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# ReGen Hall: A Scalable Model for Environmentally Sustainable, Affordable, and Compatible Student HousingA Case Study of Lower Manhattan's CBD.

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**Abstract**

Affordability, environmental sustainability, and community compatibility are the critical challenges in designing student housing, especially in rapidly growing cities with rising property prices. ReGen Hall, a 62,000 ft2 residence hall proposed for Dell Medical School in Austin, Texas, is developed as a prototype that addresses these challenges simultaneously through modular construction, net-zero energy strategies, and a community-integrated program. The project integrates manufactured modules and renewable energy systems, including a 320-kW photovoltaic array with rainwater-harvesting infrastructure, to significantly reduce operational emissions and water dependency. Life Cycle Analysis (LCA) conducted over a projected 100-year lifespan shows that the building has a total carbon footprint of 2,853 tons of carbon dioxide equivalent ($CO_2e$). Using industry benchmarks and verified methods, the analysis confirms that the project aligns with contemporary standards for low-carbon buildings and underscores the role of wood-based materials in contributing to carbon sequestration. On the economic side, cost evaluations based on regional suppliers indicate significant reductions through modular construction by bringing total project expenses well below local benchmarks for student housing, with solar incentives and operational savings further improving long-term affordability. Moreover, the project involves the historic Blackland neighborhood through a free medical clinic, shared spaces, and green courtyards to foster social connection with the surrounding community while meeting the housing needs of a diverse student population. The architectural massing also negotiates between small-scale residential fabric and institutional context, creating a gradient of public, semi-public, and private realms that makes the project's community-integration goals accessible to the surrounding neighborhood. Employing a quantitative research approach and spatial analysis, this study evaluates the environmental, economic, and social impacts of ReGen Hall. The findings demonstrate that sustainable technologies can effectively balance affordability and environmental stewardship, offering a model for future student housing developments.

**Keyword:** sustainable student housing; modular construction; affordability; ZNE; community integration

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## 1. INTRODUCTION

The intersection of sustainability and affordability in student housing has emerged as a critical area of focus in urban planning and development (Kim and Kim 2016). Rising housing costs and increased environmental concerns challenge universities and developers to find sustainable, affordable solutions for student housing (Ehlenz, Mawhorter, and Pendall 2024). In cities like Austin, Texas, where the cost of living is steadily increasing, there is a growing need for housing innovations that balance affordability, environmental sustainability, and quality of life (The Luxury Playbook 2024). The building sector also accounts for around 40 percent of global energy use and a significant share of greenhouse gas emissions (Olanrewaju, Adetunji, and Ogundepo 2019). Accordingly, student housing within the building sector underscores the growing importance of sustainable design strategies that address the concerns of transient populations, including students. Technological innovations such as photovoltaic systems, energy-efficient HVAC units, and eco-friendly materials have become part of modern sustainable housing, offering both environmental and economic benefits (Asmar and Tilton 2015).

The advantages afforded by these technologies and modern building practices can yield housing solutions that serve dual purposes: minimizing operational emissions and thereby reducing lifecycle costs. The ReGen Hall project exemplifies these principles and provides a replicable model that integrates modular construction, Passive House standards, and net-zero energy (ZNE) strategies to address the dual challenges of sustainability and affordability. The project incorporates high-performance insulation, an airtight building envelope, and a 320-kW photovoltaic system to achieve ZNE. Combined with a rainwater harvesting system and bioclimatic design elements, these features optimize energy and water efficiency while fostering a connection to nature. The use of modular construction further reduces costs and construction time, making it adaptable to various urban settings with similar climatic conditions (Kim and Kim 2016). This paper examines ReGen Hall as a case study to explore how innovative housing solutions can address critical urban challenges and contribute to the global discourse on sustainable, affordable, and accessible student housing.

## 2. LITERATURE REVIEW

In recent years, there has been an urgent need for affordable student housing, particularly in rapidly growing cities where housing prices are rising, and institutional sources are limited. Student housing development across the US is failing to meet increasing demand, as universities struggle to provide solutions that are economically viable, environmentally sustainable, and compatible with the community (Liebersohn and Lee 2023). As universities face declining public funding, the need for alternative, affordable, and sustainable housing schemes has emerged. The schemes must also adapt to diverse student demographics and environmental imperatives.

### 2.1 The student housing affordability crisis

Higher education institutions, especially in major urban areas, are facing an acute shortage of student housing. This shortage has been compounded by increasing enrollment and limited new construction. In the US, new student housing deliveries decreased from 44,000 to 36,000 beds between 2023 and 2024, despite pre-leasing levels above ninety percent in most major markets (O'Brien 2024; Arredondo 2023).

The housing shortage particularly affects marginalized and low-income students. In a 2019 survey conducted in California, nineteen percent of community college students reported experiencing homelessness, while over sixty percent outlined facing housing insecurity (Arredondo 2023). Likewise, recent national research indicates that housing insecurity affects as many as half of all community college students, highlighting the widespread nature of the crisis among postsecondary learners (Goldrick-Rab et al. 2024). Students often report working multiple jobs to pay for housing, and they often experience hidden homelessness, overcrowding, or long commutes that prevent them from succeeding academically or facing mental health challenges (Sotomayor et al. 2022). Additionally, insufficient financial aid and increasing tuition put even greater pressure on students, especially first-generation and international populations. Housing insecurity has considerable impacts on students' academic achievement, health, and progress. Studies show increased levels of stress, mental health issues, and lower social engagement among students with housing insecurity. Lacking stable housing can lead to lower GPA, less time for coursework, and reduced involvement in campus activities. Furthermore, many institutions prioritize housing for first-year or international students, while senior and graduate students are often disregarded for housing support (Sotomayor et al. 2022). Many students are unable to afford purpose-built accommodation due to competitive rental markets and the rise of private, luxury student residences. These luxury developments, often the result of public-private partnerships, tend to prioritize high-end amenities over affordability and create a form of socio-spatial segregation within the student population (Sotomayor et al. 2022; Liebersohn and Lee 2023). Students want "normal places for normal students" that prioritize affordability, safety, and community over rooftop pools and luxury resident services.

**2.2 Modular construction as an affordable and scalable solution**

To maintain affordability while managing costs, universities are considering modular and prefabricated construction. In modular housing, off-site manufactured components are assembled on-site. This feature offers faster delivery times, less waste, and lower labor costs due to controlled factory environments (Hou, Zhang, and Lai 2023; Abiodun Benedict Adeyemi et al. 2024). Furthermore, it brought Savings from bulk purchasing, automation, and parallel construction workflows. Standardization also allows for replication across campuses and cities with similar climate or zoning conditions (Abiodun Benedict Adeyemi et al. 2024; Kim and Kim 2016).

Research shows that modular housing can be scalable and adaptable while maintaining high quality and structural integrity. Prefabricated methods can save ten to twenty percent of construction costs and shorten project timelines. However, there are some issues with habitability in modular units, such as soundproofing, lighting, and thermal comfort (Hou, Zhang, and Lai 2023; Kim and Kim 2016).These point to the design trade-offs that occur when efficiency and cost-effectiveness are prioritized over occupant well-being. Nevertheless, modular construction is gaining traction, especially when paired with sustainability. Modular systems can integrate Passive House principles and renewable energy technologies, such as photovoltaics and efficient HVAC systems (Mpambane, Gyadu-Asiedu, and Aigbavboa 2025). They also support circular construction approaches that promote disassembly and reuse, which are key to long-term environmental sustainability.

Recent research is showing that universities are prioritizing the integration of sustainable technologies into student accommodation as part of their overall climate action plans (Mpambane, Gyadu-Asiedu, and Aigbavboa 2025). Smart building systems, such as real-time energy management platforms and advanced metering, are being implemented to monitor consumption patterns, detect inefficiencies, and support data-driven operations (Asmar and Tilton 2015). Renewable energy also helps residences to offset their energy use with photovoltaic panels, solar thermal collectors, and geothermal heat pumps. Furthermore, water management strategies such as rainwater harvesting, greywater reuse, and low-flow fixtures are effective at reducing water consumption and conserving water resources at the building level (Del Borghi et al. 2021). Regarding the use of materials, sustainable construction practices emphasize incorporating cross-laminated timber, compressed earth blocks, and locally sourced materials to reduce embodied carbon and support the circular economy (Arredondo 2023; Mpambane, Gyadu-Asiedu, and Aigbavboa 2025). As a case study, the University of Genoa and Florida International University conducted "living lab" programs that combine these technologies with student engagement, transforming campus housing into both sustainable buildings and learning environments (Del Borghi et al. 2021). Therefore, these practices not only reduce greenhouse gas emissions and energy costs but also enhance indoor environmental quality, thereby contributing to the creation of healthier and more resilient student communities.

**2.3 Community integration and the role of policy**

Along with affordability and sustainability, student housing developments must respond to complex sociocultural dynamics, especially in areas affected by gentrification or studentification. Studentification refers to the transformation of neighborhoods by the presence of short-term student housing, often leading to displacement, rising rents, and social fragmentation (Ehlenz, Mawhorter, and Pendall 2024). Students are typically considered temporary residents, which often places them in contrast with permanent community residents (Alamel 2015). Therefore, universities increasingly recognize the need for community-compatible housing through multistakeholder task forces and ongoing feedback loops between residents and students (Sotomayor et al. 2022). With holistic and thoughtful design, student housing can serve as a bridge rather than a barrier between institutions and surrounding communities.

Despite these opportunities, there are remaining institutional and financial constraints. Public universities across the U.S. face declining state funding, which limits their capacity to fund large-scale housing developments independently (Ehlenz, Mawhorter, and Pendall 2024; Liebersohn and Lee 2023). This often results in partnerships with private developers, where their profit interests can surpass student needs. The integration of student housing into broader urban rental markets also subjects students to market forces beyond their control (Liebersohn and Lee 2023). In a 2024 study by Ehlenz et al., a call for a student-centered evaluation of student housing policy included a discussion of housing insecurity as a contributor to student success and well-being (Ehlenz, Mawhorter, and Pendall 2024). From this perspective, housing policy is not only limited to buildings but also fundamentally about equity, resilience, and the future of higher education.

## 3. METHODOLOGY & FINDINGS

The study employs a quantitative methodology, with a focus on spatial analysis, to evaluate ReGen Hall's environmental, economic, and social strategies. The research integrates numerical data, simulations, and detailed descriptive assessments to capture the multidimensional aspects of sustainable student housing. The quantitative analysis involves evaluating energy performance with OpenStudio, conducting a life-cycle analysis with One Click LCA, and making cost projections based on actual data from modular construction suppliers. The projected energy use of 353,360 kWh per year and an Energy Use Intensity (EUI) of 32 kBtu/ft² informed the design of a 320-kW photovoltaic (PV) system, using SunWatts calculations to account for Austin's average daily sunlight of 5.5 hours. Passive House strategies, including high-performance insulation (R-34), double-pane argon-filled glazing, and operable shading systems, were modeled using software simulations to validate performance metrics. The HVAC system, equipped with energy-efficient heat pumps and energy recovery ventilators (ERV), is designed to reduce energy consumption while providing high-quality indoor air and thermal comfort, in compliance with the International Energy Conservation Code (IECC) standards for Climate Zone 2A. Similarly, the rainwater harvesting system's efficiency was assessed by calculating daily consumption and storage requirements, showing the system could sustain 100 days without precipitation. This evaluation incorporated Austin's historical precipitation patterns and drought data, ensuring resilience beyond standard design assumptions. The Life Cycle Analysis (LCA) method uses standard industry benchmarks and considers emissions from materials, transportation, and operations over 100 years. The cost savings from modular construction enable greater investment in these advanced materials and systems, offsetting their higher upfront costs and enhancing long-term sustainability.

The paper incorporates spatial and urban integration analysis to evaluate ReGen Hall's interaction with the historic Blackland neighborhood, examining its contextual, social, and design aspects. Using 3D modeling, the design process considered factors such as building scale, public space accessibility, and the environmental impact of shared green spaces. The project integrates with its surroundings through height transitions, street setbacks, and connectivity to local amenities. Specifically, the height transitions from two stories on the neighborhood side to six stories on the university side were designed to accommodate the university's density needs while respecting the community's aesthetic preferences.

### 3.1 Environmental sustainability

ReGen Hall exemplifies a comprehensive approach to environmental sustainability by incorporating advanced design principles, sustainable materials, and renewable energy systems. The annual electrical load for the 62,000 ft² residence hall is projected at 353,360 kWh, with an Energy Use Intensity (EUI) of 32 kBtu/ft² (OpenStudio 2024). According to the Sun Watts online PV array calculator (NREL, 2024), achieving Zero Net Energy (ZNE) for the residence hall in Austin's climate—where the average daily sunlight is 5.5 hours—requires a 320 kW PV array. This system includes 14 25 kW SMA inverters, managed by a City of Austin community solar virtual controller to ensure efficient operation (Community Solar, 2024). Passive House design measures, such as high-performance insulation and airtight construction, further enhance the building's environmental performance. The building envelope consists of 6 inches of cellulose insulation (R-34), double-pane argon-filled glazing, and operable shading systems to fully optimize thermal performance and natural lighting (see Figure 1)

These systems lower winter heat loss and increase summer solar heat gain, drastically reducing reliance on HVAC systems. The roof assembly integrates twelve inches of cellulose insulation, a waterproof TPO layer, and a Sedum green roof, alongside PV panels. All these factors work together to increase thermal comfort and energy efficiency. Although only one of the five building modules was directly modeled due to their largely self-contained nature and outdoor walkways, data extrapolation enabled accurate predictions of the entire building's energy performance (see Figure 2). The HVAC system incorporates advanced occupant-focused features, with each 400 ft² residential unit equipped with a MINOTAIR 6000 BTUH combination Air Source Heat Pump and Energy Recovery Ventilator (ERV) (OpenStudio 2024). This eliminates the need for exterior condenser units, ensuring consistent minimal energy use. By maintaining a uniform humidity level and filtering pollutants, the system supports residents' health and well-being. This is essential for medical students, who require a quiet, healthy, and comfortable living environment to enhance sleep quality, cognitive performance, and overall productivity. The Energy Star-certified system meets ASHRAE standards, ensuring compliance with industry regulations while contributing to long-term operational cost savings.

The modular design of ReGen Hall minimizes environmental impact while enhancing adaptability. Outdoor walkways and courtyards reduce climate control demands and foster biophilic connections to nature. The integration of rain gardens and native Texas plants, such as Mountain Laurels and Desert Willows, further enhances cooling while contributing

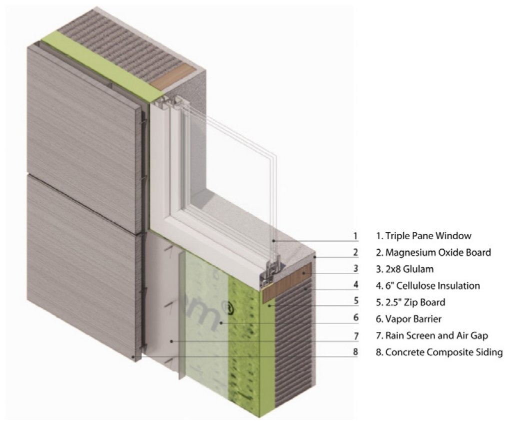



Figure 1: Envelope wall section (left) and shading systems (right). (Author, 2024).

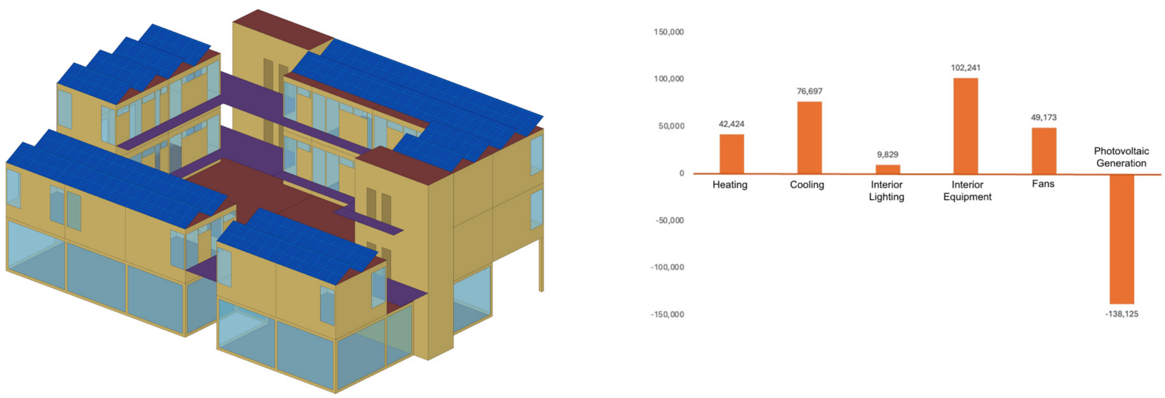



Figure 2: OpenStudio Model of a Portion of the Building with kBtu outputs. (Author 2024).

to stormwater management and reducing urban heat island effects. The rainwater harvesting system, located in the basement, includes 15 7,500-gallon storage tanks designed to provide up to 100 days of water without rainfall, exceeding Austin's record of eighty-eight dry days. The system comprises a catchment system, gutters with mesh screens, downspout filters, and a 30-psi electric diaphragm pump. It also integrates graywater storage and filtration from AC units, ensuring resilient water management alongside other mechanical systems. The tank capacity was calculated based on an average monthly water harvest of 34,342 gallons (Maxwell-Gaines 2023b), requiring at least five tanks, but was increased to fifteen for added resiliency (see Figure 3).

A Life Cycle Analysis (LCA) conducted for the project through One Click LCA evaluates the environmental impact across its projected 100-year lifespan, focusing on construction materials, transportation, operational emissions, and end-of-life considerations. The total carbon footprint is calculated to be 2,853 tons $CO_2e$, accounting for 58.1% of the emissions from materials produced in the construction process and 33.7% from material replacement in the operational process. The building's embodied carbon aligns with industry benchmarks of 320-410 kg $CO_2e/m^2$, as defined by the Carbon Heroes benchmark for US buildings, earning it a "B" rating. Despite this, the use of wood-based materials, with extensive use of wood-based materials from glulam timber to cellulose insulation, results in a total carbon sequestered of 26,425 kg $CO_2e$ for the entire building (see Figure 4).

Along with renewable energy integration, ReGen Hall minimizes operational emissions through a microclimate-focused design that extends the psychrometric chart comfort zones and enables more comfortable outdoor living year-round. This includes intentional shading, ventilation, vegetation, daylighting, and other strategies to optimize thermal comfort while maintaining exceptional energy efficiency. The project's sustainability extends beyond operational efficiency to long-term adaptability. The modular construction

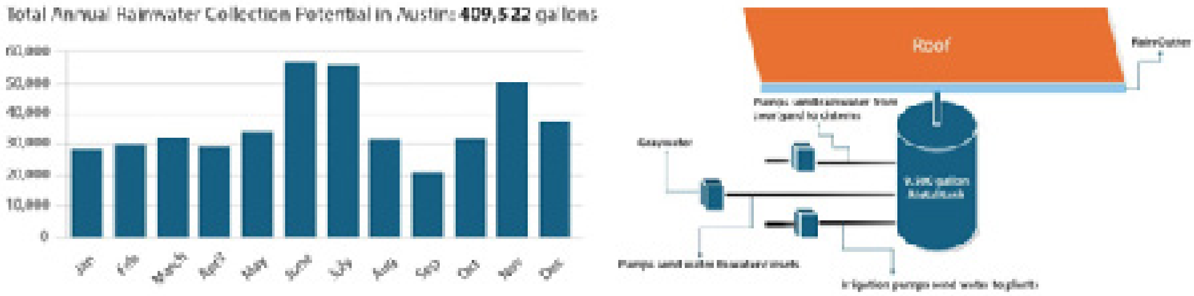



Figure 3: Annual rainwater collection in Austin (left) (Maxwell-Gaines 2023b) and rainwater collection system diagram (right). (Author 2024).

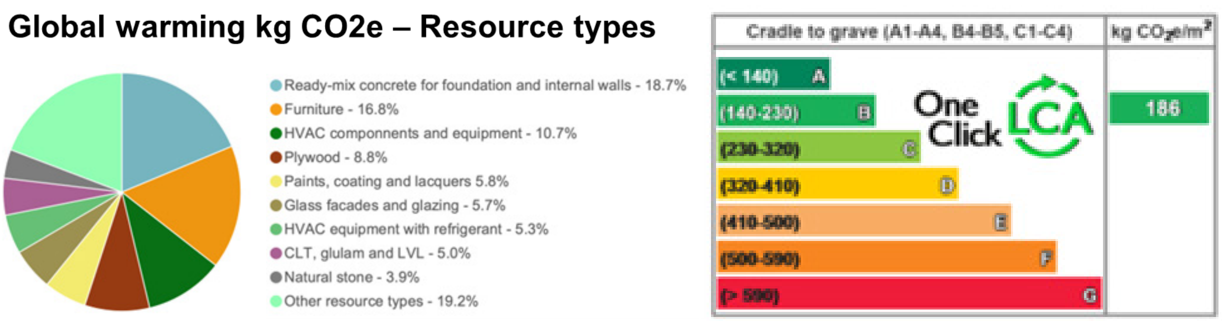



Figure 4: One Click LCA analysis, Resource Types (left) Embodied carbon benchmark (Right) (Author 2024)

approach facilitates disassembly and material reuse, promoting circularity in building practices. Materials like cross-laminated timber (CLT) and glulam beams are not only structurally sound but also help reduce thermal bridging and embodied carbon. The modular design allows for future expansions or relocations, ensuring the building remains functional and relevant over its lifespan.

The significance of indoor air quality within the Dell Medical School Housing unit cannot be overstated. This emphasis aligns with the Indoor AirPlus certification standards, a cornerstone in ensuring the health and welfare of graduate students residing in the facility. Indoor AirPlus, a partnership among public health and indoor environmental organizations, helps new home builders improve Indoor Air Quality by requiring construction practices and product specifications that minimize exposure to airborne pollutants and contaminants (EPA 2018). According to the United States Environmental Protection Agency (EPA), we spend ninety percent of our time indoors. It is essential to elevate indoor air quality to the highest standards, especially as we transition between spaces. Indoor air quality in ReGen Hall is primarily managed by source elimination and ventilation. Low-emission products with no or low levels of volatile organic compounds (VOCs), such as white pine and paper stone interiors, paints, and various other controls, are included to minimize indoor air pollution. Displacement ventilation through HVAC and Energy Recovery Ventilator (ERV) controls, with a space humidifier, maintains clean air and an ideal climate.

The merits of Indoor AirPlus certification are manifold, encompassing enhanced air quality, reduced exposure to pollutants and toxins, and greater comfort. Furthermore, it delivers a ten percent increase in energy efficiency, surpassing the standards of code-compliant homes. These initiatives are fully aligned with the rigorous criteria of the International Passivhaus Standard, which encompasses energy efficiency, airtightness, and comfort, and surpasses conventional building codes while championing sustainable living practices. Assessing insulation materials and their impact on indoor air quality in the Dell housing unit has required comparisons between traditional, lower-cost building materials and higher-quality, more expensive materials. While the financial outlay may seem substantial, the long-term benefits of residents' health outweigh the initial cost and eventually pay for themselves. An additional assessment within ReGen

Hall for Dell Medical Students is sleep. Research indicates that medical students frequently experience chronic sleep deprivation throughout their four years in school. Juggling multiple daily responsibilities forces them to prioritize their time and often leads them to sleep less than the recommended seven to eight hours a night. Sleep quality, as a part of healthy living, is critical to student performance, and must be enabled by interior acoustic quality, interior lighting control, and thermal comfort. Medical students require extensive control over these elements, as the nature of their program may lead to sleeping at unconventional hours (Sotomayor et al. 2022).

Design strategies should minimize noise transmission through walls, reduce HVAC and appliance sounds, and ensure lighting and temperature can be adjusted to individual needs. Addition of furniture and soft finishes will be within a more controllable decibel range, allowing occupants to use their own methods of control to achieve their desired noise levels. These include special acoustic doors with high insulation, low-noise appliances such as ceiling fans, and built-in smart technology that allows for airtightness around windows. The noise level of everyday conversation is 60 dBA. The wall separating the living spaces is lined with restrooms, which provide a good level of acoustic insulation, lowering conversation levels to around 40 dBA.

### 3.2 Economic affordability

Economic affordability lies at the core of the ReGen Hall project, achieved through innovative design and construction strategies that optimize cost without compromising quality or sustainability. By leveraging modular construction methods, the project significantly reduces costs compared to traditional construction while addressing Austin's housing market challenges. Prefabricated modular construction for ReGen Hall is estimated to lower construction costs by fifteen percent, reducing the total to about $161/ft2. This figure is based on current prices quoted by Oak Creek Modular Homes in Ft Worth, Texas (Oak Creek Homes Fort Worth, n.d.).

The financial savings enable greater upfront investment in sustainable infrastructure, thereby increasing stakeholder appeal and the project's overall affordability. The factory construction process also shortens construction time by leveraging bulk purchasing of building materials. Each module weighs 22,711 kilograms and is precisely calibrated for transport via 20-foot trucks with a capacity of 25,000 kilograms. Manufactured and modular home construction enhances quality control, reduces waste, and introduces flexibility and durability into the project. The production takes place indoors, with state-of-the-art technology, providing a controlled factory environment with numerous benefits. This controlled environment ensures high-quality materials, efficient automation, precise craft, and a healthier, safer environment for workers. The assembly-line-style production allows concurrent work on different modules, significantly reducing overall construction time compared to traditional methods. Moreover, workers find a much more productive and healthier working environment in one of these facilities. Designed for adaptability and sustainability, the modular panel-to-panel construction enables the building to evolve over its lifetime. This innovative approach not only facilitates easy deconstruction but also allows for efficient reconstruction at a future site, promoting mobility and versatility in architectural design (see Figure 5).

The project incorporates sustainable elements, including Passive house upgrades and solar photovoltaic (PV) systems, which help bring the total construction all-in cost to $173/ ft2, significantly undercutting the typical cost range of $200-$300/ ft2 in Austin. The solar PV system, comprising 672 bifacial monocrystalline 485-watt panels, is required to achieve ZNE for the building. The system has an installed cost of $370,300, benefiting from economies of scale to achieve a rate of $1.12 per watt. This cost is considerably lower than the average price of $2.40 per watt for smaller-scale residential systems in Austin. The 320 kW PV system generates annual savings of $67,680 and has a payback period of just 5.5 years. Comparatively, a $ 2.40-per-watt system would cost $768,000 and take 11.34 years

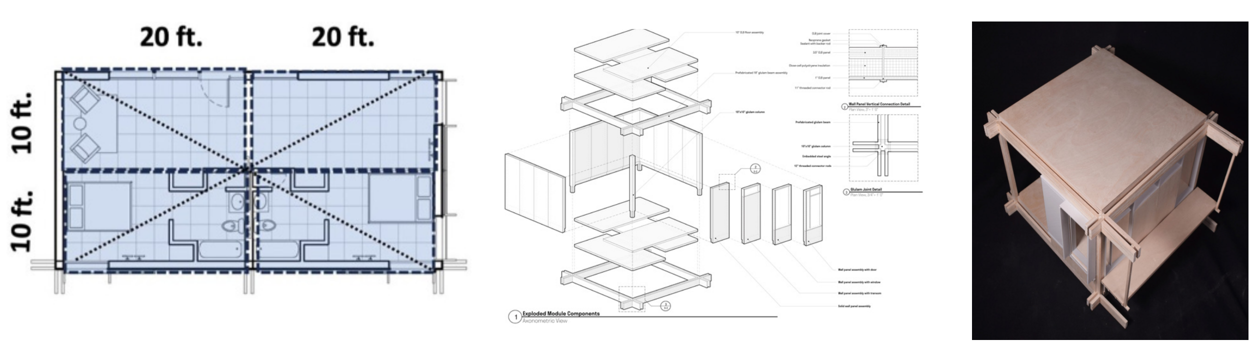



Figure 5: Modular Construction Schematic (Garrison, Powell, and Rogers 2023).

Figure 6: Photovoltaic (PV) diagram of the project (Author 2024).

to pay back. Additionally, Hall addresses the critical shortage of affordable housing for UT students, where only eighteen percent of the 50,000 students have access to on-campus housing (U.S. News & World Report 2025). Its low-carbon materials, energy-efficient technologies, and modular design make it highly replicable for student housing projects in other climate zone 2A institutions. Partnering with Oak Creek Homes, the projected construction cost for the residence hall, including Passivhaus R-34 wall insulation and R-5 ceiling insulation, is estimated at $10,827,600 for the 62,000 ft2 residential area with 120 units. The first floor 12,260 ft2 medical facilities, designed in alignment with other Dell Medical School projects, are estimated at $470 ft2, totaling $5,922,200. The total estimated construction costs for the combined residence hall and the first-floor medical facilities are $ 16,749,600 (see Tables 1 and 2 and Figure 7).

| **Site** | **Cost** |
|---|---|
| Site Prep | $1,750 |
| Foundation, Glu-lam beams, crane erection | $9,750 |
| Flatwork | $1,750 |
| Rainwater Harvesting | $1,500 |
| Courtyards, Rain Garden, and Xeriscaping | $2,500 |
| **Material** | |
| Framing | $9,900 |
| Windows and Doors | $11,200 |
| Soji Sliding Partitions | $6,250 |
| Local Limestone Sliding | $9,350 |
| Decking and Rails | $6,000 |
| Raised S-Floors | $2,200 |
| Roofing | $7,750 |
| Insulation | $1,000 |
| MgO Drywall | $5,750 |
| Wood Cabinets and Trim | $4,000 |
| PaperStone Countertops | $2,750 |
| Painting and Wood Finishes | $6,000 |
| Reclaimed Wood Floors | $4,250 |
| Hardware and Mirrors | $1,150 |
| Ceramic Tile | $2,750 |
| **Mechanics** | |
| HVAC | $14,000 |

| | |
|---|---|
| Electrical | $5,580 |
| Plumbing and Plumbing Fixtures | $7,200 |
| Appliances | $2,000 |
| **Construction** | |
| Framing Labor | $4,500 |
| Clean Up, Dumpsters, Fencing and Maintenance | $4,560 |
| Contingency | $5,000 |
| Profit and Overhead | $25,830 |

| | |
|---|---|
| Total | |
| Estimated Cost of Medical Clinic | $5,922,000 |
| Estimated Cost of Residence Hall | $10,827,600 |
| Estimated Whole Building Construction Cost with PVs | $16,749,600 |

Table 1: Preliminary Cost Estimate (per 2br – 2 bath unit +1/4 Co-Op) (Oak Creek Homes 2024)

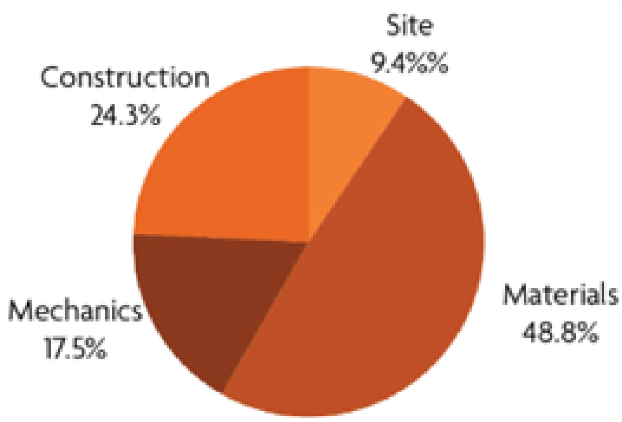



Figure 7: Cost percentages (Author 2024).

Government incentives further enhance the project's financial viability. For instance, Austin Energy's multifamily solar incentive (Austin Energy 2023) offers up to $2,500 per residential unit, while the City of Austin's Zero Energy Capable Homes Initiative and federal tax credits offset up to fifty six percent of the installed cost for commercial systems and 30% for residential installations. Additionally, utilizing incentives outlined by the Inflation Reduction Act (IRA), including photovoltaics, will receive a thirty percent federal tax credit. Moreover, the City of Austin provides rebates and incentives to both multifamily owners and tenants, and, as ReGen Hall is technically a non-profit because it is an educational building, the city offers an upfront rebate of $1.00 per watt (up to $2,500 per residential unit). The combination of both types of incentives saves $20,304 annually, providing economic viability for the project. Huge savings could be expected from rainwater harvesting, which is supported financially in many ways. Senate Bill 2 of the 77th Legislature (Texas Water Development Board 2006) exempts rainwater harvesting equipment from sales tax and allows local governments to provide exemptions on ad valorem for such equipment. The City of Austin encourages rainwater conservation through rebates for residential rainwater storage systems and discounts for stormwater management measures, reducing installation and operational costs and improving overall efficiency. By integrating modular construction with sustainable strategies, ReGen Hall represents a new approach delivers significant cost reductions, increased energy efficiency, and high-quality housing solutions for students.

### 3.3 Community integration

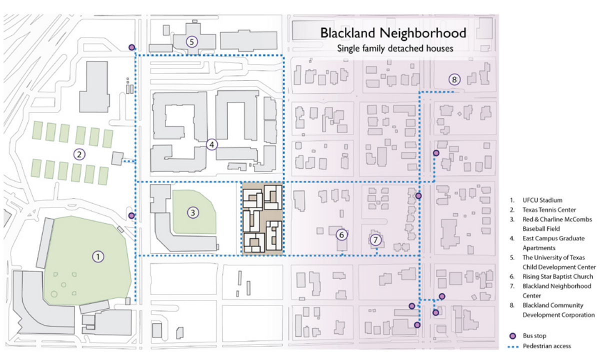
ReGen Hall is an inclusive approach to community integration that considers the historic, cultural, and social dynamics of the Blackland neighborhood of East Austin while supporting the needs of the University of Texas medical students. The project provides not only much-needed housing for medical students and their families but also integrates necessary services and public spaces with consideration for the neighborhood context. The Blackland neighborhood has had tense relations with the university historically, which led to incidents of oppression and land rights struggles. In the 1960s, the university was granted the authority to annex land in this neighborhood for campus expansion, resulting in the loss of nearly half the community.

The project location within the network of bus stops, community centers, churches, childcare facilities, and university amenities underscores a daily overlap between students and long-term neighborhood residents. The surrounding circulation patterns and adjacencies help clarify how the building participates in existing community flows rather than standing apart from them, supporting the project's broader claims of accessibility, legibility, and integration within the neighborhood. In response to concerns about urban development and the preservation of local character, the central courtyard serves as the main concept of the design. This open and inviting public space at the core of the building strategically faces the neighborhood street, adorned with native plants and trees to provide evaporative cooling and create a welcoming space for both residents and community members. Shared walkways and biophilic design features further enhance the connection to nature and offer a calming space for both students and locals (see Figure 8).

The design is based on a co-op-inspired concept that clusters medical student teams around an open lightwell or courtyard, reflecting the Dell Medical School's emphasis on team formation and community engagement. This school's approach to educating future doctors prioritizes community health and wellness, fostering environments that support long-term well-being rather than merely treating illness. The educational philosophy is reflected in the integration of the clinic into the dormitory cluster, actively encouraging sustained interaction and cooperation between medical students and the surrounding community. While this layout increases the exterior surface area exposed to the environment, it enhances ventilation and facilitates stack-effect cooling (see Figure 9).

At the heart of ReGen Hall's community integration efforts is the free medical clinic on the ground floor, staffed and operated by the medical students living above as part of their program requirements, to provide free, essential care to the community. This program addresses longstanding healthcare disparities in the area, providing a much-needed service to the residents. It is organized into three sections. The South section is an emergency clinic providing free services to low-income residents, screening patients, and ordering lab tests. Patients requiring specialized care and are referred to hospital doctors affiliated with the medical school.

The North section features a pharmacy and home nursery care center that supplies essential medications, administers vaccines, and holds wellness classes on nutrition, exercise, and health counseling. These services are vital for older Black residents who face issues with domestic abuse and depression, which are worsened by their economic challenges and the problems of gentrification and displacement. The West section is a medical lab that offers diagnostic services like scans, X-rays, and blood tests. The labs are in a basement room that meets all mechanical and plumbing needs and provide easy access to the mobile medical vans. These



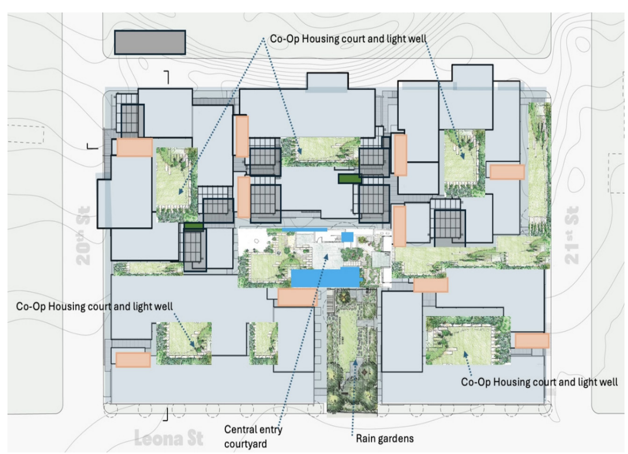




Figure 8: Surrounding typologies and services (left) and courtyard labels (right) (Author 2024).

Figure 9: Community clinic (left) and Courtyard entry (right) (Author 2024).

vans play a critical role in offering in-home care services. The service helps extend outreach and improve access to health care by providing transportation and delivering medical care directly to the homes of elderly and mobility-limited residents. This initiative not only meets a vital need in the Blackland neighborhood but also provides medical students with hands-on experience that helps them foster a deeper connection between their education and the community they serve. The housing includes 120 units in a variety of layouts, from studio apartments to three-bedroom units. Given the extended duration of medical education and the diverse demographics of students, these units are designed with an emphasis on accessibility and affordability to ensure that medical students and their families can live comfortably while staying close to the university and local amenities. Community spaces, including kitchens, dining spaces, and laundry areas, further promote a sense of belonging and collaboration among residents.

The project's commitment to environmental sustainability directly benefits the community. Currently, the site is an abandoned parking lot with over eighty percent impervious cover. By transforming it into a regenerative space, ReGen Hall reduces the urban heat island effect and improves local environmental quality. Rainwater-harvesting systems and strategically positioned exposed walkways enhance passive cooling, while the central courtyard creates a microclimate, creating comfortable spaces even during Austin's hot summers. The inclusion of greenery, native landscaping, and biophilic design reinforces the project's ecological focus while providing a serene atmosphere for residents and neighbors alike.

**4. CONCLUSION**

ReGen Hall establishes a framework for integrating sustainability and affordability in student housing, with verified reductions in energy consumption, operational emissions, and lifecycle costs. The integration of a 320-kW photovoltaic array as a renewable energy system ensures ZNE performance, while lifecycle and carbon analyses validate its long-term sustainability. These technologies and design considerations demonstrate how efficient building practices can align with ecological goals. Strategically located between the University of Texas at Austin and the historic Blackland neighborhood, the project bridges institutional needs with community values. Its design respects the neighborhood's character through an open central courtyard that fosters interaction and inclusivity. The inclusion of a free medical clinic on the ground floor strengthens ties with the local community, addresses healthcare disparities, and provides practical training for medical students. By focusing on affordability, accessibility, and cultural sensitivity, ReGen Hall creates a replicable model for addressing housing challenges in similar urban contexts.

However, its applicability beyond Austin depends on local incentives, regulatory environments, and climate-specific adaptations. The incentives will be reliant on local initiatives, necessitating further research and knowledge of regional proceedings before replicating the project elsewhere. Combining modular construction with sustainable systems, ReGen Hall demonstrates how innovative building methods can make student housing more affordable, energy-efficient, and high-quality. Designed for UT Austin students, it not only lowers costs but also minimizes environmental impact while fostering a strong connection to the surrounding community. With its thoughtful combination of smart design, sustainability, and neighborhood integration, ReGen Hall offers a practical, forward-thinking model for equitable student housing that benefits both residents and the broader community.

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