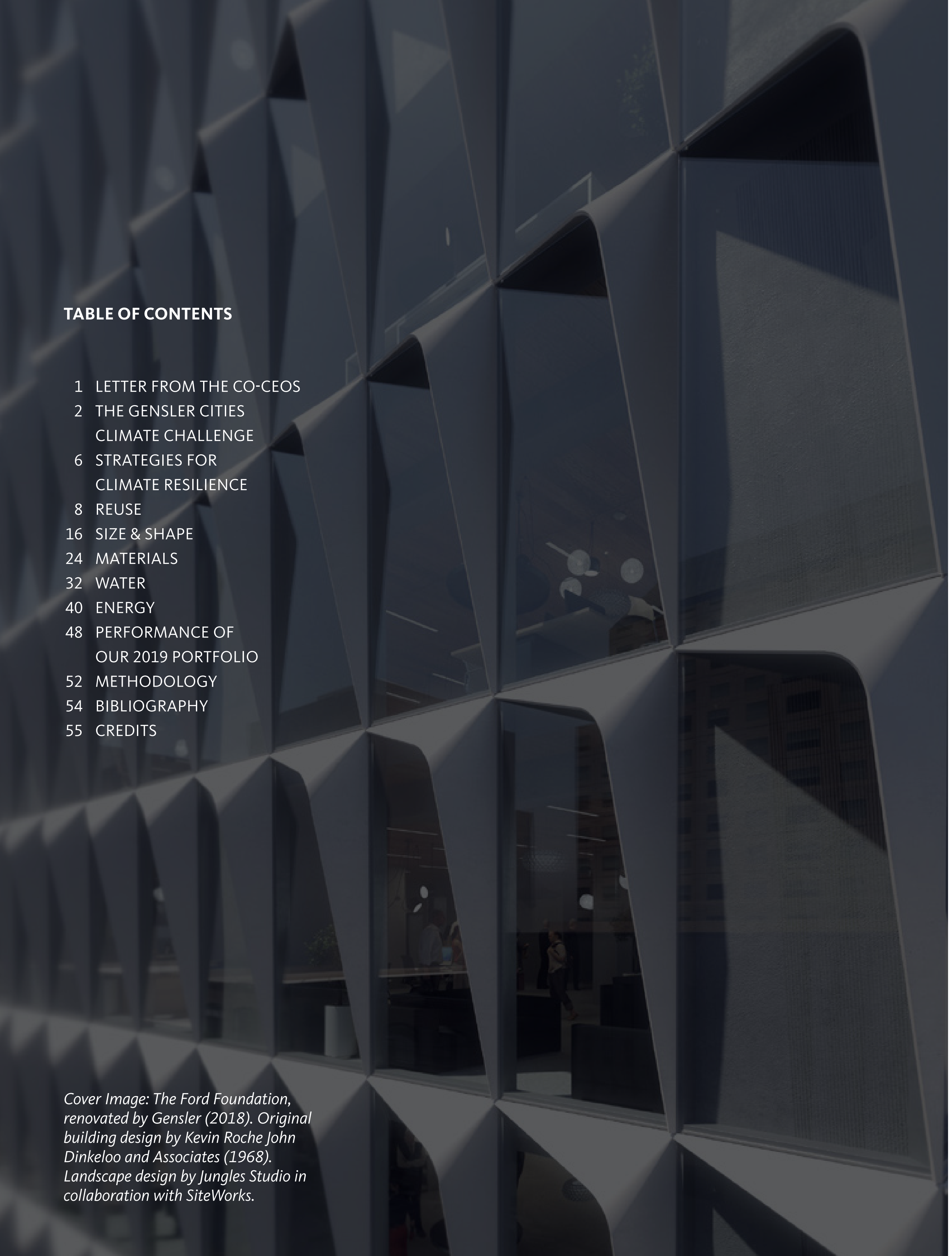
Gensler

IMPACT BY DESIGN 2020

A PUBLICATION OF THE GENSLER RESEARCH INSTITUTE

CLIMATE & RESILIENCE

SHAPING THE FUTURE OF CITIES



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Cover Image: The Ford Foundation, renovated by Gensler (2018). Original building design by Kevin Roche John Dinkeloo and Associates (1968). Landscape design by Jungles Studio in collaboration with SiteWorks.

ADDRESSING THE CLIMATE CRISIS IS MORE IMPORTANT THAN EVER. TOGETHER WE CAN CREATE AN ERA OF GLOBAL WELLNESS.

We release our annual *Impact By Design* publication at a time when the world is facing an unprecedented public health crisis—and showing great courage in responding to it. The past couple of months have revealed how closely connected we all are and how quickly millions of people can mobilize when needed.

Imagine if this kind of agility were applied to the climate crisis. In fact, an unintended consequence of the work-from-home imperative has been a measurable improvement in air quality in many cities—in just six weeks. This renews our understanding that we can make a difference through our choices and decisions—once we resolve to make it happen. But like the health crisis, in the absence of fundamental longstanding changes, the climate crisis will imperil our future well-being if we resume business as usual without addressing the essential changes that need to be made.

To spur longstanding change, last fall we announced the Gensler Cities Climate Challenge (GC³). Our plan is to eliminate all carbon emissions associated with our work within a decade. As the world's largest design firm, we have a unique obligation and opportunity to improve the impact of the built environment—but also to lead the industry. We challenge all our colleagues and clients to join us in the path toward carbon neutrality.

The built environment can help achieve a new era of global wellness. Even with the current pandemic, we can see the interconnectedness of decisions we need to make for global health and safety. Climate change continues to be an urgent challenge, affecting everything: quality of life, biodiversity, national security, the economy, and especially public health. Design can help to tackle these challenges—and enrich the human experience, promote well-being, and ensure safety.

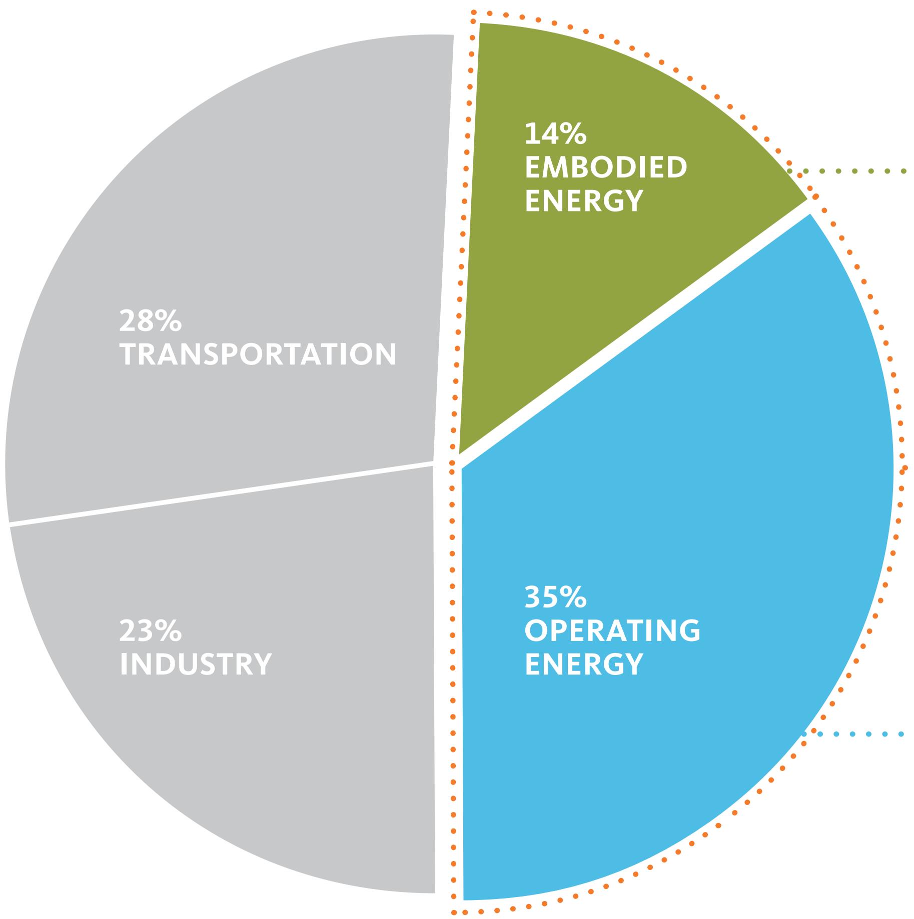
Diane Hoskins
FAIA, IIDA, LEED AP, Co-CEO

Andy Cohen
FAIA, IIDA, Co-CEO

THE GENSLER CITIES CLIMATE CHALLENGE (GC^3)

The Gensler Cities Climate Challenge (GC^3) is our commitment to achieving carbon neutrality in all our work within a decade. It also is a rallying cry to our industry, our clients, and our colleagues.

Achieving carbon neutrality entails eliminating or offsetting all CO2 emissions from the built environment. To that end, the GC^3 is focused on minimizing two primary sources: emissions related to using buildings (operating carbon), and those related to making buildings (embodied carbon).



U.S. ENERGY CONSUMPTION BY SECTOR

Sources: United Nations, U.S. Energy Information Administration

WITHIN A DECADE, WE WILL ELIMINATE ALL NET EMISSIONS ASSOCIATED WITH OUR WORK.

THE IMPACT OF MAKING BUILDINGS (EMBODIED CARBON)

The impact of energy and emissions related to the manufacture of materials and products, transporting them, and assembling the building. Embodied carbon is typically measured as Carbon Use Intensity (CUI) or CO2 equivalent (CO2e) lbs/sf/yr.

49%

OF U.S. ENERGY CONSUMPTION IS ASSOCIATED WITH THE BUILT ENVIRONMENT.

THE IMPACT OF USING BUILDINGS (OPERATING CARBON)

The impact of energy and emissions related to ongoing operations (heating, cooling, lighting, etc.). Operating energy is typically measured as Energy Use Intensity (EUI) kBtu/sf/yr for buildings; and Lighting Power Density (LPD) watts/sf for interiors. These metrics are then used to estimate carbon emissions based on a project's square footage.

TO BECOME CARBON NEUTRAL, WE NEED TO ELIMINATE OR OFFSET THE IMPACT OF BOTH OPERATING AND EMBODIED ENERGY.

EMBODIED CARBON

(MAKING BUILDINGS)

Embodied energy, the energy associated with building materials, accounts for 28% of an average building's overall energy consumption. That's approximately 9 million metric tons of CO2 emitted each year for a portfolio of our scale.

[MATERIALS EXTRACTION + MATERIALS MANUFACTURING + TRANSPORTATION + BUILDING CONSTRUCTION]

STRATEGIES

Right-sizing: strategies that use the fewest materials possible without sacrificing function.

Significant reduction through low- and zero-impact materials.

Gradual increase in reuse vs. new construction.

Offset through net-positive production and/or increase in carbon sequestration (capture through absorption).

+

OPERATING CARBON

(USING BUILDINGS)

In an average building today, operating energy accounts for 72% of the overall energy consumption. At the scale of Gensler's portfolio, that's approximately 23 million metric tons of CO2, based on our 2019 design work.

[LIGHTING + VENTILATION / SPACE HEATING / COOLING + WATER HEATING + COOKING / REFRIGERATION + PROCESS LOADS / PLUG LOADS]

STRATEGIES

Right-sizing: strategies that use the least space possible without sacrificing function.

Significant reduction in operating energy per square foot.

Gradual increase in on-site renewable energy production.

Electrification to increase flexibility for renewable procurement.

−

CARBON OFFSETS

[RENEWABLE ENERGY PRODUCTION + CARBON SEQUESTRATION]

=

TOTAL NET CARBON IMPACT

STRATEGIES FOR CLIMATE RESILIENCE

At Gensler, we define resilience as adapting to and preparing for a changing world. In this section, we highlight five strategies for promoting climate resilience, which falls into two categories: reducing consumption of fossil fuels and rethinking the built environment to live gracefully with climate change.

REUSE

In many cases, the single greatest decision to improve climate impact is to reuse buildings, spaces, and materials that already exist—adapting them to meet new needs instead of building new.

SIZE & SHAPE

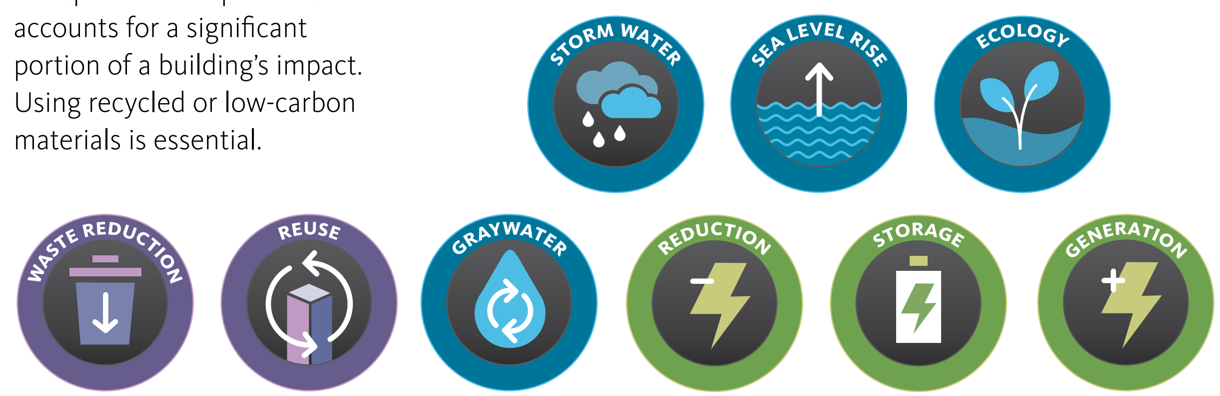
In new construction, the most direct way designers can affect performance is through design itself—size, orientation, massing, fenestration, etc.

MATERIALS

The energy expended during the production and transportation of products accounts for a significant portion of a building's impact. Using recycled or low-carbon materials is essential.

WATER

The treatment and pumping of water account for a large portion of buildings' energy and emissions, and climate-related sea level rise is creating fragile coastal conditions. Design strategies that use less water and mitigate water risks are required for long-term resilience.



ENERGY

Minimizing energy use in buildings is essential to addressing climate change. Supplementing with renewable energy production will become increasingly necessary.

Extending the life of existing structures can significantly reduce embodied carbon, compared to new construction.

Reusing existing structures instead of building anew usually results in lower environmental impact. Studies show that the additional operating efficiency of even a high-performance building can take up to 80 years to make up for the impact of having built it in the first place. Therefore, replacing an existing building should only occur if it cannot be adapted effectively or if the building that replaces it has sufficiently higher energy performance to make up quickly for the material loss.

For buildings that cannot be adapted easily or have no cultural or historic value, salvaging and repurposing the materials can prevent unnecessary waste. Deconstruction, rather than demolition, often saves 95% of a building's materials. In many older European cities, materials have upcycled through buildings for centuries. Encouraging this sort of reuse globally can have a huge impact; according to the U.S. EPA, every year the American built environment creates over half a billion tons of debris, 90% from demolition.

The design of new buildings also can extend a structure's useful life. Designing structures that can be easily adapted to various uses is essential. Using a standard size grid and relatively open floor plan will help projects adapt to varied future functions without much demolition. The cast-iron loft buildings of New York's SoHo neighborhood have been continually adapted for 150 years because of their beauty and flexibility. Preserving these structures conserves the embodied energy of the material while also reinforcing the cultural heritage of the neighborhood.

46%

Reusing existing buildings can reduce their environmental impact by 46%.

STRATEGIES

Changes to improve building efficiency, performance, or resource use.

Adding to a building's existing footprint to increase functionality while maintaining the original structure.

Bringing multiple existing buildings together to form a combined, high-performance property.

Changing the uses of buildings to meet market demand and continued function.

Leveraging design to shift a building's public or market presence.

THE FUTURE OF REUSE

More and more of the design industry's activity will focus on adaptative reuse and historic preservation, improving the long-term impact of buildings. Remediating brown- and grayfield sites in industrial areas will recover significant embodied energy while creating new communities. Considering longevity and flexibility in all buildings will make adaptation easier in the future. Design for disassembly—planning for eventual repurposing of materials and designing for a circular economy—could become standard practice.

Using transparent skin to transform a mono-use icon into a mixed-use destination. Located in the heart of downtown Chicago, Willis Tower is home to more than 100 businesses. Catalog celebrates the history of the existing structure while creating a more porous and permeable environment.

Our new design increases retail space sixfold and opens the building to the city.

Coworking areas provide cutting-edge office amenities. Event space provides increased opportunities for business and community organizations (not pictured).

A landscaped outdoor terrace provides destinations for tenants, locals, and visitors alike.

The formally single-use building now has stacked programming that accommodates event, retail, dining, and entertainment spaces.

Hackman Capital Partners selected Gensler to repurpose an industrial complex to create a unified campus. The site, comprised of four warehouse and manufacturing buildings, spans 550,000 square feet. Rehabilitating the space will deliver modern, agile office space that matches the high expectations of area tenants.

Industrial details, like this former manufacturing crane, are featured throughout the design.

The structure is supported by its original steel braced frames.

The plan features a variety of landscaped outdoor spaces for employees to work and play.

To honor the unique character of the site, we highlighted the existing high bays and sawtooth skylights.

The site's original bridges, catwalks, railway corridors, and exterior stairs will connect the campus buildings.

We built on an original chassis to add long-term value and improve worker experience. This mid-century office building needed to boost its engagement with the surrounding urban landscape to appeal to a new generation of tenants. Our intensive modeling indicates that the Fiberglass Reinforced Polymer (FRP) solar shades extend usable daylight while mitigating peak energy loads.

A five-story addition to the original chassis of the building increases the leasable area of the structure to 270,000 square feet.

The FRP solar shades enable unique form variation in response to solar exposure while also damping wind vibrations.

The high-performance facade optimizes daylight while minimizing heat gain, extending the amount of usable natural light by over 300 hours per year.

Optimizing the **physical form** of a building is one of the greatest opportunities to minimize embodied and operating energy.

The vast majority of a building's performance is influenced by its size, shape, orientation, massing, and fenestration. When just 1% of a project's up-front costs are spent, up to 70% of its life cycle costs may already be committed. Performance is first and foremost a design strategy.

Strategic decisions about size and shape can lower costs while improving performance. Consider solar orientation. Facing a building south instead of west can cut heat gain by as much as 20%, improving thermal and visual comfort and operating costs. This can decrease first costs by reducing glazing, insulation, and mechanical systems. This is especially important at the scale of cities, since the urban grid generally governs which direction buildings face.

Urban form also influences interior space. In the District of Columbia, for example, large blocks and height restrictions result in deep floor plates and relatively low ceiling heights, undermining the ability to design buildings with good natural light on the inside. As the built environment grows and evolves over time, how we shape it is an essential opportunity to improve long-term resilience.

90%

90% of a project's impact is determined by early design decisions.

STRATEGIES

Placing buildings to connect to community services and reduce transportation-related energy.

Building only as much space as needed to function effectively.

Optimizing a building's surface-to-volume ratio to improve climate impact and resource efficiency.

Positioning a building to work well with sun, wind, views, and context.

The size, shape, location, and number of windows or openings.

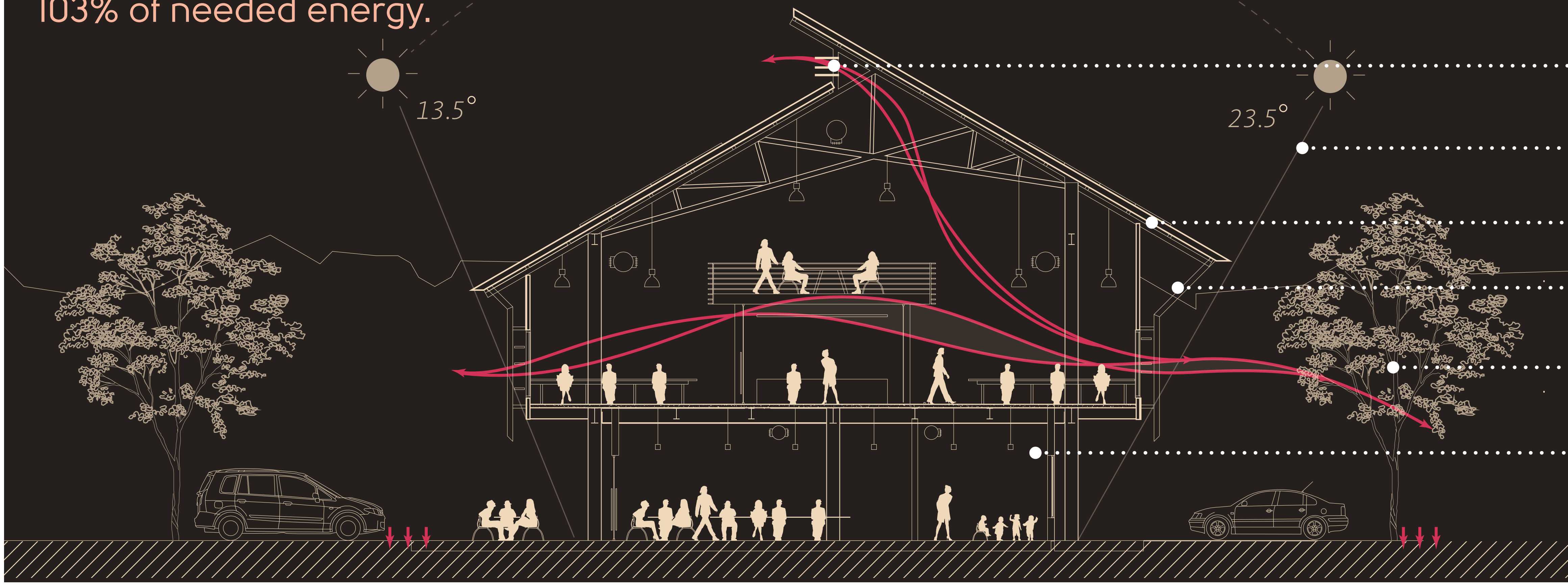
Sun shades, overhangs, and other features that improve performance.

THE FUTURE OF SIZE & SHAPE

As design technology becomes more sophisticated and integrated into everyday practice, architects and designers will increasingly generate forms that are tailored to the unique conditions of every site, dramatically enhancing performance. Artificial intelligence could assist or fully automate this process, producing novel forms and smarter results.

We used passive design strategies to maximize building performance. As the global headquarters for a growing coffee brand, this structure needed to honor the company's long-held commitment to sustainability. The building is designed to achieve LEED Platinum Certification, maximizing both energy and water credits. The design uses sustainable materials that improve space quality, including rapidly renewable cork flooring that provides a warm atmosphere for the workspace area.

Optimizing the building's form and orientation improves energy performance, allowing on-site photovoltaics to generate 103% of needed energy.



We rotated a tower form and tapered its massing to reduce wind loads. Located along the waterfront of the Fuzhou Minjiang North Business District, the client requested a striking landmark that symbolized the city and worked in harmony with the surrounding area. Inspired by the shape of the local banyan tree, the design features a mega-structure that connects the podium and tower into one dynamic sculpture form. The tower provides an environmentally responsible architectural ecosystem that brings life, comfort, and culture to the developing city.

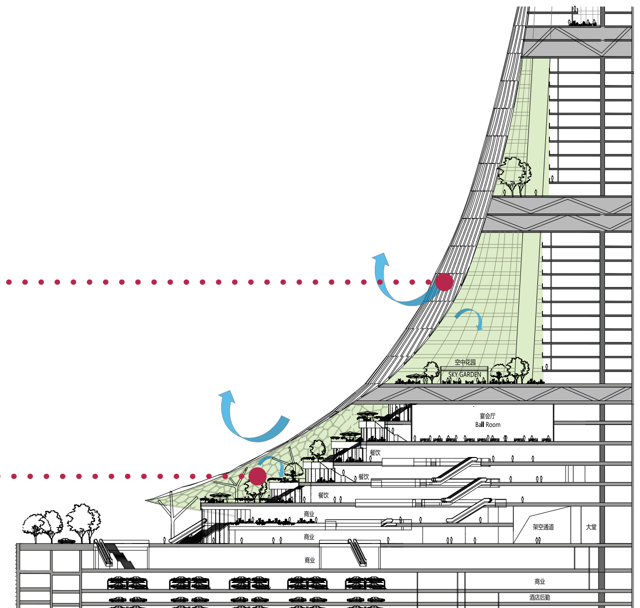
The aerodynamic crown design contributes to a nearly 2% wind load reduction with structural cost savings.

The building's structural systems, vertical transportation, and HVAC systems are designed to meet LEED Gold accreditation.

Computer simulations were used during early-stage studies to analyze and improve wind load, atrium temperature, and other key elements of the design (not pictured).

Being semi-outdoors minimizes the need for systems relating to fire-rated glass curtain walls, smoke exhaust, and air conditioning in the atrium, while also providing passive comfort and boosting cost efficiency.

The open atrium uses a static shading system that reduces solar heat gain by 19% and provides opportunities for natural ventilation of residential units.



The 45° rotation of the tower reduces wind load and structural cost by an estimated 13%.

THE UNIVERSITY OF TEXAS AT AUSTIN MOODY CENTER | AUSTIN, UNITED STATES

LOCATION DETAILS ADAPTATION REDUCTION

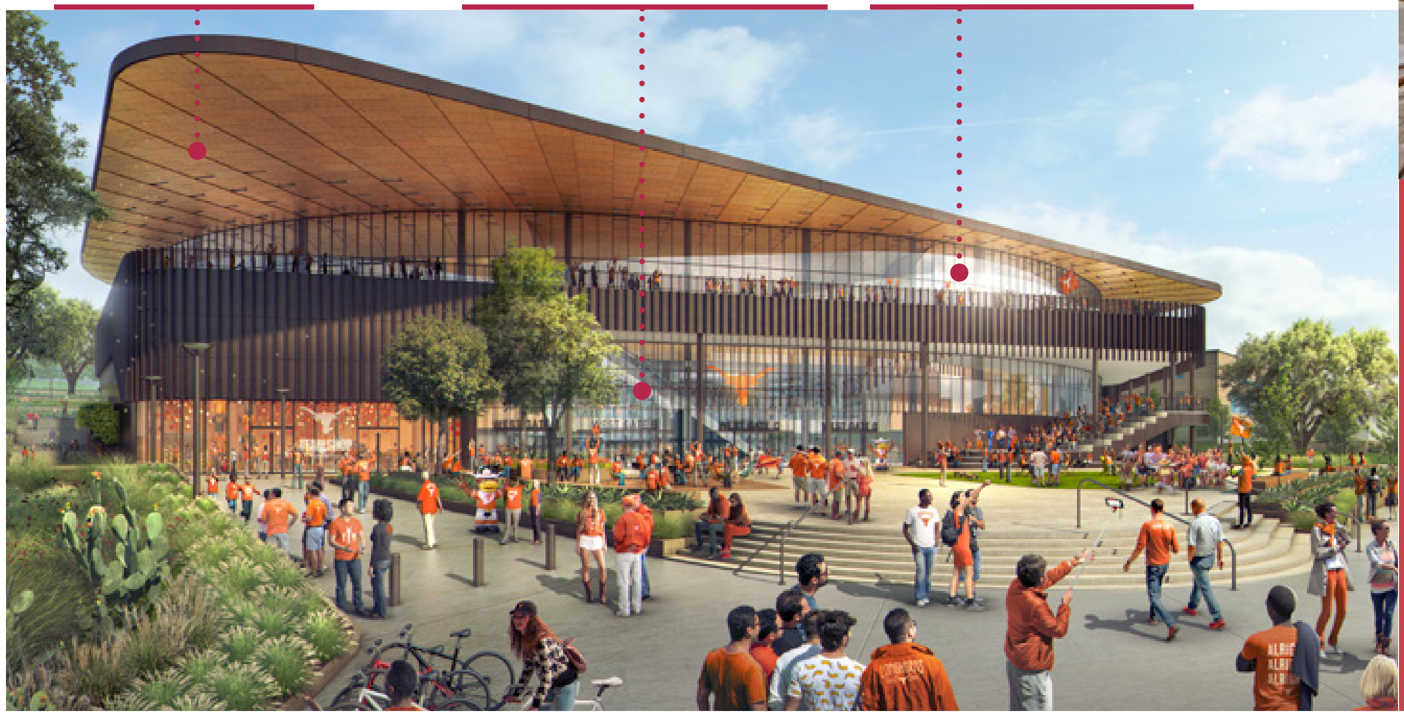
We intelligently shaped an arena to yield significant energy savings. We turned the basketball and concert venue inside out to make it more transparent and inviting than traditional enclosed sports venues. Submerging much of the space below grade maintains a humane scale while also reducing solar exposure and energy consumption. Depending on solar orientation, a large roof canopy that varies in depth shades the glazing while creating a welcoming porch-like image.

The project's design strategies save enough energy to power 86 Texas homes every year.

Deep overhangs shade the transparent facades to minimize heat gain.

The arena's location bridges the divide between east and west Austin, and also between the UT campus and the thriving downtown area.

The transparent design blends indoor and outdoor experiences.



CONSERVATION INTERNATIONAL | ARLINGTON, UNITED STATES

RECYCLING RIGHT-SIZING LOCAL MATERIALS

We consolidated office space to complement an organization's mission. Conservation International works with communities, partners, and governments all around the world to promote sustainable practices, and their office space needed to reflect their mission. We consolidated their space from two floors to one, implementing an open floor plan that allowed for a more efficient use of space.

Plant-based ceiling tiles are used throughout the space (not pictured).

The walls are finished with salvaged 100-year-old timber that is perfectly preserved and of premium quality.

The office features three live-edge tabletops salvaged from local trees.

The carpet tiles are made from re-purposed waste nylon from discarded fishing nets, among other reclaimed materials (not pictured).

Helping the client accommodate the same workforce in half the space dramatically reduces energy and material impacts.

Using low-carbon **materials and products** significantly reduces a building's overall embodied carbon.

In the U.S., 11% of all energy consumed stems from making and shipping building materials. Standard rates for embodied energy (the energy required to extract, process, and manufacture a material or product) do not even include the energy consumed while transporting materials. Since nearly 75% of all raw materials are used for buildings, we must make conscious decisions about how we source, construct, and finish our structures.

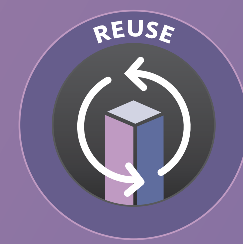
Materials vary in their impact. Cement used to make concrete accounts for nearly 10% of all emissions worldwide. It has been said that if the cement industry were a country, it would be the third-largest emitter in the world. Wood, however, has relatively low embodied energy—as much as five times less than steel. Because trees absorb CO2 while alive, wood also has the additional benefit of storing carbon in perpetuity, preventing it from being released into the atmosphere.

The life spans of materials often depend on how they are used. The longer materials are used in buildings, the more time they have to amortize. Furniture and interior finishes tend to be replaced every few years, while the structure can last as long as the building itself. High-churn projects such as retail stores are potentially far more wasteful with materials, so choosing products that can be removed and reused easily is urgent. Additionally, obtaining materials from local or regional sources can significantly reduce construction-related emissions.

49%

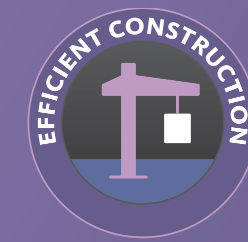
Between now and 2050, 49% of emissions will be due to embodied carbon in new construction.

STRATEGIES



Continuing the usable life of a building.

Sourcing materials and products from within the region to mitigate transportation-related impact.



Improving the building process to increase efficiency and minimize waste.

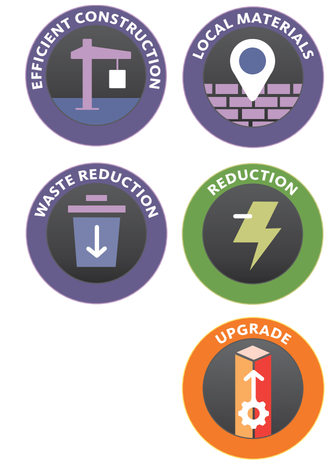
Strategies that reduce the amount of waste generated—whether from construction or during normal building operations.

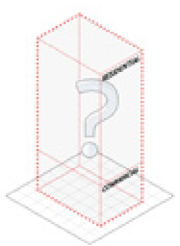
Reusing materials, products, or their ingredients.

THE FUTURE OF MATERIALS

Demand for better products will continue to challenge manufacturers to rethink their practices. More and more materials will be sourced locally, created with low-impact processes, and free of harmful chemicals. The design industry will develop simple, reliable methods to calculate the life cycle impact of materials. A boom in both natural materials (such as sustainably harvested wood) and innovative synthetics could completely change how buildings are composed: living structures grown in place could become more common, along with self-assembling and self-healing materials. Eventually, all building products could be continually upcycled to avoid waste entirely.

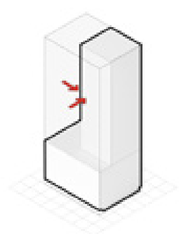
We conceptualized a mass timber prototype with resilient construction strategies. A component of a master innovation and development plan for a smart city in Toronto, Proto-Model X (PMX) is a 472,000-square-foot that will include 35 stories of retail, offices, residential, and integrated building services along Toronto's eastern waterfront district.





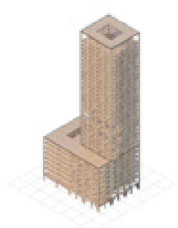
SITE

Initially, site location and conditions were not driving factors in the design. Requirements were to design a 35-story modular mass timber tower.



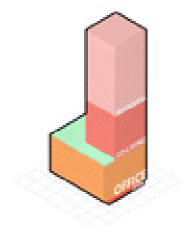
MASSING

Numerous massing options were explored to optimize constructability, structural integrity, and functional efficiency.



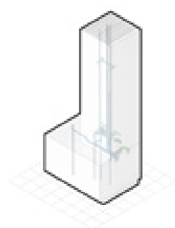
STRUCTURE

A timber brace frame lateral system was selected. A tuned mass damper was added to the roof level to deal with acceleration issues.



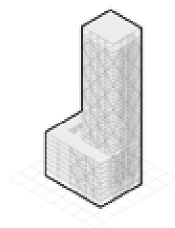
PROGRAM

The building is designed with a mixed-use program in mind. This includes ground-floor retail, office floors, co-living space, and traditional upper mid-market residential units.



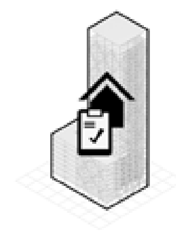
MEP

The building is designed with a fossil fuel–free mechanical, electrical, and plumbing system that connects to a thermal loop and distributes power to units through digital electricity.



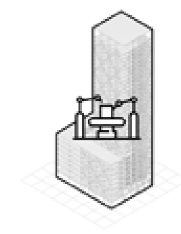
ENVELOPE

Various modular architectural expressions were explored. Ultimately, an efficient Passive House–like envelope system was selected.



BUILDING CODE

An alternative solution that illustrates how the building is consistent with the intent of the Ontario Building Code was developed.



FACTORY

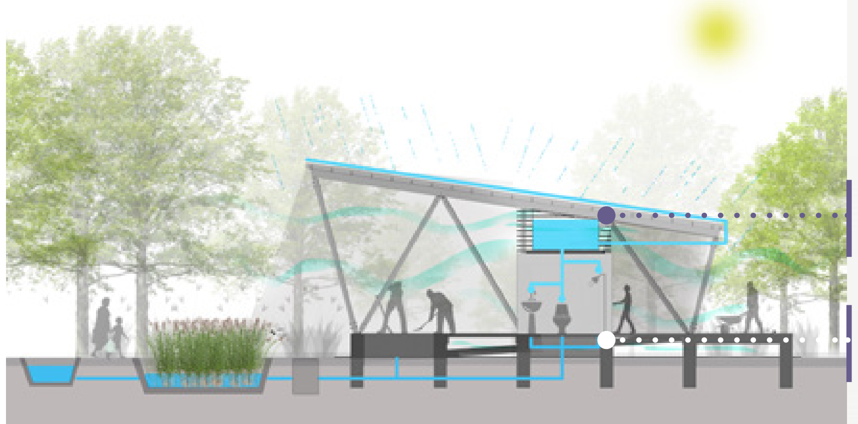
The building is designed to be optimal for factory production. Processes were set in place to monitor total piece count, number of unique pieces, and ease of assembly.

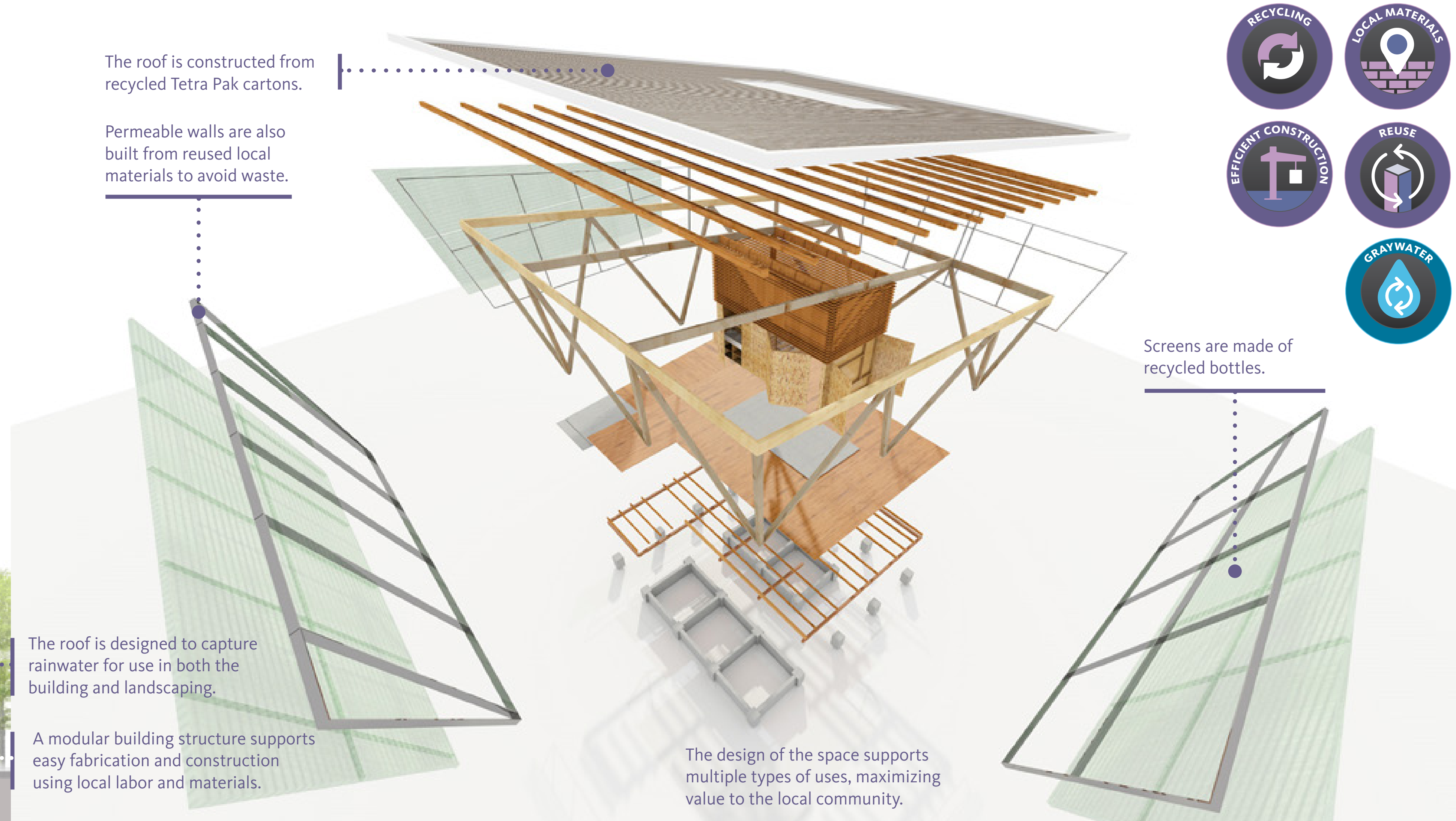
Timber structures require a smaller foundation than concrete buildings and can reduce embodied carbon by over 25%.

Digital and robotic technologies will create the optimized prefabricated building facade (not pictured).

Working with a local timber factory to produce standardized materials reduces construction waste and improves technical performance (not pictured).

We used locally sourced and recycled materials to create a multifunctional space for community residents. Developed in partnership with A-01 Architects, the Recycling and Community Center of Chira stands on the country's most populated island, serving 3,000 people across six villages. The majority of the island's residents work in the agricultural fishing industry, with a four-month off-season that poses an economic challenge to residents looking for additional employment opportunities.





The Recycling Center, in addition to solving the community's solid waste crisis, can be configured to serve as an office, fabrication lab, and community/learning center.

We used restoration and reuse strategies to reinvigorate a building's character. The Ford Foundation Center for Social Justice seeks to promote scientific, educational, and philanthropic initiatives for the benefit of all people. The design preserved 85% of existing building materials by volume, amounting to 91% embodied carbon savings. The original water capture tank was also restored and is being used for makeup water for the building's chiller plant.

Light fixtures throughout the space were refurbished and retrofitted with LEDs.

Over half of the original mid-century furniture was reused and restored.

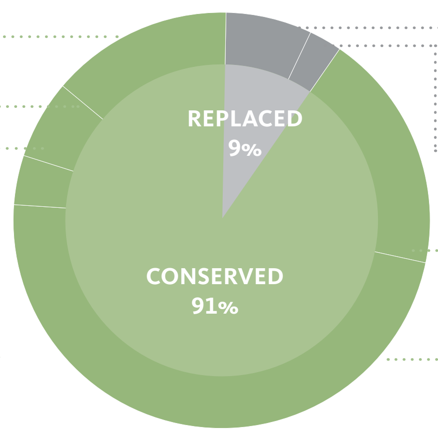
The building's original wooden floors were either restored or replaced with new, FSC-certified wood flooring.

MATERIAL REUSE BY EMBODIED CARBON

10% Other
Roofing structural deck, ceiling systems, plaza materials, structural beam, roofing finishes, foundation walls, sidewalk, skylights, interior walls, exterior atrium glazing, roofing assemblies

8% Walls

48% Structural column



7% Other
Ceiling systems, roofing finishes, plaza materials, flooring finishes

2% Interior walls

19% Floor slabs

48% Exterior atrium envelope

Saving or reusing materials resulted in 91% embodied carbon savings.

Managing water is crucial to mitigating and adapting to the effects of climate change—from minimizing water use to designing for sea level rise.

More and more of the world's population live under "water stress," meaning the demand for water exceeds the quantity or quality of their supply. The World Resources Institute estimates that 37 countries live with high water stress. Climate change has made (and will continue to make) many regions drier. Additionally, increases in runoff, flooding, or sea levels are undermining water quality and damaging infrastructure and livability.

Using less water is essential, and recycling water is even more vital. A large amount of energy is required to source, clean, move, heat, and cool water. According to the U.S. EPA, wastewater and drinking water plants are the largest consumers of energy in many American cities, accounting for 30–40% of total energy consumed and adding over 45 million tons of greenhouse gases every year. In the U.S., large commercial buildings alone use nearly a billion gallons of water a day. In all commercial buildings, 95% of water demands are for non-drinkable uses, yet potable water tends to be used for these purposes.

Buildings can employ closed-loop systems to use, treat, and reuse water completely on-site. Graywater (wastewater from baths, sinks, washing machines, and other appliances and equipment) can be used for many non-drinking purposes, such as irrigation and industrial processes. Treating and reusing blackwater (waste from toilets) is still relatively uncommon and isn't allowed in some areas. However, the technology to do so is becoming more readily available.

30-40%

30–40% of energy consumption in the United States is related to water.

STRATEGIES

Capturing rainwater on-site for use in building systems.

Reusing captured or recycled water for non-potable water requirements.

Installing fixtures and design solutions that lower water consumption.

Designing for potential flooding or water impacts of climate change and sea level rise.

Limiting human impact on existing ecosystems and aquatic habitats.

THE FUTURE OF WATER

More and more buildings are likely to incorporate closed-loop systems to treat all water on-site through carbon-neutral means. Technologies that provide drinking water by condensing moisture from the air could become increasingly affordable and common. Rooftop landscapes and urban farming could become far more common as a means of productively treating water on-site. As issues relating to sea level rise and storm surges become more prevalent, cities inevitably will develop innovative, intelligent ways to live with water.

We prioritized water conservation, filtration, and recirculation in a large training facility. The Plumbers Local 130 Union's new 48,000-square-foot space needed to prepare the next generation of plumbers for the industry's evolving water and energy demands. Located near Lake Michigan, the facility features six fully functioning "wetlabs." Hot air from 20 state-of-the-art welding booths is filtered and used as preheated makeup air, minimizing the energy used for heating. Solar vacuum tubes provide hot water and save the structure $17,000 in energy costs per year.

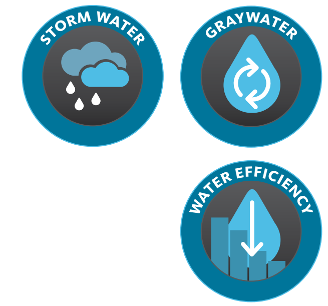
Rainwater harvesting system collects water on the roof surfaces, filters it, and stores it in a giant tank in the main lobby. This water is used to flush lavatories and operate training fixtures.

The building's advanced rainwater harvesting and graywater systems have saved hundreds and thousands of gallons of water to date.

A graywater system captures and filters water from the building's lavatories and showers, using it to irrigate the rooftop terrace and plaza (not pictured).

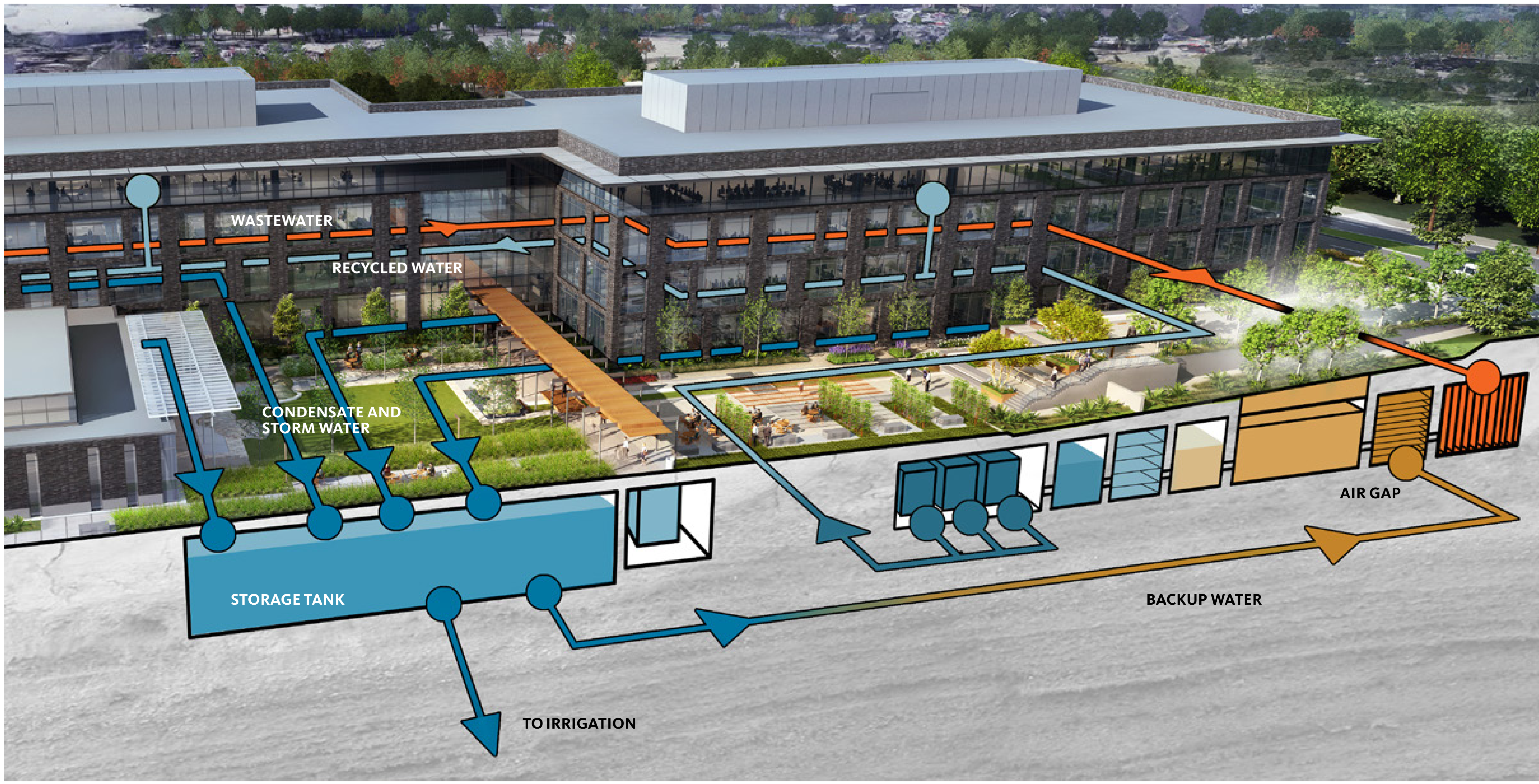
Occupancy sensors automatically shut off water in unoccupied wetlabs (not pictured).

Despite housing hundreds of training fixtures, the entire structure uses less water than a single-family home.



We utilized an innovative wastewater treatment and reuse system in a commercial building. The Planning and Development Center is a civic building devoted to recruiting top talent and serving the Austin community. In addition to providing a modern and flexible workspace, this is the first public building in Texas with a blackwater/reclaimed water system used for toilet flushing.

The reclaimed water system can treat 5,000 gallons of water per day and decreases the building's potable water by 60%.



POST-ANOREXIC REACTOR
Low-oxygen environment stimulates microorganisms to remove nitrogen.

PRE-ANOREXIC TANK
High-efficiency membrane aeration stimulates microorganisms to begin biological treatment.

PRIMARY SCREEN TANK
Wastewater intercepted from the sewer passes through coarse screening to remove solids.

HYDROPONIC REACTOR
Plant roots provide surface area for treatment microorganisms. Blowers provide oxygen to support the process.

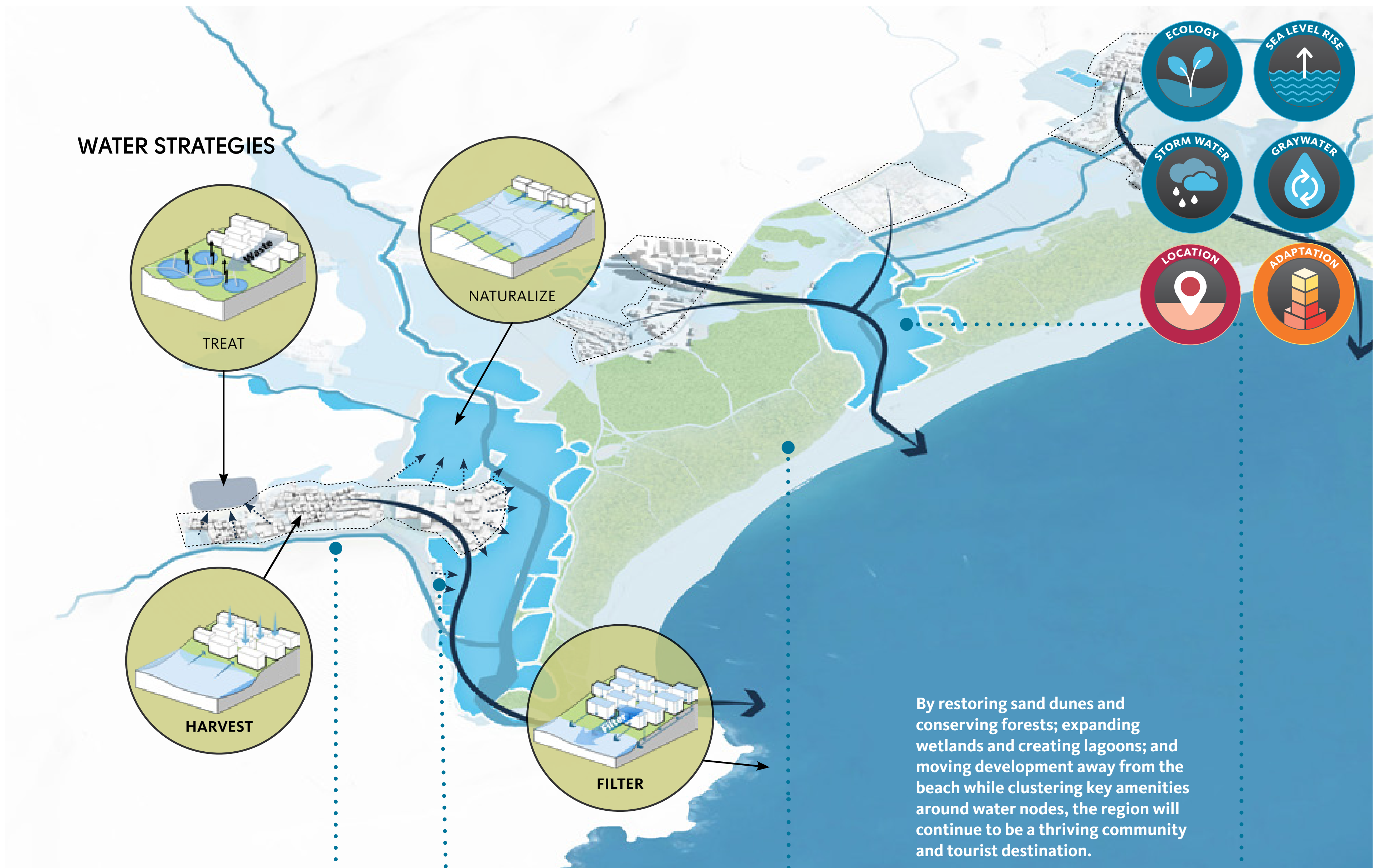
SUBMERGED MEMBRANES
Water passes through a membrane to remove biosolids and pathogens. Rejected biosolids recycle to Pre-Anorexic Tank to restart microbial process.

REUSE PUMPS
Pumps supply reclaimed water flow for toilet flushing reuse.

REUSE TANK
Tank provides clean-water storage with UV and chlorine disinfection to remove residual pathogens and provide surge capacity.

We are transforming a region in the aftermath of a tropical storm. In 2018, a typhoon gravely damaged a bayside region in southern China. Interventions must repair the region's habitat while also positioning it for a promising future.

Resilient water strategies restore the ecosystem, remodel the green infrastructure, and reactivate the local community.



By restoring sand dunes and conserving forests; expanding wetlands and creating lagoons; and moving development away from the beach while clustering key amenities around water nodes, the region will continue to be a thriving community and tourist destination.

WATERFRONT TYPOLOGIES

Optimizing energy use is crucial to reducing the carbon impact of the built environment, especially when paired with renewable strategies.

Nearly half of global greenhouse gas emissions come from the building sector. Over the past two decades, the building industry has noticeably improved its impact, but the average energy efficiency of many so-called “high-performance” buildings is only 25–35% below the previous baseline. We must do better.

Designing buildings to use less energy will continue to be the smartest strategy to achieve net-zero operations. The first certified net-zero-energy (NZE) buildings—which produce enough clean energy on-site to compensate for their annual consumption—were built in the 1990s. Nearly three decades later, there are still fewer than 100 verified NZE buildings. This figure, however, is rapidly increasing.

Renewable technology is becoming more affordable. Over the past decade, the costs for photovoltaics have dropped two-thirds for both commercial and residential structures. Estimates suggest that NZE buildings have grown tenfold in the past seven years. We cannot address climate change without retooling the built environment.

46%

46% of annual U.S. emissions are related to the building sector.

STRATEGIES

Decreasing the amount of energy required to operate a building.

On-site production of clean, renewable power.

Storing energy on-site for use at a later time.

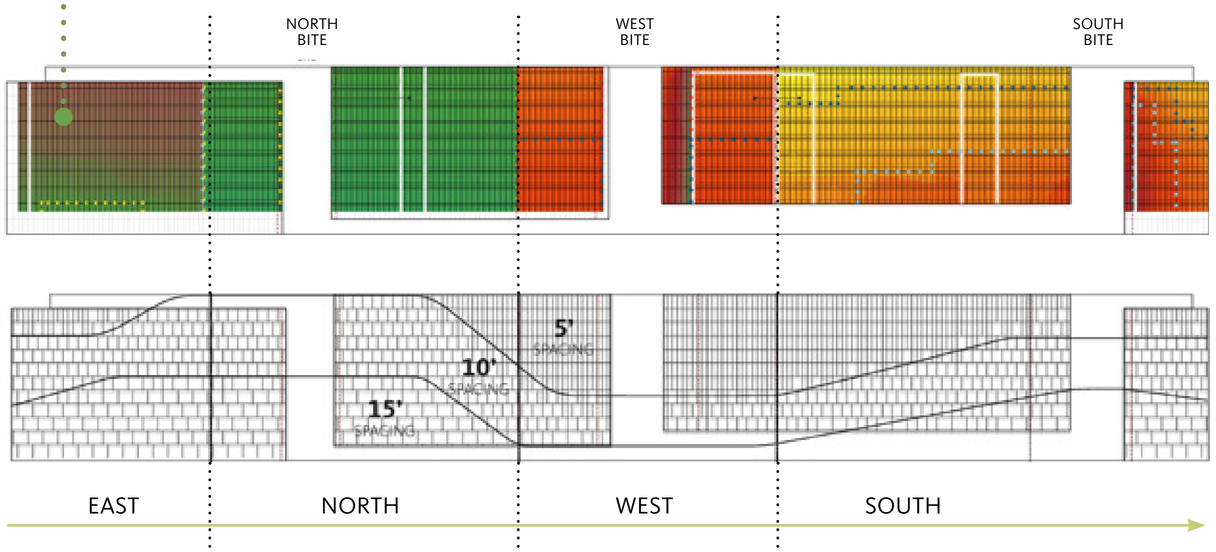
Buying renewable energy from the power grid.

THE FUTURE OF ENERGY

Over the next decade, the built environment will decarbonize rapidly, both through the greening of grids and through increasingly common uses of on-site, clean energy generation. New mechanisms for energy storage will make the process practical and affordable. Electrification will become the norm, eliminating any reliance on fossil fuels. Buildings are likely to become more closely tuned to their contexts and climates to require less and less energy.

We delivered an all-electric building that gives the client more control over their carbon footprint. Adobe sought a future-focused space that would reinforce the company's values and nurture a culture of creativity and innovation. By opting for an all-electric building, they are able to maintain greater control over their own operational carbon footprint and energy performance—electricity can be pulled from the grid at times when the energy mix is cleaner and uses more renewable sources—and in the future, battery storage or other on-site energy solutions will be easy to incorporate. These energy options provide Adobe with flexibility now and in the future, ensuring the long-term viability and performance of the building.

To minimize material use, facade hoods were distributed based on a careful study of the solar radiation that falls on the building each year.



Automated blinds and external shading hoods control solar heat gain and glare.

Public spaces have more transparent facades that provide a view into Adobe's culture and out over the city, while work areas benefit from reduced glass and external hoods to enhance performance and comfort.

The post-tensioned concrete structure maximizes floor-to-ceiling height and increases daylight penetration into the workspace.

A high-performance facade and carefully spaced hoods maximize current solar performance, while an all-electric approach provides future flexibility and resilience.

We created a net-positive, visual social hub. Our approach to the new Administrative Building supports their rapidly growing campus. Integrated energy and water submeters monitor the building's NZE performance throughout operations and occupancy. The net-positive water strategy utilizes gray water for all non-potable uses, while rainwater management strategies feature rain chains and on-site bioswales.

The "solar veil" canopy hosts an 89 kWh photovoltaic array that naturally shades the courtyard, reducing heat island effect as well as solar heat gain.

Upcycled brick, salvaged from demolition, lowers the demand for virgin materials, reducing embodied carbon emissions.

Sister-buildings are organized around a shared courtyard, which minimizes the floor plates and increases daylighting opportunities.

ADMINISTRATION BUILDING

111% of building needs are provided by on-site renewables.

We reduced energy demands through strategic orientation and massing. The occupied spaces of the Housing building are organized along East-West axes, reducing heat gain by 71%. To support our net-positive energy strategy, we specified high-performing, low-wattage site lighting and maximized indirect lighting strategies at the interior. HVAC fan coils are controlled by occupancy sensors, minimizing energy loads while spaces are unoccupied.

Operable windows reduce energy demands, while state-of-the-art mechanical systems are paired with a 76 kWh photovoltaic array.

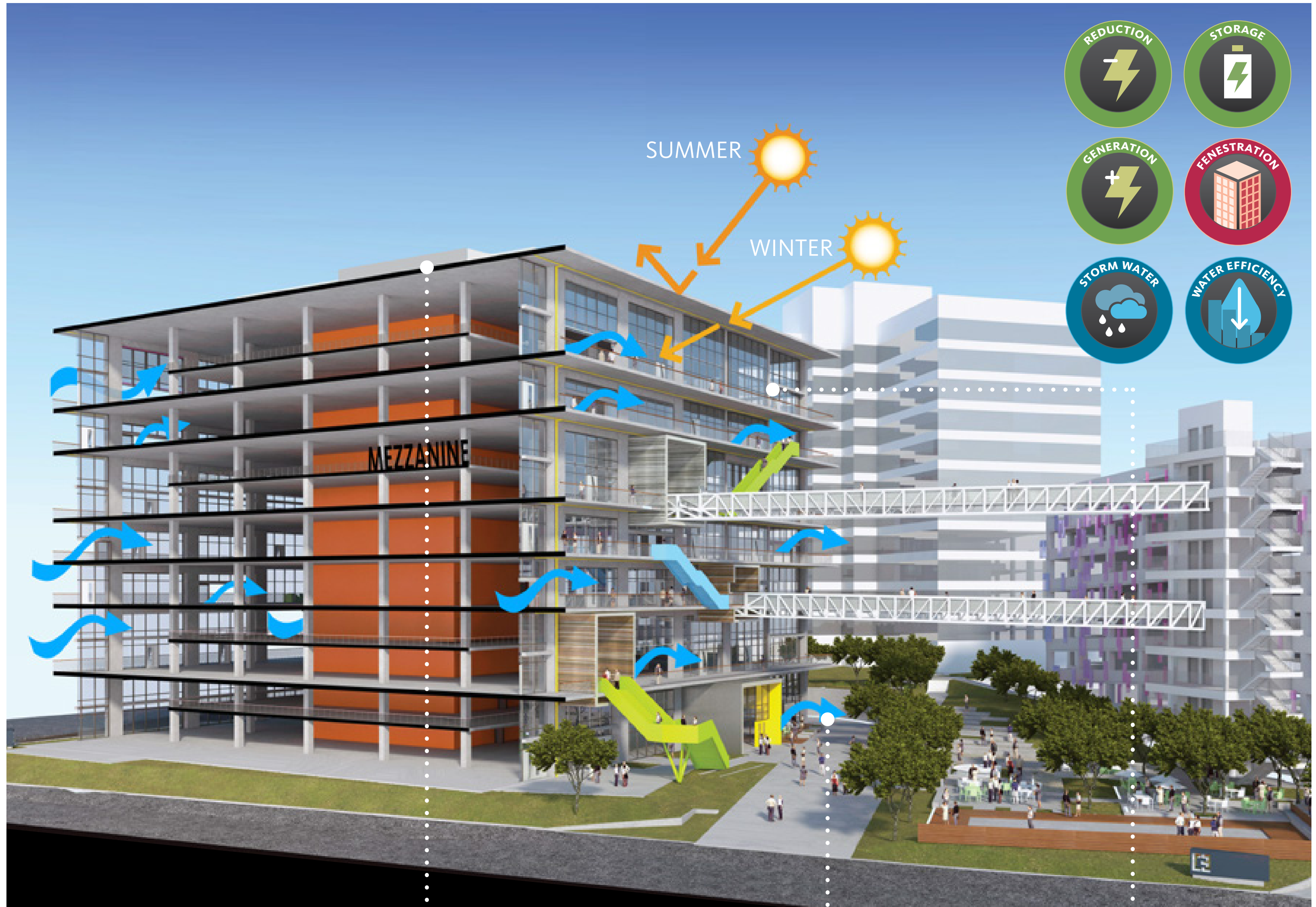
Utilizing reclaimed water saves over 898,000 gallons annually, with reciprocal energy reductions for water conveyance (not pictured).

PARKSIDE HOUSING NORTH

107% of building needs are provided by on-site renewables.

We used external staircases and communal balconies to achieve higher energy performance. Responding to the rising need for personalized, adaptable, and authentic workplaces, C3 meets the demand for creative offices in the Southern California market without compromising on sustainability.

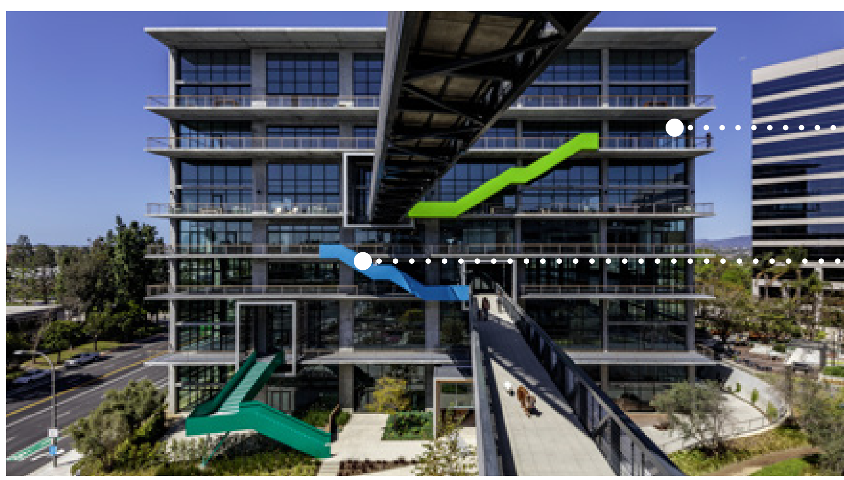
Using building integrated photovoltaics (BIPV) on the southern facade generates 26 kilowatts per year and decreases the energy demand on the building's mechanical system.



The structure's air-cooled variable refrigerant flow (VRF) system saves 8.5 million gallons of water per year compared to a conventional cooling tower.

The building's lobby is semi-conditioned, with large lift doors that open without a mechanical system. The lobby is cooled using a large ceiling fan for 75% of the year.

To capitalize on the coastal climate, the project provides a wide range of operable window and door options.



Continuous balconies on the east and west facades reduce heat gain while providing tenants access to the outdoors.

Exterior staircases and bridges lower the need for repeated elevator usage.

PERFORMANCE OF OUR 2019 PORTFOLIO

As part of the Gensler Cities Climate Challenge (GC^3), and in conjunction with our ongoing commitments to the 2015 Paris Pledge and the Architecture 2030 challenge, we are focused on measuring and reporting the designed energy performance of our portfolio on a yearly basis. **In 2019 alone, Gensler professionals worked on more than 7,000 projects representing over 1.5 billion square feet of space. These projects ranged from new commercial office buildings and workplace interiors to schools, retail stores, data centers, and hotels.**

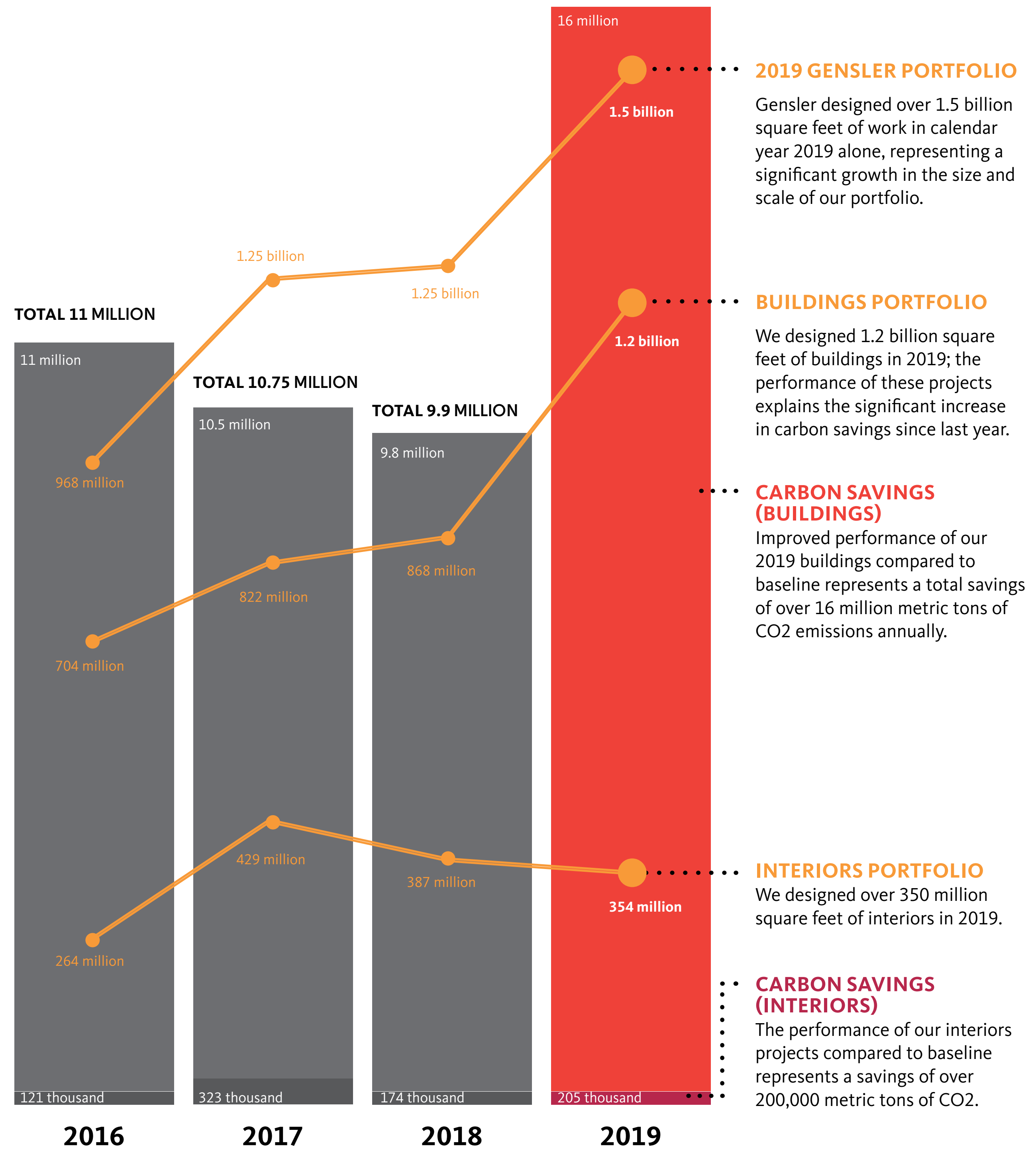
To remain consistent with the standards established by this industry-wide research initiative, we measure the designed operating energy and carbon impact of our 2019 design work against the U.S. Energy Information Agency's 2003 Commercial Buildings Energy Consumption Survey (CBECS 2003) and the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE 90.1-2007).

Analysis of our 2019 portfolio reflects both the positive impact of our work, as well as the significant work left to be done. Taken together, our 2019 work is set to avoid 16.4 million metric tons of CO_2 from being emitted into the atmosphere compared to average building energy usage—the equivalent of taking 4.2 coal-fired power plants offline for an entire year, or the power needed for 1.9 million homes for a year.

That represents a significant impact, but it's not enough. To meet our ambitious GC^3 goals, we are focused in the years ahead on continuing to reduce the carbon impact of our portfolio until we achieve carbon neutrality.

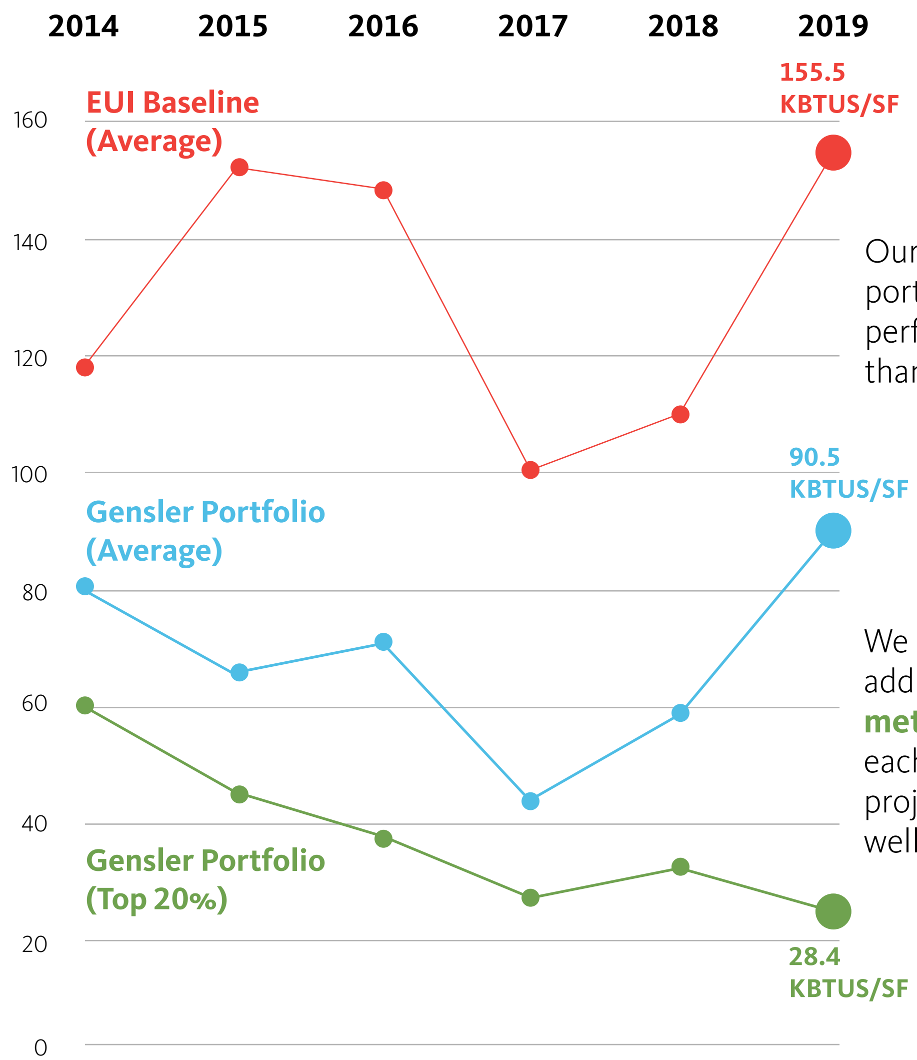
THE ENERGY SAVINGS OF OUR 2019 BUILDINGS PORTFOLIO IS EQUIVALENT TO POWERING 1.9 MILLION HOMES FOR A YEAR.

OUR 2019 PORTFOLIO IS DESIGNED TO SAVE OVER 16 MILLION METRIC TONS OF CO2 EMISSIONS



Buildings performance

Gensler's average predicted Energy Use Intensity (EUI) from 2014–2019 as compared to average (CBECS 2003 equivalent) and the performance of the top 20% of our portfolio from each year. EUI represents an estimated number based on a building's design and energy model, and is measured in kBtus per square foot per year.

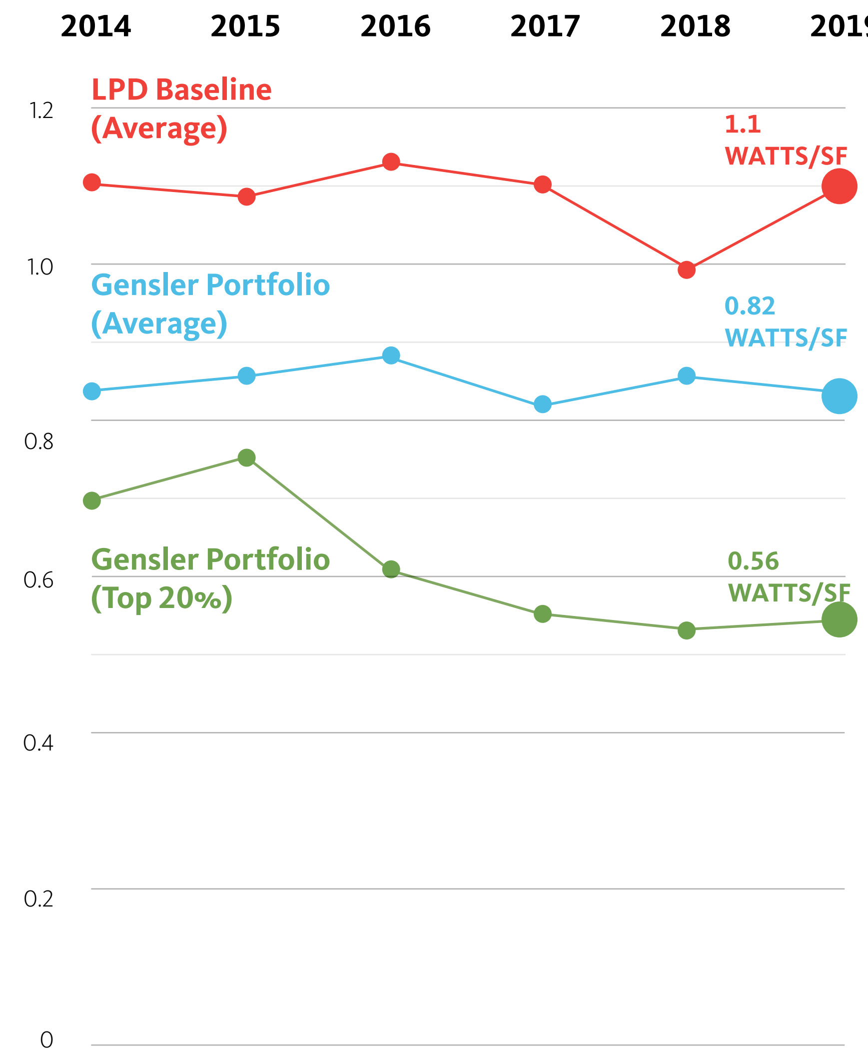


Our 2019 buildings portfolio is designed to perform **42% better** than average.

We could offset an additional **22 million metric tons of CO2** each year if all our projects performed as well as our top 20%.

Interiors performance

Gensler's average predicted Lighting Power Density (LPD) from 2014–2019 as compared to average (ASHRAE 2007 equivalent) and the performance of the top 20% of our portfolio. LPD is a calculation of the installed lighting power of an interior environment, and is measured in watts per square foot.



Our 2019 interiors portfolio is designed to perform **24% better** than average.

We could save an additional **285,000+ kilowatt hours of electricity** each year if all our projects performed as well as our top 20%.

METHODOLOGY

1. GLOSSARY OF TERMS

EUI (Energy Use Intensity): a measure of annual building energy use, expressed in kBtu/sf/yr.

PEUI (Predicted Energy Use Intensity): a measure of predicted building energy use, expressed in kBtu/sf/yr.

CBECS (Commercial Buildings Energy Consumption Survey): a national survey of various types, sizes, and occupancies of buildings in all regions of the U.S. This data is then normalized and cleaned to give an accurate estimate of commercial building energy use in the U.S. This is a measure of actual energy use and includes regulated (building system) loads and non-regulated (computers, coffee makers, portable equipment) loads.

National Baseline EUI: a constructed EUI for a particular project type and occupancy based on the CBECS data.

LPD (Lighting Power Density): a measure of the installed Watts due to lighting systems in a building, expressed in Watts/sf.

ASHRAE 90.1 2007: Energy Standard for Buildings Except Low-Rise Residential Buildings is an international standard that provides minimum requirements for energy-efficient designs for buildings except for low-rise residential buildings.

PLPD (Predicted Lighting Power Density): a measure of predicted building energy use, expressed in kBtu/sf/yr.

PS: project size in square feet.

2. PORTFOLIO SIZE CALCULATION METHODOLOGY

Square footage data was reported in 66% of Gensler's 2017 portfolio. Therefore, 34% of the portfolio was estimated:

Missing project square footage was set to median value of the project's assigned Gensler Project Type.

If median value of Gensler Project Type data was not available (77 projects), square footage was set to the median value of the assigned Practice Area's Project Category; for example, the square footage of an "Academic Campus, Library" was set to the median value of the Education Practice Area's Non-Residential Project Portfolio (57,000 sf).

Both the reported and estimated square feet totals were added to obtain the total portfolio size.

3. PORTFOLIO PERFORMANCE ANALYSIS METHODOLOGY

Analysis was conducted only on projects that had reported estimates of predicted performance for new buildings (PEUI) and buildings interiors (PLPD). Therefore, the data for projects with reported PEUI and PLPD was separated from all other data for all subsequent analysis. Gensler reported both PEUI and PLPD data for 300 projects in 2017.

Data clean up
The projects with PEUI and PLPD were separated from other projects.

Projects with a National Baseline EUI of over 1000 kBtu/sf/yr were excluded from analysis on new buildings.

Data Analysis
National Baseline (CBECS for new buildings, ASHRAE 90.1 2007 for buildings interiors), local code baseline (for both new buildings and building interiors) and the PEUI and PLPD were multiplied by the PS in square feet. Estimated PS was used in case of missing data.

Average national baseline on new buildings and buildings interiors were calculated for the whole portfolio using the following formulae:

(∑(National Baseline EUI * PS))/ ∑PS.

(∑(ASHRAE National Baseline 90.1 2007 * PS))/ ∑PS.

Average predicted portfolio performance on new buildings and buildings interiors were calculated for the whole portfolio using the following formulae:

(∑(PEUI * PS))/ ∑PS.

(∑(PLPD * PS))/ ∑PS.

Average portfolio percentage improvement over national baseline was calculated using the following formula for new buildings and buildings interiors.

New buildings: (¯X(National Baseline EUI*PS))-(¯X(PEUI*PS))/ (¯X(PEUI*PS))

Where:
National Baseline EUI–adjusted national baseline EUI expressed in kBtu/sf/yr

PS–project size expressed in sf

PEUI–predicted project EUI expressed in kBtu/sf/yr

Buildings Interiors: (¯(X)(ASHRAE 90.1 2007*PS))-(¯X(PLPD*PS))/ (¯X(PLPD*PS))

Where:
ASHRAE 90.1 2007–national baseline expressed as Watts/sf

PS–project size expressed in sf

PLPD–predicted project LPD expressed in Watts/sf

4. METHODOLOGY FOR ENERGY SAVED AND CARBON EMISSION REDUCTION

New Buildings Analysis (EUI):
Metrics used in the analysis of energy saved and carbon reduction for new buildings:

New buildings portfolio size in square feet for 2017

The average National Baseline EUI for 2017

The average PEUI, building performance for 2017

Calculation of energy saved and conversion of EUI to kilowatt-hours:
The metrics were converted to energy saved in kilowatt-hours per year using the following formula by project type:

(∑((PS x National Baseline EUI) – (PS x PEUI)) x 0.293.

Note: 1 kBtu = 0.29307 kWh

Building's Interiors Analysis (LPD):
Metrics used in the analysis of energy saved and carbon reduction for buildings interiors:

Buildings interiors portfolio size in square feet for 2017

The ASHRAE 90.1 2007 National Baseline LPD for 2017

The predicted LPD, building performance for 2017

Calculation of energy saved and conversion of LPD to kilowatt-hours:
Calculation of energy saved and conversion of LPD, to kilowatt-hours: The metrics were converted to energy saved in kilowatt-hours. The metrics were converted to energy saved in kilowatt-hours per year using the following formula: (∑((PS x ASHRAE 90.1-2007 National Baseline LPD) – (PS x PLPD)))/1000

Actual energy consumption of the building was calculated by the following formula (PS*PLPD*3120) employing the same unit conversion to kilowatt-hours.

Carbon emission reduction calculation process:
All equivalencies were calculated through entering energy reduction stats into the U.S. EPA Greenhouse Gas Equivalencies Calculator (https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator)

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Christine Barber
Jordan Goldstein
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Tim Pittman

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Georgia Wilson

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