\$5.18M	\$18.65M
6	\$0.199	\$2.39M	\$1.15M	\$1.24M	\$6.42M	\$19.81M
7	\$0.208	\$2.50M	\$1.19M	\$1.31M	\$7.73M	\$21.01M
8	\$0.218	\$2.61M	\$1.22M	\$1.39M	\$9.12M	\$22.27M
9	\$0.228	\$2.73M	\$1.26M	\$1.47M	\$10.59M	\$23.59M
10	\$0.238	\$2.85M	\$1.29M	\$1.56M	\$12.16M	\$24.97M
Total	—	\$23.59M	\$11.43M	\$12.16M	—	—



5.3 · STRATEGIC ANALYSIS

Four findings.

\$12.16M

EBITDA RECOVERY

Cash flow that would otherwise flow to the utility — capital that can be redeployed into automation, fleet electrification, or portfolio expansion.

\$14.5M

YEAR-1 EQUITY CREATION

An immediate lift in property valuation. For a REIT or PE-backed operator, an instant increase in LTV flexibility and exit pricing.

27 vs. 48%

10-YR COST GROWTH

Laggard energy rises 48%; alpha rises only 27% — because the majority of its fuel is fixed at the cost of the solar asset.

Mo. 34

TAX-ADJUSTED PAYBACK

After 30% ITC and MACRS, net cash outlay is recovered by Month 34. From Month 35: **zero-basis energy**.

CFO NOTE

By Year 10, the alpha facility saves \$1.56M annually vs. peers. The difference between a price-maker and a price-taker.

5.4 · ZERO-INTERRUPTION DEPLOYMENT

Loading docks never stop.

PHASE I · WKS 1-2

Interval audit

12 mo. of 15-min interval data analyzed for demand spikes.

PHASE II · WKS 3-6

Engineering

Structural PE stamps; refrigeration PLC compatibility for load-shifting.

PHASE III · WKS 7-10

Off-hours staging

Heavy equipment craned onto the roof during overnight or Sunday shifts.

PHASE IV · WKS 11-14

Commissioning

Real-time CFO dashboard tracks avoided costs and EBITDA expansion.

5.5 · CASE STUDY (COMPOSITE)

Northeast portfolio turnaround.

Composite based on aggregated 2025 implementations across multiple Northeast operators.

Outcomes are means of the cohort.

SECTION 06 · TAX ARBITRAGE FRAMEWORK

The federal government as a *non-voting equity partner*.

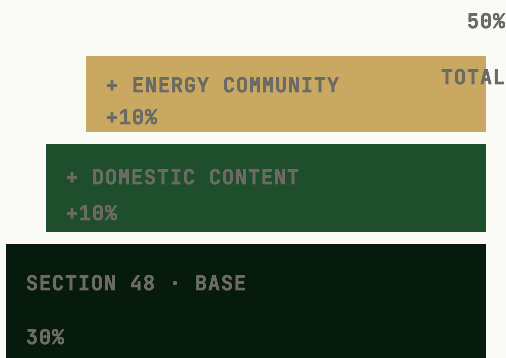
A solar project is not an expense — it is a capital reallocation that uses funds otherwise earmarked for the Department of the Treasury.

Note on tax treatment. ITC adders, MACRS treatment, and bonus depreciation phase-down schedules are subject to ongoing legislative change. All figures should be verified with qualified counsel before structuring any transaction.

6.1 · ITC STACKING

Beyond the 30%.

Section 48's base credit is 30% — the 2026 landscape allows adders that most operators overlook.



- ✓ **Domestic Content (+10%)** · U.S.-sourced steel and components.
- ✓ **Energy Community (+10%)** · former coal/fossil tracts.
- ✓ **Direct Pay & Transferability** · sell credits to third parties for cash.

6.2 · MACRS DOUBLE-DIP

Where the real IRR lives.

Solar is 5-year property. ITC reduces depreciable basis by only half (15%). The operator depreciates **85%** of system cost while having already received 30% back in cash.

6.3 · SAFE HARBOR & RECAPTURE

Placed-in-service discipline.

- ✓ **5% Safe Harbor** — lock in 2026 rates by demonstrating physical work or 5% spend.
- ✓ **Recapture protection** — ITC vests 20% per year over five.

6.4 · THE ZERO-BASIS ASSET

A 36-month payback.

NET INVESTMENT FORMULA

Net = Gross Cost
 - ITC
 - (Depreciation × Tax Rate)
 - Year 1 Energy Savings

Net often drops to **~\$0 by end of Year 3**. Beyond that: the array is a zero-basis asset producing free energy for 22+ years.

SECTION 07 · THE FIDUCIARY ROADMAP

Energy as *fiduciary duty*.

Treating energy as a variable pass-through is no longer just operational oversight — it is increasingly a breach of fiduciary duty.

7.1 · THE NEW FIDUCIARY STANDARD

Materiality & disclosure.

SEC and California CARB (SB 253, SB 261) now mandate disclosure of Scope 1 & 2 emissions alongside climate-related financial risks. **Energy volatility is a material financial risk.**

In the 2026 secondary market, buyers apply a **Grid-Risk Discount** to facilities without on-site generation — lowering exit multiples.

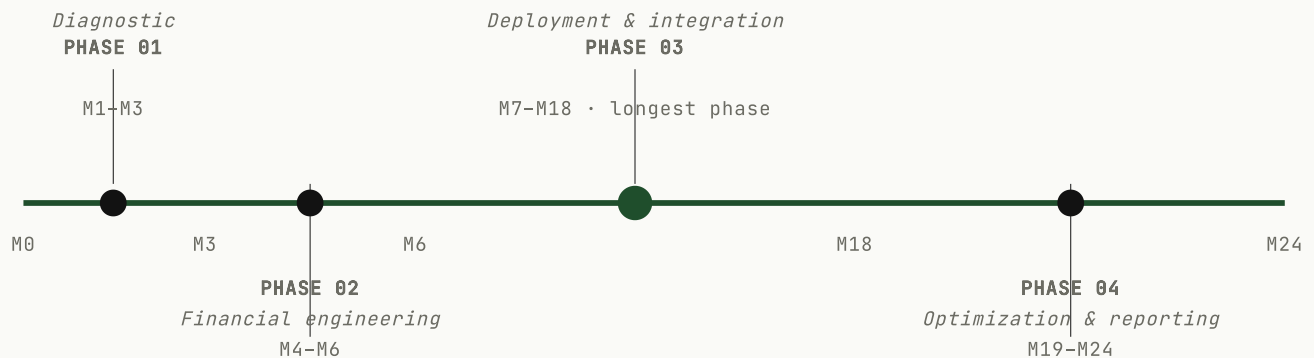
7.3 · THE FIDUCIARY QUESTION

THE QUESTION

*The status quo is a wasting asset.
The fiduciary question is no longer
whether to act — but on what
timeline.*

7.2 · THE 24-MONTH ROADMAP

Four phases. Twenty-four months.



PHASE 1 · DIAGNOSTIC

- ✓ 15-min interval audit
- ✓ LiDAR rooftop analysis
- ✓ Scope 2 carbon baseline

PHASE 2 · FINANCIAL

- ✓ ITC + MACRS optimization
- ✓ PPA vs. capex NPV
- ✓ Interconnection staking

PHASE 3 · DEPLOYMENT

- ✓ Zero-interruption installation
- ✓ Refrigeration PLC integration
- ✓ Thermal-battery commissioning

PHASE 4 · OPTIMIZATION

- ✓ EBITDA dashboard live
- ✓ Asset valuation audit
- ✓ Cap-rate expansion report

APPENDIX · ALPHA AUDIT

The alpha audit questionnaire.

Phase 1 operational and infrastructure diagnostics. Complete one form per facility. Accurate data determines whether the engagement produces a standard solar quote or a **Thermal Load Optimization Strategy**.

A.1 Energy nexus

☐ q1 Can you provide a .csv or Green Button file of 15-min interval data for the last 12 months?

☐ q2 From the last three utility bills, what was the peak kW and at what time of day?

☐ q3 Are you in a fixed-rate supply contract? Expiration and bandwidth clause?

☐ q4 Utility provider and current rate schedule (e.g., GS-3, TOU-8)?

A.2 Thermal load & refrigeration

☐ q1 What PLC or control platform is in use (Danfoss, Logix, Johnson Controls)?

☐ q2 Standard operating temperature, and the safety ceiling?

☐ q3 Are compressors equipped with Variable Frequency Drives (VFDs)?

☐ q4 On-site backup generation or thermal storage (Phase Change Materials)?

A.3 Structural & envelope

☐ q1 Year of last roof replacement, warranty provider, NDL status?

☐ q2 Specific roof membrane material (60-mil white TPO, PVC, EPDM)?

☐ q3 Original structural drawings available for point-load analysis?

☐ q4 Approx. % of roof occupied by condensers, penthouses, skylights?

A.4 Financial & tax

☐ q1 Owned, leased (Triple-Net), or held in a REIT?

☐ q2 Projected federal tax liability to absorb 30%+ ITC this fiscal year?

☐ q3 Capital allocation preference: NPV (ownership) or cash flow (PPA)?

☐ q4 Tax appetite confirmed with counsel? ITC adder eligibility reviewed?

— — END OF REPORT —

*The fiduciary question is no longer **whether** to act — but on what **timeline**.*

REPORT

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Energy & Resiliency Benchmark
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SOURCES

Mordor Intelligence
Towards Healthcare
Grand View Research
Econ Market Research
PJM • FERC • EPA AIM Act

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