SEATTLE DAILY JOURNAL OF COMMERCE

BUILDING GREEN

MARCH 23, 2017

2 STATE BILLS WOULD REWARD OWNERS WHO GREEN UP THEIR BUILDINGS

Existing buildings hold untapped potential for energy efficiency improvements. The bills would introduce new performance incentives.

What do you think about when you consider extreme energy efficiency? Perhaps you think about gigantic solar arrays, intricate water reclamation technology, or slick computerized building controls.

While all those measures are well and good, you don't have to buy fancy equipment or use high-quality materials to achieve superior energy savings. When it comes to lowering energy consumption, utility incentives — which are often just a few lines of policy text — may very well be our most powerful tool.

BY MICHAEL FRANK
MCKINSTRY

In Washington, and especially Seattle, our stringent energy codes have pushed the envelope of energy efficiency innovation in new buildings. However, our existing building stock — far larger than the number of new buildings coming online each year — holds significant untapped potential for efficiency improvements. Alternative utility incentives can help.

Frozen in place

Utility incentives are often designed to help pay down the "first cost" of an energy-saving capital upgrade. They do this by offering a one-time rebate for the savings that the building owner captures over the life of the equipment.

Unfortunately, these incentives are structured to encourage prescriptive "equipment-based" thinking rather than holistic or "systems-based" thinking. That means you can get an incentive to change your lights, but not to turn them off.

Another issue with our current utility incentives is that they're inflexibly tied to the energy code. Currently, substantial renovations to existing buildings trigger an obligation for building owners to bring the entire building up to the current energy code. However, the owner only receives rebates on improvements that go beyond the energy code.

This is informally referred to as the "frozen in place" problem, because many projects require utility incentives in order to pencil out. Without them, it's often cheaper to stand pat and, as a result, buildings remain "frozen in place."

Fortunately, these issues can be addressed by tweaks to the code. Two recent bills introduced to the Washington state Legislature would establish alternative utility incentives that would encourage building owners to reduce their energy consumption.

Meter incentives

House Bill 1963 would direct the Utilities and Transportation Commission (UTC), the regulatory body that oversees Washington's utilities, to require investor-owned utilities to offer a meter-based performance program option for the calculation and determination of energy conservation. That means any building could choose to calculate their incentives via measured building performance (as reflected by the readout from the water or electric meter) rather than by set, prescriptive one-time incentives.

Performance-based incentives pay for actual, realized savings instead of paying for unreliable, predicted savings. For every energy-saving tactic implemented, building owners (or tenants, depending on lease arrangements) save twice: once through reduced energy, and again by an incentive payment from their utility company.

This shift in incentive structure encourages deeper energy savings in buildings by rewarding innovative approaches that blend capital measures (more efficient lights or HVAC systems) with improved operational practices (how you operate equipment day-to-day) and modifications to human behaviors (how building occupants influence energy use).

For example, under Seattle

GREEN UP — PAGE 14

A $54 million renovation of Pacific Tower included major energy-saving upgrades. The work was completed under a Seattle outcome-based energy code program.

PHOTO BY CHARLIE SCHUCK

HOW 'NEGAWATTS' HELP THE BUILDING INDUSTRY FIGHT CLIMATE CHANGE

Buildings are the biggest single contributor to greenhouse gas emissions in the U.S. Curbing emissions will require constructing more efficient buildings and relying on renewable energy.

It's clear to me that if we hope to avert catastrophic climate change we need to start viewing our buildings as clean energy power plants. As I'll show below, it'll be easier than you think.

BY ZACK SEMKE
NK ARCHITECTS

Earlier this month I attended a three-day Climate Reality Leadership Corps training in Colorado led by former Vice President Al Gore. Gore and the global experts he convened for the training emphasized three things:

1. We face a climate crisis emergency.
2. We have the means to solve the crisis.
3. Cities and states need to lead climate action in the U.S. Our future depends on determined collective action now.

With reversals in U.S. climate policy underway and the Paris climate agreement in question, it's easy to lose sight of the fact that the clean energy transition is already underway.

Falling renewable-energy costs are now challenging fossil fuels on price, without subsidy, in more regions of the world. Because clean energy is technology, not fuel, innovation drives costs down. More demand for clean energy means more deployment of clean energy, which leads to more experience and learning — further driving costs down.

This is fundamentally different from fossil fuels, which are extracted commodities. Each ton of coal is harder to reach than the last, and drives costs up.

The clean energy sector has stunned energy analysts over the past few years with faster-than-predicted uptake and cost declines. For example, the overall (levelized) cost of solar energy decreased by a staggering 85 percent over the last seven years, according to investment firm Lazard. Wind energy costs went down by 66 percent over the same period.

Likewise, the lithium ion batteries used in electric vehicles, home power storage and utility scale storage dropped by 80 percent over the past six years, according to McKinsey & Co.

This nascent clean energy transition is translating into jobs. One out of every 50 new jobs created last year in the U.S. was in the solar sector. Solar jobs in the U.S. now outnumber coal mining jobs as well as oil and gas jobs.

The 35-unit Pax Futura in Columbia City will be one of Seattle's first Passive House-constructed apartment buildings.

IMAGE BY NK ARCHITECTS

Generating "negawatts"

The global boom in renewable energy is reaching an important inflection point.

Renewable energy (plus some nuclear energy) made up 51 percent of the new supply of energy in 2015 globally. Many analysts, including from AllianceBernstein and U.K. research firm Trusted Sources, expect 100 percent of net new energy supply to be non-fossil fuel by 2020.

"Peak fossil fuels" may be right around the corner. That's good news for the planet. But without a revolution in the energy consumption of our buildings, it is not enough.

The building sector is the biggest single contributor to greenhouse gas emissions in the U.S. today. We know buildings are a problem. They also can become part of the solution as a source of energy, and I'm not just talking about rooftop solar panels.

The "negawatts" we can "generate" through ultra-energy efficiency in buildings is an untapped energy resource. Those negawatts are especially valuable to the grid because their "production" naturally peaks during times of high demand.

So negawatts offset the energy that would otherwise be produced by carbon-intensive coal or gas "peaker" plants designed to meet that peak demand. In this way, buildings can become a form of climate action.

When we make our built environment more energy efficient, we are destroying demand for fossil fuels, and its price goes down. When fossil fuel prices go down, the more difficult-to-extract fossil fuels get stranded in the ground because they become too expensive to dig up for a low market price.

The more energy-efficient our buildings, the more fossil fuels are left stranded in the ground. Combine this with a transition to renewable energy, storage and demand response, and you've got the recipe for meaningful climate action.

The no-brainer choice

Architects, designers and builders have a starring role to play in climate solution-making. Architecture 2030 recognizes this, and Zero Net Carbon building design is the vehicle.

Start by creating a highly energy-efficient building to generate negawatts. Add on-site renewable energy as feasible. Finally, add locally sourced off-site renewables to reach Zero Net Carbon.

Innovation in high-performance building design is the key. If our purpose in sustainable design is to help save the planet, then we need to focus on meaningful carbon-reducing building solutions that are scalable. We do that by making our buildings so high-performing and cost-effective that the approach becomes the no-brainer choice for building owners, developers and project teams. Passive House makes this possible.

The genius of Passive House design (and other energy-efficient building approaches based on rigorous building science) is that it recognizes the building itself — its skeleton and skin — as a technology. Passive House innovation therefore improves both performance and cost, a la other clean energy technologies.

Powered by modern building science, energy modeling and an advanced analysis of the thermal properties of building structures, Passive House architecture sits squarely in the realm of information technology and science-based innovation. That is a potential game changer for the role of buildings in the clean energy transition.

Many Passive House projects today are approaching cost parity with conventional construction. When a significantly better product becomes available for little or no extra expense, then mass adoption becomes possible.

When Passive House buildings become commonplace — as they

NEGAWATTS — PAGE 14

INSIDE

ON THE COVER

The Miller Hull Partnership earned a Living Building Challenge "petal" certification for the renovation of its 14,000-square-foot studio in Pioneer Square last year. PHOTO BY LARA SWIMMER

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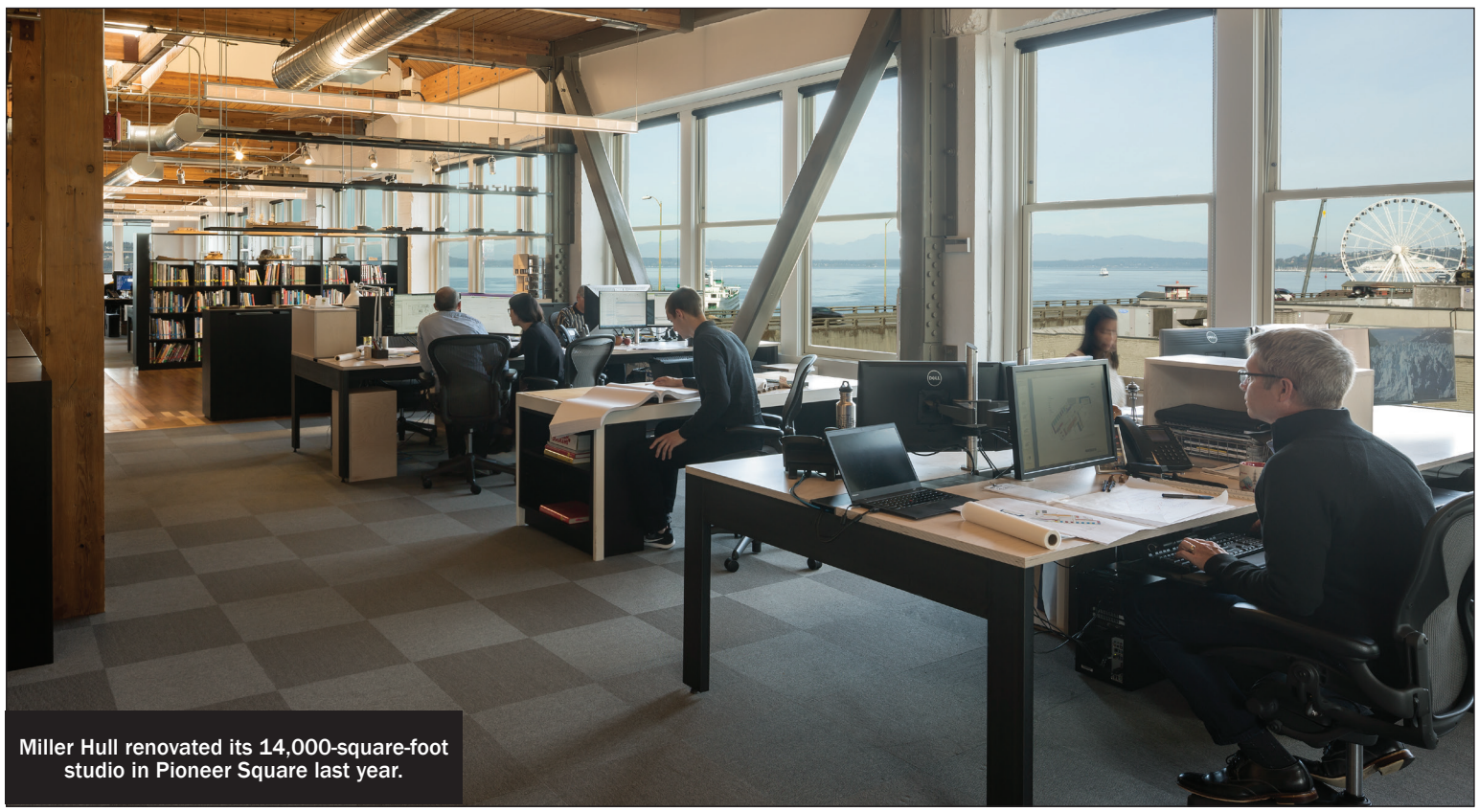
NEXT FRONTIER FOR SUSTAINABILITY? THE PEOPLE INSIDE ALL THOSE GREEN BUILDINGS

Healthy indoor spaces improve productivity and can offer a great return on investment.

BY CHRIS HELLSTERN
THE MILLER HULL PARTNERSHIP



Miller Hull renovated its 14,000-square-foot studio in Pioneer Square last year.

PHOTOS BY LARA SWIMMER

Until recently, many designers and building rating systems primarily focused on building performance.

Where once only a few parameters — like daylighting or increased ventilation — supported the health of the people in the building, the focus is beginning to shift. The building industry is now placing more emphasis on concerns such as human health and indoor environmental quality.

While Miller Hull has long taken occupant health into account in our design considerations, greater awareness and new tools are helping to make designs for health more acceptable in projects around the world.

Companies can offer a new hire almost any financial benefit that can be dreamed of, but still find the need to differentiate themselves and compete for in-demand staff. To stay competitive, some companies are providing office spaces with reduced toxins or air- and light-quality standards that far exceed their competitors' standard buildings.

Employers now have real data to validate the benefits of such design choices. A 2016 study by Harvard University's T.H. Chan School of Public Health found that improved indoor environmental quality was associated with increased productivity and higher cognitive function.

"These results suggest that even modest improvements to indoor environmental quality may have a profound impact on the decision-making performance of workers," said Joseph Allen, lead author of the study.

In addition, environmental building-rating systems like the Living Building Challenge (LBC) and the Well Building Standard are helping to increase the awareness and acceptance of more human health-centric building performance metrics.

Although not all projects may be able to undertake the full Living Building Challenge, taking steps to focus on health metrics are a tangible way to include sustainability at any project scale and for any project type. With the Living Building Challenge, the option for "petal" certification provides more opportunities for buildings that may not be able to achieve the full challenge because of existing conditions. And in Seattle, the city's Living Building Pilot Program supports this certification level and offers additional departures like increased building area and height.

Focusing on health metrics can benefit owners, occupants, designers and developers, and may be able to provide some of the greatest return on investment.

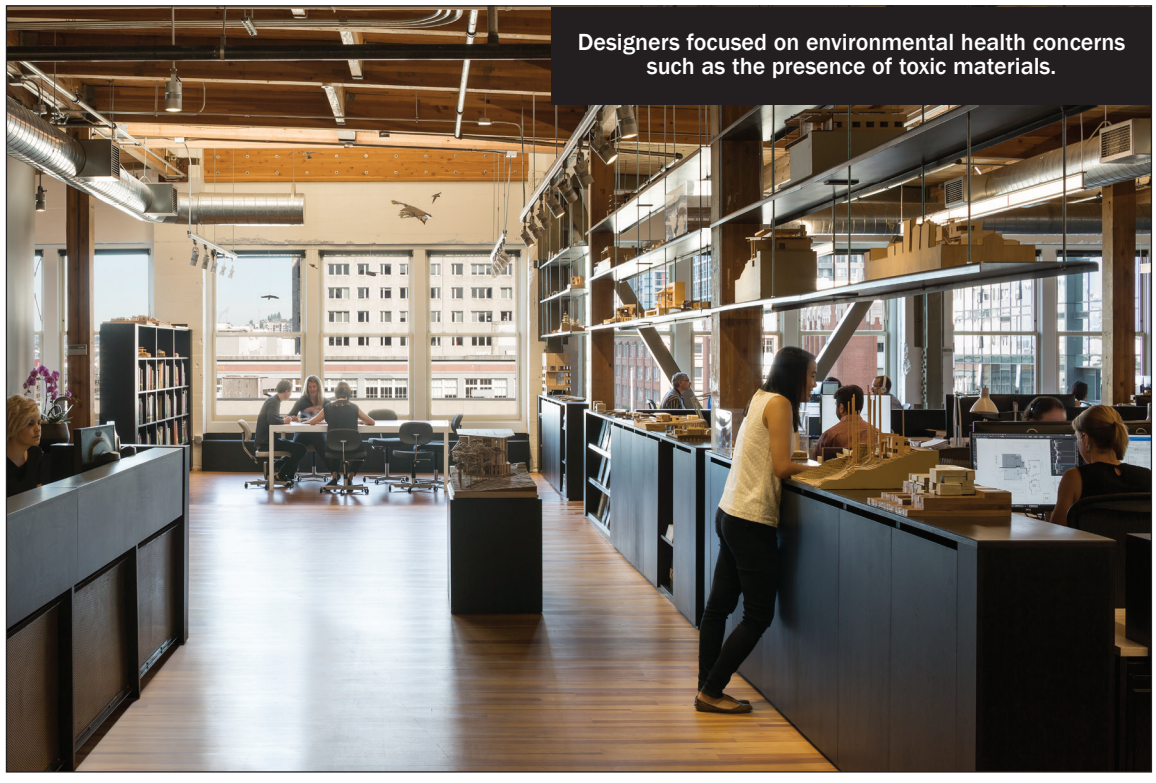
Studio renovation

Since completing the Living Building Challenge-certified Bullitt Center in 2013, Miller Hull is often asked "what's next?"

We have taken great efforts to continue to move the dial for sustainability through our work and focus on occupant health. Just recently, we achieved Living Building Challenge petal certification of our Seattle studio. We are also working on what will be the first Living Building in the Southeast at the Georgia Institute of Technology in Atlanta.

When Miller Hull needed to renovate our more than 14,000-square-foot studio in the historic Pioneer Square building we rent, we looked to the Living Building Challenge.

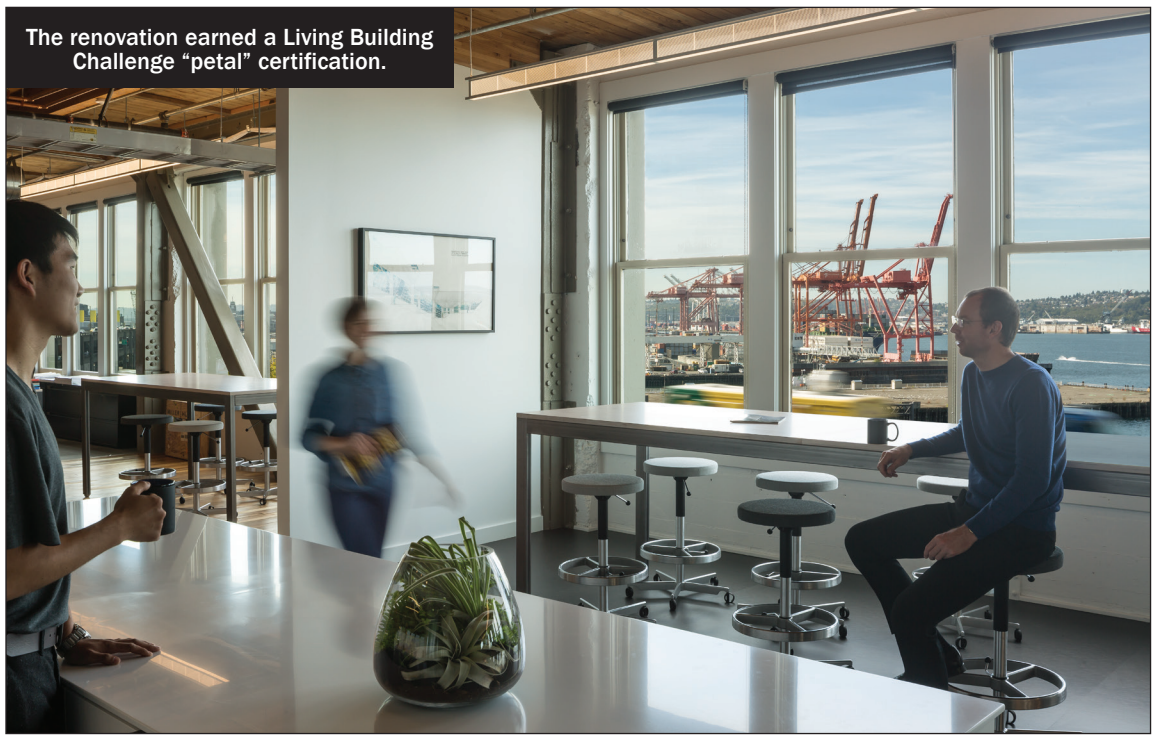
As a single-floor tenant, we would be limited in pursuing the "net positive energy" and "water" portions of the Living Building Challenge that would involve the whole building. But this allowed us to focus on building interior environmental health benefits for our staff by adhering to the LBC "red list," a list of 22 toxic materials or chemicals prohibited from the building.

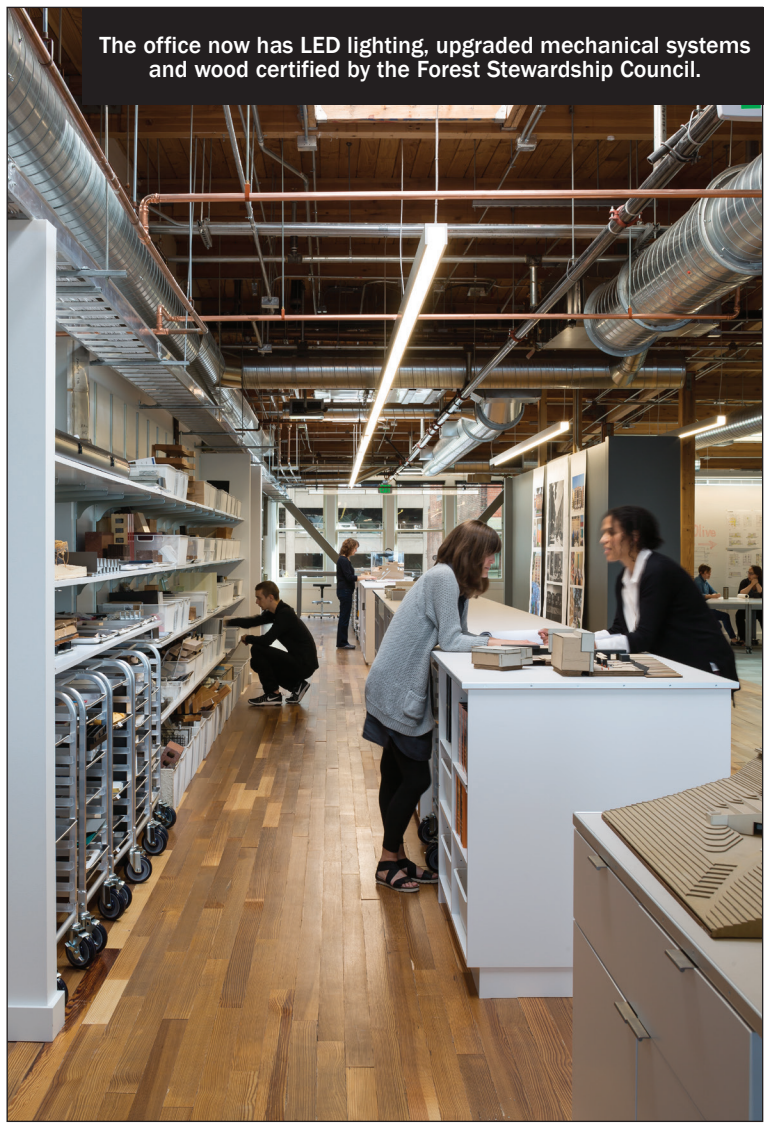


Designers focused on environmental health concerns such as the presence of toxic materials.

At certification, the project achieved 12 of 20 Living Building imperatives in five of seven petals of the challenge, including "place," "health and happiness," "materials," "equity" and "beauty."

With a palette of exceptional daylight and views of Elliott Bay to work with, our space lends itself well to our desired open-office, team-based environment. The exposed wood structure highlights the natural materials of the Pacific Northwest and gave us an opportunity to use Forest Stewardship Council-cer-


The renovation earned a Living Building Challenge “petal” certification.


The office now has LED lighting, upgraded mechanical systems and wood certified by the Forest Stewardship Council.

tified wood in our renovation.

Although it was not possible to pursue the “net positive energy” petal, we found other ways to reduce our energy use, including a switch to all-LED lighting, compliance with Seattle’s energy code, and an upgrade of a portion of the mechanical system.

Perhaps one of the most unique attributes of our renovation provided by the Living Building Challenge was the requirement to offset a portion of land equal to our project area. Working with Forterra, we were able to help protect some of the last remaining undeveloped shoreline along Puget Sound on Anderson Island, providing for a health benefit beyond our office walls.

Red list

Employing our expertise to meet the LBC red list has made a significant impact on the air quality of our space. Like any materials-vetting process of this depth, we found difficulty with the complex mechanical and electrical items and even a few product categories that do not yet have red list-free options.

But while there are numerous stories of difficult discussions with manufacturers and dead ends with product transparency requests, there are some great successes as well.

We found successes with products and local subcontractors we have used before. We found new materials and product options with a greater range of manufacturers than in years past. We found manufacturers that were willing to make ingredient substitutions to their product line to achieve compliance and we found people that had not heard of the Living Building Challenge willing to work to achieve it.

The market has made significant transformation in the past few years from where it was during some of our first Living Building Challenge work.

Miller Hull’s work continues beyond our renovation to advance both the tools available to assist with materials research and advocate for ingredient transparency within the building industry.

As both a speaker and member of the advisory group for the recent American Institute of Architects Seattle Materials Matter series, we are working with our regional colleagues to expand knowledge around materials health and raise the level of debate on the subject. We also participate in Mindful Materials, a common platform for manufacturers to provide disclosure and optimization information for their building products.

Miller Hull is also contributing to the development of Portico, the joint effort between Google and Healthy Building Network to build a healthy materials tool that will soon be available to the public. There are great advances for ingredient research on the horizon for our industry.

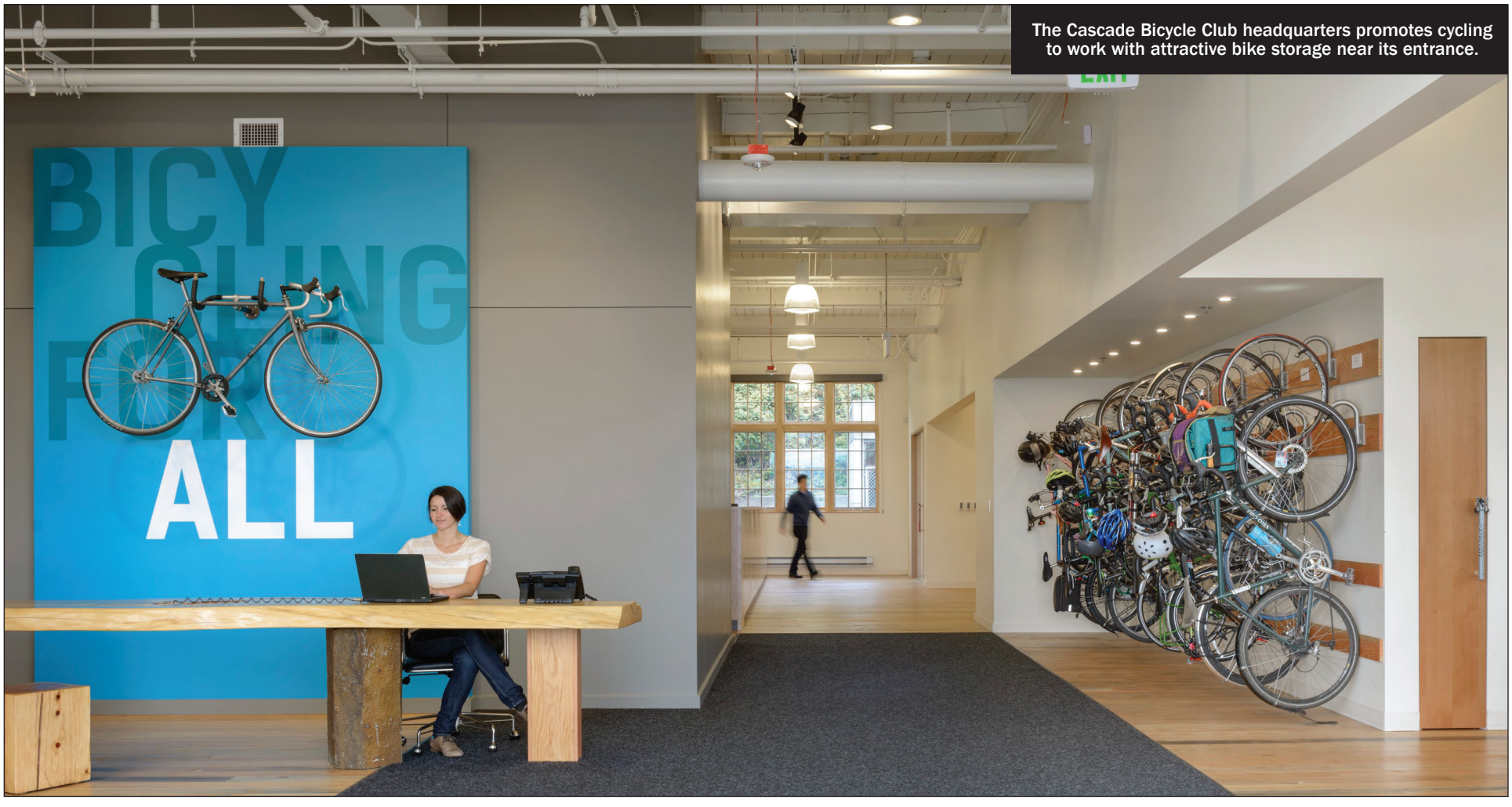
If our industry is to demand transparency from the product companies we seek to do business with, we must also be transparent ourselves. Before undertaking the renovation design, Miller Hull participated in the International Living Future Institute’s social justice program, Just. As advocates for materials ingredient transparency, we aimed to model our own corporate transparency.

Working together

At Miller Hull, each project undergoes a series of sustainability reviews throughout each project phase. Each review involves a materials evaluation as we search for healthier product and material alternatives when possible.

In addition, our firm is working to eliminate six common red list ingredients from our office master specifications, with the plan to reduce more each year. And while not everyone in our office needs to be a materials expert, staff have become more aware of the need for ingredient alternates and how to find help to incorporate them. Even the simple step of identifying one product

THE PEOPLE INSIDE — PAGE 14



The Cascade Bicycle Club headquarters promotes cycling to work with attractive bike storage near its entrance.

PHOTO BY AARON LEITZ

4 STRATEGIES TO MAKE OFFICE WORKERS HEALTHIER AND MORE PRODUCTIVE

Designers are creating more sustainable workspaces by promoting nature, biorhythmic lighting, healthy materials and physical activity.

Early sustainably designed buildings were largely seen as machines used to reduce energy and water consumption.

By examining current building energy codes and ever-increasing performance goals we can see that this mentality still exists. Although these efforts have been successful in reducing the environmental impact of buildings the importance of the building occupants' well-being has sometimes been forgotten in the process.

BY ED CLARK
ZGF ARCHITECTS

People spend 90 percent of their time indoors on average. Twenty-five percent of that time is at work, totaling approximately 90,000 hours spent within the workplace in a lifetime. Therefore, it is important that these spaces be supportive or — even better — nurturing for employees' bodies and minds. Furthermore, happy and healthy employees are more effective, and can significantly influence an organization's bottom line and marketplace success.

How can we improve the quality of our workspaces? We can incorporate a number of occupant strategies into the design process, such as circadian lighting, biophilic design, healthy material choices, and active design. Rewards for building users can include improved health, wellness and productivity.

These strategies — while effective on their own — are strongest when combined and incorporated into an office's design and work culture. Additionally, an employer's commitment to provide their staff with an optimal environment is often reciprocated with increased dedication from the staff.

Circadian lighting

We often receive too little light during the day and too much light at night. These environmental cues can disrupt our internal body clocks, negatively affecting sleep cycles and leading to a number of poor long-term health outcomes.

Circadian lighting is a design solution that varies the color and intensity of lighting based upon the natural solar patterns. There are a variety of products available for the commercial and residential market that cater to the concept. For example, there are light fixtures that change color as well as applications that control the color and brightness of smartphones, tablets and screens based on location and time of day.

These lighting products are especially pertinent in the Pacific Northwest where winter days are short, daylight illumination levels are low, and supplementing daylight with electric lighting can be fruitful. In addition to maintaining the internal body clock, light exposure can also provide an alerting effect for post-noon drowsiness some employees may encounter.

Biophilic design

Biophilia literally means "love of nature." Biophilic design leverages the intrinsic desire to be a part of nature, sets us at ease with our environment, and provides a gentle reminder of the passage of time and our place within the world. Other biophilic strategies include the use of natural or organic forms, and natural images and materials.

Biophilic design can be overt or subtle, as shown in two Seattle projects, Federal Center South Building 1202 and the behavioral health unit at Swedish Ballard.

Biophilic design strategies in Federal Center South, the headquarters for the Army Corps of Engineers, include its soft curvaceous form, abundant access to daylight and natural views, the use of natural materials and atrium plantings.

The design of the Swedish Ballard behavioral health unit is subtler, emulating movement through trees towards a bright clearing. The materials used reinforce the language of natural settings with a dark ground plane and light ceiling, vertical patterns that vary in density, and columns that dissolve as they ascend towards the sky. Lighting in the unit varies as the day progresses and supports the circadian systems of the patients and staff.

Healthy materials

Of the 82,000 chemicals registered with the U.S. Environmental Protection Agency, 85 percent of them have no health data and 67 percent have no data at all. This lack of information hinders our understanding of the impact building materials can have on environmental and human health.

History has also shown a significant time lag — years to decades — between the identification of a chemical's health hazard and its subsequent regulation. However, there is hope.

The design community is demanding transparency from manufacturers, especially for the materials that occupants come in close contact with. Organiza-

tions such as the Health Product Declaration and Environmental Product Declaration have created transparency-reporting tools for manufacturers. Others like Mindful Materials and Seattle's Healthy Materials Collaborative are gathering transparency information and pushing for market change through collaborative education and advocacy efforts.

Bolstered by recent research from Harvard's T.H. Chan School of Public Health, designers know that air free of contaminants can increase cognitive function and reduce health risks. Armed with this knowledge they continue to push forward to get more healthy materials into the workplace.

Active design

Encouraging physical activity through workplace design can lead to improved health and happiness, and can be a mechanism to reinforce social and cultural ties. This idea, known as active design, encourages architectural design that invites people to make healthy choices.

For example, placing stairs in a prominent area of an office with an irresistible view makes climbing them a positive experience. Placing stairs in locations that make them the most obvious and efficient route from A to B is also ideal. Another example of active design include using sit-stand desks, as health consequences of long-term sitting has been referred to as the "new smoking."

Building design can even influence how people get to work, and can improve occupant health. Providing quality end-of-trip bike facilities that are safe and support rider needs with showers and locker rooms will encourage employees to bike to work more often. Through active design the social and cultural opportunities of activities like biking can become the next generation of the office water cooler.

A paradigm shift is underway that places the occupant at the center of the design effort, and seeks to create nurturing environments that allow humans to thrive in the space they inhabit.

These shifts are not only good for people, but also good for business. Occupant strategies such as circadian lighting, biophilic design, healthy material choices, and active design can be readily included into the design process, rewarding building users with improved health and wellness and increased productivity.

Ed Clark is an associate partner at ZGF Architects.

Natural design elements include landscaping with driftwood, river rocks and greenery.

PHOTO BY BENJAMIN BENSCHNEIDER

The Federal Center South building has a curved form that makes the most of daylight and natural views.

PHOTO BY ANDREW BUCHANAN/SLP

‘BIOPHILIC’ DESIGN BONDS CHILDREN WITH NATURE

A Seattle Schools project shows how natural elements like living walls and rain gardens can be integrated into school spaces.

A significant gap exists between the natural and built worlds. All too often, buildings are designed with a certain separation — the edifice itself is seen as one entity while its surrounding landscape is viewed as something entirely different.

BY LAURA KAZMIERCZAK
NAC ARCHITECTURE

Over time, this chasm has negatively impacted both humans and the environment. With a greater emphasis placed on having the latest devices, children in particular are caught up in this artificial, electronic world of technology. Sensory development in humans often begins with exposure to the outdoors, and today’s children are losing out on this critical element of healthy growth.

The positive effect of nature on children is a recurring topic in educational research. Numerous studies reveal that direct exposure to natural elements has beneficial outcomes in a child’s ability to learn and grow.

One such example is from Richard Louv, author of the best-seller “Last Child in the Woods.” In his book, Louv cites case studies of preschool-aged children in Sweden and Norway who played on either flat playgrounds or uneven natural terrain. After one year, the children who played in the more natural locations exhibited better motor skills than their counterparts.

However, despite a demonstrated need for a strong connection to nature, it remains a challenge for most schools to incorporate natural outdoor space into their programs. Now that we know there exists a problem, just how do we go about addressing it? The answer is in our DNA.

Bounded spaces like this courtyard offer students outdoor areas where they can explore but feel safe.

PHOTOS BY BENJAMIN BENSCHNEIDER

Life-loving design

In 1984, biologist and Harvard University professor Edward O. Wilson published his book “Biophilia,” which coined the title term meaning, “the innate tendency to focus on life and the lifelike processes.”

Etymologically, biophilia comes from the Greek “bios,” meaning life, and “philia,” meaning fondness. As a field biologist specializing in the behavior of ants, Wilson combined his scientific knowledge with his keen sense for the human condition, ultimately arriving at his theory of biophilia.

Further studies and research involving biophilia have led to an entirely new field of design, aptly named “biophilic design.”

In 2008, Yale professor Stephen R. Kellert published a book by this very title, in which he stated that biophilic design is “an innovative approach that emphasizes the necessity of maintaining, enhancing, and restoring the beneficial experience of nature in the built environment.”

He further explains that this innate love of nature within humans is actually an essential part of our development and maturation as a species, deeply embedded in our genetic code.

Biophilia in schools

This idea of human development and maturation speaks directly to the need to incorporate this design methodol-

ogy in early childhood education spaces. How exactly can schools go about doing this? Various sources suggest ways to implement biophilic design principles to support a nature-based curriculum, as well as foster positive developmental responses from students.

Kellert details over 70 biophilic design elements that can be used to greatly enhance a user's experience of built space. At NAC Architecture, we have incorporated many of these elements into our own pre-K-12 projects.

A recent project, the Hazel Wolf K-8 E-STEM School for Seattle Public Schools, demonstrates biophilic design principles such as environmental features, exploration and discovery, views and vistas, bounded spaces and spatial variability:

- Environmental features from the outdoors are brought in via a living wall. Two of the vertical panels are independently set up for light and water so students can conduct investigations; one panel serves as the control while the other can have its features manipulated.
- Experiential learning is linked to the real world through exploration and discovery where a rain garden gives students the opportunity to investigate important questions: What types of plants and animals use this water filtering feature? How does it change over time? How does a rain garden filter rainwater?
- Views of natural surroundings lead to students' greater appreciation for the environment. The incorporation of extensive clear glass offers scenes of the outdoor environment, making nature an essential and daily part of students' lives.
- Students sense security in the outdoors in the bounded spaces created by the school's learning courtyard, offering the opportunity to experience the outside environment while still providing a feeling of safety and refuge.
- Spatial variability is created where the topography functions as a playground; a grass slope in the school's courtyard works as a natural play structure, allowing students to create their own uses for the landscape.

The amount of science on the topic of biophilia as it relates to early childhood education makes it difficult to ignore. As such, it is critical that we continue taking steps to implement design methods that encourage students' beneficial engagement with the natural environment.

Laura Kazmierczak brings a user-centric design approach to NAC's education projects, focusing on students' interactions with their learning environments. NAC Architecture is an award-winning design firm with offices in Seattle, Spokane and Los Angeles.

Living walls bring nature inside. Here, students can vary the light and water to see how they affect the plants.

The central courtyard has teaching spaces where students can learn about planting and stormwater management.

Skylights help spread daylight evenly across the space. LED fixtures are automatically controlled by daylight and occupancy sensors.

PHOTO BY INTEGRATED DESIGN ENGINEERS

ECO-FRIENDLY TRANSFER STATION ADDS PLAYGROUND TO BE A GOOD NEIGHBOR

Seattle's new North Transfer Station goes to great lengths to reduce noise, odors and visual impacts.

The design of Seattle's new North Transfer Station radically departs from what people typically associate with solid waste sorting facilities.

Leafy pedestrian pathways, a sport court and natural play areas compose a gentle, friendly expression for the facility. Within, recycling and trash processes are choreographed to maximize efficiency and encourage Seattleites to recycle ever more stuff.

BY PJ BAUSER
MAHLUM

The air is clean and the facility is relatively quiet for all the activity it contains. It is at once friendly to the community and friendly to the environment — a comprehensive model of sustainable design.

This remarkable achievement reflects the commitment of Seattle Public Utilities and the design team to create a robust community asset from a former blight. Set in the thriving Wallingford-Fremont neighborhood on the site of the previous transfer station, the new facility is now a better match to the single-family homes, small multifamily complexes and commercial buildings that surround it.

"The new North Transfer Station is a big investment in the future of Seattle," said Mami Hara, CEO and general manager for Seattle Public Utilities. "This facility allows us to have less of an impact on the environment, while safely and sustainably handling the increasing waste demands of our growing city."

Ample natural light

From the outset, Seattle Public Utilities partnered with neighbors to find solutions that met both of their needs. A primary requirement of the community was that the new facility would not be any taller than the old building. This limitation significantly influenced how the project team shaped and organized of the facility.

Tri-chorded steel trusses were used to meet the height requirement and create the 200-foot clear spans necessary for the 57,000-square-foot tipping floor. Skylights are embedded along the top of each 6-foot-wide truss, distributing daylight evenly across the space.

A wall of translucent Kalwall panels along the south facade, above trash compactors and exhaust equipment, supplements the skylights. The panels introduce diffused light, which adds brightness without shadows to enhance safety. The panels also help avoid heating the trash, which limits its off-gassing.

Together, these strategies provide ample natural light while significantly reducing the need for electric light. Adequate lighting is important in waste management work, which consistently ranks among the top 10 most dangerous jobs in the United States.

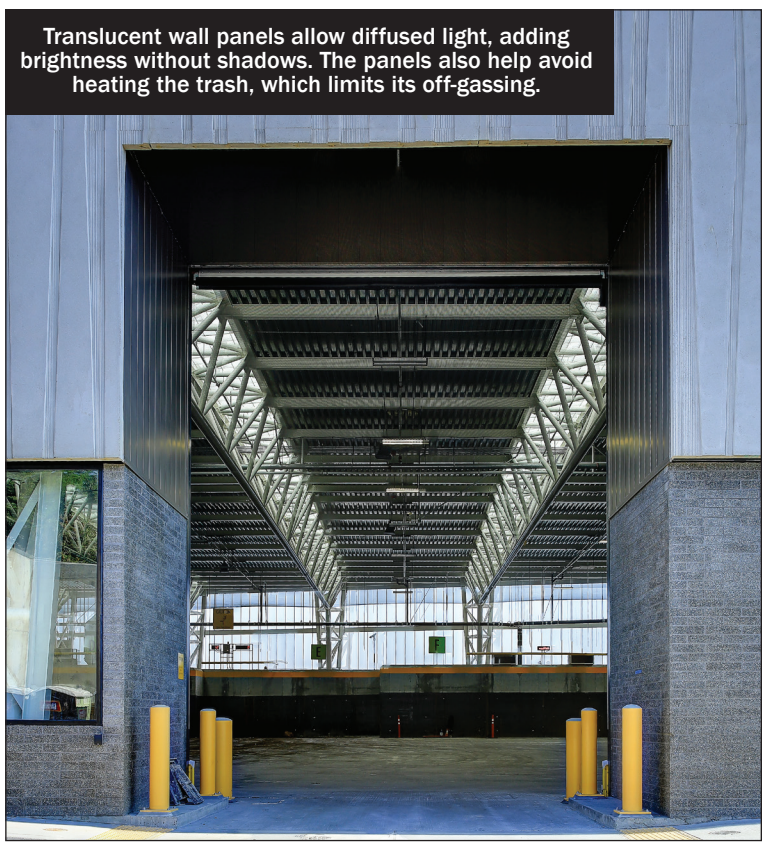
When electric lighting is needed, daylight and occupancy sensors automatically control LED fixtures. As a result, the facility achieves a very low energy usage of 32.6 kilowatts per square foot despite intensive equipment use.

Reducing impacts

The North Transfer Station's primary purpose — processing trash and recyclables for future disposal — can impose many negative environmental impacts on its neighbors. Odor, dust, noise and vermin are natural byproducts of a typical facility.

With extensive input from the community, the design team addressed these vectors holistically to minimize their impacts. To buffer internal activities from adjacent properties and reduce noise pollution, the new facility is set down into the site and a concrete retaining wall placed along northern border acts as a sound wall.

All garage doors are ultra-qui-



Translucent wall panels allow diffused light, adding brightness without shadows. The panels also help avoid heating the trash, which limits its off-gassing.

PHOTO BY TIM RICE ARCHITECTURAL PHOTOGRAPHY

The sidewalks and sport court are composed of pervious concrete, allowing water to seep directly into the ground.

PHOTO BY TIM RICE ARCHITECTURAL PHOTOGRAPHY

et and operate at high speeds for each vehicle accessing the tipping and recycling buildings. The powerful mechanical system thrusts exhaust air high into the atmosphere to decrease odor pollution. A low-flow misting system above the tipping floor limits dust.

Every surface of the site is employed to improve environmental conditions. Above the tipping building, an array of photovoltaic panels generates 150 kW power, enough to supply 10-12 homes on an annual basis. Above the 10,000-square-foot administration building and 10,000-square-foot recycling building, green roofs filter stormwater, decrease runoff and reduce the site's heat island effect.

In the public park areas, sidewalks and the sport court are composed of pervious concrete, which allows water to penetrate directly into the ground. An onsite catchment system is integrated into the landscaping to filter discharge from trash and recycling materials. The catchment system discharges the cleaned gray water directly into Lake Union, reducing the volume of water sent to the wastewater treatment plant.

Sharing the significant impacts of trash and recycling with the community are additional purposes of the North Transfer Station. The design strives to connect the community to the important functions of the station by putting trash/recycling processes on display in a positive, sanitary way.

Along the south side of the site, which faces the busy Burke-Gillman Trail, windows have been punched into the wall to allow public views down into the underbelly of the tipping floor. A viewing room above the tipping floor in the administrative building is open to the public when the building is open.

Reclaimed

Existing materials and equipment from the old facility were reclaimed for use in the new station. Two 90-ton compactors were salvaged and rehabilitated for continued use.

The art installation "Reclaimed" by Jean Shin is composed of reclaimed rebar from the site. The artwork is shaped into organic, linear contours that reference the topography of the site prior to white settlement. It highlights the full potential of waste material to be reborn within the community and upholds the ethos of sustainability.

To divert as much material as possible from the waste stream and back into productive uses, the facility separates trash and recycling processing. The recycling area is the first option presented to vehicles entering the site and is free to the public. This easy access further encourages waste to be diverted from the landfill.

The driving mission of the station is optimized in the new facility and inspired the design of the entire site. It is certified LEED gold.

PJ Bauser is an associate principal and designer at Mahlum who actively promotes the influence of the built environment on healthy communities across the Pacific Northwest.

NORTH TRANSFER STATION

Prime consultant:
CDM Smith

Architect:
Mahlum

General contractor:
Lydig Construction

Structural engineer (steel):
Integrated Design Engineers

Structural engineer (concrete):
CDM Smith

Mechanical/electrical engineer:
The Greenbusch Group

Landscape architect:
HBB Landscape Architecture

Artist Jean Shin created an installation called "Reclaimed" composed of reclaimed rebar from the site.

PHOTO BY INTEGRATED DESIGN ENGINEERS

GEORGIA TECH WANTS A LIVING BUILDING, BUT CAN DESIGNERS BEAT THE HEAT?

Atlanta's hot and humid climate requires turning to cooling strategies different from green buildings in Seattle.

BY MARC BRUNE & DAVID MEAD

PAE CONSULTING ENGINEERS

The Georgia Institute of Technology in Atlanta is aiming to build the world's next Living Building, one of a handful of such buildings on a college campus.

The building will meet the high standards of the Living Building Challenge 3.1, the built environment's most rigorous and ambitious performance standard. The LBC requires buildings to operate annually on a net-positive energy basis. This means that the building must produce 105 percent of its own energy each year.

Keeping the heat out

For Georgia Tech, designing to net-positive energy demands significant planning and design team coordination. To accomplish this, designers first prioritized cooling- and heating-load reduction options to minimize the energy needed and allow passive operation for longer periods of time.

Atlanta's climate is hotter and more humid that Seattle's. Summer nighttime temperatures in Atlanta may not drop below 70 degrees some nights, while Seattle summer temperatures frequently drop below 60 degrees.

Designers prioritized decisions that enhanced the building's ability to operate passively in Atlanta. This meant attention to strategies that would reduce summer cooling needs.

Particular attention was paid to reducing infiltration, the uncontrolled movement of outside air into the building. In Atlanta, infiltration brings in large amounts of hot air and humidity. To keep these out, designers considered options like extreme envelope airtightness, vestibules, rotating doors and air curtains. Exterior venetian blinds are employed on the building's west facade to limit the cooling load from summer sunshine. Triple-paned glazing aids in winter and summer to reduce building loads. The nighttime humidity and high temperatures also meant that natural ventilation and night flush strategies were not a great option.

Reducing energy use

Because the building will rely on renewable energy it creates onsite, reducing the total energy required is critical.

Every element of the design is evaluated using the energy models managed by PAE, the project's mechanical, electrical and plumbing designers. The models give the designers information about how much energy savings can be achieved by implementing additional energy conservation measures.

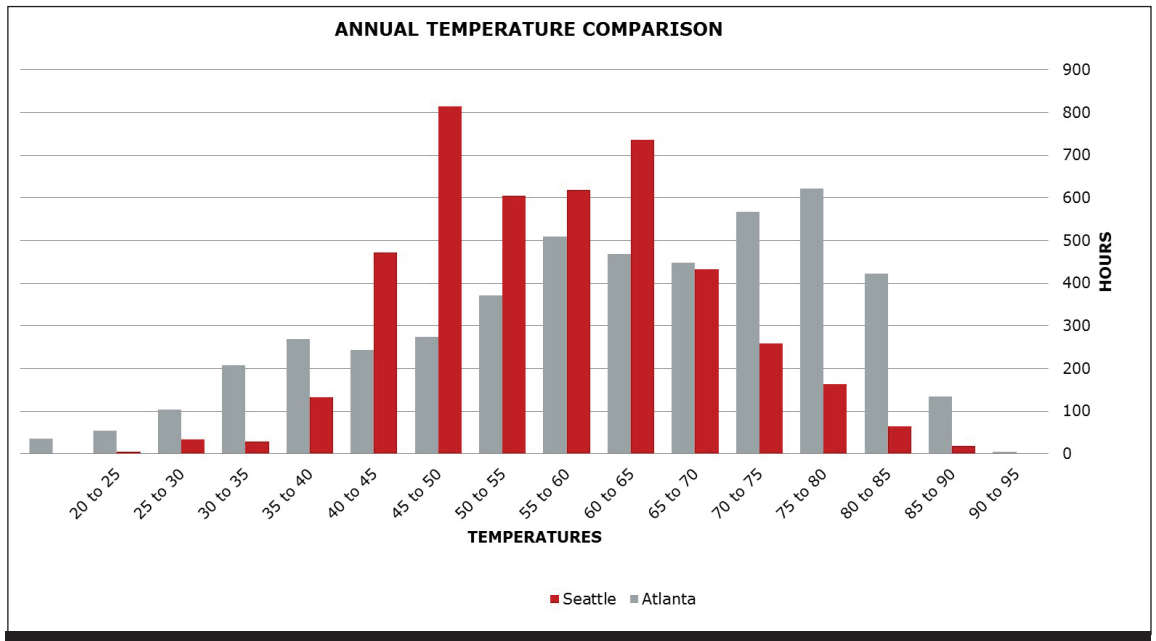
Developing an energy-use model for a project with a fixed energy goal requires a remarkable amount of intentionality and rigor, as the model ultimately determines how much photovoltaics are purchased and installed. Decisions about small operating details become crucial. Factors such as operating hours, thermostat set points and plug loads become enormously important when all power must be generated onsite.

Designers are analyzing a number of questions:

- The plans include a coffee cart to be added in the first-floor atrium and a maker space with significant power demand. Can the project accommodate the energy that would require?
- The LBC requires all potable water be generated onsite. How much energy will onsite water treatment strategies require?
- How many laptops, tablets and phones are likely to be charged at convenience outlets on a typical day?
- Would students use or bypass rotating doors intended to keep heat and humidity out of the building?

Georgia Tech's new education and research building will have a rooftop photovoltaic array.

IMAGE BY THE MILLER HULL PARTNERSHIP



Atlanta has hundreds more hours of 70- to 90-degree heat than Seattle each year.

IMAGE COURTESY OF PAE CONSULTING ENGINEERS

Indoor comfort

In order to make sure occupants experience thermal comfort with minimal energy use, strategies include radiant heating and cooling floors, dehumidification air handlers, and a closed-loop geothermal heat pump system.

Radiant cooling is unusual in humid climates because of condensation concerns on the cold radiant surface. Designers are including additional condensations sensors and temperature reset strategies to mitigate the risks.

The dehumidification air handlers being considered include dual-heat recovery wheels; one wheel provides heat recovery from the exhaust air, while the other provides free reheat. The net effect of the system is an approximately 30 percent reduction in the energy needed for dehumidification.

The building's primary heating and cooling source will be 50 350-foot-deep geothermal heat pump bores. The heat pump system increases efficiency over a more common air-source heat pump by exchanging heat with the ground, which is a constant 60 degrees in Atlanta.

Finally, the team is designing to a more expansive theory of thermal comfort than typical. Thermal comfort is defined by six primary factors: air temperature, radiant temperature, humidity, air speed, clothing level and activity level.

All six variables are being considered in the design. The end result is a building operating at higher air temperatures in summer without sacrificing occupant comfort. This reduces energy use and the size of the mechanical system that needs to be installed.

Onsite energy

After these energy-efficiency measures are included, onsite renewable energy is added to the building to balance the energy requirements.

The project's current predicted Energy Use Intensity is around 30 kilo-British thermal units per square foot annually. That requires approximately 17,000 square feet of solar photovoltaic panels to meet the predicted demand of the building.

The rooftop photovoltaic array will multitask by producing energy, collecting rainwater and providing shade for the south and west facades. Onsite battery storage is included to provide a backup option in the case of a prolonged power outage.

A model for others

Building to net-positive energy leads to different design decisions with added benefits: Extra daylight improves occupants' natural circadian rhythms, engaging the environment adds to the site's natural beauty, and

BEAT THE HEAT — PAGE 14

SWEAT THE DETAILS TO MAKE BUILDING GREEN PAY OFF

Teams that do their homework early in the project can make better choices and deliver more bang for the buck.

Seattle prides itself as a city leading the way in sustainability. However, if you look at most buildings going up it doesn't take a keen eye to see that most are built to minimum requirements.

Only a brave few are leading the charge and it's not hard to understand why. Who wants to pay the premium?

Some have figured it out by using an integrated design approach, supported by a complete project team that understands how building performance, potential and opportunities can work together to address each project's priorities.

BY DEREK JOHNSON
WALSH CONSTRUCTION CO.

This approach enables the team to understand and target the opportunities with resource conservation measures or design choices to minimize utility costs (energy, water and waste) for the right premium. With a solid incentives package, the team can reap the maximum operational savings.

As a recent example, the project team made key design decisions for a 2.9 percent premium on a $20 million project in Seattle, producing a building that performs 34 percent better than code. Combined savings and incentives produced a simple payback of less than seven years, with an 18 percent rate of return.

We have found that results like these are not one-offs — they are consistent. Whether the focus is on cost, unit affordability or just doing your part to ensure our planet is still comfortable for humankind, they can serve as motivation to anyone seeking to build buildings with optimum performance.

Making the extra effort

First, the project team needs to examine the "baseline," which represents the minimum requirements — simply, the project built to code — meeting legal, program and funder requirements.

The baseline is developed through benchmarking: examining comparable buildings with similar occupants to determine the expected average annual operational costs. Benchmarking helps to determine the average case.

Each building will have a different use with a distinct set of variables, including tenant use. It's important to understand the costs related to each of the variables.

Once benchmarked, the baseline factors into the code changes that have been incorporated beyond what is comparable in other buildings. The result is the unique baseline for the project.

The baseline, once established, provides the team an objective and detailed understanding of the building's performance: Energy Use Intensity (EUI, or miles per gallon for the building), kilowatts, therms, gallons and waste — all converted into cost. Furthermore, the baseline allows us to examine the components of the building from which savings can be obtained, such the building envelope, mechanical, electrical, plumbing, renewable systems and more.

With baseline information, the project team gains insight into which opportunities will most benefit the project's priorities (cost, sustainability, affordability and so on). Below, a few examples:

- A new construction project: The owner had the requirement to supply air volume twice that of city code. Putting in the extra effort determined that making any improvements to the building envelope beyond code did not make sense, while investing

DETAILS — PAGE 14

The 108-unit Mercy Othello Plaza apartment complex in Seattle has a building envelope that tested nearly three times more airtight than required by city code.

PHOTO COURTESY OF WALSH CONSTRUCTION CO.

THE PEOPLE INSIDE

CONTINUED FROM PAGE 5

or material to eliminate on each project, like PVC, can make a big difference and provide a gateway to changing office culture and practice.

What is clear in the complex and evolving nature of the materials industry and transparency movement is that it will take all of us collaborating to be successful.

A local group, the Healthy Materials Collaborative, has formed to do just that. Comprising more than 20 architectural firms, this group is a free, open-source collaborative that serves as a unifying presence and support network to advance product and materials transparency within the design practice.

Currently, Miller Hull is designing U.S. embassies around the world, completing a net-zero energy and water border crossing with Mexico, finishing the first phase of the Pike Place Market expansion, and even designing net-zero energy residences on each coast. Our recent selection as the architect for the University of Washington population health building provides an opportunity to continue and improve our work on occupant health and promote transparency.

We take both the challenges and lessons from our Living Building work to all our projects, and create spaces that consider occupant health for each of our clients. For all of us as designers, even starting with small steps to include designs focused on greater occupant health can make a substantial difference.

Chris Hellstern is director of Living Building Challenge Services for The Miller Hull Partnership, an award-winning firm specializing in performance-based design for a wide range of public and private buildings.

BEAT THE HEAT

CONTINUED FROM PAGE 12

putting energy-saving systems on display educates occupants.

The building will be a showcase for sustainable practices, and a healthy and positive addition to the environment. The hope is that the project will ultimately be replicable and a model that other universities and campuses around the world can look to for their own Living Buildings.

Funded through a private grant from The Kendeda Fund, the Living Building at Georgia Tech is expected to become a Living Building Challenge 3.1-certified facility in 2019. The project's design and build partners include architects Lord Aeck Sargent in collaboration with The Miller Hull Partnership and construction manager Skanska. Design team consultants include Newcomb & Boyd, PAE Consulting Engineers, Uzun + Case, Biohabitats, Andropogon and Long Engineering.

Marc Brune is an associate principal and David Mead is a building performance specialist at PAE Consulting Engineers.

NEGAWATTS

CONTINUED FROM PAGE 3

are in Europe and beginning to in Vancouver, B.C. — then the negawatts generated by this stock of ultra-efficient buildings can truly help power the grid. Future electric vehicles can be powered by these negawatts, enabling Passive House architecture to reduce emissions from both the building and the transportation sector.

Recent research by the Grantham Institute at Imperial College of London suggests that the market impact of the low and continually declining price of solar energy and electric vehicles could significantly curtail demand for fossil fuels and limit warming to between 2.4 and 2.7 degrees Celsius, when combined with strong but politically feasible climate policies. The research team concludes that decarbonization of buildings is vital to reaching the 2 degrees Celsius target.

The need to act boldly on climate solutions is urgent, given federal intransigence. Our peers in Vancouver are leading the way with their Zero Emissions Building Plan.

The city of Seattle should match that ambition and adopt Zero Net Carbon building policies aimed at making highly energy-efficient buildings scale in our city. Innovative finance structures like MEETS (metered energy efficiency transaction structure) that value building efficiency negawatts exactly like power from a power plant should be accelerated.

Now is the time to reclaim our city's position as a beacon of sustainability. It is not hyperbole to say that our future may well depend on it.

Zack Semke is chief marketing officer at NK Architects in Seattle.

GREEN UP

CONTINUED FROM PAGE 2

City Light's pilot meter-based incentive program, our client One Union Square reduced their energy consumption by 20 percent, even after starting from an 89 (out of 100) Energy Star rating. That reduction was incentivized and rewarded by performance-based incentives.

Rewarding improvements

Another bill, House Bill 1458, would direct the UTC to require that investor-owned utilities develop and implement a program to achieve greater energy savings in existing residential and non-residential building stock that fall below current energy code standards.

This specifically targets the "frozen in place" problem by requiring the program to use the buildings' energy performance baseline (the current year's normalized energy consumption) to calculate financial incentives for increasing energy savings. In other words, building owners can receive incentives for all their energy efficiency improvements, not just those beyond energy code. California adopted similar legislation in 2015.

How to make it happen

Regardless of how these bills fare in the Legislature, it is encouraging to see innovative regulatory models start to emerge at the state level.

The energy code is built to improve the energy performance of our state's entire building stock. Stringent state and local energy codes are a major reason why our state regularly leads the nation in energy performance. However, these codes can at times stand in the way of energy efficiency upgrades in existing buildings.

Alternative utility incentives simply offer an optional compliance path for customers who see an advantage in pursuing an alternative approach, whether that be existing-building upgrades or meter-based incentives. That means more energy efficiency investments, savings that get reinvested in our communities and a reduced statewide carbon footprint.

We're excited to see how the future of utility incentives will unfold. It's just a few lines of text, but the right policy can spark creative problem-solving and unlock the potential for dynamic energy savings.

Michael Frank is director of engineering at McKinstry.

DETAILS

CONTINUED FROM PAGE 13

in an energy recovery ventilating system provided great bang for the buck.

- A historic renovation of an unreinforced masonry building: There was a need to replace 100-year-old single-paned windows and improve the building envelope, such as by insulating the walls. These improvements tripled the R-value of the building, which in turn lowered the heating demand to where it made sense to remove the building from the steam system, eliminating considerable maintenance costs.

This turned into a win for the owner (a construction deduct versus a premium), for tenants (lowering utility costs and increasing comfort), and maintenance (old steam radiators replaced with electric cove heaters) — all with a substantially reduced EUI. Great!

- Waste management for new construction: Garbage costs a lot. Recycling costs less. Composting is virtually free. Making it easier for tenants to compost and recycle can save money.

Analyzing the standard practice for an owner in Seattle, we found simply increasing the size of the recycling bin while decreasing the size of the garbage bin resulted in $6,000 of annual savings with no added cost.

- Water savings: This is another low-hanging fruit! How low are you willing to go?

For every gallon supplied, that same gallon is charged in three parts: supply, sewer and drainage. That means every gallon not supplied provides close to three times the savings.

Waterless urinals, low-flow toilets and fixtures — go as low as your threshold allows. The premiums related to water savings are close to zero.

These examples are simple solutions — neither on or beyond leading edge. Operational savings to build better buildings are readily available. But it takes an alternative approach (the extra effort) in pre-construction to get to the best solution.

The bottom line

Build the baseline and understand the opportunities. Allow the project team to target the opportunities and find the best choices at the earliest point in the project.

Pre-construction costs pale in comparison to construction costs. Operational costs far exceed construction costs over time.

What does not change is the average use of resources per person. Tenants will heat their space to what makes them comfortable. They will use sinks, toilets, dryers and more the same number of times. But if it takes less therms, kilowatts and gallons, those savings are yours.

What does change are utility rates. They go up and they go up a lot. Seattle Public Utilities water, sewer and waste rates have increased 11 percent since 2014. Seattle City Light power rates have increased less, but went up 5.6 percent last year.

Bottom line: The extra effort pays and the results are consistent and should speak to anyone.

Making better choices at the earliest point in the project is important. Understanding the premiums, costs, savings and incentives related to those choices early puts you in a position to make the optimum choices for the project. Powerful!

There are several methods and approaches to accomplish this. At Walsh Construction Co., we have developed a unique Seattle-born method, the Asset Management Preservation initiative, which we apply to our cost analysis of new construction and building upgrades.

Again, whether you believe only in the bottom line, building affordable homes or simply making the planet more hospitable, the extra effort is worth it.

Derek Johnson is a project manager who joined Walsh Construction Co. in 2007 after an extensive career in the U.S. Army. He is a key contributor to Walsh's green building practices, and holds certifications in LEED and Passivhaus.

12 BEL-RED TOWNHOUSES HELP RESTORE A TRASHED SITE

The project is taking shape on a property where trash, debris and invasive plants degraded a streamside corridor.

BY EUGENE GERSHMAN & RYAN GRAMS
GIS INTERNATIONAL GROUP

The city of Bellevue has been planning for the transformation of the Bel-Red corridor for more than a decade. The area — bounded by Interstate 405 to the west, state Route 520 to the north, 148th Avenue Northeast to the east and Bel-Red Road to the south — was historically home to light-industrial buildings and suburban strip malls.

Following years of planning and "visioning" sessions with businesses, residents and other stakeholders, the city approved code changes in 2009 that set the stage for the Bel-Red corridor to become a vibrant, mixed-use, transit-oriented neighborhood. According to the city of Bellevue, the Bel-Red corridor by 2030 is expected to create 10,000 new jobs and add 5,000 new housing units.

Along with new jobs and residents, a Sound Transit light rail line will serve the Bel-Red area starting in 2023, and the burgeoning neighborhood will have new parks, trails, bike paths and other amenities. Another important element of the Bel-Red subarea plan is a focus on "redeveloping the Bel-Red area as a model of environmental sustainability" by restoring steams and rehabilitating natural habitat.

We were excited by the prospects of embracing this vision and incorporating it into one of our planned developments in this neighborhood.

Habitat restoration

Green building means different things to different people. We firmly believe that any focus on green building should take into account much more than what systems and products are used inside a structure. Protecting and preserving the natural environment is just as important as applying the latest sustainability practices to the built environment.

Located at 13601 Bel-Red Road, Park 12 is named for the 12 townhouses nestled adjacent to a private, protected park space. Park 12 is being built on an undeveloped 1.7-acre site containing a section of Kelsey Creek. Despite its exceptional location, this property sat untouched for many years due to its degraded conditions and its designation as a critical area because of its proximity to Kelsey Creek.

During the construction of Park 12, we are taking great care to improve the Kelsey Creek stream buffer and enrich the property's urban wildlife habitat. The adjacent park space will act as a private wildlife conservation area that is safeguarded from future development through a native growth protection easement.

In close partnership with Wetland Resources and GCH Planning and Landscape Architecture, we set out to create a plan that would restore the existing riparian corridor and enhance a portion of Kelsey Creek and the stream buffer. Unbeknownst to many, Kelsey Creek serves as a migratory stream for a variety of fish including Coho, sockeye, Chinook salmon and steelhead trout.

Unfortunately, the property was unmaintained and abandoned for many years. In addition to trash and other debris, a large portion of the site within the stream buffer was previously dominated by invasive species such as Himalayan blackberry and holly. Dense invasive species like Himalayan blackberry tend to crowd out and prevent native shrubs and other herbaceous plants from thriving in the area.

To address these issues, our goal in developing Park 12 is to reestablish native plantings in the stream buffer. As part of our enhancement plan, all of the invasive plant species in the future park area will be removed and replaced with native Northwest plants species like willow, rosemary and Oregon grape.

Installation of native plants will provide a greater diversity of vegetation and an increase in native food sources. This greater diversity of vegetation structure will also offer new places for animals seeking shelter or escape. In addition, we are also incorporating new habitat structures such as birdhouses, bat boxes and bee hives.

The development of Park 12 will also conserve the existing natural hydrology and preserve the existing biodiversity by further protecting existing wetlands.

The 12-unit townhouse development is being built on a 1.7-acre site bordering Kelsey Creek.

IMAGES COURTESY OF GIS INTERNATIONAL GROUP

Restoration work will involve replacing invasive plant species with native plants like willow, rosemary and Oregon grape.

Development will minimize disturbances to the onsite and offsite natural water system through grading that captures and slows runoff as well as onsite landscape-based water treatments for runoff from roofs and paved areas.

Urban sanctuary

Park 12 capitalizes on the fact that Kelsey Creek runs through the site along the eastern property line. In fact, we used this natural feature as a focal point by orienting the buildings so they face Kelsey Creek. Furthermore, the townhouse interiors have large open floor plans with floor-to-ceiling windows that allow the outdoor oasis to be viewed from inside, creating a serene indoor environment.

The site's design incorporates soft trails and outdoor gathering areas within the open area, creating a unique amenity for residents. We're using birdhouses and fallen log features to create an atmosphere where residents can engage in the sights and sounds of the restored natural environment. At the same time, however, plantings and pathways are designed in a manner to discourage unauthorized use of the stream buffer area.

We recognize that the Seattle area will continue to grow in the years ahead. We made a conscious decision to underdevelop the site in order to protect this natural habitat and offer future residents a sanctuary in an otherwise rapidly urbanizing environment.

As stewards of the built environment, we embrace this growth. We feel it's equally important that we also embrace the Bel-Red subarea plan by incorporating stream corridors as an onsite amenity and working to restore and enhance the ecological functions of these corridors.

We are tremendously excited for the future of the Bel-Red corridor, and we are pleased to have an opportunity to play our small part in achieving the city's goal of redeveloping this area as a model for environmental sustainability.

Eugene Gershman is CEO and Ryan Grams is a principal with GIS International Group, a developer and builder of single-family, multifamily and mixed-use properties throughout the Puget Sound region.