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Build Green on a Budget: Lessons from Affordable Housing

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BuildingGreen is an independent consulting and publishing company committed to providing accurate and timely information to help building industry professionals and policymakers improve the environmental performance and reduce the adverse impacts of buildings. Our purpose is to foster a thriving and equitable world through a regenerative and resilient built environment. To this end, BuildingGreen facilitates collaboration, learning, and trust to accelerate the transformation of the building industry into a force for positive change.

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Build Green on a Budget: Lessons from Affordable Housing

Sustainability doesn't have to cost more—and no one knows that better than affordable housing experts. But every project type can benefit from these 12 cost-reducing ideas that support people and the planet.

by Elizabeth Waters

This is Part Two of a two-part series related to affordable housing. It supports project teams across disciplines and building typologies with 12 specific ideas for building green on a budget. Part One emphasizes the critical importance of sustainability in affordable housing and details six steps building professionals can take to help that happen.

The built environment is responsible for an immense amount of greenhouse gas emissions, toxic chemical pollution, and waste. It also isn't ideal for our long-term economic, social, and environmental health—especially when it comes to the quality of buildings, the way communities are laid out, and where population centers are located.

As usual, the most marginalized people are the most severely impacted.

As Part One of this series discussed, to do something about this, we must effectively address systemic inequality and discrimination, climate change, and the shortage of affordable housing as the intertwined crises that they are. We will not achieve a sustainable building sector until it's sustainable for all. That's why many sustainability practitioners center equity in their work.

In this report, we'll share advice from green affordable housing experts about how to approach sustainability and resilience on projects—in site and climate analysis, project programming choices, energy efficiency and decarbonization, water conservation, and material selection—using systems thinking and culturally centered, integrative design. Experts agree that sustainability in affordable housing and other budget-constrained project types is achievable, but it requires more upfront time for thoughtful planning and effective stakeholder engagement; it can't be faked later on.

Photo: Daniel Glenn/7 Directions Architects/Planners

A sculpture of Roberto Maestas at the entranceway to Seattle's Plaza Roberto Maestas, an intentional community that supports the cultural resilience of Indigenous people and people of color.

The 12 principles and strategies shared here apply beyond affordable housing to the entire building sector. As Part One established, the affordable housing sector can be a leader in sustainability—as long as we approach it conscientiously.

"If we can solve it in affordable housing," stated Gina Ciganik, CEO at Habitable, "it's accessible to everyone."

Systems Thinking: A Foundation for Social, Economic, and Environmental Sustainability

According to a definition developed by Ross D. Arnold and Jon P. Wade of the Stevens Institute in *A Definition of Systems Thinking: A Systems Approach*, "Systems thinking is a set of synergistic analytic skills used to improve the capability of identifying and understanding systems, predicting their behaviors, and devising modifications to them in order to produce desired effects. These skills work together as a system."

Systems thinking can be applied to any system in the universe—including green building. But what does it look like in practice for project teams?

It looks like the integrative process.

The following lessons learned, derived from research and interviews with affordable housing experts, can help project teams across disciplines and building typologies as they confront pushback about cost premiums for sustainability measures.

1. Leverage an integrative process and community engagement

The integrative design process, broadly speaking, encourages early collaboration across the various disciplines and stakeholder groups involved in or affected by a project. The phrase "integrative design," notes GBRI in its article "Connecting the Dots From Systems Thinking to Sustainability: an Introduction to Integrative Process in LEED," is used mostly in the context of new construction or renovation projects, but it can be applied to any phase in a building's life cycle.

The concept of integrative design is not to be confused with Integrated Project Delivery (IPD), which is a special—if rarely used—multiparty contract, in which the primary designer, builder, and owner (at minimum) share a project's overall risk and profit. IPD is a strategy to incentivize teams to pursue an integrated design process, but teams can practice integrative design without pursuing IPD.

"A successful integrative design process is more art than science," writes Enterprise Community Partners in its Green Communities criteria for integrative design. "It also is often the determining factor in ultimately achieving a successful project." According to the organization, an integrative process encourages teams to consider the many facets of a project during its pre-development phase, including the needs of residents and the greater community, and how environmental stressors may affect them.

In the view of Daniel Glenn, AIA, principal at 7 Directions Architects/Planners in Seattle, integrative design is fundamental to sustainable design. But, he said, the process is typically more about integrating systems—by bringing in the structural and mechanical engineers and landscape architects early in the project—rather than integrating cultural considerations. For instance, he continued, integrative design does not require the hands-on community input process that 7 Directions carries out on its projects. Culture "has to be a really intentional approach," he explained. "The architect has to make an effort to figure that out."

Because there are no hard-and-fast rules for how to apply integrative design on projects, it's largely up to project teams to determine their approach. That said, there is an Integrative Process ANSI Standard, and certain green building rating systems—Enterprise Green Communities (EGC), LEED, and the Living Building Challenge—encourage or require some level of integrative process.

2. Develop a people-centered vision for sustainability

Sustainability factors don't always benefit a business, said Glenn, and architecture is a business. That's why his firm, he explained, takes a mission-driven approach to everything. "You have to have a larger vision that includes green, community, and in our case, focuses on decolonization," he continued, "which, from our perspective, is about returning land to Indigenous people and [leveraging] the opportunity for cultural resilience."

Katie Ackerly, AIA, principal and sustainable design director at David Baker Architects (DBA) in San Francisco, believes it's easier to get clients on board with sustainability initiatives when they see that those initiatives align with their mission. For nonprofit affordable housing developers, meeting the needs of residents is the top priority, and it's common for them to view investment in sustainability as being in competition with that aim, she explained. (See Part One for an in-depth discussion about this.)

"If we want to go beyond business as usual," Ackerly elaborated, "we have to find a way to recast the sustainability" features because the goals of mission-driven affordable housing developers and sustainability should be the same.

In an email to BuildingGreen, Willy Boulay, developer and vice president at LS Black Development, explained that his firm looks for architecture, engineering, and construction (AEC) partners who put tenants and affordability first. "We don't want to spend, say, $1 million premium on the fanciest exterior look," he explained. "We want to put those dollars into more functional, sustainable, efficient units that meet our future tenants where they need to be met and can help provide the best units and amenities we offer." As Part One covered, sustainability is integral to resident well-being and long-term affordability.

Developing a shared understanding of how sustainable design aligns with and furthers the aims of people-centered approaches, such as culturally responsive, inclusive, and trauma-focused design is an example of systems thinking. For instance, indoor environmental quality is an important component of resident safety and comfort. Considering the two together is a way for project teams to combine trauma-focused strategies with those that are more commonly considered "sustainable."

These ideas are reflected in the AIA Framework for Design Excellence, which puts forth ten principles with guiding questions to help architects design projects that support equity, resilience, health, and decarbonization in the built environment. "The architect's call to protect the health, safety, and welfare of the public has a new and broader meaning amid challenges such as increasing climate extremes and social inequity," the organization writes in an infographic. "Architects everywhere must recognize that our profession can harness the power of design to contribute to solutions addressing the most significant needs of our time."

As a first step, Ackerly recommends that firms start leading with their core mission. "The way I think about it," she said, "architects don't stop and define the critical questions for each project to make it the best it can be." For this reason, she continued, DBA developed guiding principles, paraphrased below, that center people and the purpose of affordable housing in its sustainable design strategy:

- **Design for human experience:** Create spaces that support personal connection, health, refuge, opportunity, and joy.
- **Connect to place:** Bolster community connection and wellbeing and repair ecologies through site planning and open-space design. DBA originally

wrote this principle as "connect to nature," but shifted the language to focus on the human desire to feel rooted, explained Ackerly.

- **Do more with less**: Use only what's necessary, leverage the beauty of raw materials, and implement simple, efficient systems. Identifying no-cost strategies and low-impact, lowest-cost materials is an easy way to align resource use reduction with the goals of housing developers, commented Ackerly.
- **Bet on the future**: Design as if the future we envision is already here, embrace change, and seize opportunities. This principle started as "decarbonize," said Ackerly, but the firm reframed it in a way that better resonates with clients.

Establishing a firm-wide sustainability vision can help teams set goals on projects. As Susan Puri, director of affordable housing at International Living Future Institute (ILFI) advised, project teams should look at the end goal. "Even if you can't get there with one project, it's helpful to know where you want to go."

3. Seek knowledge; then use its power for good

It's great to make sure teams learn about sustainability upfront, Puri continued, and aren't afraid to take on the role of advocate. She reflected that, in her experience, the projects with the most success achieving sustainability had champions who made sure it was integrated in each phase.

Boulay echoed this sentiment, stating that, for his firm, the other most important characteristic in an AEC partner is having the experience necessary to steer the project toward sustainability. Architects have got to fight the inertia of the industry a little bit, he argued, "since the rest of the industry (contractors, subcontractors, management companies, and definitely owners) will rely on repeating what's been done in the past."

Photo: Sherry Tester/David Baker Architects

Shared Evaluation Walks are one of a handful of post-occupancy evaluation tools that David Baker Architects uses to inform pre-design in other projects.

Simona Fischer, AIA, director of sustainable practice at MSR Design, went a step further, stating that for architects, staying abreast of the environmental and health impacts of buildings is a public obligation—a component of health, safety, and welfare. "In general, clients don't come to us assuming they're going to buy a building that's crap," she argued. "They think they're getting a new building that's state-of-the-art." Fischer holds that architects need to develop internal processes and workflows to make things like energy modeling an implicit part of project delivery—rather than giving clients the option to include them or not. "We're not going to ask if you if you want a nontoxic interior. You don't think you're getting a toxic interior," she said.

Part of this is shifting the way we understand cost, argues Ciganik. In her view, people typically use the word "cost" to refer to first cost, or the cost of a finished product. But first costs don't account for

the costs of a product's maintenance and long-term repair, or any environmental degradation or disease it may cause. Because of this, the first costs of toxic products are artificially low.

As a designer, developing a comfort with the funding landscape for green building is another critical way of staying educated and furthering sustainability on projects. Since the passage of the Inflation Reduction Act (IRA), "that's what my job is becoming," said Fischer—"researching incentives and rebates and things… If someone is not tapping them, they should be." She recommends project teams investigate and start making connections with potential funding opportunities in early schematic design.

Still, said Ackerly, there's "a lot of dissonance between the intent [of the IRA] and how it's implemented," noting that it's important for project teams to provide policymakers with feedback. "It's a call to action for designers," she reflected. "As practitioners, we often can bridge between the on-the-ground experience of developers and broader policy direction."

Resilient Design: The Human Connection

"Resilience is shaped by context," writes Walker Wells, executive director of Global Green USA, in the forward to Enterprise Community Partner's 2018 report *Made to Last: A Field Guide to Community Resilience*. "How we adapt to physical and social vulnerabilities is a function of our location, resources, and relationships."

Wells goes on to explain that "identity, history, and culture intertwine in the stories we tell about our communities," and these stories in turn "determine how we respond to shocks and stressors from neglect, discrimination, limited opportunity, gentrification, or a changing climate."

The report explains that a focus on both climate and cultural resilience—as well as on economic, healing, and social components—are critical to the long-term success of a community. With deep organizational experience rebuilding and strengthening the climate preparedness of communities after natural disasters, the organization writes that "for a community to be truly resilient, we must also focus on human networks and be sensitive to the unique culture of each place."

"The most resilient system turns out to be the person who knows the other people," reflected Z Smith, PhD., FAIA, principal and director of sustainability and building performance at EskewDumezRipple. In the event of disaster, he elaborated, it's the facilities manager in multifamily apartments or a designated group within a community organization who will go around and check on people. "People are fascinated with the kit, the equipment," he concluded, "but the most important thing is the people."

4. Plan for the future with—not for—communities

So to best support people, our built environment must be designed *with*—rather than *for*—the communities it serves, and achieving that requires open-mindedness, patience, and a lot of upfront effort. Probably some humility, too.

And likely for those reasons, an inclusive and integrative design process is not standard practice.

In the Enterprise report, the authors refer to this approach as "participatory engagement" and identify "creative placemaking"—which incorporates art, culture, creativity, and design into the community development process—as a strategy to achieve it. The organization explains that creative placemaking centers practices that:

- Uplift cultural identity
- Promote community participation
- Incorporate shared activities

Examples of such approaches include artist- or community-led art installations, the incorporation of social issues into design, and participatory design charettes. As Enterprise and others underline, community and cultural resilience reinforce climate resilience.

The particulars of community engagement can change from project to project based on client interests, city requirements, and community politics and expectations, said Ackerly, but she and DBA always try to leverage it to inform a project's design. Plus, she added, it often improves a project's reception in the community.

Achieving participatory design with a kit-of-parts workshop

Glenn and his firm hold kits-of-parts workshops on projects—often at both the site and the building level—to achieve community-informed design. First, he explained, the design team identifies all the elements of the site. For instance, a recent project included separate group homes for single women, survivors of sexual assault, and single mothers. Also on the site were a sweat lodge, a medicine garden, pathways, and parking.

Next, the team creates a set—or multiple sets for large groups—of two-dimensional printouts representing the elements of the site, which are color coded, labeled, and to scale. Small groups of around five people, each with their own site plan and kit, will play around with the placement of the elements within the site plan and come up with a design solution to present to the larger group. At this point, Glenn and his team will facilitate a discussion of the big ideas brought up—commonalities and differences between the design solutions presented.

"Then we take it all back to the drawing board," said Glenn, explaining that, through an iterative process, his team

Image: Doug Walker/7 Directions Architects/Planners

The Stilliguamish Elders' Longhouse is part of the Stillaguamish Village in Arlington, Washington. 7 Directions Architects/Planners facilitated a kit-of-parts workshop with the community to create a design reflective of their culture, climate, and place.

will come up with a couple options to bring back to the participants and, from there, narrow it down to a single option. Glenn characterized this as a communication process, which gives people the opportunity to think things through and provides the design team with information about what's distinct and important to the community—which helps them create a unique design.

Many architects, commented Glenn, fear that this type of engagement process turns design control over to clients. But that's not what's happening, he stressed. "We often find that what comes out of workshops aren't viable designs," he explained, "and we have to turn them into designs." But, he continued, "it's very effective, and it can be very quick, too." Engaging people and getting their input early in the process reduces back-and-forth and can be cost-effective, he said. Plus, he pointed out, it takes them through the trade-offs that architects must make. For example, if you want a bigger living room, you'll need a smaller kitchen.

To reap these benefits, the process must be carried out thoughtfully. A lot of community engagement processes, said Glenn, are done to check a box and often are not really engaging. "People are not used to looking at plans," he continued. "You can't just show them floorplans" or expect them to be able to draw their ideas like architects do. For this reason, breaking the site down into spaces and pieces can help people participate. Glenn added that his team will often present information, like the results of a site analysis, to participants ahead of the workshop.

Glenn said he has used this kit-of-parts approach "in all scales—housing, master plans, community centers—and we always learn something." He added, "Who participates is really important."

Glenn offered an example. During his time working with the Department of Housing and Urban Development's (HUD) HOPE VI program, which aims to redevelop distressed public housing, he worked on a project in Indianapolis focused on redeveloping older housing primarily for single mothers. The existing housing had a standard layout with two kids' bedrooms on the first floor, a small kitchen, a dining room, and no porch.

To understand how they could redevelop the homes, Glenn and his team planned to do a kit-of-parts exercise and decided to include the residents in this process. He recalled how some of his colleagues were hesitant to do so, concerned that that residents would request hot tubs or giant living rooms—or other financially infeasible changes. What those architects failed to comprehend, Glenn pointed out, was "that poor people understand budget and limitations better than anyone."

Sure enough, the residents provided constructive feedback. They wanted the kids' bedrooms moved to the second floor to keep a better eye on them. They wanted porches because, as Glenn explained, that's where they preferred to socialize. And, finally, they didn't in fact want big living rooms, but rather little parlors and larger kitchen spaces. Ultimately, the residents wanted homes that supported the way they lived their lives.

"The reality is," Glenn said, "you've got to figure out ways to listen and find out what people really want."

A mission-driven approach to prioritizing trade-offs

Budget is always a constraint, and project teams must always make difficult tradeoffs. As Krista Egger, vice president of Building Resilient Futures at Enterprise Community Partners, explained, a people-centered, systems approach can be used here, too.

To exemplify this, she shared Enterprise's aging-in-place prioritization charrette tool, which project teams can customize and use to balance impact priorities with cost for decision making. "Essentially, we created this big matrix and printed it out on one of those flip charts," she explained. The columns, she said, represent the categories of outcomes the team hopes to achieve (e.g., health, energy, and climate resilience), while the rows reflect other critical components of decision-making (denoted as low, medium, and high priority).

Participants then write down strategies to achieve the outcomes on sticky notes, which are color-coded yellow, green, or red to reflect cost, and place them within the boxes in the chart to brainstorm what they could include in the project. Finally, the group discusses all the ideas and rearranges the notes, first, by impact and priority and, second, by incorporating cost to create a prioritized list of strategies.

"We're trying to bring cost into the conversation with impact," said Egger. "So often, it's easy to brainstorm topics based on what kind of impact they'll have on the community, then you have to go through and cut out things that are too expensive"—at which point it's just a conversation, she said. Each project will have a different reason for being, she concluded, so the questions driving why a project team goes one way or another may be different.

It's also useful, she said, for teams to look for strategies that have multiple benefits and align with multiple priorities. "For instance," Egger added, air sealing can make projects more energy efficient, reduce noise from the outdoors, and help keep pests out.

5. To promote resilience, focus on community

When choosing and designing a site, it's critical to understand how the project might affect and be affected by the environment and how it might connect occupants to the surrounding community. For instance, thoughtful site design can reduce the energy required to heat and cool a house and help ensure it can withstand extreme weather events. Transit-oriented development can reduce occupant reliance on fossil fuels.

Climate

Low-income communities and other socially vulnerable people are more likely to be located in areas with the most exposure to climate change impacts, according to the U.S. Environmental Protection Agency (EPA). To minimize displacement, health issues, and costly repairs from severe weather events, it's especially crucial that homes in such communities be durable and resilient to extreme weather. To prepare a property for rising temperatures and natural disasters, project teams should use systems thinking to consider what existing and future climatic patterns may affect the site and how they may exacerbate residents' existing vulnerabilities.

It's also important for project teams to factor environmental characteristics, such as the sun, wind, and humidity, into decisions about a building's orientation and materials—which Glenn explained are fundamental to Indigenous design. For example, "Indigenous people in the West face our doors to the east," he said. "People think it's a spiritual thing, which is true, but it's also a very practical thing. Wind blasts across the prairies from the west."

However, designers don't always think about the sun and wind, Glenn continued, because central heating and air conditioning have enabled us to divorce buildings from their sites. Part of the issue, he acknowledged, is that architects are often not involved in *platting* (the process of dividing up sites within a master plan), meaning that roads are typically already in place by the time

they come onto a project, leaving them with fewer options for housing placement.

In addition to an understanding of the site's microclimate and how that is likely to change, "I would certainly welcome any developer, when they're designing," said Glenn, "to look at the original people from that place and try to learn from the people [who] live there, who have lived there for possibly millennia." He recommends working with a consultant who understands the topic.

Access to community services

It's also important, when choosing and designing a site, to think about how it's connected to the surrounding community. When housing is close to transit, jobs, and other resources and services, said Ackerly, people feel good, and we know it has a climate benefit. If we don't prioritize community access for residents, she concluded, we're making the green affordable housing problem harder as we're trying to solve it.

Uche Okezie, director of real estate development at HomeSight, a community development financial institution in Seattle, spoke to BuildingGreen about the affordable multifamily apartments the organization is working on at Othello Square in the city's Southeast.

The Othello Square apartment complex, which will include 68 units for purchase for families at 80% of area median income (AMI) or below, will be part of a campus that includes a community health clinic, an early childhood development center, a charter school, and workforce rental housing. Okezie noted that the development reflects transit-oriented design, so residents won't need to have cars. "The building is designed so there is not a parking space for everyone," she said, though "there's lots and lots of bike parking."

Photo: Doug Walker/7 Directions Architects/Planners

The Stillaguamish Elders' Cottages are part of the Stillaguamish Village in Arlington, Washington, designed by 7 Directions Architects/Planners.

Alternative housing models

In addition to designing housing for climate, we can re-envision housing to best serve its intended community, said Glenn. Various alternative housing models (e.g., cooperatives, co-housing, multigenerational housing, and many others) can meet different resident needs.

For instance, HomeSight's Othello Square apartments will be a limited-equity cooperative, which Okezie likened to a land trust, meaning the property will be collectively owned by the residents. To retain affordability for future buyers, each unit is subject to resale restrictions. Because the model is "really new in our region at this scale," explained Okezie, it's been difficult to find comparable products for appraising, which creates an added risk for the lender. HomeSight is eager to finish the complex in the hopes that its existence will make it easier for other co-op projects to secure financing.

As another example, 7 Directions is currently designing group homes for urban Native American women facing challenges such as homelessness and substance use disorder. The homes will be in a subdivision, and though the project team didn't get to choose the lots or change their single-family zoning, Glenn explained, they plan to lay them out in relation to each other and place a common house in the middle. This model is a type of co-housing, which Glenn noted is more typically pursued by upper-middle-class homeowners who can afford to purchase multiple lots and connect them.

Glenn also pointed to the importance of providing multigenerational housing in communities that desire it. For example, he continued, today on reservations, there may be 20 people living in a one-bedroom house, which is not only cultural but also an economic reality. "The idea of having Grandma or children in the house is not built into" how most architects in the U.S. design nowadays, which is often based on the economic unit of a single family, which is assumed to be parents and their children.

Community spaces as resilience hubs

Susan Puri of ILFI explained that, although ideally a multifamily development will have battery backup for the entire building, "most affordable housing developments have some sort of community space that can be backed up with batteries." In such a space, she continued, people can gather if it's not safe to be in their units or store perishables, such as breast milk and food, if they lose power.

Enterprise also encourages project teams to ensure buildings contain backup potable water that occupants can access during power outages.

"Increasingly," commented Z Smith of EskewDumezRipple, "people are thinking about how community rooms can act as resilience hubs." For example, in the St. Peter Apartments in New Orleans, a net-zero-energy affordable housing development designed by Smith's firm, the community rooms run on a separate system from the apartment units, allowing them to continue operating if the apartments lose power.

And just as a community room can be a resilience hub for a multifamily building, so can the residences or entire buildings be hubs for the broader community. Considering this, Simona Fischer at MSR noted that it might be beneficial when designing dwelling sizes and configurations to think about how residents may use their units to help those around them during a crisis.

Smith recounted how, in the aftermath of Hurricane Ida, the city of New Orleans lost power for nine days—but the St. Peter apartments kept running. Individual units became gathering places

for residents' friends and families who were without power. Initially, Smith shared, the complex's energy use spiked to an unsustainable level because the residents were having large gatherings and heavily using appliances. But once the building operators communicated to them that they needed to keep their energy use low while the building was on backup battery power, their total operational energy use declined enough for the onsite solar and battery system to keep up each day.

Energy and Water: The Lifeblood of Communities

As Part One of this series explained, a large percentage of low-income households are energy burdened, meaning they spend more than 30% of their income on energy bills. And, as Smith pointed out, monthly or seasonal variability in bills can exacerbate energy insecurity. Energy-burdened households are often only "a few cold winters or hot summers away from not being able to pay their bills," he said.

Like energy, water is also a significant ongoing expense for building owners and residents, with the average cost of residential water and sewage bills in the U.S. increasing faster than inflation and average annual income growth. According to Bluefield Research, these rising prices are due to a combination of factors, including aging infrastructure, advancing water treatment solutions, and climatic events. Though the cost of water has not always been correlated with scarcity, writes Joe Eaton in an article published by AARP, analysts predict that changing weather patterns (such as extreme heat, drought, and flooding) will begin to affect rates.

In the report *Ensuring One Water Works for All: Opportunities for Realizing Water Reuse in Affordable Housing*, the National Wildlife Federation (NWF) Texas Coast and Water Program cites research showing that some low-income people spend up to 19% of their monthly income on water and sanitation services, with projections indicating that in the next five years, the number of households with unaffordable water bills could triple.

For this reason, reducing and stabilizing energy and water consumption and cost in affordable housing is an important part of keeping it affordable. And in the face of climate change, "resilience and energy equity—at least reducing utility bills, if not becoming zero energy and eliminating them—will become close to nonnegotiable," argued Puri, emphasizing the need to ensure low-income people aren't bearing the brunt of it.

Project teams can use systems thinking to identify complementary energy- and water-efficiency improvements, drive down the initial cost of sustainability measures, and set property owners up to make additional improvements over time.

6. For healthy spaces (and pocketbooks), tighten the building envelope

First, experts advise, consider how the building envelope can be designed or upgraded so the building requires less energy to heat and cool. In existing buildings, said Krista Egger of Enterprise, conduct an energy audit to identify the best low-cost/high-benefit upgrades.

Chris Benedict, R.A., and her partner Henry Gifford were early practitioners in the mid-'90s of a systems approach to radically increase the energy efficiency of existing and new multifamily housing without increasing the cost of construction. "We were trying to eliminate this choice of, 'Do we do more housing, or do we do housing with energy efficiency?'" Benedict reflected in an interview with BuildingGreen. "We tried very hard to eliminate that question."

Photo: Michael Mantese/EskewDumezRipple

The St. Peter Apartments in New Orleans, designed by EskewDumezRipple and developed by SBP National, contains 50 mixed-income and affordable units and is Louisiana's first net-zero-energy apartment building.

Benedict summarized their pioneering approach—which aligns with principles formalized in the early '90s as Passive House design. They would install a "great air barrier, insulate continuously, reduce mechanical systems, and ventilate," she said. By tightening and insulating a building's envelope, they could reduce the energy required to heat and cool the interior and, as a result, specify a smaller mechanical system. The savings from the smaller system would pay for the envelope improvements—though Benedict noted that electrification is changing this calculus, explaining that replacing a large boiler with a smaller boiler saves money, but when you go from fossil fuels to electrification, that shift can be much more expensive. This can reduce or even eliminate the financial savings of leveraging a more robust envelope to "right-size" mechanical systems.

Continuous insulation

Smith explained his layered approach to installing continuous insulation, a method that prevents thermal bridging. First, "you do the sheathing, and then you do a nice environmentally friendly continuous insulation [like mineral wool]," he began. "Then a rain screen, then cladding, and [last] add insulation between studs if it's [a] wood frame."

In Minnesota, explained Laura Eder, AIA, vice president and director of sustainable design at ESG Architecture & Design in Minneapolis, affordable housing projects that receive funding through the state Housing Finance Agency are required to achieve Energy Star certification, meaning they must meet prescriptive, continuous insulation requirements. For this reason, "insulation in affordable housing is almost always better" than in market-rate housing, she said.

Advanced framing is another, tried-and-true method for reducing building costs and improving insulation, Egger pointed out. By strategically placing a building's studs, project teams can reduce the amount of total lumber required and allow more space for insulation, she explained, leading to cost savings in lumber purchased and better insulation. This is an example, Egger concluded, of how a "thoughtful approach to design upfront can pay dividends."

Ventilation

Ensuring indoor air is properly filtered, ventilated, and conditioned is critical—especially in buildings with tight envelopes and those in areas that experience extreme heat, high humidity, and wildfires or in fenceline communities. Maintaining healthy and livable indoor environments is a climate justice issue.

Enterprise Green Communities requires all new construction and substantial rehab projects to install bathroom and kitchen exhaust fans and whole-house ventilation systems. For projects in more humid climate zones, EGC also requires the implementation of dehumidification strategies to prevent mold growth.

Still, "there's no silver bullet for residential HVAC," said Ackerly, "and [it] should be more of discussion." The cheapest and easiest way to meet current code in California, she explained, is to install an HVAC system that blows outside air inside regardless of its quality or temperature and uses a MERV-13 filter, which doesn't provide enough filtration. It's a high-energy, low-comfort solution, she said. From her perspective, a central energy-recovery ventilator, which appears to be the most resilient, best performing, and healthiest way to deliver fresh air, is the best option, but a "pretty tall order."

Keeping indoor air cool is becoming increasingly important in almost all regions of the country. As Puri said, air conditioning "is an equity issue." In the Othello Square development, explained Okezie, HomeSight left space in each apartment's electric panel to add air conditioning units, which the organization would like to help the co-op purchase.

7. Give the gift of efficiency

"We need serious energy and water efficiency first and foremost," emphasized Dana Bourland, senior vice president of environment and strategic initiatives at the JPB Foundation.

Installing efficient equipment reduces building operating costs (and in some cases tenant utility costs), but it can increase upfront spending—a delicate balance that all project teams, but particularly those working within affordable housing budgets—must strike.

Enterprise Green Communities, Smith explained, aims to require "affordable housing to be more efficient … in an achievable way. Not [in] a win-the-science-fair way." EGC's building envelope criteria, he continued, seeks to optimize the intersection of affordability and "good enough" efficiency by offering projects a financially feasible path to be in the 75th percentile of energy consumers.

Improving water efficiency often goes hand in hand with energy-efficiency measures. Enterprise Green Communities criteria require projects to reduce total indoor water consumption by at least 20% by installing low-flow faucets (or adding aerators), showerheads, toilets, washing machines, and dishwashers, and encourages projects to conduct ongoing monitoring for leaks. Egger pointed out that designing an efficient plumbing layout for hot-water distribution throughout a building is another impactful water (and energy) reduction strategy, though she noted this is much easier to do in new construction than in rehabs.

In existing buildings, Egger recommends project teams replace systems or appliances, such as water heaters, space heating systems, stoves, and dryers, that are beyond their useful life with more efficient models—noting that Enterprise doesn't typically recommend replacing appliances that are still operational.

Overall, Egger advised, it's about managing upfront costs with operating expenses—ideally over the expected life of the building, not just in the first year or two.

Electrify and decarbonize

Part of achieving energy equity is ensuring that affordable properties can access and benefit from decarbonization measures. If it's possible, said Egger, converting a building to electric makes sense, particularly if it doesn't already have air conditioning, she added. Heat pumps that also provide cooling can be a value-added replacement for gas furnaces. Owners should also evaluate the possibility of installing solar on their property or subscribing to a community solar program, Egger continued, which may be necessary if the property doesn't have space for panels. Although community solar is not available in all states, an increasing number are allowing or encouraging it.

Willy Boulay of LS Black Development noted that generous federal incentives are available through the IRA, so "every single project that can have solar on it should. The payback is so quick when you combine these credits; it doesn't make sense not to install."

As Part One discussed, there can be tension—depending on where a project is located—between the need to electrify affordable housing properties and the cost of doing so. But "it's a tension that we have to walk through right now and find solutions," said Egger, which include taking advantage of federal funding.

Different approaches will be required in different markets based on utility costs and heating and cooling demand, she continued, and there will not be a silver bullet. But "we've got to move toward electrification," she declared. "We've got to make it feasible in affordable housing." If we wait to convert affordable housing units last, residents will be stuck with untenable utility bills, she explained. (See Part One as well as "Seeking a Just Transition to a Decarbonized Built Environment" for more about affordable housing and the fossil energy transition.)

Strive for net zero

Goals of net-zero energy—and, increasingly, net-zero carbon—are becoming more common for new construction and retrofits alike. But we need to ensure that affordable housing properties are not left out of the push toward net zero—both because their owners and residents have a right to reap the benefits and because we can't achieve a net-zero economy without them.

7 Directions Architects/Planners now designs all its buildings with a goal of net-zero energy, said Glenn. Although, he noted, achieving it is challenging, if not impossible, in areas serviced by utilities that don't allow net metering. In these cases, his firm is exploring alternative strategies like battery storage, or storing energy in hot water.

That said, according to Egger, it is typically easier to achieve net zero in new construction than in existing buildings. "With new construction," she explained, "you're starting with a blank slate, so you can design in enough energy efficiency" and other measures. If you have a building that's going to be retrofitted, it's going to be much more challenging to meet zero energy unless it's a gut rehab."

This is because existing buildings present more physical challenges than new

builds, Egger continued. For instance, a project team might have to figure out how to insulate uninsulated walls or replace an entire heating and cooling system, she said, which can become intrusive, expensive, and difficult. "If you don't have all the funding to go through a substantial retrofit to meet net zero, it may make more sense to phase in those retrofits to reach net zero over time," she noted, recommending that project teams implement as many measures as is financially feasible and develop a plan with the property's asset management planner to phase in the remaining improvements in the future.

Egger explained that this concept of "zero over time" has been gaining popularity over the last few years but still lacks a standardized approach. It would be helpful, she reasoned, "if we could have the building science community or the energy sustainability community more regularly provide information to owners of affordable housing properties," she said, and advise them on "what they could include in a retrofit today versus in 15 years," because ownership of affordable housing properties usually stays constant for decades.

It's worth noting that in the 2025 iteration of the Enterprise Green Communities criteria, shared Egger, Enterprise plans to strongly emphasize a goal of zero-carbon emissions rather than net-zero energy. The organization plans to create a zero-emissions pathway to align with the new federal definition of the term that will also apply to lighter rehabilitation projects. (Currently, EGC offers net-zero pathways only for substantial rehab and new construction projects.)

Products & Materials: In It for the Long Haul

To take a people-centered, systems approach to building materials is to con-

Case Study: How One Affordable Housing Project Got to Net Zero—Accidentally

Z Smith, principal and director of sustainability and building performance at EskewDumezRipple, and his team designed the St. Peter Apartments, a development of 50 mixed-income and affordable units built by SBP National in New Orleans in 2020. The project was Louisiana's first net-zero-energy apartment building—although it wasn't initially intended to be. Its story offers insight into the costs and strategies associated with various levels of energy efficiency and resilience.

The building, intended to be all electric from the outset, was initially designed to meet Enterprise Green Communities criteria. Under this scenario, the project's energy use intensity (EUI) was slated to be 32 Btus/ft^2/yr—putting the building in the 75th percentile of energy consumers—at a predicted total cost of $146/ft^2.

But as the design team was completing construction documents, recounted Smith in an email, the client asked about options to provide electrical power to the project during power outages—a strategy that is increasingly common in New Orleans, he said.

Smith and his team did the math to determine what it would cost to enable the development to operate off the grid. The moonshot number they came up with was a million dollars, divided evenly over onsite solar, onsite battery storage, and energy-efficiency improvements (since the building would have required two 40-foot shipping containers of battery storage at the original EUI of 32). The team wrote a white paper and thought that was the end of it, Smith related.

But through a series of what he described as "funny twists and turns," SBP unexpectedly received the million dollars in the form of a grant from its local utility. Here is what Smith and his team did with it:

They increased the performance of the building envelope by:

- Using damp-applied cellulose insulation instead of fiberglass batt or spray polyurethane foam (SPF) between the wood studs. Cellulose cost the most of the three options, but it increases airtightness compared with fiberglass and avoids concerns about off-gassing and the global warming potential associated with SPF, said Smith.
- Installing fiberglass-framed windows instead of PVC. Fiberglass-framed windows offer greater longevity and avoid the life-cycle concerns of PVC, commented Smith.

They maximized the building's energy efficiency by:

- Upgrading the HVAC system, choosing SEER 17 AC rather than the SEER 15 value that EGC required.
- Picking better-than-minimum-Energy Star appliances, like dishwashers and washing machines. "Energy Star is the top quartile of performers," said Smith, "but within that quartile—if you're a very careful shopper—you can get appliances that use a lot less energy." (The best performing products are recognized as Energy Star Most Efficient.)
- Installing heat-pump water heaters instead of electric-resistance water heaters.
- Installing energy-efficient LED lighting.

All told, said Smith, they spent about $300,000 on performance improvements ($6,000 per unit) and reduced the project's predicted energy consumption to an EUI of 18 for normal occupancy patterns, putting it at

continued

sider how a product's entire life cycle—from extraction of its raw materials to its disposal—affects human and environmental health. Many products contain or are made with harmful chemicals and fossil fuels. Toxic substances and pollution emitted from mines, factories, or the product itself pose hazards to ecosystems, fenceline communities, factory workers, installers, and residents along its supply chain, with impacts greatest for the most vulnerable populations—Black, Indigenous, and low-income communities, communities of color, and children.

As Part One discussed, building "green" housing with materials that cause any such damage upstream, is not "green" at all. But it might be cheap—at least initially. Getting and staying educated about the impacts of materials, collaborating with other project stakeholders, keeping an open mind, and leaving time for sufficient upfront planning can help teams effectively incorporate healthy alternatives and keep costs down.

8. Sort through the chemical noise

As Enterprise writes in its Green Communities Materials category, ingredient disclosure is the first step toward getting rid of toxic chemicals across all building products. Documents such as health product declarations (HPDs) and Declare labels disclose the ingredients in a given product. There are a variety of programs and tools available to help practitioners sort through the raw ingredient data. Some translate transparency documentation into evaluations of individual products. For instance, through the Declare program, ILFI screens product ingredients (voluntarily disclosed by manufacturers) against its Red List, a comprehensive and publicly available list of "worst-in-class" chemicals.

HPDs have a more complex ranking system, and instead of one list, the HPD Open Standard references a number of lists maintained by government agencies and NGOs around the world. Because of this, HPDs can be more difficult for the uninitiated to interpret.

Some organizations, like the Green Science Policy Institute, categorize chemicals of concern into classes to watch out for. Its Six Classes framework identifies families of chemicals that should be avoided. For instance, with more than 10,000 PFAS compounds, it's easier to avoid them as a class than to consider them individually. This method can also help minimize the chance of making *regrettable substitutions* where one problematic substance is used to replace another.

Others, including Habitable and BuildingGreen, offer guidance based on product categories.

Habitable's Informed tool classifies product types from red to green (red being the most toxic) and seeks to help time-strapped designers, who are not typically medical scientists or chemists, make safer decisions, explained Ciganik. In an ideal world, Ciganik wrote in

something like the 98th percentile. The increased efficiency allowed them to shrink the required capacity of the onsite battery storage. In 2018 prices, Smith shared, the battery cost $350,000, which he said was reasonably affordable, though a gas generator would have been much cheaper at around $75,000.

In the end, the project cost $164/ft² to build with the efficiency improvements, battery, and solar representing a premium of $18/ft², or $20,000 per unit. According to Smith, in the year the St. Peter Apartments were built, the typical multifamily housing in the area cost $170/ft² to construct—including solar and batteries. Compared to typical market-rate housing, Smith acknowledged, St. Peter is quite spartan, but "the point is, we came in within the range of a typical market-rate plus solar." The main story, he summed up, is that "the premium need not be high, and the stability for the renters—or owners—can be really life-stabilizing."

And yet, he acknowledged, the level of energy efficiency achieved in the St. Peter project often doesn't pencil out for affordable housing projects, which is why most don't go beyond what is required by Energy Star and Enterprise Green Communities. In the case of this project, the increase in efficiency and resilience didn't cost the owner anything extra. "This wasn't a developer who decided to go and spend a premium," but rather one that floated an idea in front of donors who were willing to help, said Smith.

Photo: Michael Mantese/EskewDumezRipple

When New Orleans lost power during Hurricane Ida in 2021, the St. Peter Apartments operated off-grid for nine days, becoming a gathering place for residents' friends and family who were without power.

an email, buildings would only contain "preferred" products, which are those classified in Informed as yellow or green. The organization's goal is to collect better product data by 2025 and for the industry to "step up from red" by 2030.

BuildingGreen's Product Category Guides also offer technical information and real-world context to help practitioners select products and materials in most of the major specification categories. To do that effectively, design and construction professionals need to understand the environmental and social sustainability, the functional performance and maintenance requirements, and the durability of products in addition to their toxicity to humans across the entire product life cycle.

9. Stop on red and regroup

In a recent report, *Advancing Health and Equity through Better Building Products*, Habitable shared findings from its 2019–2020 assessment of the chemical properties of products installed in 36 affordable housing projects in Minnesota. According to the report, almost 70% of the flooring, paint, countertops, insulation, and water pipes specified in these projects ranked as red and orange in Informed, and 15% ranked as yellow or green. (There wasn't enough information about the remaining 15% of product types for Habitable to evaluate them, according to the organization.)

"In general [for both market-rate and affordable housing projects], our company has changed our standard specs to include low-VOC paints, low-emitting materials, Energy Star-rated appliances, and low-emitting adhesives," said Laura Eder of ESG, adding that the firm doesn't even give clients the option to not use low-VOC paint. Eder explained that she finds Habitable's resources to be a help-

ful way to show clients why ESG chooses certain materials over others.

ESG, Eder said, also conducts extensive in-house training on material health. A recent four-part series, she elaborated, included things like understanding HPDs, knowing which manufacturers are and are not "doing great regarding circularity stuff," and what to ask manufacturers for to inform your selections. The firm also challenges its designers to think about what they would change on projects if they could do one thing differently, she added.

For her part, she said, it would be luxury vinyl tile (LVT). Vinyl products are made with high concentrations of chlorine, and the pre-polymerized feedstock, vinyl chloride monomer, endangers fenceline communities and ecosystems; and imported vinyl comes with a social toll as well (see "A Bad Week for PVC: Toxic Spill, and Imports Halted Due to Forced Labor"). "We put LVT everywhere because it's cheap," lamented Eder. "If I could zap one thing out of all housing projects, I'd start there."

10. Work with the budget, not against it

Ciganik understands that development budgets are limited. "People only have so much to spend, so if you can't afford linoleum flooring because of the first costs, then you can't afford to put it in the building," she acknowledged. "This is why we have to take systems approaches." In its report, Habitable identifies four such strategies:

1. Bulk purchasing
2. Manufacturer discounts
3. Testing materials before going all in
4. Decreasing waste

Simona Fischer at MSR Design emphasized the importance of addressing product health during design at a concept level rather than at a specific product-to-product replacement level. "By the time you're evaluating prod-

Image: Weber Thompson/HomeSight

The Othello Square apartment complex in Seattle, currently under development by HomeSight, will be a limited equity cooperative offering 68 units for purchase for families at 80% or below area median income. The project is pursuing the Living Building Challenge Petal Certification for Place, Equity, and Materials.

ucts against each other," she explained, "you're past the point of being able to make substantive changes."

For example, rather than trying to convince your spec writer or a client to swap out a cheap flooring material for an expensive one, look for ways early on to use less flooring material—or no material at all. Another idea: work in an integrative way with your team, the client, and the community to prioritize what materials are worth spending more on. Flooring materials can impact infants and young children, so perhaps a less-toxic option is a key choice in housing where young families may live, while less critical finishes can be reduced in cost or eliminated altogether.

Fischer pointed to Informed as a way for teams to "get a lay of the land" during design, "the way we use carbon analysis tools."

Uche Okezie of HomeSight shared her experience pursuing the Living Building Challenge's Materials Petal for the Othello Square apartments. In her view, the Materials Petal is one of the hardest and most expensive to achieve. During this phase, she recalled, there was a pervasive "business-as-usual" mindset that made it difficult to change the way things were done. People have their established suppliers and materials that they work with, she said, acknowledging that HomeSight too has been a little guilty of this—choosing to use certain products because they've worked in the past.

Okezie explained that seeking LBC Petal Certification taught her to be more aware of what is out there when working on a project, and how important relationships are between the project team and manufacturers. "You see the project in the middle," she reflected, "and there are these spokes that go out to the different people who are part of that." For example, she continued, the project's lead architect, who is passionate about sustainability and healthy materials, was able to educate the HomeSight team on what Okezie hesitantly called "low-hanging fruit," including Red List-free flooring and fiberglass windows (versus PVC)—both of which the team was able to install.

But other materials they'd been hoping to include, notably chromium-free plumbing and Forest Stewardship Council-certified wood, ended up being too expensive. "I mean, the biggest thing overall," advised Okezie, "is seeing what fits in your budget after you have the menu of different options."

The most significant challenge, she reflected, has been the lack of financial incentives and support available to help project teams incorporate healthy materials into affordable housing projects. We need more materials-focused policies and programs, she said, "to ensure sustainability and health are infused through the entire ecosystem of businesses that make affordable housing possible."

Beyond Design: Staying Engaged over Time

Once constructed, a building will be operational for decades—maybe even centuries, continuing to impact its occupants, environment, and broader community. Quality assurance, commissioning (and retrocommissioning), occupant feedback, and data collection can ensure buildings are working as intended, continually improve, and are used to inform other projects.

11. Bring the integrative process home

For every project, Ackerly and DBA recommend commissioning at the very end of construction. "The whole idea," she said, "is to get what you pay for." Commissioning, she estimated, could cost $100,000 for a 500,000 square-foot

building and offer a one- or two-year simple payback. And yet, she continued, it's a hard sell to owners and is not standard practice in residential construction. "I think," Ackerly considered, "it's because, on the one hand, no one does it, so they think they don't have to." In her view, engineers often think housing developments aren't complex enough to warrant commissioning, but she argued there are systems in simple buildings that need quality assurance—especially considering that residential building operators may not be as sophisticated as those in the commercial sector.

Short of commissioning, there are little things design teams can offer and hire consultants for that cost very little and therefore don't require client signoff, shared Ackerly. She explained that DBA includes quality insulation inspection, which is the process of ensuring contractors are following best practices for air sealing and insulation, blower-door testing, and unit compartmentalization. "Oftentimes, it might be that new guy who's doing the insulation," she commented, "[so there's] a continuing need for oversight" on the jobsite.

12. Pay it forward

Ackerly also recommends architects conduct post-occupancy evaluations (POEs), site evaluation walks (SEWs), resident and staff surveys, and collect utility data from completed projects —and use them as pre-design tools for later projects.

Site evaluation walks, which Ackerly suggests should include all project stakeholders (such as the asset-management oversight team, property manager, and facilities manager) and not just the developer, are "another way to elevate human-experience factors that can get forgotten," she explained. "We try to do [a walk-through] whenever we start a project, especially with a new client." Ackerly explained that, for new clients, the firm will do SEWs of projects DBA didn't design. "Now we think of post-occupancy as data gathering on existing buildings. It's really this shared experience," she said.

Ackerly noted that DBA has not charged a client for a POE. "As a pre-design tool, which is what they are" she explained, "we can use a pre-design fee, especially to cover site walks."

Additionally, DBA asks clients if they're willing to share post-occupancy utility data with the firm, which she said they typically are. Currently, she noted, the firm has about 16 projects shared with them on Energy Star Portfolio Manager and WegoWise. This type of project feedback is another great method for firms to continually improve their processes, she suggested.

To build green housing, project teams must understand, at a high level, the systems to which it is connected: broadly speaking, how a building impacts people and the environment throughout its life cycle. At the same time, teams need to expect that effective sustainability strat-

Photo: Sherry Tester/David Baker Architects

A Shared Evaluation Walk (SEW) facilitated by David Baker Architects. The firm aims to conduct an SEW for every project to discuss lessons learned from clients' previous projects.

egies will be different for every project and should allot themselves time upfront to identify and plan for them.

With time, teams can effectively and patiently engage community stakeholders, help them participate in the process, learn from them about what they need, research resource efficiency and climate resilience options, and create beautiful designs that resonate with occupants and make sense in their environments.

Plus, “if you plan in advance, there would be cost savings,” said Dana Bourland. “That’s the thing people don’t talk about at all. Doing it holistically can actually save money.”

Update: This article was edited on June 25, 2024 to reflect the correct spelling of Uche Okezie's surname.