HOTELS AS AI INFRASTRUCTURE ASSETS

Industry Perspective

How wireless building automation and distributed intelligence reduce operating costs, protect guest experience, and create a new hotel infrastructure layer.

Hospitality is a uniquely distributed operating environment. Guestrooms, public spaces, central plant, kitchens, laundry, garages and event spaces all behave differently, yet they belong to one asset, draw on one utility account and answer to one brand standard. The opportunity is to make the intelligence equally distributed.

EXECUTIVE SUMMARY

Hotels combine three characteristics that rarely exist together in other real-estate sectors. The property directly absorbs its own energy cost. That cost has to come down without ever touching the guest experience. And the building is physically and technologically fragmented in a way that makes both harder.

The burden is measurable. U.S. lodging buildings run a mean site energy intensity of 85.7 thousand Btu per square foot at an energy expenditure of $1.65 per square foot. [1] Utility cost runs roughly $2,478 per available room per year and has risen from 2.9% of total hotel revenue in 2019 to about 3.3% in 2023 — and it is heaviest as a share of revenue in limited-service and extended-stay properties, at roughly 4.0%, not in the large resorts. [3][4] Meanwhile, at a forecast 63.1% occupancy for 2026, roughly 37% of all available room nights in the United States go unsold: rooms conditioned whether or not anyone is in them. [5]

The second characteristic is what separates hospitality from every other commercial building type. The requirement is not to minimize consumption but to minimize avoidable consumption while protecting readiness. A ballroom cannot wait until hundreds of attendees arrive before beginning to cool. Domestic-hot-water optimization is worthless if hot water is unavailable during the morning peak, and actively dangerous if it lowers storage temperature into the range where Legionella grows. Efficiency and readiness are one control problem, bounded by hard safety limits.

It is also increasingly a code issue. ASHRAE 90.1-2019 requires automatic guest room setback in covered hotels above fifty guest rooms; California Title 24 requires it in every guest room with no room-count threshold. The 2021 IECC expressly recognizes a “networked guest room control system”: where the system identifies a room as unrented, the code provides an explicit 20-minute trigger for unrented setback; absent that networked indication, unrented mode must be initiated within 16 hours of continuous unoccupancy. [9][10][11] The model energy code already describes this architecture and already gives networked room-status information a quantified role.

The third characteristic is the obstacle. Guestrooms, boilers, chillers, air handlers, kitchens, exhaust systems, garages, pools and event centers arrive from different generations and different vendors speaking different protocols, so a modern hotel can contain extensive technology while still lacking any common operating understanding of itself.

Wireless building automation changes that without replacing what is already installed. Multi-protocol gateways and wireless sensing extend into guestrooms, public spaces and mechanical systems while an existing BAS continues the local control it already performs well, and the new layer supplies sensing, context, analytics, portfolio visibility and, where authorized, supervisory optimization.

LEXI has measured this in the field on guestroom HVAC, and the lesson is architectural rather than numerical: the equipment did not need to become more efficient; the building became better at determining when it needed to run. [LEXI-1] The same principle extends past the guestroom door to central plant, domestic hot water, ventilation, garages and event spaces, and a representative complex-hotel model shows how that scope underwrites. [LEXI-2]

That scope is what creates the conditions for distributed intelligence — and a governance requirement this paper treats as non-negotiable: intelligence is not authority. A model may interpret, predict or recommend. Physical control remains with deterministic permissions, operating limits, validated control pathways and human override.

The sequencing matters. Reduce operating cost, then improve comfort, reliability and visibility, then add increasingly capable local intelligence. Infrastructure should earn its place by improving the hotel before it is asked to become anything more, and it should be reusable, so that the next application does not require reinstrumenting the property. That is the transition this paper examines: from fragmented hotel systems, to connected and managed building infrastructure, to increasingly local intelligence, and ultimately to a hotel that functions not only as a consumer of technology but as an intelligent infrastructure asset.

1 · HOSPITALITY IS A DIFFERENT BUILDING PROBLEM

A hotel is not one building-control problem. It is many operating environments sharing one asset.

A hotel may resemble an office or apartment building from the outside, but its operating environment is fundamentally different.

The property has hundreds of short-duration occupants rather than a relatively stable population. Guestroom occupancy changes every day and often several times within the operating cycle of the room. Public areas may operate continuously. Restaurants and kitchens follow different schedules. Meeting and event spaces can move from completely vacant to heavily occupied within minutes. Domestic-hot-water demand rises sharply in the morning and evening. Housekeeping creates another layer of room state between vacancy and guest occupancy.

The mechanical systems serving those spaces are equally diverse. A limited-service property may consist primarily of packaged or room-level HVAC equipment. A large full-service hotel or resort may combine guestroom fan coils, rooftop units, air handlers, VAV terminals, boilers, chilled-water systems, pumps, kitchen and laundry exhaust, pool systems, garage ventilation and event-center equipment.

Federal consumption data shows how differently those loads sit from a commercial office. In U.S. lodging buildings, ventilation is the single largest electricity end use at 87 trillion Btu, ahead of lighting at 50 and cooling at 40, while space heating accounts for only 22. On the gas side, water heating is the largest end use of all, at 83 trillion Btu — larger than space heating at 66. [2] A building type whose biggest gas load is hot water and whose biggest electrical load is moving air is not an office with beds in it.

The owner does not have the luxury of optimizing any one of these systems in isolation. Together they determine utility expense, guest comfort, equipment life, maintenance workload, indoor-air quality, event readiness, engineering response, brand compliance and ultimately hotel profitability.

This is why hotel building intelligence has to operate as a property-wide system rather than a collection of isolated products.

2 · HOTELS CAPTURE THE BENEFIT OF ENERGY EFFICIENCY DIRECTLY

The property pays the utility bill, and under the current accounting framework that saving lands directly on Gross Operating Profit.

The hotel energy equation is commercially attractive because consumption and cost sit inside the same operating statement.

The hotel purchases the electricity and fuel required to operate the property. A room that remains unnecessarily conditioned while a guest is away does not create a separate utility bill for that guest. The cost stays with the property. The same is true when a ballroom is cooled for hours before it is needed, when an air handler follows an outdated schedule, when a boiler cycles inefficiently, or when ventilation continues at full design assumptions despite low actual use.

That is more than a general observation about incentives; it is a line item. Under the Uniform System of Accounts for the Lodging Industry, 12th Revised Edition, effective 1 January 2026, energy is reported within Schedule 9, "Energy, Water and Waste," an undistributed operating expense above Gross Operating Profit and unallocated to Rooms. Every avoidable dollar removed from that schedule therefore improves GOP directly, net of the cost of the systems and services used to produce the saving. [6]

The same revision adds consumption and environmental metrics to the standard hotel P&L — energy cost per kilowatt-hour, water cost per unit volume, waste cost per unit weight, and carbon emissions tracking. [6] For hotels adopting USALI 12, controllers and asset managers are therefore being asked to report energy, water, waste and related operating metrics at substantially greater granularity. That creates a data-management requirement before it becomes an efficiency opportunity, and it lands on the same infrastructure.

There is also a flow-through argument that is easy to state and rarely made. An energy saving reaches Gross Operating Profit at close to one hundred cents on the dollar, because no offsetting departmental cost is attached to it, where incremental room revenue does not. A dollar removed from Schedule 9 is worth substantially more at the GOP line than a dollar of additional room revenue.

Energy efficiency consequently does not need a separate sustainability thesis to be economically relevant. Emissions reduction and regulatory compliance strengthen the case, and Section 4 shows how quickly they are becoming binding. But the first financial reason to improve energy performance is simpler: the property is paying the bill.

3 · WHO PAYS, WHO APPROVES, AND WHO BENEFITS

The party that pays the utility bill is usually neither the party operating the building nor the party setting the standards.

Section 2 is right about the profit and loss statement and incomplete about the decision. In a branded U.S. hotel there are typically three parties, and only one of them pays for energy.

The owner funds capital and bears operating cost; a management agreement has the operator paying operating expenses on the owner's behalf and from the owner's account, and capital expenditure is the owner's to fund. The third-party manager runs the building and employs the engineering staff, typically on a base fee calculated on revenue plus an incentive fee on Gross Operating Profit — so it captures a fraction of a saving it must do all of the work to produce. The franchisor sets the standards, takes fees on gross rooms revenue, and pays no utility bill at all.

Party	Funds the capital	Sets the standards	Captures the saving
Owner	Yes — building systems are owner capital	No	Substantially all of it, at the GOP line
Third-party manager	No	No	A fraction, through a GOP incentive fee
Franchisor / brand	No	Yes — technology and system standards	None; fees are on gross rooms revenue

This is not a marginal structure. Roughly 57% of U.S. hotels are franchised, [7] and about half of branded hotels globally are operated by third-party management companies in a market so fragmented that the largest operators each hold under 3% of inventory. [8] The split is softer than the landlord-and-tenant problem in retail or the owner-and-operator problem in senior living, because the owner does at least receive the saving. But it explains why guestroom energy retrofits stall: the party who benefits has no operating staff, and the party with the operating staff benefits least.

The capital route matters as much as the incentive.

Hotel FF&E reserves typically fund guestroom furniture, soft goods and operating equipment. Building systems sit outside them; owners separately fund structural work, HVAC and elevators, major refurbishment and repositioning. A networked building-automation layer that touches plant, gateways and IT therefore reads as owner discretionary capital, which means an annual budget cycle and an investment-committee decision competing against roof and chiller replacement. That single fact predicts the length of a hotel sales cycle better than any technical objection.

Which points at the timing.

A Property Improvement Plan commonly arises around sale, franchise renewal, conversion, or a brand-required renovation cycle. During a PIP, capital is already being evaluated, rooms may already be out of service, and installation labor may already be mobilized on the property. That makes the PIP window one of the most practical times to incorporate a guestroom retrofit into an owner's capital plan.

And brand standards are a genuine gate.

A franchise agreement can require named systems and designate their sources. Hilton's current U.S. Hampton franchise disclosure document requires franchisees to install specified Hilton property-management, connected-room and digital-key platforms, states that proprietary components must be acquired from Hilton or its designated vendors, applies a procurement fee where projects are bought through Hilton Supply Management, and reserves Hilton's right to add, modify or delete elements of the system with franchisees required to make future investments. Separately, Hilton's LightStay platform has been a brand standard for managed and franchised properties since 2009, and its current energy policy requires LightStay tracking for all hotels under a portfolio-wide ISO 50001 management system. [22]

No major brand publishes an approved-vendor list for guestroom energy management. What they do publish is enough to define the real gates: the data has to land in the brand's energy platform, the devices have to coexist with mandated systems on the property network, and the standard itself can change mid-term. A building-intelligence layer that is protocol-independent and export-ready answers all three. A closed product answers none of them.

4 · WHAT HOTEL ENERGY CODES ALREADY REQUIRE

Widely adopted energy codes increasingly require guestroom setback — and the model code expressly recognizes a networked architecture.

Occupancy-based guestroom control is frequently sold as an innovation. It is more accurate, and far more useful to an owner, to describe it as a compliance floor that is rising, subject to the code edition and jurisdiction applicable to a specific property.

Provision	Applies to	What it requires
ASHRAE 90.1-2019 §6.4.3.3.5	Hotels and motels with more than 50 guest rooms	Within 20 minutes of the last occupant leaving a rented room, raise the cooling setpoint and lower the heating setpoint by at least 4°F. Unrented and unoccupied rooms reset to no lower than 80°F cooling and no higher than 60°F heating.
ASHRAE 90.1-2019 §6.4.3.3.5.2	Same	Ventilation and exhaust fans off, or outdoor air isolated from the guest room, within 20 minutes of departure.
ASHRAE 90.1-2019 §9.4.1.3	Same	Guest room lighting and switched receptacles off within 20 minutes of departure; bathrooms within 30 minutes.
2021 IECC §C403.7.6	Group R-1 buildings with more than 50 guestrooms	A three-mode structure — occupied, rented and unoccupied, unrented and unoccupied.
2021 IECC §C202 definition	A "networked guest room control system"	Where the system can identify rented and unrented status and indicates a room is unrented, the unrented mode may be triggered after more than 20 minutes of unoccupancy; absent that networked indication, unrented mode must be initiated within 16 hours of continuous unoccupancy.
California Title 24 §120.2(e)4	Every California hotel and motel guest room — no room-count threshold	Set cooling up and heating down by at least 5°F no more than 30 minutes after the room is vacated.
California Title 24 §130.1(c)8 and §130.5(d)4	Same	Guest room lighting off within 20 minutes of vacancy; under the 2025 edition, controlled receptacles off within 20 minutes.

Three things follow from that table. [9][10][11] First, some guestroom savings a vendor might claim may already be required by the locally adopted code, so an honest energy case should be built against the property's actual compliant baseline rather than a thermostat with no setback at all.

Second, the code contains a definition written for exactly this architecture. The 2021 IECC defines a networked guest room control system as one with access from the front desk or another central location that is capable of identifying the rented and unrented status of each guest room. Where that system indicates a room is unrented, the code provides an explicit 20-minute trigger; absent that networked indication, the code allows up to 16 hours of continuous unoccupancy before unrented mode must be initiated. [10] That is a quantified, code-recognized advantage of central room-status information and is available to a supervisory layer that reads room status without replacing the guestroom controller.

Third, California is the direction of travel: Title 24 applies to every guest room regardless of property size, and its 2025 edition took effect for permits filed on or after 1 January 2026. [11] Successive editions of ASHRAE 90.1 have continued to tighten guest room provisions. A property specifying equipment today should assume the requirement gets shorter and broader, not looser.

Building performance standards put a date on it

Energy codes govern new construction and alteration. Building performance standards reach the existing portfolio, and several now name lodging explicitly.

Jurisdiction	Hotel coverage	What lands, and when
Washington Clean Buildings Performance Standard	The statute names hotel and motel floor area in the covered-building threshold	Benchmarking, an operations and maintenance program, an energy management plan, and an EUI target or an alternative pathway. 1 June 2026 above 220,000 sf; 1 June 2027 for 90,001–220,000 sf; 1 June 2028 for 50,001–90,000 sf.
New York City Local Law 97	Buildings above 25,000 sf; limits set by ENERGY STAR property type	Annual report each 1 May, with a penalty of $268 per metric ton of CO_2e above the limit and stricter limits from 2030.
Seattle Building Emissions Performance Standard	Hotel is a listed building activity type with published targets	2.06 kgCO_2e per square foot per year for 2031–2035, 1.20 for 2036–2040, and zero thereafter. Reporting begins in the 2027–2030 window.
Boston BERDO 2.0	Non-residential buildings at or above 35,000 sf	Emissions standards by use type, with an alternative compliance payment of $234 per metric ton of CO_2e.
Maryland Building Energy Performance Standards	Buildings at or above 35,000 sf, with no lodging exemption	Benchmarking is required; covered buildings must meet applicable direct-GHG performance standards beginning in 2030, tightening toward net-zero direct greenhouse gas emissions by 2040.

The Seattle schedule is the one worth reading twice. [12][13][14] Its hotel targets do not bite until 2031, but the reporting obligation begins between 2027 and 2030 — which means the sensing, sub-metering and normalized building data required to demonstrate compliance have to be installed in the window that is open now. A portfolio that waits until the target year will be measuring for the first time in the year it must already comply.

5 · GUEST COMFORT IS A CONSTRAINT, NOT A COMPETING OBJECTIVE

Efficiency is valuable only inside a hard guest-experience boundary.

Poor energy management treats guest comfort and efficiency as opposing choices. Good energy management treats comfort as a control boundary.

A vacant room and an occupied room do not need the same HVAC condition. That does not mean an unoccupied room should be allowed to drift without regard to recovery time, humidity, equipment limits or guest arrival.

The correct operating question is not how far the HVAC can be turned down. It is how much unnecessary conditioning can be eliminated while ensuring the room is ready when it is needed.

That requires context: current room temperature, occupancy state, HVAC mode and equipment response, room-status information where available, elapsed vacancy, outside temperature, door or window condition, recovery characteristics and configured comfort policies.

A simple room may need only deterministic occupancy logic. A more advanced application may learn how quickly different room types recover under different weather conditions. The principle is the same in both cases: save energy during the periods in which comfort does not require full operation, and restore the required condition before the guest is affected.

This is also why hotel automation should preserve manual and operator override. The objective is not maximum automated control. It is better operating decisions.

6 · GUESTROOM HVAC: THE MOST REPEATABLE STARTING POINT

The first question is simple: does this room presently require occupied conditioning?

Guestrooms create one of hospitality’s most repeatable energy opportunities because a large portion of the hotel consists of nearly identical spaces with highly variable actual use.

Traditional room HVAC may operate from a thermostat setpoint with little understanding of room state. The thermostat knows the temperature. It may not know whether the room has checked out, is unsold, whether the guest left for six hours, whether housekeeping is servicing the room, whether a window is open, whether the room is expected to be occupied shortly, or whether the equipment is consuming an abnormal amount of energy.

Occupancy-driven HVAC adds one critical piece of context: does the space presently require occupied conditioning? An eligible vacant room can move toward a defined energy-saving condition. When occupancy returns — or another configured condition requires normal operation — the system restores the occupied policy.

Unlike many abstract AI applications, the physical mechanism is straightforward. If equipment runs fewer unnecessary hours while still meeting the room’s operating requirement, less energy is consumed. The effectiveness depends on baseline operation, occupancy, climate, HVAC type, setback limits and recovery characteristics.

From the field, and about the number

LEXI's Hampton Inn Scottsdale deployment used occupancy-driven guestroom HVAC control and was measured by comparing same-size rooms over the same days rather than relying on a before-and-after utility comparison. The measured reduction sat at the top of the published range for this class of system. [LEXI-1]

The important finding is architectural rather than numerical. The HVAC equipment was not replaced with substantially more efficient equipment. The improvement came from better operating context. That distinction is what points toward a much larger opportunity, because operating context can be extended to systems that no guestroom product touches.

It is worth being direct about why this paper does not lead with a savings percentage. Occupancy-based guestroom control is a mature category with roughly a million installed rooms across its incumbents, and published vendor claims cluster between twenty and forty-five percent. The last large independent field study — a six-hotel demonstration conducted for the U.S. Department of Energy through the Commercial Real Estate Energy Alliance — measured an average of 18.4%, a range of 10.8% to 26.5%, annual savings of $20.96 to $79.03 per guest room, and simple paybacks between 5.3 and 15.7 years. Its own stated conclusion was that limited data existed regarding actual savings verified by an independent party, because most savings values were provided by the manufacturers. [19]

A buyer has heard the percentages. What the buyer has not been offered is a measurement they can audit, a scope that continues past the guestroom door, and an infrastructure layer that survives the next application. Those are the claims this paper makes, and Sections 7 and 8 are where they have to hold up.

7 · MEASUREMENT MATTERS MORE THAN THE ALGORITHM

A command issued is not the same thing as a savings result achieved.

Hotel energy savings should be measured.

A control strategy is not successful because software reports that it executed. There are three different events: the system decided that a change should occur; a command was issued; and the building actually changed.

Those events should not be treated as interchangeable. If a guestroom HVAC controller does not respond, the intended setback did not save energy. If an operator overrides a strategy, the automated sequence did not remain active. If a plant reset causes an unacceptable comfort or equipment condition, the strategy may need to change regardless of the predicted savings.

Measurement should match the claim being made. For a guestroom-control strategy, matched-room or equipment-level measurement is particularly useful. For a whole-property project, interval utility data may be necessary. For central-plant optimization, dedicated metering and formal measurement and verification may be appropriate. Where a project seeks utility incentives or contractual savings verification, the required M&V structure should be determined before implementation.

Two disciplines follow. Do not convert an engineering estimate into a measured result. And state the baseline: where an applicable adopted code already requires guestroom setback, savings measured against a no-setback baseline overstate what a compliant property will actually see.

LEXI's complex-hotel work therefore separates measured customer evidence from modeled economics used to evaluate future projects. [LEXI-1][LEXI-2]

8 · A REPRESENTATIVE COMPLEX-HOTEL ECONOMIC MODEL

Underwrite the measurable operating case first, then test it across scenarios rather than relying on one point estimate.

Large and complex hotels create a broader efficiency opportunity than guestrooms alone, because the optimization scope extends across both distributed rooms and major shared systems.

LEXI developed a representative modernization profile for a large full-service hotel with approximately $717,000 of annual gas and electricity expense. The modeled scope includes guestrooms, public areas, central plant, event spaces, ventilation, garages and compatible lighting controls.

Metric	Representative Model
Annual utility baseline	~$717,000
Modeled gross savings	~$103,000/year
Whole-building savings rate	~14.4%
Expected fully loaded project cost	~$295,000
Illustrative utility incentive	~$70,000
Net investment after modeled incentive	~$225,000
Annual platform fee	~$30,630
Lifecycle reserve	~$10,000/year
Modeled annual net savings	~$62,000/year
Simple payback before incentive	~4.7 years
Simple payback after modeled incentive	~3.6 years

Two features of that table are deliberate. The savings are stated net of the platform fee and a lifecycle reserve before payback is calculated, rather than gross. And the baseline can be checked from outside: $717,000 across more than two hundred guestrooms is roughly $3,585 per available room, which sits sensibly between the published limited-service and resort utility benchmarks for U.S. hotels. [3] These figures are modeled rather than realized, and depend on property configuration, utility rates, baseline operation, controls authority, equipment condition, installation scope, commissioning and the availability of utility incentives. [LEXI-2]

Payback is the wrong single number

A payback period competes against a hold period, and it always loses to a roof. Hotel assets are underwritten on a discounted cash flow with a terminal capitalization rate, which means a durable reduction in operating expense can be capitalized into the value of the asset when it flows through to stabilized NOI.

To the extent the modeled net operating savings flow through to stabilized NOI after any incremental management incentive fees and other property-level adjustments, approximately $62,000 of recurring NOI at a 7.5% to 9.5% capitalization rate is equivalent to roughly $657,000 to $832,000 of asset value — against a net investment of about $225,000.

That is arithmetic, not a forecast, and the capitalization rate is an assumption that should be taken from the property's own market and chain scale rather than a national average. [24] But it reframes the decision. A 4.7-year payback is a difficult conversation with an owner planning to sell in five. A multiple on capitalized value is a different conversation entirely, and it is the one an asset manager is equipped to have.

The hotel does not need a dramatic whole-building energy reduction to justify modernization; a portfolio creates value by eliminating many smaller forms of waste across guestrooms, central plant, ventilation, public areas and event operation. Underwriting should test conservative, expected and upside cases for savings, installation cost, utility rates and incentives rather than treating the representative case as a single-point forecast.

One segment note. The model above describes a large full-service asset because that is where the absolute dollars are, but utility cost is heaviest as a share of revenue in limited-service and extended-stay properties, at roughly 4.0%. [3] The properties where energy is the largest proportional burden are the smaller ones — which is also where a wireless retrofit is typically simpler to deploy.

The supervisory architecture also lets owners optimize what already exists before deciding which major equipment truly requires replacement. Optimize first. Measure. Then target capital where the data supports it.

9 · LARGE HOTELS NEED A SUPERVISORY LAYER, NOT ANOTHER RIP-AND-REPLACE

Extend what the existing BAS can see and understand before deciding what must be replaced.

Guestroom control is only the beginning for larger properties.

A full-service hotel may already have a capable BAS. The problem is often not that the BAS is defective. It is that the BAS does not reach everything. Guestrooms may use one control environment. Central plant may use another. Event spaces may be partially integrated. Kitchens, garages, pools, exhaust systems and legacy equipment may have limited sensing. New equipment coexists with systems installed decades earlier. The result is uneven digital coverage.

LEXI's complex-hotel architecture addresses this by adding a supervisory wireless building-automation layer rather than replacing the existing system. The incumbent BAS continues to perform the local control functions for which it was designed.

Supervisory layer adds	Purpose
Wireless sensing	Extend visibility where existing coverage is incomplete
Multi-protocol connectivity	Bridge heterogeneous hotel systems
Energy and equipment context	Make operating state understandable across systems
Centralized analytics	Surface patterns, exceptions and opportunities
Portfolio visibility	Manage comparable properties using a common operating model
Remote gateway and device management	Support lifecycle, health and over-the-air operations
Authorized supervisory control	Apply schedules, setpoints, resets and sequence changes where supported

Supervisory layer adds	Purpose
Room-status context	Support networked guestroom-control workflows and code-relevant room-state information where applicable

A representative large-hotel scope developed by LEXI includes more than 200 guestrooms together with central chilled- and hot-water systems, room-level HVAC, public-space air handlers and VAV systems, kitchen and laundry exhaust, garages, pool-related systems and major meeting and event loads. [LEXI-2]

That type of property is not one HVAC system. It is an operating ecosystem. The value of the supervisory layer is that those systems can progressively be understood as one.

10 · CENTRAL PLANT AND DOMESTIC HOT WATER: TEMPERATURE IS A SAFETY VARIABLE BEFORE IT IS AN ENERGY VARIABLE

Codes and public-health guidance require the system to balance hot storage and circulation against safe delivery. Optimization that forgets the distinction is a public-health problem, not a saving.

Central plant creates a major opportunity because traditional plant operation frequently follows static assumptions. Weather changes, room occupancy changes, event loads change and domestic-hot-water demand changes, yet boiler staging, water temperatures, pump operation and other plant strategies may remain substantially fixed. Connected building context makes those strategies responsive to actual demand: depending on equipment, available points and authorized control scope, optimization can include boiler scheduling and staging, hot-water and chilled-water reset, differential-pressure reset, pump and variable-frequency-drive strategies, chiller sequencing, air-handler scheduling, ventilation optimization, abnormal-operation detection and equipment-performance trending.

Domestic hot water deserves separate treatment, and not only because it is the largest natural gas end use in U.S. lodging. [2] It is the one plant system in a hotel where an energy optimization can create a health risk.

Legionella sets the floor

Hotels are squarely inside the scope of building water management programs. The building criteria implementing ANSI/ASHRAE Standard 188-2021 capture a building with multiple housing units served by a centralized hot water system — naming a hotel as the example — and capture independently any building over ten stories or containing a cooling tower, a hot tub that is not drained between uses, a decorative fountain, or centrally installed misters or humidifiers. [15] Many full-service hotels meet one or more of those criteria.

The risk is not theoretical and the failure mode is temperature. Legionella grows best between roughly 77°F and 113°F, and CDC control guidance targets storage above 140°F and circulating hot water above 120°F. [15] A 2026 investigation of two hotel-associated legionellosis outbreaks found Legionella-positive water samples at both properties. At one property, positive hot-water samples were approximately 102°F to 118°F, while the sampled water heater was about 130°F and did not yield growth; low disinfectant residuals were also part of the operating picture. [16] The lesson is not that one temperature explains every outbreak. It is that temperature, circulation and disinfectant conditions have to be managed and verified together.

Several jurisdictions now regulate this directly. New York State requires cooling tower registration, a maintenance program and Legionella culture analysis at intervals not exceeding ninety days; New York City requires a maintenance program explicitly compliant with ASHRAE 188 and monthly sampling; New Jersey requires a water management program consistent with ASHRAE 188 for buildings with a pool, spa or cooling tower, with penalties escalating where a violation causes serious injury. [18]

The design answer, and the sensing argument inside it

The apparent conflict between Legionella control and scald prevention resolves through layered temperature management. Water can be generated and circulated hot enough to manage microbial risk, then tempered at the distribution source and limited again at fixtures as required by the applicable plumbing design and code.

Layer	Function	Temperature direction
Storage and generation	Support microbial-risk control in the tank and hot-water loop	Hot — CDC control targets are above 140°F stored and above 120°F circulating
Master mixing valve (ASSE 1017)	Temper the distribution system at the source	Down, at the source
Shower and tub valve (ASSE 1016)	Scald and thermal-shock protection at the fixture	Down, at the fixture
Fixture limiter (ASSE 1070)	Limit outlet temperature at lavatories and sinks	Down, according to the applicable fixture limit

Store hot, temper at the source, limit at the fixture. [17] A water management program's verification and validation process has to demonstrate that its control measures are being implemented and are effective. Continuous or high-frequency monitoring at selected critical points can materially strengthen that verification, expose excursions that periodic manual checks can miss, and create a more complete operating record. It supplements — rather than replaces — the sampling, documentation, inspections and other control measures required by the property's water management program and applicable law.

LEXI's DHW development framework follows a progressive control model — monitor, then advise, then control recirculation, then charge tanks predictively, then stage boilers — in that order and for this reason. Each step requires appropriate instrumentation, commissioning, safety constraints, fallback behavior and operator authorization, and monitoring comes first because it is both the least risky step and the one that establishes the operating evidence needed before more active optimization is introduced. [LEXI-3]

Water-temperature requirements, scald protection, sanitation constraints and equipment limits take precedence over optimization, without exception. The underlying principle is otherwise the same as guestroom HVAC: operate the system for the condition that actually exists rather than a permanently conservative assumption. But in domestic hot water the conservative assumption is protecting something, and the system has to demonstrate that the protection remains intact.

11 · EVENT SPACES EXPOSE THE LIMITS OF SIMPLE OCCUPANCY CONTROL

Prediction earns its place when waiting for real-time occupancy would already be too late.

Ballrooms, conference centers and large meeting rooms illustrate where more sophisticated intelligence becomes useful.

In a guestroom, real-time occupancy is often sufficient because the conditioned volume is relatively small and recovery is quick. A ballroom is different. If the system waits until 300 attendees walk into the room before beginning to cool it, the control system has already failed.

Large spaces have thermal lag created by air volume, walls and furnishings, outdoor-air requirements, humidity, equipment capacity, partitions, weather conditions and the rapidly increasing sensible and latent load created by arriving occupants. At the same time, fully pre-conditioning every event room all day simply transfers the comfort problem into an energy problem.

This is a building problem where prediction adds real value, and it is worth noting how rarely it is addressed. Incumbent guestroom energy management does not reach the ballroom, and event-management platforms know the booking but not the thermal behavior of the room.

LEXI is developing Predictive Event Space Comfort Control, an occupancy-informed thermal-management approach that does not require direct integration to an event-management platform.

Potential pre-arrival signal	Operational relevance
Historical room-use patterns	Estimate likely use windows
Pre-function-area activity	Detect gathering before entry
Setup and service-door activity	Infer event preparation
Lighting or room-state changes	Identify transition toward use
Weather and current temperature	Estimate recovery requirement
HVAC response	Understand actual thermal performance
CO_2 and indoor air quality	Confirm occupancy-related load
Manual staff overrides	Preserve operator control

Vacant energy-saving → standby readiness → pre-conditioning → occupied comfort → post-event recovery.

If the predicted event does not materialize, the system backs away from unnecessary pre-conditioning. If guests arrive, real occupancy and indoor-air-quality data confirm the load. Over time the application can learn the thermal response of each room under different conditions and refine how early conditioning should begin. [LEXI-4]

The objective is not to put AI in a ballroom because AI is fashionable. The objective is to solve an operating problem that deterministic real-time occupancy alone cannot solve efficiently — and to do it without asking the hotel to re-key its event calendar into another system.

12 · FROM SEPARATE SYSTEMS TO HOTEL OPERATING CONTEXT

The strategic asset is not the sensor reading. It is the context linking space, equipment, condition, policy and outcome.

Once rooms, equipment and environmental conditions are connected, the strategic asset is no longer the individual sensor reading. It is the context linking those readings together. Applied across a whole property, that context produces a single view of what the building can observe, what each observation is for, and — critically — where the platform's authority ends.

Consider a simplified hotel example. A room temperature of 74°F means little by itself. The same reading becomes useful when the system understands that the room is currently vacant, is expected to be needed later, outdoor temperature is high, the HVAC unit normally requires 24 minutes to recover, the room has an open-window condition, the equipment has been running longer than comparable rooms, and hotel policy permits a defined unoccupied setback.

Now the building can reason about the operating condition. The same principle applies at property scale. An event center, central plant and guestroom tower should not need to operate from entirely separate versions of reality.

Context layer	Examples
Space	Guestroom, ballroom, kitchen, lobby, corridor, plant room
Equipment	Fan coil, thermostat, rooftop unit, VAV box, air handler, boiler, chiller, pump
Condition	Temperature, humidity, CO_2, energy, equipment state
Use	Occupied, vacant, setup, event, cleaning, recovery
Policy	Comfort envelope, schedule, override, equipment constraint, safety limit
Outcome	Energy consumed, temperature recovered, alarm generated, action verified

This contextual model is what allows building intelligence to become useful rather than merely more data-rich. It is also what makes the reporting and operating requirements in Sections 2 and 4 tractable: a property that holds normalized context can produce an energy-intensity figure, an emissions report or a control record as a query rather than a separate data-reconciliation project.

Authority is strongest where the consequence of error is a comfort complaint, and it disappears where the consequence is a safety event.

13 · THE MANAGED EDGE: LOCAL INTELLIGENCE, RESILIENCE AND A DATA BOUNDARY

Put intelligence where the operating decision belongs, keep the building running locally, and move only the information the application actually needs.

The same physical structure that makes hotels difficult to operate also makes them well suited to distributed intelligence.

A hotel consists of many distributed operating zones. Every guestroom has power, connectivity, HVAC, environmental conditions, physical state, recurring operating workflows and a relationship to the rest of the building. Central systems provide another set of physically connected operating nodes.

Device → room or equipment → gateway and edge → property → portfolio → cloud.

Not every decision belongs at every layer. A thermostat control loop should not depend on a cloud round trip. A room-occupancy decision can usually be executed locally. Event-space thermal readiness benefits from local property data. Portfolio benchmarking and fleet analytics are naturally centralized. Large-model reasoning and computationally intensive workloads may still use cloud infrastructure. Distributed intelligence is therefore not a rejection of cloud computing; it is an architecture in which intelligence is placed where it best serves the operating problem.

Hotels operate continuously, which changes what cloud dependency means

A temporary internet interruption should not prevent a guestroom from maintaining an acceptable temperature. An event space should not abandon its control strategy because a remote analytics service becomes unavailable. Domestic-hot-water safety cannot depend on a wide-area network connection.

Resilience should follow an explicit operating hierarchy: normal connected operation; local autonomous operation during WAN loss; deterministic fallback if required inputs become unavailable; preservation of existing equipment or local BAS control; and operator override throughout. The exact fallback behavior is application- and equipment-specific, but loss of the cloud must not create loss of basic hotel operation.

Local processing is also a privacy boundary

Guestroom intelligence should operate on the minimum information required for the building function. HVAC optimization needs to know whether a room requires occupied conditioning. It does not need to know who the guest is.

Where compatible raw occupancy or sensor inputs can be interpreted locally, the gateway can expose a derived operational state — occupied, vacant, or confidence-qualified presence — rather than transmitting the underlying data, and identity-bearing information should be introduced only where a specifically authorized hotel workflow requires it.

In hospitality, though, the question a brand's risk team asks is not only what a system transmits but what the device is physically capable of detecting. The sensing modality should therefore be chosen so the guestroom device cannot capture what the application does not need, and what is deliberately not sensed should be documented alongside what is. Data minimization by architecture is stronger than data minimization by policy, because it survives a change of vendor, a change of operator and a subpoena.

14 · INTELLIGENCE IS NOT AUTHORITY

AI may interpret or request. Deterministic policy decides whether the physical action is allowed.

Local AI interacting with a physical hotel introduces an important governance requirement. AI models are probabilistic. Building control cannot be unrestricted.

An AI application may determine that an event is likely, that a room appears vacant, that a boiler sequence is inefficient or that an equipment condition is abnormal. That conclusion does not automatically give the model authority to act.

Protected-control requirement	Purpose
Authenticated identity	Know which system or application is acting
Authorized application scope	Limit what a workload may request
Permitted control points	Prevent unauthorized writes
Equipment operating limits	Keep commands within safe ranges
Comfort boundaries	Protect guest experience
Safety constraints	Preserve higher-priority physical requirements
Data-validity checks	Avoid action on stale or invalid inputs
Command verification	Confirm physical response
Fallback conditions	Return safely when assumptions fail
Human override	Preserve operator authority

This separation between intelligence and authority is central to LEXI's protected-control architecture. The model can recommend or request. The deterministic control layer decides whether the requested action is allowed and how it is safely executed.

Where the boundary is not negotiable

Some control paths are life-safety functions and belong to listed equipment. The mechanical code requires duct smoke detection in return-air systems above 2,000 cfm and requires that, on activation, the detectors shut down the operational capabilities of the air distribution system in accordance with the listing of the appliances used in it. [23] A supervisory intelligence layer may observe that path and report on it. It must not execute it, override it, or be capable of restarting an air handler that a duct detector has shut down. The same principle governs refrigerant detection and machinery-room ventilation interlocks.

This matters more in hospitality than in most sectors because an optimization error is rarely abstract. It becomes a cold room, a hot ballroom, unavailable hot water, an equipment alarm or a guest complaint — and, in the case of domestic hot water, potentially something considerably worse. The physical consequences are real. The governance has to be real as well.

15 · SECURITY AND LIFECYCLE MANAGEMENT MUST SCALE WITH THE GATEWAY FLEET

Managed Edge means managing both the software lifecycle and the evolution of the compute hardware beneath it.

Distributed intelligence expands the number of managed infrastructure endpoints. That makes fleet security a core operating requirement. A hotel owner should not have to choose between local intelligence and a larger unmanaged attack surface. Distributed gateways should be operated as managed infrastructure.

Fleet-security capability	Role
Secure device identity	Authenticate every gateway
Authenticated provisioning	Prevent unauthorized enrollment
Signed software	Protect software integrity
Controlled over-the-air deployment	Manage software changes safely

Fleet-security capability	Role
Health monitoring	Detect degraded or abnormal operation
Rollback and quarantine	Recover or isolate problematic nodes
Role-based authorization	Limit administrative privilege
Least-privilege access	Minimize unnecessary permissions
Network segmentation	Reduce blast radius and manage compliance scope
Auditable lifecycle management	Maintain operational traceability

Two hospitality-specific constraints

The first is payment-card scope. PCI DSS scoping guidance is clear that systems connected to a system in the cardholder data environment may be in scope irrespective of their business function, and that adequate segmentation requires purpose-built controls rather than a shared network. [20] A building-automation gateway does not escape the scoping question because it only carries thermostat data. A hotel has a front desk, food-and-beverage point of sale and a guest network, so the segmentation design is a gating question for the property's network architect and should be answered in the deployment plan rather than discovered at assessment.

The second is radio policy. Federal enforcement is settled that no hotel or commercial establishment may intentionally block or disrupt personal Wi-Fi hotspots on its premises, and there is enforcement history with substantial penalties. [21] Practically, a property's wireless intrusion-prevention configuration must not block guest hotspots, which constrains how aggressively a hotel can manage its 2.4 GHz airspace. That is one argument for using purpose-appropriate sub-GHz, Bluetooth Low Energy or mesh protocols rather than adding unnecessary Wi-Fi endpoints to crowded guest airspace.

Lifecycle has a hardware dimension

AI accelerators will evolve faster than boilers, fan coils, meters, sensors and hotel buildings, so the intelligence layer has to be upgradeable without reinstrumenting the property. Physical connectivity, normalized building context, application permissions and protected-control policy should be separable from any particular processor generation, so future edge nodes can be upgraded or replaced while preserving the underlying sensing, building integrations, control boundaries and managed operating model. The useful life of the connected building layer should not be limited to the useful life of one accelerator — which is why Managed Edge matters as much as Edge AI.

16 · FROM SMART HOTEL TO AI INFRASTRUCTURE ASSET

Technology becomes infrastructure when the same managed layer supports successive applications without successive reinstrumentation.

A smart hotel uses technology to improve the property. An AI infrastructure asset goes one step further: it operates a distributed, managed and governed digital layer capable of executing intelligence across the physical hotel.

Hospitality technology has historically been divided into categories — guest technology, property-management software, energy management, building automation, engineering systems, networking, security — each solving a specific problem with its own hardware. The question distributed intelligence changes is not which additional system the hotel should install. It is how much of the hotel's operating intelligence the infrastructure already distributed across the property can support.

The gateway connecting a thermostat can also connect environmental sensors. The occupancy state used for HVAC can serve a compatible lighting workflow. The equipment telemetry used for energy can support diagnostics. The event-space sensing used for air quality can support thermal readiness. The temperature sensing installed for domestic-hot-water optimization can strengthen the water management program's verification record. The same managed edge can progressively support more local intelligence.

That is where economic value begins to compound. Infrastructure justified by one application becomes reusable, and the hotel does not need a new parallel stack for every use case — it adds applications to a common connected foundation while upgrading software and compute independently as requirements evolve.

Underwriting layer	What belongs here
Underwritable base	Energy savings, code and building-performance compliance, equipment condition, water-safety evidence, operational visibility, and other measurable hotel applications
Expanding value	Additional local intelligence, predictive applications, portfolio coordination and new operating workflows built on the same layer
Strategic upside	Longer-term commercial uses of the managed edge that depend on future hardware and market conditions, and that no property should underwrite today

That last row deserves one honest paragraph rather than a business case. As accelerated edge hardware matures, a distributed gateway fleet may hold local compute capacity beyond what hotel operations require, and there is a plausible future in which genuinely surplus capacity has commercial value — the model LEXI describes elsewhere as AI Inference-as-a-Service. The governance that would make it safe is real work: the hotel remains the first user; life safety, guest comfort and building operations hold priority; external workloads would have to be authenticated, isolated, resource-limited, interruptible and immediately reclaimable; and any such workload adds electrical load to a building that may itself sit under an emissions cap. Until those questions are settled, the responsible position is that this is not part of the investment case. No hotel should buy building intelligence on the strength of it, and nothing in Section 8 depends on it.

Connected hotel → managed hotel edge → intelligent hotel → AI infrastructure asset.

17 · HOTEL PORTFOLIOS MAKE THE ARCHITECTURE MORE VALUABLE

Local execution creates property value. Portfolio learning makes that value repeatable.

The strategic benefit increases at portfolio scale. A single property produces operating data. A portfolio creates repeatability.

Hotel owners, operators and brands can compare HVAC performance, equipment health, energy intensity, room recovery behavior, domestic-hot-water performance, override frequency, event-space behavior, abnormal consumption, gateway and device health and application performance across many properties using a common operating model.

This changes the role of a corporate engineering or energy team. Instead of asking every property to independently discover the same issue, the portfolio identifies recurring patterns. If a control strategy works in one property type, it can be evaluated across comparable hotels. If an equipment condition reliably precedes failure, the diagnostic pattern can be distributed. If an event space consistently takes longer to recover under high humidity, the thermal model can learn from that behavior.

Portfolio scale also changes the compliance arithmetic. An owner with assets in Washington, New York City, Boston and Seattle faces different reporting regimes on different schedules. [12][13][14] A common operating model that produces energy intensity, emissions and equipment evidence in one shape across the portfolio turns multiple jurisdiction-specific data projects into one common operating foundation.

Distributed infrastructure creates local execution. Portfolio management creates institutional learning. The combination is stronger than either alone.

18 · WHERE TO START

One property. One bounded scope. Measurements named before installation, not after.

A maturity model tells an owner where they are going. It does not tell them what to sign. The first commitment should be small, bounded, measured against a stated baseline, and structured so that the result is usable whether it is good or bad.

Scope. One property. Either one guestroom tower or floor group, or one event-space cluster together with the plant serving it — not a mix, because a mixed scope cannot be attributed. Where the property is scheduled for a Property Improvement Plan, align to it.

Duration. Ninety to one hundred eighty days, spanning at least one seasonal transition and one period of high event activity.

Baseline. Stated before installation, and stated honestly: whether the existing rooms have code-compliant setback under the locally applicable code, what the incumbent control is, and what the property’s current occupancy pattern looks like. Savings measured against a non-compliant baseline will not survive contact with an asset manager.

Measurements, named in advance.

1. HVAC runtime hours per occupied room-night, normalized to degree-days.
2. Recovery time to occupied setpoint, by room type and outdoor condition.
3. Override frequency, by cause — the honest measure of whether the strategy is tolerable to staff.
4. Unresolved comfort complaints per hundred room-nights, against the prior comparable period.
5. Event-space time-to-ready, and pre-conditioning hours not spent on events that did not occur.
6. Domestic-hot-water temperature excursions at monitored critical points, with the resulting operating and water-management verification record.
7. Deployment economics: actual installation time, hardware, labor, integration and ongoing operating requirement per room and per property.

That last measurement is the one most vendor pilots omit and the one a portfolio buyer actually needs, because it is what determines whether the result can be repeated across forty properties or only demonstrated at one.

Where the case is strongest. Two conditions predict a good first property better than anything else: an extreme climate or a low-occupancy operating pattern, which increases the number of harvestable vacant-room hours; and a baseline without an existing networked guestroom control system. It is worth saying plainly that these conditions also work in reverse — a high-occupancy property in a mild climate with a modern networked system will show less, and should be chosen second.

Once the first scope is measured, the phased path below is the natural extension. It is a sequence, not a commitment.

Phase	Focus	Objective
1 · Baseline and connect	Review controls; establish gateway coverage; connect high-value systems	Create a common operating foundation
2 · Monitor and verify	Measure room HVAC, energy, plant behavior and environmental conditions	Establish trustworthy baselines and M&V
3 · Automate	Deploy proven deterministic strategies	Create measurable operating savings
4 · Optimize	Extend to plant, domestic hot water, public spaces, ventilation and compatible lighting	Tune the property using observed performance
5 · Add local intelligence	Deploy predictive analytics and selected edge applications	Solve problems fixed rules cannot solve efficiently
6 · Extend the infrastructure model	Add applications to the established layer as capabilities mature	Create incremental value without reinstrumentation

CONCLUSION

Hotels are one of the clearest environments in which distributed intelligence can begin with a practical operating problem rather than a technology thesis.

The opportunity starts with energy, because hotels absorb utility expense directly, HVAC is a large and controllable load, roughly a third of available room nights go unsold, and larger properties carry substantial central-plant, domestic-hot-water, ventilation and event-space loads. The constraint is equally clear: efficiency cannot compromise the guest experience, and in domestic hot water it cannot compromise safety.

Three things distinguish this from the category a hotel owner has already been sold. Energy codes increasingly require guestroom setback and expressly recognize networked room-status architectures, which means the honest case is built against the property's actual compliant baseline rather than a strawman. The savings should be evaluated for their potential effect on stabilized NOI and asset value rather than merely paid back, because that is how a hotel asset is actually valued. And the temperature sensing that makes domestic-hot-water optimization defensible can also strengthen the verification evidence supporting a water management program.

From there, the architecture supports increasingly local intelligence. Some decisions remain simple deterministic rules. Some benefit from analytics. Some — predictive event-space thermal readiness among them — justify more advanced local models. The criterion should always be the operating problem, not the novelty of the algorithm. As that intelligence becomes more capable, governance becomes more important: AI can interpret and recommend, protected control must govern physical action, and guest comfort, safety, equipment requirements and human override remain above optimization.

The infrastructure also needs to outlive individual applications and processor generations. Connectivity, normalized building context, protected control and fleet management should remain useful as software evolves and edge hardware is upgraded. That continuity is what allows an owner to treat the layer as infrastructure rather than a series of point solutions.

Fragmented hotel → connected hotel → managed hotel edge → intelligent hotel → AI infrastructure asset.

The most durable starting point remains the same: improve the hotel first.

SOURCES AND NOTES

LEXI project and technical sources

[LEXI-1] LEXI Devices, Inc., *Energy, HVAC & Lighting Application Explainer*, August 2026. Hampton Inn Scottsdale, occupancy-driven guestroom HVAC, measured by comparing same-size rooms over the same days. The measured average HVAC energy reduction was 51%. Scottsdale is an extreme cooling climate; the result is a property-specific measured result in a favorable cooling environment, not a forecast or expected result for another property. Savings depend on baseline operation, occupancy, climate, HVAC type, setback limits and recovery characteristics.

[LEXI-2] LEXI Devices, Inc., *Large & Complex Hotel Modernization Profile*, August 2026. Representative whole-property wireless BAS scope and modeled economics. Savings, costs and utility incentives are modeled rather than realized or guaranteed.

[LEXI-3] LEXI Devices, Inc., *Domestic Hot Water Boiler Optimization Product Requirements Document*, 2026. Development framework for progressive DHW monitoring, advisory and control.

[LEXI-4] LEXI Devices, Inc., *Predictive Event Space Comfort Control System*, June 2026. Capability under development; occupancy-informed thermal-readiness architecture for ballrooms, meeting rooms and convention spaces.

Third-party sources

[1] U.S. Energy Information Administration, *Commercial Buildings Energy Consumption Survey 2018*, Table C4 — Lodging: 85.7 thousand Btu per square foot mean site energy intensity, $1.65 per square foot energy expenditure. CBECS 2018 is the most recent completed cycle.

[2] U.S. Energy Information Administration, CBECS 2018, Tables E3 and E7 — Lodging electricity and natural gas consumption by end use.

[3] CBRE Hotels Research, *Sustainability Practices Help Control Hotel Utility Costs*, January 2025 — 2024 estimates of $2,478 per available room and $9.68 per occupied room; resorts $4,933 PAR at approximately 2.9% of revenue; limited-service $1,446 PAR and extended-stay $1,580 PAR, both approximately 4.0% of revenue.

[4] CBRE Hotels Research, *Gaining Control of Utility Costs*, April 2024 — utilities at 3.3% of total revenue in 2023 against 2.9% in 2019.

[5] CoStar and Tourism Economics, U.S. hotel forecast, August 2026 — 62.3% occupancy in 2025 and a 63.1% forecast for 2026. The share of unsold available room nights is arithmetic from that figure.

[6] Hospitality Financial and Technology Professionals, *Uniform System of Accounts for the Lodging Industry, 12th Revised Edition*, adoption date 1 January 2026 — Schedule 9, Energy, Water and Waste, as an undistributed operating expense, with added consumption and environmental metrics.

[7] American Hotel & Lodging Association — approximately 57% of U.S. hotels are franchised.

[8] JLL Hotels & Hospitality research, reported December 2024 — approximately half of branded hotels globally are third-party managed; the largest operators each hold under 3% of inventory.

[9] ANSI/ASHRAE/IES Standard 90.1-2019, §6.4.3.3.5 and §6.4.3.3.5.2 (guest room HVAC and ventilation control) and §9.4.1.3 (guest room lighting control).

[10] 2021 International Energy Conservation Code, §C403.7.6 (automatic HVAC controls in hotel guestrooms), §C405.2.5.2 (guest room lighting) and the §C202 definition of "networked guest room control system." Section numbering varies where states amend the code.

[11] California Code of Regulations Title 24 Part 6, §120.2(c) and §120.2(e)4 (guest room HVAC controls and thermostat setpoint stops), §130.1(c)8 (guest room lighting) and §130.5(d)4 (controlled receptacles). The 2025 edition applies to permit applications filed on or after 1 January 2026.

[12] Washington Clean Buildings Performance Standard, RCW 19.27A.130–.250 and WAC 194-50. The Tier 1 covered-building threshold expressly includes hotel and motel floor area. Penalties under RCW 19.27A.210 comprise a fixed amount plus a continuing-violation amount assessed per square foot per year; the current rate should be confirmed with the Department of Commerce.

[13] New York City Local Law 97, Administrative Code Article 320 and 1 RCNY §103-14 — $268 per metric ton of CO_2e above the applicable limit; limits are set by ENERGY STAR property type and tighten for the 2030–2034 compliance period.

[14] Seattle Building Emissions Performance Standard — published greenhouse gas intensity targets for the Hotel building activity type.

[15] ANSI/ASHRAE Standard 188-2021, *Legionellosis: Risk Management for Building Water Systems*, and U.S. Centers for Disease Control and Prevention water-management guidance implementing it — building criteria including multiple housing units served by a centralized hot water system, buildings over ten stories, cooling towers, hot tubs not drained between uses, decorative fountains and centrally installed misters; Legionella growth range and control-temperature guidance.

[16] U.S. Centers for Disease Control and Prevention, *Morbidity and Mortality Weekly Report, Legionellosis Outbreaks Associated with Two Hotels — U.S. Virgin Islands, October 2024–April 2025*, 2026.

[17] ASSE International Scald Awareness Task Group, *Guidelines for Temperature Control Devices* — ASSE 1017 master mixing valves, ASSE 1016 shower and tub-shower valves, and ASSE 1070 fixture temperature limiters.

[18] New York State Sanitary Code, 10 NYCRR Subpart 4-1 (cooling towers); New York City Health Code Chapter 8; New Jersey P.L. 2024, c.66.

[19] U.S. Department of Energy, Commercial Real Estate Energy Alliance, *Guest Room Occupancy-Based Controls*, September 2012 — six-hotel field demonstration; 18.4% average savings, 10.8–26.5% range, $20.96–$79.03 per guest room per year, 5.3–15.7 year simple payback, $345–$426 installed cost per room. The study predates current wireless mesh and edge hardware and is cited as the most recent large independent field measurement identified for this paper, not as a current cost benchmark.

[20] PCI Security Standards Council, *Information Supplement: Guidance for PCI DSS Scoping and Network Segmentation*, December 2016. The guidance addresses connectivity generally and does not name building automation systems specifically.

[21] Federal Communications Commission, Enforcement Advisory No. 2015-01 (DA 15-113), 27 January 2015, under 47 U.S.C. §333.

[22] 2025 U.S. Hampton by Hilton Franchise Disclosure Document, Items 5, 8 and 11; Hilton Energy Stewardship Policy Statement, updated June 2025.

[23] International Mechanical Code §606.2.1 and §606.4 — duct smoke detection and air distribution system shutdown. Adopted section numbering varies by jurisdiction.

[24] CBRE U.S. Cap Rate Survey, H1 2026. The 7.5%–9.5% range in Section 8 is an illustrative assumption; property-specific rates should be taken from the relevant market and chain scale. Capitalization is appropriately applied to stabilized NOI, not directly to GOP.

Notes on figures

Regulatory citations reflect the editions and adoptions identified at the date of publication. Energy codes, building performance standards and water management requirements are amended frequently and are adopted differently by state and municipality; the applicable requirements for any specific property should be confirmed against the adopted local code before they are relied upon. Where a provision is described qualitatively rather than by section and figure, it is because the primary text was not available for direct verification.

Forward-looking statement

Certain concepts described in this paper — including accelerated Edge AI gateways, LEIP, Predictive Event Space Comfort Control and expanded distributed-intelligence workload execution — are under development or depend on future technical, commercial, market and customer conditions. References to those capabilities describe intended architecture or illustrative models and should not be interpreted as representations of current general availability, guaranteed savings or guaranteed future revenue. Modeled economics are illustrative and are not forecasts, commitments or existing operating results.