

Design *Quarterly*

ISSUE 28

New solutions

Shaping outcomes in
a dynamic world



ISSUE 28

New solutions

Design can address changing needs and complex issues.

In this issue we explore how design delivers solutions with an impact: inspiring today's athletes, offering a resilient community "front porch," making housing more attainable, and cooling the latest microprocessor facilities. Plus, how the industry can level up sustainable design.



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☆ Feature story

Liquid cooling can help data centers meet their AI compute thermal challenges

Cooling innovation is essential for scaling AI. And it's more efficient.



By Justin Hsiao and Ben Olejniczak



The biggest front porch in Texas

How the Alief Neighborhood Center supports community resilience in Southwest Houston



By Jonas Risen



The new locker room

"The hype journey" and other trends reshaping the athlete's inner sanctum



By Dave Kadish, Scott Klaus, and Chris Pine

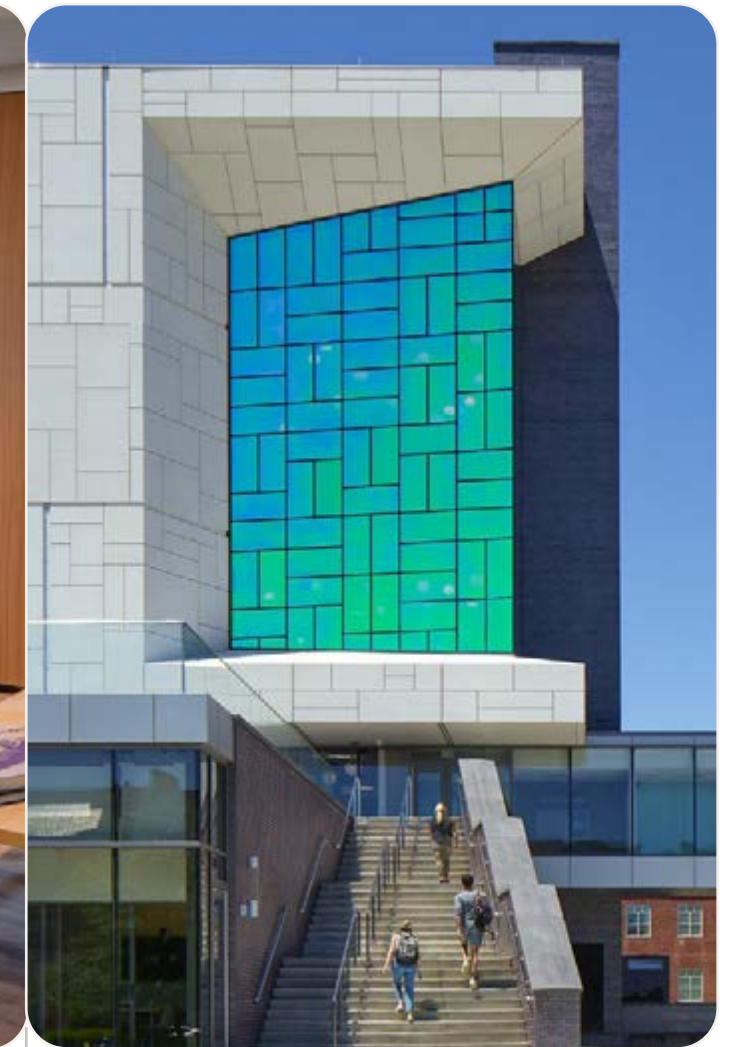


Micro housing's new mission?

Why developers and state governments are taking a fresh look at compact living in multifamily developments



By Aeron Hodges



Ask a designer: How can the architecture and engineering industry make every project sustainable?

An interview with Jill Kurtz, sustainable design leader, North America



Interview by John Dugan

Liquid cooling can help data centers meet their AI compute thermal challenges

Cooling innovation is essential for scaling AI. And it's more efficient.

By Justin Hsiao, Sabhya Katia, and Ben Olejniczak

VAULT 1

Data centers are heating up. There's a better way to keep them cool. It's time for liquid cooling.

Running an artificial intelligence (AI) chatbot like ChatGPT or Copilot requires modern accelerators like graphics processing units (GPU) or neural processing units (NPUs). These chips handle the advanced processing that makes AI possible. Performing trillions of operations per second generates heat. And these AI apps have millions of users. Modern processing requires modern cooling.



NTT Data Center Campus (TX1, TX2 and TX3) Garland, TX

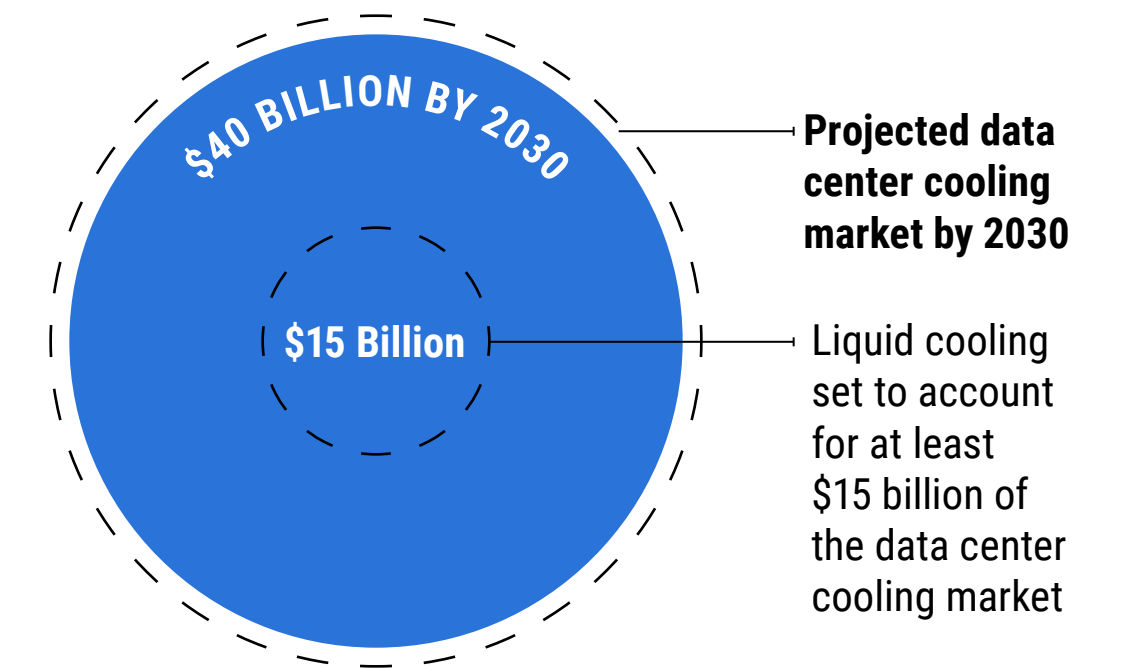
A new hybrid cooling system at NTT combines direct chip cooling with air-assisted cooling.

Data centers already use a huge amount of energy. The 2024 Report on US Data Center Energy Use¹ from the Lawrence Berkeley National Laboratory shows that data centers used 4.4 percent of all US electricity in 2023. And AI and other compute-intensive uses—training large language models, navigation for autonomous vehicles, virtual or augmented reality, cryptocurrency—will only increase that appetite. By 2028, they could consume 6.7 to 12 percent of US electricity.

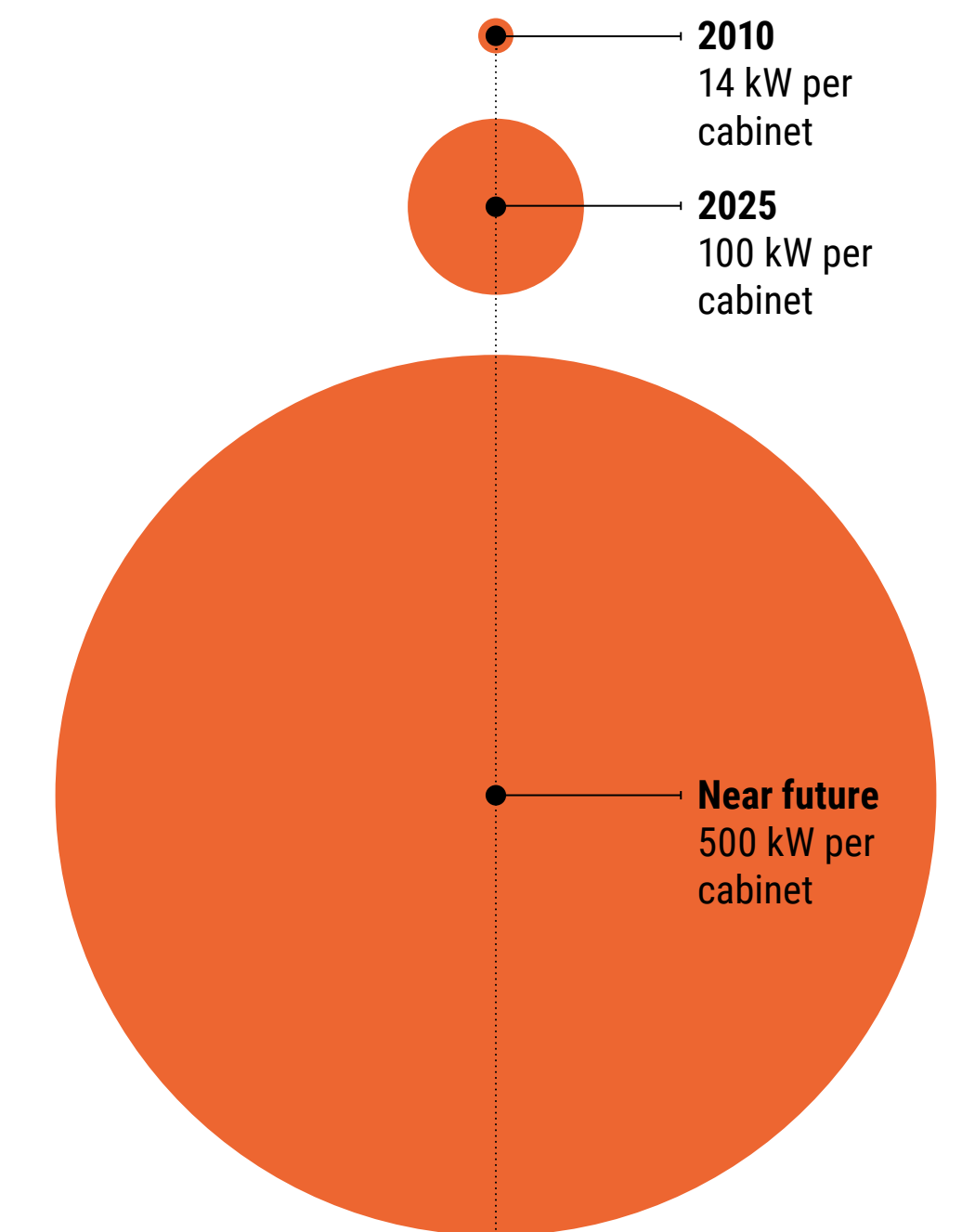
Artificial intelligence (AI) workloads have increased the power density of data centers. Higher power density means each piece of information technology equipment (ITE) consumes more energy and produces more heat per square foot. In the 2010s, cloud computing rack densities climbed to 8 to 20 kilowatts (kW).² Today, it's common to have ITE loads over 100 kW per cabinet. They are expected to surpass 500 kW soon.

With heat load densities drastically increasing, liquid cooling will be a popular solution. McKinsey projects the global data center cooling market will hit \$40 billion by 2030, with liquid cooling accounting for at least \$15 billion of that.³

PROJECTED GLOBAL DATA CENTER COOLING MARKET



INFORMATION TECHNOLOGY CABINET LOAD USAGE TIMELINE



Data from Ramboll



So, where are we today? And why are we transitioning to liquid cooling?

CONVENTIONAL AIR COOLING HAS MET ITS LIMITS.

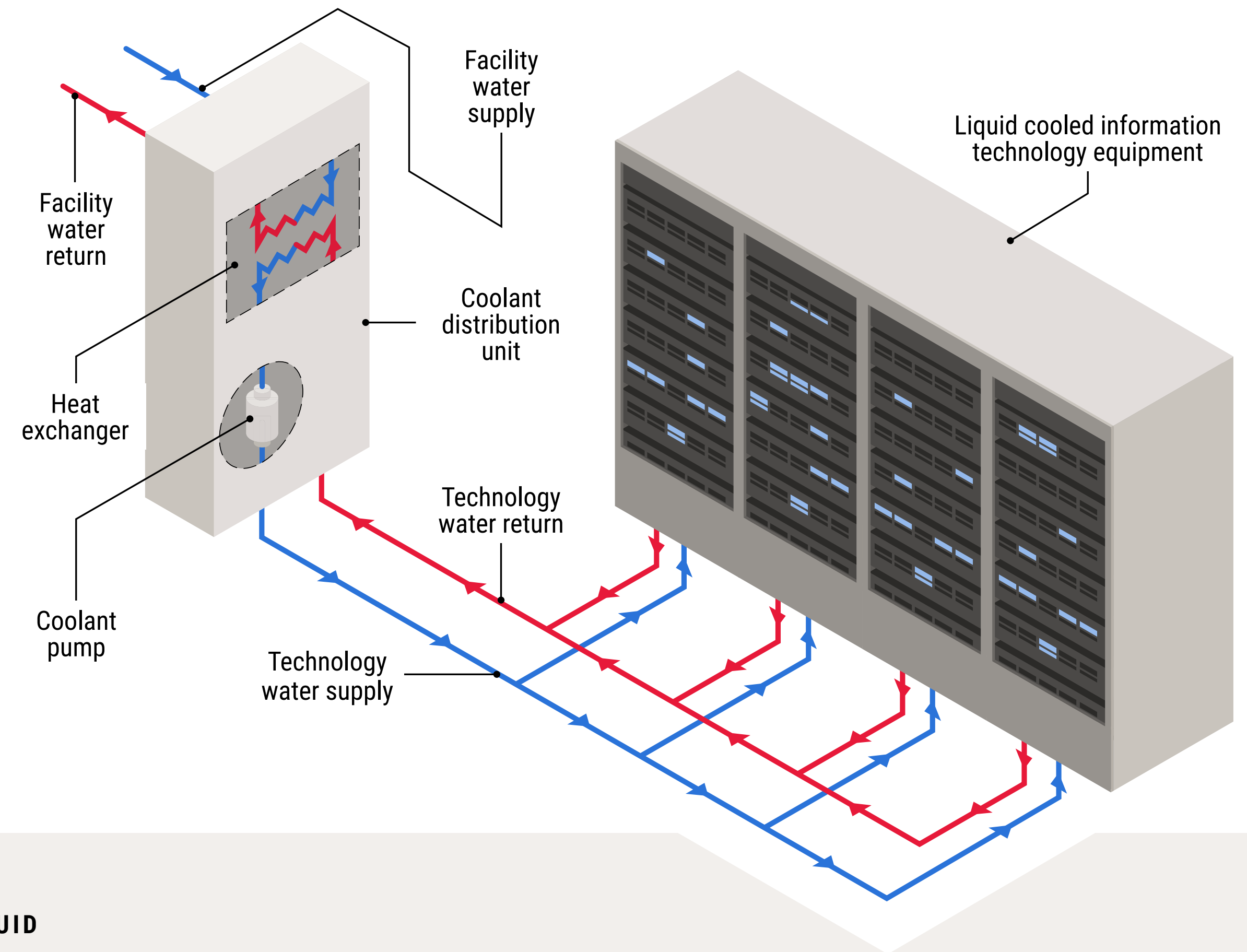
Without cooling, data center servers would overheat and fail. So, data centers need systems to remove heat from their servers, storage, and networking equipment. Air cooling—where cool air is circulated through racks of equipment, dissipating heat—has been the standard approach to cooling ITE for decades. With high density data centers, air cooling is no longer the most practical option. We are trending towards rack densities that can't be cooled with air alone. We must find a way to move more heat efficiently.

LIQUID'S ADVANTAGE?

Liquids can absorb more heat than air by volume, and they're more thermally conductive. With liquids, you get more value for your investment from a heat transfer perspective. The specific heat transfer ability of a liquid is far superior to air; you can move much more heat with liquid than you can with the same volume of air. Because liquids transfer heat so well, liquid cooling can handle data center cabinets with loads of 100 kW or more.

COOLANT DISTRIBUTION UNIT AND WATER

CDU schematic is simplified to convey facility water/technical water system interface.



WHAT MAKES UP A LIQUID COOLING SYSTEM?

Today, most liquid-cooled systems use a coolant distribution unit (CDU) for direct-to-chip (D2C) cooling. A CDU distributes coolant (commonly 25 percent propylene glycol) to a closed loop system which circulates through cold plates mounted on ITE. The CDU keeps the temperature of the coolant supply steady. The technical water system is the coolant loop that flows between the CDU and the ITE,

transferring heat gained from the ITE to the facility water loop via the CDU heat exchanger. A liquid-to-liquid heat exchanger in the CDU transfers ITE waste heat from the technical water system to the facility water system (FWS) which removes heat through the building's mechanical systems.

The CDU keeps its cooling fluids separate from the building system. This is critical for ensuring coolant quality for ITE. A liquid system should maintain manufacturer's guidelines on coolant quality—such as pH, hardness, conductivity, and dissolved solids—to help reduce equipment failure and improve performance.

LIQUID COOLING ACRONYMS AND TERMS

Cold plates

Mounted directly on CPU and GPU chips to dissipate heat

CDU

Coolant distribution unit

CRAC

Computer room air-conditioning

D2C

Direct to chip cooling

ITE

Information technology equipment

PUE

Power usage effectiveness

RDHx

Rear door heat exchanger

While AI compute is the main driver for its adoption, liquid cooling has some potential added benefits.

Efficiency

We can improve the effectiveness of air-cooling systems with aisle containment, cabinet chimneys and in-row cooling units. But pushing all this air means data center cooling systems consume roughly 30-40 percent of total data center power.⁴ Liquid coolants are more efficient than air in these high temperature racks. Higher ITE loads demand a higher required flow rate (for air or liquid) to cool them. But the liquid cooling system’s pumps use less energy than air fans to transfer the same amount of heat. When we look at the power usage effectiveness (PUE) for data centers with liquid-cooled ITE, they spend less of their total energy on cooling and more on running IT equipment.

Higher temps, higher efficiency

Because of liquid cooling’s heat-transfer performance, the coolant need not be “cold.” These systems can use warmer coolants, even up to 100°F. A dedicated liquid cooling system designed for higher temperature operations can achieve optimum efficiency. And use less water.

Compact footprint

Liquid cooling takes up less space in the data hall than air cooling systems, allowing more space for the racks and higher density computing.

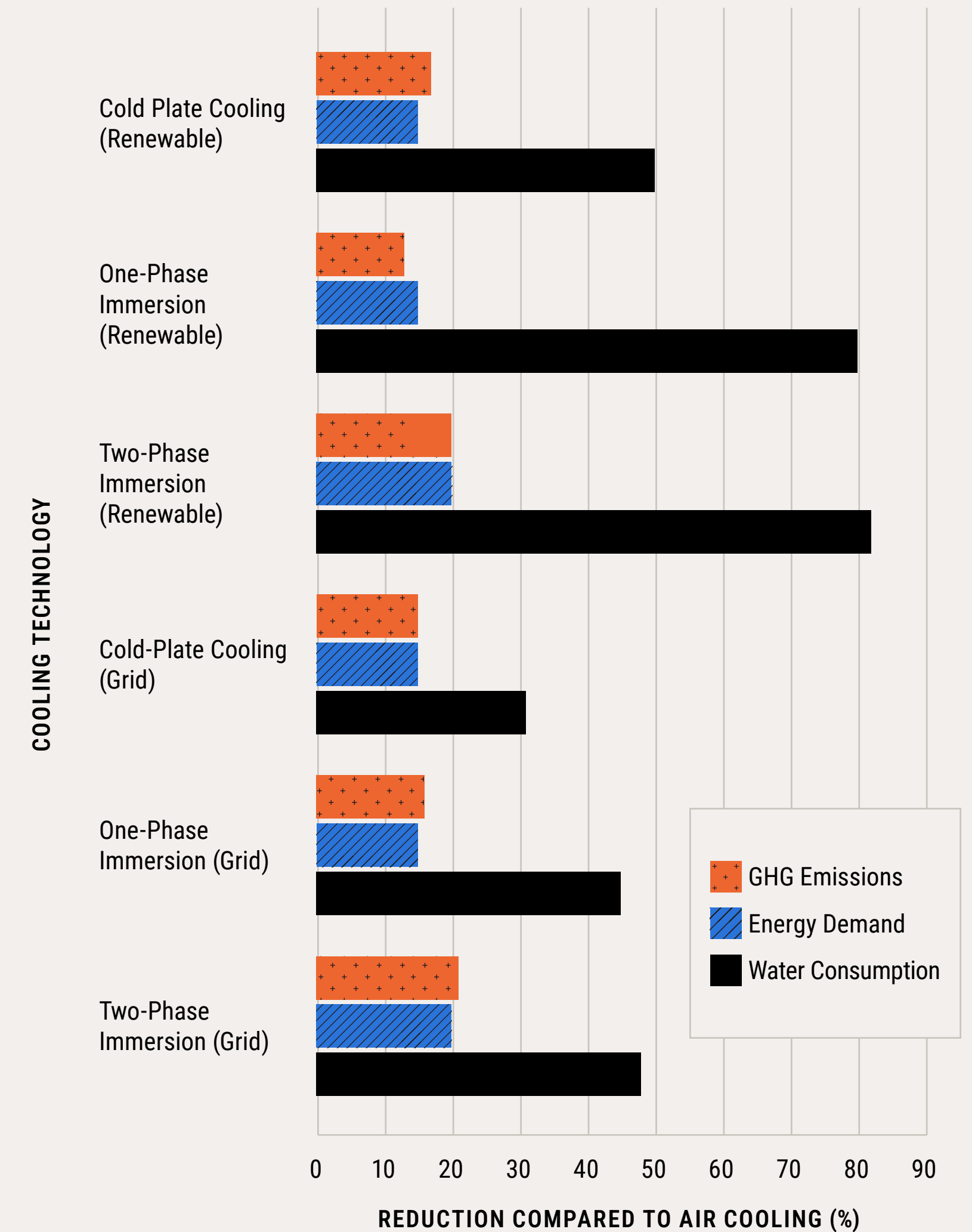
Cost of ownership

ASHRAE reports that data centers using hybrid (air/liquid) systems can reduce their total cost of ownership.⁵

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LIFE-CYCLE IMPACT OF NEW COOLING TECHNOLOGIES COMPARED TO AIR COOLING



Microsoft researchers compared GHG emissions, total energy demand and blue water consumption impacts of air-cooled, cold-plate, one-phase immersion and two-phase immersion data centers.

Introducing liquid cooled data centers to LEED® certification

Some data companies want their large-scale digital infrastructure projects to be certified as sustainable. But liquid cooling involves new technology that LEED guidelines have yet to address.

Here are four steps we're taking to make LEED-certification possible for data centers cooling their ITE with liquid systems.



Sabhya Katia

Sustainable building analyst

Chicago, IL

LEED had no established methodology for modeling or certifying liquid-cooled systems, so we created a process to support LEED approval. Working within the Optimize Energy Performance credit, we developed the energy modeling framework and documentation standards from scratch, creating a replicable process for comparing hybrid liquid-cooled systems against traditional air-cooled baselines in a format LEED reviewers could evaluate and approve.

1 Our team worked on two hyperscale data center projects for the same confidential client. Our models showed that liquid cooling offered:

- **Server fan energy reductions of 70–80 percent**
- **Lower pump energy consumption**
- **Better heat rejection efficiency**
- **Reduced cooling plant needs**

The results were impressive. The model showed gains far beyond LEED minimums for energy savings and power usage effectiveness (PUE). And our models indicated possible savings of 8–12 percent on IT equipment energy use thanks to better thermal management.

2 Liquid cooled systems are new and not widely understood. So, we educated LEED reviewers with side-by-side comparisons to air cooling, a guide to energy modeling for both systems, and data showing energy use by component.

3 We used the LEED framework to measure and prove that a liquid cooled system saved water versus a baseline air-cooled system. Our calculations show that the closed-loop system could potentially save about 92,000 gallons of water per MW per year, compared to evaporative cooling systems.

4 Next, we showed that liquid cooling was capable of meeting the International Energy Conservation Code (IECC) requirements. We compared the total annual energy cost for the liquid cooling design against a baseline building design. We demonstrated, through comparative analysis, that the liquid cooling design was capable of using less energy than code minimum air-cooled systems.

Project results are based on modeling and project-specific conditions and may not be representative of all projects.

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Our calculations show that the closed-loop system could potentially save about 92,000 gallons of water per MW per year, compared to evaporative cooling systems.

HYBRID COOLING IS AN OPTION, ESPECIALLY FOR RETROFITS.

We can combine liquid cooling and air cooling in data centers. Air cooled data centers—with direct evaporative air-handling units or air-cooled computer room air-conditioning (CRACs)—can add liquid cooling using CDUs with liquid-to-air heat exchangers. This is a common approach to retrofitting older facilities, which might otherwise become obsolete. An FWS makes it easier to cool the ITE with liquid, but it is not a necessity. Some manufacturers offer modular split-system chillers. These can replace existing CRACs and connect to existing air-cooled condensers on the roof to remove heat. We can install CDUs in mechanical galleries next to air-handling units and air-conditioned computer rooms or within white space near cabinets, depending on project needs.

Often CDU-based liquid cooling can't capture all the ITE heat in data centers by itself. So, some lower capacity air cooling is still needed. Greenfield data centers built for liquid-cooled systems typically use liquid cooling for 70 to 95 percent of the ITE load, with air cooling covering the rest.

LIQUID COOLING COMES IN VARIOUS FLAVORS.

Liquid cooling can be performed in various ways. A rear door heat exchanger (RDHx) cools the air leaving the server rack but never touches the ITE directly. Chilled water systems run cold water into the environment, pull the heat out, and send it to the building water system. Direct to chip (D2C) systems circulate coolant through a cold plate in contact with server electronics, transferring heat away in the process. Immersion cooling might be the most sci-fi looking approach. Entire servers and data racks are literally immersed in non-conductive fluid.



CHALLENGES TO DEPLOYMENT

We regularly work with hyperscale clients on cooling systems for data centers. We have found that as we venture into this new normal of D2C cooling, educating operations personnel on the fundamentals of liquid cooling goes a long way in solving some of the challenges to deployment. It helps to be on the same page when implementing these systems. Material compatibility between the coolant, liquid-cooled ITE, and distribution system (piping, CDU, and accessories) can also pose design challenges. But despite these challenges, liquid cooling is here.

As demand for AI, machine learning, and advanced processing continues to grow, so does the heat in our data racks. Liquid cooling technology isn't just critical to tomorrow's data infrastructure. It's indispensable. ■

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Justin Hsiao
Mechanical senior project engineer
Chicago, IL

Justin prioritizes energy efficiency in innovative approaches to data center design.



Ben Olejniczak
Mechanical senior project engineer
Chicago, IL

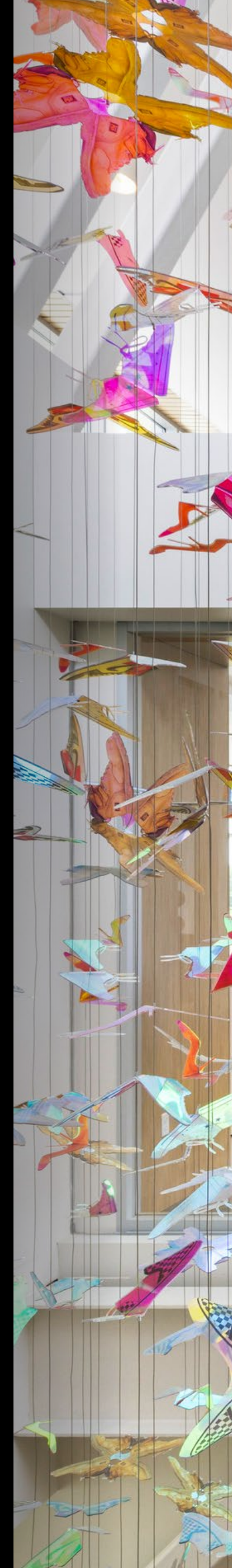
Ben brings deep technical experience to the planning, design, and delivery of hyperscale, multi-tenant, and enterprise data centers across the US.

YOU MAY ALSO LIKE

The demand for energy and water at data centers
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Sources

1. Shehabi, Arman et al. [2024 United States Data Center Energy Usage Report.](#)
2. Eisenband, David. [100+ kW per rack in data centers.](#)
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The biggest front porch in Texas

How the Alief Neighborhood Center supports community resilience in Southwest Houston

By Jonas Risen

A good front porch is welcoming, it's a gathering place for neighbors, and it provides shelter from the elements. An active front porch binds the community together.

In 2024, Houston's Alief neighborhood learned the value of a good front porch for community resilience. When Hurricane Beryl struck, the Alief Neighborhood Center held steady and remained structurally sound. Its backup energy systems kicked in and kept the building operational. Its adaptable garage was quickly converted into a distribution hub for supplies. The facility stayed open beyond regular hours as a cooling center, offering air-conditioned refuge during widespread power outages. The new Alief Neighborhood Center proved its worth under challenging conditions.

Alief was founded on community connection.

Originally Dairy, Texas, the Southwest Houston town of Alief was renamed for Alief Ozelda Magee, who started the area's first post office out of her home in 1895. This town expanded to become a suburb of Houston and today stands as one of the most diverse neighborhoods within America's most diverse city. Alief is a deeply multicultural community. More than half of its 100,000-plus residents were born in another country, and more than 90 languages are spoken here.

The community boasts about its schools and amazing selection of restaurants. Former residents aren't joking when they say they will always go back to Alief to eat. But there was no single civic place that truly belonged to everyone. Public services and programs were scattered. In a sprawling city defined by highways and long commutes, Alief lacked that welcoming "third space," a civic living room between home and work.

Three decades ago, a small group of community activists began pushing to change that. They imagined a neighborhood center that could serve every person in Alief—grandparents and toddlers, newly arrived immigrants and longtime residents, sports enthusiasts, artists, and musicians.

Planning discussions stretched across the decades. Funding cycles came and went. Residents attended open houses, voiced frustrations, and demanded transparency. For many, Alief was often dismissed as "District F" or "the Forgotten District."

Many residents were skeptical that the project would truly address the community's needs. Page, now Stantec engaged the Alief community through sustained outreach meetings and open design discussions, encouraging residents to express their priorities for the new facility, including the mix of services and amenities. Residents from different cultural groups shared traditional gathering practices and gave feedback on design that would make them feel safe and welcome.



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Five 16-foot-tall aluminum letters spell ALIEF across the entry patio, which we have taken to calling ‘the biggest front porch in Texas.’

Rebuild trust, rethink public space

When Page, now Stantec and landscape architects SWA Group began formal design work in 2017, their task was multifaceted:

- ✓ Replace an aging community hall with a modern, resilient facility.
- ✓ Consolidate multiple city departments into a one-stop civic hub.
- ✓ Reflect Alief's cultural diversity without resorting to clichés.

Extensive outreach by the design team during schematic design revealed that different cultures held different perceptions of public institutions. For some families, government-run spaces could feel intimidating or surveilled, a stigma that planners needed to counter. The answer was human-centered design at every scale. The expanding brief also required a design that could:

- ✓ Innovate a new prototype for serving communities.
- ✓ Form a new model for resilient development.
- ✓ Foster a culture of health.
- ✓ Build a heart for civic engagement.

📍 **Neighborhood resilience**
Design for flood resilience in post-Harvey Houston.

The building sits two feet above the 500-year floodplain atop an artificial hill concealing parking. Bioswales, native plantings, and preserved heritage trees manage stormwater and moderate heat.



"Alief Swarm" by the artist
Bennie Flores Ansell

A warm and open one-stop civic hub

What began as a loosely defined vision eventually manifested into a comprehensive civic ambition: a 70,000-square-foot neighborhood center anchoring a revitalized 38-acre park, uniting services from the Houston Health Department, Parks and Recreation, and General Services with a Houston Public Library branch. The building is designed so that each department has its own space and independence, while still being close enough to work easily with the others, all within a compact layout.

First floor: Health services—including the Houston Health Department, Women, Infants, and Children (WIC) and the Diabetes Awareness and Wellness Network—and Parks and Recreation programming with fitness areas, indoor gym, and activity rooms.

Second floor: A Houston Public Library branch and public technology and multimedia zones overlook the park canopy, offering computers, scanners, 3D printing, maker spaces, recording equipment, passport services, a children’s reading stage, and quiet study rooms.

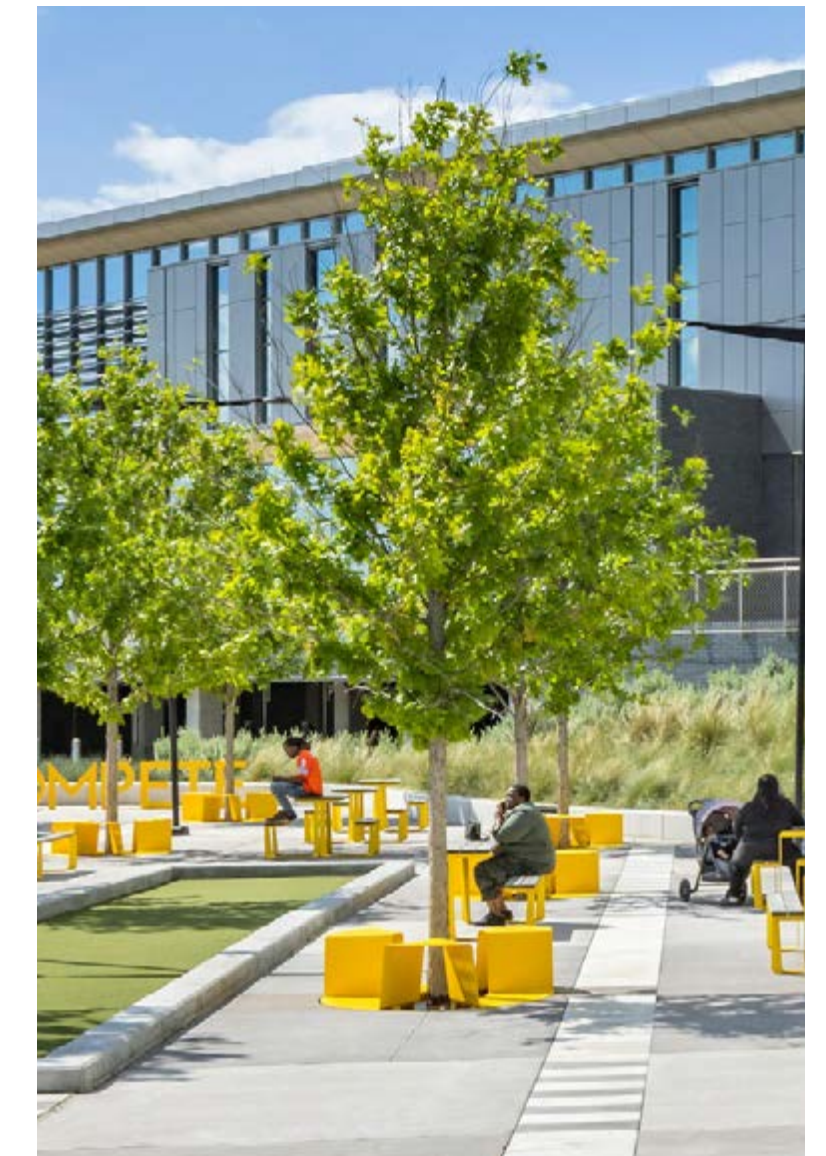
Shared meeting rooms allow cross-department programming. A parent might attend a cooking class while a child participates in after-school enrichment; a grandparent might visit the senior center while teens record music upstairs. An indoor gym with treadmills and ellipticals and a walking track are popular with the locals. This co-location model is especially significant in Houston’s low-density landscape, where transportation can be a barrier. By consolidating services, the center reduces friction and increases accessibility.



Connecting details

The **main entry stair** is a space for the community to socialize, wait for appointments, and look out over the active park space.

A **community garden**, managed by the senior center program, and a demonstration kitchen, managed by the Diabetes Awareness and Wellness Network program, provide opportunities for people of all ages to learn about how to grow and prepare health food.





Campus commons, functional, flexible and fun

On January 14, 2023, the Alief Neighborhood Center opened to the public. The decades-long vision, funded by the City of Houston, finally became a reality. A building elevated above the floodplain (see sidebar) and grounded in persistence. Five 16-foot-tall aluminum letters spell ALIEF across the entry patio, which designers have taken to calling “the biggest front porch in Texas.”

The covered plaza hosts casual meetups, celebrations, and community events. Elevated topography guides visitors upward toward the entry, while a terrace wraps the structure, encouraging exploration.

Large expanses of glass dissolve the boundary between indoors and out. The bold geometry feels iconic yet approachable, more campus commons than bureaucratic office. Inside, a central staircase cascades through the lobby, a place to sit, gather, and be among neighbors.

Armless lounge chairs on casters and modular seating encourage flexibility, and built-in charging stations keep visitors connected. Even the youngest guests are considered, with scaled seating and playful reading zones. Wayfinding is experiential and inclusive, with color-coded destinations, multilingual signage, and distinctive graphic landmarks.

Outside, SWA Group shaped the park into a resilient civic ecosystem. Thirty-two live oaks and more than 570 trees were preserved across the site, including a southwest “forest grove.”

Recreational amenities abound: basketball courts inside and outside, pickleball courts, soccer fields, a skate park, playgrounds (designed with accessible features for children of all abilities) with rope swings and modern safety features, an inviting pool with an oversized bright-blue slide, and “Mount Alief,” an elevated running path and climbing wall. A large yellow sign outside simply reads: PLAY.

Curving pathways guide visitors beneath tree canopies. The effect is lush and welcoming, intentionally departing from Houston’s flat, horizon-heavy landscapes. As landscape architect Natalia Beard explains, the goal was to create porosity, an easy flow between interior and exterior that reinforces the center as an extension of its environment.

📍 A children’s story time area and informal stage lower the scale of the space for young readers in the children’s library.

A living, breathing public space

Three years in, Alief Neighborhood Center has settled into the daily life of the community. A family sets up easels on picnic tables beneath the rope canopy. Two teenagers compare tricks at the skate park. Inside, a bank of treadmills, about half occupied, face floor-to-ceiling windows framing green views. Children sprawl across comfy chairs and brightly-colored carpet in the library's reading stage. Seniors meet friends while walking the indoor track.

Former Houston Mayor Sylvester Turner called it transformative at the center's opening: "This one-of-a-kind city destination captures the spirit of Alief and will be transformational for this community."



1,000

Average number of daily visitors to the Center

Flexible and resilient

The Neighborhood Center is highly flexible by design. The same plaza that hosts festivals can distribute aid. The same lobby and open public spaces that welcome families daily can serve as an emergency shelter and a safe meet-up space for families and first responders alike. The Alief Neighborhood Center supports resilience in emergencies and the day-to-day kind.

The neighborhood once described as forgotten now stands as a symbol of Houston's global character. The Alief Neighborhood Center reframes civic architecture not as bureaucracy but as hospitality, and wellness and community not as elusive goals but as shared endeavors that can be supported by infrastructure.

In a city defined by distance, the town of Alief finally has a place that brings everyone closer. Indeed, the Center averages more than 1,000 visitors daily. One can imagine that Alief Ozelda Magee—whose tombstone in the town cemetery that bears her name reads, "She had done what she could"—would be proud. ■

📸 The building envelope is "vacuum packed" to the program in order to maximize resources for the community.



Jonas Risen

Design principal
📍 Houston, TX

Jonas is passionate about architecture's ability to create authentic experiences, enhance people's lives, and heal communities.

ALL PHOTOS

City of Houston Alief
Neighborhood Center and Park
Houston, TX

AWARDS

- 2020 Houston-Galveston Area Council Special Recognition Award for Planning
- 2020 Rethinking the Future Award
- 2024 AIA Houston Design Award, Architecture Greater than 50,000 square feet
- 2024 ULI Houston Development of Distinction
- 2023 Society of American Registered Architects Award (SARA) National Design Merit Award

The new locker room

“The hype journey” and other trends reshaping the athlete’s inner sanctum

By Dave Kadish, Scott Klaus, and Chris Pine

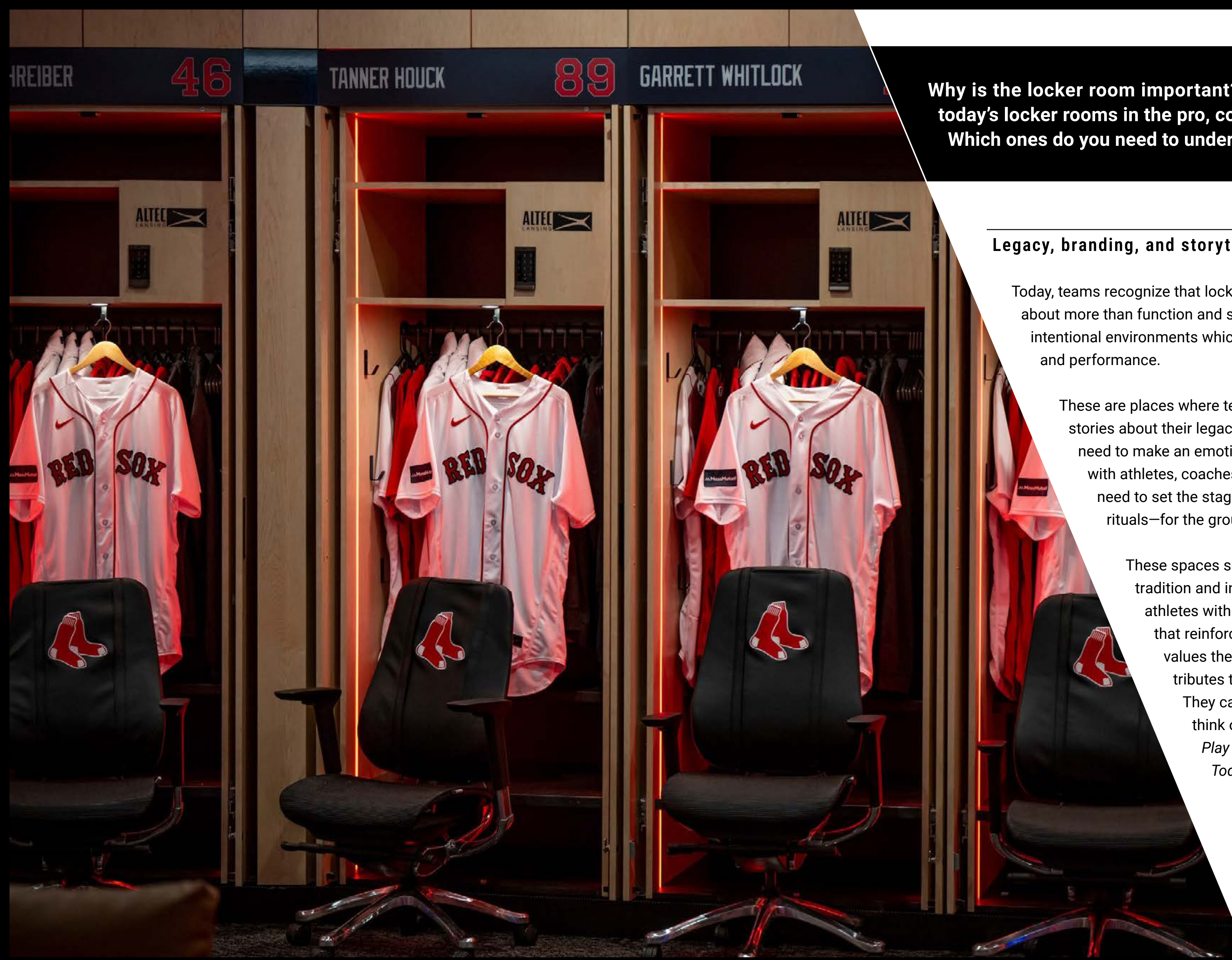


It’s the setting for the highest of the champagne-spraying championship highs, the frustrating post-game lows, plus the inspiring coaching in between. It’s the athlete’s locker room.

Sports are changing. Pro sports are growing and diversifying offerings and audiences. Women’s sports, in particular, are booming—with new leagues and franchises in the Women’s National Basketball Association (WNBA), National Women’s Soccer League (NWSL), and Professional Women’s Hockey League (PWHL). College sports are becoming more professional. The NCAA’s NIL policy allows student athletes to profit from their name, image, and likeness. And a transfer portal allows college athletes to hop athletic programs as they pursue their degrees. **High school sports participation** has bounced back post-pandemic: more than 8,200,000 students competed in high school sports in the 2024-25 school year. And we can watch almost all of it on a seat or a screen somewhere.

Sports environments are changing, too. Perhaps the most emblematic of changing expectations is the new locker room.

© W.W. Thorne Stadium, Aldine Independent School District
Houston, TX



Why is the locker room important? What are the design trends influencing today's locker rooms in the pro, college, and high school sports contexts? Which ones do you need to understand and incorporate in your next athletic facility?

Legacy, branding, and storytelling:

Today, teams recognize that locker rooms are about more than function and storage; they're intentional environments which shape mindset and performance.

These are places where teams can tell stories about their legacy to inspire. They need to make an emotional connection with athletes, coaches, and staff. They need to set the stage for important rituals—for the group or individual.

These spaces serve as symbols of tradition and inspiration for athletes with design elements that reinforce the history and values they aspire to and tributes to sports legends. They can become iconic: think of Notre Dame's *Play Like a Champion Today* emblem.

Design trend

We need to design locker rooms for emotional readiness, and ritual (pregame, halftime, postgame celebration or reset). They must accommodate low-tech communication—the coach's whiteboard—as well as branding. Innovations like LED lighting are key to branding in this space. A shared district locker room can transform into a team space with LED-projected logos, for instance. The Instagram-friendly moment is a must—especially in college sports. So, we need to design efficient spaces that can become a backdrop like a red carpet leading to the locker room. These spaces need to accommodate multimedia production, even interviews.

However, the NCAA's NIL rules about players' likenesses are reshaping college team branding in these spaces. Graphics are more likely to show an idealized figure or historic legend, not a specific current athlete. Professionals are transient, so these graphics at pro facilities aren't about current players; they're often historic figures.

📍 **Boston Red Sox Clubhouse Upgrades** Boston, MA
Stantec provided interior design, lighting design and construction administration services for this clubhouse upgrade project.
Partners: AHA Consulting Engineers, Younts Design
Architect: DAIQ Architects

The hype journey:

The locker room is increasingly part of a larger “hype journey” that includes preparation spaces, tunnels, and thresholds leading to the arena or field. The hype journey stimulates the senses. It puts competitors in the right headspace for competition. The hype journey builds on sports rituals, but amplifies them with modern audio, lighting, and aesthetics.

Design trend

Designers curate finishes, lighting, sound, and spatial sequencing to support focus, motivation, and team culture. The latest in audio systems, lighting effects, graphics, countdown clocks, and music are used to heighten anticipation. Immersive sound and controllable lighting make it possible to customize the hype journey for each team, even athlete. And they also can be tuned for various moods and situations.

Transitions are important here. Locker rooms connect to hype tunnels, thresholds, and controlled transitions from private team areas to the field of play. The locker room may be a key starting point for this sequence. The design mission may be to carry the hype forward along the journey.

© W.W. Thorne Stadium, Aldine Independent School District
Houston, TX



Inclusivity, equity, and users

It wasn't so long ago that officials, trainers, or female athletes had to change for the game in converted storage rooms if they were allotted any space at all. Today, dedicated locker rooms for female athletes are a given. But we're also moving toward dedicated locker rooms for officials, coaches, and trainers. This evolution has design implications.

Design trend

We're seeing a lot more female officials and female trainers, even at the high school level. So current designs provide two equally sized locker rooms for the officials. In the past, a trainer's space used to be part of the locker room. Now, it's often a separate space connected to the field so that the female trainers can tape up female athletes, for example.

In heritage buildings like Fenway Park or others where space is maxed out, the design challenge is to carve out these new must-haves from existing or unused spaces.

The sum total of locker room spaces expected is trending upward.

“

Designers curate finishes, lighting, sound, and spatial sequencing to support focus, motivation, and team culture.

Flexibility and multifunction vs. specialization

Depending on the context, the locker room may need to be extremely flexible or may be part of a detailed sequence.

Design trend

High school and district facilities prioritize flexibility, allowing multiple teams, sports, or tournaments to use the same locker rooms.

In Texas and other places, locker rooms for district facilities we are designing may serve up to six high schools, connect to football and soccer fields, and attach to an arena for basketball and volleyball as well. They need to be extremely flexible. Large locker rooms can be divided up for tournaments. These district hubs can use LED lighting and projection systems to reflect the identity of the schools using the facility, with flexible graphics to accommodate multiple teams and events.

In Boston, White Stadium is being revitalized to accommodate both professional and high school events, concerts, and community activities. Multifunction sports venues need flexible locker rooms.

Locker rooms increasingly look like clubhouses, incorporating or connecting with recovery rooms, training rooms, even lounges in the athlete's inner sanctum.

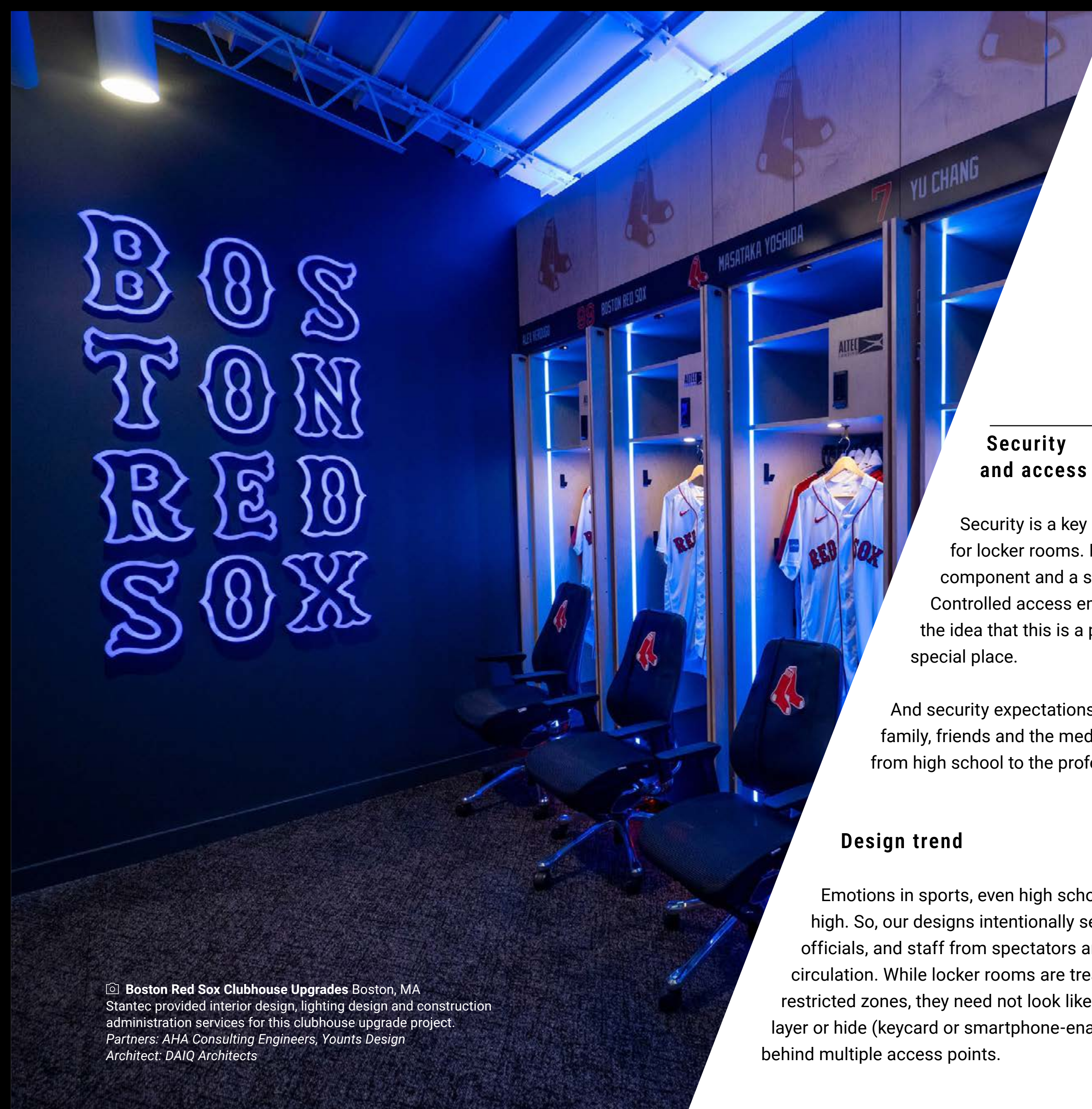
Some locker rooms, however, can be hyper specialized. We're designing locker rooms for college athletes with highly choreographed entry and exits. Football players re-enter from the field through a "car wash" where they drop their gear, hang up their pads and have the dirt and grass air blasted off them before they step into a plunge pool before finally returning to the locker room and trainer's room.

How flexible or specialized your locker room needs to be will determine the design direction.

📍 **University of Houston Memorial Hermann Football Operations Center**
Houston, TX
Stantec in association with DLR Group

Football team members make their way from the hype tunnel through the Operation Center's large overhead rolling doors on their way in and out of the stadium.





© Boston Red Sox Clubhouse Upgrades Boston, MA
Stantec provided interior design, lighting design and construction administration services for this clubhouse upgrade project.
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Architect: DAIQ Architects

Security and access

Security is a key consideration for locker rooms. It has a safety component and a symbolic one. Controlled access emphasizes the idea that this is a protected, special place.

And security expectations and access for family, friends and the media can vary from high school to the professional level.

Design trend

Emotions in sports, even high school athletics, run high. So, our designs intentionally separate players, officials, and staff from spectators and public circulation. While locker rooms are treated as restricted zones, they need not look like it. Designs can layer or hide (keycard or smartphone-enabled) entry behind multiple access points.

With locker rooms at major venues doubling as green rooms for the talent at concerts or events, they need to accommodate event and security staff and their sometimes very tight protocols on short notice.

Interpretations of the inner sanctum can vary from team to team. We've worked with professional teams that require a dedicated family lounge where partners, spouses, and children can visit before, during, or after the game. Others wanted an attached dining or party space just for the team. One professional baseball team wanted the family room as far away from the lockers as possible. Why? Too distracting.

Dedicated multipurpose rooms and media spaces offer flexibility to create anything from a team debriefing room to a postgame media interview space; allowing teams to keep the locker room more private.

Pride, professionalism, and performance

The common threads which run through locker room design from high school to university to the pros are pride, professionalism, and performance. Our designs must enhance pride in the team, and enrich the professionalism of the individual athletes, organization, and staff. And locker rooms must deliver value in competition. They need to tip the needle forward to victory. Like sports, locker rooms have come a long way and won't stop evolving anytime soon. ■



Dave Kadish
Architect
Boston, MA

Dave works on large commercial, residential, academic, and master planning projects.



Scott Klaus
Senior design architect
Houston, TX

Scott has deep experience in education facility projects with a passion for sports facility design.



Chris Pine
Architect
Houston, TX

Chris designs education centers, gallery spaces, mixed-use housing, offices, and sports and entertainment facilities.

MORE SPORTS →

Micro housing's new mission?

Why developers and state governments are taking a fresh look at compact living in multifamily developments

By Aeron Hodges



New housing attainability issues are inspiring the latest wave of interest in micro housing and design for compact living.

📷 Proto
Cambridge, MA

Housing affordability is a persistent issue in urban areas like Boston, Toronto, Vancouver, New York City, and Washington, DC. The sky-high rental rates in these North American cities even inspired our compact living design research project in the 2010s.

In our design research, we developed design prototypes for micro units and communal housing for Boston. It helped us articulate a vision for micro housing in multi-unit residential buildings. Our design research yielded a model compact living unit that we took on tour around Boston to collect feedback. It prompted conversations in the design and housing community in Boston. The result?

In 2018, the Boston Planning & Development Agency (BPDA) approved a two-year Compact Living pilot program, aimed at opening options for local housing. We helped craft the design guidelines for new residential units that are smaller in size than typical units but not lacking in design innovation and functionality.

Since then, we have designed compact dwellings or “micro units” for a variety of residential buildings. [Watermark Seaport](#), [Proto](#), [Troy Boston](#), and One Mystic to name a few.

 Western Michigan University
Arcadia Flats Student Housing
Kalamazoo, MI

What are micro units?

They are affordable compact dwellings that offer convenience and access to the community in an efficient design. They typically range in size from 250 square feet up to 400 square feet.

A well-designed micro unit should have all the usual elements of a regular sized unit, a space for every function. Our design research shows that a well-designed micro unit uses space for efficiency. It prioritizes storage, leverages smaller appliances, but doesn't skimp on natural light and ceiling height.

The multiunit dwellings which feature micro units should offer attractive social and shared spaces. When well-designed, they can deliver amenities and shared spaces that encourage social connection.

A good micro unit uses less energy for heating and cooling, promotes access to public transit for more people, sometimes costs less to build, uses less waste, and is cheaper to maintain. Sometimes, micro housing can be more economical to build, but its cost per square foot goes up because of the higher density of kitchen and bath features. Micro units were an appropriate option for city dwellers in dense urban environments with high rents. Housing needs keep changing. And yet housing affordability remains a stubborn issue in cities.

Limited supply and higher rents

Demand still exceeds supply in many cities. When we look at historic data for extremely expensive places, new housing builds simply haven't kept up with population growth. Cities like NYC, Boston, DC, Miami, San Francisco, Toronto, and Los Angeles still have expensive housing with median rents for one-bedrooms over \$2500.

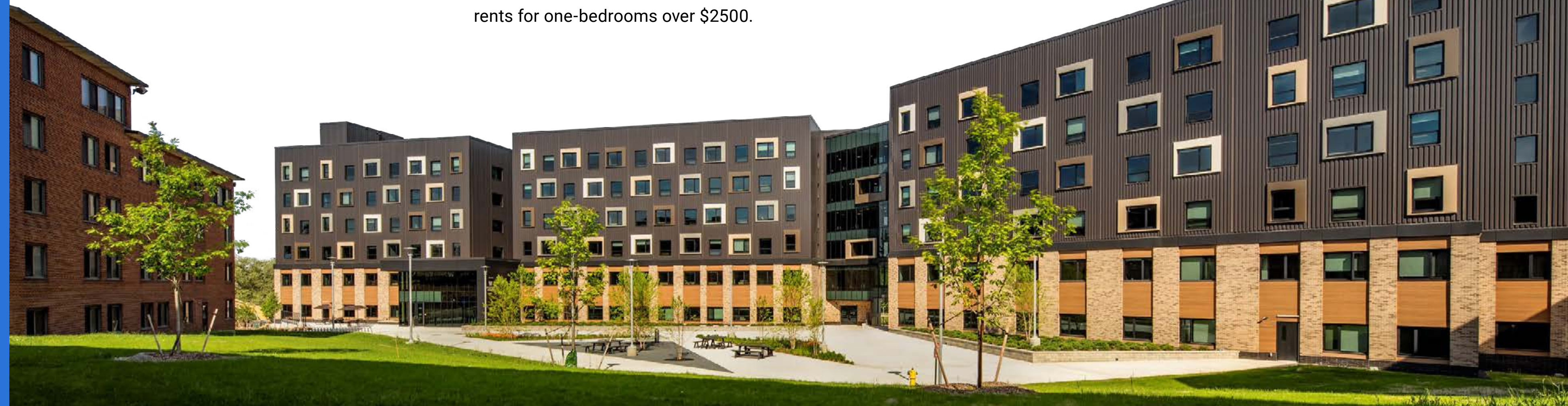
Rents in Toronto and Vancouver have stabilized as more compact units have become available. While data shows that building higher-end housing offers some relief to the market in general, it doesn't offer relief in the form of new attainable units. To make housing more affordable, we need to build more housing at an attainable price point.

We can build housing that serves a specific slice of underserved demographics: single person households, graduate students, empty nesters, retirees, and where people are looking to downsize and prefer a more connected social setting closer to other people and more urban amenities.

RENT IN LARGE METRO AREAS¹

\$3,442	San Francisco, CA
\$2,953	Los Angeles, CA
\$2,924	New York, NY
\$2,839	Boston, MA
\$2,457	Washington, DC
\$2,593	Miami, FL
\$2,251	Denver, CO
\$2,664*	Vancouver, BC
\$2,503*	Toronto, ON

*CAD



Housing attainability isn't just for cities, anymore.

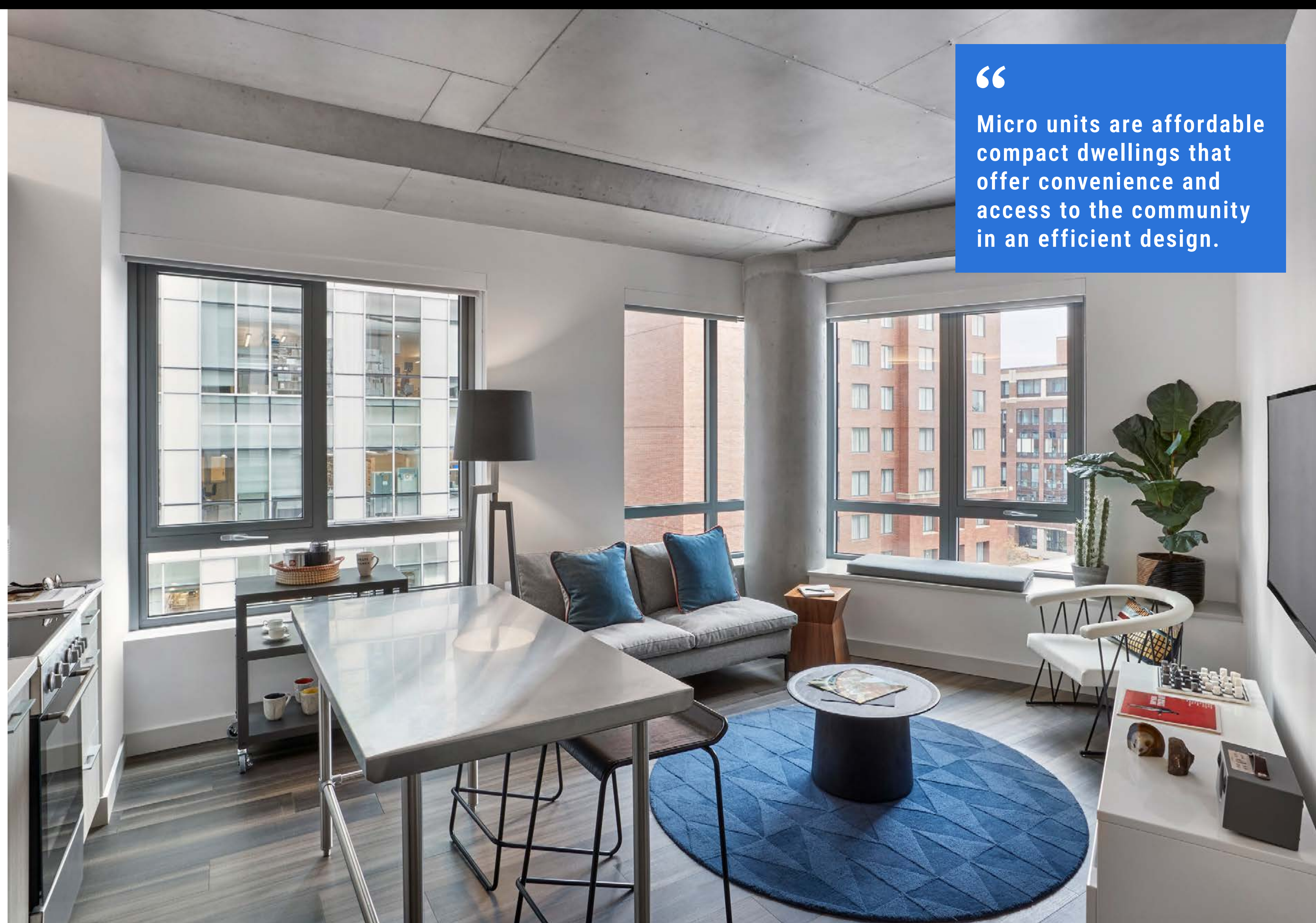
What's changing about the housing crisis? Since the pandemic, the areas where people want to live have changed. Post-pandemic, with remote work options, many have looked towards suburban living. Housing design has embraced wellness and work from home spaces. And the tight labor market has made many employers keenly aware of how important it is to offer housing options in their recruitment efforts.

On the supply side, while home building surged in 2023 with 1.4 million new homes added, it wasn't enough to meet the need of 1.8 million newly formed families.² More recently, escalating construction, financing, and materials costs have significantly slowed supply in all major markets. Zillow estimates that the U.S. housing shortage is roughly 4.7 million units.

There are two arguments for taking another look at micro housing:

1. In dense urban environments land can be costly and scarce, but the location is highly attractive to renters. Micro housing allows for "highest and best" uses for development with good return on investment.
2. Housing is an ecosystem. Building more micro housing with a few specific demographics in mind can loosen up the market. It allows more traditional housing options to go back into the supply pool and put some downward pressure on rents. Research has shown even new market rate housing can bring down rents nearby.³

📍 Proto
Cambridge, MA



“

Micro units are affordable compact dwellings that offer convenience and access to the community in an efficient design.

Where can micro housing development, micro units, and compact living make a difference in housing attainability?

Research workers in innovation hubs

Research and innovation hubs welcome a transient demographic. Entrepreneurs, researchers, and interns may come and go within a few years, even months. Knowledge hubs and university areas in urban areas also tend to be highly walkable with access to public transit. The research workers have less need for private space and more interest in access to the start-up office and the city beyond. The micro unit provides an easy landing pad solution for knowledge workers coming in on contract. And it supports the innovation economy locally.

Proto offers mostly studio and one-bedroom apartments for graduate students and millennial STEM workers in the Kendall Square neighborhood, a science and innovation hub in Cambridge, MA.

Key design feature?

A fully-furnished micro unit offers even more convenience to the innovation hub worker on the move.

Senior housing

Increasingly seniors are choosing to age in place with dignity. This is not incompatible with well-designed compact living spaces. Senior living centers offering smaller, more affordable units can shift the balance of their space to better communal spaces for activity and amenities. These community areas can enrich the day-to-day lives of seniors.

We recently presented micro unit approach to Ed Augustus, Massachusetts Secretary of Housing and Livable Communities, who is looking to solve housing supply and affordability issues for seniors and young professionals.

Key design feature?

Accessibility. We can design senior housing to be slightly larger versions of typical smart/efficient micro unit layout with adaptive features to support aging in place.



© Eastern Connecticut State University (ECSU)—Shafer Hall Renovation
Willimantic, CT

Graduate student housing

Graduate students are transient. They move around to complete their education. And universities want to make them welcome in their community of ideas. It's a perfect job for the micro unit. Residences near university campuses could feature micro units and compact dwellings for adult graduate students like the mix provided at **Arcadia Flats**. We can design these units to be efficient and cost-conscious.

Then we devote more amenity spaces to study and collaboration, fostering social and idea exchange that enhances the educational experience. Micro units are a good fit for a learning/living environment where collaboration is desirable.

Undergraduate institutions want to keep housing affordable to keep students on campus for community and shared experiences. On the **Eastern Connecticut State University—Shafer Hall Renovation**, we designed micro units that provided new residences and gave an older building new purpose.

Key design feature?

Compact apartments for graduate students can provide amenities like a private bathroom and kitchen, offering the elevated lifestyle these academics desire.

Seasonal work in the hospitality industry

After the pandemic, many of us decided to get out and appreciate the outdoors. Many resort areas have been booming ever since—with more opening all the time. The ski industry, for example, is projected to double by 2035.⁴ But seasonal communities such as ski resorts and island getaways often face severe shortages of housing for seasonal service and tourism industry workers. The high property values and rugged terrain in these communities make the cost of housing unaffordable for the workers their attractions need to operate.

Vail Resorts and other resorts have pledged to invest millions in workforce housing. Recently, Winter Park Resort's Conifer Commons showed what is possible with modular construction for seasonal workers. Residential buildings offering micro units could be part of the solution. Affordable buildings with smaller unit sizes would enable more staff to live closer to the resorts. And opening some common areas could include amenities to attract new recruits.

Key design feature?

Mountain towns in protected areas tend to have extraordinary site constraints. So, the smaller footprint of micro unit residences may expand the range of possible sites.

“

The new wave of interest we are experiencing for our micro housing design research shows that it has applications far beyond the original.

New applications for compact living research.

Compact living design is not a panacea for the housing attainability issue. But the new wave of interest we are experiencing for our micro housing design research shows that it has applications far beyond the original. We believe the right-sized micro unit has a great deal to offer to communities, developers, employers, and housing agencies. We are excited to refine and adapt this design approach to meet tomorrow's housing attainment needs. ■

Eastern Connecticut State University (ECSU) – Shafer Hall Renovation
Willimantic, CT



Aeron Hodges

Principal

📍 Boston, MA

Architect Aeron leads designs for residential communities in high-barriers-to-entry markets.

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2. Zillow. [US housing deficit grew to 4.7 million despite construction surge](#). July 9, 2025.
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4. [Future Market Insights, Inc.](#)



ASK A DESIGNER

How do we advance the sustainable impact in our work?

Sustainable design leader,
North America, Jill Kurtz

Interview by John Dugan

Jill Kurtz wants to embed sustainability in processes, projects, and organizations. To do that, she wants us to see sustainability not merely as a technical problem, but also as a change and process problem. With an education spanning architecture, sustainability, environmental buildings, and qualitative research, she understands where and how design, data, people, and decision making intersect. In her role as Sustainable Design Leader North America, Jill applies big-picture, systems-level thinking to the transdisciplinary challenge of designing sustainable buildings. She develops Buildings-wide strategies for environmental and social responsibility and refines our sustainability practice. Her mantra is “intention requires rigor.” The *Design Quarterly* hopped on a call with Jill to find out where she thinks sustainability in the A&E industry is headed and how her upcoming AIA National Conference workshop with the Large Firm Roundtable (LFRT) can help design firms get on the right path.



JILL KURTZ

Jill Kurtz is sustainable designer leader for Stantec Buildings, North America.

📍 Houston, TX

📍 **George Mason University Fuse at Mason Square** Arlington, VA

We designed this tech hub with global citizenship in mind. The result was a 70 percent reduction in energy use from baseline and energy use intensity (EUI) of only 39 kBTU per square foot.

The plan saves 150,000 kg CO2e through building reuse, onsite photovoltaic generation, and local carbon sequestration, targeting net zero carbon emissions by 2040.

Q What led you to focus on sustainability in your career?

JILL KURTZ: I was feeling a little frustrated after I got my Bachelor of Architecture degree. I wanted to make sure my profession focused on people, providing value and making an impact. I wanted what I was doing to feel like it would outlive me. I spent a year living in India working as a nonprofit architect and that really rocked my world; It reframed what matters. It was so critical to realize most of the world has to think about “what am I going to do when the power goes out, or what do I do when there’s not enough water?” I made a career pivot and have spent the last 20 years fully focusing on sustainability in the built environment.

Now with Stantec I’m excited to grow my impact and help refine design processes. Sustainability isn’t just a technical problem, it’s a people and process problem and change must happen from within to improve the outcome. As an integrated firm we can evolve the way we approach our work from the inside out.

Q In the DQ, we often say that sustainability can’t just be the final stage in your design process. But if it’s a starting point, it guides the design.

JK: I say all the time, intention requires rigor. We can have the best intentions to do better, but if we don’t define them clearly from the beginning and follow through with rigor, then we’ll never improve our projects. I also firmly believe sustainability success on projects is tied to firm culture. We value what we measure and prioritize what we talk about in our organizations.

Q How does this relate to your leadership with the AIA LFRT?

JK: Our field is going through an evolution in sustainability. We’ve been talking about the ideal process and tools for too long. We know how to make projects better. The focus of our LFRT group is on how to share lessons learned from within our firms and how to grow a culture that sets those teams and projects up for success.



Q What is the AIA Conference topic?

JK: It’s an interactive workshop at the AIA National Convention called “Organizing for Impact: Embedding Sustainability in Structures, Culture, and Careers.”

Rather than discussing the technical things we’re doing on projects, it’s asking how are your organizations structured to have sustainability show up? What are the common career paths you’re finding? How have your accountability structures evolved to show this as a core value?

Our thesis, plainly, is that sustainability used to be this extra, nice to have thing on projects. And now it’s becoming a core value to design firms and their approaches to work.

However, we haven’t fully operationalized that value in our business structures, our career pathways, our training, and our accountability metrics.

They’re lagging. It’s in our mission statement yet many firms don’t yet have people at the leadership table who focus on this evolution.

📍 Austin Independent School District
New Rosedale School
Austin, TX

Universal and inclusive design are at the core of this “school within a park” which serves students with complex needs.



The HSSC unites 13 different programs under one roof and connects two existing historic structures, reducing embodied carbon by 30 percent. The outdoor classroom's landscape collects water, reducing 50 percent of potable water use. And a geothermal field reduces energy use by 75 percent.

Q Is there one way architecture and engineering organizations should approach sustainability?

JK: I don't think we can align our practices on a single way of working across the industry. There's a recognition that there's such diversity in how the work is delivered; there's not a one-size-fits-all. However, I think there are some core elements we should clearly define to make us all better. We should be learning from each other.

Q What's getting in the way of sustainable approaches in the design industry?

JK: People say sustainability is everyone's responsibility and that diminishes the importance of specialists and innovators. That mentality has held us back because it means we're not creating space within organizations and career paths for that expertise to thrive. We need to build a foundational culture around sustainability, but we still need the people to provide the rigor and move us forward. We need our specialists to measure our progress and do the research to push us to what is next.



Q Sustainability and decarbonization have their own terminology. But to succeed you need buy-in from those that live in the language of business and budgets. Is it more effective to talk about operational savings?

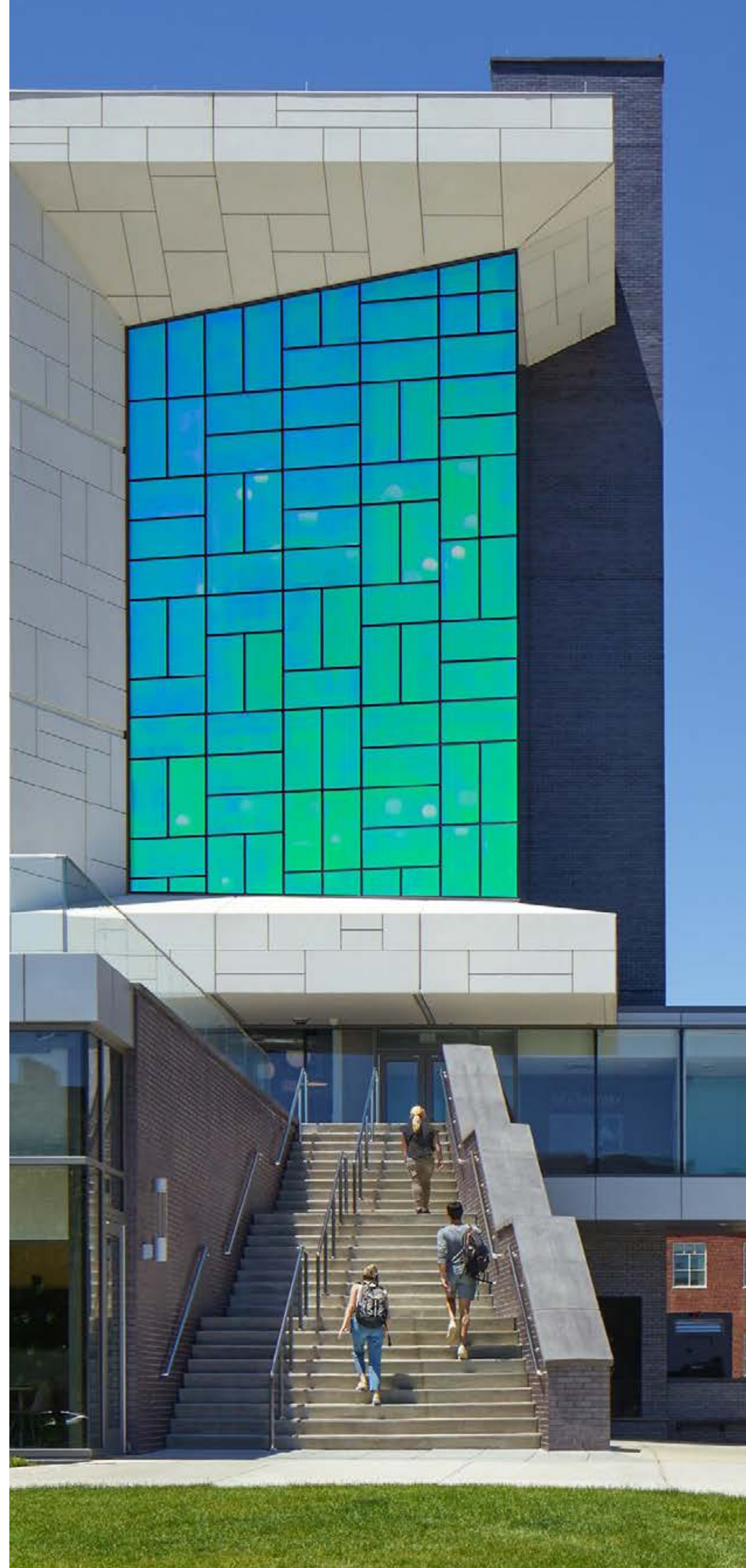
JK: It can be discouraging that we still have to make the case for the return on investment for sustainable design. The business case needs to include more than energy strategies. I like to talk about “impact measurement.” Let’s also measure retention value for increased daylight or health value for improved air quality as well.

Q And the conversation lights up?

JK: Yes, clients love talking about impacts, but it requires a shift in how we speak. It’s about who the clients are, what they are valuing. We must adapt so that we’re not techno speaking. Rigor matters and we need to be consistent about how we’re measuring things. But you need to connect that knowledge to what others value.

 University of Maryland E.A. Fernandez IDEA Factory College Park, MD

The IDEA Factory, a dynamic hub for innovation and entrepreneurship, features dichroic glass that shades interiors blue or pink throughout the day.



Q What makes you a good fit for this job?

JK: My strength has been in that translation and sitting in between the disciplines. My superpower has been synthesizing complex information or analysis so clients can make decisions. I love building strong sustainability practitioners who can guide a project process and also dig in to talk about a wall detail or boiler efficiency.

Q You have to connect internally and externally at various levels.

JK: Adam Grant talks about how; in the past we rewarded people who knew the most. But today, we have information everywhere, so the goal isn’t to know the most. The goal is to know where the dots are and how to connect them.

Sustainability can be like accounting, where you’re tallying up emissions, and that is important. We need that scientific rigor and accountability.

We also need sustainability as a storyteller, as a catalyst, and as a source of inspiration.

Q What’s next for the industry and sustainability?

JK: Our industry has set many goals. Architecture 2030 has proven we’ve done well in reducing the energy of new assets and greening the electrical grid. Next up, we need to double down on existing building assets and building materials. Those have been underappreciated in the overall equation. We also need to look at resilience. Do we have enough clean and reliable power when we need it? Those resilient strategies start to factor in more with energy transition. We must plan for the unexpected. Most importantly, we need to shift beyond “doing less” to design that gives back, restores, and works with nature to leave things better than we found them. ■

Jill Kurtz will host “Organizing for Impact: Embedding Sustainability in Structure, Culture & Careers” for the Large Firm Roundtable (LFRT) at AIA26 on June 10th in San Diego, CA.



John Dugan
Team lead, content
Chicago, IL

John Dugan is the editor of *Design Quarterly* and creator of the *Design Hive* podcast. He collaborates with Buildings authors on thought leadership content.

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📷 **Front and back covers:**
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