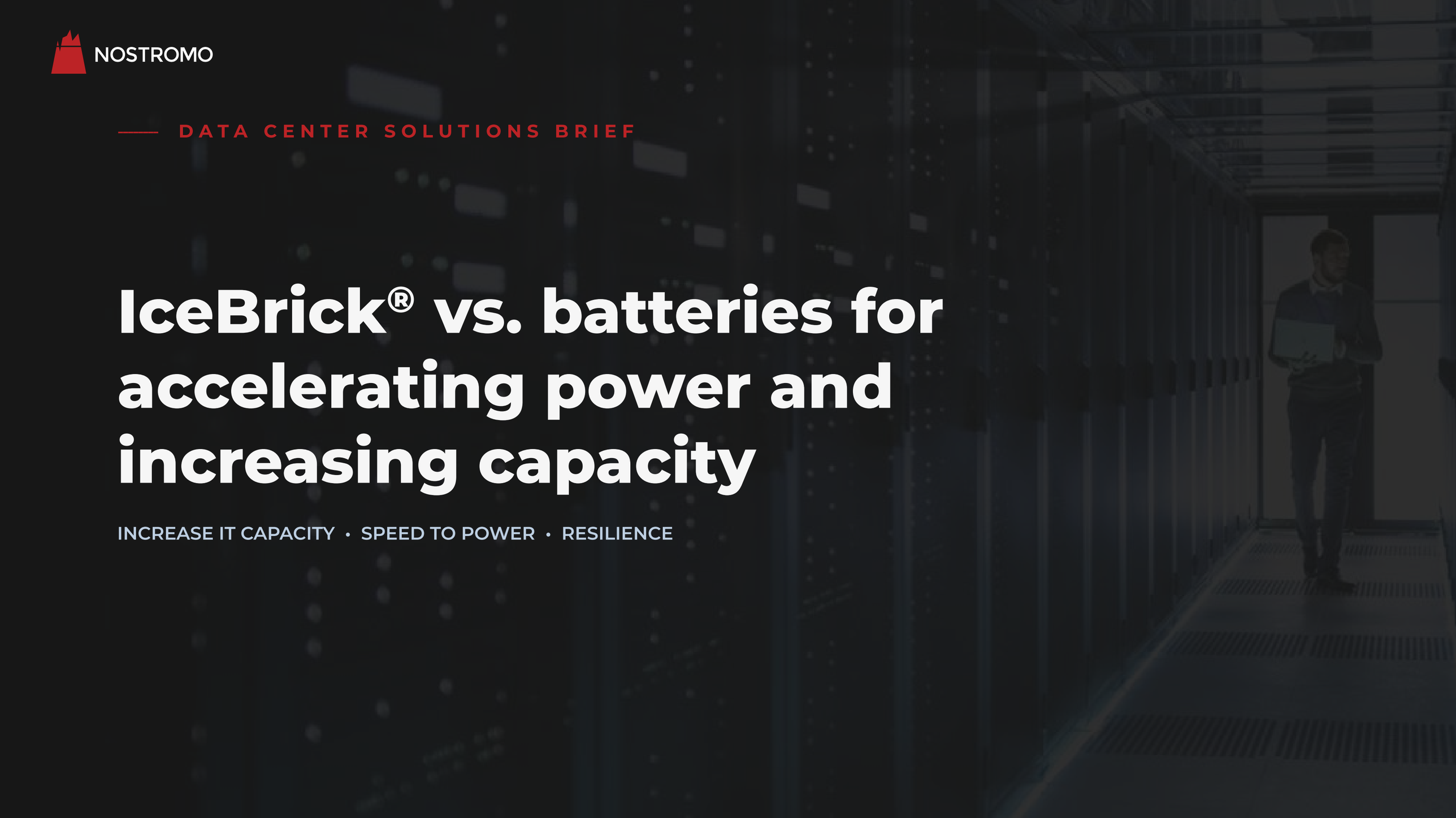
NOSTROMO

DATA CENTER SOLUTIONS BRIEF

IceBrick® vs. batteries for accelerating power and increasing capacity

INCREASE IT CAPACITY • SPEED TO POWER • RESILIENCE



BENEFITS AT A GLANCE

Eight ways IceBrick® changes the math for data centers.

01

INCREASE IT CAPACITY

Add up to 15% capacity on the same power envelope.

02

SPEED-TO-POWER

Flexible cooling power loads for faster, larger grid connection.

03

EFFICIENCY

Twice the capacity value compared to same-size batteries.

04

LOWER COST

Levelized cost performance 40-46% less than lithium-ion batteries, with twice longer useful life.

05

POWER + COOLING CAPACITY

Energy provided as cooling, solving for both capacity constraints.

06

SAFE & SUSTAINABLE

100% safe, 100% recyclable, entirely US-made.

07

SIMPLE DEPLOYMENT

Compact, modular, no special permits, no white-space involvement. No downtime.

08

FLEXIBLE ACQUISITION

Purchase or as-a-service, supported by the U.S. DOE.

NOSTROMO

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Data Center Solutions Brief.

INTRODUCTION

Power demands for cooling can be up to **40%** of a data center's total **peak power** use on the hottest summer days, limiting the power available for compute and hence the sellable IT capacity. The IceBrick system, a next-generation thermal energy storage technology, was designed to **unlock compute power** on existing power envelopes and enable **larger grid connections**, while enhancing reliability.

IceBrick is an ice-based cold energy storage system for air and process cooling. It connects and delivers energy directly to the chilled-water circulation. By shifting day-time loads from peak hours to nighttime, when there is surplus capacity, IceBrick **unlocks 5–15% of power capacity** for compute, on existing grid connections. IceBrick can also make all cooling load flexible and curtailable at peak hours or on-demand, enabling larger and faster connection to the grid, or to upgrade existing connections.

The additional cooling load (created by the additional compute workload) either forces chillers to work harder, reducing efficiency, or necessitates adding more chillers.

IceBrick solves both constraints simultaneously by providing both **energy** and **cooling**. Furthermore, reducing cooling load when discharging the IceBrick improves chiller efficiency for any remaining load they need to serve, freeing up more power for compute.

The simulation presented in this brief shows that **90%** of IceBrick energy output converts to additional **compute**, compared to only 50% of the output of batteries, due to the IceBrick's efficiency gain and batteries' efficiency cost. Furthermore, given its twice-long useful life, the levelized cost of IceBrick per additional kW of IT capacity is 40 - 46% lower than that of batteries.

IceBrick also offers unique practical benefits, such as fast deployment, due to minimal or no permitting requirements, absolute safety, complete recyclability, and back-up for cooling systems, its failure is the second most common cause for downtime.

DATA CENTER COOLING LOADS

Cooling consumes up to 40%* of peak power on the hottest summer days.

That demand limits the power available for compute - and caps the sellable IT capacity of every power constrained data center.

Cooling is the largest non-IT power use. It accounts for nearly all PUE variation, and is therefore the single biggest target for unlocking stranded capacity.

(Image Credit: Microsoft)

*25-40% depending on design and measurement methodology.

01

Unlocking Capacity

INCREASE IT CAPACITY • LEVELIZED PUE • RESILIENCE

COOLING DRIVES PUE

PUE swings 10-15% between night and mid-day.

When ambient temperature peaks, chillers are at their **least efficient** operating conditions using the most power to remove the same amount of heat. The remaining power capacity is what's left available for compute and ancillary equipment.

Air-cooled chillers swing the hardest because their efficiency is most sensitive to ambient temperature.

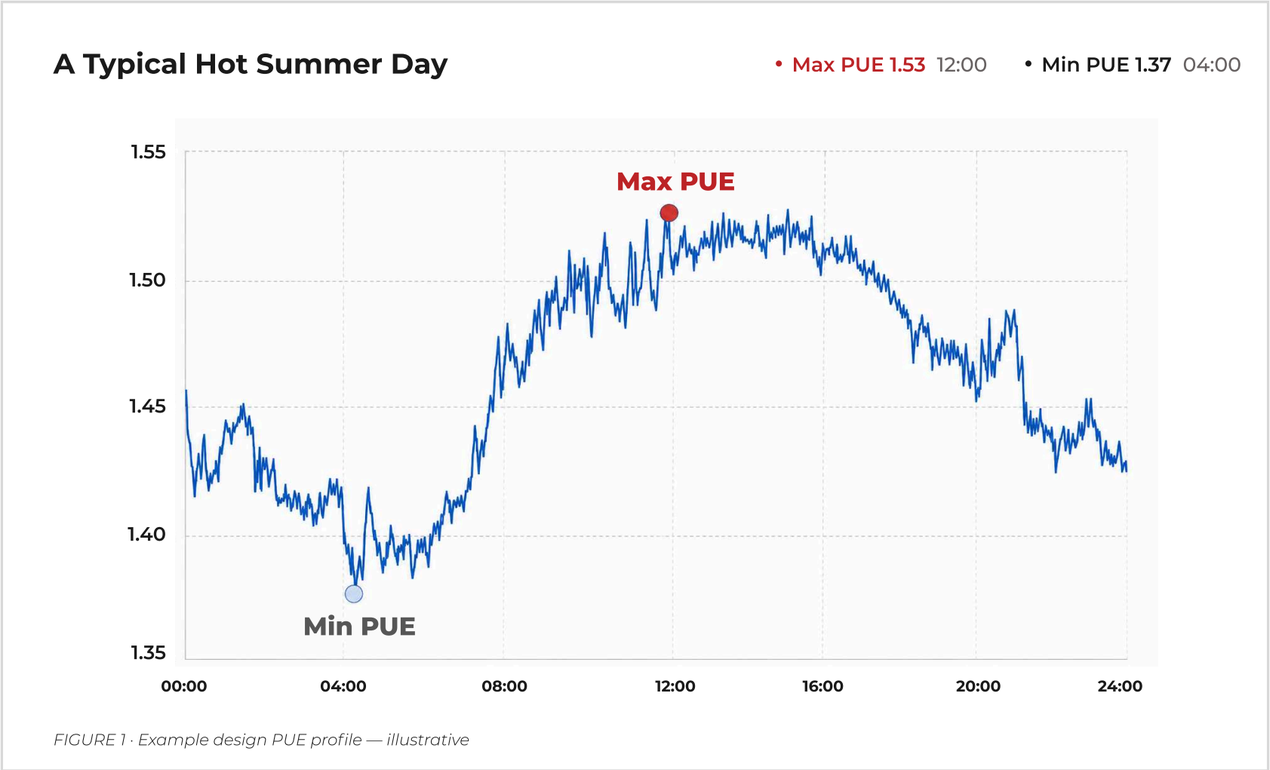


FIGURE 1 · Example design PUE profile — illustrative

LOAD SHIFTING FOR OPTIMIZING PUE

IceBrick® levelizes the daily PUE - unlocking 5-15% more IT capacity.

Daily PUE With IceBrick Load Shifting

Storage charges at night under target PUE; discharges to replace chiller load at peak

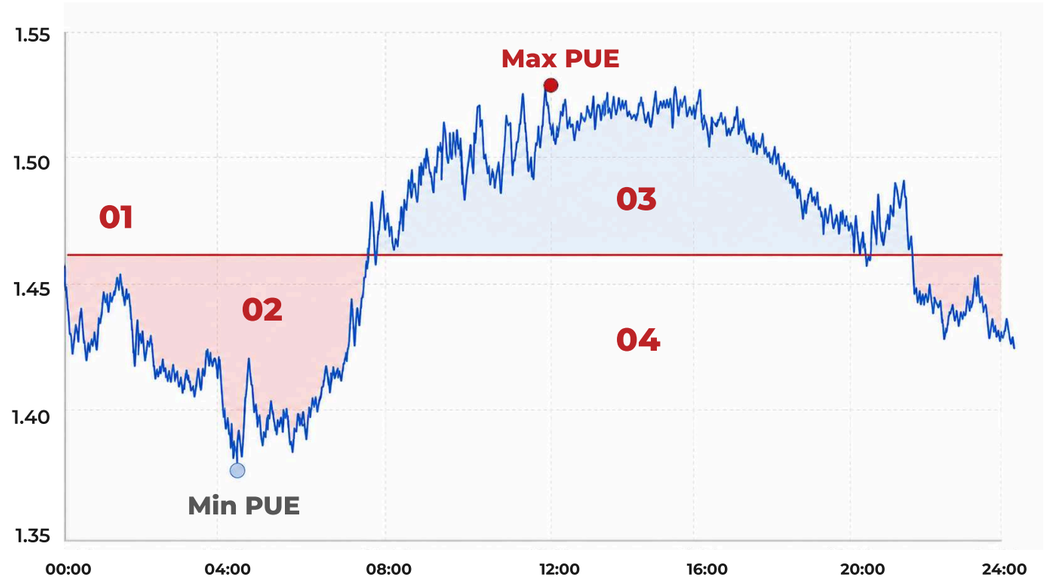


FIGURE 2 · IceBrick PUE Composer™ — illustrative

01 Compute Target PUE
Software calculates a lower target PUE for the site, which will be the operational threshold for storage activity.

02 Charge at Night
Below the target PUE, IceBrick recharges using surplus low-PUE capacity when the facility's chillers are operating most efficiently.

03 Discharge at Peak
Above the PUE target, IceBrick replaces chiller load by discharging cold energy directly into the chilled-water circulation.

04 Improve Efficiency
Reducing chiller load at the least-efficient hours improves kW/RT for any remaining load , freeing-up more power for compute.

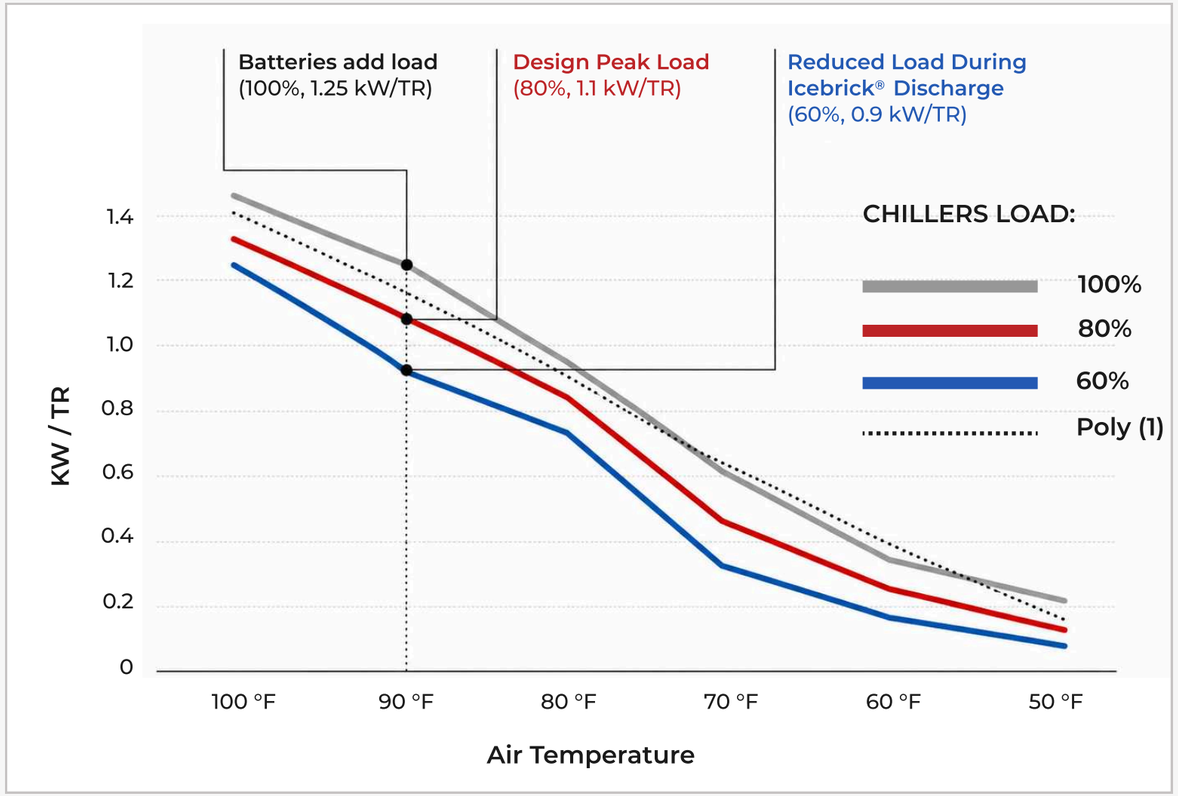
02

IceBrick vs Batteries

EFFICIENCY · LEVELIZED COST · COOLING · RESILIENCE · SAFETY

EFFICIENCY GAIN VS PENALTY

IceBrick provides twice the capacity gain vs the same size batteries.



Air-Cooled Chiller Efficiency (kW/TR) at Different Load %

Most air-cooled chillers lose efficiency when loads increase. When adding electric power but without installing more chillers, the additional cooling required for the new compute workload will reduce the data center's chiller plant efficiency, and therefore also the net power available for additional compute. By contrast, when the IceBrick discharges cold energy, it not only reduces chiller workload, but also makes it more efficiency for its remaining duty, freeing-up more power for compute.

See case study in the next slide.

CASE STUDY · 100 MW DATA CENTER

90% of IceBrick output becomes compute vs 50% of battery

	ICEBRICK	BATTERY
Storage size charged at night	10 MW	14 MW
New cooling load created	−4.3 MW (efficiency gain)	+3.5 MW
Chiller efficiency impact	+3.3 MW gain	−3.5 MW loss
Net to compute	9 MW (90%)	7 MW (50%)

+9 MW

ICEBRICK → COMPUTE

From a 1.0 MW system. 90% capture rate.

+7 MW

BATTERY → COMPUTE

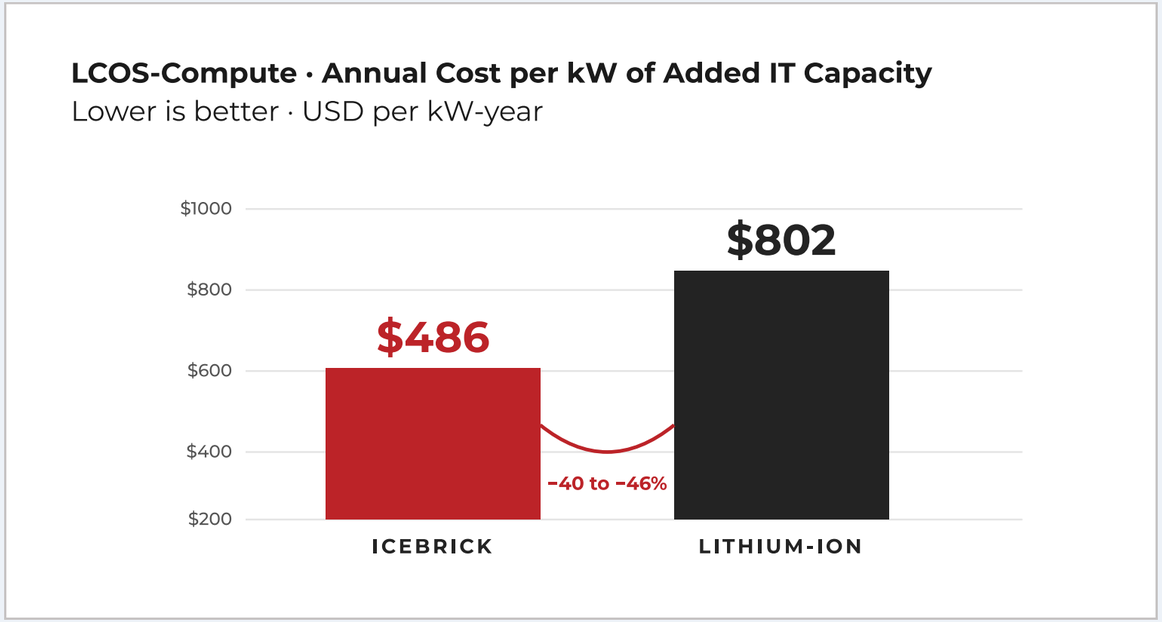
From a 14 MW system. 50% capture rate.

LEVELIZED COST OF STORAGE FOR COMPUTE

IceBrick levelized cost is 40–46% less per added kW of IT capacity than lithium-ion.

Levelized cost of strorage (LCOS) for compute reflects the present value of all costs of the additional compute (kW) over the life of the asset

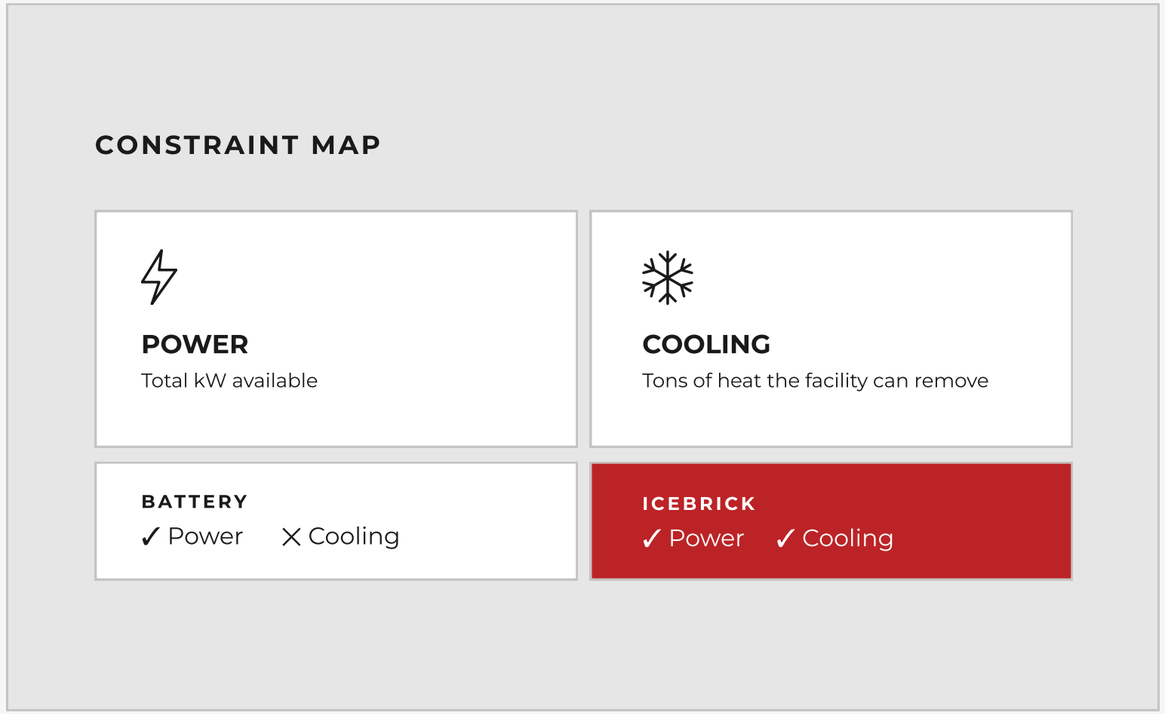
- 22–25 year useful life - twice that of lithium-ion
- Efficiency contribution embedded in the cost basis
- Savings widen further if added cooling capacity is needed



See full analysis in our **Blog**

POWER AND COOLING, TOGETHER

As kW/rack intensifies, cooling becomes the next hard limit.



IceBrick adds **both power** and peak **cooling** capacity.

Adding more chillers is often not viable: tight spacing causes air recirculation, drops efficiency, raises risk, and consumes the very power you wanted to put into compute.

COMPACT & MODULAR

Configures to whatever space the site can spare.

CONFIG · 01

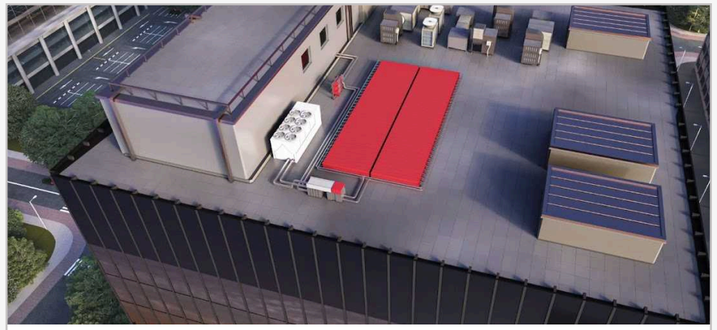
Stacked Basement

Up to 12 high · 6-7 ton-h / sqft · highest density.

CONFIG · 02

Wall Configuration

1-2 bricks wide up to 12 high · 6-7 ton-h / sqft



CONFIG · 03

Flat Rooftop

1–3 bricks high · .79 ton-h / sqft · spreads across available roof.

3×
DENSITY VS TRADITIONAL THERMAL ENERGY STORAGE

9.5 ton-h
PER ICEBRICK UNIT

14' × 20" × 10"
SINGLE UNIT DIMENSIONS

192
CAPSULES PER ICEBRICK

RESILIENCE

Cooling failure is the #2 most common cause of downtime.

Batteries can keep the equipment running. They cannot keep it cool.

IceBrick discharges cold energy on demand and keeps charging chillers in reserve providing real backup for the second most common downtime cause.

- Size for partial backup, N+1, or 2N cooling
- Charging chillers available as backup support
- Reduced strain extends useful life of chiller plants

BACKUP COVERAGE MATRIX

Failure Mode	Battery	ICEBRICK
Grid power loss	Yes	Yes *
Chiller failure	No	Yes
Air recirculation strain	No	Yes
Heat wave surge demand	No	Yes

* Cooling power demand

SAFETY & PERMITTING

Non-flammable. No special permits. Deploy almost anywhere.

100% NON-FLAMMABLE

Water-based encapsulated ice - no thermal runaway, no fire risk.

FAST DEPLOYMENT

No special permits, no fire suppression upgrades, no special insurance.

100% RECYCLABLE

Fully recyclable materials, non-toxic from manufacture to end of life.

100% US-MADE

Domestic supply chain, predictable lead times, price certainty.

CONTRAST

Large battery installations require fire-suppression systems, special permits, and additional insurance - adding cost and months to deployment.

03

Speed to Power

GRID CONNECTION · LOAD FLEXIBILITY · DEPLOYMENT TIME

THE GRID PROBLEM

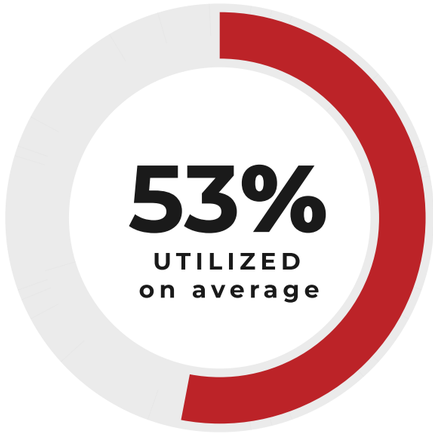
Grid connections take years. Nearly half of US data centers planned this year face delays or cancellation.

Interconnection queues, can delay development by 3–7 years.

Yet on average **only 53% of the grid's capacity is utilized**. Outside 100–200 hours of peak demand, most regional grids could already serve all proposed new load - if it could be made flexible.

National Grid Capacity Utilization

Annual average · headroom available outside peak hours



>100 GW

NEW DATA CENTERS CAN BE POWERED IF LOADS ARE CURTAILABLE AT PEAK

LOAD FLEXIBILITY

Curtailable cooling buys priority in the interconnection queue.

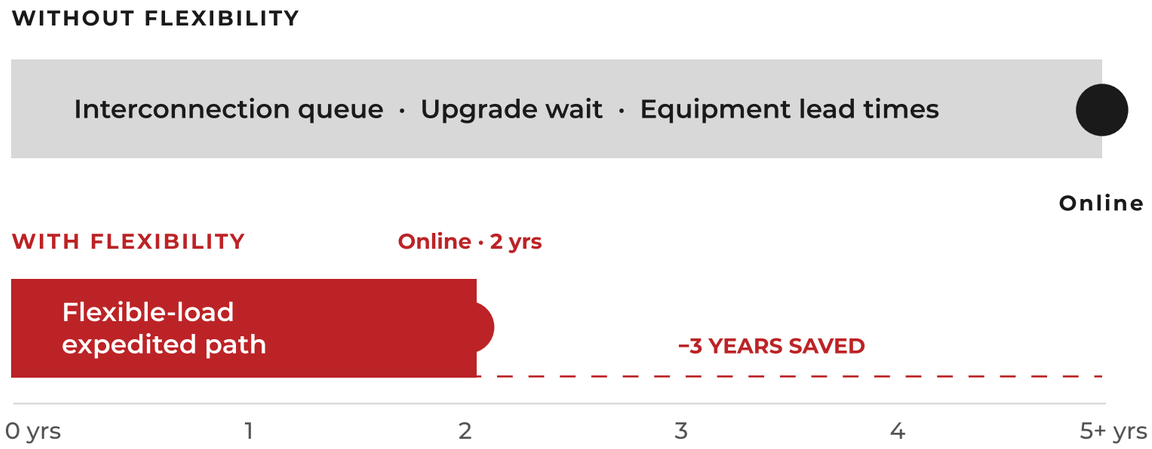
Utilities and grid operators offer shorter connection timelines for facilities with flexible demand.

A site that can commit to curtail during peak events can be provided the flexible capacity on a non-firm basis and gain priority for available firm capacity.

Behind-the-meter storage also eliminates the 6–9% Transmission and Distribution energy loss - a more efficient, more resilient grid for ratepayers.

Grid Connection Timeline · With vs Without Flexibility

Illustrative - years from request to operation



SPEED TO POWER · TWO SCENARIOS

Accelerating Connections with Load Flexibility

SCENARIO A

Increase grid connection for an existing site.

TODAY · 12 MW POWER LIMIT

8 MW IT, 1 MW ancillary, 3 MW cooling

REQUEST · 20 MW

13.5 MW IT, 1.5 MW ancillary, 5 MW cooling

UTILITY APPROVES 15 MW · ICEBRICK COVERS THE 5 MW DURING PEAK

Operator gets the full **20 MW operational envelope** by curtailing 5 MW of cooling load at peak - within the utility's 15 MW approval.

SCENARIO B

Accelerate connection for a new 100 MW site.

YR 2 · UTILITY OFFERS 50 MW

37.5 MW IT, 2.5 MW ancillary,
10 MW cooling

YR 4+ · FULL 100 MW

75 MW IT, 5 MW ancillary, 20 MW cooling

YR 2 WITH ICEBRICK · ICEBRICK SHEDS 20 MW COOLING (30 MW OTHER)

Site reaches 100 MW two years sooner by combining IceBrick cooling curtailment with other flexible resources, or operating until then at 62.5 MW instead of 50 MW (with 12.5 MW (20%) MW curtailable by IceBrick alone).

COMPARING TO OTHER SOLUTIONS

IceBrick is an optimal load curtailment tool and should be part of any flexibility stack

Capability	ICEBRICK	Batteries	Gas Generation	Diesel Generator	Manage Compute Load
Load flexibility	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Increase cooling capacity	**Yes**	No	No	No	No
> 8 hour duration	No	No	**Yes**	Limited (permit)	No
Backup energy	**Cooling**	Power	Power	Power	No
Reduce compute	**No**	**No**	**No**	**No**	Yes
Minimal / no permitting	**Yes**	No	No	No	**Yes**

INSIGHT

IceBrick is uniquely the only technology that adds cooling capacity, provides cooling backup, and avoids special permitting - all without reducing compute.

04

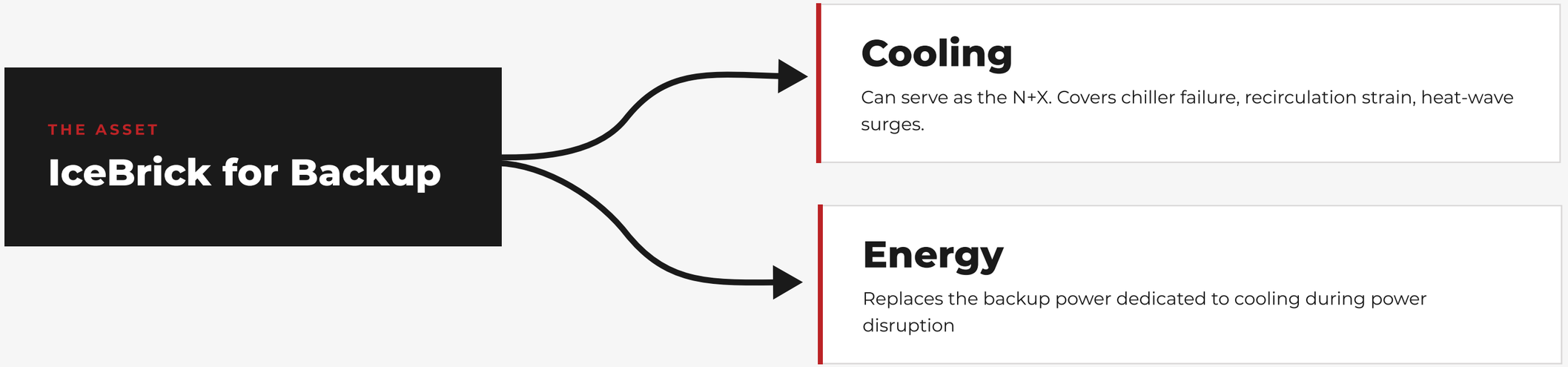
Operational Resilience

RELIABILITY · REVENUE · PAYBACK

OPERATIONAL RESILIENCE · TWO-IN-ONE

One system - backs up two infrastructures: Energy & Cooling

IceBrick stored energy is available as back up in events of loss of either power OR cooling, one system backing up two critical infrasturctures. At the same time, IceBrick doesn't sit idle, but can provide flexibility to accelerate power or load-shifting to unlock capacity.



CONVENTIONAL N+X

2 assets · idle capacity · maintenance cost · zero ROI

ICEBRICK 2-IN-1

1 asset · generates ROI via capacity + savings

05

Financial Considerations

MAXIMUM VALUE · TOTAL FLEXIBILITY

FINANCIAL CONSIDERATIONS

Maximum Value. Total Flexibility

OPTION I

Purchase

CUSTOMER-OWNED & OPERATED

2–3 yr	Payback when used to unlock additional capacity
22–25 yr	Useful life

INCENTIVES

- Investment Tax Credit (40-50%)
- Bonus depreciation (100% expensed against corp taxes in Year 1)
- Utility subsidies (varies by utility)

OPTION II

Service

NOSTROMO FINANCED AND OPERATED

No capex	Operating-expense model - no upfront capital outlay
12–20 yr	Service term
Early buyout	Buyout options available following year 5

OTHER FINANCIAL GAINS

- NEGOTIATE MORE FAVORABLE PPA TERMS
- DEMAND RESPONSE

THE ICEBRICK® TECHNOLOGY

Ice-based cold energy storage, engineered for the data center era.

- **Small Footprint** - 3× density of legacy ice-based TES
- **High Reliability** - 22–25 years of useful life
- **100% US-Made** - supply chain & price certainty
- **No White Space Involvement**
- **No Downtime for Installation**
- A**dvanced System Management** - to maximize impact and options
- **Full Control** - steady, responsive output

SUPPORTED BY

U.S. Department of Energy

LET'S TALK

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TECHNICAL SPECIFICATIONS

IceBrick360 · **Gen 2**